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Dear Customer,

Congratulations on receiving your Murphy Aircraft Kit. You will find enclosed a manual and shipping list.

Due to upgrading our computer filing systems, we are in the process of changing all part numbers to an alpha-numerical system. This will mean that in the interim period until this is complete there may be discrepancies between the part numbers in the manual, written on the part and the part numbers on the shipping lists. However, the parts are the same, just the number is changing.

The manuals are in the process of being rewritten to reflect these changes, as are all drawings. The shipping list you receive may already be inline with the new system.

The change in the numbering system is simple to understand:-

- The first one to three alpha digits do not change.
- If there is a dash in the number it is removed.
- The number sequence is amended to always have four digits, i.e. zeros are added in front of the number to make up the four digits.
- Suffix letters such as L and R for left and right remain the same.

Therefore for example

AIL-12 becomes AIL0012
AIL-123 becomes AIL0123
Fus-308L becomes FUS0308L
F-1 becomes F0001 etc.

We apologies for any inconvenience this may cause, but should you have a problem, please contact our drawing office or technical department and we will be happy to help.

Assuring you of our best service at all times.
Best Regards,



Darryl Murphy

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Important Notice:

Re.: Proseal, Zinc Chromate Primer, Fiberglass Resin, Tubeseal and Meta-sol (cleaning solvent).

Dear Customer,

The use of one or more of these five chemicals may be required in the assembly of your Kit Aircraft.

Due to recent changes in Federal Transport Regulations it has become unfeasible for us to send any of these Chemicals with your Kit.

You can acquire these products at most aircraft supply outlets or even an automotive/marine supply store.

**Remember you will want an alcohol safe Proseal if you plan to use auto fuel in your Aircraft, as some auto fuels do contain alcohol and may disolve regular Proseal.**

Thank you

Technical Support Department

# Construction Manual

Congratulations on your purchase of your new kitplane and welcome to the Murphy Aircraft family. You are now the owner of one of the finest kit aircraft on the market today. With over 10 years of kitplane production, the result is an advanced aircraft kit which is intended to make your building process an enjoyable and rewarding experience.

As you may well understand, the writing, editing and illustration of an assembly manual of this scope is a monumental undertaking. Our technical staff have worked numerous hours editing and re-editing in order to be certain that the released version of the manual is absolutely correct. However, we are not infallible, so if you have questions or suggestions, by all means contact one of our technical people to discuss the problem. You will find at the beginning of each section a form that can be photocopied and then faxed to us via our 1-800 builder fax number. We make every effort to reply to faxes received by 10:00 am the same day. Please note that this fax number is for builder support only and is not available for sales or other purposes.

The manual layout the construction of your kitplane along a logical and proven path. We do ask that you work on the assemblies in the order in which they are presented:

1. Tail Section Assembly
2. Wing Assembly
3. Fuselage Assembly

Please note that the reasoning behind the 1-2-3 assembly sequence is that the Tail Section Assembly kit can be built with relative ease while learning skills required in the subsequent assemblies. Each section of the manual is laid out in a step-by-step format that walks you through each assembly. As you complete each assembly, you will move onto larger, more complicated parts that will require the skills you have previously learned. For this reason, Murphy Aircraft asks that you resist the temptation to jump ahead to larger, possibly more interesting parts. In due time you will reach those parts and by following the manual, only have to build them once!

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Throughout this manual various styles of "bullets" will be used to convey information, as a general rule they will be used as follows:-

- ➢ Advisory information.
- • Lists of facts to be adhered to, factual information or consequences.
- 1) Methods or processes to be followed.
    - a. Sequence of steps within the Methods or Processes to be followed.


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**Please read the following information carefully, you will need to refer to it often throughout the building process. It contains information on corrosion protection, drilling, deburring, gusset building etc. Also included is a section on bolt and rivet selection to assist you in areas of the manual where bolt or rivet sizes have not been indicated.**

## 1.1 Metal Surface Preparation

**As a protective measure against corrosion, mating metal surfaces should be fully deburred, cleaned with Acetone, and then coated liberally with primer. This provides a seal between the surfaces to prevent corrosion and moisture ingress. It is a good practice to coat the end of the rivet on the inside surface after installation.**

**As an optional measure, the rivets can be dipped in primer prior to installation. This provides protection inside the hole and seals out moisture, be careful to avoid getting excess chromate on the exterior surfaces.**

**Epoxy primer must be mixed in accordance with the manufacturers directions as displayed on the containers. It is advisable to mix only the amount required at the time in a small container for immediate use. However, it is possible to mix larger amounts for reuse but these must be kept in a sealed container and stored in a freezer or refrigerator.**

## 1.2 Drilling Holes

**It is good practice to only use a #40 drill to make pilot holes when doing any assembly work. If possible never drill to final hole size until assembly is complete and you are confident to do so. This allows for any movement between parts or adjustment you may need to make which could cause misalignment of the holes during final assembly.**

- Always use a sharp drill bit as:
  - A sharp bit will not wander as easily as a dull one.
  - You can drill faster with a sharp bit.
  - You don't have to push as hard, risking bending flanges etc.
- Always be careful to drill square to the work surface.
- Always make sure when drilling through multiple parts or layers that they are clamped together tightly and there is no movement during drilling.
- Always deburr holes on both sides of each part before final assembly.
- Always keep work surfaces clean and free from swarf which can scratch and damage panels.


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## 1.3 Standard Torque Table [Inch Pounds] *

The following information is provided for reference when using AN grade hardware. Most of the time torque values are done to feel. However, this table does provide a good guideline.

**Note: Occasionally bolts, other than a standard bolt will be specified in the manual. These have been specially selected to provide the necessary strength for the particular connection, and where a standard bolt would not be strong enough. It is important that the bolts specified are used where instructed.**

**Fine Thread Series**

| Bolt Size | Standard Nuts (MS20365, AN310, AN315) | Shear Nuts (MS20364, AN320, AN316, AN23-31) |
|---|---|---|
| 10-32 | 20-25 | 12-15 |
| 1/4-28 | 50-70 | 30-40 |
| 5/16-24 | 100-140 | 60-85 |
| 3/8-24 | 160-190 | 95-110 |
| 7/16-20 | 450-500 | 270-300 |
| 1/2-20 | 480-690 | 290-410 |
| 9/16-18 | 800-1000 | 480-600 |
| 5/8-18 | 1100-1300 | 660-740 |

**Coarse Thread Series**

| Bolt Size | Standard Nuts (MS20365, AN310, AN315) | Shear Nuts (MS20364, AN320, AN316, AN23-31) |
|---|---|---|
| 8-32 | 12-15 | 7-9 |
| 10-24 | 20-25 | 12-15 |
| 1/4-20 | 40-50 | 25-30 |
| 5/16-18 | 80-90 | 48-55 |
| 3/8-16 | 160-185 | 95-110 |
| 7/16-14 | 235-255 | 140-155 |
| 1/2-13 | 400-480 | 240-290 |
| 9/16-12 | 500-700 | 300-420 |

*** The above calculations were obtained from the** *Standard Aircraft Handbook***.**

## 1.4 Bolt Lengths

**Throughout the building process there will be instances where bolts are used to fasten parts or materials together. Unless specified, it will be builder who determines the correct length of the bolt to be used.**

**The "Rule of Thumb" for determining bolt length is that the bolt must be long enough to pass through the parts or material being fastened together so that:**

- The threaded part of the bolt is never in shear [i.e. no threads are allowed inside hole].
- No more than three and no less than one thread must be showing when the nut is attached and tightened to the correct torque value.
- Although it is not mandatory to use washers on steel or aluminum parts it is a good practise to use one under the nut.


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**More precise determinations of Grip Length are found in a number of books including the Standard Aircraft Worker's Manual.**


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**Bolt Identification**
AN bolts may be obtained in the following materials:-

- [ - ] Steel, cadmium plated
- C Corrosion resisting steel
- DD Aluminum alloy

The coding symbols shown in the bolt identification number follow the basic AN [Dash] number and identify the material required.

Figure 1.4.1 shows how the material of the bolt may be distinguished by bolt head markings.

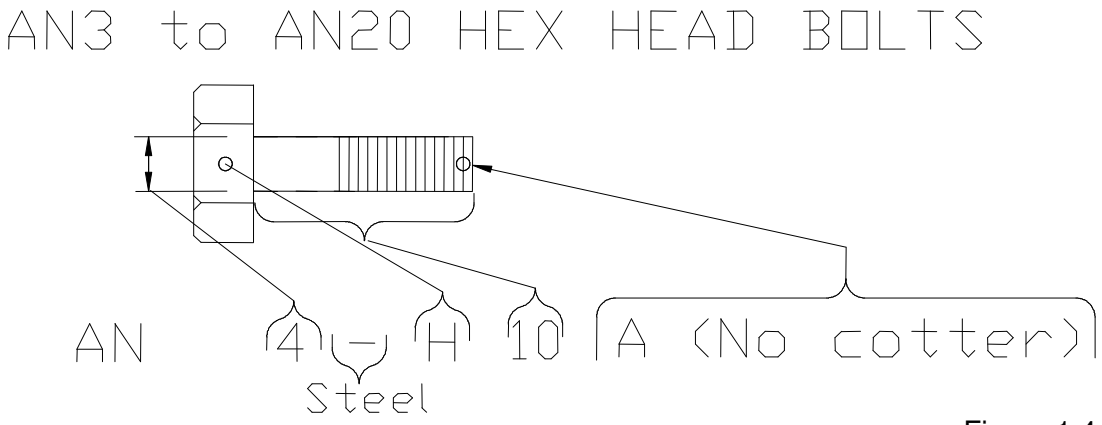



Figure 1.4.1

Example: AN4 - H10A

- AN Army Navy Standard
- 4 Diameter in 1/16 inch increments or 1/4 inch diameter
- - Steel, cadmium plated
- H Bolt with drilled head and shank required; leave off if plain head required
- 10 Refer to table 1 for bolt length and bolt thread corresponding to “10”
- A The adding of the letter A indicates that the cotter pin hole is not required


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## 1.5 AN3-AN20 Hex Head Bolt Length

**Table 1 - Bolts**

| Dash | AN3 | AN4 | AN5 | AN6 | AN7 | AN8 | AN9 | AN10 |
|---|---|---|---|---|---|---|---|---|
| Number | 10-32 | 1/4-28 | 5/16-24 | 3/8-24 | 7/16-20 | 1/2-20 | 9/16/18 | 5/8-18 |
| 3 | 15/32 | 15/32 | | | | | | |
| 4 | 17/32 | 17/32 | 19/32 | | | | | |
| 5 | 21/32 | 21/32 | 23/32 | 45/64 | 23/32 | | | |
| 6 | 25/32 | 25/32 | 27/32 | 53/64 | 27/32 | 27/32 | 31/32 | |
| 7 | 29/32 | 29/32 | 31/32 | 61/64 | 31/32 | 31/32 | 1-1/32 | 1-1/64 |
| 10 | 1-1/32 | 1-1/32 | 1-3/32 | 1-5/64 | 1-3/32 | 1-3/32 | 1-5/32 | 1-9/64 |
| 11 | 1-5/32 | 1-5/32 | 1-7/32 | 1-13/64 | 1-7/32 | 1-7/32 | 1-9/32 | 1-17/64 |
| 12 | 1-9/32 | 1-9/32 | 1-11/32 | 1-21/64 | 1-11/32 | 1-11/32 | 1-13/32 | 1-25/64 |
| 13 | 1-13/32 | 1-13/32 | 1-15/32 | 1-29/64 | 1-15/32 | 1-15/32 | 1-17/32 | 1-33/64 |
| 14 | 1-17/32 | 1-17/32 | 1-19/32 | 1-37/64 | 1-19/32 | 1-19/32 | 1-21/32 | 1-41/64 |
| 15 | 1-21/32 | 1-21/32 | 1-23/32 | 1-45/64 | 1-23/32 | 1-23/32 | 1-25/32 | 1-49/64 |
| 16 | 1-25/32 | 1-25/32 | 1-27/32 | 1-53/64 | 1-27/32 | 1-27/32 | 1-29/32 | 1-57/64 |
| 17 | 1-29/32 | 1-29/32 | 1-31/32 | 1-61/64 | 1-31/32 | 1-31/32 | 2-1/32 | 2-1/64 |
| 20 | 2-1/32 | 2-1/32 | 2-3/32 | 2-5/64 | 2-3/32 | 2-3/32 | 2-5/32 | 2-9/64 |

**Note: To determine grip length, deduct the figure indicated below from the lengths shown in table 1.**

| | | | | |
|---|---|---|---|---|
| AN3 » 13/32 | AN4 » 15/32 | AN5 » 17/32 | AN6 » 41/64 | AN7 » 21/32 |
| AN8 » 25/32 | AN9 » 29/32 | AN10 » 61/64 | AN12 » 1-3/32 | AN14 » 1-1/4 |
| AN16 » 1-3/8 | AN18 » 1-1/2 | AN20 » 1-11/16 | | |


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**Table 2 - Screws**

**Recommended Hole Sizes for Self-tapping Sheet Metal Screws**

| Metal | | Clearance Drill for Sheet Metal Screws | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | Material. | #2 | #4 | #6 | #7 | #8 | #10 | #12 | #14 |
| 0.015 | Steel<br>Alum. | 52 | 44 | 37 | | | | | |
| 0.018 | Steel<br>Alum. | 52 | 44 | 37 | 33 | | | | |
| 0.024 | Steel<br>Alum. | 51<br>52 | 43 | 36 | 32 | 27 | 19 | | |
| 0.03 | Steel<br>Alum. | 50<br>52 | 42<br>44 | 36<br>37 | 32<br>33 | 31<br>32 | 27 | 19 | 13 |
| 0.036 | Steel<br>Alum. | 49<br>52 | 42<br>44 | 35<br>37 | 32<br>33 | 31<br>31 | 26<br>27 | 19 | 13 |
| 0.048 | Steel<br>Alum. | 49<br>51 | 41<br>44 | 34<br>37 | 31<br>32 | 30<br>30 | 24<br>27 | 18<br>20 | 11 |
| 0.06 | Steel<br>Alum. | 48<br>50 | 39<br>43 | 32<br>36 | 30<br>31 | 29<br>29 | 24<br>27 | 16<br>19 | 8<br>8 |
| 0.075 | Steel<br>Alum. | | 38<br>43 | 31<br>35 | 29<br>30 | 28<br>28 | 22<br>26 | 14<br>17 | 6<br>7 |
| 0.105 | Steel<br>Alum. | | <br>42 | 30<br>34 | 28<br>29 | 25<br>26 | 20<br>26 | 13<br>15 | 4<br>6 |
| 0.125 | Steel<br>Alum. | | | <br>31 | <br>29 | 25<br>26 | 18<br>23 | 9<br>14 | 1<br>4 |
| 0.135 | Steel<br>Alum. | | | <br>31 | <br>29 | 24<br>25 | 18<br>23 | 9<br>14 | 1<br>4 |
| 0.164 | Steel<br><br>Alum. | | | <br><br>31 | <br><br>29 | <br><br>24 | 17<br><br>21 | 7<br><br>12 | 15/64<br><br>3 |
| 0.187 | Steel<br><br>Alum. | | | <br><br>31 | <br><br>29 | <br><br>24 | 17<br><br>21 | 7<br><br>12 | 15/64<br><br>3 |

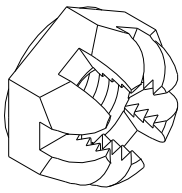

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**Table 3 - Clearance Drill Sizes for AN Bolts, Screws and Cotter Pins**

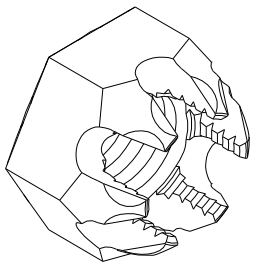
| AN BOLTS | | AN SCREWS | | COTTER PINS | |
|---|---|---|---|---|---|
| **Size** | **Drill** | **Size** | **Drill** | **Size** | **Drill** |
| # 10 | # 11 | # 4 | # 32 | 1/16 | # 48 |
| 1/4 | 1/4 | # 6 | # 28 | 3/32 | # 36 |
| 5/16 | 5/16 | # 8 | # 19 | 1/8 | # 28 |
| 3/8 | 3/8 | # 10 | # 11 | 5/32 | # 16 |
| 7/16 | 7/16 | 1/4 | 1/4 | 3/16 | # 4 |
| 1/2 | 1/2 | 5/16 | 5/16 | 1/4 | # 1 |
| 9/16 | 9/16 | | | | |
| 5/8 | 5/8 | | | | |
| 11/16 | 11/16 | | | | |
| 3/4 | 3/4 | | | | |
| 7/8 | 7/8 | | | | |
| 1 | 1 | | | | |

## 1.6 Nuts

### AN310 CASTELLATED NUT



AN310-4



AN310-6

**Figure 1.6.1**

The AN310 Castle Nut is designed to be used in conjunction with a cotter pin for safe tying. The nut may be used in tension and on assemblies that turn on the bolt or vice versa. This nut is used primarily with the AN3 to AN20 series bolt.

Example Callout: AN310D4

An AN310 Aluminum nut [D]for use on a 1/4 in [4] bolt. Thread from table - 1/4-28NF-3.


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**AN315 PLAIN NUT**

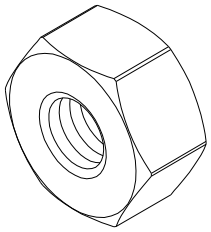


**Figure 1.6.2**

The AN315 Plain Nut may be safe tied through the use of a shakeproof or lock washer, and may be used in conjunction with the AN3 to AN16 series bolt. The nut is available in right [R] or left [L] hand thread.

**AN316 CHECK NUT**

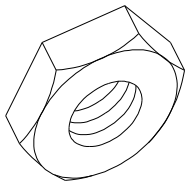


Figure 1.6.3

This nut is used as a check nut to eliminate travel of other nuts or parts on the threads of a bolt or rod. This nut must not be used in tension or shear. The AN316 nut may be had in either right [R] or left [L] hand thread.

| UNF-3 THREAD SIZE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-40 | 8-36 | 10-32 | 1/4-28 | 5/16-24 | 3/8-24 | 7/16-20 | 1/2-20 | 9/16-18 | 5/8-18 | 3/4-16 | 7/8-14 | 1-14 | 1-1/8-12 | 1-1/4-12 |
| | | -3 | -4 | -5 | -6 | -7 | -8 | -9 | -10 | -12 | -14 | -16 | -18 | -20 |
| | | -3 | -4 | -5 | -6 | -7 | -8 | -9 | -10 | -12 | -14 | -16 | -18 | -20 |
| | | | -4 | -5 | | -7 | -8 | -9 | -10 | -12 | -14 | | -18 | -20 |
| -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 | -9 | -10 | -12 | -14 | -16 | -18 | -20 |
| | | | | | | | | | | | | | | |


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**AN365 SELF-LOCKING FIBRENUT**

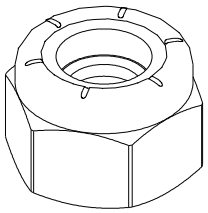


**Figure 1.6.4**

The Fibrenut is used extensively throughout the aircraft. Because of the locking ability of the fibre in the nut, cotter pins or lock washers are not needed. It is unsafe to use the same fibrenut more than once or twice as the nylon wears with each tightening, eventually loosing its locking strength completely. During build, if a step calls for repeated nut use on the same bolt always substitute a plain nut until the final install.

## 1.7 Washers

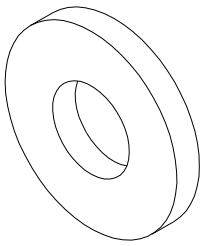


Figure 1.7.1

**The** AN960 **plain washer is available in the following materials:-**

- Steel [Cadmium plated].
- Aluminum alloy [code D].
- Brass [code B].
- Corrosion resistant Steel [code C].

The code letter [none for steel] follows the basic number.

The inside diameter is indicated by the last dash number which is expressed in screw sizes as #6, #8 and #10, or; AN960-6, AN960-8, AN960-10.

Washers requiring an inside diameter of 3/8, 7/16 or 1/2 inch are called out as AN960-616, AN960-716, and AN960-816 respectively.

The washers are made in a regular and light [L] series in all the above metals except brass. If the washer is of the light [L] series, the “L” will follow the dash number.

For anodised aluminum washers, the letter “P” is added before the dash number.


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Note: - **The** AN970 **washer provides a greater bearing area than the AN960 plain washer, and is used to prevent local crushing of the surface.**

## 1.8 Plastic Coating

The protective plastic film [if present] on the aluminum should be left on for as long as possible during the assembly of your aircraft. This helps to prevent the aluminum parts from being scratched.

## 1.9 Layouts

When marking out, use a 'fine tip' felt pen for accuracy. It will show up well and does not wipe off easily until cleaned. Always clean off markings with a solvent [M.E.K. works well] prior to final assembly as some inks may prove corrosive if left on.

## 1.10 Deburring

**ALWAYS DEDURR BY HAND, NEVER USE A DRILL!**

**Holes can be deburred with a deburring tool or a drill bit of a larger size than the hole. Simply put the tool or point of the drill bit into the hole and rotate just enough [usually only one rotation is necessary] to remove any burrs, do not remove enough metal to in effect counter sink the hole.**

**A cordless screwdriver with a drill bit installed can speed things up, but be very careful as it is easy to remove too much metal! Try on a scrap piece of metal first to 'get the feel'. Do not use a cordless drill.**

**With a swivel deburring tool, insert tool into hole and turn once. Generally the tool only deburrs one side; you may have to repeat it for the opposite side of the material.**

**Figure 1.10.1 shows the profile of correct and incorrect [overdone] deburred holes.**

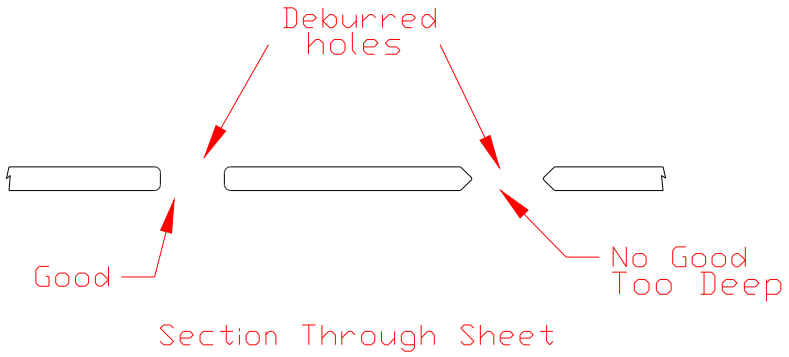



Figure 1.10.1


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## 1.11 Edges

All edges should be filed to remove shear or tin snip marks and the corners 'Chamfered' with a file, as shown in Figure 1.11.1.

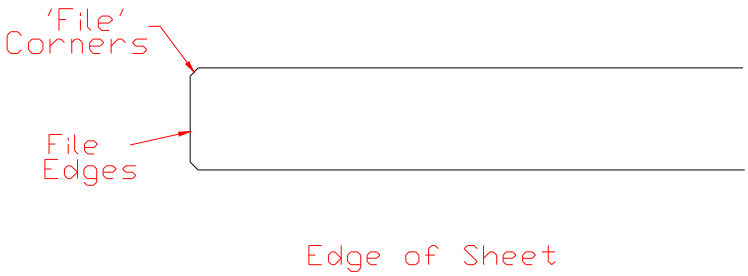



Figure 1.11.1

All flange ends should have corners rounded or chamfered at 45 degrees and filed to remove sharp edges and burrs. See Figure 1.11.2.

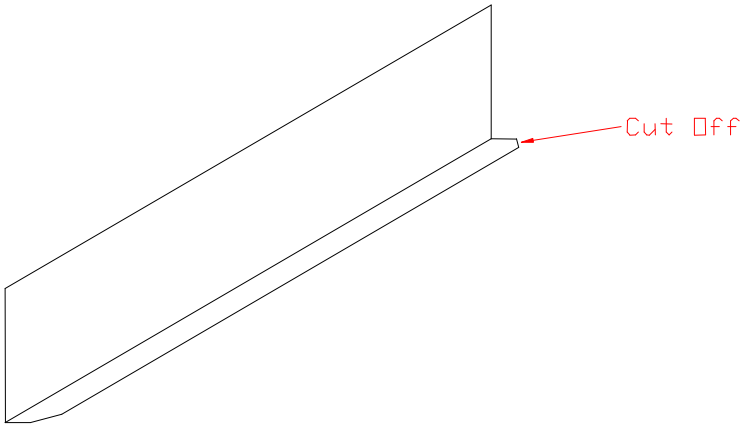



**Figure 1.11.2**

## 1.12 Inside Corners and Bend Radii

**Always have the largest possible radius in the corner or bend for strength.**

**See Figure 1.12.1.**


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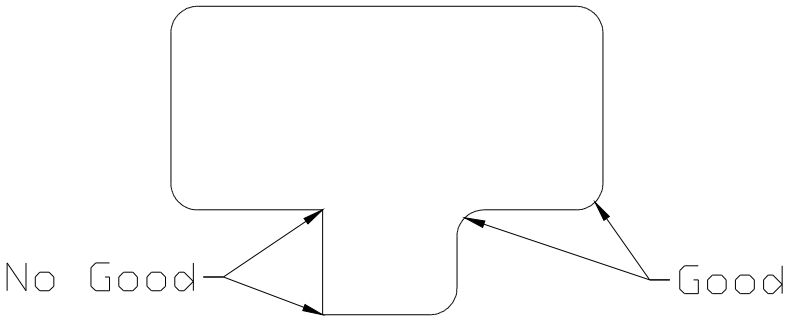



Figure 1.12.1


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## 1.13 Edge Distance

Edge distance is simply the distance from the center of the rivet or bolt hole to the edge of the skin, flange or fitting. The proper edge distance is required to ensure that the rivets or bolts are not ripped from their location because of inadequate shear strength.

The 'rule of thumb' is that the edge distance from center line of the hole to edge of material should always equal twice the rivet/bolt diameter.

At Murphy Aircraft we normally allow and additional 1/16" allowance in case we need to drill to the next size or trim material back. To go any greater dimension than this does not increase the strength, it just adds extra weight and can be unsightly.

**A** *circle template* **will assist you in laying out edge distance, they are cheap and easily obtainable at most office or school supply store.**

- Always make sure that you have adequate edge distance on your parts.
- Rule of thumb for edge distance is: Rivet or bolt diameter X 2

  i.e. 1/8" rivet X 2 = 1/4" edge distance

  or 3/16" bolt X 2 = 3/8" edge distance

**Avoid more than 2 1/2 times edge distance**

## 1.14 Riveting

The standard rivet used in all Murphy aircraft is the Avex rivet. Many people mistakenly refer to them as pop rivets. "Pop" is a brand name. The correct terminology is blind rivet which simply means it can be used from one side only. There are considerable differences between the Avex rivet and the more common pop rivet.

**Never substitute a pop type rivet for the Avex rivets.**

**In the kit there are three diameters of rivets, 1/8", 5/32" and 3/16". They come in various lengths. There are also two head styles, countersunk and domed. In addition, there are two materials, aluminum and stainless steel. The stainless steel rivets are used in a few locations, normally in high shear application. In your kit you will also find a number of large head all aluminum rivets. These rivets are non-structural and are used in installing the windows.**

- Always check carefully with the instructions to ensure you use the correct diameter, lengths, heads and material of rivet for the various locations and applications.
- Always check that you are using the proper grip length rivet for the job you are doing.

**i.e. 1/8" X 1/8" rivet [refers to diameter x grip length] will secure only up to 1/8" of material thickness, just as a 1/4" grip length rivet will secure only up to 1/4" of material.**

- Make sure the rivet is all the way into the hole and that the parts being riveted have not pulled away from each other or separated.
- Keep rivet gun square to the work when pulling rivets.


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**Rivet Chart**

| Rivet Number | Rivet Diameter & Length |
|---|---|
| RV-1410 | Rivet, 1/8" x 3/16" Avex |
| RV-1414 | Rivet, 1/8" x 5/16" Avex |
| RV-1512 | Rivet, 5/32" x 1/4" Avex |
| RV-1521 | Rivet, 5/32" x 1/2" Avex |
| RV-1613 | Rivet, 3/16" x 1/4" Avex |
| RV-1619 | Rivet, 3/16" x 3/8" Avex |
| RV-1621 | Rivet, 3/16" x 1/2" Avex |
| RV-1631 | Rivet, 3/16" x .781 Avex |
| RV-2621 | Rivet, 3/16" x 1/2" Avex LH |
| RV-2631 | Rivet, 3/16" x .781 Avex LH |
| RV-4412 | Rivet, 1/8" x 3/16" CSK Avex |
| RV-4621 | Rivet, 3/16" x .500 CSK Avex |
| RV-4514 | Rivet, 5/32" x 3/8" CSK Avex |
| RR-5402 | Rivet, 1/8" x 1/8" S.S. |
| RR-5404 | Rivet, 1/8" x 1/4" S.S. |
| RR-5406 | Rivet, 1/8" x 3/8" S.S. |
| RR-5408 | Rivet, 1/8" x 1/2" S.S. |
| RR-5602 | Rivet, 3/16" x 1/8" S.S. |
| RR-5604 | Rivet, 3/16" x 1/4" S.S. |
| RR-5606 | Rivet, 3/16" x 3/8" S.S. |
| RR-6602 | Rivet, 3/16 x 1/8 Closed End |
| RR-6406 | Rivet, 1/8" x 3/8" Closed End |
| RR-6604 | Rivet, 3/16 x 1/4 Closed End |
| RR-6606 | Rivet, 3/16 x 3/8 Closed End |
| RV-6614 | 3/16" x 1/2 SS Varigrip |
| RR-7402L | Rivet, 1/8" x 1/8" Fabric |
| RR-7404L | Rivet, 1/8 x 1/4" Large Head Al. |
| RR-7408 | Rivet, 1/8 x 1/2 " Aluminum |
| RR-8402 | Rivet, 1/8 x 1/8 Al/SS |
| RR-6402 | Rivet, 1/8 x 1/8" Closed End |
| RR-6403 | Rivet, 1/8 x 3/16 Closed End |
| RR-6404 | Rivet, 1/8 x 1/4 Closed End |
| MS2047OADS | Rivet, 1/8 " Solid Shank |
| RR-7604 | Rivet, 3/16" x 1/4" Alum |
| RR-5608 | Rivet, 3/16" x 1/2" S/S/ |
| riv-1 | Rivet, 1/8" x 5/16" SS |
| riv-2 | Rivet, 5/32" x 1/4" SS |

Note:
Length is the Maximum material thickness that can be riveted.

In the Rivet chart:

- LH = LARGE HEAD
- CKS = COUNTERSUNK OR FLUSH
- S.S = STAINLESS STEEL
- CLOSED END = TANK RIVET
- ALUM = ALL ALUMINUM


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## 1.15 Aircraft Solid-Shank Rivets

The solid-shank rivet increases in girth and strength when properly installed. A steel bolt will actually decrease in diameter when it is installed and torqued. Some manufacturers of special fasteners attempt to duplicate the natural action of solid-shank rivets by putting expanding sections on the fasteners' pulling stems. Most of these special fasteners only approximate the natural shank expansion of a driven solid-shank rivet.

**Since pure aluminum weighs one-third as much as steel, aluminum alloy solid-shank rivets are lighter than many other fasteners. Their lightness is an advantage, but it limits their usefulness: Solid-shank rivets greater than 1/2 inch in diameter are** not **used. However, the allowable range, between 3/32" and 1/2" in diameter, offers enough variety for the needs of most typical aircraft construction or repairs.**

## 1.16 Riveting Solid Shank

Riveting is sometimes referred to as a "mushrooming" process. When the rivet is being driven certain physical changes take place; the rivet diameter cross-sectional area increases, the manufactured head expands, the shank expands to the size of the hole, and the hardness of the rivet increases due to the cold working action changing its temper designation from T4 to T3

There are three steps involved in planning and executing a solid-shank rivet joint for structural repair, layout, installation, and inspection.

The chart below shows the rivet sizes, drill sizes, Cleco colors, bucking bar weights, minimum edge distances, and minimum rivet pitches for layout and installation of the commonly used solid-shank rivets.

| Rivet Diameter | Drill Size | Cleco Color | Bucking Bar Weight | Edge Distance | Rivet Pitch |
|---|---|---|---|---|---|
| 3/32 | 40 | Silver | 2-3.0 lbs | 6/32 | 9/32 |
| 1/8 | 30 | Copper | 3-4.0 lbs | 1/4 | 3/8 |
| 5/32 | 21 | Black | 3-4.5 lbs | 10/32 | 15/32 |
| 3/16 | 11 | Gold | 4-5.0 lbs | 6/16 | 9/16 |

Rivet spacing is important when laying out rivets to obtain a joint which is structurally sound and aesthetically balanced. The layout of rivets may be in rows abreast or transverse. One of the advantages of placing rivets in transverse row is that it reduces rivet failure along the metal's grain structure. Rivets laid out in rows abreast have a greater tendency to fail along the grain.

### Rivet Pitch

Rivet pitch is the distance between one rivet [and row of rivets] and the next rivet [or row of rivets]. Some handbooks refer to rivet pitch as gage.


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**Note:-**

- Minimum rivet pitch is 3D, or 3 diameters, of the rivet being driven.
- The diameter of a rivet is expressed as D and the length as L.
- Average rivet pitch is 6 to 8 diameters.
- Maximum rivet pitch is 24 times the thickness of the top sheet of metal.
- Minimum transverse rivet pitch is 2.5 diameters of the rivet being driven.

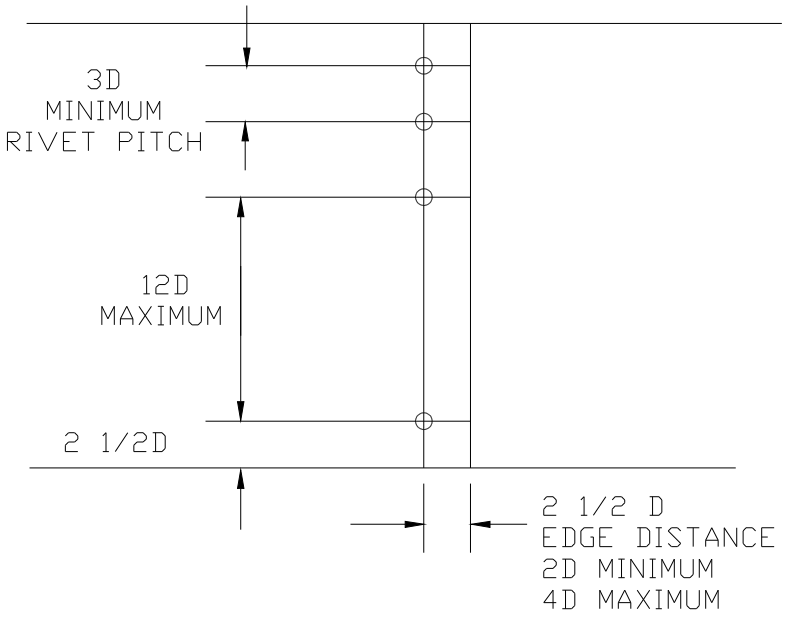



Figure 1.16.1

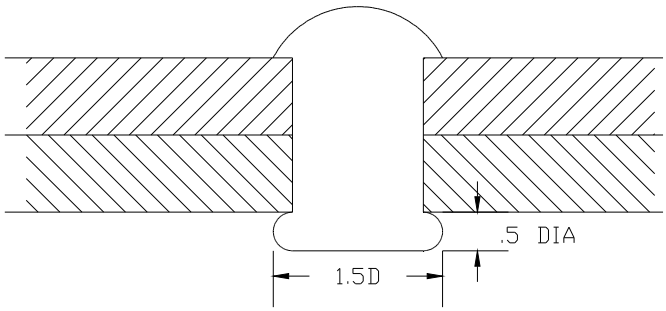
Edge distance [as previously described] is the distance from the edge of the metal to the center of the first rivet or row of rivets. On aircraft, the minimum edge distance is 2D and the maximum is 4D. If an edge distance is larger than 4D, the edges may curl upwards and not lie flat. When aircraft rivets are installed, if using less that 2D edge distance, the bearing edge strength of the metal will be weakened.

All rivet holes must be center punched prior to drilling, this will prevent the drill from 'walking' over the surface of the metal and defacing it. The indentation made by a center punch must be hard enough to catch the point of the drill, yet light enough to prevent denting the surrounding mental.

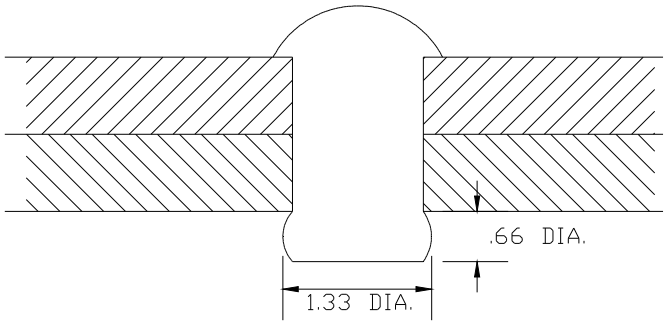
Proper drill selection depends upon the size of the rivet being used. The hole for a solid-shank rivet is drilled approximately .002 to .004 of an inch larger than the nominal rivet diameter.

A rivet that is driven into a properly prepared hole needs to be sized according to diameter and length so that a correct size bucktail can be formed. Figure 1.16.2 shows the width and height of a normally driven bucktail.

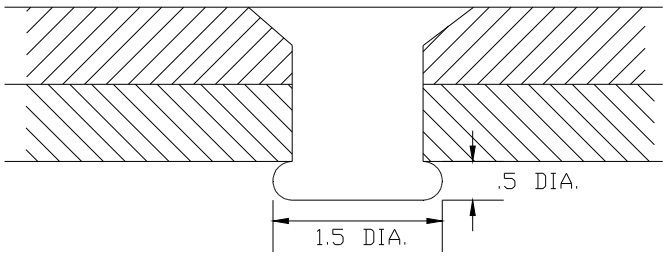

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RECOMMENDED UPSET DIMENSIONS ARE
1.5D WIDE, .5D HIGH, NEVER FLATTER




FOR THIN SKINNED AIRCRAFT THE
RECOMMENDED UPSET DIMENSIONS ARE
1.33 x DIA. WIDE AND .66 x DIA. HIGH




COUNTERSUNK RIVETS ARE DRIVEN TO THE SAME
UPSET DIMENSION AS UNIVERSAL HEAD RIVETS

Figure 1.16.2

The use of thin skins on many light aircraft requires that the upset rivet head be 0.66 times the diameter of the rivet height, and 1.33 inches times the diameter of the rivet wide.

To determine the rivet length for a particular job, the thickness of all the metal parts must be known. The total thickness of all the individual thickness of the metal to be secured is referred to as the grip length. The grip length plus 1.5D is the proper length of the rivet, see Figure 1.16.3.


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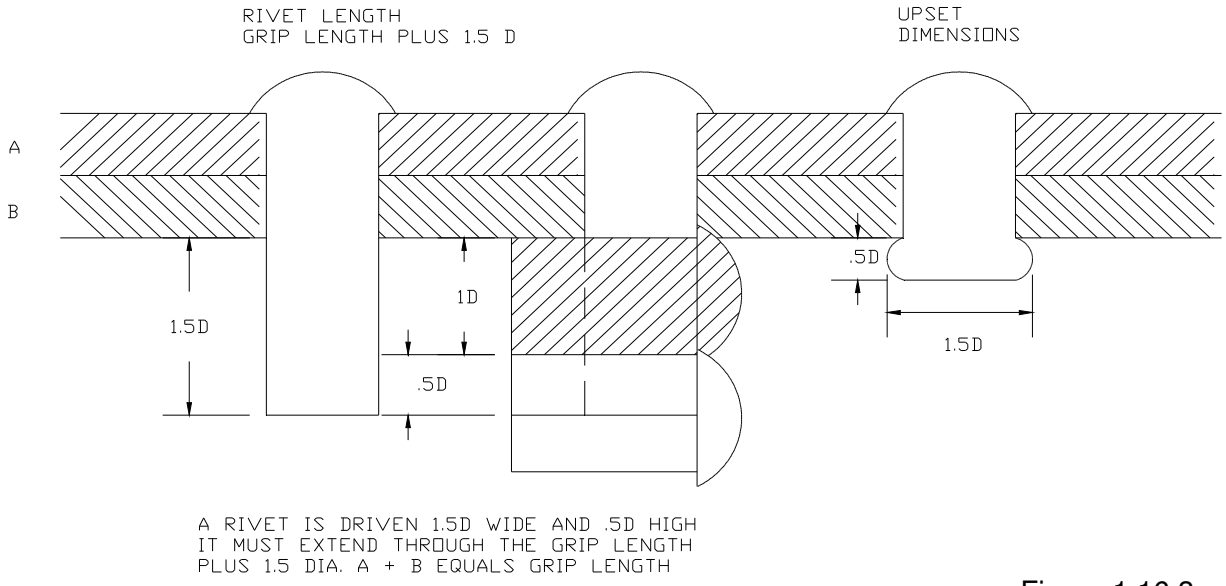



Figure 1.16.3

The hand tool used to drive a rivet is called a pneumatic rivet gun or rivet hammer. Rivet guns are normally powered by compressed air and are classified as light-, medium-, or heavy-hitting.

- A light-hitting gun is used to install 3/32 and 1/8 inch diameter rivets.
- Medium-hitting guns are used to install 5/32 and 3/16 inch diameter rivets.
- Heavy-hitting guns are used to install larger diameter rivets and some special fasteners.

There are two types of gun sets, one for universal head rivets and one for countersunk.

- The universal gun set is sized to fit the various shapes of manufactured heads on the rivet's driven end. The opposite end of the universal gun set fits into the rivet gun barrel and is held in place by a beehive retainer spring.

- The countersunk gun set fits all sizes of flush head rivets. The countersunk rivet cannot use the beehive retainer ring. The countersunk rivet set uses a specially designed retainer spring.

## 1.17 Bucking Bars

**The tool used to form an upset head while using a pneumatic rivet gun is called a bucking bar. Bucking bars are made in various shapes, sizes and weights. The weight of the bucking bar must be proportional to the size of the rivet.**

**To obtain a proper upset head, a good technique to use is shown in Figure 1.17.1. As the gun is firing, press the bucking bar firmly against the forming rivet shank and roll the bar slightly. This rolling action will aid in the formation of a barrel-shaped buck tail.**


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If the bucking bar is too light for the size of rivet and gun, the metal will bend toward the bucktail. If the bucking bar is not held firmly against the rivet shank, the metal will bend away from the gun.

The face of the bucking bar must be smooth with no nicks or scars. The presence of nicks or scars on the face of the bucking bar will mark the bucktails and could lead to rivet failure.

All scarred or marked bucktails must be drilled out and replaced with fresh, unmarked rivets.

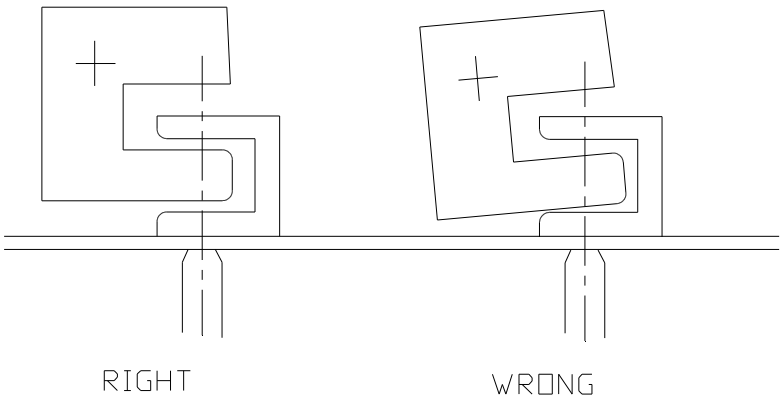



Figure 1.17.1

## 1.18 Rivet Codes and Identification

**The manufacturing of all solid-shank rivets is governed by Federal Specifications and Standards QQ-A-430. Solid-shank rivets are identified and catalogued by head shape, alloy contend, shank diameter, and shank length. See Figure 1.18.1**

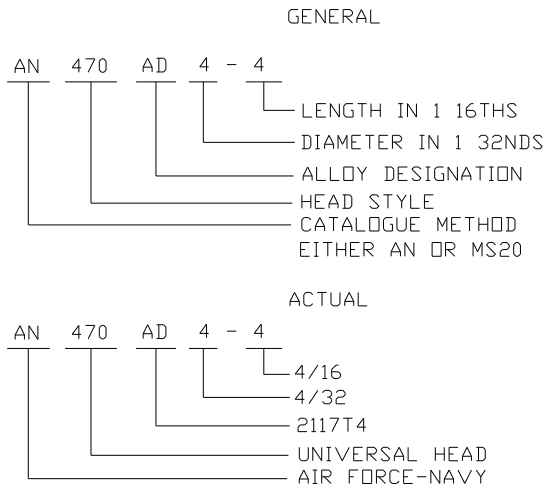



Figure 1.18.1


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Two shorthand methods of coding are used to identify all aircraft rivets.

For example: - AN470AD4-5, or MS20470AD4-5.

- AN means Air Force-Navy and MS20 means Military Standards 20.
- 470 designate a universal style rivet head.
- AD refers to the alloy 2117T4.
- The hyphenated numbers designate the rivet diameter in thirty-seconds of an inch and the length in sixteenths of an inch. Thus, in this example, 4 means 4/32nds-inch diameter, and 5 means 5/16ths-inch length.

Although the AN and MS20 methods of cataloguing rivets are similar, it is important to be consistent in which of the two methods are used when ordering or identifying rivets. The rivet code is also used in blueprints, drawings, and technical manuals.

## 1.19 Rivet Head Styles

**Four styles of rivet heads are used to construct an aircraft: round, flat, universal, and countersunk. The latter two being the most commonly used.**

**Figure 1.19.1 is a cross-sectional view of the universal and countersunk head rivets, showing their diameters and lengths.**

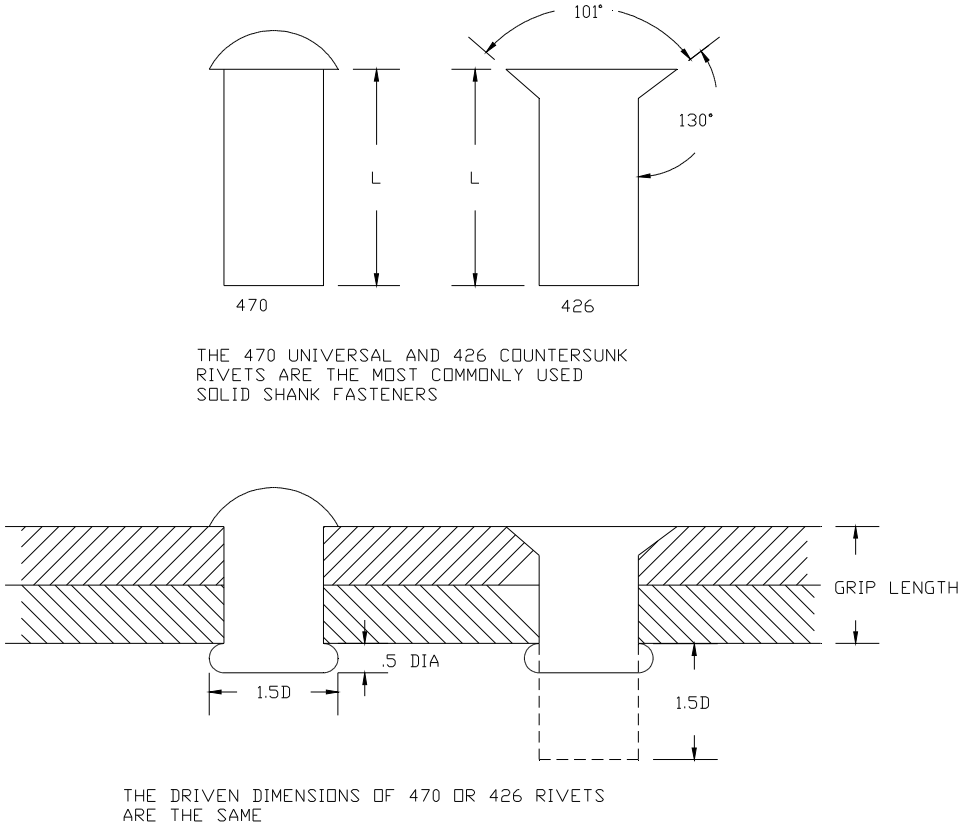



Figure 1.19.1


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## 1.20 Universal Head Rivets

**Universal head rivets, also known as protruding head rivets, are used internally in structural areas and on the skin surfaces of low to medium speed aircraft. A universal head rivet can with stand a much stronger bearing load than a countersunk rivet because the head is installed flat and binding on the surface of the riveted metal while the countersunk rivet is installed into a machine-tapered well.**

**The universal head rivet is a combination of several older head styles. When rivets were first used, various rivet head styles were available. Round head (AN430) rivets were used internally on high strength structural areas. The flat head (AN442) rivet was used in tight areas where the round head could not be installed. Some modern jet aircraft still use round and flat head rivets in structural areas.**

**Aircraft built prior to World War II were low speed aircraft, so a smooth aerodynamic air flow over the wing was not a major concern. As the speed of the aircraft increased, the need for smaller protruding head rivets accounted for the development of a modified brazier head (456), which causes less drag than larger protruding head rivets. Today, brazier head rivet styles are likely to be found only on aircraft built before 1955. Because the rivet sets used to drive rivets other than universals are difficult to obtain today, the older styles can be replaced by universal head rivets. Advisory Circular 43.14-1 explains the procedure.**

## 1.21 Countersunk Rivets

**As aircraft speeds increased, the need for smooth airfoils led to the development of the countersunk rivet. After experimenting with head angles of 78°, 90° and on high-speed jet fighters, 110°, the aircraft industry adopted a 100° standard. All of these experiments were attempts to increase the bearing strength of the rivet head around the skin.**

**The countersunk rivet has to be installed in a depression in such a way as to be flush with the surface of the skins it is holding together. The depression in the skin is called a nest or a well. The well can be made using a freehand or microstop countersink cutter.**

**Whenever the metal is cut to form a well or nest, the area around the rivet head is weakened. To compensate for this loss of strength, aircraft manufactures must install a greater number of rivets in order to increase bearing and shearing strengths. Figure 1.21.1 shows how countersunk rivets re installed, by either machine or dimple methods**

**To remedy the loss in bearing strength caused by machine countersinking, the NACA (National Advisory Commission for Aeronautics) developed a method of countersinking that has been adopted by aircraft manufacturing companies.**


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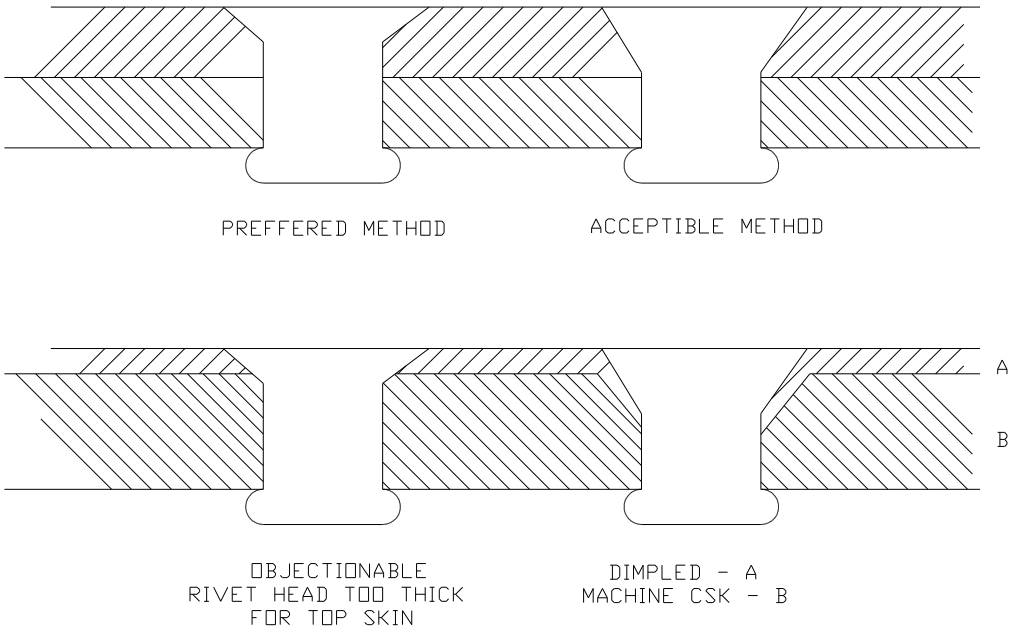



Figure 1.21.1

Two different angles may be cut into the top skin, 60° or 82°. Military aircraft were the first to use the 60° well on some of the older jet fighters. The 82° well is used when installing wing slugs on the Boeing 747. On some aircraft, a universal is installed from the inside of the wing and driven into an 82° well.

Installing rivets using either the 60° or 82° NACA countersink method makes them as strong as universal head rivets. When coldworked, the bucktail formed in the 60° or 82° angle well is stronger than the conventional countersink riveting method because the driven head is packed into its well, creating a much stronger head than the regular countersunk rivet can produce.

## 1.22 Dimpling

**Thin skins are never machine countersunk, because the cutter will go completely through the thin skin into the second skin and reduce the bearing strength around the countersunk rivet head. There is an alternative process called 'dimpling', which solves this problem.**

**Dimpling can be done in two ways, cold dimpling or hot dimpling [for thicker aluminum alloys, not discussed in this document]. Cold dimpling of sheet metal skins is done on material less than 0.040 of an inch thick if countersunk rivets are required. The benefit of cold dimpling is that it produces stronger shearing and bearing strengths in the joint than would a driven universal head rivet of the same size.**

**Dimpling bars or sets can be made in the shop by cutting steel stock to the same size as the rivet to be used, and then setting a microstop countersink to cut about 0.015 of an inch deeper than the rivet head.**


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**To use the dimpling bar, drill a hole into the sheet metal just as you would for a universal head rivet, place the dimpling bar under the rivet hole and insert a countersink rivet. Using a rivet gun with a mushroom head set or a ball peen hammer, tap the rivet head into the dimpled well. Because dimpling does not produce the flushness of a machine countersunk rivet, be careful not to hit the area around the head too hard, or the metal surrounding the rivet will stretch, creating a problem which could be difficult to remedy. Metal that becomes stretched must be removed and replaced either by a patch or by changing a complete skin panel.**

## 1.23 Inspection of a Rivet Joint

**There are three places to check when inspecting a rivet joint: The MFG [manufactured] head, the shop head, and the skin around the rivet heads. Any damage to either of the two rivet heads is not critical because rivets can be drilled out and replaced.**

Note: **Never oversize the hole when drilling out a damaged rivet!**

- If skin damage is extensive, a new skin panel must be installed.

The procedure for removing rivets depends upon the situation. If, for example, an aircraft has extensive damage to a wing leading edge or a section of the spar, the mechanic will remove the damaged metal as well as some of the parts that are still useable. In removing rivets from reusable aircraft parts, it is essential that the rivet holes do not become oversized.

**The correct way to remove the rivets is as follows:-**

1. File a flat spot on all protruding head rivets except the 2117 rivets.
2. Center punch each MFG head.
3. Back up each rivet with a bucking bar.
4. **Select a drill** *ONE SIZE SMALLER THAN THE RIVET BEING REMOVED***.**
5. Drill each rivet to only the depth of the MFG. head.
6. Use a pin punch, the same size as the drill, to snap off the drilled MFG. heads.
7. Back up each remaining stem by tapping out the shank without stretching the metal.

**A different procedure is followed in removing the occasional rivet badly driven during re-assembly.**

1. Such rivets should be removed by the same size drill as the rivets being installed.
2. Drill the depth of the MFG. head only.
3. Lightly tap off the MFG. head.
4. Gently knock out the remaining shank.


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Figure 1.23.1 illustrates an assortment of faulty rivets which must be removed and replaced. The most troublesome rivet fault is a clinched rivet, which results from improper bucking action. The rivet forms to one side, which can lead to a corrosive condition at a later date. Rivets that crack do so because they became too hard while the bucktail was forming. This is a result of hitting the rivet too lightly or allowing an icebox* rivet to recover its age hardening by keeping it out of the freezer too long before driving.

** Icebox rivet is a nickname given to rivets made of alloy 2017T4, more than 3/16 of an inch in diameter, and all rivets of the alloy 2024T4.These two alloys are too hard to drive in their original heat-treated condition. They must be re-heat treated and kept in a frozen condition until ready for use.*

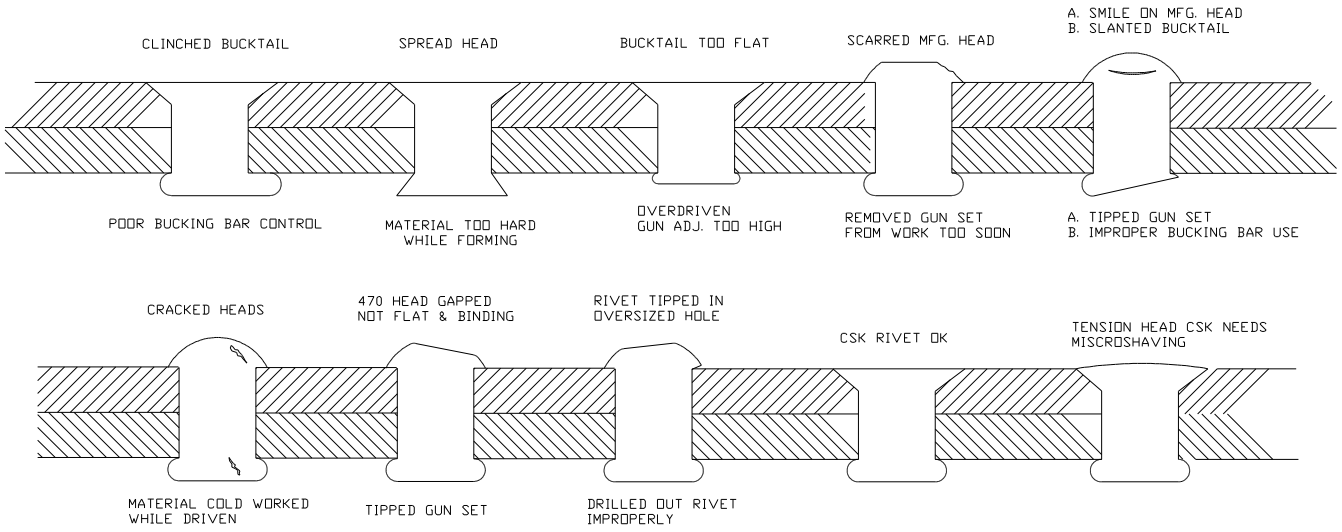



Figure 1.23.1


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## 1.24 Fiberglass Construction

**Fairings, cowlings and wing tips for the aircraft are fiberglass; you will be required to work with fibreglass to fit these parts. You will be required to purchase enough fiberglass cloth, resin and catalyst to complete and fit these parts.**

**It is highly recommended that the builder review the construction of the fairing sections at this time in order to understand the work they need to perform.**

**The following list has some recommendations about using fiberglass.**

- As the windshield installation involves the use of fiberglass, it is suggested that the builder install the windshield before working on the fairings. This will give the builder practice using fiberglass.
- If a builder chooses to follow our instructions, a proven fairing will result; the builder may also employ some of his/her own creativity into the construction.
- Keep the weave of the cloth straight and mark your cuts with a black felt pen. Cut the cloth with sharp scissors.
- If the fiberglass cloth lies smoothly while dry, it will easily conform to the mold when wetted out with resin.
- Keep the fiberglass cloth clean. If possible, keep it in an area away from where you will be using the resin. Oil, dirt or solvents will deteriorate the cloth and prevent the resin from properly bonding to the cloth.
- It is much easier to handle fiberglass cloth if you spread it over a smooth slick surface. Keep the loose ends of the fiberglass trimmed if possible.
- Keep all necessary tools at hand. Ensure you have good light and work in a well ventilated area. Keep the room temperature between 68 to 80 degrees Fahrenheit.
- Always abide by the instructions and warning labels provided on the resin containers.
- Allow yourself plenty of time to work with the fiberglass and resin.

If more information is required about the use of fiberglass or lay-up procedures, an excellent reference book is Sportplane Construction Techniques by Tony Bingelis. This book can be purchased at any EAA Bookstore or EAA Chapter.


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## 1.25 Making Gussets

**A gusset is a flat, often triangular plate, used to connect and reinforce a joint where several members meet at different angles. In this section we show the method by which gussets can be made easily and that will fit and function correctly.**

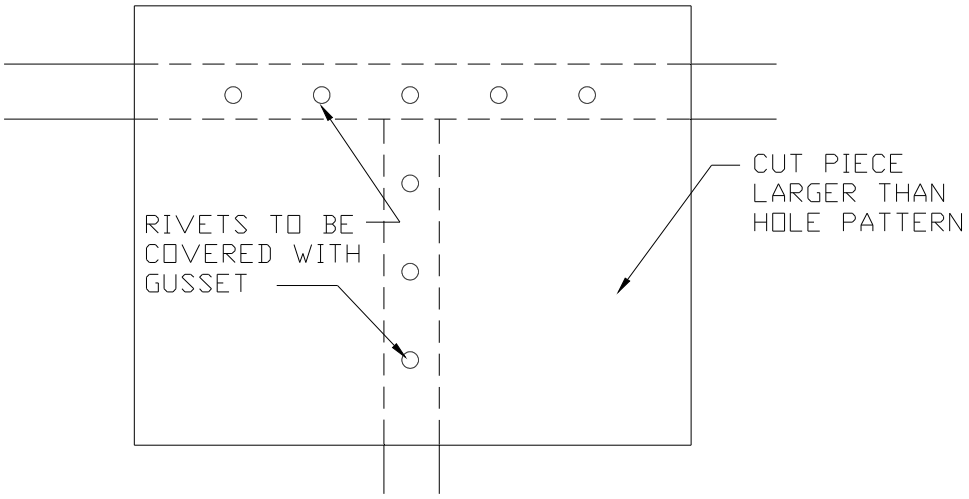
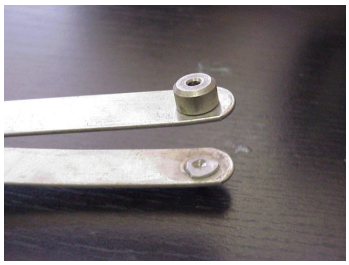



Figure 1.25.1

1. Where a gusset is required, decide the size and number of rivet holes to be reinforced. Cut a piece of the appropriate material to a size greater than the holes to be covered. See Figure 1.25.1.

2. If possible, backdrill through the rivet holes. Cleco while drilling.

3. If unable to backdrill, another method to transfer the hole pattern needs to be sought.



It may be possible to use a 'hole finder' as pictured

4. Remove the gusset.

5. Draw circles around the end holes to mark out the shape of the gusset. As shown in Figure 1.25.2. The radius of the circle should be two times the hole diameter.


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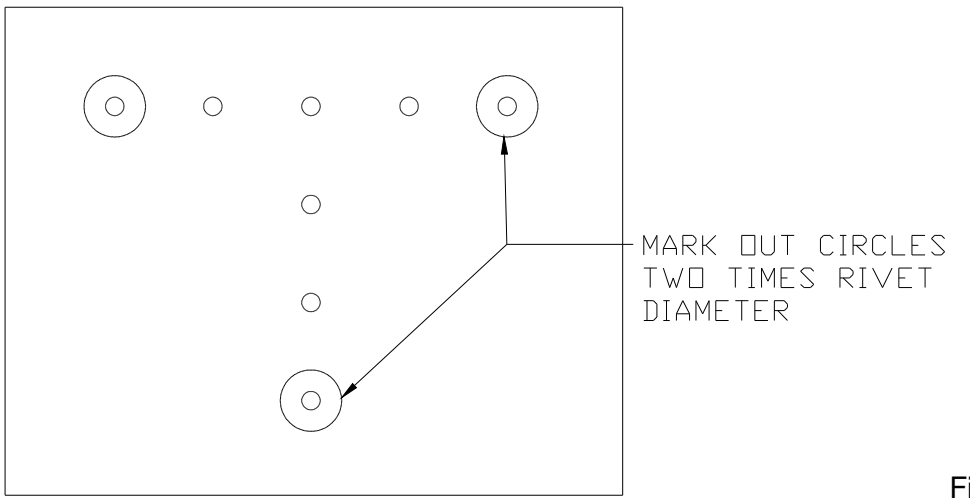



Figure 1.25.2

6. Draw tangent lines to the circles. See Figure 1.25.3.

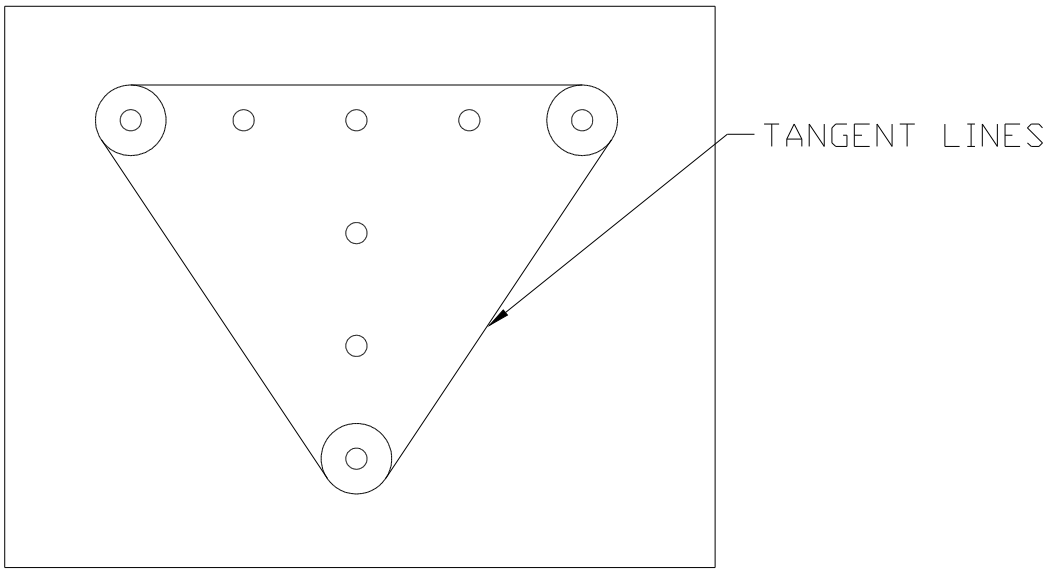



Figure 1.25.3

7. Cut out the gusset following the marked lines.
8. Deburr all edges.
9. Cleco the finished gusset in place, and rivet.

NOTE: **This method will also work for odd shaped gussets. Follow the rivet pattern, mark out the circles and shape by the same method as described above.**


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## 1.26 Using Sealant

**WARNING –**

When using sealants:-

- Always wear good quality rubber gloves.
- Avoid getting sealant on your skin. If sealant does get on to your skin, use a brush and soapy water to remove. – do not use solvent, M.E.K. etc. on skin.
- Always work in a well ventilated area.

- To prepare surfaces ready for applying sealant, use a Scotchbrite pad and scuff surfaces well.

**Immediately before applying sealant, ensure all surfaces are clean and free of dust particles.**

- **DO NOT USE ANY SOLVENT OR M.E.K. AFTER SCOTCHBRITING THE SURFACE**

- The sealant used is a two part mixture. It is very important that the mix ratio specified by the manufacturer is adhered to exactly and that it is used at room temperature. Improper mix ratio or too low a temperature may slow or stop the sealant from curing.

- A small inexpensive digital scale is very useful in ensuring the right mixture.

- Only mix enough sealant to do the job, it cannot be stored. It is better to under estimate and run out before completing an assembly. You can always mix a little more to finish up. Working time is about 2 hrs.

- The best way to mix the sealant is on a flat sheet of material, such as aluminum. Use a putty knife or a piece of aluminum to mix.

- When mixing, scrape sealant upwards from mixing surface to make ensure a complete and smooth and even mix.

- How much do I use? - After riveting you should see a small amount of sealer being squeezed out all along the joint.

## 1.27 Do's and Don'ts in Handling Aluminum Sheets

- Do **- use a soft leaded pencil or a fine tip felt pen to mark aluminum sheet.**
- Do **- bend aluminum where possible so the flange bend line runs perpendicular to the metal grain (direction or rolling).**
- Do **- use the recommended minimum or larger bend radius in bending aluminum sheet.**
- Do **- use a protective layer between adjacent alclad sheets.**
- Do **- store aluminum sheet in a dry area.**
- Don't **- scratch the surface of aluminum – retain plastic film or protect sheet against abrasion.**


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- Don't **-use a brown sulphite sand paper -this paper, when wet, will cause corrosion**


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## 1.28 Cable Rigging

**Follow the instructions that come with the nico press tools you use. It is very important that a GO-NO gauge or callipers are used after crimping to ensure the crimping is complete.**

.


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## 1.29 Push Pull Tube Fabrication

The following is a standard practice for manufacturing the push pull tubes used throughout the aircraft.

The example shown is for the 1/4" (HM-4M) Rod End Bearing in 3/4" x .035 tubing. Other combinations are:

- 1/4" HM-4M Rod End Bearing, AN316-4 Jam Nut and CC-28 End Plug for 1" x .058 tubing
- 5/16" HM-5M Rod End Bearing, AN316-5 Jam Nut and CC-30 End Plug for 1" x .058 tubing.

**To determine the length of the tubing between the two Rod End Bearings:-**

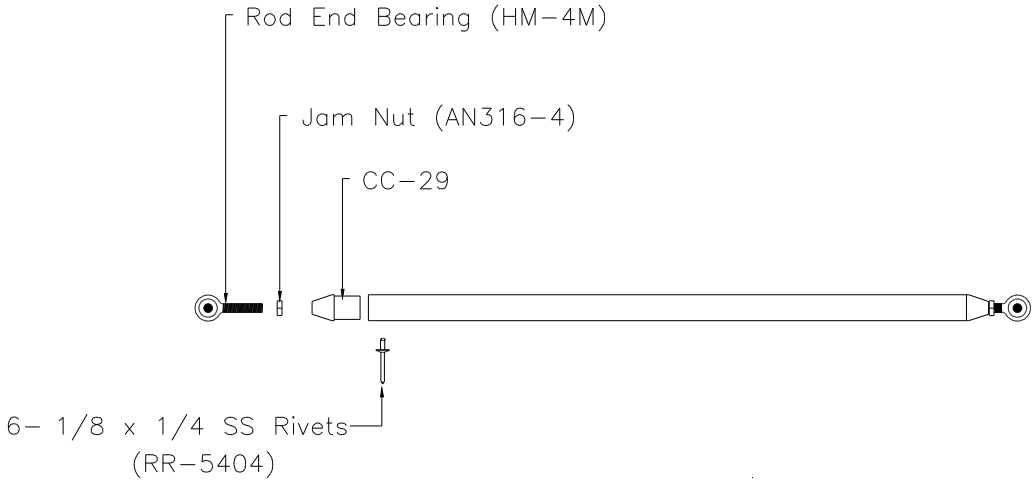



**Figure 1.29.1**

**Calculate or measure the total length required between centers of the rod end bearings.**

**Add together: 2 x the head of the end plugs and 2 x [the thickness of the jam nut plus 3 to 5 threads plus distance from top thread to center of the rod end].**

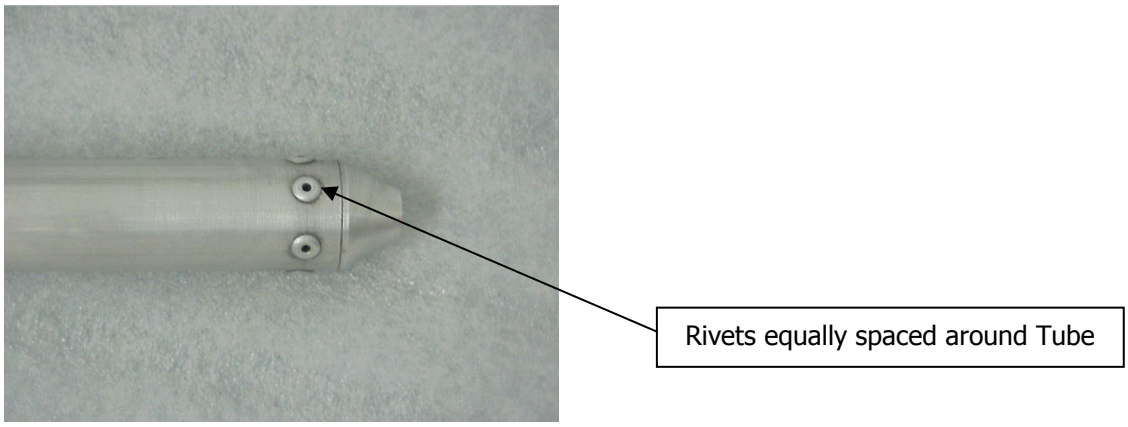
**Deduct the sum from the total length required.**

**Cut the tube and deburr the ends.**

**Insert the appropriate CC End Plug.**

**On the tube draw a line 3/8" in from both ends and layout an equally spaced rivet pattern of 6 holes**


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**Drill #30 holes. Remove the End Plugs. Deburr, zinc chromate and re-install the parts**

**Rivet together using RR-5404 1/8" x 1/4" SS rivet.**

## 1.30 Reamers

The reamer is a tool used to produce holes of very close tolerances. Reamers are available in a range of sizes and types to cover the various hole diameters.

In using the reamer there are several pointers that bear mentioning:

- Be sure the reamer is lined up perfectly with the hole.
- Never remove more than 0.012 of material in one operation.
- A reamer should never be turned backward after the reaming operation has been started.


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## 1.31 Metal Working Glossary of Terms

| | |
|---|---|
| **DUCTILITY** | **The ability of a metal to be permanently deformed under tension without fracturing.**<br><br>**A good example is wire which is drawn and stretched to dimension through a series of dies.** |
| **ELASTIC LIMIT** | **The maximum stress that a metal will withstand without permanent deformation.** |
| **ELONGATION** | **Elongation is a percentage figure determined by measuring the amount of stretch a material test specimen can be pulled after the** elastic limit **or** yield point **has been passed until the metal is fractured** |
| **FATIGUE** | **A term used to describe the progressive failure of a metal part under conditions of cyclic loading.** |
| **MALLEABILITY** | **The ease with which a metal may be hammered or deformed under compression without cracking or fracturing.** |
| **HARDNESS** | **Hardness is the ability of a metal to resist indentation; or the ability to resist wear against other metals.**<br><br>**Relative hardness may be determined by scratching one metal against another to see which is harder** |
| **PLASTICITY** | **The degree of deformation a metal will withstand without permanent rupture.** |
| **TENSILE STRENGTH** | **The maximum unit stress that a material can be stretched to fracture-sometimes referred to as "ultimate strength".** |
| **TOUGHNESS** | **That property in metal, relative to strength and ductility, which allows the metal to absorb work.** |
| **WORKABILITY** | **A general term applied to metals which refers to the ease with which a metal may be formed (worked).** |
| **YIELD POINT** | **The minimum unit loading which will produce permanent deformation.** |


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## 1.32 Turnbuckle Assemblies

Turnbuckle assemblies are used with control cables to provide desired cable tension. They are made in a range of sizes and in both long “L” and short “S” assemblies. The long assembly is indicated by the letter “L” and the short assembly is indicated by the letter “S” following the dash number. The size is given by the dash number indicating the rated strength of the assembly in hundreds of pounds. The assemblies are made up of three parts (1 barrel and 2 ends). The barrel is made of brass and the ends of 2330 nickel steel heat treated by 125,000 lbs / sq. in. and cadmium plated. The threads on all parts are Class 3NF

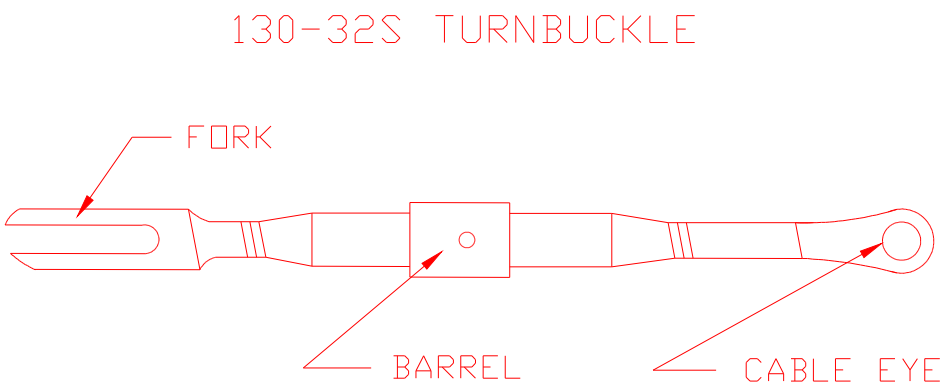



Figure 1.32.1

## 1.33 Safety Methods for Turnbuckles

General: **Make safe all turnbuckles with safety wire using either the double or single wrap method, or by using any appropriately approved special ‘safe-tying’ device complying with the requirements of FAA Technical Standard Order TSO-C21. The swaged and unswaged turnbuckle assemblies are covered by AN Standard Drawings.**

- Ensure the correct safety wire sizes and materials are used.
- Do not reuse safety wire**.**
- Adjust the turnbuckle to the correct cable tension so that no more than three threads are exposed on either side of the turnbuckle barrel.
- Do not lubricate turnbuckles**.**


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**Double Wrap Method of using safety wire for 'safe-tying' turnbuckles, this is the preferred method, although either of the other methods described is satisfactory.**

The method of double wrap 'safe-tying' is shown in Figure 1.33.1.

1. Use two separate lengths of the proper wire.
2. Run one end of the wire through the hole in the barrel of the turnbuckle and bend the end of the wire towards opposite ends of the turnbuckle.
3. Pass the second length of the wire into the hole in the barrel and bend the ends along the barrel on the side opposite the first.
4. Spiral the two wires in opposite directions around the barrel to cross each other twice between the center hole and the ends.
5. Pass the wires at the end of the turnbuckle in opposite directions through the holes in the turnbuckle eyes or between the jaws of the turnbuckle fork.
6. Lay one wire along the barrel and wrapping the other at least four times around the shank of the turnbuckle, binding the laid wires in place before cutting the wrapped wire off.
7. Wrap the remaining length of safety wire at least four turns around the shank and cut it off.
8. Repeat the procedure at the opposite end of the turnbuckle.

**Swaged terminal method of 'safe-tying' is as follows:**

1. Pass the ends of both wires; through the hole provided in the terminal [if the hole is too small, enlarge it slightly if possible].
2. Wrap both ends around the shank as described above.

Note: **If it is not possible to enlarge the hole enough to allow passage of both wires, pass one wire through the hole and loop it over the free end of the other wire, and then wrap both ends around the shank as described.**

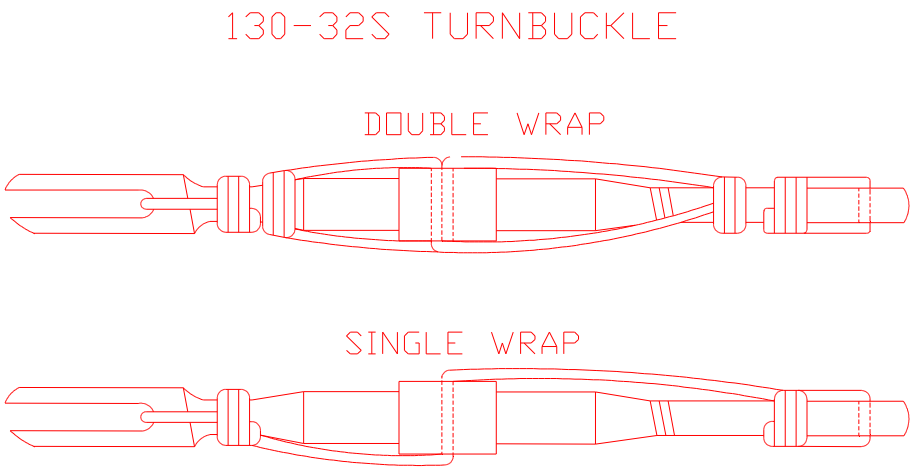



Figure 1.40.1

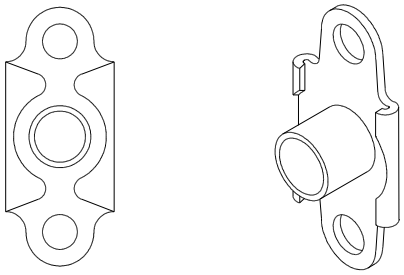

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## 1.34 Nut Plates (Floating Anchor Nuts)

Nut Plates may used in areas where you need to frequently remove a plate or part for inspection purposes, or where it is impossible to get access to hold a nut to fasten.

**Installing Nut Plates**:

1. If a hole is not already in place, locate the position you wish to fit the nut plate.
2. Drill a clearance hole for the bolt.
3. Partially screw the bolt into the nut plate to aid supporting it, and with the nut plate held in place drill #40 holes through the holes in the flanges on the nut plate.
4. Remove the nut and drill the two flange holes out to #30.
5. On your work area drill the two #40 holes out to #30 and countersink (or dimple) to accept a RV-4412 CSK rivet.
6. Deburr all parts.
7. Cleco the nut plate on the back side of the work and rivet. See Figure 1.34.1.



F5000-3

Figure 1.34.1


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## 1.35 Some Final Thoughts...

The last page of this section contains instructions for building a work table, if you do not have one. Any table will do as long as it is sufficient in size and robust enough to build all the components on. The most important and critical thing is to ensure that the table is absolutely flat, containing no twists. Any twist in the table will translate into twisted aircraft sections, which usually results in an aircraft that doesn't fly straight hands off.

When you are reading the drawings, you will see both solid and dashed lines. This is standard drawing practice and the solid lines denote the top most [visible] layer of material while dashed lines denote a part or material layer hidden [non visible] beneath another.

A common request throughout the manual is for you to draw a center line down the flange of parts. This center line is used for lining up the part with a pre-punched hole in another part. This line, drawn with a felt pen, is for reference only and does not to be 100% accurate.

> *We have heard many stories of builders spending numerous hours measuring and drawing lines or creating apparatus to do the same. Such extremes are not necessary. At Murphy Aircraft, we simply hold the felt pen between the thumb and forefinger and use the middle finger as a gauge. By eyeball estimating only, put the tip of the pen in the center of the flange and using the middle finger as a slider, run the pen along the part, drawing your middle line.*

Cleco, Cleco pliers, #40 holes, #30 holes. If these are strange sounding words, about a thousand hours from now they will be second nature to you.

- A Cleco is a temporary "clamp" that utilizes existing pre-punched holes to secure parts to each other.
- Cleco pliers are used to install/remove Clecos.
- Clecos come in four colors to help differentiate between sizes.
    - Silver Clecos are 3/32" and are used in #40 holes.
    - Brass Clecos are 1/8" and are used in #30 holes.
    - Gold Clecos are 3/16" and are used in #11 holes.
    - Black Clecos are 5/32" and are used in #21 holes.

The majority of holes in the pre-punched panels are #40. These are pilot holes, and using 3/32" Clecos (silver) allow for aligning of parts for final drilling. As you drill out the holes to the required size, try to place Cleco every forth or fifth hole to ensure proper part alignment. When the #40 holes are drilled out to #30, to maintain correct location, drill the first hole then fit a 1/8" Cleco (brass) into it before removing the next 3/32" Cleco ready to drill, repeat hole by hole, replacing the small for the large Clecos as you go.

Before beginning construction of each component, read the relevant manual section to gain a full understanding of what is required before starting, it may mean reading more than once and be referred to again during building.

Whenever possible, lay the all the parts out in order on the table as per the exploded drawings at the beginning of the section. This will help to gain a better understanding of what you are building and the route you have to take to do so. Also errors are less likely to occur.


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## 1.36 SR Series Work Table Construction

**To build your kit safely, you require a sturdy worktable of a suitable size, as stated before:-**

> *"The most important and critical thing is to ensure that the table is absolutely flat, containing no twists. Any twist in the table will translate into twisted aircraft sections, which usually results in an aircraft that doesn't fly straight hands off"***.**

Bear this in mind as it is worth taking the time and effort to ensure the trueness when constructing your work table.

**Material requirements**

| PART | DESCRIPTION | QUANTITY |
|---|---|---|
| A | ¾" X 7 ¾ " X 24 ½ " PLYWOOD PIECES | 9 |
| B | ¾" X 7 ¾ " X 94" PLYWOOD PIECES | 4 |
| C | ¾" X 7 ¾ " X 96 " PLYWOOD PIECES | 2 |
| D | ¾" X 30 " X 96 " PLYWOOD PIECES | 2 |
| E | ¾" X 6 " X 30 " PLYWOOD PIECES | 10 |
| F | ¾" X 6 " X 92 ½ " PLYWOOD PIECES | 4 |
| G | ¾" X 6 " X 21 ½ " PLYWOOD PIECES | 5 |
| H | 2" X 2 " X 7 ¾ " WOOD PIECES | 4 |
| J | 2" X 2 " X 6 " WOOD PIECES | 4 |
| | WOOD GLUE | TO SUIT |
| | WOOD SCREWS 1 ½" AND 2 ½" | TO SUIT |


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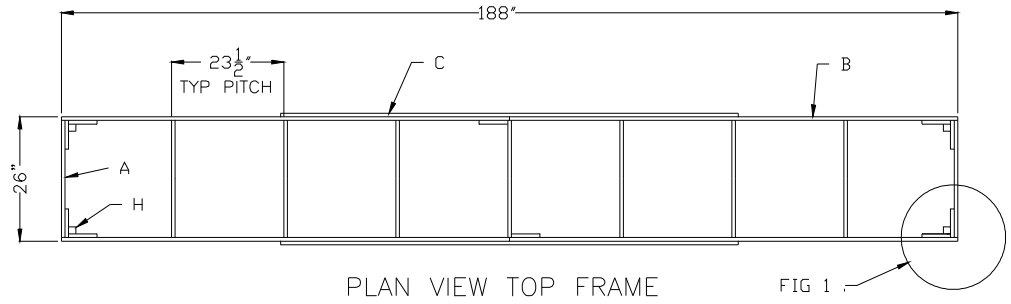



Fig 1.36.1

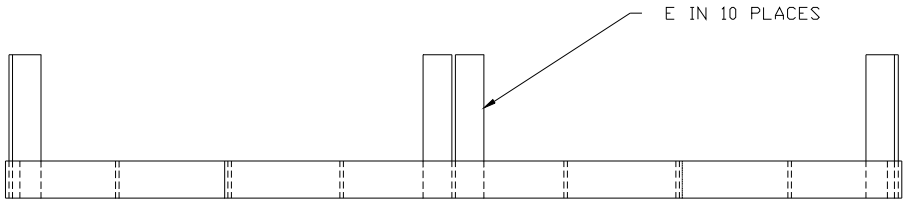



Fig 1.36.2

SIDE VIEW TOP FRAME [LEGS UP]

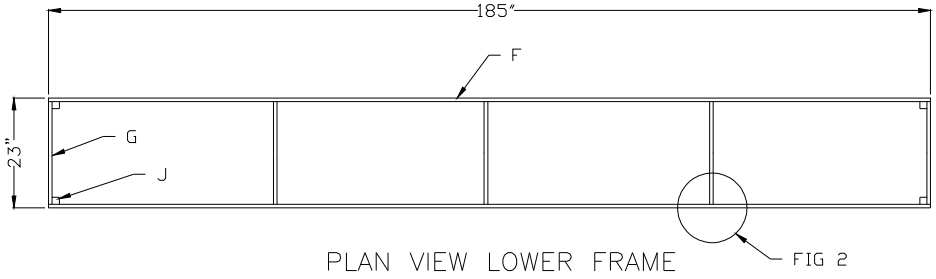



Fig 1.36.3

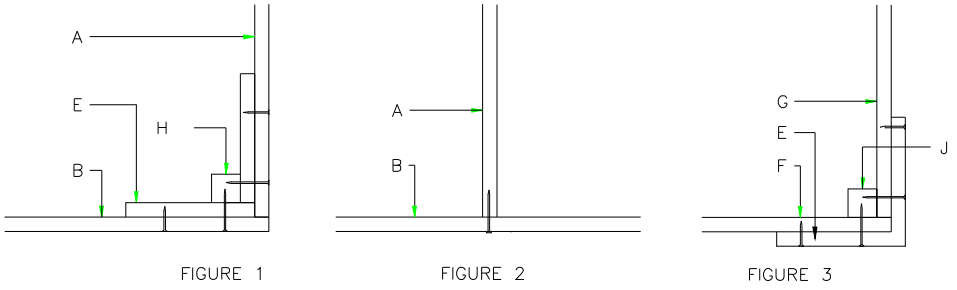



Fig 1.36.4

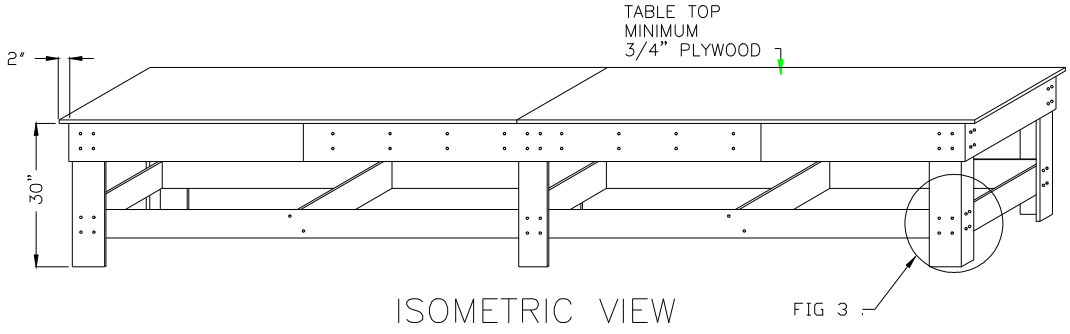



Fig 1.36.5

DGM1185


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## 1.37 REBEL, ELITE & MAVERICK Work Table Construction

**Material requirements**

| PART | DESCRIPTION | QUANTITY |
|---|---|---|
| A | ¾" X 7 ¾ " X 42 ½ " PLYWOOD PIECES | 9 |
| B | ¾" X 7 ¾ " X 94" PLYWOOD PIECES | 4 |
| C | ¾" X 7 ¾ " X 96 " PLYWOOD PIECES | 2 |
| D | ¾" X 48" X 96 " PLYWOOD PIECES | 2 |
| E | ¾" X 6 " X 30 " PLYWOOD PIECES | 10 |
| F | ¾" X 6 " X 92 ½ " PLYWOOD PIECES | 4 |
| G | ¾" X 6 " X 39 ½ " PLYWOOD PIECES | 5 |
| | WOOD GLUE | TO SUIT |
| | WOOD SCREWS 1 ½" AND 2 ½" | TO SUIT |

**Top Asssembly:**

1. Lay down flat 2 sheets of min. 3/4" plywood end to end. Surface should be flat and true to provide the best table surface.

2. Layout 9 pieces A and 4 pieces B as shown in Top plan view. There should be a 2" offset from the edge of plywood to the face of the top frame assembly (pieces A and pieces B ).

3. Assemble end piece A and leg pieces E with 2x2 corner piece. Glue and screw as shown in Figure 1.37.1.

4. Glue and screw pieces B to pieces A as shown in Figure 1.37.2.

5. Install intermediate support table legs as shown in Top plan view. Secure with glue and 4 screws at each connection location.

**Base Assembly:**

6. Layout 5 pieces G and 4 pieces F on true flat surface.

7. Assemble pieces F and pieces G to leg pieces E with 2x2 corner piece. Glue and screw as shown in Figure 1.37.3.

8. Glue and screw pieces F to pieces G as shown in Figure 1.37.2.

9. Turn table top assembly upside down. Put base assembly in place on leg pieces E and support in place with blocks or scrap pieces.


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Glue and install 4 screws at all connecting locations. See isometric view.

**Table Surface:**

10. With assembled top frame sitting on plywood sheets mark a pencil line along edges of all frame pieces. Lift frame about 2" off plywood and hold up with temporary blocks. Lay down a bead of glue between all pencil lines, and let frame down onto plywood sheets. Clamp plywood sheets to top frame assembly.

11. Flip entire top assembly and plywood over to right side up with clamps secured in place. Snap a chalk line along centerlines of pieces A and pieces B on top side of plywood.

12. Drill, countersink and install screws at 12" o/c through plywood to all pieces A and pieces B .

13. Attach stiffener pieces C to o/s face of pieces B and install a double row of screws at 12" o/c.


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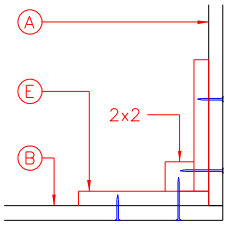



FIGURE 1.37.1

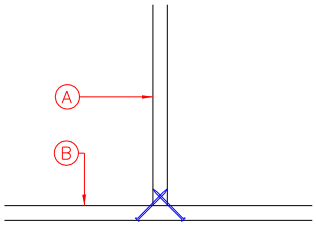



FIGURE 1.37.2

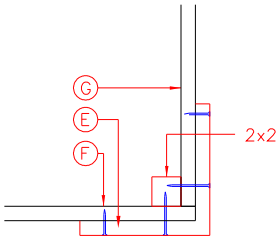



FIGURE 1.37.3

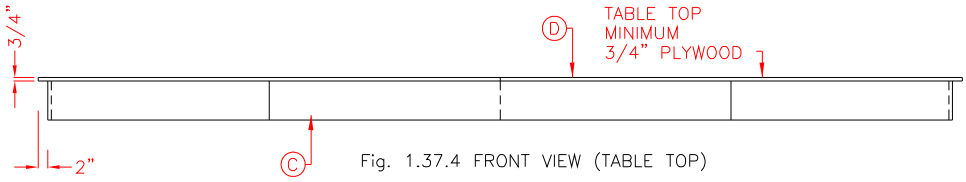



Fig. 1.37.4 FRONT VIEW (TABLE TOP)

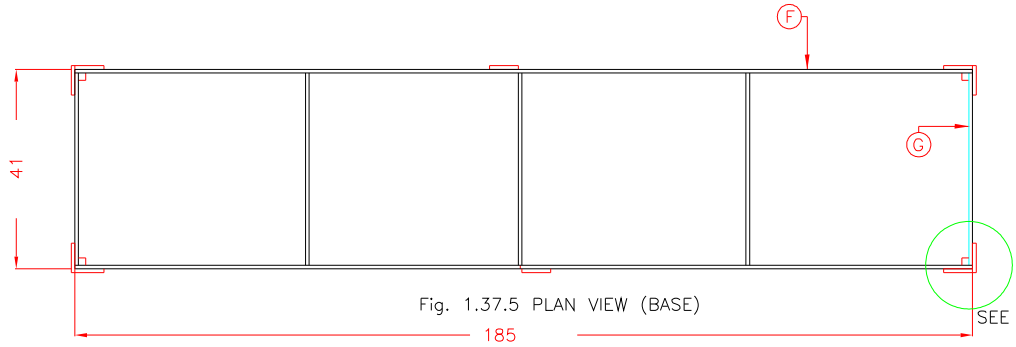



Fig. 1.37.5 PLAN VIEW (BASE)

SEE FIGURE 1.37.1

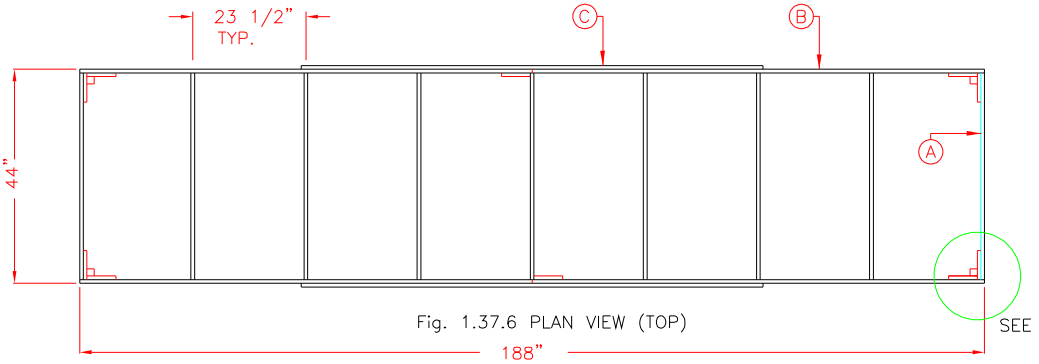



Fig. 1.37.6 PLAN VIEW (TOP)

SEE FIGURE 1.37.3

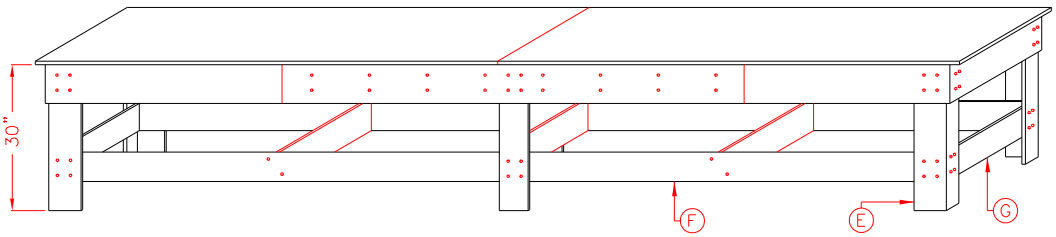



Fig. 1.37.7 ISOMETRIC VIEW


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# Rebel and Elite
# Table Construction

Top Assembly:

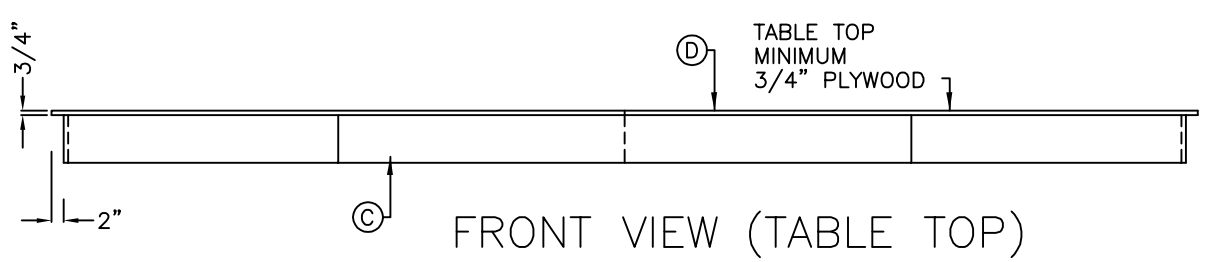
1. Lay down flat 2 sheets of min. 3/4" plywood end to end. Surface should be flat and true to provide the best table surface.
2. Layout 9 pieces Ⓐ and 4 pieces Ⓑ as shown in Top plan view. There should be a 2" offset from the edge of plywood to the face of the top frame assembly (pieces Ⓐ and pieces Ⓑ ).
3. Assemble end piece Ⓐ and leg pieces Ⓔ with 2x2 corner piece. Glue and screw as shown in figure 1.
4. Glue and screw pieces Ⓑ to pieces Ⓐ as shown in figure 2.
5. Install intermediate support table legs as shown in Top plan view. Secure with glue and 4 screws at each connection location.

Base Assembly:

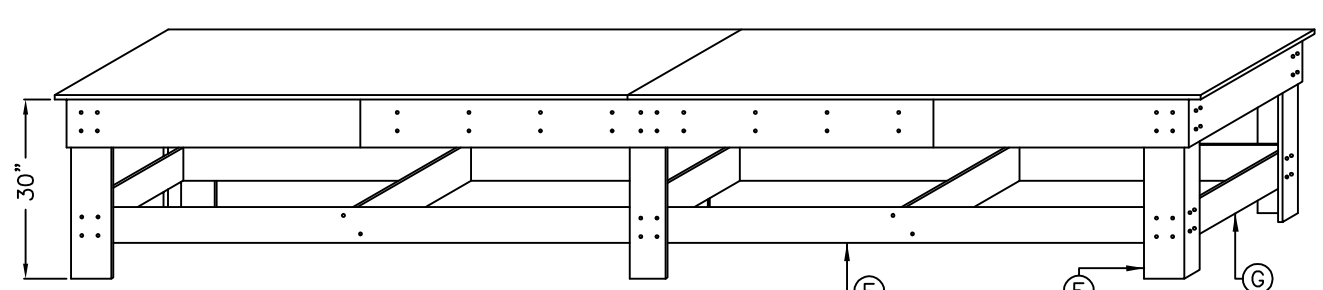
6. Layout 5 pieces Ⓖ and 4 pieces Ⓕ on true flat surface.
7. Assemble pieces Ⓕ and pieces Ⓖ to leg pieces Ⓔ with 2x2 corner piece. Glue and screw as shown in figure 3.
8. Glue and screw pieces Ⓕ to pieces Ⓖ as shown in figure 2.
9. Turn table top assembly upside down. Put base assembly in place on leg pieces Ⓔ and support in place with blocks or scrap pieces. Glue and install 4 screws at all connecting locations. See isometric view.

Table Surface:

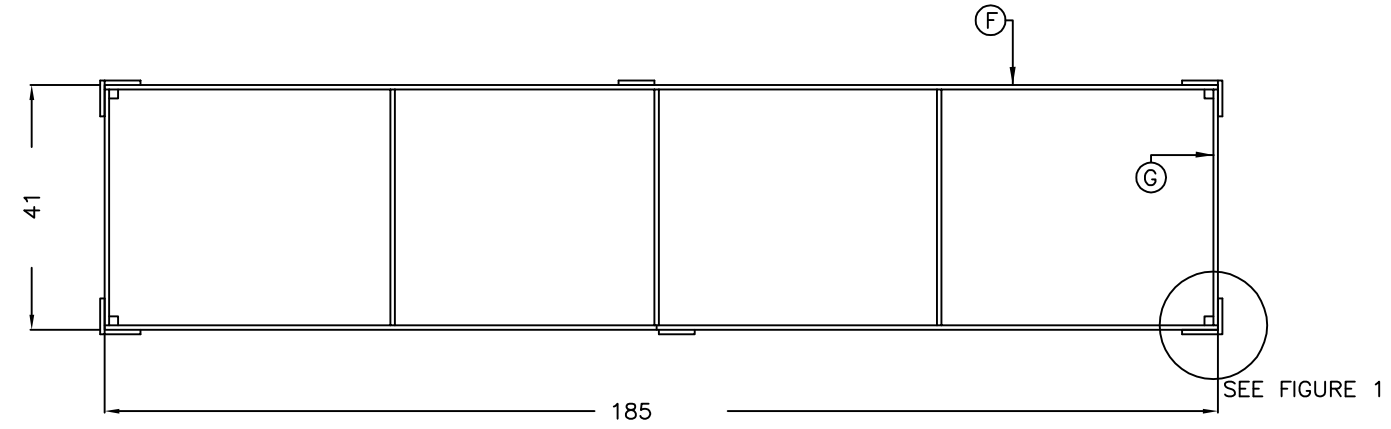
10. With assembled top frame sitting on plywood sheets mark a pencil line along edges of all frame pieces. Lift frame about 2" off plywood and hold up with temporary blocks. Lay down a bead of glue between all pencil lines, and let frame down onto plywood sheets. Clamp plywood sheets to top frame assembly.
11. Flip entire top assembly and plywood over to right side up with clamps secured in place. Snap a chalkline along centerlines of pieces Ⓐ and pieces Ⓑ on top side of plywood.
12. Drill, countersink and install screws at 12" o/c through plywood to all pieces Ⓐ and pieces Ⓑ .
13. Attach stiffener pieces Ⓒ to o/s face of pieces Ⓑ and install a double row of screws at 12" o/c.



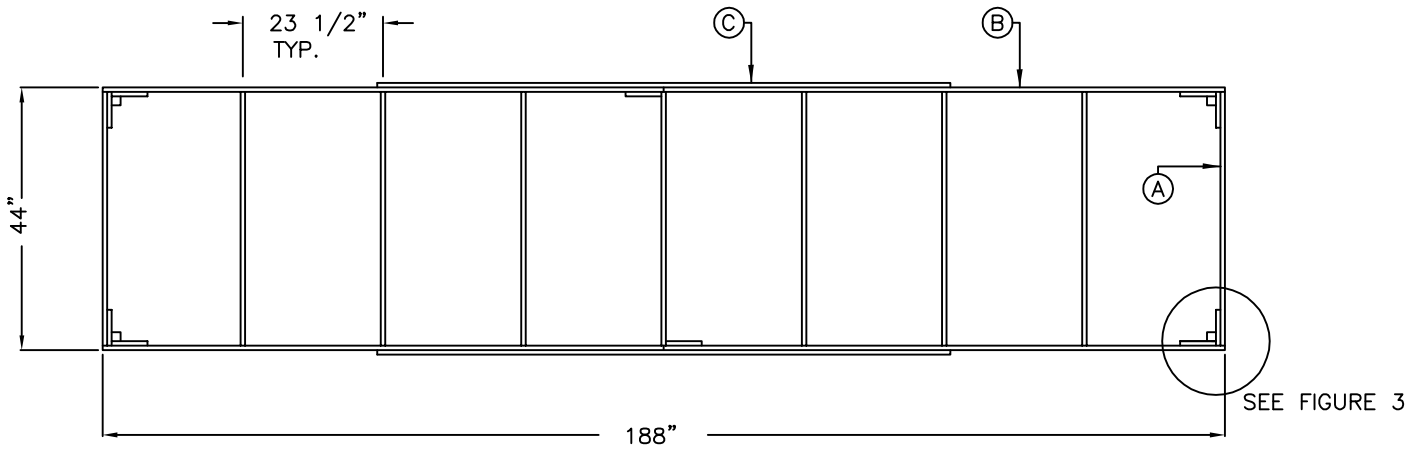

FRONT VIEW (TABLE TOP)




ISOMETRIC VIEW




PLAN VIEW (BASE)




PLAN VIEW (TOP)

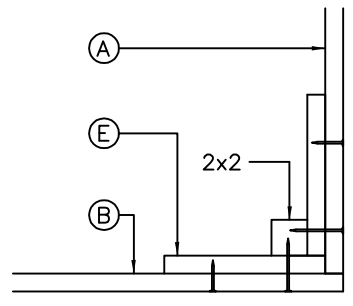



FIGURE 1

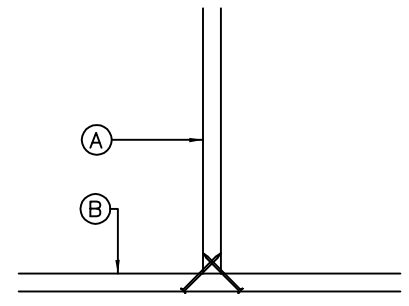



FIGURE 2

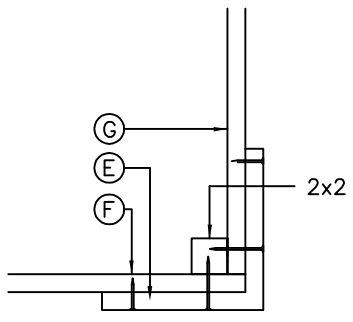



FIGURE 3

## BILL OF MATERIALS

| PART | NO. REQ'D. | SIZE of PLYWOOD PIECES |
|---|---|---|
| A | 9 | 3/4" x 7 3/4" x 42 1/2" |
| B | 4 | 3/4" x 7 3/4" x 94" |
| C | 2 | 3/4" x 7 3/4" x 96" |
| D | 2 | 3/4" x 48" x 96" |
| E | 10 | 3/4" x 6" x 30" |
| F | 4 | 3/4" x 6" x 92 1/2" |
| G | 5 | 3/4" x 6" x 39 1/2" |

* 6 SHEETS of 3/4" PLYWOOD REQ'D.

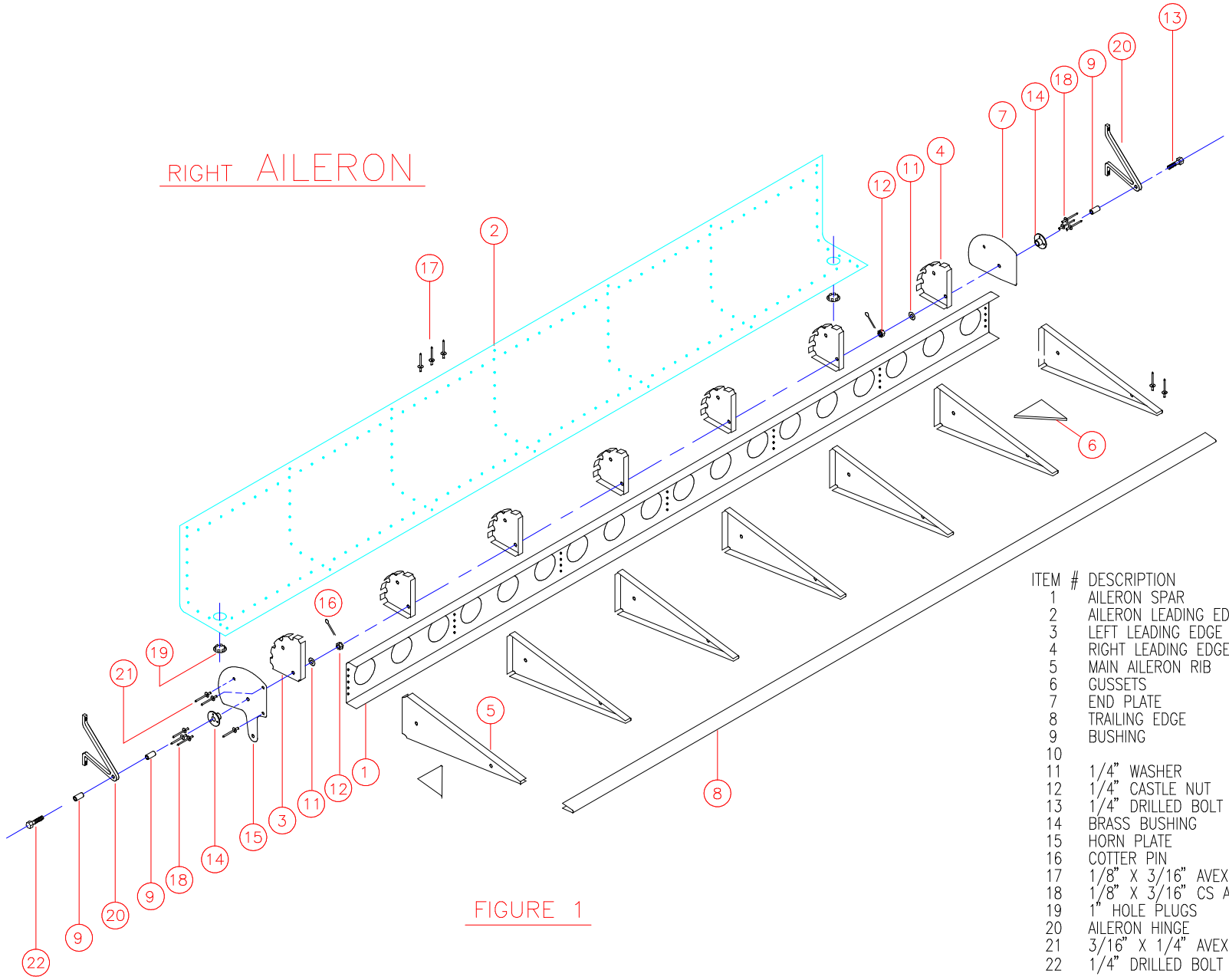



FIGURE 1

| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | AILERON SPAR | AIL-20 | 4 |
| 2 | AILERON LEADING EDGE | AIL-21 | 4 |
| 3 | LEFT LEADING EDGE RIB | AIL-22L | 14 |
| 4 | RIGHT LEADING EDGE RIB | AIL-22R | 14 |
| 5 | MAIN AILERON RIB | AIL-23 | 28 |
| 6 | GUSSETS | AIL-29 | 8 |
| 7 | END PLATE | AIL-24 | 4 |
| 8 | TRAILING EDGE | AIL-28 | 4 |
| 9 | BUSHING | AIL-26 | 8 |
| 10 | | | |
| 11 | 1/4" WASHER | AN960-416 | 6 |
| 12 | 1/4" CASTLE NUT | AN310-4 | 6 |
| 13 | 1/4" DRILLED BOLT | AN4-14 | 4 |
| 14 | BRASS BUSHING | AIL-27 | 8 |
| 15 | HORN PLATE | AIL-25 | 4 |
| 16 | COTTER PIN | MS24665-132 | 6 |
| 17 | 1/8" X 3/16" AVEX RIVETS | RV-1410 | 1300 |
| 18 | 1/8" X 3/16" CS AVEX RIVETS | RV-4412 | 24 |
| 19 | 1" HOLE PLUGS | 245-160 | 8 |
| 20 | AILERON HINGE | W-125 | 6 |
| 21 | 3/16" X 1/4" AVEX RIVET | RV-1613 | 24 |
| 22 | 1/4" DRILLED BOLT | AN4-21 | 2 |

## *2.1 Assembly Tools*

1) Variable speed Hand Drill
2) #40, #30 (short and long) & #11 Drill Bits
3) Quantity of 3/32", 1/8", & 3/16" Clecos
4) Cleco Pliers
5) Deburing Tools
6) Felt Marker
7) Riveter
8) ½" Drill Bit or ½" Template and Round File
9) Approximately 8 Spring Clamps
10) Tape Measure

****One left and one right aileron is required for each wing so make sure you make two of each.****

## *2.2 Rib Install*

1) Lay out all parts for a right aileron as in the exploded view drawing. Make sure the rib flanges are facing the correct direction. The trailing edge ribs (AIL-23) are symmetrical and therefore there are no lefts and rights. The leading edge ribs (AIL-22L & AIL-22R) are not symmetrical so make sure you have the correct rib facing the correct direction. ***The long flange of the rib goes against the spar**.

2) With a felt pen label the ribs and rib locations on the spar from one to seven. Mark a line down the center of each rib flange.

3) Clamp the spar to the edge of your table as in Figure 2.2.1.

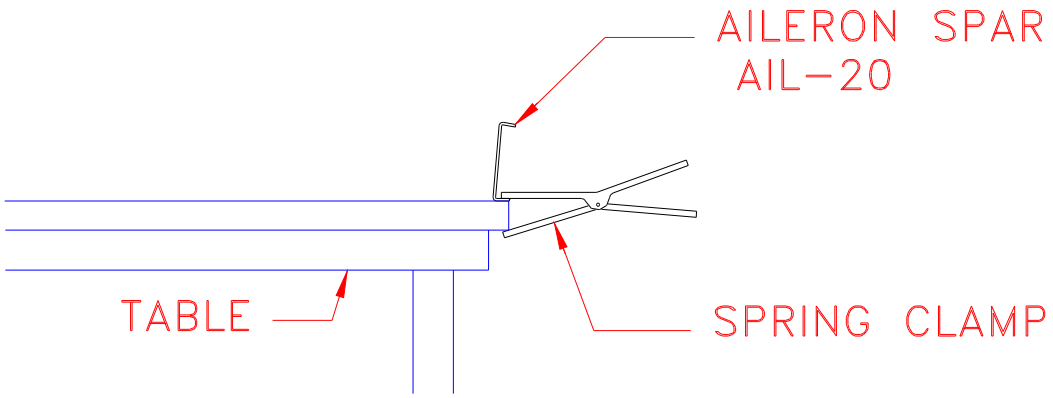



Figure 2.2.1

4) Place a leading edge rib (AIL-22L or AIL-22R) in front of the spar. End ribs must be flush with the ends of the spar. Make sure you can see the line you drew on the rib when looking through the factory punched holes in the spar. Figure 2.2.2.

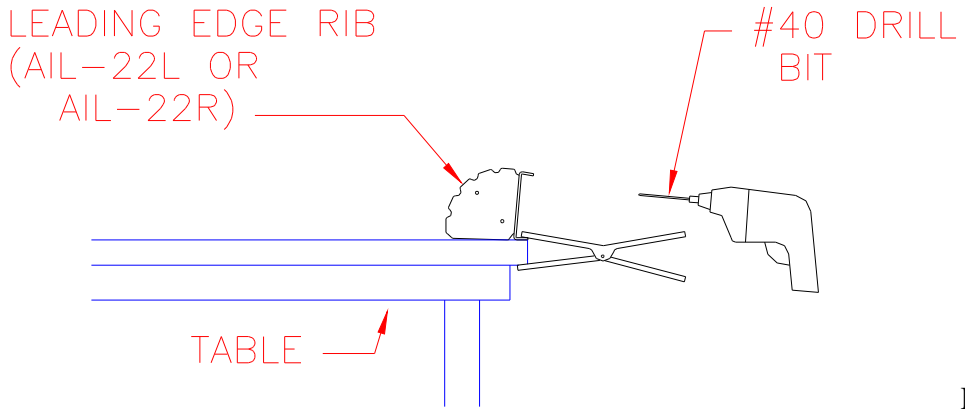



Figure 2.2.2

5) When you can see the line through the holes, drill through the top hole with a #40 drill. Cleco, then drill the bottom hole and again cleco. Drill remaining holes in rib. You may wish to use a small block of wood to hold the flange of the rib in place while drilling and to protect the fingers.

6) Repeat steps 4 & 5 until all leading edge ribs are drilled.

7) Remove the leading edge ribs and unclamp the spar from the table.

8) Turn the spar around and position trailing edge ribs (AIL-23) in place. Check that the flanges are in the same direction as the leading edge ribs. Figure 2.2.3.

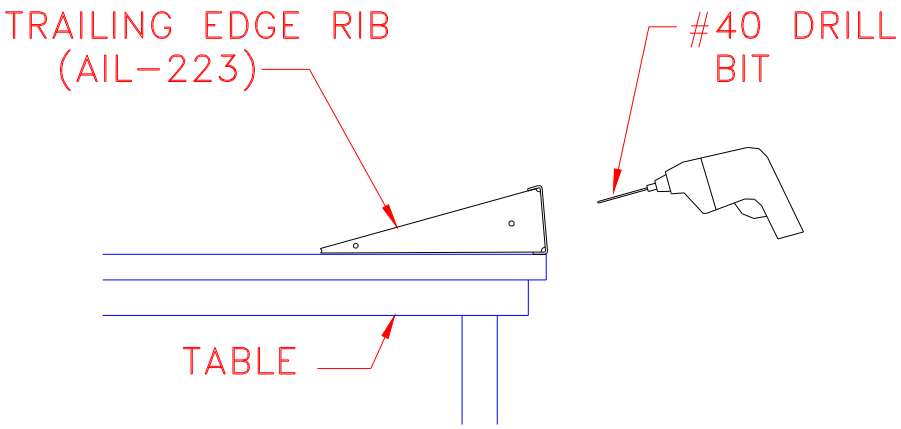



Figure 2.2.3

9) Check that you can see the line on the ribs. Then drill and cleco as you did with the leading edge ribs.

10) Cleco the leading edge ribs, the spar and the trailing edge ribs together and drill out all #40 holes to #30 holes. It helps if you use an extra long #30 drill bit. Figure 2.2.4.

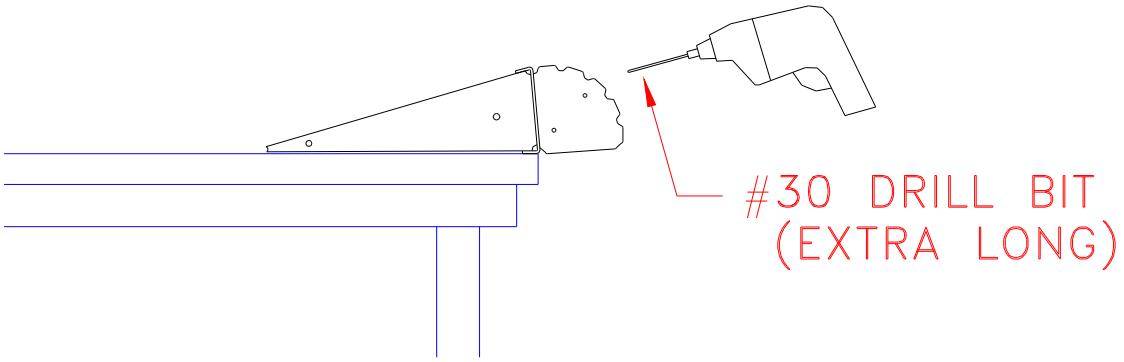



Figure 2.2.4

11) Disassemble and debur all parts.

12) Chromate all mating surfaces and rivet together with 1/8" rivets.

13) All four ailerons can be taken to this stage. Be sure you build two left and two rights.

14) Cut four trailing edges (AIL-28) to a length 1/8" shorter than the aileron spars (AIL-20).

15) Fit a trailing edge (AIL-28) over the trailing edge ribs (AIL-23) of one aileron assembly. The end ribs will offset or stick out 1/16" each at each end. Figure 2.2.5.

16) Make sure the aileron spar (AIL-20) and trailing edge (AIL-28) are straight and parallel. Figure 2.2.5.

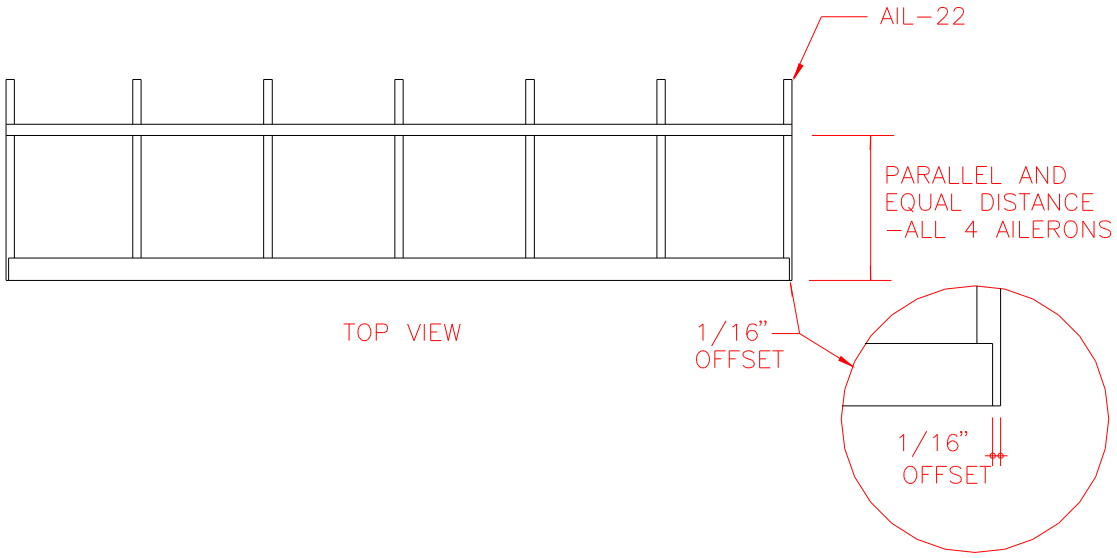



Figure 2.2.5

17) Drill four #30 holes through the trailing edge into each rib. Debur, chromate and rivet with 1/8" rivets.

**NOTE:** The two trailing edge rivets should be offset to each other to allow rivet clearance. Figure 2.2.6.

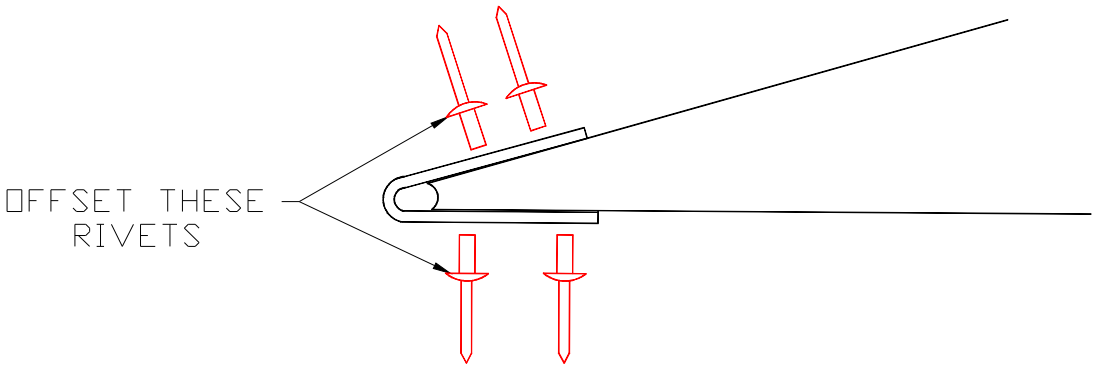



Figure 2.2.6

## *2.3 Aileron Horns*

1) Cleco two end plates (AIL-24) to two aileron horns (AIL-25). The five #11 holes can be used for alignment. Figure 2.3.1.

2) Using the aileron horn as a guide, drill existing #40 holes to #30 holes in the end plates.

3) Repeat previous steps for the other two end plates and aileron horns.

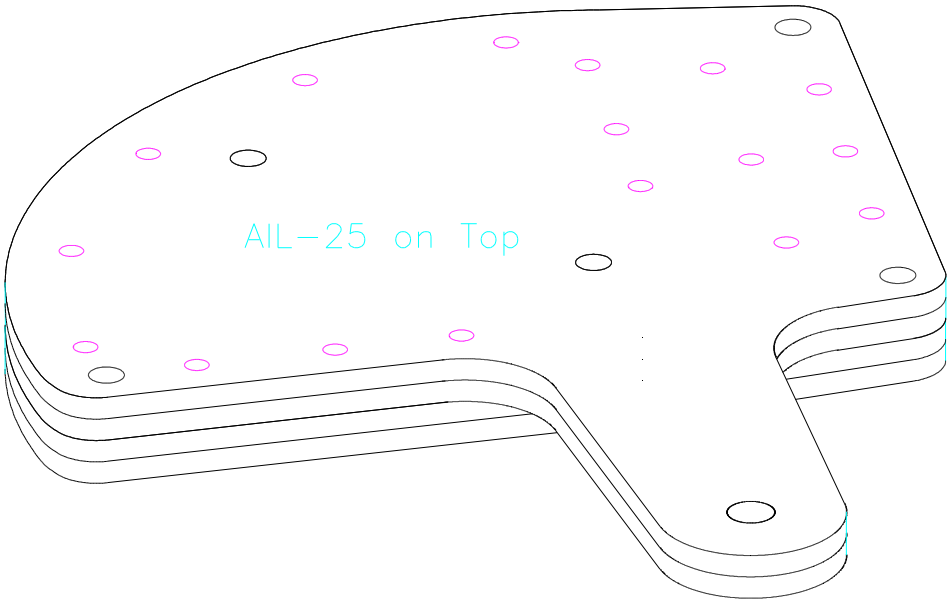



Figure 2.3.1

4) Cleco an end plate (AIL-24) to the right end of each right aileron assembly and to the left end of each left aileron. The two 3/16" holes in the leading edge rib will match the #11 holes in the end plates.

5) Using the end plate as a guide, drill #30 rivet holes into the ribs. With a #11 drill bit, drill through the two tooling holes at the rear of each end plate and cleco solidly in place.

6) Remove the cleco from the pivot position hole. Drill this hole out to ½" in both the end plate and the leading edge rib. If you do not have a ½" drill then use a ½" template to outline and then file to shape.

7) Insert a brass bushing (AIL-27) into the ½" hole. Using the five countersunk holes in the bushing, drill five #30 holes through the end plate and rib.

8) Disassemble, debur, chromate mating surfaces and rivet together with 1/8" rivets. In the four #11 holes use 3/16" rivets. In the brass bushing, use four 1/8" countersunk rivets (RV-4412).

9) Use the same procedure to install the aileron horn plates (AIL-25).

## *2.4 Installing Skins*

1) Place the assembly on its back near the edge of the table. Place a number of weights on the trailing edge to insure the trailing edge lies flat on the table. Figure 2.4.1.

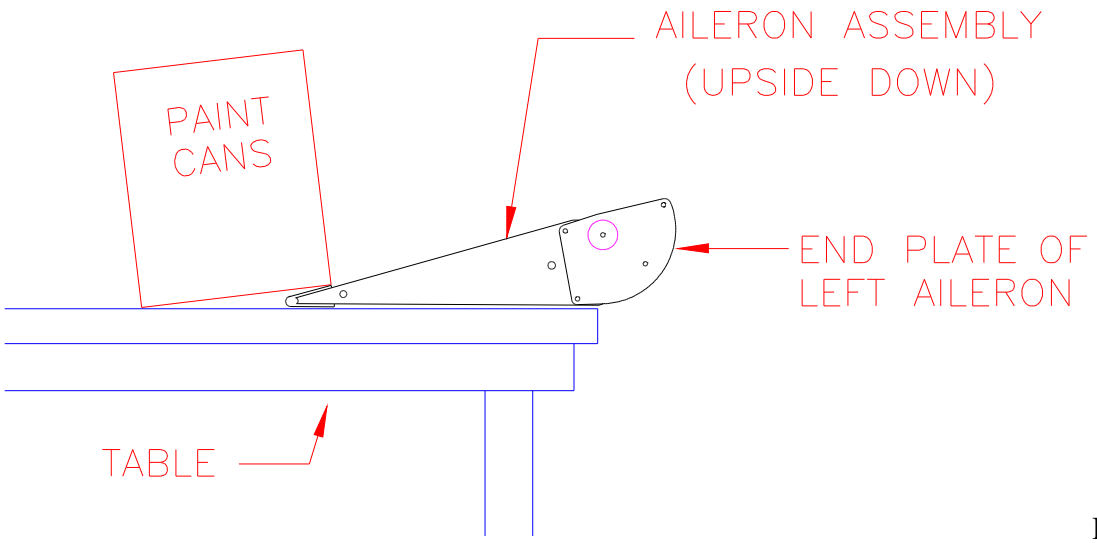



Figure 2.4.1

2) Position the leading edge (AIL-21) over the aileron assembly. Insure the leading edge is snug against the leading edge ribs. The leading edge is approximately 1/8" shorter in length than the aileron spar and must be centered. Then clamp with spring clamps. Figure 2.4.2.

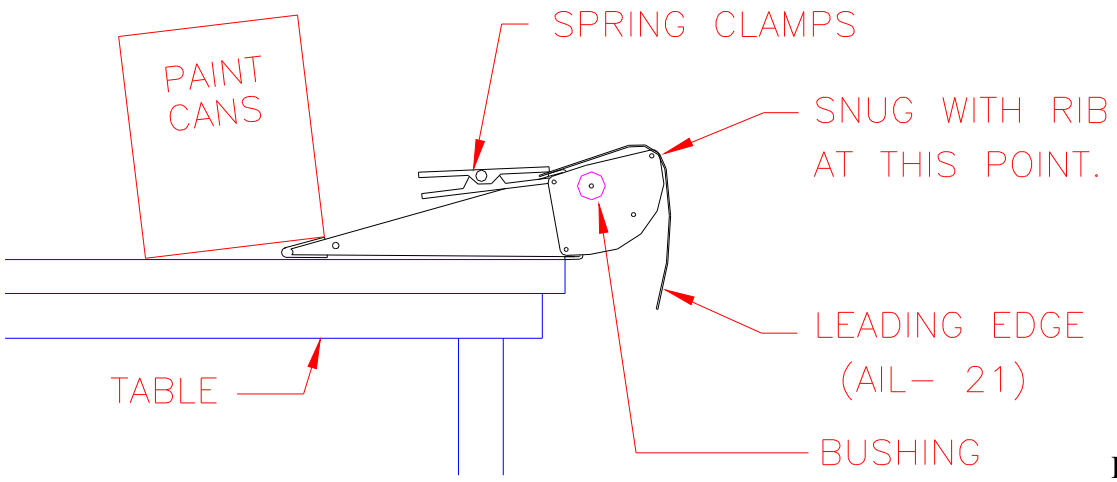



Figure 2.4.2

3) Starting from the center of the spar and working out evenly on both sides drill through the punched holes in the leading edge and into the spar with a #30 drill bit. Drill the second hole into the trailing edge ribs. Make sure you can see the line on the leading edge ribs and then drill the three holes into the bottom flat surface. If the line is not visible move the ribs using the holes in spar for access. Use plenty of clecos. Figure 2.4.3.

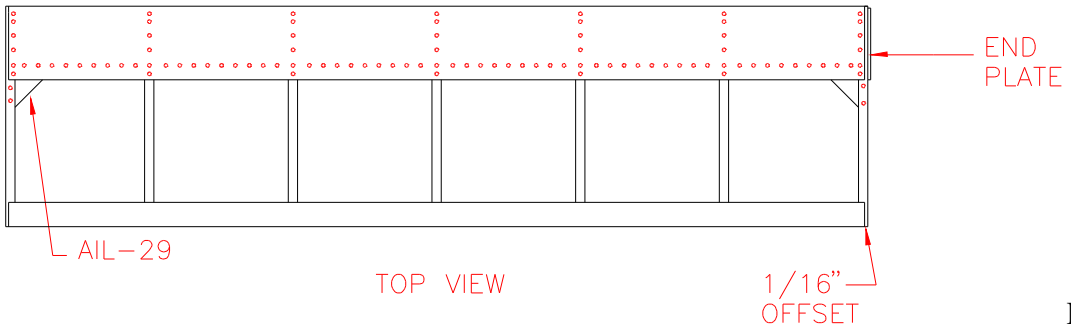



Figure 2.4.3

4) Position and drill the gussets (AIL-29) as in Figure 2.4.3. The gussets go under the rib and spar flange.

5) Remove leading edge and debur all holes. Chromate mating surfaces and rivet together with 1/8" rivets.

6) At this point it is worth waiting for the chromate to dry before continuing with the top of the leading edge to prevent drill filings from sticking to the wet chromate.

7) Turn aileron over on table and replace weights or paint cans. Figure 2.4.4.

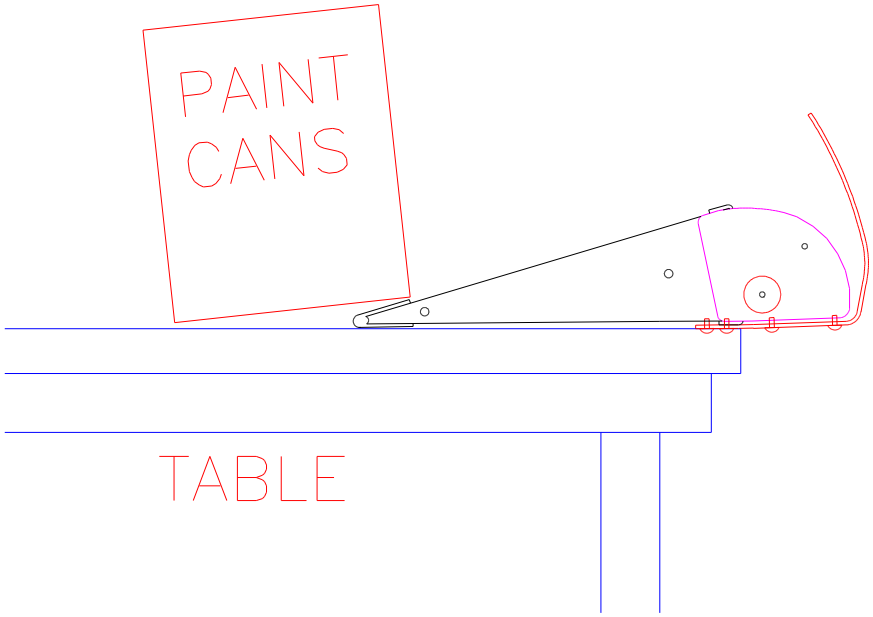



Figure 2.4.4

8) Fold the top of leading edge over and clamp in place. Make sure the leading edge is snug against all leading edge ribs. Figure 2.4.5.

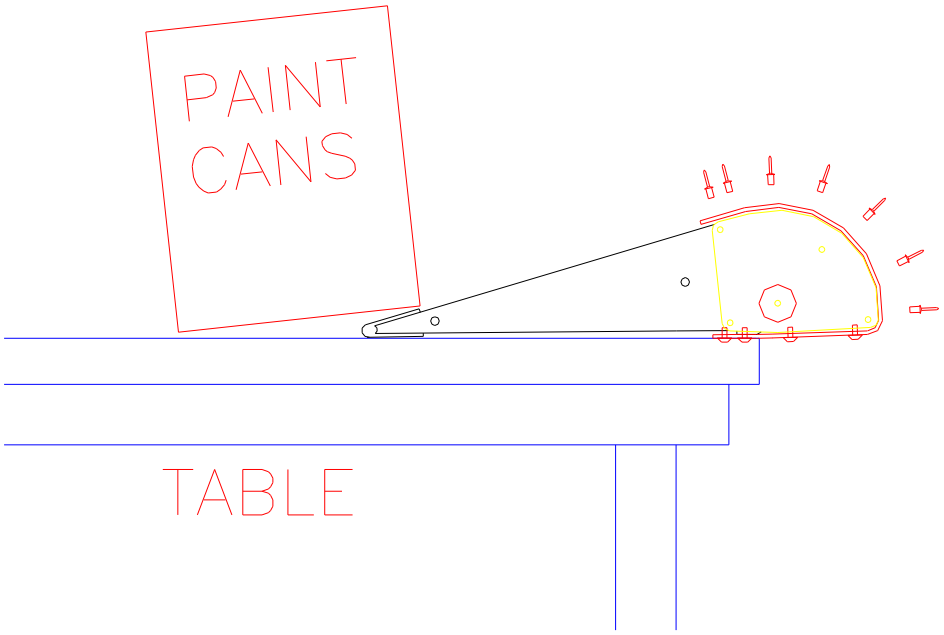



Figure 2.4.5

9) Starting from the center, drill out evenly on both sides through punched holes. Cleco often.

10) If you can see the line on the leading edge rib tabs through the holes in the leading edge you can now drill these holes out. If the line is not visible move the ribs using the holes in spar for access.

11) After all holes are drilled, debur, chromate mating surfaces and rivet together with 1/8" rivets.

12) Finish all the ailerons to this stage.

13) The ailerons are to be covered with fabric glued on with polytak. This fabric must also be secured with fabric rivets to prevent it from lifting off the ribs. Drill #30 holes into the ribs as in Figure 2.4.6. **NOTICE**, it is not necessary to use rivets in the end ribs.

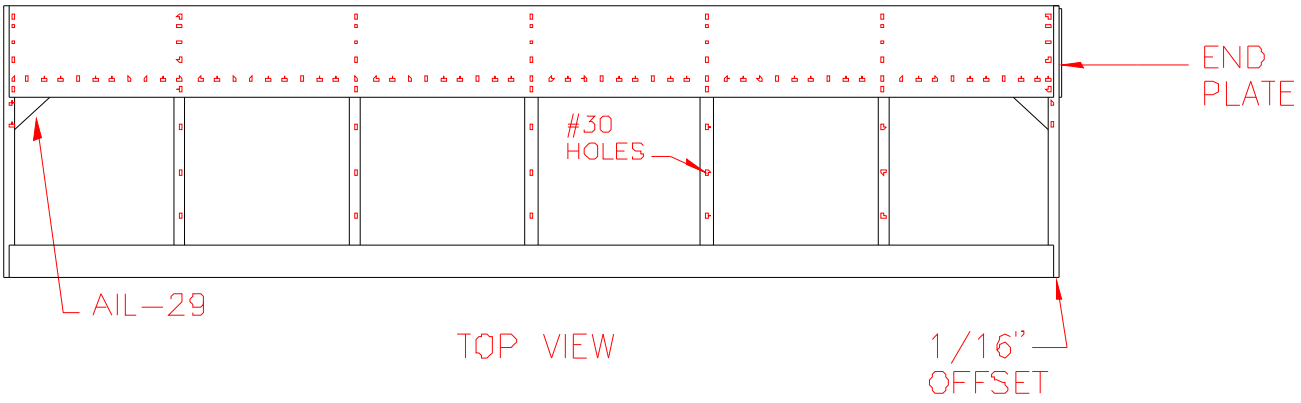



Figure 2.4.6

## *SPECIAL NOTE*

In some countries it is necessary to have structures inspected before the fabric covering can be installed. Please check with your local inspector before fabric covering.

It will be necessary to purchase Stits Polybrush, Stits Polytak and Stits Reducer to start the fabric covering process.

**NOTE:** These instructions are written for one aileron only, but it is obviously best to do all at once for purposes of spraying, painting, etc.

1) Pre-drill with a #30 bit, all holes for fabric riveting. The rivets are spaced at approximately 3 1/2" spacing along each rib as in figure 3.0.1. (3 rivets per rib)

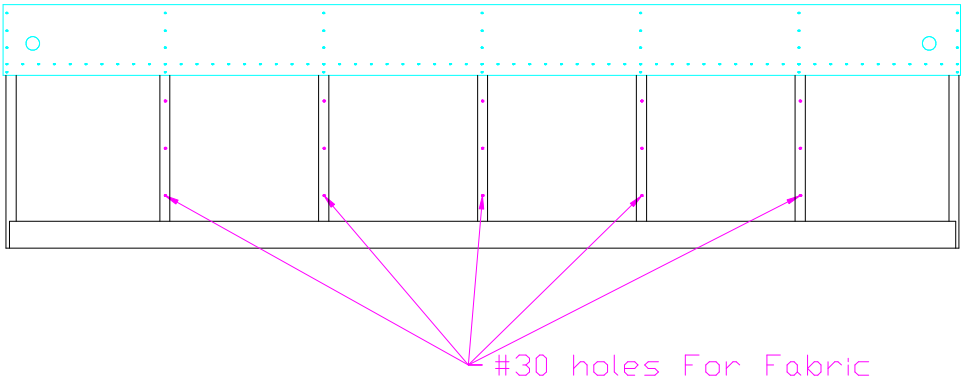



Figure 3.0.1

2) Debur all holes and edges. Also, file off any sharp edges on rivet heads etc. which could tear the fabric..

3) Using a small block of wood with a slot cut in it, bend a slight downward flange along the edges of the leading edge skin. This keeps sharp edges from tearing the fabric. Figure 3.0.2.

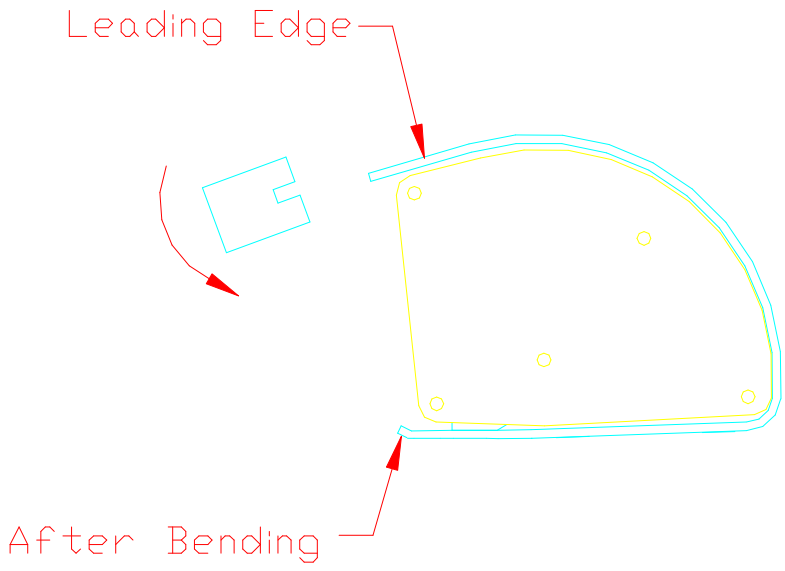



Figure 3.0.2

4) Clean all surfaces completely with acetone or MEK.

**NOTE:** Flannel batten may now be attached to the leading edge if desired.

5) Apply surgical tape to all sharp edges, including the ribs, trailing edges and sharp corners. Also tape all rivet heads.

6) Roll out the fabric on a table and lay the aileron on top. Using a pinking shears, cut the fabric allowing enough clearance at the ends, that the fabric can be folded to completely cover the end. Figure 3.0.3.

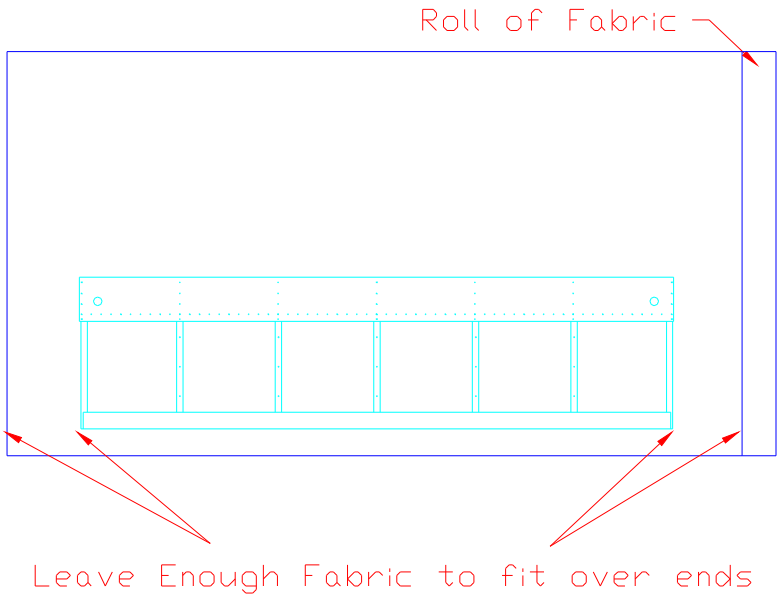



Figure 3.0.3

7) Wrap the fabric around the aileron as shown in figure 3.0.4. Overlapping on the bottom of the trailing edge. Trim off any excess material.

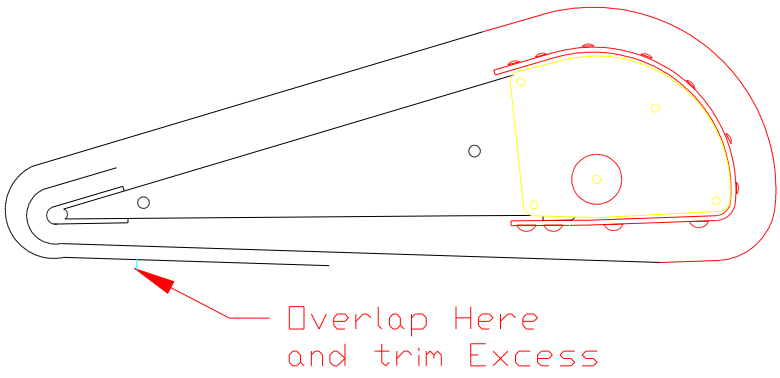



Figure 3.0.4

8) Using a small paint brush, apply polytak cement to the top and bottom sides of the trailing edge and attach the end of the fabric.

9) Wrap the fabric around as shown and apply polytak to the underside of the trailing edge and attach the overlapping piece. Figure 3.0.5.

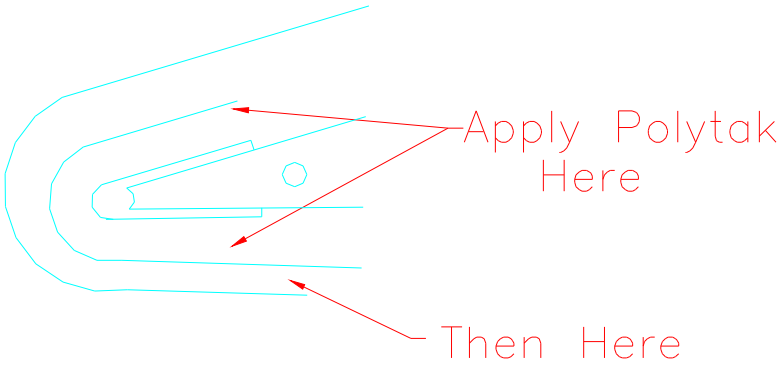



Figure 3.0.5

10) Fold the ends of the fabric and trim any excess material. When done the side will overlap so that the entire end rib is covered.

11) Apply polytak to the entire end of the aileron, then fold over one side of the fabric to attach it.

12) Apply a second coat of polytak over the first flap of fabric and attach the second flap over it.

13) Repeat previous steps for the opposite end. Then let the polytak dry completely.

14) Using a household iron, heat the fabric at 250º F beginning at the center of the aileron and working outward.

15) Apply heat to the ends, taking out as much of the wrinkling around the leading edge as possible.

16) Heat the fabric at 350º F using the same procedure as mentioned above.

17) Use a soldering iron to burn out the pilot holes in the aileron bushings and all fabric rivet holes in the ribs.

18) Apply 1/2" reinforcing tapes to the ribs, trimming at the leading and trailing edges.

19) Re-burn the rivet holes through the tape.

20) Install the 1/8" fabric rivets (RR-7404L).

21) Finishing tapes are applied by coating the area fully with polybrush. First apply the 1 1/2" finishing tape to each rib, overlapping on the leading and trailing edges by about 1".

22) Apply 3" finishing tape to the trailing edge as in Figure 3.0.6. It will cover the ends of the tape on each rib. Figure 7.

**NOTE:** For finishing tape other than 1 1/2" can be cut from excess fabric.

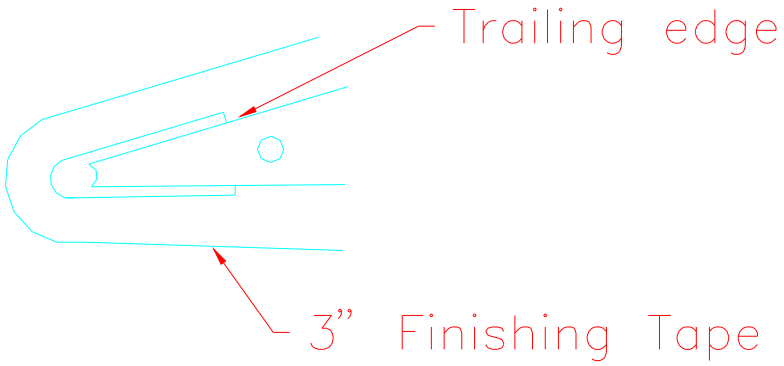



Figure 3.0.6

23) Apply 2" finishing tape along the rear of the leading edge as in figure 3.0.7.

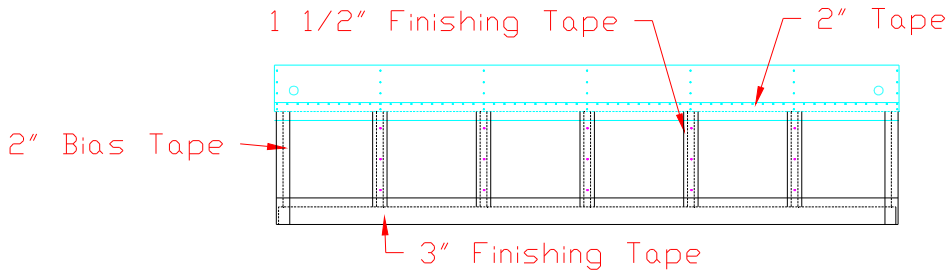



Figure 3.0.7

24) Apply 2" finishing tape to the ends so that it straddles the edge. Overlap on the leading and the trailing edges .

25) Brush the entire surface of the aileron with polybrush, being sure to seal the weave, but avoiding runs on the surface.

26) Allow the aileron to dry completely.

27) Using a small finishing iron, press down the edges of all finishing tapes so they are flush to the surface.

28) Hang the aileron on hooks and spray on a second coat of polybrush. Allow to dry.

29) Iron edges as necessary as in step 27.

30) (Optional) Apply a second spray coat of polyspray.

31) Apply a coat of polyspray. Allow to dry.

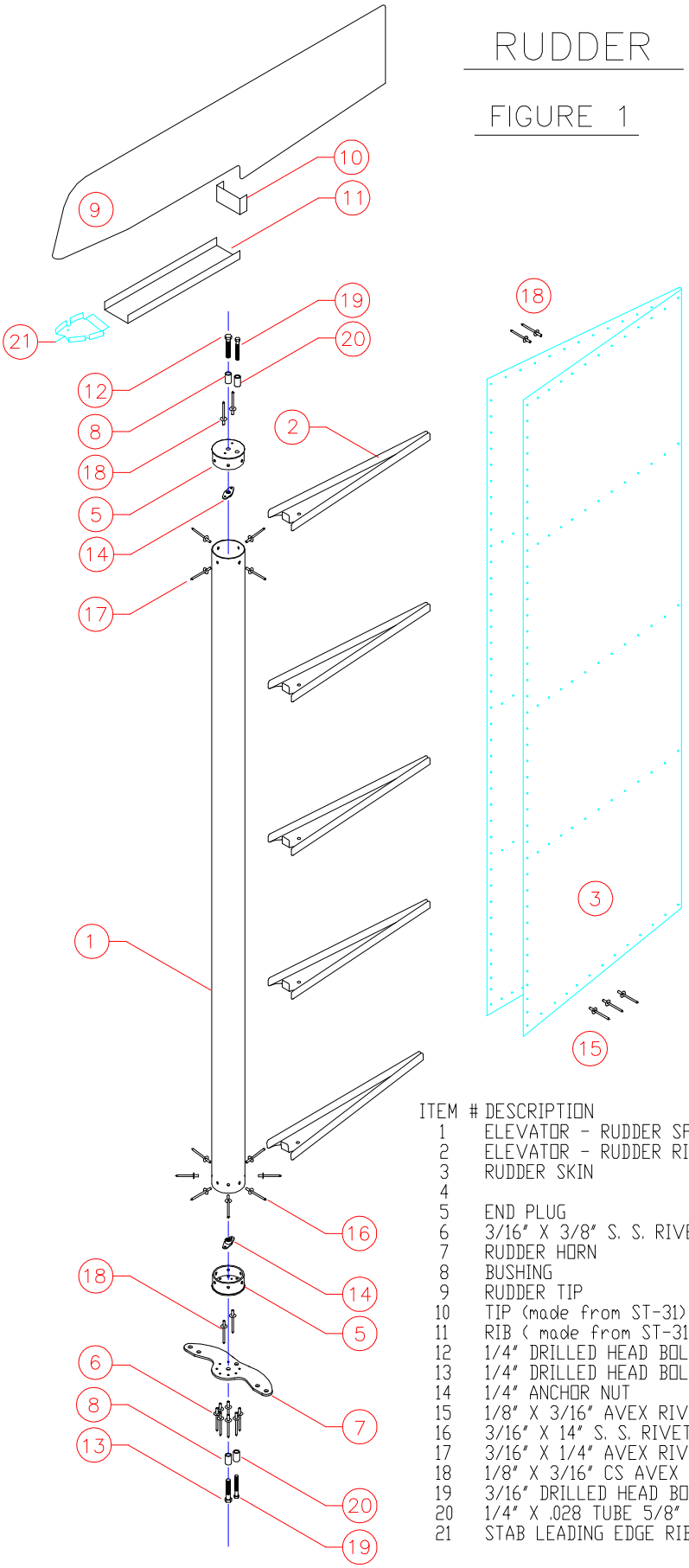
32) Apply some water to the surface and wet sand the edges to be sure of a smooth finish. **CAUTION:** If possible, avoid sanding over any rivet heads, as this could cause a hole in the fabric covering.

33) Repeat previous steps for the other three ailerons (Flaperons)

34) (Optional) Paint the surface of the aileron as desired.

# RUDDER

## FIGURE 1




| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | ELEVATOR - RUDDER SPAR | EL-25 | 1 |
| 2 | ELEVATOR - RUDDER RIB | EL-26 | 5 |
| 3 | RUDDER SKIN | RU-25 | 1 |
| 4 | | | |
| 5 | END PLUG | EL-31 | 2 |
| 6 | 3/16" X 3/8" S. S. RIVETS | RR5606 | 7 |
| 7 | RUDDER HORN | RU-26-1 | 1 |
| 8 | BUSHING | AIL-26 | 2 |
| 9 | RUDDER TIP | EL-28 | 1 |
| 10 | TIP (made from ST-31) | EL-30 | 1 |
| 11 | RIB ( made from ST-31) | EL-29 | 1 |
| 12 | 1/4" DRILLED HEAD BOLT | AN4H-11A | 1 |
| 13 | 1/4" DRILLED HEAD BOLT | AN4H-12A | 1 |
| 14 | 1/4" ANCHOR NUT | F5000-4 | 2 |
| 15 | 1/8" X 3/16" AVEX RIVET | RV-1410 | 230 |
| 16 | 3/16" X 14" S. S. RIVET | RR-5604 | 15 |
| 17 | 3/16" X 1/4" AVEX RIVET | RV-1613 | 4 |
| 18 | 1/8" X 3/16" CS AVEX RIVET | RV-4412 | 26 |
| 19 | 3/16" DRILLED HEAD BOLT | AN3H-10A | 2 |
| 20 | 1/4" X .028 TUBE 5/8" LONG | EL-32 | 2 |
| 21 | STAB LEADING EDGE RIB | FIN-35 | 1 |

## *4.1 Assembly Tools*

1) Variable speed Hand Drill
2) #40, #30, #11 and 5/32" Drill Bits
3) Quantity of 3/32",1/8" and 3/16" Clecos
4) Cleco Pliers
5) Deburing Tools
6) Felt Marker
7) Riveter
8) Hacksaw or tube cutter
9) Tape Measure
10) 3/8" and 7/16" Wrenches
11) 1032 Thread Tap
12) 1/8" Dimple Tool for Hand Riveter

Lay out all the parts for the rudder as in the exploded view drawing

## *4.2 Anchor Nut Install.*

1) Hold a 1/4" anchor nut (F5000-4) to the inside of an end plug (EL-31) with a AN4H-11A bolt and bushing (AIL-26). Figure 4.2.1.

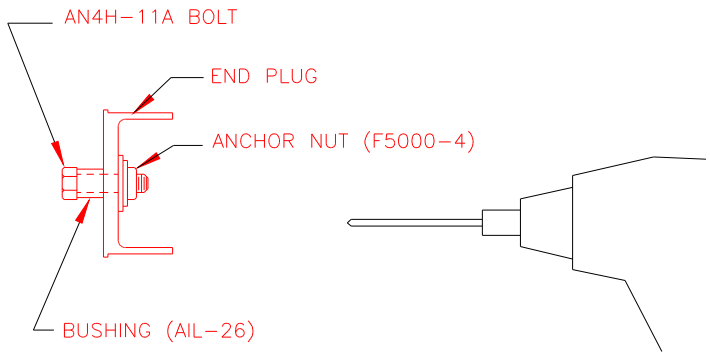



Figure 4.2.1

2) With a#30 drill bit back drill through the anchor nut and end plug. Figure 4.2.1.

3) Remove the anchor nut and bushing and countersink the end plug with a 1/4" drill bit until the head of a 1/8" CS rivet is flush. Figure 4.2.2.

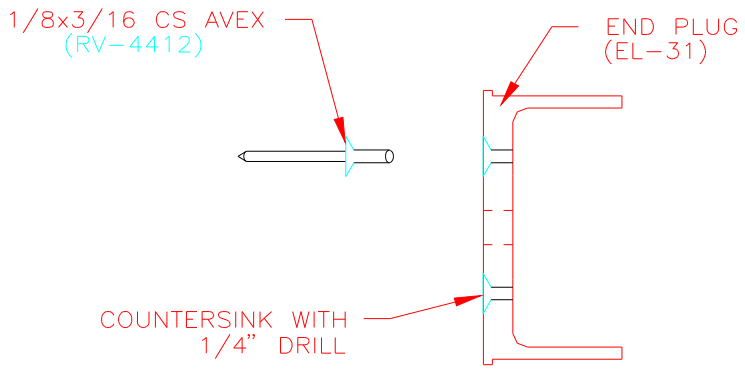



Figure 4.2.2

4) Rivet the anchor nut in place with two 1/8" CS rivets (RV-4412).

5) You will require six of these end plugs for the rudder and elevator. You will save time by doing all six at the same time.

6) Bolt the rudder horn (RU-26-1) to an end plug with a bushing (AIL-26) and a AN4H-12A bolt. Figure 4.2.3.

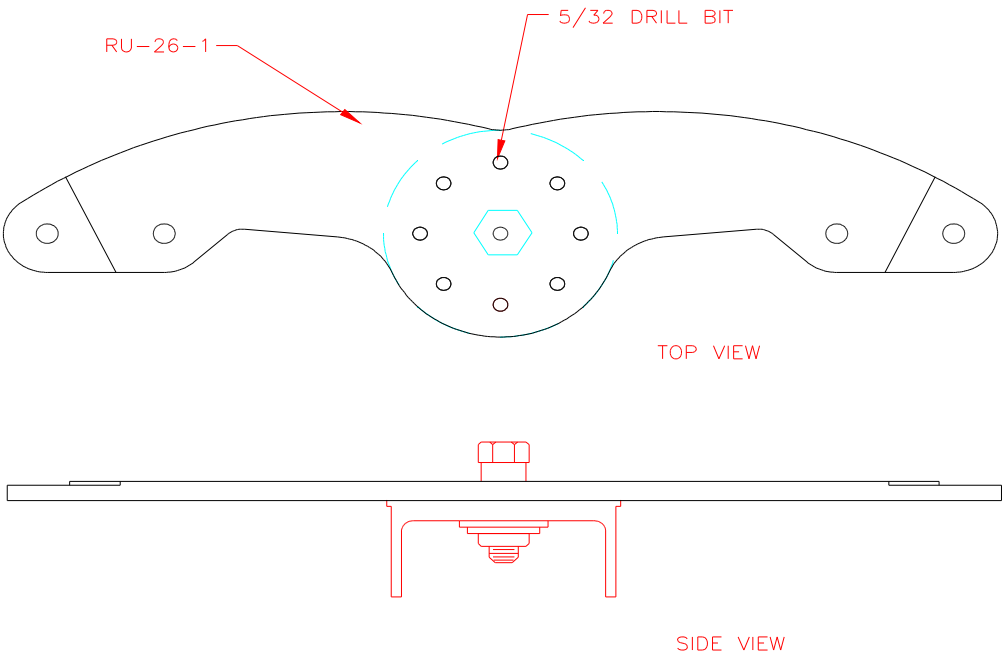



Figure 4.2.3

7) Align the horn, so the holes when drilled, will not interfere with the anchor nut. Drill out the 5/32" hole shown in figure 4.2.3. Drill the other 7 holes out with a #11 drill bit.

8) Remove the horn and bolt to another end plug. Drill a 5/32" hole through this end plug using the 5/32" hole in the horn as a guide. Do NOT drill the other seven holes.

9) Tap out the 5/32" hole in the end plugs. Drill the 5/32" hole in the horn out to #11.

## *4.3 Spar Assembly*

1) Cut the Elevator-Rudder Spars to 47 1/8". Place the three rudder-elevator (EL-25) side by side on a level surface. Figure 4.3.1.

2) Drag a piece of aluminum over the three spars. This will leave a perfectly straight mark on each spar. You can also use a sheet of carbon paper wrapped around a straight edge to mark the tubes. Figure 4.3.1.

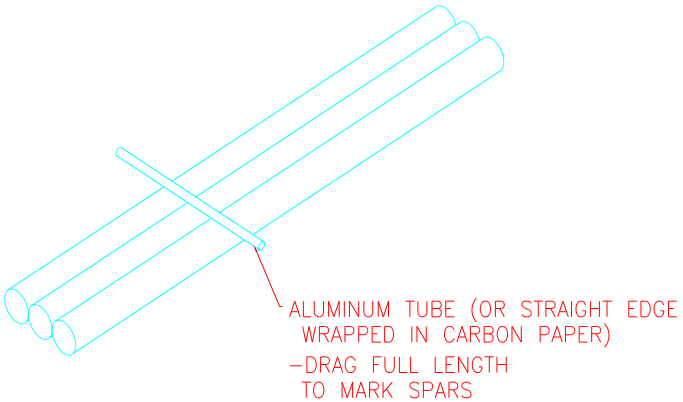



Figure 4.3.1

3) Select one tube for the rudder spar. Wrap a piece of paper around the tube 1/2" from the end. Using the edge of the paper draw a line around the tube with a felt pen.

4) Insert one of the end plugs into the tube. Position the threaded hole directly in line with the line made in step 2. **PLEASE NOTE**: Because of the tolerances on the tubes, the end plugs will in some cases be a press fit. It may be necessary to sand the inside of the tube for a better fit.

5) Drill a #11 hole through the tube and end plug 1/2" from the end and directly opposite of the full length line. Figure 4.3.2.

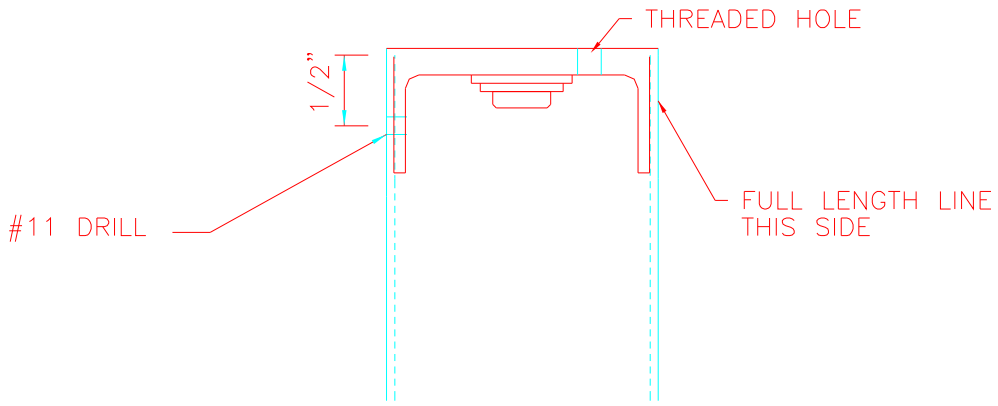



Figure 4.3.2

6) Repeat steps for the other end of tube.

7) Mark the rib locations on the spar as in figure 4.3.3.

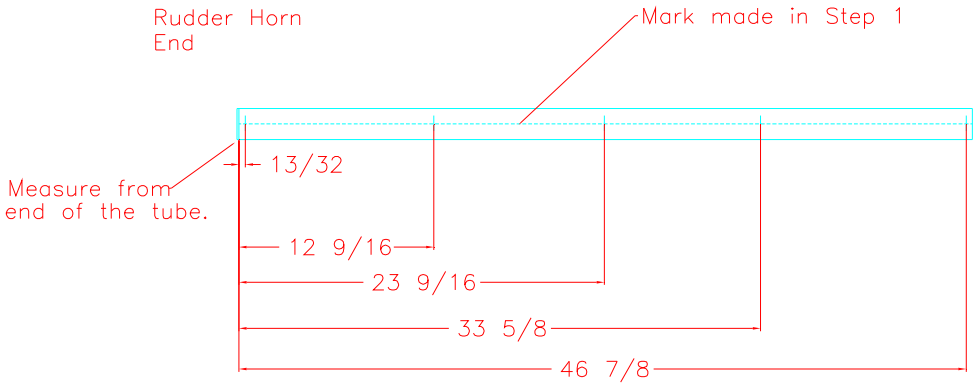
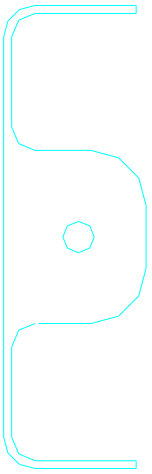



Figure 4.3.3

8) Drill a #30 hole at these marked locations.

## *4.4 Rib Install*

1) Drill a #30 hole in the center of the tab of each of the elevator-rudder ribs (EL-26). Figure 4.4.1. With a felt pen draw a line down the center of each flange of the ribs.



End view of elevator-rudder rib

Figure 4.4.1

2) Cleco the five ribs to the spar as in figure 4.4.2. Mark each rib and corresponding hole for re-assembly later.

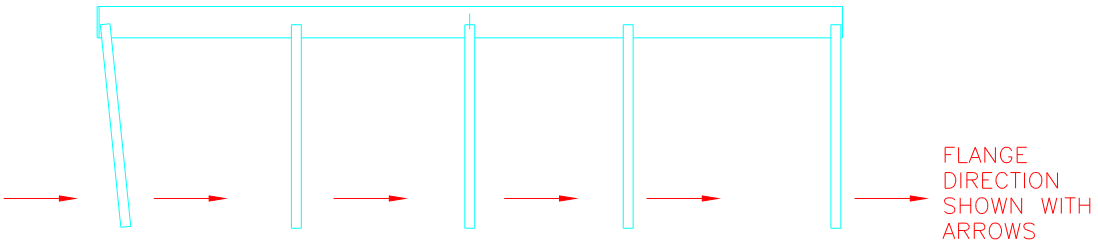



Figure 4.4.2

**NOTE**: The trailing edge of the rib, at the horn end, will not come back as far as the other ribs. This is normal.

## *4.5 Skin Install*

1) On the rudder skin (RU-25) measure the distance shown in figure 4.5.1

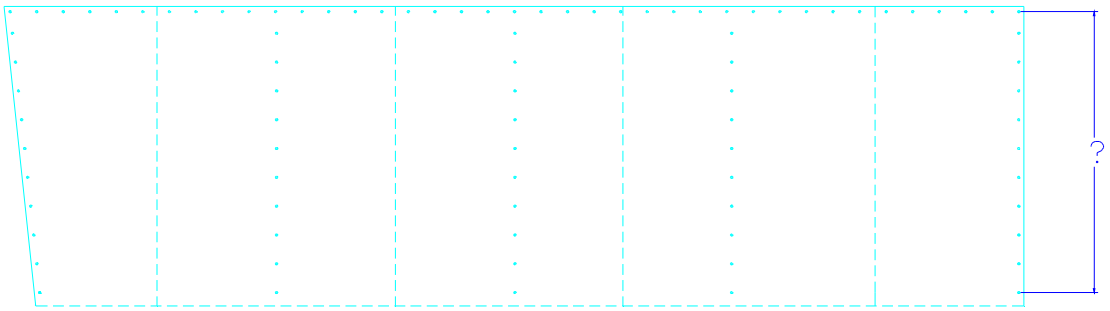



Figure 4.5.1

2) Draw a centerline along the length of the spar. Figure 4.5.2.

3) From the centerline measure back the same distance as you measured in step 1. Figure 4.5.2.

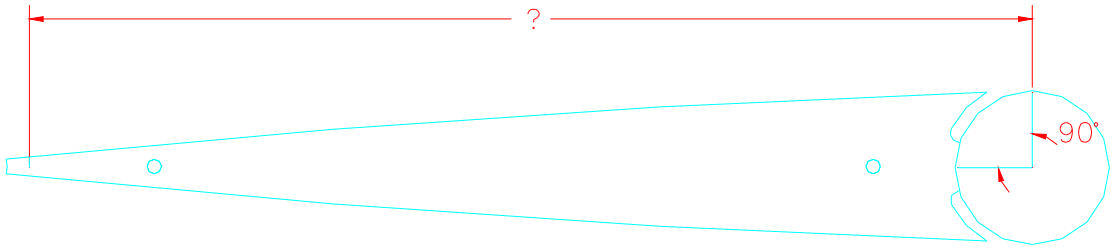



Figure 4.5.2

4) Drill a #40 hole into the center of the rib flange at this position. Its helpful to insert a small piece of wood to support the trailing edge while drilling.

5) Follow the same procedure to locate and drill the hole on the right side of the rib.

6) Repeat steps for each of the three center ribs.

7) Cleco the rudder skin (RU-25) to the ribs as in figure 4.5.3

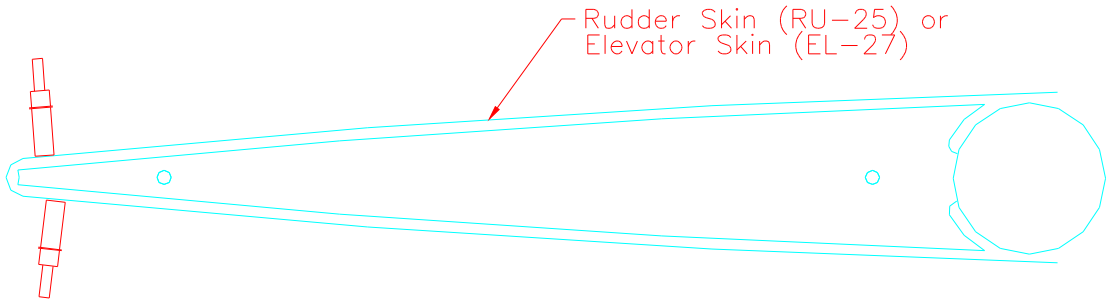



Figure 4.5.3

8) Align the edge of the skin straight along the length of the spar and center the skin between the end of the spar. Check both sides carefully before continuing. Starting from the center work your way evenly outwards using a #30 bit to drill through the skin into the spar. Use plenty of clecos. Complete one side then turn over and do the other side.

9) Starting from the front of the ribs and working backwards drill through the skin and into the ribs with a #30 drill bit. The bottom end rib should protrude approximately 1/16" past the skin. Use plenty of clecos while drilling.

10) Drill the end holes in the skin that go into the spar and end plug out to #11 holes.

11) Dimple all the rivet holes on the top rib and top row of skin.

12) Remove the skin.

13) On the end ribs only, drill out the #30 hole in the small rib flange, spar and end plug to #11 holes. Also drill a #11 hole directly opposite to the one drilled previously.

14) At each end and into each end plug there should now be four #11 holes. At the horn end only, drill four more #11 holes equally spaced between the existing holes for a total of eight #11 holes in the spar and end plug. Figure 4.5.4.

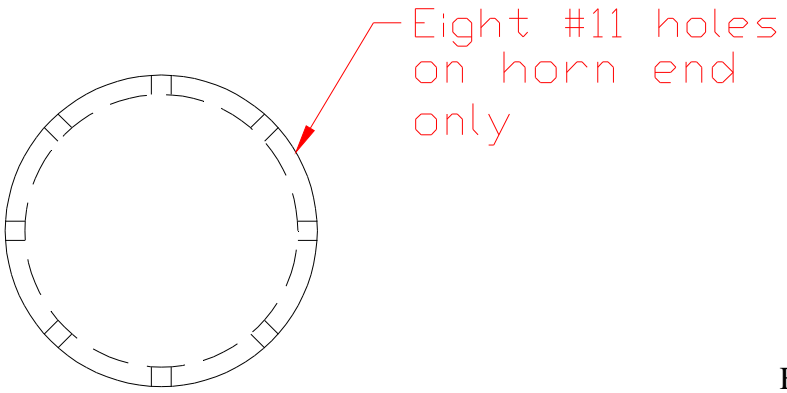



Figure 4.5.4

15) Disassemble and debur all parts.

16) Soak a rag with tube seal and push through the rudder spar tube. The tube seal is an anticorrosion agent and will protect the inside of the tube.

## *4.6 Finishing*

1) Chromate mating surfaces and rivet together as follows:

2) Rudder horn to end plug use seven 3/16" SS Rivets (RR-5606).

3) End plug on rudder horn end to spar with 3/16" SS Rivets (RR-5604).

4) End plug on top of rudder and top end rib to spar with 3/16" rivets (RV-1613). Again, attach the end rib but leave the skin holes open.

5) Skin to spar at top end plug with 3/16" rivets (RV-1613).

6) Skin to spar at bottom end plug with 3/16" SS rivets (RR-5604).

7) Skin to top rib with 1/8" CS rivets (RV-4412).

8) Skin to spar and ribs with 1/8" rivets (RV-1410).

**NOTE:** IF you are building your REBEL in the experimental or amateur built category your local inspector may insist on seeing all sub-assemblies before closing.

## *4.7 Rudder Horn Install*

1) From the 1/4" x .028 tube (EL-32) cut six 5/8" lengths. You will use two on the rudder and two on each elevator half section.

2) Bolt the 5/8" tube to the end plugs with AN3H-10A drilled head bolts.

3) This drilled bolt will be used to safety tie the hinge bushing attach bolt during assembly. Figure 4.7.1.

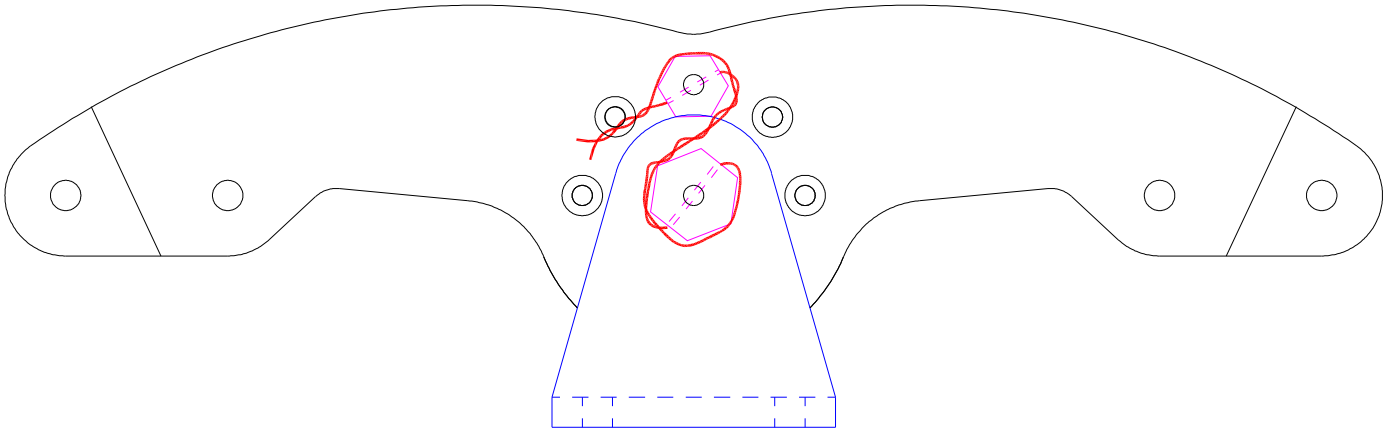


Figure 4.7.1

4) When installing rudder to fin use this figure for a guide to installation. Figure 4.7.2.

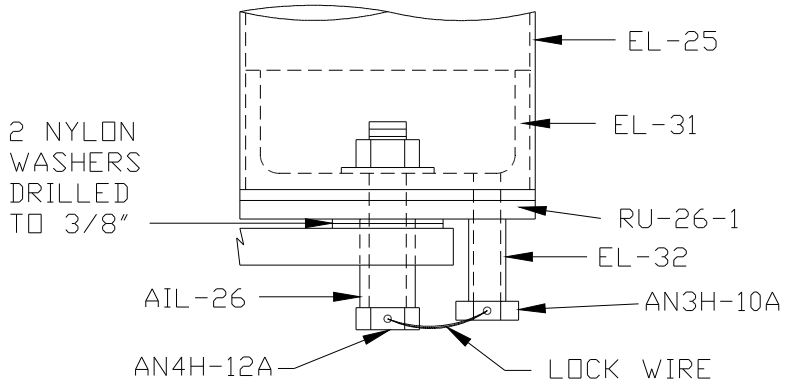



Figure 4.7.2

## *ULTRALIGHT RUDDER ASSEMBLY*

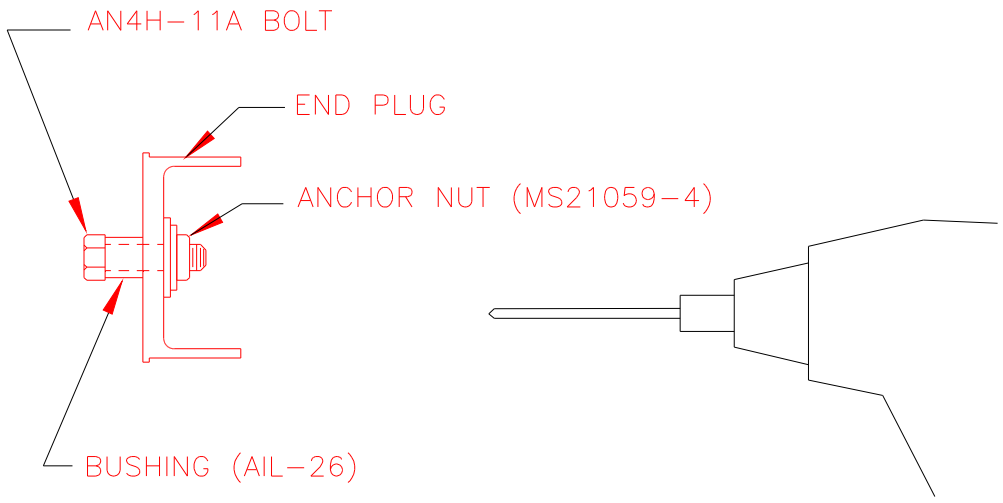
To assemble the rudder will require the following tools:

1. Variable speed Hand drill
2. 1/16", #30, #11 and 5/32" Drill bits
3. Quantity of 1/8" and 3/16" Clecos
4. Cleco Pliers
5. Deburing Tools
6. Felt Marker
7. Riveter
8. Hacksaw or Tube Cutter
9. Tape Measure
10. 3/8" and 7/16" Wrenches
11. 1032 Thread Tap

1/8" Dimple Tool for Hand Riveter

1) Lay out all the parts for the rudder as in Figure 1.

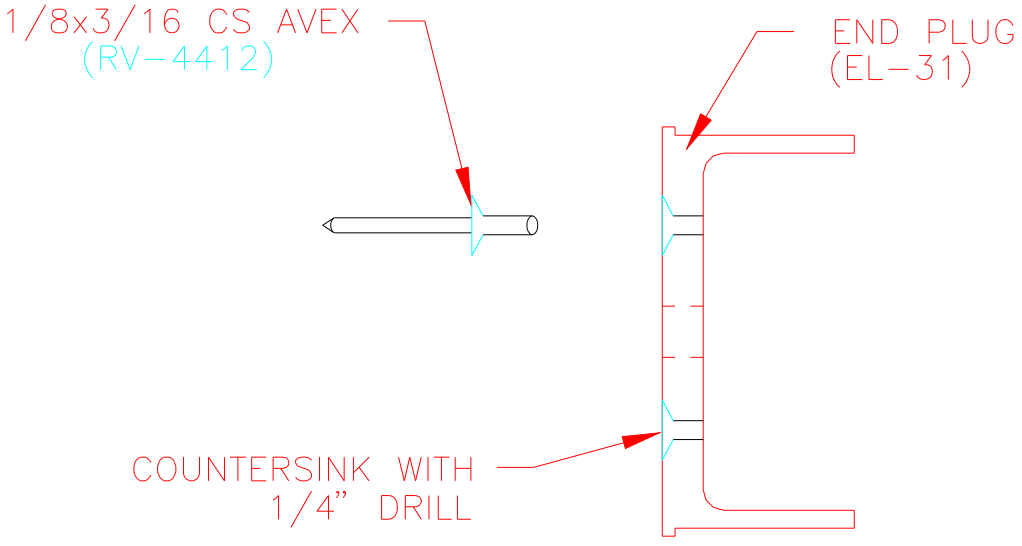
2) Hold a 1/4" anchor nut (MS21059-4) to the inside of an end plug (EL-31) with a AN4H-11A bolt and bushing (AIL-26). Figure 2.




(Figure 2)

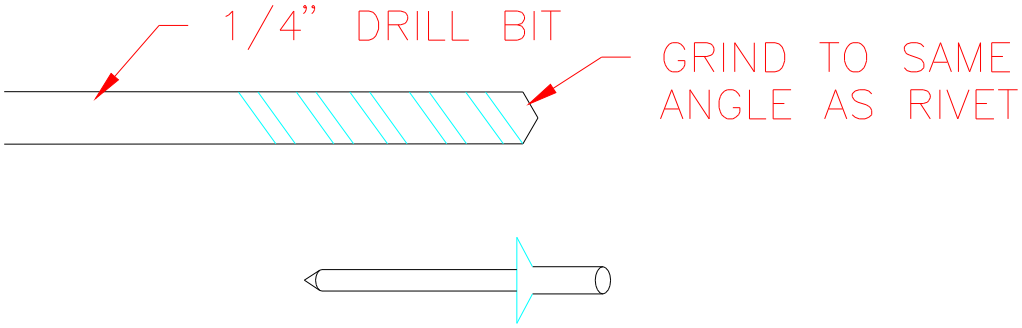
3) With a #30 drill bit , back drill through the anchor nut and end plug. Figure 2.

4) Remove the anchor nut and bushing and countersink the end plug with a 1/4" drill bit until the head of a 1/8" x 3/16" CS Avex rivet is flush. Figure 3.




(Figure 3)

**NOTE:** If you have a grinder you can sharpen the drill bit to the same angle as the rivet taper for a better fit. Figure 4.

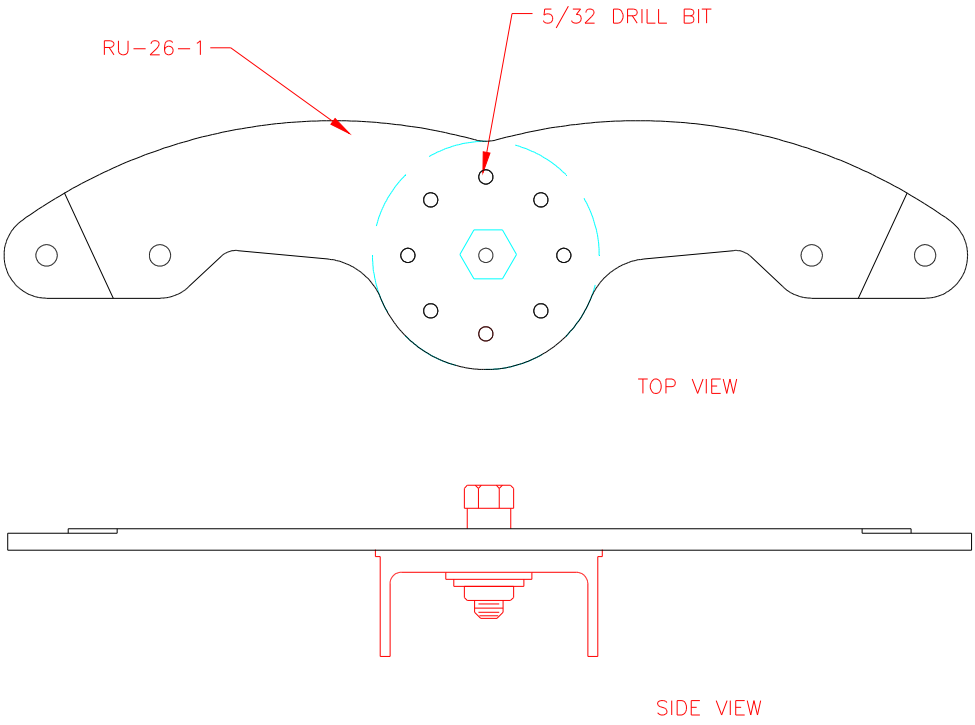



(Figure 4)

5) Rivet the anchor nut in place with two 1/8" x 3/16" CS Avex rivets (RV 4412).

6) You will require six of these end plugs for the rudder and elevator. You will save time by doing all six at the same time.

7) Bolt the rudder horn (RV-26-1) to an end plug with a bushing (AIL-26) and a AN4H-12A bolt. Figure 5.




(Figure 5)

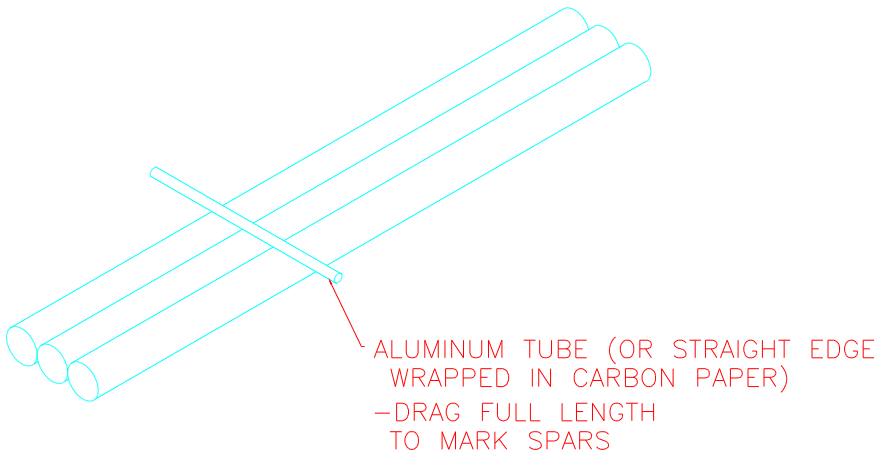
8) Align the horn so the holes , when drilled, will not interfere with the anchor nut. Drill out the 5/32" hole shown in Figure 5. Drill the other 7 holes out with a #11 drill bit.

9) Remove the horn and bolt to another end plug. Drill a 5/32" hole through this end plug using the 5/32" hole in the horn as a guide. Do **NOT** drill the other seven holes.

10) Tap out the 5/32" holes in both end plugs to 1032 thread.

11) Cut the rudder-elevator spars to 47 1/4". Place the three rudder - elevator spars (EL-25) side by side on a level surface. Figure 6.

12) Drag a piece of aluminum over the three spars. This will leave a perfectly straight mark on each spar. You can also use a sheet of carbon paper wrapped around a straight edge to mark the tubes. Figure 6.

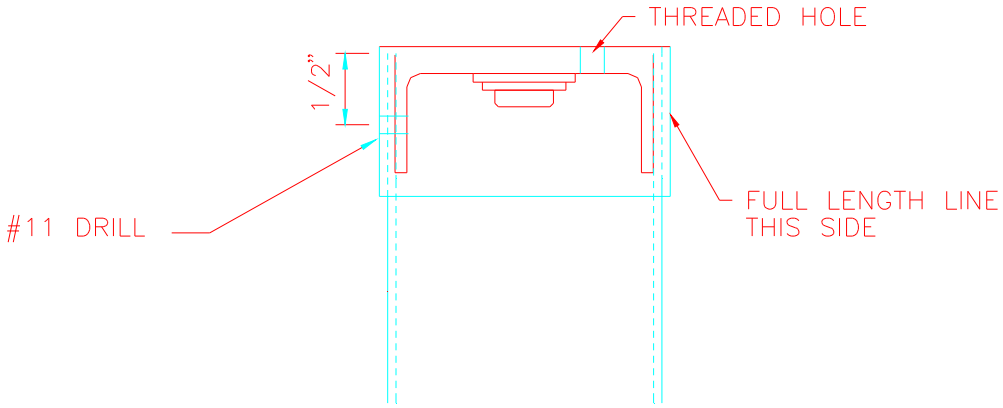



(Figure 6)

13) Select one tube for the rudder spar. Wrap a piece of paper around the tube 1/2" from the end. Using the edge of the paper draw a line around the tube with a felt pen.

14) Insert one of the end plugs into the tube. Position the threaded hole directly in line with the line marked in step 12.

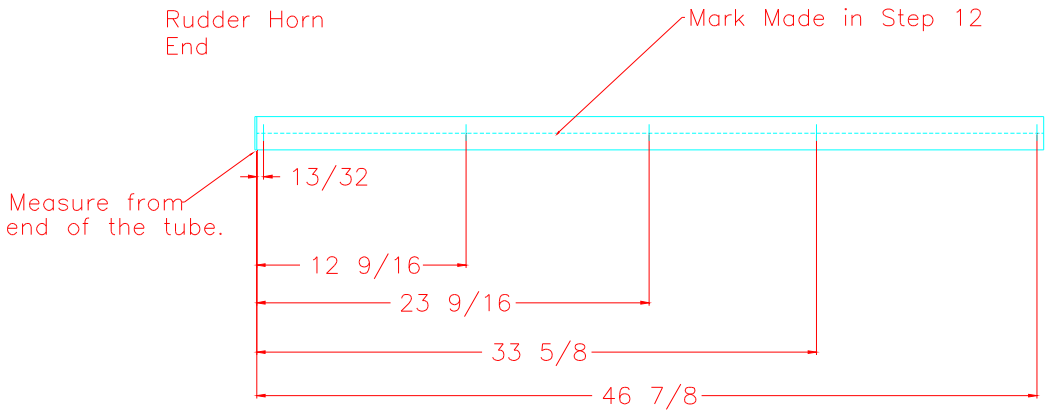
15) Drill a #11 hole through the tube and end plug 1/2" from the end and directly opposite of the full length line. See Figure 7.




(Figure 7)

16) Repeat steps 13, 14, and 15 for the other end of tube.

17) Mark the rib locations on the spar as in Figure 8.

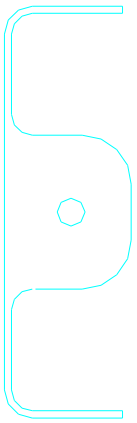



(Figure 8)

18) Drill a #30 hole at these marked locations.

19) Drill a #30 hole in the centre of the tab of each of the elevator - rudder ribs (EL-26). See Figure 9.

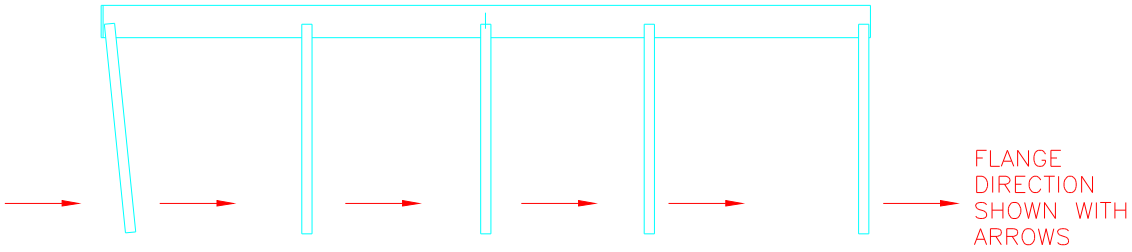
With a felt pen draw a line down the centre of each flange of the ribs.



END VIEW OF ELEVATOR – RUDDER RIB

(Figure 9)

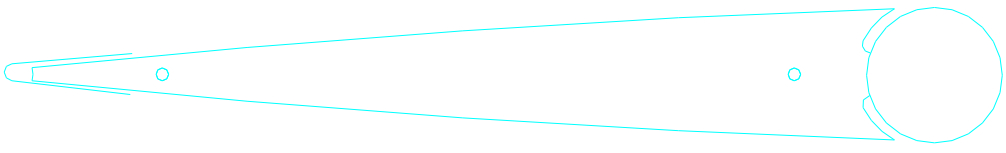
20) Cleco the five ribs to the spar as in Figure 10. **NOTE:** Flanges of end ribs face inward for ease of covering.




(Figure 10)

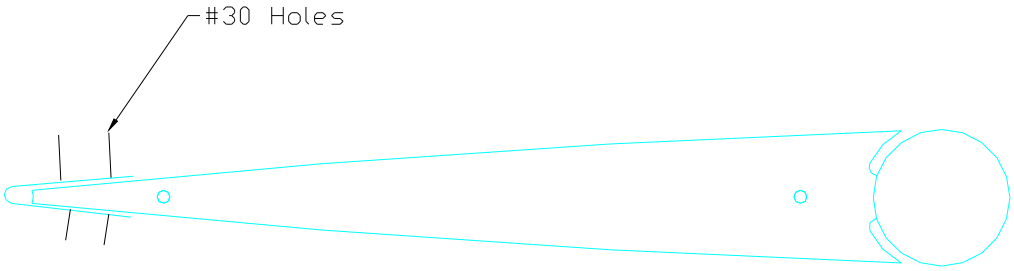
21) Cut a piece of trailing edge material (AIL-10) at 45 15/32" long.

22) Press trailing edge material onto the ribs. Drill #30 holes and cleco the trailing edge onto the ribs. Ensure ribs are properly aligned. See Figure 11.



(Figure 11)

23) Drill #30 holes at trailing edge. Offset the holes so the rivets will clear. Figure 12.

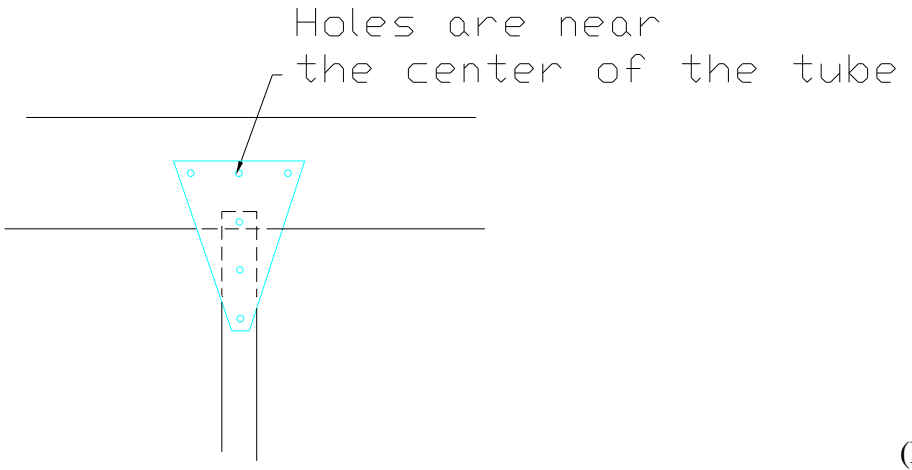



(Figure 12)

24) Remove the trailing edge. Debur, chromate and rivet trailing edge on with 1/8" x 3/16" (RV 1410) Avex rivets.

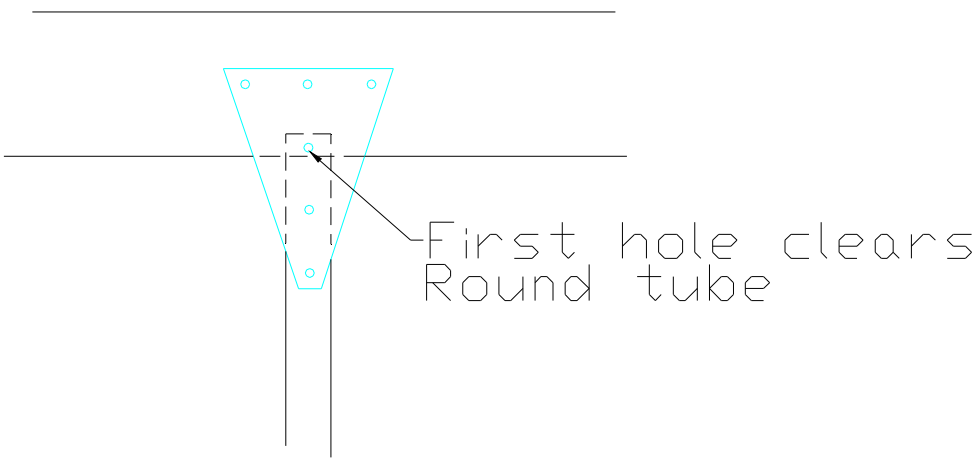
25) Use Figure 13, 14, and 15 as a pattern and cut out two of each gussets for rudder. Make from 12" x 48" x .032 material (EL-38). **NOTE:** Figure 13, 14 and 15 are full size and will follow this page.

26) Clamp gussets in place and drill into the tube with a #30 drill. Cleco. See Figure 16.




(Figure 16)

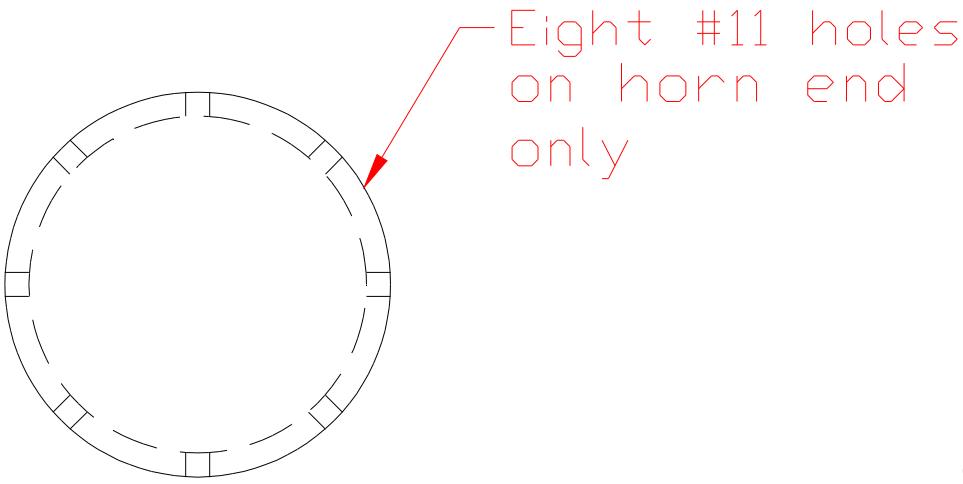
27) Drill three #30 holes through the gusset, into the rib flange. Cleco. Figure 17.




(Figure 17)

28) Remove parts.

29) At each end and into each end plug there should now be four #11 holes. Drill four more #11 holes between the existing holes for a total of eight equally spaced #11 holes in the spar and end plug at the horn end only. See Figure 18.




(Figure 18)

30) Disassemble and debur all parts.

31) Soak a rag with tube seal and push it through the rudder spar tube. The tube seal is an anticorrosion agent and will protect the inside of the tube.

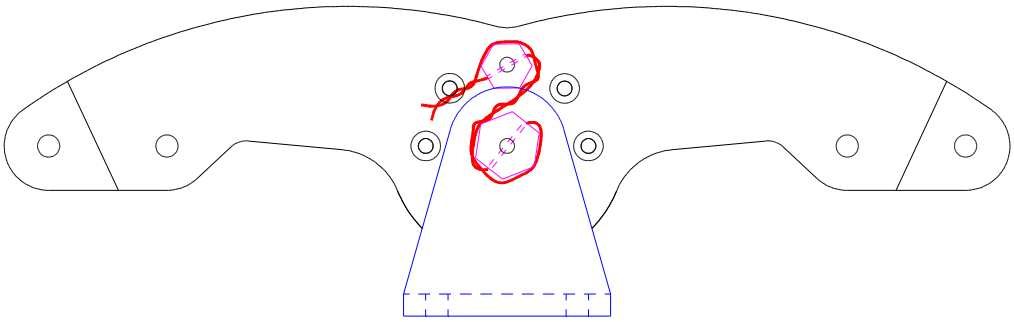
32) Chromate mating surfaces and rivet together as follows:

1. Rudder horn to end plug use seven 3/16" x 3/8" stainless steel rivets (RR 5606).
2. End plug on rudder horn end to spar with eight 3/16" x 1/4" stainless steel rivets (RR 5604).
3. End plug on top of rudder with four 3/16" x 1/4" Avex rivets (RV 1613).
4. All other rivets are 1/8" x 3/16" Avex (RV 1410).

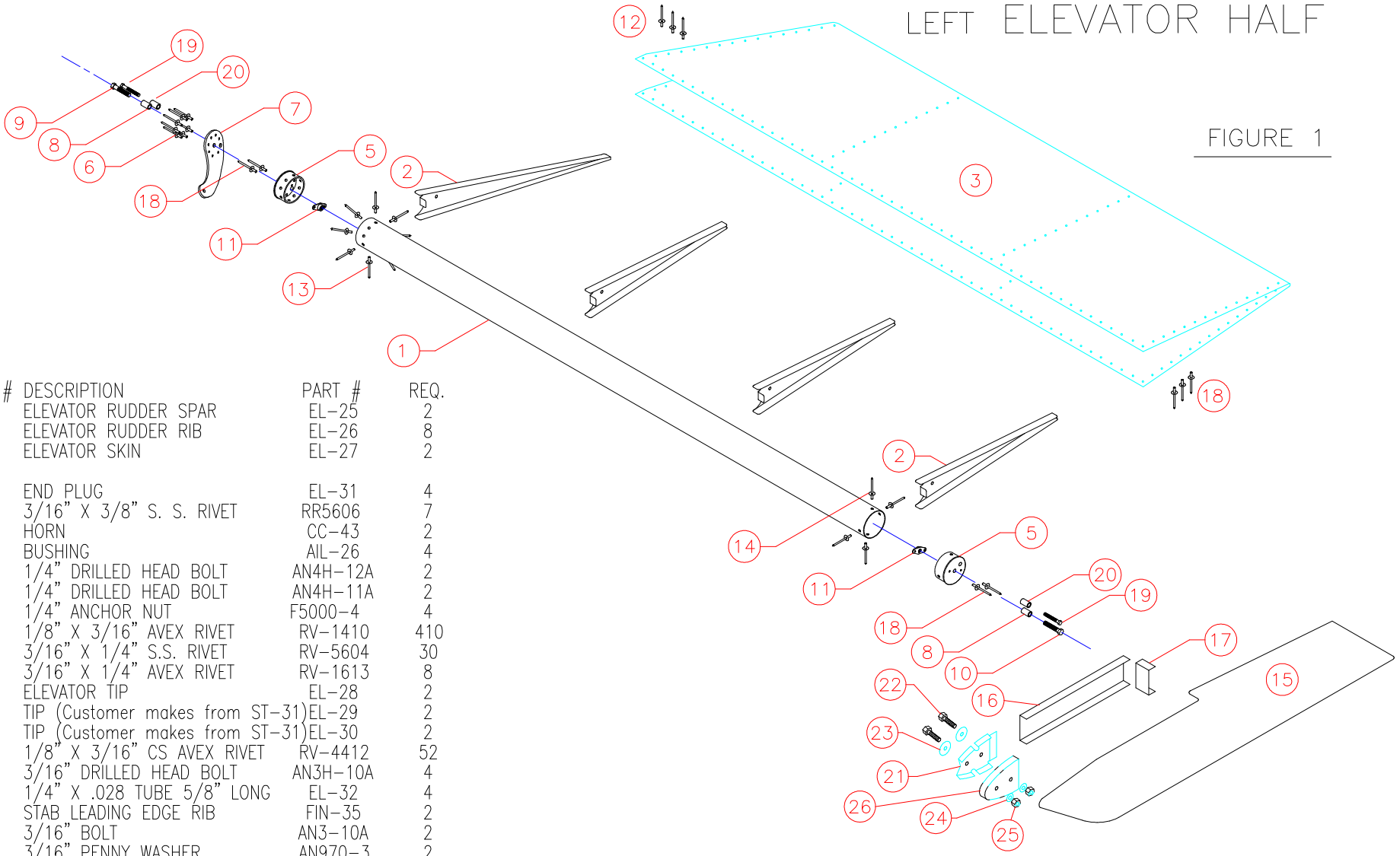
33) From the 1/4" x .028 tube (EL-32) cut six 5/8" lengths. You will use two on the rudder and two on each elevator half section.

34) Bolt the 1/4" x .028 x 5/8" tube to the end plugs with AN3H-10A drilled head bolts.

35) This drilled bolt will be used to safety tie the hinge bolt during assembly. Figure 19.

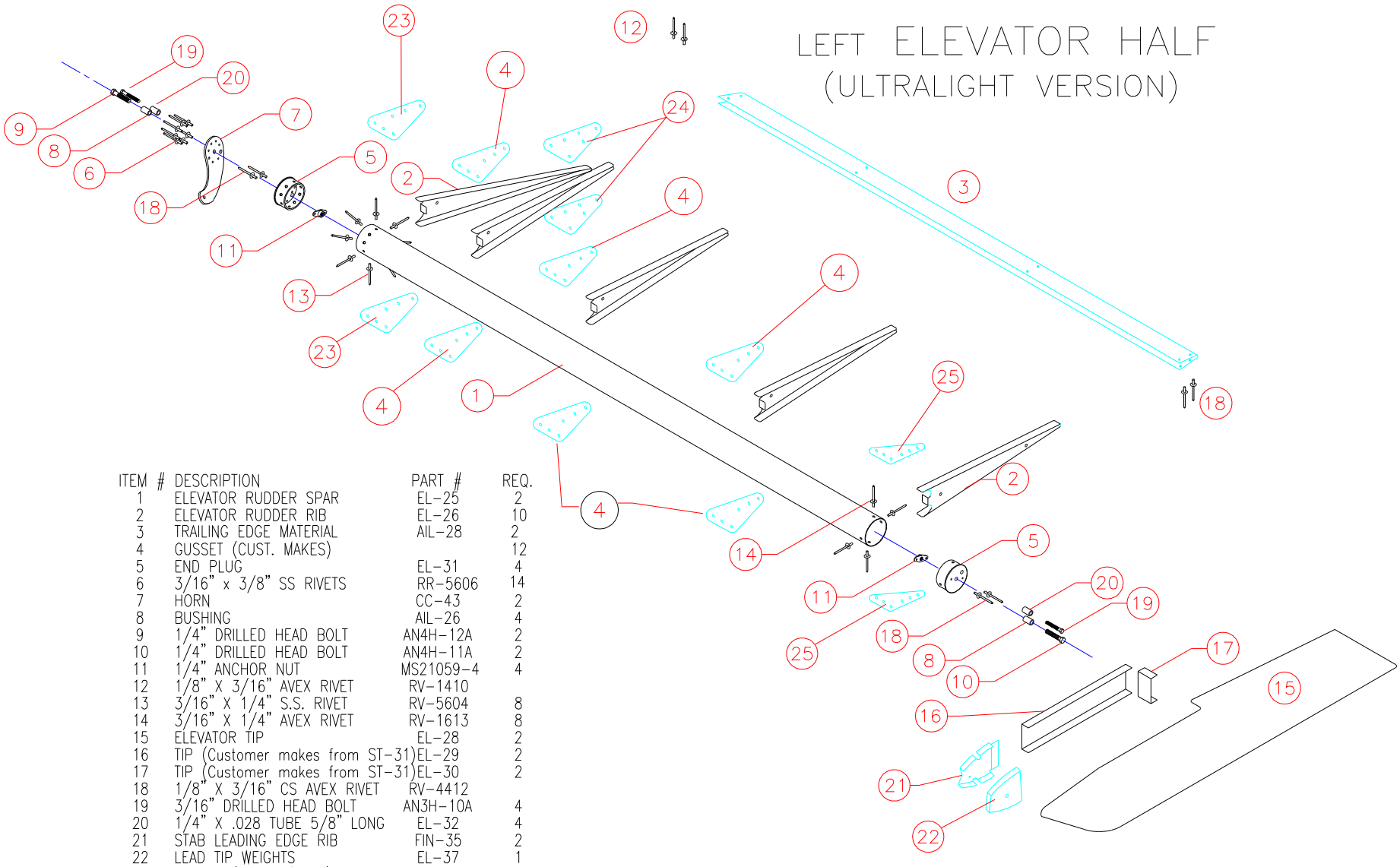


(Figure 19)




| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | ELEVATOR RUDDER SPAR | EL-25 | 2 |
| 2 | ELEVATOR RUDDER RIB | EL-26 | 8 |
| 3 | ELEVATOR SKIN | EL-27 | 2 |
| 4 | | | |
| 5 | END PLUG | EL-31 | 4 |
| 6 | 3/16" X 3/8" S. S. RIVET | RR5606 | 7 |
| 7 | HORN | CC-43 | 2 |
| 8 | BUSHING | AIL-26 | 4 |
| 9 | 1/4" DRILLED HEAD BOLT | AN4H-12A | 2 |
| 10 | 1/4" DRILLED HEAD BOLT | AN4H-11A | 2 |
| 11 | 1/4" ANCHOR NUT | F5000-4 | 4 |
| 12 | 1/8" X 3/16" AVEX RIVET | RV-1410 | 410 |
| 13 | 3/16" X 1/4" S.S. RIVET | RV-5604 | 30 |
| 14 | 3/16" X 1/4" AVEX RIVET | RV-1613 | 8 |
| 15 | ELEVATOR TIP | EL-28 | 2 |
| 16 | TIP (Customer makes from ST-31) | EL-29 | 2 |
| 17 | TIP (Customer makes from ST-31) | EL-30 | 2 |
| 18 | 1/8" X 3/16" CS AVEX RIVET | RV-4412 | 52 |
| 19 | 3/16" DRILLED HEAD BOLT | AN3H-10A | 4 |
| 20 | 1/4" X .028 TUBE 5/8" LONG | EL-32 | 4 |
| 21 | STAB LEADING EDGE RIB | FIN-35 | 2 |
| 22 | 3/16" BOLT | AN3-10A | 2 |
| 23 | 3/16" PENNY WASHER | AN970-3 | 2 |
| 24 | 3/16" WASHER | AN960-10 | 2 |
| 25 | 3/16" FIBER NUT | AN365-1032A | 2 |
| 26 | LEAD TIP WEIGHTS | EL-37 | 1 |

# LEFT ELEVATOR HALF
## (ULTRALIGHT VERSION)



| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | ELEVATOR RUDDER SPAR | EL-25 | 2 |
| 2 | ELEVATOR RUDDER RIB | EL-26 | 10 |
| 3 | TRAILING EDGE MATERIAL | AIL-28 | 2 |
| 4 | GUSSET (CUST. MAKES) | | 12 |
| 5 | END PLUG | EL-31 | 4 |
| 6 | 3/16" x 3/8" SS RIVETS | RR-5606 | 14 |
| 7 | HORN | CC-43 | 2 |
| 8 | BUSHING | AIL-26 | 4 |
| 9 | 1/4" DRILLED HEAD BOLT | AN4H-12A | 2 |
| 10 | 1/4" DRILLED HEAD BOLT | AN4H-11A | 2 |
| 11 | 1/4" ANCHOR NUT | MS21059-4 | 4 |
| 12 | 1/8" X 3/16" AVEX RIVET | RV-1410 | |
| 13 | 3/16" X 1/4" S.S. RIVET | RV-5604 | 8 |
| 14 | 3/16" X 1/4" AVEX RIVET | RV-1613 | 8 |
| 15 | ELEVATOR TIP | EL-28 | 2 |
| 16 | TIP (Customer makes from ST-31) | EL-29 | 2 |
| 17 | TIP (Customer makes from ST-31) | EL-30 | 2 |
| 18 | 1/8" X 3/16" CS AVEX RIVET | RV-4412 | |
| 19 | 3/16" DRILLED HEAD BOLT | AN3H-10A | 4 |
| 20 | 1/4" X .028 TUBE 5/8" LONG | EL-32 | 4 |
| 21 | STAB LEADING EDGE RIB | FIN-35 | 2 |
| 22 | LEAD TIP WEIGHTS | EL-37 | 1 |
| 23 | GUSSET (CUST. MAKES) | | 4 |
| 24 | GUSSET (CUST. MAKES) | | 4 |
| 25 | GUSSET (CUST. MAKES) | | 4 |

To assemble the two elevator halves you will require the same tools as the rudder assembly.

Approximate time for this job is 4 hours for each half. If you are installing the optional trim system add another 2 1/2 hours.

Assembly of the elevator halves is very similar to the rudder assembly.

## *5.1 Horn Install*

1) Lay out the parts for an elevator half as in the exploded view drawing. The elevator half shown is the left side. If a trim system is to be installed it is normally installed on the left side. If you are installing a trim you may wish to build the less complicated right side first.

2) Bolt a control horn (CC-43) to an end plug (EL-31) with a bushing (AIL-26) and a AN4H-12A bolt. Figure 5.1.1.

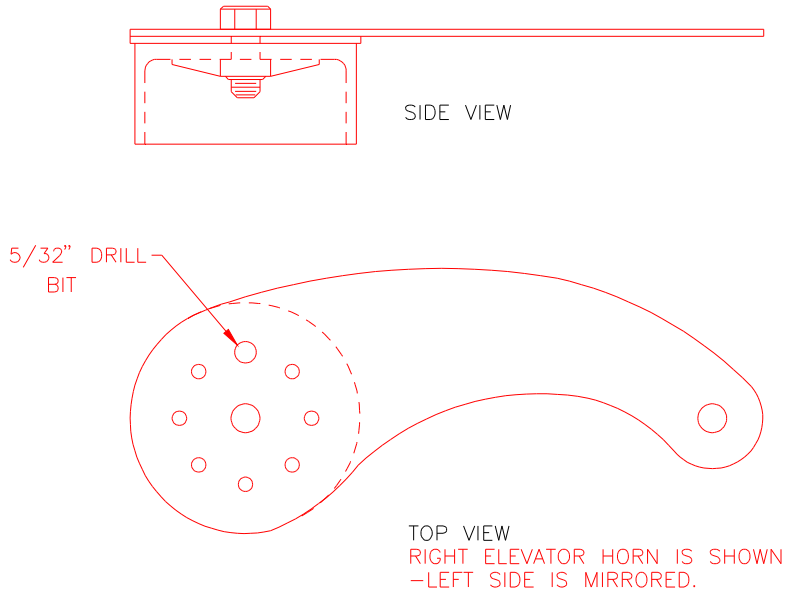



Figure 5.1.1

3) Align the horn so the holes when drilled will not interfere with the anchor nut installed in the rudder instructions. Drill out the 5/32" hole shown in Figure 5.1.1. Drill the other 7 holes out with a #11 drill bit.

4) Remove the horn and bolt to another end plug. Drill a 5/32" hole through this end plug using the 5/32" hole in the horn as a guide. Do ***NOT*** drill the other seven holes.

5) Tap out the 5/32" holes in both end plugs to 10-32 thread. Drill the 5/32" hole in the horn to #11.

## *5.2 Elevator Spar*

1) On a elevator-rudder spar (EL-25) wrap a piece of paper around the tube 1/2" from the end. **NOTE:** The EL-25 are cut to 47 1/8" as the Rudder Assembly section. Using the edge of the paper draw a line around the tube with a felt pen.

2) Position the end plug and horn as in figure 5.2.1.

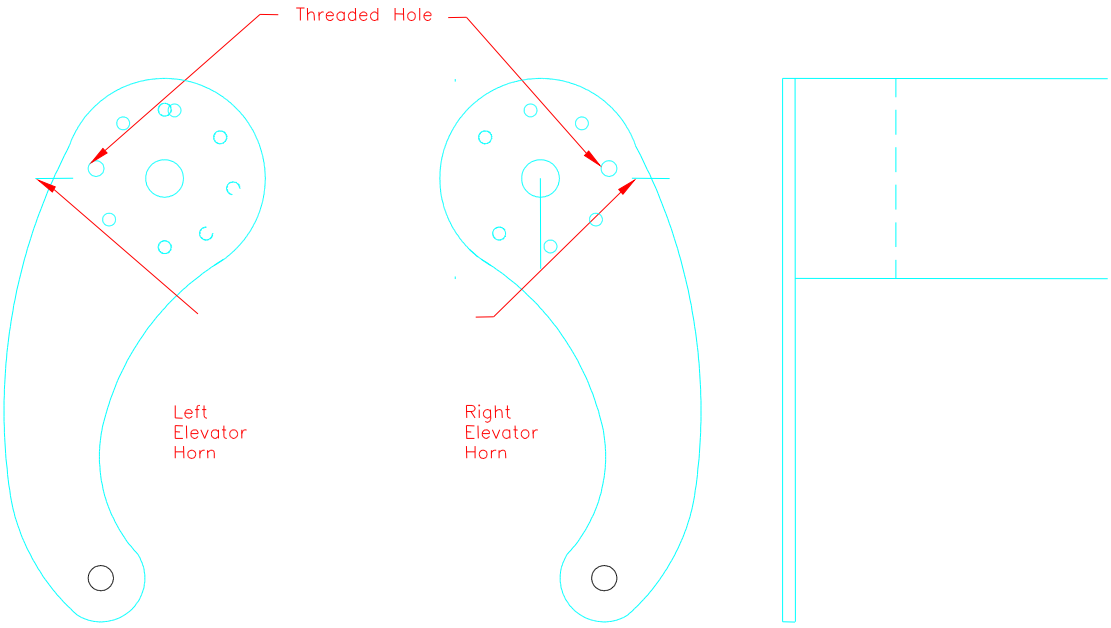



Figure 5.2.1

**NOTE:** The position of the horns are reversed for the left and right elevator halves. The outboard end plugs are oriented with the threaded hole towards the rear of the elevator.

3) Drill a #11 hole through the tube and end plug 1/2" from the end and directly opposite of the full length line. Figure 5.2.2.

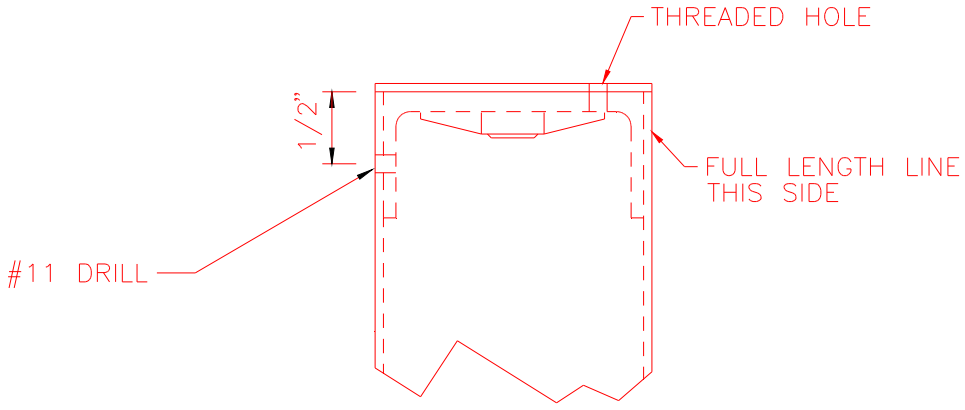



Figure 5.2.2

4) Repeat for other end.

5) Mark the rib location on the spar as in figure 5.2.3.

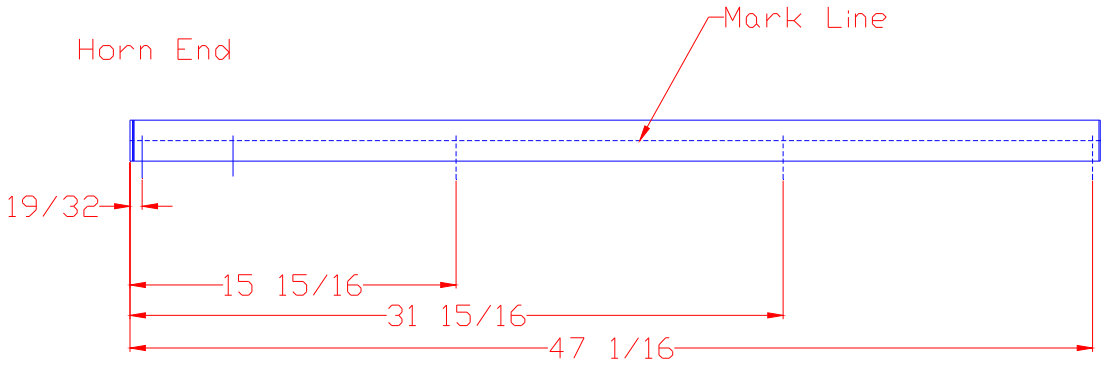



Figure 5.2.3

6) Drill a #30 hole at these marked locations. Measurement with horn on.

## *5.3 Rib Install*

1) Drill a #30 hole in the center of the tab of each of the elevator-rudder ribs (EL-26). With a felt pen draw a line down the center of each flange of the ribs.

2) Cleco the four ribs to the spar as in figure 5.3.1.

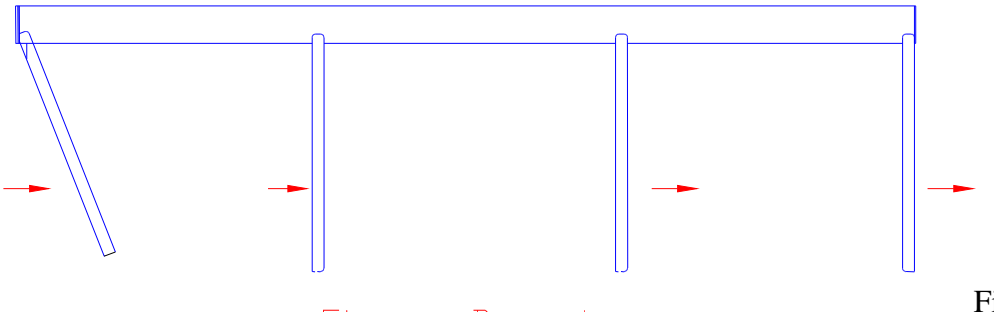


Figure 5.3.1

3) Follow steps in the rudder assembly pertaining to the rib install.

## *5.4 Skin Install*

1) Cleco the elevator skin (EL-27) to the spar and rib assembly as you did with the rudder.

2) Align the skin along the length of the spar and center it between the ends of the spar. Starting from the center work your way evenly outwards using a #30 drill bit. Use plenty of clecos. Complete one side then turn over and do the other side.

3) Starting from the front of the ribs and working backwards drill through the skin and into the ribs with a #30 drill bit. The horn end rib will protrude approximately 1/16" past the skin. Use plenty of clecos while drilling.

4) Drill the end holes in the skin that go into the spar and end plug out to #11 holes.

5) Dimple the outboard rib holes.

6) Remove the skin.

7) On the end ribs only drill out the #30 hole in the rib, spar and end plug to #11 holes.

8) At each end and into each end plug there should now be four #11 holes. At the horn end only, drill four more #11 holes equally spaced between the existing holes for a total of eight #11 holes in the spar and end plug.

9) Disassemble and debur parts.

10) Soak a rag with tube seal and push through the elevator spar.

## *5.5 Finishing*

1) Chromate mating surfaces and rivet together the RIGHT elevator HALF as follows:

2) Control horn to end plug with seven 3/16" x 3/8" SS rivets (RR-5606).

3) Control horn end plug to spar with 3/16" SS rivets (RR-5604). Attach the end rib, but leave skin holes open.

4) End plug on outboard end to spar with 3/16" rivets (RV-1613). Attach the end rib, but leave the skin holes open.

5) Skin to the spar at the horn end with 3/16" SS (RR-5604).

6) Skin to the spar at the outboard end with 3/16" rivets (RV-1613).

7) Outboard rib to skin with 1/8" CS rivets (RV-4412).

8) All other rivets are 1/8" rivets (RV-1410).

9) If you are not using the optional electrical trim system you can complete the left elevator half in the same manner as the right.

10) If you are using the trim system see the separate instructions for assembly.

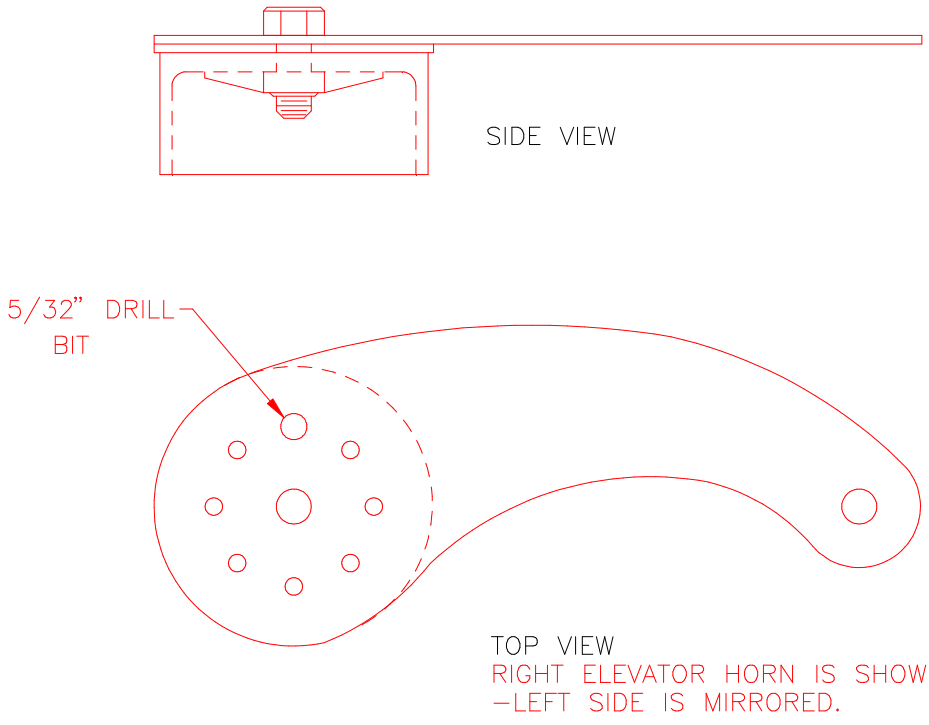
## *ULTRALIGHT ELEVATOR ASSEMBLY*

To assemble the two elevator halves you will require the same tools as with the rudder.

Assembly of the elevator halves is very similar to the rudder assembly.

1) Lay out the parts for an elevator half as in Figure 1. The elevator half shown in Figure 1 is the left side. If a trim system is to be installed it is normally installed on the left side. If you are installing a trim you may wish to build the less complicated right side first. **NOTE:** The end plug is prepared as in rudder section.

2) Bolt a control horn (CC-43) to an end plug (EL-31) with a bushing (AIL-26) and a AN4H-12A bolt. Figure 2.




(Figure 2)

3) Align the horn so the holes , when drilled, will not interfere with the anchor nut installed in step 6 of rudder instructions. Drill out the 5/32" hole shown in Figure 2. Drill the other 7 holes out with a #11 drill bit.

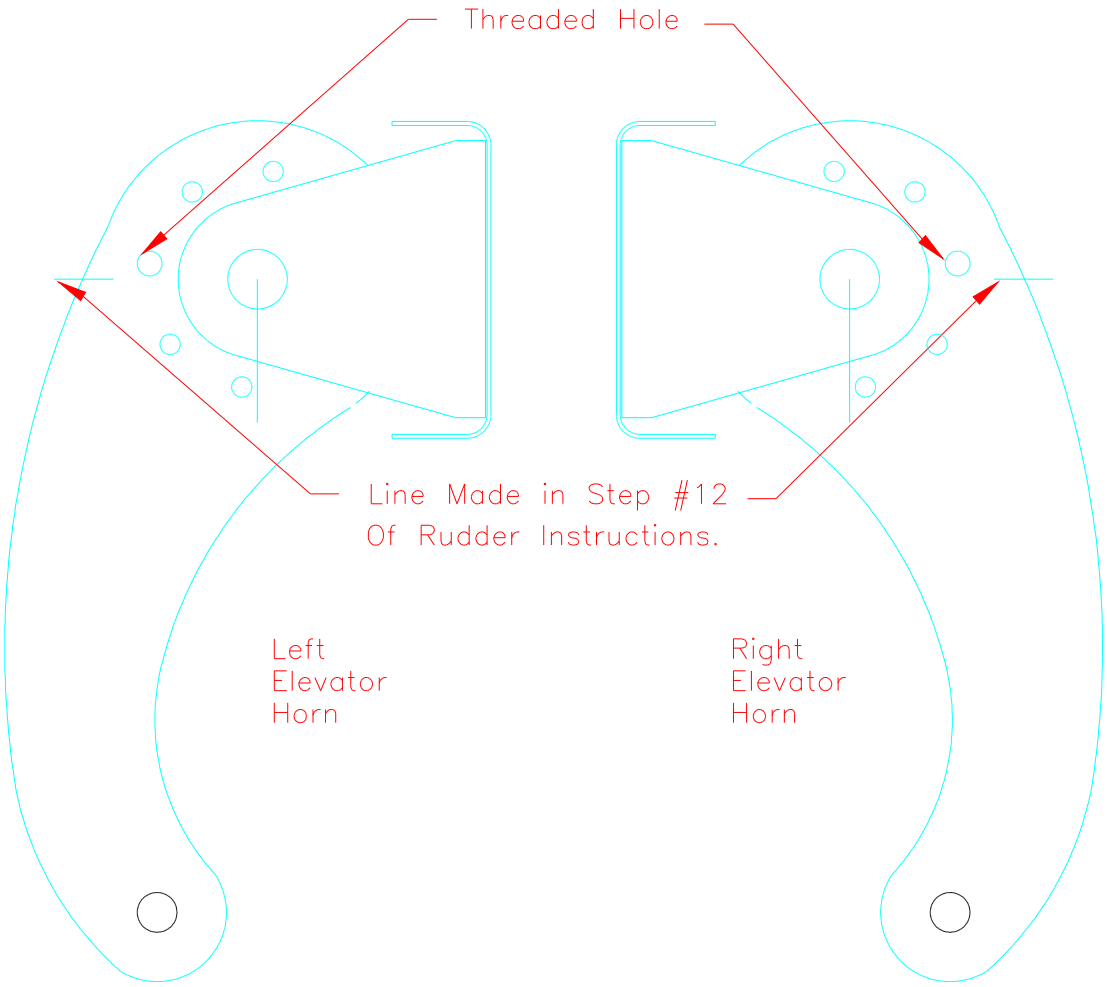
4) Remove the horn and bolt to another end plug. Drill a 5/32" hole through this end plug using the 5/32" hole in the horn as a guide. Do NOT drill the other seven holes.

5) Tap out the 5/32" holes in both end plugs to 1032 thread.

6) On a elevator - rudder spar (EL-25) wrap a piece of paper around the tube 1/2" from the end. Using the edge of the paper, draw a line around the tube with a felt pen.

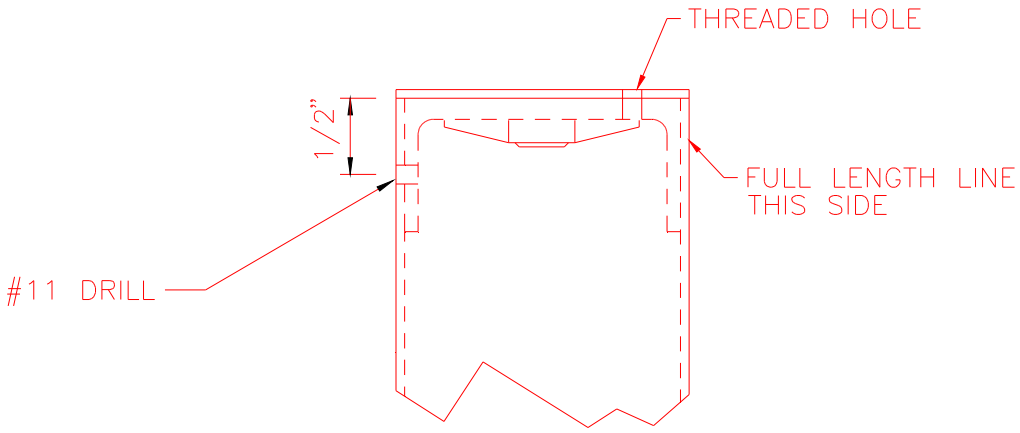
7) Position the end plug and horn as in Figure 3.

**NOTE:** The position of the horns are reversed for the left.




(Figure 3)

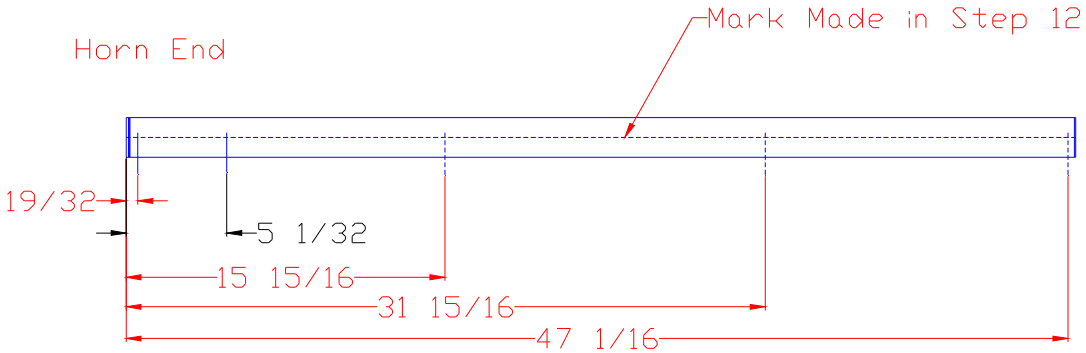
8) Drill a #11 hole through the tube and end plug 1/2" from the end and directly opposite of the full length line. See Figure 4.




(Figure 4)

9) Repeat steps 6 to 8 for other end.

10) Mark the rib locations on the spar as in Figure 5.

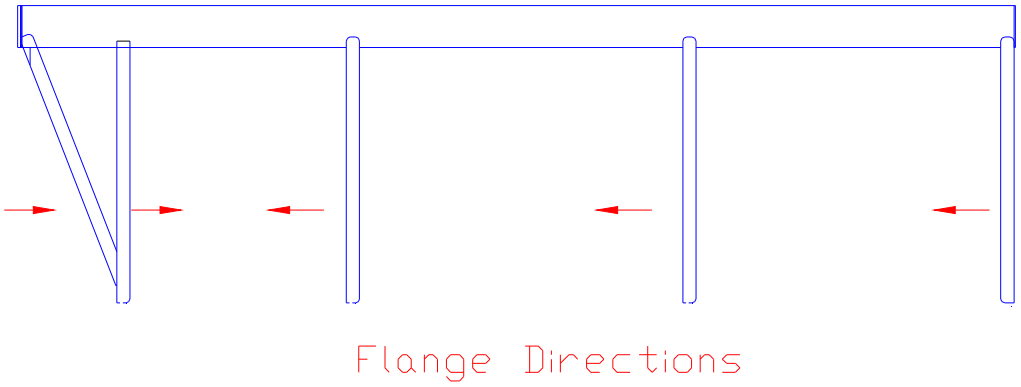



(Figure 5)

11) Drill a #30 hole at these marked locations.

12) Drill a #30 hole in the centre of the tab of each of the elevator - rudder ribs (EL-25). With a felt pen draw a line down the centre of each flange of the ribs.

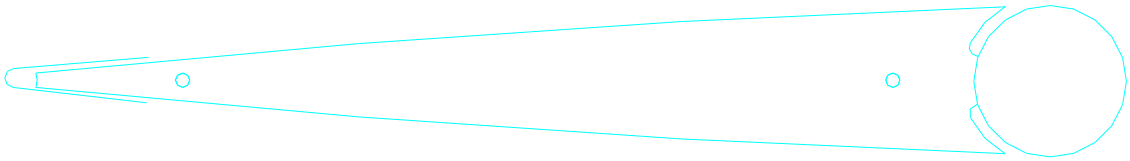
13) Cleco the five ribs to the spar as in Figure 6.




(Figure 6)

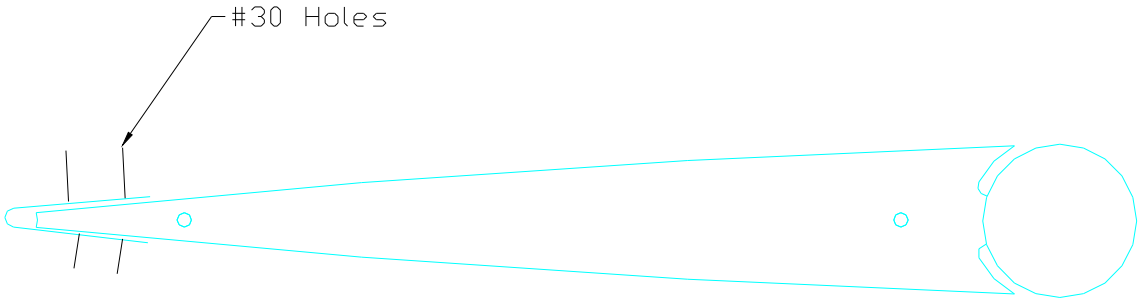
14) Cut two trailing edges from trailing edge material (AIL-28).

15) Press trailing edge material on the ribs. Drill #30 holes and cleco on the ribs. Ensure ribs are in their proper locations. Figure 7.



(Figure 7)

16) Drill #30 holes at the trailing edge. Offset the holes so the rivets will clear. See Figure 8.



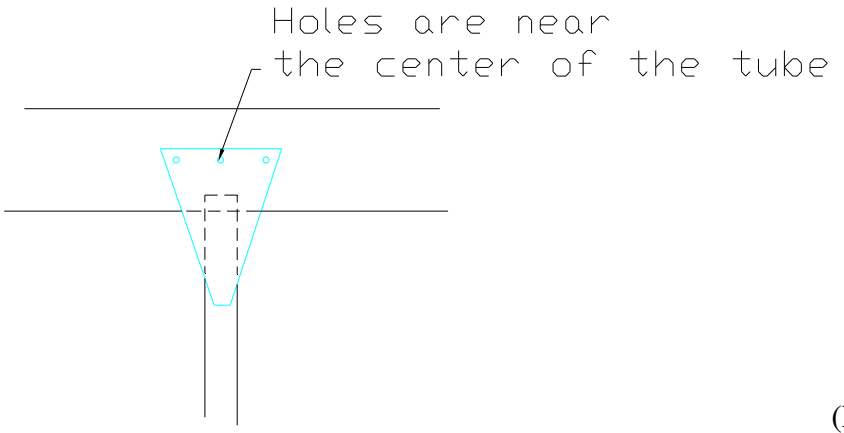

(Figure 8)

17) Remove trailing edge. Debur, chromate and rivet trailing edge on with 1/8" x 3/16" Avex rivets.

18) Use Figure 17, 18, 19, and 20 as a pattern and cut out 2 of each gusset for elevator. Make from 12" x 48" x .032" material (EL-38).

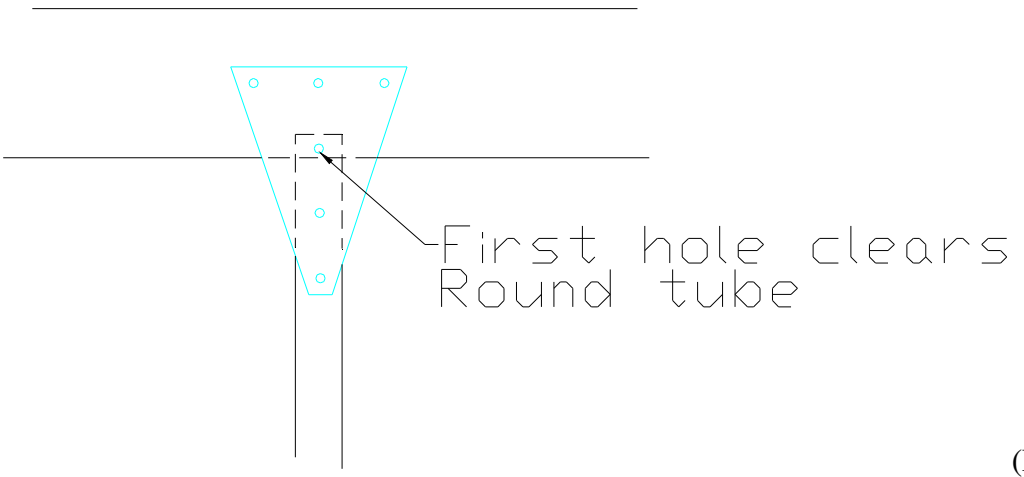
**NOTE:** Figure 17, 18, 19 and 20 are full size and will follow this page.

19) Clamp gussets in place and drill three #30 holes into the tube. Cleco. See Figure 9.




(Figure 9)

20) Drill three #30 holes through the gusset into each rib flange. Cleco. Figure 10.




(Figure 10)

22) Disassemble and debur all parts.

23) Soak a rag with tube seal and push it through the elevator spar tube. The tube seal is an anticorrosion agent and will protect the inside of the tube.

24) Chromate mating surfaces and rivet together as follows.

***1.*** Elevator horn to end plug use seven 3/16” x 3/8” stainless steel rivets ((RR-5606).

***2.*** End plug on elevator horn end to spar with eight 3/16” x 1/4” stainless steel rivets (RR-5604)

***3.*** End plug on top of elevator with four 3/16" x 1/4" Avex rivets (RV-1613).

***4.*** All other rivets are 1/8" x 3/16" Avex rivets (RV-1410).

25) From the 1/4" x .028" tube (EL-32) cut six 5/8" lengths. You will use two on the rudder and two on each elevator half sections.

26) Bolt the 5/8" tube to the end plugs with AN3H-10A drilled head bolts.

27) This drilled bolt will be used to safety wire the hinge bushing attach bolt during assembly.

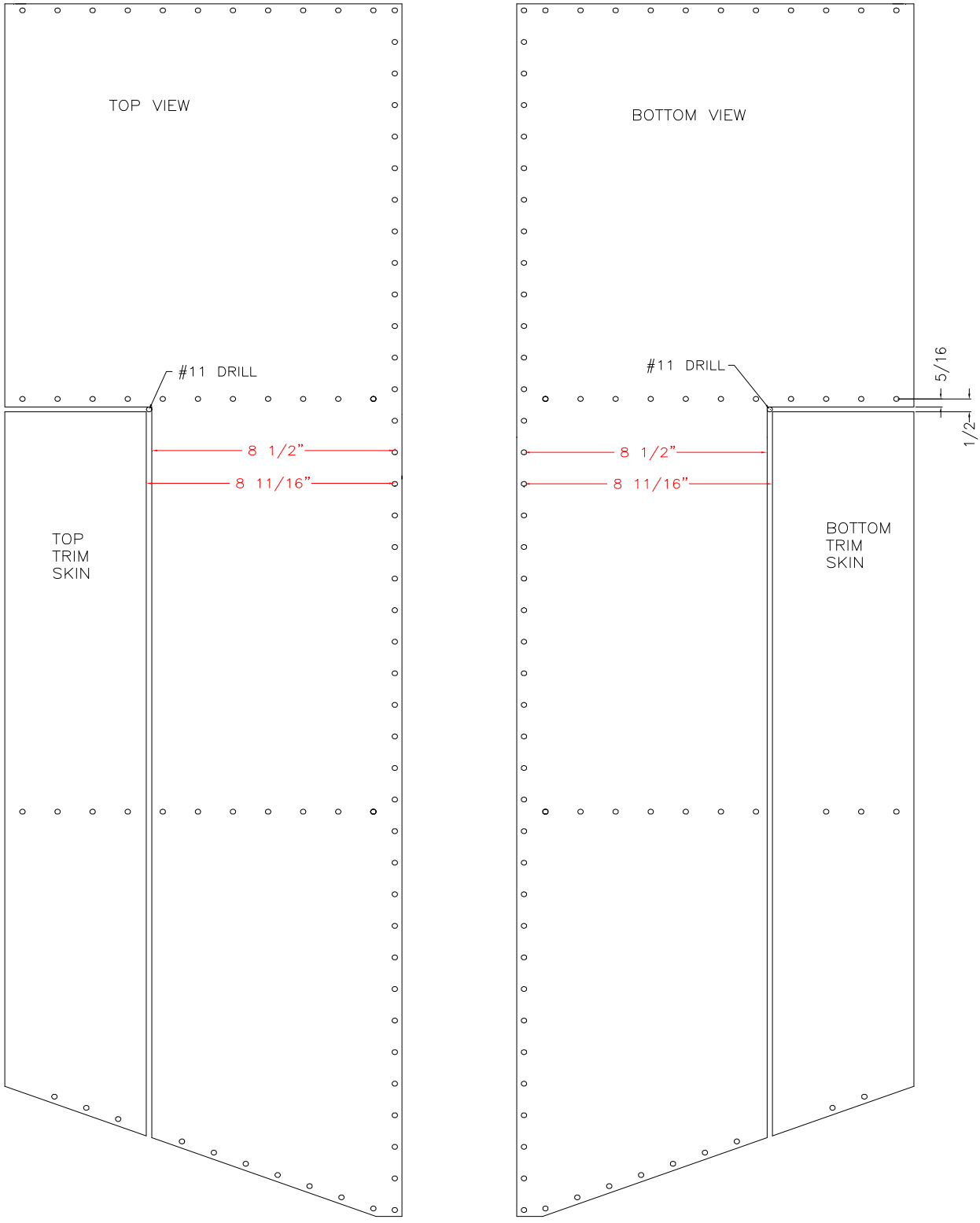

TOP VIEW
#11 DRILL
8 1/2"
8 11/16"
TOP
TRIM
SKIN
BOTTOM VIEW
#11 DRILL
5/16
1/2
8 1/2"
8 11/16"
BOTTOM
TRIM
SKIN

Fig. 6.1.1

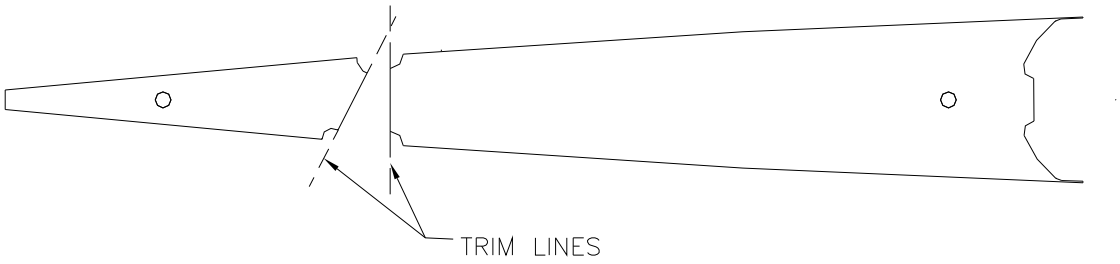



Fig.6.1.2

| REC# | PART# | DESCRIPTION | REQ | SHIP | REC | SHORT | CHK |
|---|---|---|---|---|---|---|---|
| 1 | | REBEL (Elevator Trim Option) | | | | | |
| 2 | | | | | | | |
| 3 | | Hinge ALUM. | | 30” | | | |
| 4 | EL-26 | Elevator – Rudder Rib | | 2 | | | |
| 5 | EL-33 | Trim Spar | | 1 | | | |
| 6 | EL-34 | Trim Spar | | 1 | | | |
| 7 | MAC-S4 | Servo Kit | | 1 | | | |
| 8 | EL-36 | Trim Horn | | 1 | | | |
| 9 | EL-35 | Servo Attach Plate | | 1 | | | |

## *6.1 Skin Layout*

The trim is on the left elevator half.

1) Complete the left elevator half to the end of the elevator assembly.

2) Mark out the skins as in figure 1.

3) Drill a #11 hole at the inside corner of the lines both top and bottom.

4) Cut the trim skin off.

**NOTE:** Don't try to cut along the lines. Make a first cut through the center of the scrap material then trim to final size. The scrap area is between the elevator line and trim skin line. Use a hacksaw to cut through the trailing edge section. See step 5a for trimming of the bottom of the trim skin.

## *6.2 Rib and Spar Install*

1) Cut the center rib, outboard rib and two extra ribs in your trim kit into two sections as in Figure 2.

2) The bottom of the trim skin can be trimmed to final size by putting the angled trim spar (EL-33) in place, drilling through from the top skin and clecoing in place. The skin can then be trimmed along the bottom of the trim spar. Figure 6.2.2.

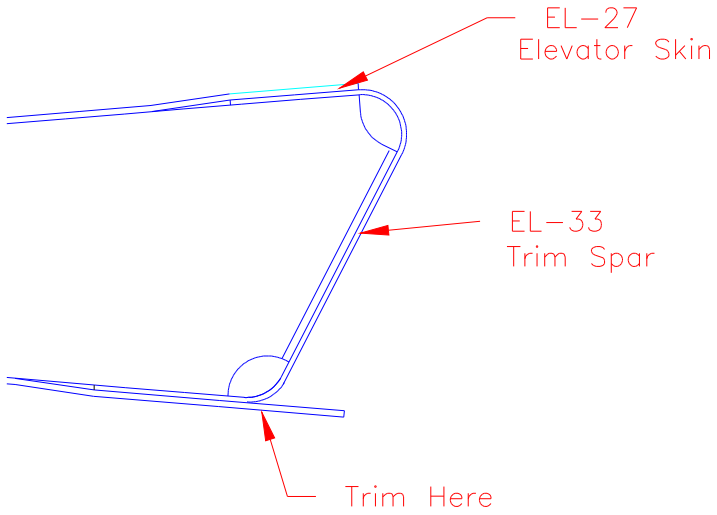



Figure 6.2.2

3) Position, drill and cleco the new section in place as in Figure 6.2.3.

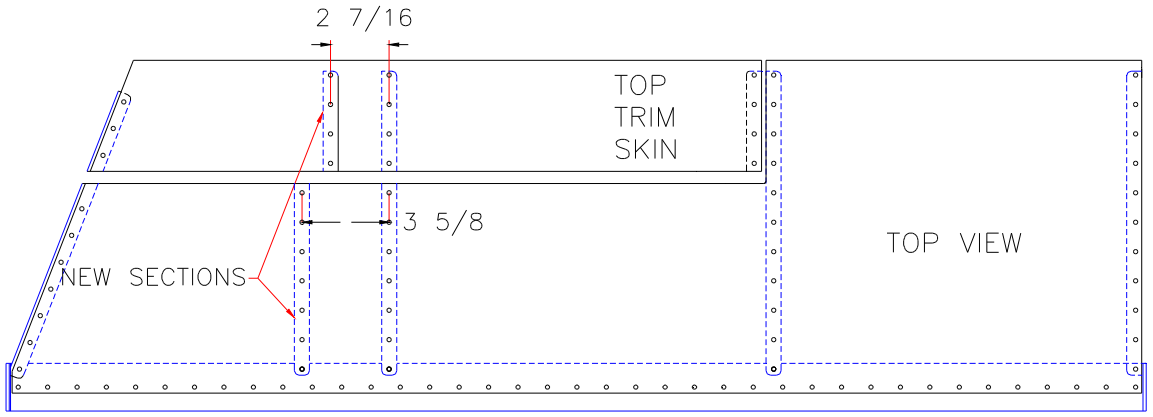



Figure 6.2.3

4) Cut the two trim spars (EL-33 and EL-34) to length and position in place. Small angles can be made up from ST-40 angle material to attach spars to ribs as in figure 6.2.4. (See stab section)

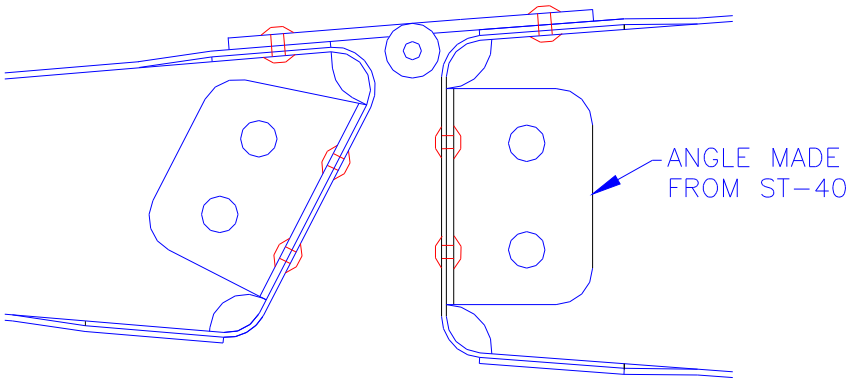



Figure 6.2.4

5) Cut hinge material to length, position and drill #30 holes as in Figure 6.2.5.

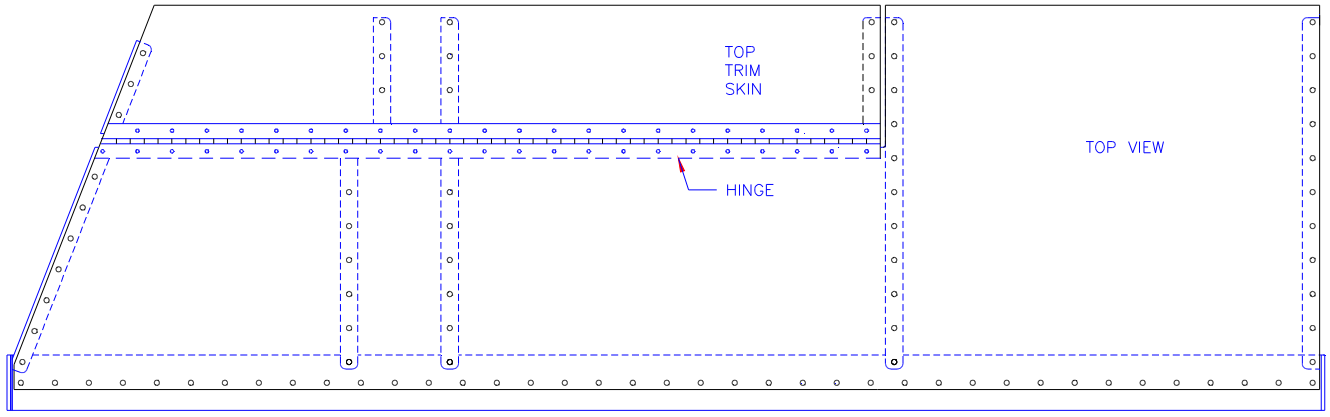



Figure 6.2.5

## *6.3 Servo Mount*

1) Mount the servo and backing plate (EL-35) with 1/8" rivets (RV-1410) as in figure 6.3.1. Use the holes in the servo as drill guides.

2) Cut a hole in the bottom of the skin between the two ribs just large enough for the servo to fit through. Figure 6.3.1.

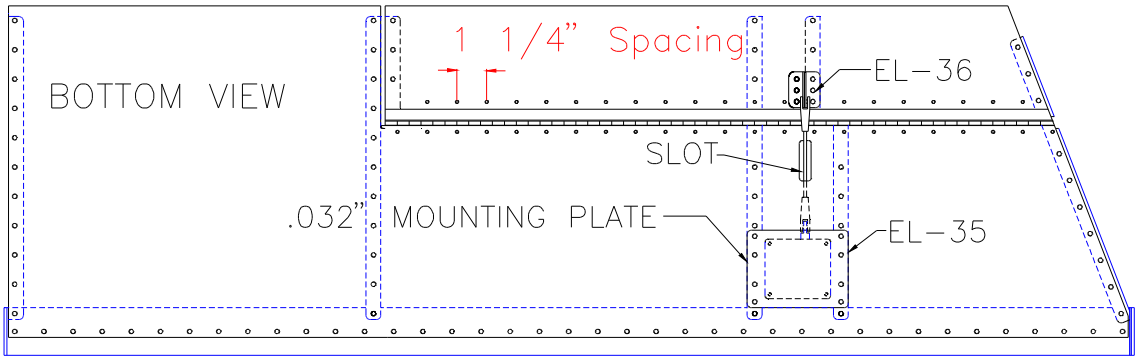



Figure 6.3.1

3) Lay out the trim horns as in Figure 6.3.2. Offer the push rod fork up to the trim horn before drilling the fork location holes to check the edge distance. Also the horn will need "scalloping" around the chosen mounting hole to alow full travel of the fork. Attach the horns (EL-36R & EL-36L) together with RV-1410 rivets.

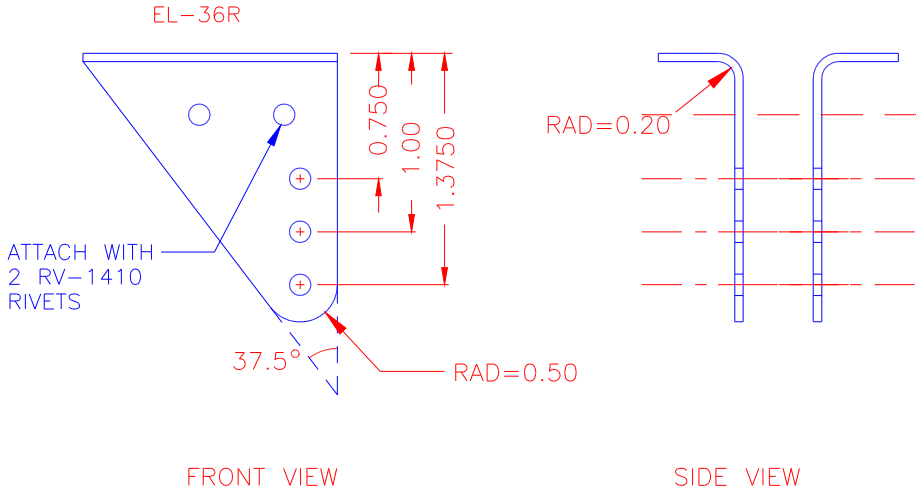



Figure 6.3.2

4) Position the trim horns on the bottom of the trim tab as in Figure 6. Drill and cleco in place.

5) Cut a slot in the bottom of the skin large enough to provide full movement of the servo push-pull rod. Figure 6.3.2 and Figure 6.3.3.

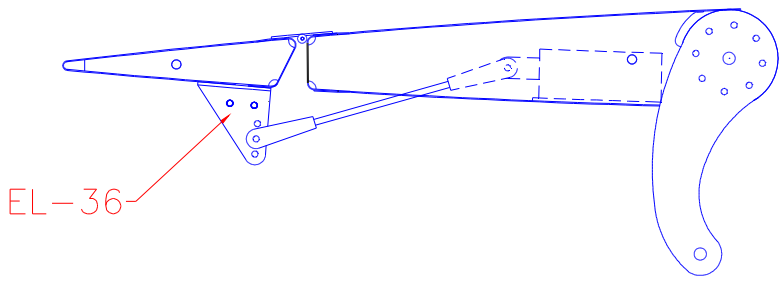



Figure 6.3.3

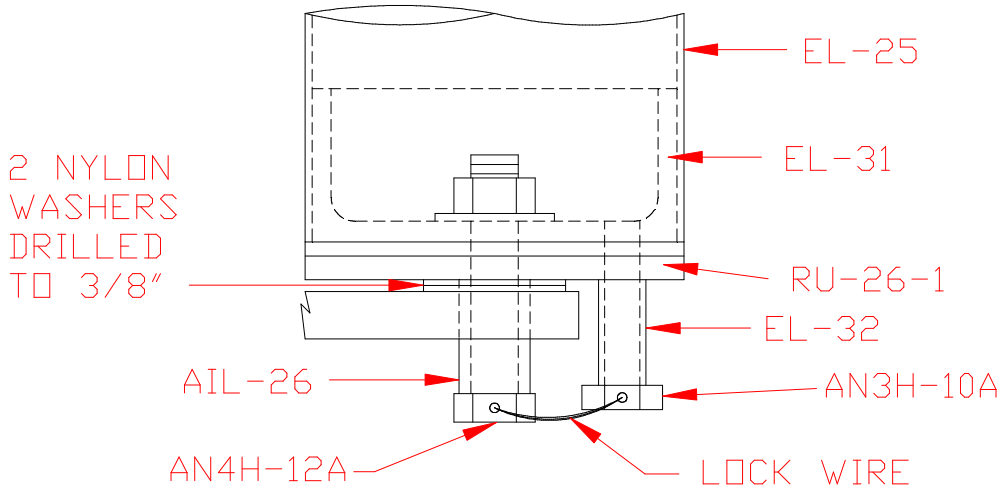
6) Adjust servo rod for neutral trim when the servo is at midpoint of its travel. You can check travel on the servo by connecting to any 12 volt battery.

7) Disassemble, debur, chromate and rivet together the same as with the right elevator half. Rivet the hinge to the trim and elevator with 1/8" rivets (RV-1410). Rivet the EL-35 to the Elevator with 1/8" rivets.

8) The servo wires should exit the elevator through the root rib, behind the elevator horn.

## *SPECIAL NOTES:*

Please be sure to tighten and safety tie the hinge bolts before finally attaching the elevator/rudder rib. Ensure that the steel bushing is clamped tight against the end plug or horn. The steel bushing should pivot inside the hinge bracket.




Under normal circumstances it is not necessary, however some builders may prefer easy access to the hinge bolt for inspection, lubrication, etc. If so, an access hole may be cut in the fiberglass at that location and filled with a plastic hole plug, similar to the ailerons.

If you are installing wiring for lights, etc. and desire easier access to the inside of the tip after installation, bolt the tip with MS35207-267 pan head screws and floating anchor nuts (F5000-3). These are quickly and easily removable and would allow the tip to be removed for routine inspection, servicing, etc.

## *7.1 Fiberglass Trim*

1) Each fiberglass tip comes in the kit as one fiberglass molded part which must be cut into two halves as shown in Figure 7.1.1. **NOTE:** A flange should remain on one part half as shown.

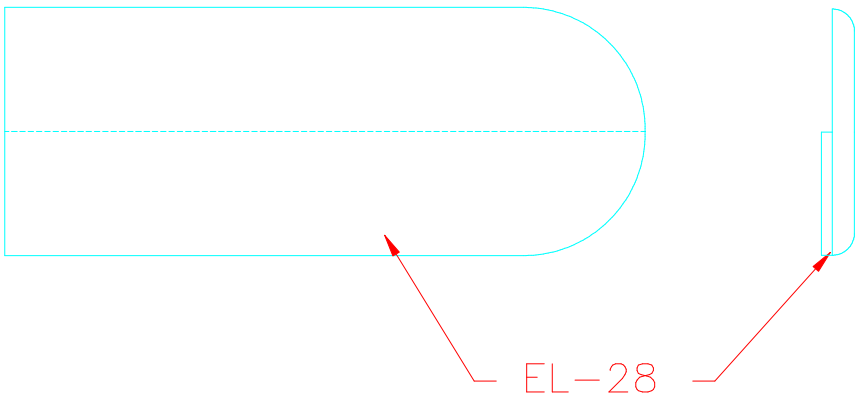



Figure 7.1.1

2) The edges of the part should be trimmed and sanded until smooth, then the halves fitted together as in Figure 7.1.2.

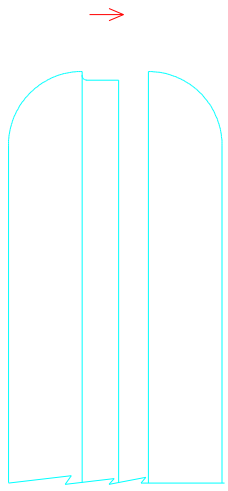


Figure 7.1.2

3) With the parts clamped together drill one #30 hole at each end of the mating flanges and cleco.

4) With the parts held together with clecos, mark and drill #30 holes at 1 1/2" nominal spacing along the mating flanges and cleco as required. Figure 7.1.3.

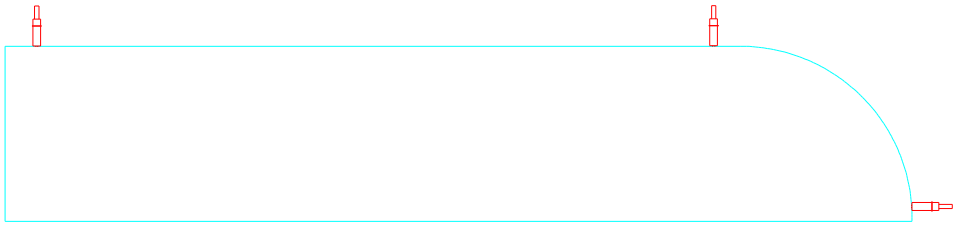


Figure 7.1.3

## *7.2 Tip Install*

1) With the elevator held neutral to the stab, slide the tip over the tail assembly until it overlaps (about 5/8") the flange of the outboard elevator rib. The curve at the leading edge should be flush with the stab leading edge. **NOTE:** The tip will come slightly past the elevator trailing edge. Figure 7.2.1.

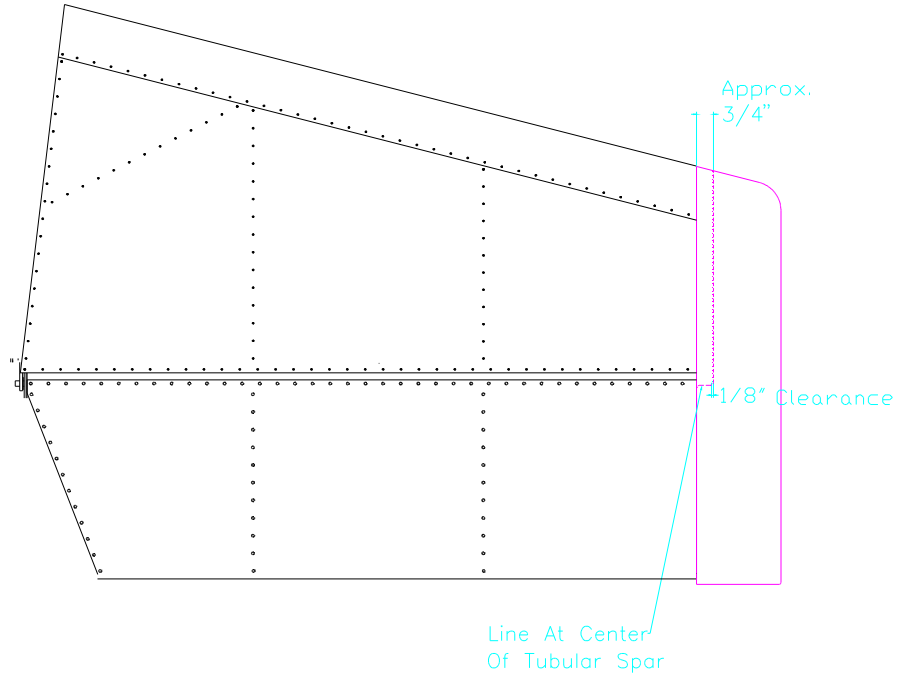



Figure 7.2.1

2) Mark a line approximately 3/4" back from the edge of the fiberglass tip with a felt pen. (Be sure to allow at least 1/8" clearance from the end of the stabilizer after trimming. Mark another line from the center of the elevator spar tube to the first trim line. (Mark both sides of the fiberglass). Figure 7.2.1

3) Remove the fiberglass, disassemble and trim along the marked lines.

## *7.3 Rib Install*

1) Measure and cut tip rib (EL-30) from the ST-31 material to fit immediately aft of the elevator spar tube. The part should be approximately 3 1/2" long. Figure 7.3.1.

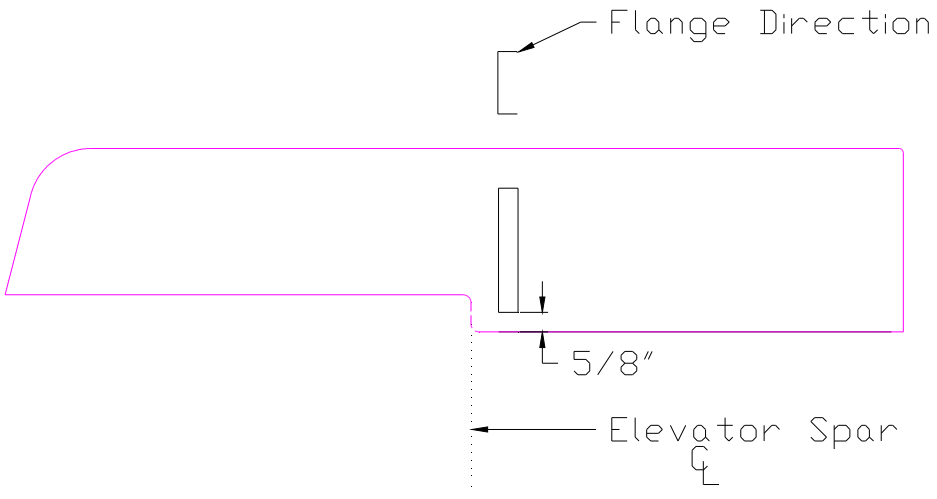



Figure 7.3.1

2) Position the rib about 5/8" back from the edge as shown in Figure 7.3.1 to clear the elevator rib flange after mounting. Drill three #30 holes through the fiberglass into the flange of the new rib.

3) Cleco in place.

4) Reassemble the glass tip and mark a line on the outside of the fiberglass along the center of the flange of the new rib. Drill three #30 holes into the rib and cleco.

5) Cut off the rear flange of one Leading Edge Rib (FIN-35). Place the rib inside the fiberglass tip and clamp in place. Drill one #30 hole into each flange of the rib and cleco in place. Figure 7.3.2.

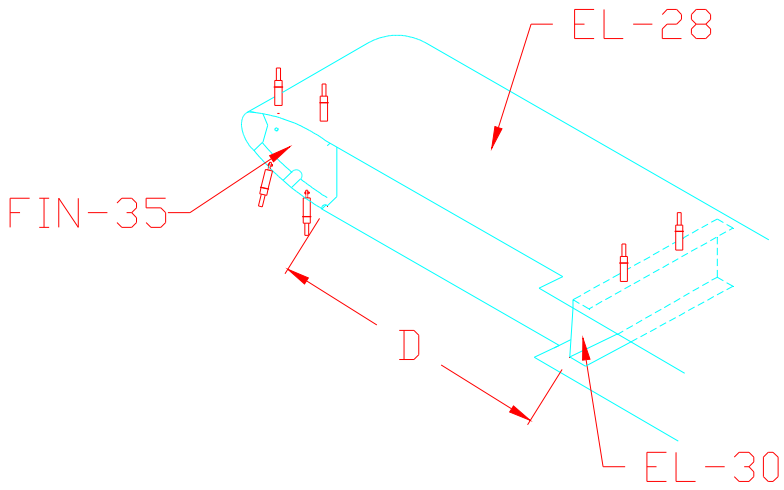



Figure 7.3.2

6) Measure the distance from the Leading Edge Rib (FIN-35) to the web of the tip rib (EL-30). Add 5/8" and cut another Tip Rib (EL-29) to this length. (Cut from ST-31 material).

7) Drill two holes 5/8" back from one end of the EL-29 rib and cut along the bends to the holes as shown. Figure 7.3.3.

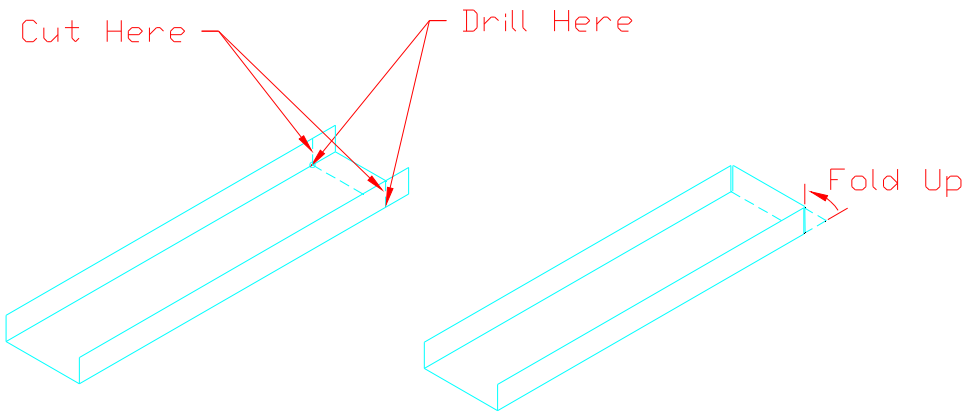



Figure 7.3.3

8) Fold the bottom flap up as shown above.

9) Fit the EL-29 rib between EL-30 and FIN-35 as shown with the front edge butted against FIN-35. Drill three equally spaced #30 holes through the folded flange of EL-29 into EL-30.

10) Cleco in place.

11) Drill #30 holes at 1 1/2" nominal spacing through the fiberglass into the flanges of the EL-29 rib.

12) Cleco in place.

## *7.4 Counter Weight Install*

1) Cut a piece of .032" gusset material 3" x 1" (cut from W-143). Sand all corners and edges.

2) Place the gusset as in Figure 7.4.1 to bridge the joint between FIN-35 and EL-29. Drill six #30 holes through the gusset and into each rib. Debur and attach using 1/8" rivets (RV-1410).

3) Cut the counterweight (EL-37) in half so there are two triangular shaped pieces. Figure 7.4.1.

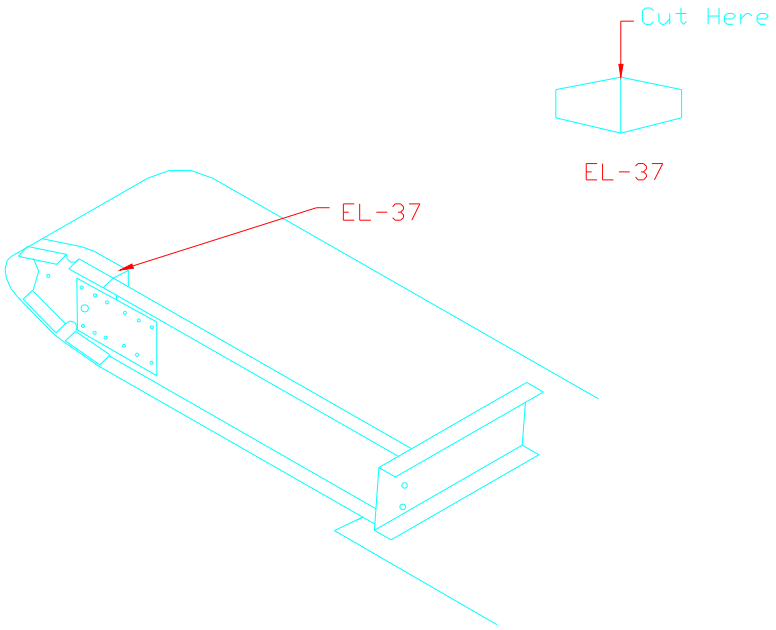



Figure 7.4.1

4) Drill #11 hole through the counter weight (EL-37) for mounting.

5) Remove the top portion of the fiberglass. Clamp the weight in place on the back side of the leading edge rib (FIN-35) and drill through the weight (EL-37) into the rib.

6) Debur all holes and edges.

7) Bolt EL-37 weight to the inside of the leading edge using a AN3-10A bolt, AN970-3 washer and AN365-1032 fiber nut.

## *7.5 Final Install*

1) Attach all parts to the bottom fiberglass half using 1/8" rivets.

2) Cleco the tip assembly back together and slide into place over the elevator rib. Figure 7.5.1.

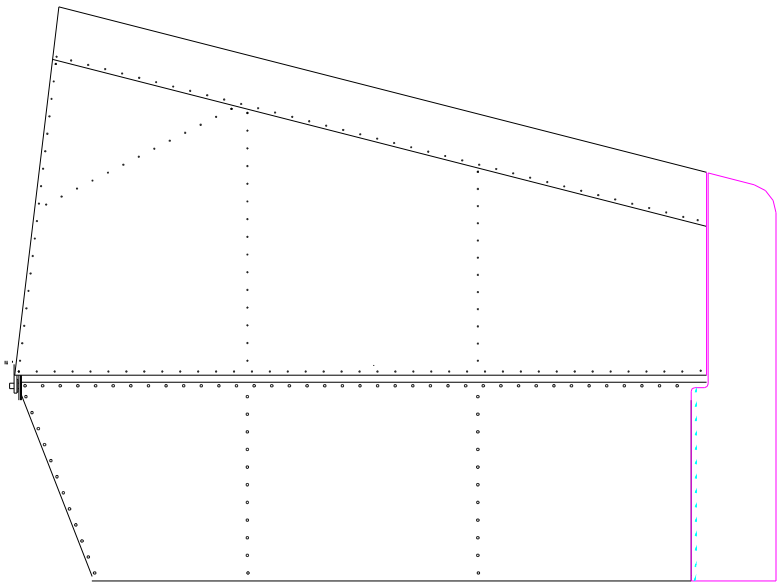


Figure 7.5.1

3) Drill #30 holes at 1" nominal spacing between the existing rivets in each flange of the elev/rudder end ribs. Cleco the assembly onto the elevator using these holes.

4) Support the bottom of the tip assembly, then remove the top half of the tip.

5) Cut a 1 3/4" piece of ST-40 angle. Use the angle gusset to attach tip rib EL-30 to the elevator rib as shown. See Figure 7.5.2.

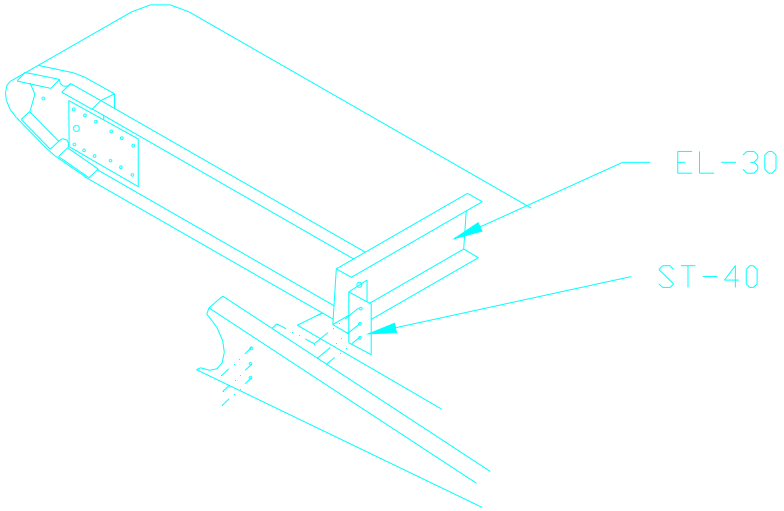



Figure 7.5.2

6) Drill three #30 holes through the angle into each rib. Debur and rivet using 1/8" rivets.

7) Reattach the top fiberglass half and rivet all parts using 1/8" rivets.

8) Mark a line from the trailing edge of the elevator across the trailing edge of the fiberglass tip.

9) Trim the fiberglass along this line.

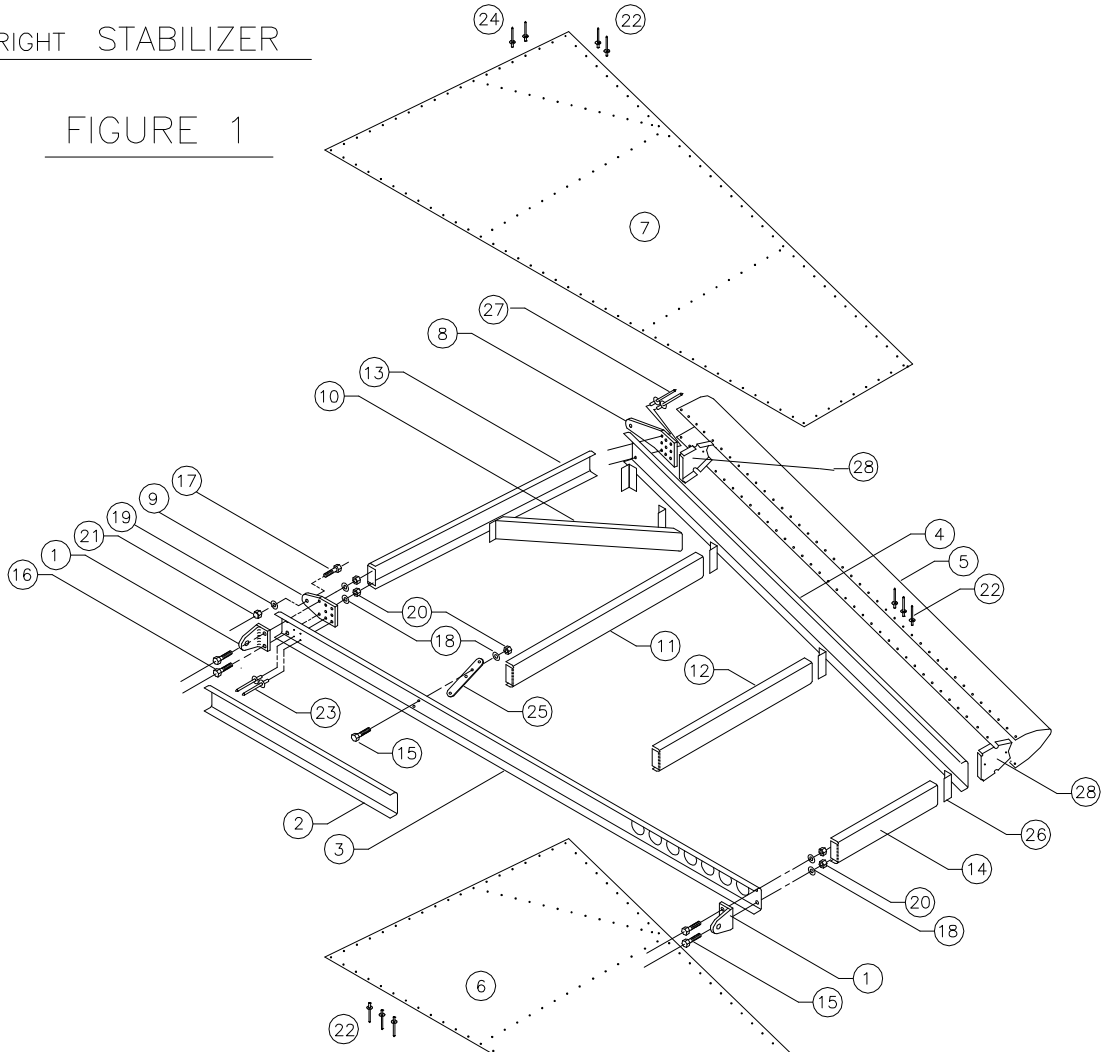
10) Place a folded strip of fiberglass cloth (1" wide) between the two surfaces. Wet with fiberglass resin and clamp tightly until set.

11) Autobody filler can be used to fill any cracks and inconsistencies in the completed tip.

12) Sand smooth before painting.

RIGHT STABILIZER

FIGURE 1




| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | TAIL SURFACE CONTROL HINGE | ST-25 | 4 |
| 2 | FIN-STAB SPAR DOUBLER | ST-26 | 2 |
| 3 | FIN-STAB MAIN SPAR | ST-27 | 2 |
| 4 | FIN-STAB FRONT SPAR | ST-28 | 2 |
| 5 | FIN-STAB LEADING EDGE | ST-29 | 2 |
| 6 | RIGHT STAB SKIN | ST-30R | 2 |
| 7 | LEFT STAB SKIN | ST-30L | 2 |
| 8 | FRONT STAB ATTACH BRACKET | ST-32 | 2 |
| 9 | REAR STAB ATTACH BRACKET | ST-38 | 2 |
| 10 | RIB (Custmer makes from ST-31) | ST-33 | 2 |
| 11 | RIB (Customer makes from ST-31) | ST-34 | 2 |
| 12 | RIB (Customer makes from ST-31_ | ST-35 | 2 |
| 13 | RIB (Customer makes from ST-31) | ST-36 | 2 |
| 14 | RIB (Customer makes from ST-31) | ST-37 | 2 |
| 15 | 3/16" BOLT | AN3-5A | 10 |
| 16 | 3/16" BOLT | AN3-6A | 4 |
| 17 | 1/4" BOLT | AN4-5A | 2 |
| 18 | 3/16" WASHERS | AN960-10 | 14 |
| 19 | 1/4" WASHERS | AN960-416 | 2 |
| 20 | 3/16" FIBER NUT | AN365-1032 | 14 |
| 21 | 1/4" FIBER NUT | AN365-428 | 2 |
| 22 | 1/8" X 3/16" AVEX RIVET | RV-1410 | 520 |
| 23 | 3/16" X 3/8" AVEX RIVET | RV-1619 | 12 |
| 24 | 1/8" X 3/16" CS AVEX RIVET | RV-4412 | 80 |
| 25 | STRUT ATTACH BRACKET | ST-39 | 2 |
| 26 | ANGLE STC. MAT. (3/4" X 1 1/2" X .020) | ST-40 | |
| 27 | 3/16" X 1/4" AVEX RIVET | RV-1613 | 9 |
| 28 | STAB LEADING EDGE RIB | FIN-35 | 2 |

## *8.1 Assembly Tools*

1) Variable Hand Drill

2) #40, #30, #11 and 3/16" Drill Bits

3) Quantity of 3/32", 1/8" and 3/16" clecos

4) Cleco Pliers

5) Deburing Tools

6) Felt Marker

7) Riveter

8) Aviation Snips

9) Tape Measure

10) Two 3/8" Wrenches

11) Square

12) Straight Edge

13) 1/8" Dimple Tool for Hand Riveter

The assembly procedure for the two stabilizer halves is the same with the exception of the strut attach bracket (ST-39). The procedure explained here is for the right stabilizer half. **Note:** The main skins on the Stab are labeled left and right. This is for identification only, to distinguish difference in creases. You will need one left and one right per Stab. Before installing the stabilizer lay the parts out as per the 3-D exploded view drawing to give you an idea of their locations.

## *8.2 Rib and Spar Install*

1) Draw a line 90 degrees to the edge of your table. Figure 8.2.1.

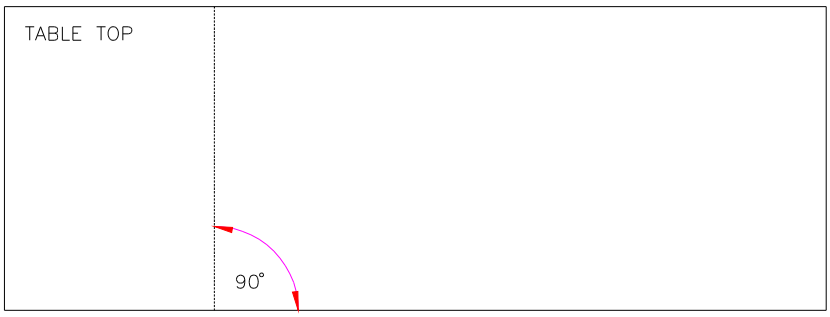
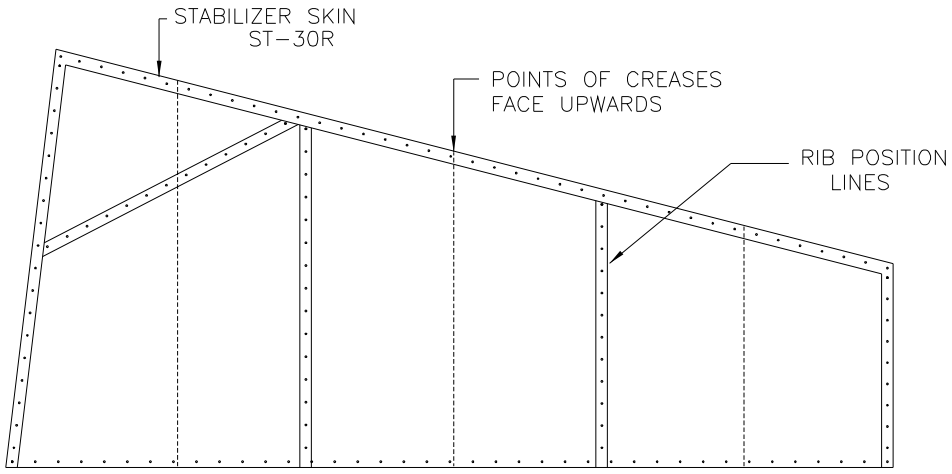



Figure 8.2.1

2) With a felt marker lay out the position of the ribs and front spar on the inside surface of a right stabilizer skin (ST-30R). Figure 8.2.2. **NOTE:** The point of the crease is facing up from the table for layout only. This allows the builder to flatten the skin as much as possible with the least amount of effort. This skin is used in the layout procedure, later it will be replaced with the left skin so the points of the crease face outward.




[DGM1205]

Figure 8.2.2

3) Drill out the two pre-punched #40 holes (hinge bolt holes) at the root end of the main stabilizer spar (ST-27) to #30. Figure 8.2.3.

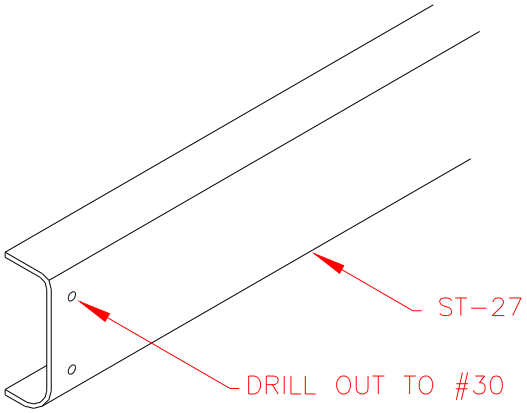



Figure 8.2.3

4) Cleco the rear stabilizer attach bracket (ST-38) to the backside of the spar. Figure 8.2.4.

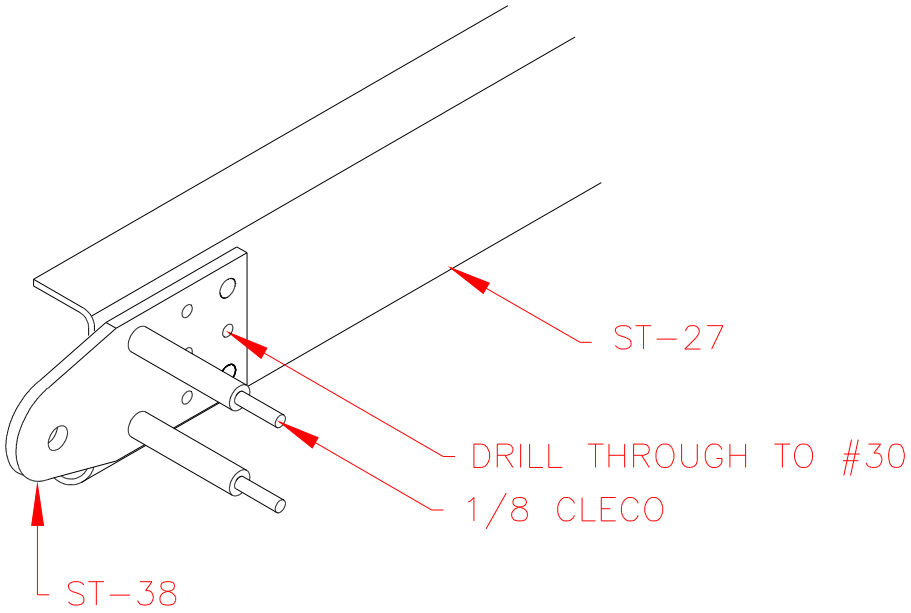



Figure 8.2.4

5) Using the attach bracket as a drill guide, drill the four #30 holes through into the spar. Figure 8.2.4.

6) Move the clecos to two of the holes just drilled. Figure 8.2.5.

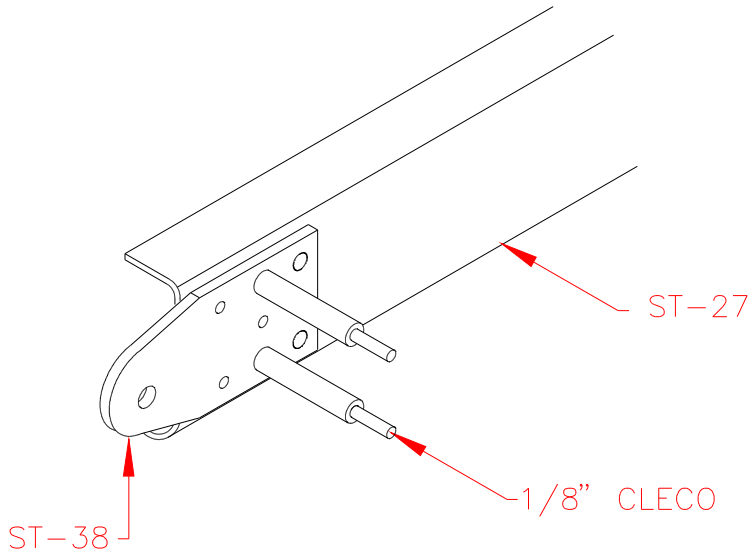



Figure 8.2.5

7) Drill out one of the hinge bolt holes in the spar and attach bracket to 3/16". Figure 8.2.6.

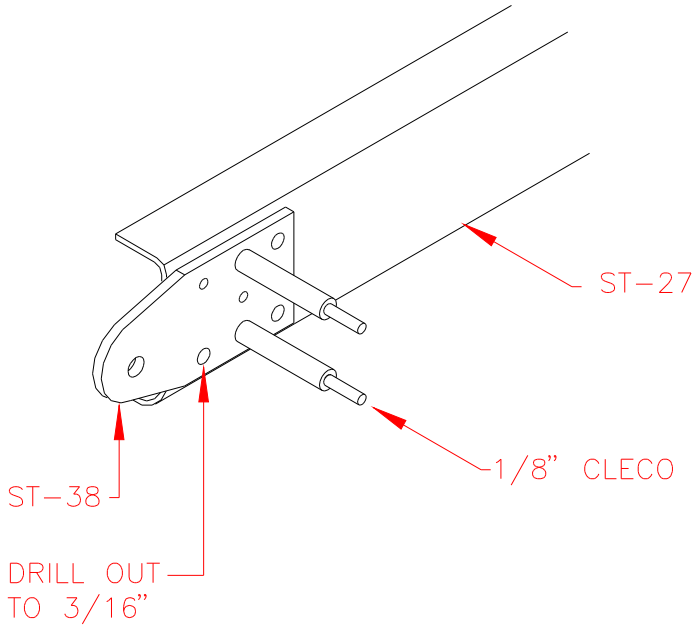



Figure 8.2.6

8) With a AN3-5A bolt, bolt together a tail surface control hinge (ST-25), (The AN3-5A bolt is used only for positioning here and will be replaced with a bolt of the right length during final assembly) the spar and the attach bracket. Figure 8.2.7.

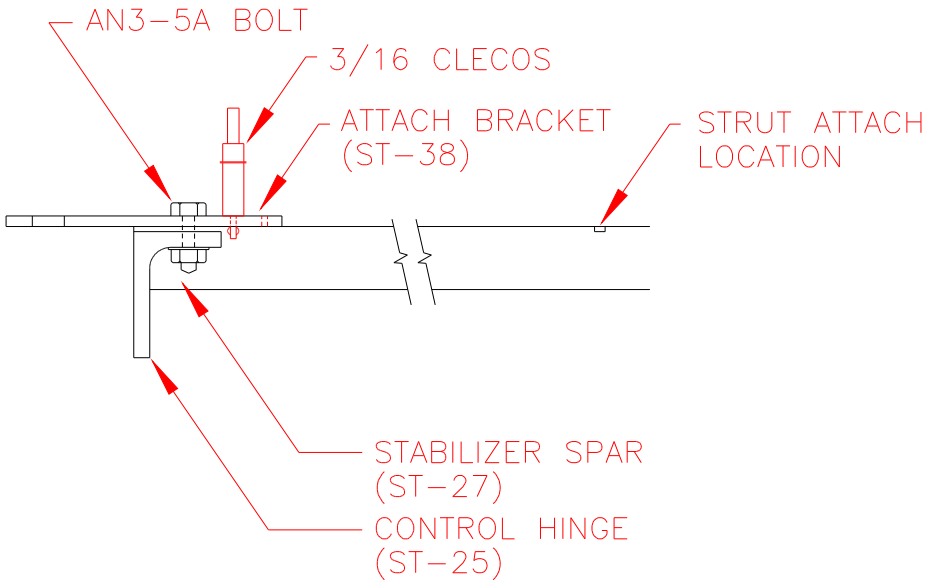



Figure 8.2.7

9) With a 3/16" bit drill back through the second hole in the control hinge through the spar and attach bracket.

10) Install another AN3-5A bolt.

11) Remove clecos and position the stabilizer spar doubler (ST-26) in the main spar and butted up to the control hinge. Figure 8.2.8.

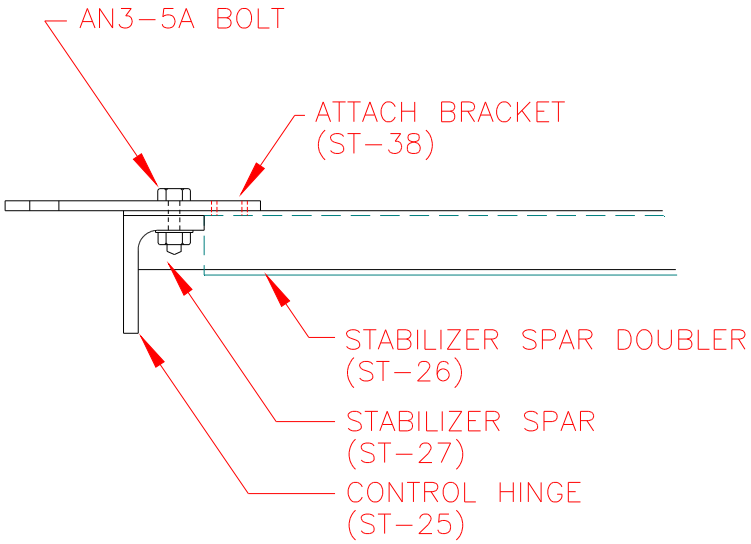



Figure 8.2.8

12) Drill out all the remaining holes in the attach bracket and main spar and through the spar doubler to #11.

13) Drill the #40 pre-punched hole in the spar at the strut attach bracket (ST-39) location out to 3/16". Figure 8.2.9.

14) Cleco the strut attach bracket (ST-39) to the back side of the spar as in Figure 8.2.9.

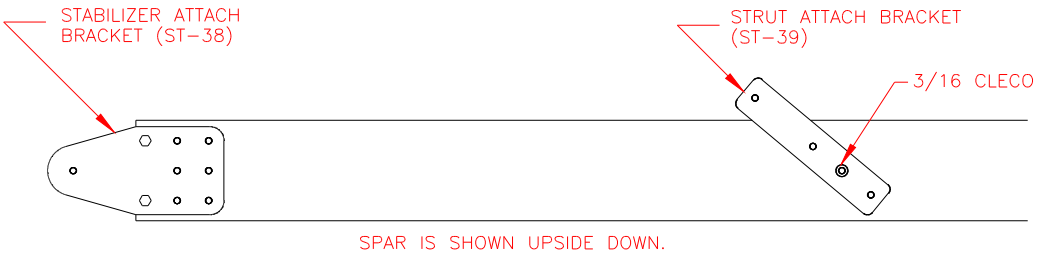



Figure 8.2.9

15) Cut out a template using Figure 8.2.10 as a guide.

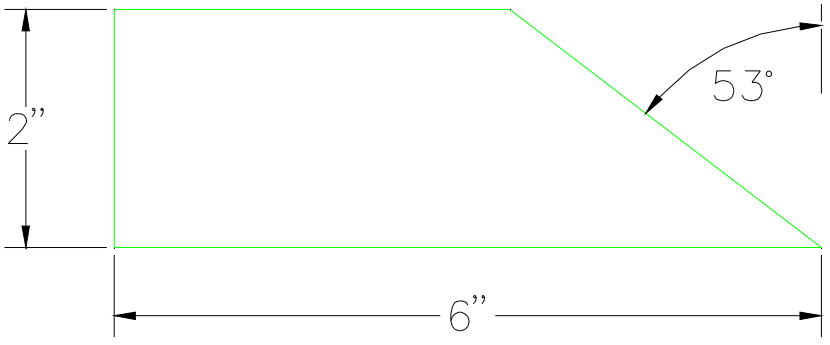



Figure 8.2.10

16) With the spar on its edge, align the strut attach bracket with the template. Then drill out the two remaining holes to 3/16". Figure 8.2.11.

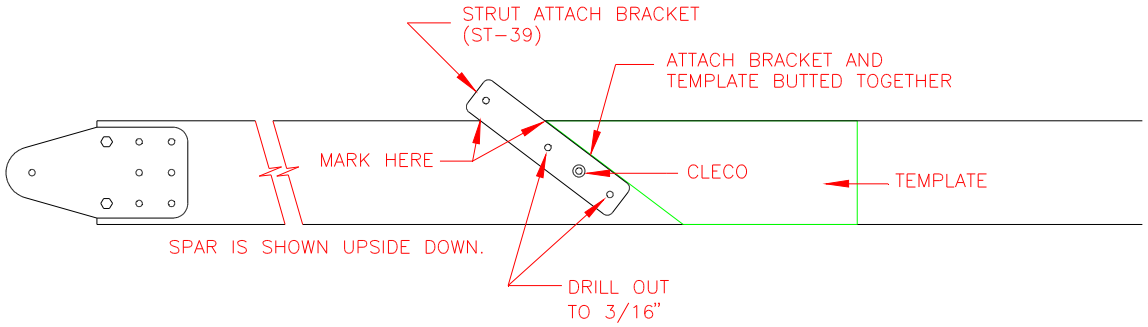



Figure 8.2.11

17) With a felt pen mark the spar where the strut attach bracket will exit the skin. Figure 8.2.11. Remove the strut attach bracket.

18) At the outboard end of the spar drill out one of the pre-punched #40 holes to #11.

19) Bolt a control hinge in place with one AN3-5A bolt. Back drill through the second hole in the control hinge with a 3/16" drill bit.

20) Disassemble and debur.

21) Reassemble the spar, spar doubler and rear attach bracket only.

22) Clamp the spar assembly and skin to the table as in Figure 8.2.12.

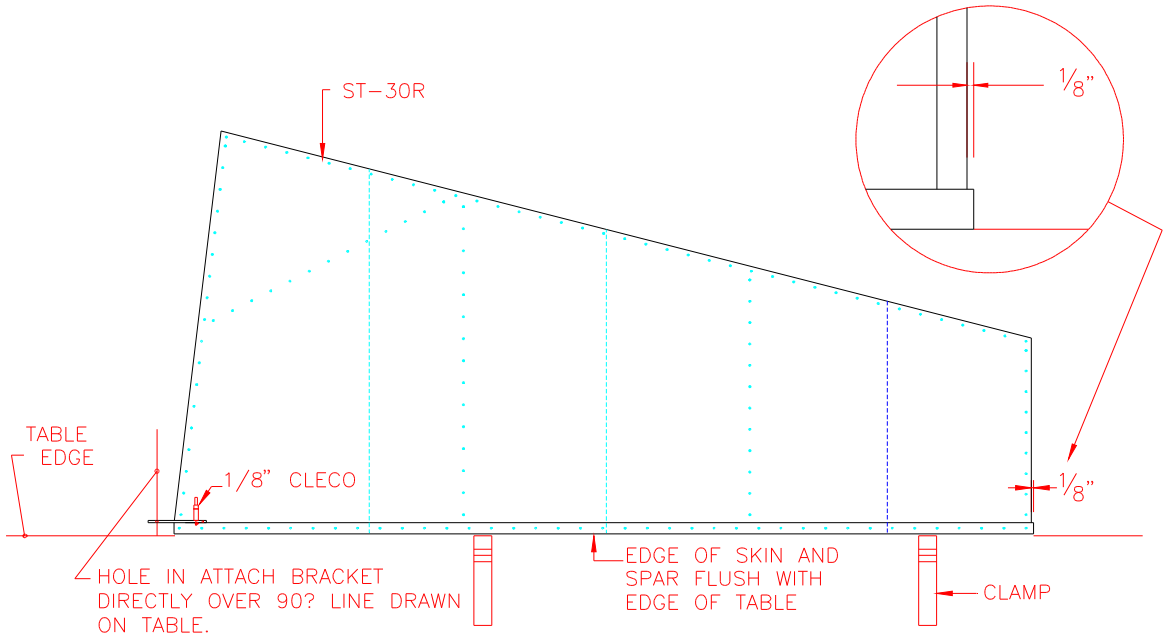



Figure 8.2.12

23) From 2" x 5/8" stock material (ST-31) cut the inboard rib (ST-36) approximately 1 1/2 inches longer than necessary.

24) Drill two #30 holes approximately one inch from one end rib and in the center of the radius of the bend. Figure 8.2.13.

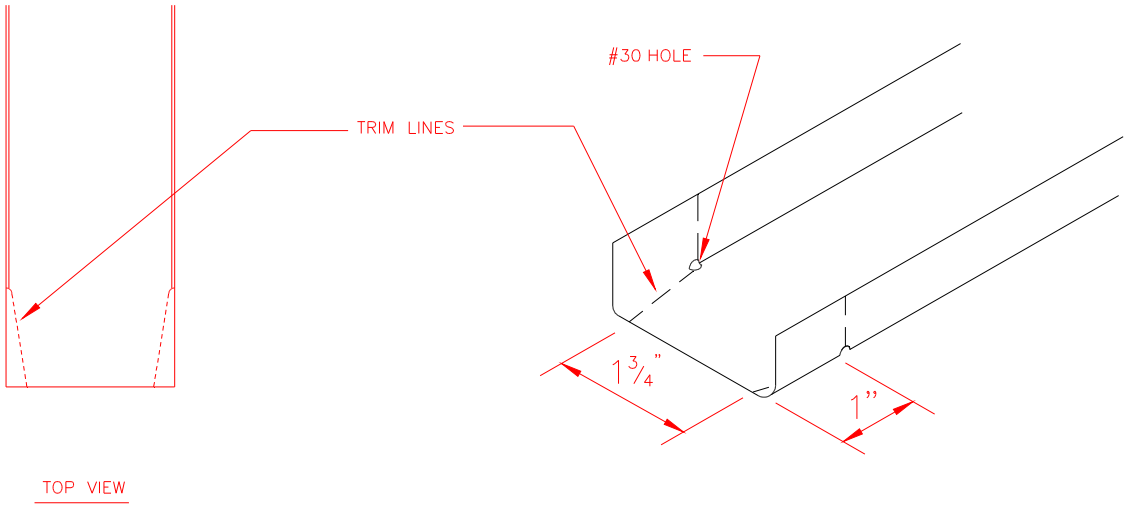



Figure 8.2.13

25) Using snips trim the rib as in figure 8.2.13.

26) Place a wood block inside the rib and bend the flange over 90º. Figure 8.2.14.

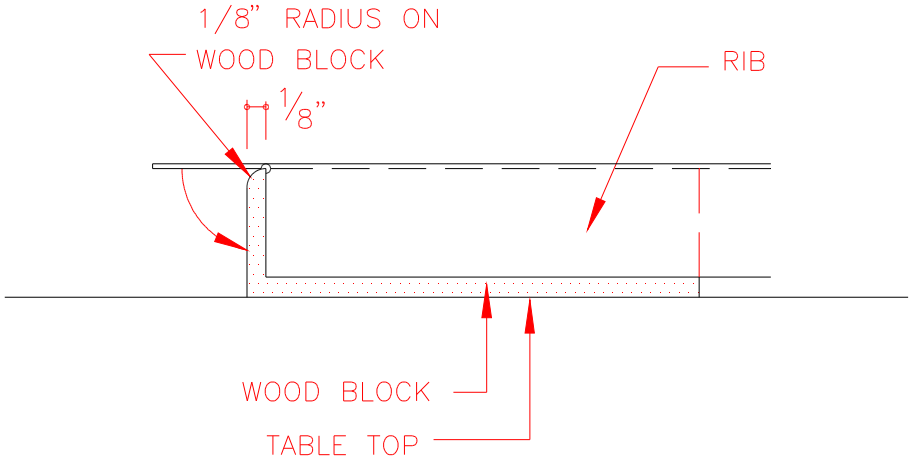



Figure 8.2.14

27) Position the rib over the skin and butted up to the spar using the line drawn in step 2.

28) Back drill three #30 holes through the spar and into the centerline of the bent flange on the rib. Cleco in place.

29) Repeat steps for the remaining ribs.

30) Trim each rib flush with the flange of the front spar. Figure 8.2.15.

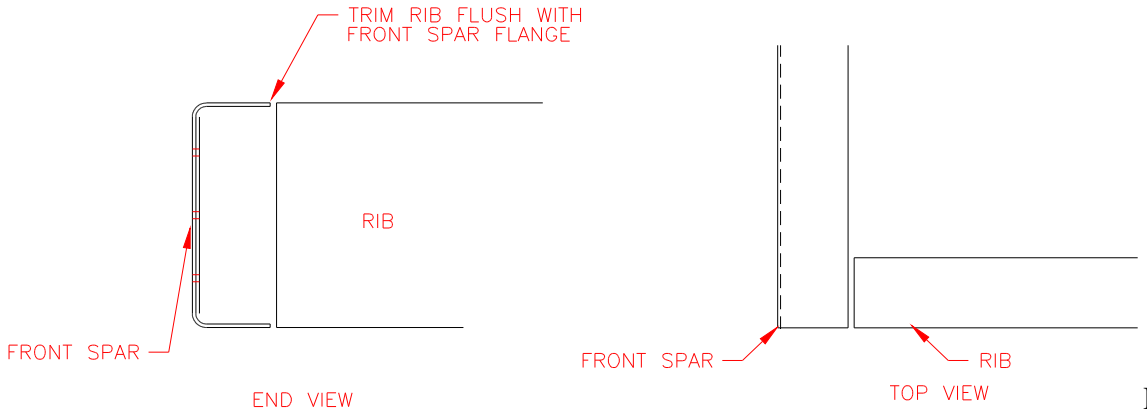



Figure 8.2.15

31) Position the front spar (ST-28) and trim to the correct length.

32) From the stock angle material (ST-40) cut six sections 1 5/8" long. These angles will be used to attach the ribs to the front spar.

33) Position one of the angle sections to a rib and front spar as in figure 8.2.16.

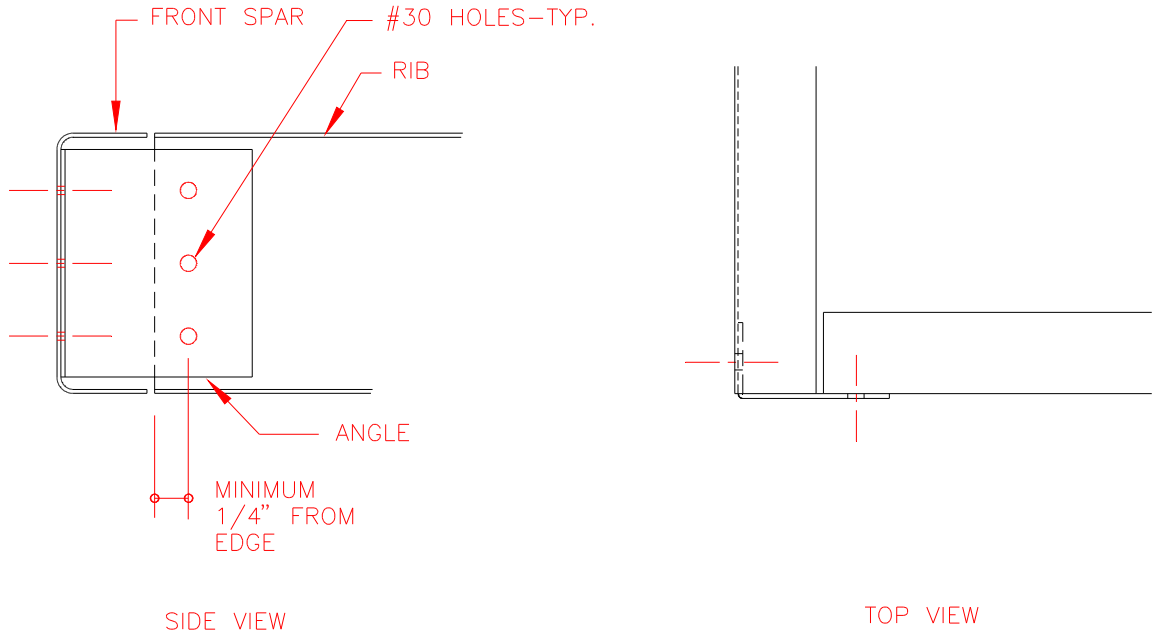



Figure 8.2.16

34) Drill #30 holes in the locations shown in Figure 8.2.16. Cleco.

35) Repeat steps for each rib.

## *8.3 Attach Bracket Install*

1) Position the front stabilizer attach bracket (ST-32) as in figure 8.3.1.

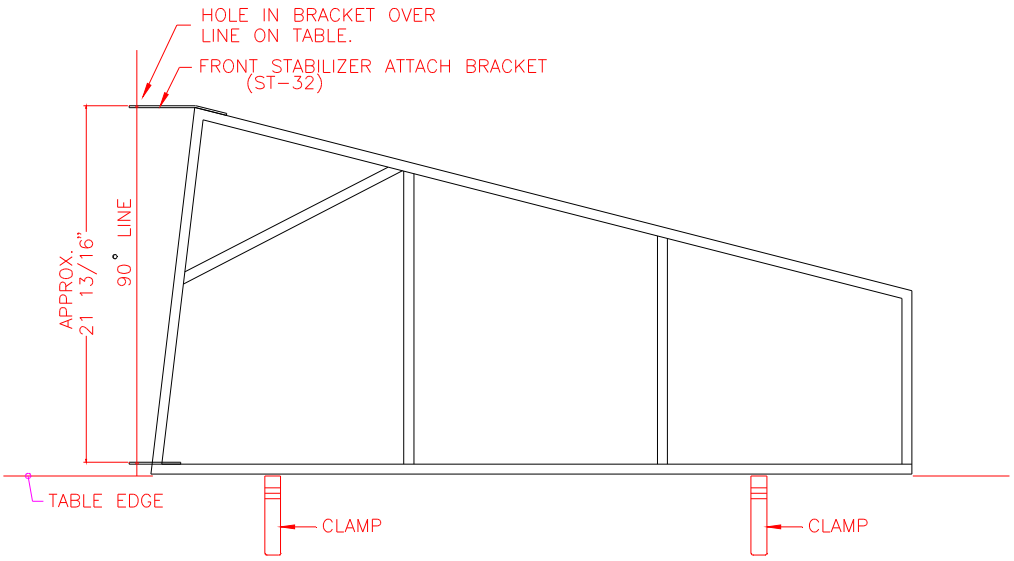



Figure 8.3.1

2) Remove the root rib (ST-36) and drill back through the pre-punched holes in ST-32 into the front spar with a #30 drill. Cleco into place.

3) Drill out the #30 holes in the front spar and bracket with a #11 drill. Figure 8.3.2.

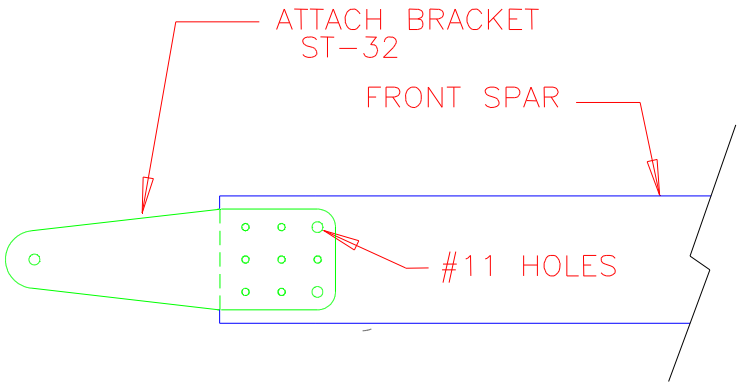



Figure 8.3.2

4) Replace the root rib, transfer the exit location of the strut attach bracket (ST-39) on the spar to the skin.

## *8.4 Skin Install*

1) Position the top skin in place.

2) Using the pilot holes in the skin, drill #40 holes at the ends of all ribs and spars. Cleco together.

3) Drill out all holes in ribs and rear spar only to #30. Use plenty of clecos.

4) Locate the fin-stab leading edge rib (FIN-35) on the front spar as in figure 8.4.1. It is located butted up against the attach bracket, the flanges face outward. Drill two #30 holes through the ribs and spar material. Cleco into place.

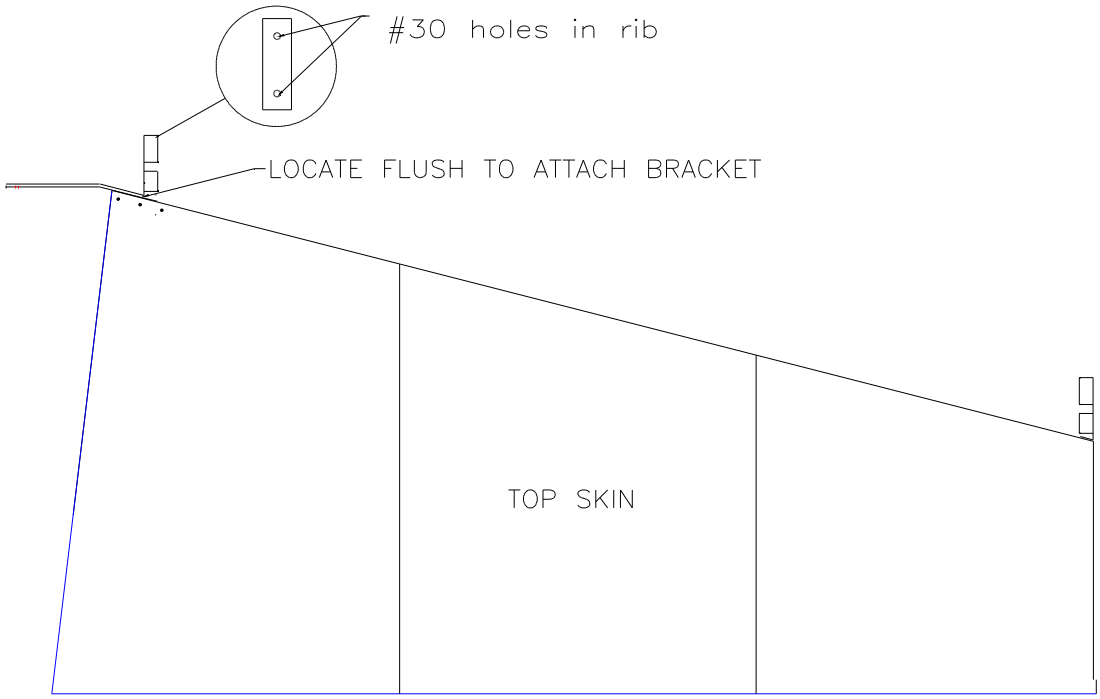



Figure 8.4.1

5) To align the Fin-Stab Leading Edge (ST-29), draw a line down the center of the bend. Place the leading edge on the spar and align it so the line is in line with the center of the spar. See figure 8.4.2.

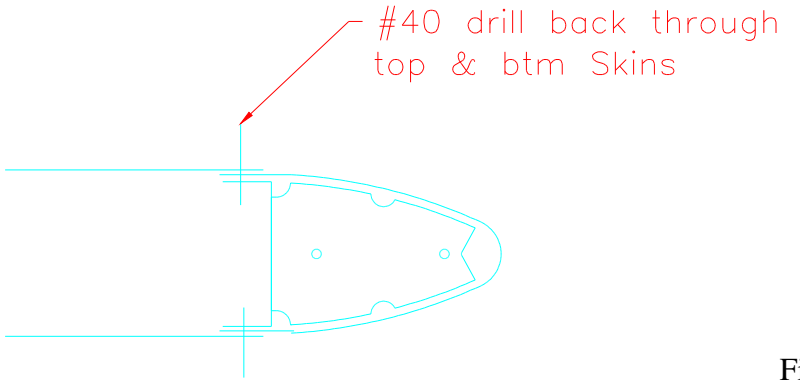



Figure 8.4.2

6) Overlap the skin on the leading edge. Drill, with a #40 drill, the end holes through from the skin and cleco in place. Turn over and repeat.

7) Drill the remainder of the holes from the skins into the spar and leading edge. Figure 8.4.3.

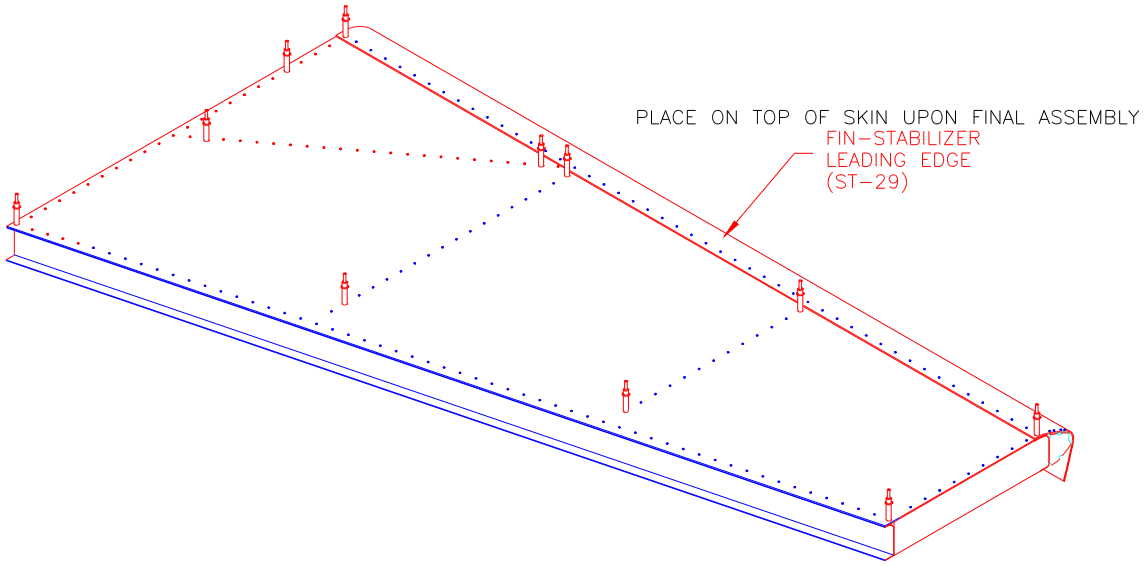



Figure 8.4.3

8) Drill the leading edge, skin and front spar holes out to #30 holes. Each of the fingers of the Fin-Stab Leading Edge Ribs need two #30 holes. Gently drill through the leading edge of the skin through the ribs. Do the same for each finger. **NOTE:** Leading edge will overlap stab skins on final assembly. Figure 8.4.4.

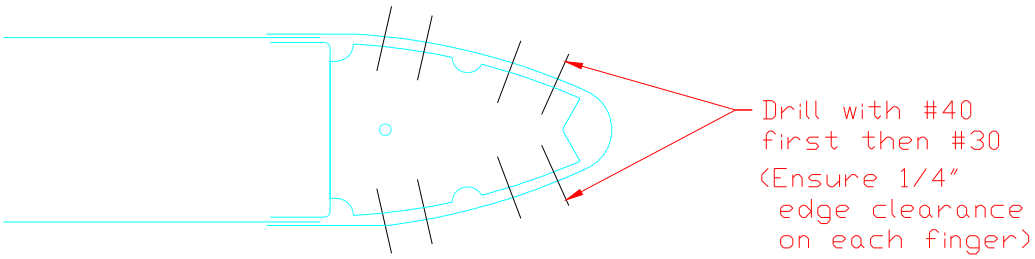



Figure 8.4.4

9) Remove the leading edge skin, turn the assembly over and place on two parallel 2 x 4's. Figure 8.4.5.

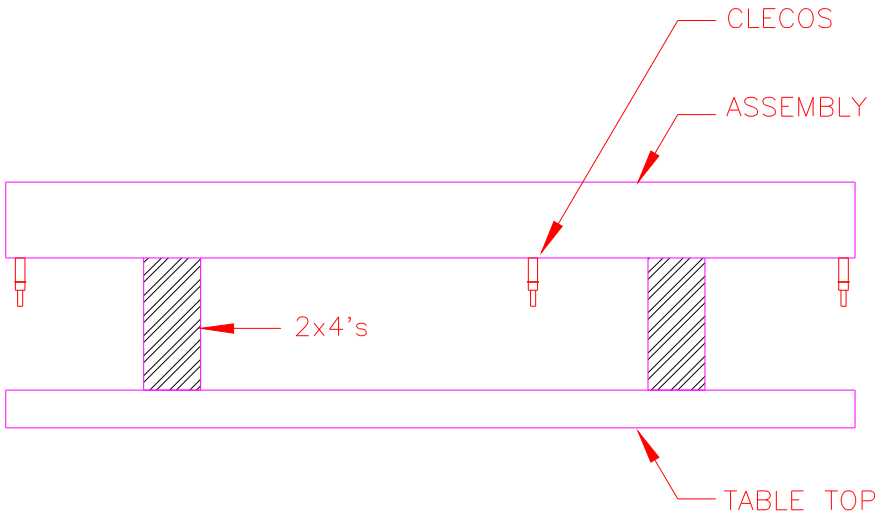



Figure 8.4.5

10) Position the skin in place and drill out to #30 holes in all ribs and rear spar only. Drill two #40 holes into front spar.

11) Position the leading edge and cleco in place. NOTE: Make sure corresponding holes are directly opposite of each other.

12) Drill out to #30 holes. Use plenty of clecos.

13) Disassemble and dimple all holes in rib (ST-36) and skins at root position for countersunk rivets.

14) In the bottom skin cut out the exit location of the strut attach bracket.

15) Debur all holes and edges.

## *8.5 Final Install*

1) Chromate all mating surfaces and reassemble as follows:

2) Inboard hinge, spar, attach bracket and root rib with two AN3-6A bolts, two AN365-1032 fiber nuts and two AN960-10 washers.

3) Outboard hinge, spar and tip rib with two AN3-5A bolts, two AN365-1032 fiber nuts and two AN960-10 washers.

4) Strut attach bracket to spar and spar doubler with three AN3-5A bolts, Three AN365-1032 fiber nuts and three AN960-10 washers.

5) Use 3/16” rivets (RV-1619) in stabilizer attach bracket to the front spar and spar doubler.

6) Use 3/16” rivets (RV-1613) to join the front attach bracket to the front spar and root rib.

7) Skins to root rib use 1/8” CS rivets (RV-4412).

8) All other rivets are 1/8” (RV-1410) rivets.

| ITEM# | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | TAIL SURFACE CONTROL HINGE | ST-25 | 2 |
| 2 | FIN-STAB SPAR DOUBLER | ST-26 | 1 |
| 3 | FIN-STAB MAIN SPAR | ST-27 | 1 |
| 4 | FIN-STAB FRONT SPAR | ST-28 | 1 |
| 5 | FIN-STAB LEADING EDGE | ST-29 | 1 |
| 6 | RIGHT FIN SKIN | FIN-25R | 1 |
| 7 | LEFT FIN SKIN | FIN-25L | 1 |
| 8 | FIN ATTACH BRACKET | FIN-27 | 1 |
| 9 | RIB (Customer makes from ST-31) | FIN-28 | 1 |
| 10 | RIB (Customer makes from ST-31) | FIN-29 | 1 |
| 11 | RIB (Customer makes from ST-31) | FIN-30 | 1 |
| 12 | RIB (Customer makes from ST-31) | FIN-30 | 1 |
| 13 | RIB (Customer makes from ST-31) | FIN-34 | 1 |
| 14 | 3/16" X 1/4" AVEX RIVETS | RV-1613 | 18 |
| 15 | 3/16" WASHER | AN960-10 | 4 |
| 16 | 3/16' FIBER NUT | AN365-1032 | 4 |
| 17 | 1/8" X 3/16" AVEX RIVET | RV-1410 | 260 |
| 18 | FIN STAB ATTACH BRACKET | FIN-33 | 1 |
| 19 | 3/16" BOLT | AN3-5A | 4 |
| 20 | ANGLE STOCK MAT. (3/4" 1 1/2" X .020) | ST-40 | |
| 21 | 1/8" X 3/16" CS AVEX RIVET | RV-4412 | 40 |
| 22 | STAB LEADING EDGE RIB | FIN-35 | 2 |

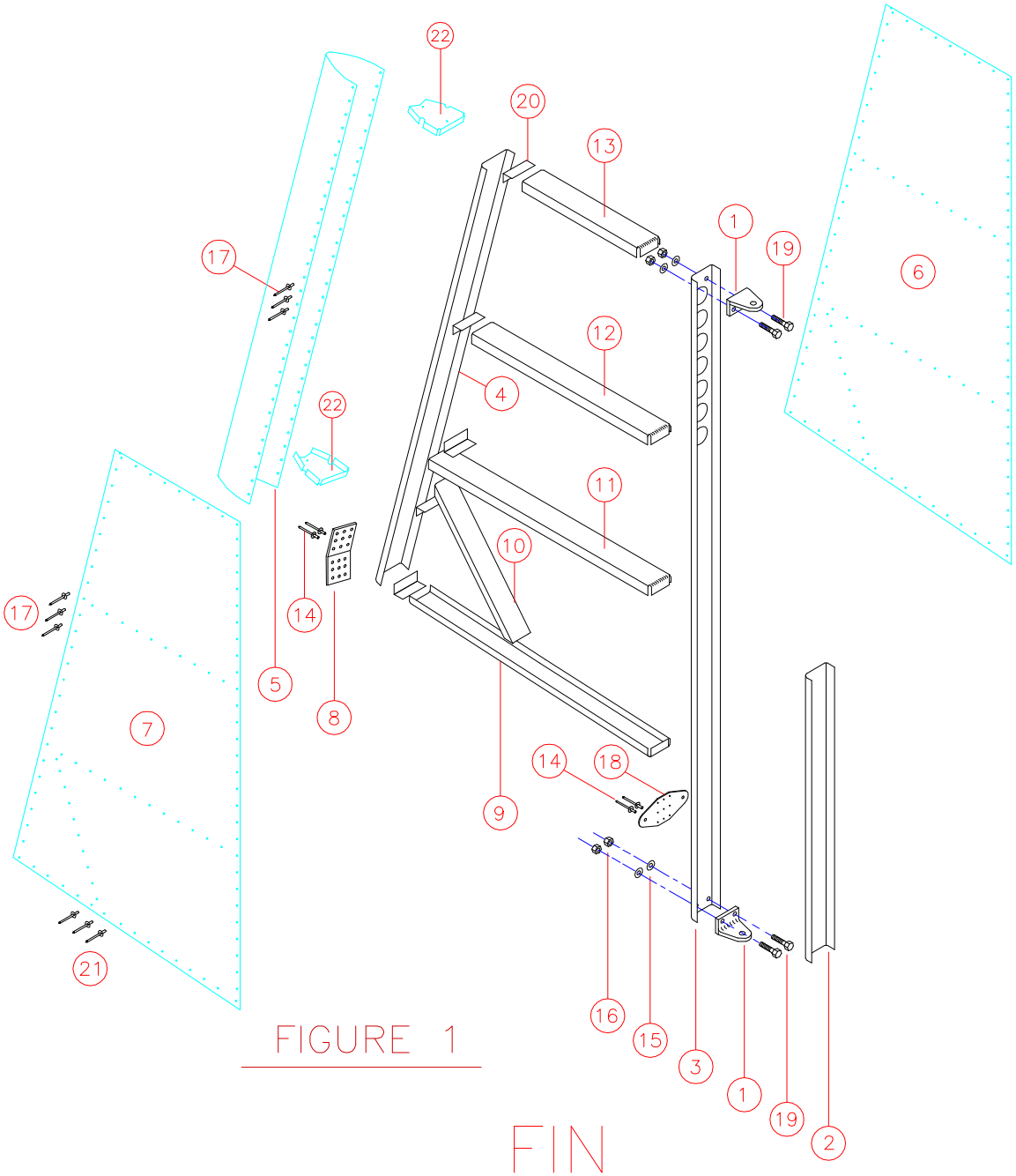



FIGURE 1

FIN

To assemble the fin you will require the same tools as with the stabilizer. Approximate time for this job is 3 - 4 hours. The assembly procedure for the fin is very similar to that of a stabilizer half. Again layout the parts as per the exploded drawing.

## *9.1 Rib and Spar Install*

1) With a felt marker lay out the position of the ribs and front spar on the inside surface of a right fin skin (FIN-25R). Figure 9.1.1.

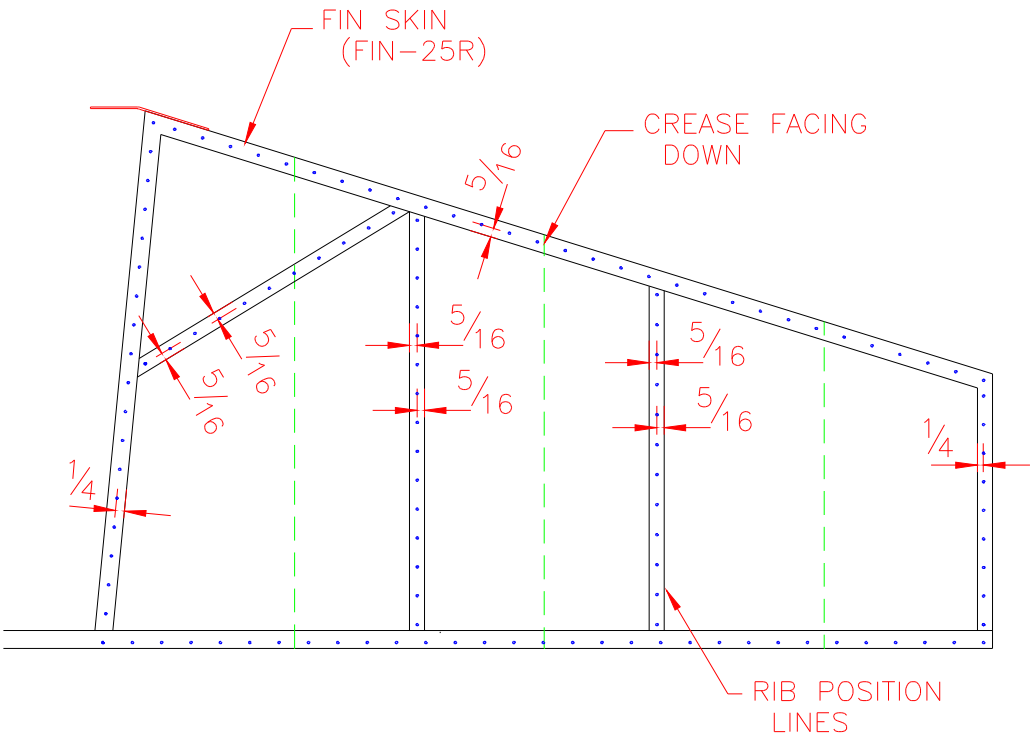



Figure 9.1.1

2) At each end of the spar drill out (in stages) one prepunched #40 hole to #11.

3) Bolt a control hinge (ST-25) in place at each end with AN3-5A bolts.

4) Back drill through the second hole in the control hinges with a #11 drill.

5) Position the stabilizer spar doubler (ST-26) in the spar and butted up to the control hinge at the bottom end.

6) Drill two #30 holes at the bottom end of the spar doubler. Figure 9.1.2. **NOTE**: The top end of the doubler is drilled when installing the FIN-30 rib.

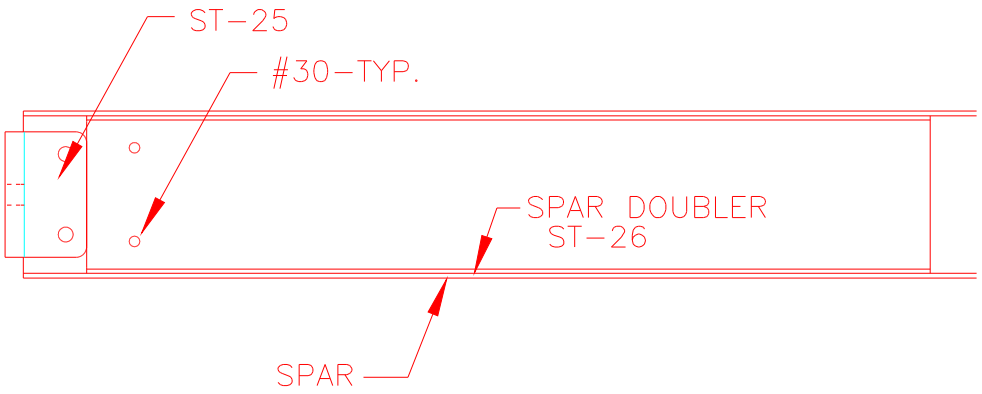



Figure 9.1.2

7) Remove the doubler and debur holes, replace and secure with 1/8" clecos.

8) Mark a line across the spar 9 9/16" from the bottom end. Figure 9.1.3.

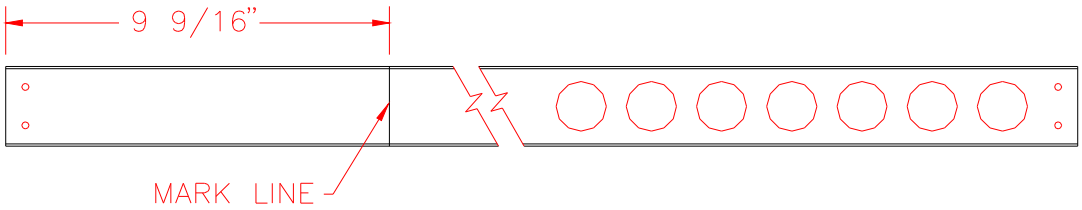



Figure 9.1.3

9) Center the fin-stabilizer attach bracket (FIN-33) over the line. Clamp in place. Figure 9.1.4.

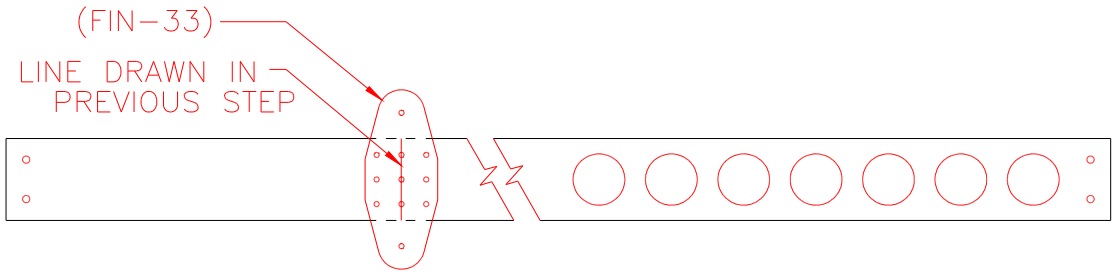



Figure 9.1.4

10) Drill through the ST-33 into the spar and doubler with a #30 drill. Hold securely with clecos then drill out all holes with #11 drill. Remove ST-33 and put aside.

11) Draw a parallel line 22 13/16" from the edge of the table. Figure 9.1.5.

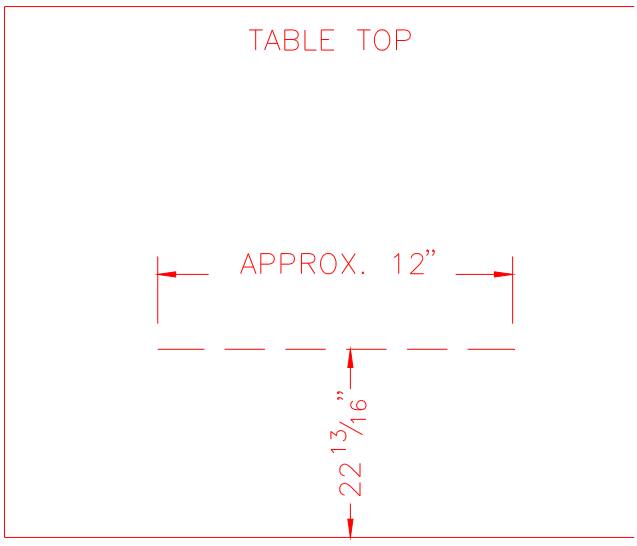



Figure 9.1.5

12) Clamp the spar assembly and skin to the table as in figure 9.1.6.

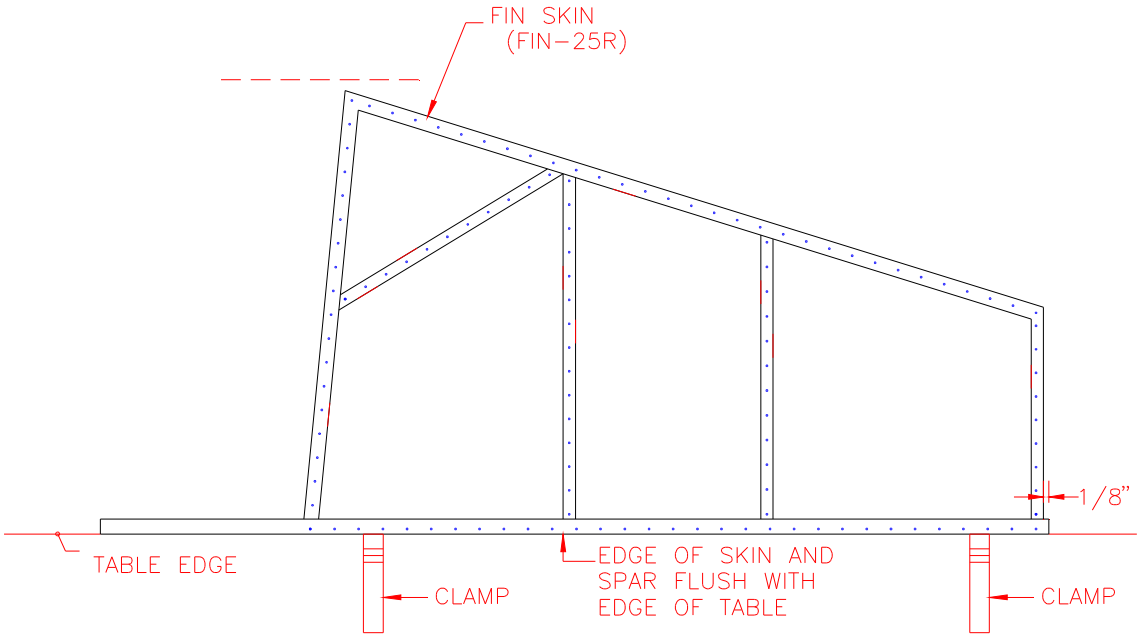



Figure 9.1.6

13) Follow stabilizer assembly 8.2 (steps 23 to 34) for the ribs and front spar.

## *9.2 Attach Bracket Install*

1) Position the front fin attach bracket (FIN-27) as in figure 9.2.1.

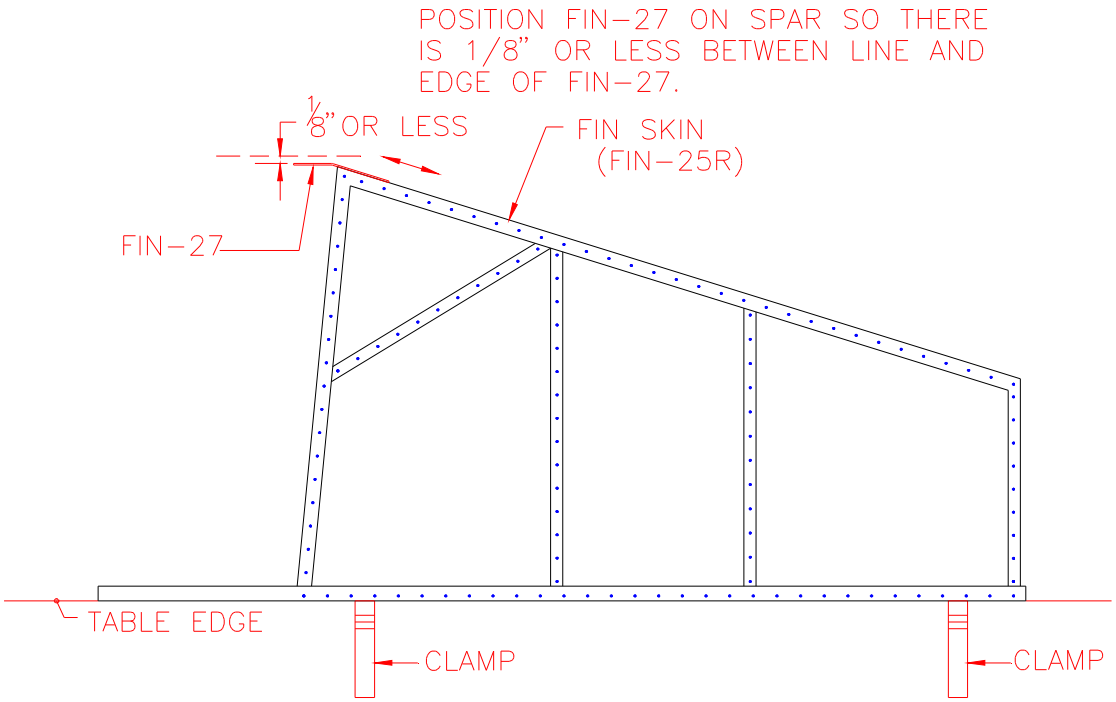



Figure 9.2.1

2) Drill back through FIN-27 into front spar with #11 drill.

3) Position the top skin in place.

4) Follow stabilizer assembly 8.4 ignoring step 14.

## *9.3 Final Install*

1) Chromate all mating surfaces and reassemble as follows:

2) Hinges to spar with four AN3-5A bolts, four AN365-1032 fiber nuts and four AN960-10 washers.

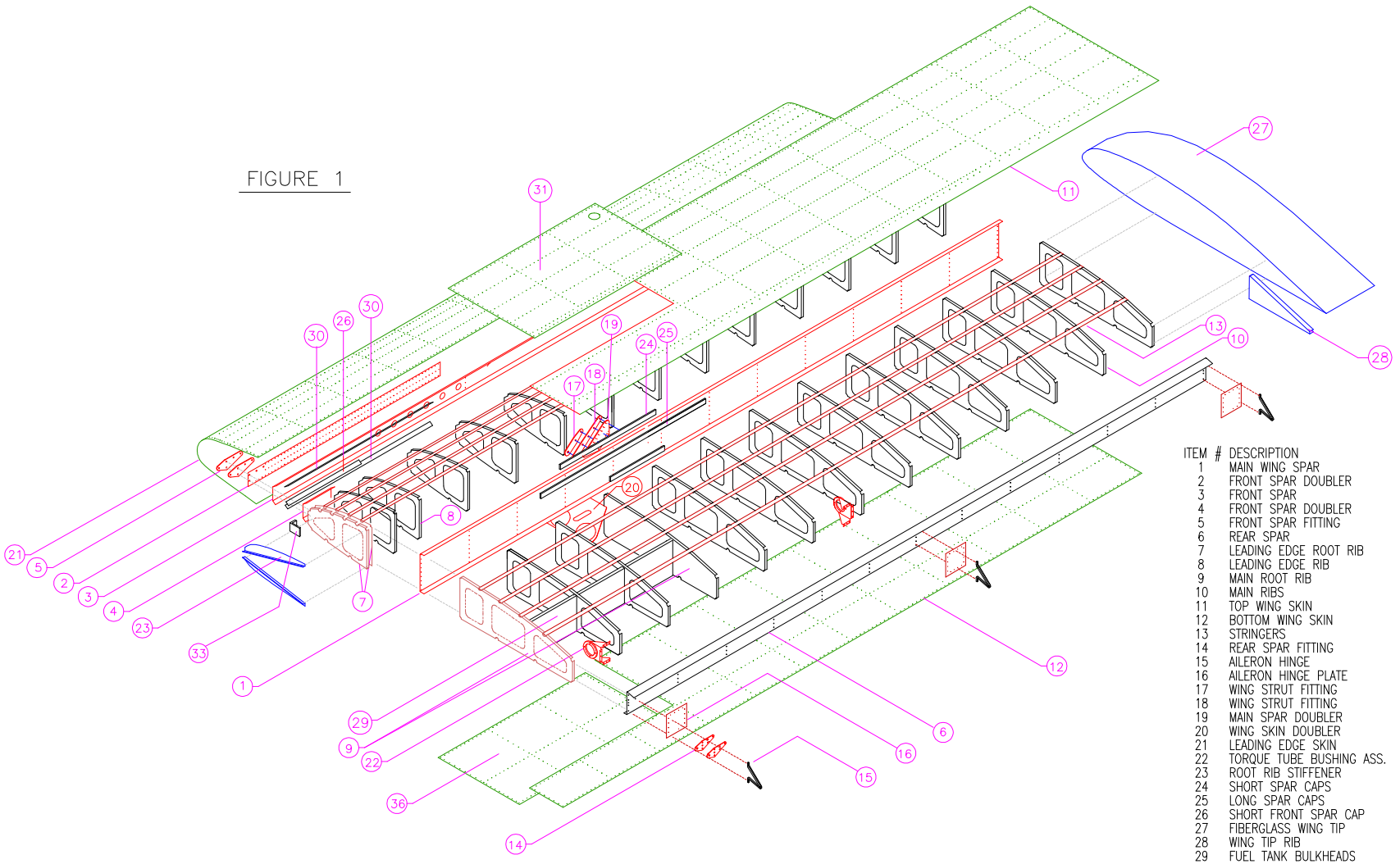
3) Fin-Stabilizer Attach Bracket (FIN-33) to spar and doubler with 3/16" x 1/4 rivets (RV-1613).

4) Front Fin Attach bracket (FIN-27) to front spar with 3/16" rivets (RV-1613).

5) Skins to root rib with 1/8" CS rivets (RV-4412).

6) All other rivets are 1/8" rivets (RV-1410).

FIGURE 1




| ITEM # | DESCRIPTION | PART # | REQ. |
|---|---|---|---|
| 1 | MAIN WING SPAR | W-112 | 1 |
| 2 | FRONT SPAR DOUBLER | W-118 | 1 |
| 3 | FRONT SPAR | W-117 | 1 |
| 4 | FRONT SPAR DOUBLER | W-116 | 1 |
| 5 | FRONT SPAR FITTING | W-119 | 2 |
| 6 | REAR SPAR | W-122 | 1 |
| 7 | LEADING EDGE ROOT RIB | W-172 | 2 |
| 8 | LEADING EDGE RIB | W-120 | 13 |
| 9 | MAIN ROOT RIB | W-173 | 2 |
| 10 | MAIN RIBS | W-121 | 11 |
| 11 | TOP WING SKIN | W-126 | 1 |
| 12 | BOTTOM WING SKIN | W-127 | 1 |
| 13 | STRINGERS | W-130 | 12 |
| 14 | REAR SPAR FITTING | W-124 | 2 |
| 15 | AILERON HINGE | W-125 | 3 |
| 16 | AILERON HINGE PLATE | W-133* | 3 |
| 17 | WING STRUT FITTING | W-111 | 1 |
| 18 | WING STRUT FITTING | W-110 | 1 |
| 19 | MAIN SPAR DOUBLER | W-603 | 1 |
| 20 | WING SKIN DOUBLER | W-601 | 1 |
| 21 | LEADING EDGE SKIN | W-128 | 1 |
| 22 | TORQUE TUBE BUSHING ASS. | CC-37&CC-38 | 2 |
| 23 | ROOT RIB STIFFENER | W-142 | 1 |
| 24 | SHORT SPAR CAPS | W-137* | 1 |
| 25 | LONG SPAR CAPS | W-138 | 2 |
| 26 | SHORT FRONT SPAR CAP | W-140 | 1 |
| 27 | FIBERGLASS WING TIP | W-144 L or R | 1 |
| 28 | WING TIP RIB | W-145 | 1 |
| 29 | FUEL TANK BULKHEADS | W-157 | 3 |
| 30 | LONG FRONT SPAR CAPS | W-139 | 2 |
| 31 | TOP FUEL TANK SKIN | W-158 | 1 |
| 32 | TANK BAFFLE MATERIAL (not shown) | W-170 | 1 |
| 33 | ROOT RIB ATTACH BRACKET | W-161 | 1 |
| 34 | FUEL CAP (not shown) | 4483-1 | 1 |
| 35 | FILLER NECK (not shown) | 4808-5 | 1 |
| 36 | BOTTOM FUEL TANK SKIN | W-158 | 1 |

* Note: Parts with this mark are made from raw stock

**NOTE:** Upon final installation of the ailerons, use the bolts listed in the aileron exploded view drawing. Tighten the bolts so that the steel bushings (AIL-26) are clamped tight against the aileron hinges (W-124). Add some type of grease to allow easy movement of the brass sleeve (AIL-27) of the aileron over the fixed steel bushing (AIL-26).

1) Variable Speed Hand Drill

2) a) Standard Drills - "F", #40, #30, #11, 5/32",7/32",1/4",9/32",5/16",11/32",3/8", and 1/2"

b) 12" Long Drills - #40,#30,#11

3) Reamers - 1/4",5/16",3/8".

4) Quantity of 3/32", 1/8" and 3/16" clecos.

5) Cleco Pliers

6) Deburing tools

7) Felt Marker

8) Riveter

9) Aviation Snips

10) Tape Measure

11) 36" or 48" Level

12) Hacksaw, 2 1/4" and 2 1/2" Hole Saws or Jigsaw

13) Flat and 1/4" Round Files

14) Two of each - 3/8" ,7/16", 1/2",9/16" Wrenches

Assembly of the wings is very similar for both the left and right side. This procedure is written for the right side. However, it is noted where the right and left procedures differ.

## *10.2 Spar Caps*

1) From the four Main Spar Caps (W-138) supplied, cut two Spar Caps 43" long (W-138), two Spar Caps 24" long (W-137), and two Spar Caps 13" long (W-163). One of each will be used on each wing.

2) On one of the 24" Spar Caps (W-137) drill #30 holes 9/32" from each end. Figure 10.2.1.

3) Between these holes drill 10 equally spaced #30 holes for a total of 12 holes. Figure 10.2.1.

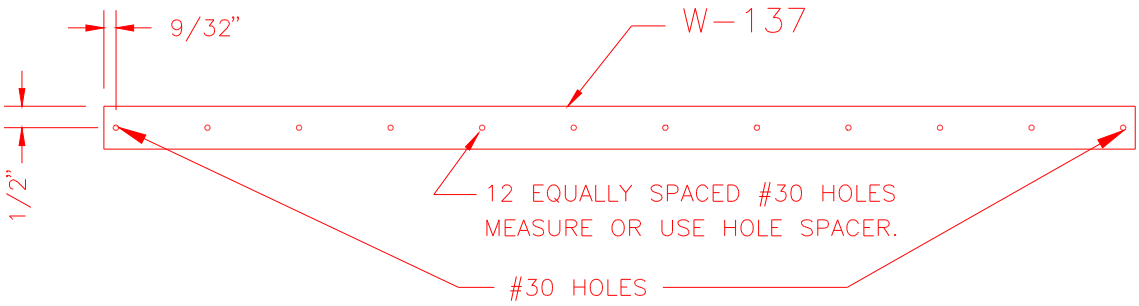



Figure 10.2.1

4) Clamp a drilled 24" Spar Cap (W-137) to the center of a 43" long Spar Cap (W-138). Figure 3.

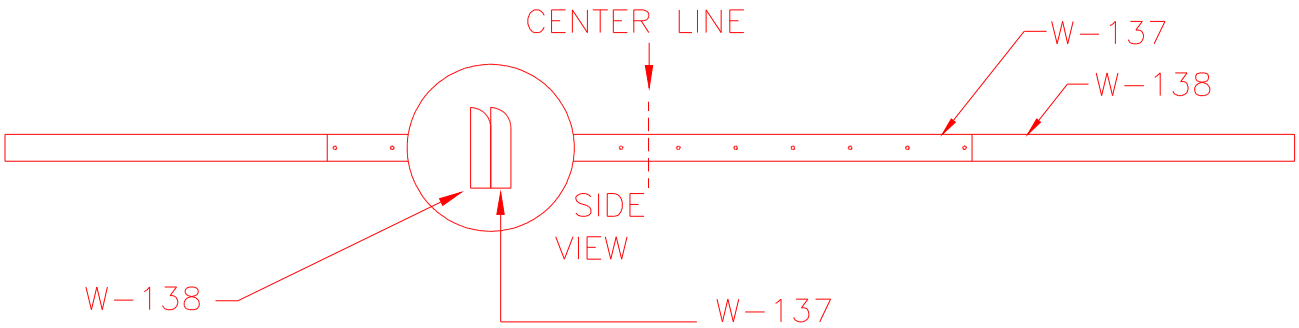



Figure 10.2.2

5) Using the holes in the W-137 as a drill guide, center and drill twelve #30 holes in W-138.

6) Drill #30 holes 9/32" from each end of W-138. Figure 10.2.3.

7) Drill five equally spaced holes in the remaining undrilled portion of each end of W-138. Figure 10.2.3.

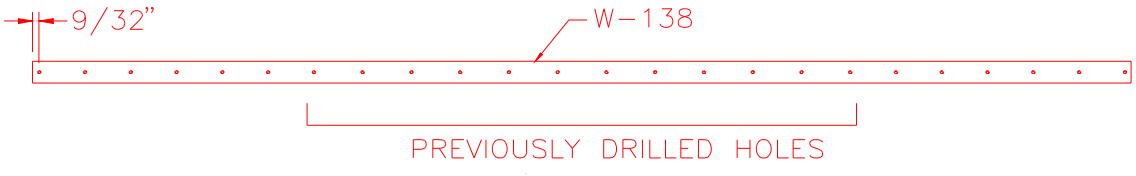



Figure 10.2.3

8) The ends of both Spar Caps (W-137 and W-138) may be sanded to reduce weight if desired. Figure 5. (WEIGHT SAVING/AIRCRAFT = .18 lbs.). Figure 10.2.4

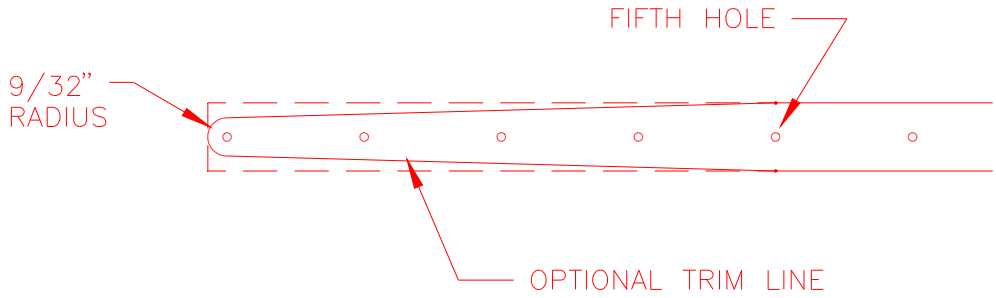



Figure 10.2.4

9) Clamp a Spar Cap, (W-138) securely to the Main Spar (W-112) as in Figure 10.2.5.

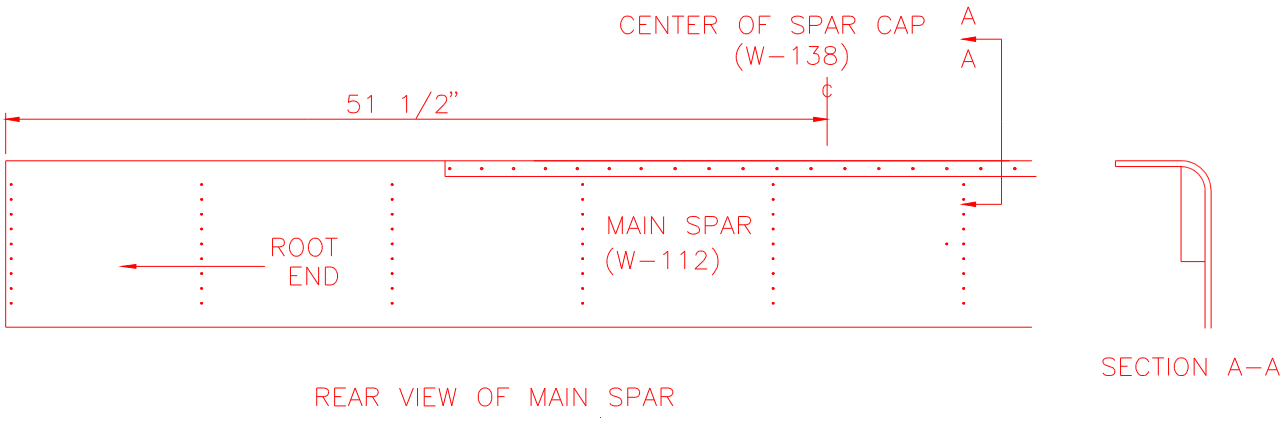



Figure 10.2.5

10) Using the holes in the spar cap as a guide, drill twenty-four #30 holes in the spar.

11) Cleco W-137 and W-138 to the Main Spar (W-112) as in Figure 10.2.6.

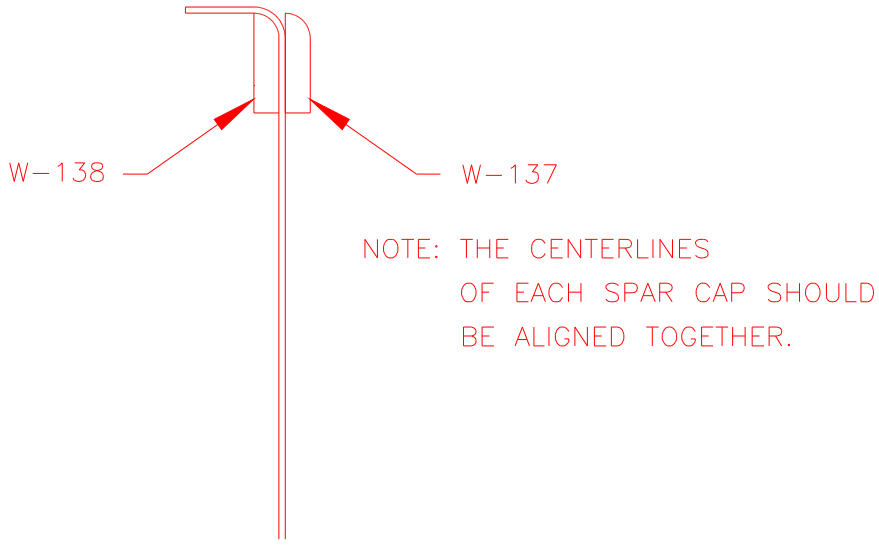



Figure 10.2.6

12) Drill out all holes with a 5/32 drill, then ream out to 3/16".

13) Disassemble and debur.

14) Proseal, (see note below) mating surfaces and bolt together with twelve AN3-10A bolts and twelve AN3-6A bolts plus appropriate AN960-10 washers and AN365-1032 nuts.

*__IMPORTANT__*: Prepare the mating surfaces and apply Proseal between the (W-138) spar cap and Main Spar web in the area of the first eight fasteners at the inboard end of the cap. Insert bolts "wet" as well. Mix just enough Proseal for the application you are doing now.

15) Clamp the Main Spar to the table edge. Figure 10.2.7.

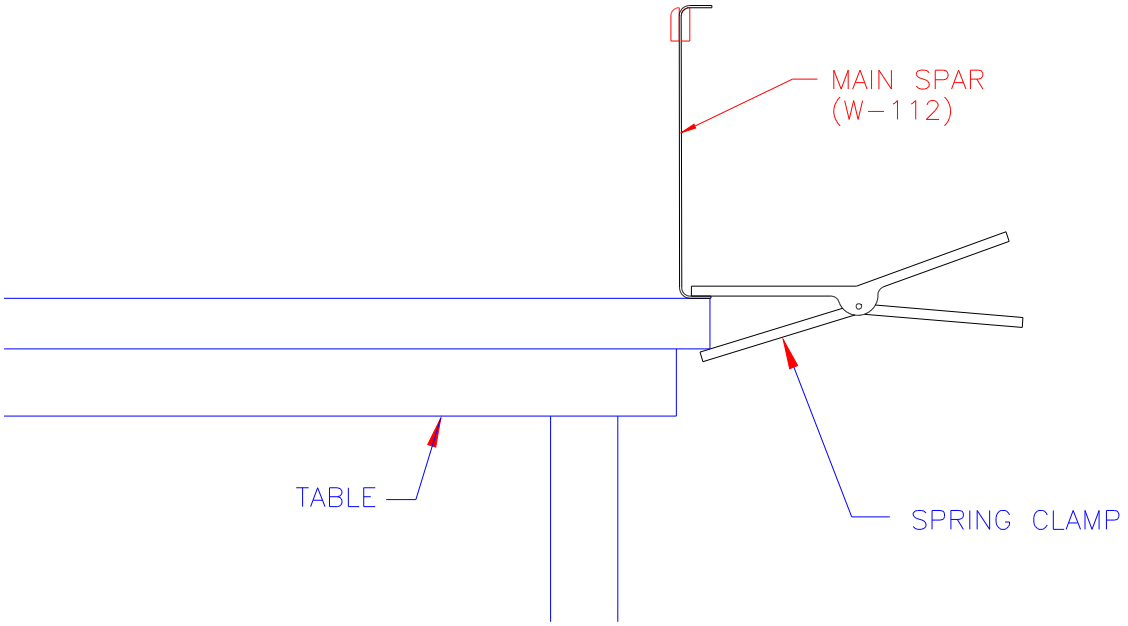



Figure 10.2.7

16) Position and cleco the Main Spar Doubler (W-603) on the front side of the Spar using the pre-punched hole in the Main Spar Doubler and the hole in the spar. Ensure the bottom edge of the Main Spar Doubler is parallel to the bottom web of the Main Spar. Drill the bottom hole to #11, cleco and drill the other two holes to #11. See Figure 10.2.8.

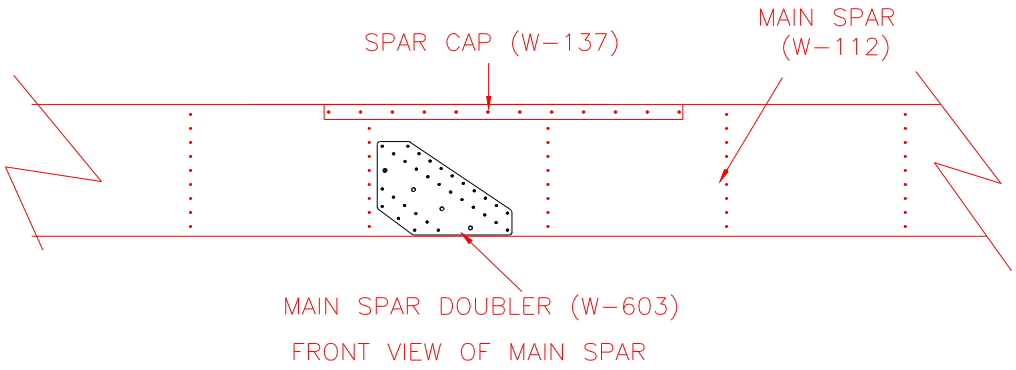



Figure 10.2.8

17) Using the Main Spar Doubler as a drill guide (W-603), drill out the holes in the Main Spar to #40.

18) Back drill all the holes in the Main Spar and Main Spar Doubler to #30, cleco as you drill.

19) Cleco the Main Spar (W-112), Main Spar Doubler (W-603), Long Wing Strut Fitting (W-110) and Short Wing Strut Fitting (W-111) together. Figure 10.2.9.

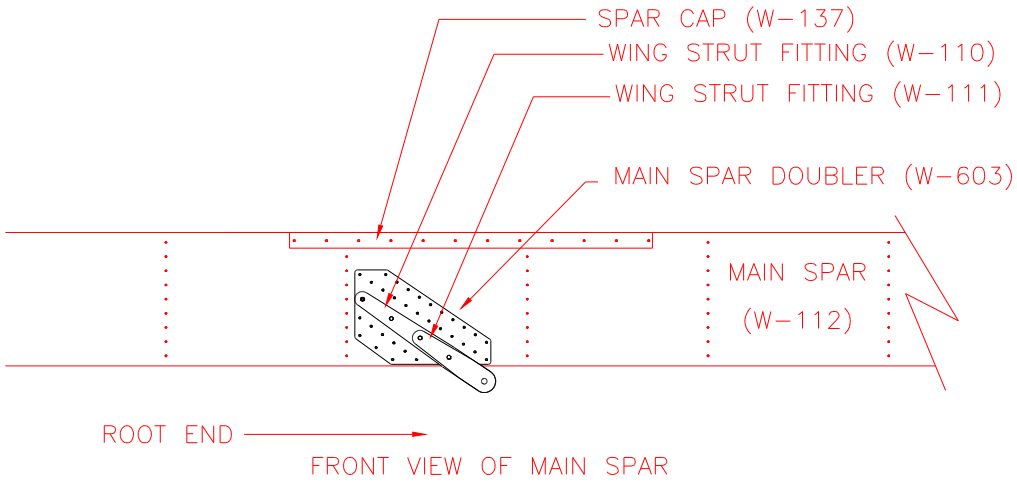



Figure 10.2.9

20) Drill out the four wing-strut fitting attach holes to 7/32" and then ream out to 1/4". Disassemble and debur.

21) Countersink and debur the bottom five holes in the rear face of the Main Spar web. This is done in order to accommodate the bottom Spar Cap which will be installed over these rivet heads later. You will use 1/8" CS rivets (RV-4412) in these five holes. These are inserted from the backside of the Spar. Chromate the mating surfaces of the Main Spar (W-112) and Main Spar Doubler (W-603) and rivet in

place with 1/8" rivets (RV-1410). Do not bolt the Wing Strut Fittings in place at this time. Figure 10.2.10.

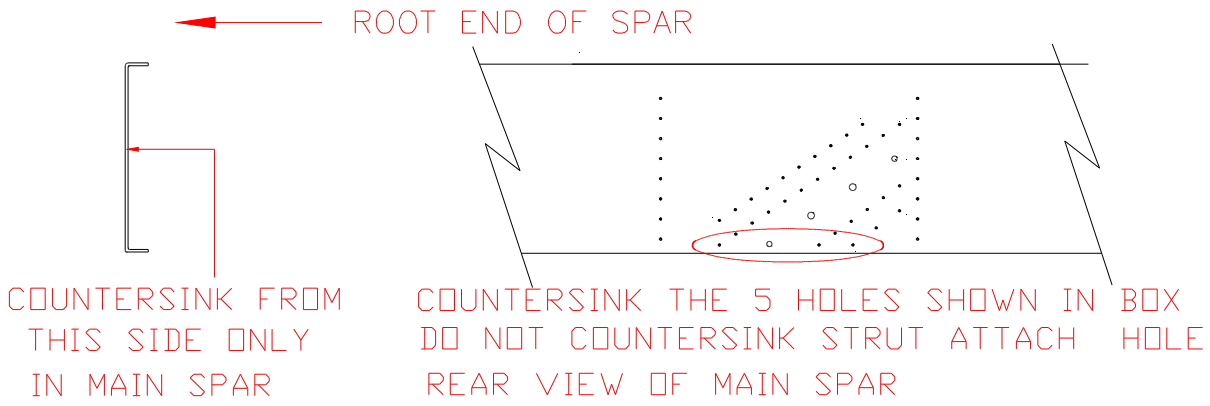



Figure 10.2.10

## *10.3 Rib Install*

1) Lay out the thirteen Leading Edge Ribs (W-120) and one Leading Edge Root Rib (W-172) in front of the spar. Ensure the Root Rib is at the #1 position.

2) With a felt pen, label the ribs and their locations on the Spar from 1 to 13, (# 1 being the root rib).

**NOTE** There is a #1 and #1A Leading Edge Rib. For rib locations see Figure 10.3.3.

3) Around each rib draw a line down the center of all the rivet flanges.

4) Cut out the rear top corner of the #5 and #6 ribs that come in contact with the 24" Spar Cap (W-137). See Figure 10.3.1.

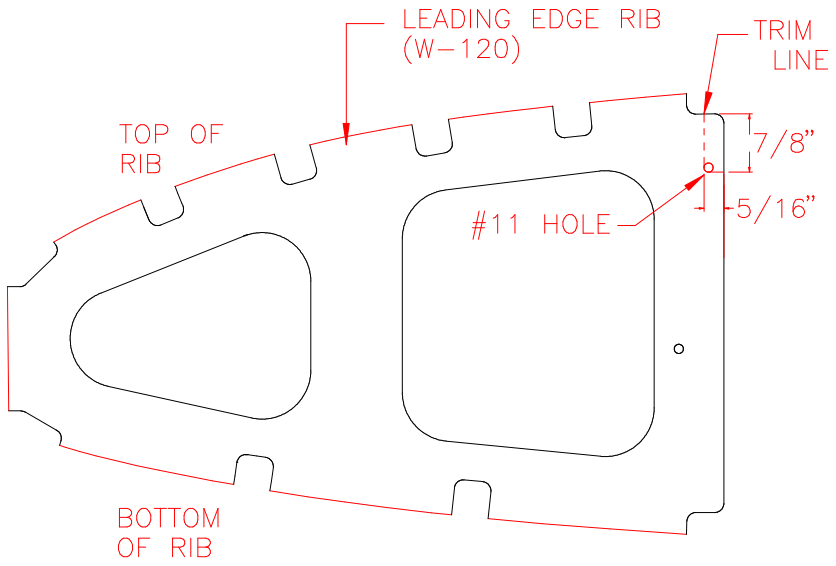



Figure 10.3.1

5) Place the Leading Edge Root Rib (W-172) in front of the Spar. Figure 10.3.2.

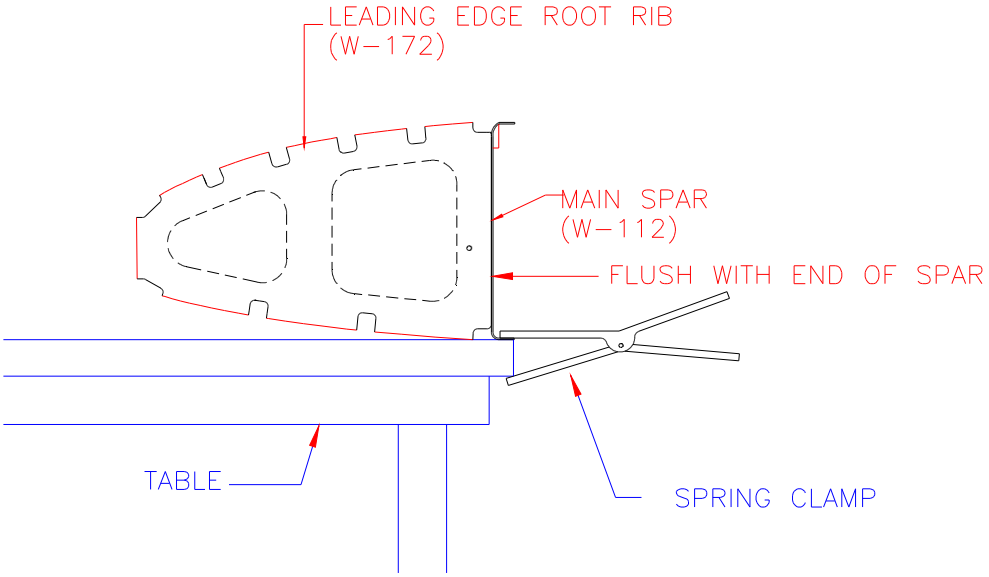



Figure 10.3.2

6) When you can see the line on the rib flange through the center of the prepunched holes in the spar, drill through the top hole with a #40 drill. Cleco, then drill the bottom hole and again cleco. Drill remaining holes in the rib. Do not drill out to #30 at this time. **NOTE** Be sure that the Spar and Leading Edge Root Rib are both flush at the top and bottom. You can do this by clamping a small strip of .020 along the rib flange and on the top of the spar. You can do this for the other ribs as well.

7) Repeat steps until all Leading Edge Ribs are drilled.

**NOTE:** All Leading Edge and Main Ribs for both Wings are the same. There are no right and left ribs. Therefore, the rib flanges will point inboard in the LH wing and outboard in the RH wing.

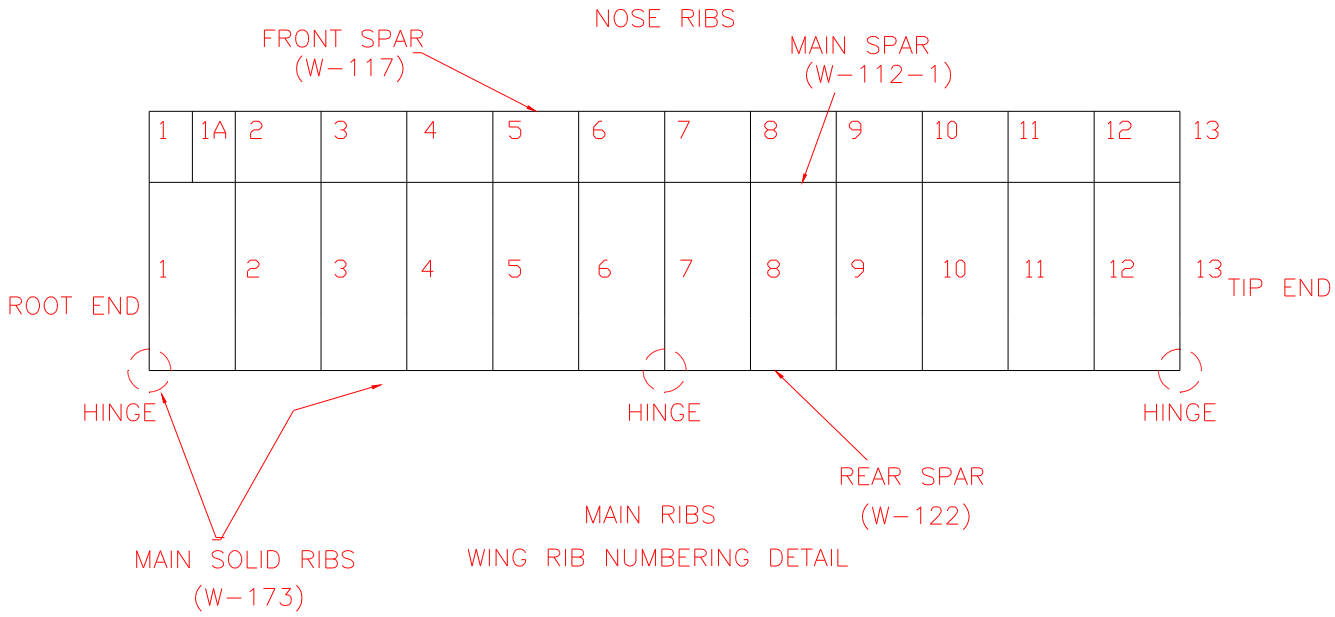



Figure 10.3.3

8) Remove the Leading Edge Ribs and unclamp the Spar from the table.

9) Turn the Spar around and lay out the eleven Main Ribs (W-121) and two Main Solid Ribs (W-173).

*** IMPORTANT NOTE:** Both wings require the fitting of a solid Main Rib (W-173) in the "#4" location (If the Extended Fuel Tanks are to be installed, the solid rib will be put into the #5 location).

10) Label and mark the Main Ribs as you did for the Leading Edge Ribs.

11) Position a rib on the spar and when the line is visible through the center of the prepunched holes in the spar drill and cleco as you did with the Leading Edge Ribs, starting at the #1 rib location.

12) Repeat for all thirteen ribs. Ribs #4,5,6 and 7 will interfere with the 43" Spar Cap (W-138) and will have to be trimmed as in Figure 10.3.4.

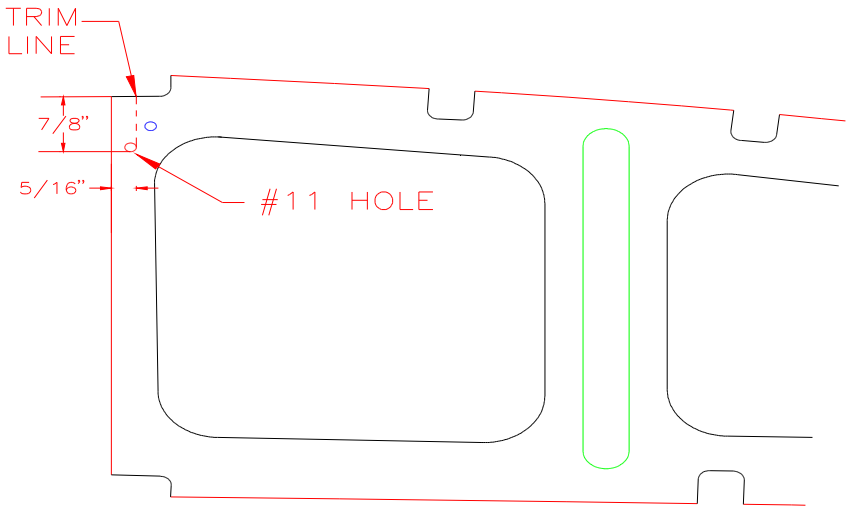



Figure 10.3.4

13) Cleco the Leading Edge Ribs, Main Spar and Main Ribs together and drill out all #40 holes to #30 holes. It helps to use an extra long #30 drill bit. Disassemble and debur.

14). Clamp a 13" Spar Cap (W-163) to the Main Spar lower web so it is centered between the #5 and #6 rib rivet holes. Ensure the radius on the Spar Cap nests into the spar flange radius. Figure 10.3.5.

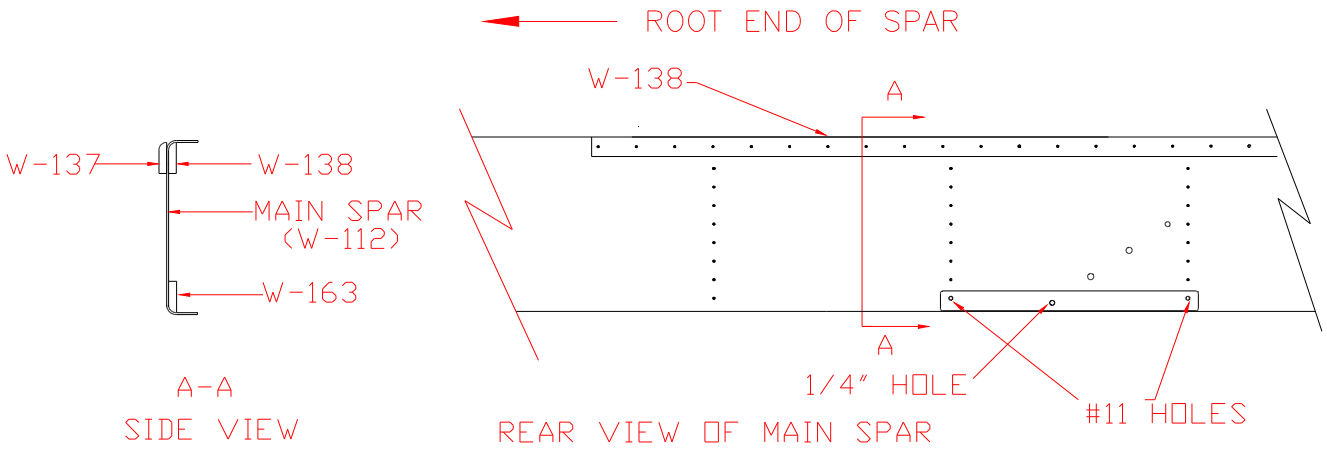



Figure 10.3.5

15) Using the existing rib rivet holes in the spar as a guide, drill through each end of the Spar Cap with a #30 drill, then enlarge to #11. Drill through the bottom Strut Fitting attach hole using a 1/4" drill. Figure 10.3.5.

16) Disassemble and debur all holes and edges in the Leading Edge Ribs, the Main Spar and the Spar Cap . **NOTE:** The ends of the Spar Cap should be rounded to a 1/2" radius about the #11 holes.

17) Chromate and attach the Spar Cap , Main Spar and #5 and #6 Leading Edge Ribs with two AN3-6A bolts, AN960-10 washers and AN365-1032 fibernuts.

18) Measure and cut a relief, (similar to that of step 33, Figure 15, but on the bottom of the rib) into Main Ribs #5 and #6 to clear the new spar cap. Debur.

19) Put the spar and ribs aside for the time being.

## *10.4 Rear Spar*

1) Label the rib locations on the Rear Spar (W-122) as in Figure 10.3.3.

2) From the .032 Raw Stock (W-143), cut out 6 Hinge Backing Plates (W-133), three for each wing. Figure 10.4.1.

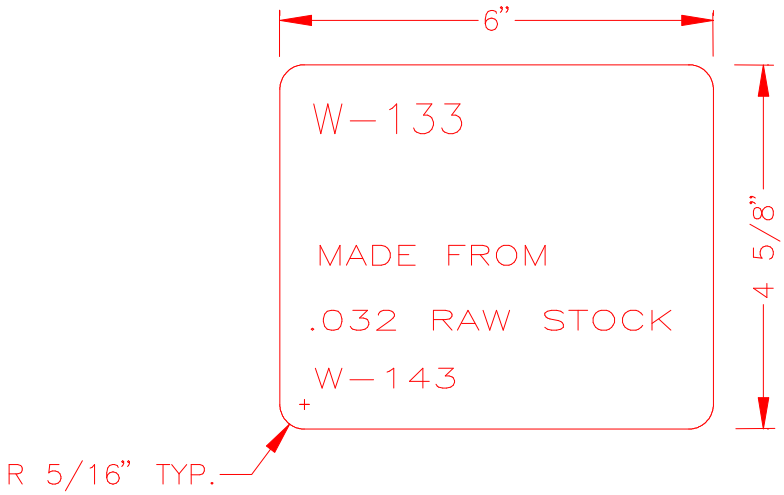



Figure 10.4.1

3) Place a hinge backing plate at the outboard end of the spar as in figure 10.4.2.

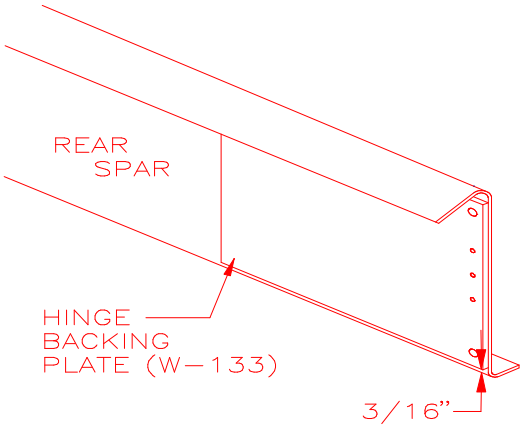



Figure 10.4.2

4) Drill back through the spar into the hinge backing plate the five rib attach holes.

5) Remove the plate and mark out as in figure 10.4.3.

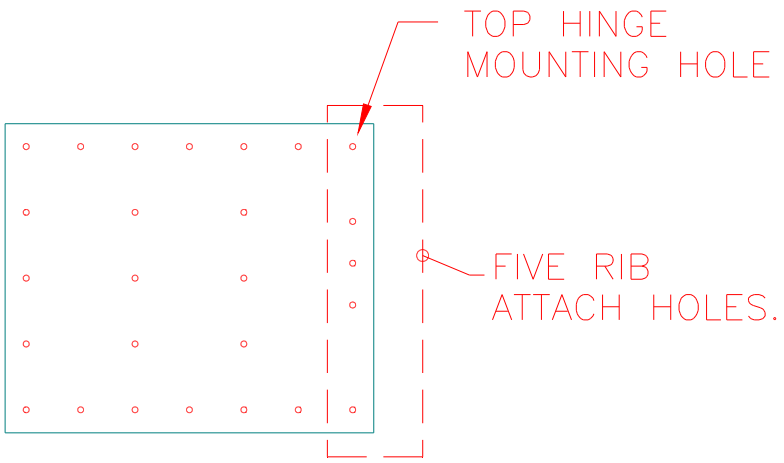



Figure 10.4.3

6) Reinstall backing plate and drill out all marked rivet locations to #30.

7) Drill out the top hinge mounting hole to #11. Figure 10.4.4.

8) With an AN3-5A bolt, AN960-10 washer and AN365-1032 nut, attach an Aileron Hinge (W-125) to the spar. Figure 10.4.4.

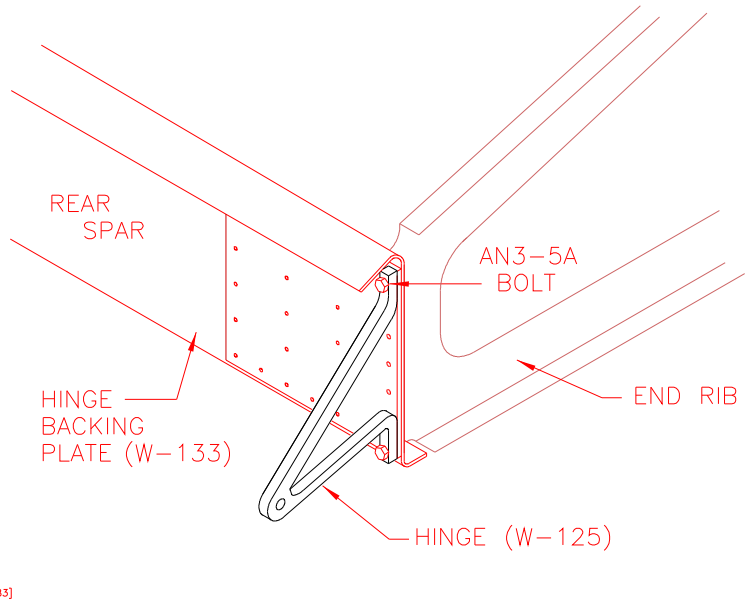



Figure 10.4.4

9) Using the bottom hole in the hinge as a drill guide, drill out the hinge backing plate, rear spar and rib to #11.

10) From (ST-40) angle stock material, cut a length 4 5/8" long. Trim the 3/4" flange down to 1/2".

11) Position it at the outboard end of the rear spar as in figure 10.4.5.

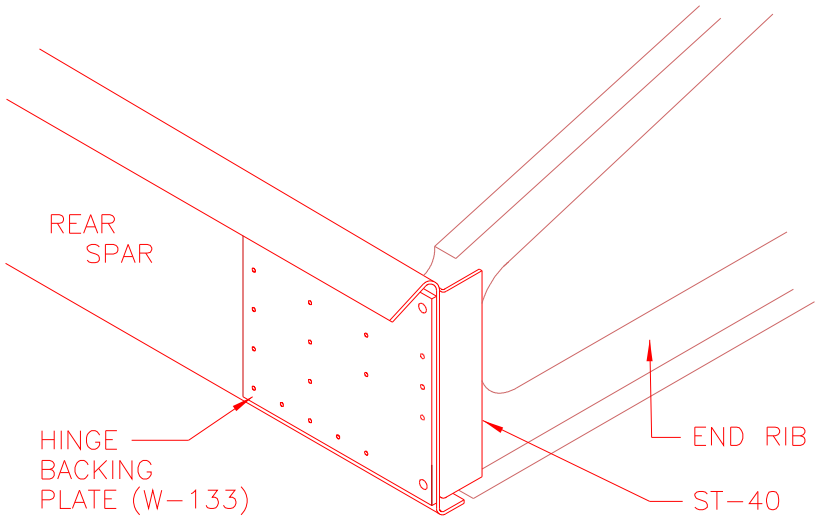



Figure 10.4.5

12) Drill back, through the hinge backing plate, the two #11 holes and the three #30 holes. **NOTE:** The section of ST-40 will be used to mount the wing tip later. It is only required on the right wing as the web of the main rib which faces outwards on the left wing will be used instead.

13) At the #7 rib location position a Hinge Backing Plate. Back drill through the Rear Spar into the Hinge Backing Plate the rib attach holes to #40 as in Figure 10.4.6.

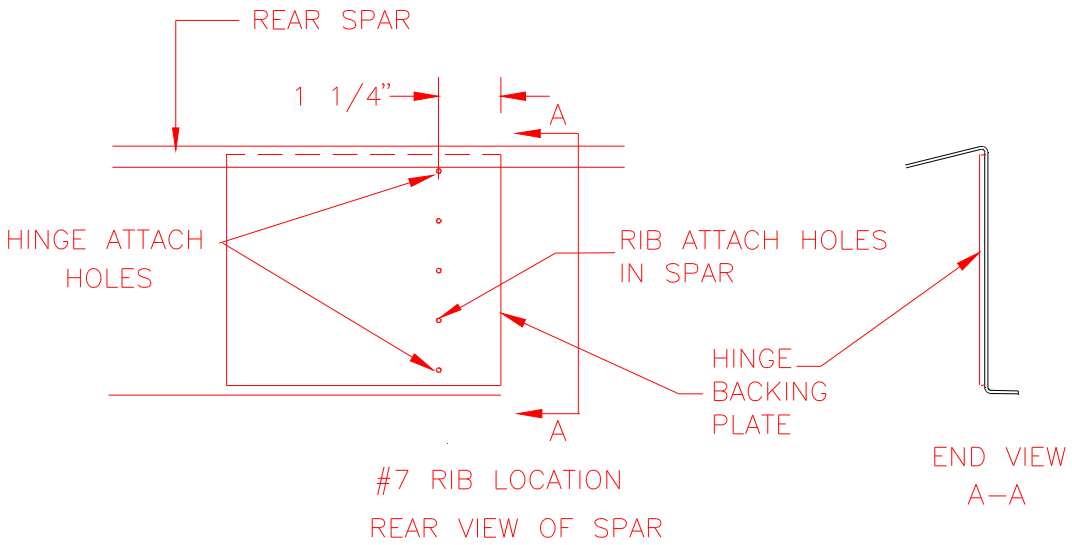



Figure 10.4.6

14) Drill five more #40 holes in Backing Plate and spar, as in Figure 10.4.7.

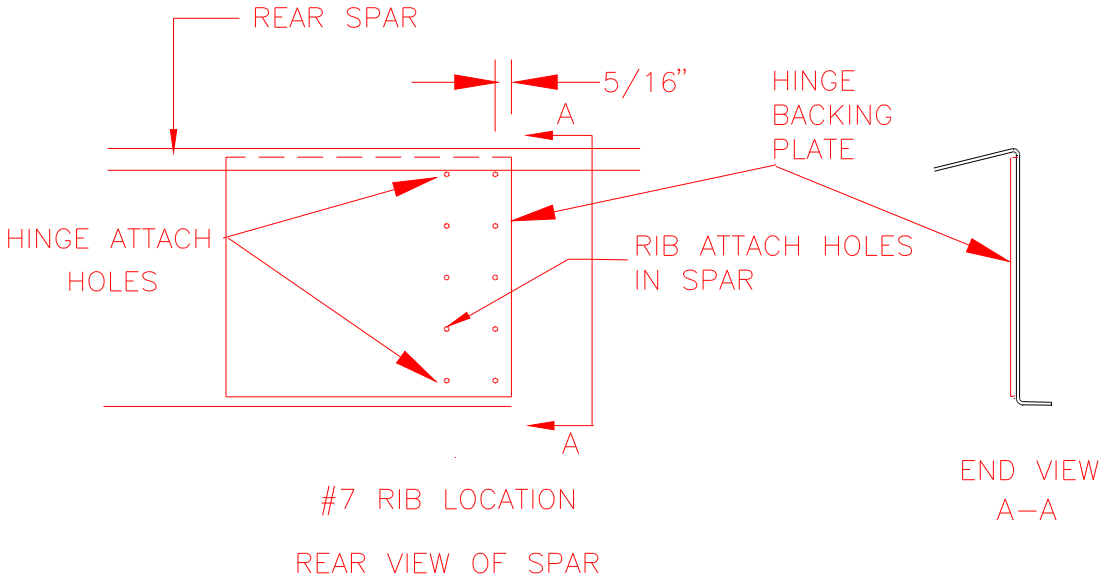



Figure 10.4.7

15) At the root position of the Rear Spar, position a Hinge Backing Plate. Back drill through the Rear Spar into the Backing Plate #40 holes. Cleco as you go. Figure 10.4.8.

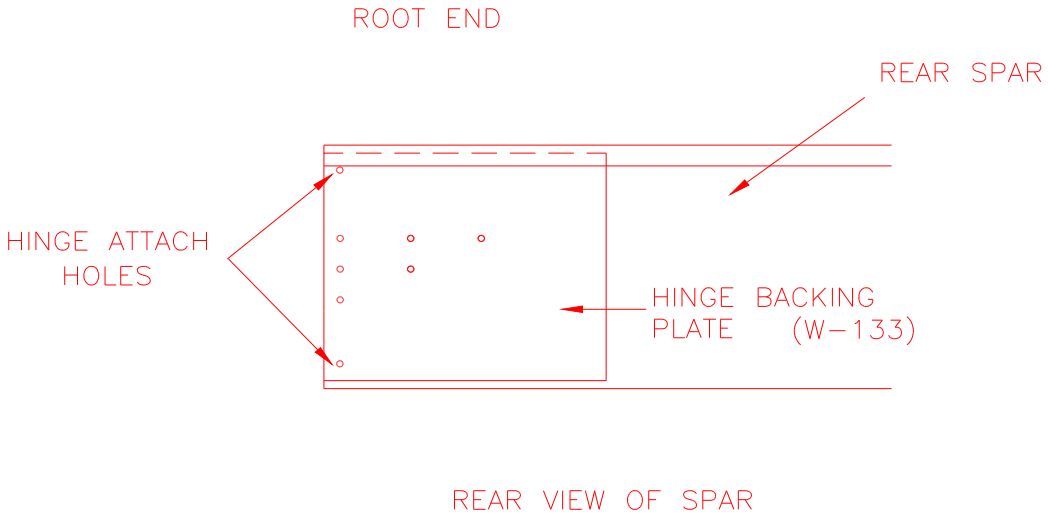



Figure 10.4.8

16) Remove the Hinge backing Plate and mark out and drill to #40. Cleco the Hinge Backing Plate to the Rear Spar and back drill the holes into the spar as in Figure 10.4.9.

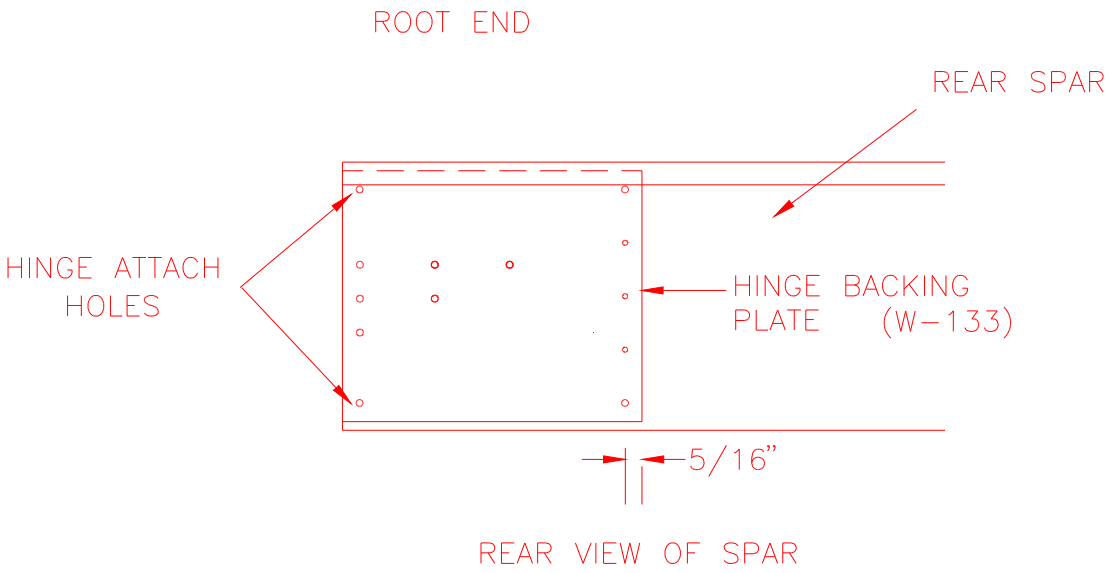

ROOT END
REAR SPAR
HINGE ATTACH HOLES
HINGE BACKING PLATE (W-133)
5/16"
REAR VIEW OF SPAR

Figure 10.4.9

## *10.5 Rib and Spar Assembly*

1) Cleco the Main Spar, Main Ribs and Leading Edge Ribs together.

2) Place a spacer or a wedge under the Main Spar to make the rear bottom portion of the Main Ribs lay flat against the table. See Figure 10.5.1.

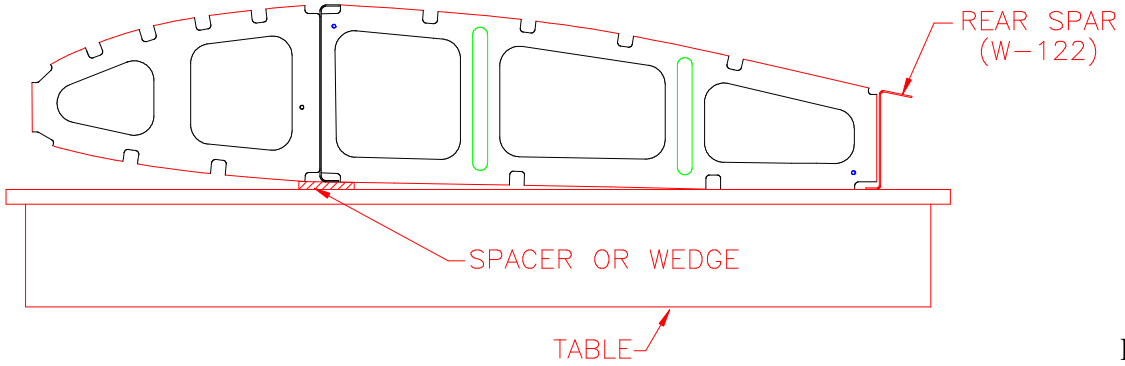



Figure 10.5.1

3) Position the Rear Spar and Hinge Backing Plates against the Main Ribs as in Figure 10.5.1.

4) When you can see the previously drawn line on the Root Rib flange through the prepunched holes in the Rear Spar, drill to #40 and cleco as you did on the Main Spar.

5) Repeat Step 50 for each rib using lots of clecos as you go. Then drill out all holes in the Rear Spar and Main Ribs to #30.

6) Drill out the two Hinge Attach holes at ribs #1,#7 and #13 with a #11 drill. See Figure 10.4.9.

7) Cleco the two Rear Spar Fittings (W-124) to the root end of the Rear Spar and Hinge Backing Plate. Bolt the two fittings together with a 1/4" bolt to ensure alignment. See Figure 10.5.2.

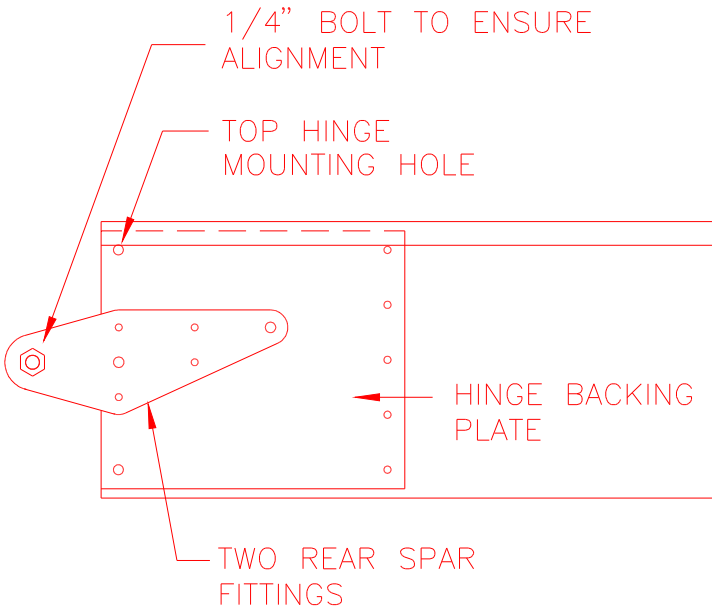



Figure 10.5.2

8) Drill out the six holes in the Rear Spar Fittings and Rear Spar to 5/32" and then ream out to 3/16". Cleco as you go.

## *10.6 Torque Tube Install*

1) On the two Bearing Bases (CC-38) mark and drill out nine #40 holes in the flanges as in Figure 10.6.1.

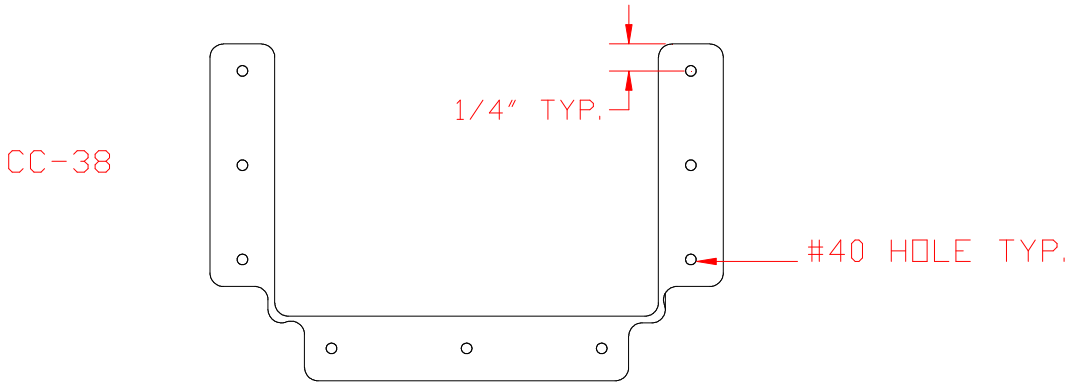



Figure 10.6.1

2) Attach two Delrin Bearings (CC-37) to the two Bearing Bases (CC-38) with eight flush AN 509-1032 R10 Machine Screws, eight AN960-10 Washers and eight AN365-1032 Nuts. See Figure 10.6.2.

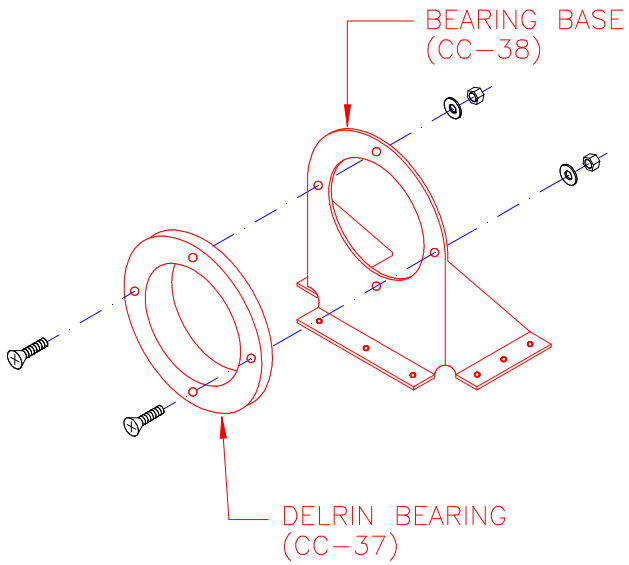



Figure 10.6.2

3) Remove the solid #4 Main Rib or if you have the extended fuel tank the solid #5 Main Rib.

4) Cut the 12 foot long 2" x .035 Tube into two equal lengths. These will become the Torque Tubes.

5) Position the inboard Bearing Base between ribs #1 and #2 with the flat side towards the root. Position the outboard Bearing Base between the #6 and #7 ribs with the flat side to the tip. See Figures 10.6.3 and 10.6.5.

6) From the outboard end of the Wing slide a Torque Tube (cut in Step 58) through the Main Ribs and the two Delrin Bearings. **NOTE:** It may be necessary to lightly sand the Delrin Bearings to get a good fit, so that the Torque Tube turns smoothly and easily, but has no excess play.

7) Center the inboard Bearing Base on the Rear Spar with the center flange butted up to the Root Rib flange. See Figures 10.6.3 and 10.6.4.

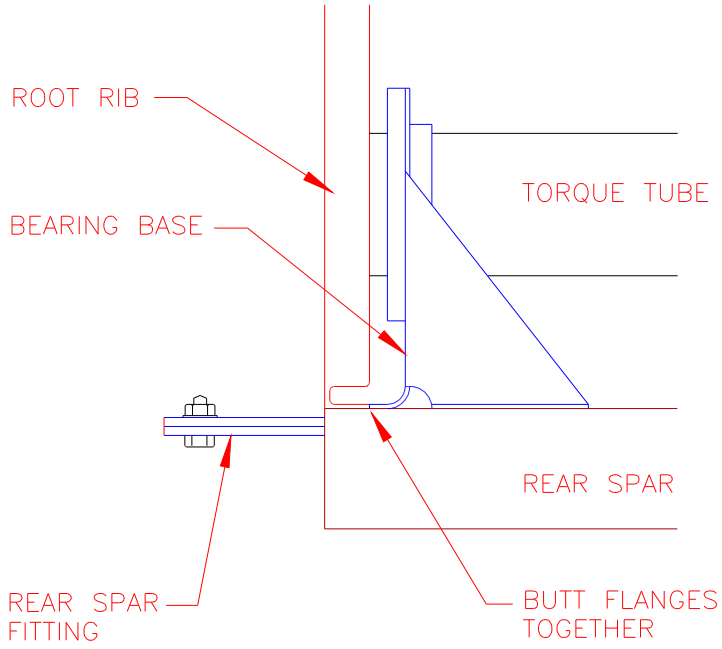



Figure 10.6.3

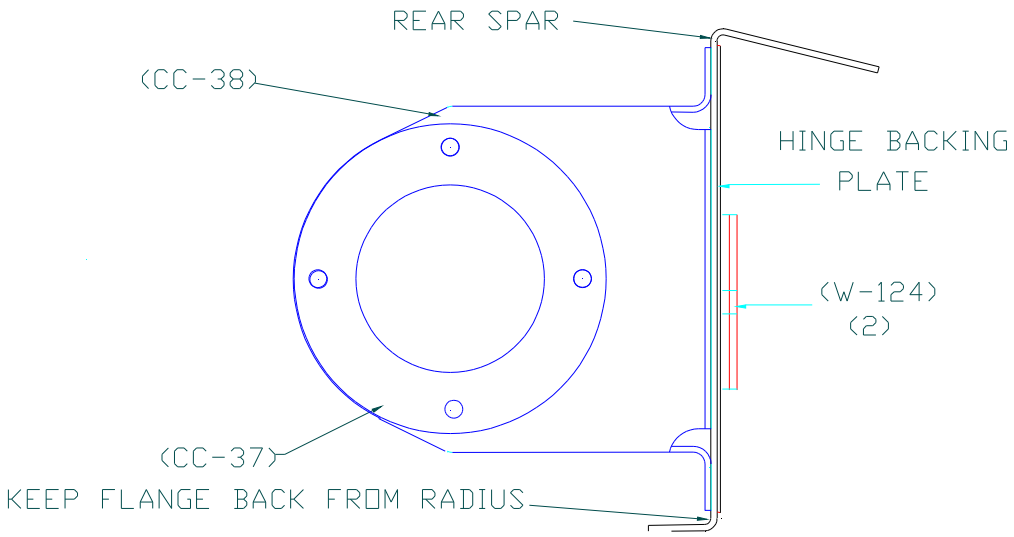
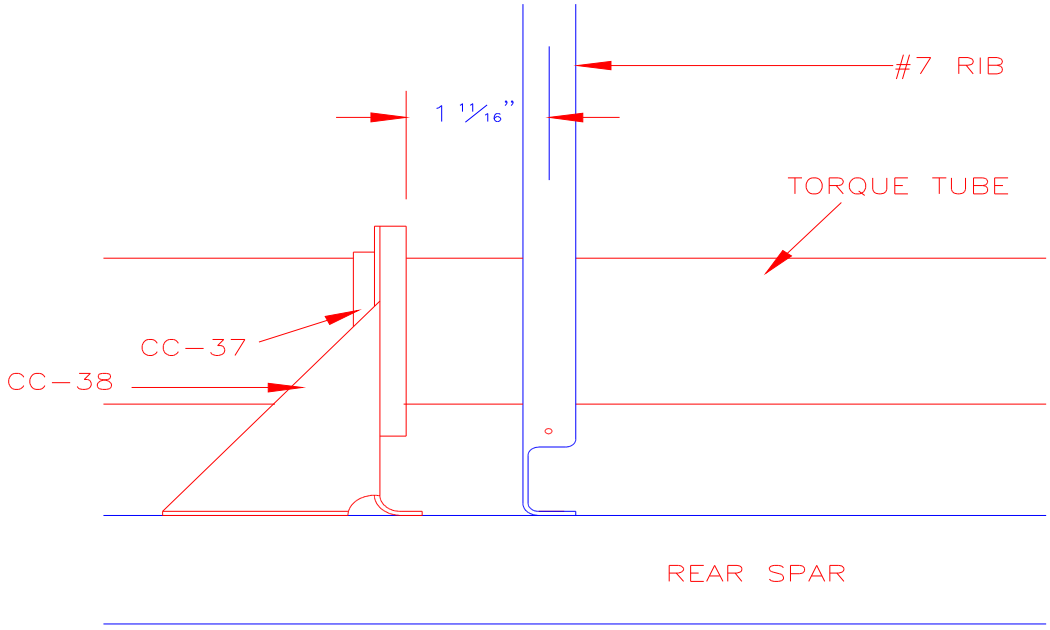



Figure 10.6.4

8) Hold the Torque Tube level with the top of the spar and drill two #40 holes back through the inboard Bearing Base into the Rear Spar. Cleco.

9) Position the outboard Bearing Base as in Figure 10.6.5.




TOP VIEW OF OUTBOARD BEARING ASSEMBLY

Figure 10.6.5

10) Drill two #40 holes back through the outboard Bearing Base into the spar and cleco.

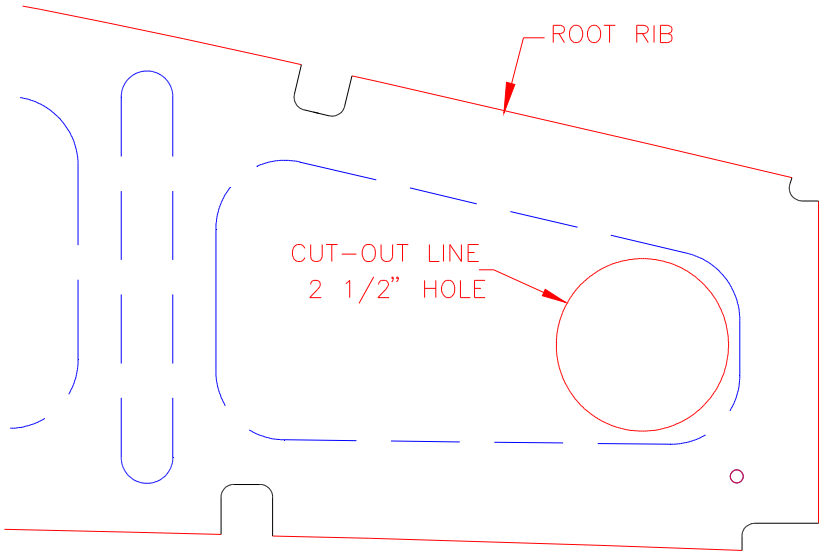
11) Ensure that the Torque Tube turns freely.

12) Back drill the remaining holes into the Rear Spar. **NOTE:** The center hole of the vertical flange on the inboard Bearing Base will go through the Rear Spar Attach Fittings.

13) Drill out to #30. Cleco securely.

14) Push the Torque Tube up against the Root Rib. Draw a line around the tube on the rib.

15) Remove the Root Rib and cut out a 2 1/2" hole where the Torque Tube will exit. Press the Root Rib into the #4 rib and transfer the hole location for the Torque Tube . Cut out the 2 1/2" hole. See Figure 10.6.6.




ROOT RIB AS SEEN FROM INBOARD

Figure 10.6.6

16) Remove the Torque Tube and debur the outboard end.

17) In a 1" Sleeve (CC-100) drill eight #30 holes as in Figure 10.6.7.

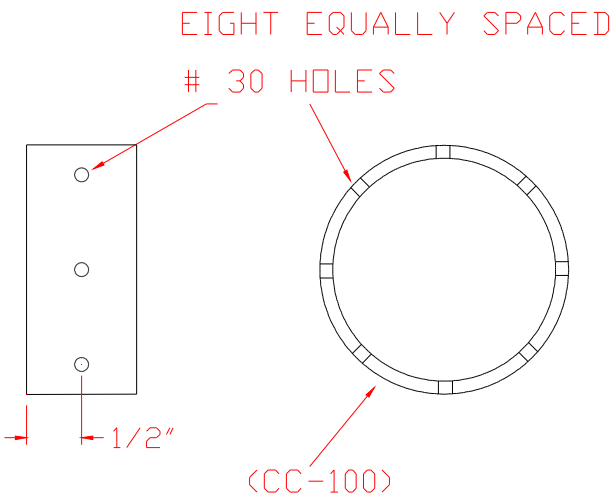



Figure 10.6.7

18) Bolt a Control Horn (CC-43) to an End Plug (EL-31) with a 1/4" bolt and using the Control Horn as a drill template drill out the eight #11 holes into the End Plug. Ensure that the Control Horn is facing the direction for the wing that you are doing. See Figure 10.6.8.

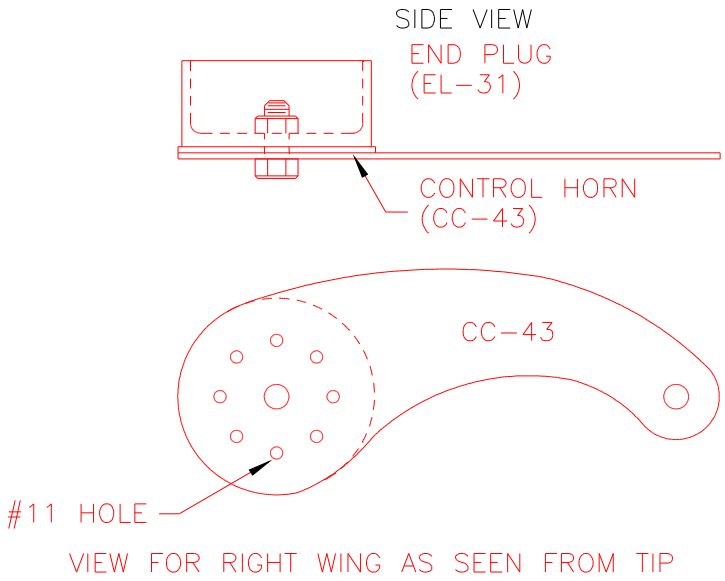



Figure 10.6.8

19) Slide the Sleeve (CC-100) over the outboard end of the Torque Tube.

20) Slip the Control Horn (CC-43) and the End Plug (EL-31) assembly into the end of the Torque Tube.

21) Stagger the holes in the Sleeve with the holes in the End Plug and drill to #30 and then to #11. See Figure 10.6.9.

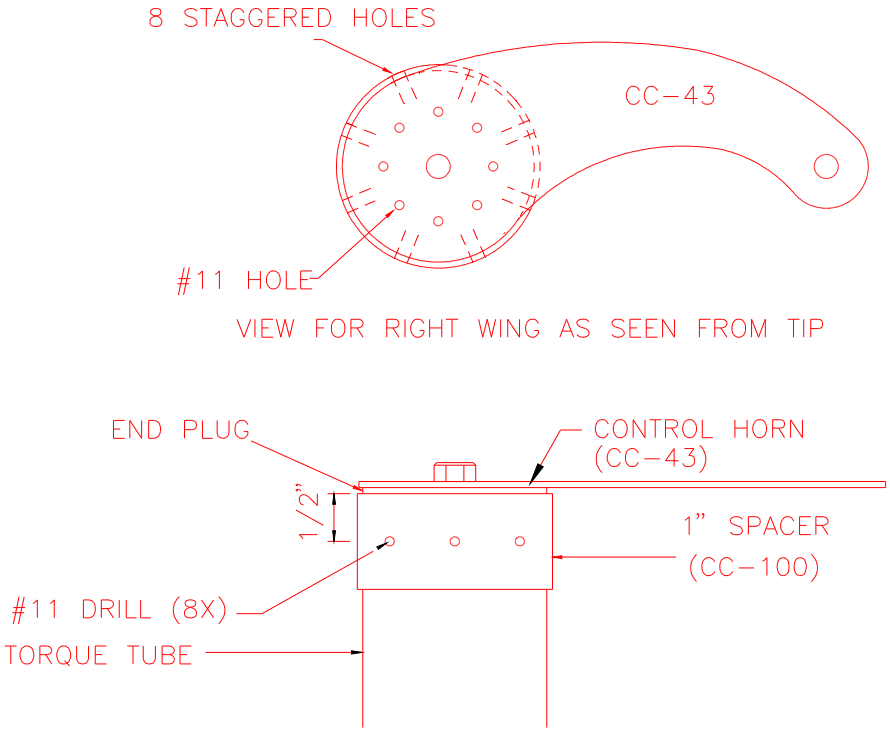



Figure 10.6.9

22) Disassemble and debur Torque Tube. Chromate mating surfaces and assemble as follows:

23) Control Horn to End Plug with 3/16" SS rivets (RR-5606)

24) Sleeve, Torque Tube and Plug assembly with 3/16" SS rivets (RR-5606)

25) Replace Root and #4 ribs.

26) Slide a 2” Washer (M2W) onto the Torque Tube and replace Torque Tube into the Bearings.

## *10.7 Front Spar*

1) Cut a Front Spar Cap (W139) into two equal lengths. These parts then become Short Spar Caps (W-140).

2) Lay out a Front Spar (W-117) as in Figure 10.7.1.

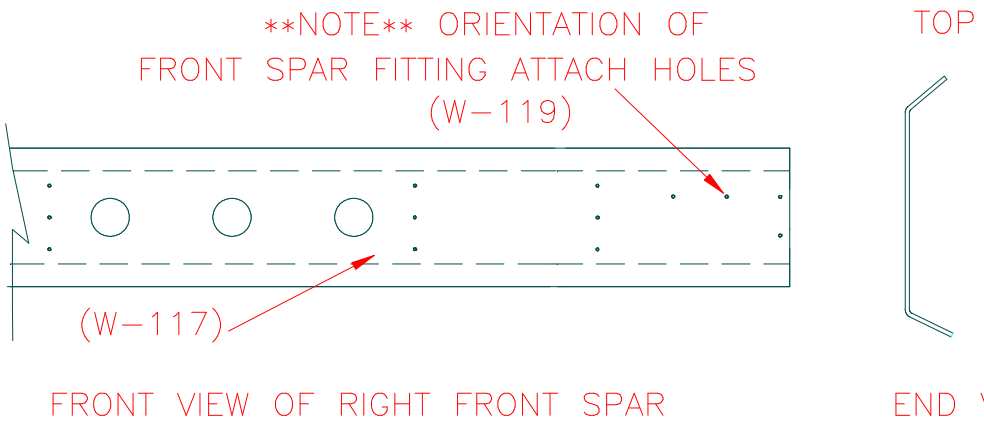



Figure 10.7.1

3) On the table lay out the right Front Spar (W-117), Front Spar Doubler (W-116), two long Front Spar Caps (W-139) and one short Front Spar Cap (W-140). See Figure 10.7.2.

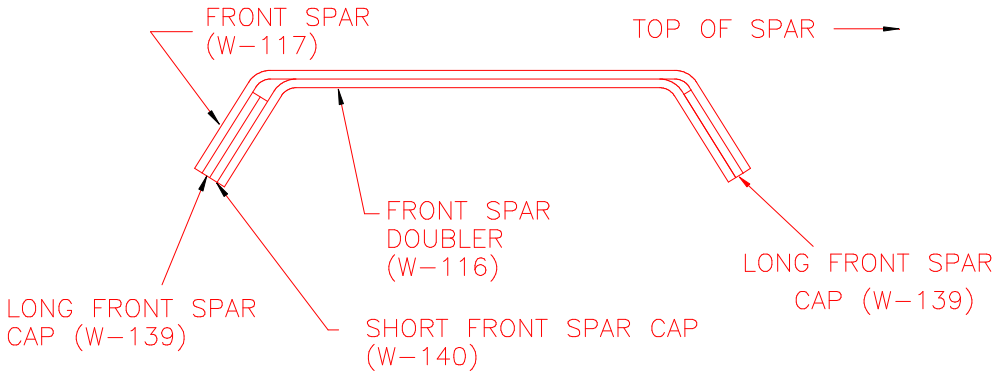



Figure 10.7.2

4) Ensure all parts are flush with the Root end. Then back drill the Front Spar Attach Fitting holes into the Front Spar Doubler (W-116) with a # 40 drill.

5) Remove Front Spar Doubler (W-116) and Spar Caps (W-139,W-140).

6) Place a Front Spar (W-117) face down and centered over the Front Spar Tripler (W-118) and flush with the root end. Back drill all the rivet holes into the Front Spar Tripler to #40. **DO NOT** drill lightening holes in the Front Spar Tripler. Cleco as you go. See Figure 10.7.3.

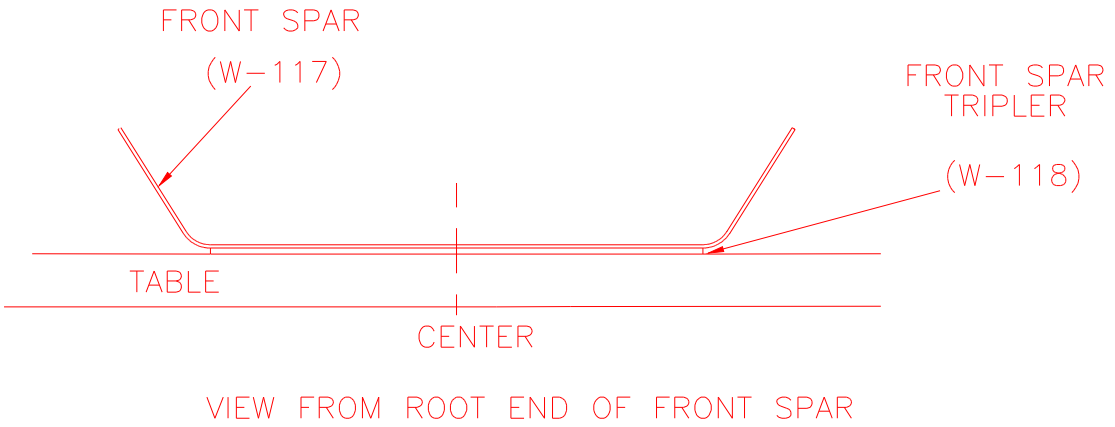



Figure 10.7.3

7) Mark the location of each lightening hole in the Front Spar (W-117) to the Front Spar Tripler (W-118).

8) Remove the Front Spar Tripler, mark out and drill to # 40 as in Figure 10.7.4.

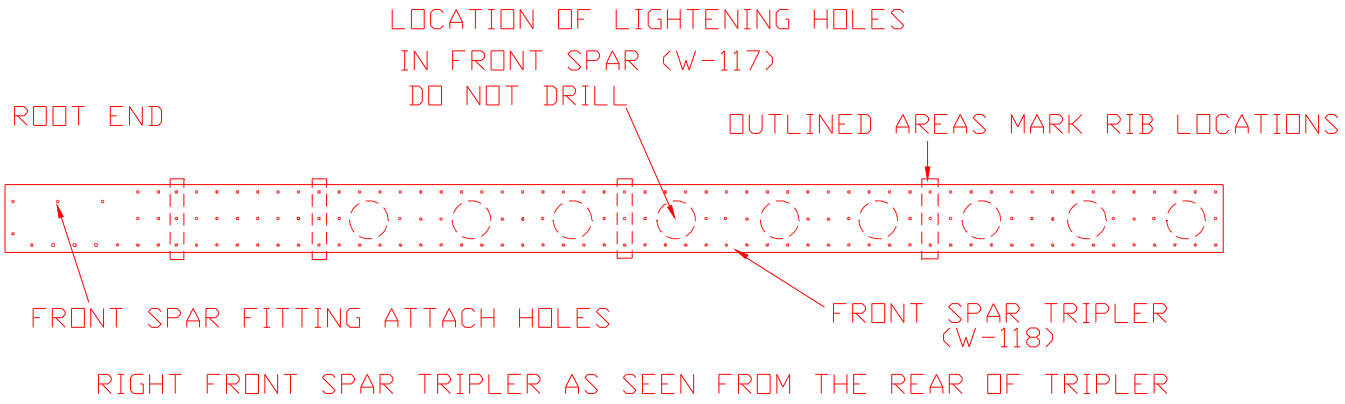



Figure 10.7.4

9) Cleco the Front Spar Tripler to the front of the Front Spar and back drill the Front Spar to #40.

10) Cleco the Front Spar(W-117), Front Spar Tripler (W-118) and Front Spar Doubler (W-116) together and back drill the Front Spar Doubler to #40 through the Tripler and Front Spar.

11) Drill out the four Front Spar Fitting attach holes in the Front Spar, Front Spar Doubler and Front Spar Tripler to #11. See Figure 10.7.4. **NOTE:** These holes will be drilled to 1/4" later.

12) On each Leading Edge Rib drill a #40 hole in the center of the Front Spar Attach flange. **NOTE:** Do not drill the Leading Edge Root Rib. See Figure 10.7.5.

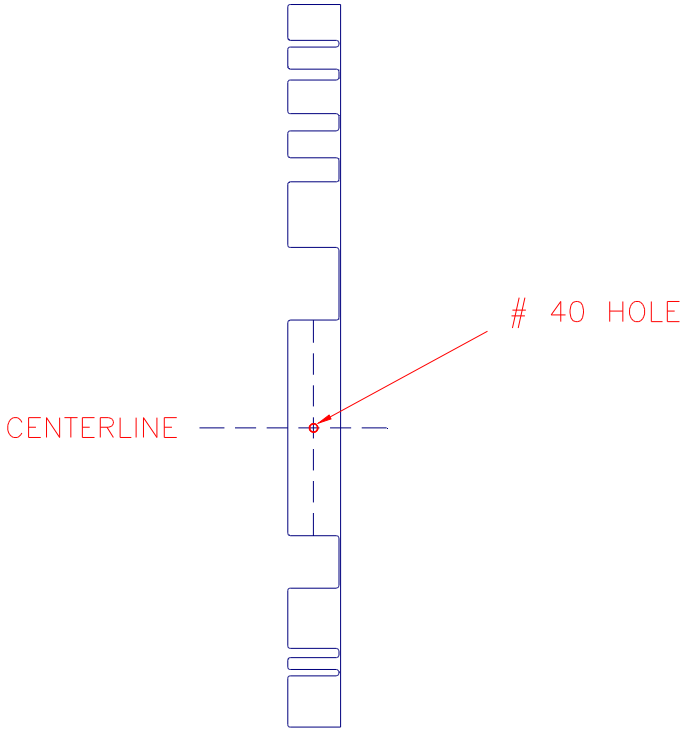



Figure 10.7.5

13) Cleco the Front Spar onto the Leading Edge Ribs using the holes just drilled in the flanges. Position the ribs so the lines on the flanges are visible through the center of the prepunched holes in the Spar. Drill the remaining two holes to #40. Reassemble the Front Spar Tripler, Doubler and Front Spar to the Leading Edge Ribs and then drill all the #40 to #30 in the ribs and securely cleco in place. See Figure 10.7.6.

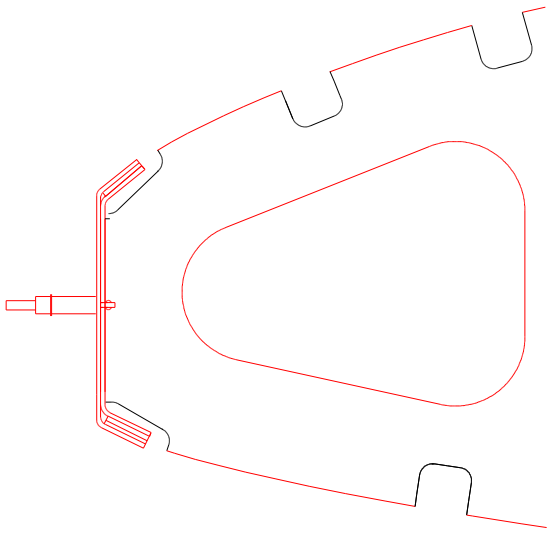


Figure 10.7.6

## *10.8 Leading Edge Root Rib*

1) Remove the Leading Edge Root Rib from the assembly.

2) Cut the flanges off a second Leading Edge Root Rib (W-172) as in Figure 10.8.1. This will become a doubler for the Leading Edge Root Rib.

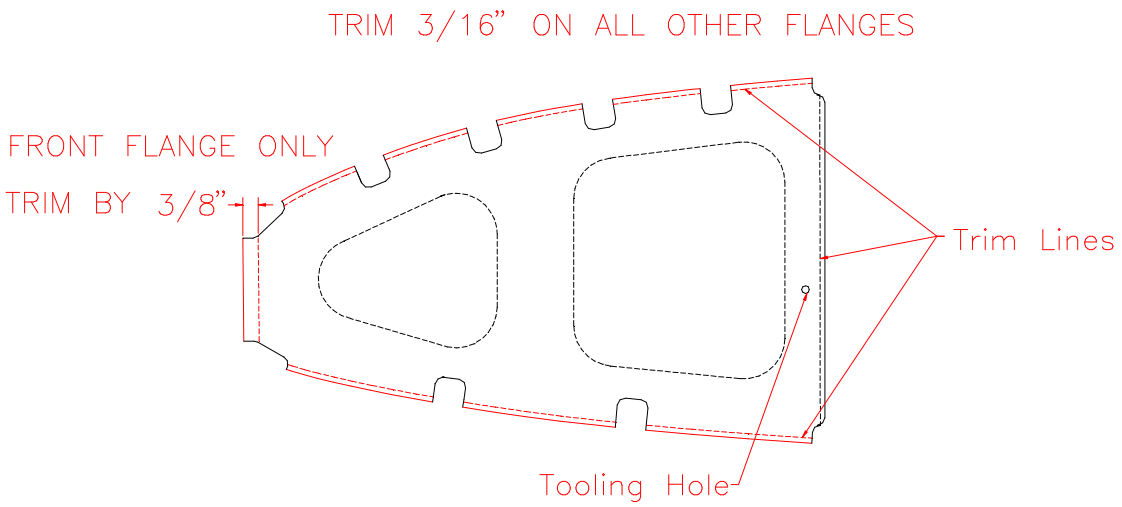



Figure 10.8.1

3) On the Root Rib trim the front flange only as in Figure 10.8.1.

4) Insert the Doubler into the Leading Edge Root Rib. Cleco together through the rear #11 tooling hole. Cleco the Leading Edge Root Rib back onto the Main Spar.

5) On the Root Rib Attach Bracket (W-161). Drill a #30 hole as in Figure 10.8.2.

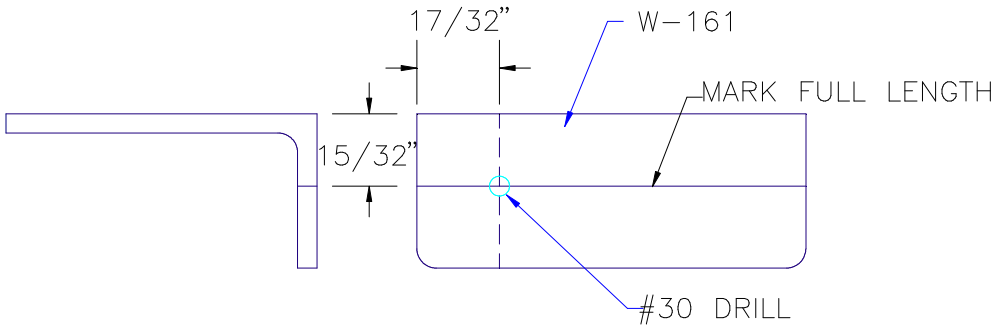



Figure 10.8.2

6) Clamp a Packer ( cut 2 1/2" long from the W-138 raw material) to the inside of the Angle Bracket and drill a hole through the Angle Bracket and the Packer first to #30 and then out to #11. See Figure 10.8.3.

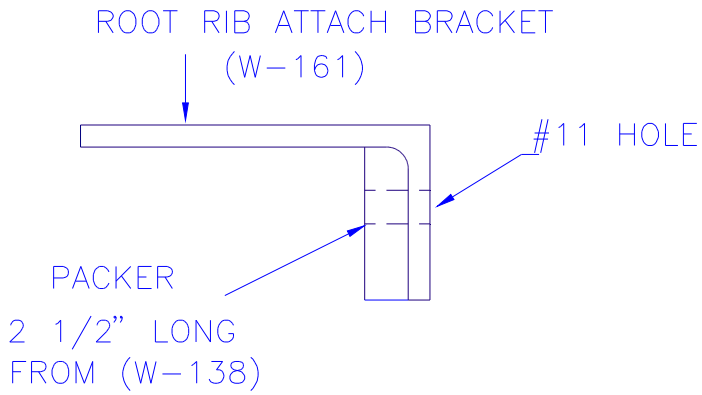



Figure 10.8.3

7) Drill six #30 holes into the Root Rib Attach Bracket (W-161) as in Figure 10.8.4.

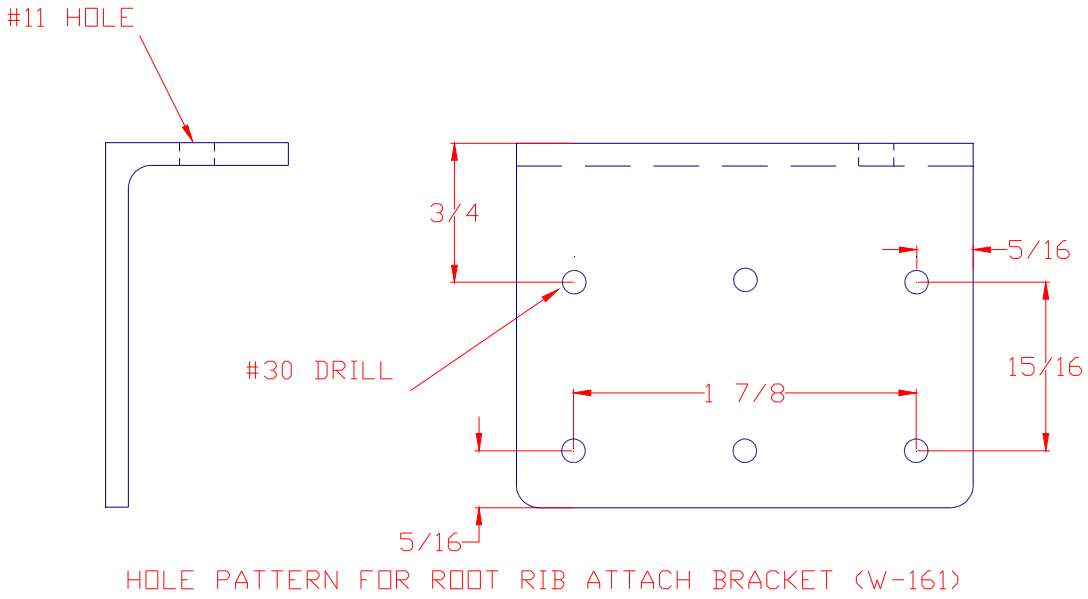



Figure 10.8.4

8) Use a AN3-10A Bolt to temporarily attach the Root Rib Attach Bracket, Packer , two Front Spar Attach Fittings and Front Spar Tripler to the Front Spar. See Figure 10.8.5 and Figure 10.8.6.

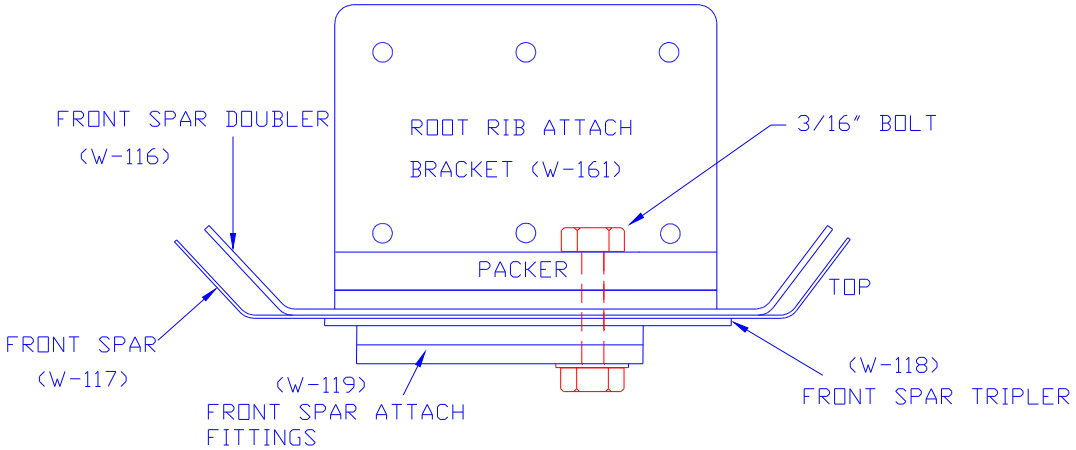



Figure 10.8.5

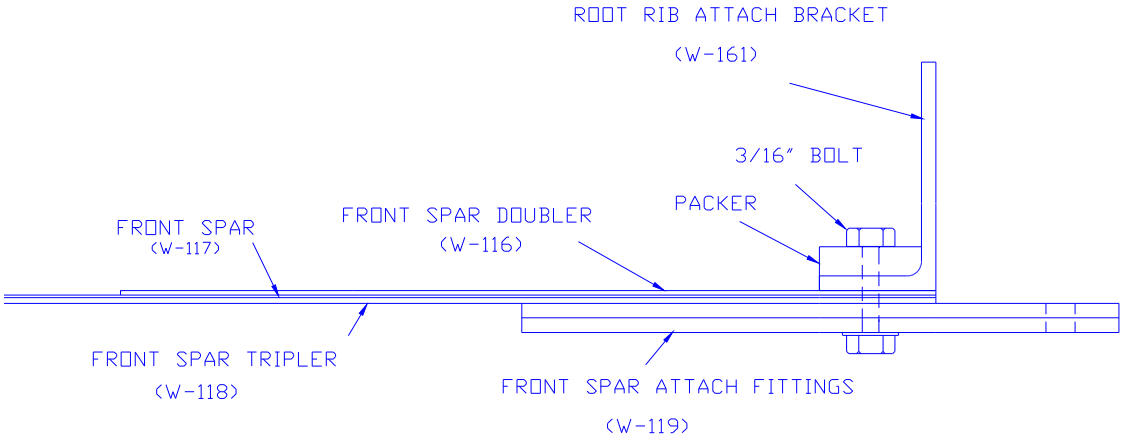



Figure 10.8.6

9) Ensure the line on the flange of the Root Rib Attach Bracket is in the center of the other hole in the Spar. Then drill to #11.

10) Use another AN3-10A bolt to temporarily secure the assembly.

11) Back drill the six #30 holes through the Root Rib Attach Bracket into the Root Rib and doubler. See Figure 10.8.7.

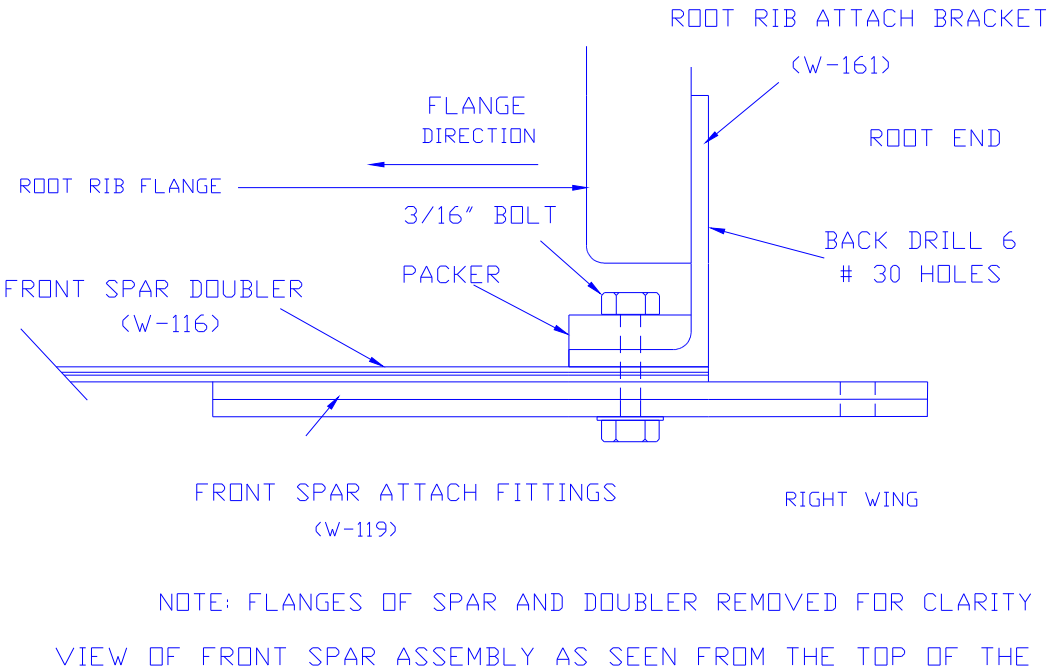



Figure 10.8.7

*** Note**: It is important that you let the Front Spar and Root Rib Attach Bracket find their own position on the rib. Do not force it back.*

**Note**: As there are no left and right ribs, the root rib installation will be different for each wing. See Figure 10.8.9 for the left wing view.

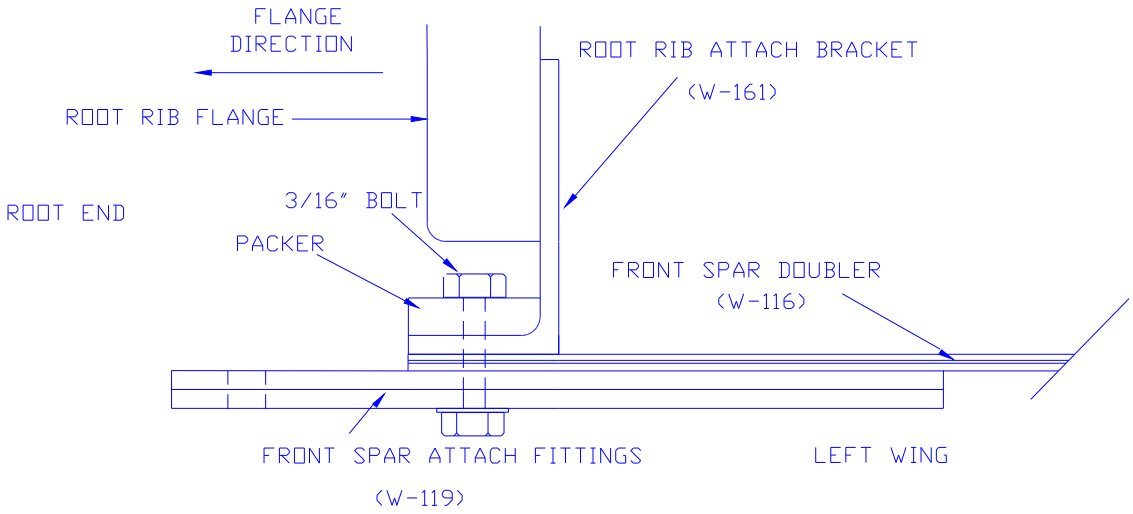



Figure 10.8.9

12) Open up the six #30 holes to #11. Cleco.

13) Cut a Root Rib Stiffener (W-142) into two equal lengths.

14) Hold a Root Rib Stiffener (W-142) against the Leading Edge Root Rib. Trim length to suit. See Figure 10.8.10.

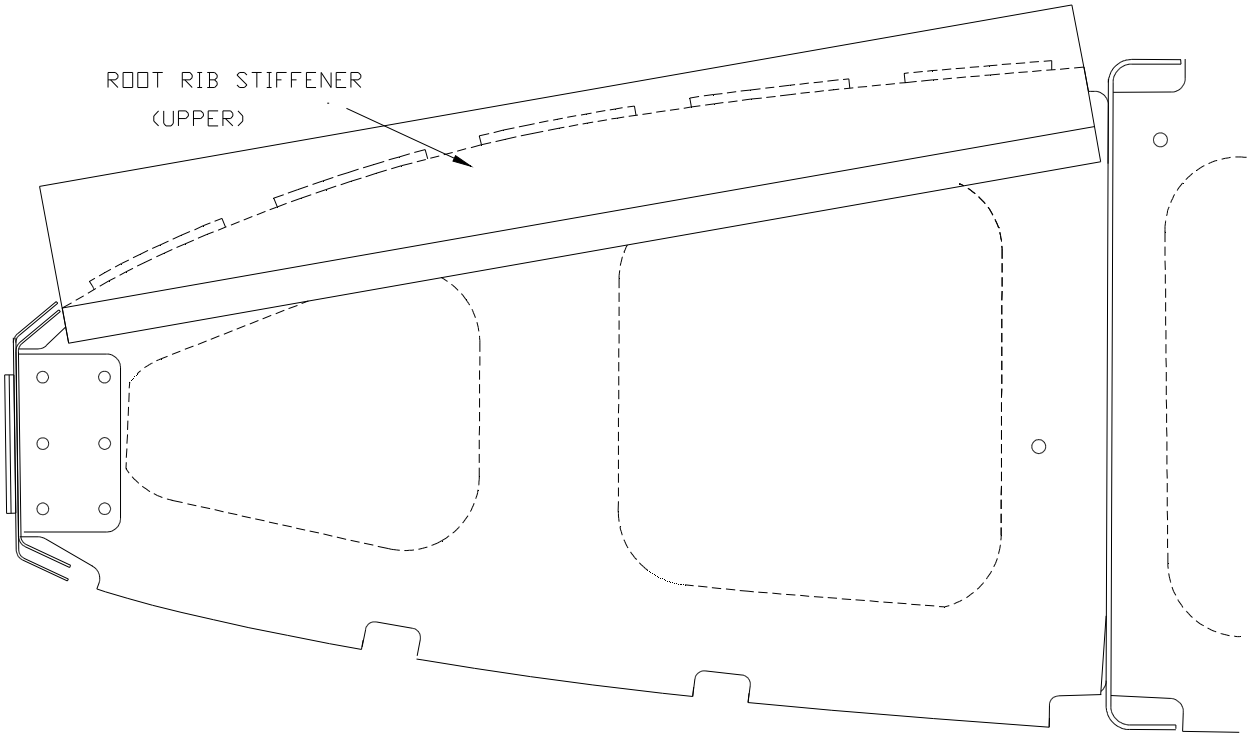



Figure 10.8.10

15) Trace the shape of the Leading Edge Root Rib (W-172) on the back of the Root Rib Stiffener (W-142). See Figure 10.8.10.

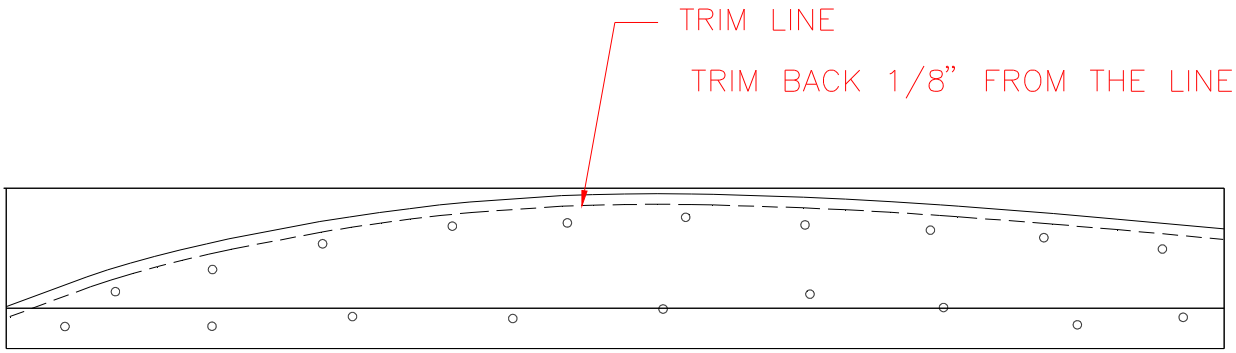



Figure 10.8.11

16) Trim and drill to #40 as in Figure 10.8.11.

17) Reposition against the Leading Edge Root Rib, drill and cleco.

18) Repeat steps for the bottom edge of the Leading Edge Root Rib. See Figure 10.8.12.

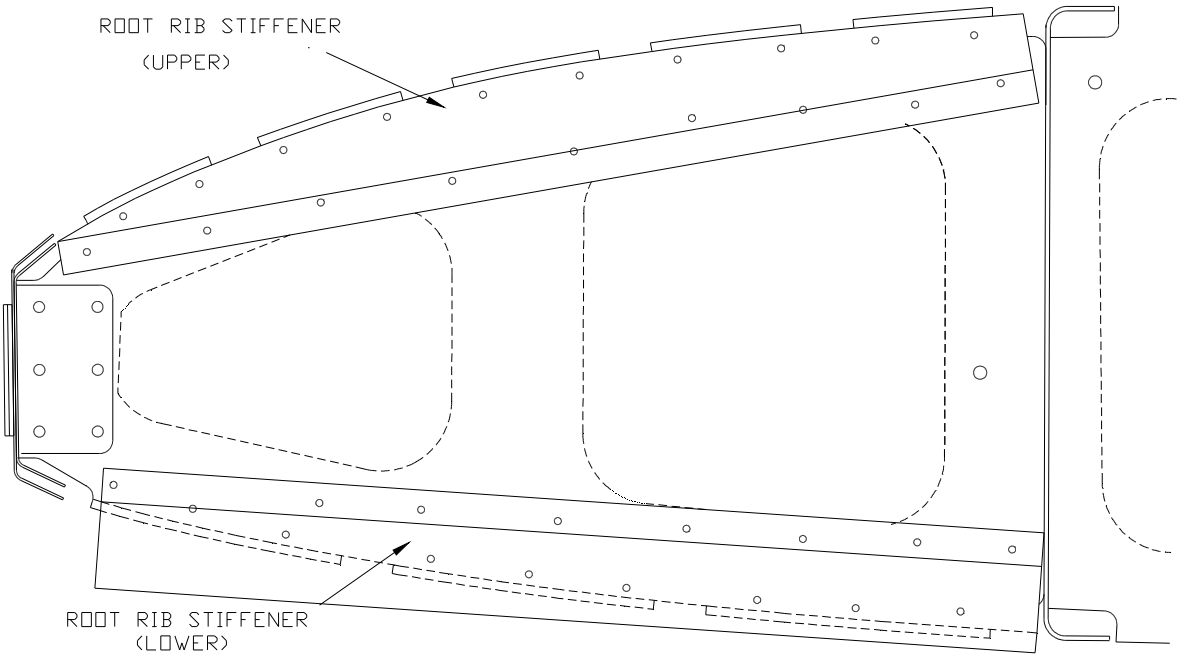



Figure 10.8.12

* **Note:** When doing the left wing, the Root Rib Stiffeners will be inside the wing.

19) Drill #40 holes into the Leading Edge Root Rib and Doubler as in Figure 10.8.13.

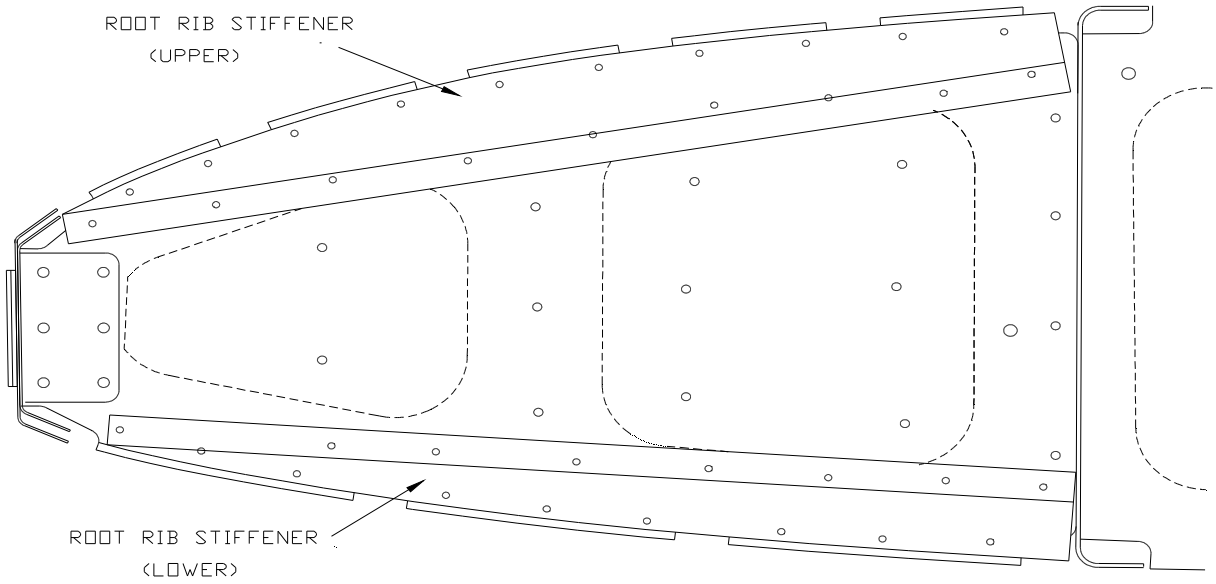



Figure 10.8.13

20) Drill out all #40 holes in the Leading Edge Root Rib, Doubler and Root Rib Stiffeners to #30.

21) Drill out the four attach holes for the Front Spar Attach Fittings (W-119) to 1/4".

22) Disassemble the root section and debur all parts.

23) Chromate the mating surfaces of the Leading Edge Root Rib, Doubler and Root Rib Stiffeners. Rivet together with 1/8" rivets (RV 1410).

24) Chromate the Root Rib Attach Bracket and rivet to the Root Rib and Doubler with 3/16" rivets (RV-1613).

25) Chromate mating surfaces and rivet the Front Spar, Leading Edge Ribs, Tripler and Doubler together with 1/8" rivets. Bolt the front Spar Fittings, Doubler, Spar, tripler, Root Rib Angle Bracket and Packer together with two AN4-6A bolts, two AN4-11A bolts. **NOTE:** Bolt heads should face forward. See figure 10.8.14.

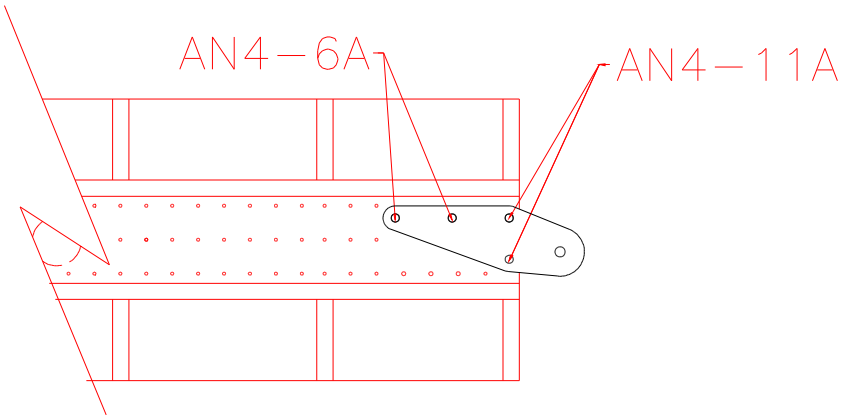



Figure 10.8.14

## *10.9 Wing Skins and Stringers*

**NOTE:** Each wing has twelve **Full** length extruded Stringers on the skins. These Stringers prevent oil canning and carry some of the compressive loads. Until these stringers are on, the skins are very easily damaged. It is recommended that two people carefully move the skin to avoid creasing.

1) Place a Top Wing Skin (W-126) on a flat table. Position a Top Tank Skin (W-158) under the Root End. Ensure the top edges are flush and the Tank Skin protrudes out 1/2". See Figure 10.9.1.

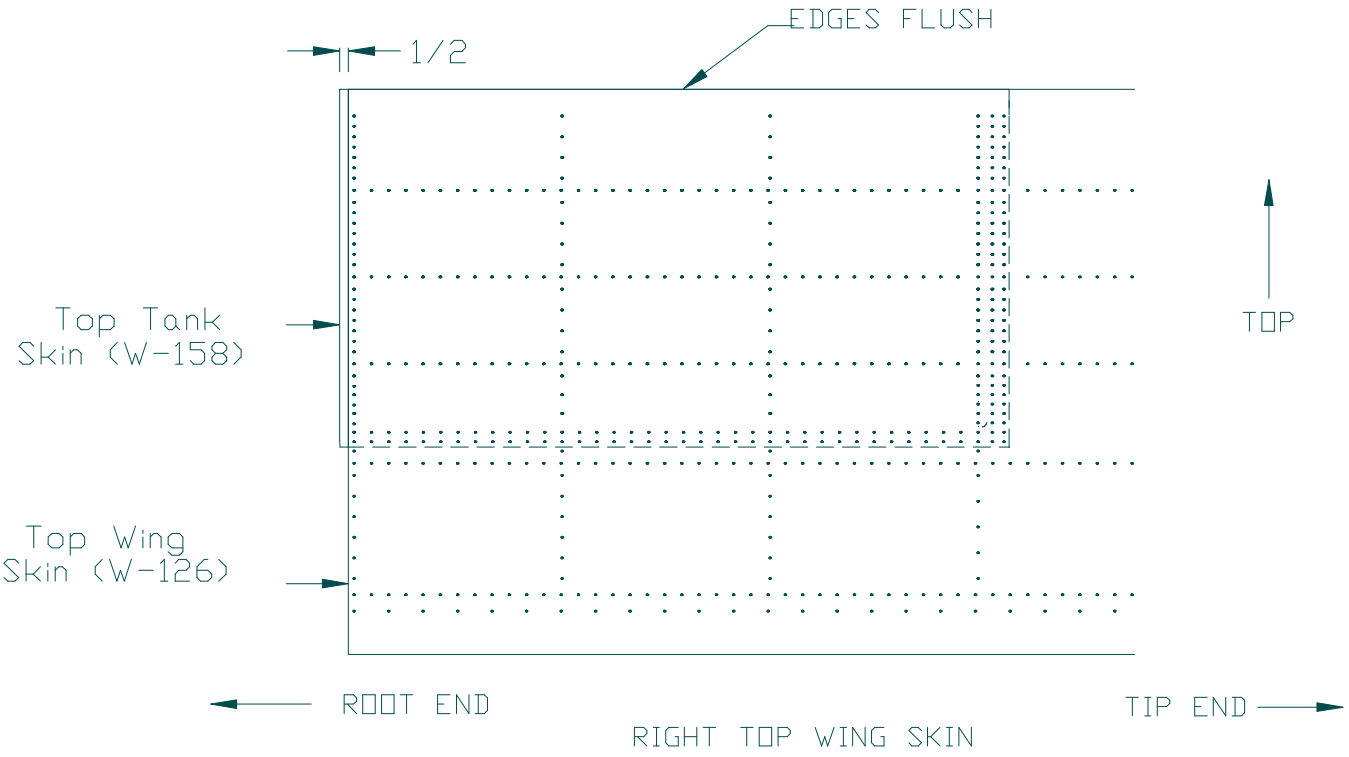



Figure 10.9.1

2) Using a #40 drill, transfer the holes in the tank area from the Top Wing Skin to the Top Tank Skin (W-158). Cleco as you go. Do not drill out to #30 at this time.

3) Repeat steps using the Bottom Wing Skin (W-127) and the Bottom Tank Skin (W-158). Put the Tank Skins aside for now.

All rivet locations for the Stringers have been prepunched in the skins. It is possible to mark the center of each Stringer rivet flange and drill back through the skin as you go. However, it is easier and the chance of damaging the skins is less if the following procedure is followed.

4) Nail four 3/8" plywood strips to the workbench. Figure 10.9.2.

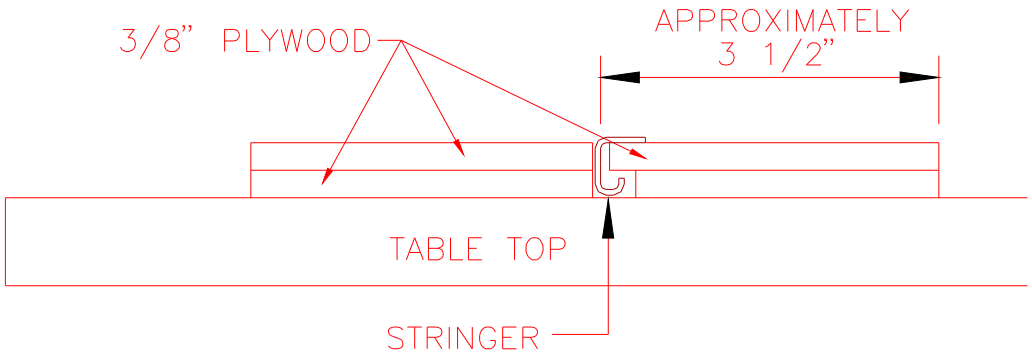



Figure 10.9.2

5) Draw a line down the center of a Stringer. Slide the Stringer between the plywood strips. Position a skin over the Stringer. When the line is visible through the center of the prepunched holes drill each hole out to #40. Use plenty of clecos. **DO NOT** drill out to #30 at this time. Figure 10.9.3. See Figure 10.9.4 for Stringer orientations.

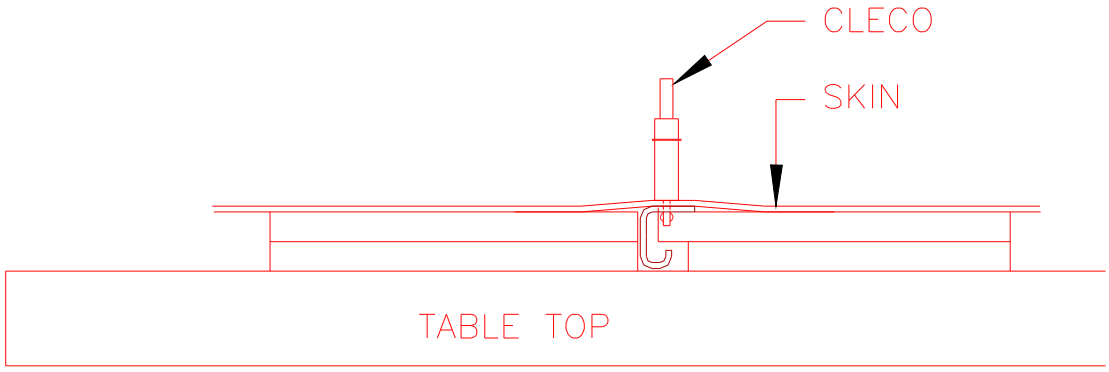



Figure 10.9.3

6) Fit the full length Stringers to the Leading Edge Skins. Trim 3/32" off the Root End of the six Leading Edge Stringers in the R/H wing. The Leading Edge Root Ribs will interfere with the Stringers otherwise.

**NOTE:** Trim 3/4" off the Root end of all six Leading Edge Stringers used in the L/H wing when doing this step.

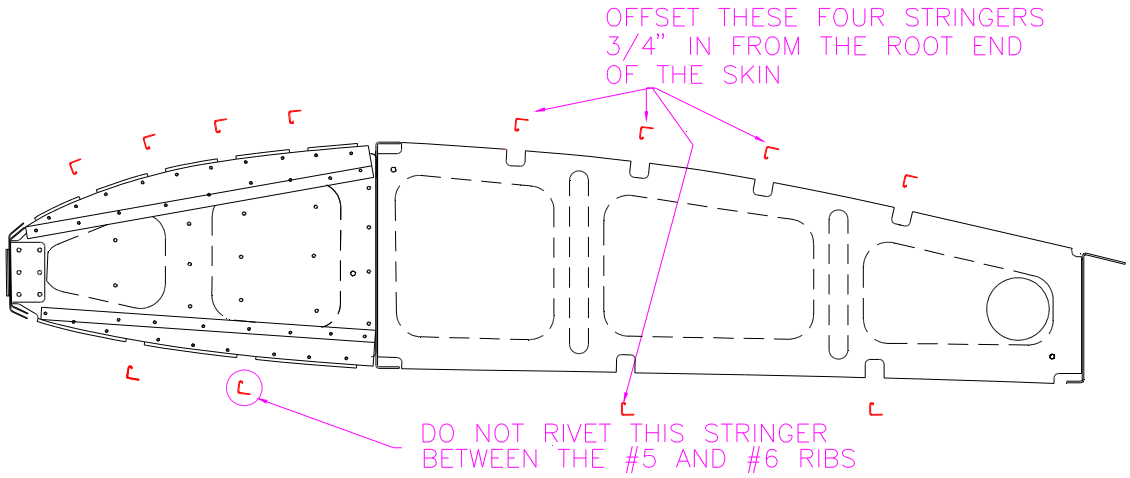



Figure 10.9.4

7) On the Leading Edge Skins you can at this time drill all the Stringers to #40 and then to #30. Disassemble and debur the Leading Edge Skins and the Stringers. After Chromating the mating surfaces, rivet together with 1/8" rivets (RV-1410). **Do Not** rivet the bottom Leading Edge Stringer between the #5 and #6 ribs. See Figure 10.9.4.

8) Place the Wing assembly upside down on the table on two 2" x 4"s. See Figure 10.9.5

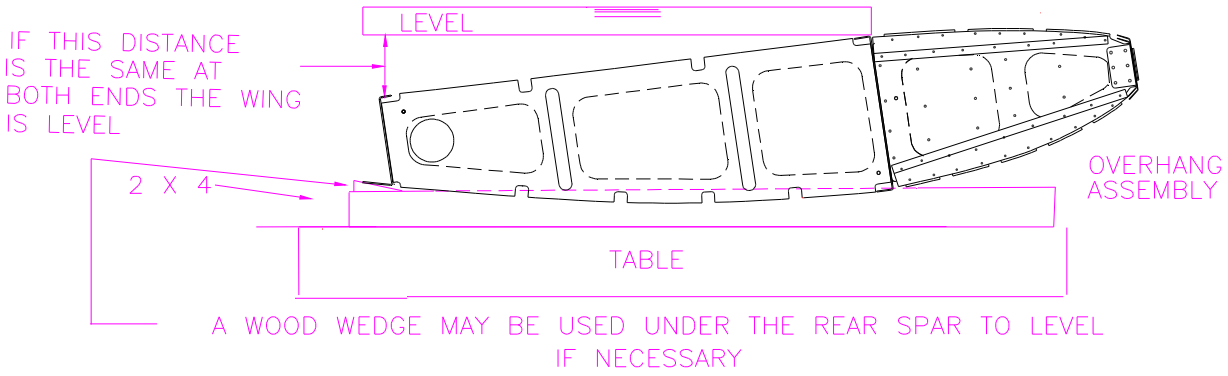



Figure 10.9.5

**NOTE:** Ensure the Wing is level from end to end. Small wood wedges may be used to level the wing.

9) Position the Bottom Skin with Stringers and Bottom Tank Skin (W-158) on the Wing assembly. Use six 3/32" clecos in each rib. See Figure 10.9.6.

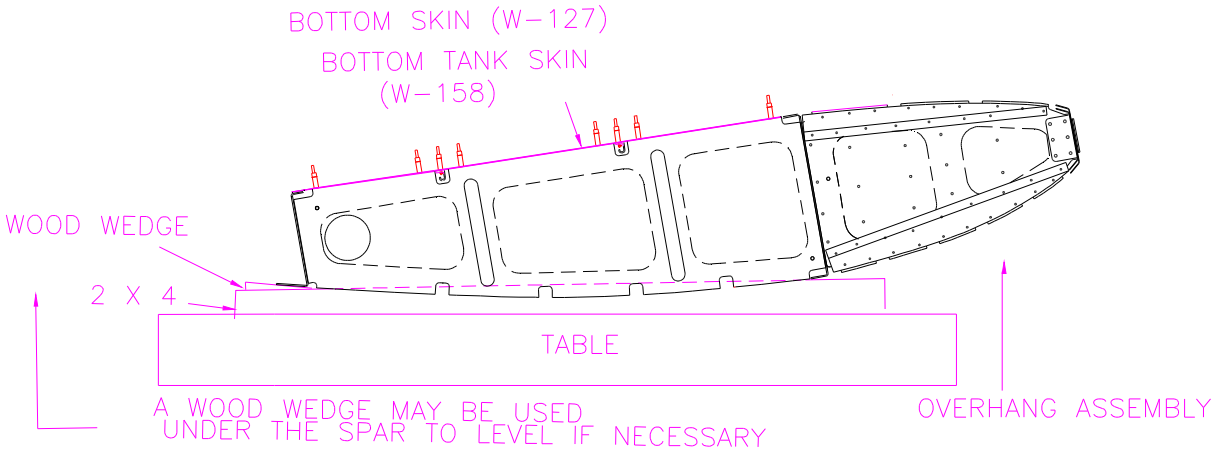



Figure 10.9.6

10) Back drill through the Skin all the rib holes to #40. **Do Not** drill into the Rear Spar at this time.

11) Draw a line down the center of each Leading Edge flange if you have not already done so.

12) At the root end replace the two long front Spar Caps (W-139, W-140) use a small piece of tape at two or three places along the Front Spar assembly to help hold them in place. It is important that the

Spar Caps are not pushed too tightly into place as to cause the edge to touch the radius of the spar. Remember that the Wing is upside down. Figure 10.9.7.

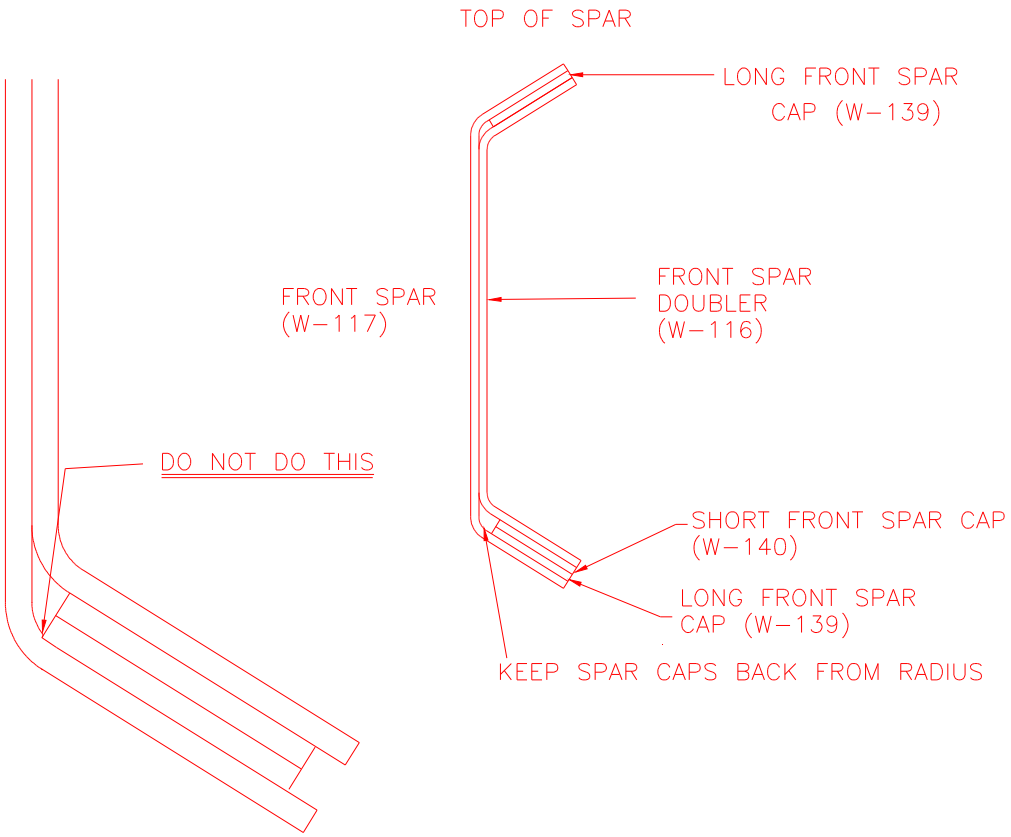



Figure 10.9.7

13) Cleco the Leading Edge Skin (W-128) to the Leading Edge Ribs. Figure 10.9.8.

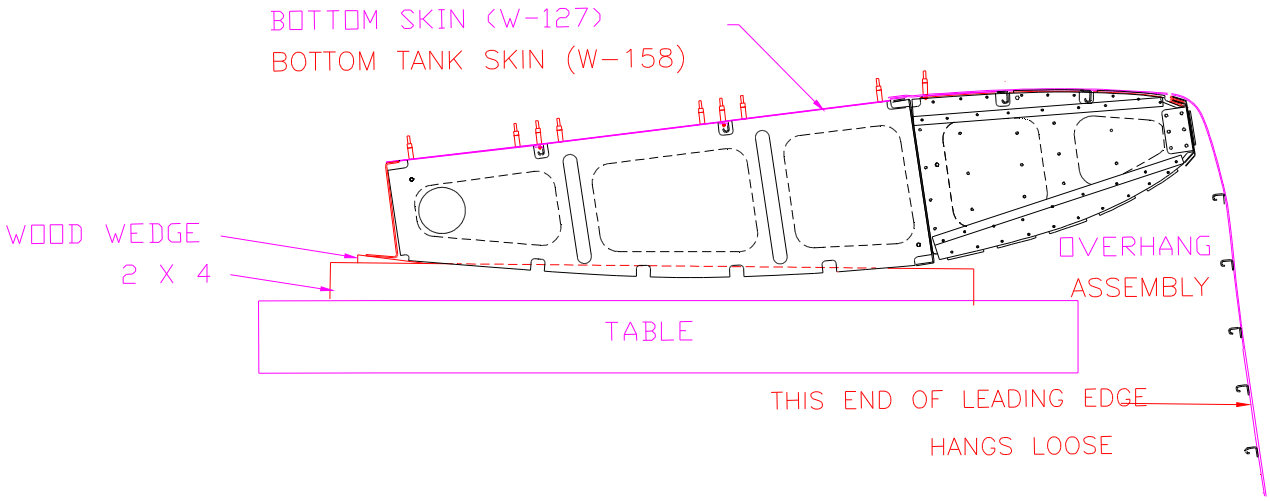
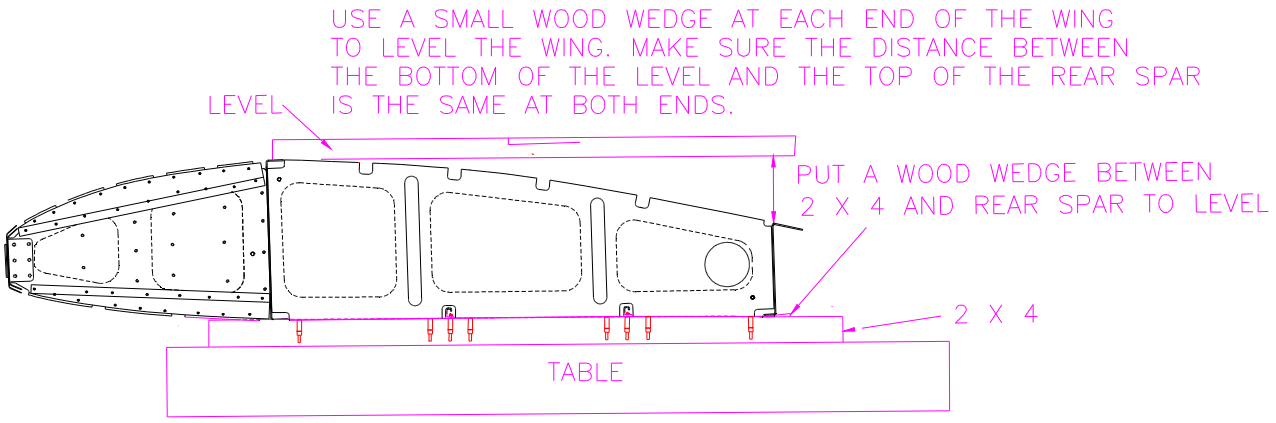



Figure 10.9.8

14) Starting near the center of the Main Spar and insuring you can see the line on the flange of each Leading Edge Rib, drill the Leading Edge Ribs with a #40 drill bit. Work evenly across the ribs and use lots of clecos. **NOTE:** It is easiest at this point to have another person underneath the wing with a block of wood etc. to manipulate the rib flanges into position for drilling.

15) Remove the Leading Edge Skin. **DO NOT** remove the Bottom Skin.

16) Turn the wing over and level again as in Figure 10.9.9.




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Figure 10.9.9

17) Mark and cut the bottom skin where the torque tube horn will end. See figure 10.9.10 for hole location. Please refer to 10.14 and complete torque tube installation now.

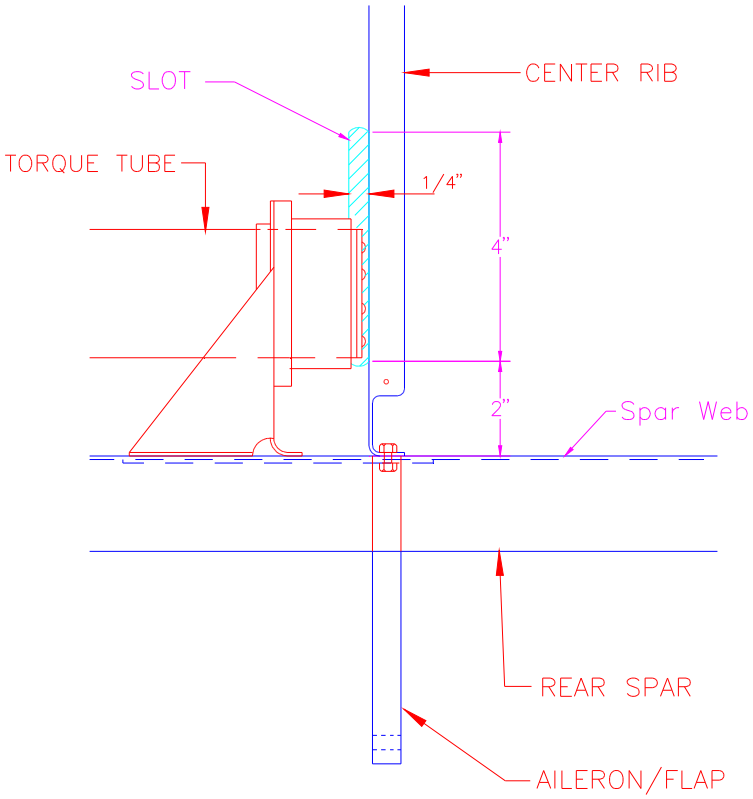



Figure 10.9.10

## *10.10 Wet Tanks*

1) Drill thirteen #40 holes on both the upper and lower flanges of each Wet Tank Bulkhead (W-157). See Figure 10.10.1.

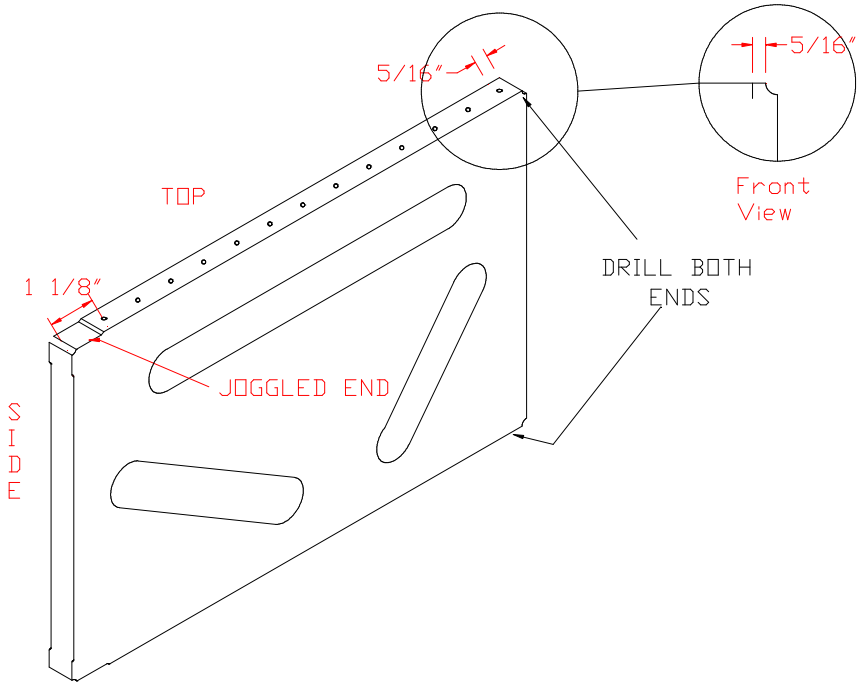



Figure 10.10.1

2) Drill ten equally spaced #40 holes through the side flanges of two of the Bulkheads only. **DO NOT** drill the third Bulkhead. See Figure 10.10.2.

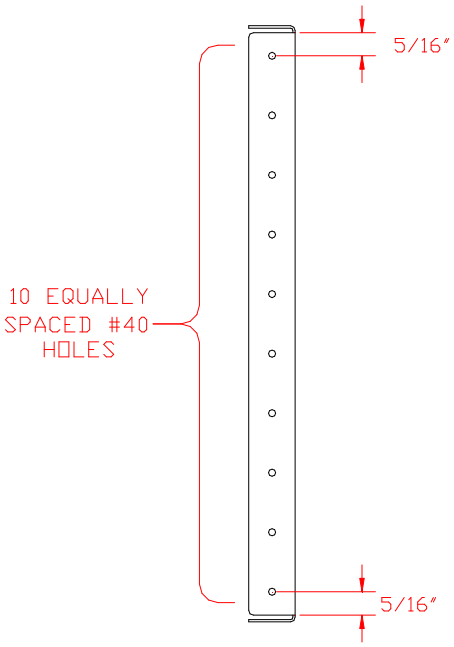



Figure 10.10.2

3) Bend the top flanges of the Bulkheads to match the camber top of the Wing Ribs. Rough fit the Bulkheads into the Wing to check the angle of the flange. Figure 10.10.3.

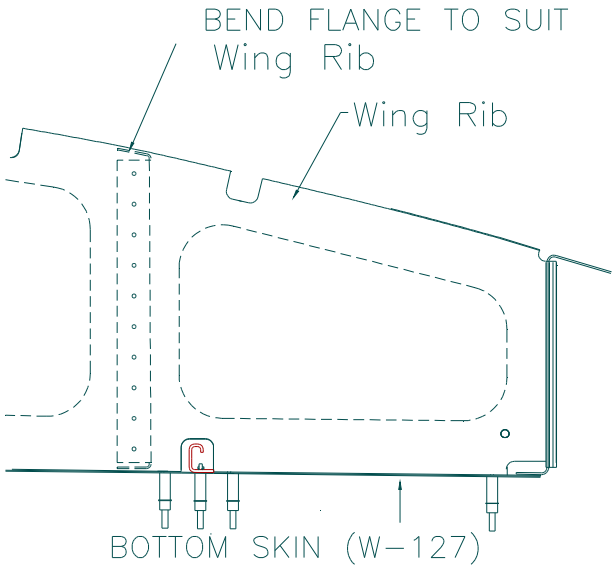



Figure 10.10.3

**Note:** The side flanges of the Bulkheads are joggled to fit the stiffening beads in the Wing Ribs. Be sure that the Bulkheads are properly seated in the Ribs, i.e.; the center of the Bulkhead side flanges must line up with the center of the Wing Rib beads. The two Bulkheads with the drilled sides should be in bays #1 and #3. See Figure 10.10.4.

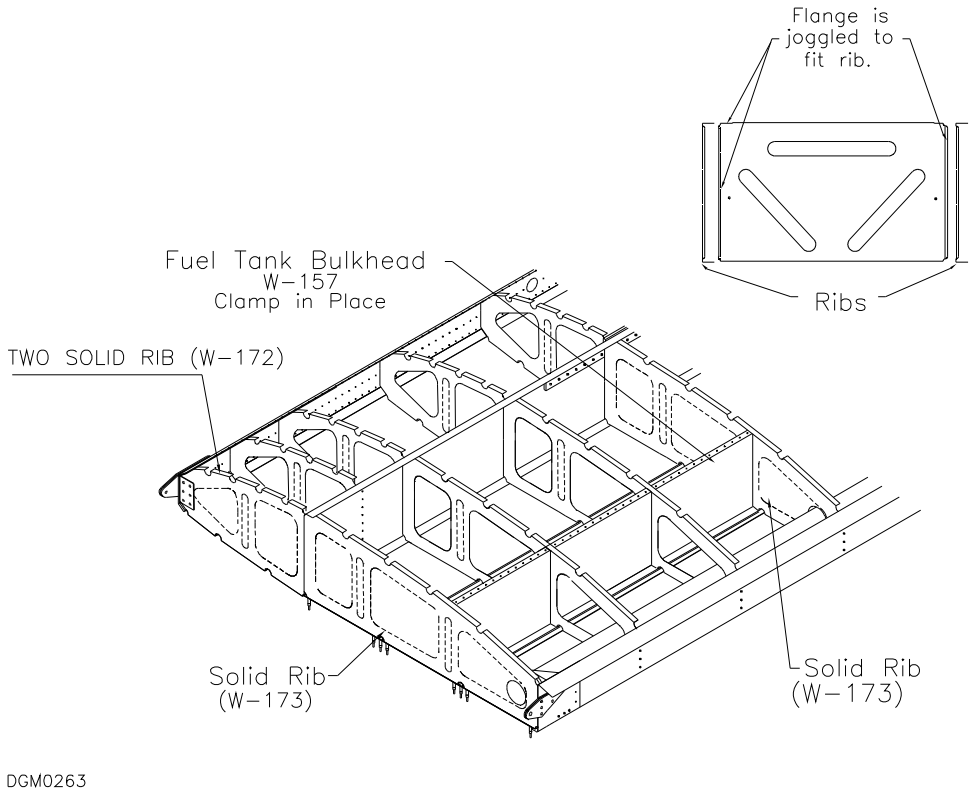



Figure 10.10.4

4) Remove the center Bulkhead.

5) Using a long #40 drill, back drill the ten holes in each Bulkhead side flange into the Wing Ribs. Ensure that the bottom flange is flush with the Bottom Skin.

6) Remove the two Bulkheads. Mark the center of the side flanges of the undrilled Bulkhead. Insert the undrilled Bulkhead into the middle bay. Use the holes drilled in earlier to back drill into the line on the middle Bulkhead.

7) Cleco all three Bulkheads securely into place.

8) With a long #40 drill bit, back drill the thirteen holes in each Bulkhead into the Bottom Skin and Bottom Tank Skin.

9) Cleco into position the Top Skin with Stringers and Top Tank Skin (W-158). Use six 3/32” clecos in each rib. See Figure 10.10.5.

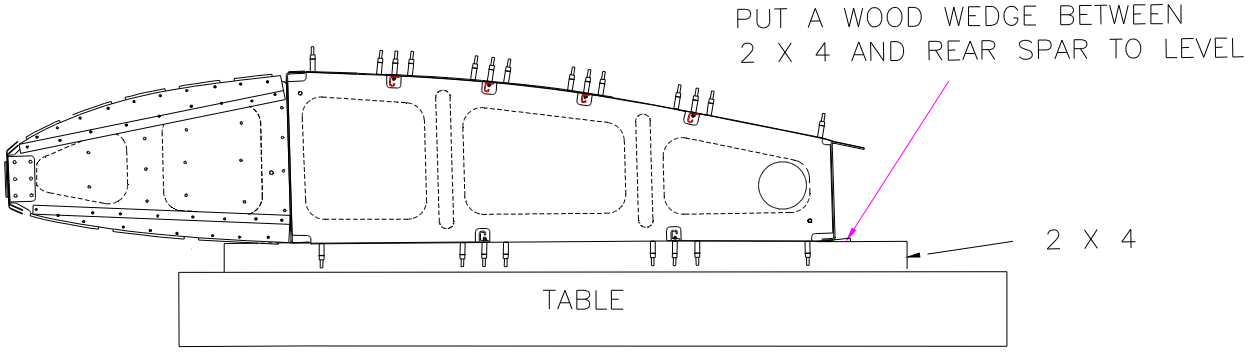



Figure 10.10.5

10) Back drill through the Skin all the Rib holes to #40. **DO NOT** drill into the Rear Spar at this time.

11) Cleco the Leading Edge Skin to the Leading Edge Ribs. See Figure 10.10.6.

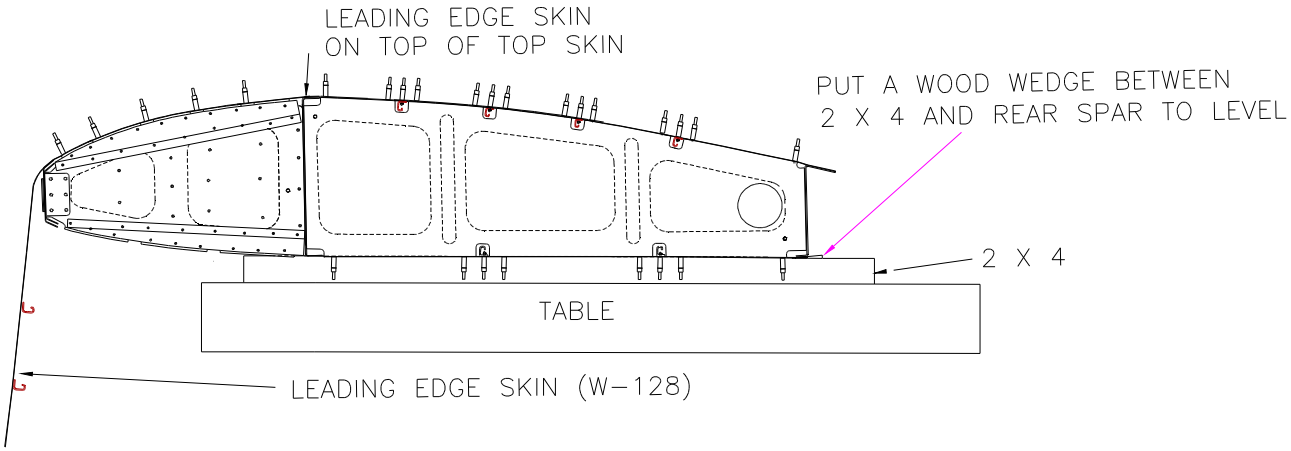



Figure 10.10.6

12) Repeat step14 10.9.

13) Turn the wing over.

14) Cleco the bottom section of the Leading Edge Skin in place. See Figure 10.10.7.

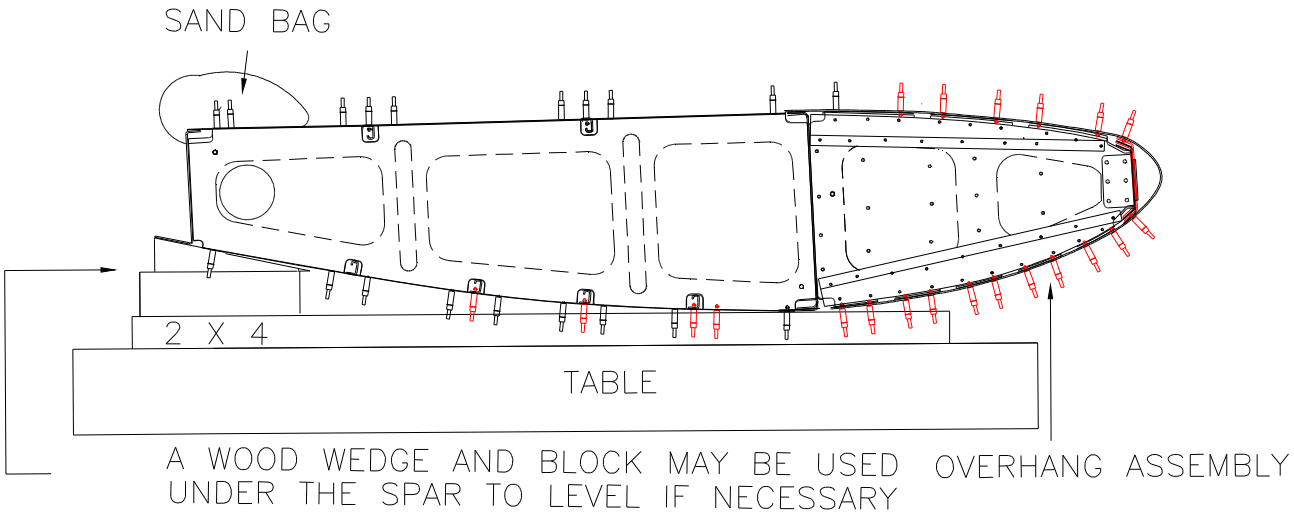



Figure 10.10.7

15) Ensure that the wing is absolutely level. **NOTE:** Sand, lead shot bags or any suitable weights can be used to hold the Wing in place.

16) Drill #40 through the wings Skins into the Front and Rear Spar. Use plenty of clecos.

17) Back drill through the Leading Edge Skin, Bottom Skin and Bottom Tank Skin into the Main Spar. Use a #40 Drill and plenty of clecos.

18) Remove the clecos in the area where the Wing Skin Doubler (W-601) will go. Figure 10.10.8.

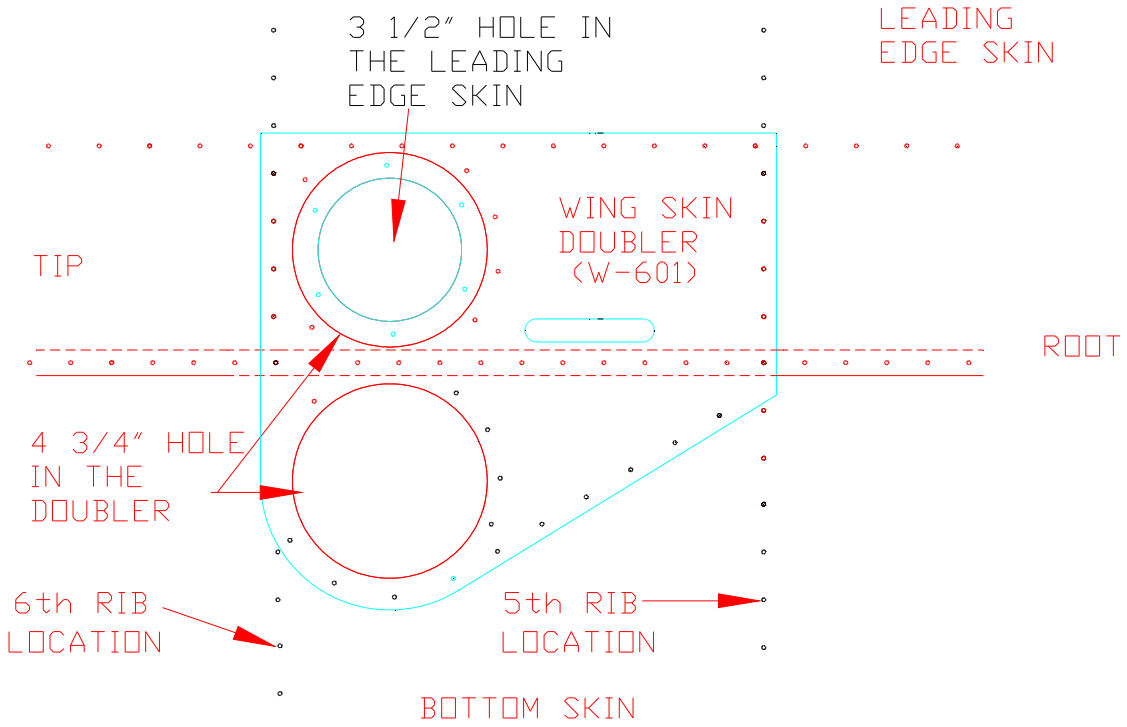



Figure 10.10.8

19) Cleco the Wing Skin Doubler in place. See Figure 10.10.8.

20) Back drill through the Doubler into the Bottom Skin with a #40 drill. **NOTE**: The Main Rib hole locations in the Doubler can be drilled later when the Bottom Skin is removed.

**NOTE:** You will need to locate and cut out the 3 1/2" hole in the Bottom Skin and drill the six holes for your Cover Plate before you mount the Skin to the Wing. See Figure 10.10.8.

21) Turn the wing over and again ensure that the wing is absolutely level.

22) Repeat steps for doing the Top Skin and Top Tank Skin.

23) Level the Wing one more time then drill all the holes in the top of Wing to #30.

24) Dimple all the rivet holes in the Tip Rib location for countersunk rivets. Using countersunk rivets in this location will allow the fiberglass Wing Tip to lay flat. The Main Spar is too heavy to dimple so use a large drill bit and by hand countersink the last hole in the Main Spar Flange.

25) Turn the wing over, ensure it is level and then drill out all holes in the bottom to # 30.

26) Repeat for the Bottom Skin.

27) Remove the Bottom Skin and remove the clecos in the bottom of the Leading Edge Skin.

28) With a long #40 drill bit, back drill the thirteen holes in each Fuel Tank Bulkhead into the Top Skin and Top Tank Skin.

29) Drill a #40 hole through the Top Skin and Top Tank Skin in the position shown in Figure 10.10.9. This will become your fuel outlet hole.

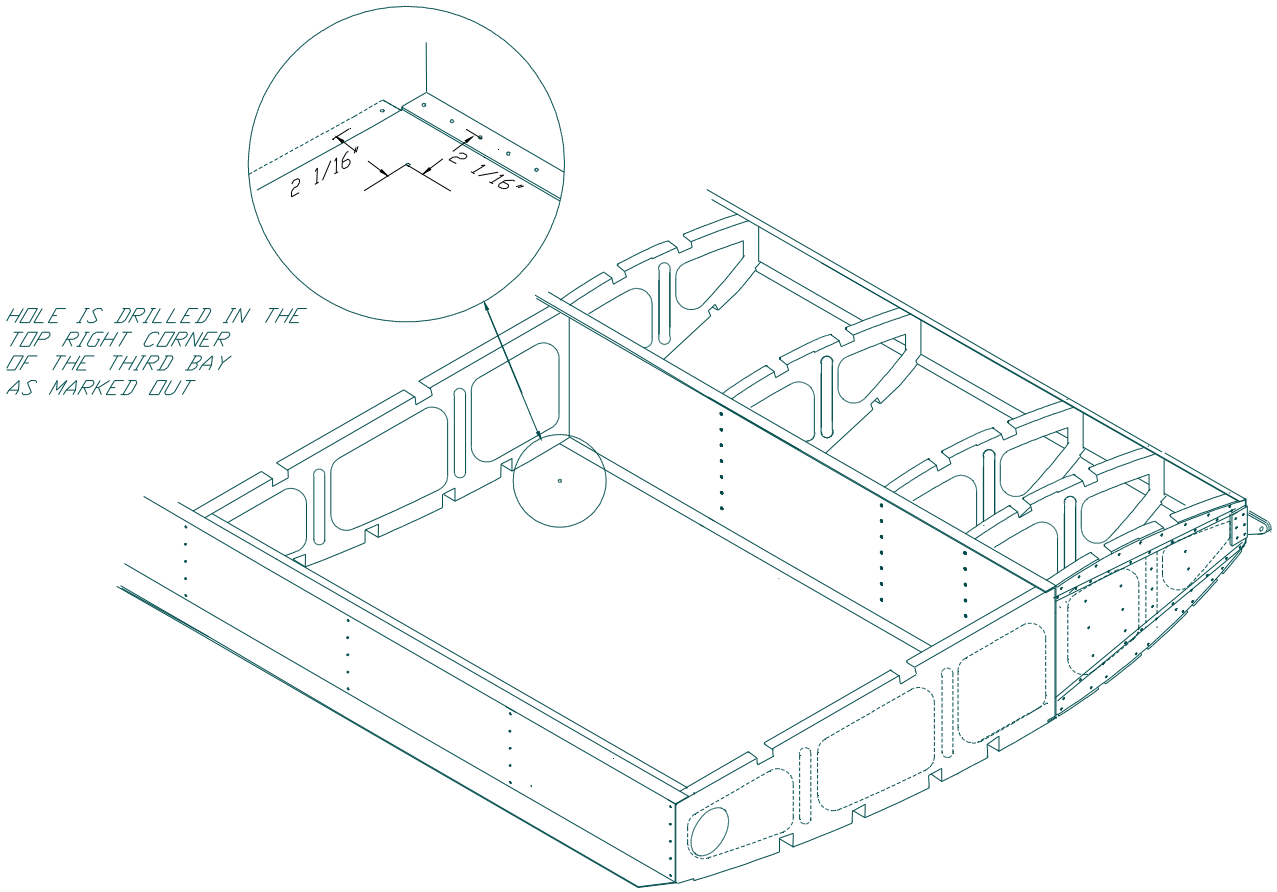



Figure 10.10.9

30) Turn the wing over.

31) Drill the Bulkhead holes out to #30.

32) Remove the Leading Edge Skin and Top Wing Skin. Dimple the Leading Edge Root Rib, Leading Edge Skin at the Root Rib location, the Tip Leading Edge Rib, Leading Edge Skin (at the tip end), Main

#13 Rib and the Top And Bottom Wing Skins at the tip end. **DO NOT** dimple the Main Spar at these locations.

33) Remove the two center Gas Tank Ribs.

34) Drill 1/2" fuel flow holes into the lower rear most point of the Wet Tank area. These holes will allow fuel flow between the bays. Figure 10.10.10.

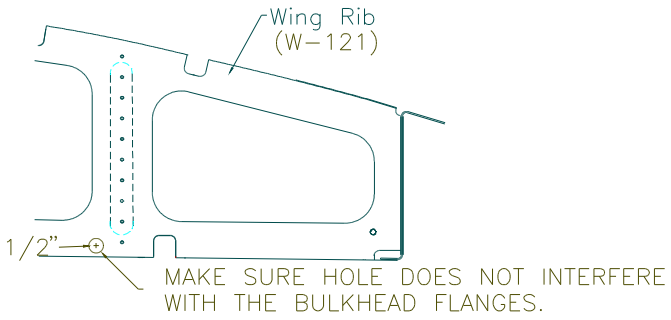



Figure 10.10.10

35) Install two Baffle Plates on each rib. The Baffle Plates will help prevent fuel sloshing. See Figure 10.10.11

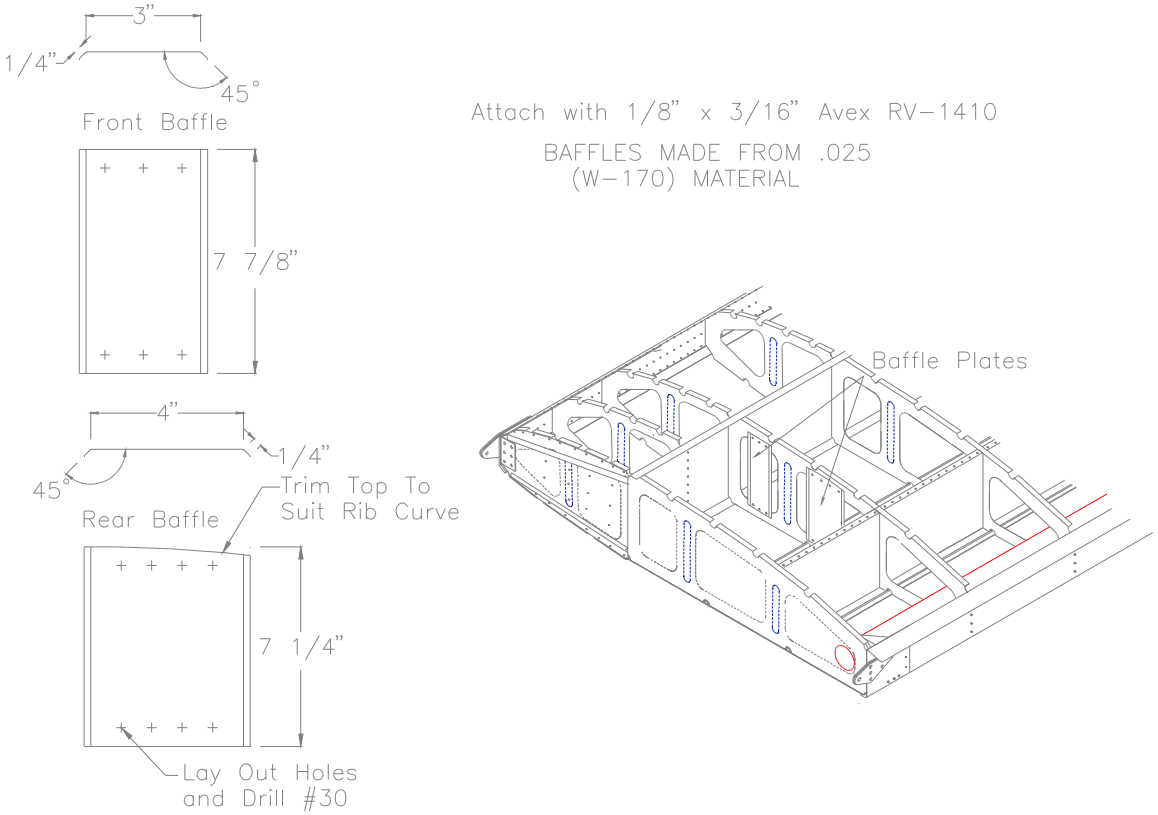



Figure 10.10.11

36) Trim the Top and Bottom Wing Skins as in Figure 10.10.12.

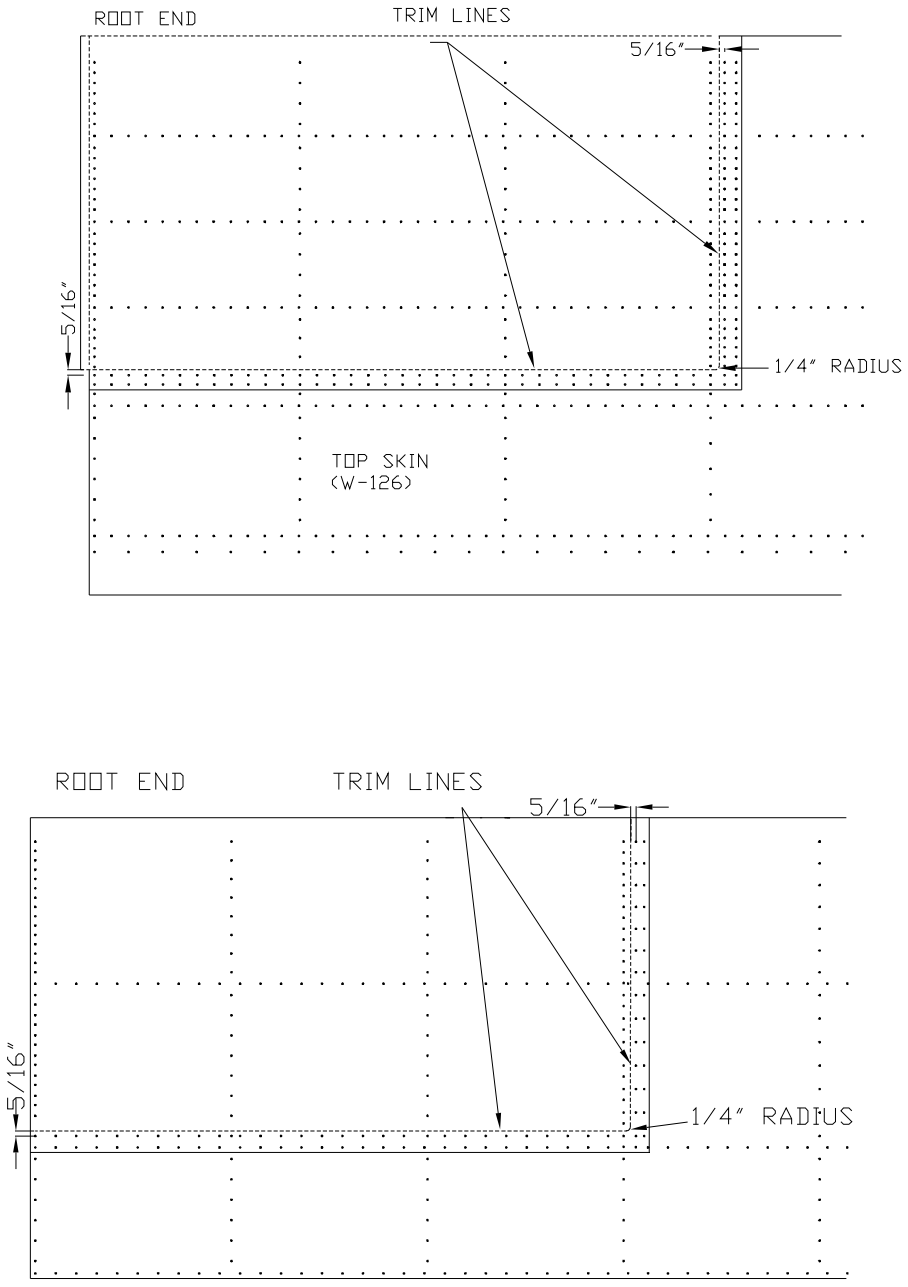



Figure 10.10.12

37) In the Top Tank Skin cut a 2 1/2" hole around the #40 hole drilled earlier.

38) Center the Fuel Filler Neck over the hole and drill twelve #30 holes through the Tank Skin using the Filler Neck as a drill guide. Figure 10.10.13.

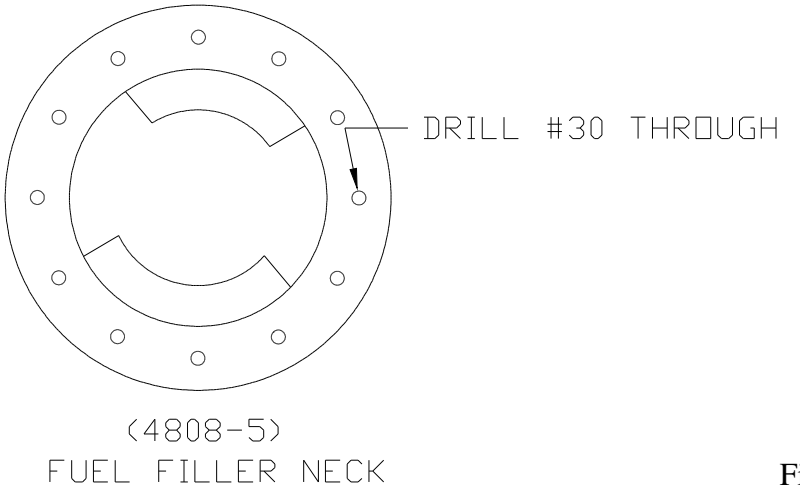



Figure 10.10.13

39) Debur the Skin.

40) Remove the Root Rib.

41) Trim two Fuel Tank Outlets (W-159) and fit one at the lower front corner and one at the top corner of the Root Rib (**These will be used as sight gauge fittings**). Drill five #30 holes through the flange into the Root Rib. **NOTE:** Locate the Fuel Tank Outlet as close as possible to the upper forward corner of the rib. It may be necessary to flatten, (with a hammer and dolly), the stiffening swage of the rib in the immediate area of the Fuel Tank Outlet. See Figure 10.10.14.

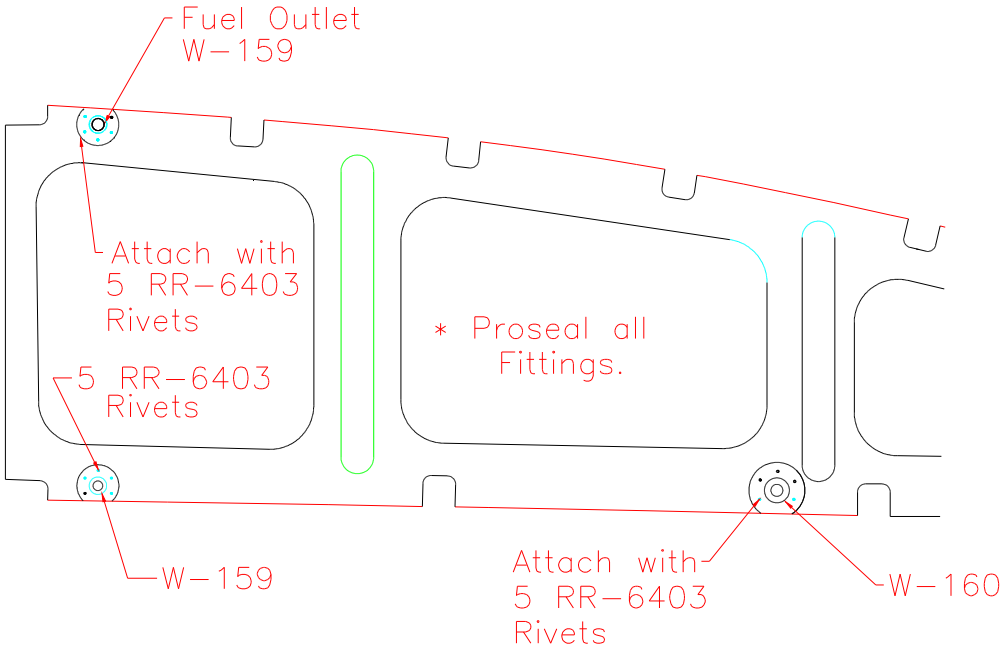



Figure 10.10.14

42) Trim a Fuel Tank Outlet (W-160) to fit at the lower rear corner of the Root Rib (just in front of the Bulkhead). Drill five #30 holes through the flange into the Root Rib as in Figure 10.10.14. **NOTE:** It should be a close as possible to the corner without overlapping the Bulkhead Flange. Carefully flatten,

with a hammer and dolly, the stiffening swage of the Root Rib in the immediate area of the Fuel Tank Outlet (W-160) fitting.

43) For each Stringer cut out location in the tank area of the Root Rib, bend up an angle from .032 material to close the opening. Drill but do not rivet at this time. Figure 10.10.15.

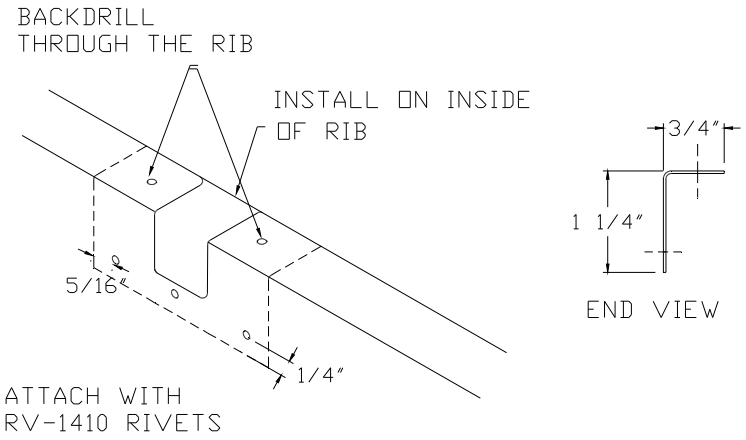



Figure 10.10.15

44) Replace the Root Rib into the Wing assembly.

45) At the top and bottom cutaways in the Root Rib for the Main Spar close the opening with a Corner Bracket made from .032. Figure 10.10.16.

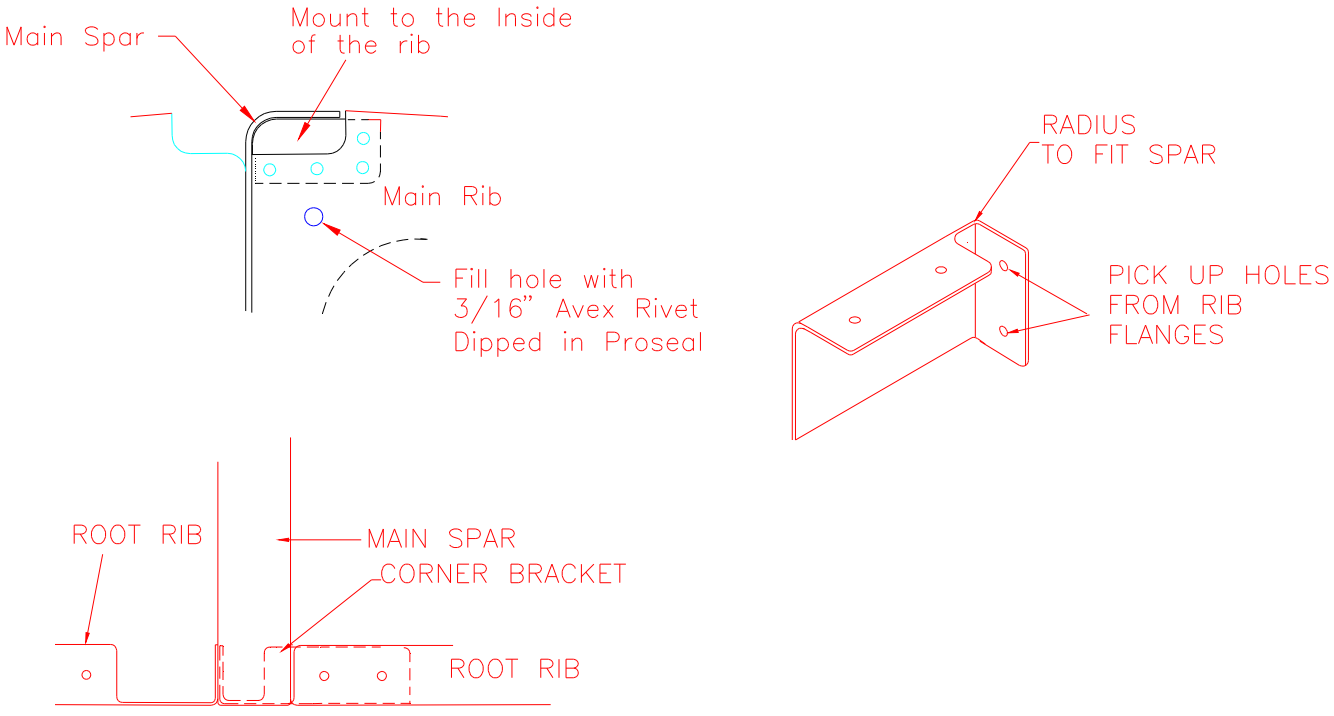



Figure 10.10.16

46) Where the outboard solid Wing Rib is cut away for the Spar Cap bend up a Corner Bracket as in Figure 10.10.17.

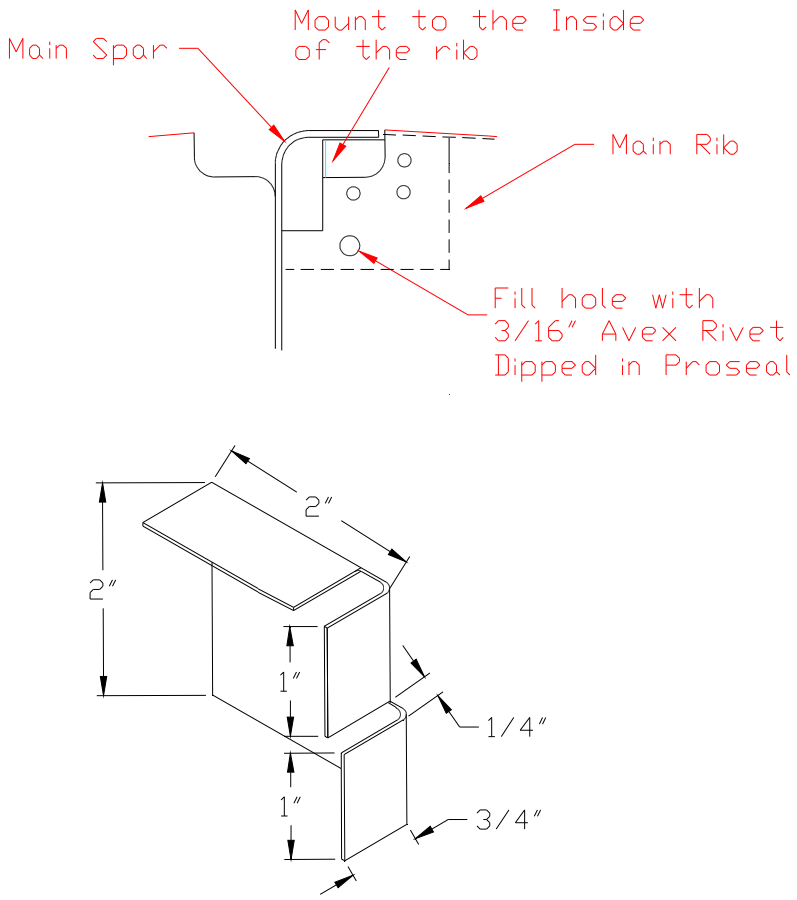



Figure 10.10.17

47) Where the Stringers pass through the outboard Main Root Rib, cut an angle to the shape as in Figure 10.10.18.

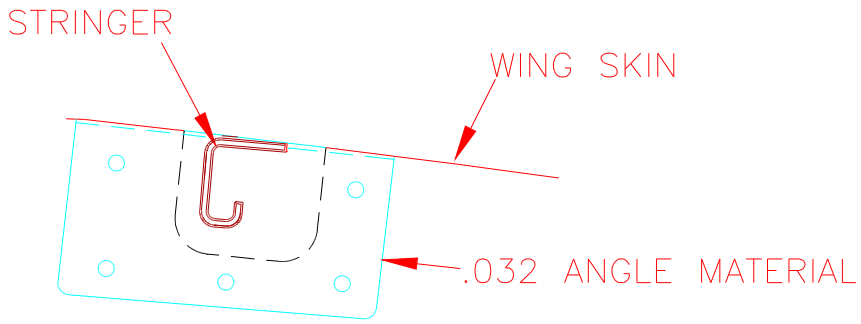



Figure 10.10.18

48) In the right Bottom Skin cut out two inspection holes as in Figure 10.10.19.

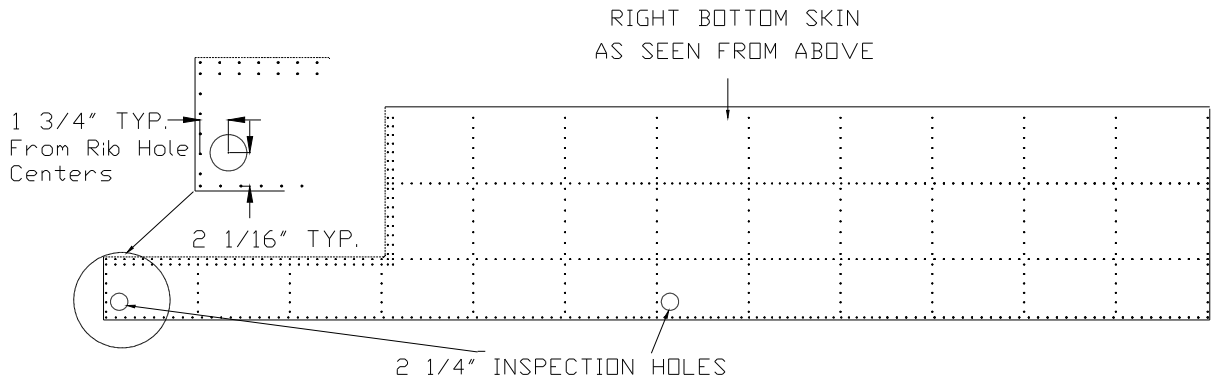


Figure 10.10.19

**NOTE:** These inspection holes are on the Flange side of the Ribs. They allow access to the Aileron Hinge Bolts. Check to make sure the outboard ones do not clash with the control horn slot on the left wing.

49) When doing the Left Wing, the inspection holes will be located as in Figure 10.10.20.

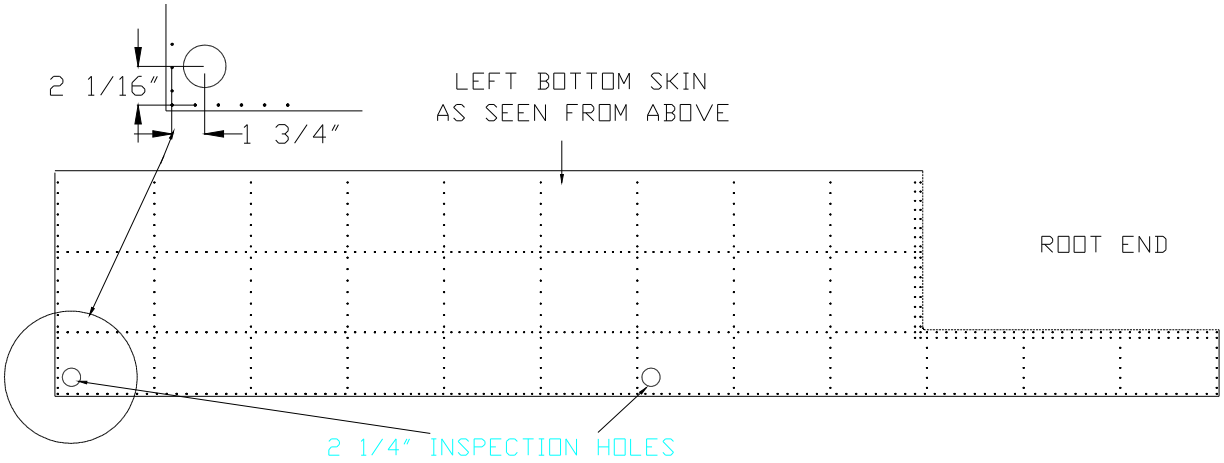



Figure 10.10.20

50) Drill five #30 holes through the Flange of a Water Drain Outlet (W-159) and into the Bottom Tank Skin. Drill out the center to 5/16". See Figure 10.10.21.

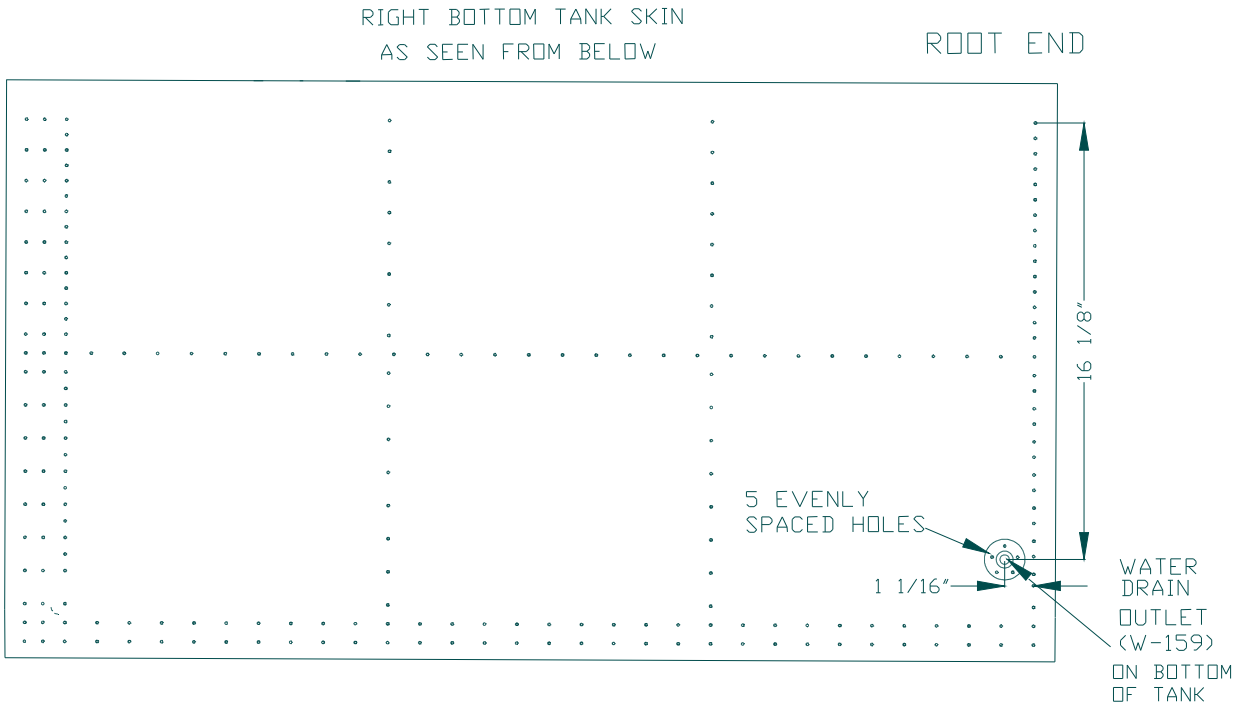



Figure 10.10.21

## *10.11 Finishing*

1) Chromate mating surfaces and rivet together the Rear Spar, three Hinge Backing Plates, and two Bearing Bases with 1/8" rivet (RV-1410). Do not rivet where Ribs will go.

2) Chromate and bolt the Wing Strut Fittings (W-110 and W-111) to the Main Spar as in Figure 10.11.1.

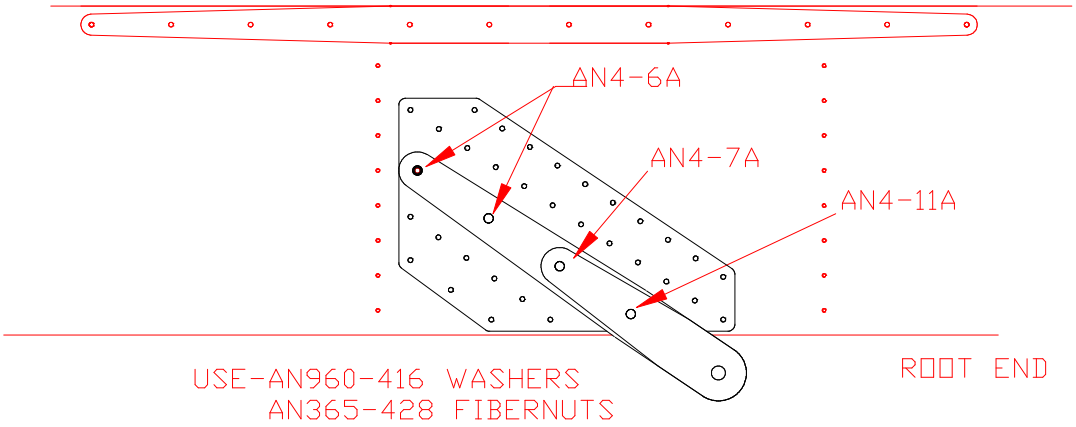



Figure 10.11.1

3) Chromate and rivet the Front Spar and Leading Edge Ribs and Main Ribs to Main Spar from Rib location #5 to the tip with 1/8" rivets (RV-1410). **NOTE:** When using Extended Tanks start at the #6 Rib location in this step and the next step.

4) Chromate and rivet the Rear Spar to the Main Rib from #5 location to the tip with 1/8" rivets (RV-1410).

5) (STEPS 5 TO 7 RELOCATED TO DIFFERENT PROCEDURE)

8) Wipe down with M.E.K. (Methyl Ethyl Keytone) or Acetone all mating areas of Gas Tank parts. Trim the excess off the Top and Bottom Tank Skins at this point, 3/8" from center of the hole to the outside edge. See Figure 10.11.3.

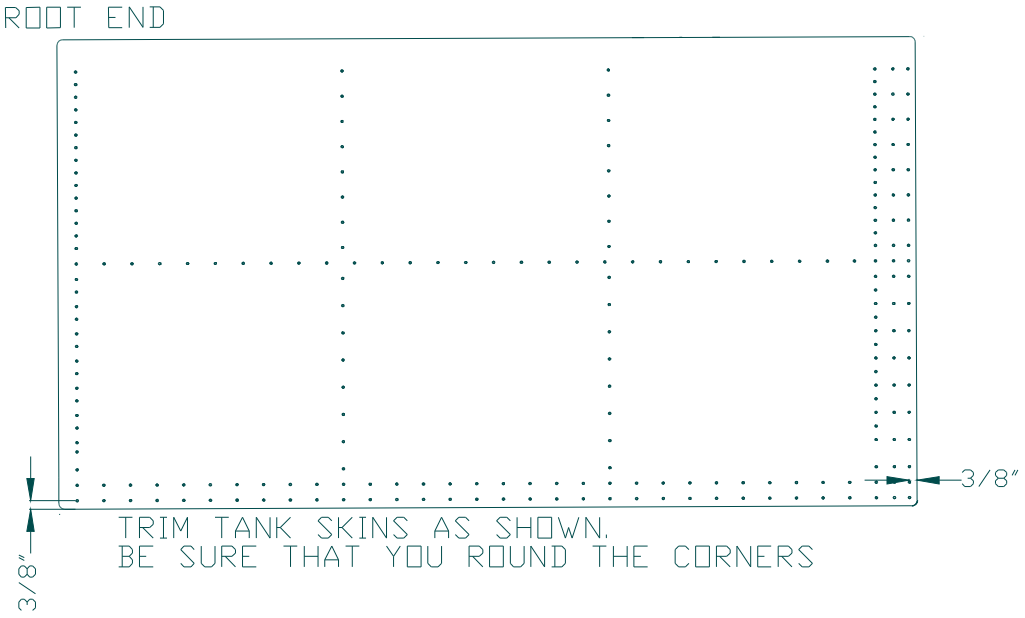



Figure 10.11.3

9) Scotchbrite all mating areas of Gas Tank parts. Wipe dust away with a **clean** cloth. **Do not use M.E.K. or Acetone after Scotchbriting**. Handle the parts as little as possible after cleaning to prevent the oil in your hands from transferring to the parts.

10) Mix up some Proseal.

**Note:** When using Proseal always cover both mating surfaces before fitting together and riveting. Always dip the rivet in Proseal before inserting in the hole.

11) Proseal and rivet the Fuel Outlets (W-159 and W-160) to the Tank Root Rib with 1/8" tank rivets (RR-6403).

12) Proseal and rivet the Corner Brackets made earlier to the Solid Tank Ribs with 1/8" tank rivets (RR-6403).

13) Proseal and rivet the Leading Edge Ribs and Main Ribs from #1 to #4 to the Main Spar with 1/8" tank rivets.

14) Chromate and rivet the Rear Spar to the Main Ribs #1 to #4.

15) Bolt on the two Rear Spar Fittings to the Rear Spar with six AN3-5A Bolts, AN960-10 Washers and AN365-1032 Nuts.

16) Proseal and rivet the three Gas Tank Bulk Heads in place with 1/8" tank rivets.

17) Chromate the Mating surfaces and rivet the Bottom Tank Skin and Bottom Skin together with 1/8" Rivets (RV-1410). Make sure the Tank Skin is on the outside.

18) Slide the angle made in earlier down the Tank Stringer to its approximate location.

19) Rivet the two Bottom Stringers to the Tank Skin and Bottom Skin. Where the one Stringer goes into the Tank area use Proseal and 1/8" tank rivets. For the rest use chromate and 1/8" Avex Rivets.

20) Proseal and rivet the Water Drain Outlet in place with 1/8" tank rivets.

21) Place the Wing upside down and level.

22) Chromate all mating surfaces except in the Tank area.

23) Proseal the Tank Area.

24) Cleco the Bottom Skin and Tank Skin in place.

25) Chromate and cleco securely the bottom of the Leading Edge in place. Use Proseal in the Tank Area.

26) Rivet the Tank area with 1/8" tank rivets. Use tank rivets in the Main Spar at the Tank location. Both top and bottom .

27) Do not rivet the Bottom Skin at this time as you only have so much time to finish the Tank area.

28) After riveting, clean up any excess Proseal on the outside of the Tank with a cloth dampened with M.E.K. or Acetone.

29) Turn the Wing over and ensure it is level.

30) Slide the angle on the Stringer in place on the Rib and rivet in place with tank rivets.

31) Inside the Tank, cover all Rivet ends with Proseal. A small stiff brush works well to do this.

32) Fillet all corners and edges with Proseal. Pay close attention to the corners where the Ribs, Bulkheads and Spars meet and where the Stringer goes through the #4 Solid Rib. Figure 10.11.4.

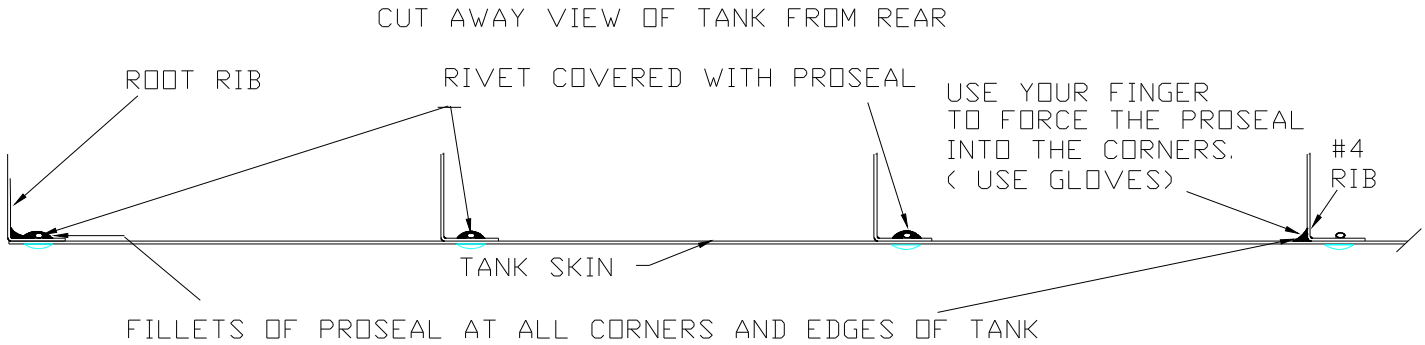



Figure 10.11.4

33) Let the wing sit for at least 24 hours.

34) Turn the wing over and rivet the Bottom Skin and bottom of the Leading Edge in place with 1/8" Avex Rivets.

35) At the Root end of the Front Spar, it is necessary to use 1/8" Avex Rivets (RV-1414).

36) Turn the wing over and ensure it is level.

## *10.12 Aileron Hinge Install*

1) Bolt on the three Aileron Hinges (W-125) with a 1/16” Hinge Spacer (W-610). Temporarily mount the aileron using a castle nut for ease of removal.

2) Glue the template in figure 10.12.1 to a still piece of thin cardboard.

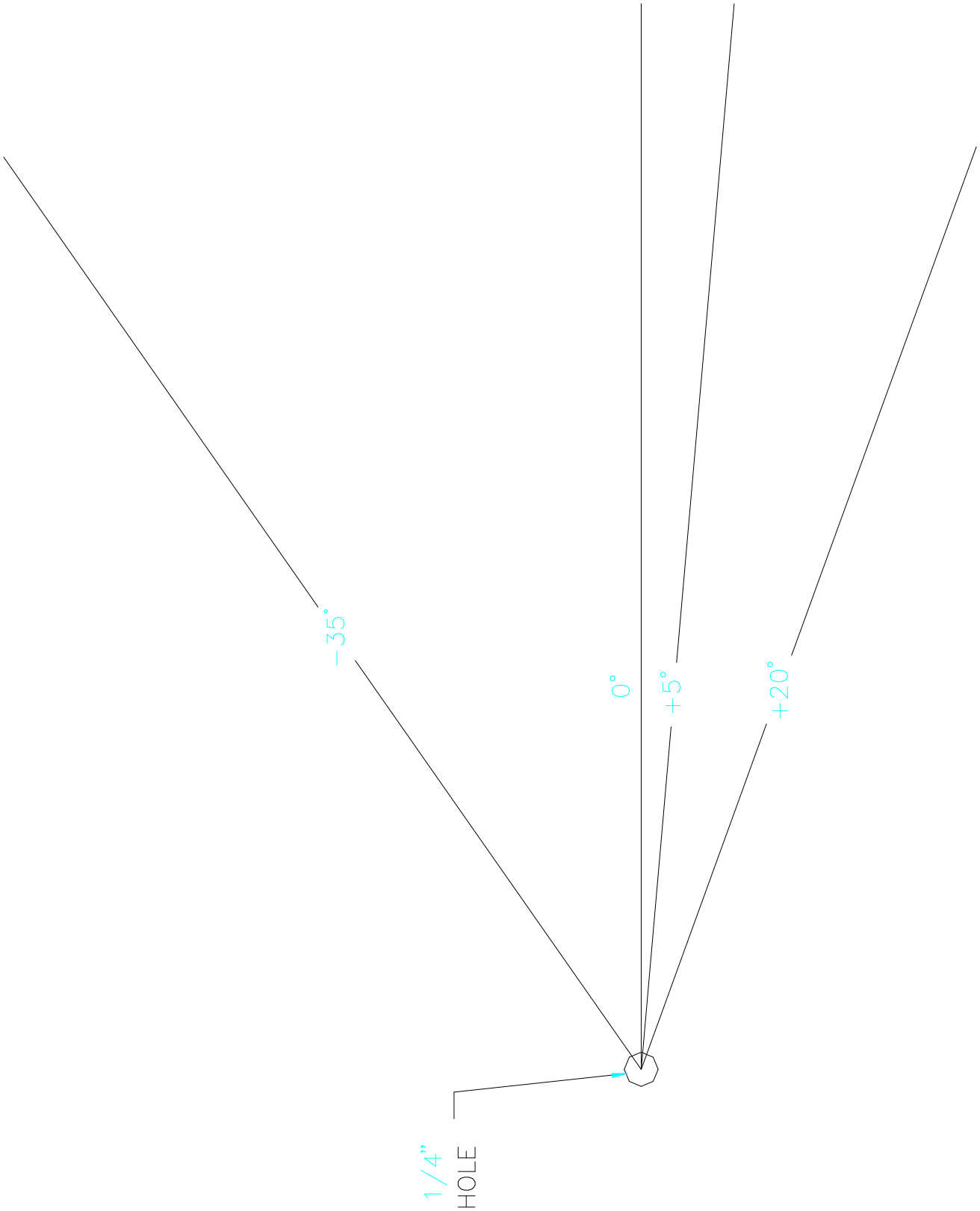


Figure 10.12.1

3) Draw a line from the pivot position to the trailing edge on each end of the aileron for the right wing. Figure 10.12.2.

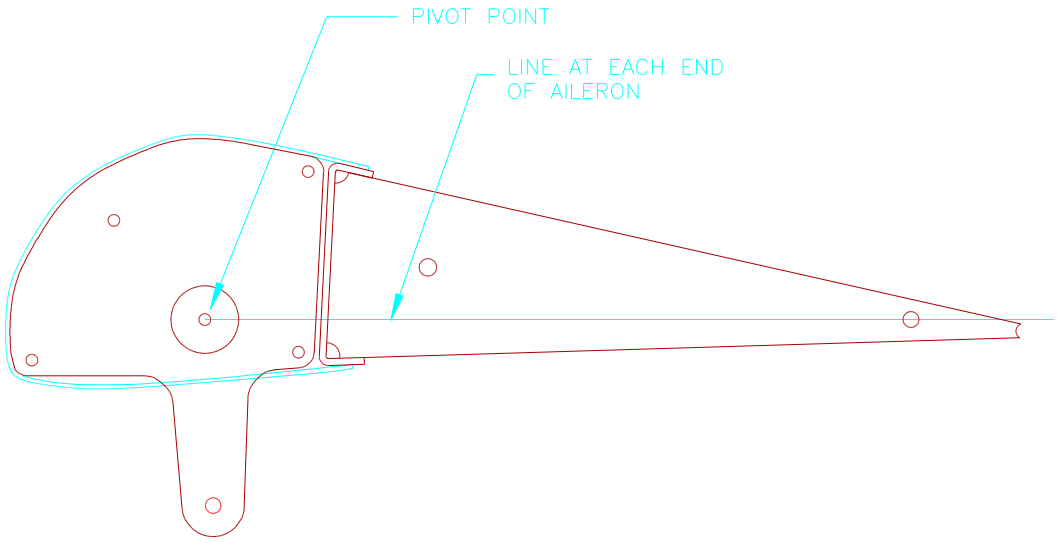



Figure 10.12.2

4) Mount the template to one end of the ailerons. Figure 10.12.3.

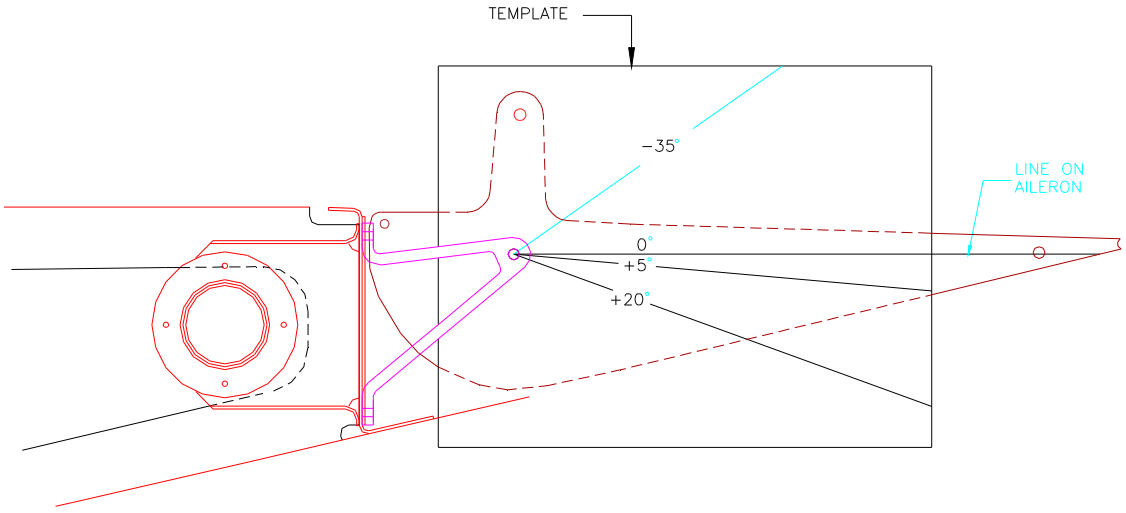



Figure 10.12.3

5) Put the aileron in the neutral position.

6) Align the 0º line on the template with the line you drew on the aileron.

7) Holding the template stationary, move the aileron through its range of -35º to + 20º.

8) If the aileron does not clear the top skin by 1/16", either replace the W-610 with a 1/8" Hinge Spacer (W-605) or use both. See Figure 10.12.4.

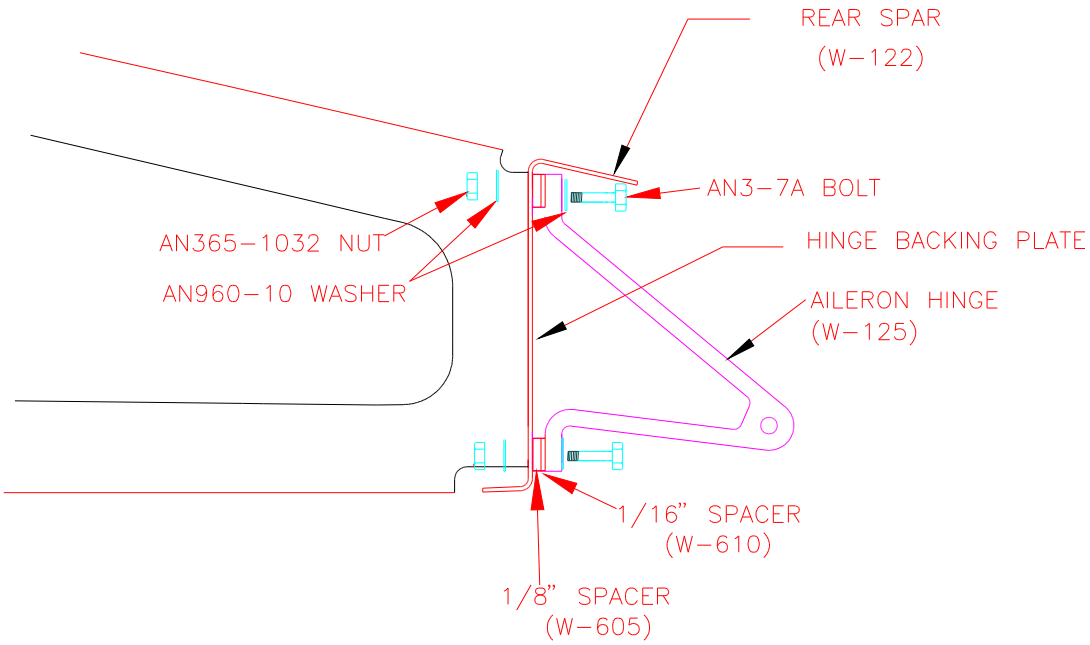



Figure 10.12.4

9) Chromate the Leading Edge Skin Front Spar and Leading Edge Ribs.

10) Rivet the top of the Leading Edge in place but do not rivet into the Main Spar or first hole in the Leading Edge Ribs. It will be necessary to slip the Tank Skin and Top Skin under the Leading Edge later.

## *10.13 Pro Sealing the Tanks*

1) Proseal and rivet the Fuel Filler Neck (4808-5) to the inside of the Top Tank Skin where you put the hole earlier, using 1/8" RR-6403 Tank rivets.

2) Make sure that the Fuel Sight fittings and the bottom fuel fitting are plugged. Test the Bottom Tank Skin for leaks by putting some gas into the tank and let it sit for awhile. If there are any leaks they should show. To seal them take some Proseal and mix a little MEK in it to thin it out and then just brush it around the whole inside of the tank. Let the Tank sit over night.

3) Cleco the Top Skin and Stringers to the wing.

4) Proseal the two Main Rib Brackets you made previously. Rivet them in place using 1/8" tank rivets.

5) Using the Stringers as a guide, slide the Stringer Brackets onto the end of the Stringers. Proseal them well and rivet them to the Ribs the same as you did the bottom ones earlier. Use 1/8" tank rivets.

6) Remove the Top Wing Skin, leaving the three Stringers that are in the Fuel Tank area still on the Wing.

7) Proseal the Stringers, Main Ribs, Main Spar Tank Bulkheads and the Top Tank Skin. Use lots of Proseal.

8) Cleco the Top Tank Skin to the Ribs, Main Spar, Stringers and Bulkheads. Using 1/8" tank rivets, rivet the Top Tank Skin in place. Let the Wing sit for 72 hours to ensure proper drying of the Proseal.

9) Test the tank for leaks. This is done by putting a thin latex glove over the Filler Neck and attaching it tightly so as it will not leak. Ensure that the two side bottom fittings and the one underneath the Bottom Skin are plugged. In the top corner sight fitting put in an air line. Blow the glove up so it is expanded. **DO NOT EXCEED 3 PI**. Let the Wing sit over night. If the Glove has gone down you more than likely have a leak. If there was a sudden temperature change, do the test again during the day since the temperature should basically stay the same. If the glove does not go down at this time then you know it is sealed and you are done with the test. If it is still leaking fill the Tank with air again, take a brush dipped in soap and water and run it along the seams. You should see bubbles where the air is leaking out. To seal the leaks you can do the same as you did for the Bottom Tank or you can get some Sloshing Compound and slosh your tank.

10) Chromate the Top Wing Skin, the Stringers, Rear Spar, Main Ribs and Main Spar. Cleco together.

11) Using 1/8" Avex Rivets, starting in the middle of the Wing, rivet the Top Wing Skin. **Make sure that you use 1/8" (RV 4412) Countersunk Rivets in the tip of the Wing .**

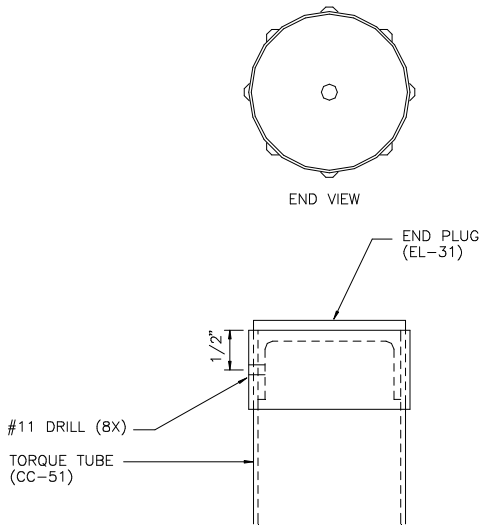
## *10.14 Installing Flaperon Horns*

1) Slide a 2" washer (M2W) and a ½" spacer (CC-54) onto the torque tube root end.

2) Ensure that the torque tube is pulled rootward and the ½" sleeve (CC-54) is against the 2" washer (M2W), then drill eight equally spaced #11 holes through the spacer and tube 1/2" from the end.

3) Deburr end of the torque tube and sleeve.

4) Slide a sleeve (CC-100) over the end of the tube and an end plug (EL-31) into tube.




6)

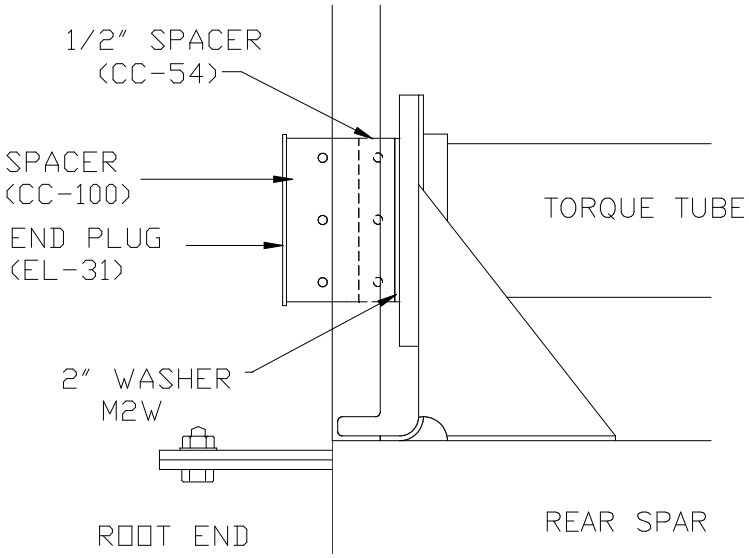



**Figure 10.14.1**

7) Disassemble and deburr.

8) Make a push-pull tube (CC-82) from 3/4" x .035 tubing (CC-51) as in figure 10.14.2.

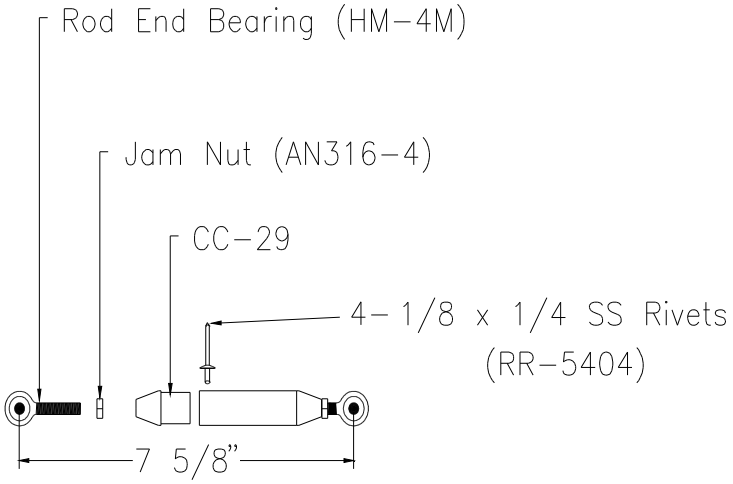



Figure 10.14.2

9) Attach push-pull tube (CC-82) to the control horn (CC-43) with an AN4-11A bolt, AN970-4 washer and an AN365-428 fibernut. Figure 10.14.3.

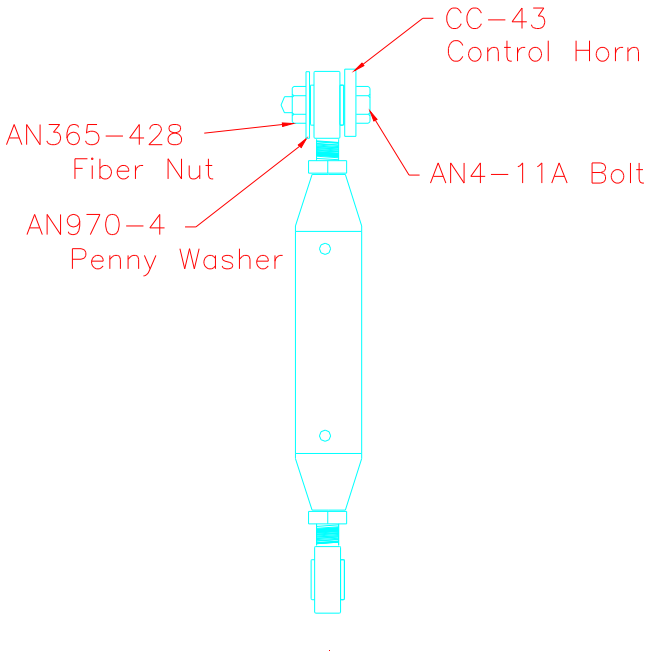



Figure 10.14.3

10) With the flaperons in neutral position attach the other end of the push-pull tube (CC-82) to the flaperons with an AN4-13A bolt, AN960-416 washer and AN365-428 fibernut. Figure 10.14.4.

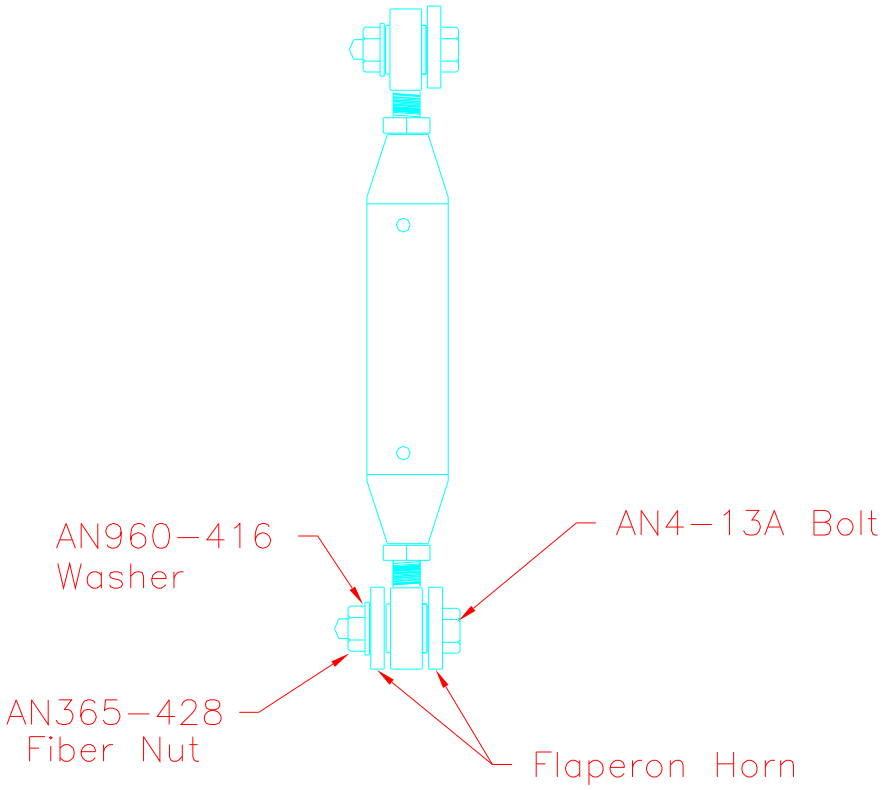



Figure 10.14.4

11) Ensure flaperon still has 20º up deflection and 40º down deflection.

12) Set flaperon so it is at 20º up deflection.

13) Bolt, (allowing some movement) a control horn (CC-43) to the end plug at the root end of the torque tube. Securely cleco together all parts fitted in step 250. Adjust control horn (CC-43) so that it clears the bottom of the wing by 1/2". Figure 10.14.5.

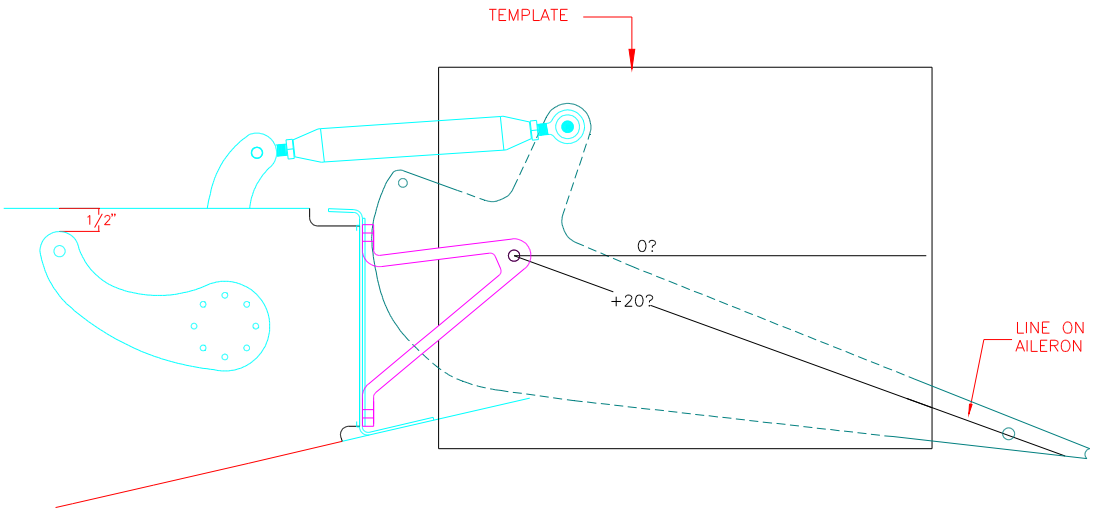



Figure 10.14.5

14) Drill eight #11 holes through control horn into the end plug. Figure 10.14.6.

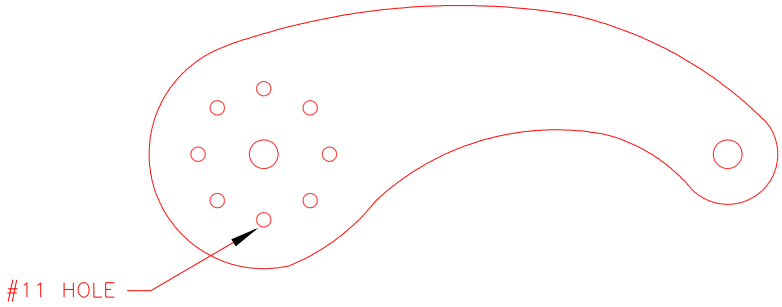



Figure 10.14.6

15) Remove and deburr parts.

16) With suitable 1/4" hardware, temporarily bolt another control horn (CC-43) onto the root control horn. Figure 10.14.7.

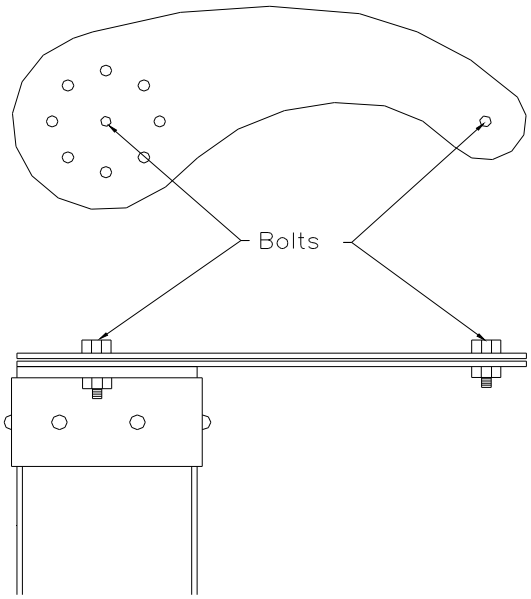



Figure10.14.7

17) Drill a #11 hole through both parts approximately 1 1/2" from the end hole. Remove temporary bolts. Mark and store matched horn. Store the drilled horn. Deburr parts, chromate mating surfaces and rivet previously fitted root control horn and associated parts with sixteen 3/16" x 3/8" SS rivets (RV-5606). Figure 10.14.8.

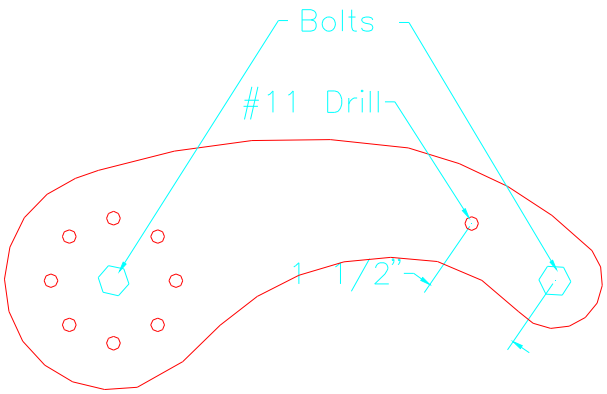



Figure 10.14.8

18) Bolt the horns together.

## *11.1 Rib Install*

1) Install the outboard flaperon on the wing. Place the flaperon in the neutral position.

2) Slip the Wing Tip Rib (W-145) over the wing skins and position so the end of the Wing Tip Rib is parallel and 1/2" short of the end of the flaperon. Figure 11.1.1.

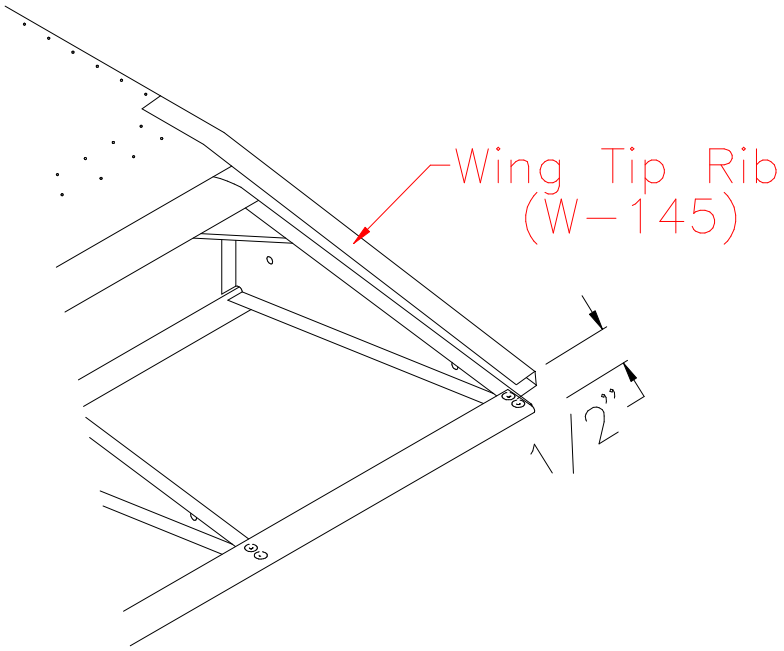



Figure 11.1.1

3) Drill two #40 holes through the Wing Tip Rib (W-145) and Wing Rib (W-121) or the ST-40 on the right wing and cleco. **NOTE:** When locating the holes keep in mind that a total of six will be used to attach the Wing Tip Rib.

4) Remove the Flaperon and mark the Wing Tip Rib (W-145)where a 1/2" hole will be drilled to allow the Flaperon attach bolt access to the hinge. Trace the outline of the Wing Tip Rib (W-145) on to the Wing Skins.

5) Remove the Wing Tip Rib (W-145) and drill the 1/2" hole. Debur.

6) The rivets within the area marked out on the wing skin will need to be removed.

7) Replace the Wing Tip Rib on the wing. Drill the corresponding holes from the wing skin into the Wing Tip Rib. Drill the other four holes in the web of the Wing Tip Rib. All holes can be drilled to #30 at this time in the Rib. Debur.

8) Dimple the holes in the Wing Tip Rib that match the wing skins holes.

9) Chromate the mating surfaces. Rivet the Wing Tip Rib to the wing rib with 1/8" Avex rivets. Rivet the wing skins, wing rib and wing tip rib with 1/8" CS rivets (RV-4412).

10) Repeat these steps for the other wing.

11) Mark a line 1" in from the end rib rivets. Mark a line between every second rivet. Figure 11.1.2.

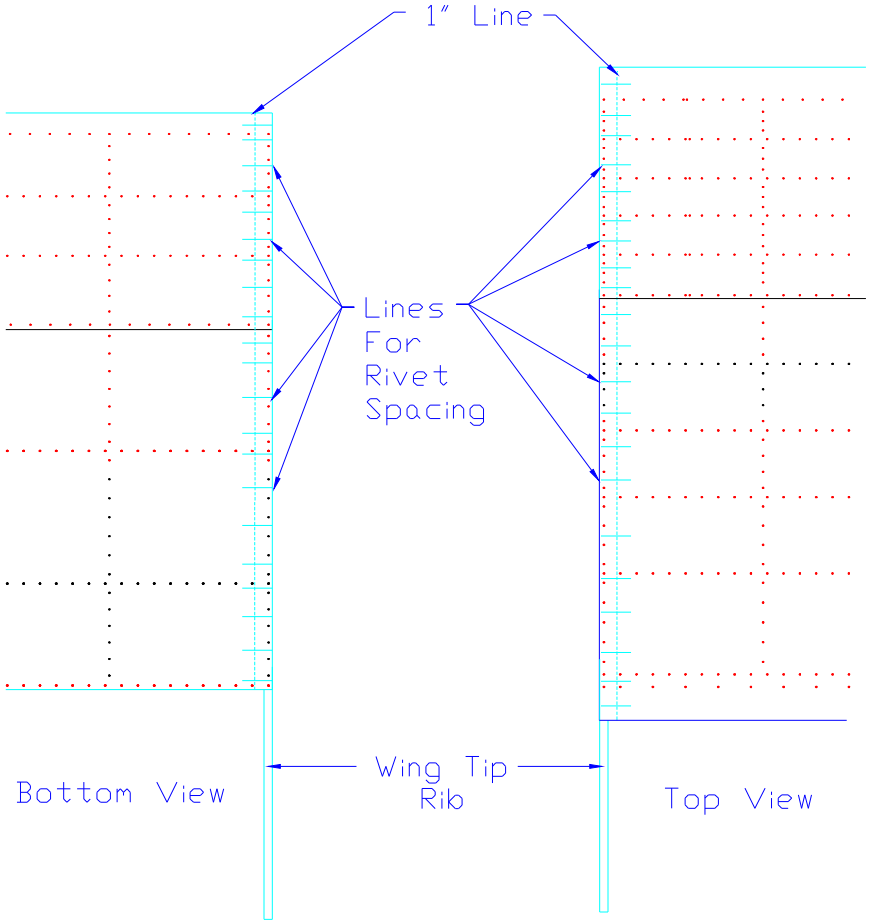



Figure 11.1.2

## *11.2 Wingtip Install*

1) With the flaperons on the wing, slide a fiberglass wing tip over the end of the wing approximately 5/8". Ensure that the Wing Tip Rib (W-145) remains parallel to the flaperon in the neutral position.

2) Mark a line on the wing tip 1" from the line on the wing. Ensure the front of the wing tip is tight with the leading edge of the wing. Drill a #30 hole through fiberglass wing tip and wing and cleco. Figure 11.2.1.

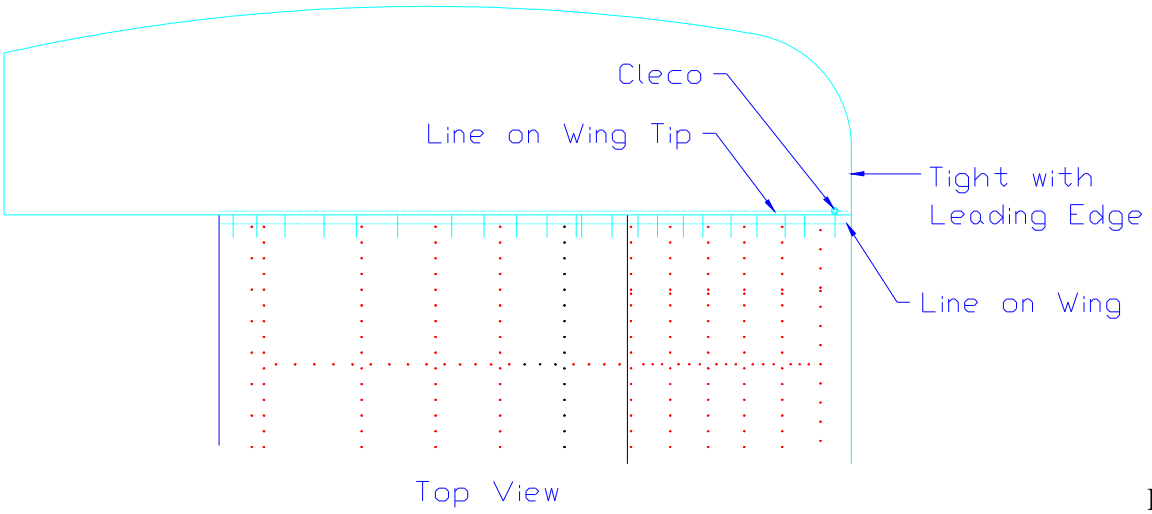



Figure 11.2.1

3) Drill #30 hole near center of the wing area. Cleco. Drill #30 hole toward the rear.

4) Drill #30 holes over the upper part of the wing tip at each line. Figure 11.2.2.

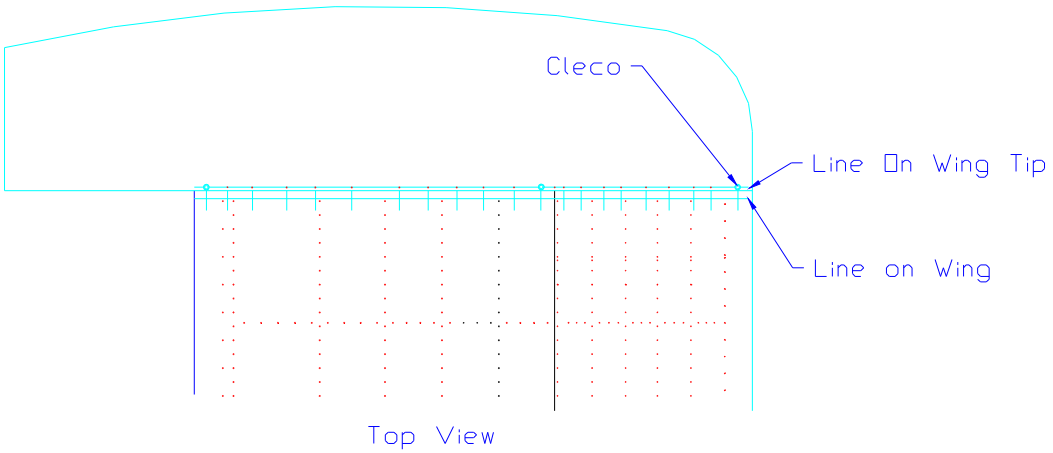



Figure 11.2.2

5) Turn the wing over.

6) Drill the bottom side of the wing tip as you did for the top side. Ensure that the tip is not forcing the Wing Tip Rib (W-145) out of parallel of with the aileron.

7) Drill #30 holes through the fiberglass wing tip and Wing tip Rib (W-145) and cleco.

**NOTE**: Trailing edge of the wing tip may droop slightly.

8) Drill #30 holes at 1" spacing for the rest of the trailing edge rib.

9) Turn the wing over and repeat previous steps.

10) Trim the fiberglass to clear the flaperon if necessary.

11) Put a saw kerf in the outer edge of the wing tip to allow it to be squeezed together. Figure 11.2.3.

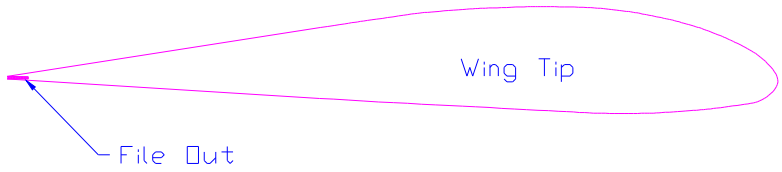



Figure 11.2.3

12) Mark the fiberglass wing tip so the trailing edge matches the flaperon. Figure 11.2.4.

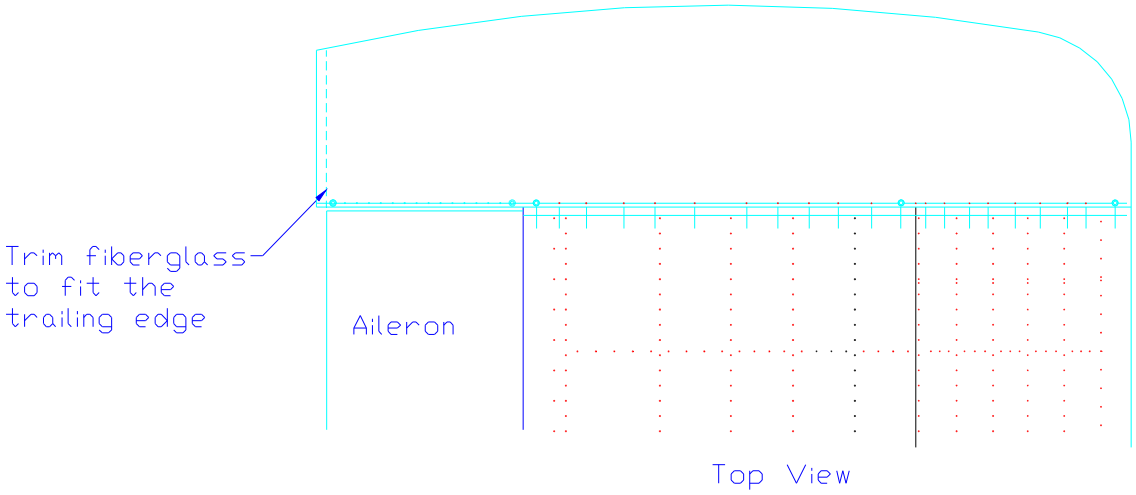



Figure 11.2.4

13) Remove the wing tip. Trim, debur and sand edges.

14) Chromate is recommended between the wing and wing tip to prevent moisture buildup.

15) Rivet the wing tip on with 1/8" Avex rivets.

16) Use a piece of 1" fiberglass with resin and place between the two layers of the wing tip. Clamp closed the two layers until resin is dry. Sand if necessary.

17) Drill 1" to allow access to aileron bolt. Figure 11.2.5.

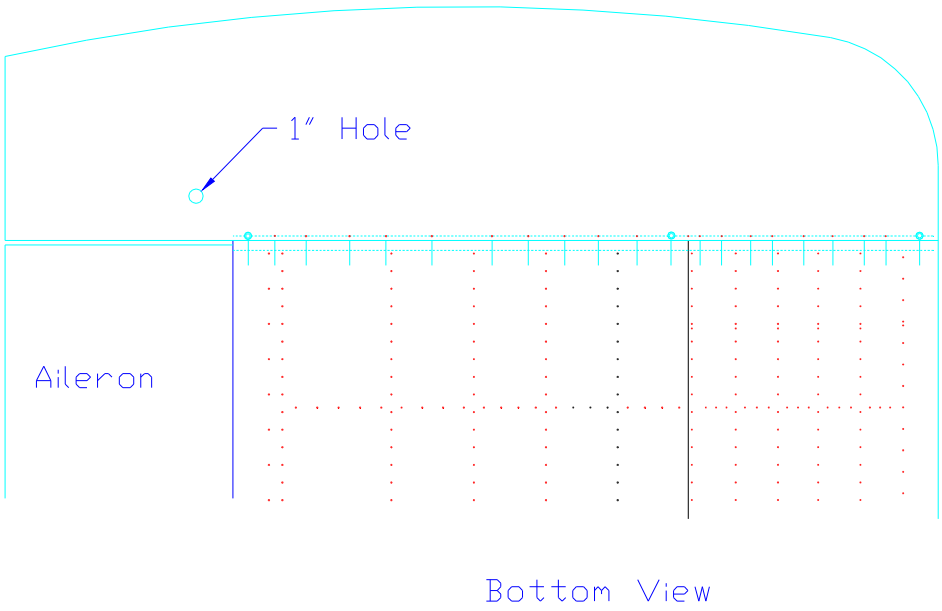



Figure 11.2.5

18) Repeat for the other wing.

Tuesday, August 25, 1998

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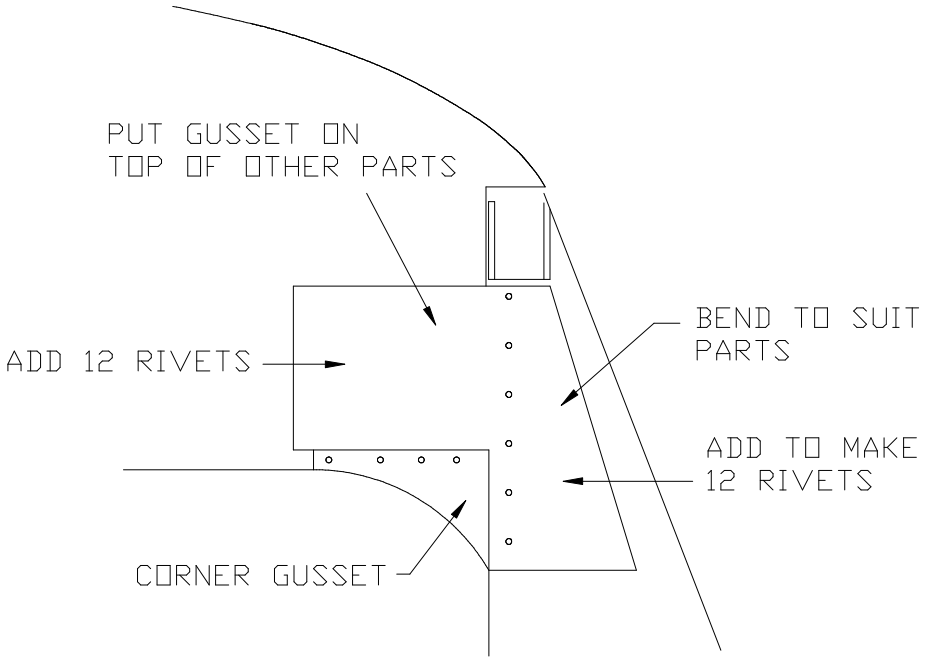
To all Elite and Rebel Builders:

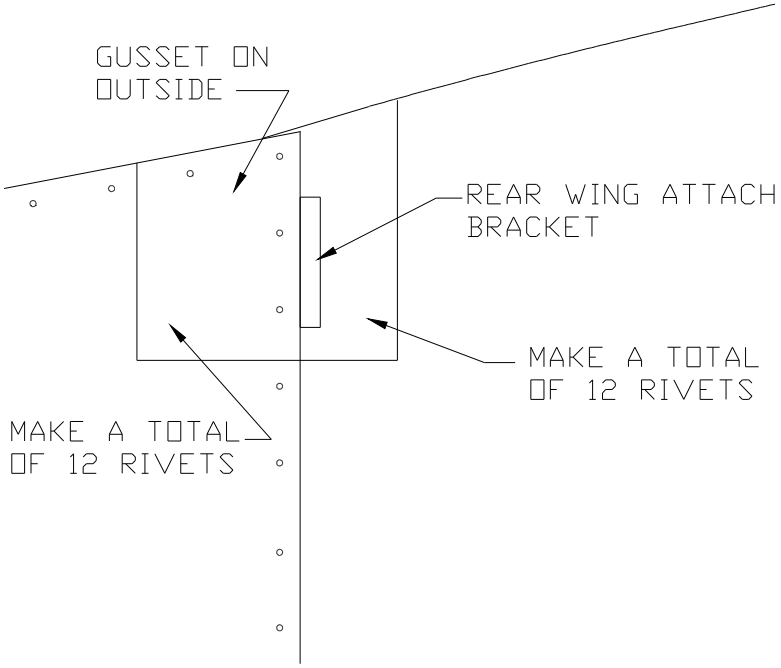
It has come to our attention that aircraft on floats, especially those that put on the larger engines and do not move the firewall back, have developed small cracks on the firewall around the top engine mounts. Also there was slight deformation in the skins around the top of the door posts causing the rivets to shear.

We have come up with two fixes that will solve the problems:

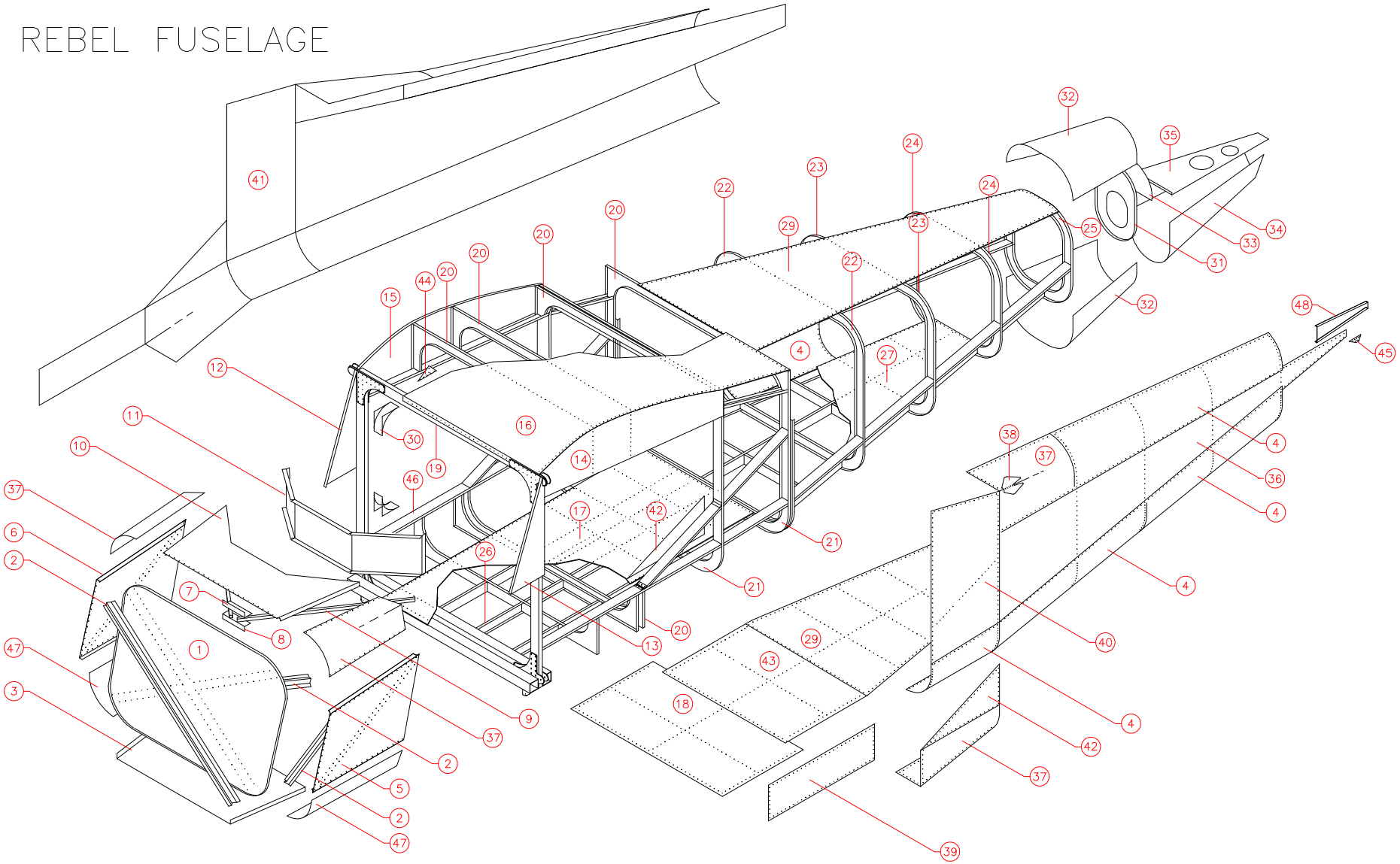
1) Firewall: On the firewall you will need to place a channel across the top between the two engine mounts. A 2" piece of channel should be used to accomplish this. On the existing firewall there are two pieces of witches hat section (FUS-12) that are on the front and back, therefore the new channel must be installed in two pieces with a 6" overlap. One piece of the channel will go on the back of the firewall sandwiched between the top engine mount bracket and the firewall. The other piece will go on the front of the firewall between the engine mount and the firewall. There are already existing parts in this area (dashboard brace, etc.) so you may need to stagger the overlap to one side or the other to accommodate them. Use a nominal 1" rivet spacing to attach the channel and a 3/4" rivet spacing on the overlap.

2) Door Posts: .032" doublers are needed on the top front and rear door post. See figures for the locations and approximate sizes of the doublers. Add rivets so that you get a total of twelve rivets on each side of the overlap on each doubler.






Again, these changes are recommended for those aircraft flying on floats or those contemplating putting their aircraft on floats.


REBEL FUSELAGE

**REBEL Fuselage Parts List**

| ITEM # | DESCRIPTION | PART # | REQUIRED |
|---|---|---|---|
| 1 | FIREWALL | FUS-6 | 1 |
| 2 | FIREWALL STIFFENER (Made from FUS-12) | FUS-63 | 2 |
| 3 | FRONT FLOOR | FUS-7 | 1 |
| 4 | CORNER WRAPS | FUS-33 | 16 |
| 5 | LEFT FRON SIDE PANEL | FUS-11L | 1 |
| 6 | RIGHT FRONT SIDE PANEL | FUS-11R | 1 |
| 7 | FIREWALL BRACKET | FUS-20T | 1 |
| 8 | FIREWALL BRACKET | FUS-20B | 1 |
| 9 | DASHBOARD BRACES | FUS-19 | 2 |
| 10 | FRONT UPPER PANEL | FUS-8 | 1 |
| 11 | DASHBOARD BRACES | FUS-18 | 1 |
| 12 | RIGHT DOOR BRACE | FUS-9R | 1 |
| 13 | LEFT DOOR BRACE | FUS-9L | 1 |
| 14 | LEFT FUSELAGE ROOT RIB | FUS-27L | 1 |
| 15 | RIGHT FUSELAGE ROOT RIB | FUS-27R | 1 |
| 16 | CABIN ROOF | FUS-28 | 1 |
| 17 | MAIN CABIN FLOOR | FUS-47 | 1 |
| 18 | BOTTOM SKIN | FUS-40 | 1 |
| 19 | CAGE ASSEMBLY | | 1 |
| 20 | SQUARE BULKHEAD QUARTER | RBULK-1 | 16 |
| 21 | ROUND BULKHEAD QUARTER | RBULK-2A | 6 |
| 22 | ROUND BULKHEAD QUARTER | RBULK-2B | 4 |
| 23 | ROUND BULKHEAD QUARTER | RBULK-2C | 4 |
| 24 | ROUND BULKHEAD QUARTER | RBULK-2D | 4 |
| 25 | ROUND BULKHEAD QUARTER | RBULK-2E | 4 |
| 26 | FIN - STAB RIB MATETRIAL | ST-31 | |
| 27 | INNER REAR FLOOR PANEL | FUS-41 | 1 |
| | | | |
| 29 | REAR FUSELAGE TOP & BOTTOM | FUS-23-2 | 2 |
| 30 | CORNER GUSSET | FUS-37 | 4 |
| 31 | BULKHEAD | FUS-36 | 1 |
| 32 | REAR FUSELAGE WRAP | FUS-29 | 2 |
| 33 | BULKHEAD DOUBLER | FUS-43 | 1 |
| 34 | TAIL WRAP | FUS-30 | 1 |
| 35 | TAIL BULKHEAD | FUS-31 | 1 |
| 36 | REAR FUSELAGE SIDE | FUS-22-1 | 2 |
| 37 | TAPERED CONRER PANEL | FUS-10 | 6 |
| 38 | OUTER FUELAGE GUSSET | FUS-51 | 2 |
| 39 | LOWER SIDE PANEL | FUS-26 | 2 |
| 40 | LEFT SIDE PANEL | FUS-24L | 1 |
| 41 | RIGHT SIDE PANEL | FUS-24R | 1 |
| 42 | PANEL | FUS-25 | 2 |
| 43 | BOTTOM SKIN | FUS-39 | 1 |
| 44 | CABIN GUSSET | FUS-52 | 4 |
| 45 | TAIL GUSSET | FUS-53 | 2 |
| 46 | DOOR SILL (Customer makes from ST-31) | FUS-14 | 2 |
| 47 | LOWER FRONT TAPERED CORNER PANEL | FUS-70 | 2 |
| 48 | TAIL REINFORCE GUSSET | FUS-89 | 2 |

To assemble the fuselage you will require the following tools:

1) Variable Speed Hand Drill

2) #40, #30. #11, 1/4", 5/16" Drill Bits

3) Quantity of 3/32", 1/8" and 3/16" Clecos

4) Cleco Pliers

5) Deburing Tools

6) Felt Markers

7) Riveter

8) Tape Measure

9) Level

10) Snips

11) Crimping Pliers

12) 3/8" & 7/16" Wrenches (Two of Each)

13) Dimple Tool For Rivets

14) Hacksaw

15) File

16) Chalk Line or Long Straight Edge

## *12.1 Tailcone Assembly*

**Important:** Make sure your table is level for its full length before starting. If done regularly, few alignment problems will occur.

1) Using a chalk line or a long straight edge, draw a line down the center of the table. Figure 12.1.1.

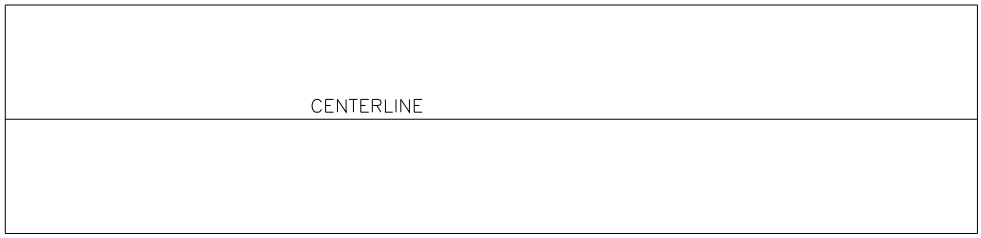



Figure 12.1.1

2) Center the Rear Fuselage Bottom Skin (FUS-23-2) on the centerline of the table with the flanges up as in figure 12.1.2. **NOTE:** The top and bottom skins are the same.

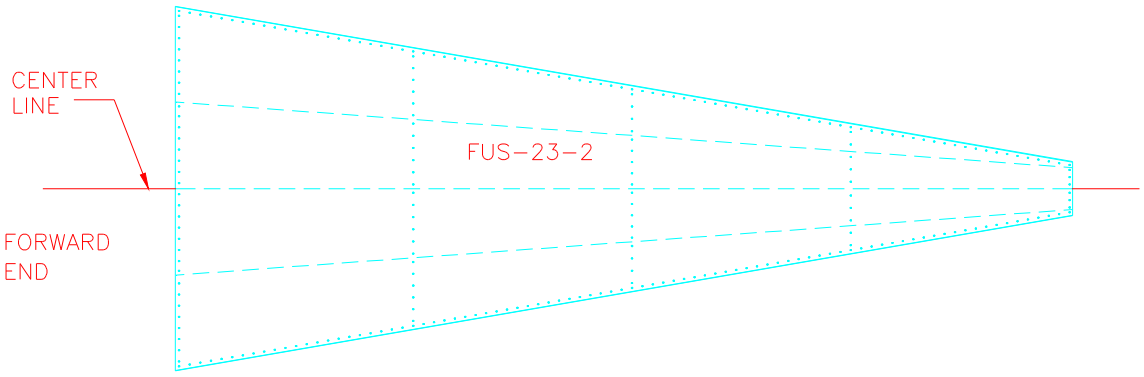



Figure 12.1.2

3) On the forward end of the Bottom Skin (wide end) ensure the two center holes are evenly spaced over the centerline. Drill a #40 hole into the table through one hole only as in figure 12.1.3.

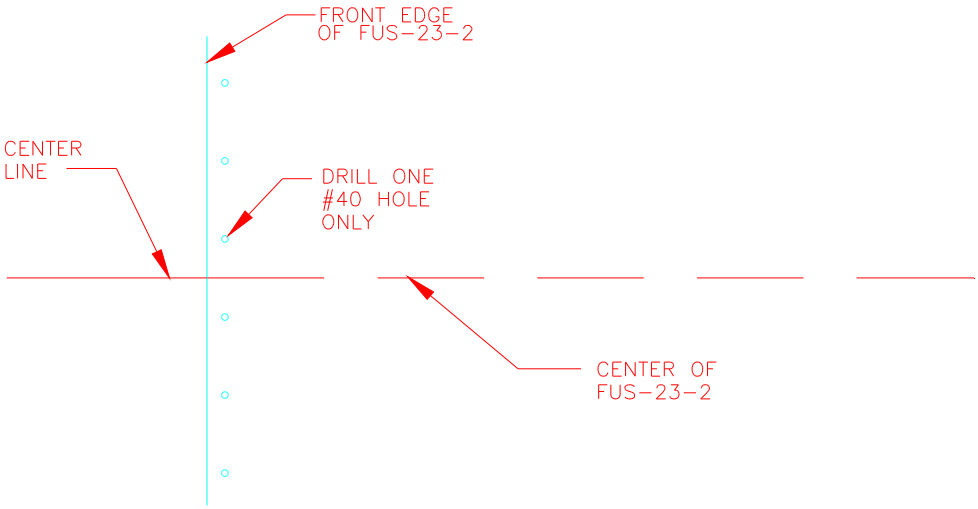



Figure 12.1.3

4) Repeat step for the rear end of the bottom skin.

5) Using a short 2" x 4" or anything suitably flat, hold the skin down and drill a #40 hole into the table beside each bulkhead location as in figure 12.1.4.

**NOTE:** Clean the wood chips from under the skin before clecoing to the table. Throughout building your fuselage clean the table often. A rivet head, mandrel or any small object caught between the table and the skins can cause nasty, unsightly dents and gouges in your aircraft. When drilling through the skins and into the table, hold the skin tightly against the table. This will allow the wood chips to come through the hole and prevent them from being trapped between the skins and table.

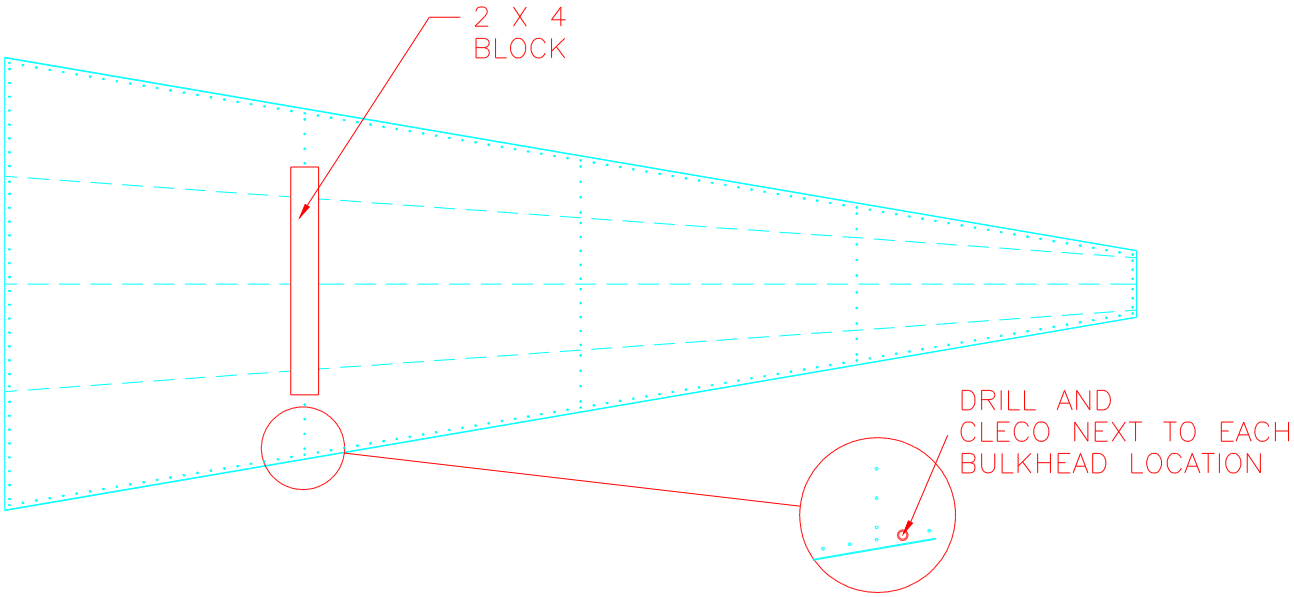



Figure 12.1.4

6) At each bulkhead position, drill #40 the bulkhead aligning holes into the table. Figure 12.1.5.

7) From the forward end of the skin, label the bulkhead positions from "A to "E". Figure 12.1.5.

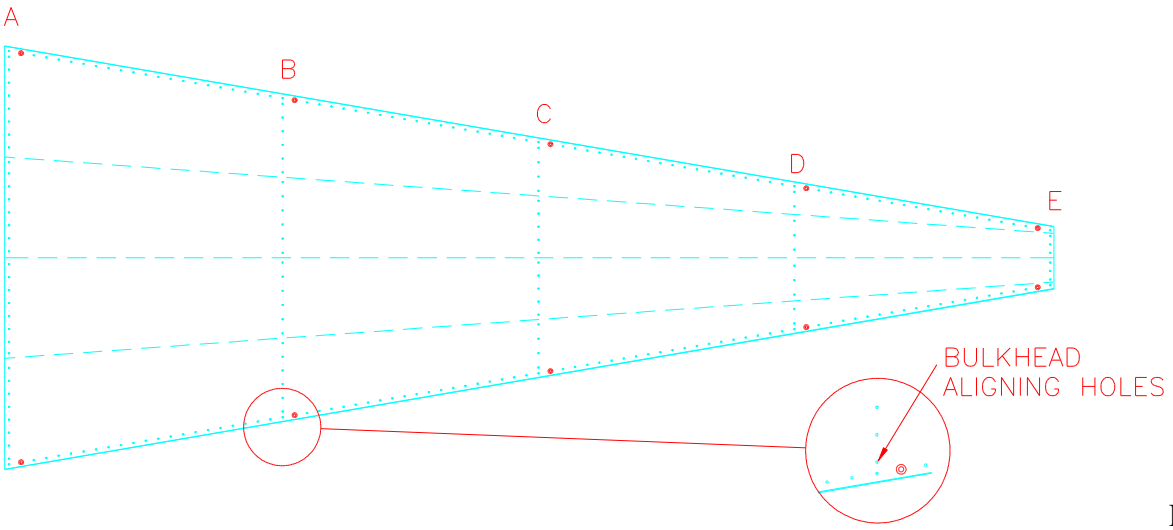



Figure 12.1.5

8) Cleco the labeled bulkhead quarter sections (RBULK 2A to 2E) to their respective places. The flanges face forward. Figure 12.1.6.

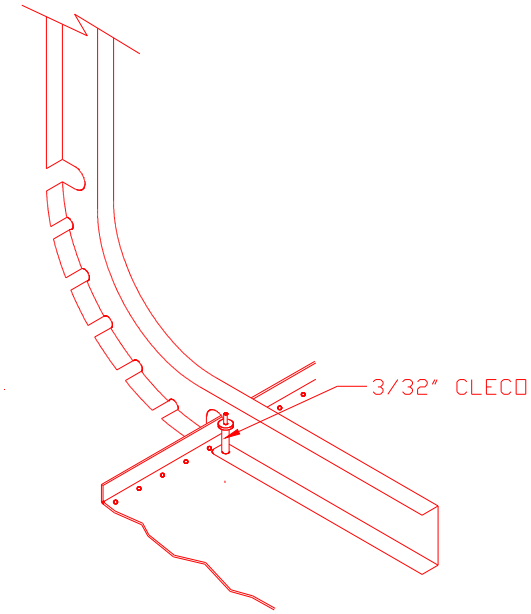



Figure 12.1.6

9) The two bulkhead sections at "E" will require trimming the legs before assembly is possible. Figure 12.1.7. **NOTE:** Only the legs against the skin should be trimmed.

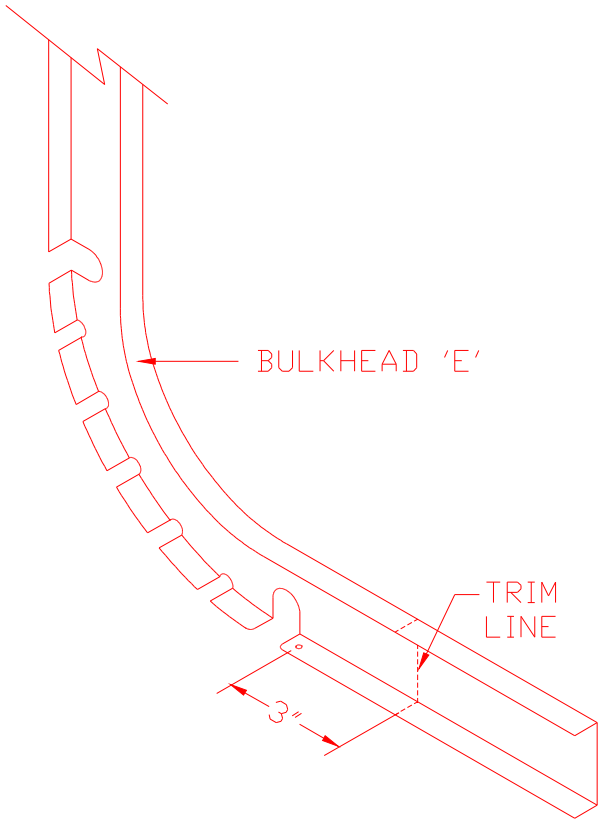



Figure 12.1.7

10) The leg of one quarter section will fit into the leg of the opposing quarter section.

11) At bulkhead positions A,B,C and D, the legs will overlap approximately 4". At position "E" the overlap will be approximately 2 5/8".

12) At positions A,B,C and E only, drill nine #30 holes through the overlaps and cleco together as in figure 12.1.8.

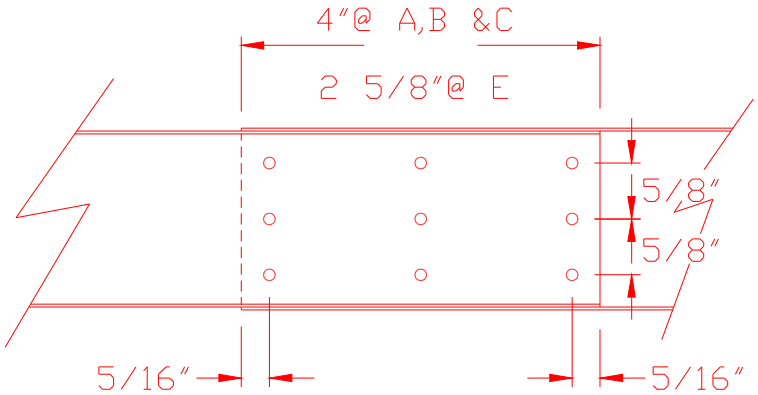



Figure 12.1.8

13) On the top of the inside flange, drill five equally spaced holes as in figure 12.1.7. The outside flanges will be drilled from the skins. Please note that if an inside sub floor is being installed, these holes will not be required on the bottom junctions as they will be drilled through the sub floor. Figure 12.1.9.

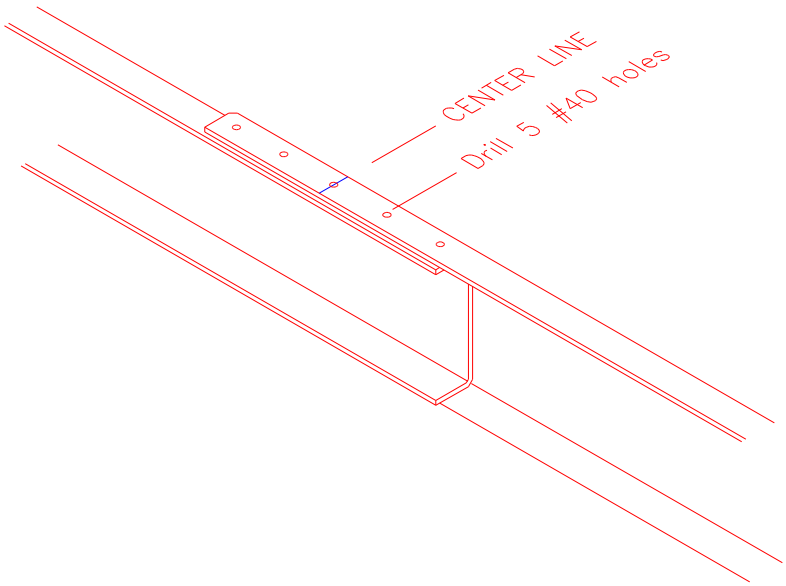



Figure 12.1.9

14) Locate Elevator Pulley Brackets (FUS-254 L&R). Layout, clamp together and drill for pulley bolt and cotter pin. Drill three #40 pilot holes in each lower flange. Trim the parts. Figure 12.1.10.

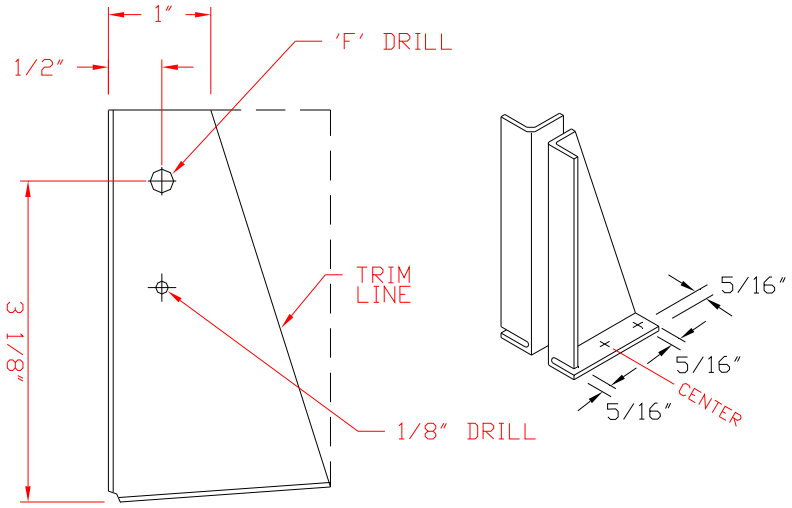



Figure 12.1.10

15) Drill bulkhead "D" as in Figure 12.1.11.

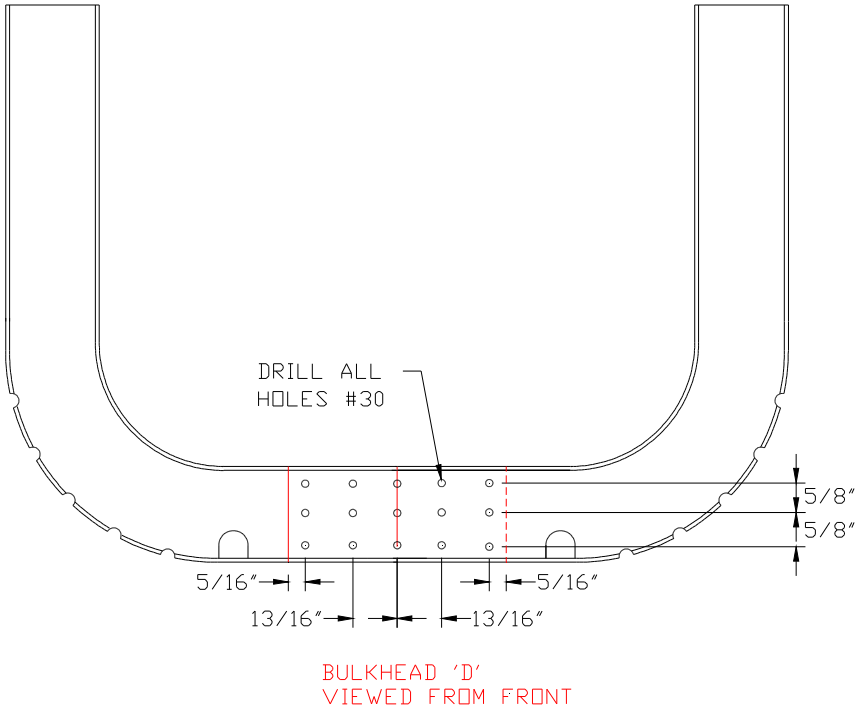



Figure 12.1.11

16) Bolt two BB-128 pulleys between pulley brackets with an AN4-14A bolt, AN960-416 washer and AN365-428 nut

17) Center pulley assembly behind bulkhead "D" and drill back through the bulkhead sections into pulley assembly and drill through pulley assembly into the Rear Bottom Skin. Figure 12.1.12.

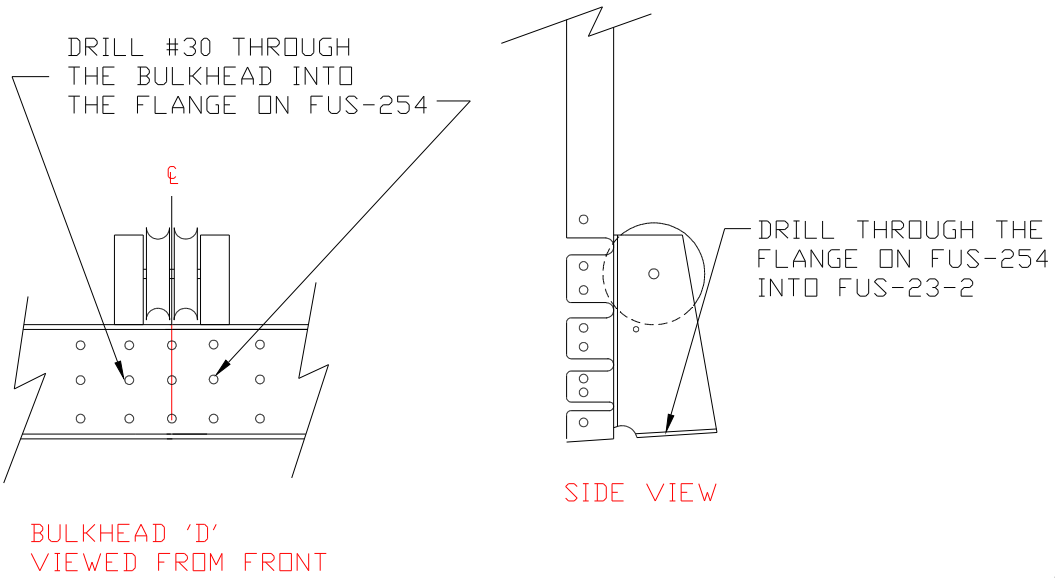



Figure 12.1.12

18) The bottom assembly should now look like Figure 12.1.13.

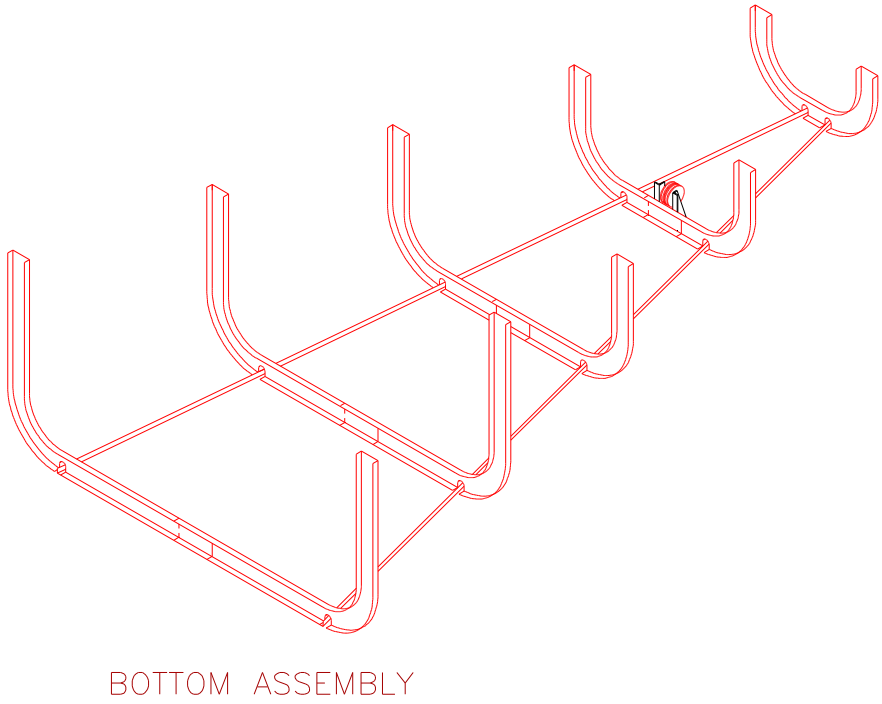



Figure 12.1.13

**NOTE:** Before disassembling, label each bulkhead for easy assembly in the future. An easy method for labeling is shown in figure 12.1.14.

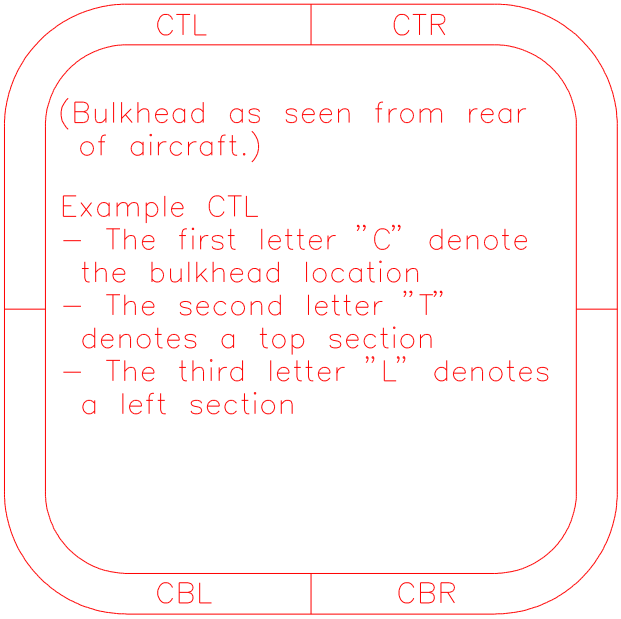



Figure 12.1.14

19) Disassemble and remove all parts from the table.

20) Cleco the second Rear Fuselage Skin (FUS-23-2) to the table in the same locations as you did for the bottom skin.

21) The procedure for the top skin is the same as for the bottom skin with the following exceptions:

a) the bulkhead quarter sections for location “A” will be square cornered

b) bulkhead “D” overlap and riveting is the same as other bulkheads.

22) The top assembly should look like figure 12.1.15.

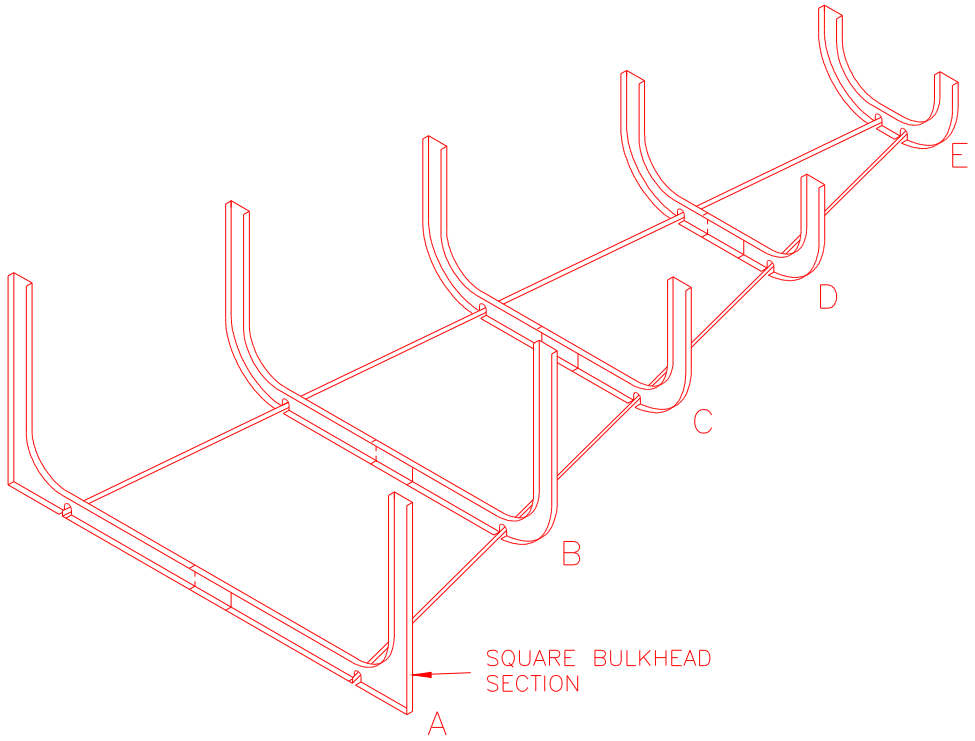



Figure 12.1.15

23) Disassemble and remove from the table.

24) The procedure for the two Rear Fuselage Sides (FUS-22-2) is similar to that used for the top and bottom.

25) The single piece bulkhead (FUS-36) can be positioned and clecoed to the side skin at the rear end. The lightening hole in FUS-36 should be at the bottom.

26) The left side assembly should look similar to figure 12.1.16.

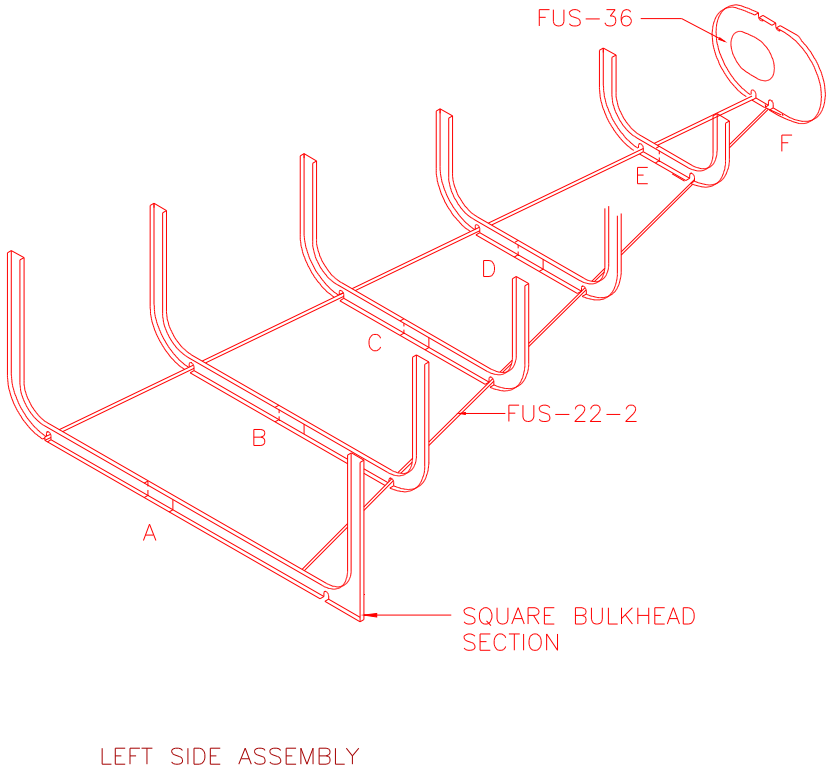



Figure 12.1.16

27) The right side assembly should look like to figure 12.1.17.

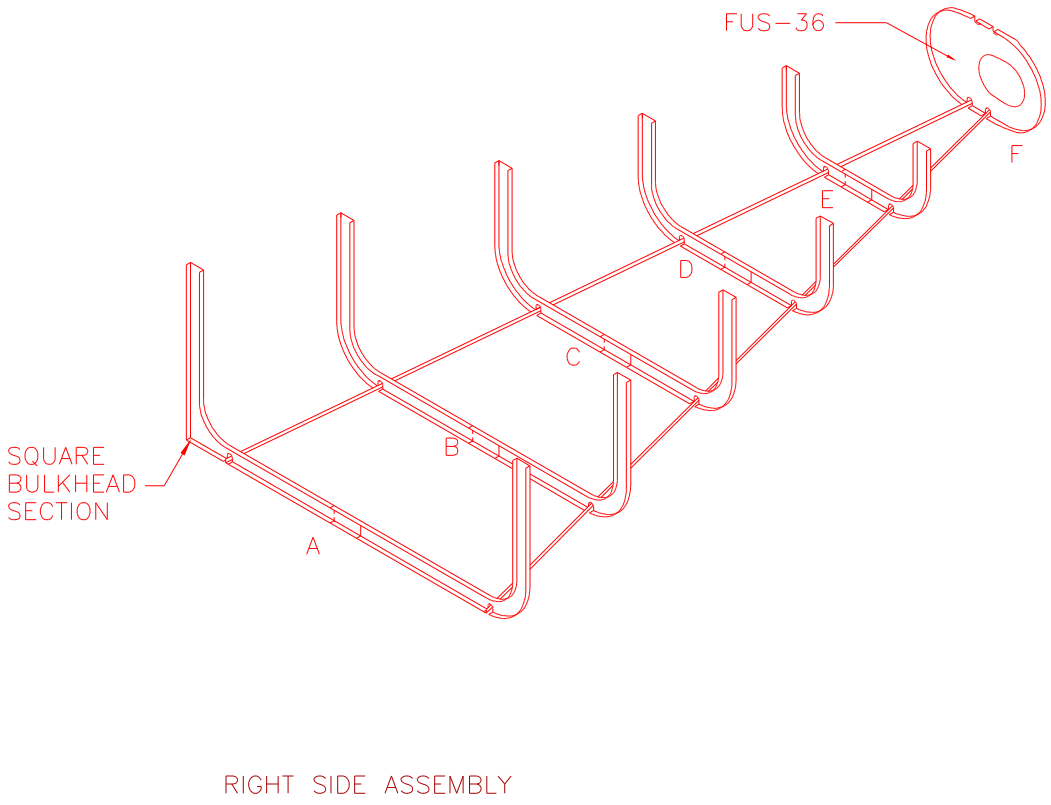



Figure 12.1.17

28) The overlaps of the legs on the side skins should be cut down to 4” as in figure 12.1.18.

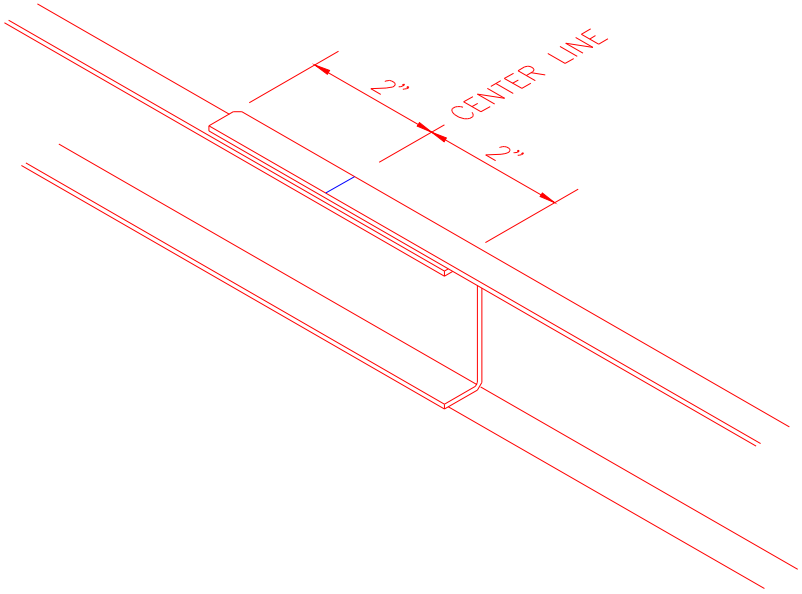



Figure 12.1.18

29) Disassemble and remove the assembly from the table. Debur all parts.

30) Assemble the five bulkheads on the table.

31) Chromate their mating surfaces.

32) Rivet together the bulkheads using nine 1/8" rivets (RV-1410) at each overlap.

33) On the bulkhead flanges draw a line as in figure 12.1.19.

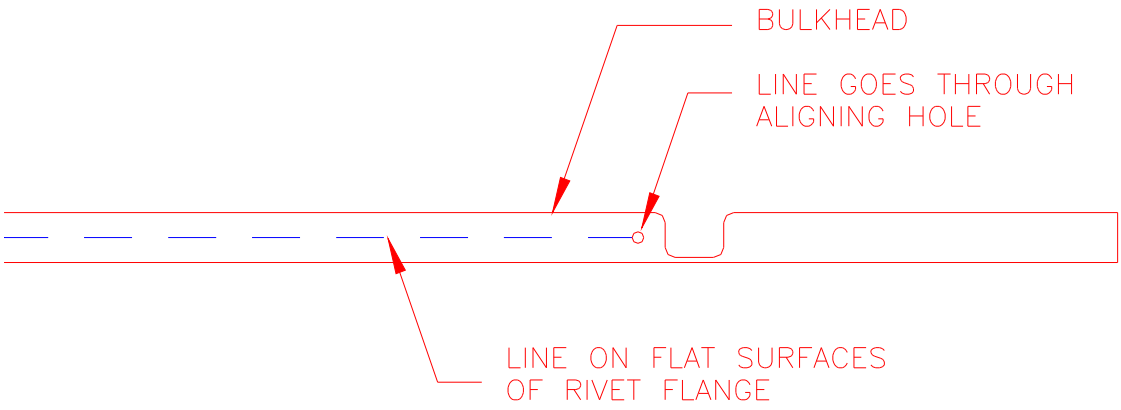



Figure 12.1.19

34) Cleco the bottom skin (FUS-23-2) back on the table.

35) Cleco the completed bulkheads to the skin.

36) Cleco the side skins to the bulkheads.

37) Cleco the top skin in place.

38) The tail cone will now look like figure 12.1.20.

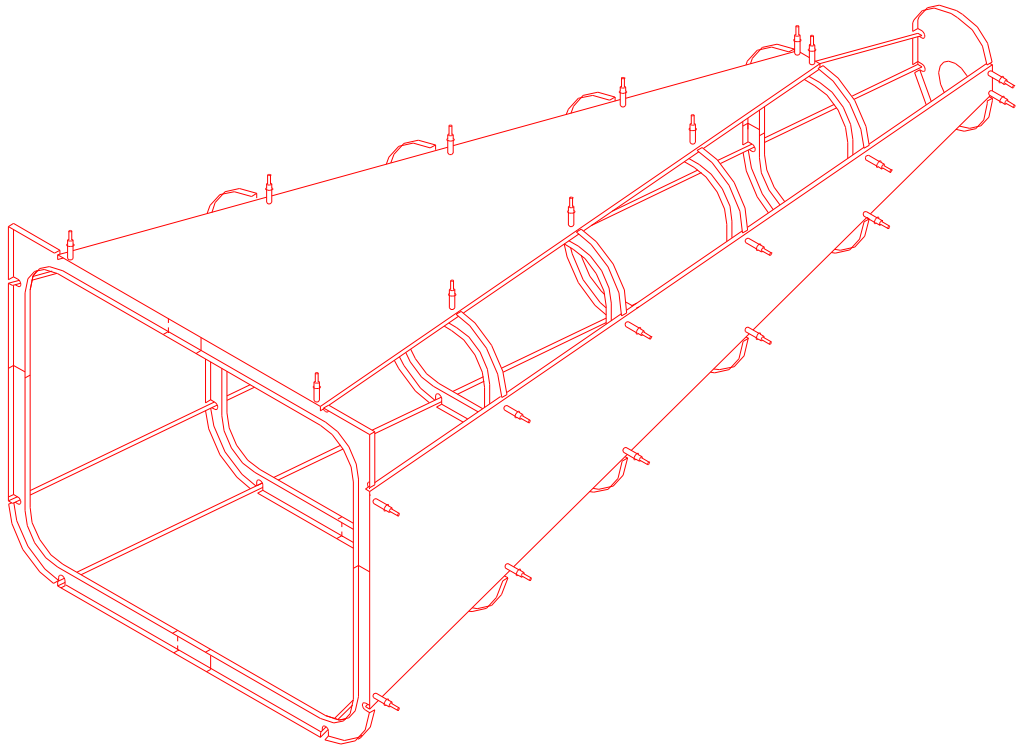


Figure 12.1.20

39) On bulkheads B, C, D and E the lines on the rivet flanges should be visible through the prepunched holes in the side and top skins.

40) Drill out bulkheads B, C and D with a #30 drill. Drill out bulkhead "E" to #40 only. Start from the center of each bulkhead side and work outwards. Use plenty of clecos. **DO NOT** drill out bulkhead "A".

**NOTE:** The assembly can be turned on its side for drilling the bottom portion of the bulkheads.

41) Remove the bottom skin and debur.

42) Chromate the mating surfaces and rivet the bottom skin to bulkheads B, C and D with 1/8" rivets (RV-1410).

43) Do not rivet the end holes of the bulkheads.

44) Turn the assembly over and cleco to the table.

45) Remove one skin at a time, debur, chromate and rivet.

46) On a piece of 1/2" or thicker plywood, trace the out line of a round bulkhead corner. Figure 12.1.21.

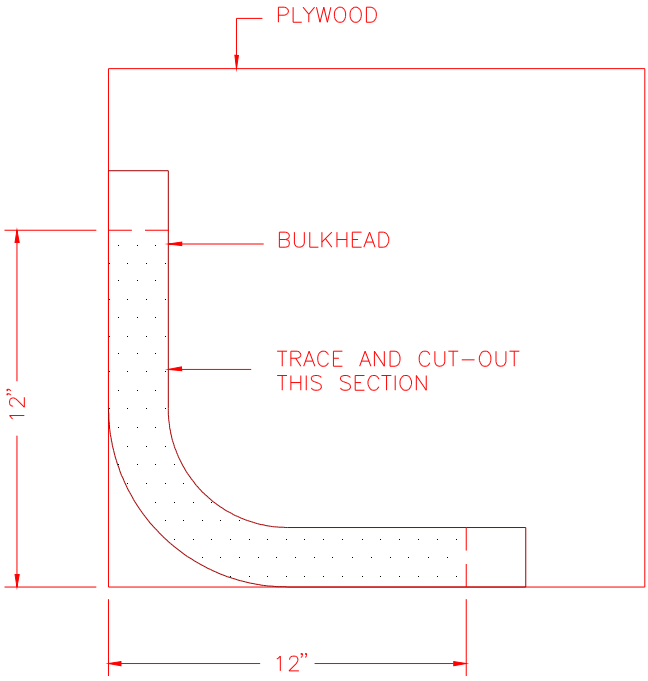



Figure 12.1.21

47) Cut two traced sections out leaving the legs approximately 12" long.

48) Clamp these wood sections to the flat sides of the round corners of bulkhead "A". Figure 12.1.22.

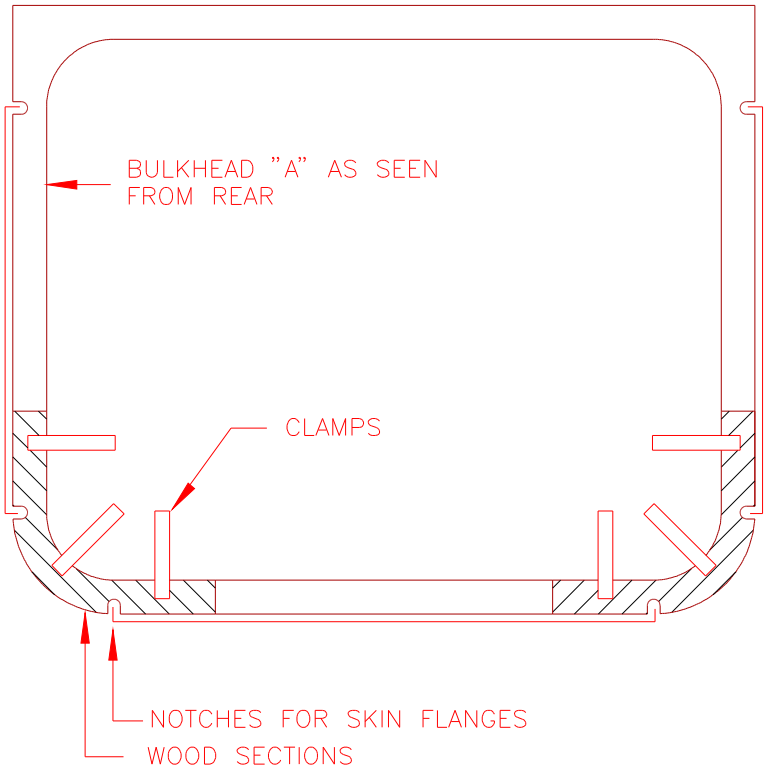



Figure 12.1.22

**NOTE:** The wood sections will help hold the rib square while putting on the rolled corners (FUS-33).

49) On one of the rolled corners (FUS-33) draw a line 5/16" from the edge on the inside. Figure 12.1.23.

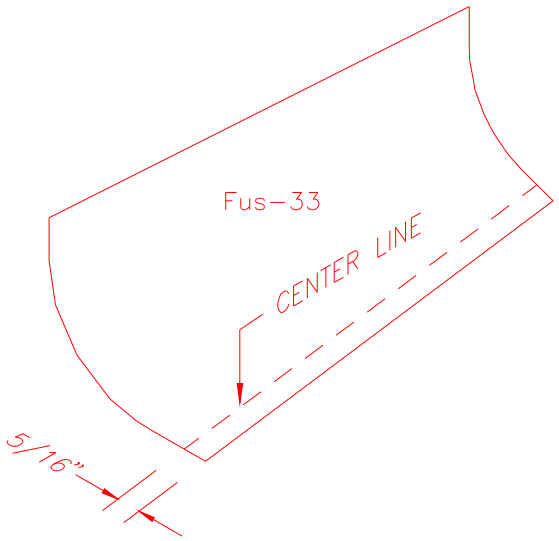



Figure 12.1.23

50) Push the rolled corner under the bottom skin (FUS-23-2) so the line is visible through the holes on the edge of the skin. Figure 12.1.24.

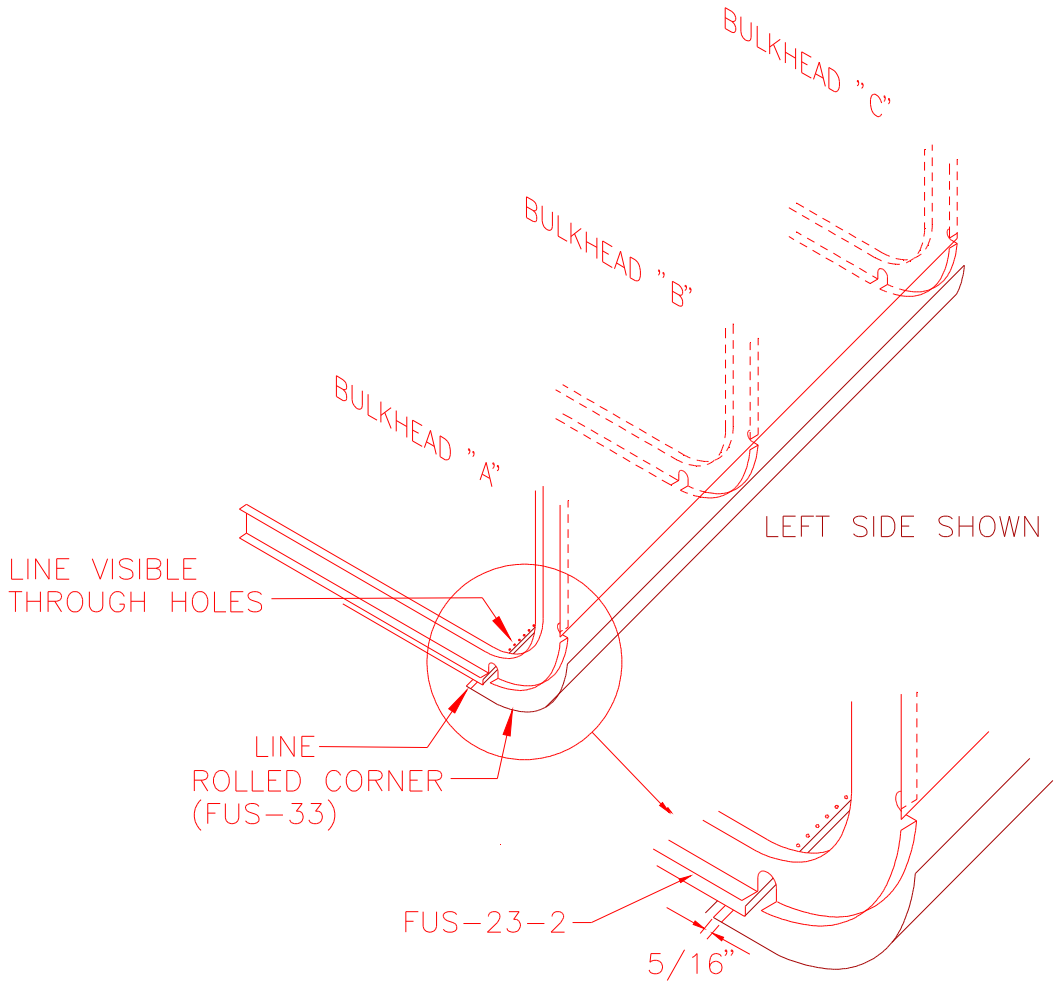



Figure 12.1.24

51) Ensure the rolled edge sticks out past bulkhead "A" enough to be trimmed flush later.

52) Ensuring you can see the line through the holes, drill out all the holes through the rolled corners with a #40 drill. **NOTE:** If you are building the aircraft without the inner floor, you can drill directly

with a #30 bit. When drilling, start with the ends of the rolled corners, then the center. Continue drilling by dividing the space between holes in half until all are drilled. Cleco often.

53) Mark another rolled corner and insert between bulkhead C and previously installed rolled corner, keeping a 5/8" overlap.

54) Drill and cleco as you did previously using existing holes as a guide.

55) Attach six or more pieces of tape (filament tape works best) to rolled corners and then pull corners snugly up against the side skin. Figure 12.1.25.

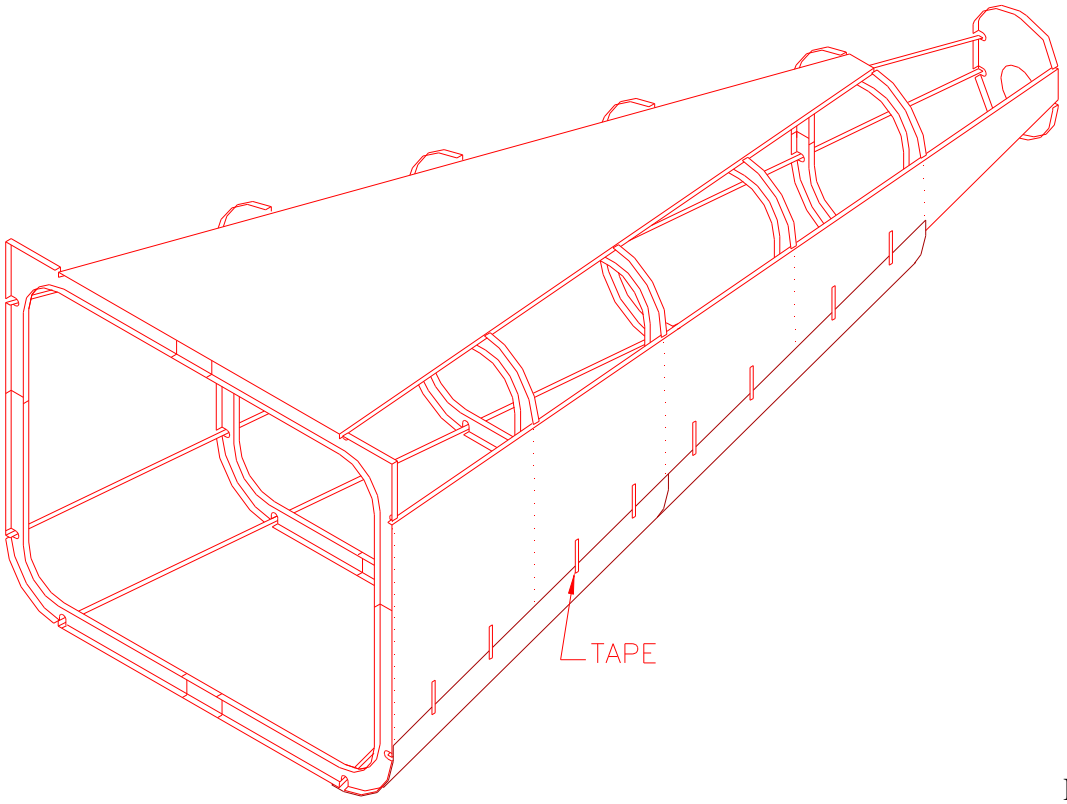



Figure 12.1.25

56) Drill back through the side skin with a #40 drill as before. Again if you are not installing the inner floor, you can drill directly with a #30 drill.

57) With a long #30 bit, drill back through the pre-drilled holes in the bulkhead corners. Ensure the bulkheads are straight.

58) Using the bulkheads as guides, mark the trimmed position of each rolled corner.

59) Remove rolled corners and trim. **NOTE:** Ensure 5/16" from center of holes to edge of sheet.

60) If you are **NOT** installing the inner floor, chromate mating surfaces and rivet corners in place with 1/8" x 3/16" avex rivets.

61) If you are going to install the inner floor then reinstall with clecos only.

62) Follow previous steps for the right side.

63) Remove the two wood sections from the bottom of bulkhead “A”.

64) Clamp the wood sections to the top corners of bulkhead “B”.

65) The procedure for the top corners is the same except the round corners start at bulkhead “B”. The rear top corner will only span two bulkheads. Ensure that bulkhead “A” is flat and straight. **NOTE:** The top rolled corners can be drilled directly with a #30 bit. Remove and trim

66) Chromate mating surfaces and rivet top corners in place with 1/8” x 3/16” avex rivets. **NOTE:** Do not rivet at bulkhead “B” and “E” locations

**NOTE:** The Float Hard Points should now be installed as detailed in Chapter 12.27. This is optional.

## *12.2 INNER FLOOR CHANNEL INSTALLATION*

The inner floor will add approximately 6 1/2 - 7 lbs to the *REBEL* in its bare state. If carpeted it will be even greater.

1) Cut channels from stock material (ST-31) for each of the locations shown in Figure 12.2.1.

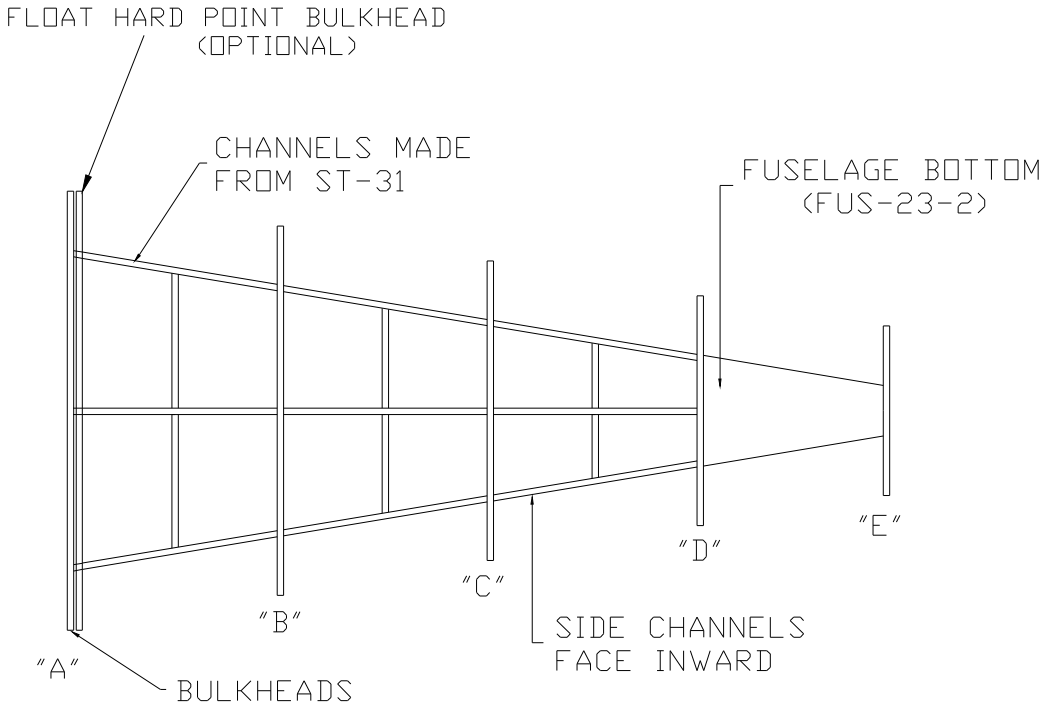
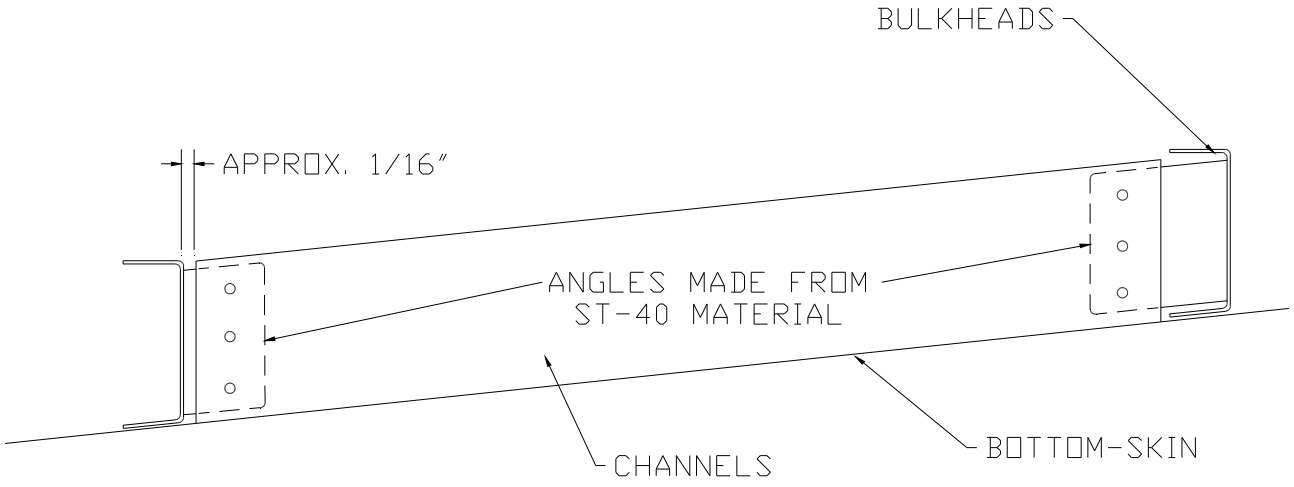



Figure 12.2.1

**NOTE:** There should be approximately 1/16" clearance at both ends of each channel. The bulkheads are at an angle to the bottom skin of approximately 6 degrees and it is necessary to cut the ends of the channels at this angle. . Use angle brackets (made from ST-40) to attach all floor channel to each bulkhead. Figure 12.2.2. The channels at the sides should face inwards and butt up to the flanges of




FUS-23-2. Figure 12.2.3

Figure 12.2.2

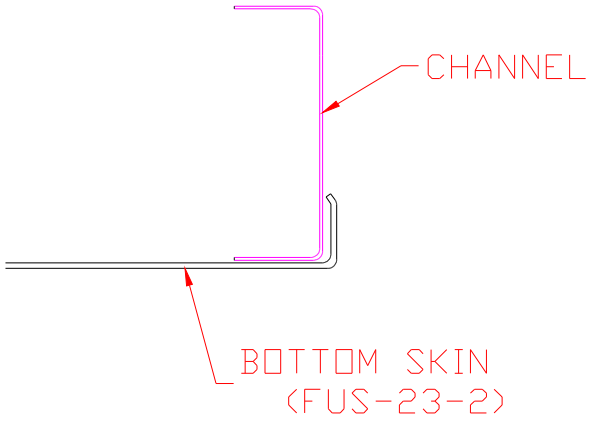



Figure 12.2.3

2) Cut channels from stock material (ST-31) for the side skins. The angle between the bulkheads and side skins is approximately 10º. **NOTE:** The channels on the side skins should have the flanges facing downward. Figure 12.2.4.

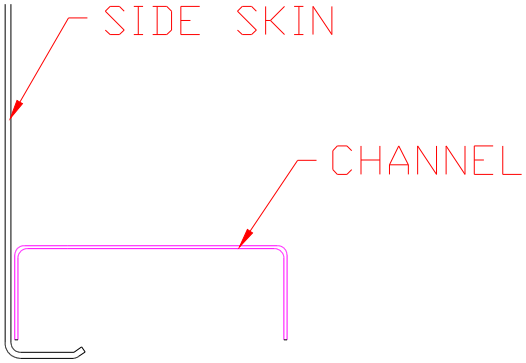



Figure 12.2.4

3) Mark the center lines on the bottom skin for the longitudinal center channels and the cross channels. Figure 12.2.5.

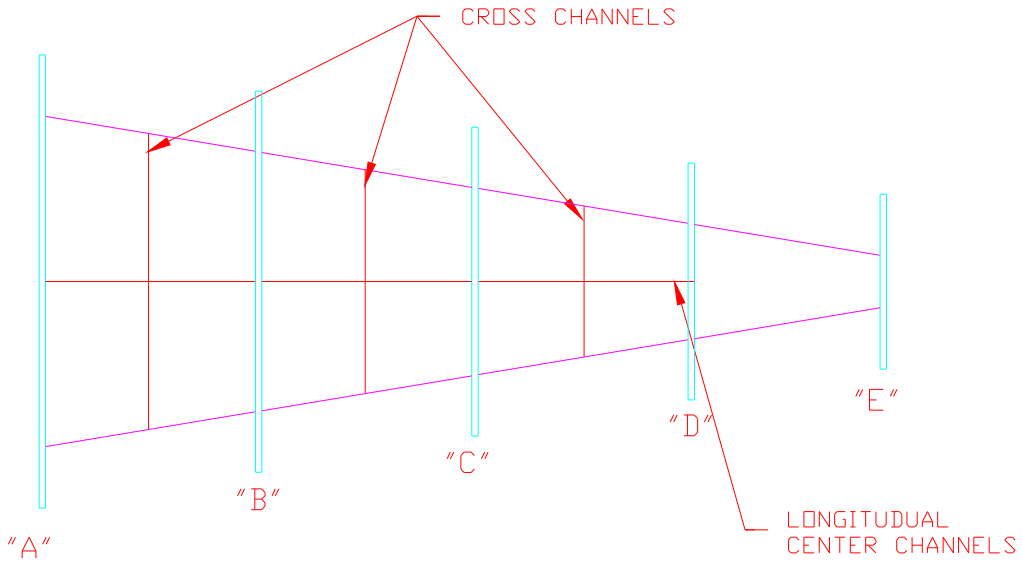



Figure 12.2.5

4) Drill #40 holes on the centerlines at approximately 1 1/4" spacing. **NOTE:** The end holes for each channel should have 5/16" minimum edge distance.

5) Turn the cone section on its side.

6) Position any channel and drill one hole at each end. Cleco.

7) Repeat for each channel. Finish drilling all the holes in the channels.

**NOTE:** On the center longitudinal channels and cross channels you can drill directly with a #30 drill bit. On the side channels, drill with a #40 drill bit. These will be drilled out to final size with the rolled corners.

8) Disassemble and debur. **NOTE:** Ensure the edges of all channels are free of burrs.

9) Chromate only the center and cross channels mating surfaces. Rivet in place with 1/8" (RV-1410) rivets.

10) Turn the fuselage upright and drill out the channels for the sides to #40. **NOTE:** The side channels need to be back slightly from the inside radius of the side skin. Figure 12.2.4.

11) Replace and cleco the rolled corners in place with the channels and drill out all the holes to #30.

12) Disassemble and debur.

13) Chromate the mating surfaces and rivet together the rolled corners, channels and con section with 1/8" rivets. Do not rivet the ends at bulkhead "A" and "E".

**Helpful Hint:** When installing the Rear Inner Panel (FUS-41) and Corner Wraps on the inside, it has been found that a piece of clear lexan or similar material, cut to match the FUS-41 and corner wraps,

allows the builder to see the channels and make accurate drilling patterns. This then can be transferred to the actual parts.

14) Position the Rear Inner Panel (FUS-41). Figure 12.2.6.

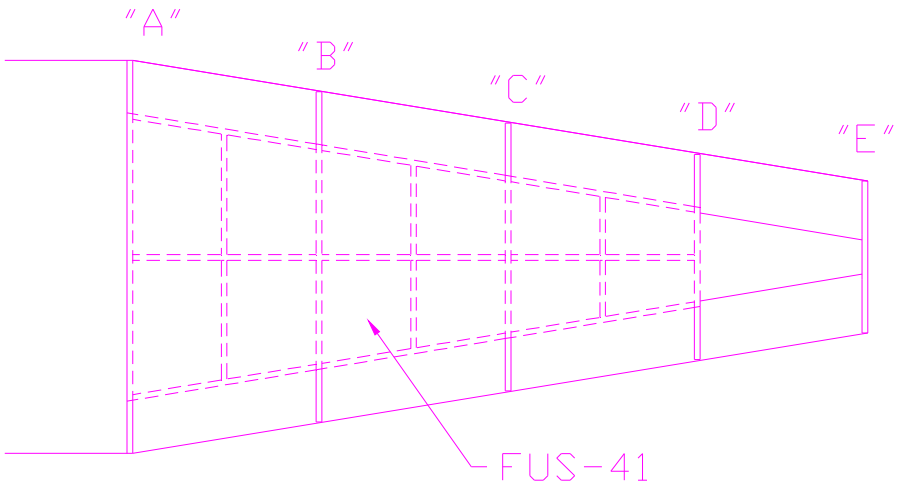



Figure 12.2.6

**NOTE:** Use a piece of plywood over the channels so you can climb into the fuselage without damaging the channels on the skin.

15) Mark the panel along the side channels and the ends at bulkhead “A” and “D”.

16) Remove the panel and trim to size.

17) Reinstall and mark the center positions of the flanges on the bulkheads and channels onto the floor panel. Figure 12.2.7.

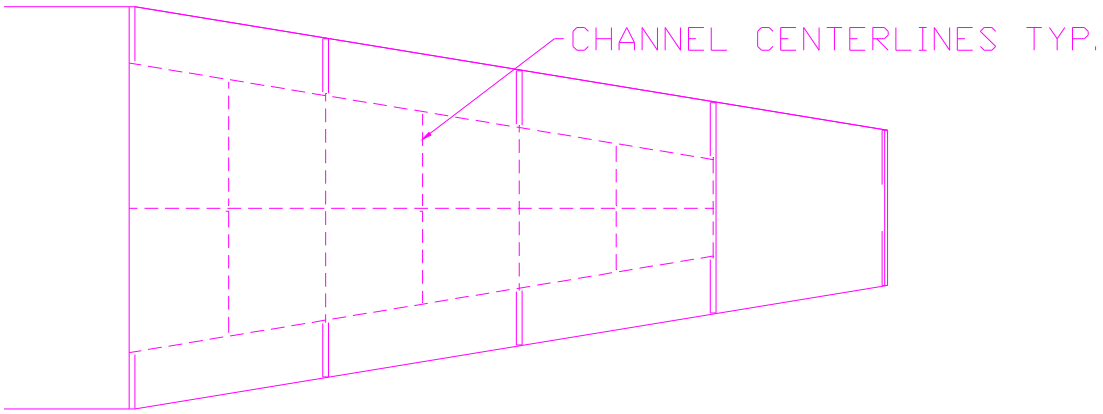



Figure 12.2.7

18) Join the opposing marks to the centerline of the channels and bulkheads. Along these lines drill #30 holes with a nominal spacing of 1 1/4”. **NOTE:** Do not drill the side channels at this time.

19) Position a Corner Wrap (FUS-33) between bulkhead “C” and “D”. Figure 12.2.8.

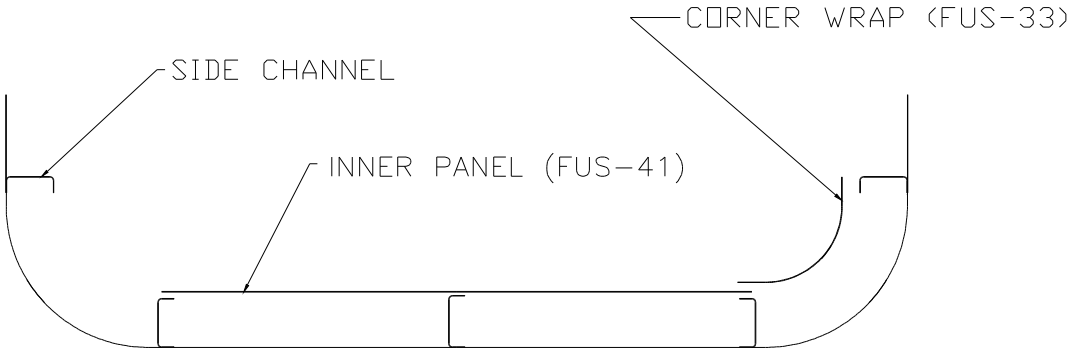



Figure 12.2.8

20) Ensure the corner wrap is tight against the bulkheads. Drill #30 holes with a nominal spacing of 1 1/4" into the side channels, floor channels and panel. Use plenty of clecos.

21) Drill into the bulkheads but leave the front bulkhead of each wrap, undrilled until the next corner wrap is in place. Continue adding corner wraps until bulkhead "A" is reached.

22) Trim the ends and sides of the corner wraps so the edge distance to the center of the rivets is 5/16".

## *12.3 Installing Rear Bulkheads*

1) On the two Rear Fuselage Wraps (FUS-29), draw a line down the inside center. Draw another line 5/8" back from the edge and crossing the center line. Figure 12.3.1.

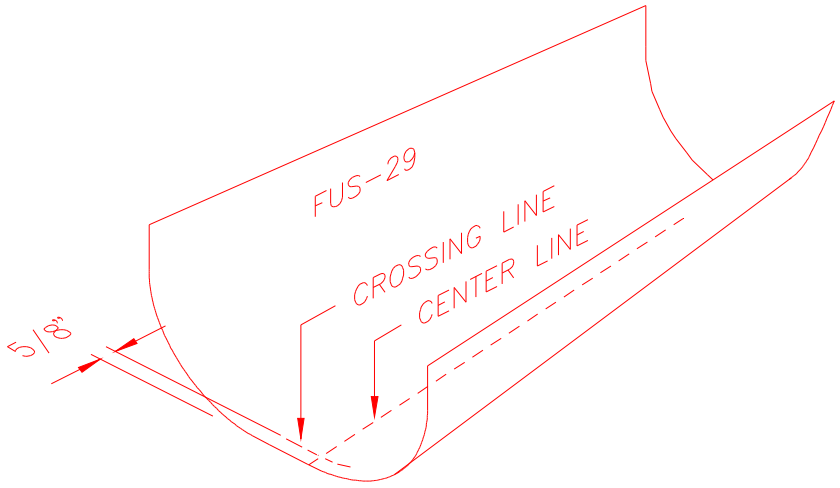



Figure 12.3.1

2) Mark a center line on the top and bottom of bulkhead "E" using the center line of the table as a guide. Figure 12.3.2.

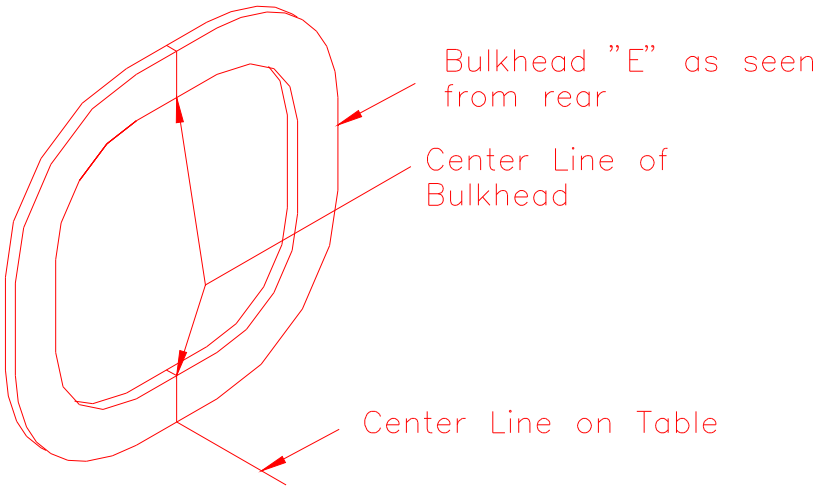



Figure 12.3.2

3) Slide the wide end of one FUS-29 under bulkhead "E" and Bottom Skin so it's centerline is aligned with the bottom center line of the bulkhead and the crossing line matches the edge of the bottom skin.

4) Align the rear of FUS-29 so the center lines up with the center line of the table.

5) Drill back through the holes in bulkhead "E" and bottom skin into FUS-29 and table. Cleco to the table.

6) Remove the one piece bulkhead (FUS-36) from the cone section.

7) Drill two #40 holes in each of the tabs of FUS-36. Figure 12.3.3.

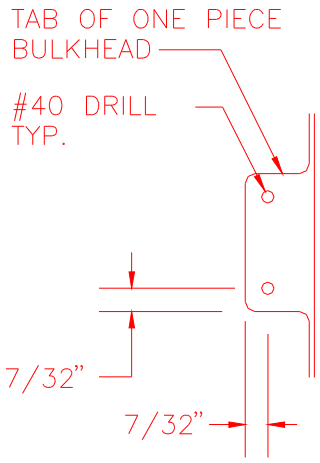



Figure 12.3.3

8) Place the bulkhead, flat side down, over a piece of .032 material (W-143) and trace out the section shown in figure 12.3.4.

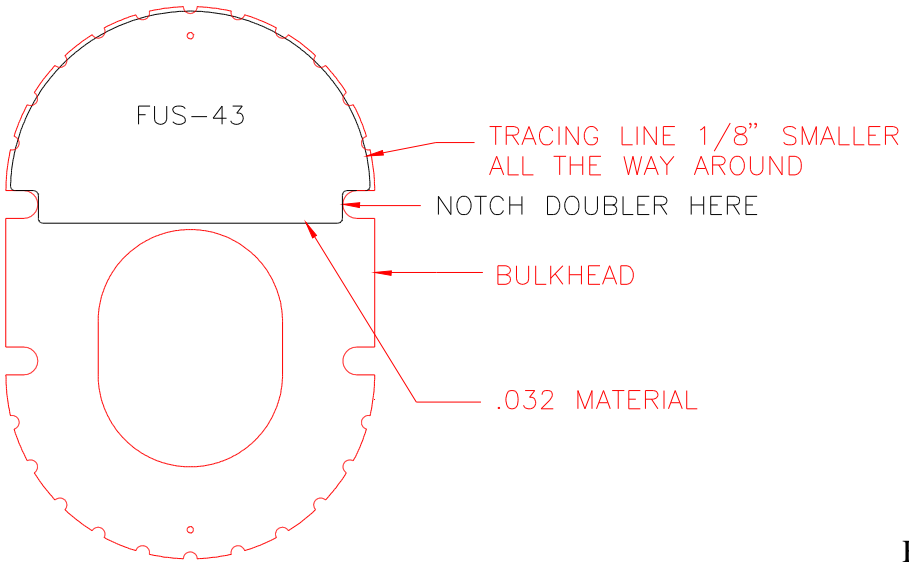



Figure 12.3.4

9) Cut the bulkhead doubler (FUS-43) out 1/8" smaller than the traced line.

10) File the edges smooth. Put aside for future use.

11) Place the bulkhead onto a piece of 1/2" or thicker plywood.

12) Drill through the tooling holes with a #11 bit.

13) Cleco the bulkhead to the piece of plywood.

14) Trace the outline of the bulkhead on to the plywood.

15) Remove the bulkhead from the plywood. Cut out the wood bulkhead 1/8" smaller than the traced line. Figure 12.3.5.

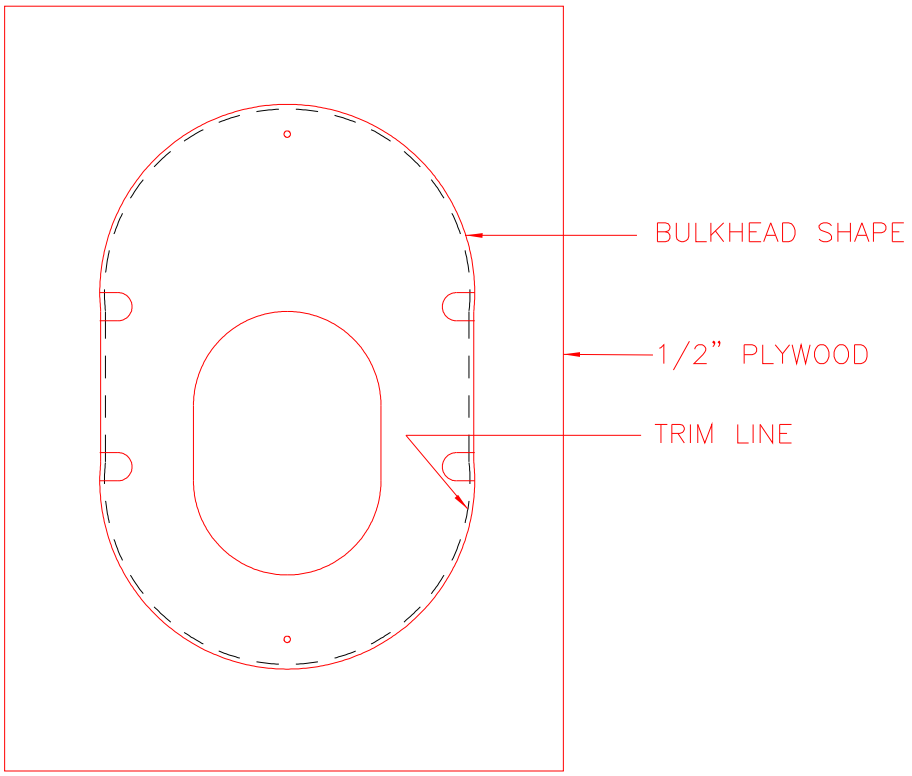



Figure 12.3.5

16) Cleco the bulkhead to the wood bulkhead with flanges outward. **NOTE:** The wood bulkhead will help keep the one piece bulkhead (FUS-36) flat. ENSURE IT REMAINS FLAT.

17) Drill four extra #40 holes through the bulkhead and into the wood bulkhead. Figure 12.3.6.

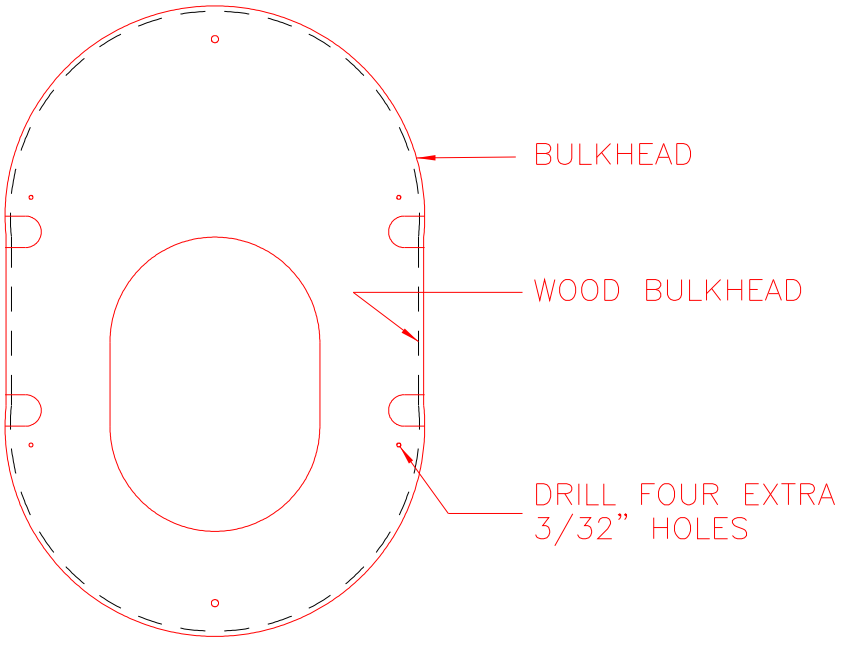



Figure 12.3.6

18) Cleco to insure the flat surface of the bulkhead lies flat against the wood bulkhead.

19) Cleco the bulkhead into the cone assembly and cleco to the sides.

20) Draw a center line down the wood bulkhead using the center line on the table. Figure 12.3.7.

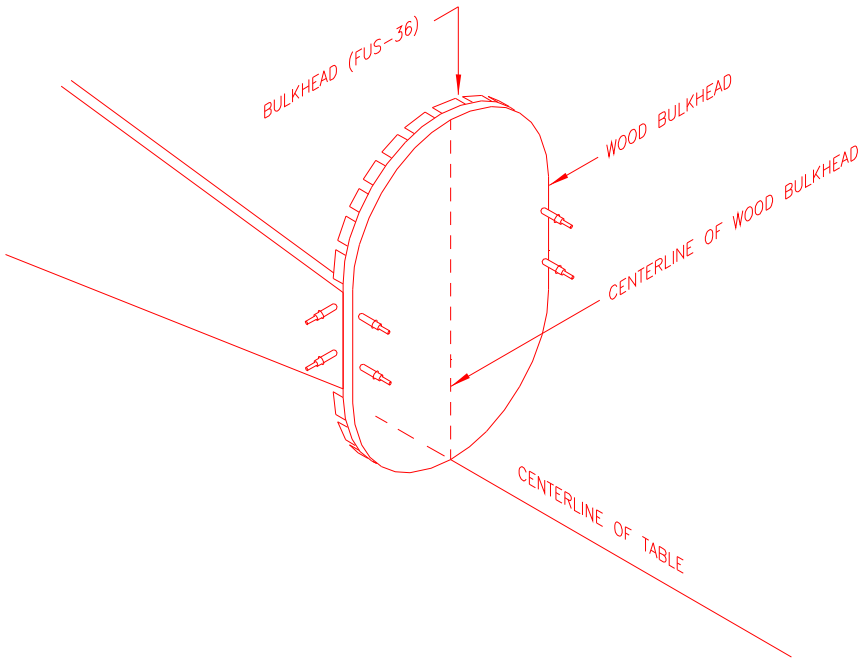



Figure 12.3.7

21) Ensure the center line of the FUS-29 and wood bulkhead line up with the center line on the table.

22) Using the one piece bulkhead as a guide, drill one #40 hole on each side of the centerline of FUS-29. Figure 12.3.8.

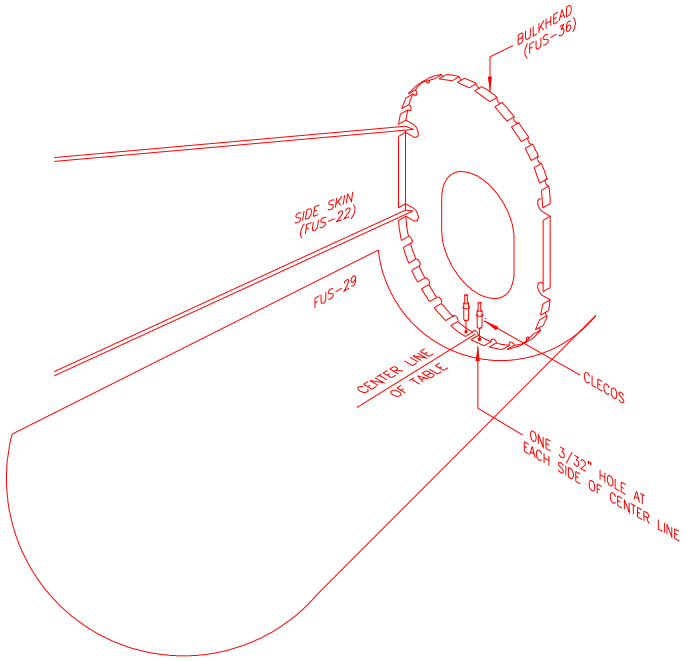



Figure 12.3.8

23) Cleco securely to the table.

24) Attach six or more pieces of tape to each side of FUS-29.

25) Pull up both sides snugly against the side skins (FUS-22-1) and tape in place. **NOTE:** Insure there has been no movement of the centerlines.

26) Drill back through the side skins and bottom corners of bulkhead "E" with a #30 bit. DO NOT drill out the bottom corners of FUS-36.

27) Cleco securely.

28) Follow a similar procedure for the top FUS-29 with the following exceptions:

a) The corners of FUS-36 can be drilled.

b) The assembly can be turned over on its back if preferred

c) You will have to climb into the tail cone and drill outwards.

**IMPORTANT:** When climbing inside the fuselage use plywood or some other means of protecting the skins from damage.

29) After drilling the FUS-29's, trim as required as shown in figure 12.3.9.

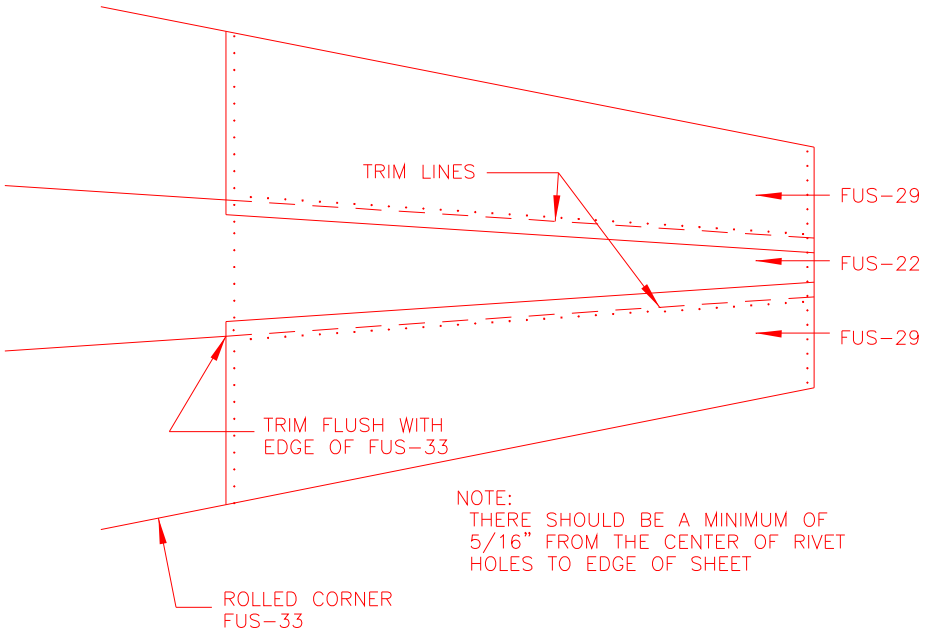



Figure 12.3.9

30) Cleco the tail cone assembly back on the table with the wood bulkhead removed.

31) Draw a line down the inside center of FUS-30. Figure 12.3.10.

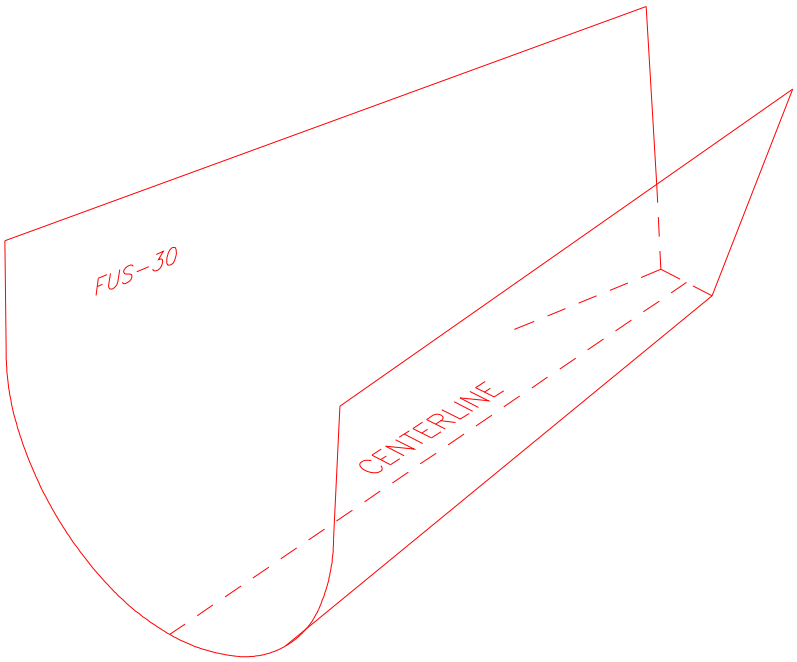



Figure 12.3.10

32) Position the bulkhead doubler (FUS-43) onto the one piece bulkhead. Figure 12.3.11

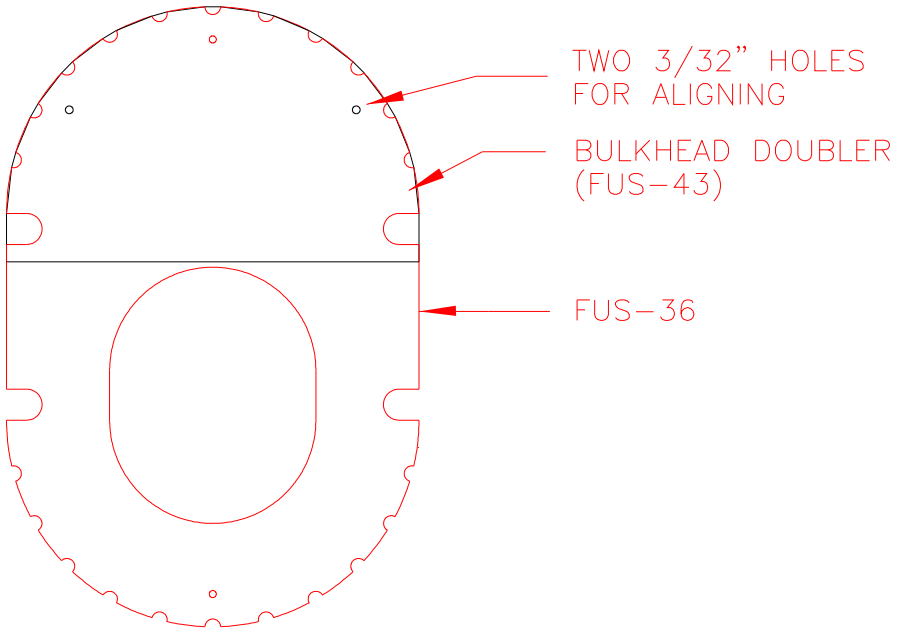



Figure 12.3.11

33) Drill two #40 holes for aligning and cleco in place. Figure 12.3.11.

34) Draw a line 5 5/8" down from the top of FUS-36. Figure 12.3.12.

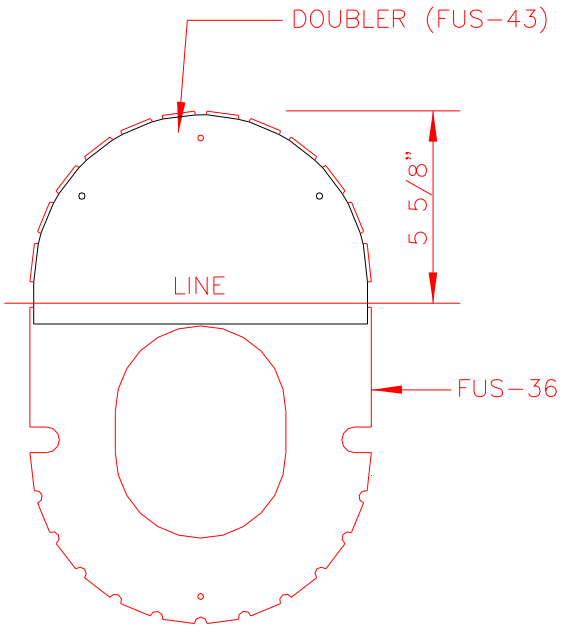



Figure 12.3.12

35) The Horizontal Bulkhead (FUS-31) may need to have an additional slotted hole near the front, not two. It will be easier to add this center hole now. Some parts may already have three slotted holes. Figure 12.3.13.

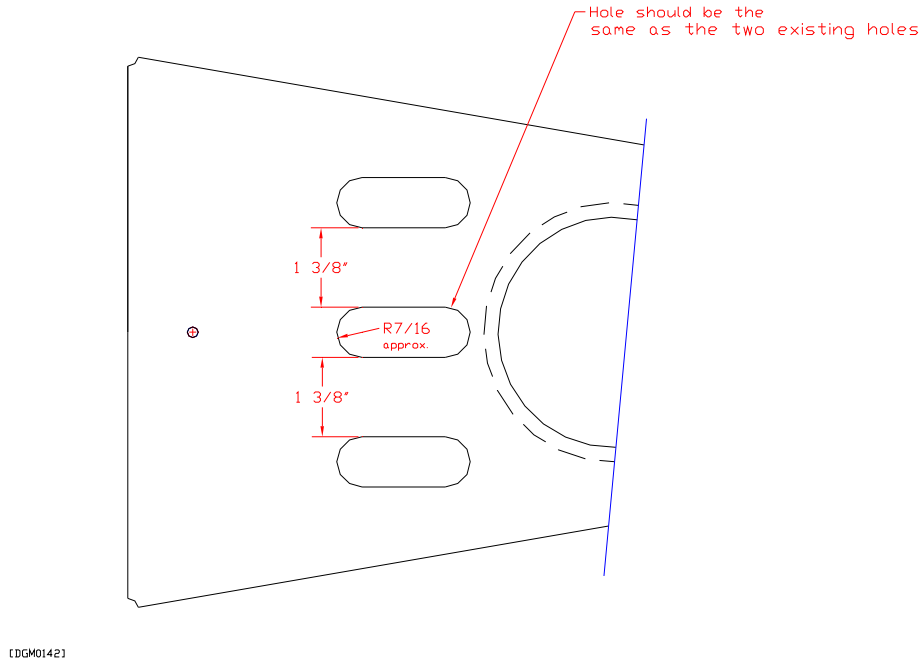
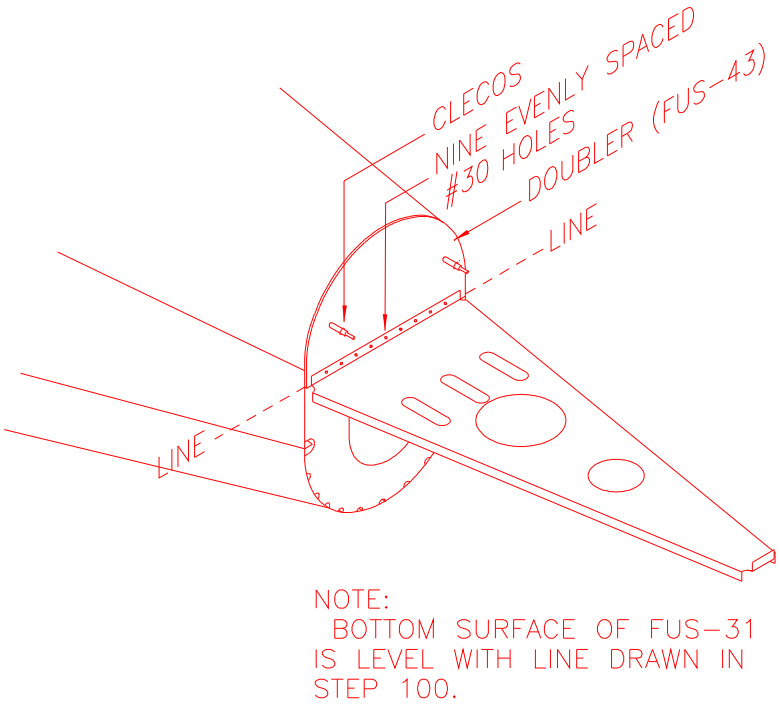



Figure 12.2.13

36) Debur the new opening.

37) Position the horizontal bulkhead (FUS-31) as in Figure 12.3.14.




[DGM0143]

Figure 12.3.14

38) Drill nine equally spaced #30 holes through the horizontal bulkhead flange, bulkhead doubler (FUS-43) and one piece bulkhead (FUS-36). Cleco. Figure 12.3.14

## *12.4 Fin Install.*

1) On the pre-assembled fin, draw a line 8" up from the bottom edge of the fin spar. Figure 12.4.1.

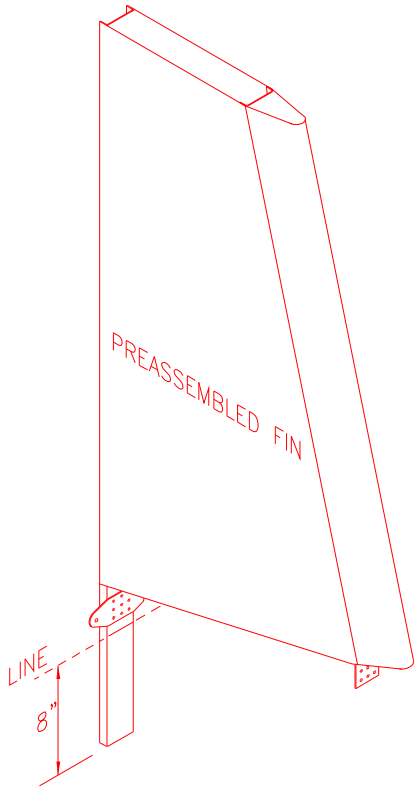



Figure 12.4.1

2) Position the fin with the bottom surface of the horizontal bulkhead (FUS-31) level with the line. Figure 12.4.2.

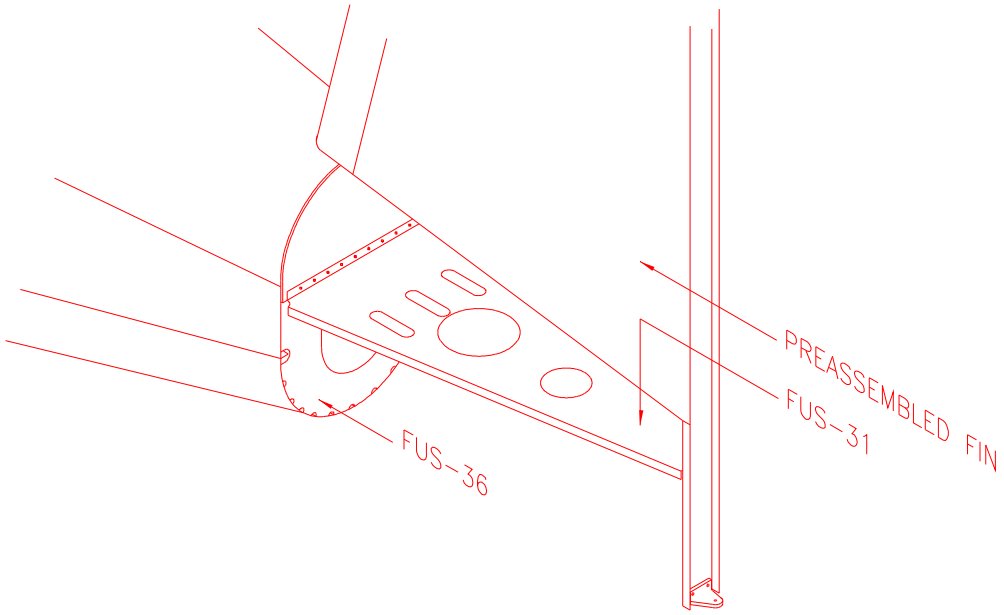



Figure 12.4.2

3) Drill three #30 holes through the horizontal bulkhead flange and fin spar. Cleco.

**NOTE:** Before positioning the front attach fitting for the fin a decision will have to be made on which direction the offset will be. This is entirely dependent on the engine used. If the propeller rotation is counter clockwise as seen from the pilot's seat, the offset must be 3/4" to the right side of the aircraft. A clockwise rotation requires a 3/4" offset to the left. Figure 12.4.3.

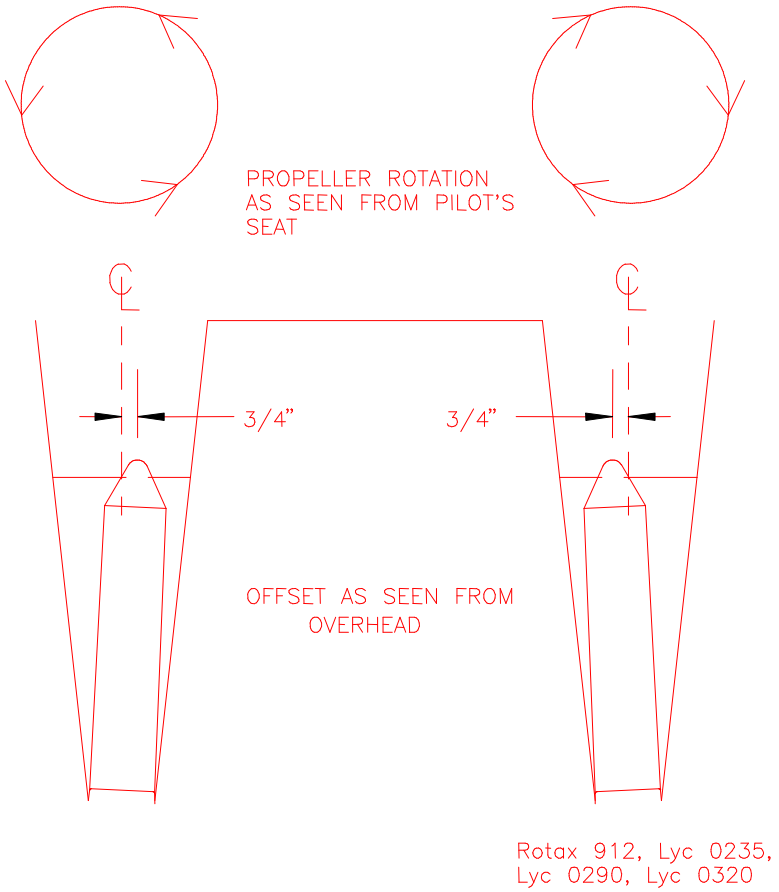



Figure 12.4.3

4) Position the fin with the correct offset.

5) Drill one #30 hole near the top of the front fin attach bracket and cleco in place. Figure 12.4.4.

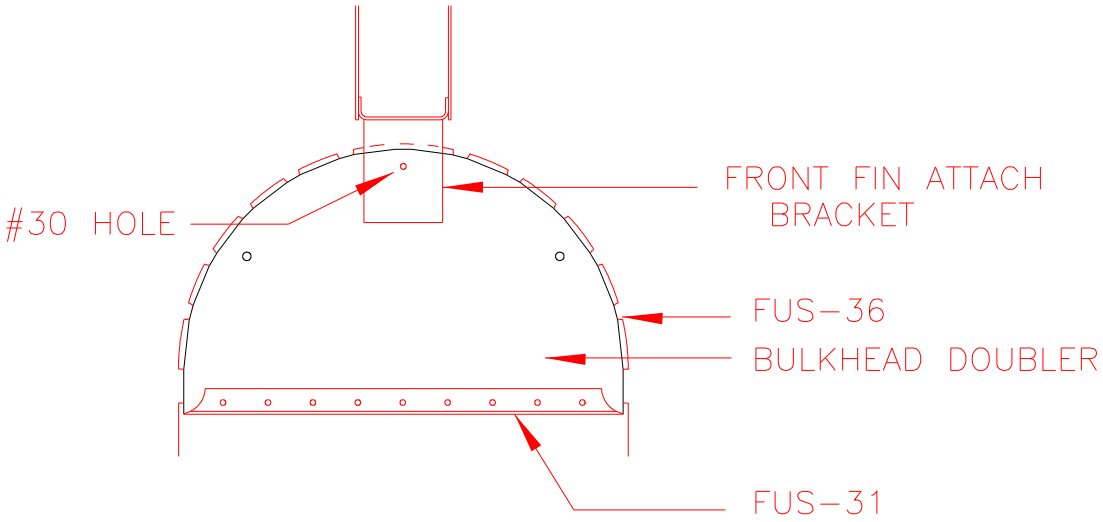



Figure 12.4.4

6) Cut four 1/2" plywood spacers. Slide one under each end of the existing tail cone. Locate the other two where the Tail Wraparound (FUS-30) will be placed. This lifts the entire structure 1/2" off the table.

7) Slide the Tail Wraparound under the fin spar and tail cone assembly.

8) Ensure the centerline on Tail Wraparound aligns with the centerline on the table and the line on the one piece bulkhead (FUS-36). Figure 12.4.5.

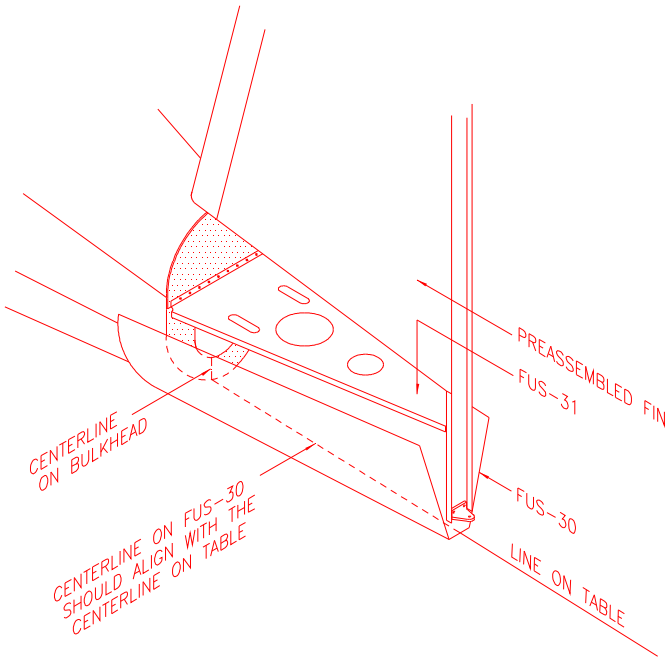



Figure 12.4.5

9) The rear edge of FUS-30 should be flush with the fin spar flange. Figure 12.4.6.

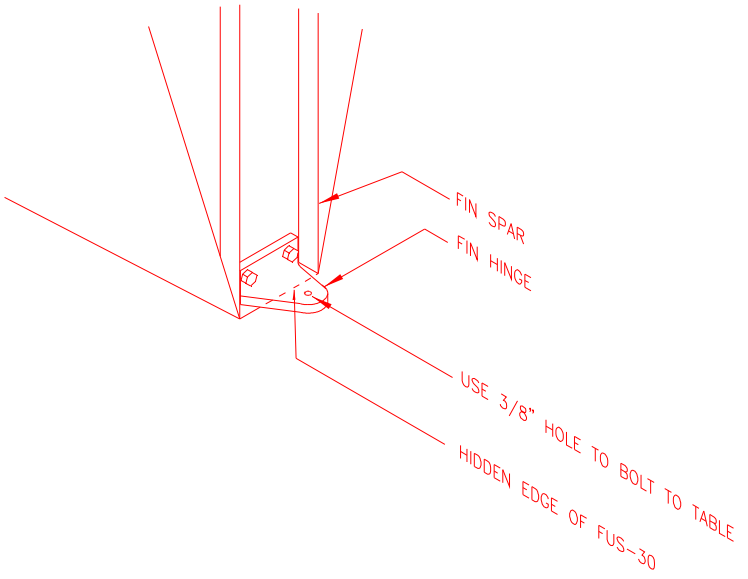



Figure 12.4.6

10) Drill a 3/8" hole through the pivot hole of the bottom fin hinge bracket and into the table on the centerline. Figure 12.4.6.

11) Bolt or pin to the table to ensure it is fixed in position.

12) Attach a number of tape strips to the sides of FUS-30 and pull snugly over the horizontal bulkhead (FUS-31). **NOTE:** Because the sides of FUS-30 are longer than necessary, the tape has a tendency to break on the sharp edge. It is also difficult to get the sides flat. Both of these problems can be solved by placing a block of wood on the FUS-31. Figure 12.4.7.

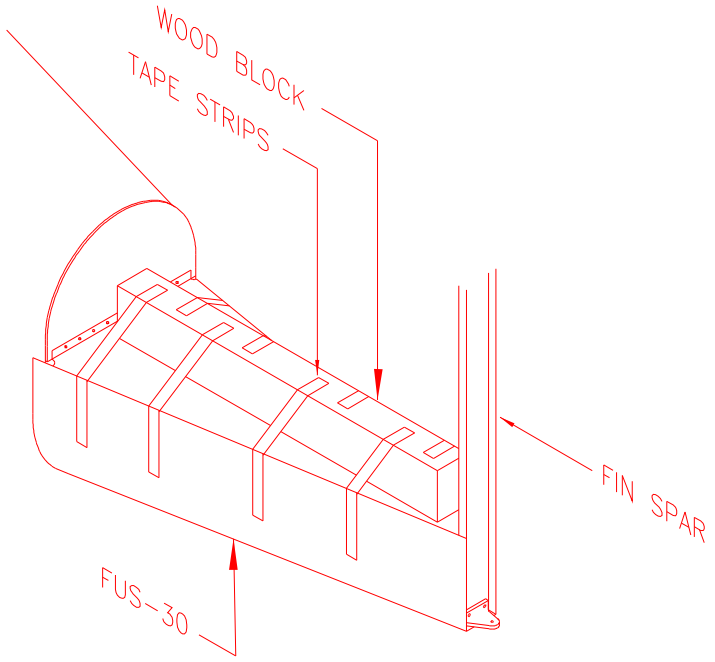



Figure 12.4.7

13) Clamp the two tailspring supports (TS-1) to the fin rear spar so that the top surface of the support tabs is flush with the bottom of the hinge bracket. Figure 12.4.8.

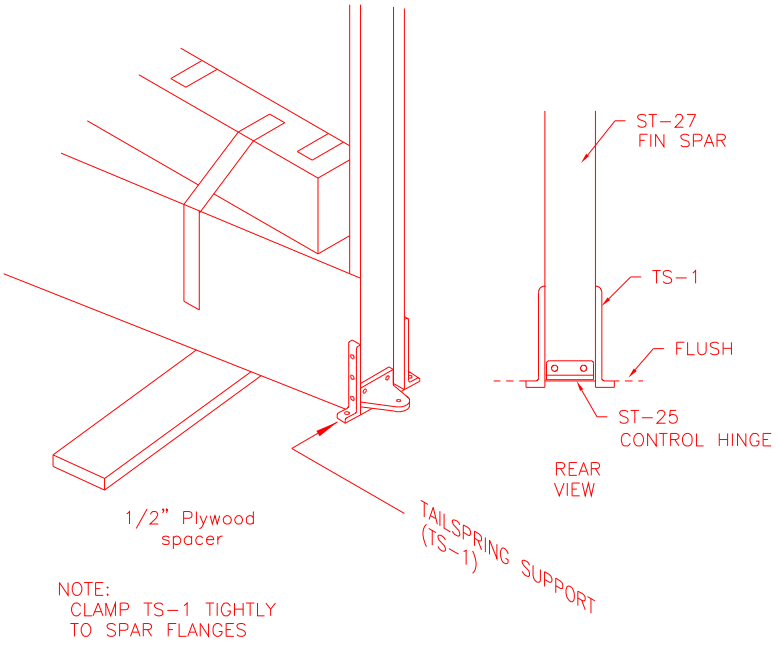



Figure 12.4.8

**NOTE:** Clamp TS-1's tightly to the spar flanges. The rear edge of FUS-30 may stick out past the edge of the fin spar. This will be trimmed later.

14) With a #30 bit, drill out the three holes in each tailspring support (TS-1), FUS-30 and the fin rear spar.

15) Cleco securely.

## *12.5 Tail Wrap Install*

1) Ensure all the edges of FUS-30 are lying flush on the bottom of FUS-36 and on the sides of the horizontal bulkhead (FUS-31).

2) Drill a #30 hole through FUS-30 and into each end of the flange of the Horizontal Bulkhead (FUS-31). Figure 12.5.1

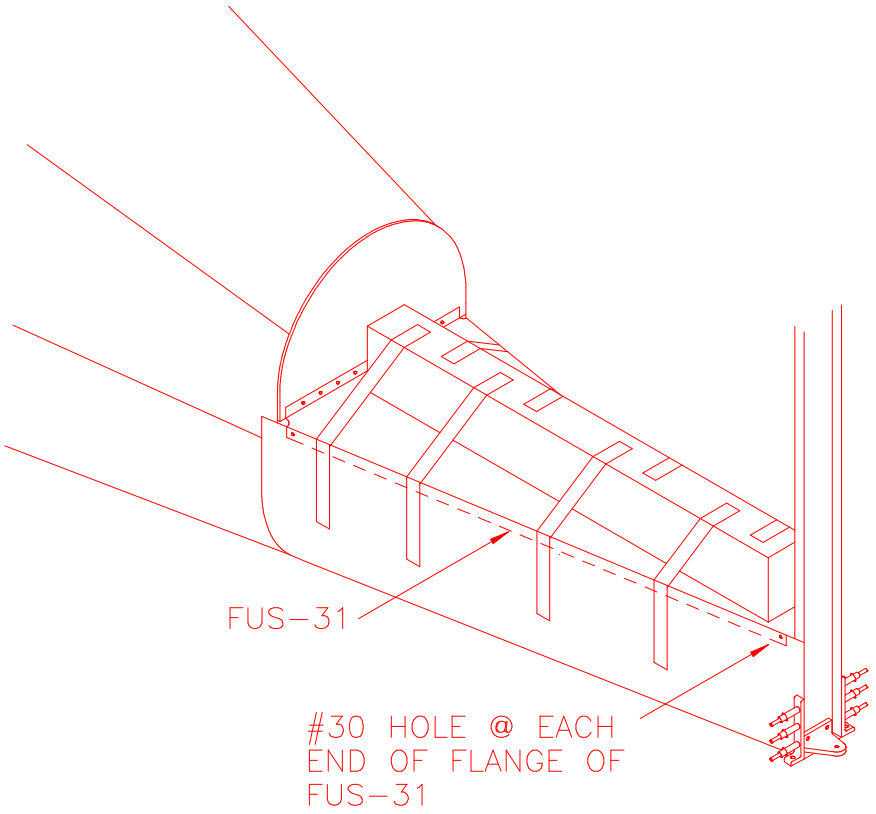



Figure 12.5.1

3) Drill 20 equally spaced #30 holes between the two end holes in each flange.

4) Carefully crawl down the fuselage and drill outwards for the bottom holes in the one piece bulkhead (FUS-36).

5) Run a marking pen along the top surfaces of the horizontal bulkhead to find the top trim line of Tail Wrap (FUS-30).

6) Run a marking pen along the edge of the fin post for the rear trim lines.

7) Remove the Tail Wrap (FUS-30) and trim.

8) Trim the front of the Tail Wrap (FUS-30) 5/16" from the center of the holes forward.

9) Replace the Tail Wrap (FUS-30).

10) Cut out two gusset plates as in figure 12.5.2.

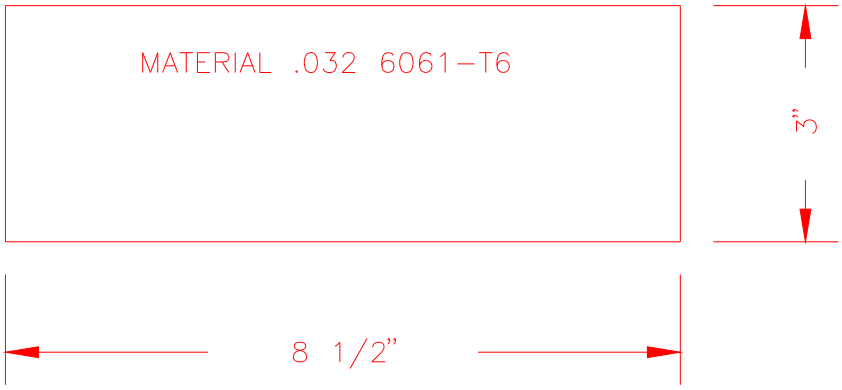



Figure 12.5.2

11) Place one gusset plate on the left side as in Figure 12.5.3.

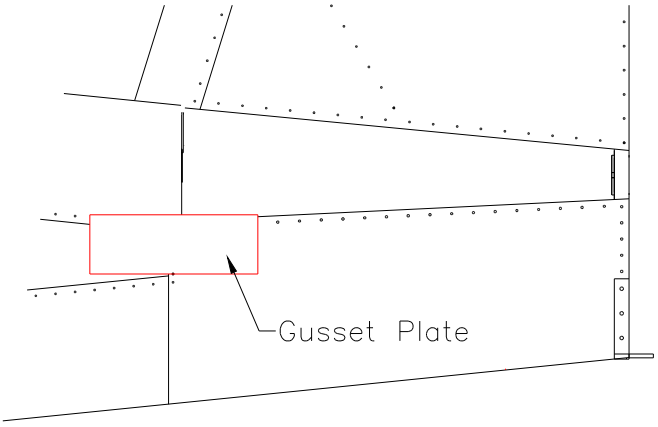



Figure 12.5.3

12) With the right side of the Tail Wrap (FUS-30) removed, drill back into the gusset plate as in figure 12.5.4.

**NOTE:** If someone is not available to hold the gusset for drilling, tape it to the fuselage. Another way to accomplish this is to make a piece of lexan the same size as the gusset. Drill the holes on the lexan and transfer them to the gusset.

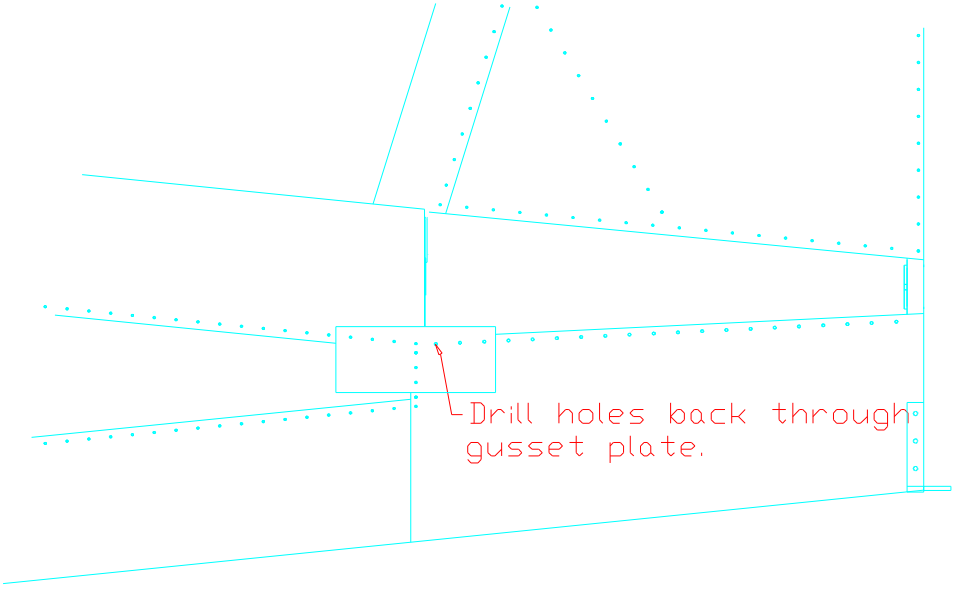



Figure 12.5.4

13) Remove the gusset plate.

14) Layout the gusset plate as in Figure 12.5.5.

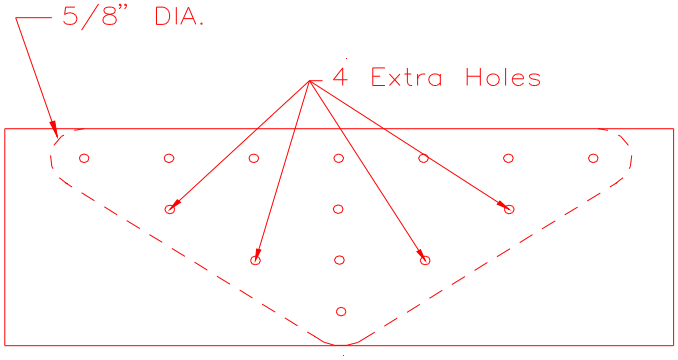



Figure 12.5.5

15) Trim the gusset and put aside for now.

16) Find a Tail Wrap Stiffener (FUS-89).

17) Nest the FUS-89 behind the Side Skin (FUS-22-1) (flanges face inward) and slide toward the rear of the aircraft until it fits snug inside the side skin and the flanges fit in the slots on the One piece Bulkhead. With a felt pen mark top and bottom gusset holes on FUS-89 through the holes in the side skin. Figure 12.5.6. Remove part.

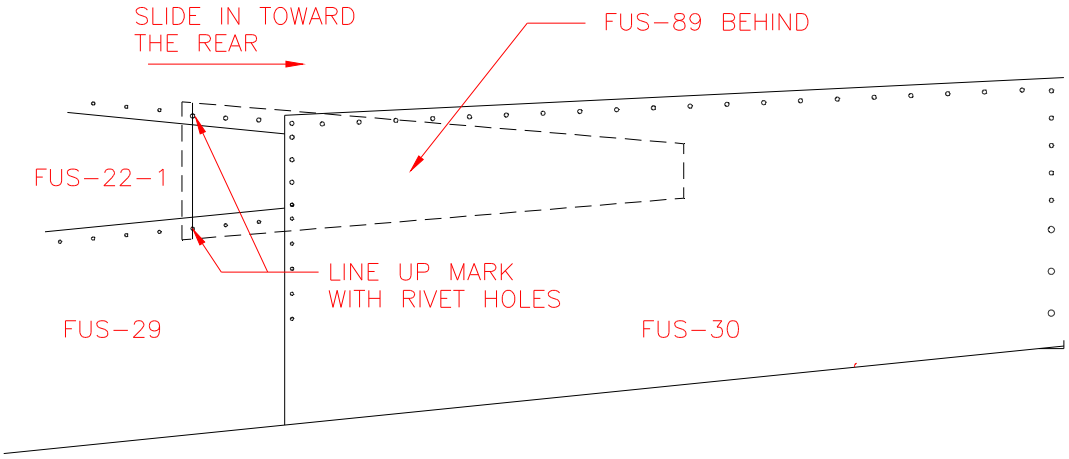



Figure 12.5.6

18) Ensuring proper edge distance, mark a line between the two holes you just marked on FUS-89. Also make sure that the two holes you have marked have proper edge distance top and bottom. See Figure 12.5.7.

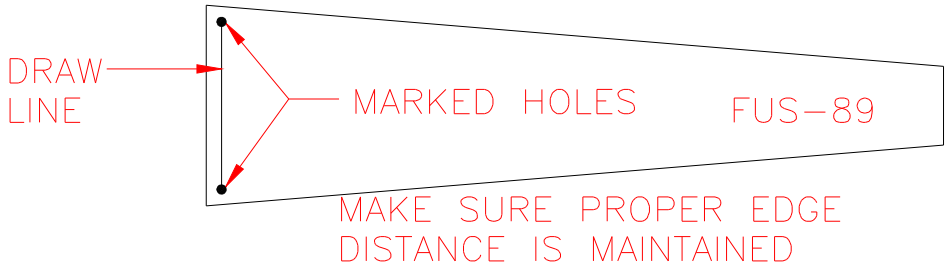



Figure 12.5.7

19) Replace the FUS-89 so that you can see the line you just marked through the top first hole on the FUS-29. Figure 12.5.8.

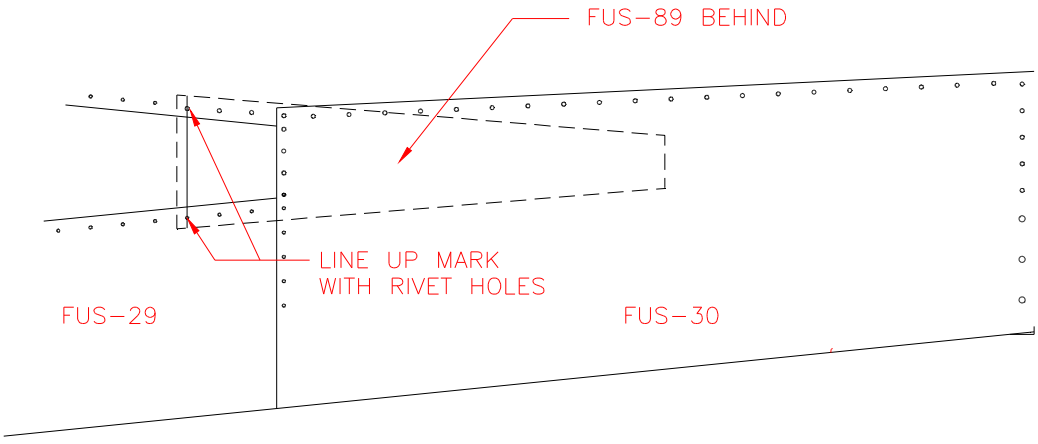



Figure 12.5.8

20) Drill #30 through FUS-89. Cleco. Drill #30 the bottom hole through and cleco. Figure 12.5.8.

21) Drill #30 and cleco all rivet holes that you can see FUS-89 through. Next, follow the line of bottom rivets on FUS-29, mark a line on the Tailwrap FUS-30. Figure 12.5.9.

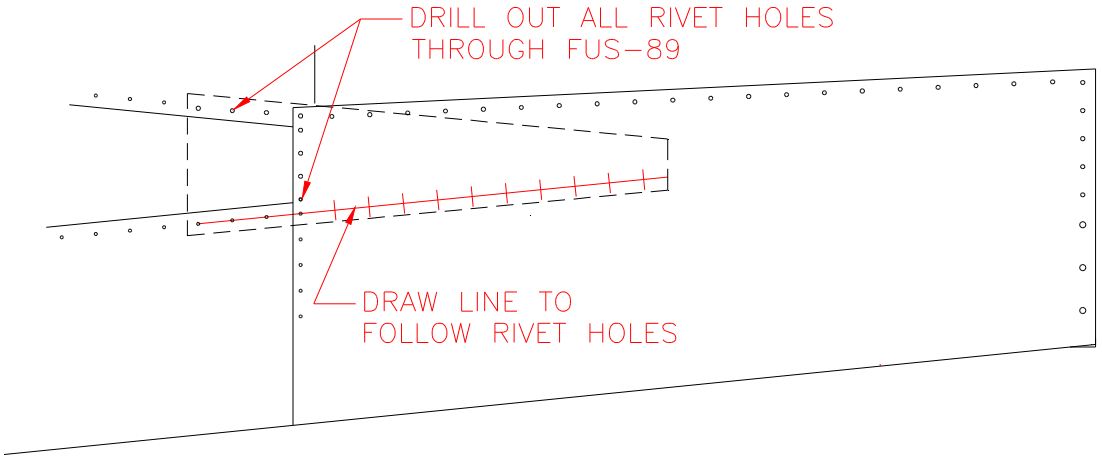



Figure 12.5.9

22) Mark out a 1" nominal rivet pattern to the end of the FUS-89 and drill #30. Cleco as you go. Figure 12.5.9

23) Following the top line of rivets on FUS-29, mark a line along the aircraft. Layout a 1" nominal rivet pattern to the end of FUS-89. Drill #30 and cleco as you go. Figure 12.5.10.

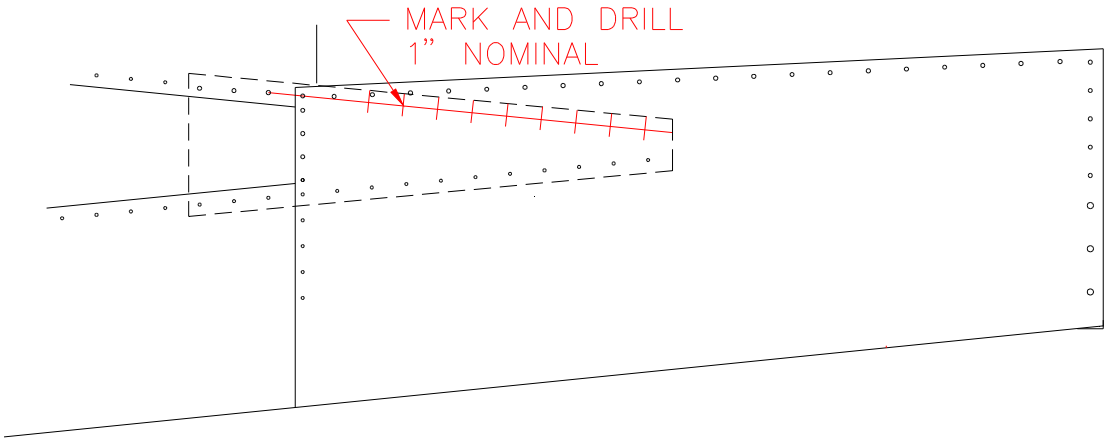



Figure 12.5.10

24) Layout and drill #30 two evenly spaced holes between the front top rivet hole and the bottom hole on the FUS-29's. Figure 12.5.11.

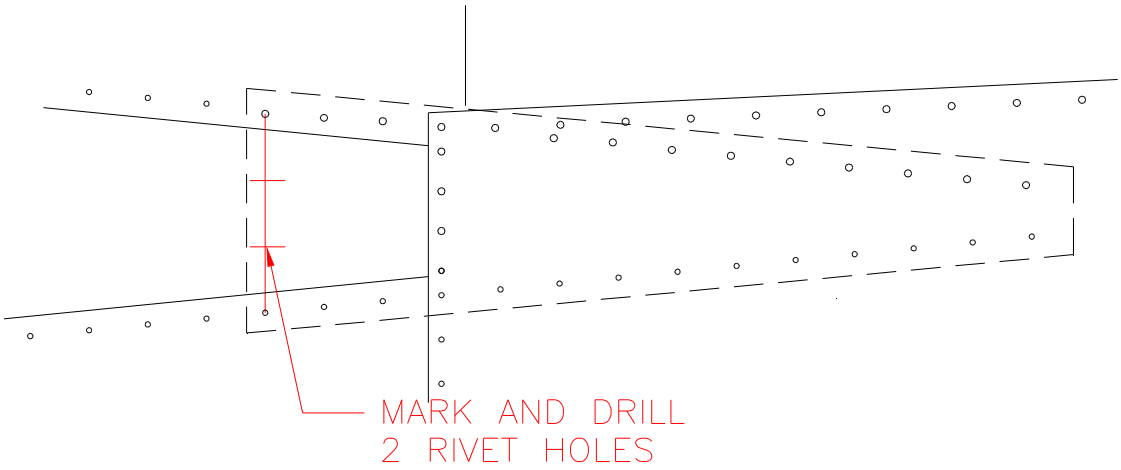



Figure 12.5.11

25) Remove FUS-89 and debur all holes. Replace and cleco.

26) Repeat steps for the opposite side of the aircraft.

27) Reinstall gussets and drill the two extra holes. Repeat for the other side.

28) For a better fairing fit, dimple the holes indicated in figure 12.5.12.

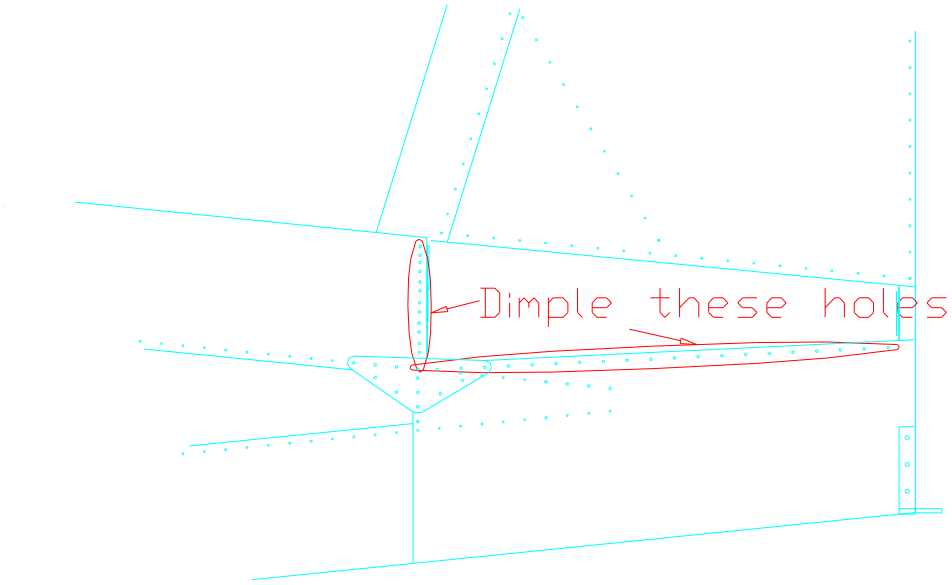



Figure 12.5.12

29) Drill five #30 holes through the Tail Wrap (FUS-30) and fin spar on each side. Figure 12.5.13.

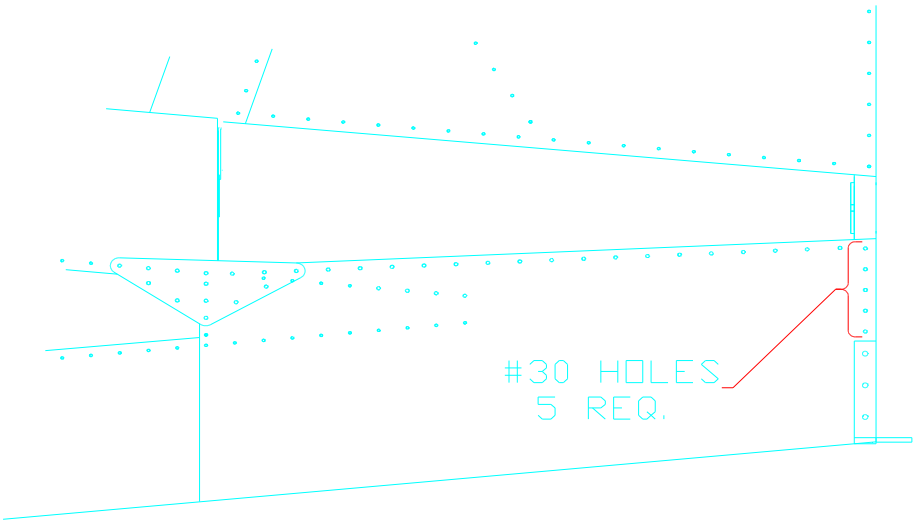



Figure 12.5.13

## *12.6 Tailspring Anchor*

1) Remove the Horizontal Bulkhead (FUS-31).

2) Clamp a straight edge to each side of the Tail Wrap (FUS-30). Figure 12.6.1.

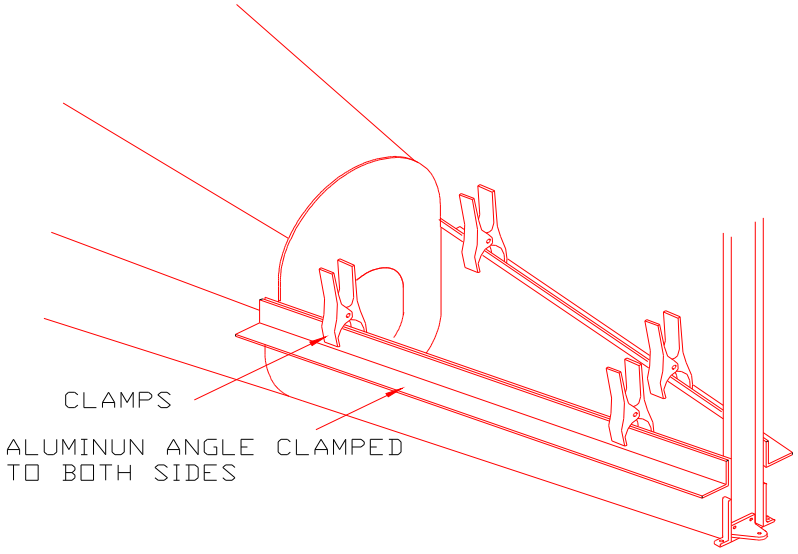



Figure 12.6.1

3) Place the Tailspring Support Bulkhead (FUS-49) in place as in figure 12.6.2.

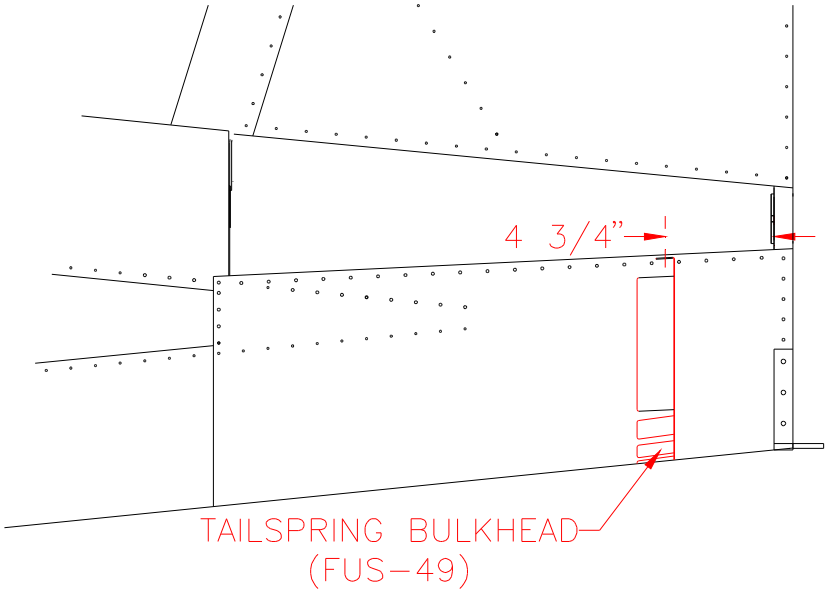



Figure 12.6.2

4) Ensure the bulkhead flanges sit flush on the sides and bottom of the Tail Wrap (FUS-30)

5) Drill two rows of #30 holes through the Tail Wrap (FUS-30) and Tailspring Bulkhead (FUS-49). Figure 12.6.3.

**NOTE:** Do not drill the bottom tab where the tailspring bolt will go.

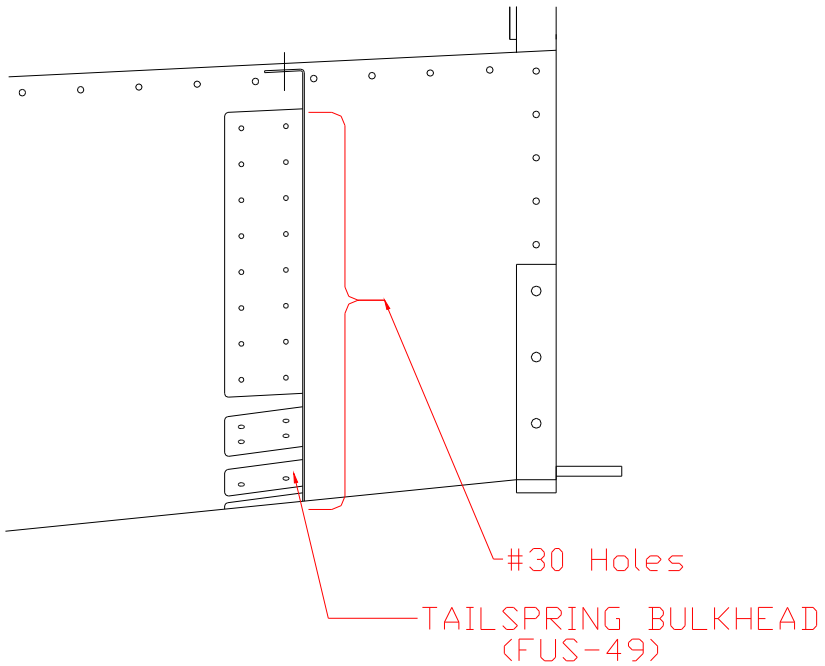


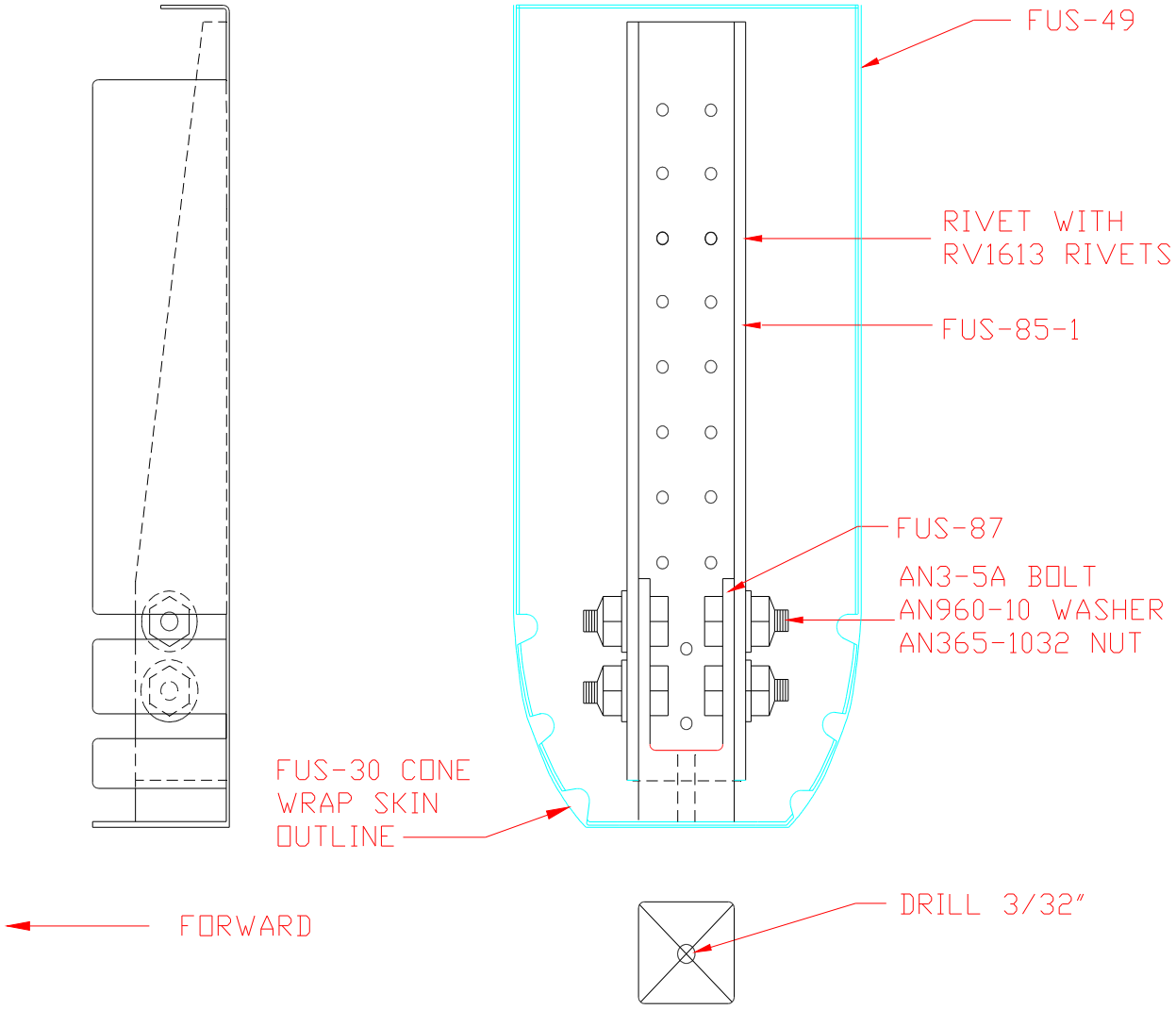

Figure 12.6.3

6) Locate the Tailspring Anchor (FUS-85-1) on the forward side of the Tailspring Bulkhead (FUS-49) and the center line of the bulkhead. Slide the fitting down the bulkhead until it touches the bottom of the fuselage.

7) Mark the location of the anchor onto the bulkhead. Clamp the anchor onto the bulkhead, leaving about 1/32" clearance to the fuselage bottom. Drill #40 and cleco in place.

8) Fit the Tailspring Anchor Fitting (FUS-87) into FUS-85. Slide it down to the bottom of the fuselage. It is important that this part be shaped to fit the bottom of the fuselage. You will have to fit and shape by sanding until you have a snug fit into both FUS-85-1 and the fuselage bottom. Figure 12.6.4.

Figure 12.6.4




9) Drill a #40 hole in the bottom center of FUS-87. Fit FUS-87 back into fuselage. Clamp FUS-87 to FUS-85. Drill through the bottom fitting into the fuselage bottom. Drill out holes in FUS-85 to FUS-49 to #11. Take out the clecos and remove FUS-85 as one unit.

10) Drill and cleco FUS-87 and FUS-85 together through the four pilot holes provided. Open all four holes up to 3/16" and debur. Bolt together with AN3-5A bolts with washers and AN365-1032 fiber nuts. The heads of the bolts are inside and the nuts are outside.

11) Rivet the FUS-85-1 and FUS-87 assembly to the Tailspring Bulkhead (FUS-49) with 3/16" rivets (RV-1613).

12) A 1/8" packer will be necessary to take up the space between Tailspring Bulkhead (FUS-49) and the Horizontal Bulkhead (FUS-31).

13) The packer should be the same size as the top flange. Make from FUS-57 stock material.

14) Tape the packer in place. Replace FUS-31 and drill 4 #30 holes through the horizontal bulkhead, packer and Tailspring Bulkhead.

15) Remove the Horizontal Bulkhead (FUS-31) and packer. Debur all parts.

16) Rivet the Tailspring Bulkhead (FUS-49) with 1/8" rivets (RV-1410).

## *12.7 Fin Attach Bracket*

1) Drill nine #11 holes into the front fin attach bracket and bulkhead (FUS-36). Figure 12.7.1.

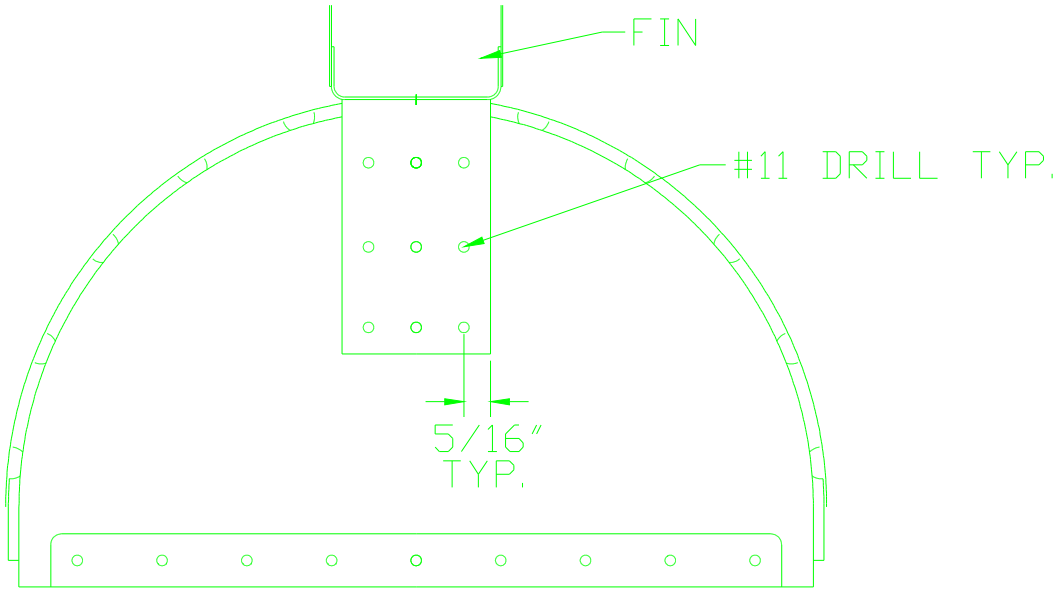



Figure 12.7.1

2) Drill a row of #30 holes around the perimeter of the bulkhead doubler. Figure 12.7.2.

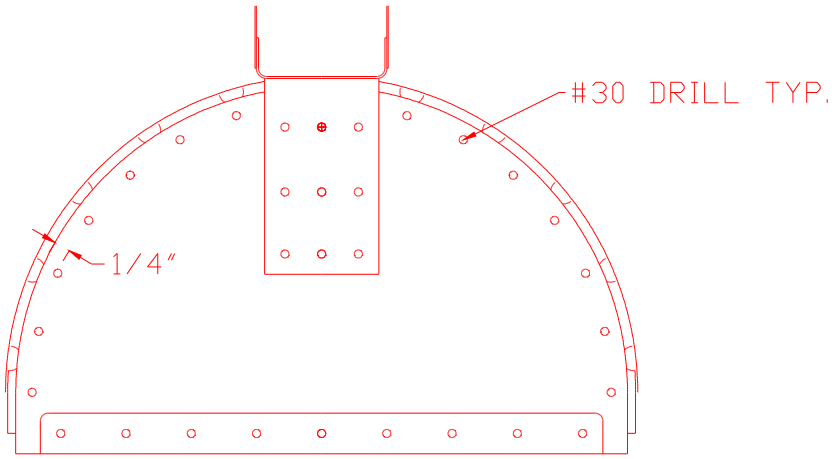



Figure 12.7.2

4) Dimple all the holes that are between the lines in Figure 12.7.3. The stabilizer halves will be mounted between these lines.

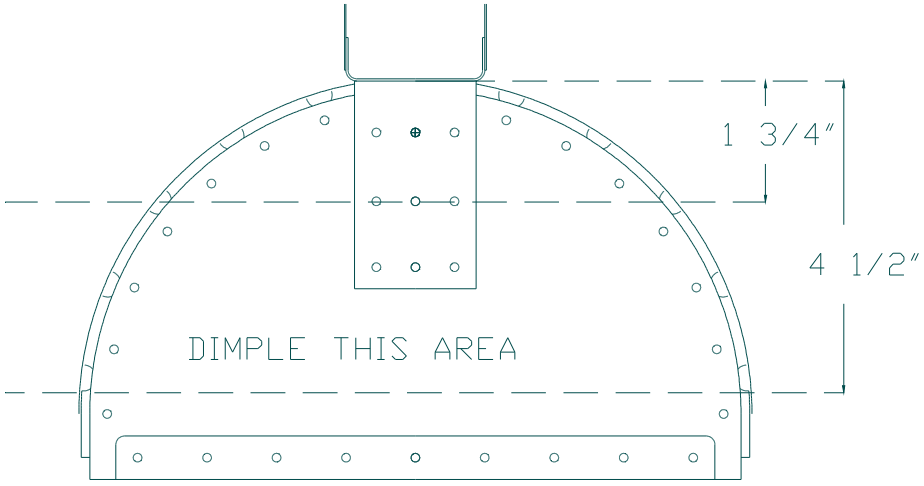



Figure 12.7.3

4) Disassemble from FUS-36 Bulkhead back. Debur all holes and edges.

5) Chromate all mating surfaces.

6) Rivet and bolt together:

   a. In #30 holes use 1/8" (RV-1410) rivets.

   b. In dimpled holes, use 1/8" CS (RV-1412) rivets.

   c. In the fin front attach bracket use nine 3/16" (RV-1613) rivets.

   d. Use six AN3-6A bolts to attach the two tailspring supports (TS-1).

## *12.8 Forward Fuselage*

1) At one end of the Bottom Skin (FUS-39), mark a line between the two end holes. Figure 12.8.1.

**NOTE:** The pre-drilled holes run along the sides. There is no front or back to this part.

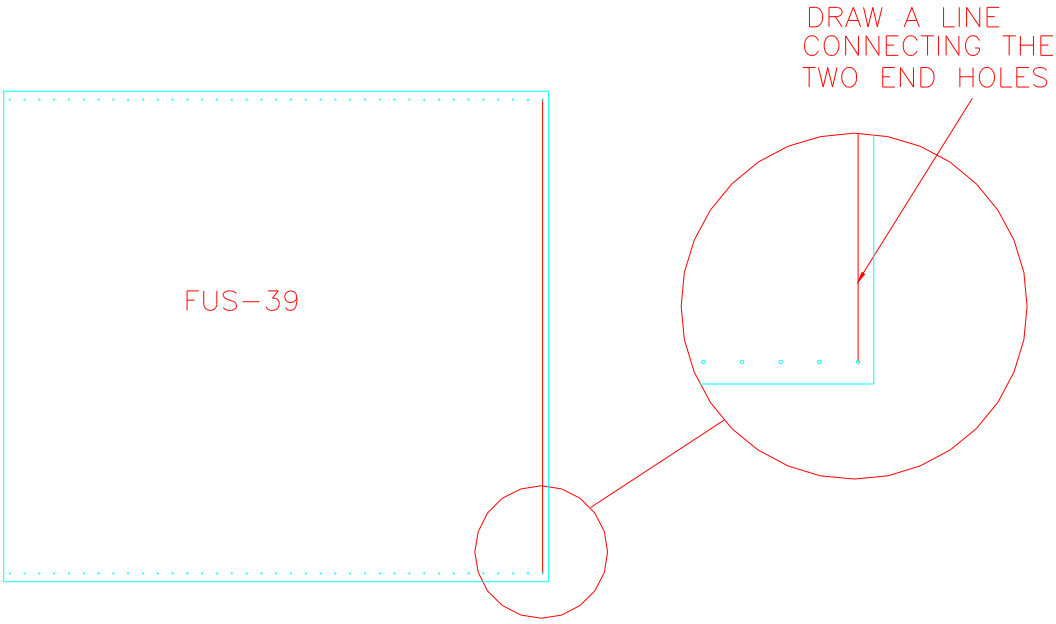



Figure 12.8.1

2) Slide and center the Bottom Skin (FUS-39) under bulkhead "A" and Bottom Tail Cone Skin (FUS-23) so that the line can be seen through the outer two holes in the bulkhead. Drill two holes with a #40 drill and cleco bulkhead "A", Bottom Cone Skin (FUS-23) and Bottom Skin (FUS-39) together. Figure 12.8.2.

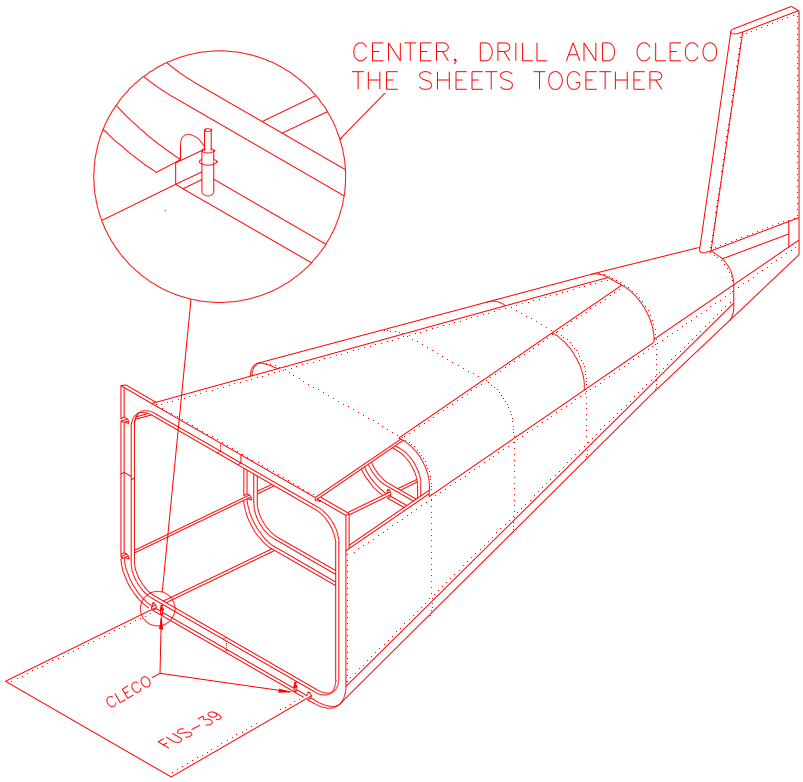



Figure 12.8.2

3) Cleco the Left and Right Fuselage Panels (FUS-24) in place. Figure 12.8.3.

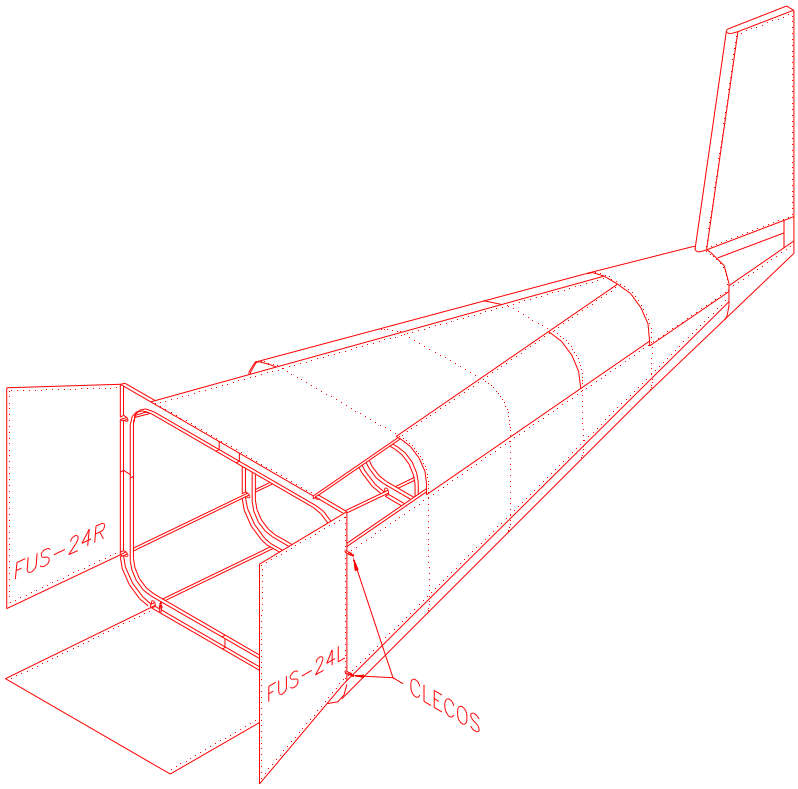



Figure 12.8.3

4) Assemble two round bulkhead sections so that their outside measurement is 44". Figure 12.8.4.

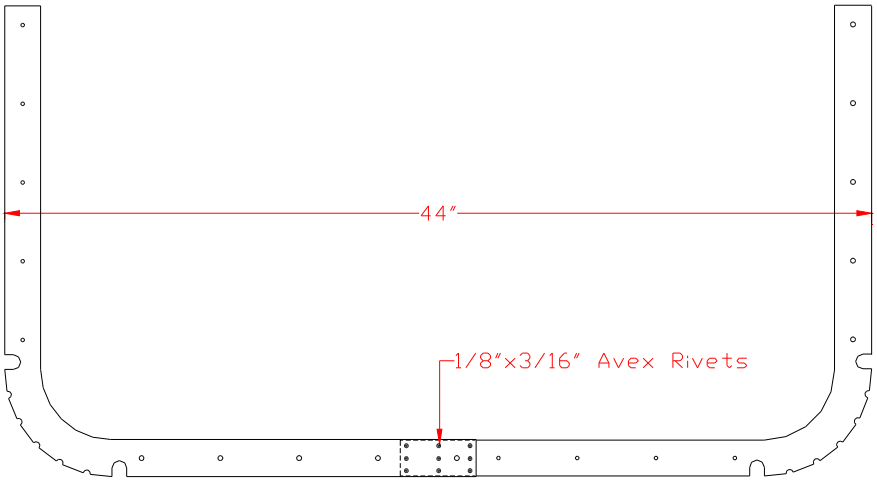



Figure 12.8.4

5) Assemble two square bulkhead section so that the out side dimension is 44". Figure 12.8.5.

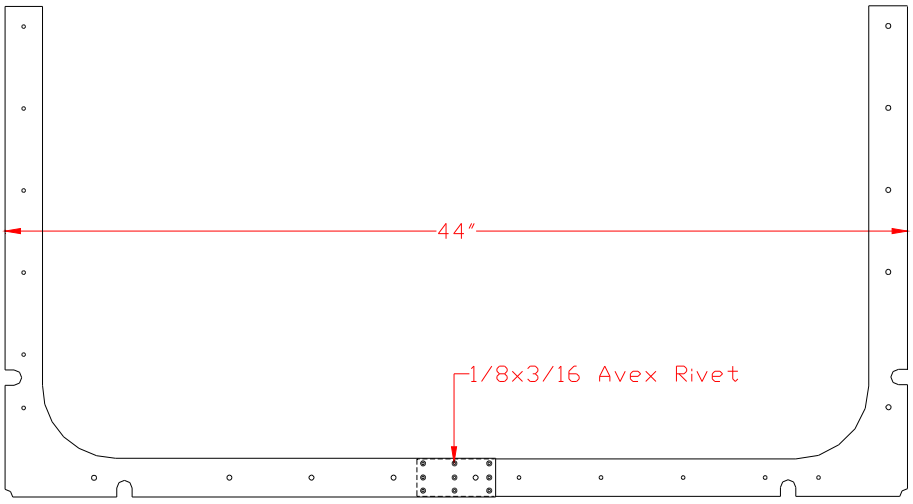



Figure 12.8.5

6) Cleco the two round bulkhead and the two square bulkheads to the Fuselage Panels (FUS-24) as in Figure 12.8.6.

**NOTE:** The bulkhead sections at this station have the flanges facing backwards. Call this bulkhead "F".

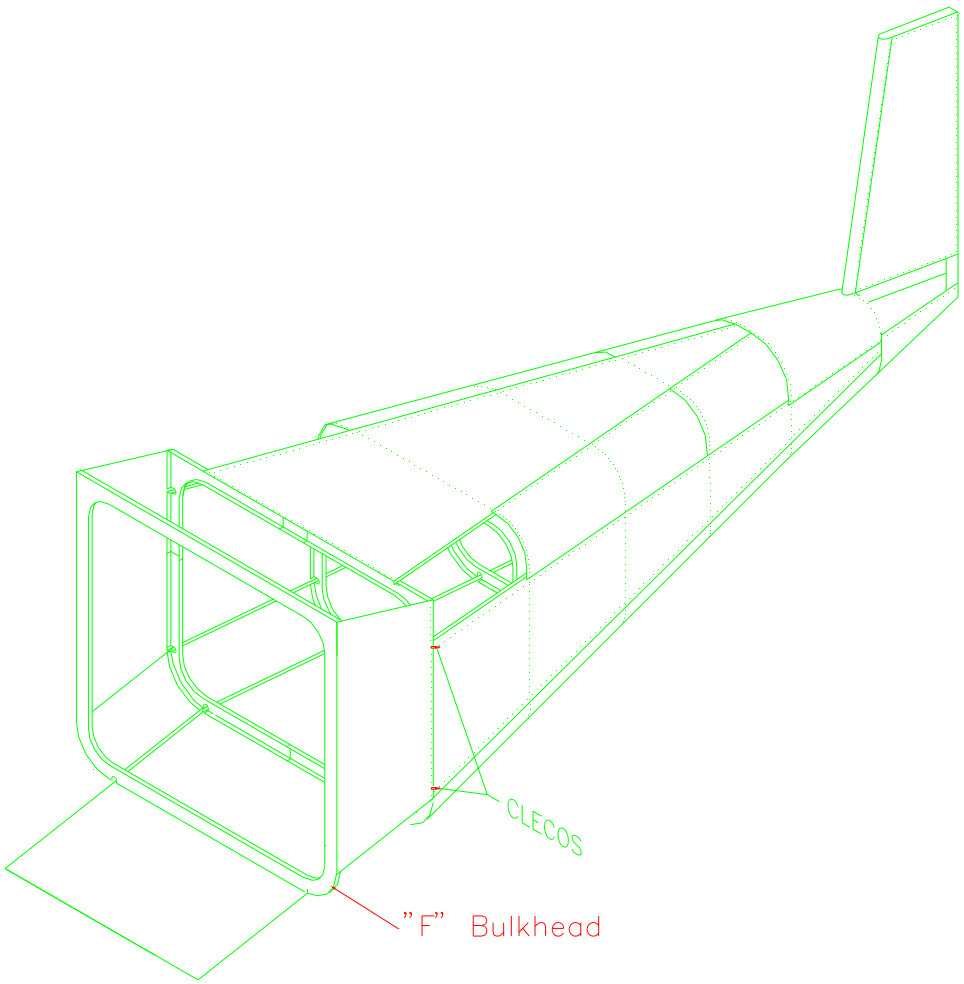



Figure 12.8.6

7) Find and mark the center of the overlapping sections on the bottom and sides.

8) Trim the side legs so there is approximately 4" overlap.

9) Cut four reinforcing angles (FUS-53) from ST-40. Figure 12.8.7.

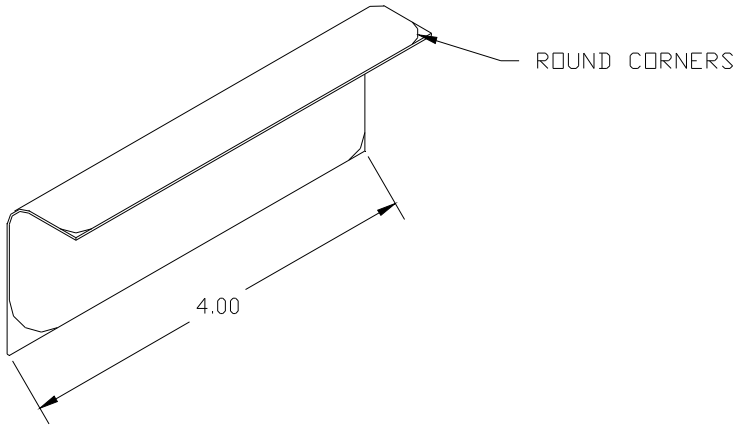



Figure 12.8.7

10) Position one reinforcing angle on each end of the top flange of the square bulkhead. Drill #30 holes as in Figure 12.8.8. **NOTE:** Save the other two angles for later on.

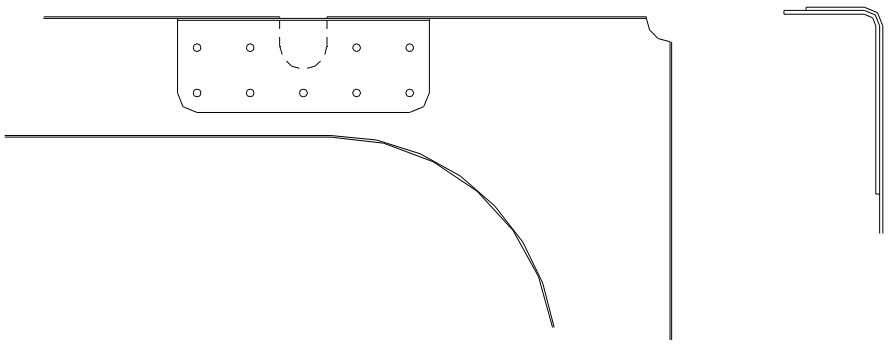


Figure 12.8.8

11) Chromate the mating surfaces and rivet in place with 1/8" rivets.

12) Draw a line on the center of the flanges on the bulkhead. Cleco the bulkhead onto Fuselage Panels (FUS-24).

13) Place the 1/2" plywood bulkheads that you made earlier onto the lower corners of bulkhead "F". Center bulkhead "F" on FUS-39 and drill the two outer #40 holes. Cleco.

14) Cleco a Panel (FUS-25) to each side. Figure 12.8.9.

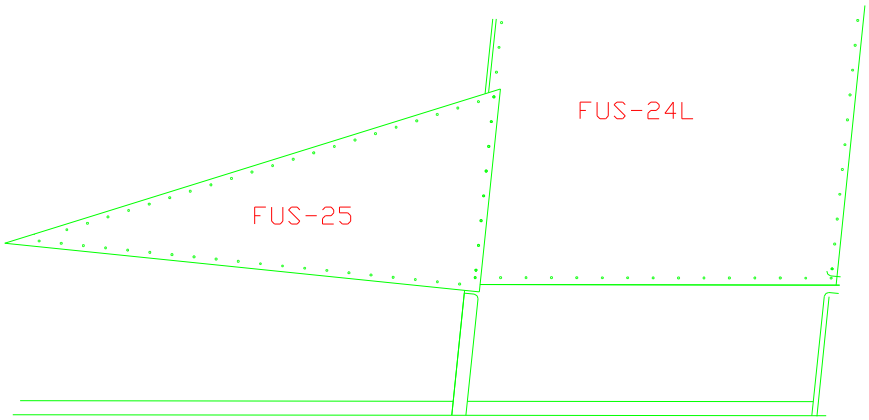



Figure 12.8.9

15) Drill the sides of bulkheads "F" and "A" to #30. Drill out the top section of "A" to #40.

16) Turn the fuselage on its side. Draw a line connecting the two holes from bulkhead "F". Mark a hole pattern of approximately 1". Drill bulkhead "A" and "F" with a #30.

17) Disassemble and debur all holes and edges. Chromate the mating surfaces.

18) Rivet the two FUS-24's, FUS-25's and the bulkheads together with 1/8" rivets (RV-1410).

**NOTE:** Do not rivet the corner areas of the bulkheads where the rolled corners will be installed later.

**NOTE:** If you are going to install the spring gear refer to Chapter 16 to see when you need to install the gear. Follow the next section carefully. If you are going to install the spring gear do not cut the carrythroughs in half.

## *12.9 Cage Assembly*

1) Cut into two pieces one Bottom Carrythrough (FUS-5) as in Figure 12.9.1.

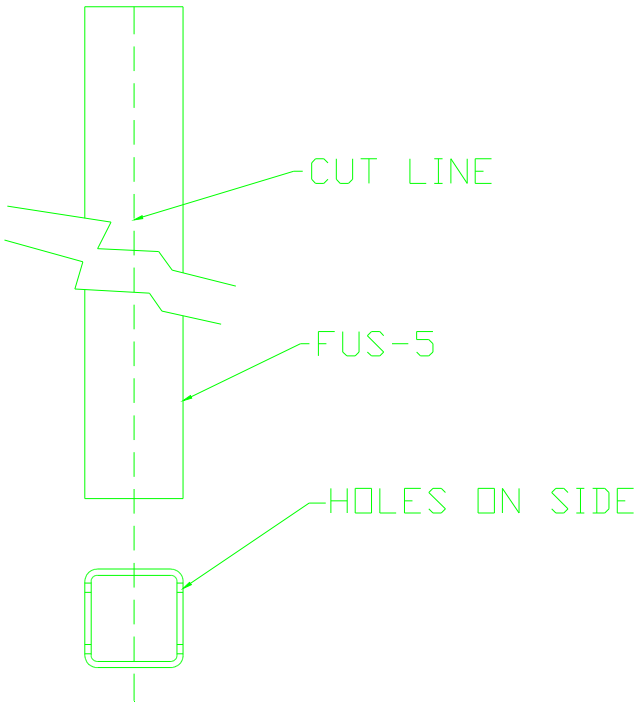



Figure 12.9.1

**NOTE:** FUS-5 can be cut into two parts using a bandsaw, table saw or radial arm saw.

2) File or sand the cut edges smooth.

3) Trim the ends of both half sections of the Bottom Carrythrough (FUS-5) as in Figure 12.9.2.

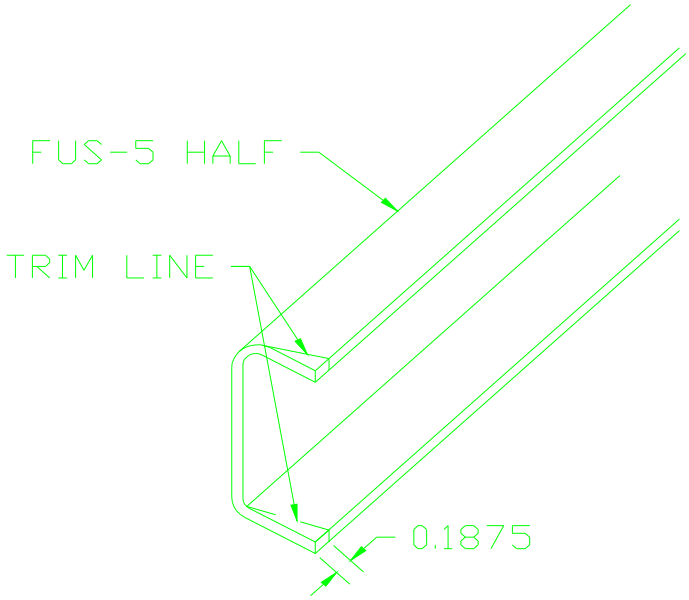



Figure 12.9.2

5) If installing spring gear, the forward FUS-5 will need trimming as in Figure 12.9.4., now or during corner wrap installation.

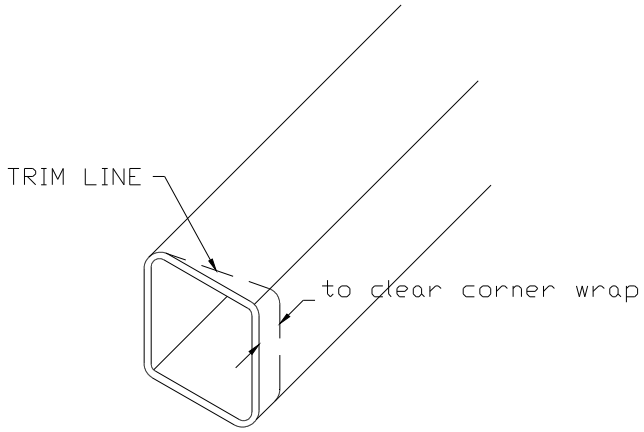



Figure 12.9.4

5) To the Bottom Carrythroughs (FUS-5), cleco and bolt a Bottom Carrythrough Gusset (FUS-2) to each end. Figure 12.9.4.

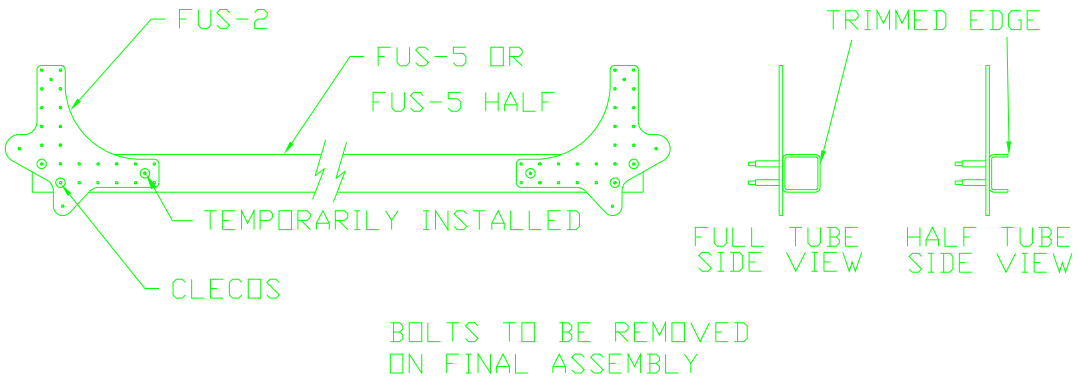



Figure 12.9.4

6) Drill out all remaining #30 holes through the Bottom Carrythrough Gussets (FUS-2) into the Bottom Carrythrough (FUS-5) to #11.

7) Countersink the four holes shown in Figure 12.9.5 for 3/16" CS rivets (RV-4621). Figure 12.9.5.

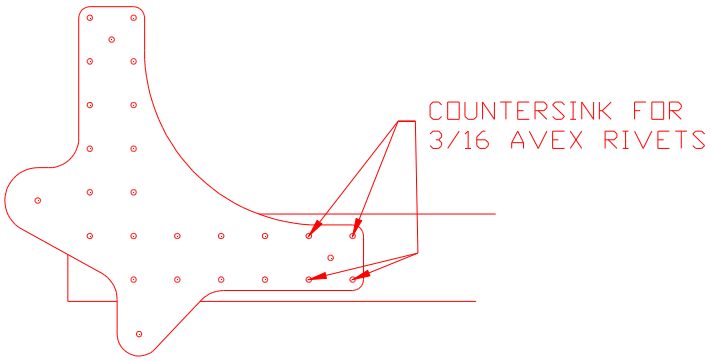



Figure 12.9.5

8) Disassemble.

9) Cleco and bolt the Fuselage Uprights (FUS-4) to the Bottom Carrythrough Gussets (FUS-2). Figure 12.9.6.




Figure 12.9.6

10) Drill all remaining #30 holes through the Bottom Carrythrough Gusset (FUS-2) into the Fuselage Uprights (FUS-4).

11) Debur all edges and holes.

12) Chromate mating surfaces and rivet the Bottom Carrythroughs (FUS-5) to the Bottom Carrythrough Gussets (FUS-2) as in Figure 12.9.7.

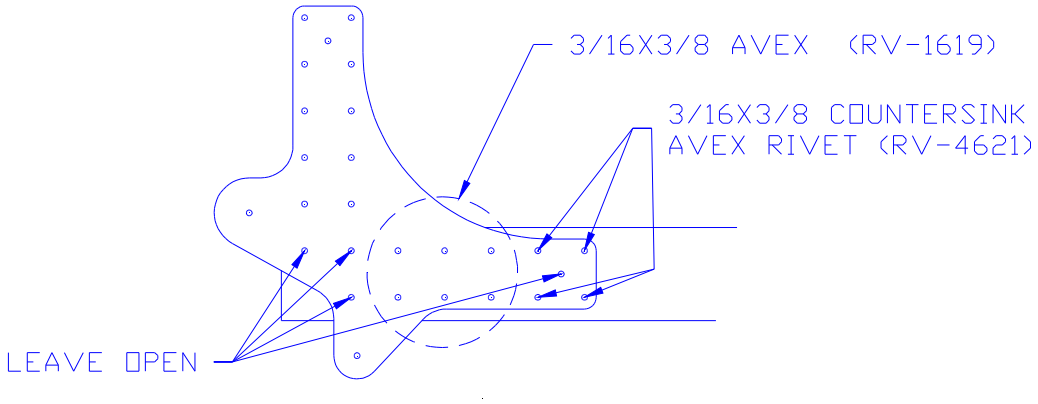



Figure 12.9.7

13) Cleco the Fuselage Uprights (FUS-4) to the two Carrythroughs (FUS-5). Figure 12.9.8.

IF YOU INTEND TO FIT SPRING GEAR, CUT OFF THE LOWER TABS ON FUS-2's FLUSH WITH THE LOWER SURFACE OF THE CARRYTHROUGH TUBES. ALSO DO NOT DRILL OUT 5/16" HOLES INDICATED IN 12.9.9.

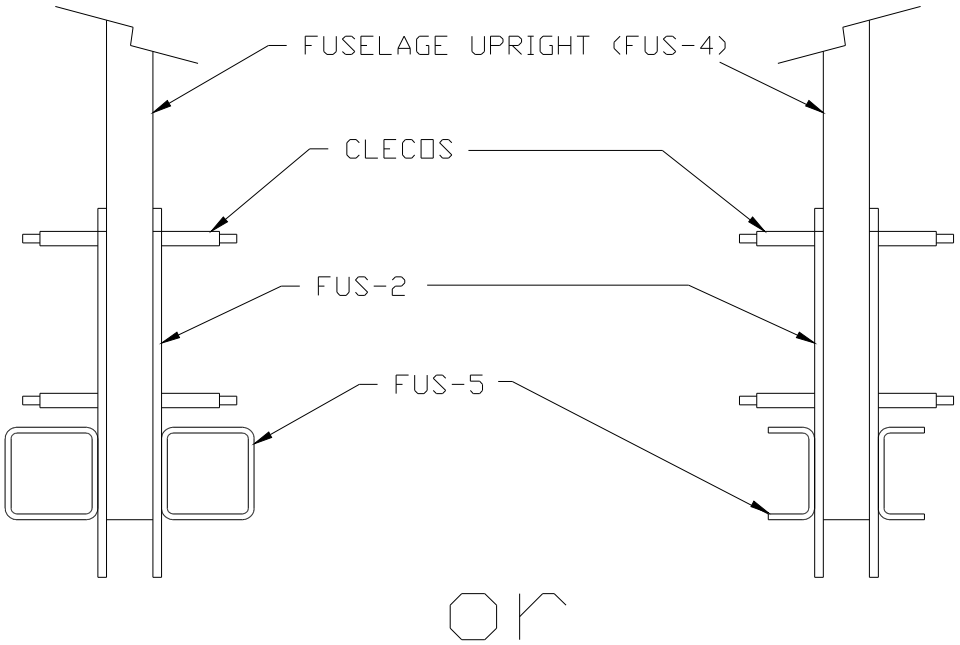



Figure 12.9.8

14) Cleco and bolt the Top Carrythrough (FUS-3) and Four Top Carrythrough Gussets (FUS-1) to the Fuselage Uprights (FUS-4). Figure 12.9.9.

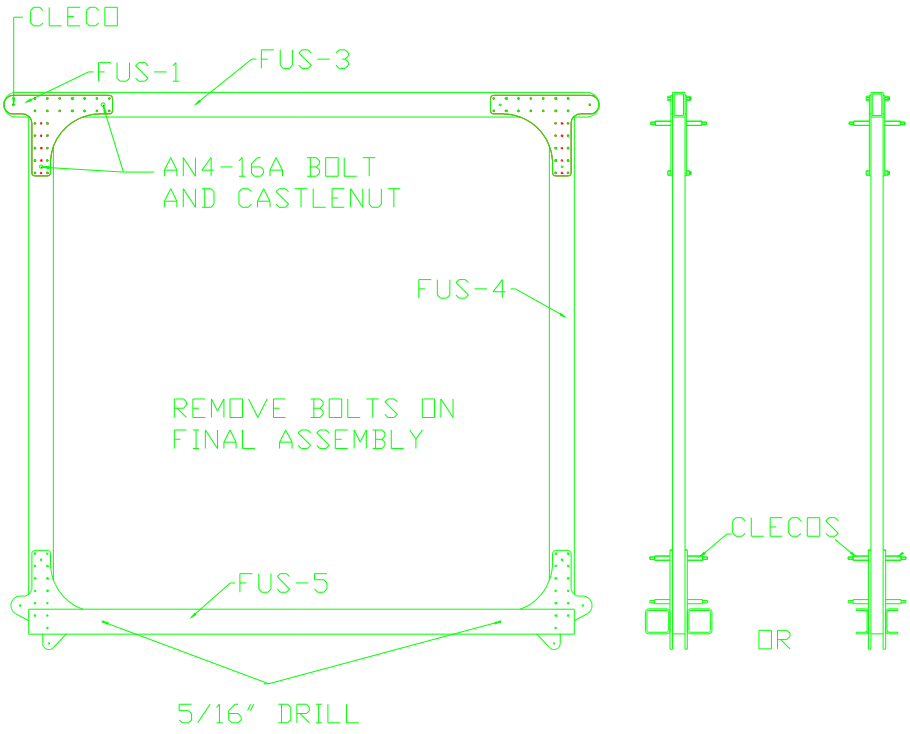



Figure 12.9.9

15) Drill out all #30 holes to #11.

16) Drill out the two holes shown in Figure 12.9.9 to 5/16". On aircraft with full tubes drill 3 of the 4 holes pre-drilled at each end of the rear FUS-5 to 7/16". This is so the bolts can be inserted, and a 3/8 socket put on their heads. Do not drill any holes in the front FUS-5. Figure 12.9.10 and 12.9.13.

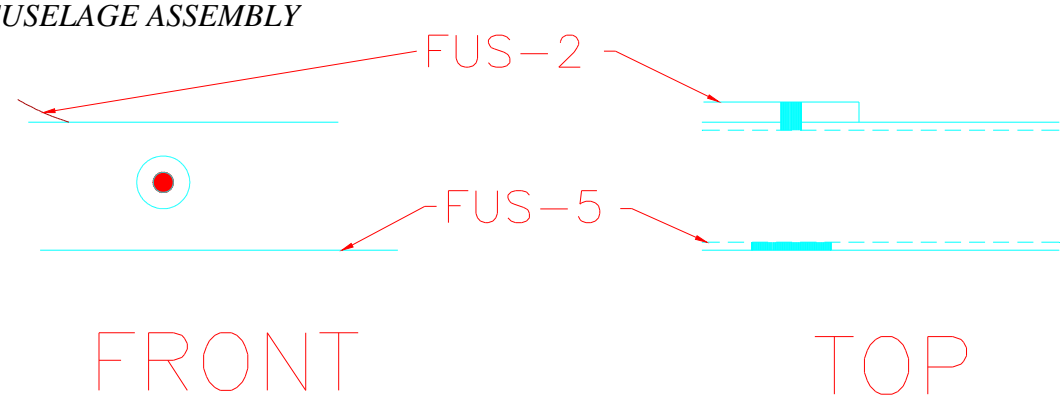



Figure 12.9.10

17) Mark one side of the unit “Front”.

18) Drill an extra row of #11 holes in the four Top Carrythrough Gussets (FUS-1) and Uprights (FUS-4). Figure 12.9.11.

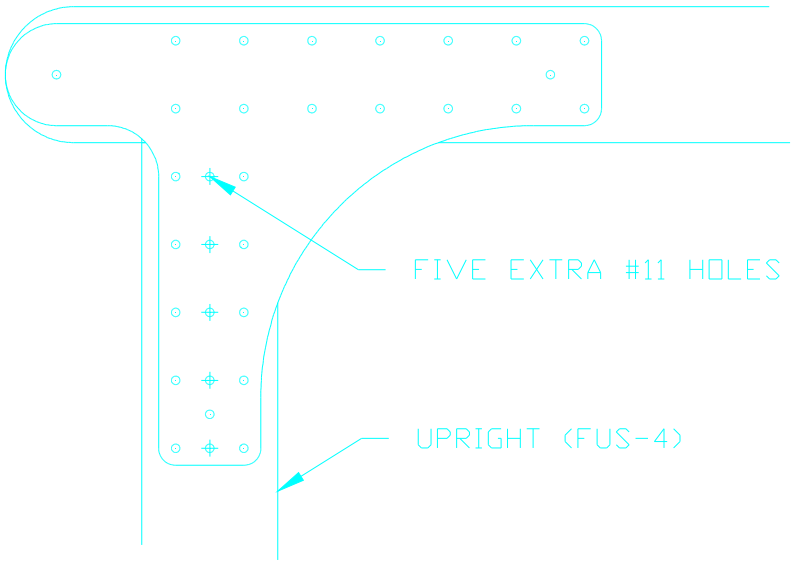



Figure 12.9.11

19) Disassemble. Debur all holes and edges.

20) Chromate all mating surfaces.

21) Rivet the assembly together with 3/16” rivets (RV-1619) in the Bottom Carrythrough Gussets (FUS-2), 3/16” rivets (RV-1613) in the two rear Top Gussets only. Do not install the front top gussets at this time. In the rear top gussets do not install the two rivets shown in figure 12.9.12.

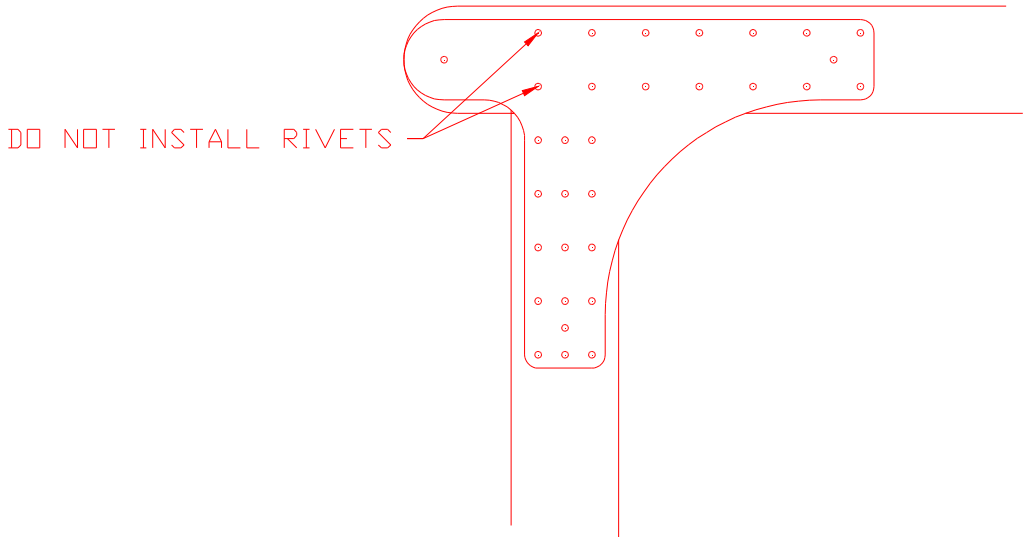



Figure 12.9.12

22) In the bottom outer corners of the Bottom Carrythrough Gussets use three AN3-20A bolts. Figure 12.9.13.

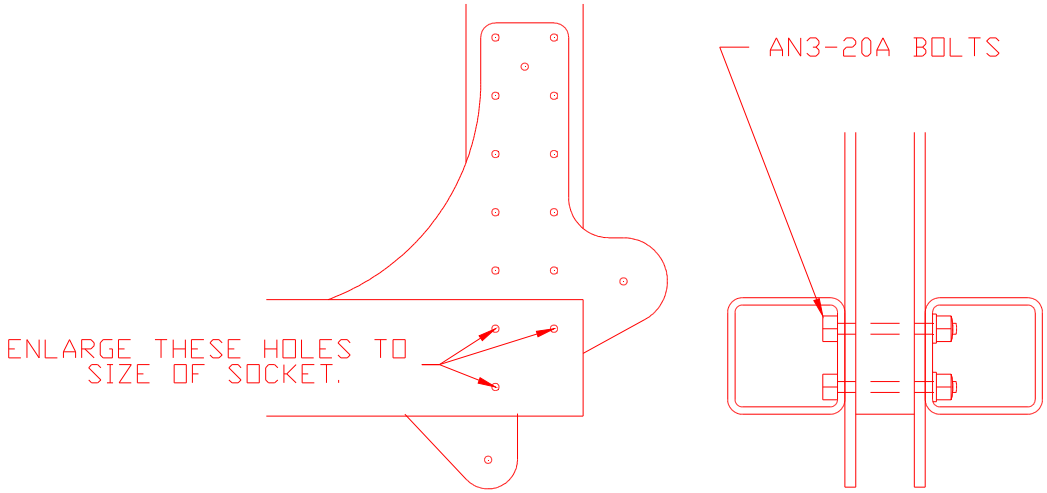



Figure 12.9.13

**NOTE:** The bolts are inserted through the rear FUS-5, as the front FUS-5 must have no enlarged holes in it in this area. The nuts can be accessed through the end of the front FUS-5 with a wrench.

23) Mark the center of the Bottom Carrythroughs (FUS-5).

24) Layout the positions of the four landing gear attach points on the table. Figure 12.9.14.

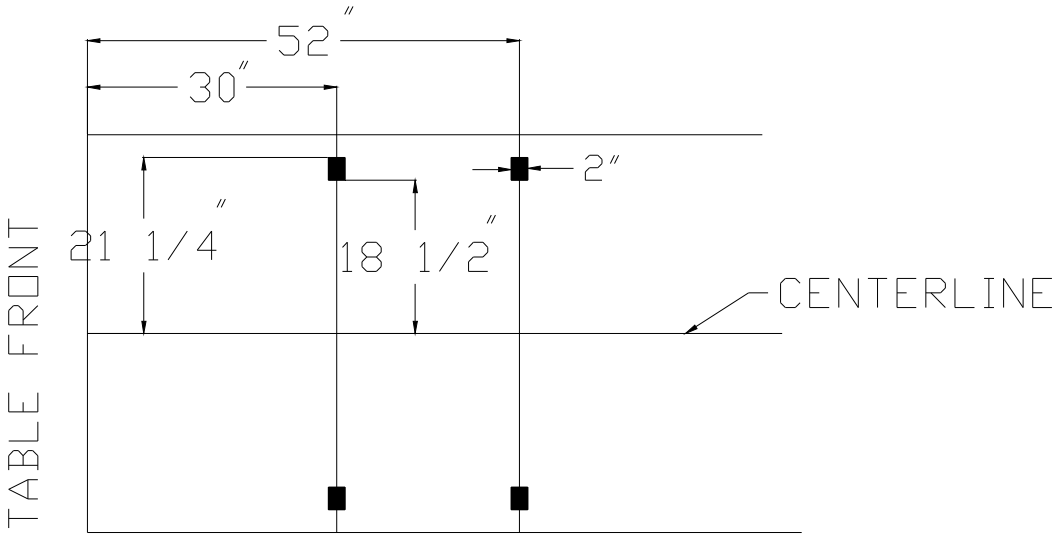



Figure 12.9.14

**NOTE:** To have the Bottom Carrythroughs (FUS-5) sitting flush on the table, it is necessary to cut two holes in the table for the Bottom Carrythrough Gussets (FUS-2). When the fuselage is placed on the table, it will cause the tail end to stick out past the end of the table.

25) Drill a hole at each corner of the areas to be cut out. The hole should be as large as the width of your jigsaw blade.

26) Cut out the areas.

27) Drill two #F holes into the table between the two FUS-5's and approximately 12" on each side of the centerline. Figure 12.9.15.

28) Clamp the assembly down with 1/4" bolts and small clamping blocks. Figure 12.9.15.

**NOTE:** 3/4" plywood approximately 2" x 5" works well for clamping blocks. Ensure the FUS-5 are 90º to the centerline of the table.

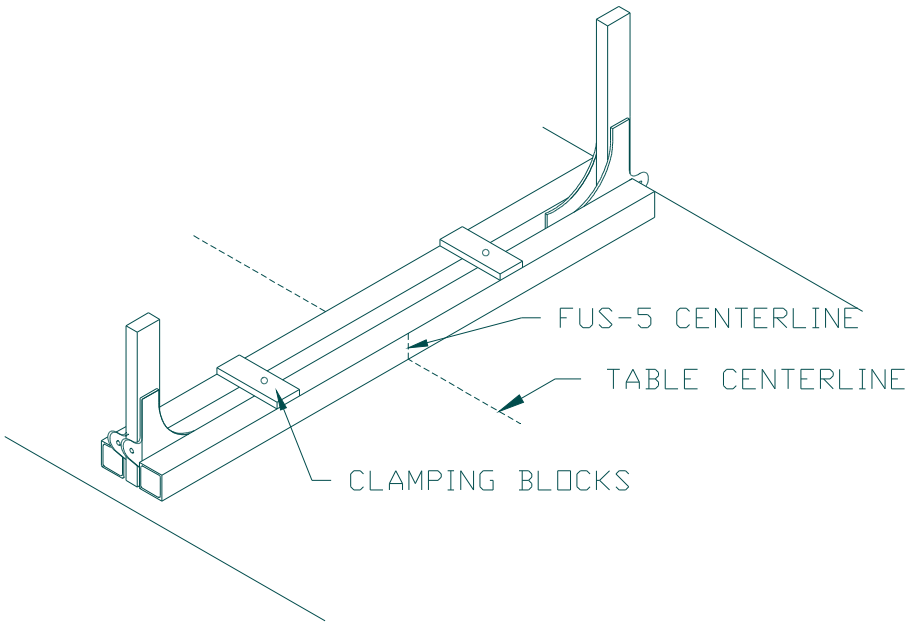



Figure 12.9.15

29) On each Upright (FUS-4) drill a #40 hole 1 1/16" up from the table and on the centerline. Figure 12.9.16.

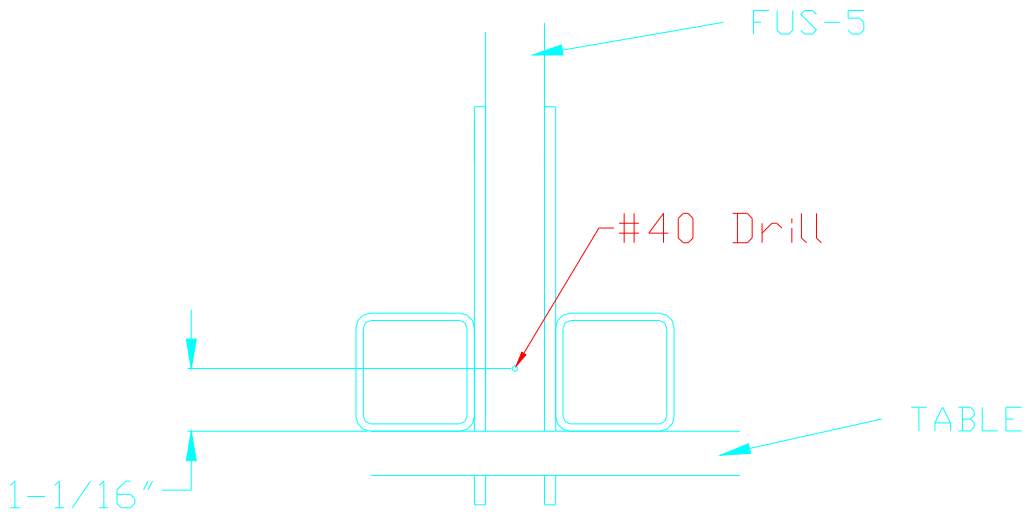



Figure 12.9.16

## *12.10 Cage Join*

1) Cleco a Lower Side Panel (FUS-26) to each FUS-25. Figure 12.10.1.

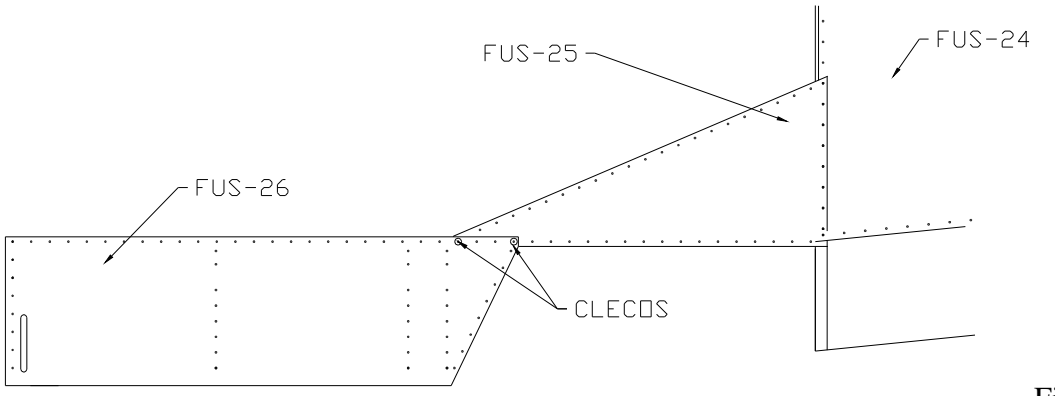



Figure 12.10.1

**NOTE:** It is now necessary to elevate the fuselage tail cone section and position it in relation to the front cage assembly.

2) Put a block 16" high under the fin hinge bracket. Figure 12.10.2.

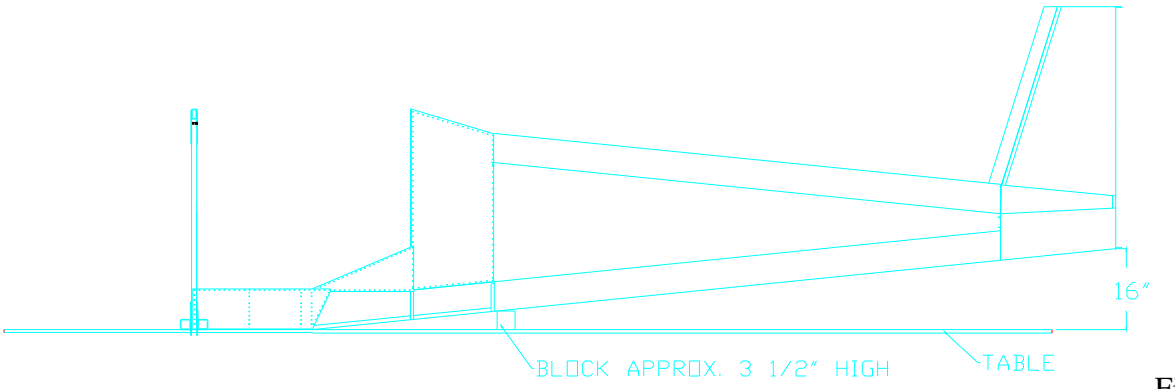



Figure 12.10.2

3) Put a block approximately 3 1/2" high under bulkhead "A". Figure 12.10.2.

4) Move the small block under the fuselage until the left bottom hole in FUS-26 is 1 1/16" above the table.

5) Move the entire assembly forward until the forward bottom holes in the FUS-26 can be clecoed to the holes drilled earlier in the FUS-4's.

6) Ensure that the fuselage cage (FUS-4) Uprights are 90º to the table and the "F" bulkhead in parallel to FUS-4. Figure 12.10.3.

**NOTE:** To ensure that FUS-4 and bulkhead "F" are parallel, measure the distance between the two nearest the table and again near the top. Both dimensions should be the same. If they are not the same, lower or raise the cone section of the fuselage until even.

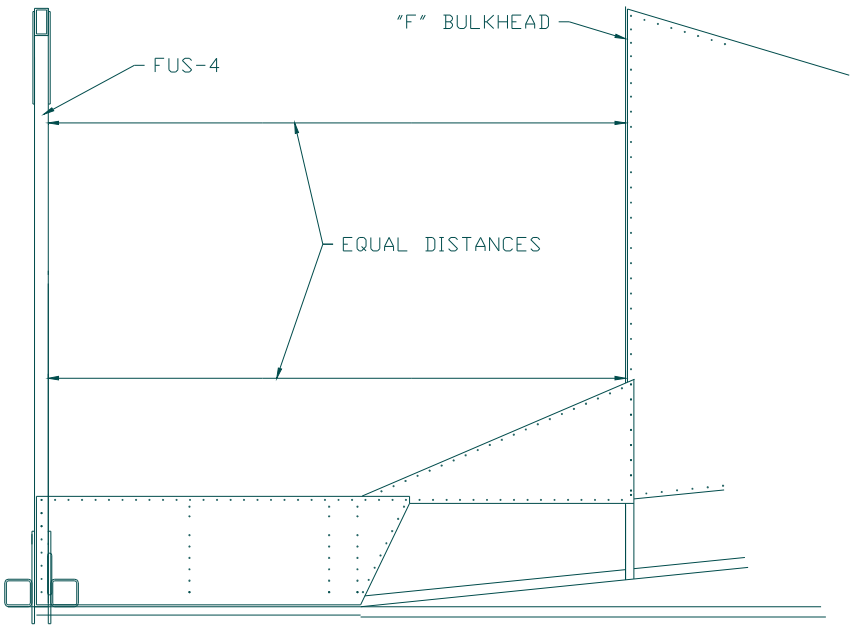



Figure 12.10.3

7) When you are sure that everything is in alignment, drill the forward top hole of FUS-26 in the uprights (FUS-4) and cleco. Figure 12.10.4.

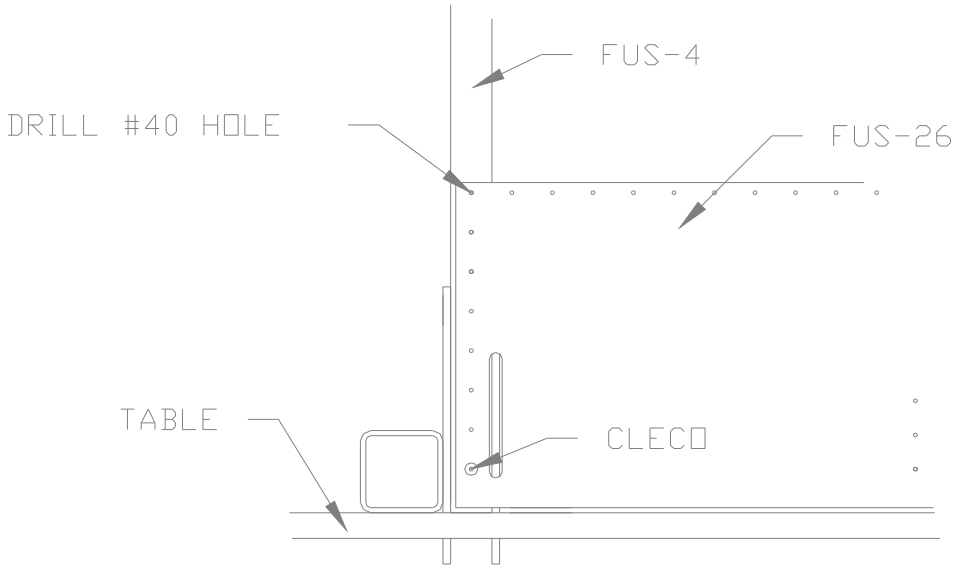



Figure 12.10.4

8) Straighten the top flange of both fuselage root ribs (FUS-27) so that the top flanges are 90º to the web of the rib. This can be done with crimping pliers, shrinking machine or hammer and dolly. The rib when finished should lie flat when placed on a table.

9) Position the Left Fuselage Root Rib (FUS-27L) as in figure 12.10.5. **NOTE:** FUS-27 may have to be trimmed to fit.

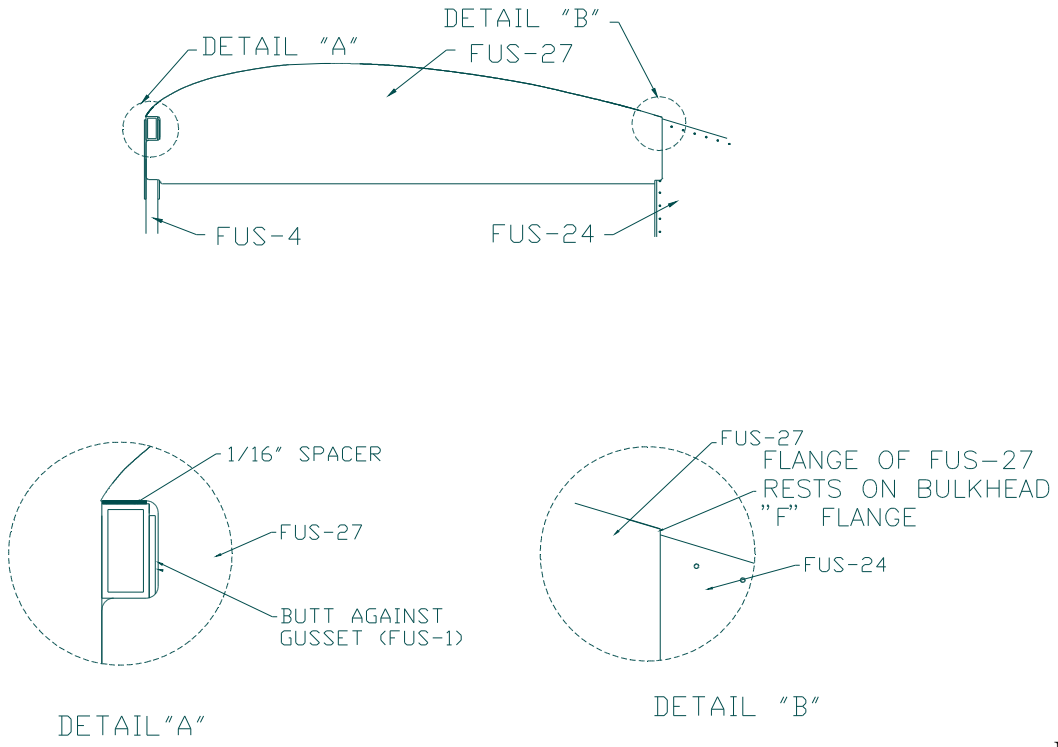



Figure 12.10.5

10) Drill back through bulkhead "F" and FUS-24 into the Root Rib (FUS-27) with a #30 drill. Cleco. Figure 12.10.6.

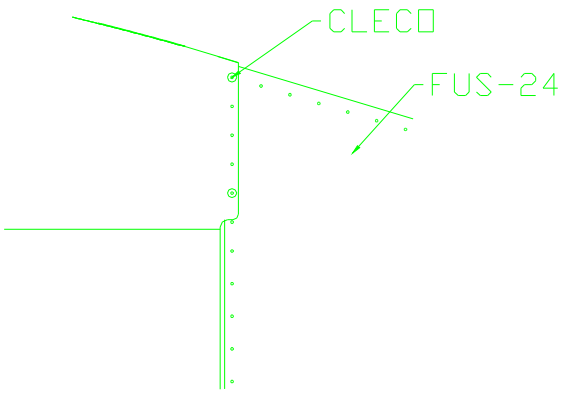



Figure 12.10.6

11) Drill five #30 holes through root rib and upright (FUS-4). Cleco. Figure 12.10.7.

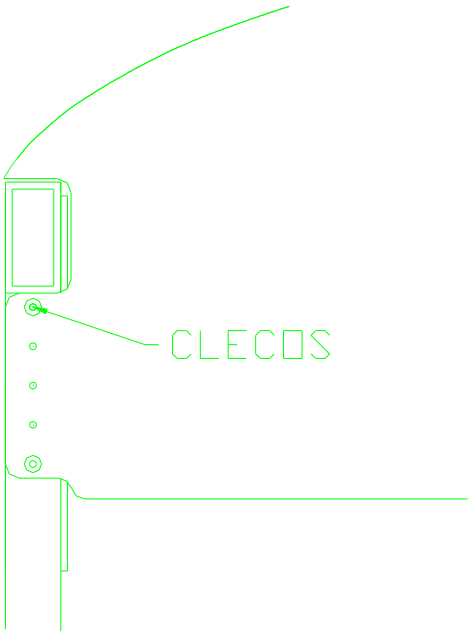



Figure 12.10.7

12) Repeat steps for the right side.

13) On six square bulkhead quarters draw a line as in step 33, section 12.1.

14) Draw a line 9/16” down from the top edge of each FUS-26 on the inside surface.

15) Loosen off the clamps on the cage section.

16) Slip in place the Fuselage Bottom Skin (FUS-40).

17) Cleco FUS-40 to FUS-39. There are no holes at the front of FUS-40.

18) Ensure alignment of the cage and re-tighten clamps.

## *12.11 Rear Landing Gear Bracket*

1) Take 2 of the square bulkhead quarters you drew lines on and assemble so they have a distance of 44” across. Build three sets of these.. Figure 12.11.1.

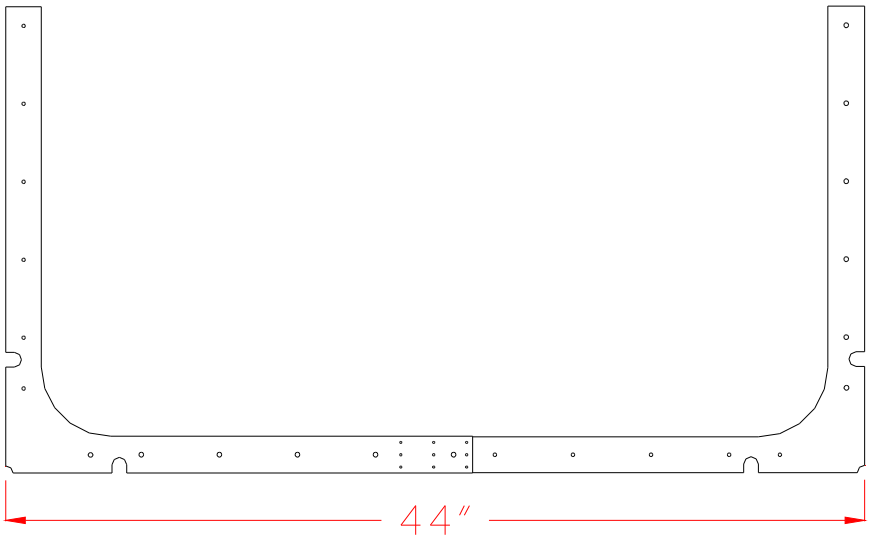



Figure 12.11.1

**NOTE:** If the spring gear option was chosen, part # FUS-45 and part # FUS-61 are not required to be installed. Go to 12.12 Cage Bulkhead Install .

2) Position on Rear Landing Gear Attach Bracket (FUS-45) as in Figure 12.11.2.

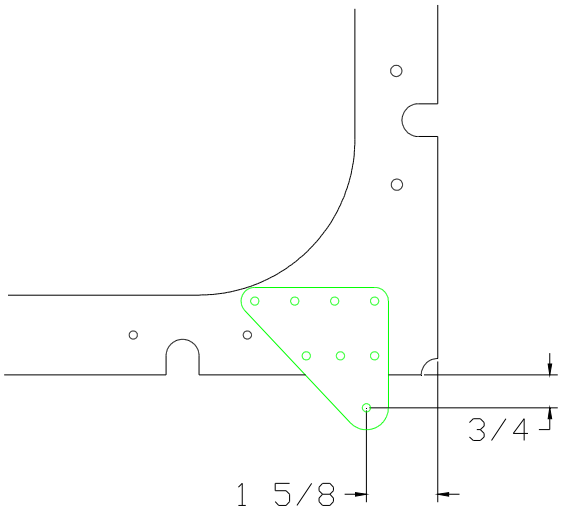



Figure 12.11.2

3) Back drill through FUS-45 and into the bulkhead with a #30 drill. remove the FUS-45.

4) Position the second bulkhead up against the first and back drill the #30 holes. Figure 12.11.3.

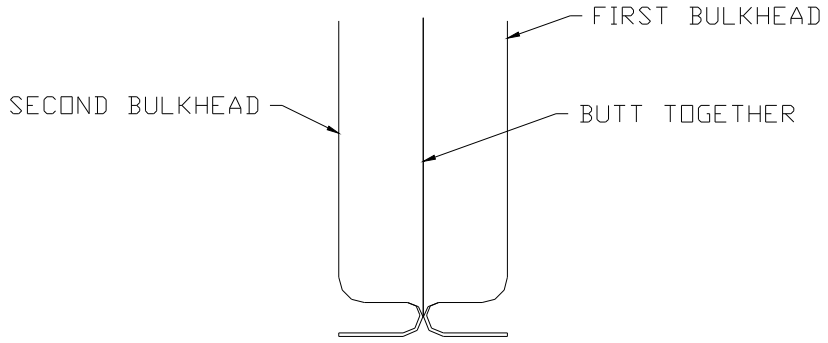



Figure 12.11.3

5) Cleco the second bulkhead into position.

6) Cleco two FUS-45's into place.

7) From the stock 1" x 1" x .065" square tube (FUS-46) cut two spacers (FUS-61) 3 1/2" long.

8) Position as in figure 12.11.4.

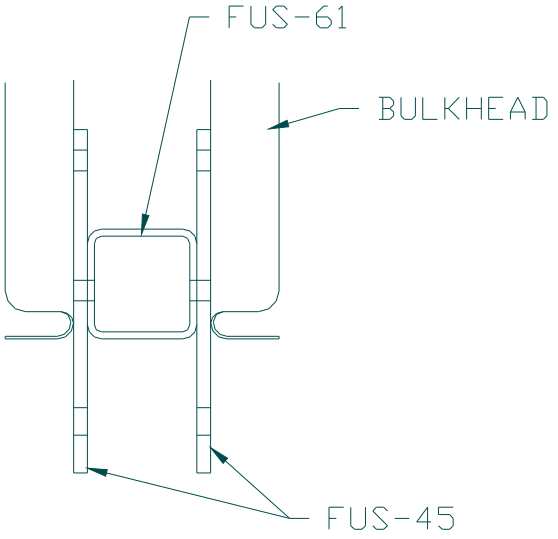



Figure 12.11.4

9) Back drill through the bulkheads, FUS-45 and into the spacer (FUS-61) with a #11 drill.

10) Repeat for the other side.

11) Debur all holes and edges. Chromate mating surfaces of FUS-45's, spacers and bulkheads.

12) Rivet together with 3/16" rivets (RV-1613).

13) Place the Rear Landing bulkhead assembly in its approximate location and layout the hole for the rear landing gear attach brackets on the Fuselage Bottom Skin (FUS-40). Figure 12.11.5.

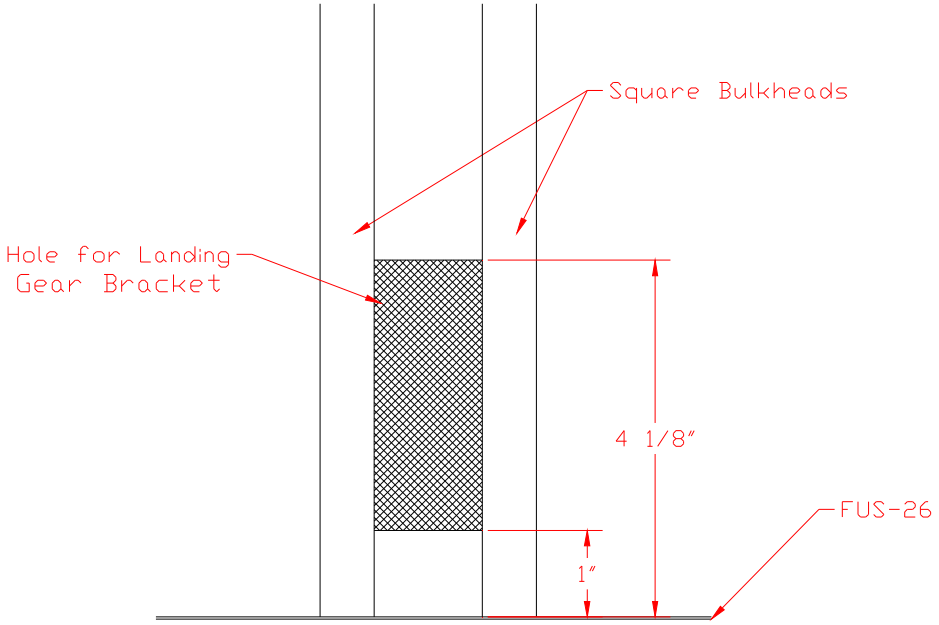



Figure 12.11.5

14) If you removed the bottom skin (FUS-40) to make the holes, replace now.

## *12.12 Cage Bulkhead Install*

1) Cleco the bulkhead quarters in place paying attention to flange directions. Figure 12.12.1.

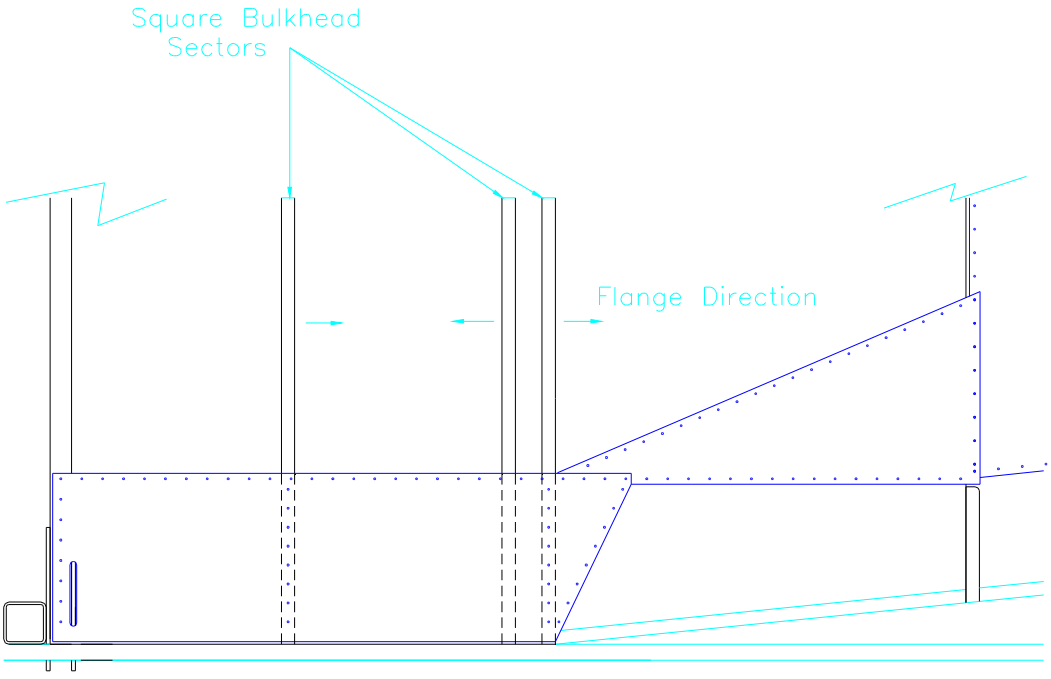



Figure 12.12.1

2) Draw lines from the middle bulkhead to the rear bulkhead to locate the hole location for the second rear landing gear bulkhead. Mark the location of the center of the bulkhead flange onto FUS-26 and draw a line parallel to its mate. Drill intersecting points to #40. Figure 12.12.2.

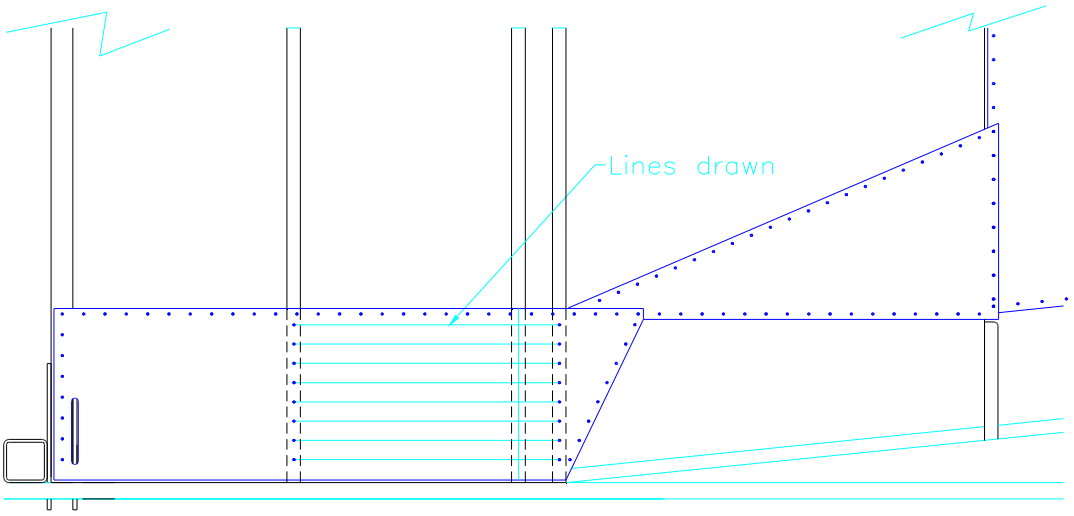



Figure 12.12.2

3) Transfer the lines drawn to the bulkhead flanges. Figure 12.12.3.

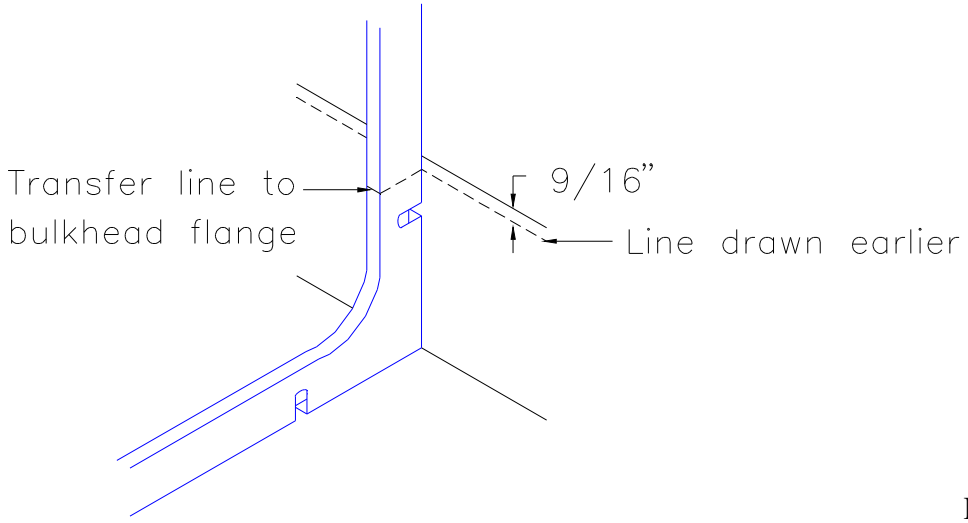



Figure 12.12.3

4) Cut each bulkhead off at the line.

## *12.13 Door Sills*

1) Cut two door sills (FUS-14) from Stabilizer Rib Material (ST-31) 1/16" shorter than the distance between the cage upright (FUS-4) and "F" bulkhead. They will be approximately 42" long.

2) Position one door sill along the top of FUS-26 so that the radius is level with the top edge of FUS-26. Figure 12.13.1.

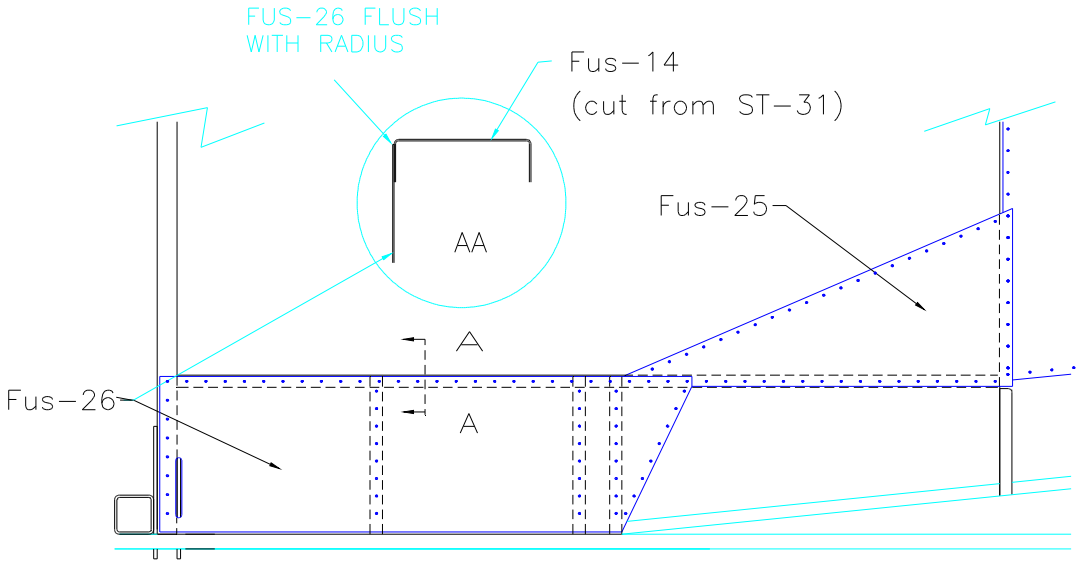



Figure 12.13.1

3) Drill out the top row of holes in FUS-26 and into the door sill to #30. Cleco.

4) Drill out the bottom row of holes in FUS-25 and into the door sill to #40. Cleco. You will back drill these holes to #30 when installing the corner sections.

5) Install angle brackets made from ST-40 material at each end of the Door Sill. Figure 12.13.2.

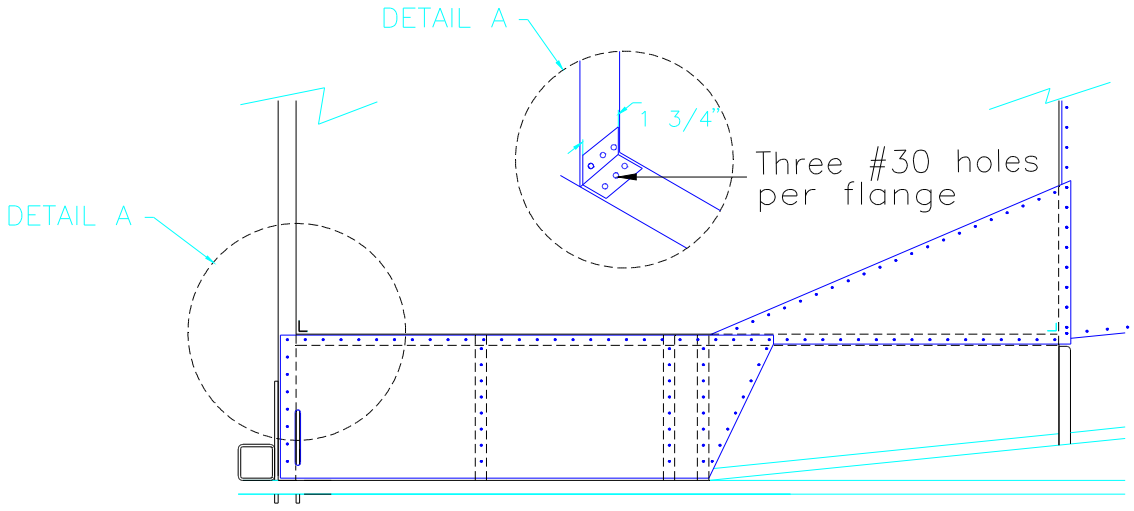



Figure 12.13.2

6) Repeat steps for the other side.

7) Replace the six bulkhead sections.

8) Drill the overlapping sections for nine #30 rivets as done previously for the other bulkheads.

9) Debur, chromate and rivet together with 1/8" rivets (RV-1410).

10) Replace the bulkheads and cleco to the floor (FUS-40) and panels (FUS-26).

11) At each intersection of the Door Sill and Bulkheads, install an angle made from ST-40 material. Figure 12.13.3.

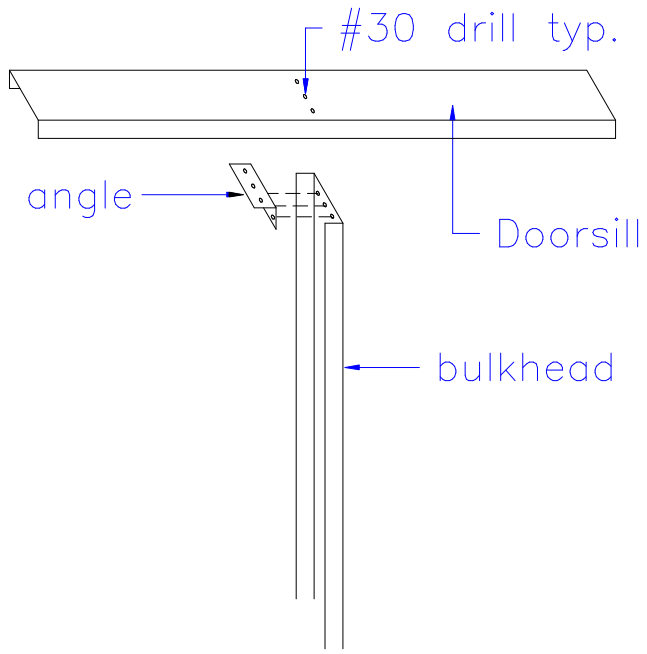



Figure 12.13.3

12) Cut two rear angle sills (FUS-15) from ST-31 material. The radius should be level with the top edge of FUS-25. Figure 12.13.4.

13) Also cut two stiffeners (FUS-21) to go between bulkheads “F” and “A”. Figure 12.13.4.

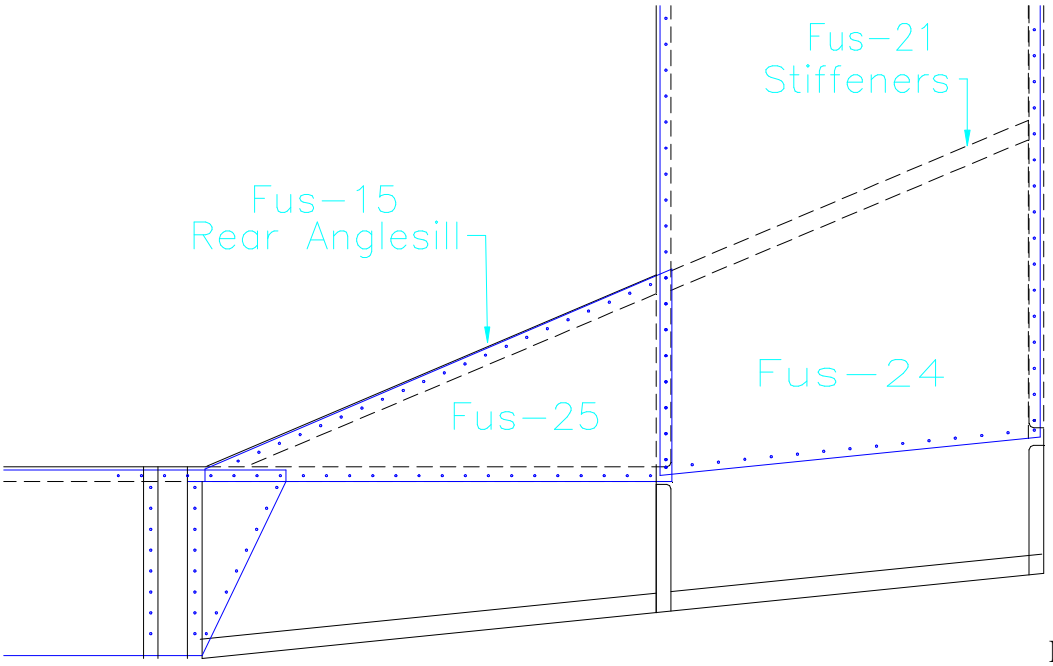



Figure 12.13.4

14) Cut and fit angles (ST-40) at each end of the rear angle sill and stiffeners. On the ends of the Rear Angle Sills trim the angle brackets to have equal leg lengths. It will be necessary to open the angles to fit.

Drill three #30 holes in each angle bracket leg. See Figure 12.13.5 and Figure 12.13.6 and read the following note before drilling.

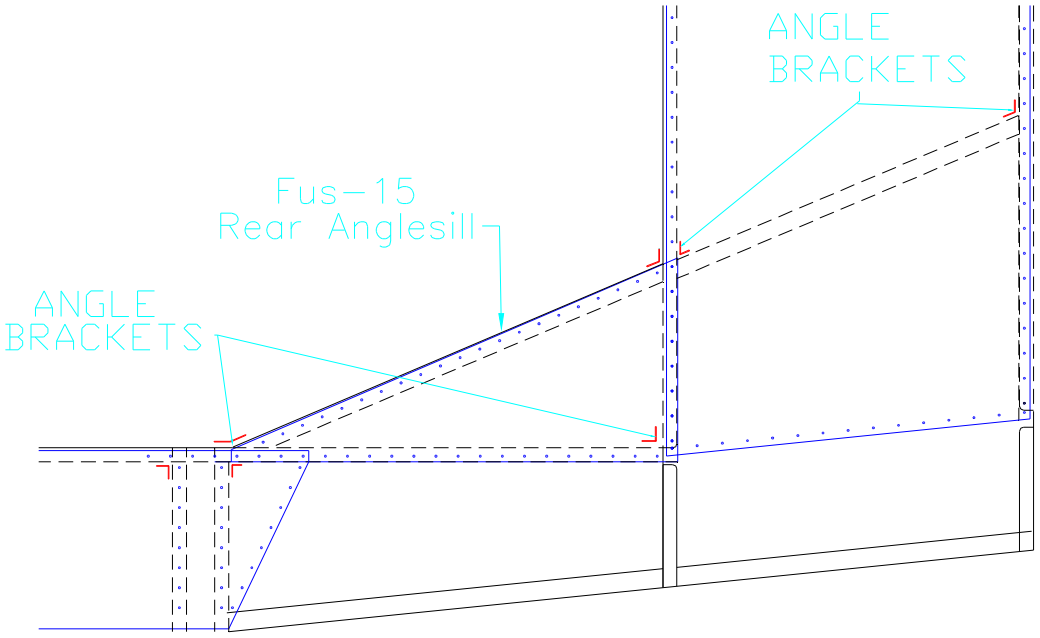



Figure 12.13.5

**NOTE:** At the front end of the rear angle sill use the same holes for the sill angle bracket and bulkhead angle bracket. At the rear end use the same holes for the rear sill angle bracket and stiffener angle brackets. Figure 12.13.6.

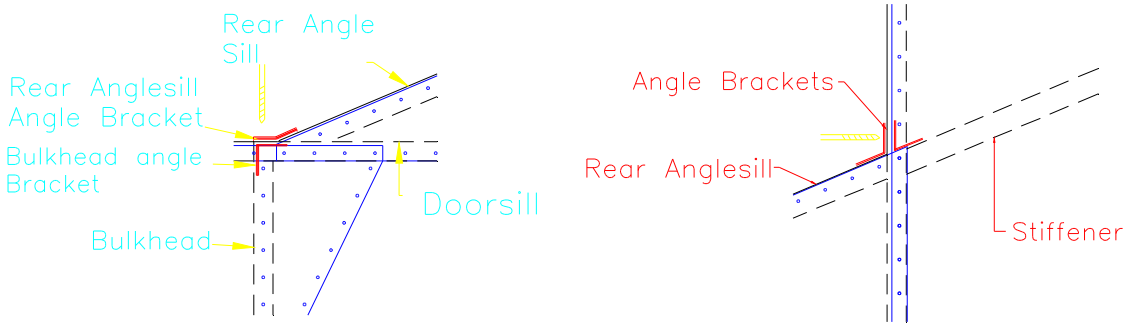



Figure 12.13.6

15) Using the holes in FUS-25 as a guide, draw a line across FUS-24. Figure 12.13.7.

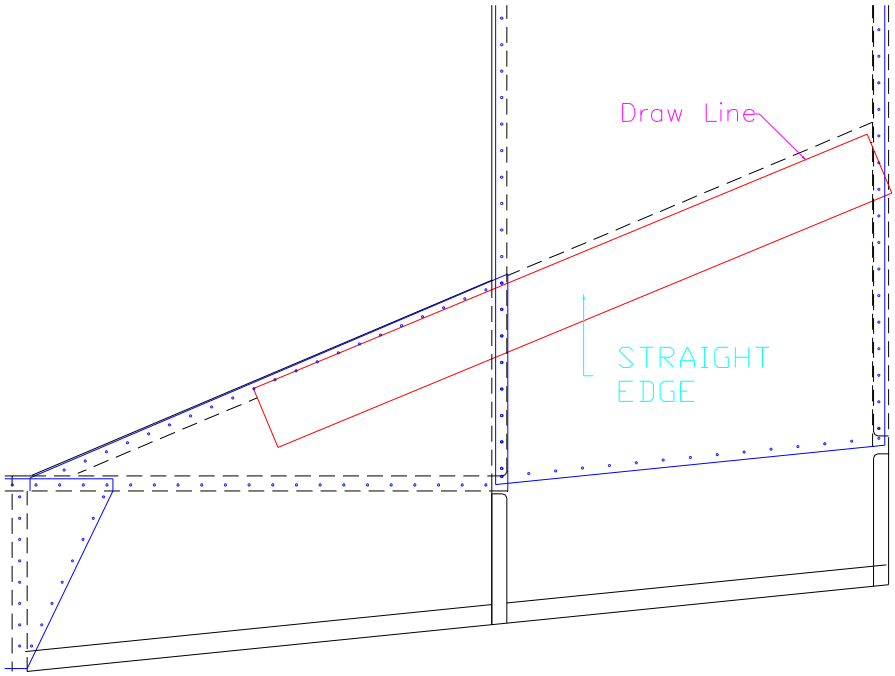



Figure 12.13.7

16) One half inch (1/2") from both ends of the stiffener (FUS-21) and on the line drawn earlier, drill #30 holes.

17) Drill another 12 equally spaced holes in between.

18) Disassemble all sills and angle brackets. Debur all edges and holes.

19) Chromate and rivet together with 1/8" rivets (RV-1410). Do not put rivets in the areas shown in figure 12.13.8.

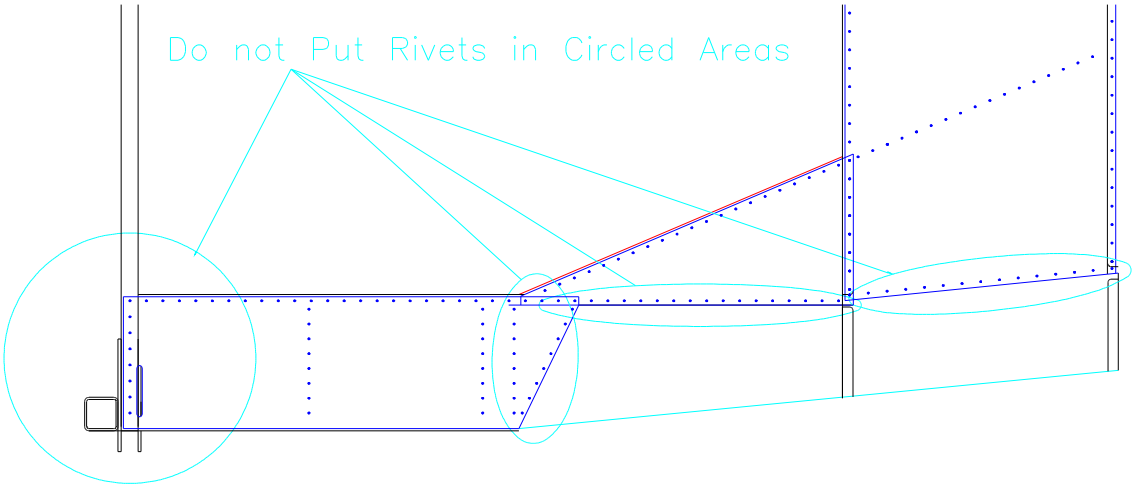



Figure 12.13.8

## *12.14 Cabin Roof*

1) With a #11 bit, drill back through the two open holes in the top carrythrough (FUS-3) and into the flange of the Fuselage Root Ribs (FUS-27).

2) On the top of the bulkheads "F" and "A", bend the flanges to have the same slope as the roof line.

3) Cut two angles from stock material (FUS-35) long enough to fit under the top flanges of bulkheads “F” and “A”. Figure 12.14.1.

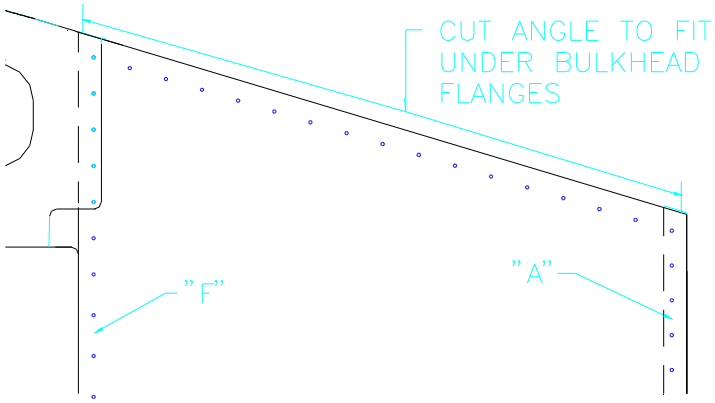



Figure 12.14.1

4) Place one of the angles under the bulkhead flanges and against FUS-24.

5) Drill all holes out to #30.

6) Repeat for the other side.

7) Debur all holes and edges.

8) Chromate the mating surfaces and rivet in place with 1/8” rivets (RV-1410).

9) Install angle brackets under the root ribs (FUS-27). Figure 12.14.2.

**NOTE:** Make the front lower angles to use the existing hole in the Top Fuselage Gusset (FUS-1).

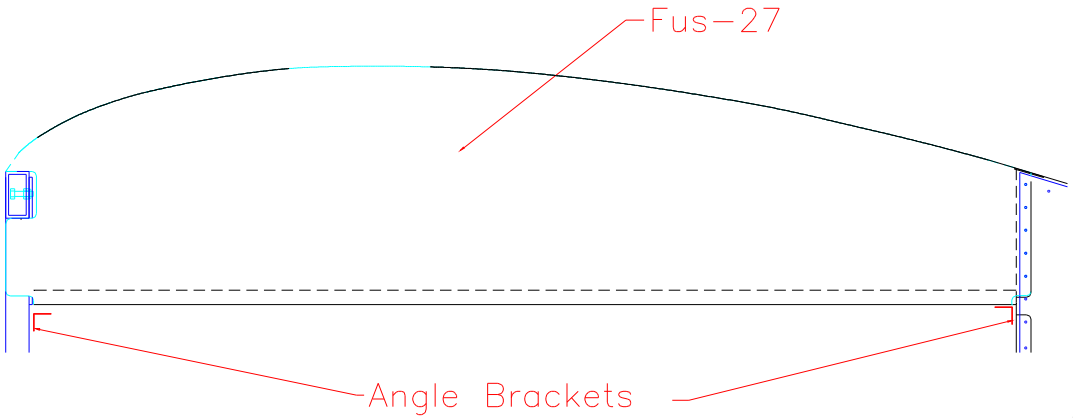



Figure 12.14.2

10) Trim four square bulkhead quarters to fit in the Root Ribs (FUS-27). Figure 12.14.3.

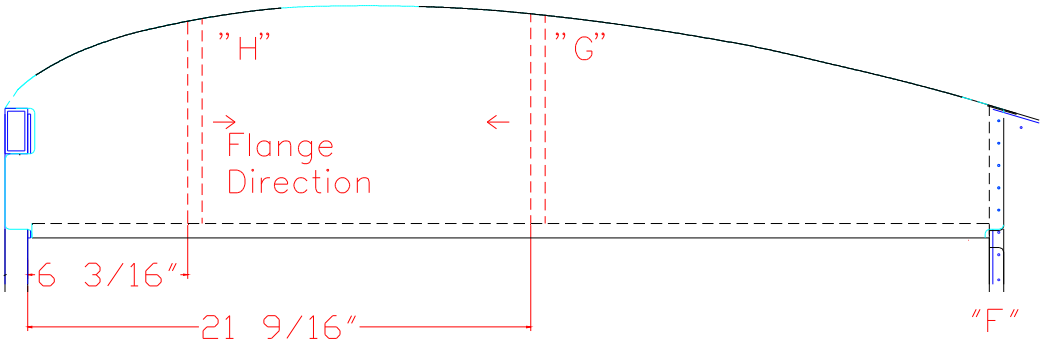



Figure 12.14.3

11) Ensure the two sections are the exact width as bulkhead "F". Then drill nine holes in overlapping section.

12) Back drill through bulkhead flanges into the Root Rib (FUS-27) with #30 bit.

**NOTE:** Ensure the top flanges of bulkheads are pushed up tightly against the top flanges of the Root Rib (FUS-27).

13) Install angle brackets as you did with the lower bulkheads , attaching the bulkhead to the Root Rib.

14) Disassemble and debur all holes and edges.

15) Chromate mating surfaces.

16) Rivet together with 1/8" rivets (RV-1410). **NOTE:** The front angle brackets under the Root Rib (FUS-27) requires 3/16" rivets (RV-1613).

17) Position the Cabin Top (FUS-28). Figure 12.14.4. **NOTE:** The Cabin Top is wider than necessary. Once fitting and pre-drilling is complete, trim to match Root Ribs (FUS-27).

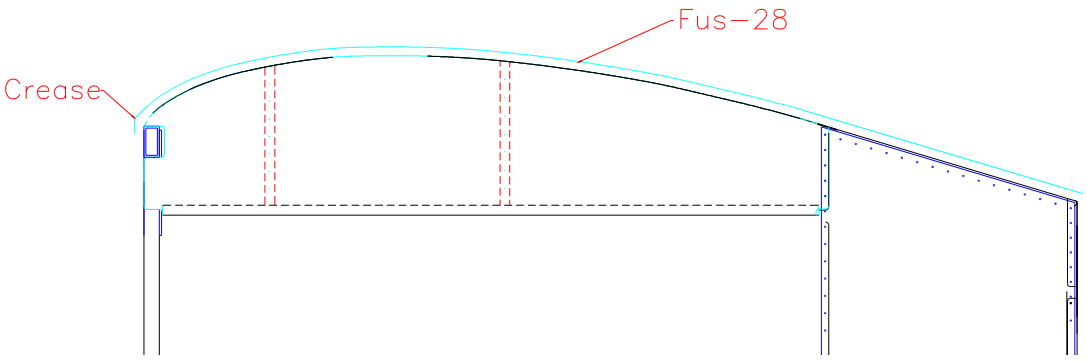



Figure 12.14.4

18) Cleco the two front Top Carrythrough Gussets (FUS-1) in place, sandwiching the flange of the cabin top against the Top Carrythrough (FUS-3).

19) Drill back through the Top row of holes in the gussets with a #11 drill bit. Cleco.

20) Tape the cabin top down securely.

21) From inside the cabin drill a #30 hole through the aligning holes at the end of each bulkhead. **NOTE:** Keep them straight.

22) Draw a line joining the two holes. Mark off hole spacing of approximately 1" and drill to #30.

23) At bulkhead "A", drill back through all holes with a #30 bit.

**NOTE:** Work from the center out and use plenty of clecos.

24) Drill the top flanges of the Root Rib (FUS-27) and the angles at 1" nominal spacing.

25) Mark the cabin top for trimming at bulkhead "A" location. Figure 12.14.5.

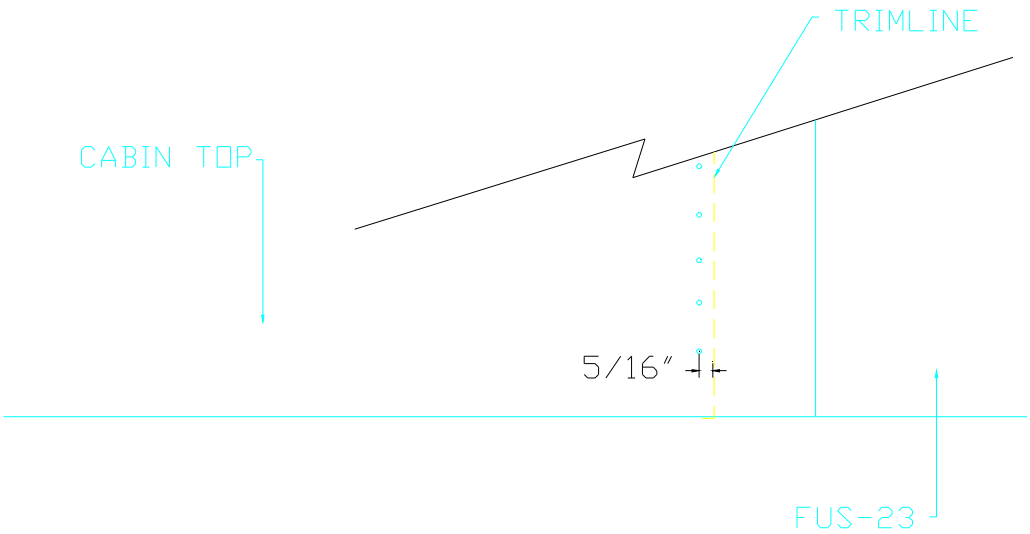



Figure 12.14.5

26) Between the two Top Carrythrough Gussets (FUS-1) drill a row of #30 holes at 1 1/4" spacing and 5/8" from the crease.

27) Dimple all the holes in the top flanges of the Fuselage Root Ribs (FUS-27). This will allow the fairing box, which is riveted to the wing, to lie flat.

28) Remove the top. Trim the edges as necessary. Debur all holes and edges.

29) Chromate the mating surfaces and rivet together with:

a. 1/8" CS rivets (RV-4412)in the top flange of FUS-27.

b. 1/8" rivets (RV-1410) at bulkhead locations and front flange of cabin top.

c. 3/16" rivets (RV-1613) in the Top Carrythrough Gussets (FUS-1).

d. Do not rivet the cabin top to the angles (FUS-35) at this time. Cleco only.

30) Cut out four gussets (FUS-51) from .032 material. Figure 12.14.6.

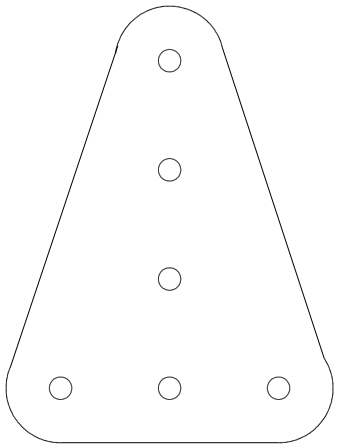


Figure 12.14.6

31) On each top bulkhead and inside FUS-27's lower flange install a gusset. Figure 12.14.7.

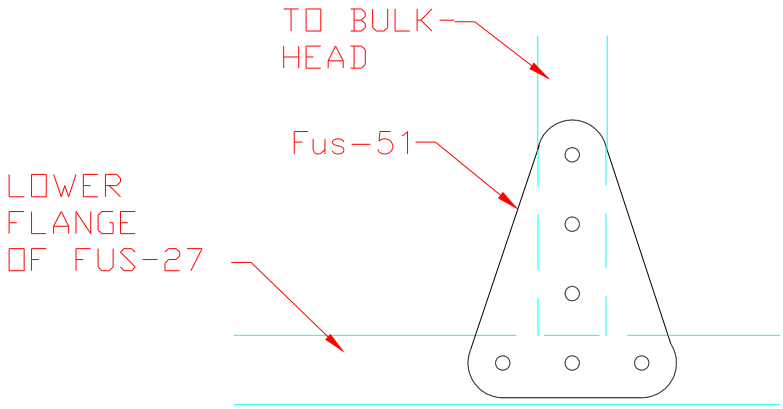



Figure 12.14.7

32) Position a Tapered Corner Panel (FUS-10) in an upper corner between bulkheads "A" and "B". Ensure that the corner overlaps the cabin top and FUS-24 by at least 3/4". Tape or have someone hold securely.

33) Reach inside and draw a line along bulkhead "B".

34) Trim the corner wrap as in Figure 12.14.8.

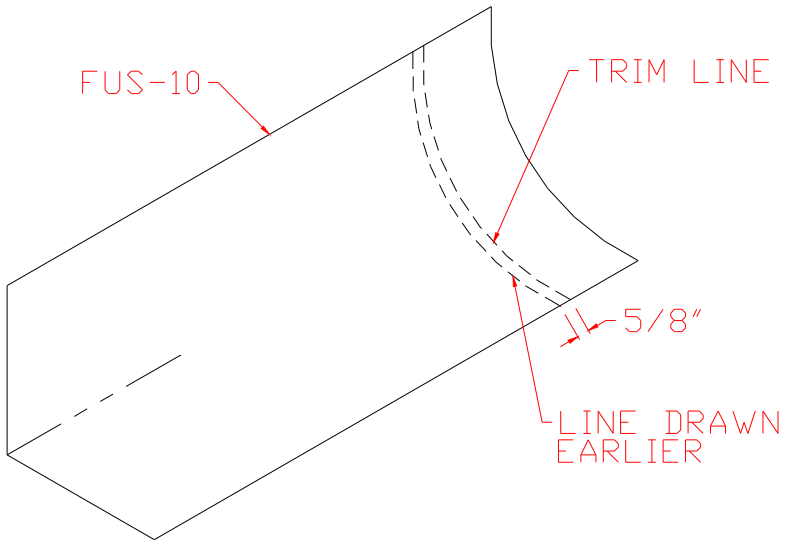



Figure 12.14.8

35) You can install the corner panel as it is but you will get a better fit by doing the following:

a) Cut a quarter moon on a piece of 1/2" - 3/4" plywood with a radius of 5 1/2". Figure 12.14.9.

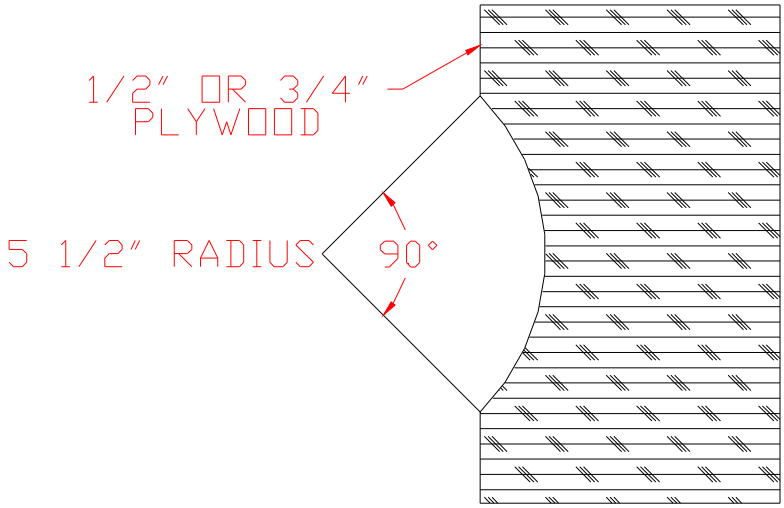



Figure 12.14.9

b) With a file or sandpaper shape the cutout so it fits the corner of the fuselage when held 90º to the centerline.

c) Place the plywood in a vise.

d) Hold the corner panel in the cutout portion with 5/8" hanging out one end. Figure 12.14.10.

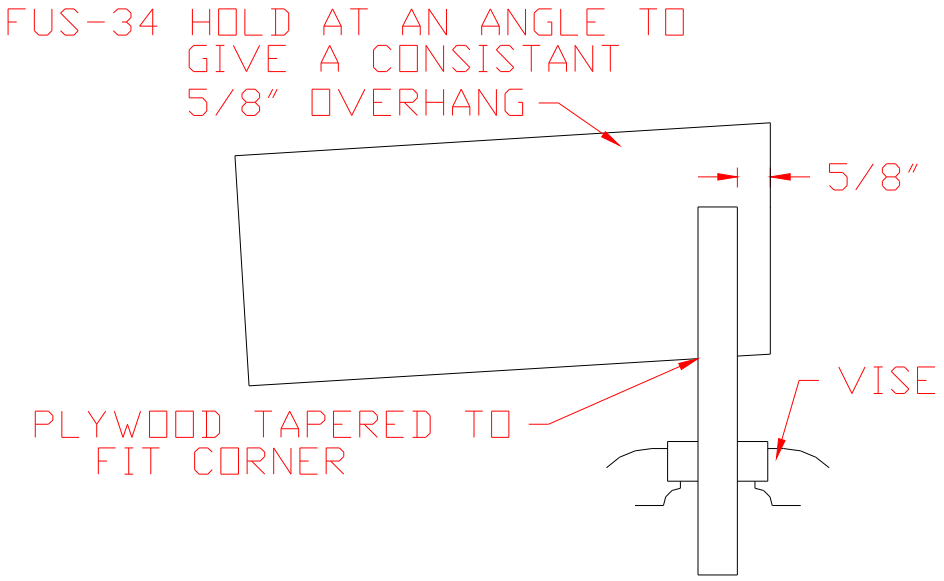



Figure 12.14.10

e) Use a steel bar, heavy wood dowel, etc. to hammer the edge down for a perfect fit. While forming, make trial fittings often.

36) After forming, tape securely in place.

37) Back drill from the inside with a #30 bit.

38) Mark the sides for trimming even with the edges of the adjacent corner panel.

39) Mark the end for trimming to have 5/16" clearance from the center of the holes.

40) Remove and trim.

41) Debur all holes and edges.

42) Chromate mating surfaces.

43) Insert the front edges under the sides (FUS-24's) and cabin top.

44) Rivet in place with 1/8" rivets.

45) Repeat for the other side.

46) Position and drill to #40 the two lower corner panels between bulkheads "F" and "A".

47) Mark for trimming.

48) Remove and trim.

49) Re-install corner panels and cleco securely.

50) Position the tapered corner panels in front of bulkhead "F".

51) Mark for trimming.

52) Remove and trim.

53) Form the curved edge as you did earlier.

54) Reposition and drill to #40.

55) Cleco securely.

## *12.15 Double Floor Install*

**NOTE:** The double floor must be installed from bulkhead "F" forward even if you are not putting in the complete floor. We recommend that if weight is not a problem, that you also put the floor in between bulkhead "F" and "A". This will give you an area to carry luggage. The channel locations (made from ST-31) between bulkhead "A" and the forward fuselage cage are shown in Figure 12.15.1. If you have not put in the channels for the inner floor at the rear of the fuselage you should read over the section on channel installation earlier in this chapter.

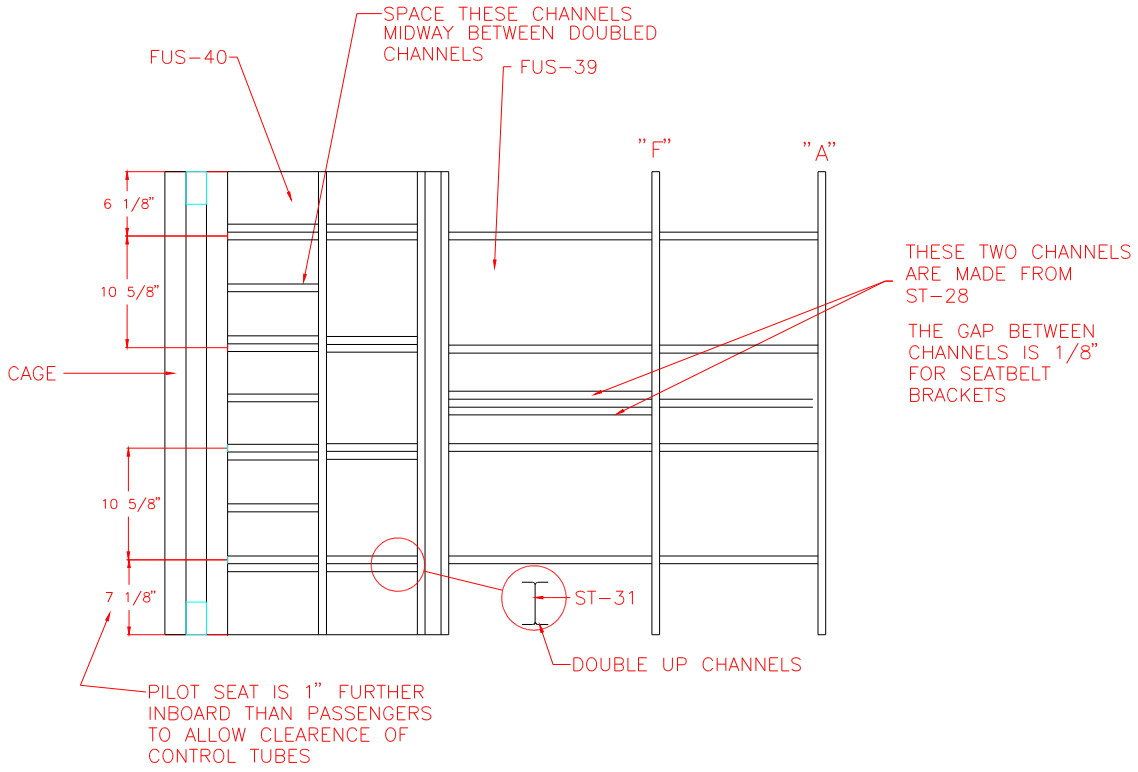



Figure 12.15.1

**NOTE:** The floor channels are dimensioned correctly. The pilot seat will sit 1" farther away from the door to allow the aileron push-pull tube clearance from the seat. When locating the ST-28 channels, use 1/8" spacers to ensure that they are parallel to each other. Do not rivet these channels until the seat belt installation is completed later. Remove 1/8" spacers after the front floor is located and drill into the channels.

**NOTE:** If your are considering installing the Lycoming O-290 or O-320 engines, modifications must be made to the fuselage. At this point, refer to Chapter 13 if you are installing an engine larger than the O-235 Lycoming.

## *12.16 Dashboard Install*

1) Position the dashboard (FUS-18) as in Figure 12.16.1.

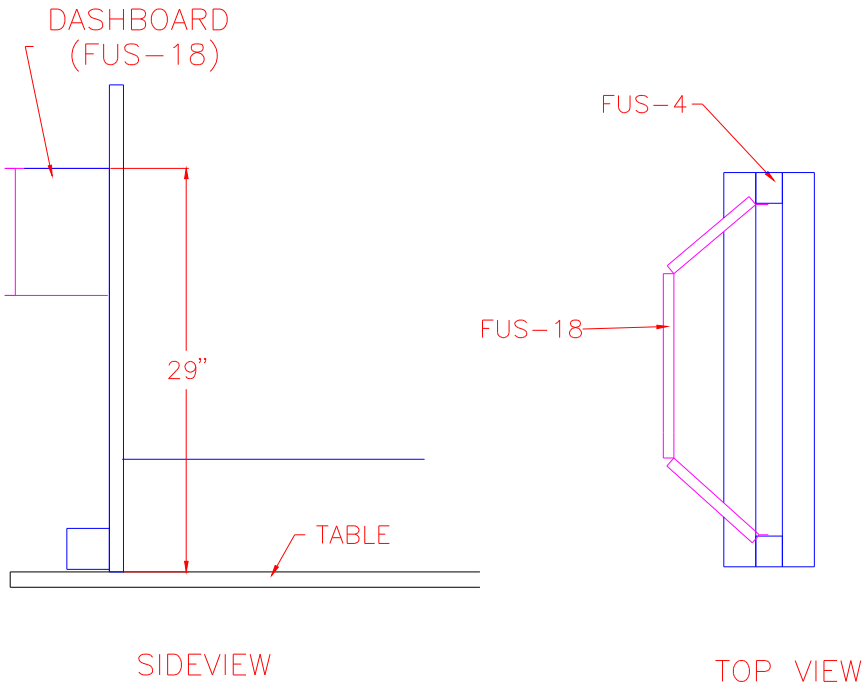



Figure 12.16.1

2) Place the end edges of the dashboard flush with the rear face of the uprights (FUS-4).

3) Drill 8 equally spaced #30 holes in the center of each dashboard flange and centerline of FUS-4's. Figure 12.16.2.

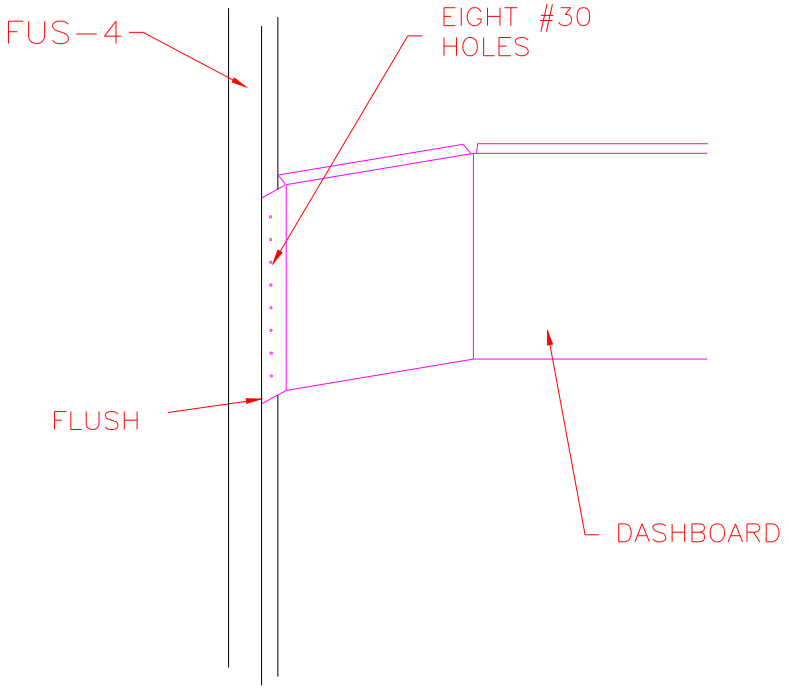



Figure 12.16.2

4) Remove and debur holes and edges.

5) Chromate mating surfaces.

6) Rivet together with 1/8" rivets.

## *12.17 Firewall Install*

1) On the firewall (FUS-6) find and mark the center of the side flanges. Figure 12.17.1.

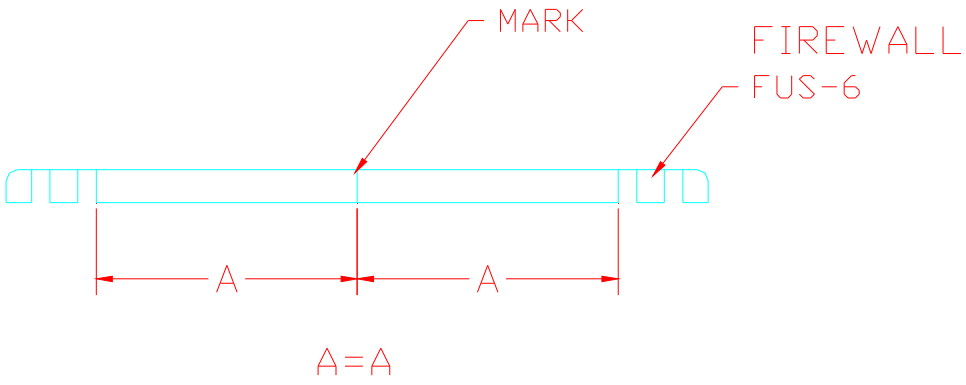



Figure 12.17.1

2) Draw a line along the flange 3/8" from the back face of the firewall on both sides. Figure 12.17.2.

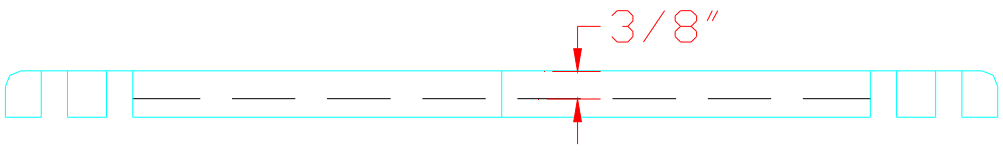



Figure 12.17.2

3) On the left front side panel (FUS-11L) draw a line between the two front center holes. Figure 12.17.3.

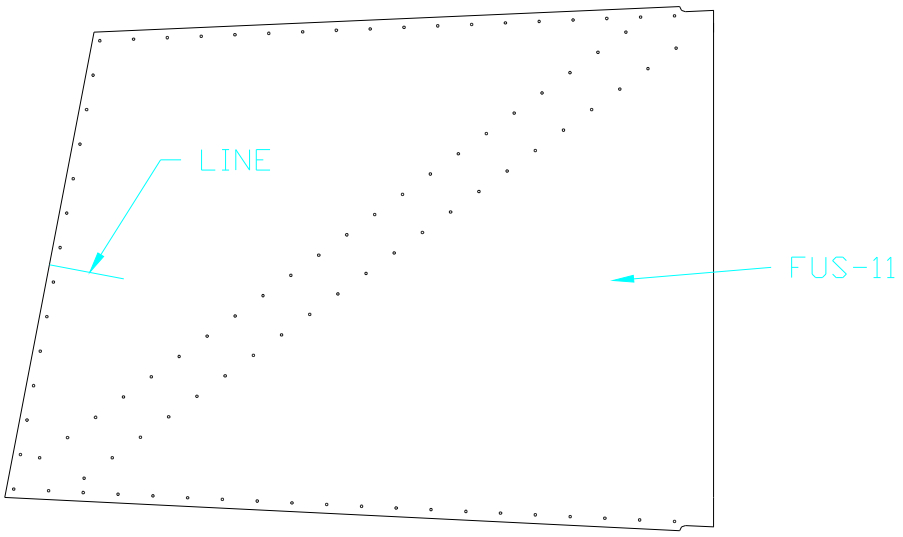



Figure 12.17.3

4) Align the center line of FUS-11L with the center line of the left side of the firewall (the flanges face forward and narrow end is at bottom).

5) Position the holes in FUS-11L over the line 3/8" from the rear face of the firewall.

6) Drill the end holes to #30 and cleco.

7) Drill the remaining holes.

8) Repeat for the right side.

9) Find and mark the center point of the bottom flange of the firewall.

10) Draw a line 5/16" from the rear face of the firewall.

11) Position the front floor (FUS-7) with the prepunched holes over the line and the center marks aligned.

12) Drill to #30.

13) Dimple all the holes in the sides and bottom of the firewall.

14) Debur all edges and holes.

15) Rivet the sides and front floor to the firewall with 1/8" CS rivets (4412).

**NOTE:** Leave the center hole in the bottom flange open. Leave 3 holes open on each end of each flange.

16) Approximately 24 1/2" in front of the uprights (FUS-4's) nail a block that is 1 3/32" high. Figure 12.17.4.

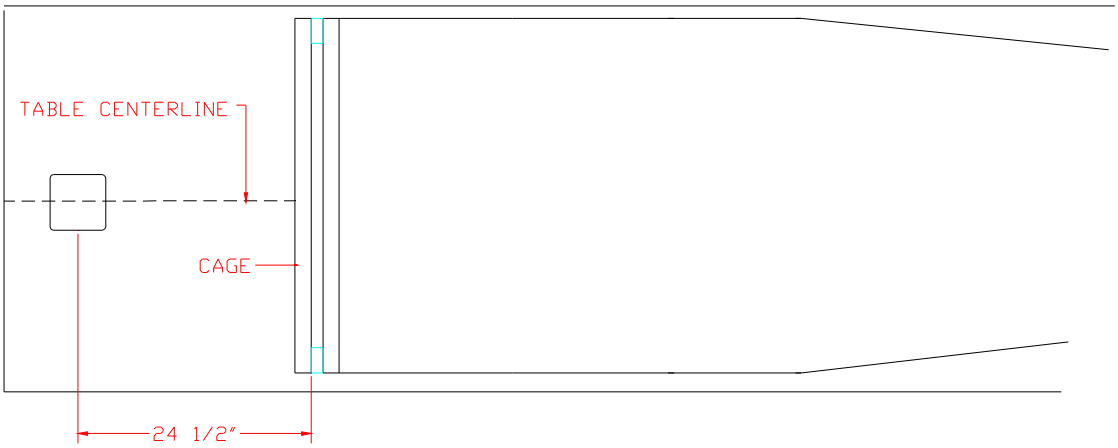



Figure 12.17.4

17) Extend the table center line to the top of the block.

18) Remove clamps on cage.

19) Position the front assembly as in figure 12.17.5.

**NOTE:** It will be necessary to slip the sides behind the FUS-26's and the front floor (FUS-7) under the bottom carrythroughs (FUS-5). It will be necessary to trim the sides of the front floor (FUS-7) where it will slip under the carrythroughs to clear the gusset plates.

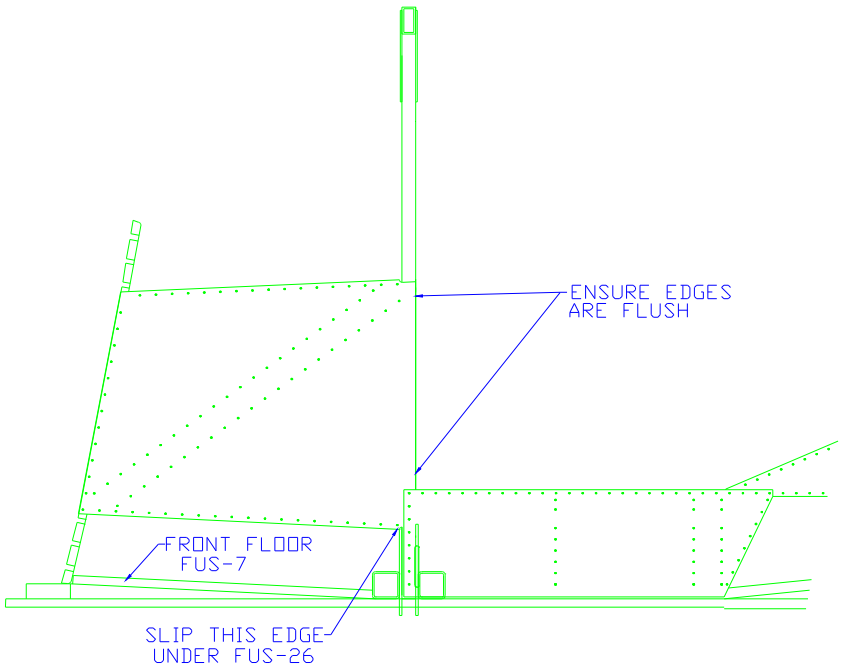



Figure 12.17.5

20) Place some heavy weights on the bottom carrythroughs to maintain alignment (Sand bags work well).

21) Drill one hole at the top and one hole at the bottom of each FUS-11.

22) Cleco.

23) Align the center line on the bottom of firewall with the center line on block.

24) Drill through the open hole in the bottom flange of firewall into block.

25) Cleco the firewall to the block.

26) On the front upper panel (FUS-8) draw a line from the front center hole to the back. Draw this line on the back side of the panel.

## *12.18 Forward Cage Assembly*

1) Find and mark the center of the center section of the dashboard. Figure 12.18.1.

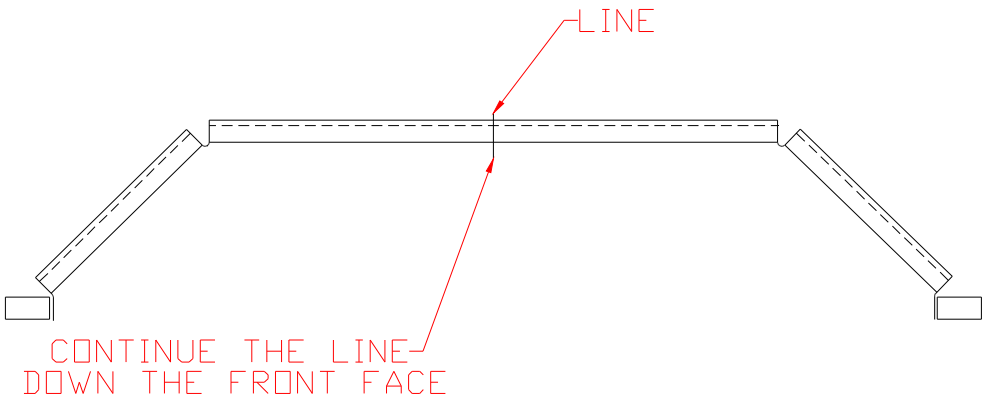



Figure 12.18.1

2) On the top flange of the firewall draw a line 5/16" from the rear face of the firewall.

3) Find the center of the flange and mark.

4) Align the front upper panel with the firewall flange.

**NOTE:** You may have to trim the back edge of the upper front panel to fit.

5) Drill to #30 and cleco securely.

6) Align the line on the front face of the dashboard with the line on the bottom of the upper front panel.

7) Drill one #30 hole only in the center to hold alignment.

8) Mark the shape of the dashboard on to the bottom side of the upper front panel.

9) Remove the upper front panel.

10) Measure 1/8" back from the lines drawn earlier.

11) Trim.

**NOTE:** By trimming back 1/8", the sharp edge of the upper front panel will not stick out past the radius of the dashboard.

12) Reinstall upper front panel.

13) On the upper front panel draw lines 7/16" back from the face of the dashboard.

14) Drill to #30 on approximately 1" spacing.

15) Dimple the holes in the firewall.

16) Remove and debur all holes and edges.

17) Chromate mating surfaces and rivet together as follows:

    a) In dashboard use 1/8" rivets

    b) In firewall use 1/8" CS rivets (RV-4412).

**NOTE:** Do not rivet the five center holes in the firewall or the two outside holes on each side of the dashboard.

18) Cut two ST-40 angle material at 1 7/8" long. Drill three #40 holes as in Figure 12.18.2.

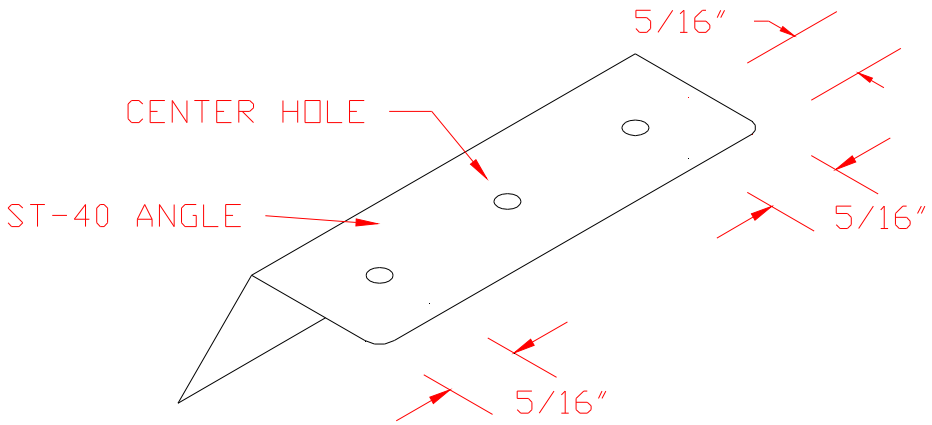



Figure 12.18.2

19) Locate angle so that it is flush with the inside of the upright of the cage and the same height as the upper front panel (FUS-8). Drill the three #30 holes in the cage. Figure 12.18.3.

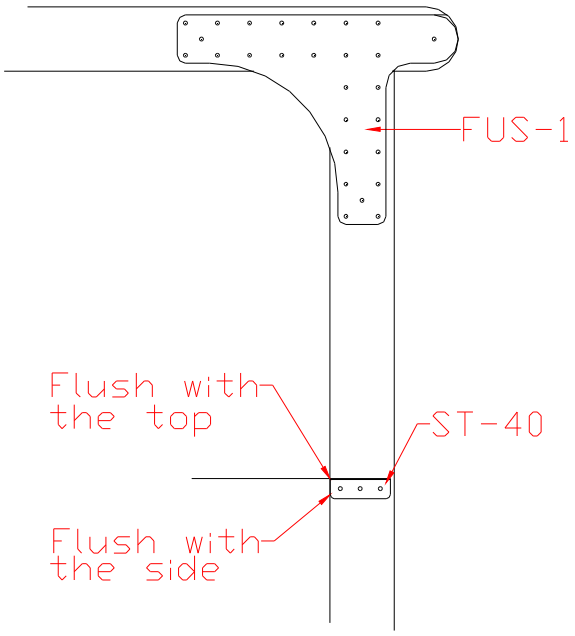



Figure 12.18.3

20) Remove and debur. Chromate the mating surfaces and rivet in place with 1/8" rivets (RV-1410). Repeat for the other upright..

21) Position a tapered corner panel (FUS-10) on one of the upper corners.

**NOTE:** It will be necessary to trim the section to fit round the upright. Trim back far enough that the side of the tapered panel fits past the back edge of the upright. Figure 12.18.4.

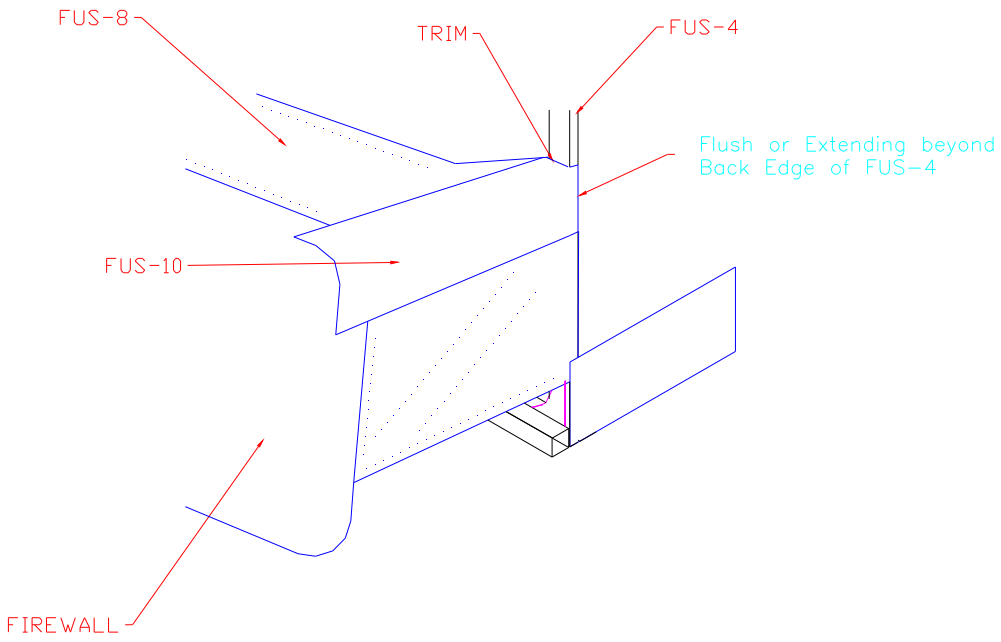



Figure 12.18.4

22) The tapered corner should have, as close as possible, a 90º angle at the cage upright. (It may require the ST-40 angle to be trim on the outer edge to allow fitting of tapered corner)

23) Tape securely.

24) Drill from the inside with a #30 bit, the rows of holes in FUS-8 and FUS-11 that will attach the tapered corner wraps.

25) In each corner tab of the firewall drill two #30 holes.

26) Locate and drill three holes into the ST-40 angle on the cage ensuring that minimum edge distances are kept.

27) Mark the firewall end for trimming.

28) Remove and debur.

29) Dimple all forward holes in corner wrap and firewall.

30) Remove and trim.

31) Cut a 2" x 1 3/16" notch in the top of the Door Post Brace (FUS-9L). Figure 12.18.5.

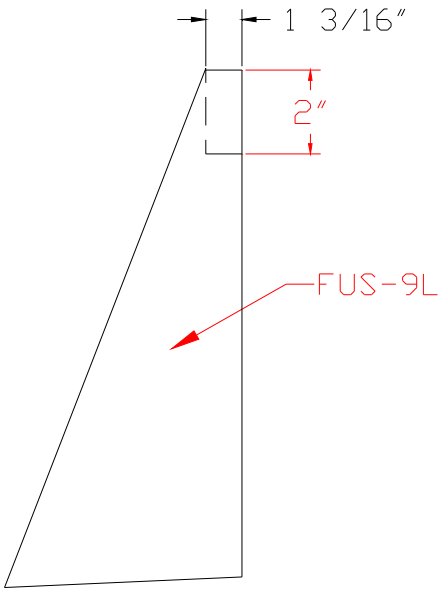



Figure 12.18.5

32) Position the FUS-9L as in Figure 12.18.6.

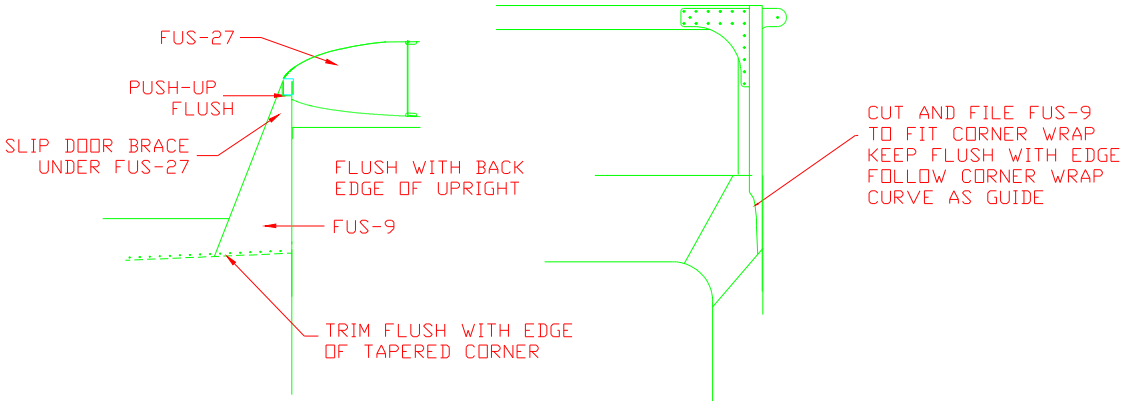



Figure 12.18.6

33) Clamp or tape securely.

34) Drill back through tapered corner into door post brace.

35) Drill five #30 holes at top of door brace using five holes in root rib (FUS-27) as a guide.

36) Drill a #30 hole at 5/16" down from the top edge of the tapered corner wrap through door post brace into cage. Figure 12.18.7. Draw a line from the center of this hole to the lowest hole in the tapered corner wrap at the firewall. Draw a line from the center of hole in the cage to the forward most hole in the door post brace.

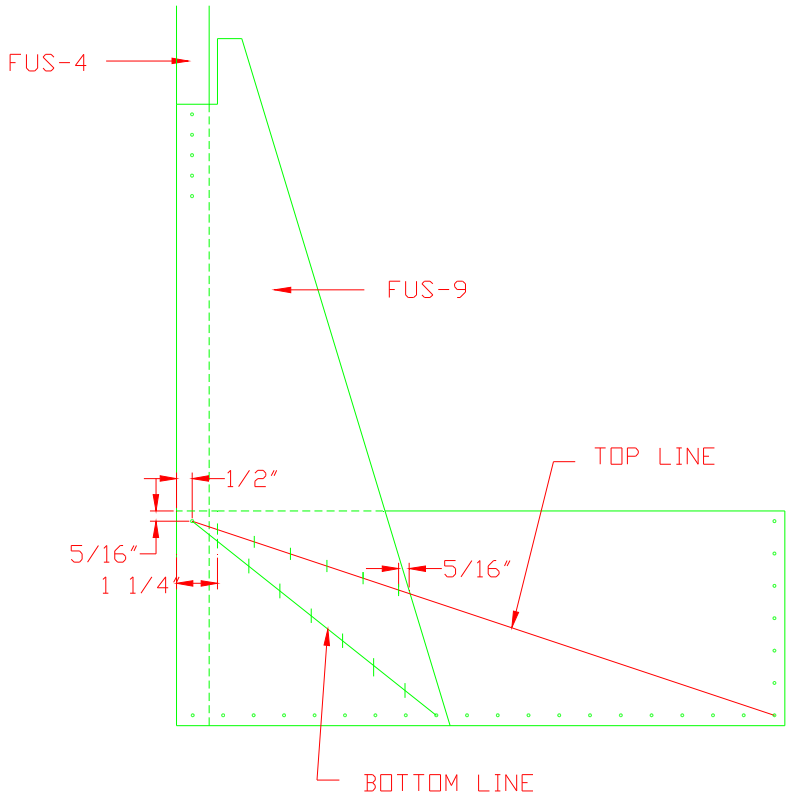



Figure 12.18.7

37) On the upper line measure 1 1/4" in from the backside of the cage. Measure 5/16" in from the front edge of the door post brace and mark a line. Divide four equally spaced marks between these two points. Figure 12.18.8.

38) On the lower line measure 1 1/4" in from the backside of the cage and mark a line. Divide six equally spaced marks between this hole and the lower corner hole. Figure 12.18.8. Drill the seven marks with a #30 drill.

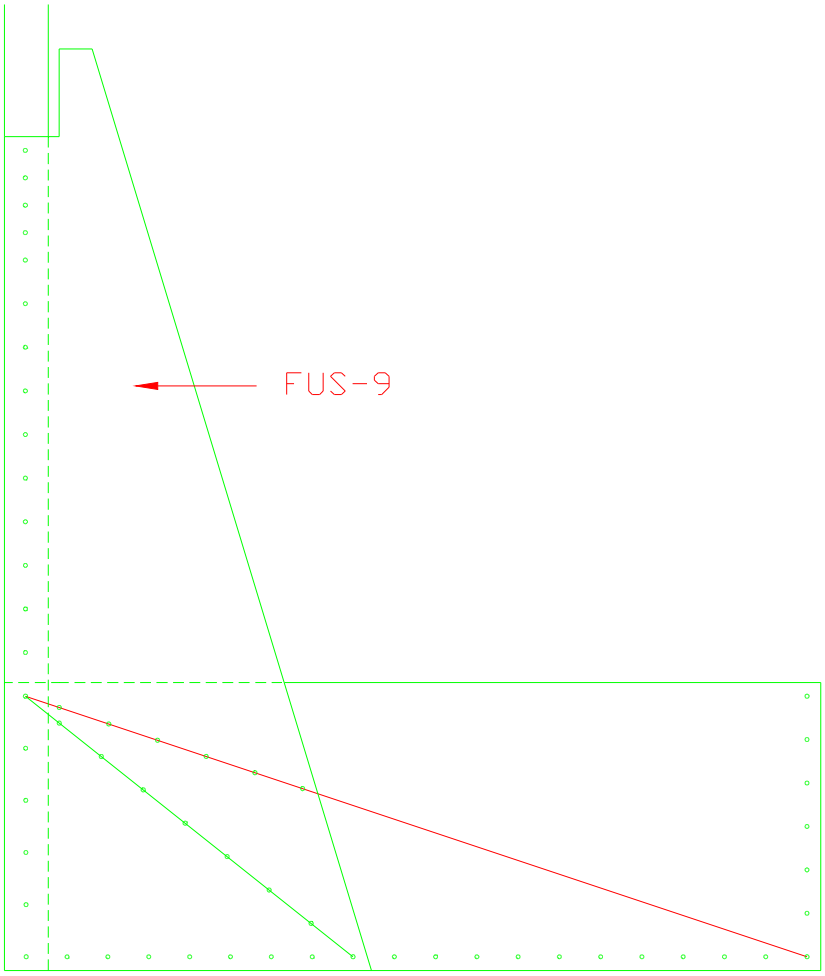



Figure 12.18.8

39) Repeat steps for the other side.

## *12.19 Door Gussets*

1) Remove door post braces.

2) Replace door post braces but this time on the out side of the root ribs.

3) Cut a FUS-37 into four separate corner gussets. Figure 12.19.1.

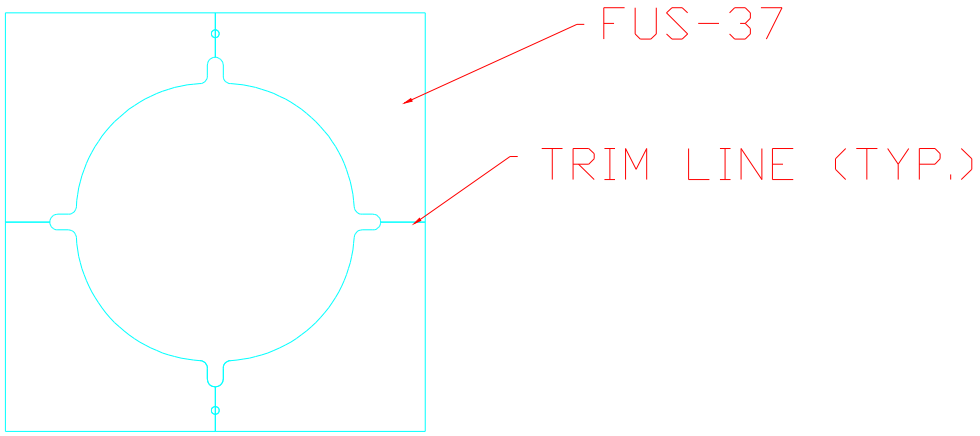



Figure 12.19.1

4) Position one corner gusset as in Figure 12.19.2.

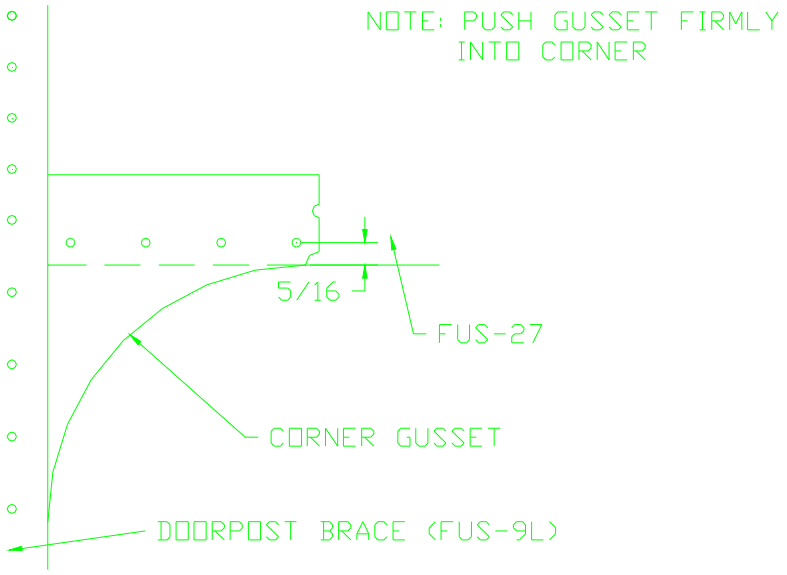



Figure 12.19.2

5) Drill through FUS-9 into gusset.

6) Drill four equally spaced #30 holes through gusset and root rib.

7) Remove the corner gusset.

8) Trim as in Figure 12.19.3.

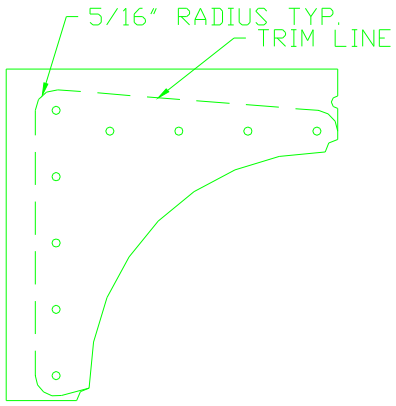



Figure 12.19.3

9) Follow steps 369-373 for each outside position shown in figure 12.19.4.

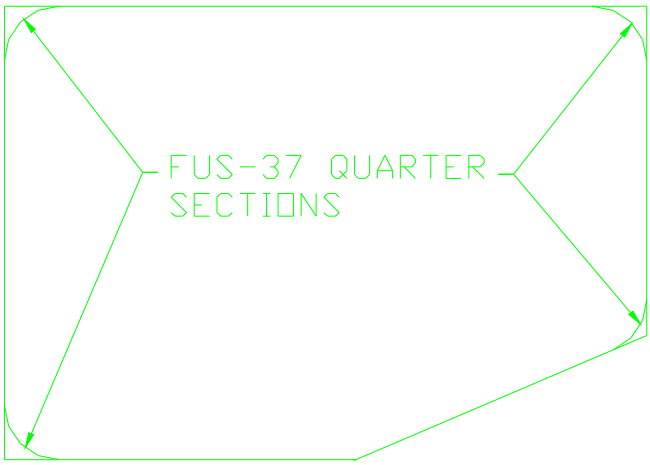



Figure 12.19.4

10) Remove, trim, debur and chromate each quarter section gusset.

11) Rivet in place with 1/8" rivets.

**NOTE:** Do not make or install inside gussets at this time. Do not put rivets into uprights at this time.

## *12.20 Engine Mount Gussets*

1) From .032 sheet stock cut out two engine mount reinforcing gussets (FUS-54). Figure 12.20.1

2) Position one gusset on the fuselage as in figure 12.20.2.

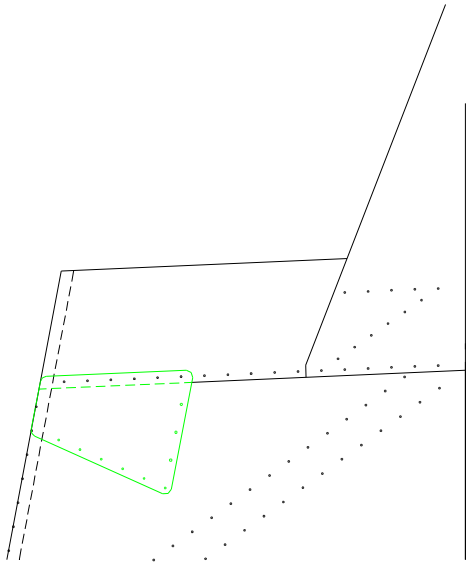


Figure 12.20.2

3) Drill the top holes from inside the fuselage and the other holes from the outside (all #30). Cleco in place.

4) Mark the front edge flush with the firewall for trimming.

5) Remove and trim front edge.

6) Round corners to 5/16" radius.

7) Remove the tapered corner panel and door post brace.

8) Debur all holes and edges.

9) Chromate all mating surfaces.

10) Rivet the tapered corner panel and door post brace in place with 1/8" rivets.

**NOTE:** a) Use 1/8 x CS rivets (RV-4412) in firewall flanges.

b) Do not rivet the engine mount reinforcing gusset in place at this time. Cleco.

11) Repeat for other side.

## *12.21 Landing Gear Cutout*

1) Remove the weights from the carrythroughs.

2) Gently turn the fuselage upside down on the table or preferably on the floor.

3) Drill out all bulkheads and channels for the inner floor.

**NOTE:** Nominal rivet spacing for channels in 1 1/4".

4) Drill into the bottom carrythrough as in figure 12.21.1 "A" or "B". Mark and cut out the hole for the landing gear. **NOTE:** If installing spring gear do not cut out skin.

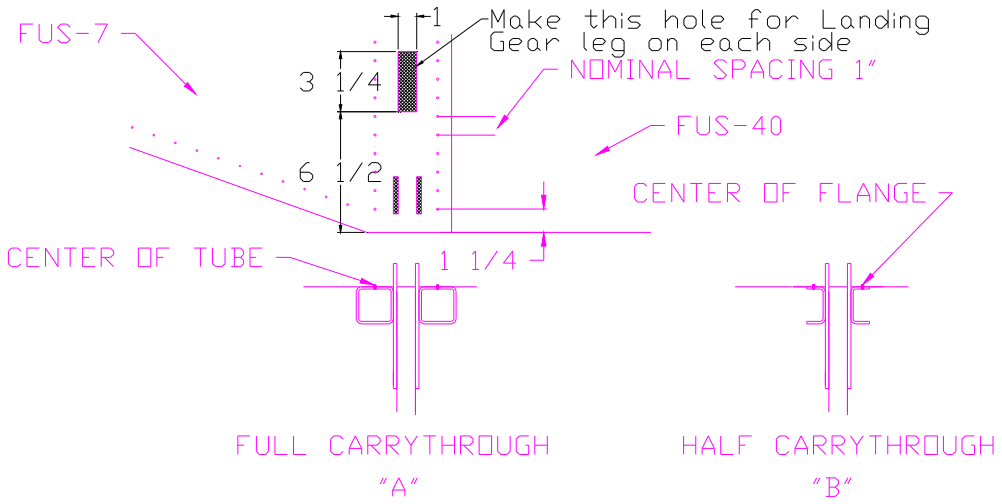



Figure 12.21.1

## *12.22 Tapered Corner Panels*

1) Install the two bottom tapered corner panels (FUS-70) as you did for the top.

**NOTE:** It will be necessary to make notches for the carrythrough gussets (FUS-2).

2) Position on stock angle (FUS-35) on a side of the fuselage. Figure 12.22.1.

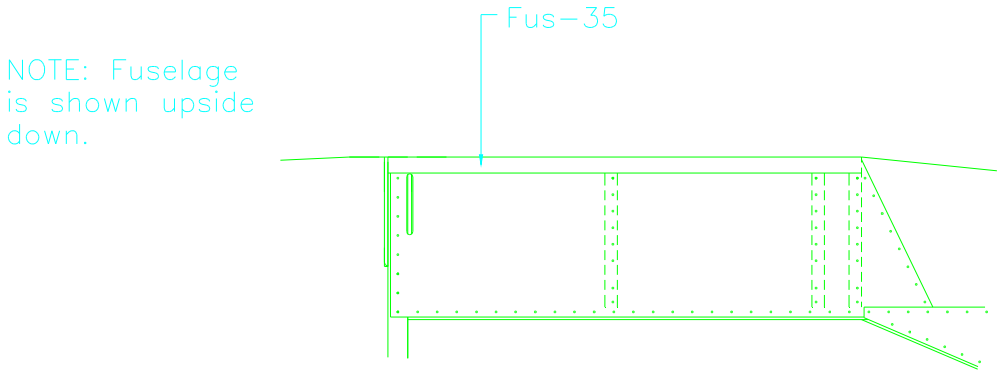



Figure 12.22.1

3) Drill through (FUS-35) and into FUS-40 and FUS-26 on 1" centers.

4) Repeat for other side.

5) Mark the two FUS-35's for trimming as in Figure 12.22.2.

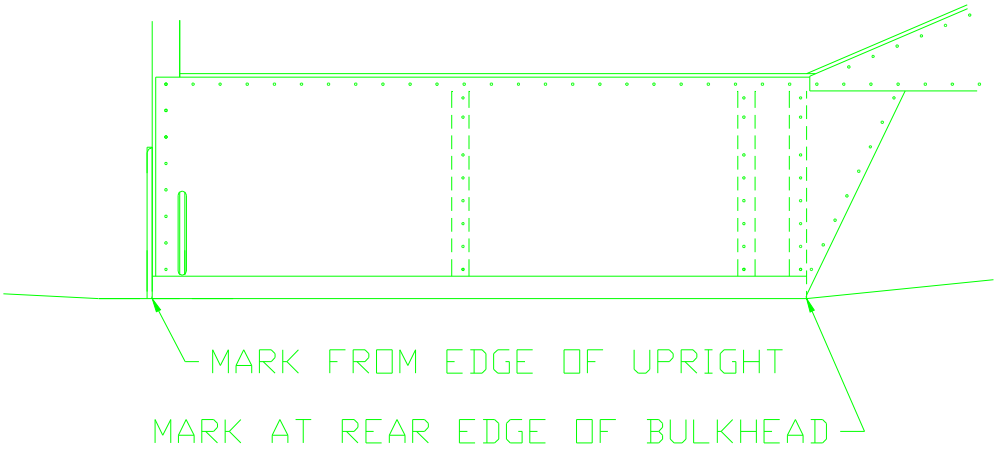



Figure 12.22.2

6) Remove the two FUS-35's.

7) Trim.

8) Debur all holes and edges.

9) Chromate mating surfaces.

10) Rivet together with 1/8" rivets (RV-1410).

## *12.23 Engine Mount Install*

1) From .032 sheet stock (W-143) cut out two bottom engine mount reinforcing gussets (FUS-55). Figure 12.23.1.

2) Inside the fuselage place one gusset on the front floor as in Figure 12.23.2

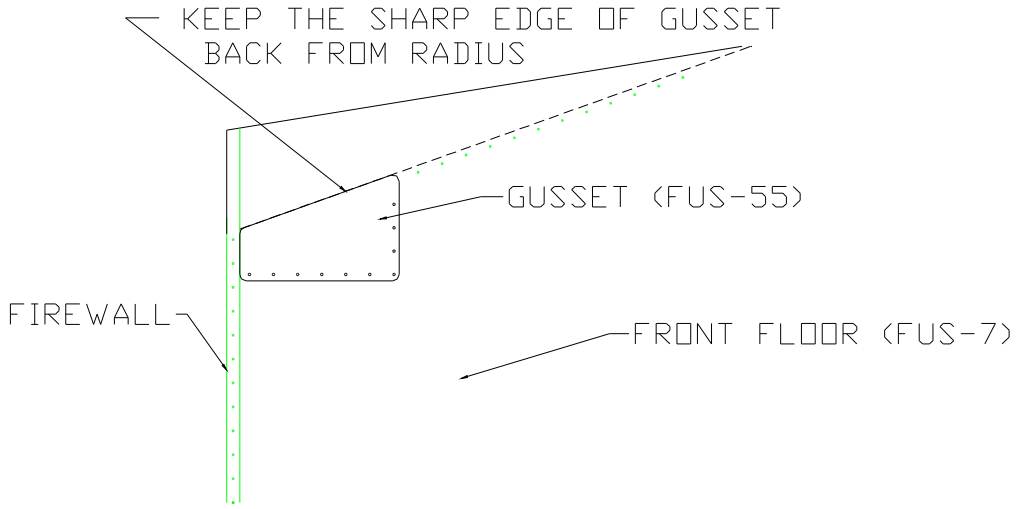



Figure 12.23.2

3) From inside the fuselage drill down through the holes in the gusset. Cleco.

4) Drill up through the holes in the side of the floor.

5) Repeat for other side.

6) Disassemble the tapered corner panels and gussets.

7) Debur all holes and edges.

8) Chromate the mating surfaces of the tapered corner panels and rivet in place with 1/8" rivets.

**NOTE:** a) Use 1/8" CS rivet (RV-4412) in the firewall flanges.

b) Do not rivet gussets in place at this time. Cleco only.

9) Drill four #30 holes in the firewall as shown in Figure 12.23.3.

**NOTE:** The holes for the engine mount bolts may be drilled by these dimensions, however for better accuracy, they may be located by positioning the engine mount and back drilling through the four mount points. It will be necessary to trim the top washers of the mounts to fit inside the flanges.

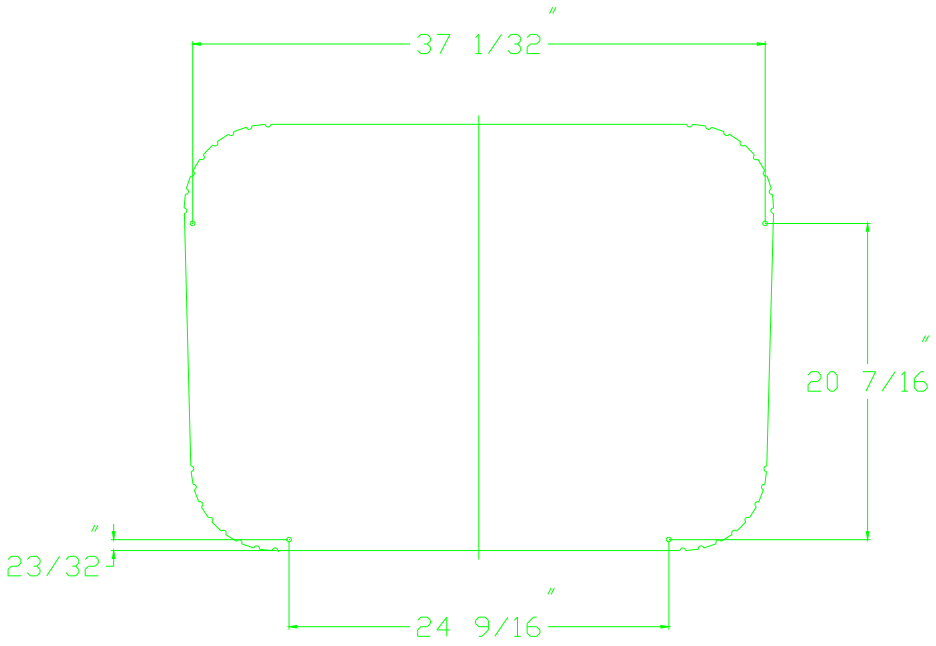



Figure 12.23.3

**NOTE:** Begin with the top engine mount bracket.

10) Mark a horizontal center line onto the front of FUS-86 as in Figure 12.23.4.

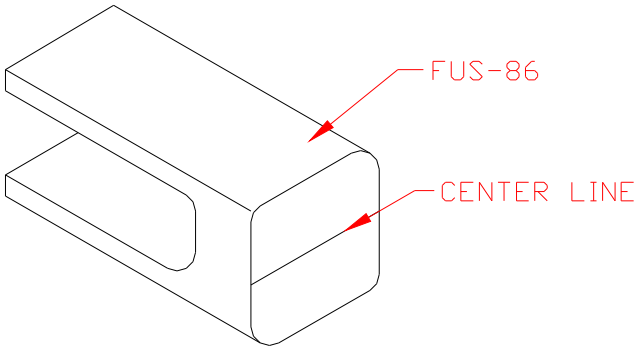



Figure 12.23.4

11) Align the FUS-86 part inside the FUS-85-1 bracket, then mark and trim off the end of FUS-85-1 to fit as shown. Debur all edges after trimming. The corners of the FUS-86 part should be rounded so as to avoid interference when the rivets are installed. Figure 12.23.5.

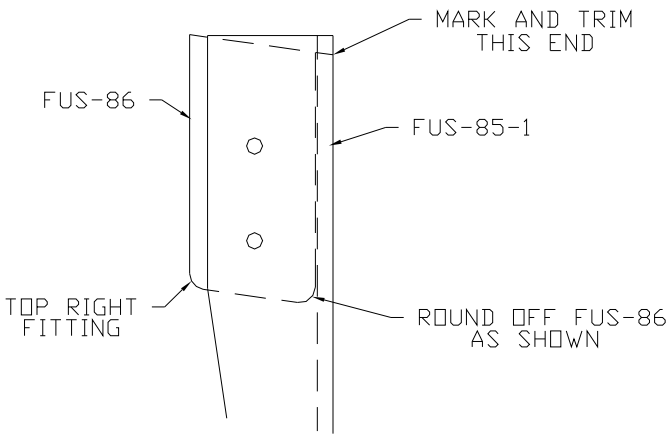



Figure 12.23.5

12) Drill through the #30 holes in the FUS-85-1 bracket into the FUS-86, then cleco FUS-85-1/86 together.

13) Drill the #30 holes out to 3/16" and debur

14) Cleco FUS-85-1/86 together using the two bottom holes.

15) Position the assembly behind firewall and line up the line on FUS-86 through the top hole on the firewall and center mark with a drill. See Figure 12.23.6.

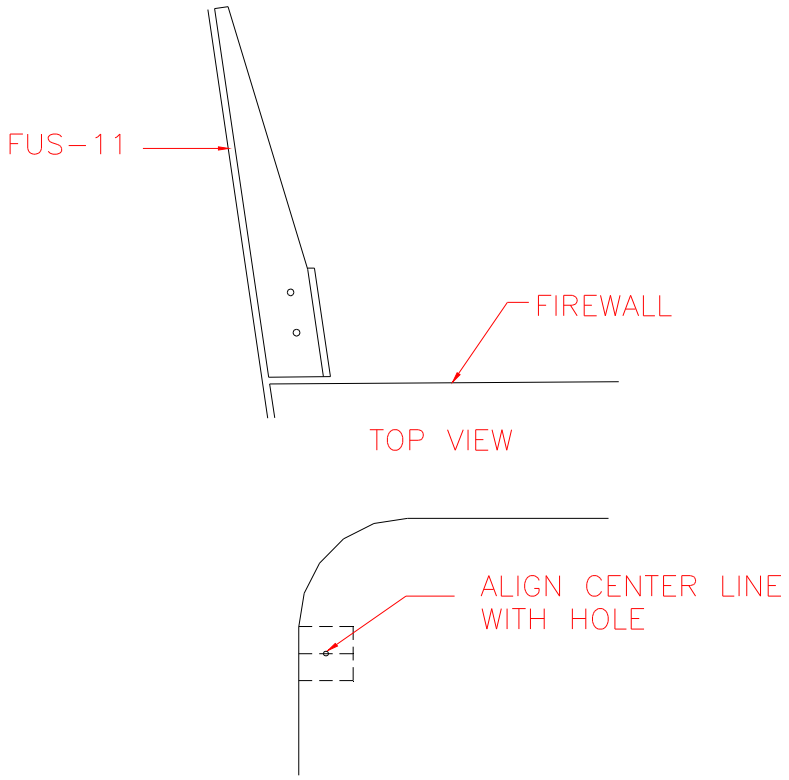



Figure 12.23.6

16) Remove and pilot drill the end of FUS-86 with a #30 drill.

17) Cleco assembly back in place using the hole in the firewall and drill all rivet holes in the bracket, through the doubler and the side piece FUS-11 with a #30 drill. **NOTE:** On some older parts it may be necessary to leave the furthest hole forward out for the top fittings since a rivet here will interfere with FUS-86. This hole may be drilled and a rivet installed for the bottom fittings since the orientation of FUS-86 is opposite.

18) Drill all holes to #11 for rivets and firewall to 5/16" for bolts (1/4" if you are fitting a Rotax 912).

19) Dismantle the parts and gussets. Debur all holes.

20) Install engine mount bolt AN5-27 into FUS-86.

21) Bolt FUS-86/FUS-85 together using 16 AN3-5A bolts. Figure 12.23.7.

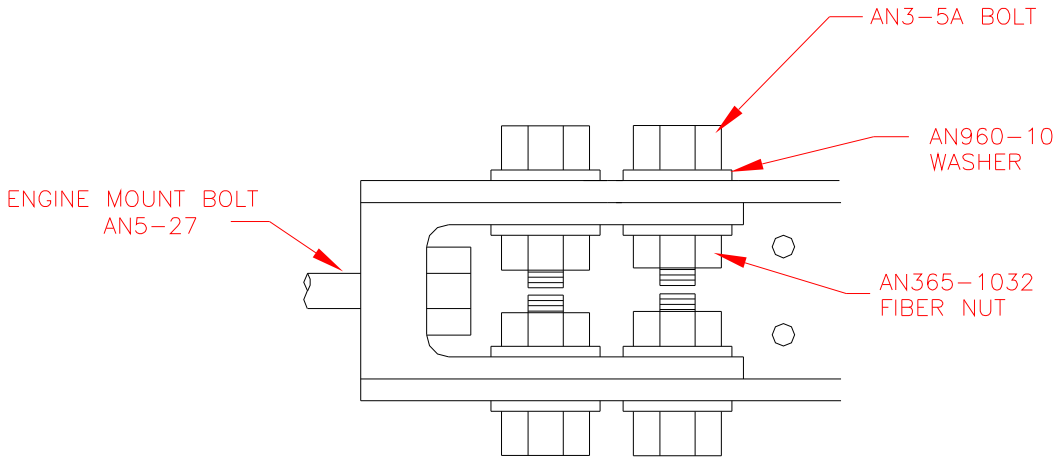



Figure 12.23.7

22) Chromate mating surfaces.

23) Rivet gusset and corner panels with 1/8" rivets (RV-1410). Rivet mounting brackets with 3/16" rivets (RV-1613).

24) Repeat steps for the bottom fittings.

## *12.24 Dashboard Brace*

1) Cut two Dashboard Braces (FUS-19) 22" long from stock 5/8" x 5/8" x .035" square tubing.

2) Position the two braces on the bottom ledges of the dashboard and against the firewall. Figure 12.24.1.

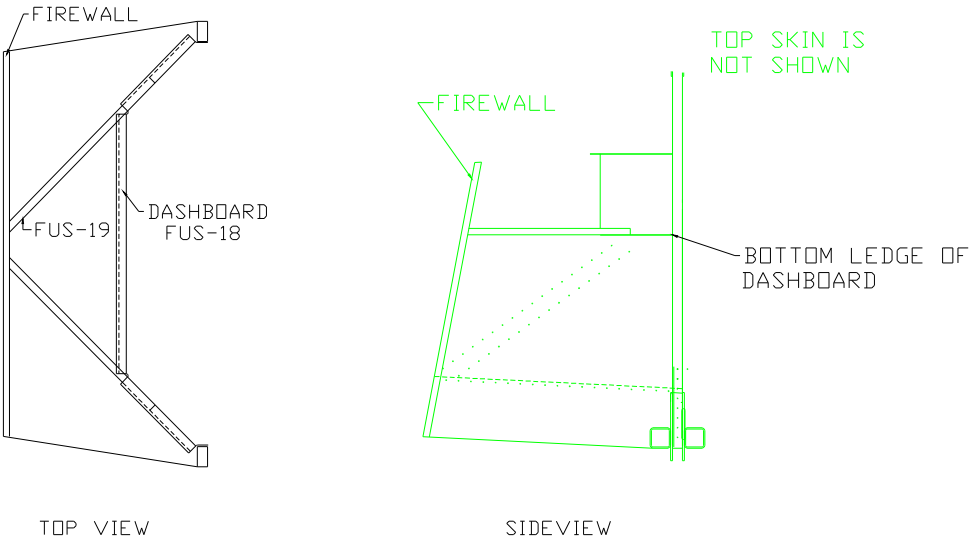



Figure 12.24.1

3) From the bottom side of the dashboard flange drill six #30 evenly spaced holes into one dash board brace. Cleco.

4) Repeat for other side.

5) Position the bottom firewall bracket (FUS-20B) against the firewall and underside of dashboard braces. Figure 12.24.2.

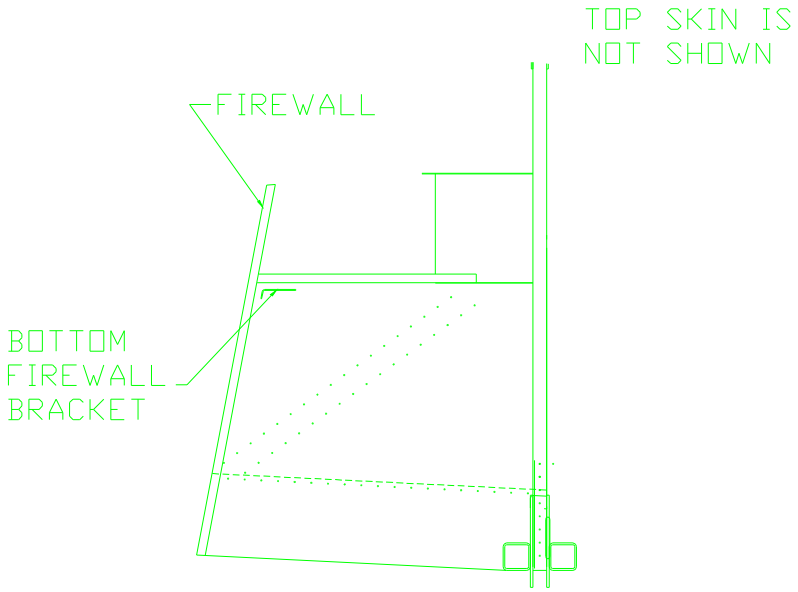



Figure 12.24.2

6) Drill eight evenly spaced #30 holes through the firewall bracket flange and into the firewall. Cleco.

7) Drill three evenly spaced #30 holes through the firewall bracket and into each dashboard brace. Cleco.

8) Repeat steps for the top firewall bracket.

9) Remove the firewall brackets and dashboard braces.

10) Debur all holes and edges.

11) Chromate all mating surfaces.

12) Rivet together with 1/8" rivets (RV-1410).

## *12.25 Witches Hat Install*

1) From the stock witches hat section (FUS-12) cut two lengths 41 1/2" long.

2) Position one on the front of the firewall. Figure 12.25.1. **NOTE:** It does not matter which one goes on the front or back.

3) Cut a piece of ST-31 channel to tie the top engine mounts together. Put the large length on the front and a small piece on the back with a 6" overlap. Layout and drill a 1" nominal double rivet line.

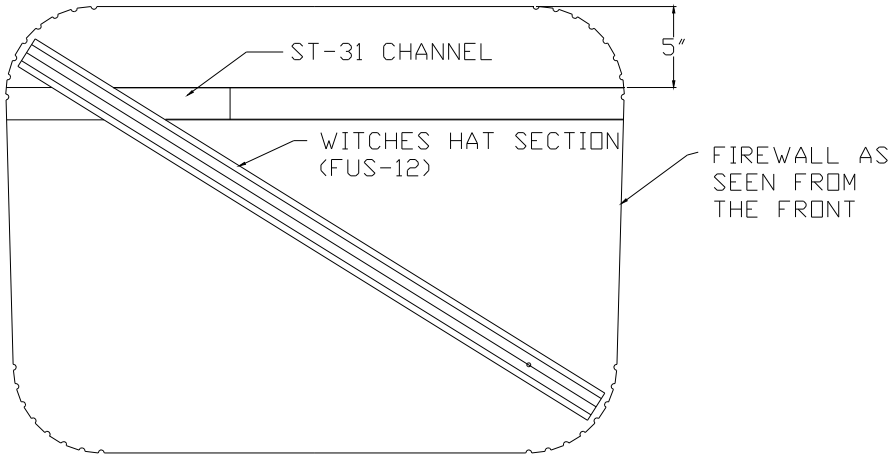



Figure 12.25.1

4) Back drill the holes through the firwall into the witches hat. Figure 12.25.2.

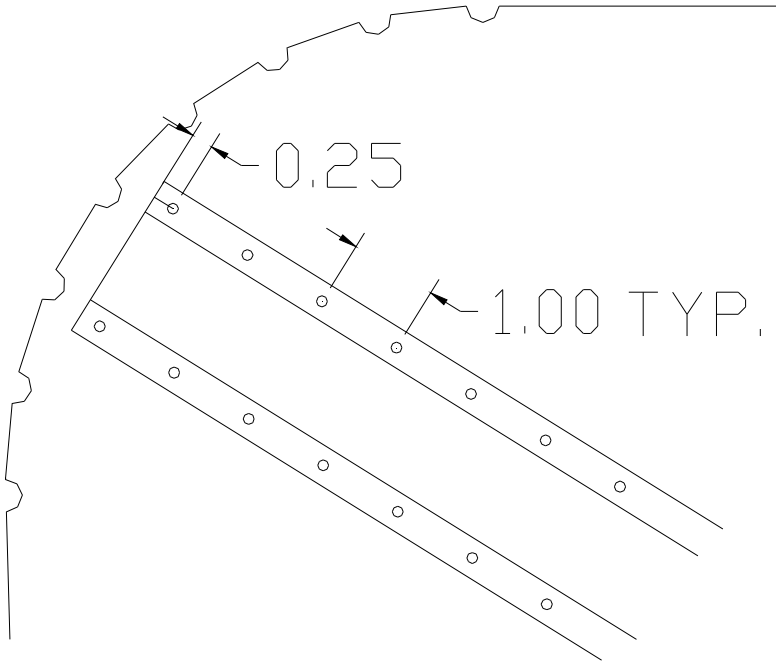



Figure 12.25.2

5) Repeat steps on the back of the firewall with the witches hat going to the opposite corners.

6) Remove parts and debur all holes and edges.

**NOTE:** The ends of each section can be trimmed on an angle for a more pleasing appearance and less weight. Figure 12.25.3.

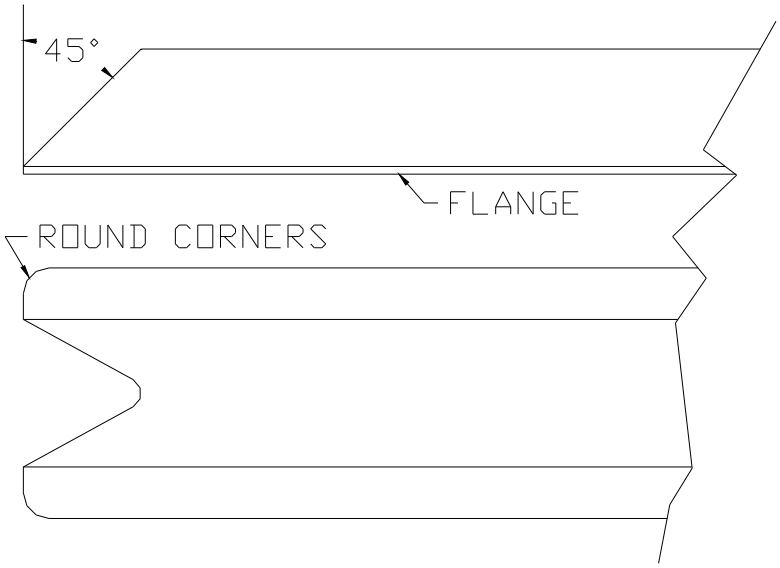



Figure 12.25.3

7) Chromate mating surfaces and rivet with 1/8" rivets (RV-1410).

**NOTE:** Put all rivets in from the front of the firewall for a better appearance.

8) From the stock witches hat section (FUS-12) cut two front side panel stiffeners (FUS-56). Figure 12.25.4.

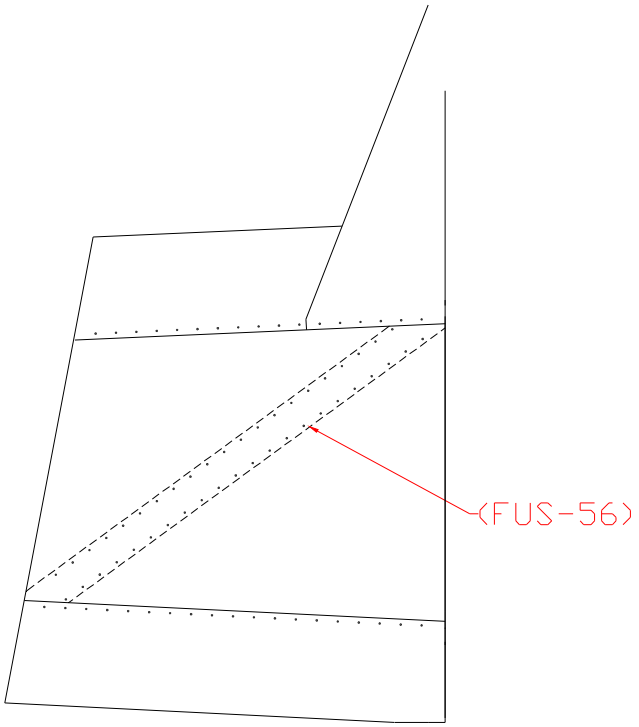



Figure 12.25.4

**Builders Tip**: Hold the uncut section against the outside face of the right front side panel for marking. Trim, then use on the inside left side panel. Do the same for the opposite side.

9) Position one side in place and drill to #30.

10) Repeat for other side.

11) Remove and debur all holes and edges.

12) Chromate mating surfaces.

13) Rivet with 1/8" rivets (RV-1410).

## *12.26 Wing Attach Bracket*

1) Cut two square bulkhead sections to fit in front of bulkhead "F". The flange will face the front. Figure 12.26.1.

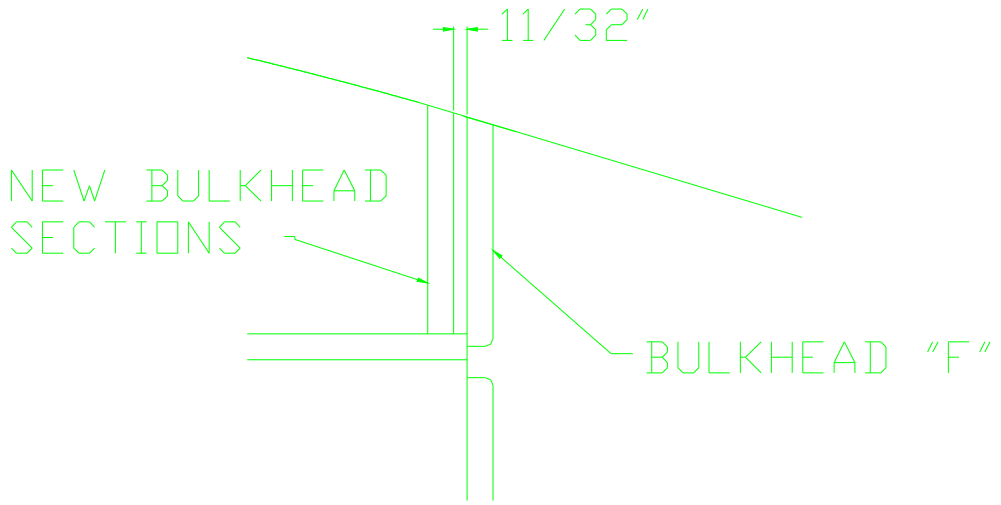



Figure 12.26.1

**NOTE:** There should be a space of 11/32" between the bulkheads. You can use four rear wing attach brackets (FUS-69) sandwiched together between the bulkheads at each side to ensure the correct spacing. Bend the top flanges of the new bulkhead sections up against the cabin roof.

2) From inside the fuselage drill out the cabin top and fuselage root ribs. Use the same spacing as in Bulkhead "F".

3) Mark and trim the legs of the new bulkhead sections for 4" of overlap at center and drill the nine #30 holes in the overlap section as you did for each of the other bulkheads.

4) Install angle brackets as you did with the other bulkheads in roof section.

5) Call the new bulkhead sections "G".

6) Cleco four rear wing attach brackets (FUS-69) together. Figure 12.26.2.

7) Drill two #30 holes as in Figure 12.26.2.

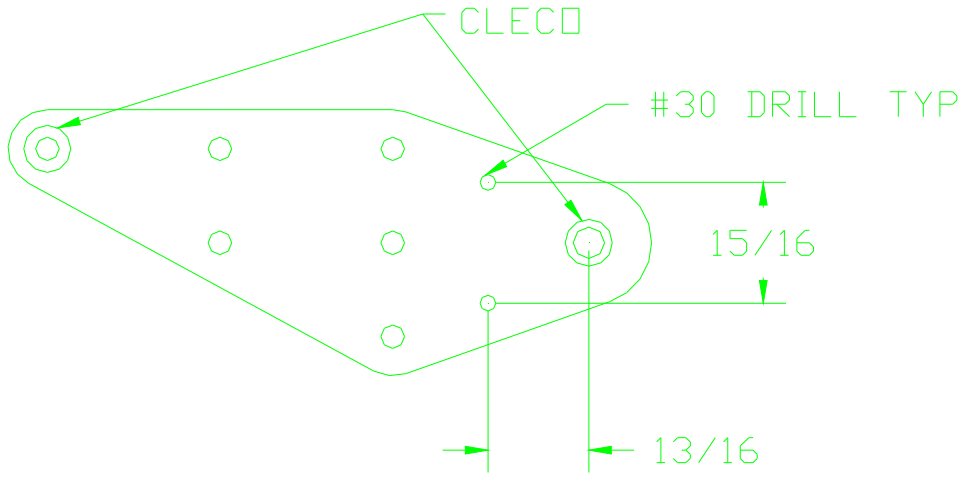



Figure 12.26.2

8) Disassemble.

9) On the two inner fittings mark and trim as in Figure 12.26.3

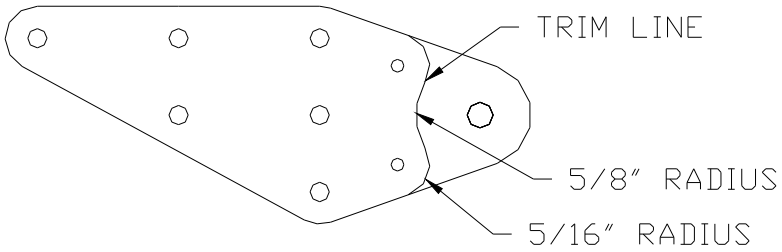



Figure 12.26.3

10) Cleco the four fittings together using the #30 holes just drilled.

11) On the left wing find the distance from the top skin to the attachment hole in the rear spar fittings (W-124). Figure 12.26.4.

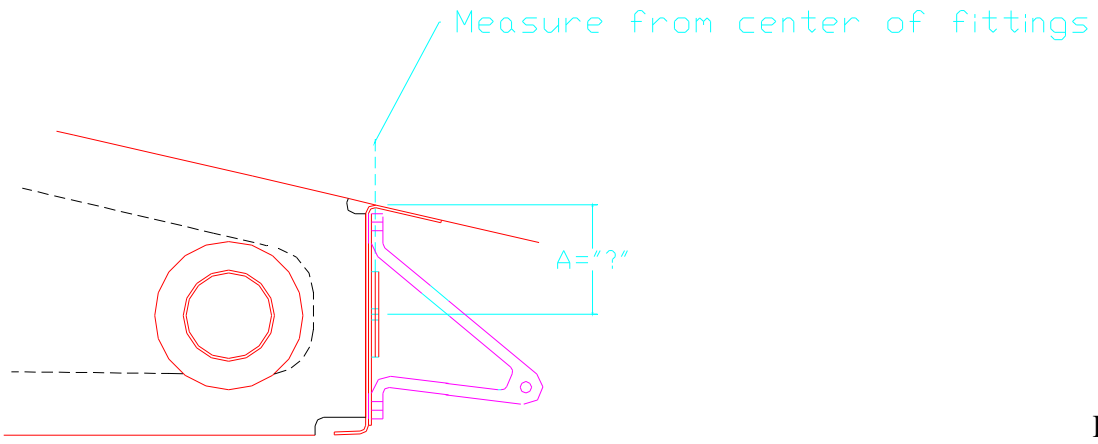



Figure 12.26.4

12) Draw a line down the center of the space between bulkheads "F" and "G". Figure 12.26.5.

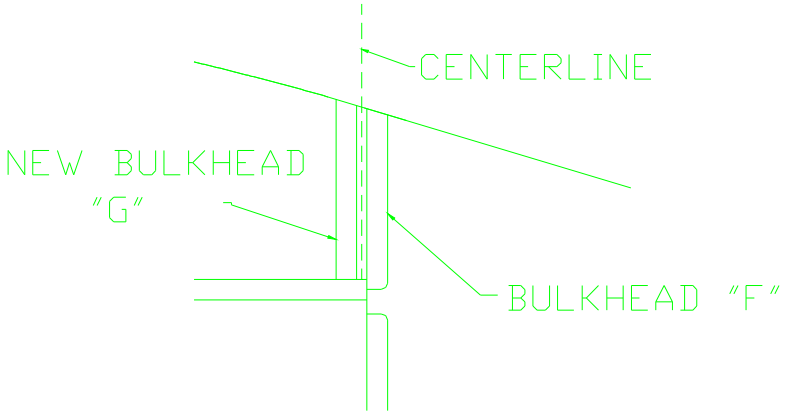



Figure 12.26.5

13) On the centerline and from the top of the fuselage mark the distance measured in step 141. See Figure 12.26.6.

14) Mark and cut out a slot between the two bulkheads as in Figure 12.26.6.

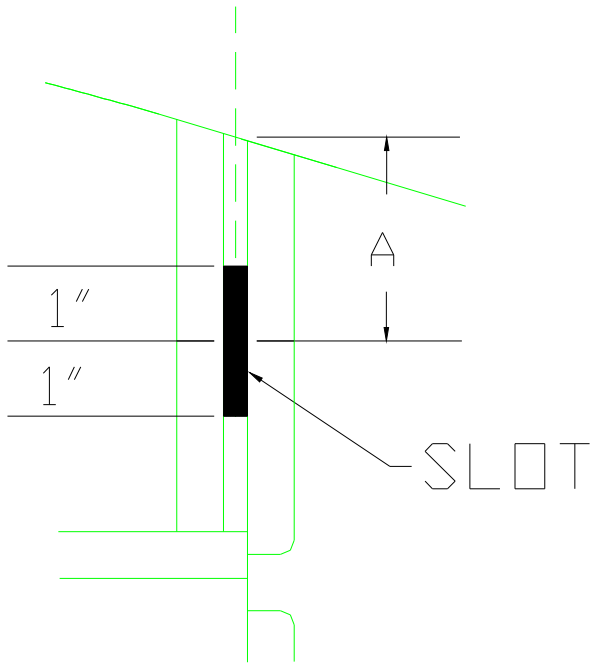



Figure 12.26.6

15) Remove bulkhead “G”.

16) Insert the four rear attach brackets (FUS-69) into the slot. Figure 12.26.7.

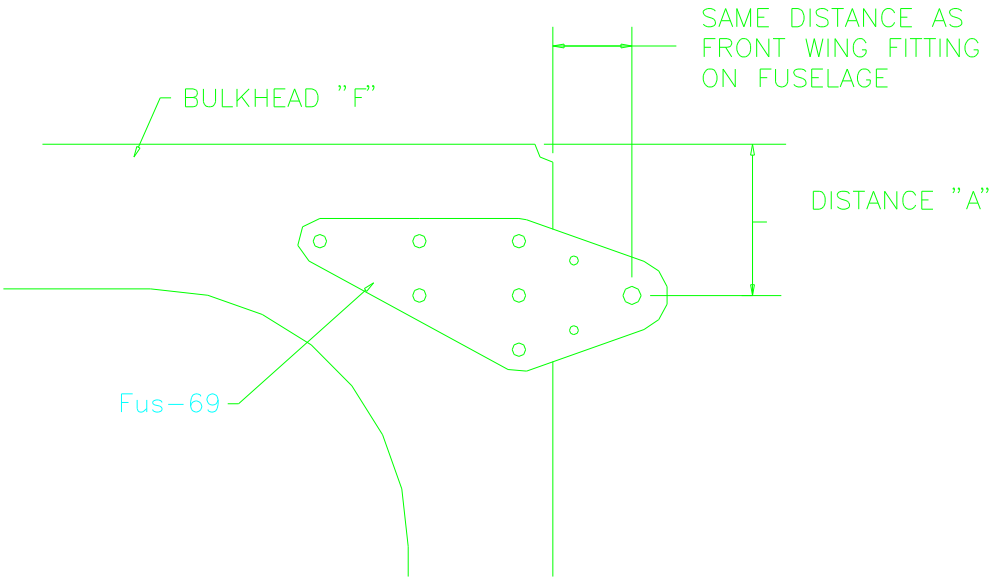



Figure 12.26.7

17) Ensure the wing attach hole in the rear attach brackets (FUS-69) is in the correct location as in Figure 12.26.7. Drill the five attach holes back through the fitting and into bulkhead "F" with a #30 drill.

18) Repeat steps for the right side.

19) Replace bulkhead "G".

20) Back drill to #30 through bulkhead "F" and the rear spar fitting into bulkhead "G".

21) Drill the #30 holes out to #11.

22) Remove and debur all holes and edges.

23) Install the reinforcing angles (FUS-53), following the same procedure you did earlier.

24) Chromate mating surfaces.

25) Rivet bulkhead "G" in place with 1/8" rivets (RV-1410).

26) Bolt rear spar fittings in place with AN3-6A bolts.

## *12.27 Float Attach Points (optional)*

1) Locate bulkhead "A", and mark a line from the center of the radius onto the outside skin. Mark a box 1" x 1/4" as shown in figure 12.27.1.

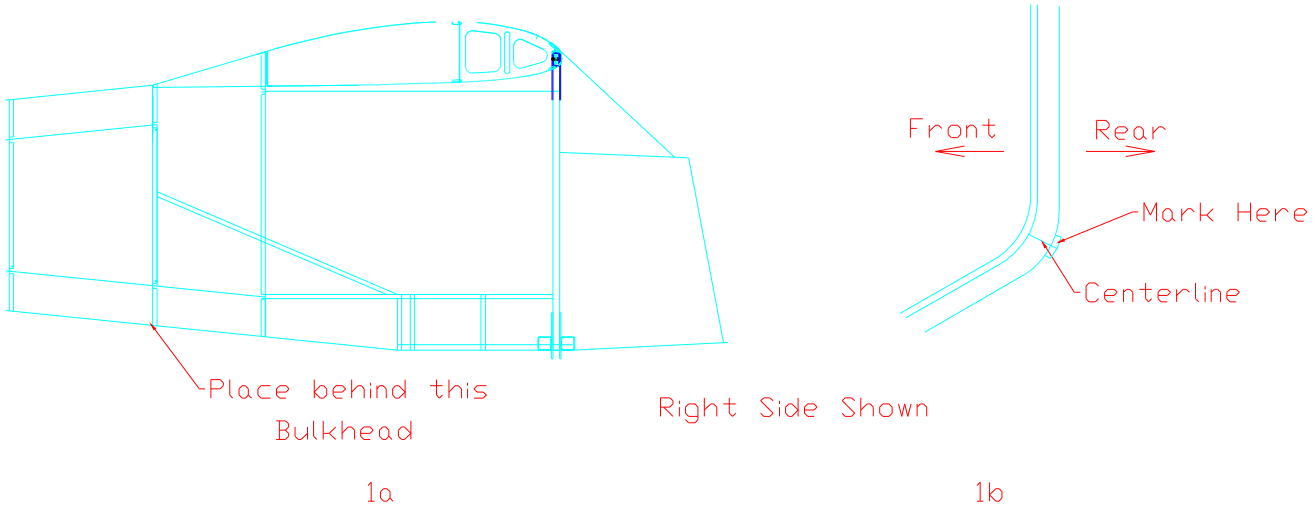



Figure 12.27.1

2) Drill a 1/4" hole through the outer skin directly behind the bulkhead, in the marked area.

3) Using aviation snips, cut out the marked area for the FUS-42 lug.

4) File all sharp edges on the hole.

5) Put the Float Hard Point (FUS-42) bracket into place on the bulkhead radius with the lug sticking out through the hole.

6) Back drill through the bracket into the bulkhead using a #11 bit. Drill only the four end holes as in figure 12.27.2.

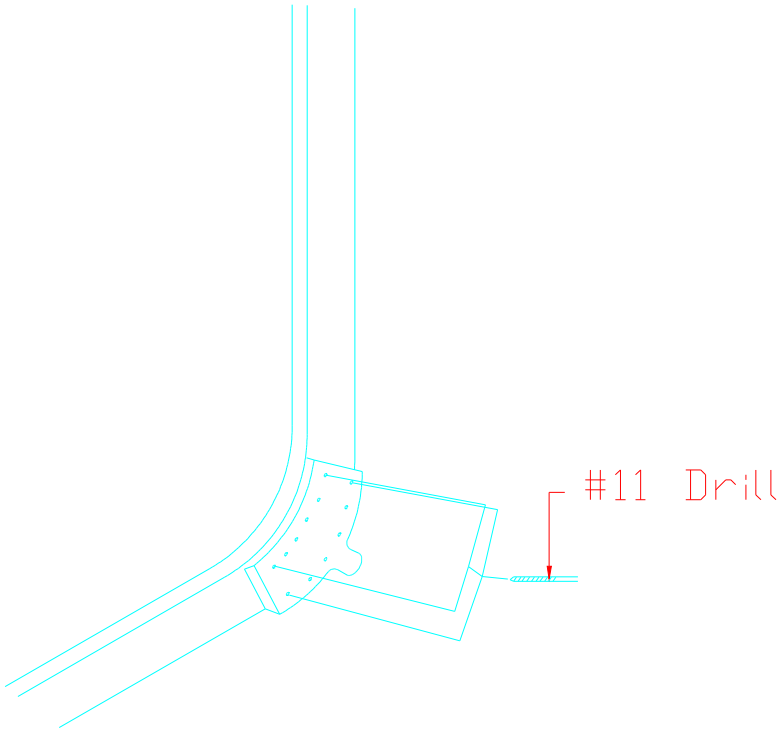



Figure 12.27.2

7) Cleco the bracket in place.

8) Drill the remaining holes with a #30 drill then remove the bracket (FUS-42).

9) Repeat for the left side of the fuselage.

10) Clamp two additional bulkheads in place back to back with the original bulkheads. Figure 12.27.3.

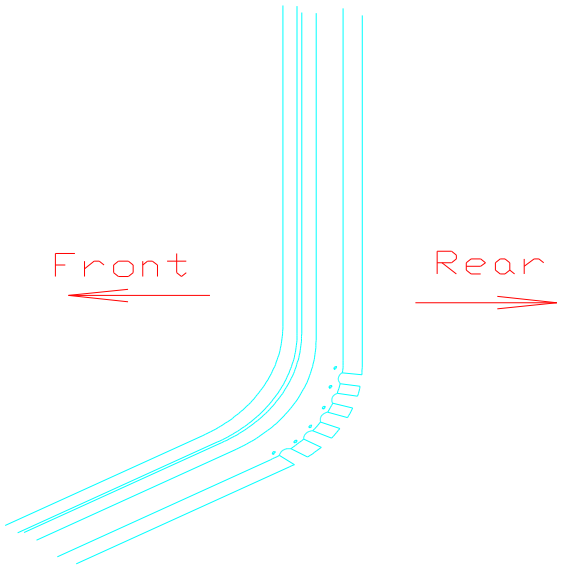



Figure 12.27.3

11) The bulkheads should be nested, marked, trimmed and attached to each other, same as the other bulkheads you did earlier.

12) Clamp the new bulkheads in place against the existing bulkheads and drill back through the bracket holes into the new bulkheads.

13) Debur all holes.

14) Put the brackets back in place and cleco together with the bulkheads on each side as in figure 12.27.4. Also place a 1/4" spacer on the floor between the bulkheads at the center of the aircraft.

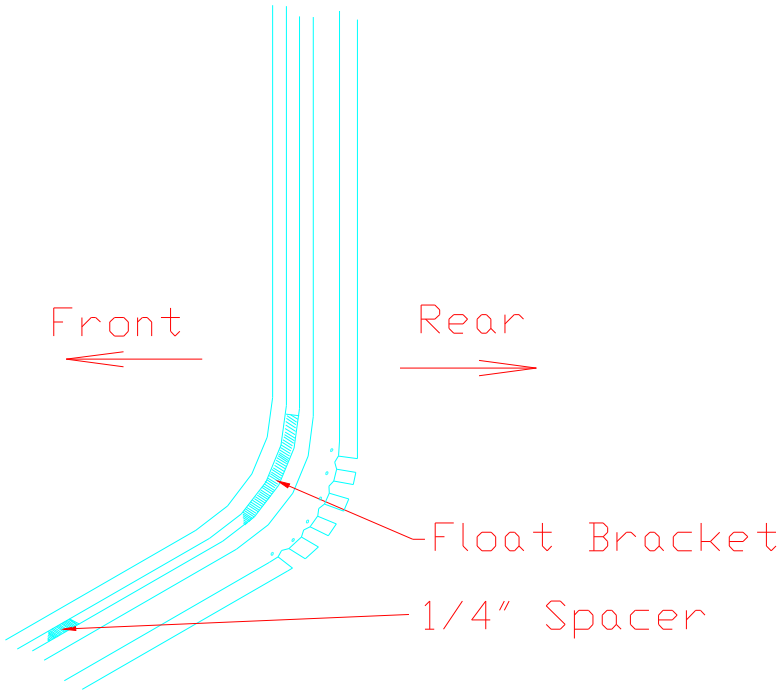



Figure 12.27.4

15) Drill the remaining holes in the bracket to #11.

16) Attach the brackets using 3/16" rivets (RV-1619).

17) At the top of the bulkheads, layout and drill nine attachment holes from the forward bulkhead to the aft bulkhead. You will bend the new bulkhead over to accomplish this. Bulkheads are back to back at the top as in Figure 12.27.5.

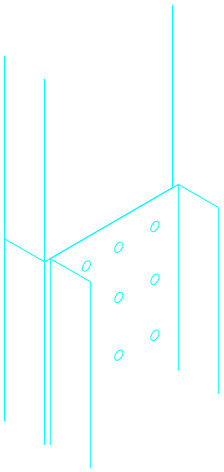


Figure 12.27.5

18) Attach bulkheads at this point using 1/8" rivets (RV-1410).

19) On the outside of the floor skin, mark a line along the center of the new bulkhead flange. Drill, debur and rivet the bulkhead through the floor at the same spacing as the other bulkheads.

20) Repeat for the side skins.

21) Remove the 1/4" spacers.

22) Rivet the bulkhead to the outer corner wrap (FUS-33) using RV-1410 rivets.

23) Cut a strip of .032 gusset material wide enough to cover the gap between the bulkheads forming a sealed beam. The strip should cover from the top end of the new bulkhead to about 4" into the floor. Figure 12.27.6.

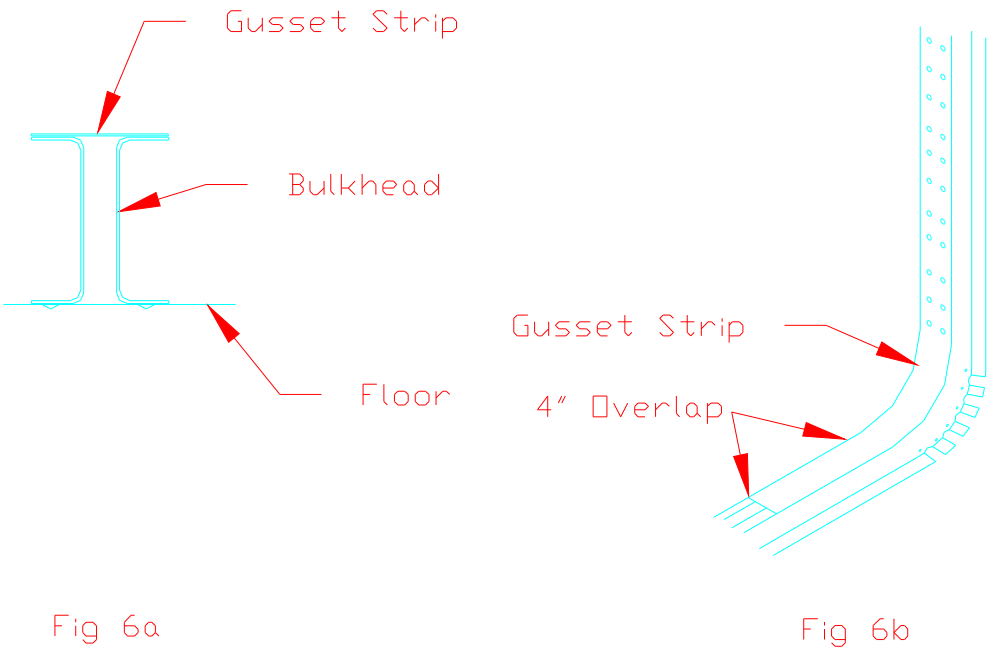



Figure 12.27.6

24) Drill and rivet into the flanges of the bulkheads along the vertical and around the radius at the bottom. Rivet with the same spacing as on the outside flanges of the bulkheads.

**NOTE**: The 4" overlap should not be drilled or riveted until the inner floor is installed.

## *12.28 Finishing Gussets*

1) Measure the distance from the edge of one flange to the edge of the other. Figure 12.28.1.

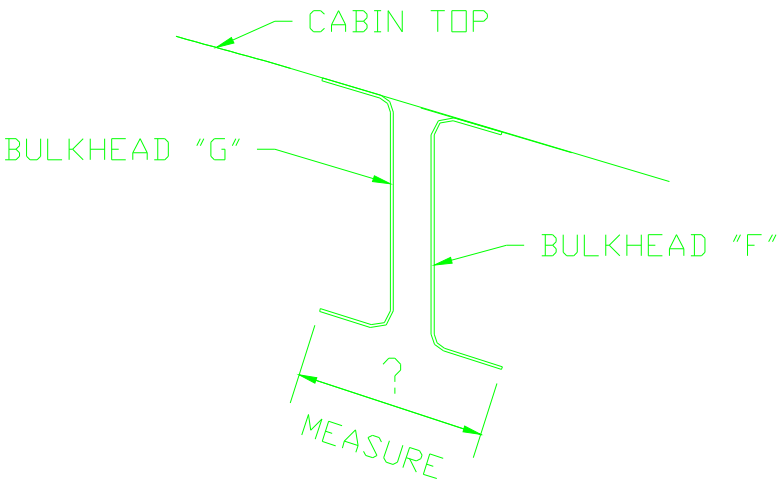



Figure 12.28.1

2) From raw stock (FUS-62) cut a strip the width measured in previous step and 48" long.

3) Center and clamp the strip to the two bulkheads.

4) Drill with the same spacing as the cabin top to #30.

**NOTE:** You will notice that as the strip approaches the rounded corners it will no longer fit the flanges. Do not drill in the corners.

5) Cut two short strips approximately 1" wider than the measured distance and long enough to go around the corner.

6) Position one short strip and drill at 1" spacing to #30.

**NOTE:** The short strip and the long strip should overlap so that four holes will be common in each. Figure 12.28.2.

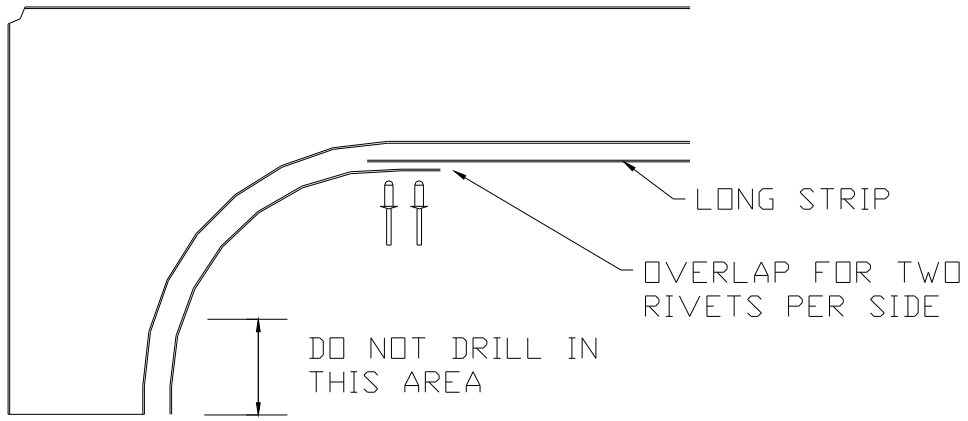



Figure 12.28.2

7) Mark and trim the excess width off the short strip.

8) Trim the excess length off the long strip.

9) Repeat for the other side.

10) Debur all holes and edges.

11) Chromate mating surfaces.

12) Rivet with 1/8" rivets.

13) From Stock material (W-143) cut and form two outer fuselage gussets (FUS-51) as in Figure 12.28.3.

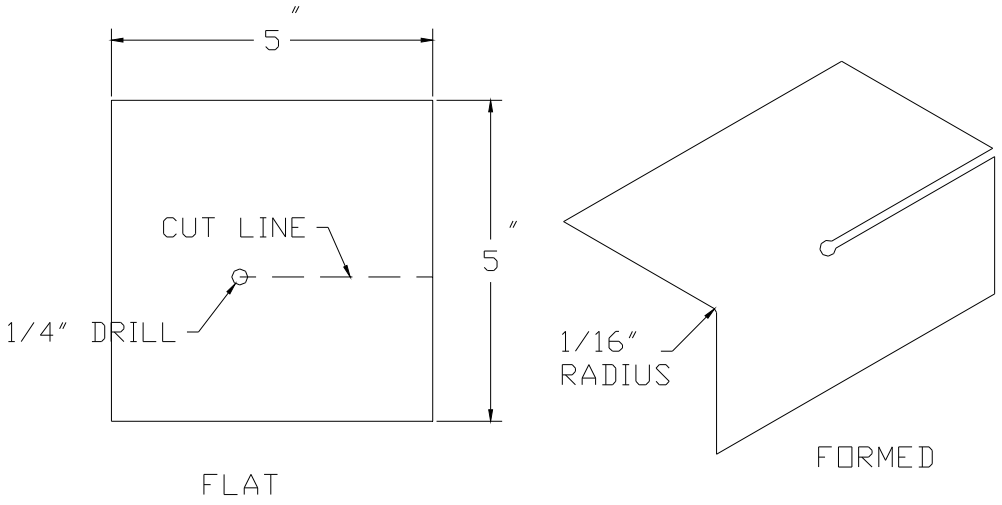



Figure 12.28.3

14) Position one gusset at bulkhead "A" position as in figure 12.28.4

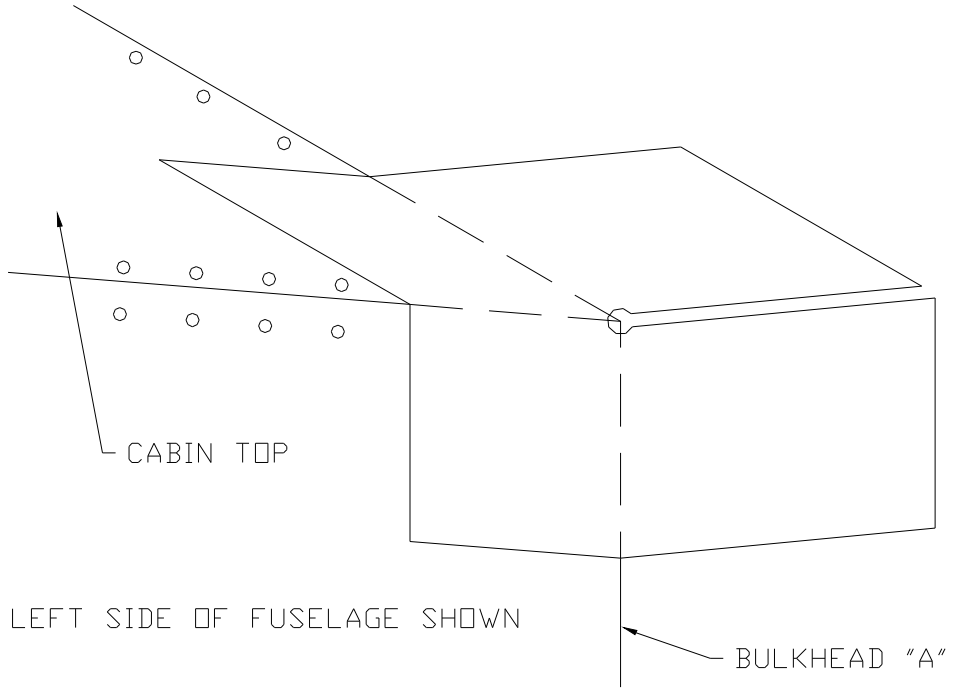



Figure 12.28.4

15) In the forward half of the gusset drill back through the fuselage skins into the gusset with a #30 drill bit.

16) In the rear section of the gusset drill 3 holes in the top and 3 in the side. Figure 12.28.5.

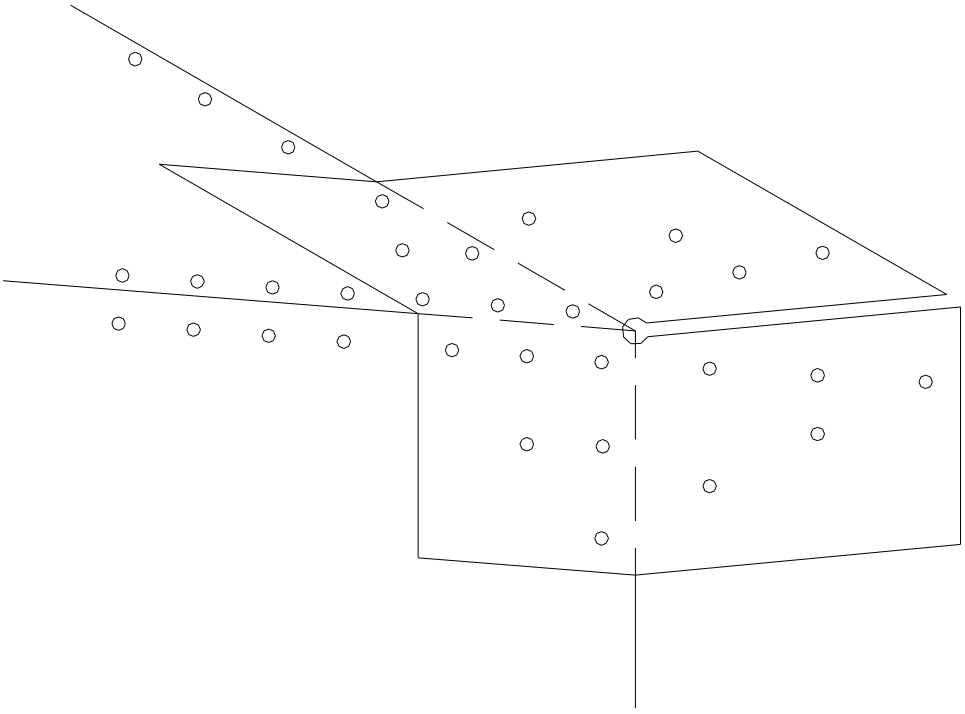


Figure 12.28.5

17) Draw a 5/8" circle around the rivet hole at each corner.

18) Join the circles and trim. Figure 12.28.6.

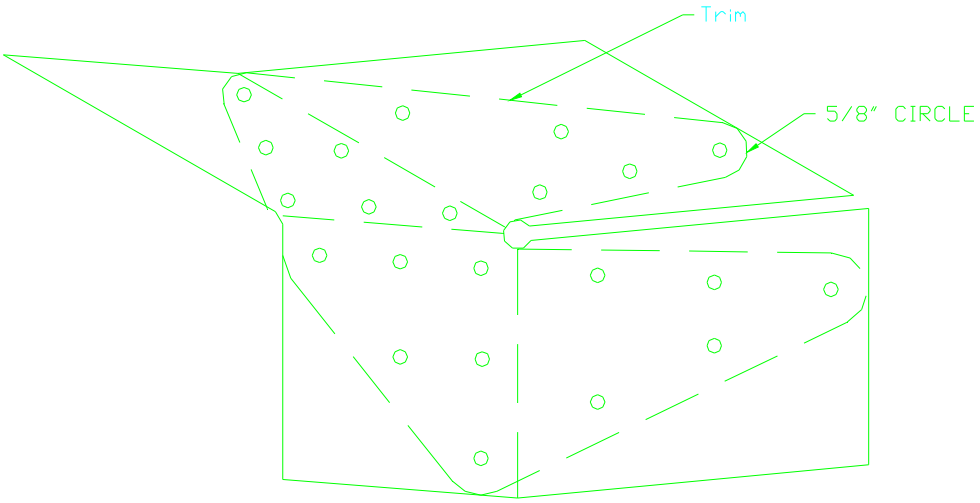



Figure 12.28.6

19) Debur all holes and edges.

20) Chromate mating surfaces and rivet in place with 1/8" rivets (RV-1410).

21) Cut a channel from ST-31 to fit between bulkheads "F" and "A" as in Figure 12.28.7. Use angle brackets made from ST-40 material to install the channels.

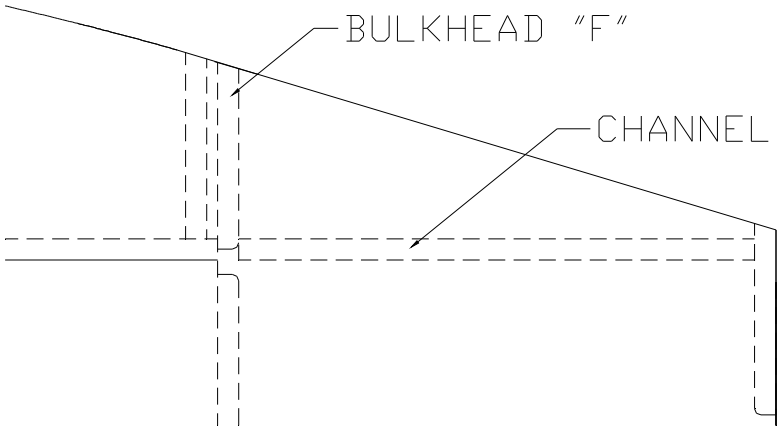



Figure 12.28.7

## *12.29 Fairing Box Install*

1) Mount the wing on the fuselage.

2) Mark and cut two strips of .020 material (from FUS-62) as in Figure 12.29.1. The width should be measured as the distance from the outside of the fuselage to the wing plus 3/4" for overlap on the roof. **NOTE:** Remember to make 2 opposite fairing boxes, 1 for the left side of the fuselage and 1 for the right. All illustrations are for the left side.

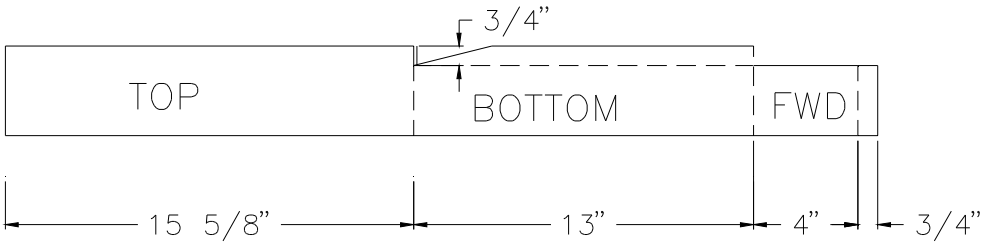



Figure 12.29.1

3) Mark the bending lines as shown on the drawing and mark and cut out the 3/4" bend relief of the bottom flange. Debur all edges.

4) Using the first bend line as a guide, align the outboard edge of the fairing strip flush with the edge of an aileron rib (AIL-23) as in figure 12.29.2.

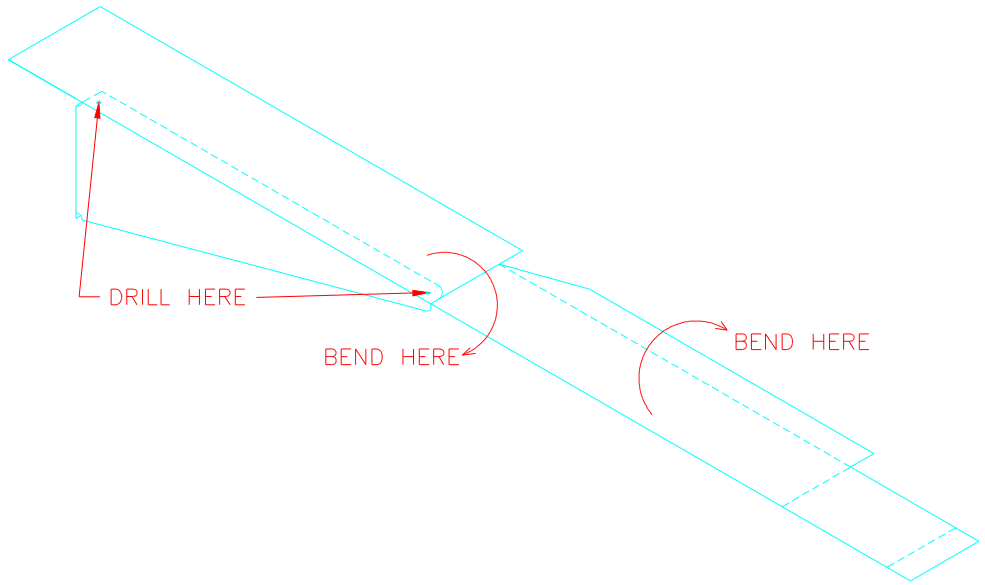



Figure 12.29.2

5) Drill a #40 hole through the .020 skin and the aileron rib at the top front corner. Cleco in place as in figure 12.29.2. Drill a hole at the top rear corner.

6) Make a 90º bend in the 3/4" bottom flange which has the relief cut out of it.

7) Bend the fairing strip at the first bend line to match the shape of the aileron rib.

8) Cleco the aileron rib in place using the top flange holes drilled earlier. Drill similar #40 holes through the strip into the ends of the bottom flange of the aileron rib. Cleco at the new holes. See figure 12.29.3.

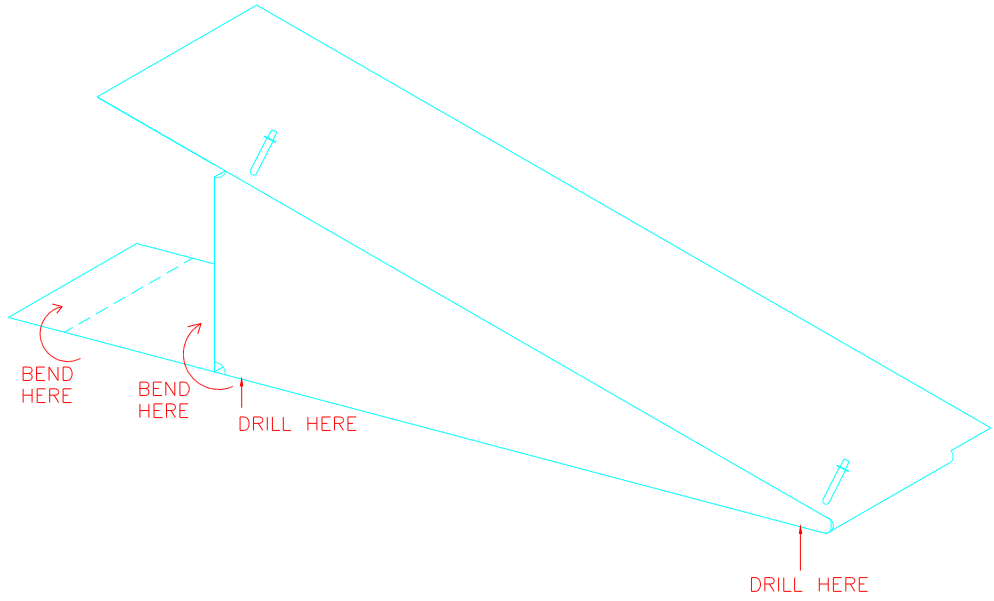



Figure 12.29.3

9) Make a 90º bend in the strip at the end of the forward portion, then bend up the forward portion of the strip to match the front of the aileron rib. **NOTE:** One cleco will have to be removed for the top so the flange can now fit, sandwiched, between the top side of the strip and the aileron rib as in figure 12.29.4.

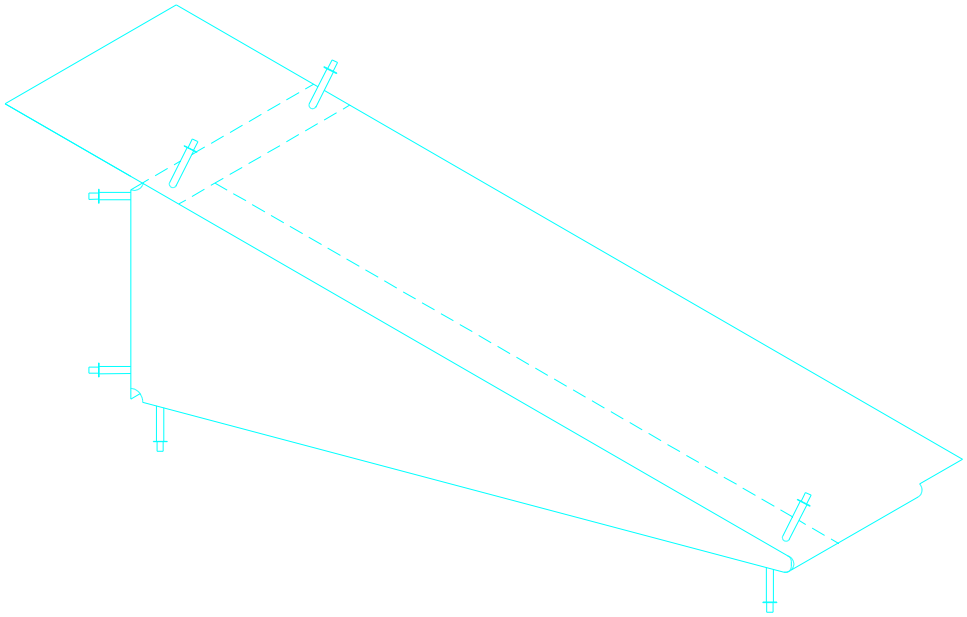


Figure 12.29.4

10) Drill a #40 hole through the top of the fairing into the flange which is now sandwiched and cleco together.

11) Drill #30 holes at 1-1/2" nominal spacing between the clecoed holes.

12) Place the fairing box against the fuselage with the flange overlapping onto the roof skin and align the trailing edge with the trailing edge of the flaperon. **NOTE:** Be sure that the flaperons are in neutral position. The wing may be removed after this step if preferred. See Figure 12.29.5.

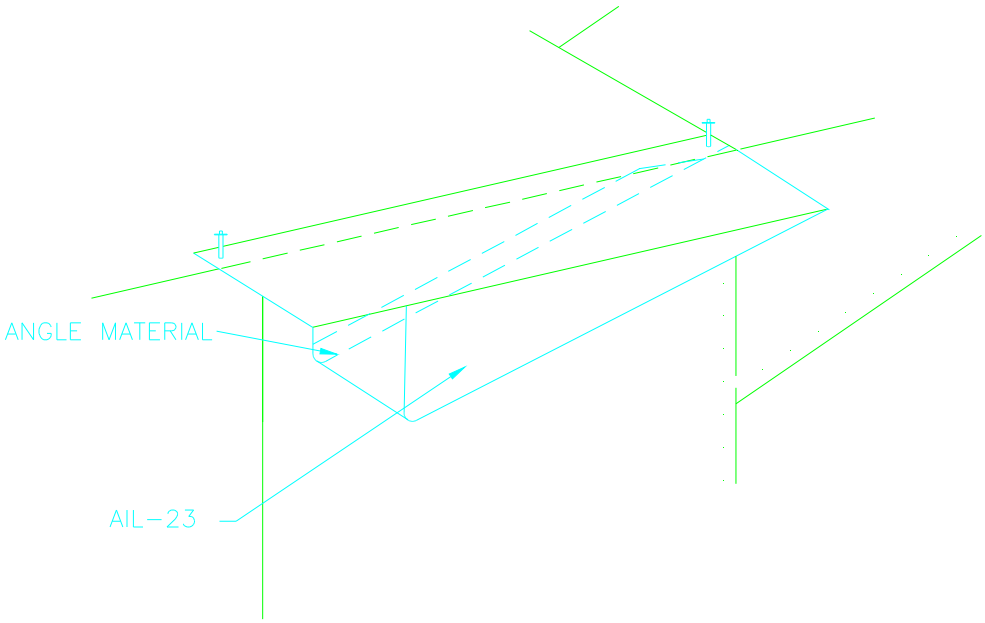



Figure 12.29.5

13) Drill #30 holes through the ends of the overlapping flange into the roof skins and the flange of the FUS-27 fuselage rib and cleco.

14) Drill #30 holes at 1 1/2" nominal spacing between the end holes.

15) Using a felt pen, mark a line along the bottom of the box onto the side of the fuselage. Also mark lines at the ends of the bottom flange along this line.

16) Remove the fairing box from the side of the fuselage.

17) Mark a line 3/8" above the line marked earlier. Drill #30 holes 5/16" from each end of the line as marked earlier.

18) Drill #30 holes at 1 1/2" nominal spacing between the end holes.

19) Cleco the fairing box back onto the side of the fuselage using the top holes. From inside the cabin, back drill through the holes into the bottom flange of the fairing box.

20) Remove the box and disassemble it. Debur all holes and edges including those on the fuselage.

21) Reassemble the box and attach it to the fuselage using 1/8" rivets (RV-1410).

22) Repeat for the other side.

## *12.30 Seat Belt Bracket*

1) From stock material (FUS-57) cut a seatbelt shoulder attach bracket (FUS-58). Figure 12.30.1.

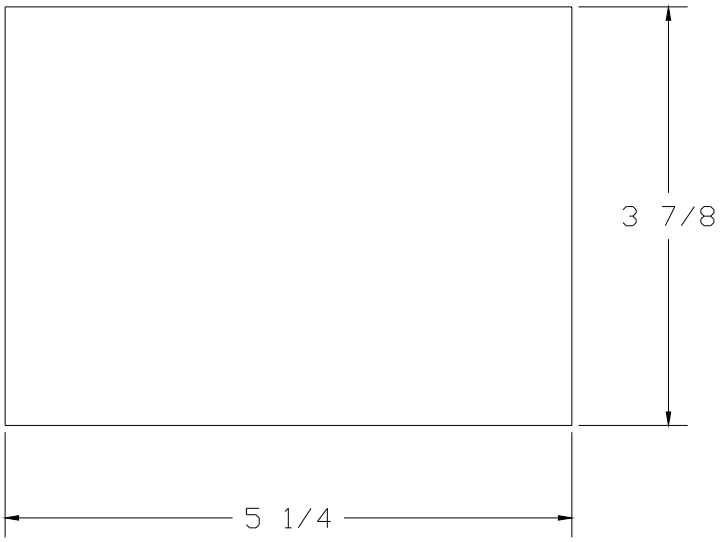



Figure 12.30.1

2) Position and drill as in Figure 12.30.2.

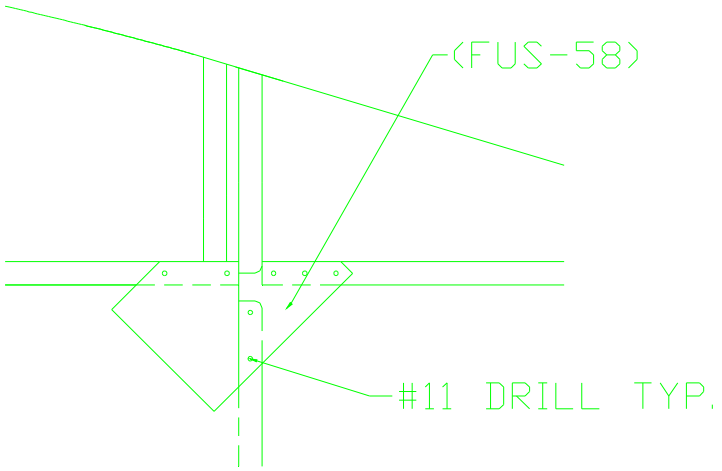



Figure 12.30.2

3) Remove the seatbelt shoulder attach bracket.

4) Position a corner gusset (FUS-37) on the inside of the fuselage root rib and bulkhead "F". Figure 12.30.3.

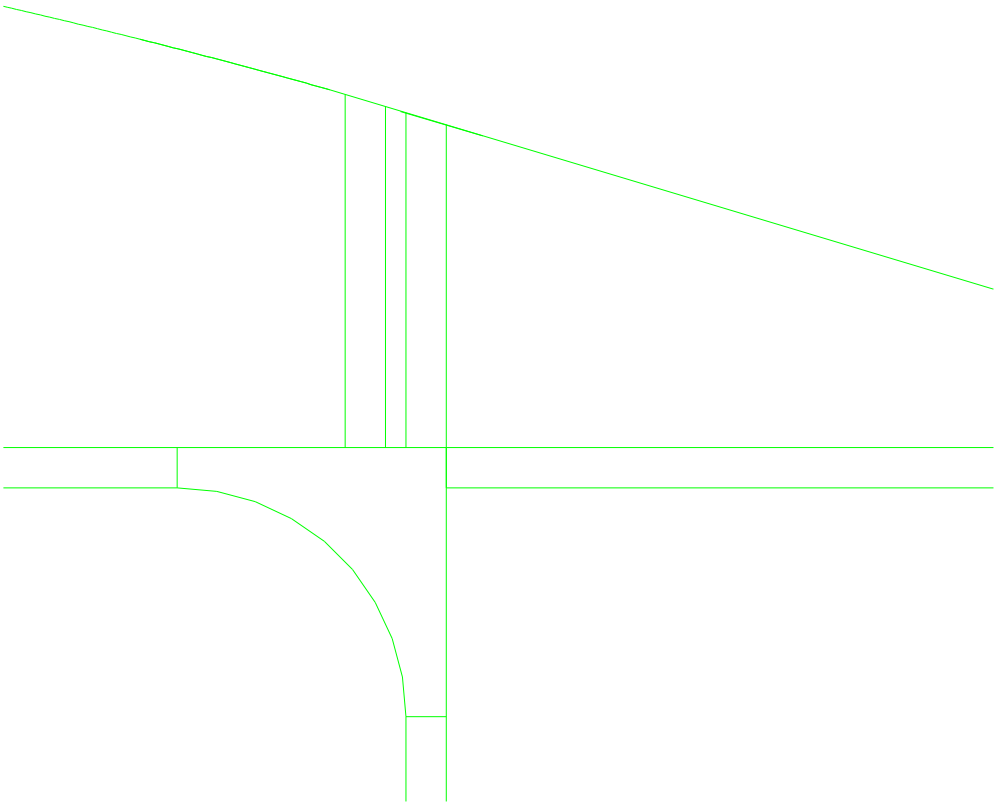


Figure 12.30.3

5) Mark and trim the gusset to fit bulkhead "F" and inside flange of the Fuselage Root Rib (FUS-27). Figure 12.30.3.

6) Hold gusset in place and reposition seatbelt attach bracket (FUS-58).

7) Cleco in place.

8) Drill back through (FUS-58) and into corner gusset. Cleco.

9) Mark the outline of the corner gusset on to the FUS-58.

10) Find the seatbelt shoulder harness attach bolt position as in Figure 12.30.4

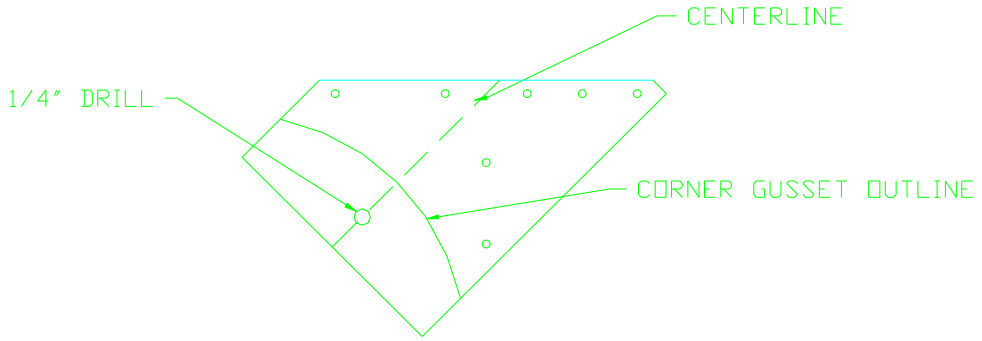



Figure 12.30.4

11) Trim the bracket as in Figure 12.30.5

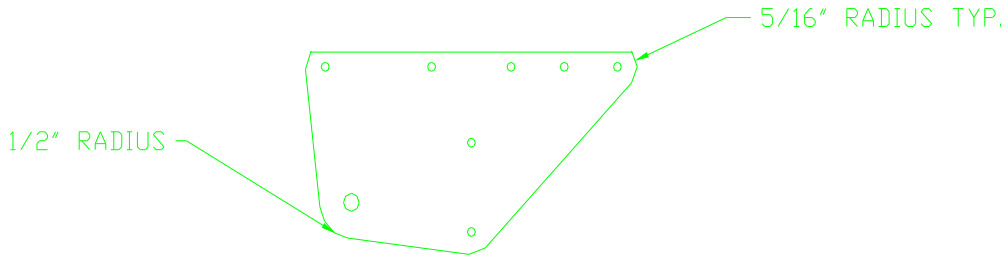



Figure 12.30.5

12) Debur all holes and edges of corner gusset and attach bracket.

13) Chromate mating surfaces.

14) Rivet together with 3/16" rivets (RV-1613).

15) Repeat for other side.

16) From stock material (FUS-57) cut a side seatbelt attach bracket (FUS-59). Figure 12.30.6.

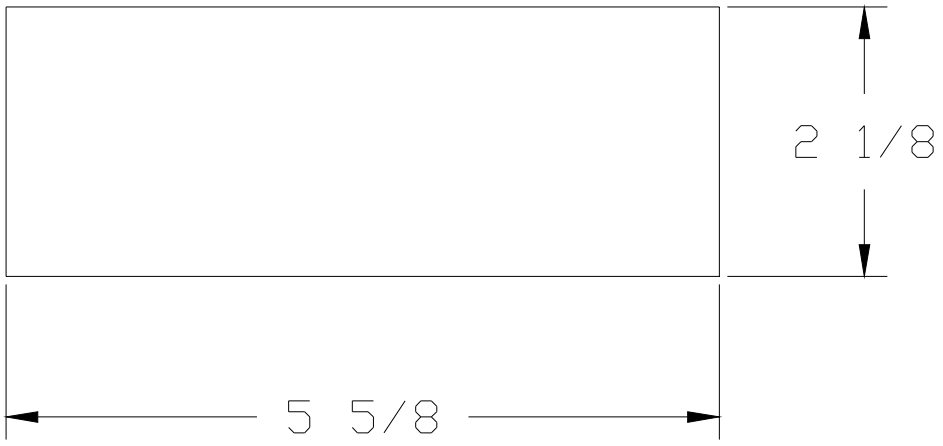



Figure 12.30.6

17) Position a FUS-25 against the inner side of the door sill and rear angle sill (FUS-15). Figure 12.30.7.

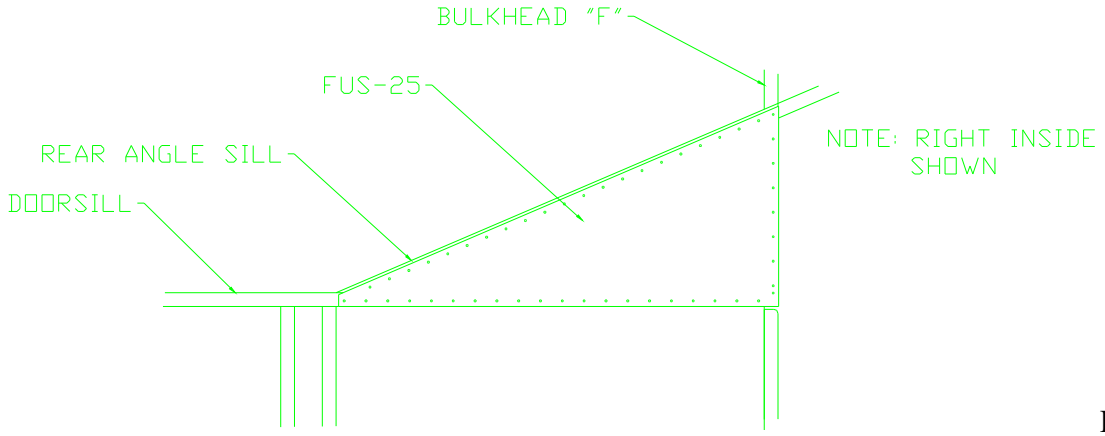



Figure 12.30.7

18) Drill sills and bulkhead “F” to #30. Cleco.

19) Position the side seatbelt attachment bracket as in Figure 12.30.8.

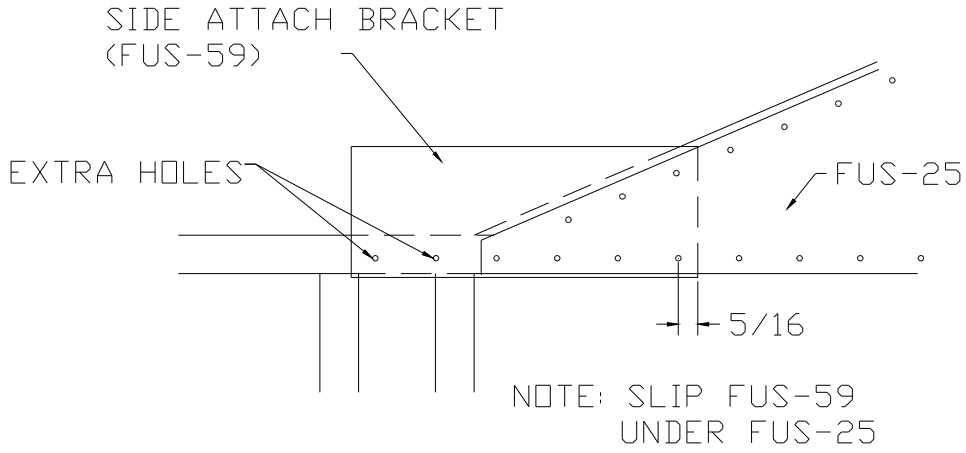



Figure 12.30.8

20) Drill back through FUS-25 into FUS-59 with a #30 drill. Drill two extra holes. Figure 12.30.8.

21) Remove FUS-59 and place on top of FUS-25.

22) Drill out to #11.

23) Mark the edge of both sills on to FUS-59.

24) Find and drill the seatbelt attach hole. Figure 12.30.9.

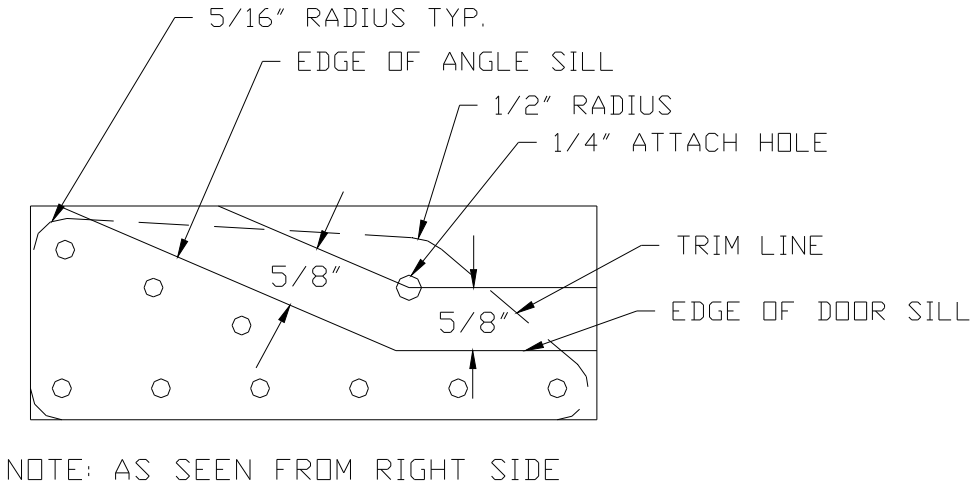



Figure 12.30.9

25) Mark and trim Figure 12.30.9.

26) Repeat for the other side.

27) Do not rivet in place at this time.

28) From stock material (FUS-57) cut a floor seatbelt attach bracket FUS-60. Figure 12.30.10.

**NOTE:** Only one FUS-60 is used for both seatbelts.

29) Remove one of the heavy channels made from ST-28 in the center section of the floor.

30) Position the floor bracket as in Figure 12.30.11.

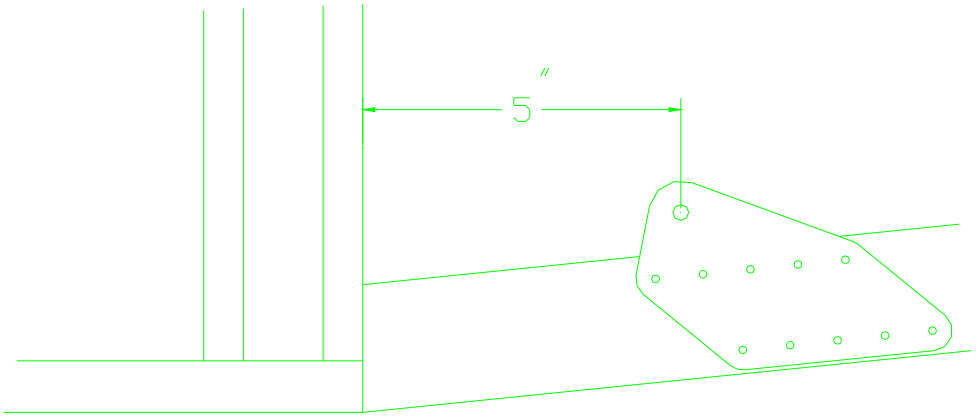



Figure 12.30.11

31) Drill out the ten #30 holes.

32) Replace the second heavy channel.

33) Drill back through both channels and brackets to #11.

34) Remove and debur.

35) Chromate mating surfaces of the channels and rivet in place with 1/8" rivets (RV-1410).

**NOTE:** Do not final install the floor bracket at this time as it is easier to install the inner floor without it.

## *12.31 Inner Floor Install*

1) Install the rear inner panel (FUS-41) if you have not done so already. Figure 12.31.1.

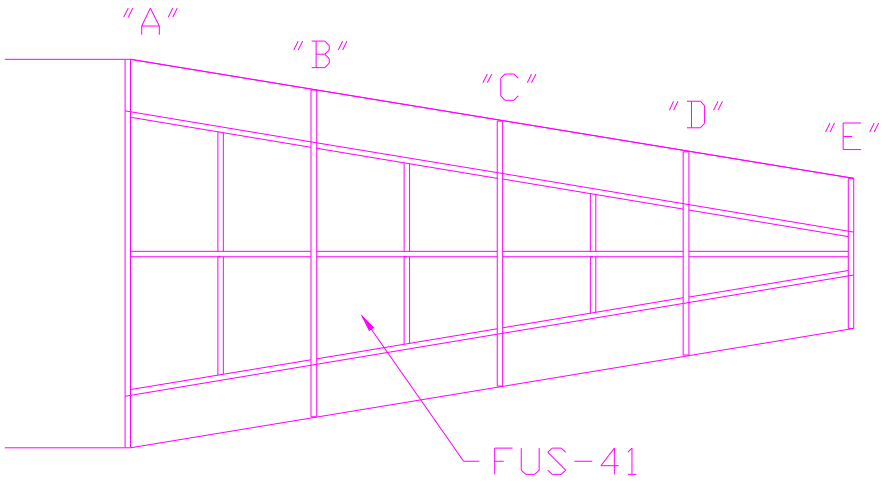



Figure 12.31.1

2) Position the main cabin floor (FUS-47).

**NOTE:** To achieve a good fit it is necessary to crease the floor where it slopes up between the two bulkheads which are back to back. The crease can be made by hanging cabin floor skin over the edge of the bench and pushing down with your palm.

3) Mark the floor for trim lines and center position of each channel and bulkhead.

4) Join the marks for the centers of all channels and bulkheads.

5) Trim and reposition.

6) Mark where the seatbelt floor bracket will come through the floor.

7) Cut a notch in the floor 1/16" larger than the protruding section of the seatbelt floor bracket.

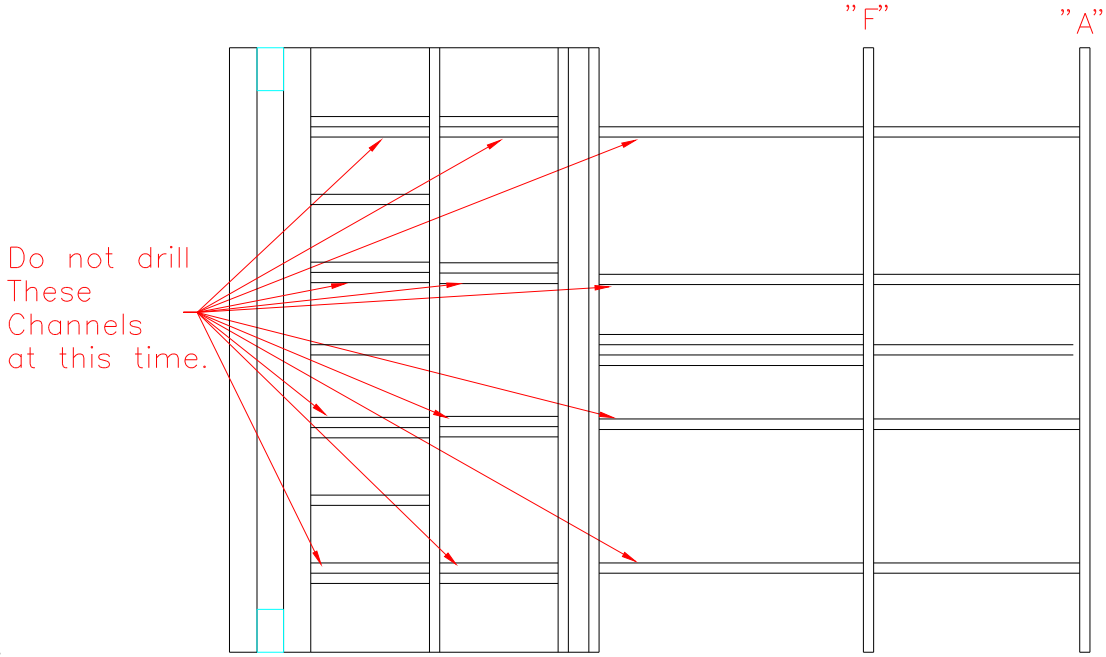
8) Remove floor.

9) Chromate mating surfaces of the seatbelt floor bracket.

10) Rivet the bracket in place with 3/16" rivets (RV-1613).

11) Replace the floor.

12) With a nominal spacing of 1 1/4" drill out the floor and into channels and bulkheads to #30. Do not drill out the areas shown in Figure 12.31.2




. Figure 12.31.2

**NOTE:** The channels "Not Drilled" will be done when the seat rails are located. Go to the Seat Assembly section and locate the Seat Rails now. Do not rivet at this time.

13) Cleco down the floor securely.

14) Position an Inner Corner Wrap from bulkhead "A" forward. The top edge should be flush with the radius of the door sill and under the triangular panel (FUS-25).

15) Drill through FUS-25 and the corner wrap.

16) Use a nominal spacing of 1" in the door sill and bulkheads. Do not drill into the bottom floor skin and channel.

17) Place another corner wrap which will extend past the uprights.

18) Drill into the door sill and bulkheads but do not drill into the bottom channels.

19) Position a corner gusset (FUS-37) against the bottom carrythrough gusset (FUS-2) where the corner wraps extend past the uprights. Figure 12.31.3.

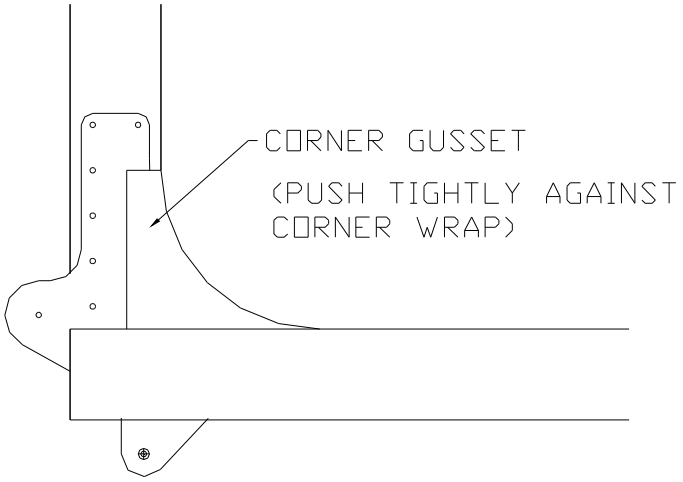



Figure 12.31.3

20) Mark the corner wrap along the edge of the corner gusset.

21) Mark the corner gusset for trimming. Figure 12.31.4.

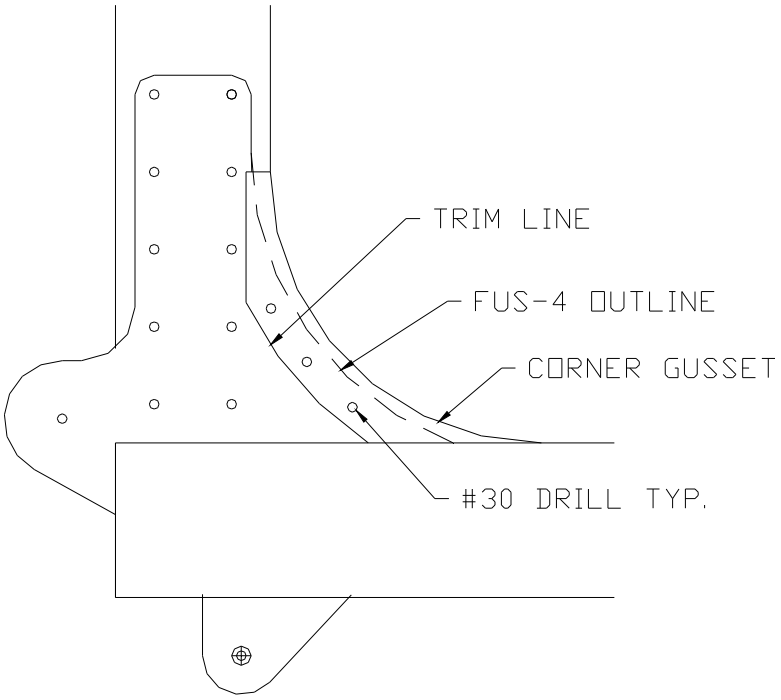



Figure 12.31.4

22) Remove the corner wrap and gusset.

23) Trim.

**NOTE:** Landing gear should be installed at this point before the floor is riveted in unless you are willing to install inspection holes to have access to the upper landing gear bolts. If you are installing Spring Gear do not rivet the bottom skin (FUS-40), the main cabin floor (FUS-47), the corner wraps and the front floor (FUS-7). The fuel lines must be run around the door before the corner wraps can be riveted in. If you are installing Spring Gear run the fuel lines after you have installed the Spring Gear. Also corner gussets

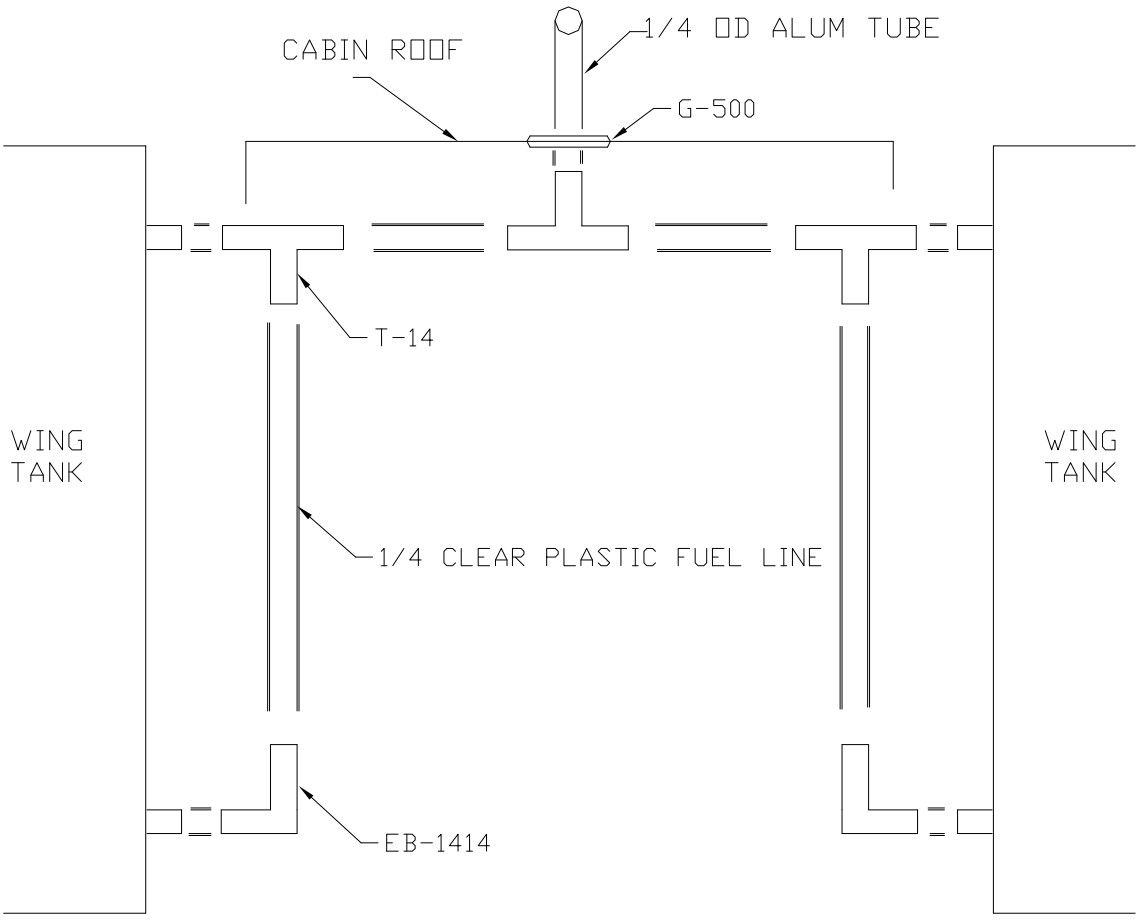
should be installed around the inside of the door the same way you did the outside. Install a strip to attach the inner gusset to the outer gusset with approximately 5-6 rivets on each flange.

24) Chromate mating surfaces and rivet all #30 holes with 1/8" rivets (RV-1410). This includes the corner gussets, corner wraps, seatrails and floor. **NOTE:** If you are installing Spring Gear or Bungee gear leave all these parts cleco'd at this time and go ahead to the appropriate assembly section and complete it.

# FUEL TANK CROSS VENTING

If you are installing the flush mount style fuel cap, note that it is a non-vented cap. In order to properly vent tanks, allowing for proper fuel flow, it is necessary to cross vent the tanks. The following drawings illustrate how to properly cross vent the fuel tanks for your aircraft.

**NOTE:** Although not necessary, we strongly recommend cross venting of fuel tanks when using the standard fuel cap as well.



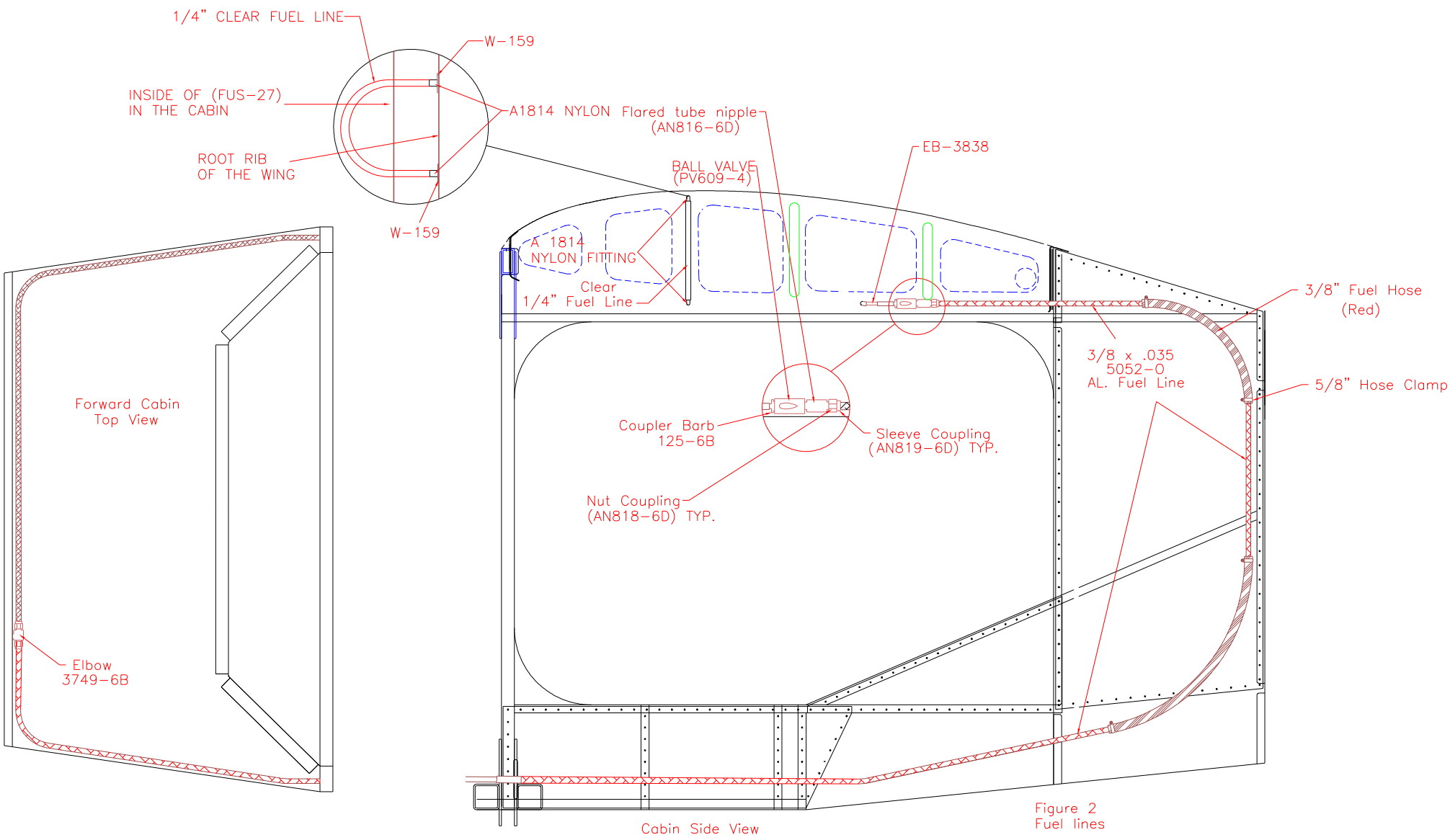
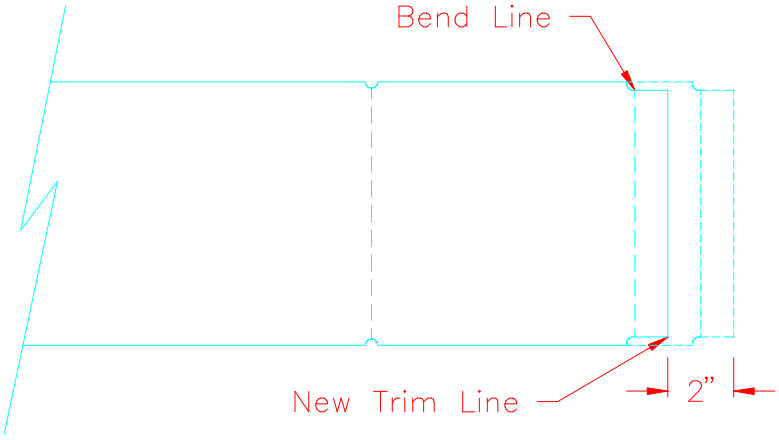



Figure 2
Fuel lines

**NOTE:** For O-320 Lycoming engine installation, remove steps 303 to 351a and replace with the following:

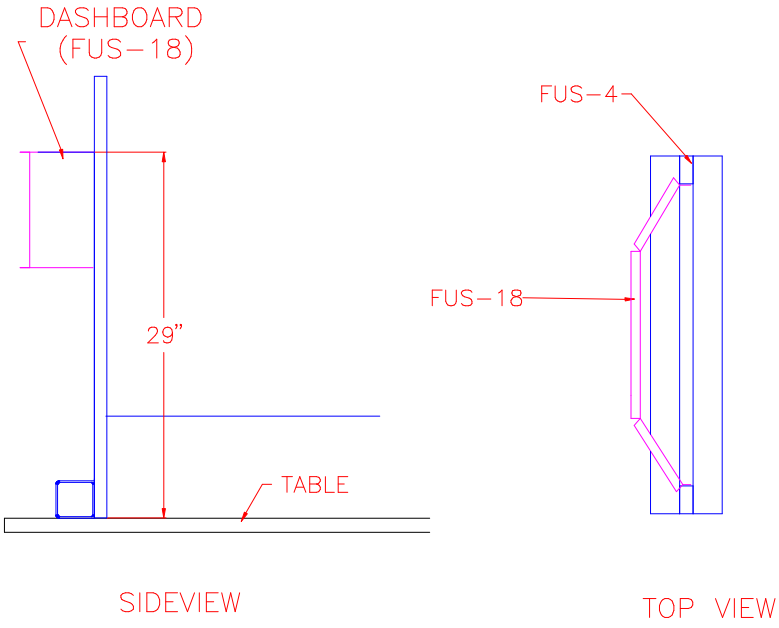
303a) Take the Dashboard (FUS-18) and trim the side panels by 2" on each end. Figure 108a.




(Figure 108a)

**NOTE: This will bring the Dashboard back maintaining clearance for avionics and instrumentation. New CC-5-1 Control Sticks must be purchased when performing this modification.** .

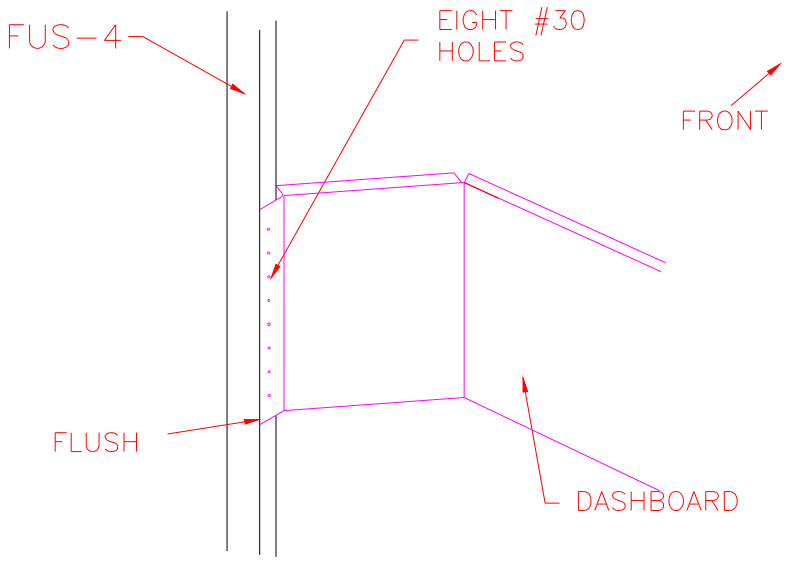
303b) Clamp the dashboard (FUS-18) in place as in Figure 108b.




(Figure 108b)

304) Place the edges of the dashboard flange, flush with the rear face of the uprights (FUS-4's).

305) Drill eight equally spaced #30 holes in the centre of each dashboard flange and centreline of the FUS-4's. Figure 109.



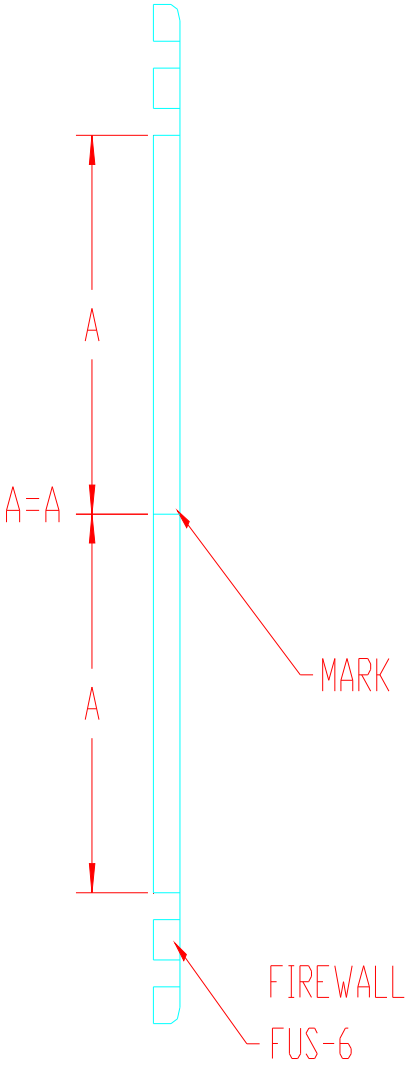

(Figure 109)

306) Remove and debur holes and edges.

306a) Cleco dashboard in place.

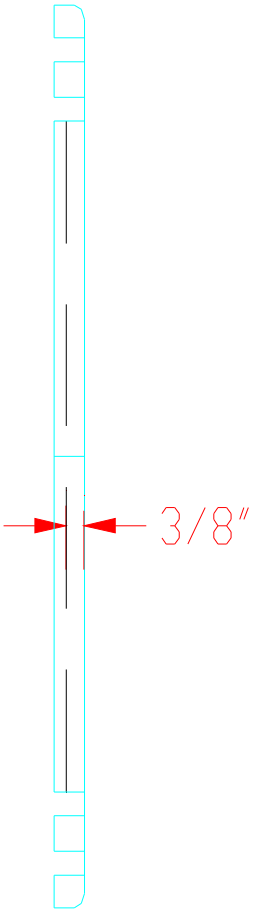
**NOTE: We do not recommend riveting the dash until instrument layout is done.**

307) On the Firewall (FUS-6-1) find and mark the centre of the side flanges. Figure 110.



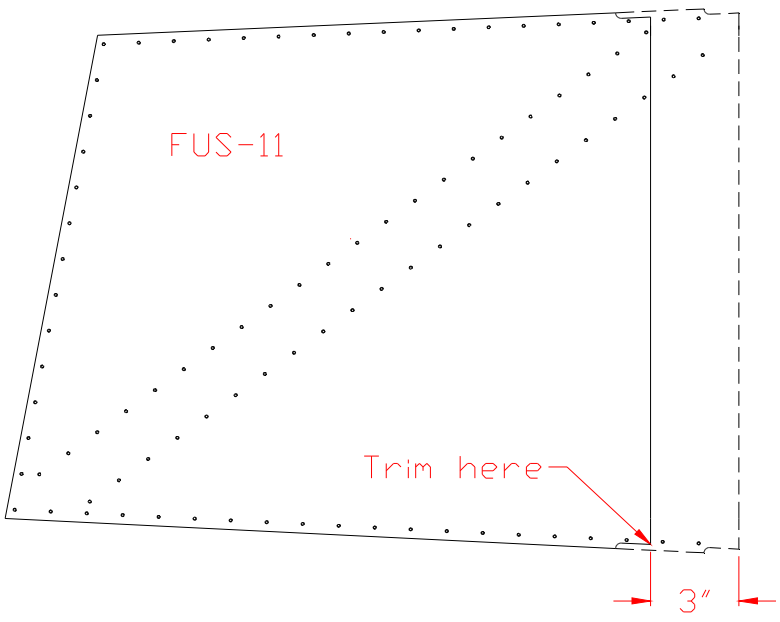

(Figure 110)

308) Draw a line along the flange 3/8” from the back surface of firewall on both sides. Figure 111.




(Figure 111)

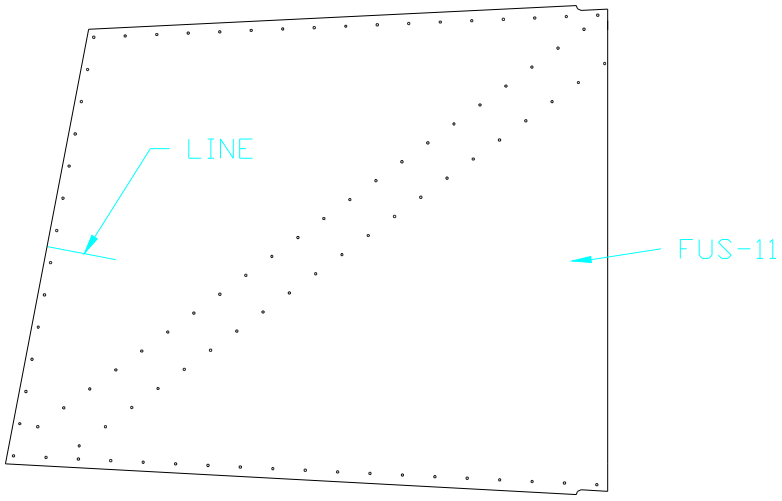
309) On each Front Side Panel (FUS-11) mark a trim line, 3" from the rear. Trim. Trim each flange to match the old part. Figure 111a.




(Figure 111a)

310) On the left Front Side Panel (FUS-11L) draw a line between the two front centre holes.

Figure 112.




(Figure 112)

311) Align the centre line of FUS-11L with the centre line of the left side of the firewall (the firewall flanges face forward and the narrow end is at the bottom).

**NOTE: The flanges on FUS-11's will need to be trimmed to fit properly on the firewall.**

312) Position the holes in FUS-11L over the 3/8" line on the firewall flange.

313) Drill the end holes to #30 and cleco.

314) Drill the remaining holes to #30.

315) Repeat for the right side.

316) Find and mark the centre point of the bottom flange of the firewall.

317) Draw a line 5/16" from the rear face of the firewall.

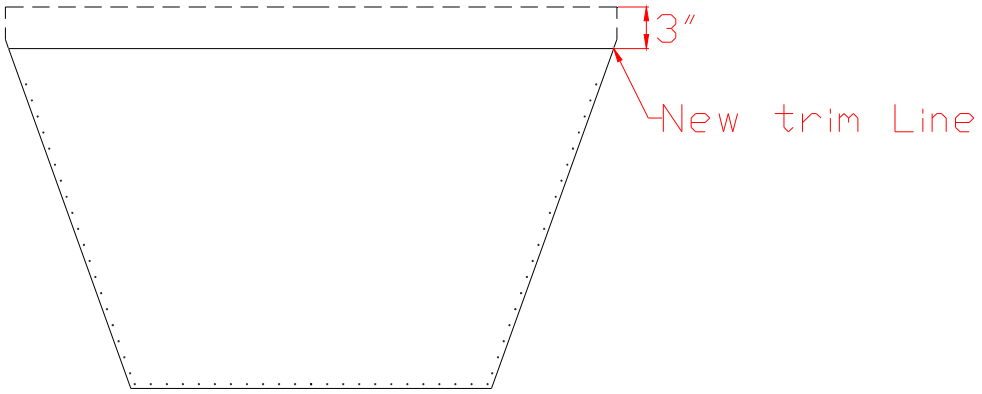
318) Position the Front Floor (FUS-7) with the pre-punched holes over the line with the centre marks aligned.

319) Drill holes to #30.

320) Dimple all the holes in the sides and bottom of the firewall.

321) Debur all edges and holes.

321a) On the rear of the Front Floor (FUS-7), trim the flanges forward by 3". Trim 3" off the rear of FUS-7. Figure 112a.

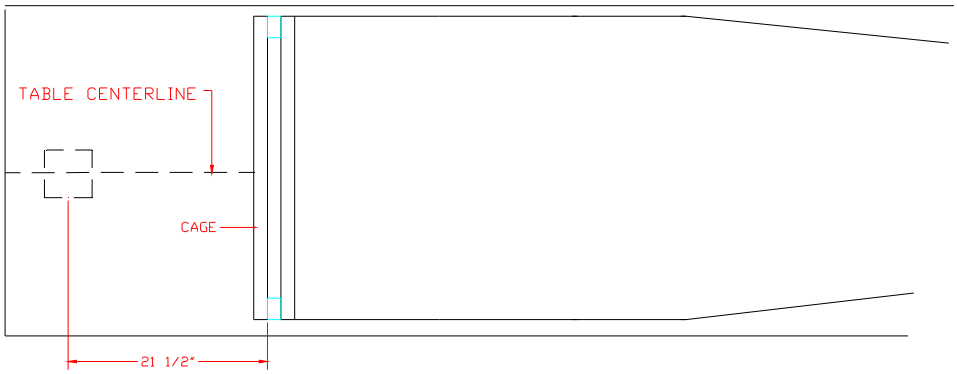



(Figure 112a)

322) Rivet the sides and front floor to the Firewall with 1/8" x 1/4" CS Avex Rivets (RV-4412).

**NOTE: Leave the centre hole in the bottom flange open. Leave 3 holes open on each end of each flange.**

323) At approximately 21 1/2" in front of the uprights (FUS-4's), nail a block that is 1 3/32" high. Figure 113.



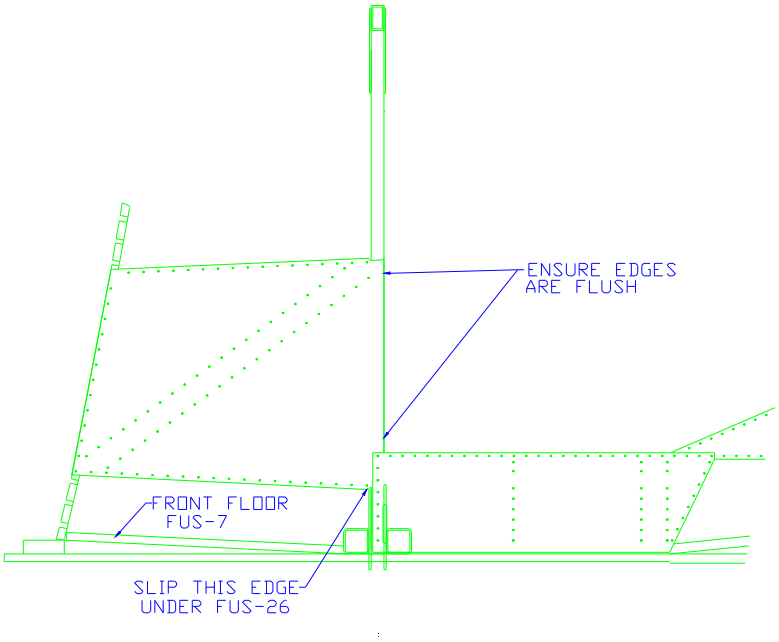

(Figure 113)

324) Extend the table centre line to the top of the block.

325) Remove the clamps on the cage.

326) Position the front assembly as in Figure 114.

**NOTE:** It will be necessary to slip the sides (FUS-11) behind the FUS-26's and the front floor (FUS-7) under the Bottom Carrythroughs (FUS-5). It will be necessary to trim slots for the landing gear attach points to fit through. The flanges on FUS-7 may need trimming.




(Figure 114)

327) Place some heavy weights on the bottom carrythroughs to maintain alignments (sand bags work well).

328) Ensuring that the firewall is on the block and the rear of the FUS-11's are flush with the uprights, drill one #30 hole at the top and bottom.

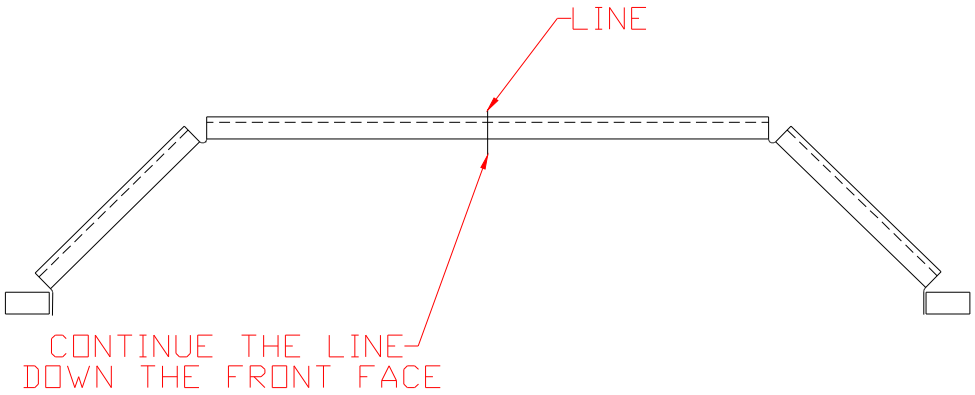
329) Cleco.

330) Align the centre line on the bottom of firewall with the centreline on the block.

331) Drill #30 hole through the open hole in the bottom flange of firewall into block.

332) Cleco the firewall to the block.

333) Find and mark the centre of the centre section of the dash. Figure 115.




(Figure 115)

334) On the top flange of the firewall, draw a line 5/16" from the rear face of the firewall.

335) Find the centre of the flange and mark.

336) On the Front Upper Panel (FUS-8) draw a line from the front centre hole to the back. Draw this line on the under side of the panel.

337) Trim the flanges of FUS-8 at the front. Align the front upper panel with the firewall flange.

**NOTE: You will have to trim the back edge of the Upper Front Panel to fit later.**

338) Drill to #30 and cleco securely.

339) Align the line on the front face of the dashboard with the line on the bottom of the Upper Front Panel.

340) Drill one #30 hole in the centre only to hold alignment.

341) Mark the shape of the dashboard on to the bottom side of the Upper Front Panel.

342) Remove the Upper Front Panel.

343) Measure 1/8" forward (toward the firewall) from the line drawn in step 341.

344) Trim at this line.

**NOTE: By trimming back 1/8", the sharp edge of the Upper Front Panel will not stick out past the radius of the dashboard.**

345) Reinstall the Upper Front Panel.

346) On the Upper Front Panel draw a line 7/16" forward from the face of the dashboard.

347) Drill #30 holes along this line at 1" nominal spacing.

348) Dimple these holes.

**NOTE: You may not want to rivet the Upper Front Panel in yet so that electronics will be easier to install. Do not rivet the firewall to the Upper Front Panel until the extension for the windshield is added. See Window Mods(0320).**

349) Chromating mating surfaces and rivet together as follows:

1. In the dashboard use 1/8" x 3/16" avex rivets (RV-1410).

2. In the firewall use 1/8" x 1/4" Countersunk Avex Rivets (RV-4412).

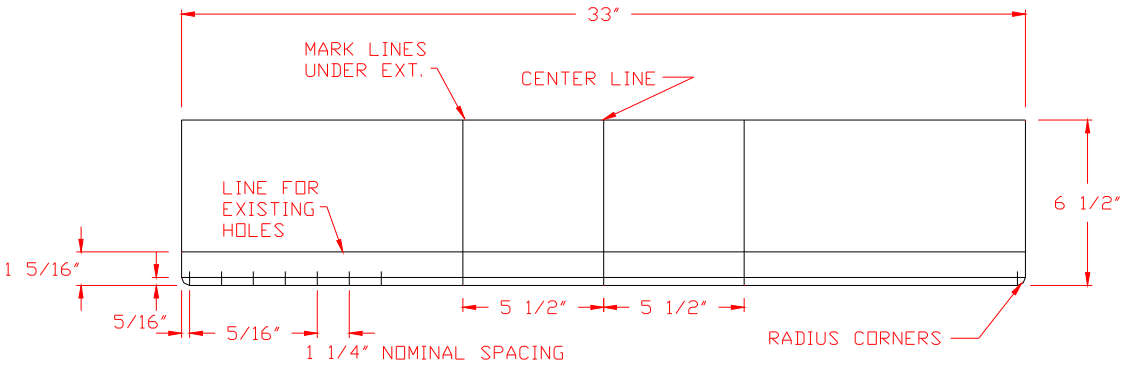
350) Step 350 and step 351 has been removed.

351a) Cut two pieces of ST-40 angle material at 1 7/8" long. Drill three #40 holes as in figure 115a, on page 123 in chapter 13.

**WINDSHIELD MOD 0320**

1) Cut a strip of .032" material 33" x 6 1/2".

2) Mark and draw a line 1 5/16" in from one long edge. Figure 1. Slip it under Fus-8 (Front Upper Panel) until it is centered and the line is centered on the existing holes. Each end should cover one tab on Firewall. Drill #30 and cleco the two outside holes. Next, drill #30 and cleco the remaining holes. This is now the Front Upper panel Extension. Label the top of the extension.




(Figure 1)

3) Remove Extension and measure 5/16" back from the edge you just drilled. Draw a line. Figure 1. Measure 5/16" in from both ends and mark. Lay out evenly spaced holes with a nominal 1 1/4" spacing. Drill #40.

4) Cleco the Extension back on top of the FUS-8 Panel. Drill #40 and cleco through the holes on the rear edge of the Extension into Fus-8. Drill these holes out to #30 and cleco.

5) Remove Extension and debur all holes and edges. Radius rear corners. Figure 1.

6) Cleco extension back on FUS-8. Dimple all holes and flush rivet.

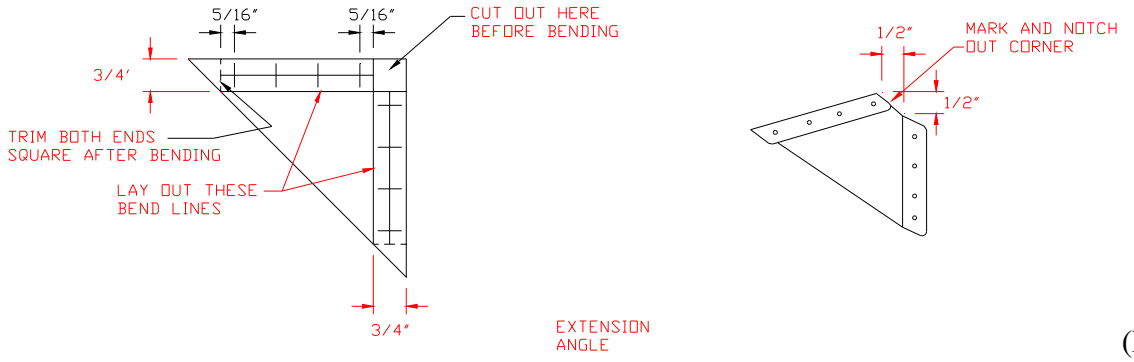
7) Mark centre line on under side of Extension. Figure 1. Measure out 5 1/2" on either side of the line and mark a line square to the Firewall. Now mark a line from the point the line touches the Firewall down about 6". **NOTE:** Make sure both lines are square to the Firewall not the edge of the Panel Extension.

8) Make cardboard templates for the two Extension Angle Brackets as follows: Cut a triangular piece of cardboard 5" x 5". Place the triangle under the Extension on one of the lines in step 7. Trim the top edge of the triangle until it matches the angle of the Extension.

8a) Lay the cardboard template on a piece of .032" material and trace the outline. Mark lines 3/4" to the outside for flanges as shown in Figure 3. Also mark and drill holes in the flanges as shown. Cut out the part.

8b) Using the first part as a guide, mark, drill and cut a second bracket.

8c) Bend the parts as in Figure 2. **NOTE:** Be sure to make one left and one right bracket.




(Figure 2)

9) Take one Extension Angle Bracket (with its flange pointing toward the centre) and place it on the line on the firewall. Keeping the top flange tight to the bottom of the Panel Extension, line up the line on the firewall with the centre of the holes on the flange. Drill #40 and cleco. (Remember to keep the part square to the firewall).

10) Repeat with the other Angle Bracket.

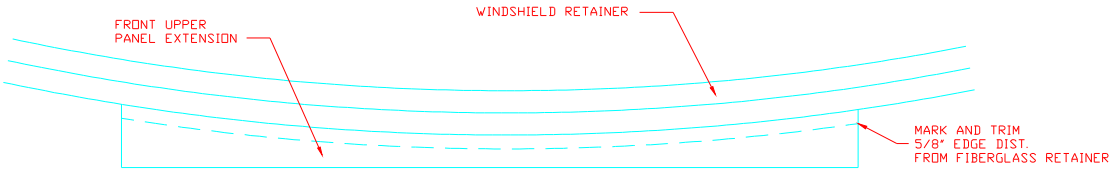
11) Line up the top holes with the line on the bottom of the Extension panel. Clamp, drill #40 and cleco both Angles.

12) Drill all holes, **except** the forward most top hole on both brackets to #30 and cleco.

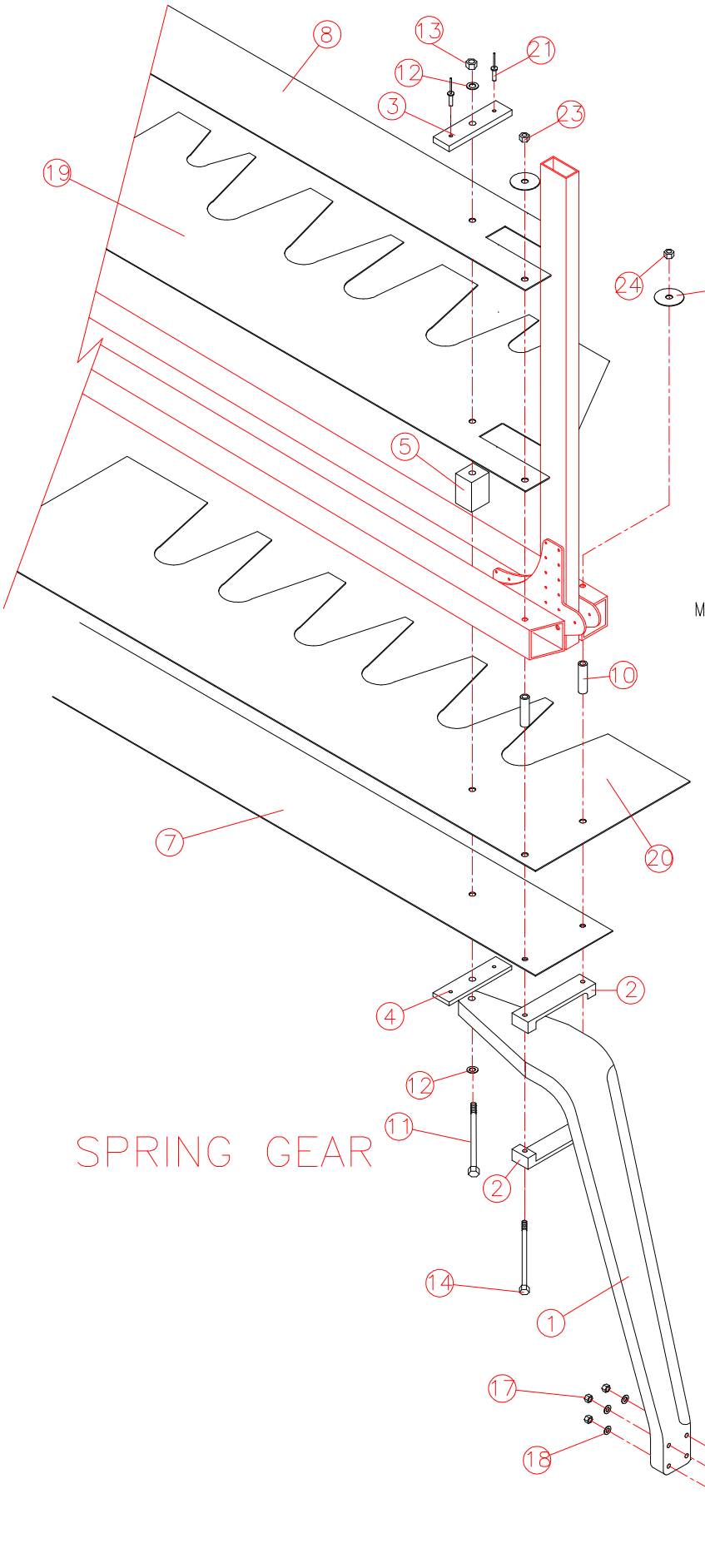
13) Remove Angles, debur holes and edges and radius the corners.

14) Cleco Angles back in place and rivet to Firewall using 1/8" x 3/16" avex rivets. Next, dimple the first three Rivet holes forward of the Firewall in each Angle and flush rivet. **NOTE:** Do not rivet the forward top rivet hole on each Angle. These will be used later for the Cowl attach bolts.

15) Leave the Upper Panel Extension long for now. After the Windshield has been completely installed you will mark a line 5/8" from the forward edge of the bottom of the Fiberglass retainer and trim. File the corners to shape and sand edges. Figure 4.




(Figure 4)




| Man # | Description | |
|---|---|---|
| 1 | SPRING GEAR | |
| 2 | SADDLE | |
| 3 | TOP PLATE | |
| 4 | BOTTOM PLATE | |
| 5 | SPACER BLOCK | |
| 6 | PLASTIC GEAR LEG FAIRING | |
| 7 | BOTTOM GUSSET PLATE | |
| 8 | TOP GUSSET PLATE | |
| 9 | 5/16" PENNY WASHER | |
| 10 | 7/16" x 1 7/8" CRUSH TUBES | |
| 11 | 3/8" BOLT | |
| 12 | 3/8" WASHER | |
| 13 | 3/8" NUT | A |
| 14 | 5/16" BOLT | |
| 15 | AXLE | |
| 16 | 1/4" BOLT | |
| 17 | 1/4" NUT | A |
| 18 | 1/4" WASHER | A |
| 19 | 35 1/2" x 12" .063 ALUM. | |
| 20 | 43 3/4" x 12" .063 ALUM. | |
| 21 | 3/16" X 3/4" AVEX RIVET | R |
| 22 | #6 PAN HEAD SCREW | |
| 23 | 5/16" NUT | |

## *14.1 Floor Doublers*

1) Put the Fuselage up on a table. Support the cage and tailcone area. Place the aircraft in flight attitude with the floor of the aircraft level. Figure 14.1.1.

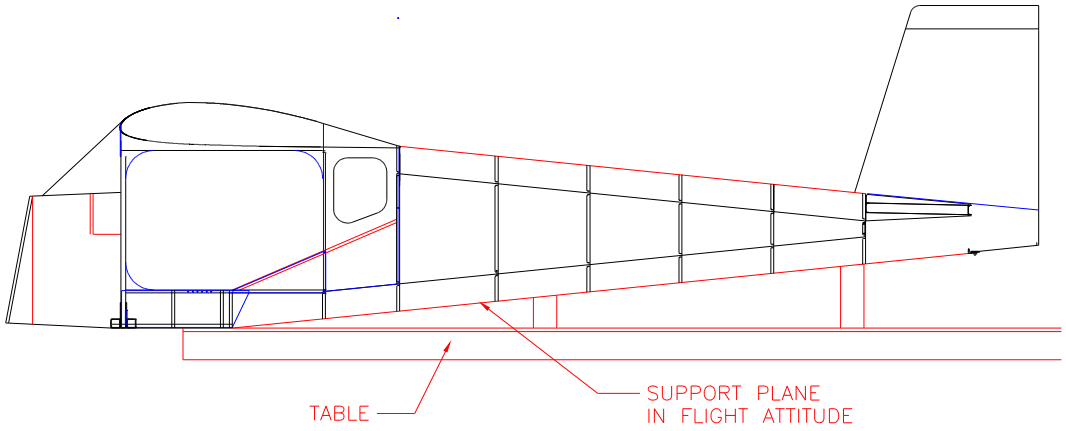


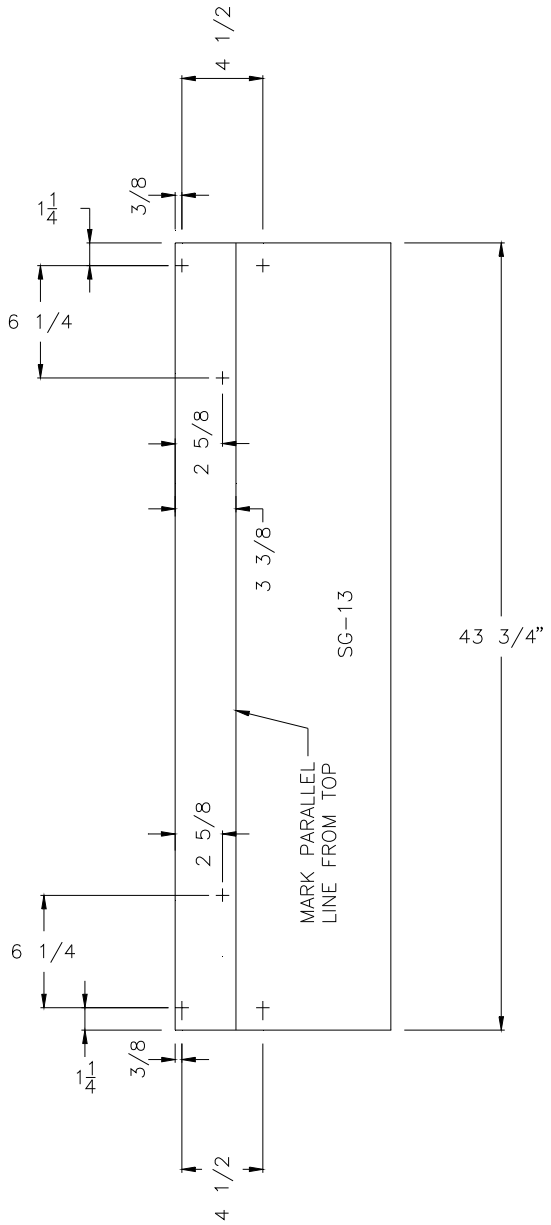

Figure 14.1.1

2) If you haven't already cut the bottom tabs of the FUS 2's flush with the bottom skin (FUS-40). Do not cut the side tabs on the FUS-2. Debur any sharp edges.

3) Next, find the SG-13 (43 3/4" x 12" x .063") plate. Verify the outside measurements of this plate otherwise subsequent ones will be wrong. Measure and mark six bolt holes on the SG-13. See Figure 14.1.2. Be careful how you mark these holes, the measurements are critical for the proper fit of the Spring Gear.

4) In stages drill the six holes out to 1/4".

Figure 14.1.2




5) From the top corner of the SG-13 plate mark a parallel line 3 3/8" down. Figure 14.1.2.

6) Remove the cleco's from the bottom skin (FUS-40) and remove it from the aircraft.

7) On a flat table lay the SG-13 under the bottom skin (FUS-40) so that the 3 3/8" line you just marked is located at the top edge of the skin. Figure 14.1.3.

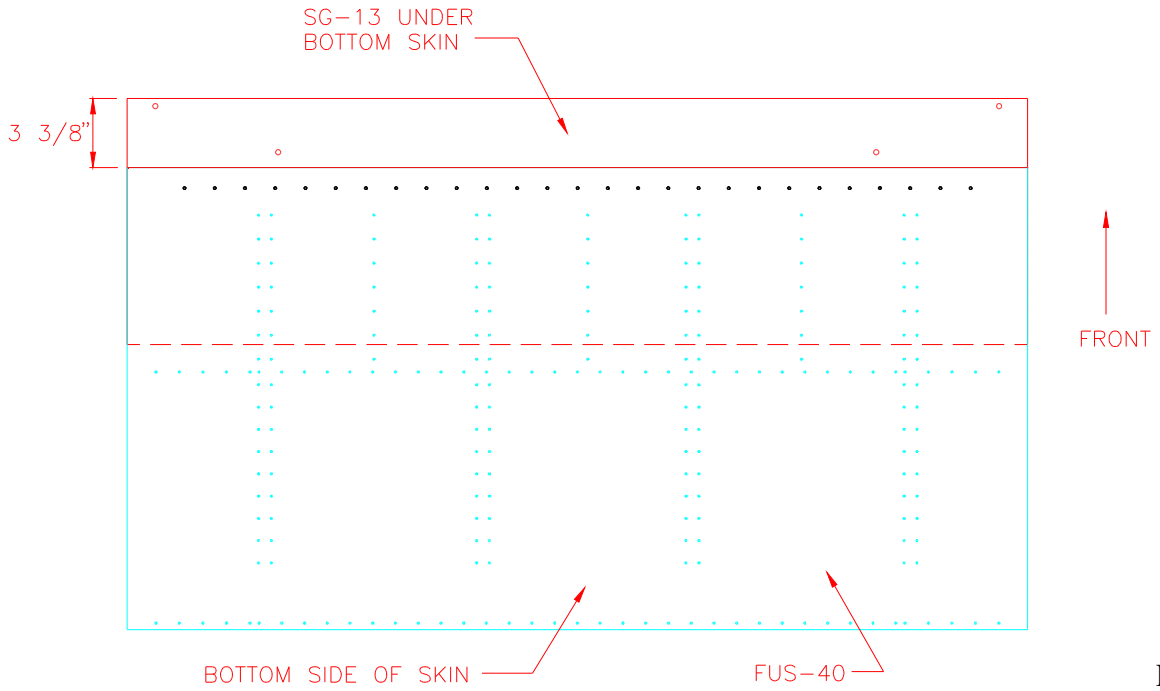



Figure 14.1.3

8) With the two parts clamped together, carefully drill (#30) all the existing channel holes through FUS-40 into SG-13. Then drill the carrythrough holes (#11). Cleco as you go. After all the holes are drilled remove the parts and debur all the holes.

9) Next, carefully place the top of SG-13 under the Front Floor (FUS-7). To hold it in place cleco the SG-13 to the cage with clecos using the line of holes you drilled earlier. Next, clamp FUS-7 so that the 3 3/8" line on SG-13 is flush with the edge on FUS-7. Transfer the holes from FUS-7 through SG-13. Remove the part and debur all holes.

10) Cleco the bottom skin (FUS-40) back onto the bottom of the aircraft.

11) On a table place the SG-7 (43 3/4" x 5 1/4" x .063") under the SG-13 plate so that the top edges are flush to each other. Drill through all carrythrough holes, cleco as you go. Also, carefully transfer the six 1/4" holes through the SG-7 plate. Figure 14.1.4.

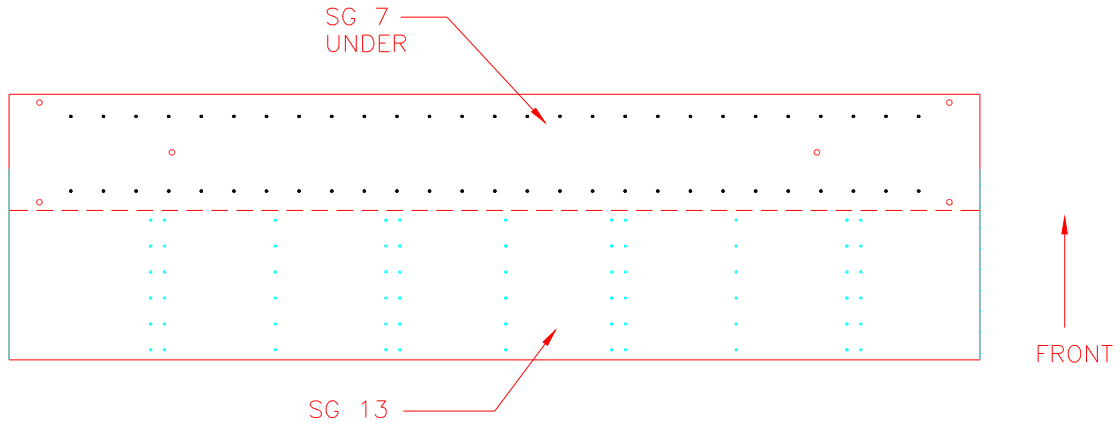



Figure 14.1.4

12) Next, you will lighten the SG-13 by sculpting out the part. First mark a parallel line from the top edge 7 1/4" down on the part. See Figure 14.1.5.

13) On that line mark six lines on the centers between each of the channel rows as per Figure 14.1.5. Cut out these marks with a 2 1/8" hole saw.

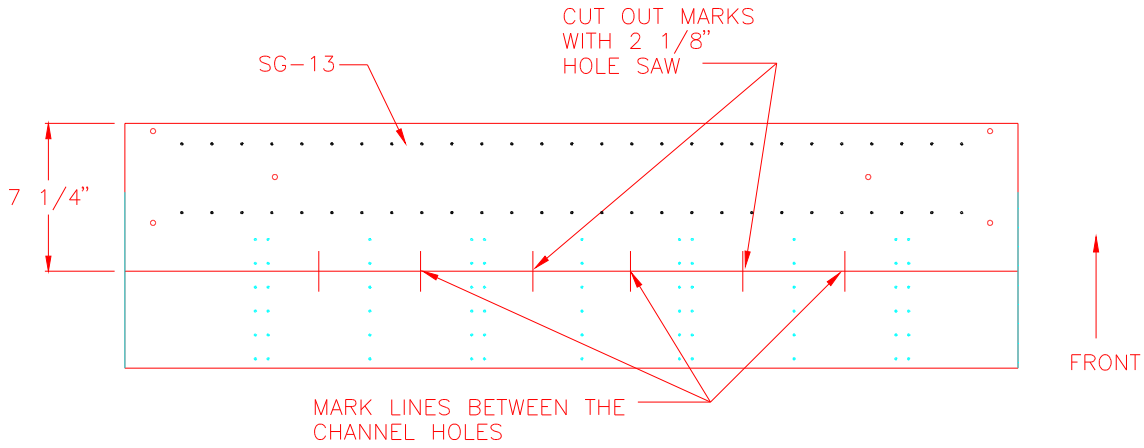



Figure 14.1.5

14) From the bottom channel holes mark line 1/4" from the hole edges down to the bottom of SG-13. Figure 14.1.6. From those marks join a line back to the 2 1/8" holes you just cut. Cut out along these lines. Debur all edges.

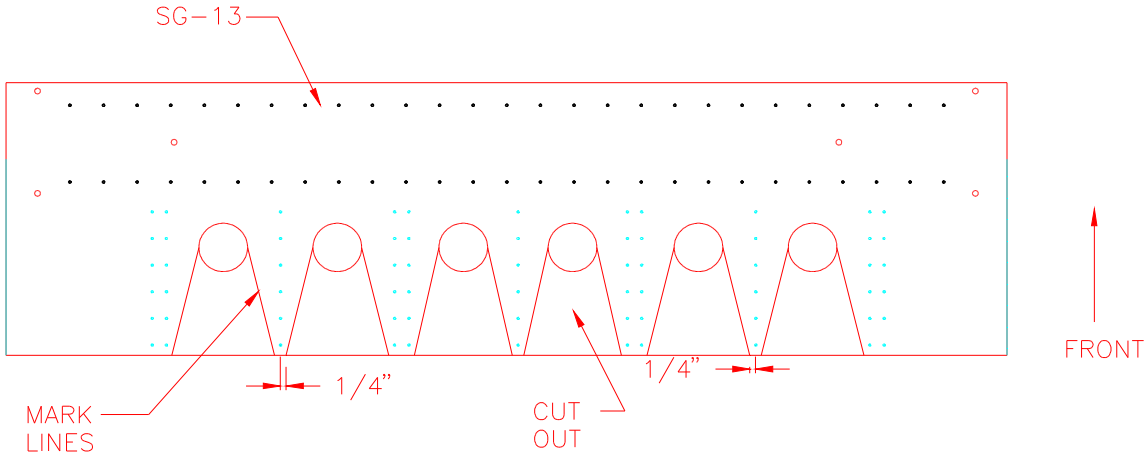



Figure 14.1.6

15) Measure and mark a line 5/16" out from the notch edges. Figure 14.1.7. Mark a 1" nominal rivet pattern. **NOTE:** If a new rivet is going to interfere with an existing channel rivet do not put the new rivet in.

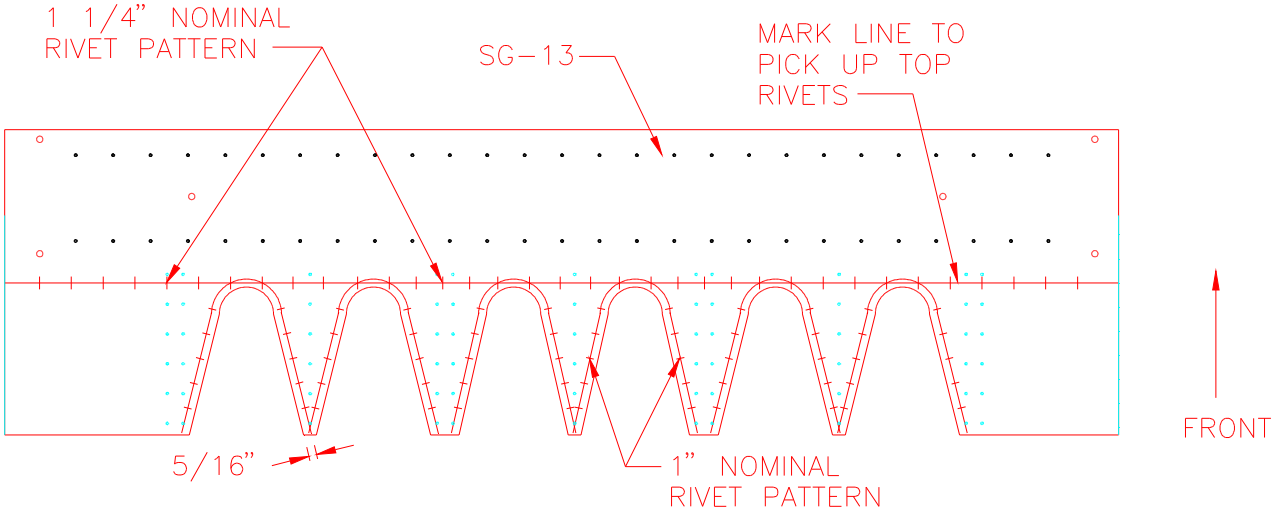



Figure 14.1.7

16) Picking up the two top rivet marks on each 2 1/8" hole, mark a line across SG-13 through these points. Use the intersection of the line on the tops of the cut holes as reference points. Mark a 1 1/4" nominal spacing between each set of 2 1/8" holes. From the two outer holes mark a 1 1/4" nominal spacing to the outside edges of SG-13. Figure 14.1.7.

17) Drill all holes #30 and debur.

18) Remove the Main Cabin Floor (FUS-47) and the Corner Wraps clecoed inside of the Cabin.

19) Take the other SG-13 plate ( 43 3/4" x 12" x .063") and cut it to the same dimensions as Figure 14.1.8. This piece now becomes SG-14.

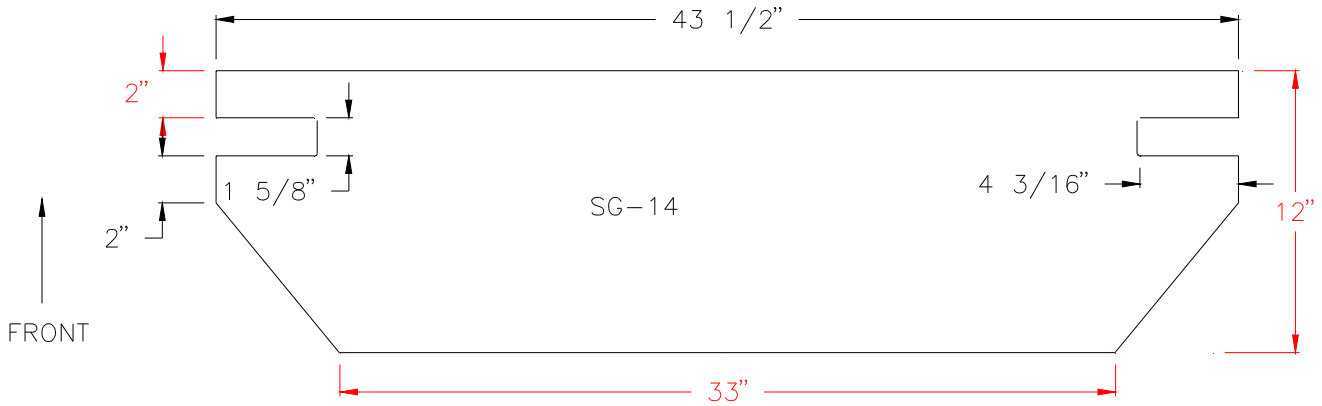



Figure 14.1.8

20) Clamp the SG-14 you just cut under the Main Cabin Floor (FUS-47). Transfer all holes through the FUS-47 into SG-14. Cleco as you go. Make sure you keep the top edges flush with each other, the side tabs on SG-14 will stick out from the Main Cabin Floor.

21) Unclamp the parts. Debur all holes and edges on SG-14.

22) Cleco the Main Cabin Floor (FUS-47) back into the cabin.

23) Next, cut out the other SG-7 ( 43 3/4" x 5 1/4" x .063") plate to match the shape of SG-14. Figure 14.1.9. This piece becomes SG-8.

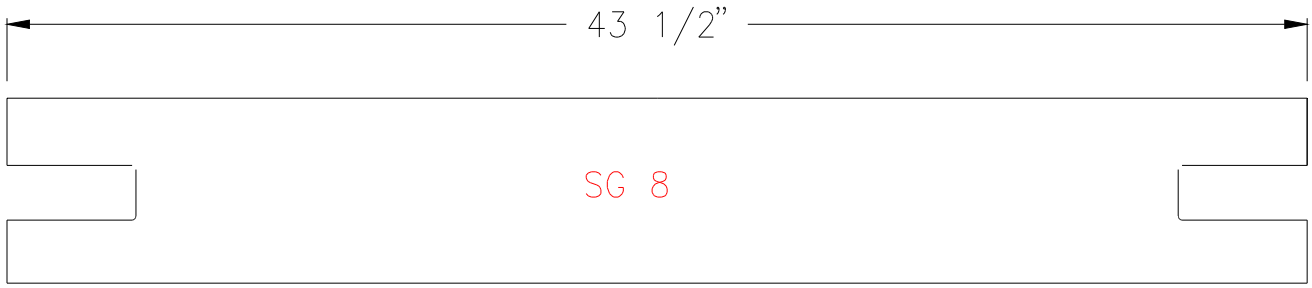



Figure 14.1.9

24) Clamp SG-8 under SG-14 and transfer all the holes. Figure 14.1.10.

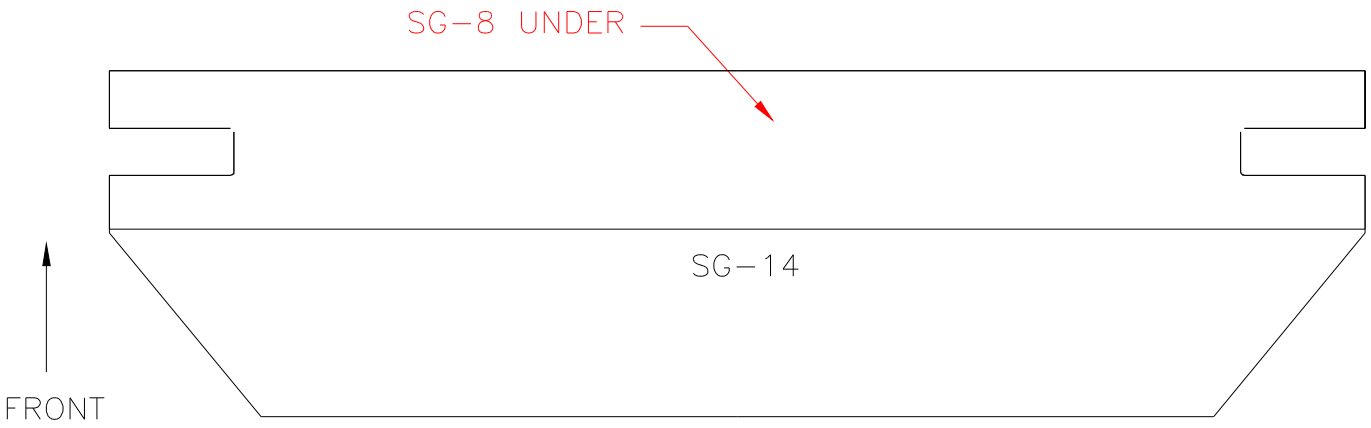



Figure 14.1.10

25) Remove parts. Debur all holes and edges.

26) Again, as you did for SG-13, you will lighten the SG-14.

27) Measure down from the top of SG-14 and mark the two lines as shown in Figure 14.1.11.

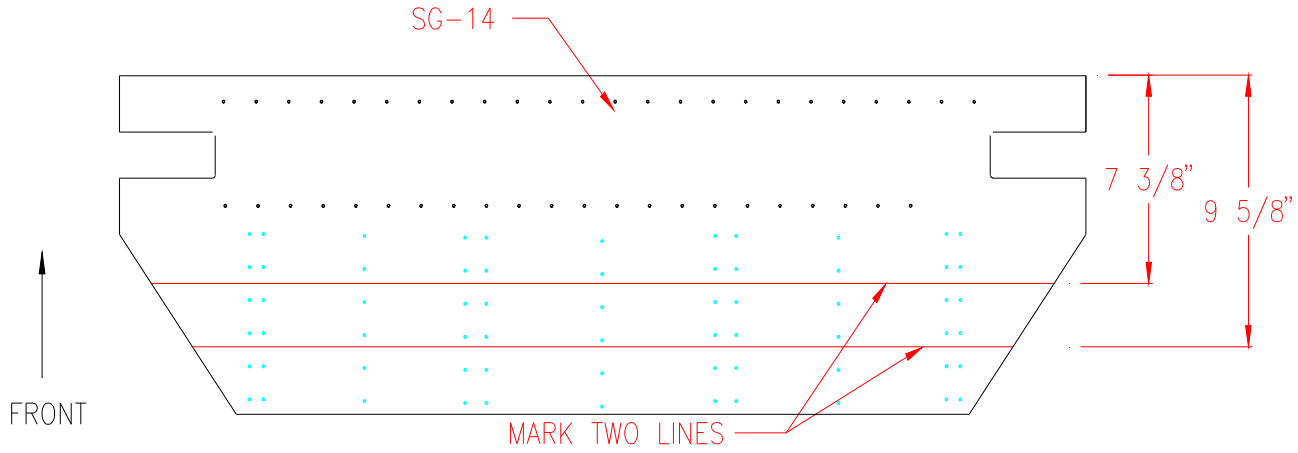



Figure 14.1.11

28) Find the center lines between the existing channel rivet holes and mark on the lines you just drew.

Figure 14.1.12.

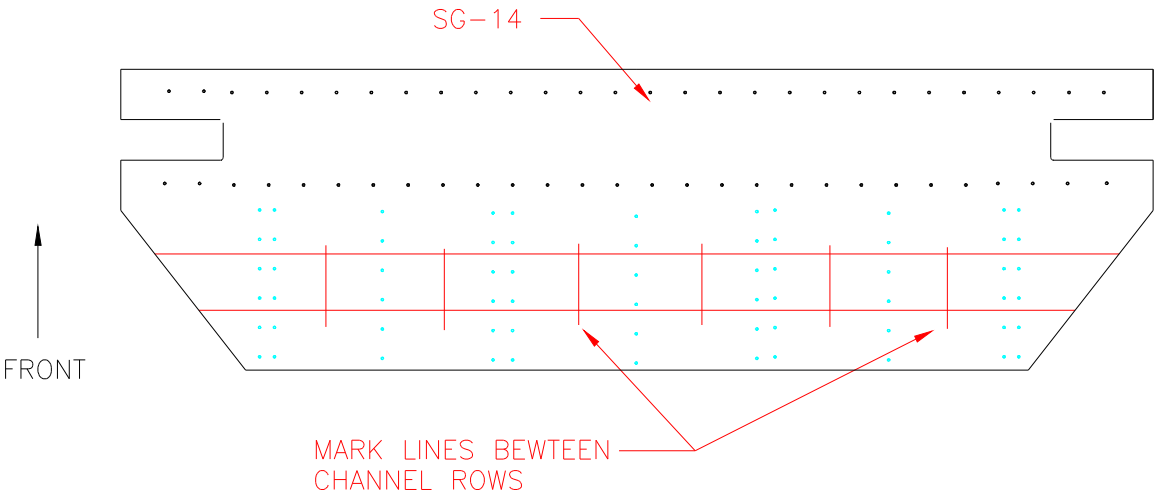



Figure 14.1.12

29) With a hole saw cut out the six holes. Four holes are 2 1/8" and two holes are 1 1/4". Figure 14.1.13.

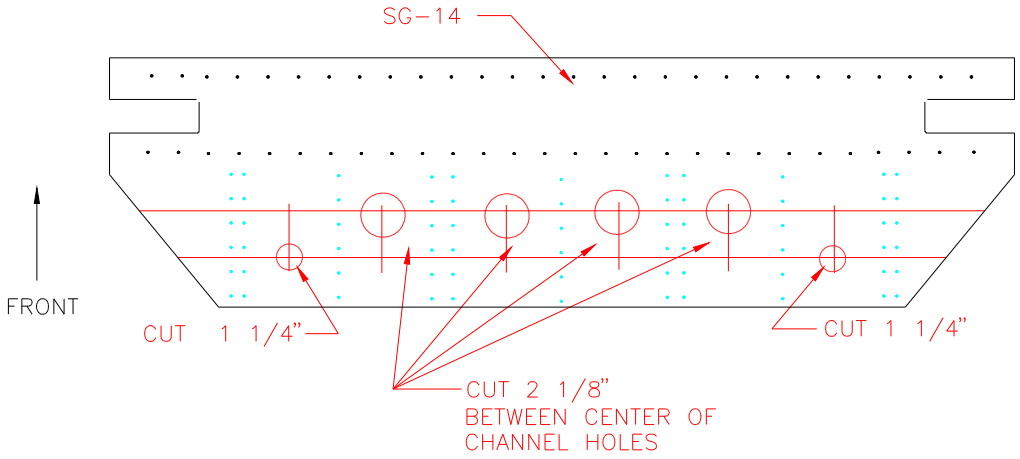



Figure 14.1.13

30) From the center of each bottom existing channel rivet hole measure over 1/4". Figure 14.1 14. From the outside edges, measure over the distances from Figure 14.1.14. Mark lines at these locations. From these marks draw lines up to the holes you just cut out.

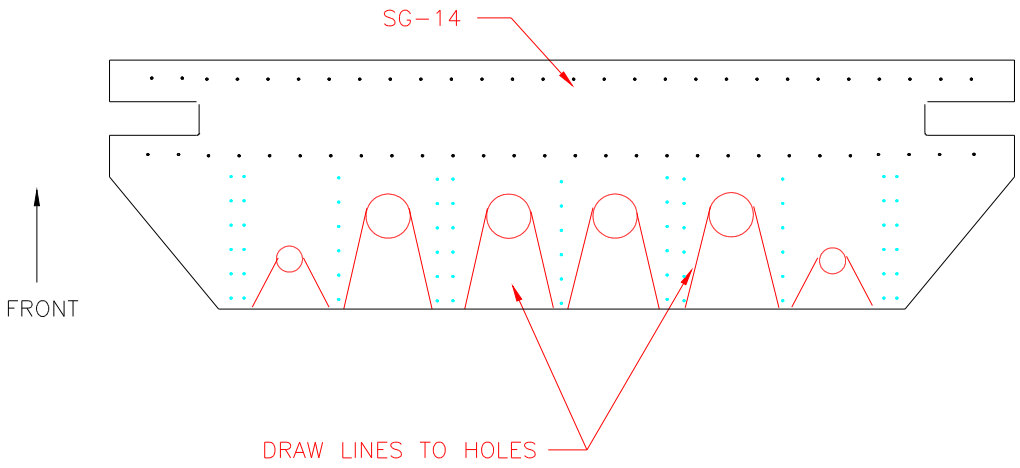



Figure 14.1.14

31) Cut out all the notches.

32) Around each notch you just cut out, mark a line at 5/16". Figure 14.1.15. On the sides of notches mark out a 1" nominal rivet pattern. **NOTE:** If a new rivet hole is too close to an existing rivet hole do not mark a new hole.

33) On the top of each 2 1/8" notch hole mark out a 1 1/4" nominal rivet pattern. Figure 14.1.15. Draw a line across SG-14 so that it intersects the four notch hole lines. Mark a 1 1/4" nominal rivet pattern between notches as you did previously.

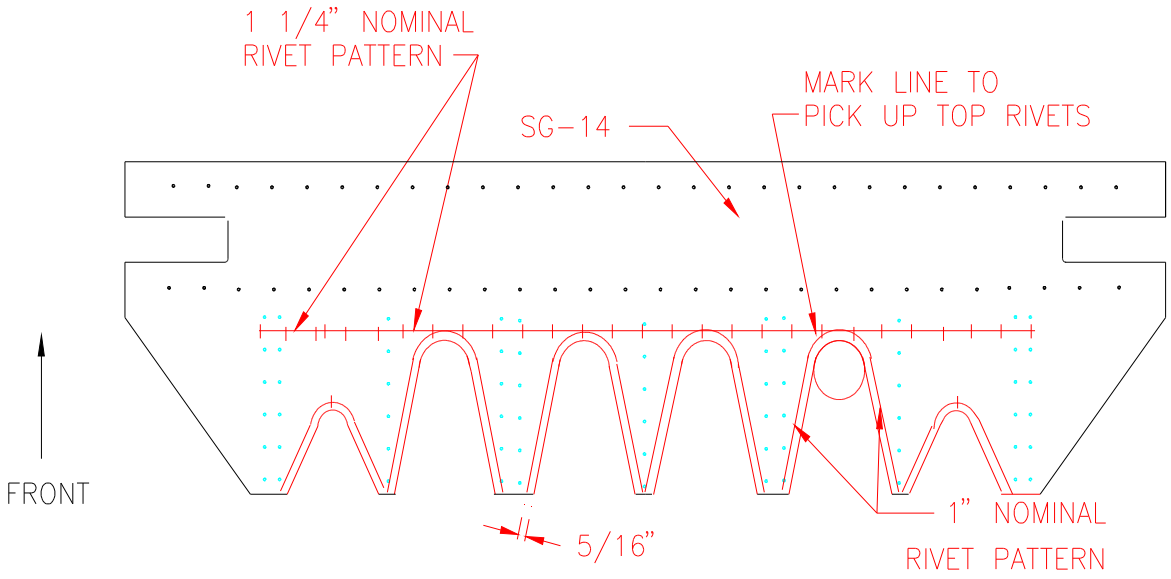



Figure 14.1.15

34) Drill all holes #30. Debur all holes and edges.

35) Now make a packer strip to fit under the SG-13. This packer is used to take up the gap between the overhang of SG-13 and FUS-7 Front Floor skin. Cut the packer to 43 3/4" x 3 3/8" from .020 material.

36) Slip this packer under the FUS-7 Front Floor so the forward edge is flush with the front carrythrough tube. Transfer all holes through the FUS-7 into the packer strip.

37) Remove the packer and debur all holes and edges.

38) Next, cleco the packer strip and SG-7 to SG-13. Figure 14.1.16.

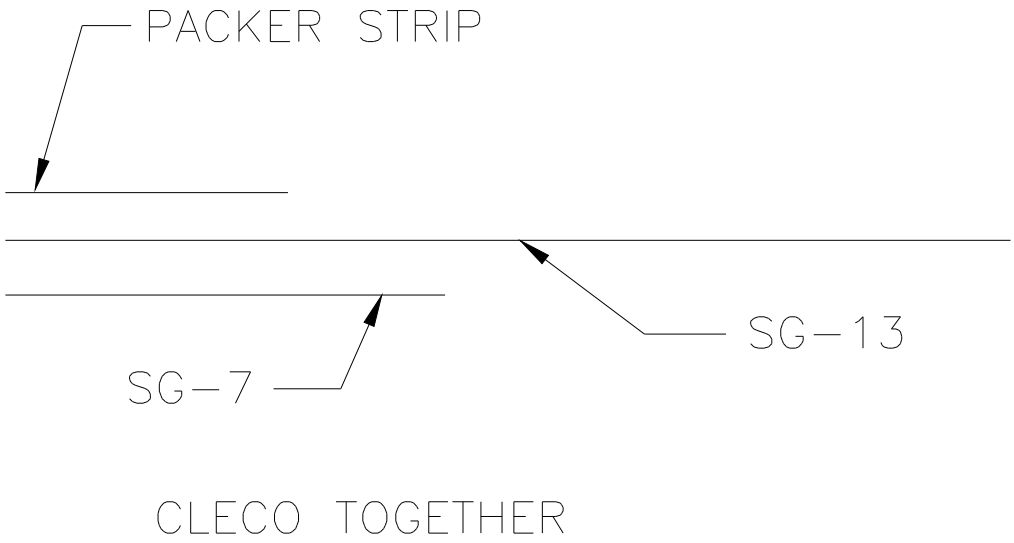



Figure 14.1.16

39) Cleco this assembly (SG-7, SG-13 and packer strip) to the carrythroughs along with the bottom skin (FUS-40) and the front floor skin (FUS-7). Figure 14.1.17.

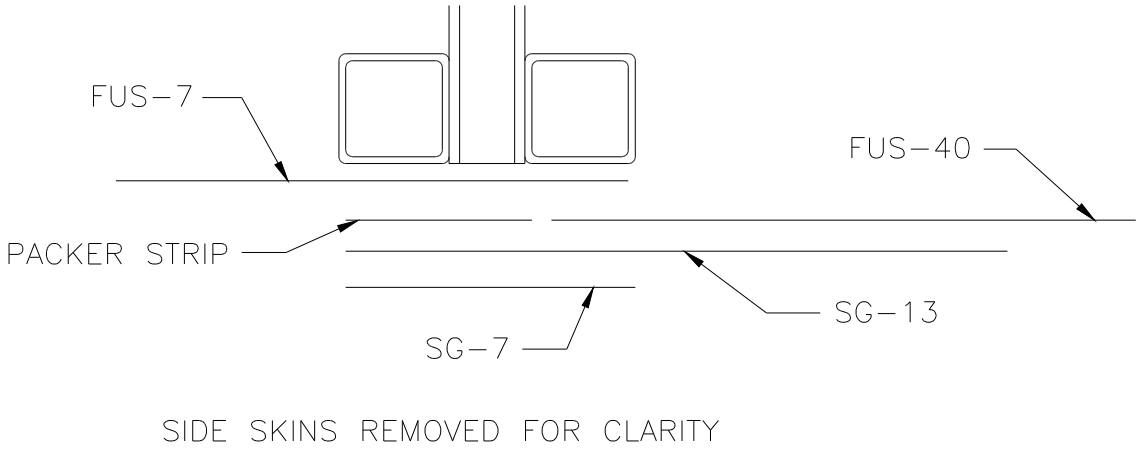



Figure 14.1.17

40) Make sure that the assembly has plenty of clecos in it to keep it secure.

41) Cleco SG-8 on top of SG-14 and cleco the assembly onto the main cabin floor and carrythroughs with the top edges flush. **NOTE:** You may have to trim the side tabs slightly to fit the parts around the cage uprights.

## *14.2 Inspection Holes*

1) Next, on the left side of the aircraft cut a 1 1/2" inspection hole in the lower side panel (FUS-26). Figure 14.2.1. It gives access to the bolt for attaching the nut to hold the Spring Gear in place.

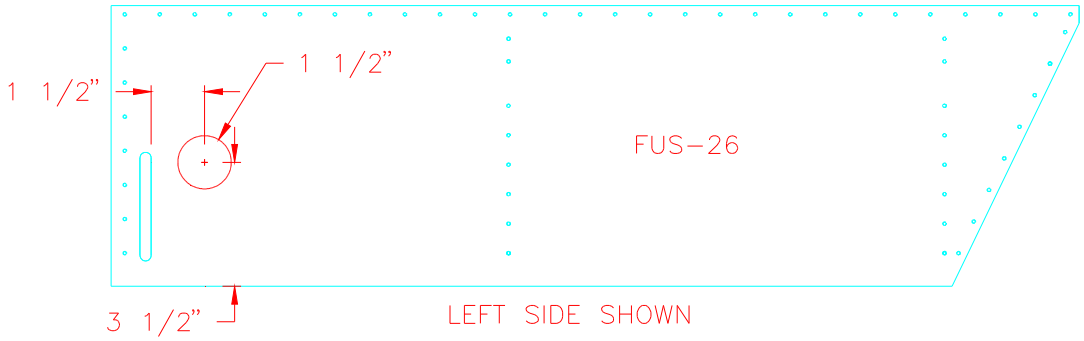



Figure 14.2.1

2) Repeat step for the right side of the aircraft.

3) Cut two 2 3/4" diameter plates out of .032" material (from SG-19). Measure 5/16" in from the edge. Layout a rivet pattern as per Figure 14.2.2. Drill all holes #30. Debur all holes and edges.

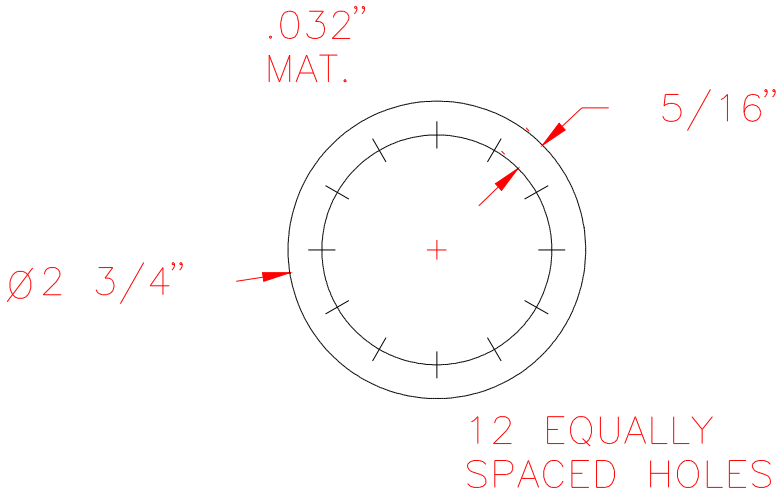



Figure 14.2.2

4) On the left side inspection hole mark a line 5/16" out from the edge of the hole. Figure 14.2.3. Mark a line from the top to bottom of this line. Drill two #30 holes at the intersections.

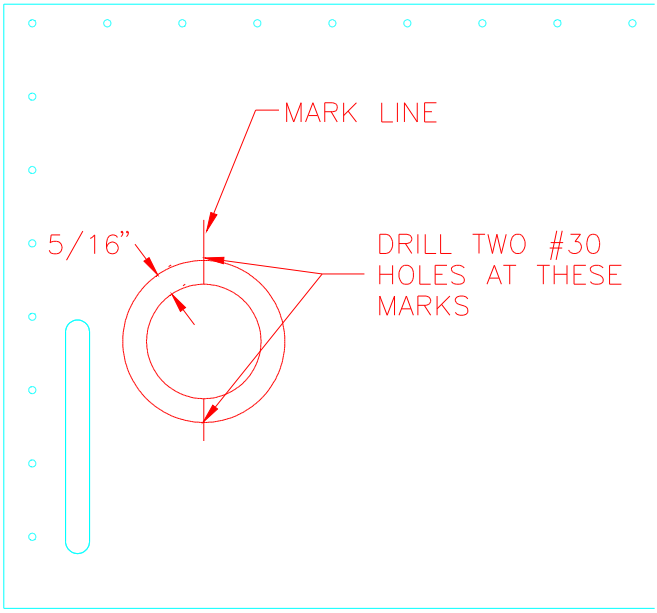



Figure 14.2.3

5) Cleco an inspection cover onto the holes and drill #30 the remaining holes using the inspection cover as a drill guide. Remove the cover and debur all holes and edges.

6) Repeat steps for the right side inspection hole.

7) Put the finished inspection covers away for now.

## *14.3 Spring Gear Install PLEASE REFER TO SPRING GEAR REINFORCEMENT SUPPLEMENT*

1) Using a long 1/4" drill bit, drill through the six 1/4" holes on the SG-7. Drill all the way through the cage to the inside of the cabin **NOTE:** These holes must be drilled square to the cage tubes. Have someone help you keep the drill bit square to the work while you are drilling. **IMPORTANT:** On the two outside 1/4" holes that will be going through the carrythroughs, have someone look in the inspection holes to make sure that the drill does not contact the fuel line (if installed) when it breaks through.

**IMPORTANT:** This is a critical area and special care must be taken when drilling out these holes.

2) Repeat step using a long 3/8" drill bit for the two inside holes and a long 5/16" drill for the four outside holes.

3) Remove the SG-7, SG-13 and the packer strip from the bottom skin (FUS-40) and the front floor (FUS-7). Debur all holes.

4) Remove enough clecos from the bottom skin (FUS-40) and front floor (FUS-7) so that you have easy access to the bottom carrythroughs (FUS-5).

5) Next, drill the 5/16"holes in the top of the carrythrough out to 7/16' so that a 7/16" crush tube will fit through the top of the carrythroughs. **NOTE:** these 7/16" holes are only drilled in the top of the carrythroughs. The 7/16" crush tube pushes up against the top doublers on final installation. See exploded view at the front of this section and Figure 14.3.1.

6) You may have to file out the 7/16" hole slightly so the crush tube fits in easily.

7) Cut four pieces of SG-10 raw material 7/16" x .058 round tube 2" long. These are now the crush tubes. Trim these crush tubes so that when they are inside the carrythroughs they sit flush with the top outside edge. Figure 14.3.1.

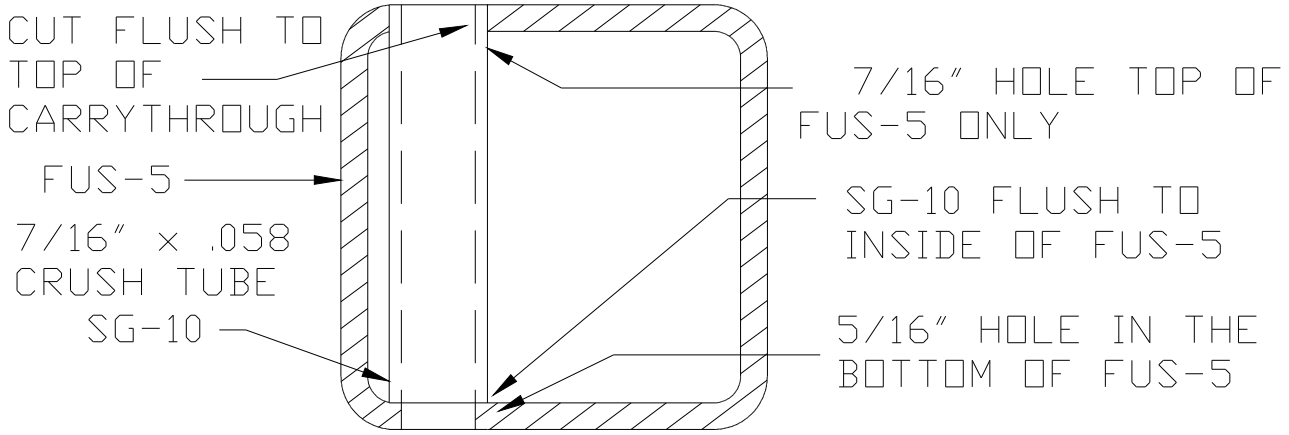



Figure 14.3.1

8) You may have to file the top edge of the crush tubes (SG-10) so they fit snug inside the top radius of FUS-5. Figure 14.3.1.

9) Get together the four saddles (SG-2), the two spacer top plates (SG-3) and the two bottom plates (SG-4).

10) Clamp two saddles (SG-2) together (to get two sets) with the holes lined up. Also clamp a top plate (SG-3) and a bottom plate (SG-4) together (to get two sets) with the holes lined up.

11) Drill the holes on the saddles to 5/16" and the top and bottom plates to 3/8". Debur.

12) Assemble the parts as per Figure 14.3.2. You can use tape to hold the bolts in place so they don't drop back down. Cleco the assembly back onto the bottom of the aircraft using plenty of clecos.

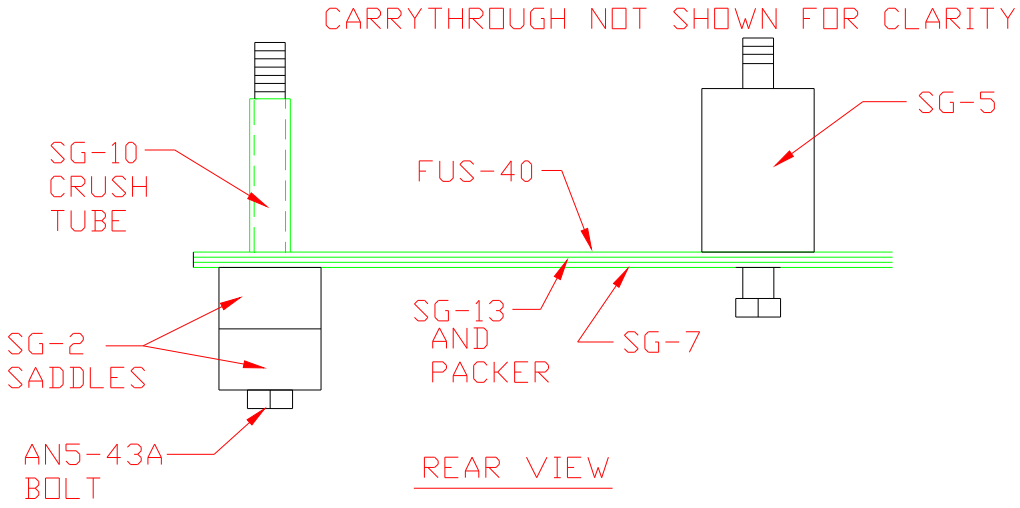



Figure 14.3.2

13) Make sure the crush tubes (SG-10) and the spacer block (SG-5) fit in their proper locations. (The spacer block fits between the two bottom carrythroughs). **NOTE:** When you final install the spacer blocks put some silicone(Proseal) on the outer surface so they stay in place. This is so that if you remove the Spring Gear to mount Floats, the blocks do not move out of position.

14) See Figure 14.3.3 for assembly.

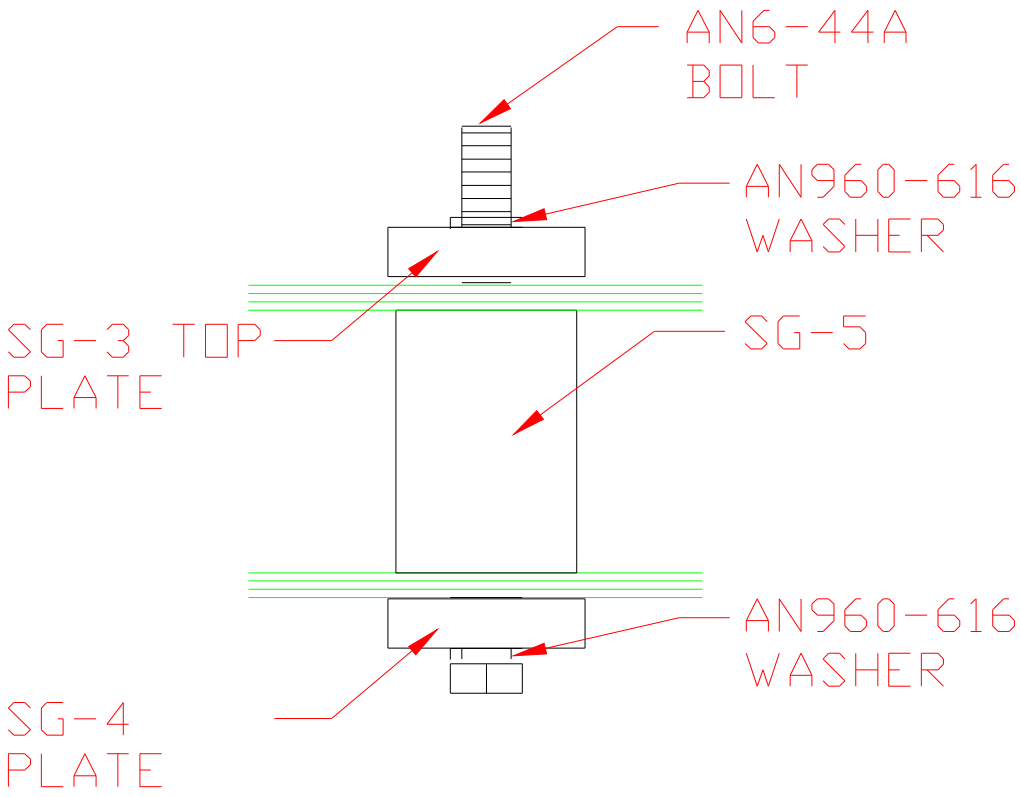



Figure 14.3.3

**NOTE:** In the next few steps you will find some areas where flush rivets are required. In these areas dimple and flush rivet.

15) With the bolts held in place, you may now rivet the bottom skin (FUS-40), the SG-7, SG-13, packer strip and the front floor (FUS-7). Rivet all channel holes with 1/8" rivets (RV-1410). Where there are many thicknesses of material use 1/8" rivets (RV-1414).

16) With the plates riveted in place you can now drill #30 the rivet holes around the sculpted parts of SG-13 through the bottom skin (FUS-40). Rivet these holes with 1/8" rivets (RV-1410).

17) When the bottom is completely riveted you may work inside the cabin. Rivet the SG-14, SG-8 and the main cabin floor (FUS-47) down. Use 1/8" rivets. Again use 1/8" (RV-1414) rivets where the material is thicker. You may also rivet the corner wraps at this time.

18) The entire floor on the inside of the cabin and the bottom skins should be completely riveted at this time. **NOTE:** Do not rivet in the holes used for the Seat Rails at this time.

19) Take the two Spring Gear Legs (SG-1L & SG-1R) and drill the four 3/16" axle mount holes out to 1/4". Be sure that the holes are drilled square to the part.

20) Now, carefully slide a Spring Gear (SG-1R or SG-1L) between the SG-2 saddles. Figure 14.3.4. You will have to drop the two AN5-43A bolts slightly so it fits between the saddles.

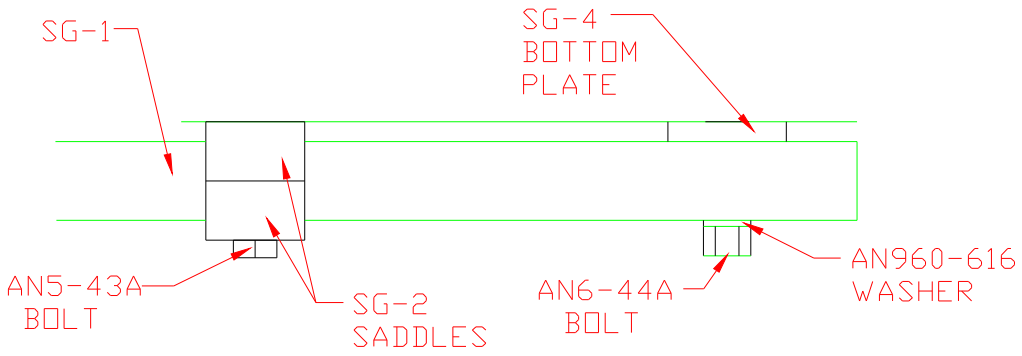



Figure 14.3.4

21) Slide a SG-4 bottom plate between the Spring Gear and the SG-7 plate. See Figure 14.3.4

22) Install your AN6-44A bolt through the end hole of the Spring Gear. Put a AN960-616 washer and a AN365-624 nut on the end of the bolt.

23) Through the inspection hole you drilled on the side of the aircraft put a AN970-5 penny washer (you may have to trim the washer to get it to fit properly), and a AN365-524 nut on the AN5-43A bolts.

24) Repeat step for opposite side.

25) For the other two AN5-43A bolts, use a AN970-5 penny washer and a AN365-524 nut.

26) Tighten down all bolts. Make sure the Spring Gear seats properly between the SG-2 saddles. **NOTE:** You may have to file the edges of the spring gear slightly to get a good fit.

27) Take an inspection cover and rivet it onto one of the inspection holes with 1/8" rivets.

28) Repeat for opposite side.

29) Square the SG-4 bottom plate so it points to the front of the aircraft. Mark holes as per Figure 14.3.5. Drill #11 and rivet with 3/16" (RV-1631) rivets. Repeat for opposite side. **NOTE:** Drill only through the bottom of the tubes.

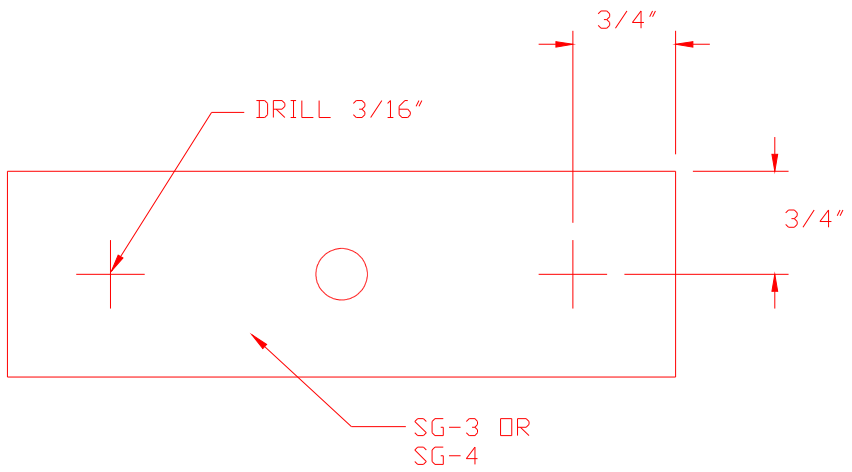



Figure 14.3.5

30) Repeat for the SG-3 top plates inside the aircraft.

31) Recheck all the skins to make sure that all areas are riveted inside the aircraft and on the bottom of the aircraft.

32) Next, you may rivet the Seat Rails in place with 1/8" (RV-1410) rivets. **NOTE:** You may need to put packer strips under the front of the seat rails because of the change in thickness of material where you added the SG-14.

## *14.4 Fairing Install*

1) Take a Plastic Fairing cover (SG-6) and place it over the top of one of the Spring Gear Legs. Adjust it so it sits snug against the bottom skin on the aircraft

2) With a #40 drill, (maintaining a 5/16" edge distance on the Fairing), drill nine holes through the Fairing into the skin. Space the holes so that the Fairing is properly supported.

3) Attach the Fairing to the aircraft using 9 #6 Pan Head screws with 9 - #8 washers (AN960-8).

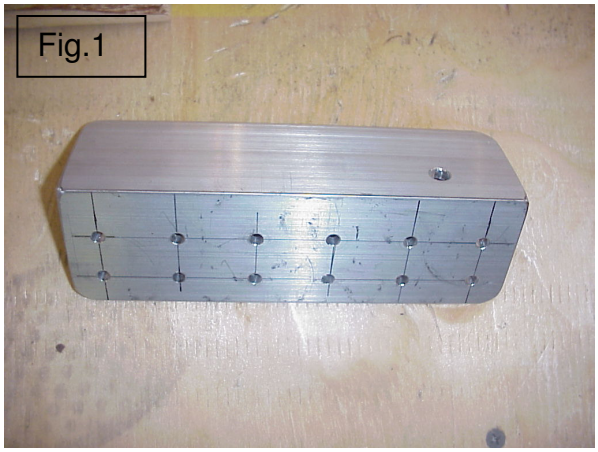
4) Repeat steps for the opposite side.

**NOTE:** In your kit you will receive two shims (SG-20 & SG-21). These are to be used after you have installed your axles and wheels to align your spring gear if necessary.

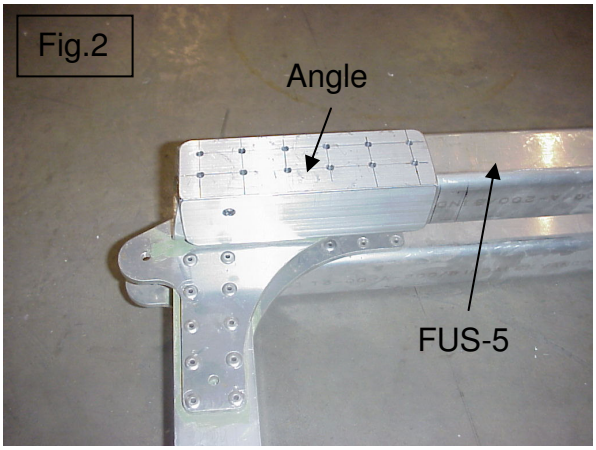
Rebel and Elite spring gear reinforcement……17/12/01
SPRING GEAR ATTACH REINFORCEMENT

A large number of Rebels and several Elites are flying with spring gear and have given no service problems in the gear attach area. This includes the factory demonstrators. However, a number of aircraft have shown cracking problems around the ends of the forward FUS-5, where the front 5/16" clamping bolt passes through. This appears to be caused by some confusion with the manual, and that this area gives little room for engineering errors. The following modification reinforces the entire area, is optional on existing aircraft, and can be ordered from shipping at minimal cost, but is included as standard on all new kits.

1/ Use these instructions at chapter 14.3 in the Rebel manual, and chapter 9.7 and 10 in the Elite manual.
2/ Locate the SG-0040 [2" X 2" 3/16"] angle. Cut two lengths 61/2" long. The angle must lie flush with the end of the FUS-5, but clear the SG-3.
3/ Lay out a rivet pattern as shown in Fig.1. Drill at #40. Be careful to miss any existing holes, respect at least ½" edge distance from the ends, and make sure your horizontal rivet lines keep at least ¼" from the start of the radii of the FUS-5.
4/ With the floor skins and SG-14 and SG-8 with the Rebel, and FUS-428 and FUS-429 with the Elite in place, position the angle as in Fig. 2, PRIOR to drilling the 5/16" holes.

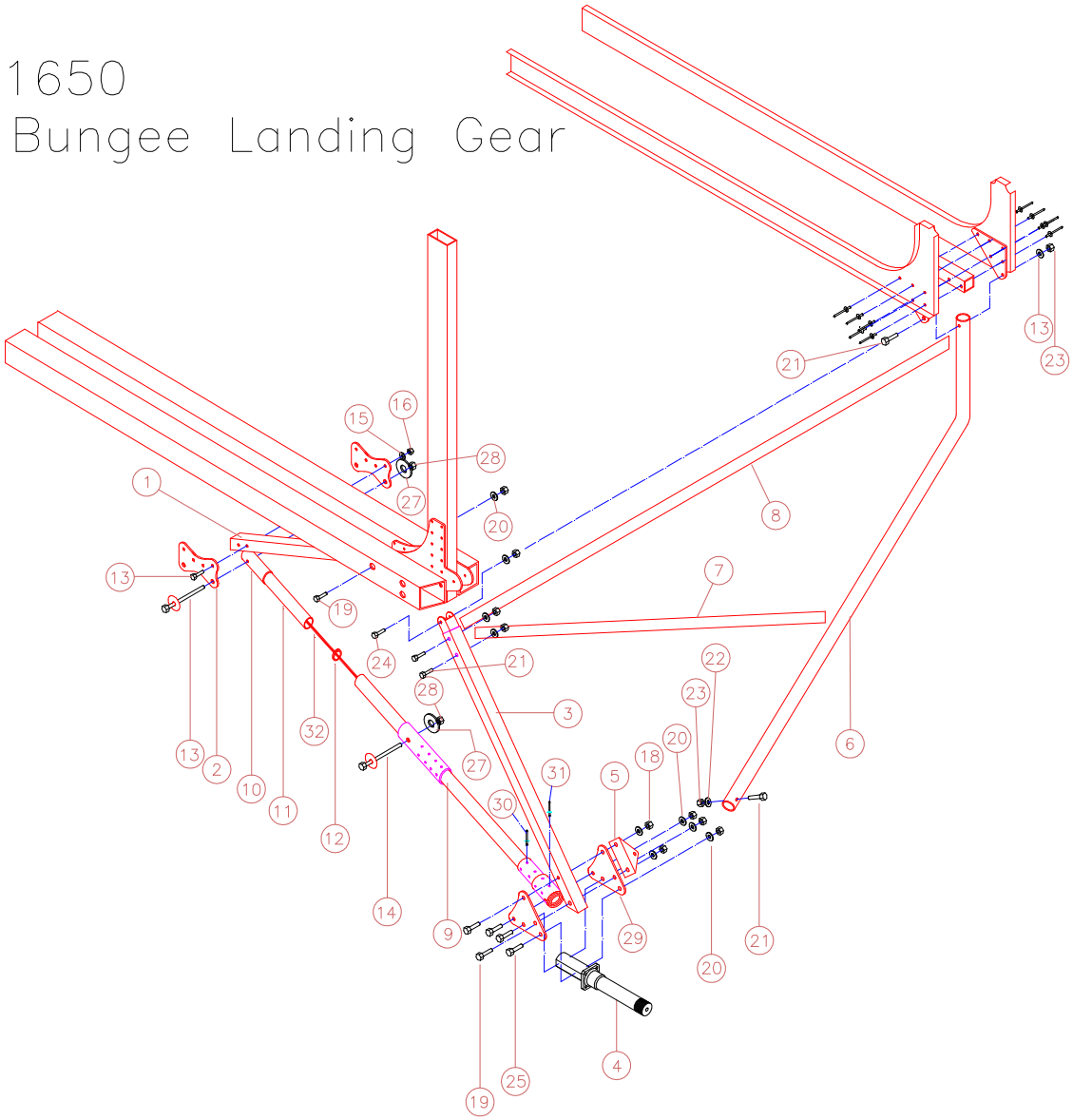


SG-0040




5/ Drill through your #40 holes into the FUS-5, open the holes up to #11 and cleco firmly in place.
6/ Go ahead and drill out the 5/16" holes as indicated in the manual through the whole assembly.
7/ The angle is riveted on the vertical face with RV-1621's, and the rivet line that holds the SG-14 and 8/ FUS-428 and FUS429 in place is carried onto the horizontal face of the angle, with RV-1621 's.

# 1650
# Bungee Landing Gear




| Item # | Description | Part-No. | Required |
|---|---|---|---|
| 1 | Center Tube | LG-26 | 2 |
| 2 | Cloverleaf Center Gusset | LG-27-1 | 2 |
| 3 | Main Gear Leg(consist of: | LG-44 | 2 |
| | Main Gear Leg | LG-33 | |
| | Main Gear Leg Doubler | LG-34 | |
| 4 | Axle | LG-107-1 | 2 |
| 5 | Drag Brace Gusset | LG-41 | 2 |
| 6 | Drag Brace Assembly | LG-13-1 | 2 |
| 7 | Lower Landing Gear Channel | LG-47-1 | 2 |
| 8 | Upper Landing Gear Channel | LG-60 | 2 |
| 9 | Lower Slide Tube(consist of: | LG-43 | 2 |
| | Lower Slide Tube | LG-37 | |
| | Slide Tube Outside Doubler | LG-35 | |
| | Slide Tube Outside Triple | LG-36 | |
| | Lower Slide Tube Sleeve | LG-40 | |
| 10 | Upper Slide Tube Doubler | LG-4 | 2 |
| 11 | Upper Slide Tube | LG-5 | 2 |
| 12 | Slide Tube Bumper Disk | LG-6-2 | 2 |
| 13 | 3/16" Bolt | AN3-15A | 4 |
| 14 | 3/8" Bolt | AN6-35A | 4 |
| 15 | 3/16" Washer | AN960-10 | 4 |
| 16 | 3/16" Fiber Nut | AN365-1032 | 4 |
| 17 | 5/16" Penny Washer | AN970-5 | 0 |
| 18 | 5/16" Fiber Nut | AN365-524 | 14 |
| 19 | 5/16" Bolt | AN5-20A | 6 |
| 20 | 5/16" Washer | AN960-516 | 14 |
| 21 | 1/4" Bolt | AN4-15A | 8 |
| 22 | 1/4" Washer | AN960-416 | 8 |
| 23 | 1/4" Fiber Nut | AN365-428 | 8 |
| 24 | 5/16" Bolt | AN5-16A | 2 |
| 25 | 5/16" Bolt | AN5-17A | 6 |
| 26 | 5/16" Bolt | AN5-35A | 0 |
| 27 | 3/8" Penny Washer | AN970-6 | 8 |
| 28 | 3/8" Fiber Nut | AN365-624 | 4 |
| 29 | Main Gear Leg Gusset | LG-32 | 4 |
| 30 | 1/8" x 3/16" Avex Rivet | RV-1410 | 48 |
| 31 | 1/8" x 5/16" Avex Rivet | RV-1414 | 16 |
| 32 | Safety Cable Assembly | | 2 |

To assemble the landing gear will require the following tools:

1. Variable speed hand drill.
2. #11, 1/4", 5/16", 3/8" drill bits.
3. Quantity of 3/16" clecos.
4. Deburring tool.
5. Felt marker.
6. Tape measure
7. 3/8", 7/16", 1/2", 5/8" wrenches.
8. Nico press.
9. Cable cutters or cold chisel and hammer.

Approximate time for this job is 6 hours.

## *15.1 Slide Tube Assembly*

1) Place the fuselage upright on two sawhorses. **NOTE:** Skins are removed for clarity.

2) Drill out front landing gear attach points to 5/16". Figure 15.1.1.

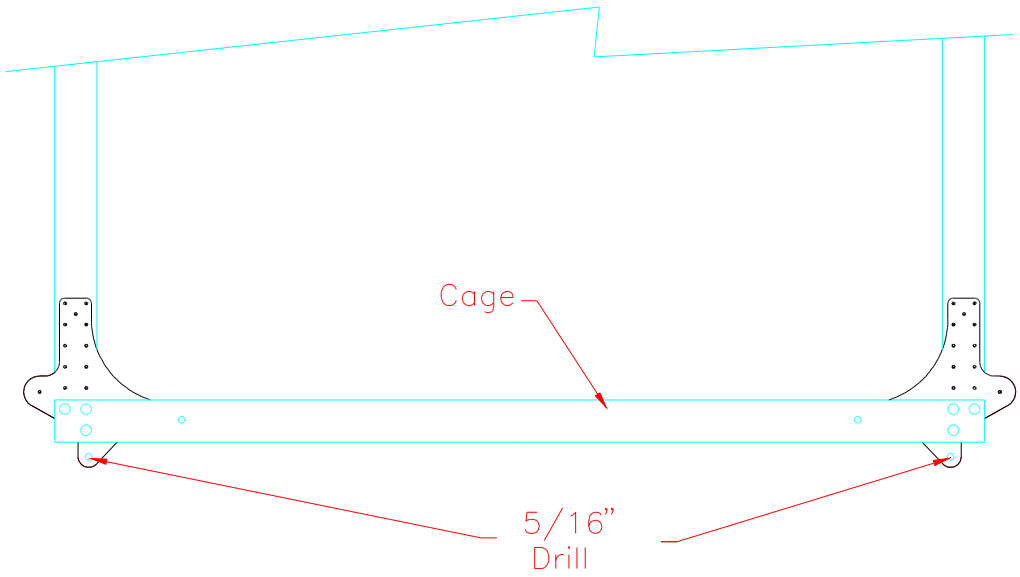



Figure 15.1.1

3) Drill the single hole ends of the center tubes (LG-26) out to 5/16" and fit into place as in Figure 15.1.2.

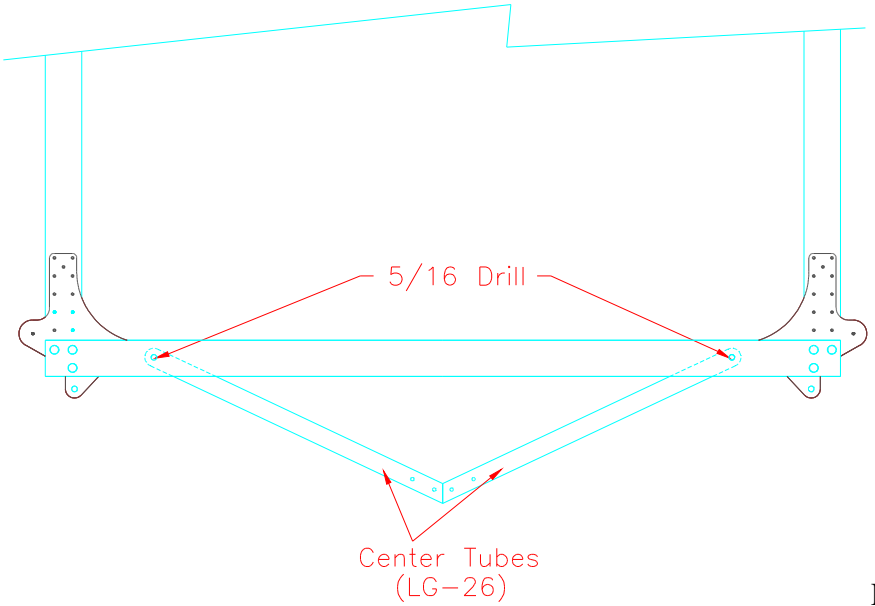



Figure 15.1.2

4) Bolt in place with AN5-20A bolts.

5) Attach two center tube gusset (LG-27-1) to the LG-26's with four AN3-15A bolts. Tighten this assembly.

6) Slip one Upper Slide Tube Doubler (LG-4) over the Upper Slide Tube (LG-5) (on the end of the LG-43 assembly) and drill hole to 3/8". Figure 5.1.3.

Figure 15.1.3

7) Measure the distance between the top hole you just drilled to the hole in the LG-43 assembly. Figure 15.1.4.

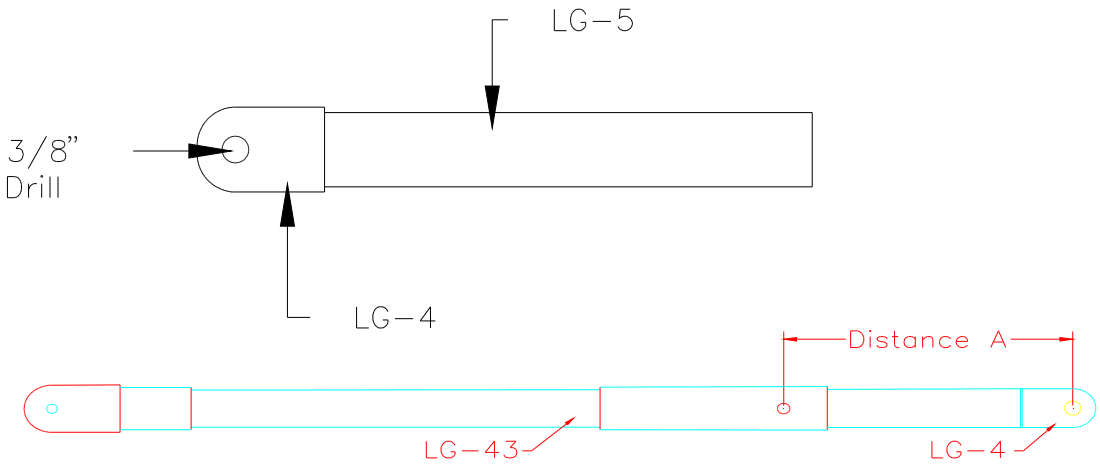



Figure 15.1.4

8) Assemble two safety cables using the measurement plus 3". Figure 15.1.5. Before swaging the one end, slip it into the Delrin Bushing (LG-6-1).

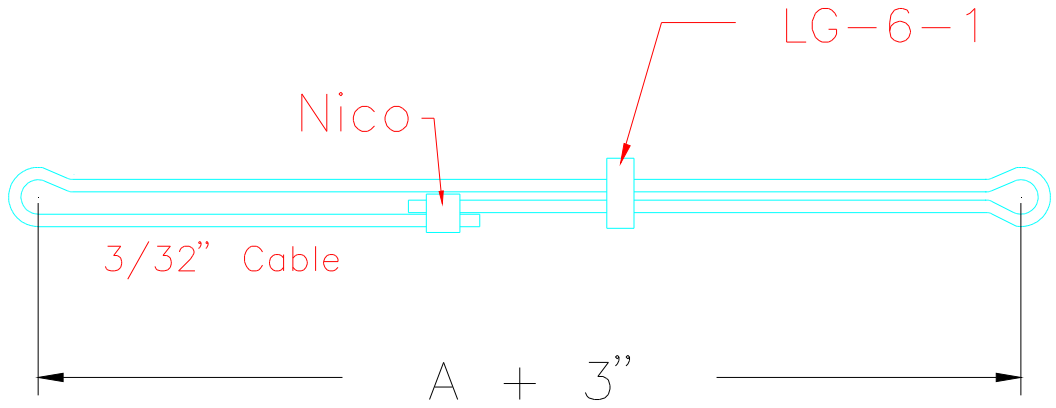



Figure 15.1.5

9) Remove the LG-4 and LG-5 assembly from the LG-43 assembly and attach it, with the safety cable, to the LG-27-1's with two AN6-35A bolts, four AN970-6 penny washers and two AN365-624 fiber nuts. **NOTE:** Ensure the bolts go through the ends of the cable assembly. Figure 15.1.6.

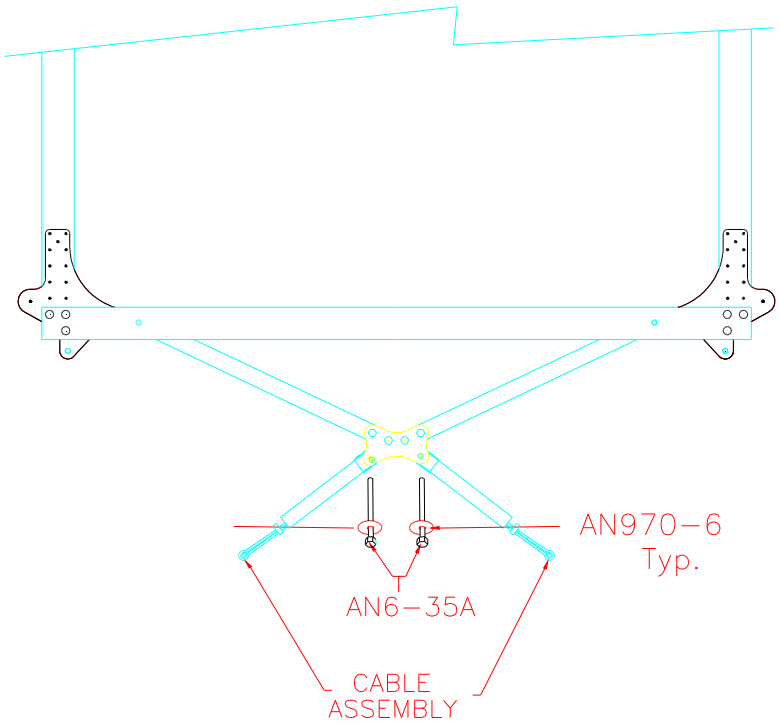



Figure 15.1.6

10) Drill the top hole in the Main Gear Leg Assembly (LG-44) to 5/16".

11) Put a small amount of grease on each side of the top hole in the main gear leg assembly (LG-44) and attach to the cage with AN5-16A bolts. Do not over tighten. Legs must swing freely. Figure 15.1.7.

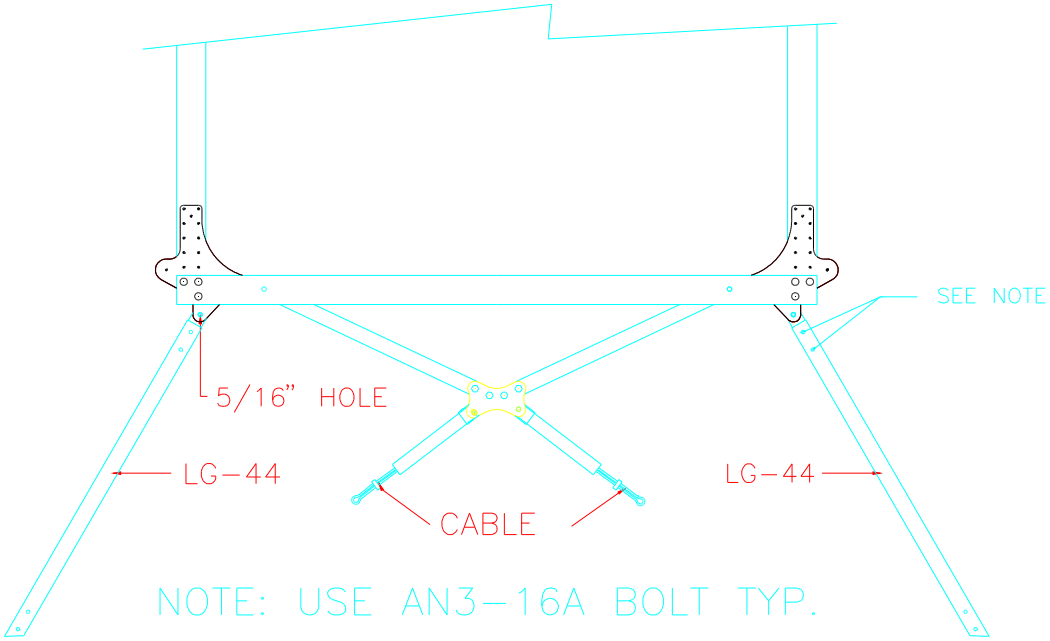



Figure 15.1.7

## *15.2 Axle Install*

1) Assemble the wheels and hubs per instructions given with the wheel kit.

2) Attach brake Calipers to the axle (LG-105).

3) Pin with a 3/16" bolt. Cut off excess axle so that it is flush with the end of the axle block.

4) Place one main gear leg gusset (LG-32) on the axle block and pin. Center the LG-32 and lightly drill (#11) the other hole in the block for a locator hole. Remove the LG-32 and place a pin to hold the axle in the axle block and drill (#11) the other hole the rest of the way through the block on a drill press. Then drill both axle holes to 5/16".

## *15.3 Drag Strut Brace*

1) Attach two LG-32, one LG-41 'Drag Brace Gusset' and one axle assembly to the bottom end of each main gear leg assembly, with AN5 bolts as shown in Figure 15.3.2. You will notice that the holes in LG-41 are off center. This is done so the sides of the LG-41 parts lie flat with the edges of the LG-32 gusset.

2) Put the drag struts (LG-13-1) in place and put AN4-15A bolts through fitting and strut as in Figure 15.3.1. **NOTE:** It may be necessary to trim LG-13-1 and drill a new hole at the lower location.

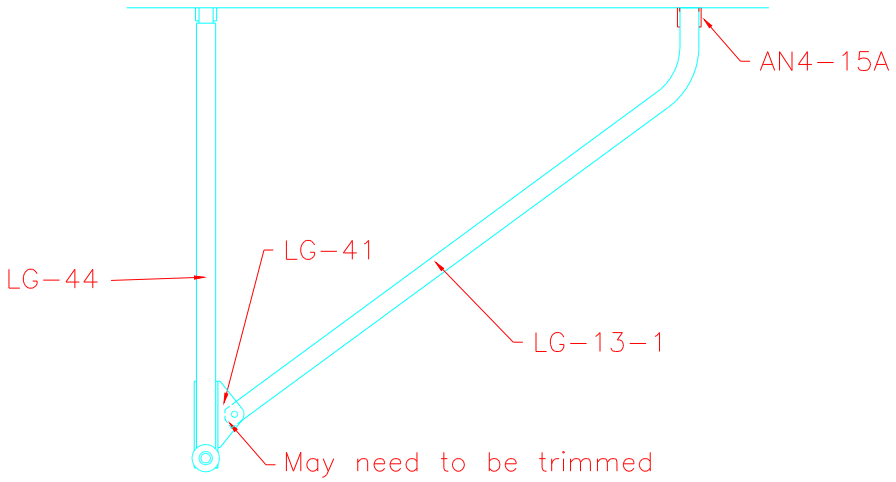



Figure 15.3.1

3) Center other end in the fuselage fittings and drill 1/4" through one side of the strut only. Pin with an AN4 bolt. Drill from opposite side. Lightly grease short end of LG-13-1 and install with two AN4-15A bolts. Do not over tighten.

4) On the lower slide tube assembly (LG-43) layout and drill four rows of four #30 holes as in Figure 15.3.2.

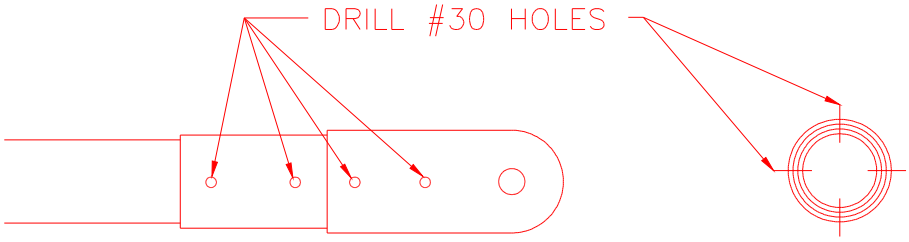



Figure 15.3.2

5) Deburr all holes and edges and rivet together with eight 1/8" rivets (RV 1410) and eight 1/8" rivets (RV 1414). Figure 15.3.3.

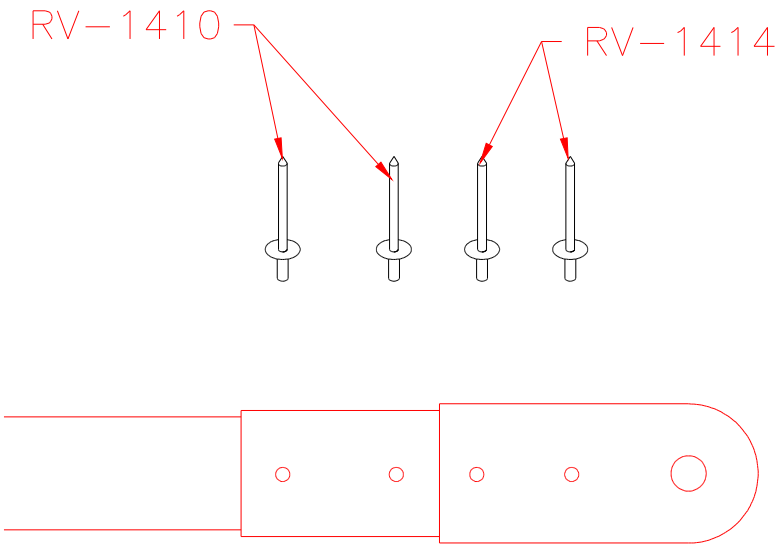



Figure 15.3.3

6) Pin the lower slide tube sleeve LG-40 onto the lower slide tube with an AN3 bolt. Drill and rivet with four rows of four 1/8" rivets (RV 1410). Figure 15.3.4.

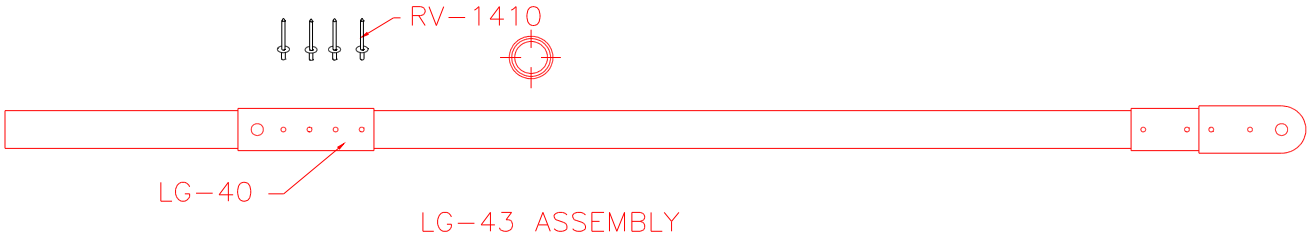



Figure 15.3.4

7) Drill both #11 holes of the lower slide tubes to 5/16" and deburr.

8) Assemble as in Figure 15.3.5, also see the assembly drawing at the beginning of this section for bolt sizes etc.

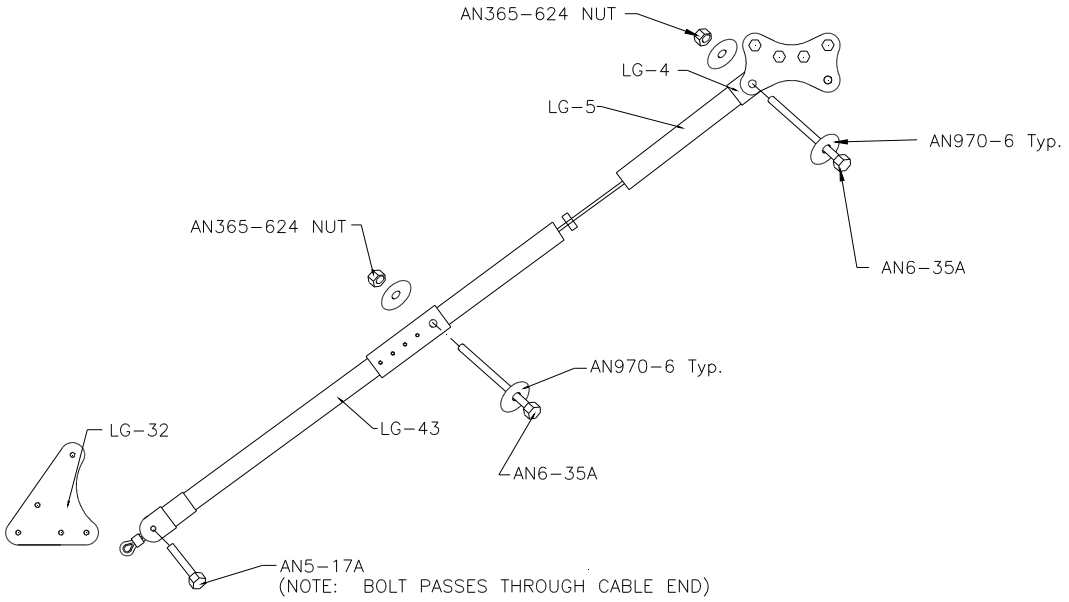



Figure 15.3.5

9) Repeat the necessary steps to complete both sides of the landing gear.

10) Install wheels and hubs.

## *15.4 Landing Gear Covering*

1) Cut four of each gusset from excess .025 or .032 material to the size shown. Round the corners and drill #30 holes where indicated. Figure 15.4.1 and 15.4.2.

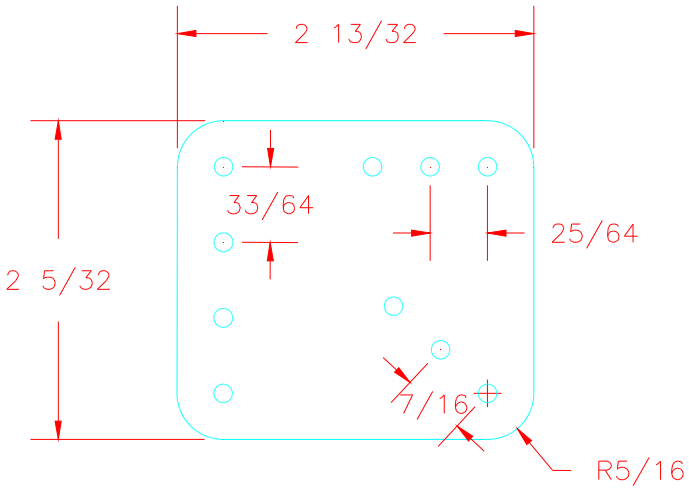



Figure 15.4.1

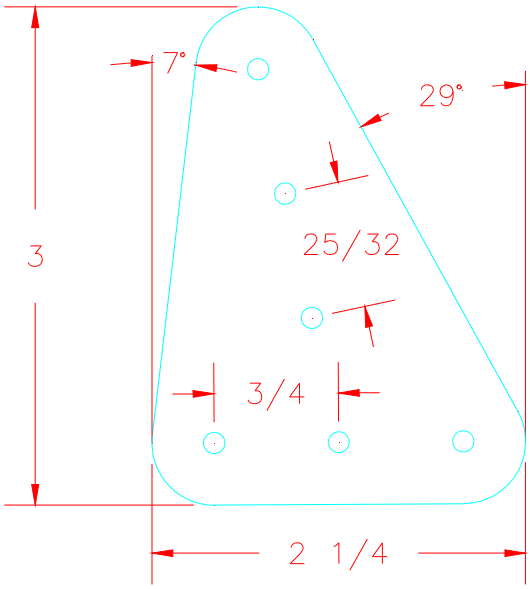



Figure 15.4.2

2) Gather two LG-47 and two LG-60 channels from the kit. Cut LG-47 to fit between the gear legs as shown in Figure 15.4.3

3) Using the gussets made in step 1 as a template, drill the holes to #30 into the gear legs and LG-47 channel. Cleco. Figure 15.4.3. Repeat for the back side.

.

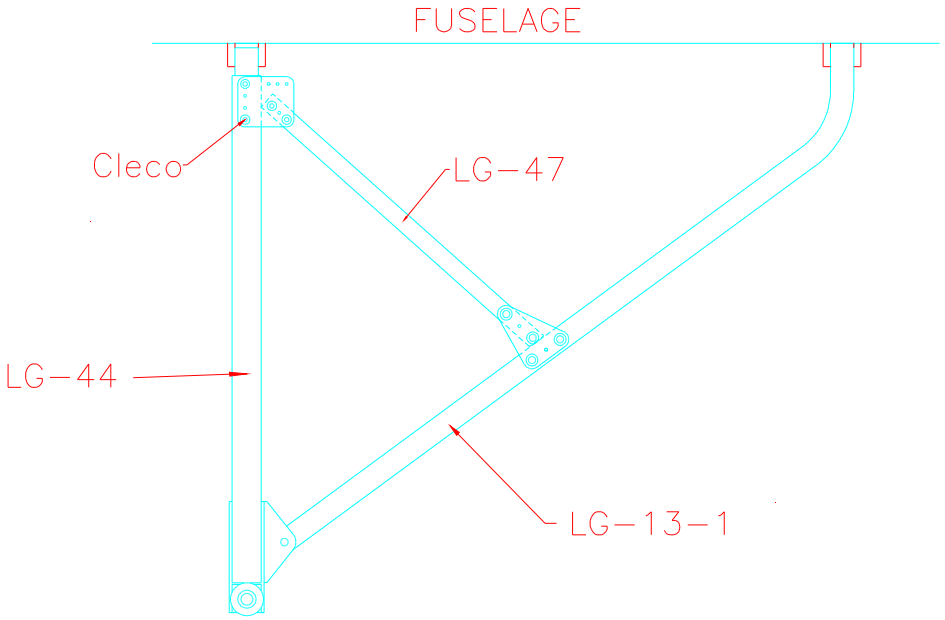



Figure 15.4.3

4) Cut the LG-60 channel to length if necessary with reliefs to fit between the gear legs at the top as in Figure 15.4.4.

5) Drill in place using the gusset holes as a template. Figure 15.4.4.

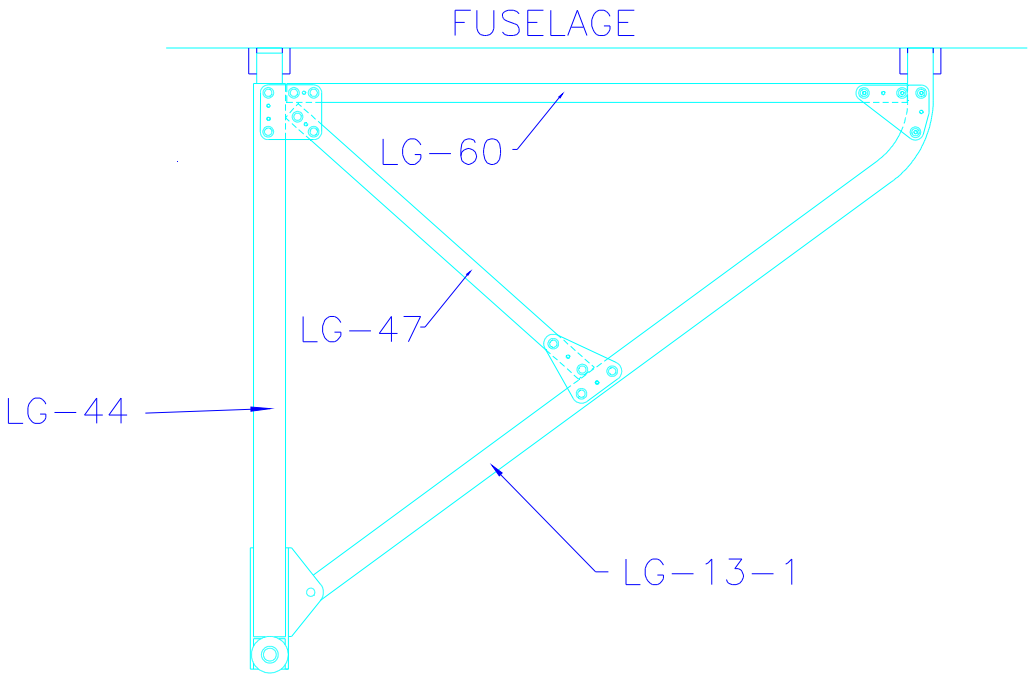



Figure 15.4.4

6) Deburr all parts and attach to the gear legs with 1/8" rivets (RV-1410).

7) The landing gear can be covered similar to other parts of the aircraft using the top channel as a support for the seam. The middle channel should be covered with reinforcing tape and have fabric rivets installed.

8) Follow all other procedures as per the stits covering manual.

## *15.5 Bungee Cord Installation*

**Notes:** - Installing bungee cord is at least a two man job. You may wish to install bungee cord after covering and painting. Tie landing gear temporarily with rope to allow for disassembly when painting.

1) To install bungee you will need four 2" hose clamps, a sharp knife or razor blade, electrician's tape and a roll of strong cord, preferably waxed (flat rib stitching cord works well).

2) Do not cut any lengths of bungee cord supplied in the kit until you have completed the required number of wraps.

3) Begin by clamping one end of the cord to LG-43. Make one complete wrap around the two bolts and pull as tight as possible. Repeat for a total of 5 wraps. See Figure 15.5.1 for details.

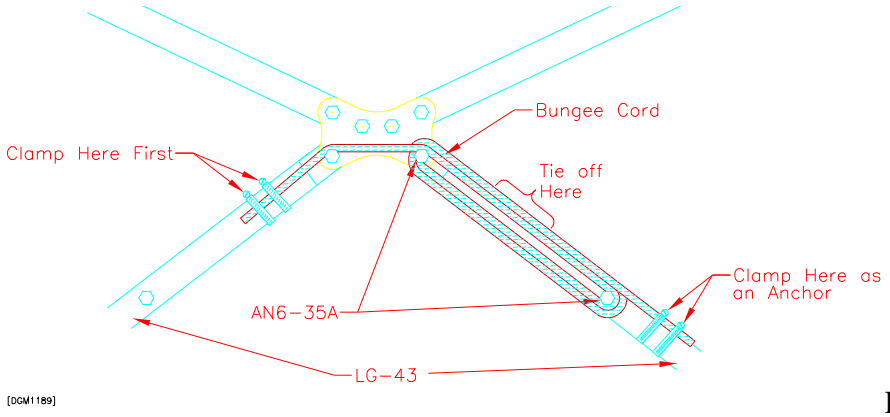



Figure 15.5.1

4) Clamp other end to the opposite LG-43. Tie off with cord as shown in Figure 15.5.2.

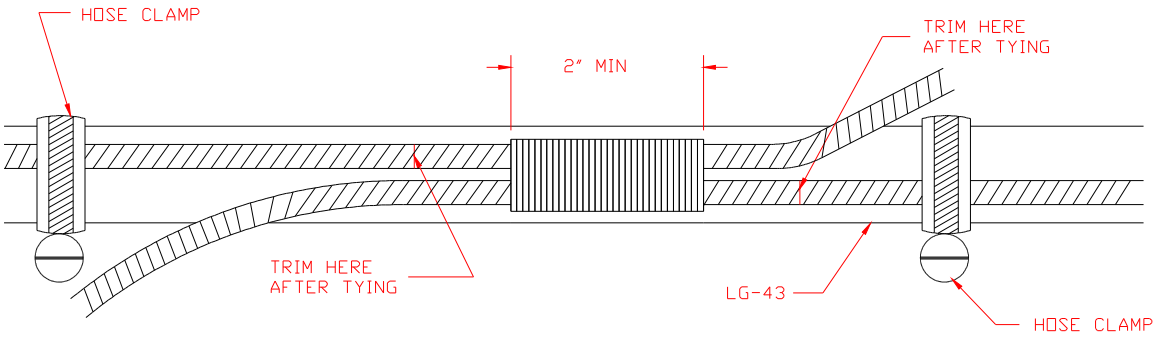



Figure 15.5.2

5) After tying securely, wrap ends with tape close to cord to prevent fraying. Cut bungee with razor blade approx. 1" past the tie area. Remove clamps. Repeat for the other three locations.

## *15.6 Disc Brake Installation*

1) The master cylinders may be mounted according to the controls section of this manual.

Line routing and reservoir location may vary. Reservoir is shown on the top firewall, but may be placed as preferred, provided that adequate gravity flow and access for filling and inspection is maintained. Figure 15.6.1.

2) For brake line routing see Figure 15.6.1. Use high pressure plastic hose (NNR-4-035) from the master cylinder to the wheel. Clamp using Brass Elbow Fittings (269-4A) at both locations.

3) Use 3/16 T.D. Nylon Tubing (485-4) from the reservoir to a 1/4" Brass Compression Tee (264-4).
**NOTE:** The 3/16" T.D. Nylon Tubing (485-4) has to be safety wired to clamp in place at the reservoir. From the 1/4" Brass Compression Tee (264-4) run 3/16" T.D. Nylon Tubing (485-4) to Brass elbow Fittings (269-4a) at the master cylinder.

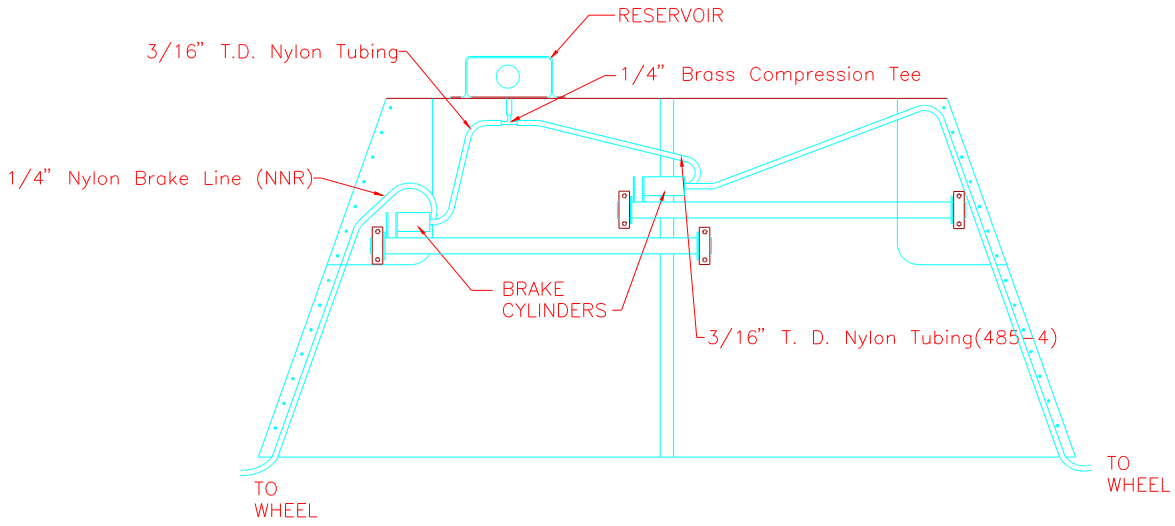


Figure 15.6.1

4) Fill reservoir with standard automotive type **(Automatic Transmission Fluid)** as brake fluid and bleed all air from the system.

**NOTE:** For safety reasons it is important to safety wire the bolts which attach the rotor to the wheel rim. This can be done as shown in Figure 15.6.2.

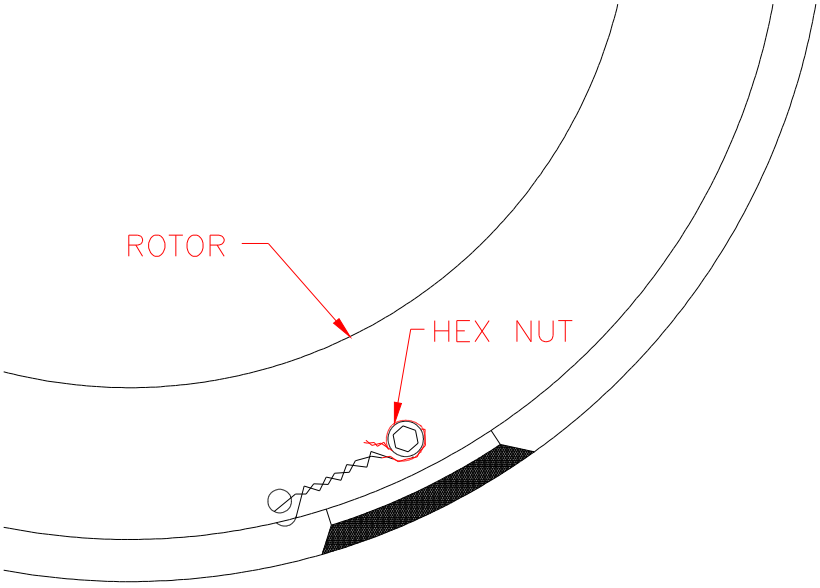
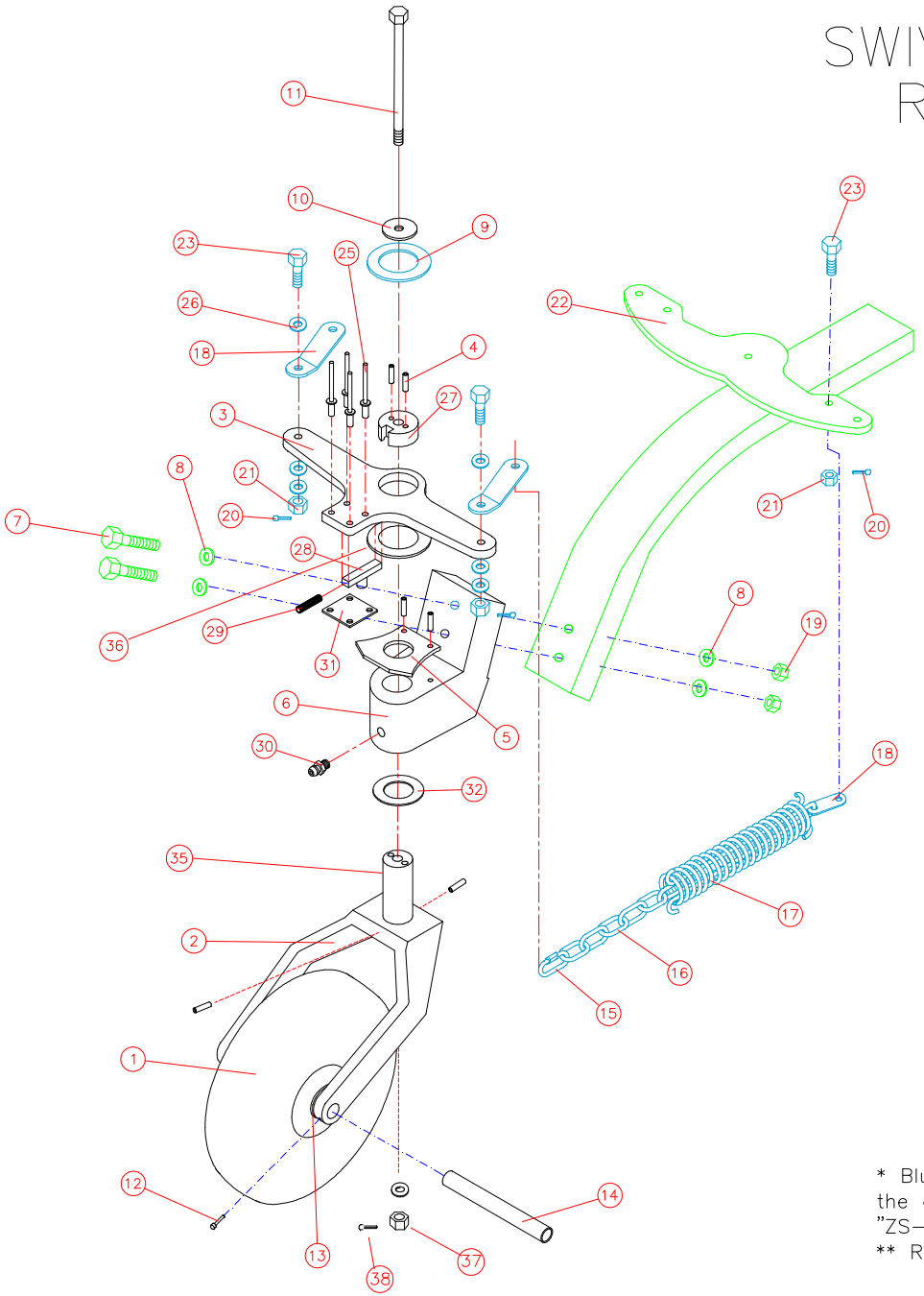



Figure 15.6.2

**NOTE:** The tied end of the safety wire should be folded around the head of the bolt to prevent snagging.



# SWIVEL TAILWHEEL LG-207
# REB/REN/MAV

| No. | Description | Part # | Req. |
|---|---|---|---|
| 1 | Castor Wheel | 6 x 225 | 1 |
| 2 | Tailwheel Yolk | LG-19 | 1 |
| 3 | Swivel Steering Bar | LG-54 | 1 |
| 4 | 1/8" x 1/2" Split Pins | SP-24 | 4 |
| 5 | Cam | LG-58 | 1 |
| 6 | Tail Wheel Swivel | LG-18 | 1 |
| 7 | 1/4" Bolts | AN4-17A | 2 |
| 8 | 1/4" Washer | AN960-416 | 5 |
| 9 | Washer | AN960-1616LT | 1 |
| 10 | 1/4" Penny Washer | AN970-4 | 1 |
| 11 | 1/4" Bolt | AN4-34 | 1 |
| 12 | 3/32" x 1/2" Socket Cap Screws | BRI-622 | 2 |
| 13 | 1/2" Steel Flat Washers | SAE-PLTD | 4 |
| 14 | Tail Wheel Axle | LG-21 | 1 |
| 15 | 1/8" Quick Link (NOT IN LG-207) | 158003 | 2 |
| 16 | Chain (NOT INCLUDED IN LG-207) | #80 SASH | 8" |
| 17 | Compression Spring (NOT IN LG-207) | 091815 | 2 |
| 18 | Hummer Tang | T12-HT6 | 4 |
| 19 | 1/4" Fiber Nut | AN365-428A | 2 |
| 20 | Cotter Pin | MS24665-132 | 4 |
| 21 | Castle Nut | AN310-3 | 4 |
| 22 | Rudder Horn (NOT INCLUDED IN LG-207) | RU-26-1** | 1 |
| 23 | 3/16" Drilled Bolt | AN3-6 | 4 |
| 25 | 1/8" x 3/8" SS Rivet | RR-5406 | 4 |
| 26 | 3/16" Washer | AN960-10 | 6 |
| 27 | Cap | LG-57 | 1 |
| 28 | Slider Pin | LG-55 | 1 |
| 29 | Pin Return Spring | C-526 | 1 |
| 30 | Grease Nipple | GF-641 | 1 |
| 31 | Spring Plate | LG-59 | 1 |
| 32 | Washer | AN960-1216L | 1 |
| 33 | 5/16" Washer | AN960-516 | 6 |
| 35 | Tail Wheel Shaft | TW-13 | 1 |
| 36 | Washer | AN960-1616L | 1 or 2 |
| 37 | Castle Nut | AN310-4 | 1 |
| 38 | Cotter Pin | MS24665-132 | 1 |

* Blue & green(gray in b/w hardcopy) colored parts will not be included in the assembly of LG-207. They will be shipped separately (See shiplist "ZS-RB#SWIVEL").
** RU-15 for MAVERICK

Tools that are required to assemble the Tailskid are the following:

1. Variable Speed Drill
2. 3/8” Drill, #11 Drill
3. Felt Pen
4. 3/8” and 9/16” Wrenches

## *16.1 Tailspring Support*

1) Cut 5" of Tailspring Support Block (TS-2) from raw stock(CC-77). Drill a #11 hole in one end of the TS-2. Place the hole 1/4" in from the end and in the center of the block. See figure 16.1.1.

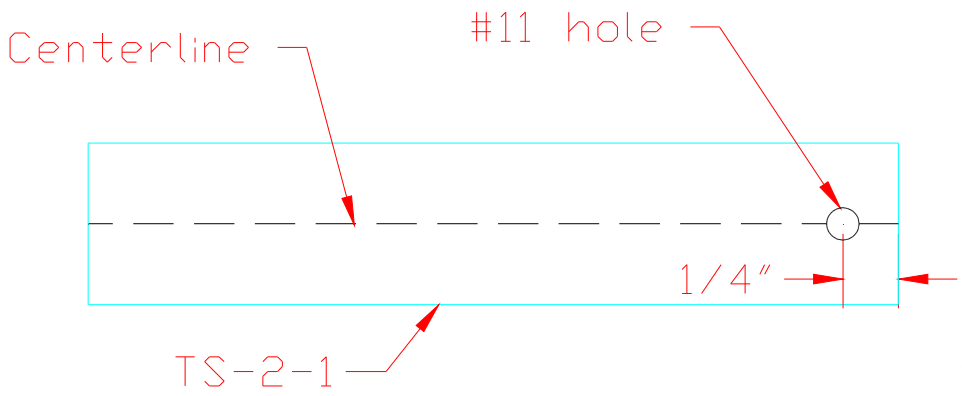



Figure 16.1.1

2) Repeat step for the 3/16" Tailspring Spacer (TS-7).

3) Bolt TS-2 to one (TS-1-1). Place centerline of TS-2 so it is centered in the hole of the other TS-1-1. Figure 16.1.2. Drill with a #11 drill so that a mark is present. Remove TS-2. Finish drilling. Repeat for TS-7 using TS-2 as a guide.

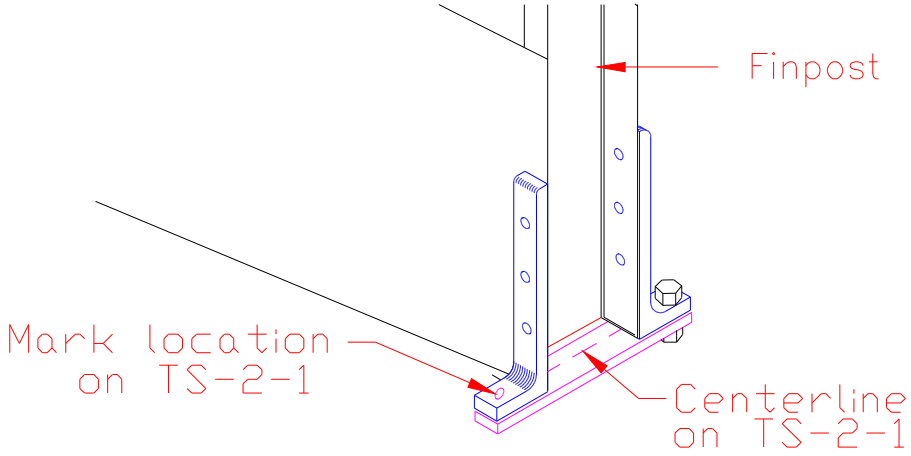



Figure 16.1.2

4) Remove any sharp edges on TS-2 and TS-7. Sanding of the ends is required to make both parts the same width as TS-1-1.

5) Cleco TS-2 and TS-7 in place.

## *16.2 Tailspring Mount*

1) Back Drill from inside the fuselage to 3/8" at the tailspring bulkhead..

2) Position the tailspring (TS-8) so that the 3/8" hole is lined up with the hole in the fuselage. **NOTE:** It may be necessary to alter Delrin Spacer (TS-5) between the tailspring and fuselage to ensure that the tailspring is flat against TS-2. Figure 16.2.1.

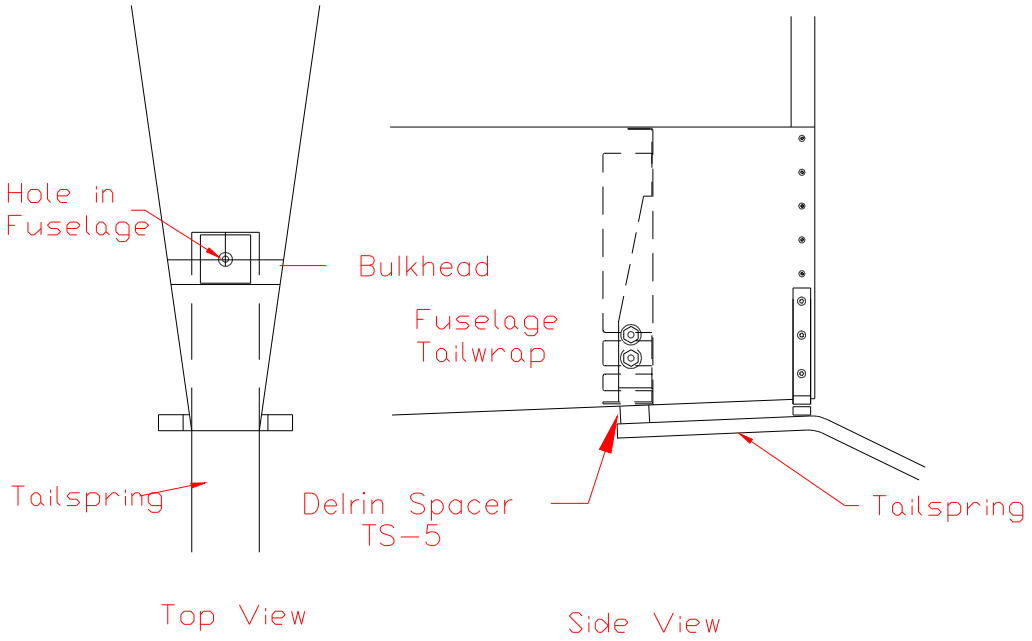



Figure 16.2.1

3) Attach the tailskid with an AN6-17A bolt, two AN960-616 washer, and an AN365-624 fibernut. Figure 16.2.2.

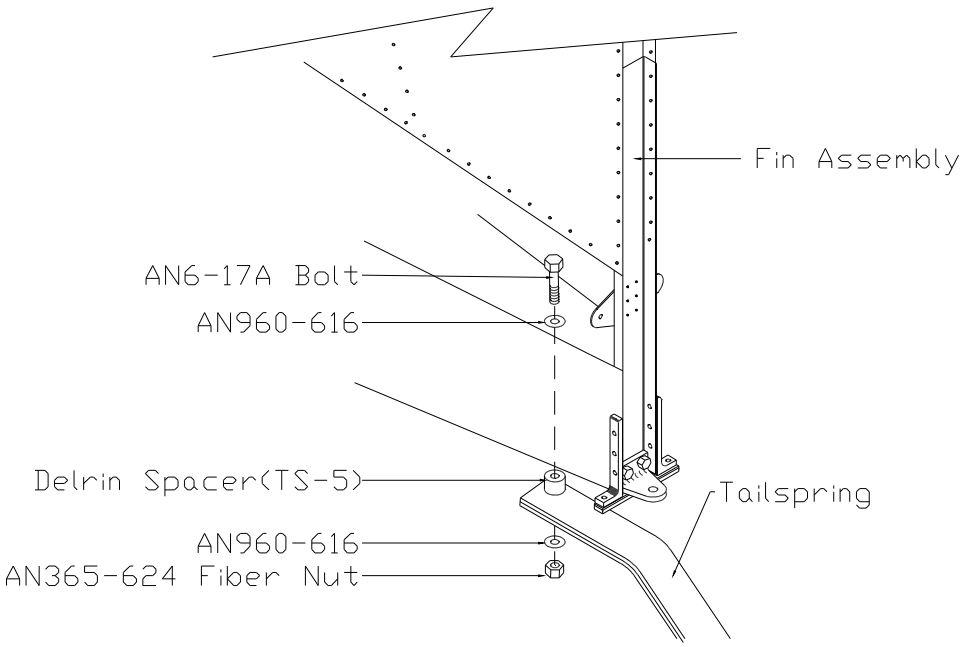



Figure 16.2.2

**NOTE:** The Tailspring Bulkhead is removed in figure 16.2.2 for clarity of the bolt assembly.

4) Re-center the tailspring.

5) Remove one of the clecos in TS-2 and TS-7. Position one Spacer (TS-4-2 & TS-8)) up against the Tailspring. Figure 16.2.3. Mark through TS-1-1, TS-2 and TS-7. Remove TS-4-2/TS-8 and drill to #11.

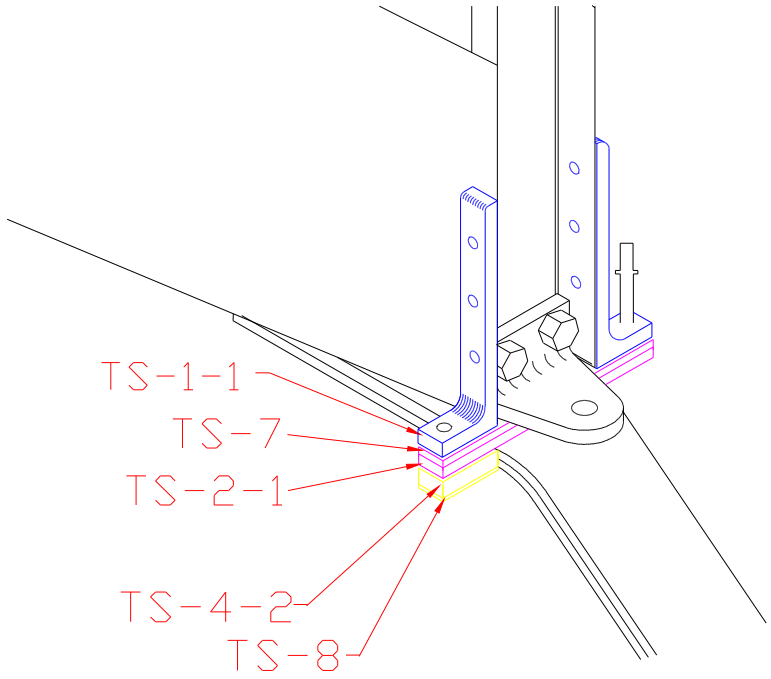



Figure 16.2.3

6) Bolt TS-4-2/TS-8 in place. Repeat for the other TS-4-2/TS-8.

7) Draw a Line down the center of both faces of the tailspring attach bracket (TS-3). Draw a line in the center of it's length. Figure 16.2.4.

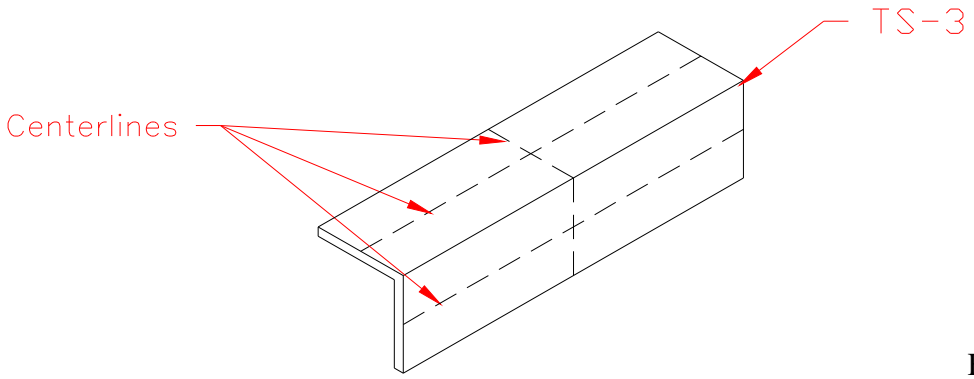



Figure 16.2.4

8) Position as in Figure 16.2.5.

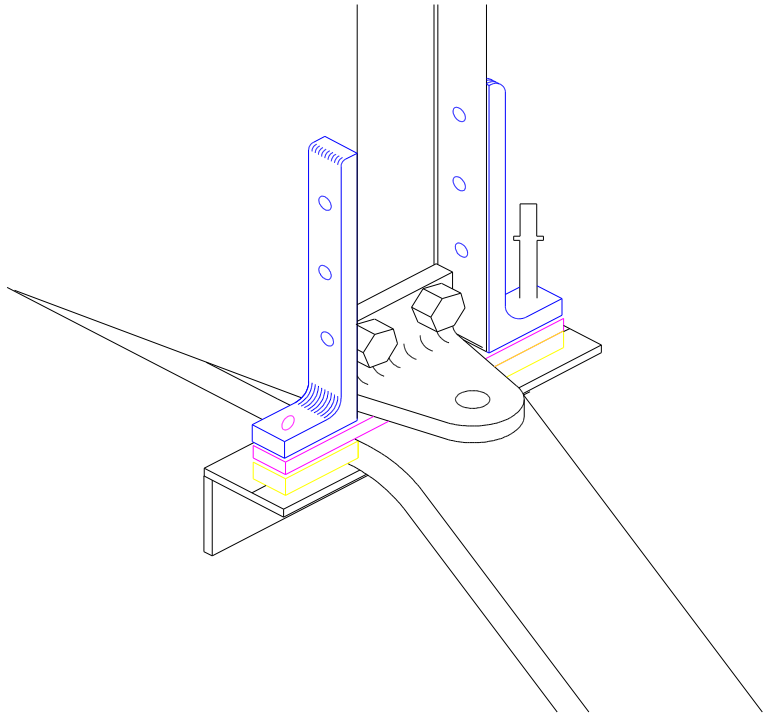


Figure 16.2.5

9) Drill #11 holes using TS-1-1, TS-7, TS-2 and TS-4-2/TS-8 as a guide onto the TS-3. Remove and drill holes in TS-1-1, TS-7, TS-2 and TS-4-2/TS-8 and TS-3 to 1/4" drill size.

10) Drill #11 holes in the other face of TS-3 at 2 1/2" from the center line. Figure 16.2.6.

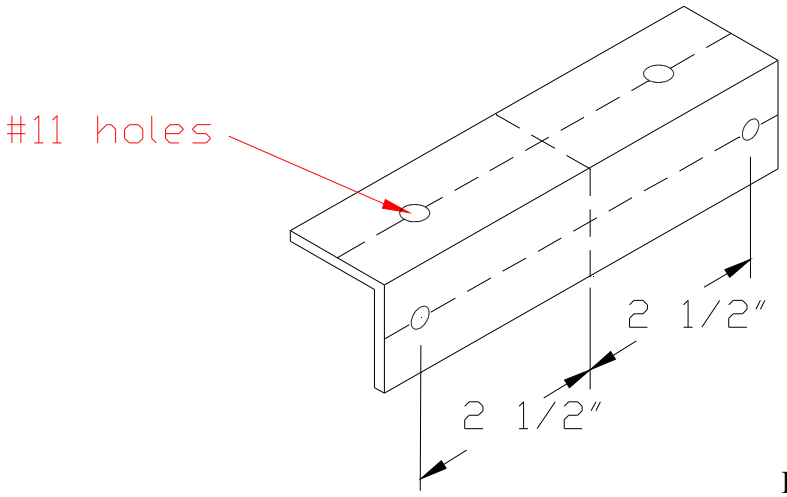



Figure 16.2.6

11) Trim TS-3 as in Figure 16.2.7.

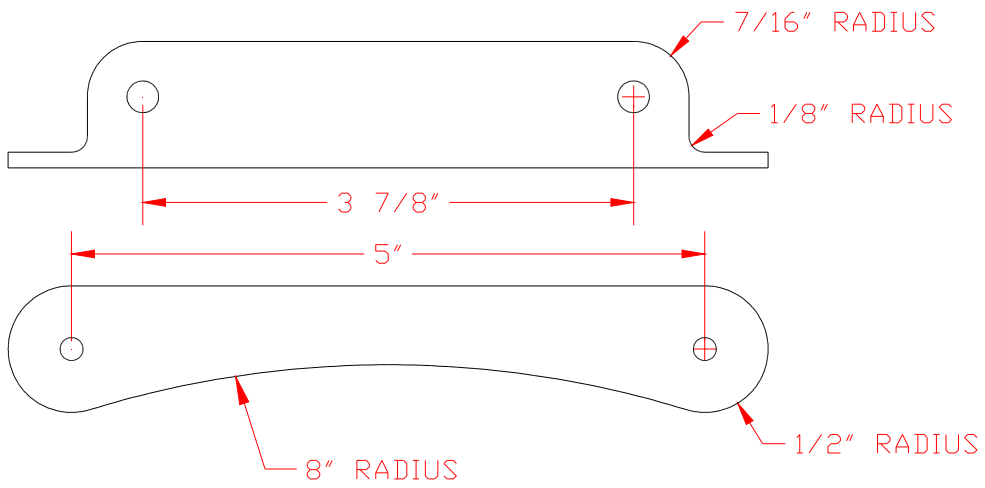



Figure 16.2.7

12) Bolt together as in Figure 16.2.8.

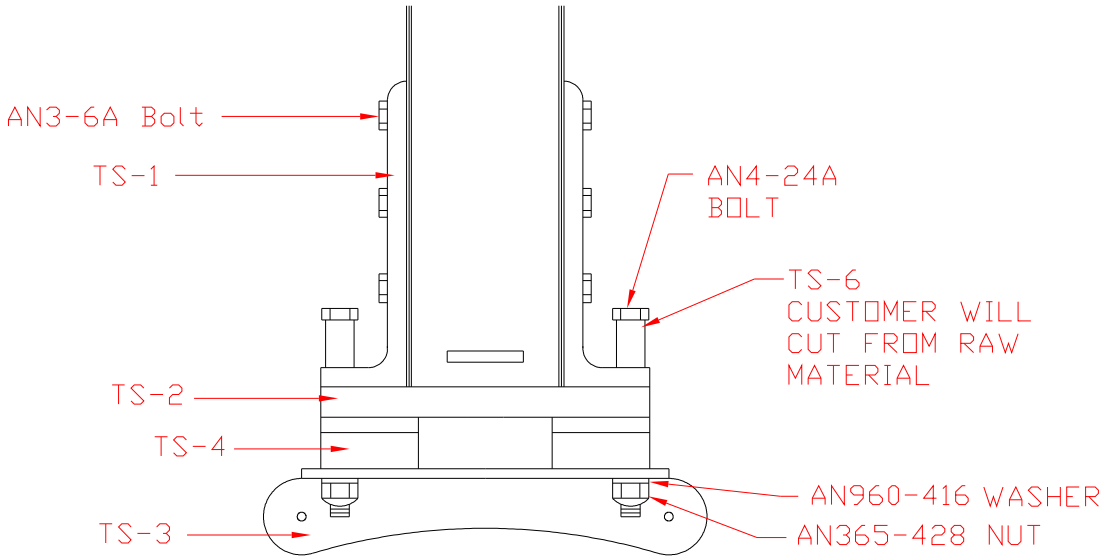



Figure 16.2.8

13) Assemble the tailwheel as per instruction supplied with wheel parts.

## *17.1 Stabilizer Install*

**NOTE:** The fin installation should be completed and the Fin-Stab Attach Bracket (Fin-33) be installed prior to stabilizer installation. Also the aircraft should be leveled using the Front Carrythroughs as the leveling point.

1) Place the stabilizer in position as shown in Figure 17.1.1. Insert an AN4-5A bolt to attach the Rear Attach Bracket (ST-38) to the Fin-Stab Attach Bracket (FIN-33). Always drill attachment holes to exact size to avoid a sloppy fit.

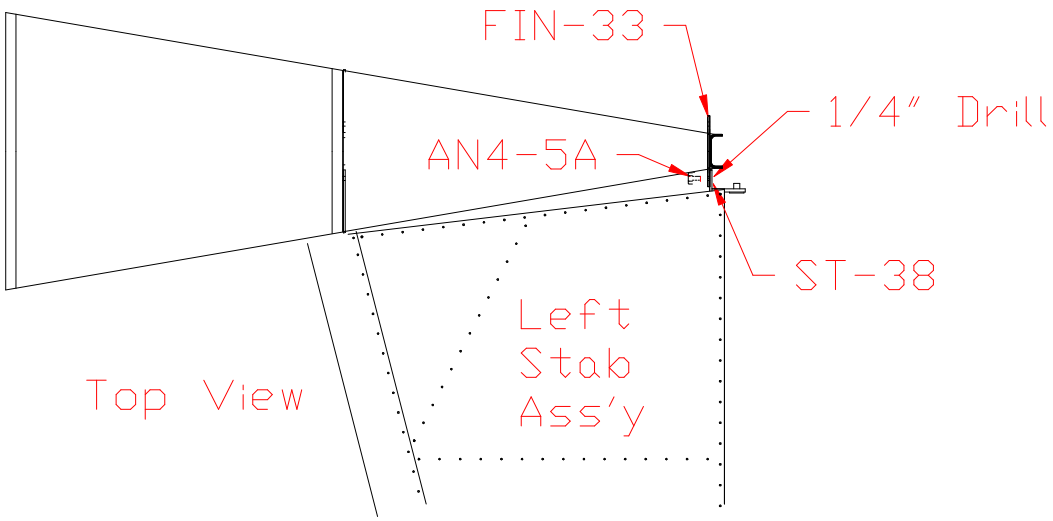



Figure 17.1.1

2) Using a level as shown in Figure 17.1.2, ensure that the stabilizer is level horizontally and supported in place.

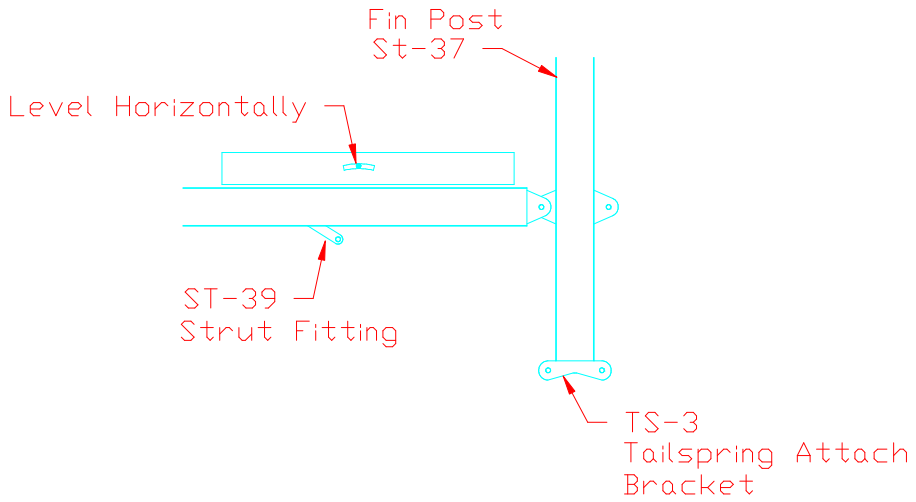



Figure 17.1.2

3) Measure the distance between the holes in the Stabilizer Strut Attach Bracket (ST-39) and the Tailspring Attach Bracket (TS-3).

4) Subtract 1 1/2" from this measurement and cut the length from the 5/8" x .058" stock (ST-42).

5) Insert one Tailstrut Fork Fitting (ST-41) into the end of the tube.

6) Drill two 5/32 holes as shown in Figure 17.1.3. Remove the fork fitting and debur all holes.

7) Re-insert the fork fitting and secure using two 5/32" solid shank aluminum rivets (MS2047-AD516). Coat the end of ST-41 with zinc chromate before inserting it. (Cut the rivets so that one and a half times its diameter sticks out of the tube.) Buck the rivet until it has a head of approximately half its diameter in thickness. Figure 17.1.3.

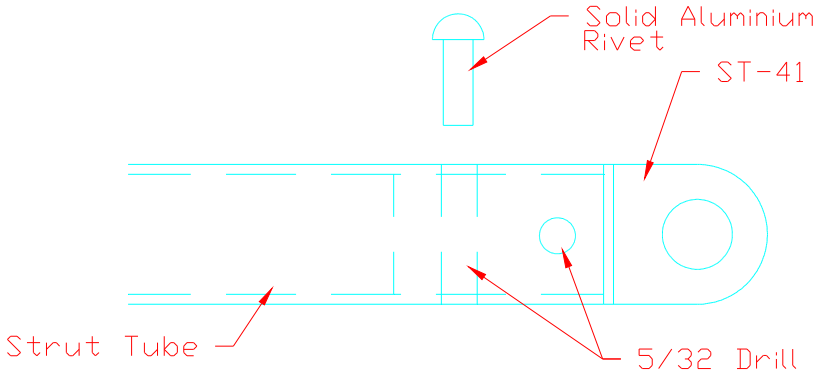



Figure 17.1.3

8) Insert an AN3 bolt through the strut fork and the Tailspring Attach Bracket (TS-3) and another through a second fork fitting (ST-41) attached to the Strut Attach Bracket (ST-39). Figure 17.1.4.

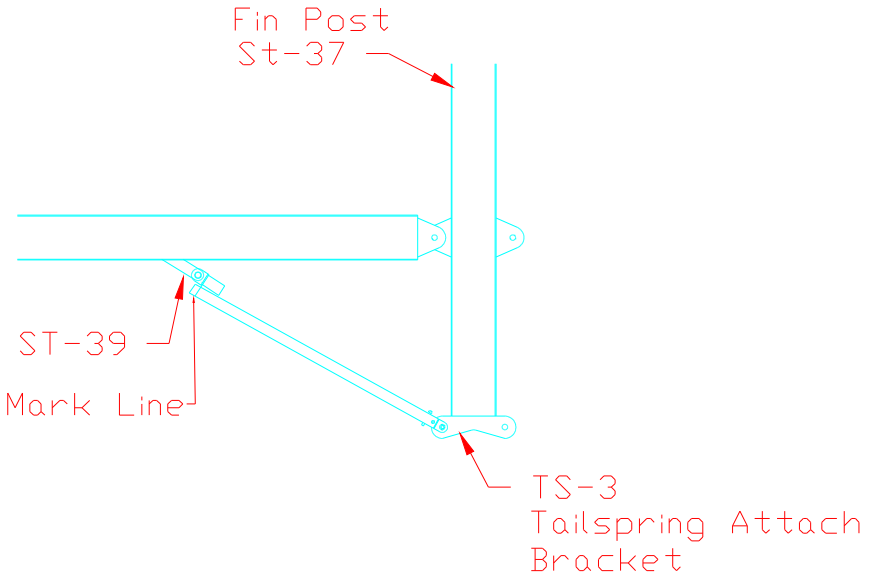



Figure 17.1.4

9) Mark a line on the end of the tube and cut to length. **NOTE:** Allow some extra for trimming.

10) Insert the ST-41 into the tube and check the length. Sand the tube until the length is correct.

11) Pour a small amount of tubeseal in the tube and shake it to evenly coat the inside of the tube.

12) Drill, debur and attach the ST-41 the same as you did earlier.

13) Repeat steps for the opposite stabilizer half.

14) Cut a small block of wood 1/2" wide by 11/32" high and tape it 20" from the end of a level as shown in figure 17.1.5.

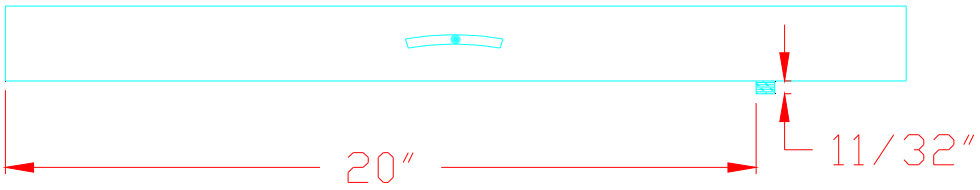



Figure 17.1.5

15) Place the level on the stabilizer as shown in Figure 17.1.6, with the end just behind the leading edge and the block just in front of rear stab spar.

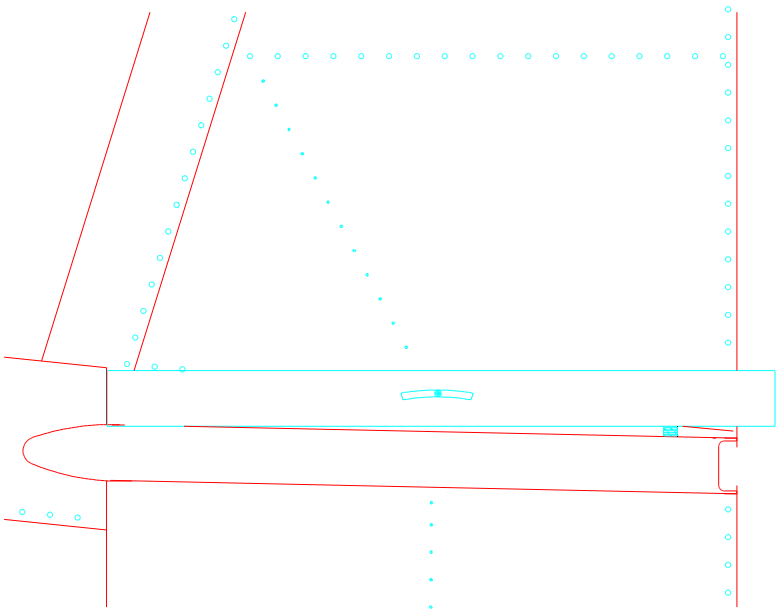


Figure 17.1.6

16) Raise the front of the stab until the bubble shows level. This will set 1° of "angle of incidence".

17) Support in place and repeat steps for the opposite side.

18) Ensure that the rear spars of the two stabilizer halves are in line when looking from the side.

**NOTE:** If the Fin Attach Bracket and Front Stab Attach Bracket interfere some slight sanding or filing maybe required.

19) Using a 3/16" bit drill through each front stab attach bracket (ST-32) into the bulkhead and doubler.

20) Cleco each fitting, then one at a time drill the holes to 1/4" and debur.

21) Insert an AN4-5A bolt in each hole, then have someone screw on a F5000-4 floating anchor nut onto each bolt from inside the airplane.

22) Back drill through the anchor nuts using a #30 bit, into the bulkhead to locate the rivet holes for the anchor nuts.

23) Debur the holes and attach the anchor nuts using 1/8" CS rivets (RV-4412) from the outside. Figure 17.1.7.

24) Attach the front stab fittings as shown in figure 17.1.7.

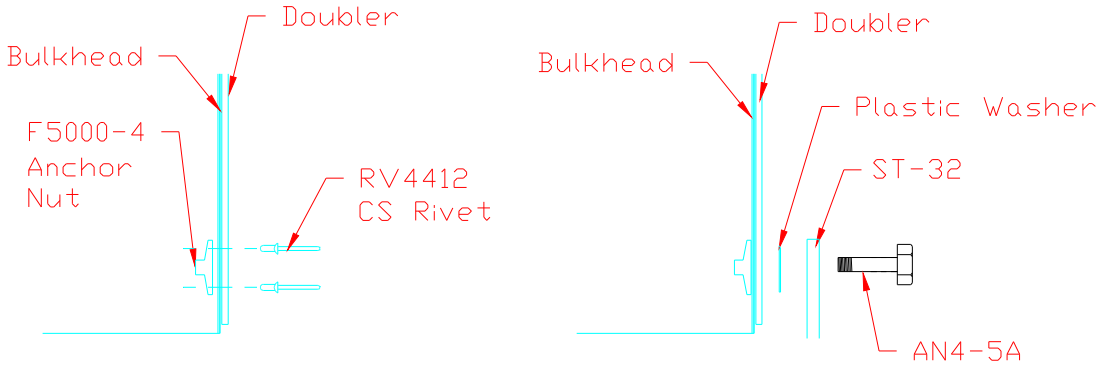



Figure 17.1.7

25) The rear attach bracket (ST-38) can be secured to the fin stab attach bracket (FIN-33) using a AN4-5 bolt, AN960-416 washer and AN365-428 fibernut. Figure 17.1.8.

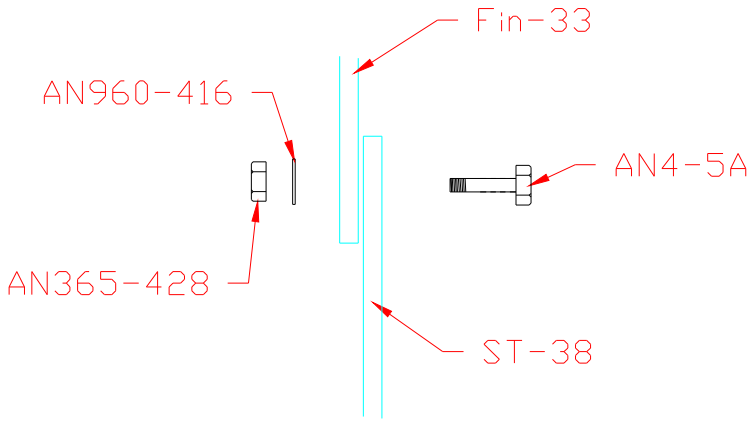



Figure 17.1.8

26) The strut fitting can be secured as shown in Figure 17.1.9. Drill through using a 3/16" bit prior to final installation.

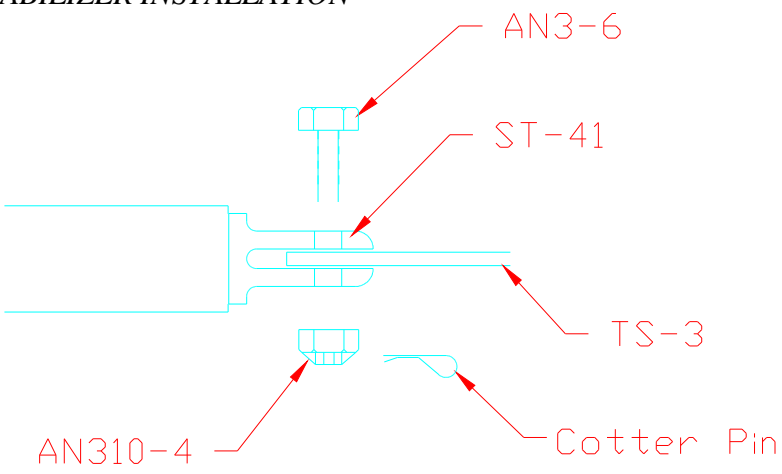



Figure 17.1.9

## *18.1 Wing Attach*

1) Place the fuselage on two saw horses. Level the fuselage longitude and latitude using the cage as a reference point. Figure 18.1.1.

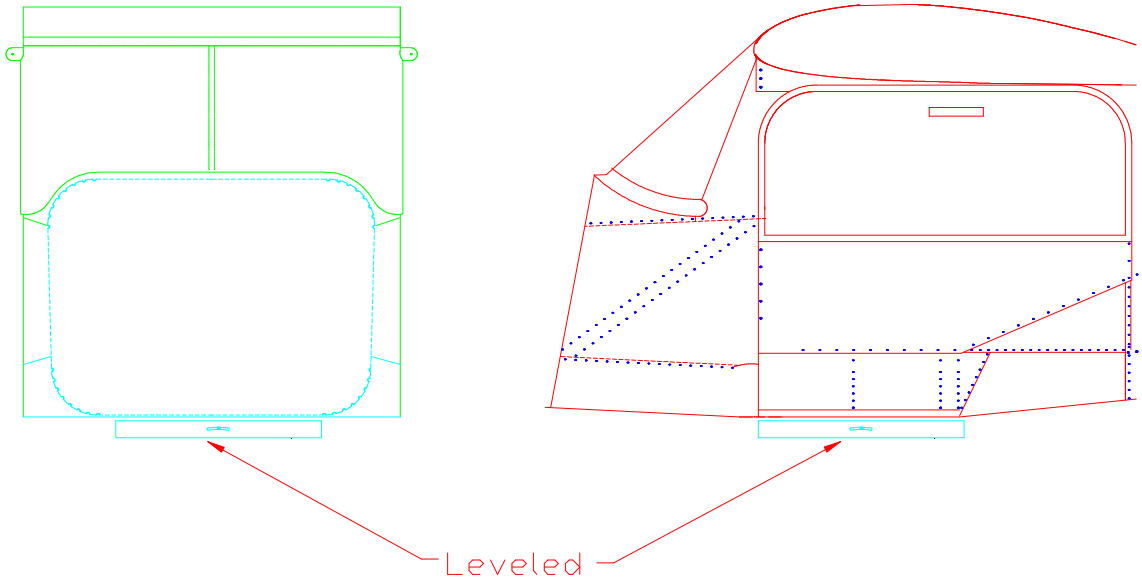



Figure 18.1.1

2) Install left wing on the fuselage using the bolts specified. Brace the tip so that the wing has 1° of dihedral. Figure 18.1.2.

**NOTE:** Ensure the fittings are centered and the legs of the fittings are parallel to each other. Spacers such as washers must be used to ensure straight fit. There should be no play between the fittings.

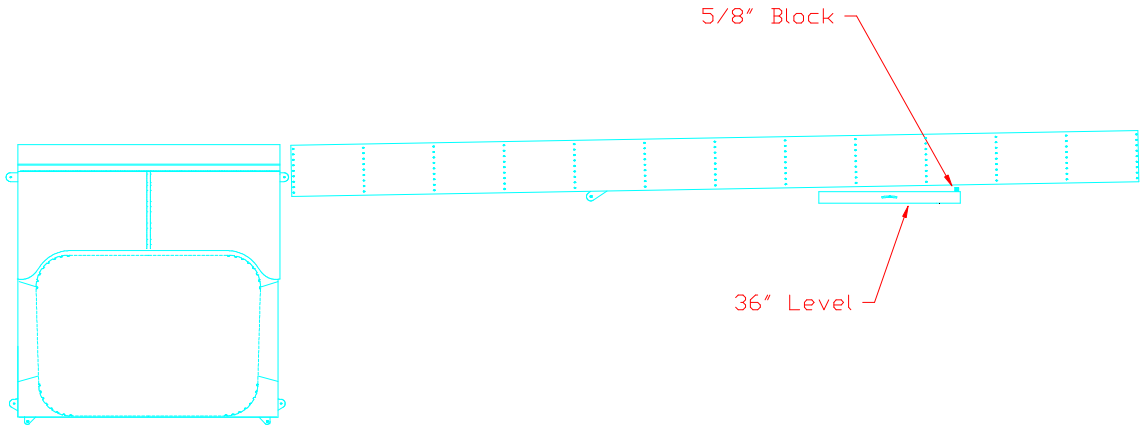



Figure 18.1.2

When attaching wing to fuselage it is important to have a fairly snug fit on all bolt holes to eliminate enlarging of holes during normal flight loads. Although not absolutely necessary, it is highly recommended to drill undersize and then ream to final size.

To attach the wing to the fuselage, the front attach point of the two will need to be drilled with a 3/8" drill. An AN6-16A bolt, one AN960-616 washer and one AN365-624 fibernut will be used.

To attach the rear wing and fuselage attach points, they will need to be drilled with a 1/4" drill. An AN4-3A bolt, AN960-416 washer and AN365-428A fibernut will be used.

The lower strut to fuselage will be drilled with a 3/8" drill. An AN6-20A bolt, two AN960-616 washers and one AN365-624 fibernut will be used.

The upper strut attach point to wing will be drilled with a 3/8" drill. An AN6-15A bolt, two AN960-616 washers and one AN365-624 fibernut will be used.

**NOTE:** On initial setup of the aircraft using castle nuts will save the fiber in the fibernut until really needed. It is also easier to remove bolts when limited man-power is around**.**

**On final installation of the wings you will need to make spacers or washers to fill the gap between the front wing fitting and the fuselage attach point.**

3) Repeat for the right wing. Be sure that the fuselage is level.

4) Drill the holes in the FUS-2 bracket and the Strut Attach Brackets (W-110 and W-111) to 3/8".

5) Take a measurement from the center of the Strut Attach Brackets hole to the center of the hole in FUS-2. Figure 18.1.3.

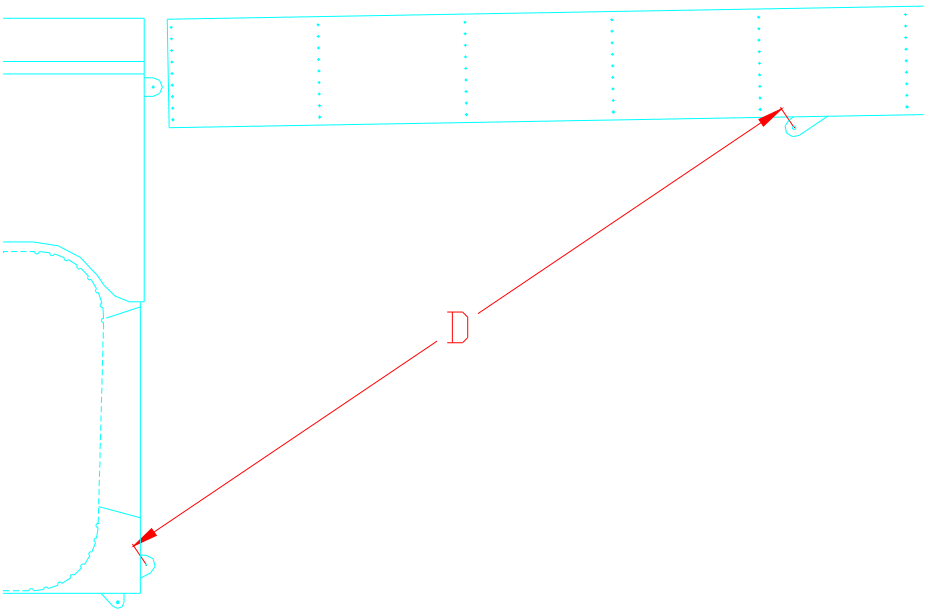



Figure 18.1.3

6) Record this measurement.

## *18.2 Strut Attach*

1) Cut strut material (W-147) into two lengths 65.5" long. Some kits will have W-147 cut already.

2) Cut one end of (W-147) at 14º. Figure 18.2.1.

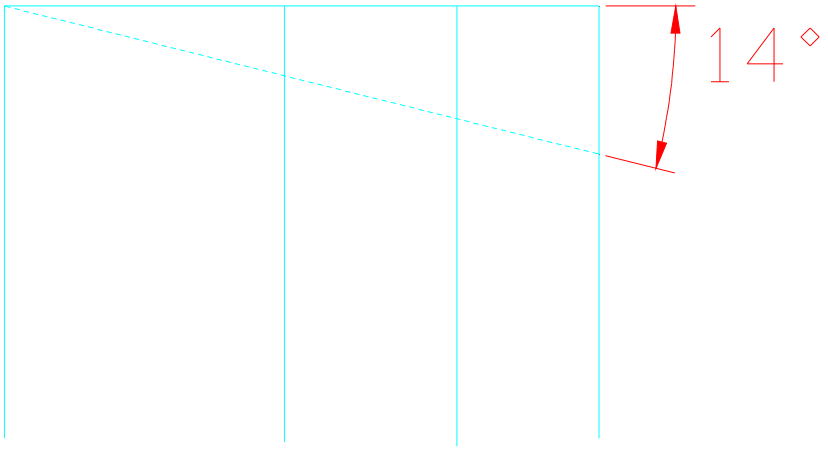



Figure 18.2.1

3) Subtract 1 3/4" from the measurement that was recorded earlier. Cut the strut at 14º at this length. Figure 18.2.2.

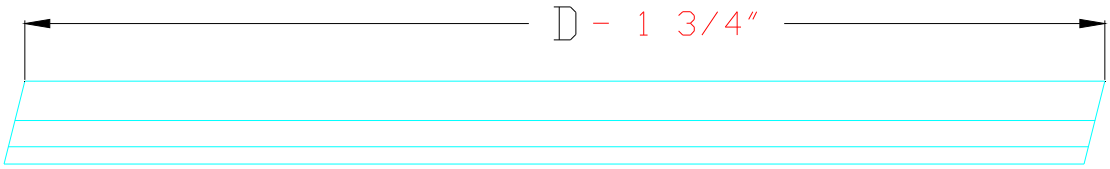



Figure 18.2.2

4) The cut at each end of the strut should be parallel to each other.

5) Sand and debur both ends.

6) Drill the W-148 and W-149 strut blocks to 3/8".

7) Slide W-148 and W-149 strut blocks into the strut. Figure 18.2.3.

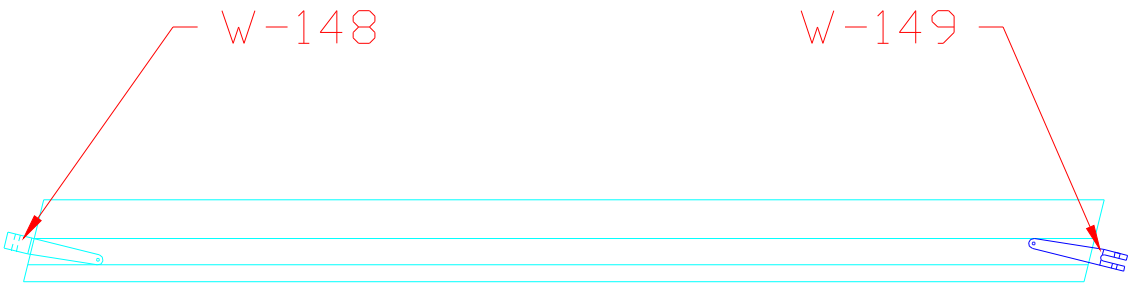



Figure 18.2.3

8) Attach strut to wing and fuselage. Center strut between the two strut blocks (W-148 and W-149). Also center blocks in the flat area of the strut. Figure 18.2.3.

9) Mark a line on W-148 and W-149 along the end of the strut. Remove the strut assembly from the wing and fuselage.

10) Remove one block and locate the end hole on the strut. Trace the block on the strut. Then measure to find hole. Figure 18.2.4.

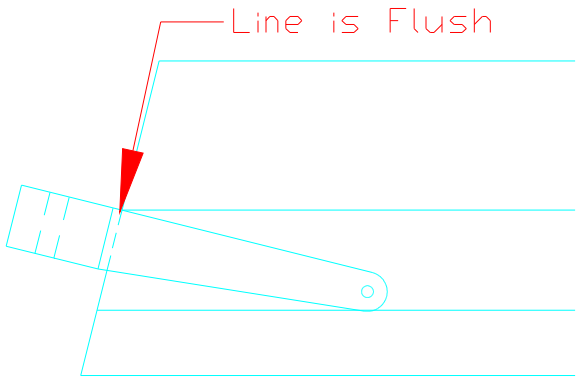



Figure 18.2.4

11) Drill hole out with a #11 drill. Pin block inside strut. Mark a line on the strut that shows the center of the block. Figure 18.2.5.

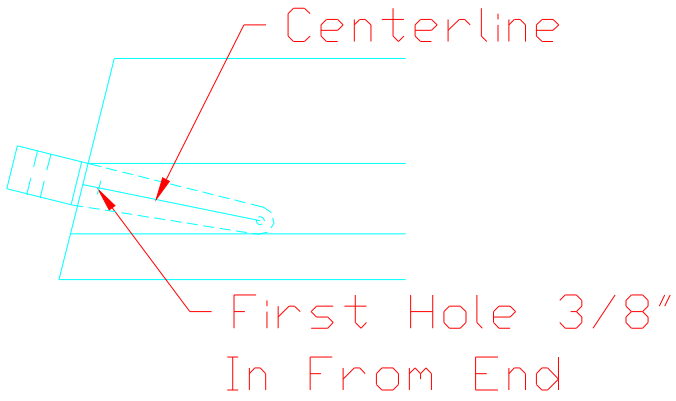



Figure 18.2.5

12) Mark a line 3/8" in from the edge of the strut. Figure 18.2.5.

13) Drill through strut and into block, just enough to be able to pin it.

14) Mark and drill three more holes equally spaced along this line. DO NOT DRILL ALL THE WAY THROUGH, just enough to mark the block.

15) Remove block. Drill block on a drill press to ensure holes are straight through.

16) Replace block and finish drilling the strut. Drill holes out to 1/4" and bolt with AN4-21A bolts.

17) Repeat steps for the other end of the strut. Attach this strut to the plane.

18) Repeat steps for the other strut.

## *19.1 Metal Wing Fairing Option*

1) Use the two templates provided and cut out two Inboard and two Outboard Wing Strut Fairings. Deburr any rough edges. Mark on each of the Fairings either Inboard or Outboard.

2) Mark the center bend lines on each Fairing.

3) Using a piece of tubing, bend one Inboard Fairing inwards and one Inboard Fairing outwards. This will make one right side and one left side Fairing. Repeat for the two Outboard Fairings. Figure 19.1.1.

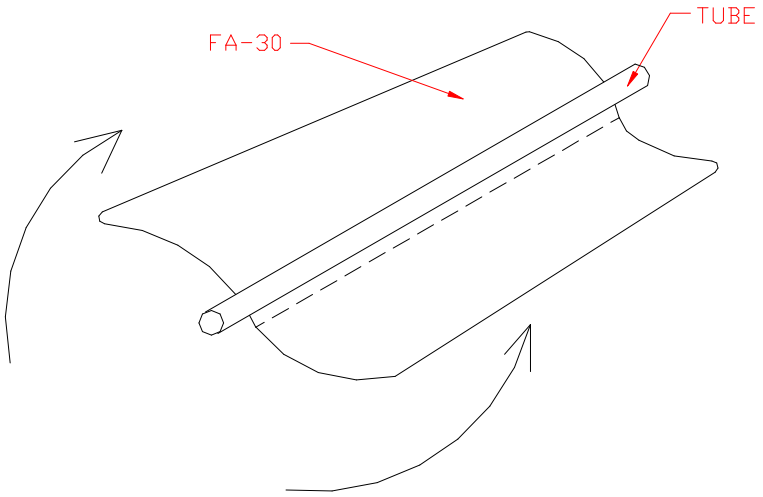



Figure 19.1.1

4) Take one Outboard Fairing and wrap it tightly around the Wing Strut. Find where it meets the trailing edge of the Strut and break the two ends (approx. 1/2") for the rivet holes. See Figure 19.1.2.

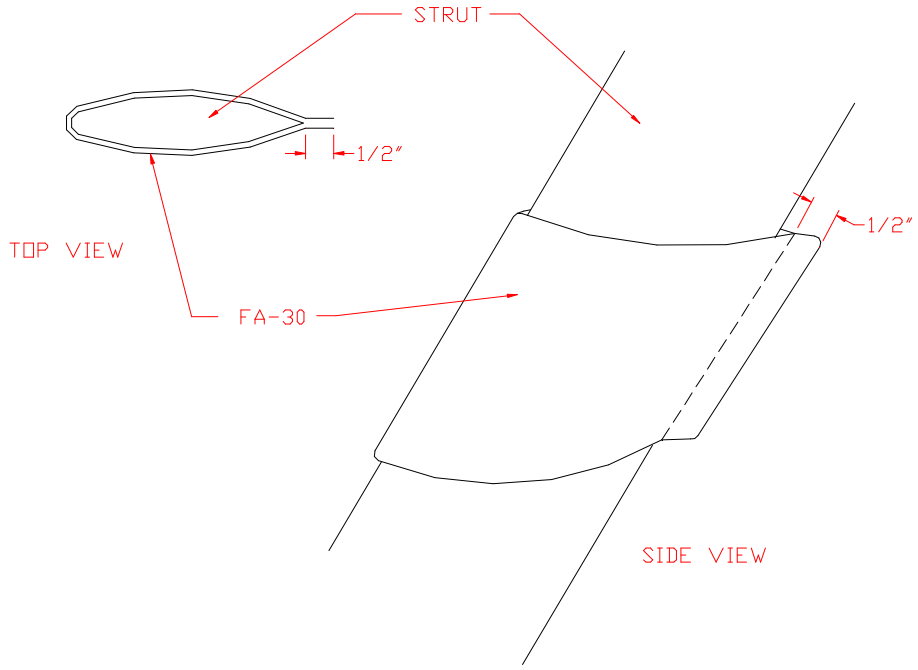



Figure 19.1.2

5) Clamp the Fairing to the Strut using two clamps. Shift the Fairing slightly to get a good fit with the Wing. You may have to trim the fairing to get a good fit.

6) When a good fit to the Wing and a snug fit around the Strut is attained, mark two holes with a 1/4" edge distance at the top and bottom in the flange of the Fairing. Drill #30 holes. If the bottom of the Fairing is slightly crooked remove it now and trim. Replace Fairing and cleco. Figure 19.1.3.

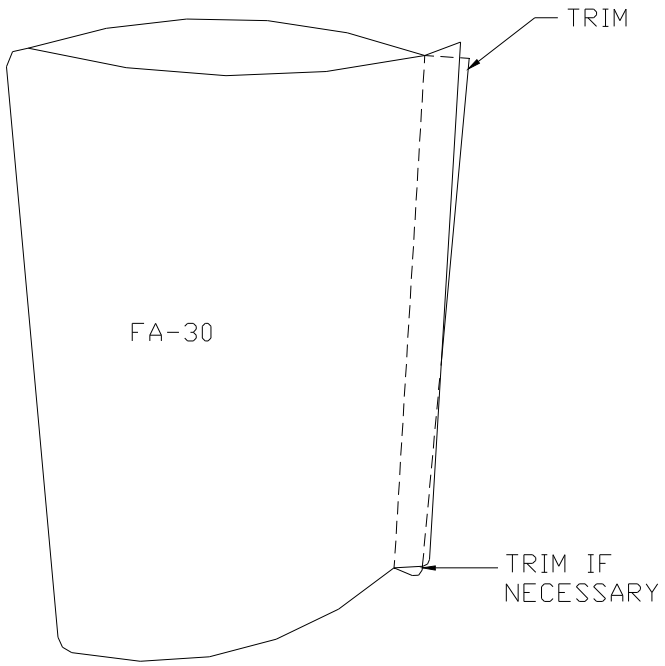



Figure 19.1.3

7) Mark two more holes equal distance between the existing holes and drill #40. Deburr and rivet (RV-1410) together.

8) Slide the Fairing snug up against the Wing making sure it is tight against the Leading Edge side of the Strut. Drill two #32 tap drill holes on opposite sides of the lower end of the Fairing and put in two sheet metal screws. Figure 19.1.4.

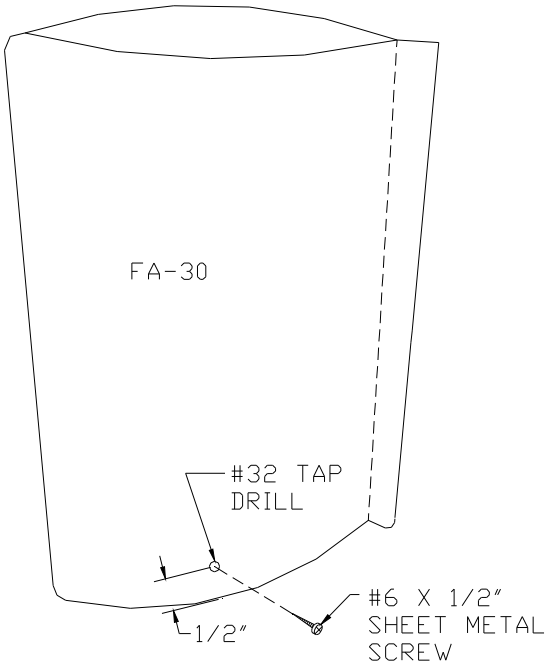
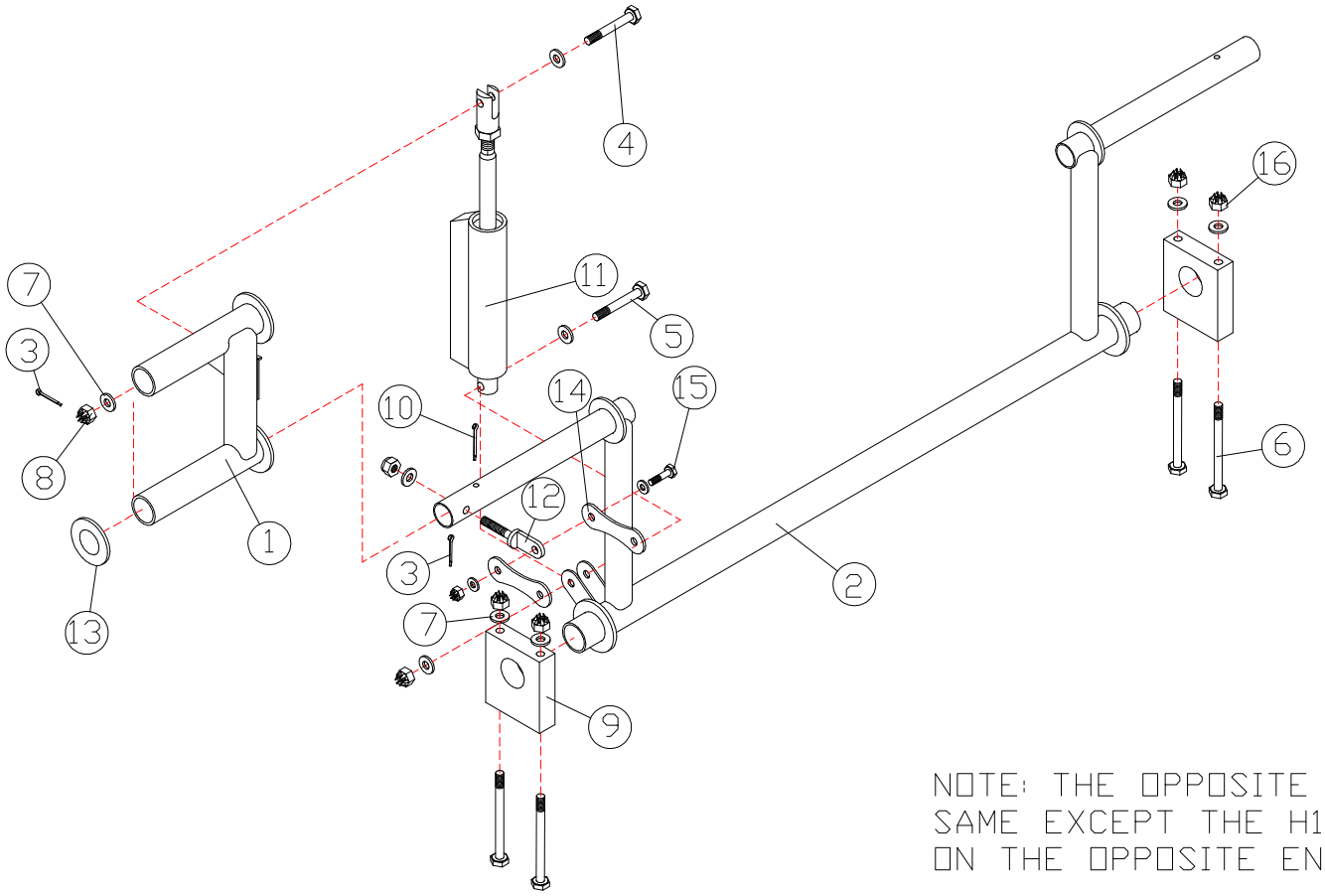



Figure 19.1.4

9) Repeat steps for the other three Fairings.

**NOTE:** For the Inboard Fairings the procedure is the same as the Outboard Fairing except the Fairing is fitted snug to the Fuselage instead of the Wing. Also the sheet metal screws will be placed at the top end of the Fairings.

REBBEL BRAKE/RUDDER PEDAL ASSEMBLY
PILOTS LEFT RUDDER ASSEMBLY SHOWN 2-Jun-98

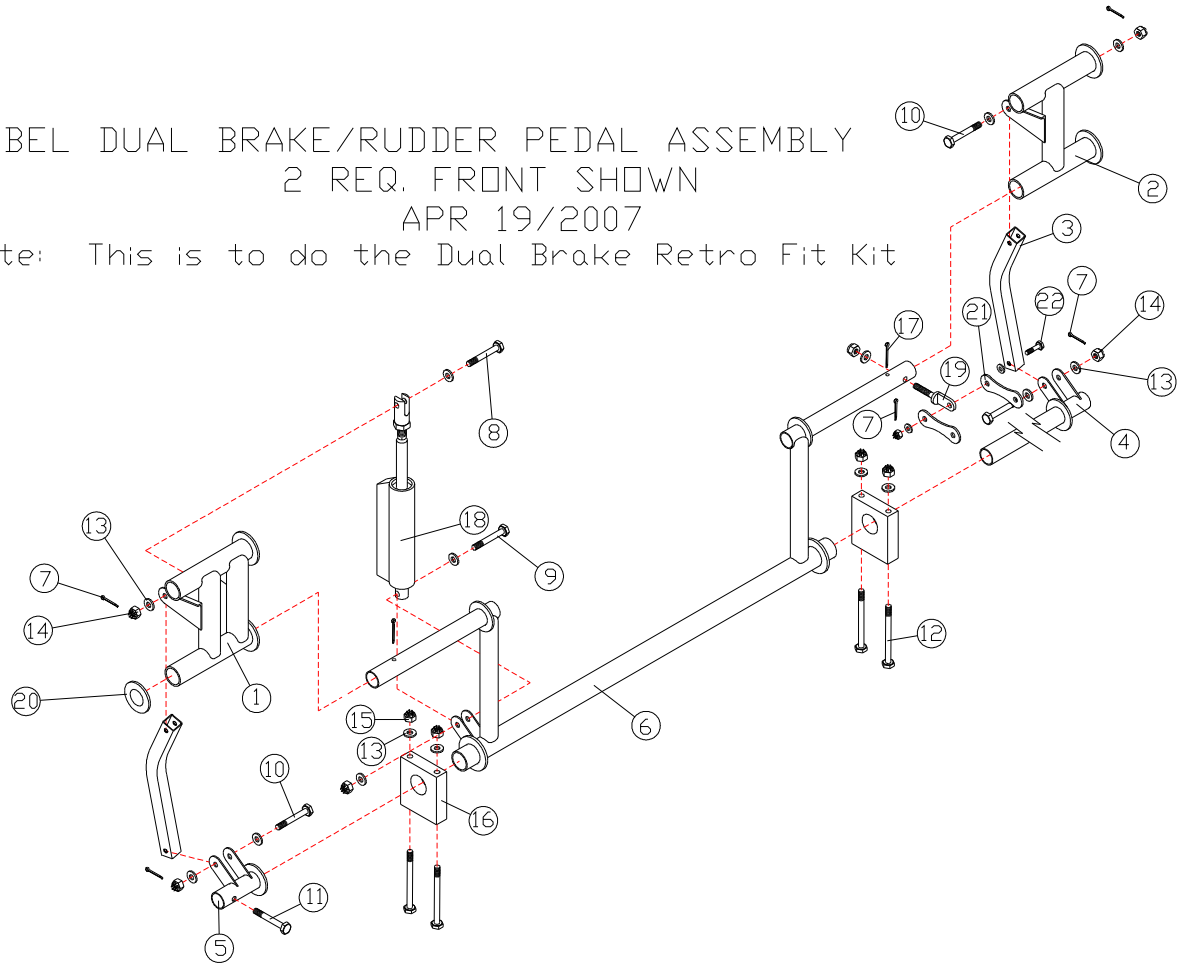



REBEL Brake/Rudder Pedal Parts List

| | NAME | PART NO. | QTY |
|---|---|---|---|
| 1 | BRAKE PEDAL | BP-4 | 2 |
| 2 | RUDDER PEDAL ASY | RP-14 | 2 |
| 3 | COTTER PIN | MS24665-132 | 4 |
| 4 | BOLT | AN3-10 | 2 |
| 5 | BOLT | AN3-11 | 2 |
| 6 | BOLT | AN3-22A | 8 |
| 7 | WASHER | AN960-10 | 24 |
| 8 | CASTLE NUT | AN310-3 | 4 |
| 9 | RUDDER BLOCK | RP-13 | 4 |
| 10 | COTTER PIN | MS24665-357 | 2 |
| 11 | MASTER CYLINDER | MC-4A | 2 |
| 12 | EYE BOLT | AN42B-10A | 2 |
| 13 | WASHER | AN960-1016 | 2 |
| 14 | TANG | T12-HT4 | 4 |
| 15 | BOLT | AN3-4 | 4 |
| 16 | FIBER NUT | AN365-1032 | 10 |

NOTE: THE OPPOSITE SIDE ASSEMBLY IS THE SAME EXCEPT THE H12-HT4 TANG ASSEMBLY IS ON THE OPPOSITE END.

REBEL DUAL BRAKE/RUDDER PEDAL ASSEMBLY
2 REQ. FRONT SHOWN
APR 19/2007
Note: This is to do the Dual Brake Retro Fit Kit

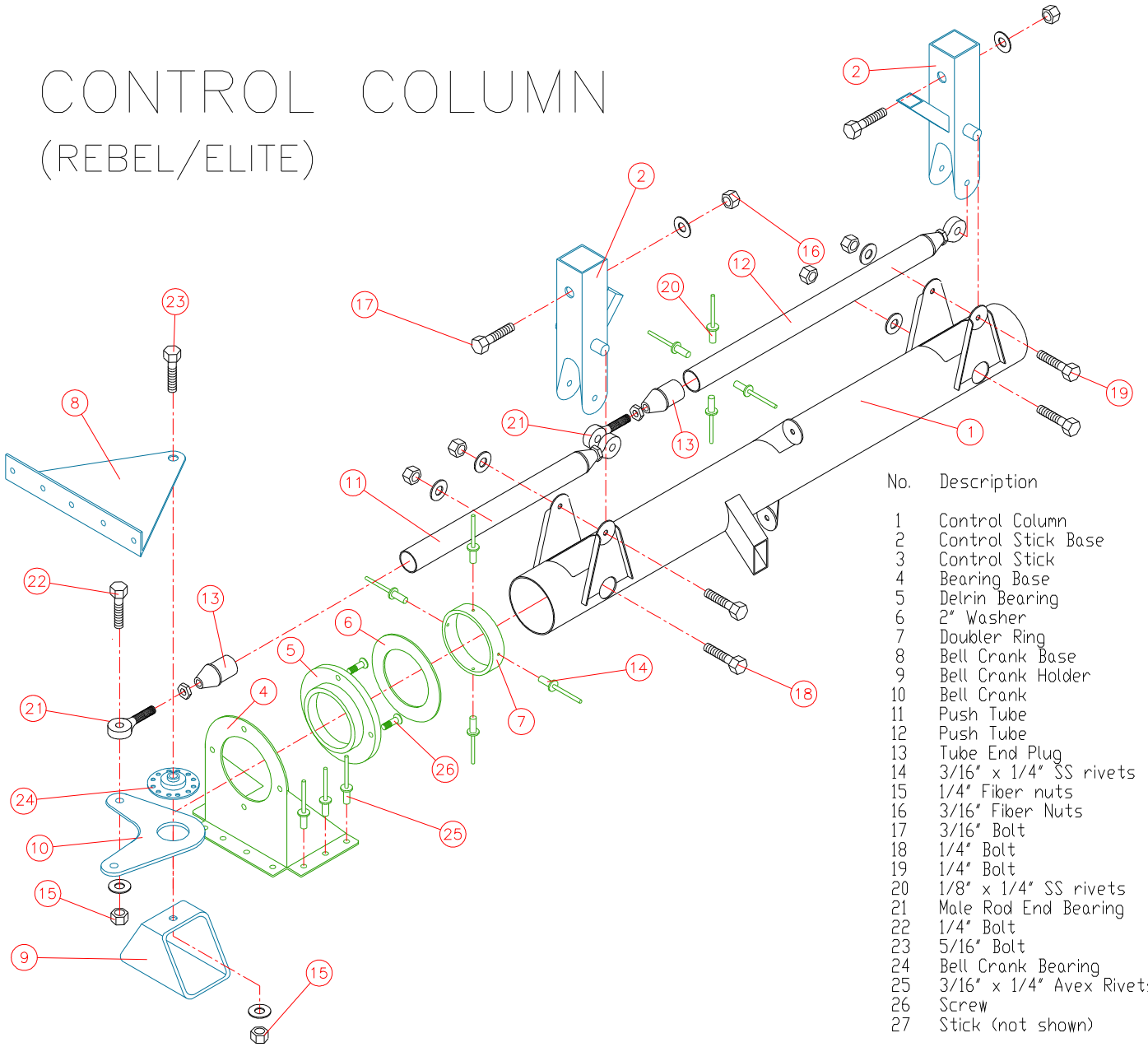



[REBEL Dual Brake Retrofit]

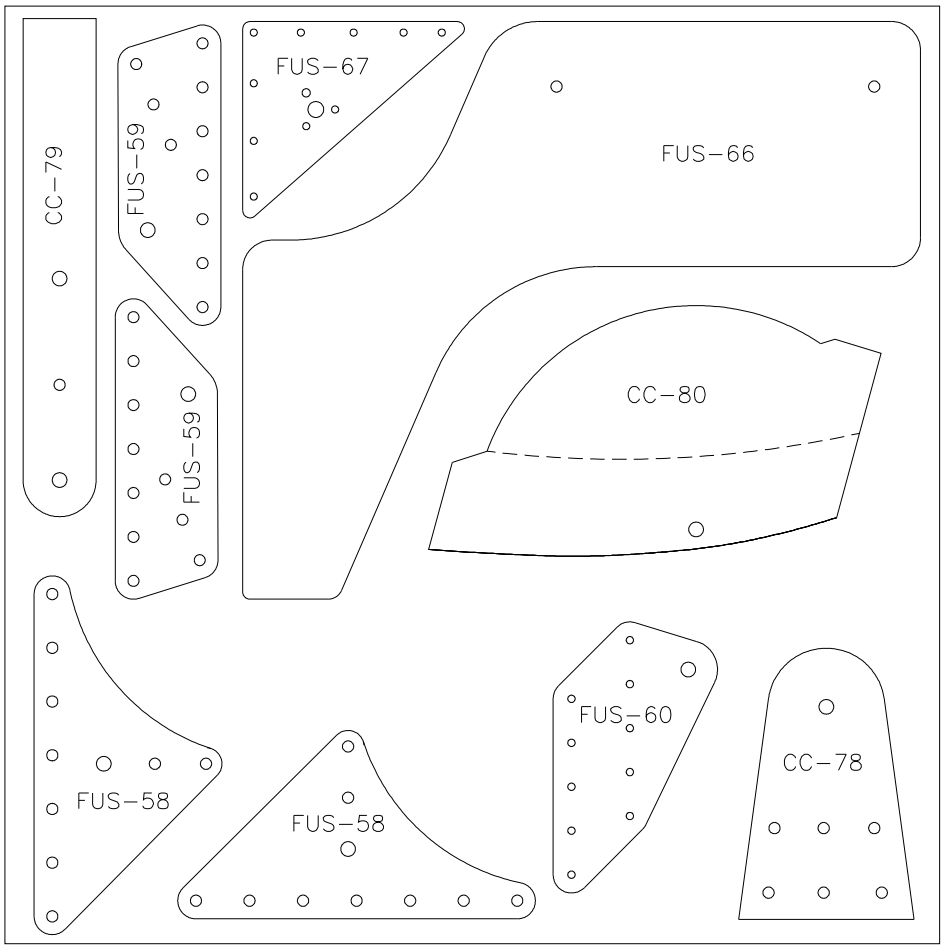
REBEL Dual Brake/Rudder Pedal Parts List 2-Jun-97

| | NAME | NO. | AMOUNT |
|---|---|---|---|
| 1 | MASTER BRAKE PEDAL | RP-15 | 2 |
| 2 | SLAVE BRAKE PEDAL | RP-16 | 2 |
| 3 | PUSHROD | RP-17 | 4 |
| 4 | SLAVE BRAKE TORQUE TUBE | RP-18 | 2 |
| 5 | MASTER TORQUE FITTING | RP-19 | 2 |
| 6 | RUDDER PEDAL ASSEMBLY | RP-14 | 2 |
| 7 | COTTER PIN | MS24665-132 | 14 |
| 8 | BOLT | AN3-10A | 2 |
| 9 | BOLT | AN3-11A | 2 |
| 10 | BOLT | AN3-12A | 8 |
| 11 | BOLT | AN3-11A | 2 |
| 12 | BOLT | AN3-22A | 8 |
| 13 | WASHER | AN960-10 | 48 |
| 14 | CASTLE NUT | AN310-3 | 14 |
| 15 | FIBER NUT | AN365-1032 | 12 |
| 16 | RUDDER BLOCK | RP-13 | 4 |
| 17 | COTTER PIN | MS24665-357 | 4 |
| 18 | MASTER CYLINDER | | 2 |
| 19 | EYE BOLT | AN42B-10A | 2 |
| 20 | WASHER | AN960-1016 | 2 |
| 21 | TANG | T12-HT4 | 4 |
| 22 | BOLT | AN3-4 | 2 |

# CONTROL COLUMN
## (REBEL/ELITE)




| No. | Description | Part # | Req. |
|---|---|---|---|
| 1 | Control Column | CC-35-1 | 1 |
| 2 | Control Stick Base | CC-36 | 2 |
| 3 | Control Stick | CC-5 | 2 |
| 4 | Bearing Base | CC-38 | 2 |
| 5 | Delrin Bearing | CC-37 | 2 |
| 6 | 2" Washer | A-M2W | 2 |
| 7 | Doubler Ring | CC-54 | 2 |
| 8 | Bell Crank Base | CC-41 | 1 |
| 9 | Bell Crank Holder | CC-42 | 1 |
| 10 | Bell Crank | CC-47-2 | 1 |
| 11 | Push Tube | CC-50 | 0.4 |
| 12 | Push Tube | CC-50 | 0.6 |
| 13 | Tube End Plug | CC-29 | 4 |
| 14 | 3/16" x 1/4" SS rivets | RR-5604 | 8 |
| 15 | 1/4" Fiber nuts | AN365-428 | 6 |
| 16 | 3/16" Fiber Nuts | AN365-1032 | 2 |
| 17 | 3/16" Bolt | AN3-14A | 2 |
| 18 | 1/4" Bolt | AN4-13A | 2 |
| 19 | 1/4" Bolt | AN4-25A | 2 |
| 20 | 1/8" x 1/4" SS rivets | RR-5404 | 16 |
| 21 | Male Rod End Bearing | HM4M | 4 |
| 22 | 1/4" Bolt | AN4-7 | 1 |
| 23 | 5/16" Bolt | AN5-16 | 1 |
| 24 | Bell Crank Bearing | MI-25 | 1 |
| 25 | 3/16" x 1/4" Avex Rivets | RV-1619 | 28 |
| 26 | Screw | AN509-1032R | 8 |
| 27 | Stick (not shown) | (ELITE) CC-5-1 | 2 |
| | | (REBEL) CC-5 | 2 |




FUS-57
2024-T3 16"x16"x.125

[DGM0528]

## *20.1 Brake Pedal Install*

1) Slide the left brake pedal (BP-4) on the pedal assembly (RP-14). The lugs on the pedal and brake should face to the front of the airplane. Figure 20.1.1.

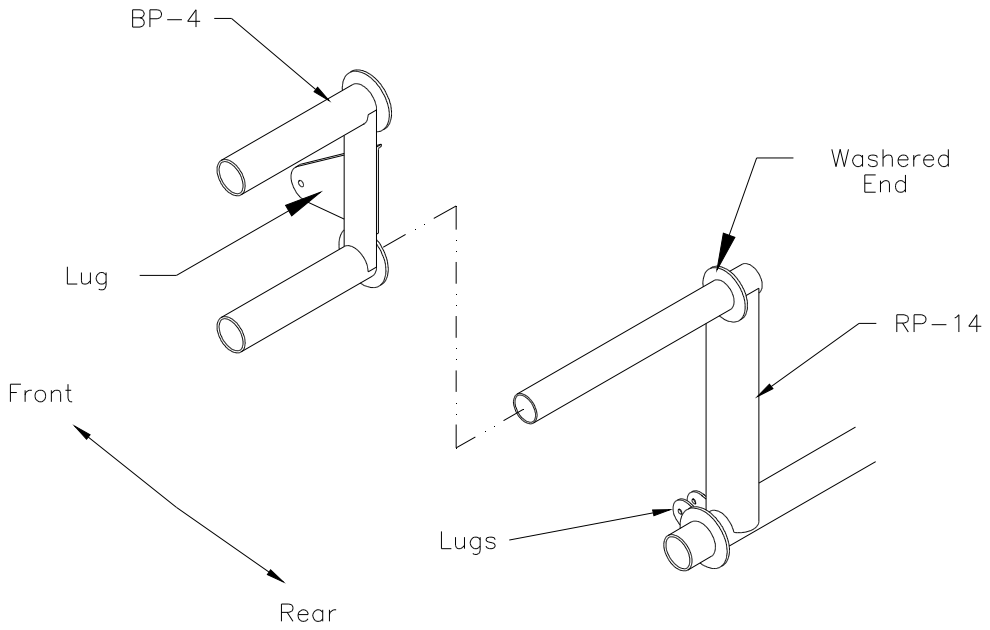



Figure 20.1.1

2) Assemble the brake slave cylinder with the threaded fork on the end. Bolt the fork to the brake pedal lug with an AN3-7 bolt and castle nut (AN310-3). Drill a 3/16" hole through the bottom lugs and brake slave cylinder. Figure 20.1.2

**NOTE:** Left oil fittings should exit toward the passenger side. The right oil fitting should exit forward. It may be necessary to cut off a couple of threads from the brake cylinder shaft to allow clearance upon assembly.

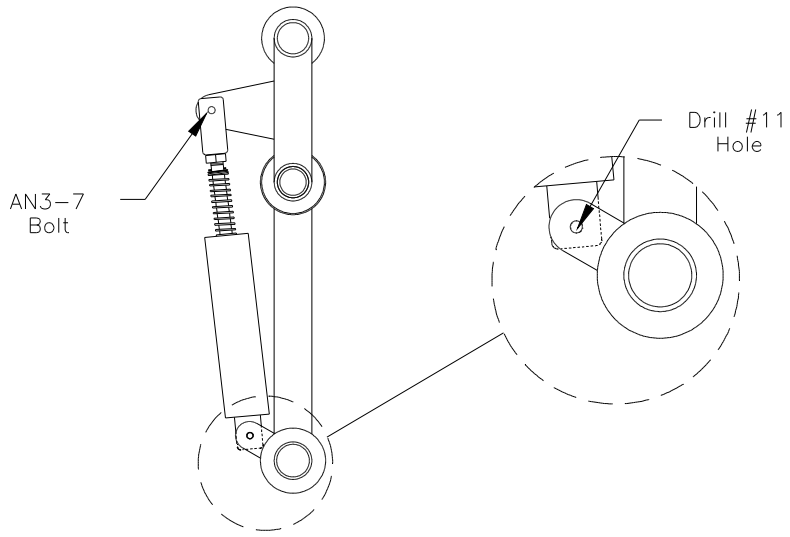



Figure 20.1.2

3) Slide a washer (M18-L ) onto the Rudder Pedal against the Brake Pedal. Drill a #30 hole through the rudder pedal and install a cotter pin (MS24665-357). Figure 20.1.3.

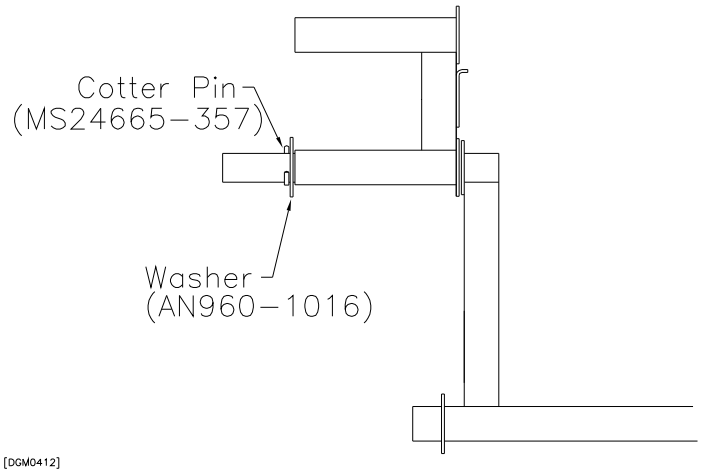



Figure 20.1.3

4) Repeat steps for the other pedal assembly.

5) Drill #11 holes 3/8" in from the end ends of the rudder pedals. Insert eyebolts (AN42B-10A) and attach with fiber nuts (AN365-1032). Ensure that the eyebolts are approximately 90º to the rudder pedals. Figure 20.1.4.

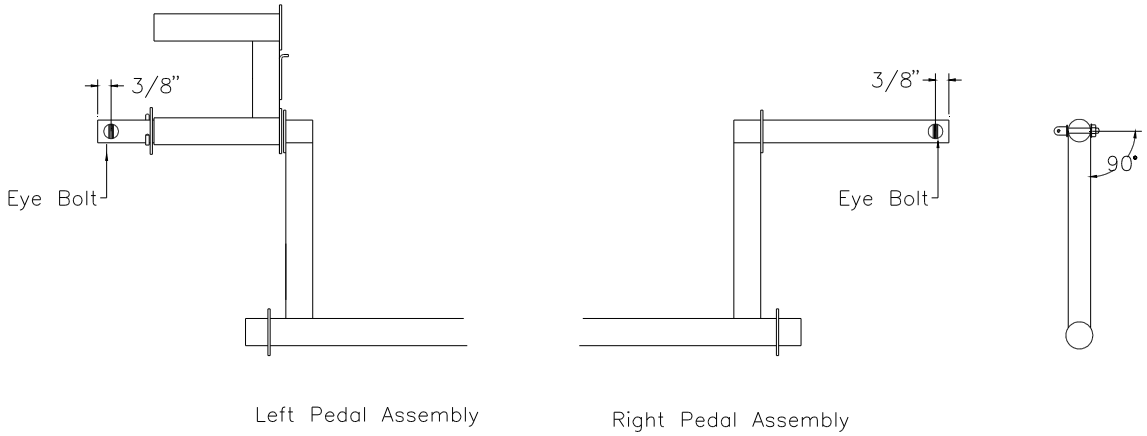



Figure 20.1.4

## *20.2 Rudder Pedal Install*

1) On the cabin front floor, measure the distance from the firewall to the bottom carrythrough.

2) Cut a Floor Stiffener from 5/8" x 5/8" square tubing (FUS-14) to the measurement you just found.

3) Position the 5/8" tube on the floor center and back drill #30 holes through the floor into the tube at 1" spacing. Figure 20.2.1.

4) Remove, debur and chromate mating surfaces. Rivet to the floor with 1/8" (RV-1410) rivets.

5) Slide two bearing blocks (RP-13) onto each rudder pedal assembly. Position both pedal assemblies on the floor as in figure 20.2.1. Position pedals so that they are behind the engine mount brackets. Ensure that the rudder pedals clear the engine mounts.

6) Drill back through bearing blocks and into the floor with a #11 drill.

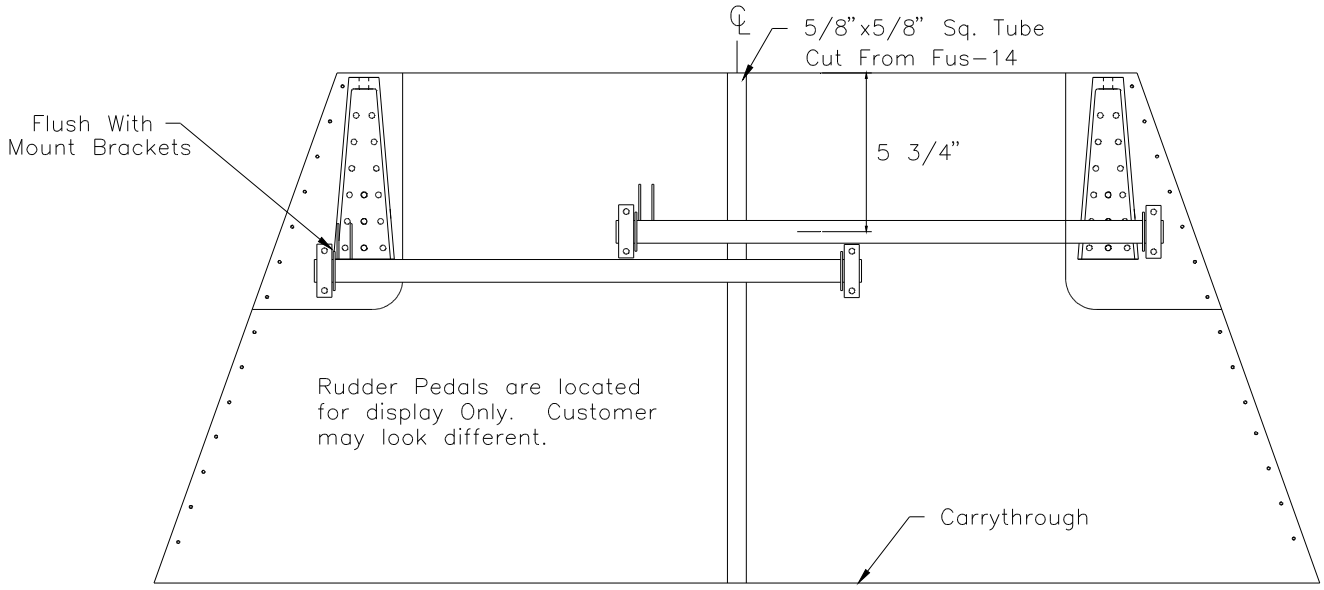



Figure 20.2.1

) Make two doublers from .032 raw stock (W-143). Figure 20.2.2.

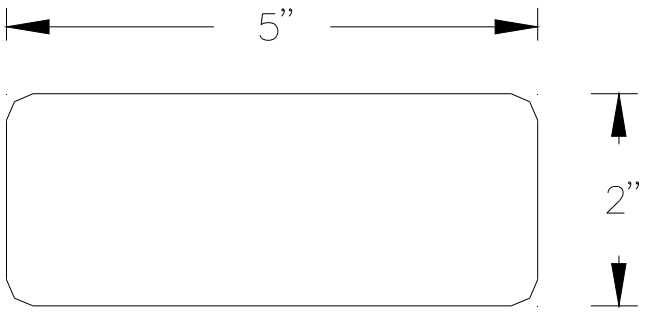



Figure 20.2.2

8) Center doubler over the bearing block at the center of the floor. Drill #30 holes around the outer edge of the doubler and cleco. Figure 20.2.3.

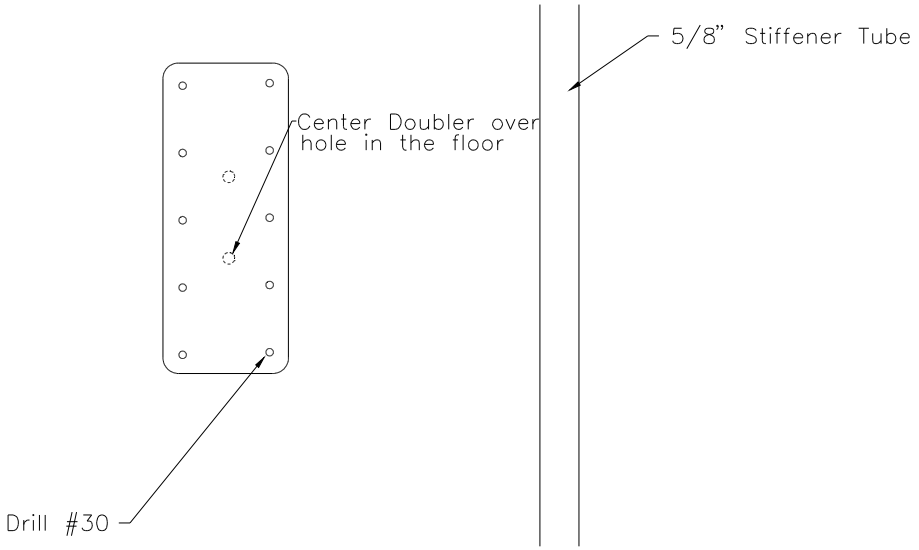



Figure 20.2.3

9) Back drill doublers for the bearing blocks. Figure 20.2.4.

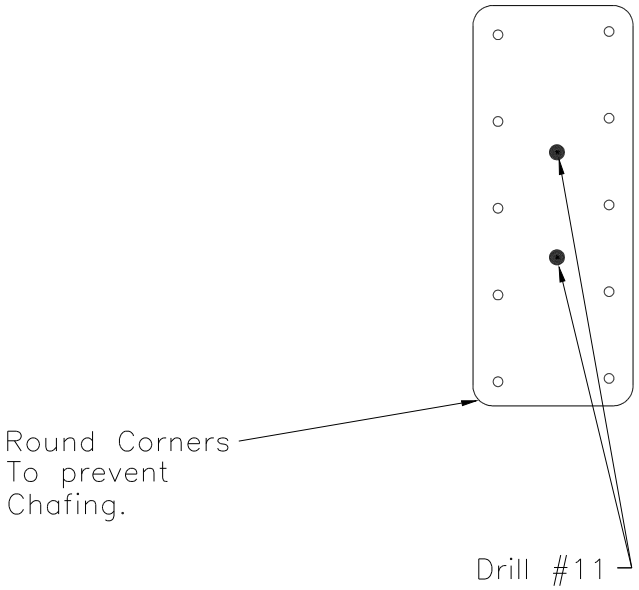



Figure 20.2.4

10) Remove doublers. Debur floor and doublers.

11) Chromate and rivet doublers to the floor using 1/8" (RV-1410) rivets.

12) Attach rudder pedal assemblies and bearing blocks to the floor with AN3-22A bolts, AN365-1032 fiber nuts and AN960-10 washers.

13) Drill a #40 hole part way through each outside tube of the rudder pedals. Drill a #40 hole into the side of the Bottom Engine Mount Bracket (FUS-85-1). Attach Rudder Pedal Return Springs (311-606). Figure 20.2.5.

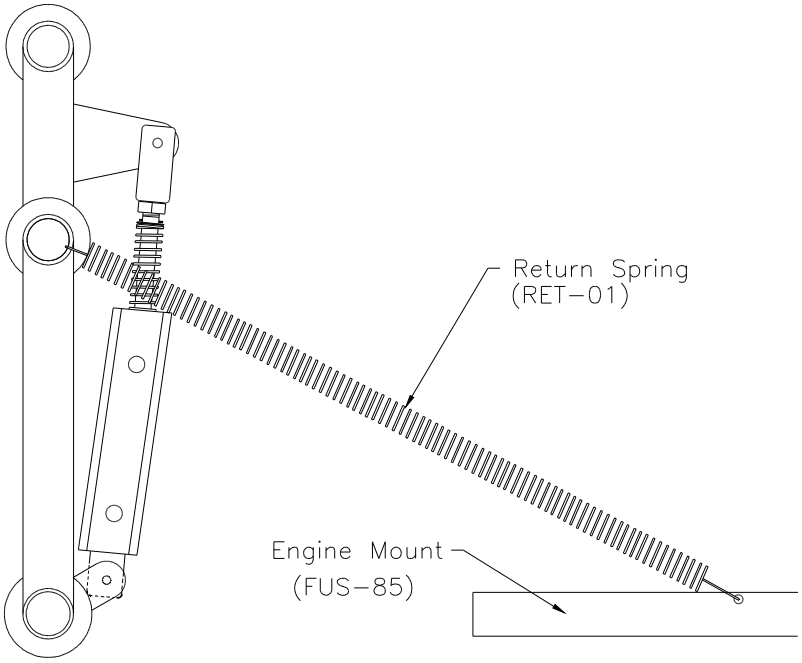



Figure 20.2.5

## *20.3 Control Column Install*

1) Bolt Delrin Bearing (CC-37) inside the bearing plates (CC-38) similar to what was done in the wing assembly.

2) Install the control sticks (CC-5) in the control stick bases (CC-36). Make one left and one right stick. Figure 20.3.1.

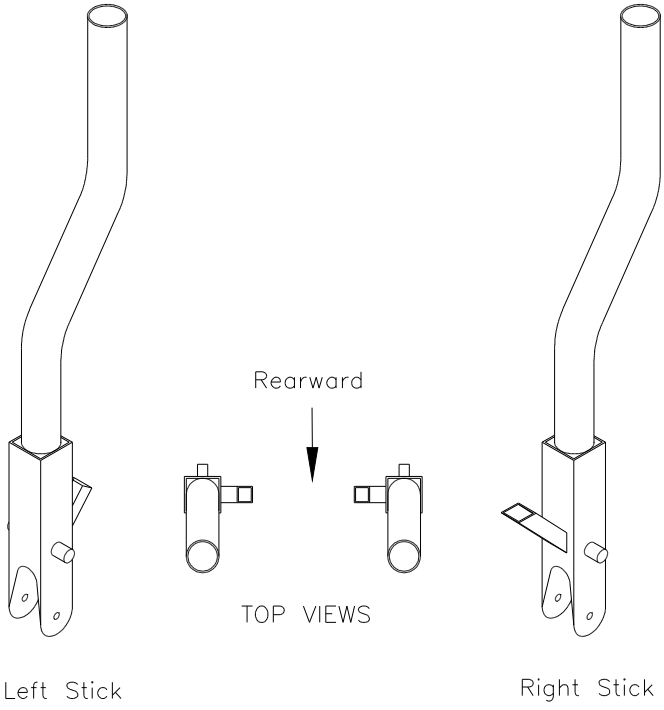



Figure 20.3.1

3) Drill a #11 hole through the control stick base and control stick. Bolt together with AN3-13A bolts, AN960-10 washers, AN365-1032 fiber nuts. Figure 20.3.2.

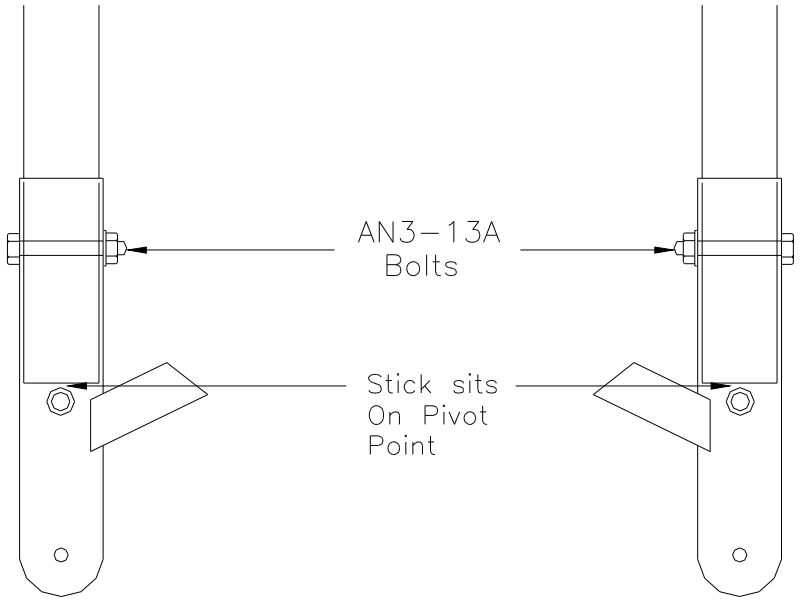



Figure 20.3.2

4) Drill or grind out two 3/4" holes through the control column (CC-35). Figure 20.3.3.

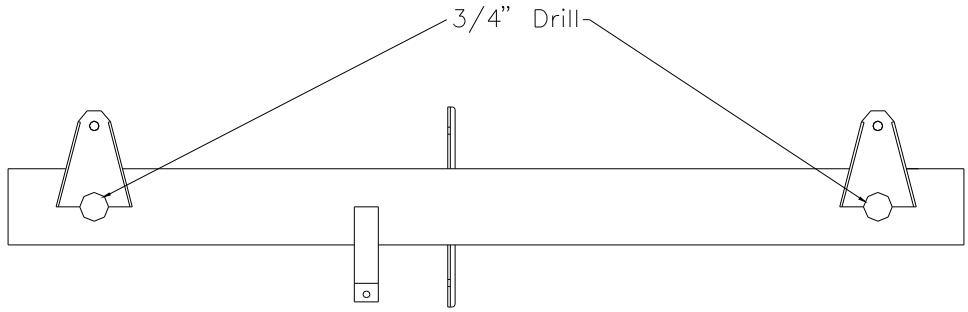



Figure 20.3.3

5) Attach the Control Sticks to the Torque Tube (CC-35) with AN4-25 bolts, AN960-416 washers, AN310-4 castle nuts and MS24665-132 cotter pins. Figure 20.3.4.

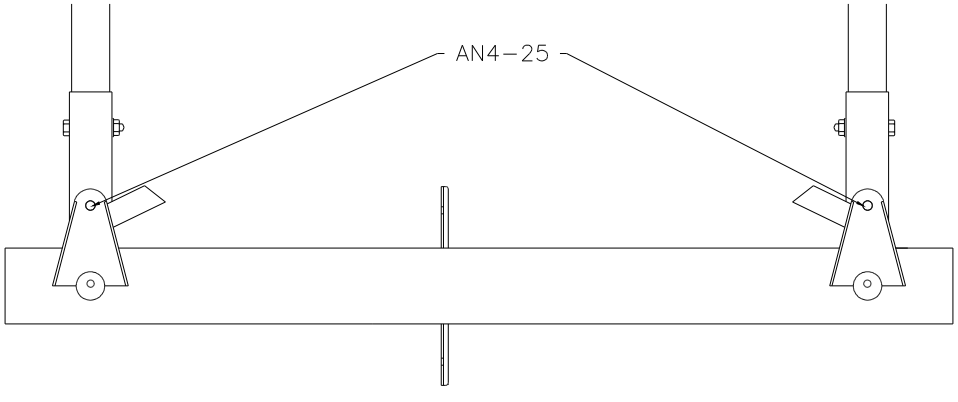



Figure 20.3.4

6) Make the Control Stick Connector Tube (CC-39) from 3/4" x .035" tube (CC-51). Figure 20.3.5.

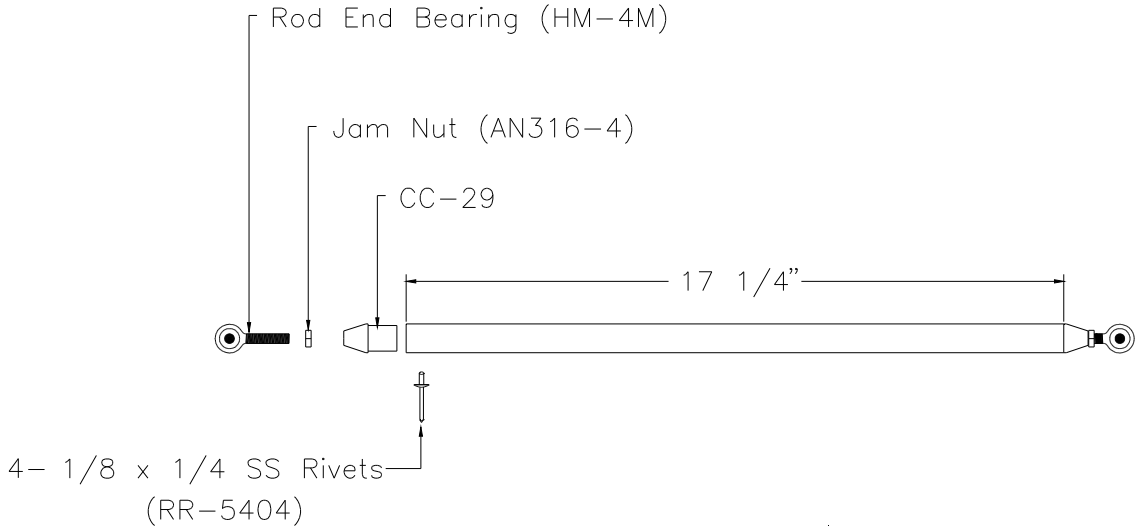



Figure 20.3.5

7) Adjust the connector tube to fit between the Control Sticks. Make sure the sticks are vertical. Figure 20.3.6.




Figure 20.3.6

8) Attach one end of the connector tube to the passenger stick assembly. Use AN960-416 washers to take up the excess space. Figure 20.3.7.

**IMPORTANT:** Use a washer under the head and the nut and tighten until the sides of the Stick Base angle in slightly. Otherwise the end of the bolt can stick out too far and catch on the sides of the control column. Be sure to test for smooth operation without interference. **NOTE:** you will be adding another rod end for CC-40 later. Do not final install.

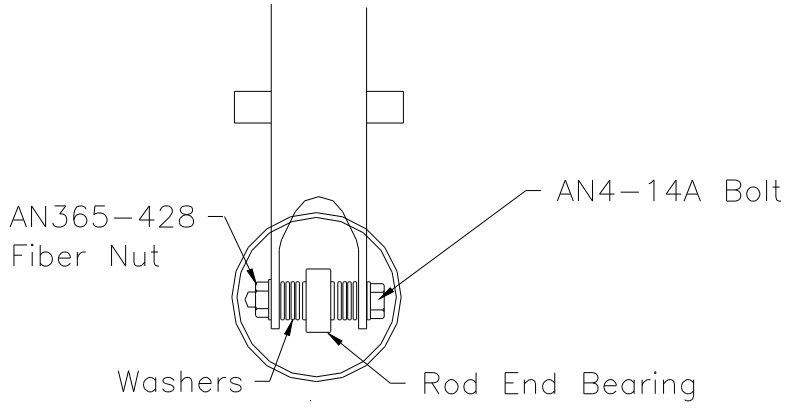



Figure 20.3.7

9) Slide the doubler rings (CC-54) onto the Control Torque Tube (CC-35). Drill four #11 holes through each doubler ring. Figure 20.3.8.

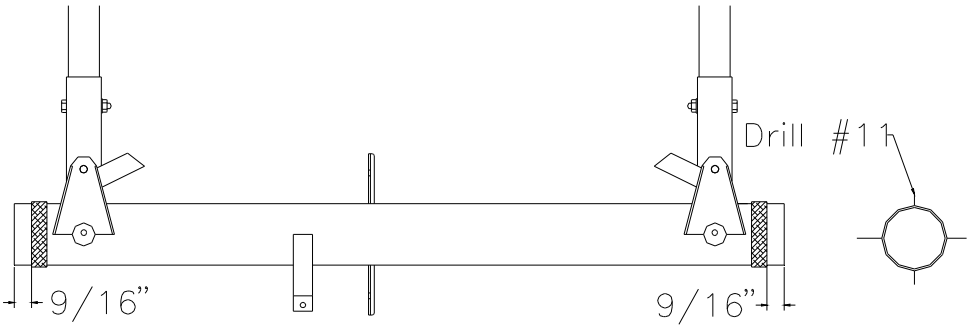



Figure 20.3.8

10) Remove the doubler rings. Debur. Rivet the rings on with 3/16" S.S. rivets (RR-5604).

11) Slide 2" washers (A-M2W) on the torque tube up against the doubler rings.

**NOTE:** .040 re-enforcing plates will need to be made to attach Control Bases to cage on the cut carrythrough versions.

12) Place a bearing base assembly on each end of the control torque tube assembly. Figure 20.3.9.

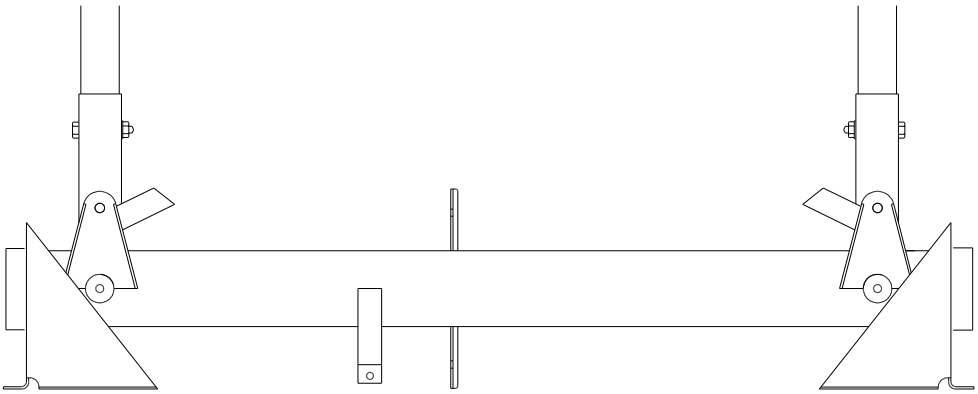


Figure 20.3.9

13) Center assembly on the Carrythroughs (FUS-5). Figure 20.3.10.

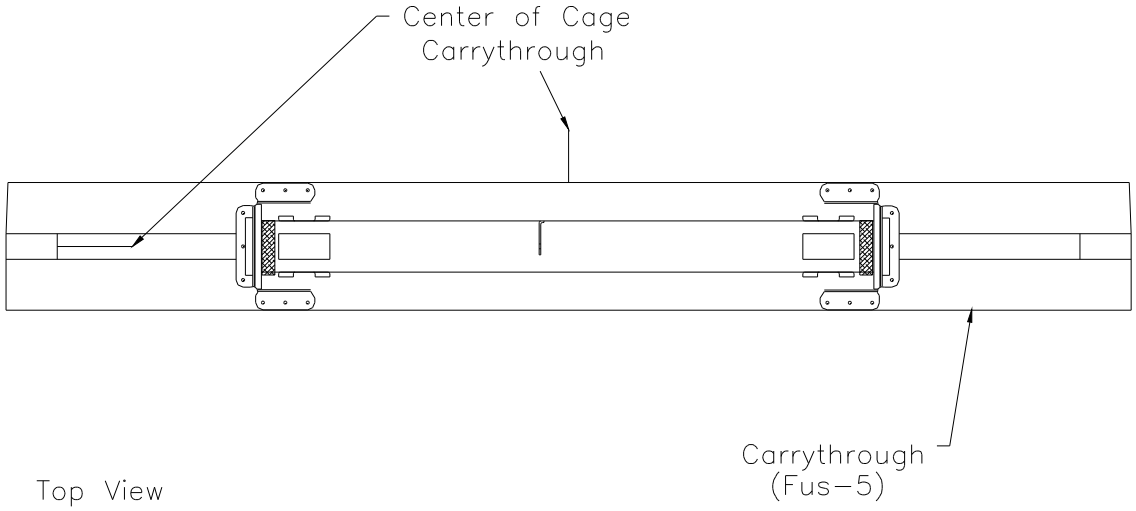



Figure 20.3.10

14) Drill #11 holes and cleco the bearing bases to the floor. Figure 20.3.11.

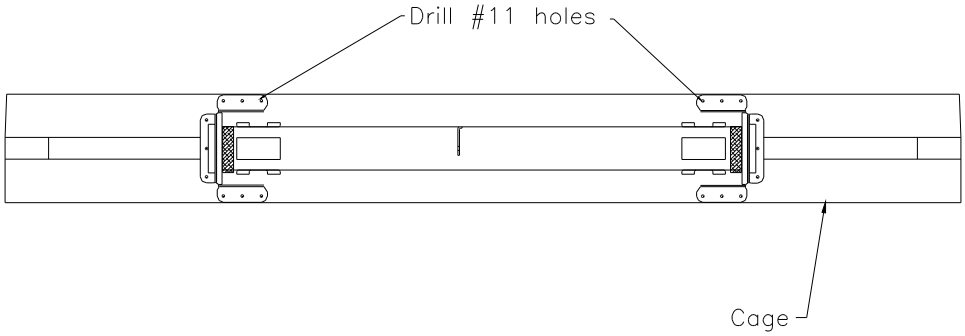



Figure 20.3.11

15) Locate and mark the position of the elevator stop (CC-67). Figure 20.3.12.

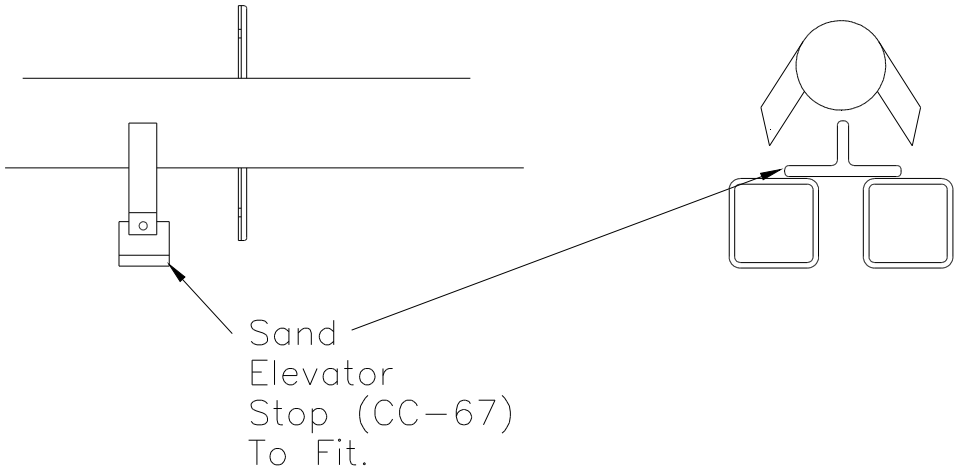



Figure 20.3.12

16) Remove control column assembly.

17) Drill four #11 holes through the elevator stop (CC-67) into the carrythroughs (FUS-5). Figure 20.3.13.

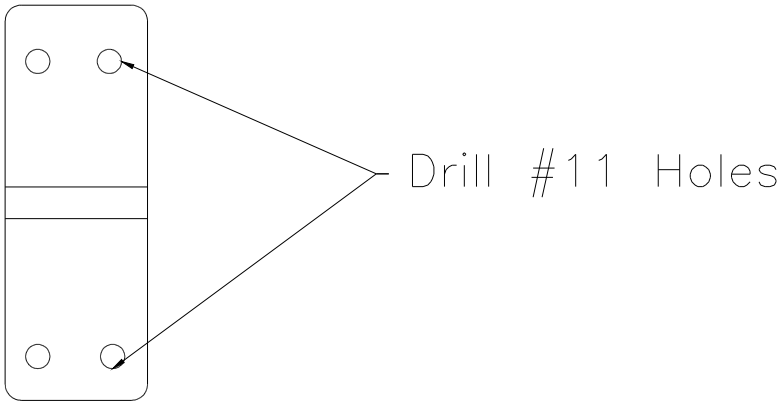



Figure 20.3.13

18) Debur the elevator stop. Chromate mating surfaces and rivet with 3/16" (RV-1621) rivets.

19) Debur and chromate mating surface of the bearing bases. Rivet the control column assembly to cage with 3/16" (RV-1613) rivets. Install AN3-6A bolts with washers under the heads into the stop tubes on the column for both elevator and flapperons. Adjust with washers so bolt head contacts stop or torque tube to achieve desired control deflections.

## *20.4 Bell Crank Install*

1) Position the bell crank holder (CC-42) as per figure 20.4.1.

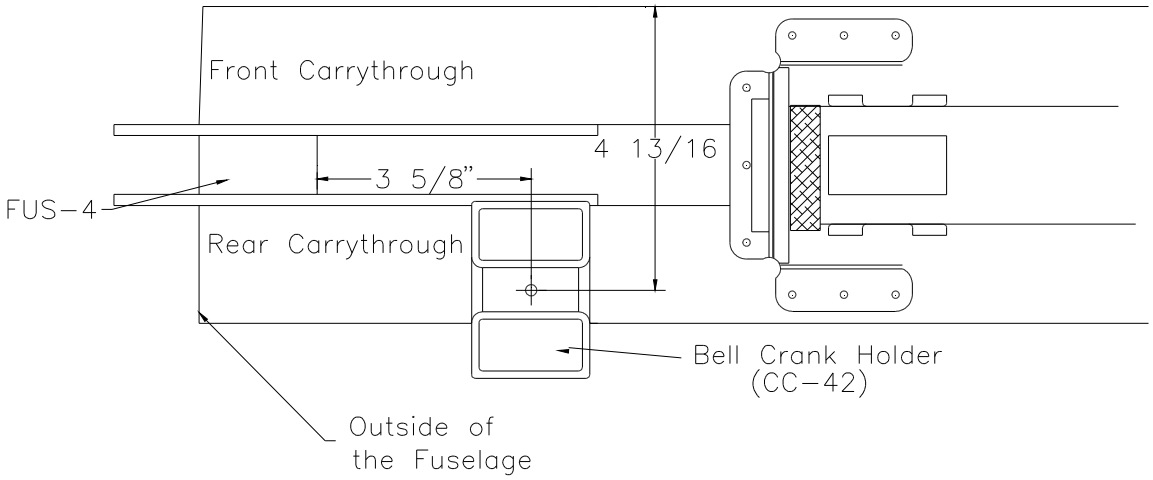



Figure 20.4.1

2) Drill six #30 holes through the bell crank holder into the floor. Figure 20.4.2.

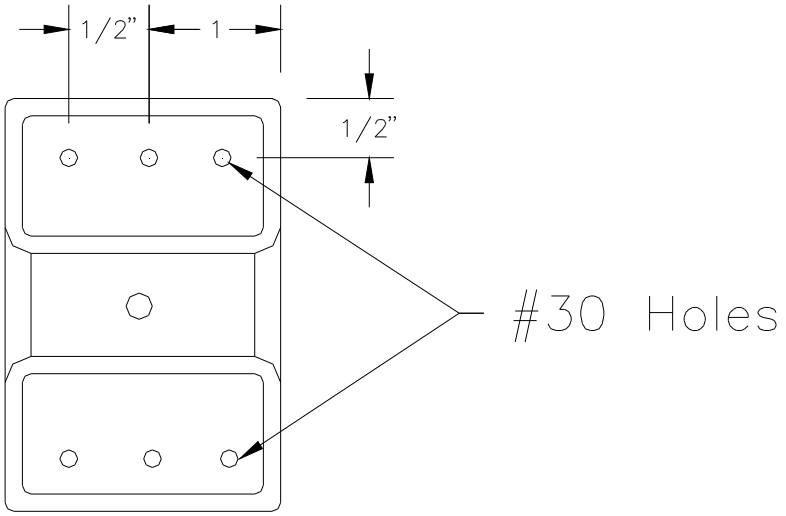



Figure 20.4.2

3) Debur all holes.

4) Rivet the bell crank holder to the floor with 1/8" (RR-5406) S.S. rivets.

5) Use the Bell Crank Bearing (MI-25) as a drill guide to drill twelve #30 holes into the mixer (CC-47-2). Figure 20.4.3.

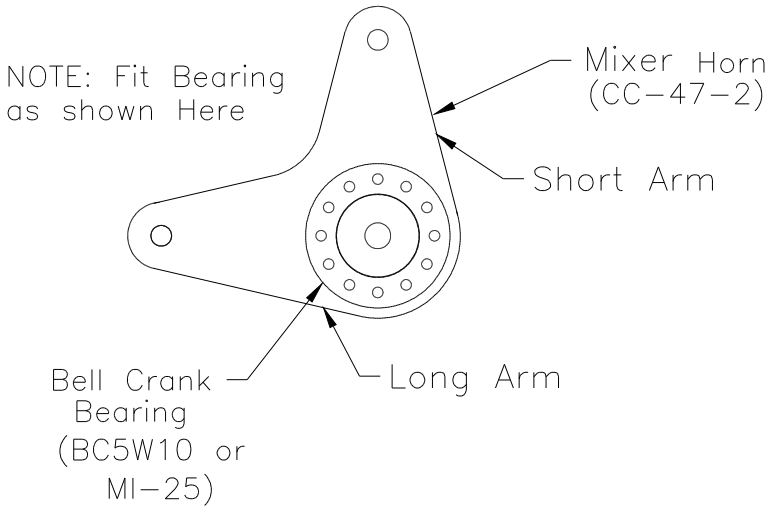



Figure 20.4.3

6) Debur mixer.

7) Attach bell crank bearing to the mixer with 1/8" (RR-5404) S.S. rivets. Insert rivets in a one up, one down pattern. Figure 20.4.4.

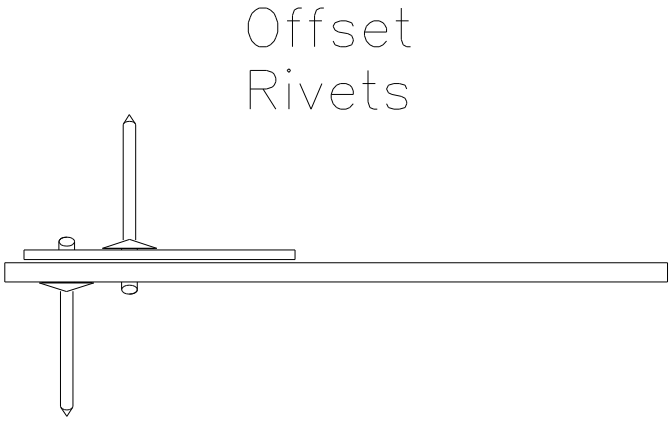



Figure 20.4.4

8) Drill out the hole in a W-62-1 to 5/16". Cut the W-62-1 in half so that you have two equal parts of approximately 3/8" long. Figure 20.4.5.

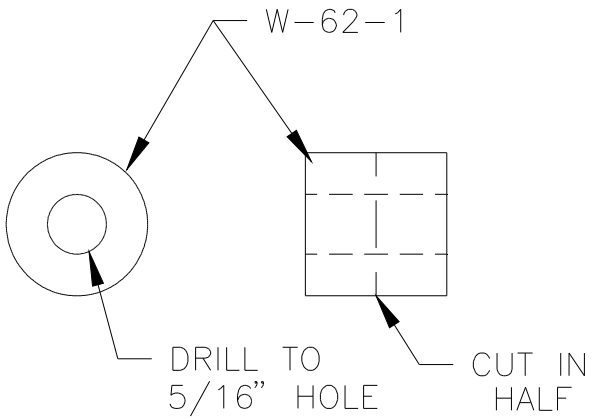



Figure 20.4.5

9) Place the spacers and bellcrank on top of the bell crank holder. Position the Bell Crank Brace (CC-41) centered on the top spacer. Layout and drill 7 #30 holes through the Bell Crank Brace into the fuselage. Figure 20.4.6.

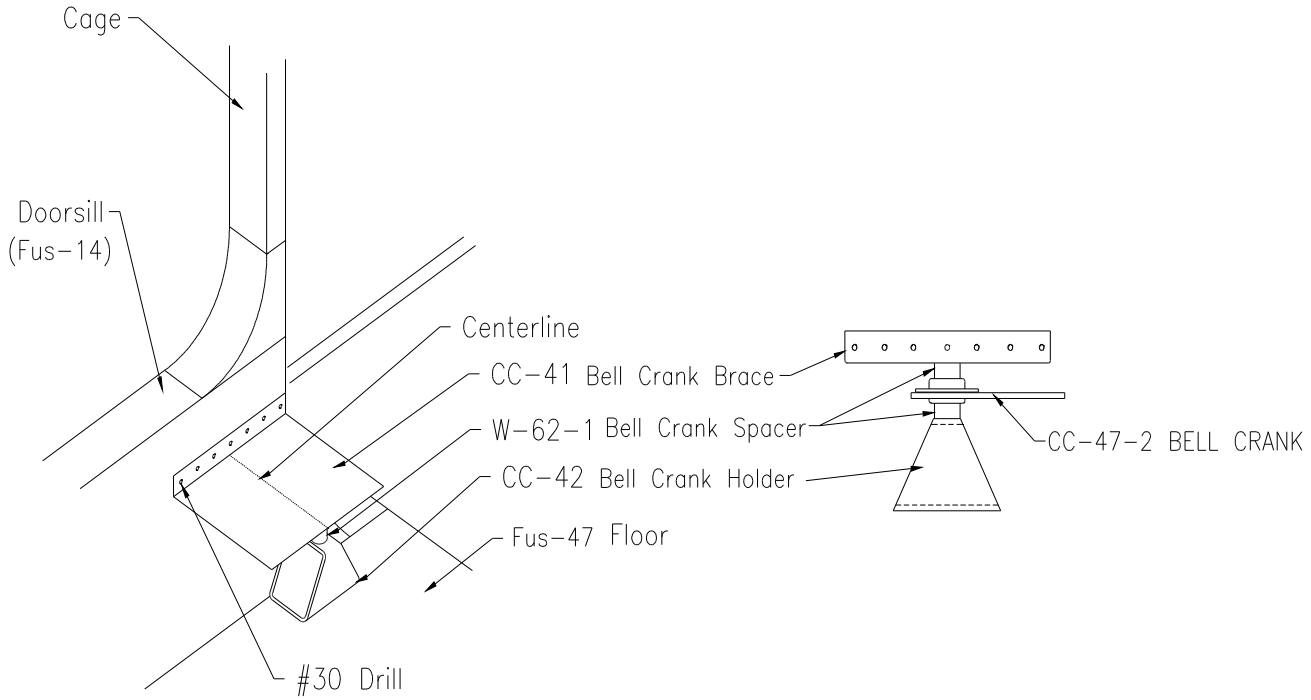



Figure 20.4.6

10) Locate and drill a 5/16" hole along the centerline for the bell crank bolt. Figure 20.4.7.

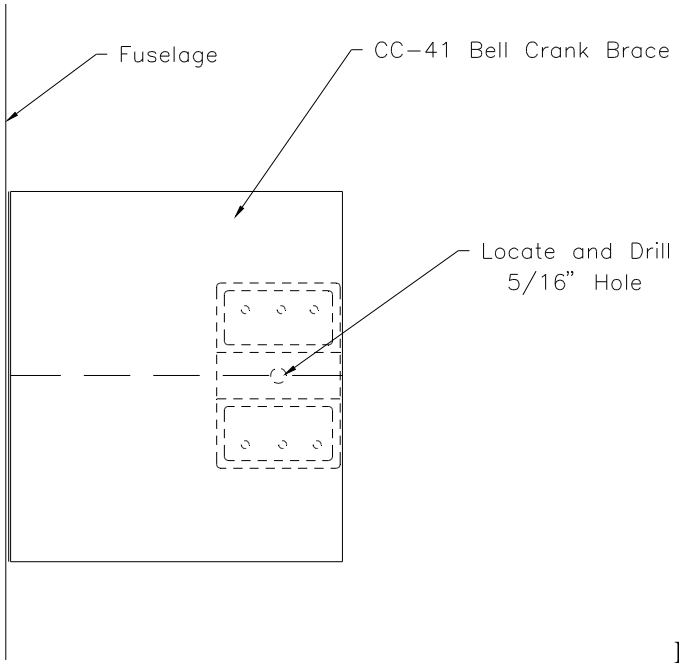



Figure 20.4.7

11) Trim the Bell Crank Brace (CC-41) as in Figure 20.4.7.

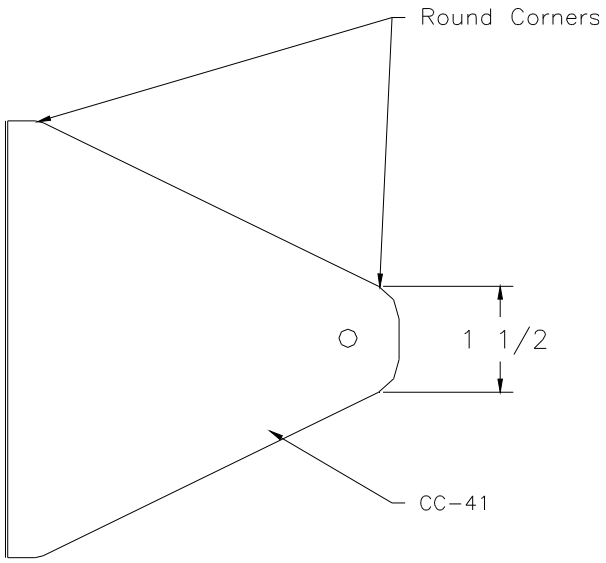



Figure 20.4.8

12) Apply a break along two edges of the Bell Crank Brace. Figure 20.4.9.

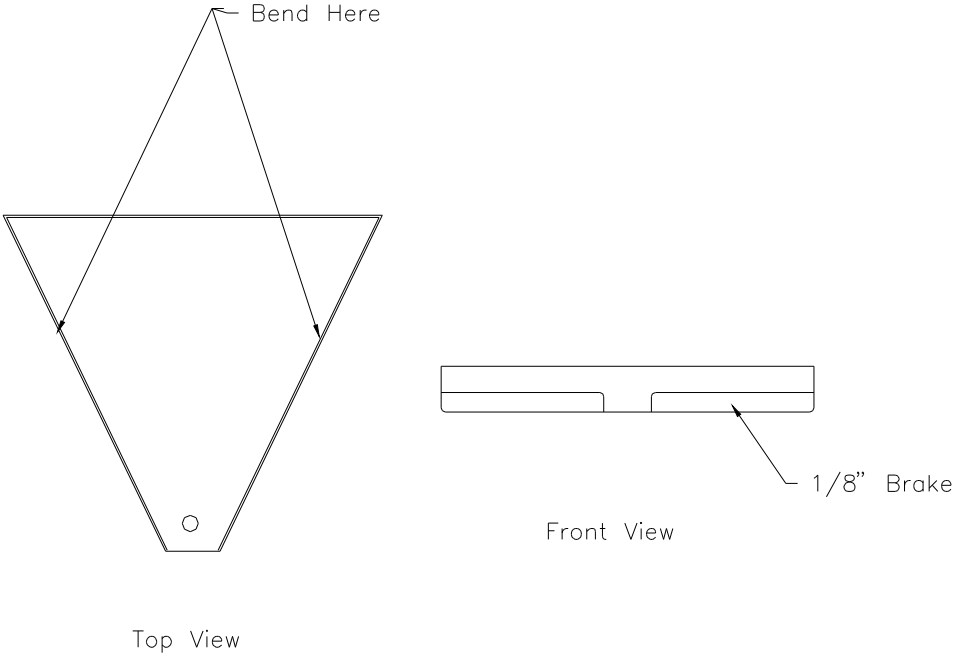



Figure 20.4.9

13) Debur all holes and edges. Rivet together with 1/8" (RV-1410) rivets.

14) Bolt the Mixer Bell Crank and Bell Crank Spacers into place with a AN5-21A bolt, AN960-516 washer and AN365-528 fiber nut. Figure 20.4.10.

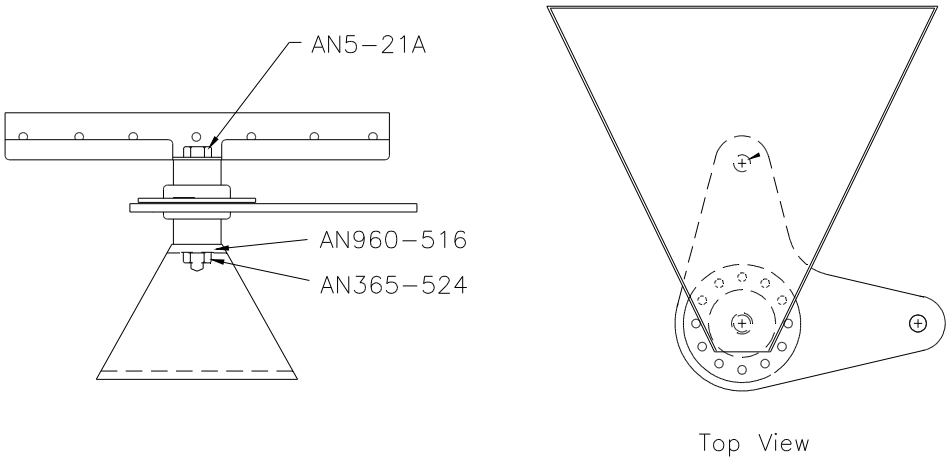



Figure 20.4.10

## *20.5 Mixer Install*

1) Make a push-pull tube (CC-40) from 3/4" x .035 tubing (CC-51). Adjust to length by turning the rod end bearings then lock in place with a jam nut (AN316-4) on the outboard end only. Figure 20.5.1

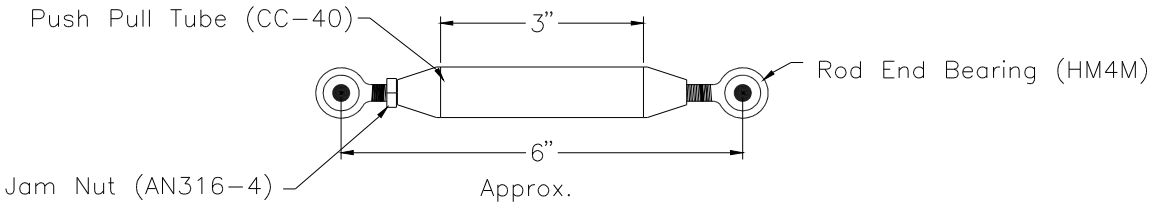



Figure 20.5.1

2) Attach one end of the push-pull tube to the pilots stick along with the connector tube. Use a couple of washers (AN960-416) if necessary to take up some space. Figure 20.5.2.

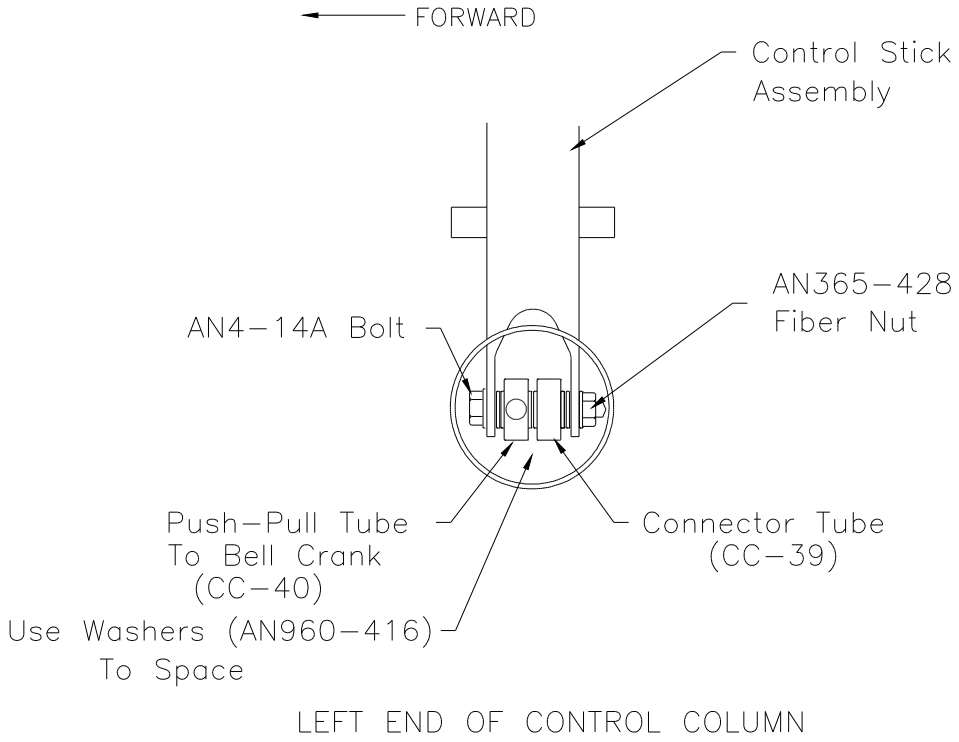



Figure 20.5.2

3) Adjust the push-pull tube until CC-47-2 is 90º to the control column. Figure 20.5.3.

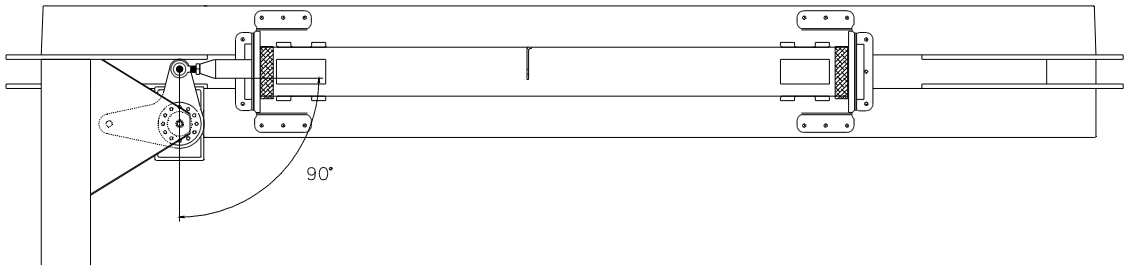



Figure 20.5.3

4) Attach the other end of the push-pull tube to the bell crank with an AN4-11A bolt, AN970-3 washer (drilled out to 1/4"), 2 AN960-416 washers, AN365-428 fiber nut. Figure 20.5.4.

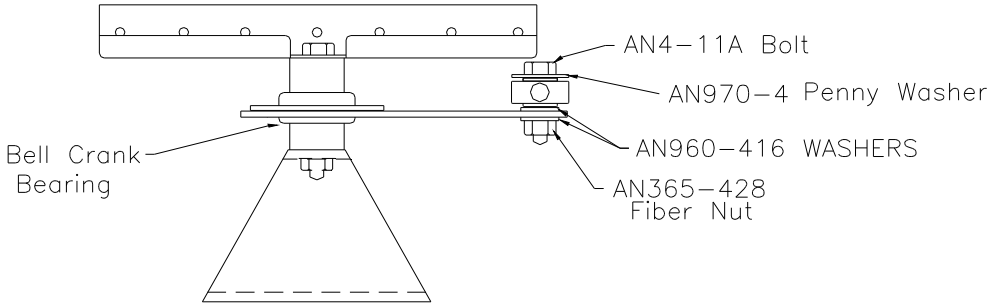



Figure 20.5.4

5) Trim mixer arm (CC-76) to the dimensions shown in figure 20.5.5.

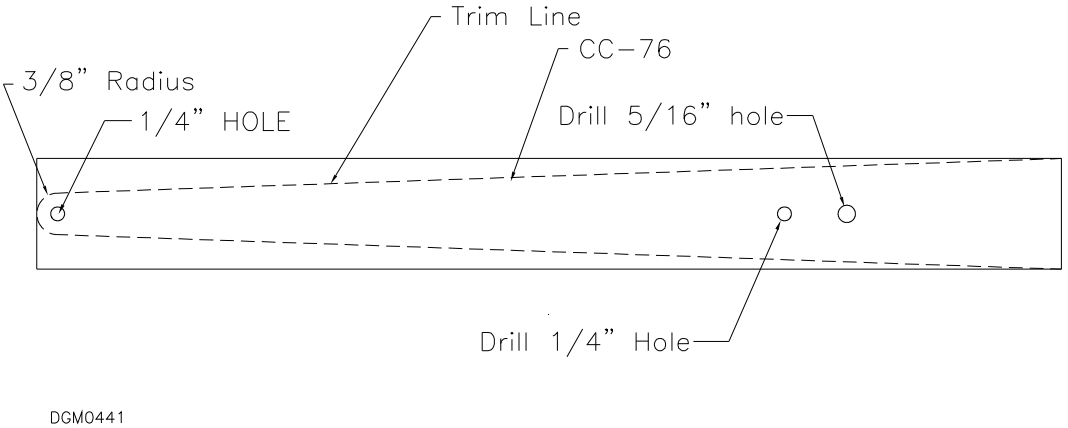



Figure 20.5.5

6) Using the full size drawings, cut out the doublers for the mixer arm assembly. Drill holes as shown. Figure 20.5.6 and Figure 20.5.7. (Cut from FUS-57)

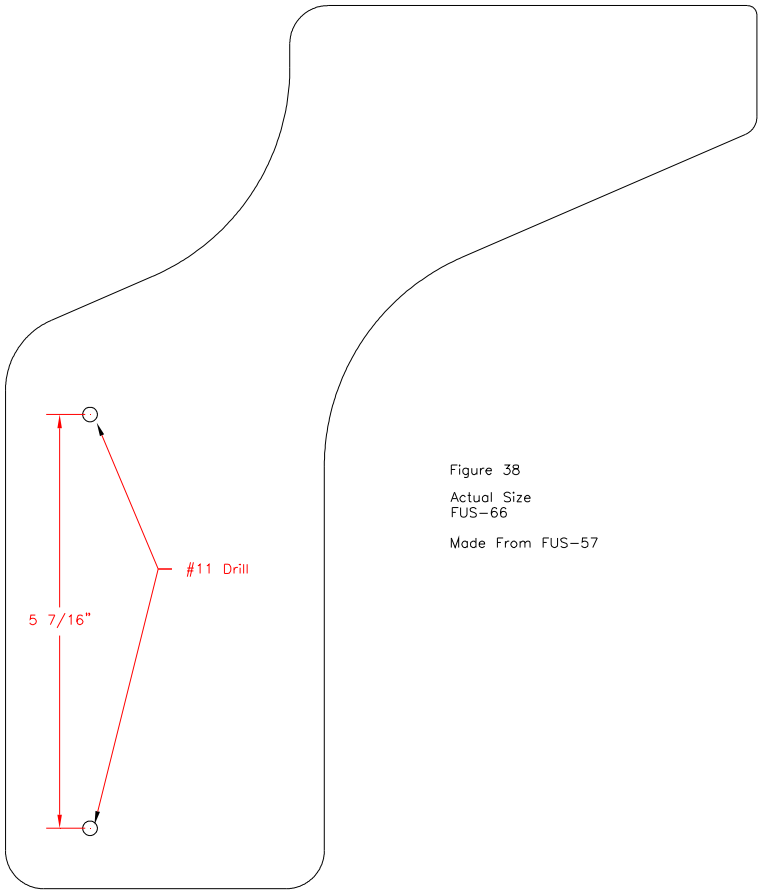



Fig. 20.5.6

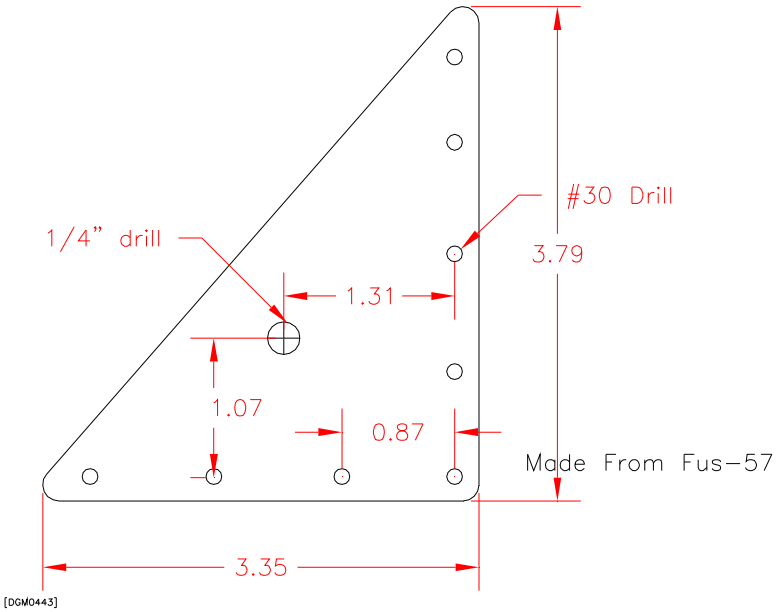



Fig. 20.5.7

7) Put the doublers in, on the inside of the pilots door and drill #30 holes for attachment to the fuselage. Figure 20.5.8.

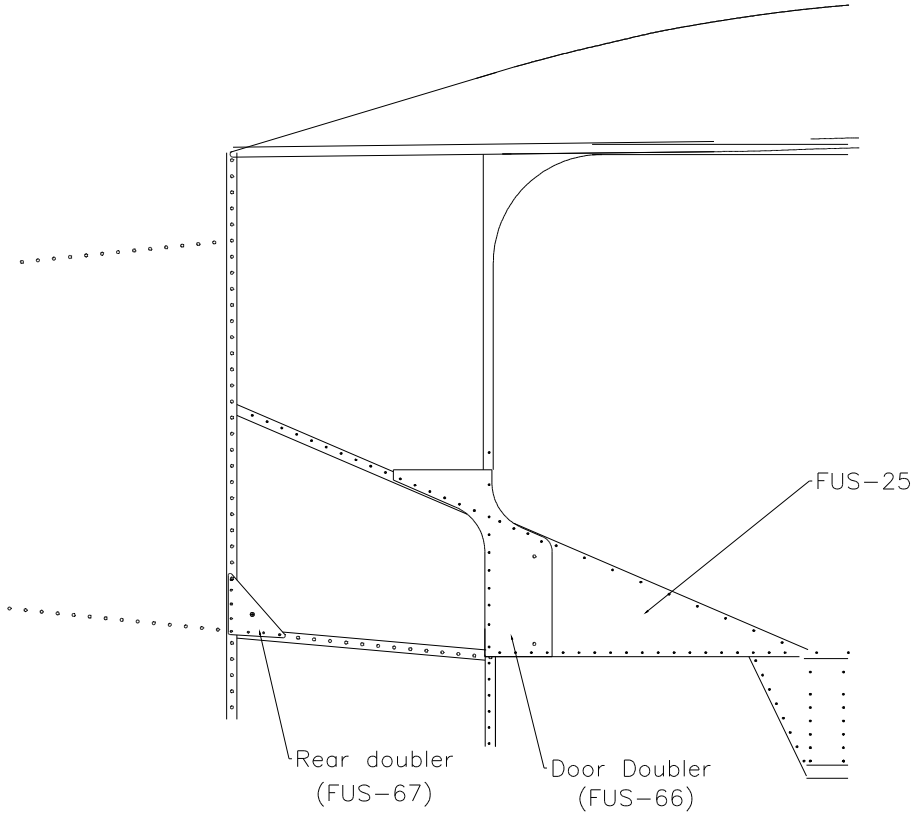



Figure 20.5.8

8) Use a felt marker to mark the location of the #11 holes on the inside fuselage skin (FUS-25).

9) Remove the door doubler and position a floating anchor nut (F5000-3) on the back side of each #11 hole. Figure 20.5.9.

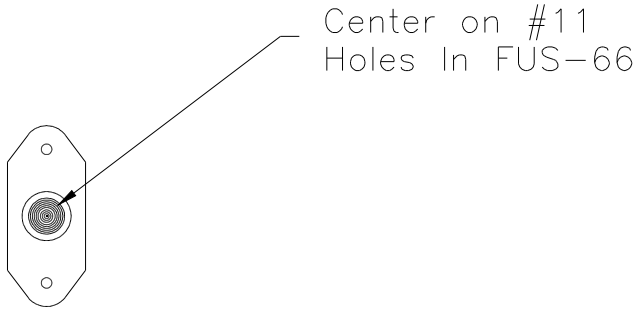



Figure 20.5.9

10) Drill the two #30 attachment holes through each floating anchor nut (F5000-3). Figure 20.5.10.

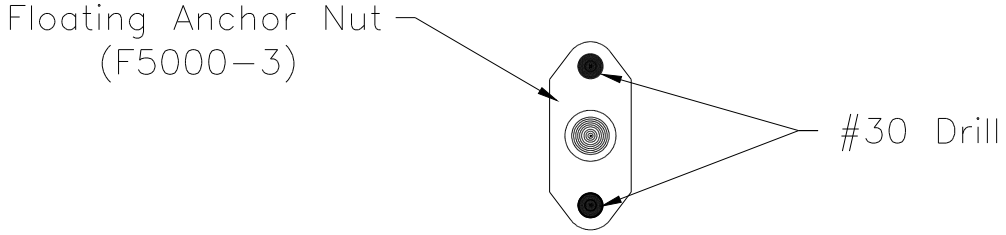



Figure 20.5.10

11) Countersink the four holes to allow countersunk rivets to sit flush.

**NOTE:** Be sure to countersink the anchor nut attachment holes on the outer side of the doubler. Figure 20.5.11.

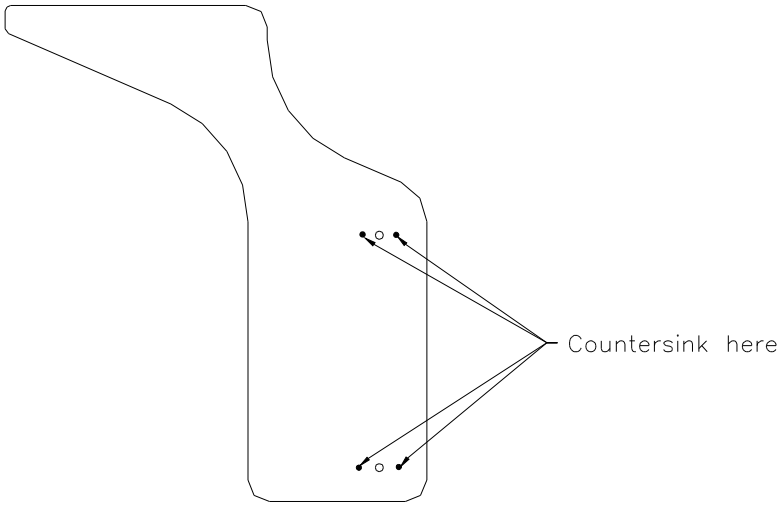



Figure 20.5.11

12) Debur all holes and edges.

13) Attach the floating anchor nuts (F5000-3) to the doubler (FUS-66). Rivet from the front side of the doubler with 1/8" CS rivets (RV-4412).

14) Using the marks made earlier as a guide, cut a hole large enough to allow the floating anchor nuts to enter.

15) Debur doublers and mating surfaces.

16) Rivet doublers into place with 1/8" (RV-1410) rivets.

17) Cut two mixer arm retainers from raw stock (CC-77) at 6" long.

18) Cut two spacers at 1" length from the same material.

19) Sand and round corners of the parts. Figure 20.5.12.

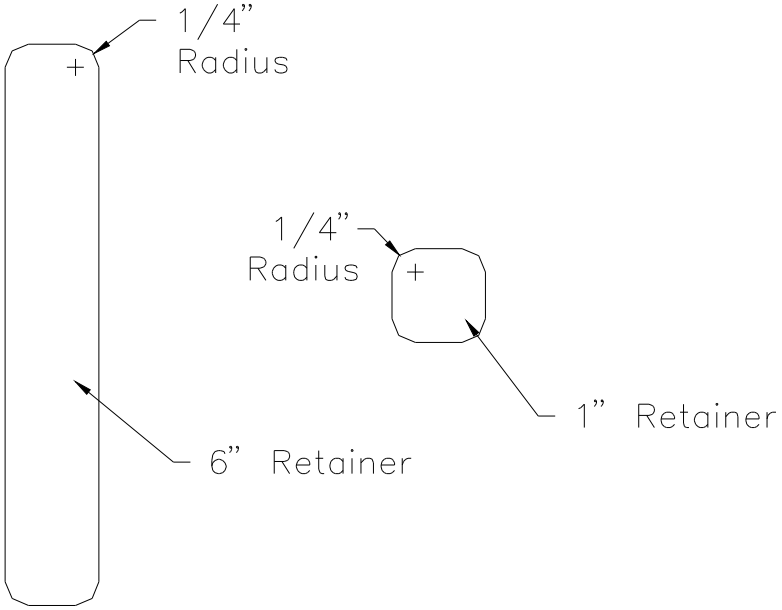



Figure 20.5.12

20) Drill two #11 holes into one 6" retainer. Figure 20.5.13.

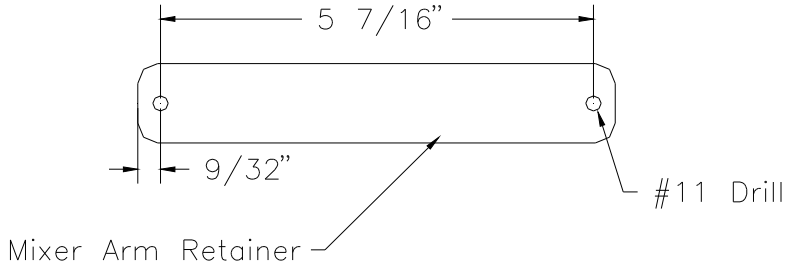



Figure 20.5.13

21) Use 6" retainer as a guide to drill the holes in the other 6" retainer and 1" spacers.

22) Bolt the retainers into position with AN3-11A bolts. Figure 20.5.14.

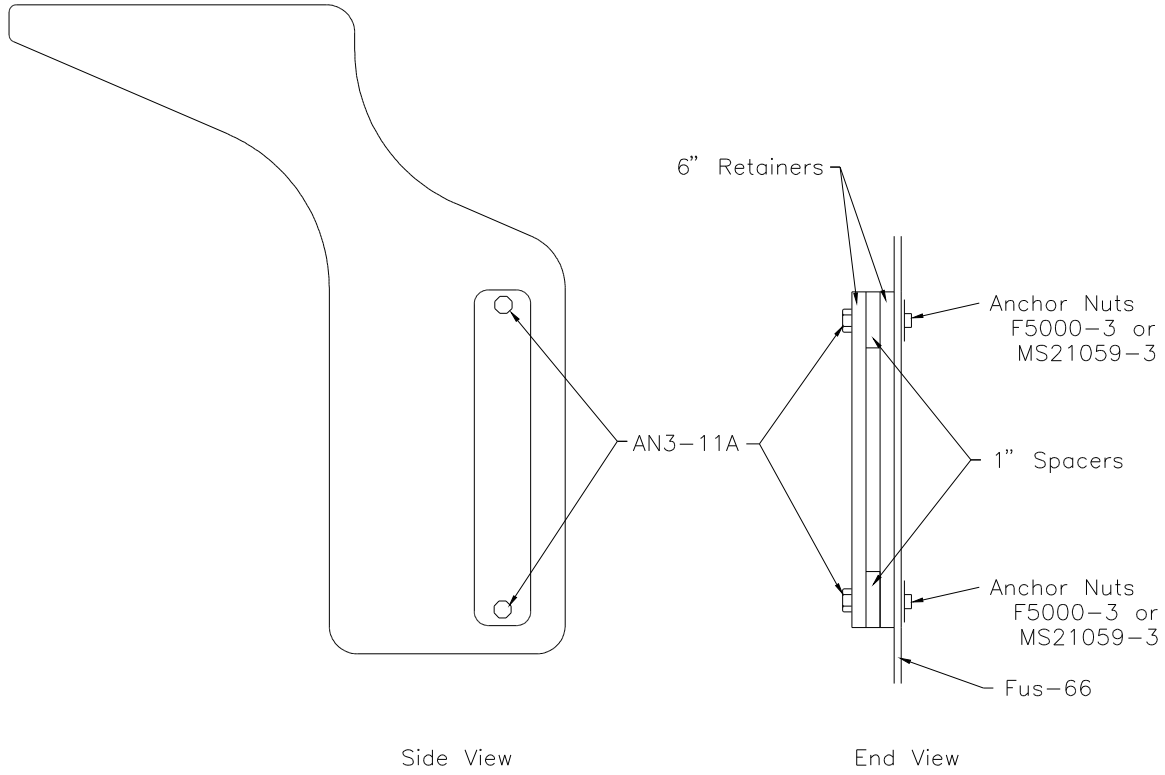



Figure 20.5.14

23) Install a Bell Crank Bearing (MI-25) in the mixer horn (CC-48-2) as done earlier.

24) Attach the mixer assembly to the mixer arm with an AN5-14A bolt, 4 AN960-516 washers, one AN970-5 penny washer and one AN365-524 fibernut. Figure 20.5.15.

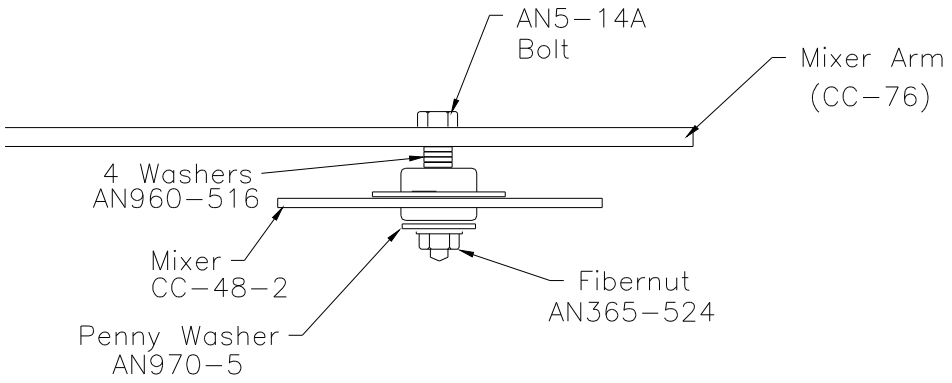



Figure 20.5.15

25) Drill the 1/4" hole in the rear doubler to 1/2" diameter.

26) Center a brass bushing (AIL-27) in the 1/4" hole on the rear doubler. Figure 20.5.16.

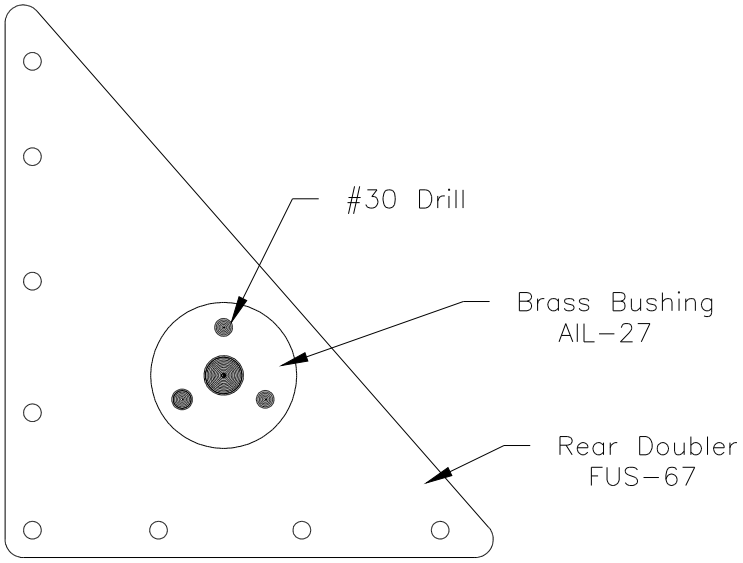



Figure 20.5.16

27) Drill three #30 attachment holes and rivet in place with 1/8" CS (RV-4412) rivets.

28) Slide the wide end of the mixer arm between the retainers and attach mixer arm to the rear doubler. The arm should move freely within the retainers. Sanding of the arm may be required. Figure 20.5.17.

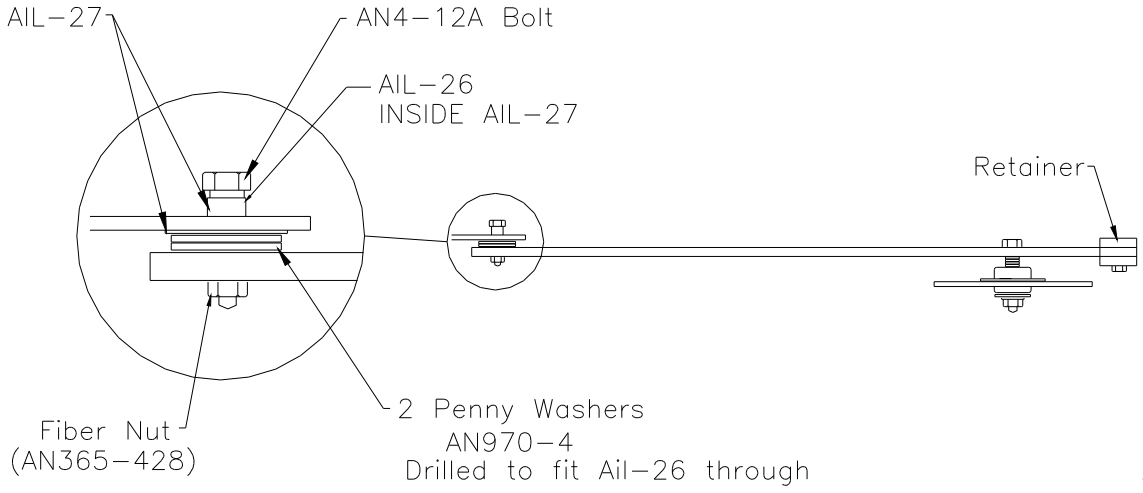



Figure 20.5.17

## *20.6 Flap Control Horn*

1) With the wings attached to the fuselage, locate the position were the torque tube enters the fuselage. Mark and cut a 3" hole in each Fuselage Root Rib (FUS-27) to allow the tube to enter.

2) Cut two pieces of ST-31 channel to fit between bulkhead "F" an "G" along the roof line. Figure 20.6.1.

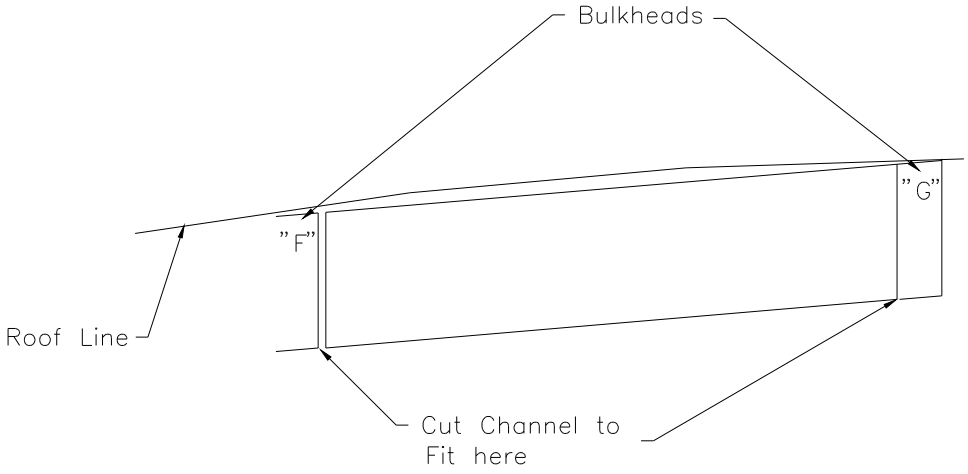



Figure 20.6.1

3) Cut four angles from (ST-31) for attachment and attach channel into position. Rivet angles similar to the floor channels using 1/8" rivets (RV-1410). Figure 20.6.2. **NOTE:** Do not rivet one channel in place yet. You have to final install the Hanger first.

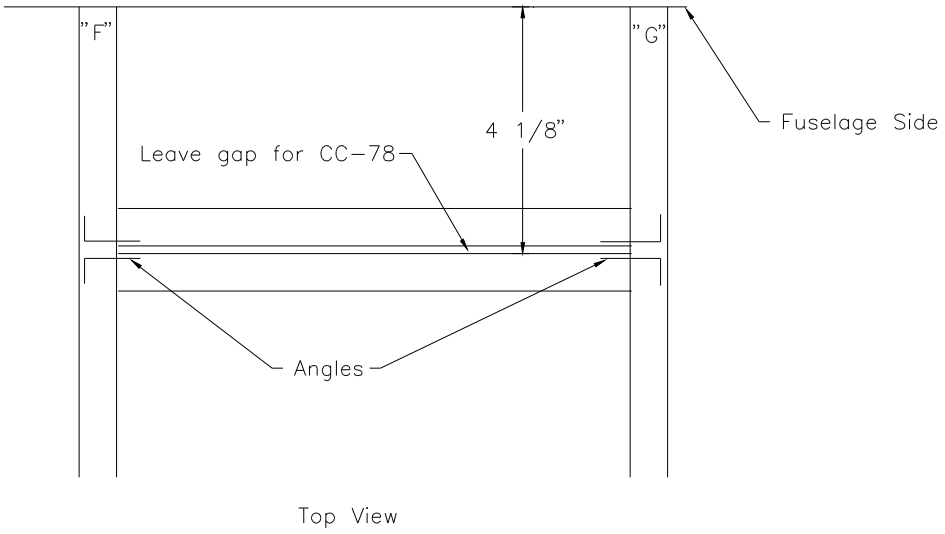



Figure 20.6.2

4) Cut out Torque Tube Hanger (CC-78) from .125 material (FUS-57). Figure 20.6.3.

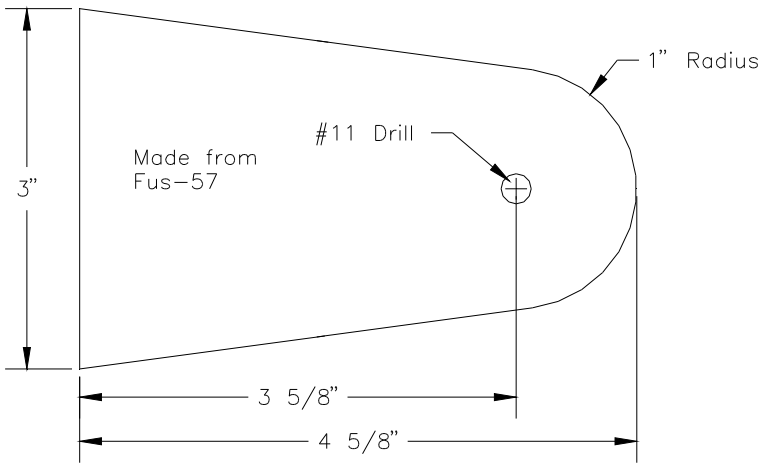



Figure 20.6.3

5) Cut two torque tubes for the inside the fuselage from 2" x .035" tube material (CC-64). Cut one tube 5 3/8" long and the other 40 1/4" long.

6) Install the right control horn assembly, which was made in the wing assembly, to the 40 1/4" long tube. Drill eight #11 holes through the end of the tube and end plug.

7) Remove and debur. Chromate and rivet with 3/16" S.S. rivets (RR-5604).

8) Install the left control horn assembly to the 5 3/8" long tube. Drill eight #11 holes through the end of the tube and end plug.

9) Remove and debur. Chromate and rivet with 3/16" S.S. (RR-5604).

10) Install a AN4-16A bolt into the anchor nut of each horn end plug. Tighten snugly. Grind or cut off the head of the bolt. Repeat for each horn. Figure 20.6.4.

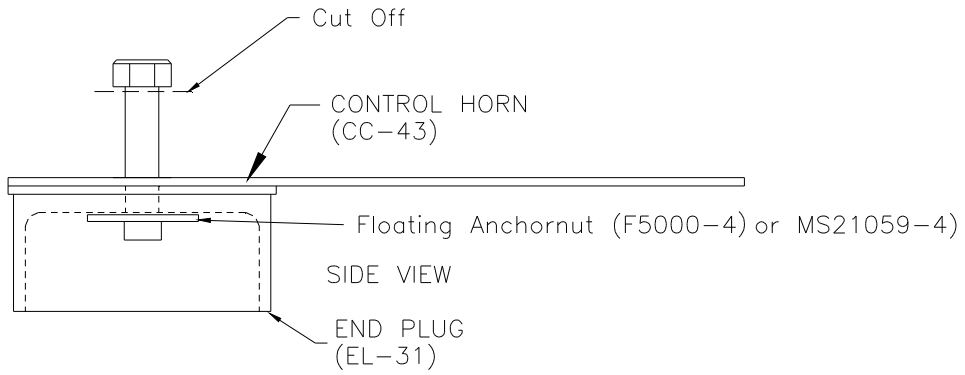



Figure 20.6.4

11) Make a similar horn assembly for the in-board end of each fuselage torque tube. Do not install the floating anchor nuts.

12) Drill the center hole of two end plugs to 3/8".

13) Bolt together as in figure 20.6.5 with an AN4-16A bolt, two AIL-26 metal bushings and an AN365-428 fibernut. The metal bushing should be tight against the hanger bracket. The control horns should move freely on the bushings.

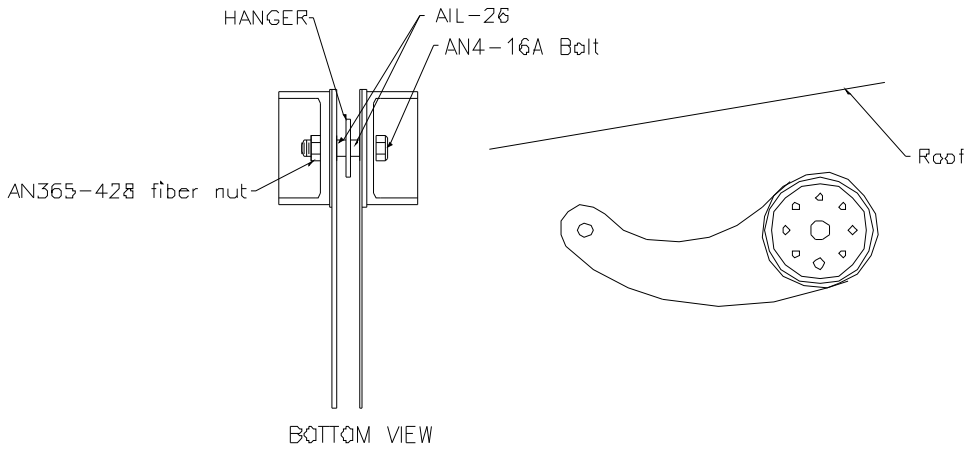



Figure 20.6.5

14) Slide the torque tubes through the holes in the fuselage and onto their corresponding end plugs.

15) Attach the wings. Ensure the bolt in the fuselage torque tube slides into the end plug of the wing torque tube. Figure 20.6.6.

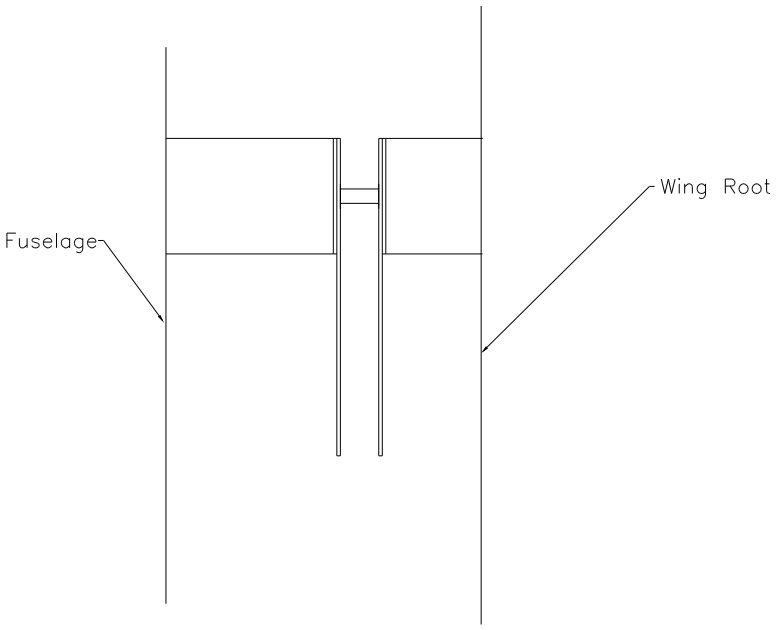



Figure 20.6.6

16) Align all torque tubes so that there is no binding at the pivot points. Locate the hanger (CC-78) position on the channel on the roof. Clamp the hanger onto the channel. Figure 20.6.7.

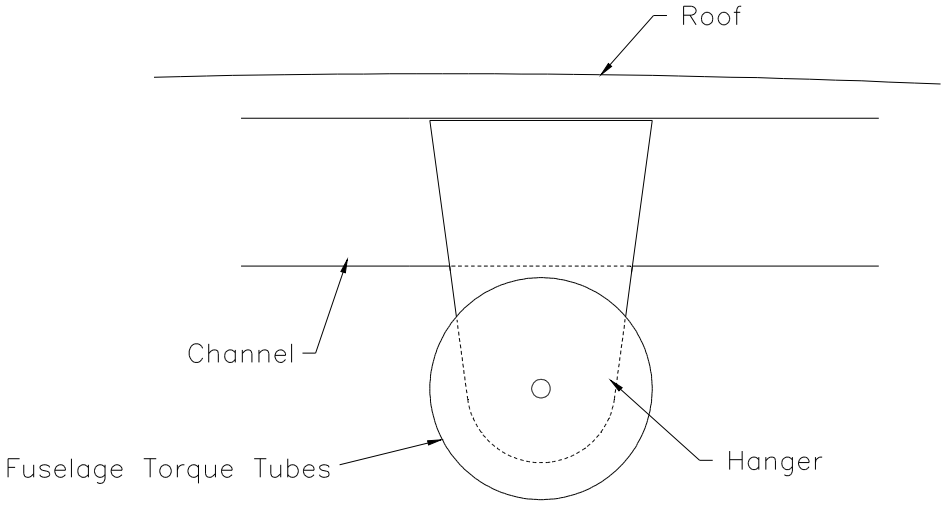



Figure 20.6.7

17) Trace the position of the hanger on to one of the channels. Figure 20.6.8.

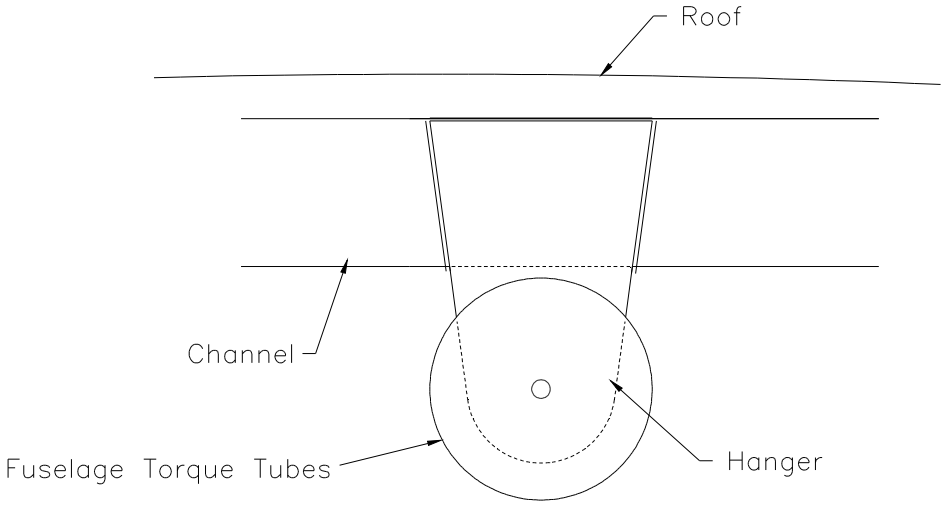



Figure 20.6.8

18) Remove wings.

19) Remove fuselage torque tubes.

20) Disconnect the horn assembly from the hanger.

21) Replace the hanger in it's location on the channel and drill six #11 holes through hanger and channel. Figure 20.6.9.

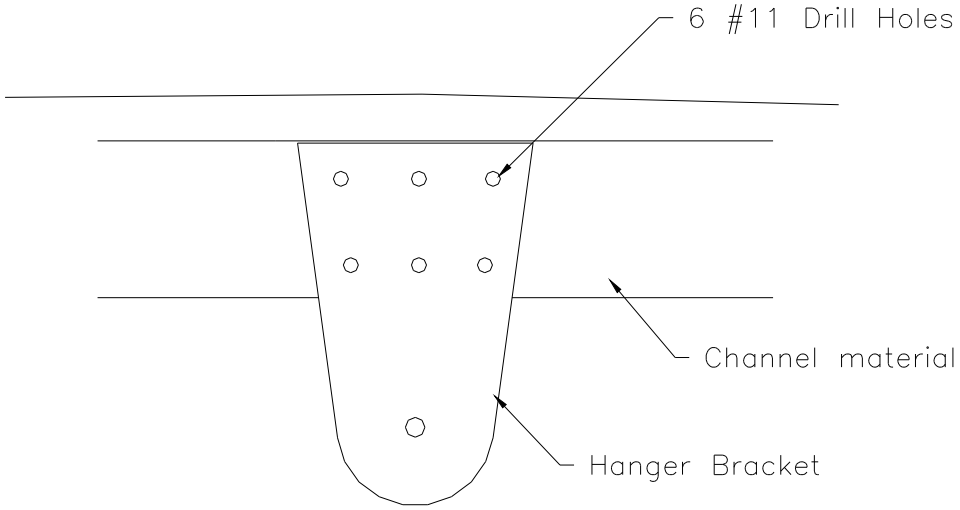



Figure 20.6.9

22) Sandwich the hanger between the two channels. Figure 20.6.10.

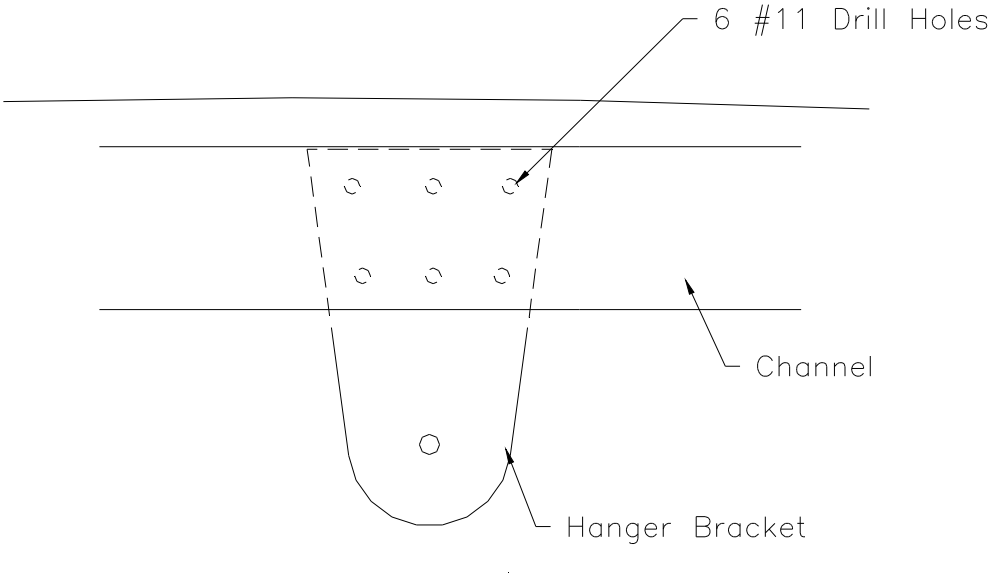



Figure 20.6.10

23) Keeping the channel tight to the hanger, back drill the six #11 holes through the channel. Cleco in place.

24) Debur all holes and rivet the second channel in place.

25) Rivet the hanger and channels together with 3/16" rivets (RV-1613).

26) From scrap .020 material fabricate a strap to go between the two channels behind the hanger to tie them together. Layout a nominal rivet pattern and rivet with 1/8" rivets. Also fabricate two gussets to tie the channels to the bulkheads.

27) Bolt the end plugs back on the hanger.

28) Slide the torque tubes through the holes in the fuselage and onto the horns.

29) Attach the wings to the fuselage.

30) With torque tubes tightly on the inside end plugs, install spacers (W-62-1) between the wing horn and the fuselage horn. It maybe necessary to sand the spacers. Figure 20.6.11.

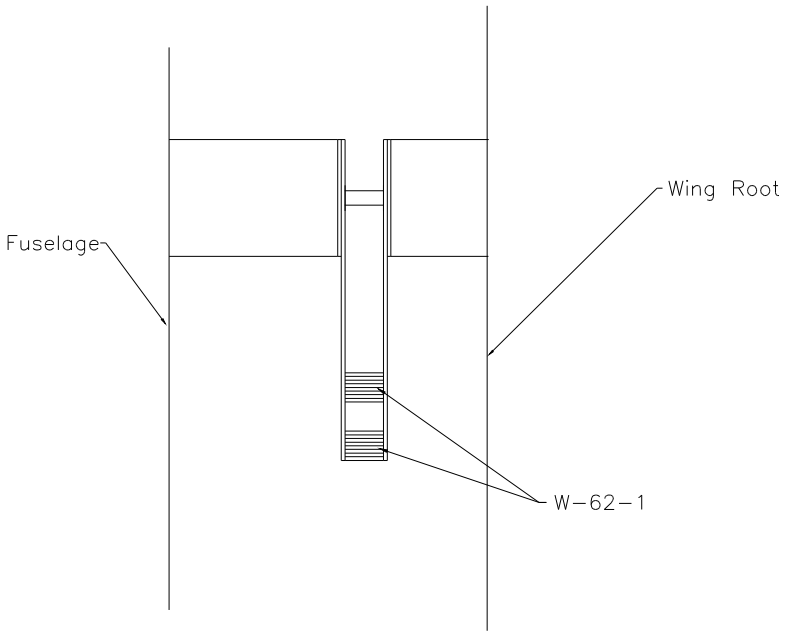



Figure 20.6.11

31) Bolt the W-62-1 spacers in with AN4-11A bolts, AN960-416 washers and AN365-428 fiber nuts.

32) Adjust the right wing flaperons so that the trailing edge is 5 1/4" up from neutral position. Figure 20.6.12.

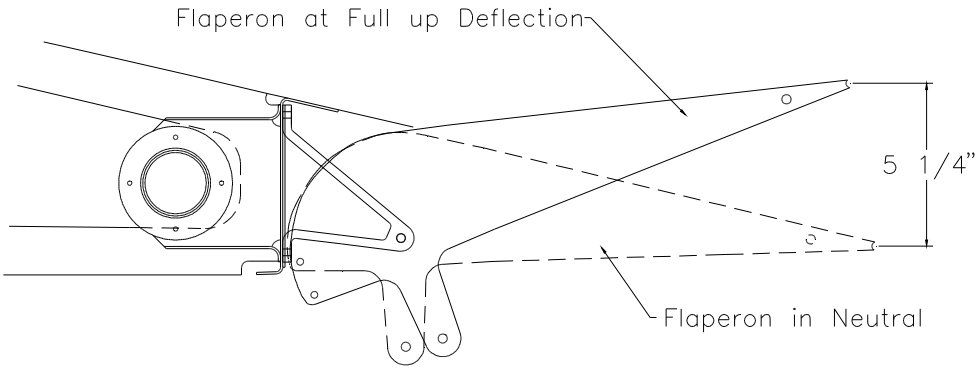



Figure 20.6.12

33) Adjust the right horn in the fuselage so that it just clears the bulkhead "F".

34) Drill a #40 hole through the torque tube and end plug. Cleco to hold in place.

35) Return flaperons to neutral.

36) Adjust the mixer arm (CC-76) so that there is 7/8" clearance between the mixer and the top spacer block. Figure 20.6.13.

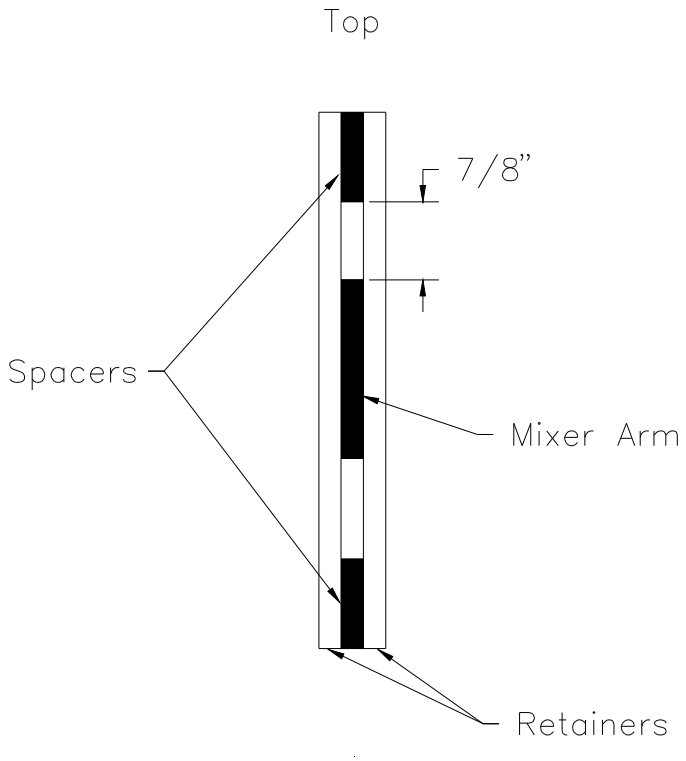



Figure 20.6.13

## *20.7 Push Pull Tubes*

1) Cut a push-pull tube from 1” x .058” tube (CC-50) to fit between the bell crank (CC-47-2) and mixer (CC-48-2). Figure 20.7.1.

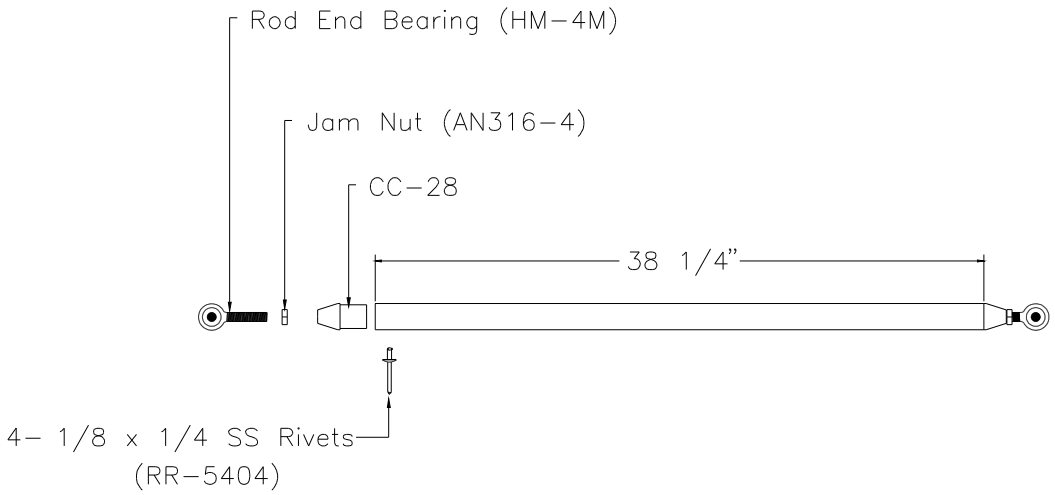



Figure 20.7.1

2) Attach end plugs (CC-28) and rod-end bearings (HM-4M).

3) Attach Push-Pull tube to the bell crank (CC-47-2) with a AN4-10A bolt, AN970-4 penny washers and AN365-428 Fiber nut.

4) Adjust push-pull tube so that a 90º angle is achieved between Mixer Horn (CC-48-2) and the tube when the controls are neutral.

5) Attach push-pull tube to the bell crank (CC-47-2) with a AN4-10A bolt, AN970-4 penny washer and AN365-428 fiber nut.

6) Countersink the two inside fuselage torque tube horns to allow a 1/4" countersunk bolt (AN509-416-R-16). Figure 20.7.2.

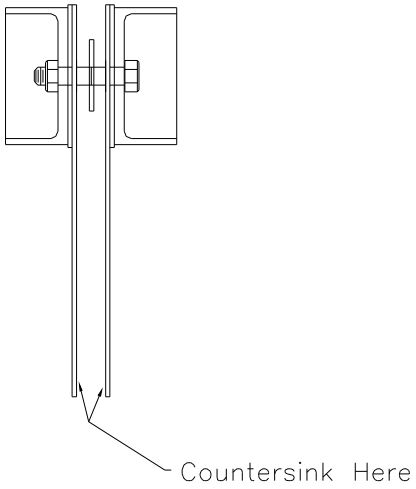



Figure 20.7.2

7) Adjust the aileron to the neutral position. Adjust the mixer horn (CC-48-2) to neutral.

8) Measure between bolt holes on the mixer arm bellcrank and horn on the torque tube.

9) Cut and assemble a push-pull tube from ¾" X 0.035 tube to this measurement, in the same way as in Fig. 20.7.1. .

10) Adjust the rod-end bearings to fit between the mixer and horn on the torque tube. Figure 20.7.3. Bolt the push-pull tube to the torque tube horn with AN509-416-R-16 countersunk bolts, AN970-4 penny washer and AN365-428 fibernut.

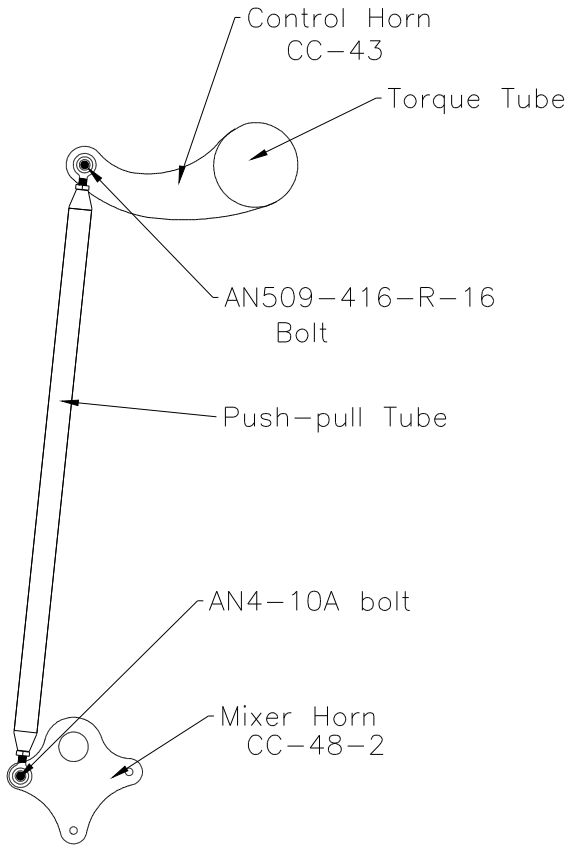



Figure 20.7.3

11) Bolt the push-pull tube to the mixer horn (CC-48-2) with AN4-10A bolts, AN970-4 penny washers and AN365-428 fiber nuts.

12) Cut and assemble a second tube in the same way to the measurement between the other two bolt holes.

13) Attach the tube to the Mixer.

14) Adjust the push-pull tube so that the angle at the left horn is the same as the right horn. Figure 20.7.4.

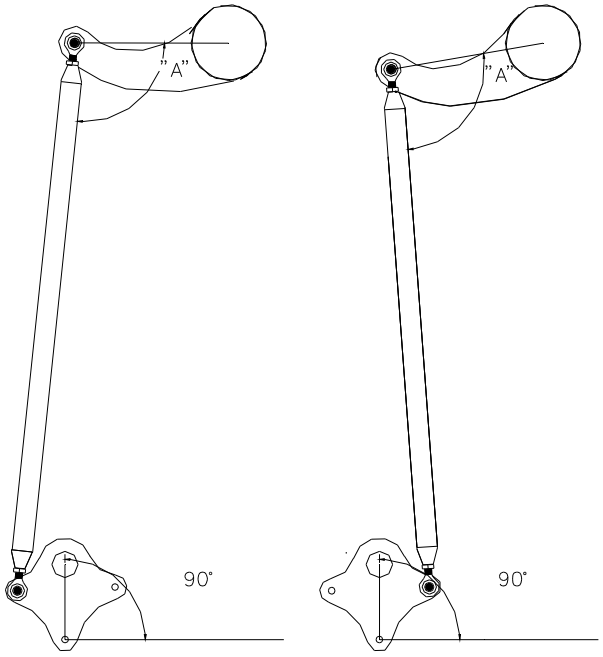



Figure 20.7.4

15) Adjust the rod-end bearings of each push-pull tube to fit between mixer and horn on the torque tube. Figure 20.7.5. Bolt the push-pull tube to the torque tube horn with AN509-416-R-16 countersunk bolt, AN970-4 penny washer and AN365-428 fibernut.

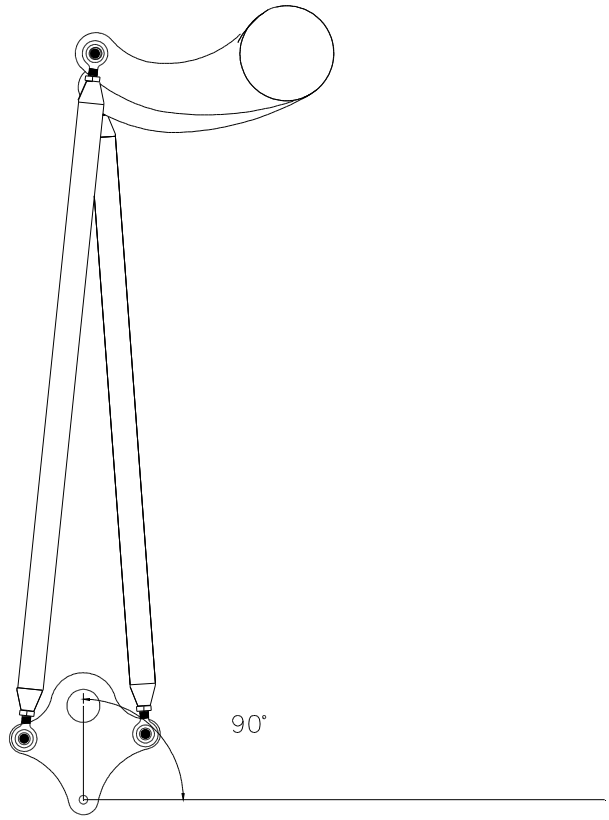



Figure 20.7.5

16) Drill a #40 hole through torque tube and end plug. Cleco.

17) Remove wings.

18) Remove fuselage torque tubes.

19) Disconnect the horn assembly from the hanger.

20) Place the end plugs into the matching torque tubes. Line up the holes and drill a total of eight #11 holes through torque tube and end plug. Figure 20.7.6.

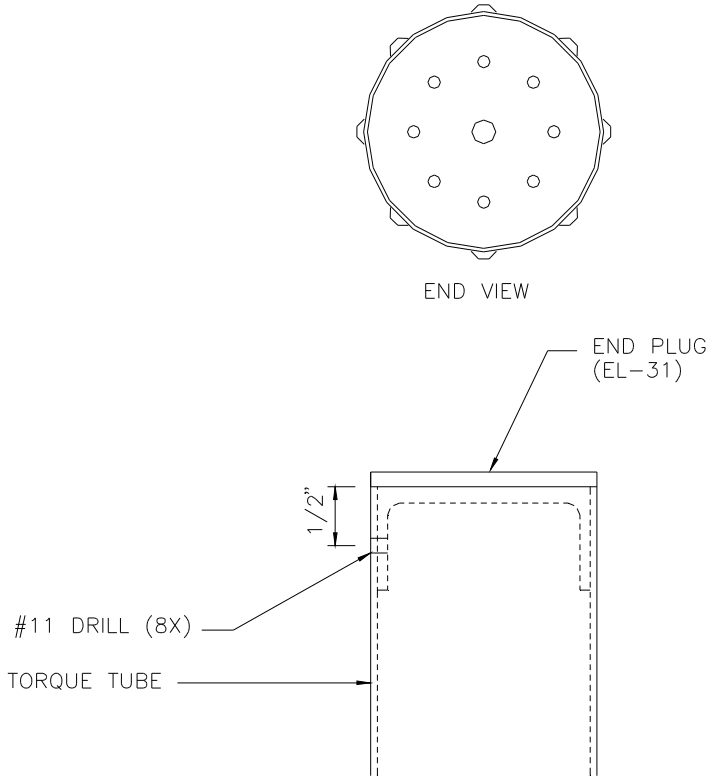



Figure 20.7.6

21) Bolt the inside end plugs back onto the hanger.

22) Slide the torque tubes through the holes in the fuselage and onto the horns. Rivet together with 3/16" S.S. rivets (RV-5604).

23) Bolt the push-pull tubes onto the inside horns.

## *20.8 Elevator Horn*

1) Cut two doublers from .040 material (FUS-68). Figure 20.8.1.

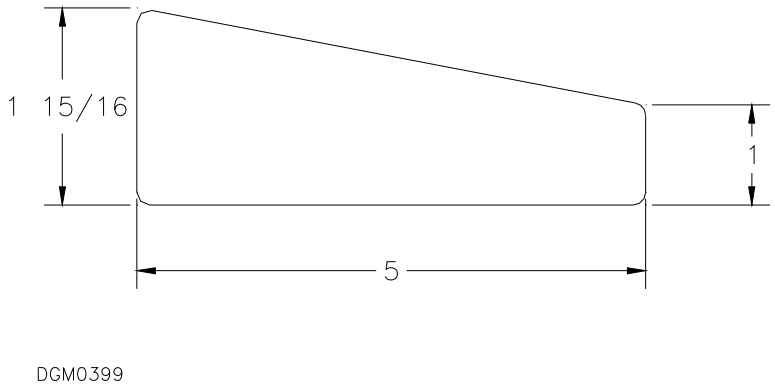



Figure 20.8.1

2) Brake a 90º bend into each part to add strength. Figure 20.8.2.

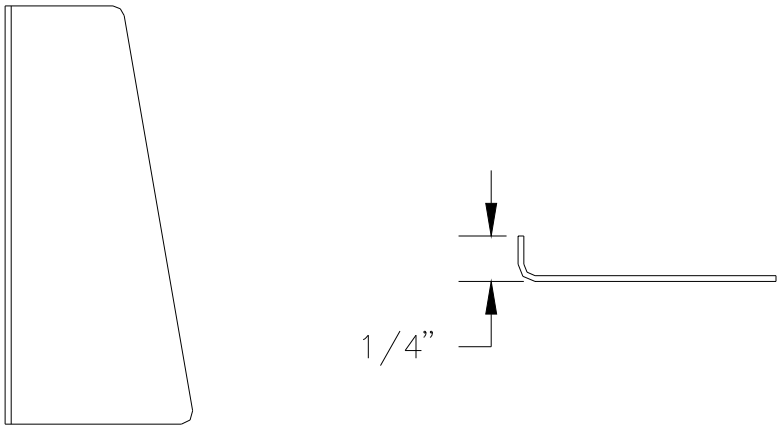



Figure 20.8.2

3) Position the doublers near outer holes on the bottom of FUS-31. Figure 20.8.3.

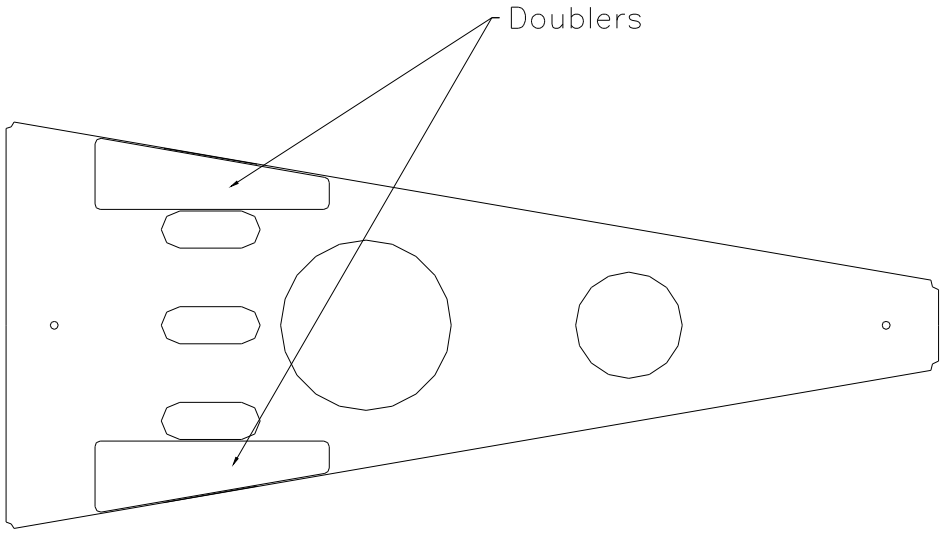



Figure 20.8.3

4) Drill four #30 holes in each end of the doublers. Figure 20.8.4.

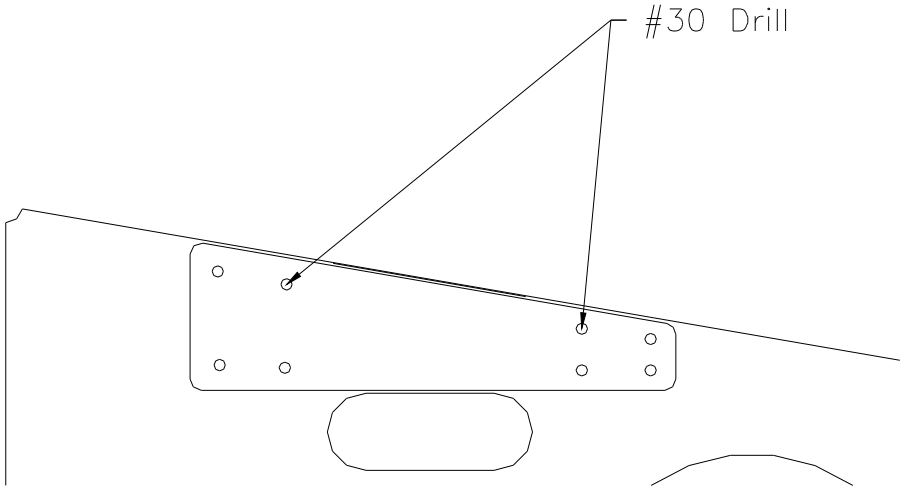



Figure 20.8.4

5) Debur holes and edges.

6) Chromate and rivet together with 1/8” (RV-1410) rivets.

7) Install two bearing blocks on the ends of the elevator horn. Center the horn in the holes of the FUS-31. Figure 20.8.5.

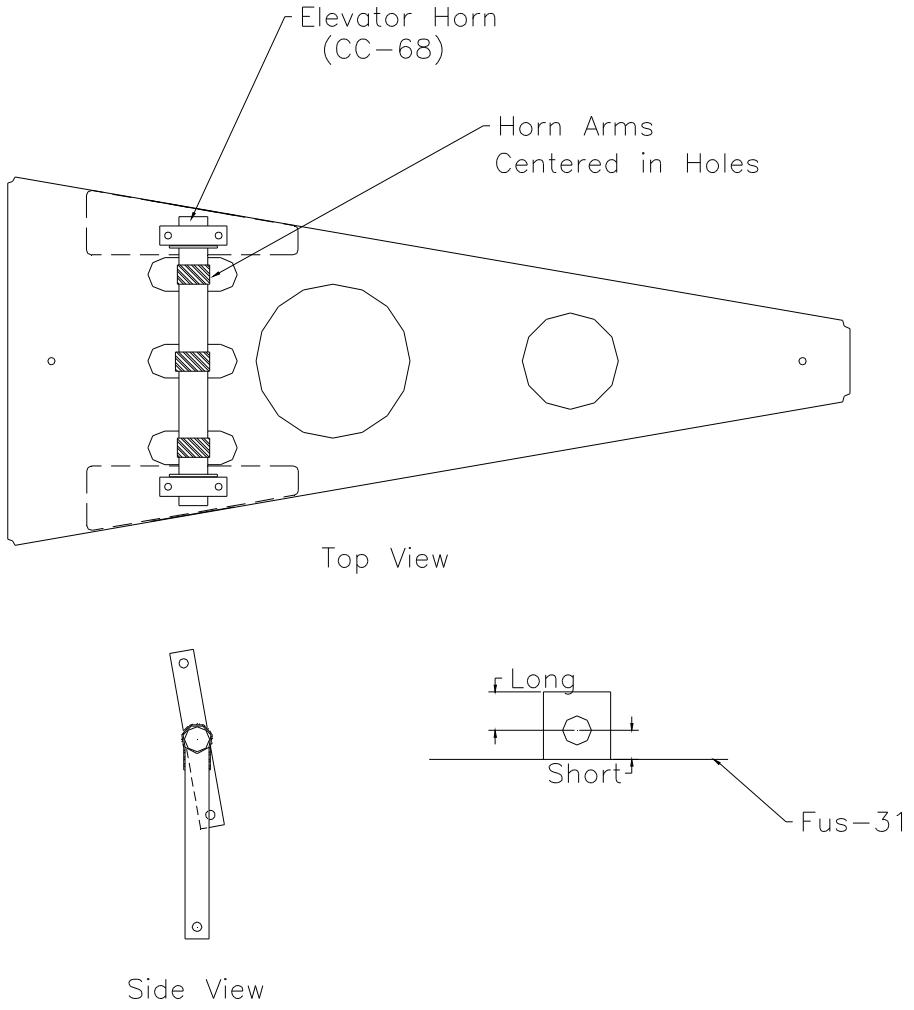



Figure 20.8.5

8) Drill #11 holes using the bearing blocks as guides, through the doublers and fuselage bulkhead. Debur.

9) Bolt together with AN3-22A bolts, AN960-10 washers and AN365-1032A fiber nuts.

10) On the sides of the tailcone measure the approximate position of the exit hole for elevator push-pull tubes. Mark the shape of the hole using a felt pen. These are not exact sizes and trimming will be necessary. Figure 20.8.6.

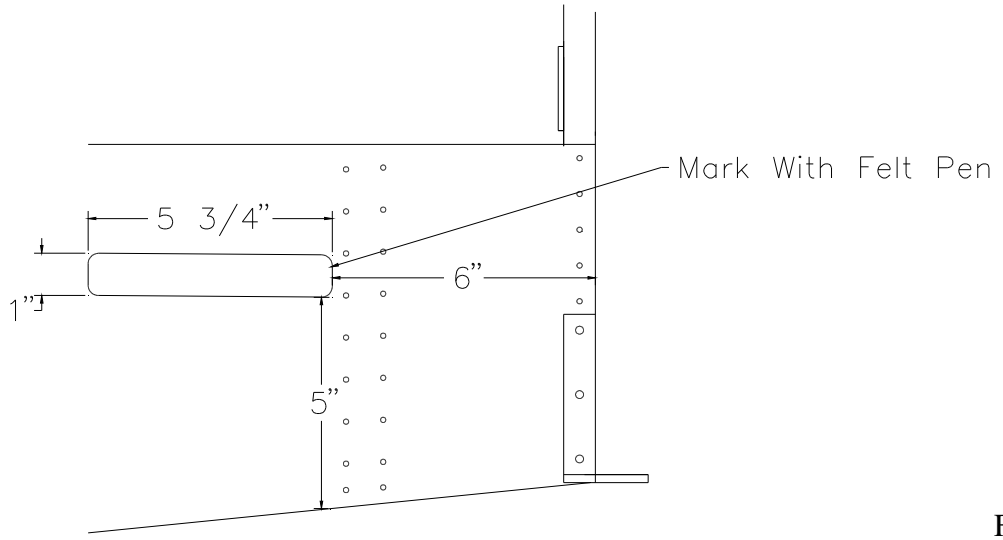



Figure 20.8.6

11) Drill 1/4" holes just inside of each corner of the marked outline. Figure 20.8.7.

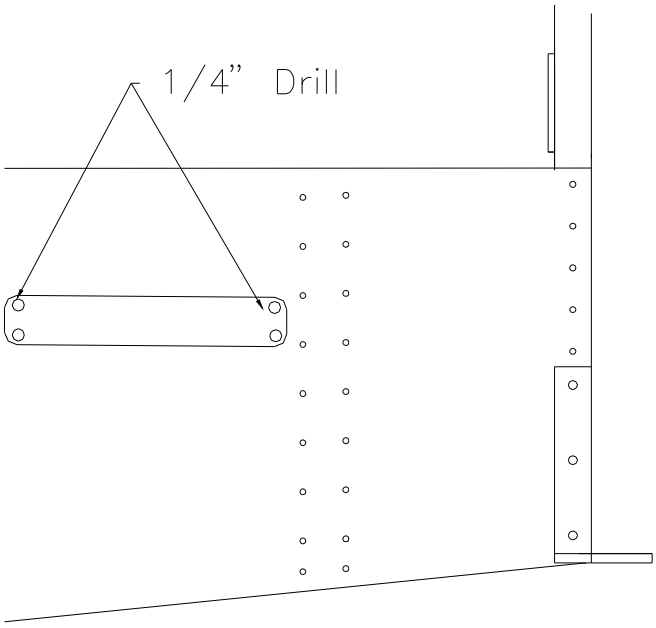



Figure 20.8.7

12) Cut out between the holes, allowing 1/8" clearance inside the lines.

13) Cut two elevator push-pull tubes (CC-75) from 3/4" x .035 tubing (CC-51) and install end plugs and hardware. Figure 20.8.8.

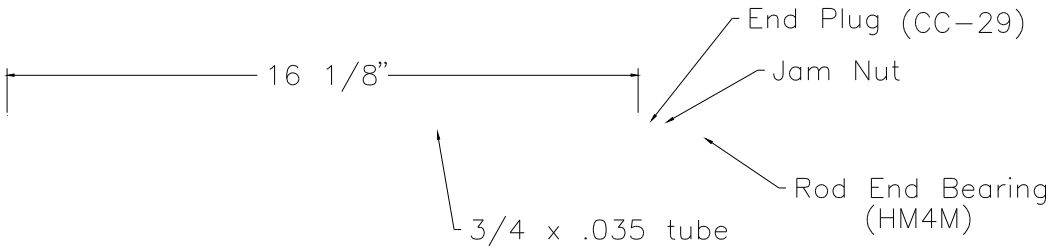



Figure 20.8.8

**NOTE:** Stabilizer and elevator must be installed before this section can be completed.

14) Attach the elevator push-pull tube to the elevator horn with AN4-10A bolt, AN960-416 washers for spacers and AN365-428 fiber nut.

15) Adjust the elevator push-pull tube so that the elevator is neutral when the elevator horn is neutral. Figure 20.8.9.

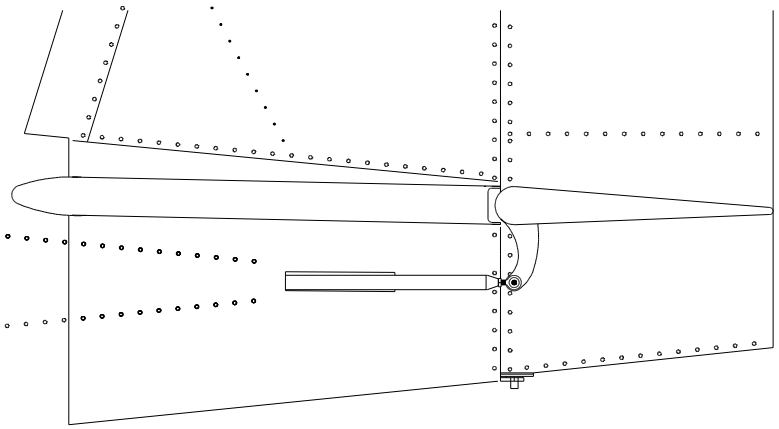


Figure 20.8.9

**NOTE:** It may be necessary to sand the exit hole to do this adjustment.

16) Trim the opening to allow 25º up and 25º down deflection of the elevator.

17) Disconnect and remove the push-pull tubes.

18) Mark and cut a .032 doubler from W-143 to strengthen the opening. Mark from the inside of the fuselage onto the doubler the shape of the hole. Make the doubler 1" larger than the cutout.. Figure 20.8.10.

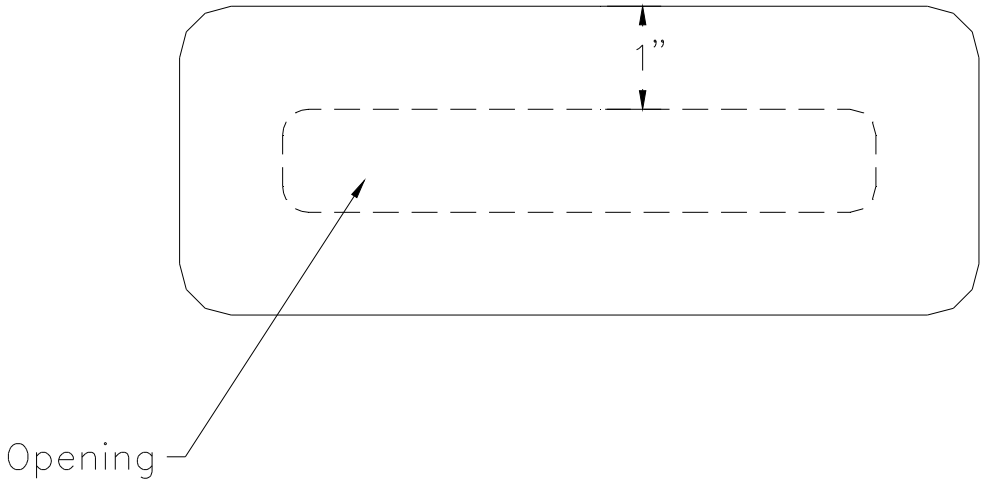



Figure 20.8.10

19) Debur all edges.

20) Hold the doubler in place and drill #30 hole through doubler and fuselage tail wrap. Figure 20.8.11.




Figure 20.8.11

21) Debur and chromate mating surfaces. Rivet on with 1/8" (RV-1410) rivets.

22) Repeat steps for the other side.

23) Attach the wings.

24) Install the spacers and bolts between the fuselage torque tubes and the wing torque tubes.

## *20.9 Teleflex Cable Install*

1) Attach the teleflex cable to the mixer arm with the clevis fork assembly (31800-4192). Figure 20.9.1.

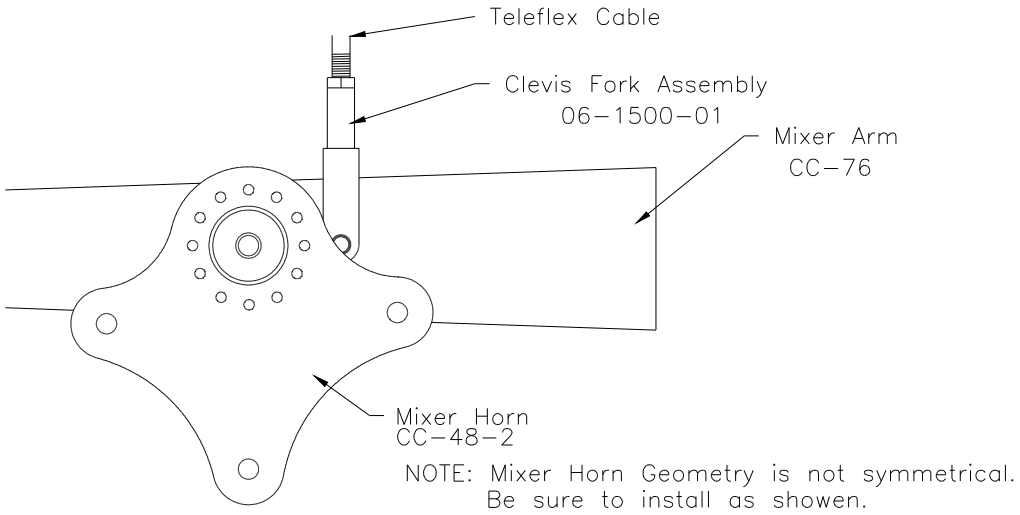



Figure 20.9.1

2) Slide the cable through its full travel and set the cable to that a 1/4 of the full cable travel is showing at the mixer arm (CC-76).

3) Position the teleflex cable retainer over the cable and use it as a guide to drill the two #11 holes into FUS-66 door doubler. Figure 20.9.2.

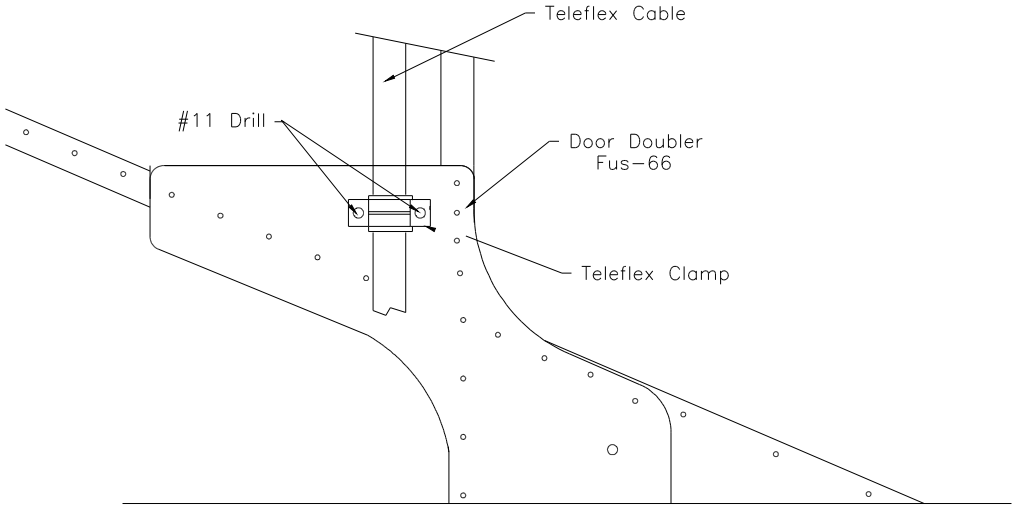



Figure 20.9.2

4) Bolt the cable retainer to the door doubler with AN3-5A bolts, AN960-10 washers and AN365-1032 fiber nuts.

## *20.10 Cable Guide Install*

1) Position elevator cable guides in a straight line from the tabs on the control column to the pulleys at the end of the floor in the rear of the aircraft. Ensure that the cable will not interfere with the seatbelt bracket. Figure 20.10.1.

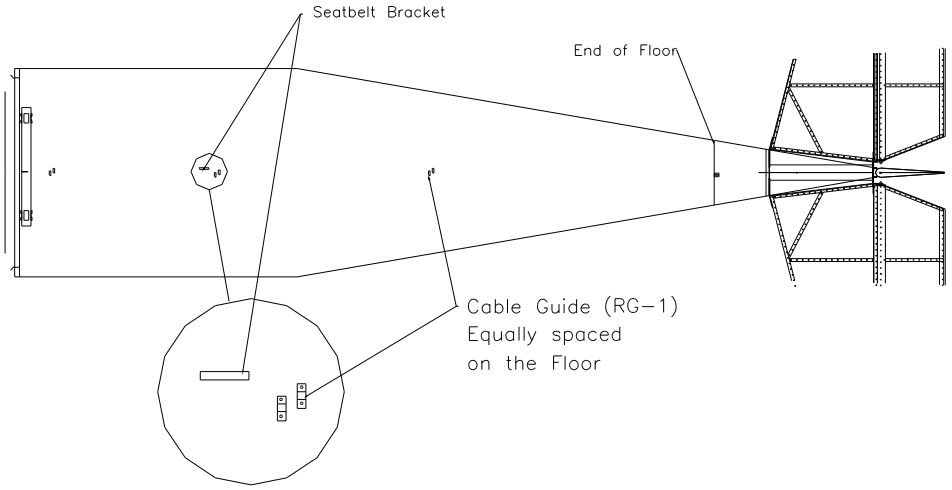



Figure 20.10.1

2) Drill #30 mounting holes for each guide and rivet using 1/8" aluminum rivets (RR-7408).

## *20.11 Elevator Cable*

1) Assemble 1/8" cable and bolt to the elevator horn. Figure 20.11.1.

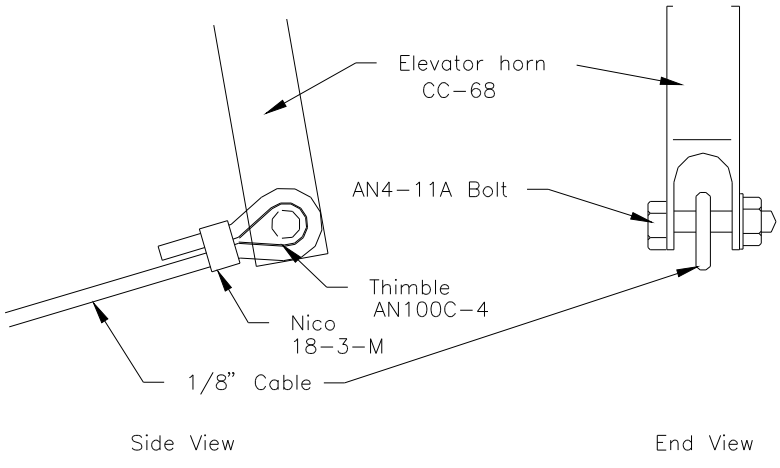



Figure 20.11.1

2) Run the cable through the cable guides to the control column.

3) Attach turnbuckles (AN130-22S) to the control column. Attach cable to turnbuckles. Figure 20.11.2.

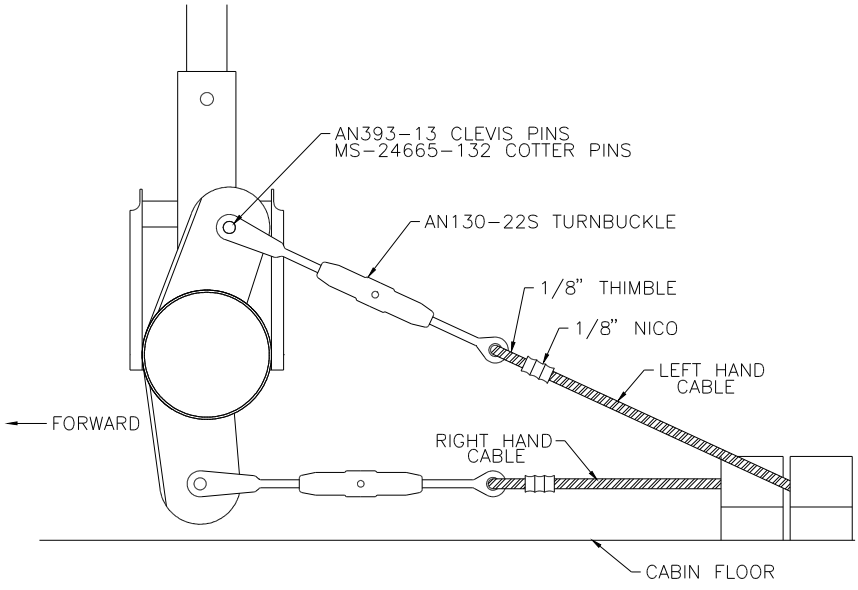



Figure 20.11.2

4) Position the cable cover (FUS-64) over the cable between the first and last cable guides. Then drill through each flange #30 holes at 1" spacing.

5) Rivet the cable cover to the floor using 1/8" rivets (RV-1410).

6) Locate and install cable guides for the rudder cable along the inside walls of the fuselage. Ensure cable clears the mixer controls. Keep cable as straight as possible. Figure 20.11.3.

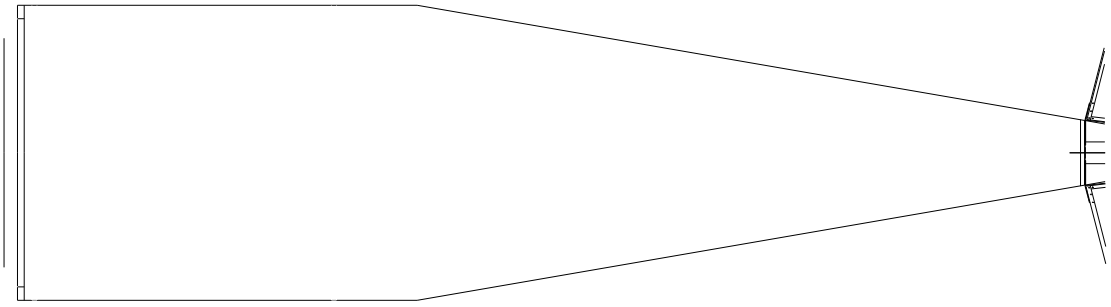


Figure 20.11.3

7) Run 1/8" cable along the guides from the rudder pedals to the back through the guides.

8) Locate the approximate location of the exit point for the cable. Drill two holes and cut out between as in Figure 20.11.4.

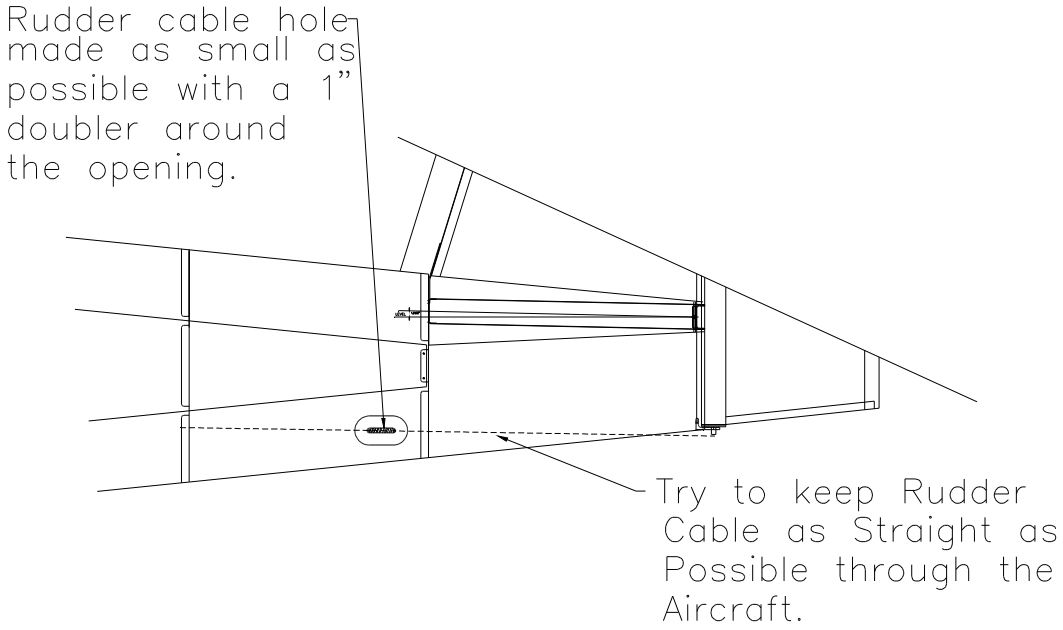



Figure 20.11.4

9) Run the cable through the slot to the rudder. File the hole if necessary to allow the cable free movement with adequate clearance.

10) Assemble cable and attach to the outermost holes in the rudder horn. Figure 20.11.5.

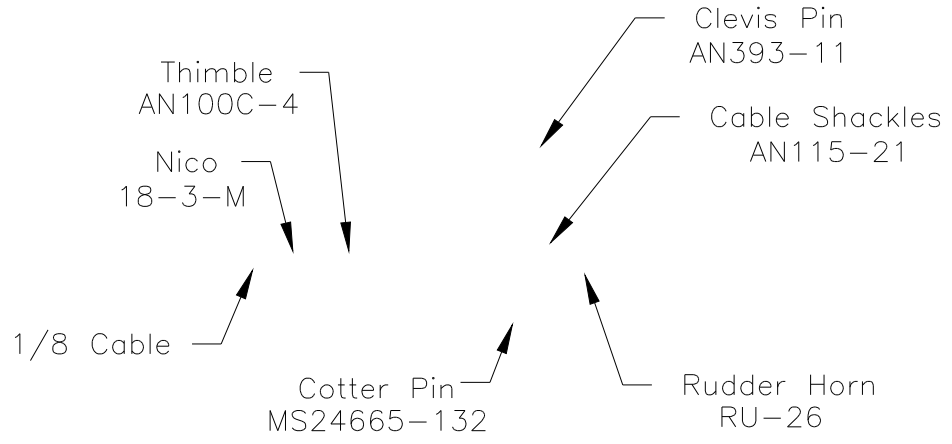



Figure 20.11.5

11) Repeat for the other side.

12) With the rudder pedals in neutral position, attach the rudder cables to the T12-HT4 tangs on the rudder pedal eyebolts using an AN100C-4 Thimbel. figure 20.11.2.

## *20.12 Flap Control*

1) Cut the flap rib (FUS-65R) to fit between front three roof bulkheads. Figure 20.12.1.

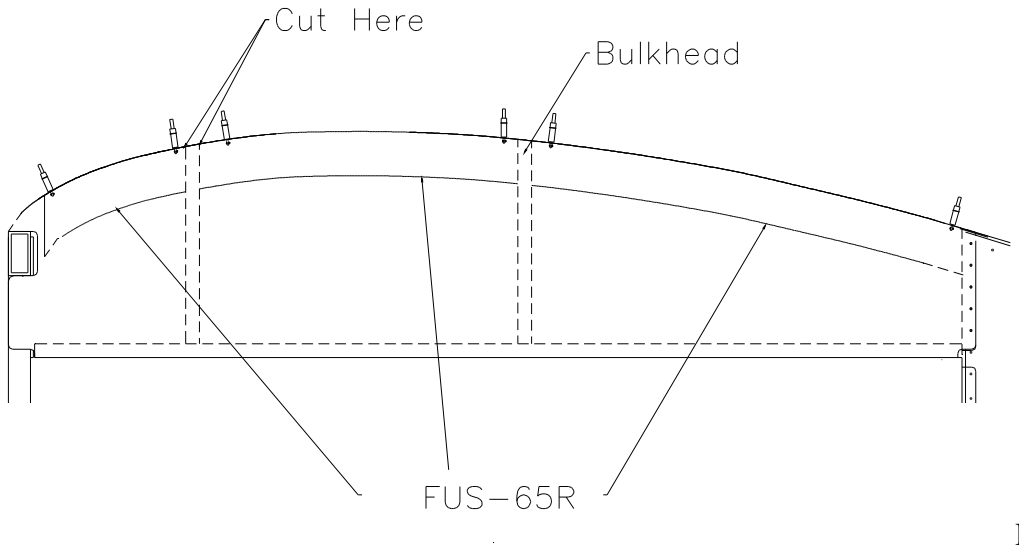


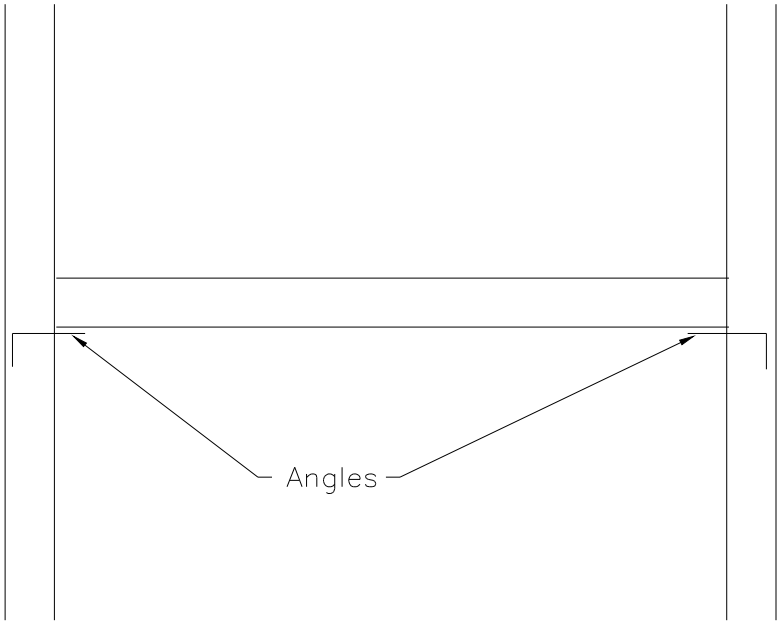

Figure 20.12.1

2) Drill #30 holes back through each end of the flap rib channel and roof. Cleco in place.

3) Drill remaining holes at 1" spacing.

4) Cut angle brackets from FUS-35 to attach the flap ribs to each bulkhead. Figure 20.12.2.

**NOTE:** This is done similar to the floor channel installation.




Top View

Figure 20.12.2

5) Debur parts. Chromate mating surfaces.

6) Rivet together with 1/8" rivets (RV-1410).

7) Using figure 20.12.3 as a template cut a flap handle (CC-79) out of .125" material (FUS-57).

8) Cut a flap guide (CC-80) out of .125" material (FUS-57). Use the full size figure 20.12.4 as a guide.

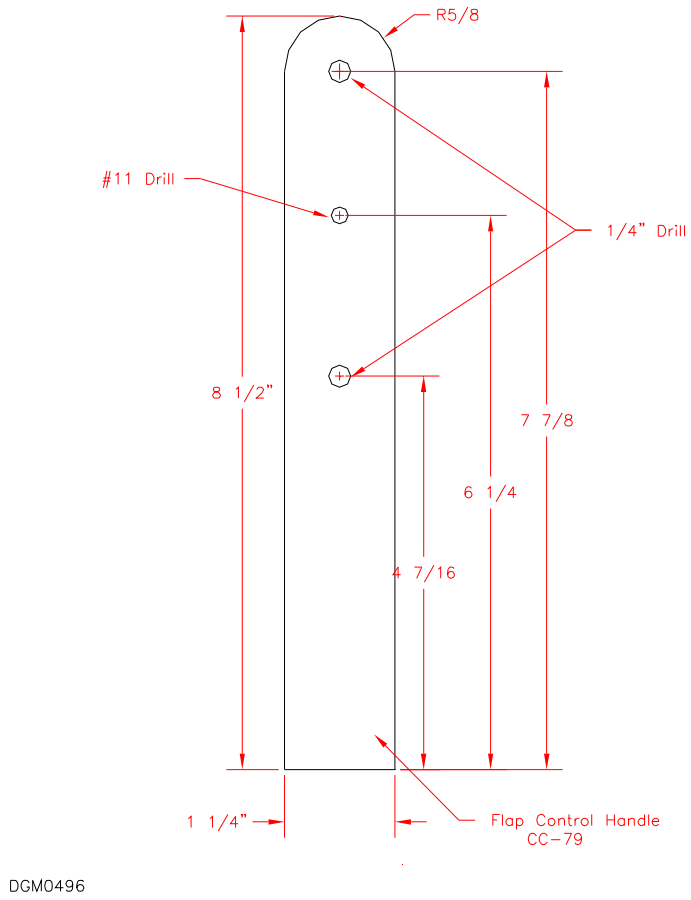



Figure 20.12.3

9) Drill and rivet a .020 doubler strip along the flap rib. Figure 20.12.5. (1" Spacing is recommended)

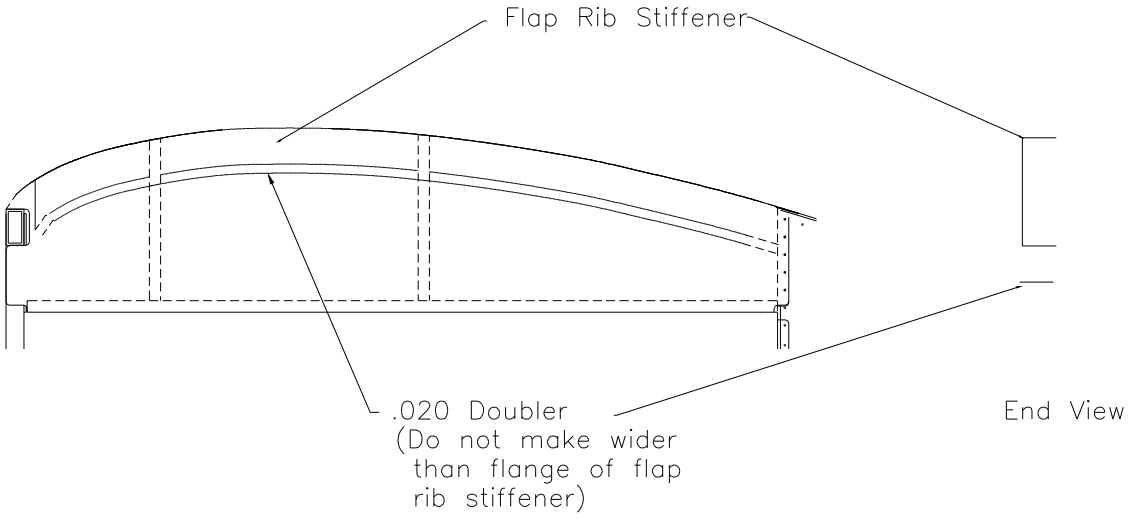



Figure 20.12.5

10) Position the flap guide on the flap rib. Figure 20.12.6.

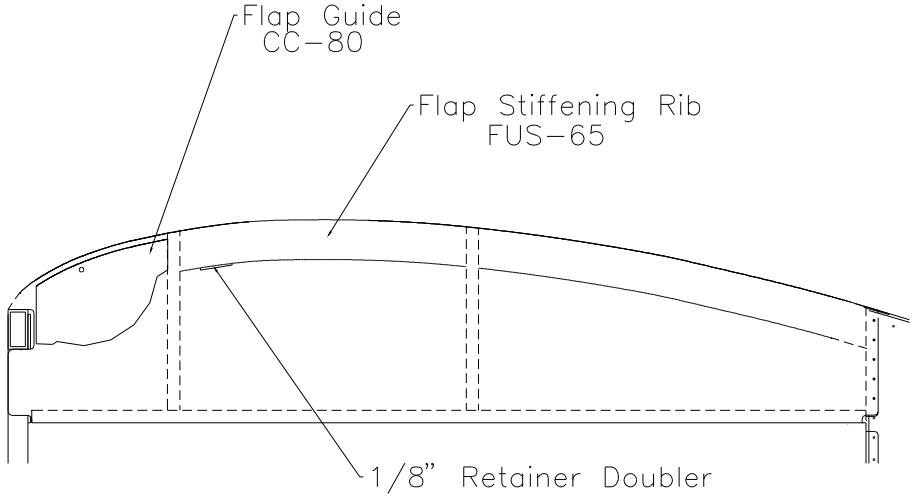



Figure 20.12.6

11) Clamp in place and drill the 1/4" hole through the flap rib. Cleco in place.

12) Drill eleven #11 holes to attach flap guide to rib. Figure 20.12.7.

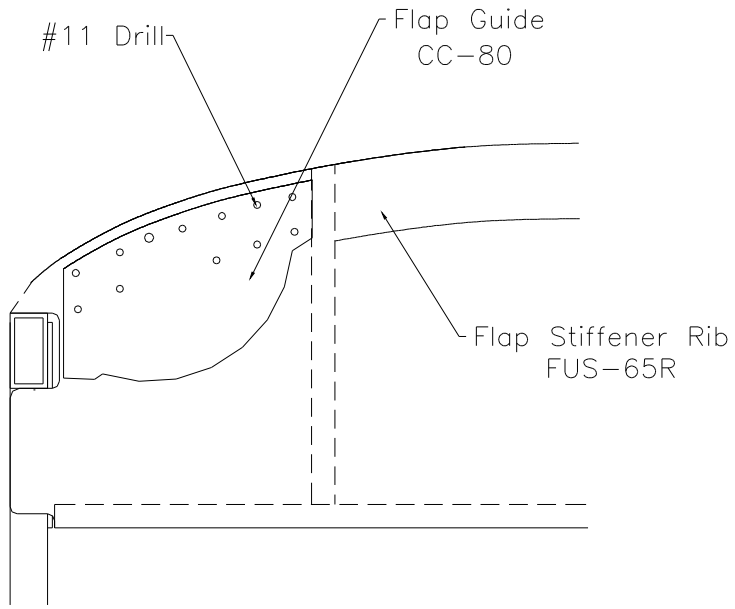



Figure 20.12.7

13) Attach the top hole of the flap handle (CC-79) to the flap guide (CC-80) with AN4-10A bolts.

14) Attach teleflex cable to the center hole of the handle.

15) From scrap .125 material, make a doubler to mount the teleflex retainer (31509) to the flap rib.

16) Attach doubler to the flap rib with 1/8" avex rivets.

17) Position the doubler and drill #11 holes to mount it to the flap rib. Remove, debur and chromate the mating surface. Rivet to the flap with 3/16" x 1/8" avex rivets (RV-5604).

18) Bolt cable retainer to doubler with AN3-6A bolt.

19) Place a felt pen in the center hole of the flap handle and mark a line along the length of travel.

20) Center the controls. Adjust the flap handle so that there is 7/8" space between the mixer arm and the top spacer. Mark the location of the hole in the flap handle onto the flap guide.

21) Mark a spot on the line 1/2" forward of the mark. This is for the reflex position.

22) Mark 3 spots on the line at 1/2" spacing rearward from the mark made earlier. This is for the flap positions.

23) Drill 1/4" holes at the five marks. Debur.

24) Cut the head off a AN4-10A bolt. Install a AN316-4 Jam Nut. Insert the AN4-10A bolt into the flap handle and attach with AN316-4 Jam Nut. Figure 20.12.8. Sand bolt as necessary to allow smooth operation of flaps.

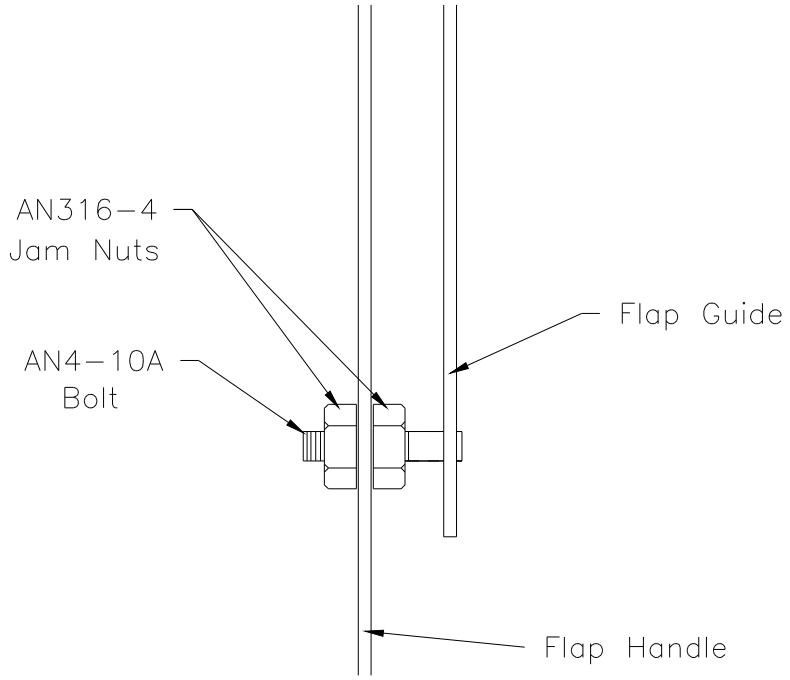



Figure 20.12.8

25) Adjust and safety wire the turnbuckles on the rudder pedals and control column.

# BRAKE PEDAL UPGRADE-SUPER REBEL, ELITE, REBEL, and MAVERICK

After extensive testing in our number two SR prototype, the brake pedal geometry as shown in the manual can be upgraded to improve confined taxiing.

1/ Remove the two tabs from the bottom of the brake pedal to which you would normally attach the bottom of the brake cylinder. File smooth. Fig. 1
2/ File and shape four pieces of 0.063" (BRK-220) supplied by using the full size template to form anchors for the bottom of the brake pedal to the floor as shown in fig. 2. Drill 3/16" holes to take the cylinder retaining bolt, and three #11 holes equally spaced along the flange that will be riveted to the floor.
3/ Bolt the angles to the brake cylinder, position on the floor and drill into the floor through the #11 holes.
4/ Rivet in place with RV-1613 rivets. Fig. 3. Adjust brake pedal to desired position.

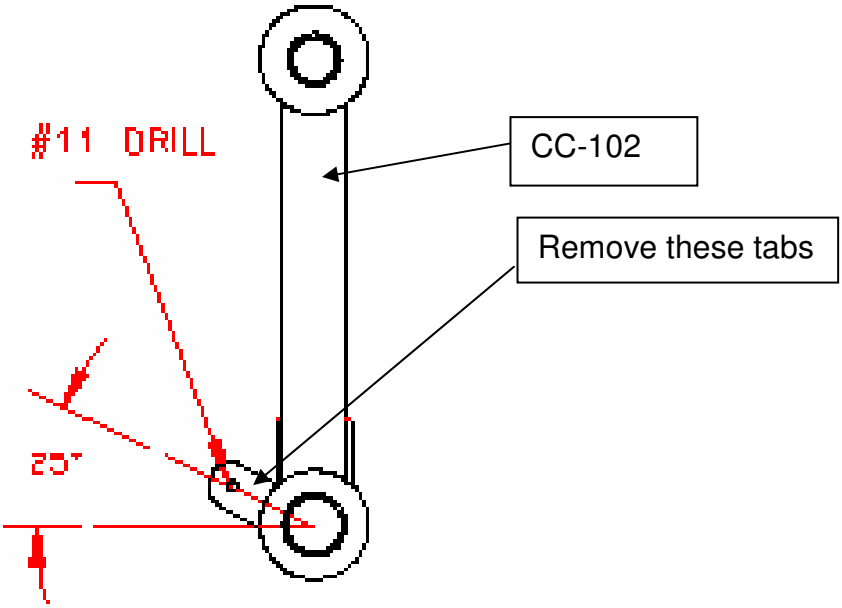
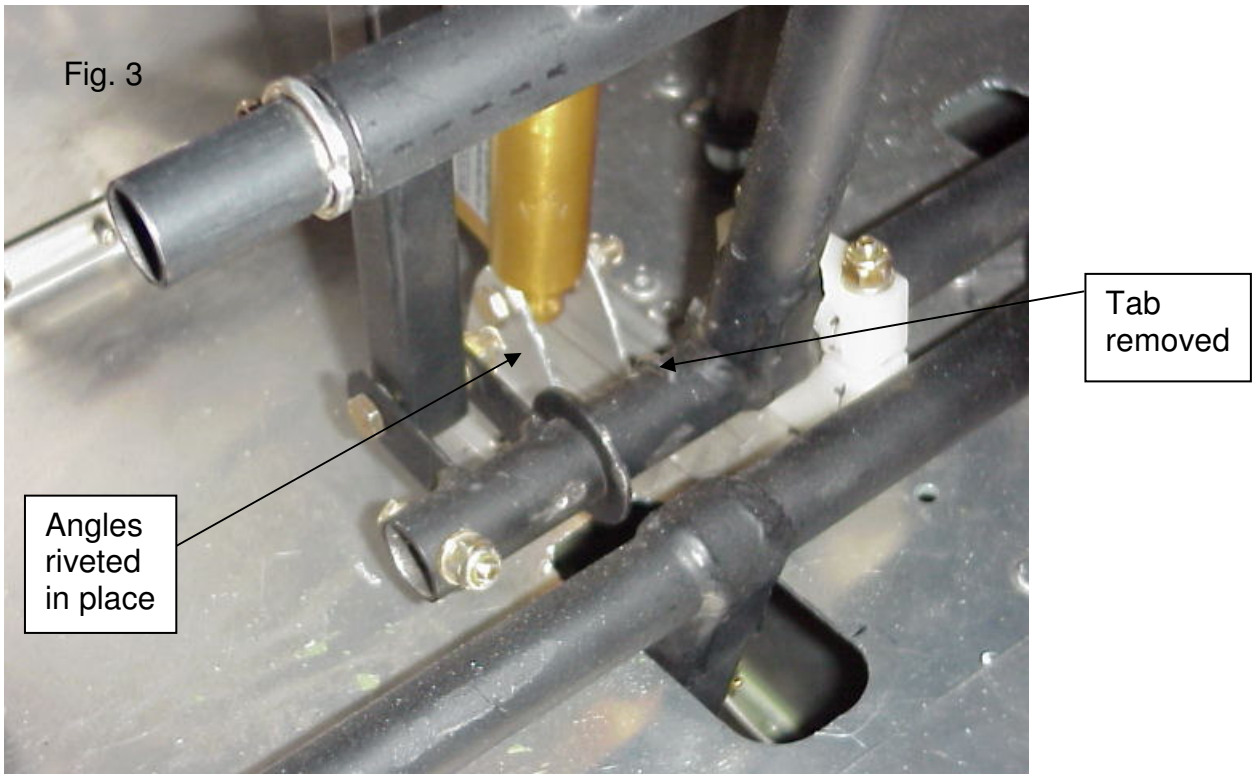



Fig. 1




Fig. 2




SEAT SLIDING MECHANISM UPGRADE-SUPER REBEL

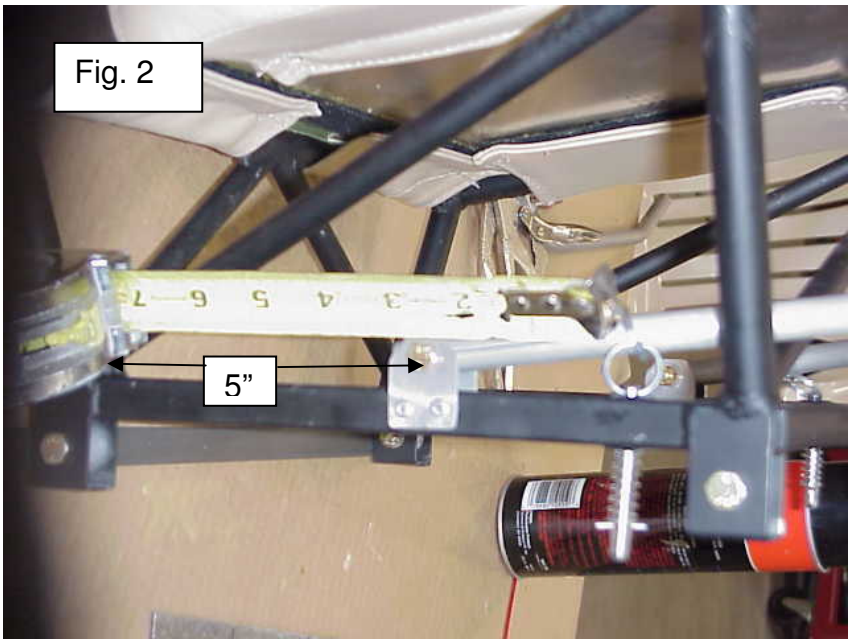
The system used on our own SR demonstrator to slide the seats back and forward was upgraded by the following procedure.

1/ Take the SA-31 supplied in the upgrade kit, and cut five inches off each end. Make up four gussets from 0.040 raw stock (SA-250) using the full size templates provided, and drill two #30 and one #11 hole in each. Fig. 1

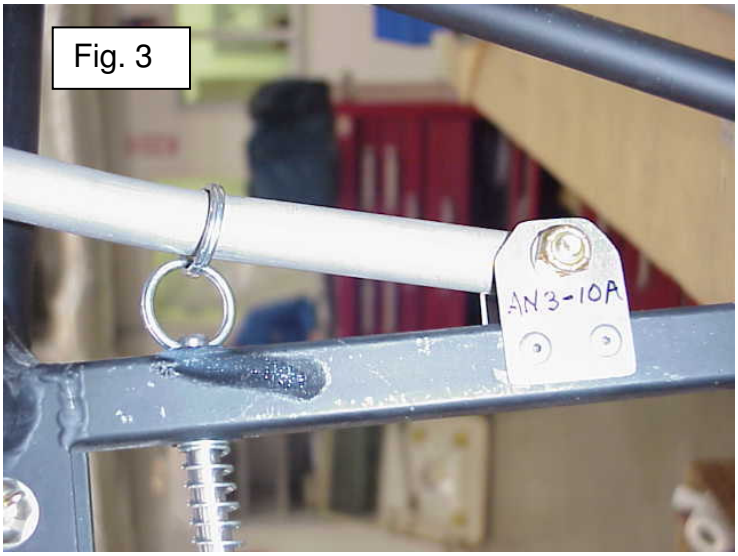



2/ Drill a #11 hole ½" from the cut end of the SA-31.

3/ Rivet the gussets into position on the lower seat tube in the position shown in Fig. 2.




4/ Slide the split rings onto the SA-31 and bolt the SA-31 to the gussets with AN3-10A’s.




5/ The rest of the seat assembly is the same as detailed in the manual.





## *21.1 Bottom Fairing*

1) Place a bottom stabilizer fairing against the underside of the stabilizer as in Figure 21.1.1, with the long flange facing downward.

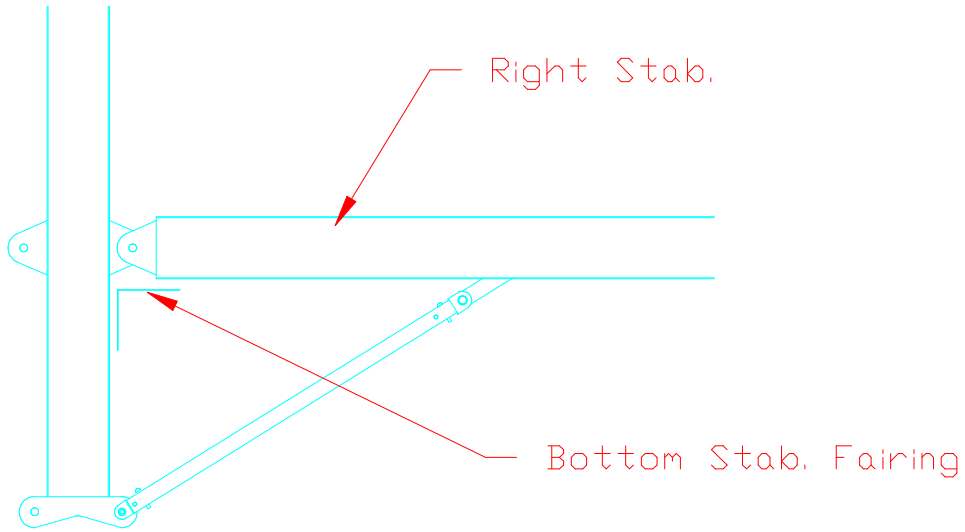



Figure 21.1.1

2) Allowing 3/4” overlap, mark the part for trimming as in Figure 21.1.2.

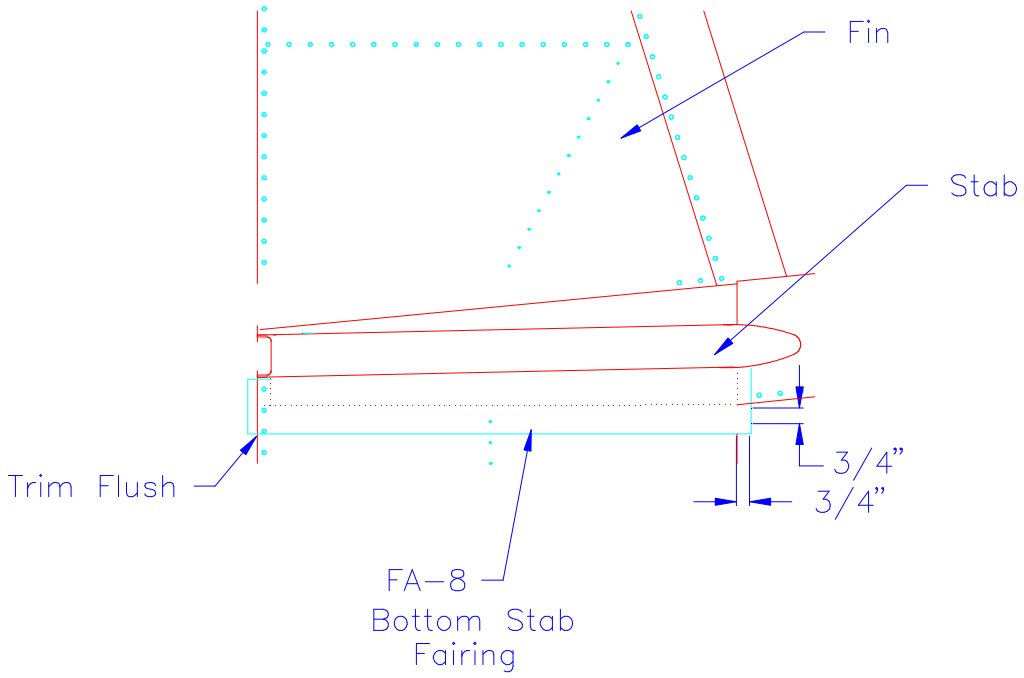



Figure 21.1.2

3) Trim the part to size, allowing 3/4” clearance along the top flange as well.

4) Debur all edges and put a small break 1/4” wide along the edge of each flange as in figure 21.1.3. This can be done using a hand break, or just a slotted block of wood.

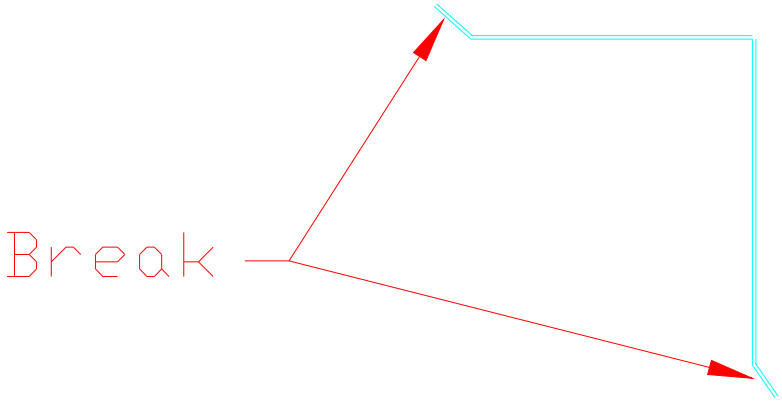



Figure 21.1.3

5) Holding the fairing in place, drill #30 holes through the fairing into the root rib of the stabilizer at 2" nominal spacing. **NOTE:** These rivets must be offset from the original countersunk rivets in the stabilizer.

6) Deburr all holes, apply chromate to the mating surfaces and rivet using 1/8" rivets (RV-1410). Figure 21.1.4.

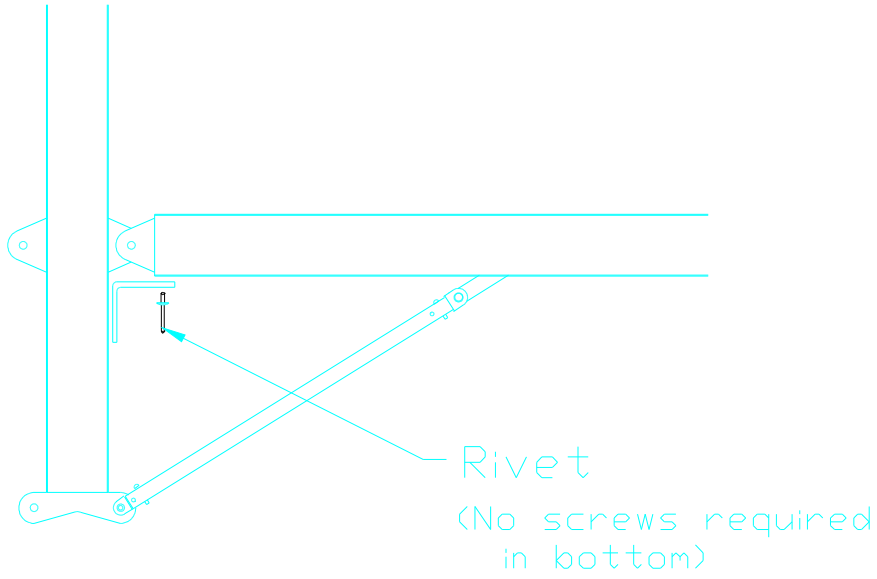



Figure 21.1.4

7) Repeat steps for opposite side.

## *21.2 Top Fairing*

1) Draw a line 3/4" in front of the bulkhead (FUS-36). Using a tape, measure the length of the arc at the line, between the fin and the stabilizer. Figure 21.2.1.

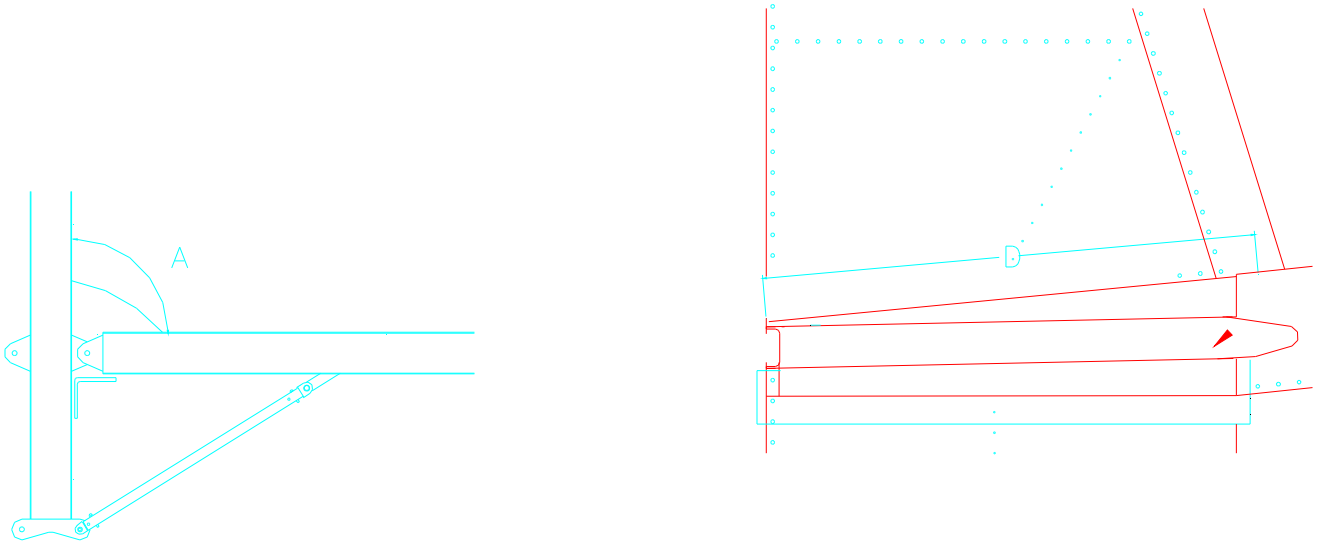



Figure 21.2.1

2) Measure the distance from the junction of the stabilizer and fin spar to the middle of the line.

3) Cut from FA-20 to a width of 8" by the length measured. Then mark a center line down the middle of the part. Figure 21.2.2.

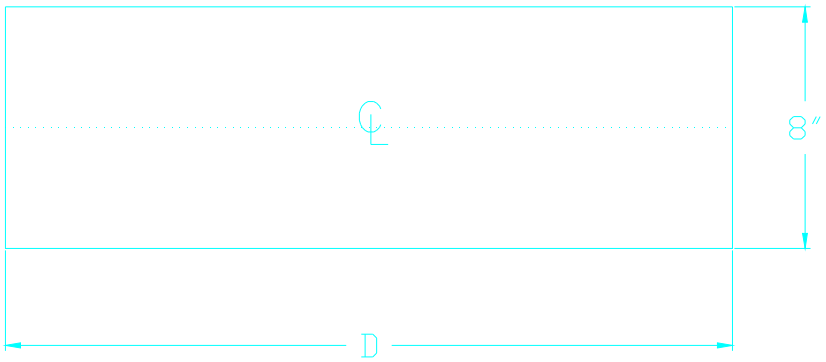



Figure 21.2.2

4) Repeat steps for the opposite side.

5) Divide the length of the arc in half and mark the end points 1/2" the distance each way from the center. Figure 21.2.3.

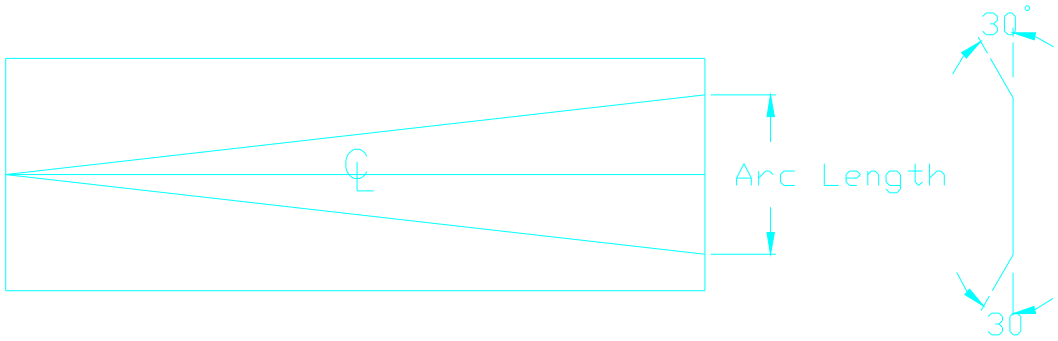



Figure 21.2.3

6) Mark lines from the center to the marks and bend at about 30º as seen in Figure 21.2.3.

7) Then hold the part against a 2" diameter tube as shown and bend it over the tube, until the proper radius is reached. Figure 21.2.4.

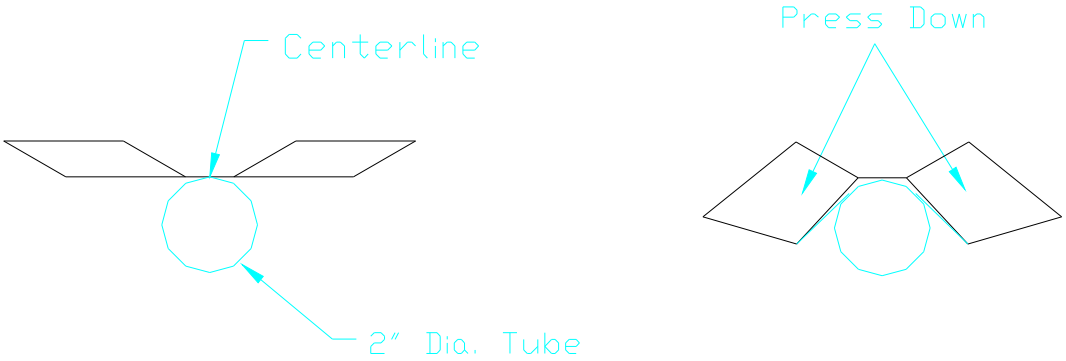



Figure 21.2.4

**NOTE:** The part will taper from a sharp corner on one end to an arc on the other.

8) Repeat steps for the opposite side.

9) Put the fairing in place to check for fit. Make any adjustments to the angles and radius to fit. Figure 21.2.5. A number of small adjustments maybe necessary.

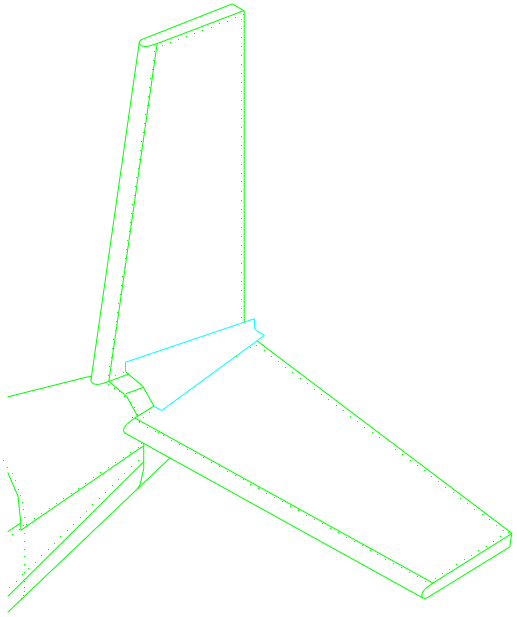


Figure 21.2.5

10) Mark and trim the flanges of the fairing allowing for 3/4" overlap on the fin and the stabilizer.

11) Debur all edges and put a small break, 1/4" wide, along the edge of each flange as in Figure 21.2.3.

12) Hold the stab fairing in place drill a #30 hole in the middle of the arc into the bulkhead (FUS-36). Also drill in the end and middle of the stab fairing flanges into the stab and fin, being sure to avoid rivets already installed underneath.

13) Debur all holes and attach the fairing using sheet metal screws.

14) Repeat steps for the opposite side.

15) Cut from FA-20 about 5" x 8" for the leading edge fairing.

16) Bend to the shape of the leading edge of the stab and place it over the leading edge butted against the fuselage.

17) Trace the contour of the fuselage onto the part, remove and trim.

18) Debur the edges and put the part back in to place. Figure 21.2.6.

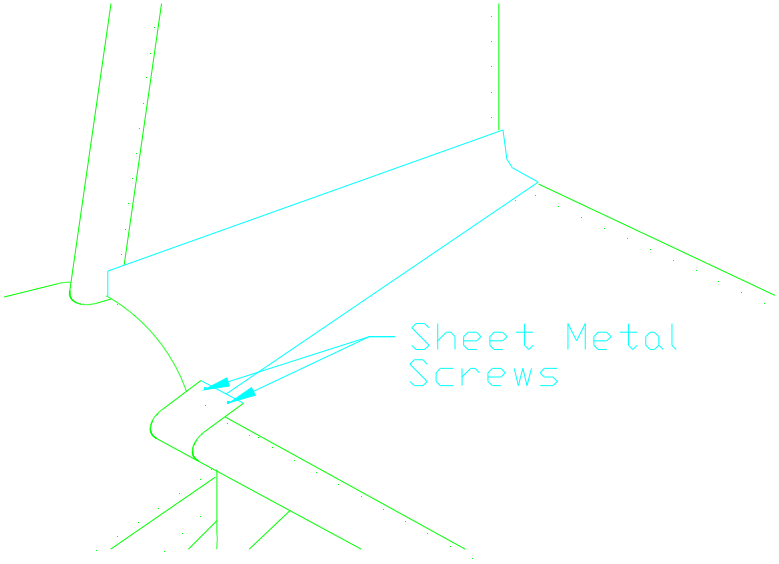



Figure 21.2.6

19) Remove the front screw from the top fairing and slide the leading edge fairing under it. Drill through the attachment hole.

20) Place the leading edge fairing back on top and secure with the sheet metal screw.

21) Drill and debur a second hole as in figure 21.2.6 and secure with a sheet metal screw.

22) Drill two holes and secure the bottom edge with sheet metal screws.

23) Repeat steps for the opposite side.

## *22.1 Seat Panels*

1) Trim two upright seat panels (SA-47) as in figure 22.1.1. Also layout and drill #30 holes.

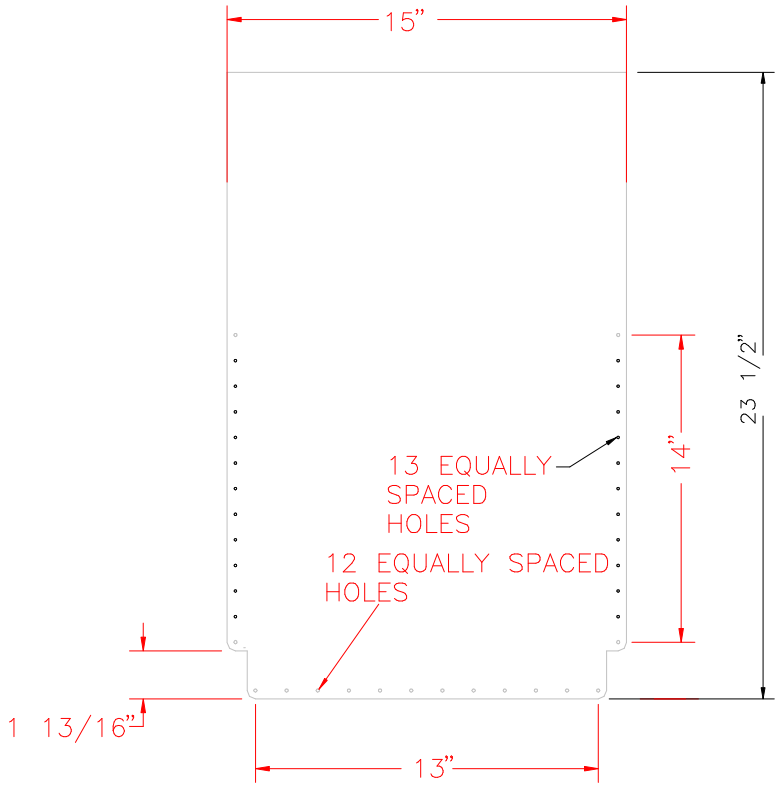



Figure 22.1.1

2) Lay a seat back frame over one trimmed SA-47 panel. Mark the back of the seat panel for trimming. **NOTE:** Where the line marked for trimming intersects with the edge of the material draw a 2” radius circle. This is to be trimmed also. Layout and drill 7 #30 holes along each top edge of the panel. Make sure you leave 5/16” edge distance around the holes. Figure 22.1.2.

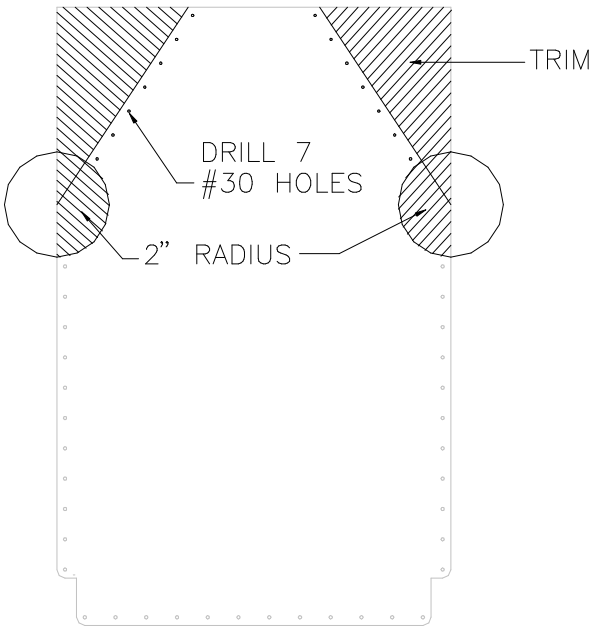



Figure 22.1.2

3) Trim two SA-28's to make bottom seat panels (SA-29) as in figure 22.1.3. Layout and drill #30 holes around the edges.

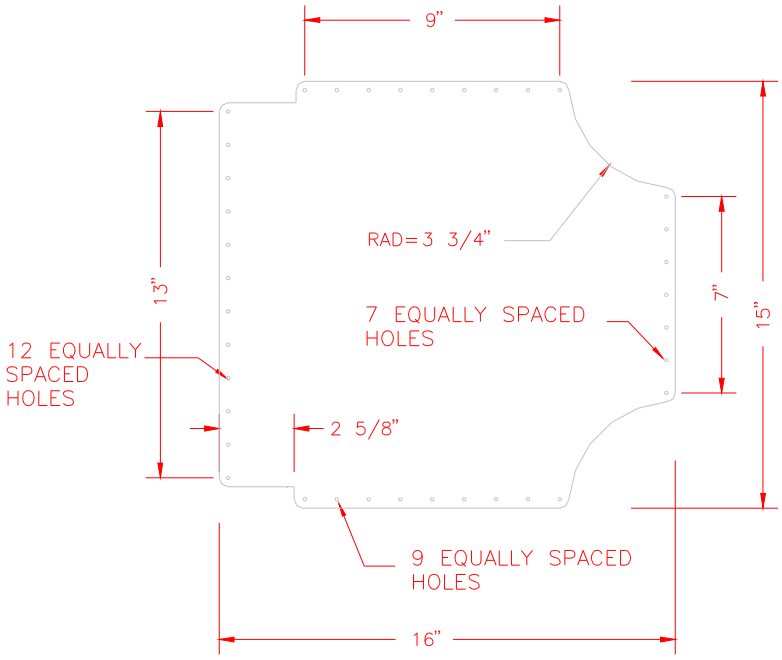



Figure 22.1.3

4) Place a bottom seat panel onto a seat bottom (SA-19) and drill four #30 holes into the seat bottom using SA-28 as a drill guide. Cleco. Figure 22.1.4.

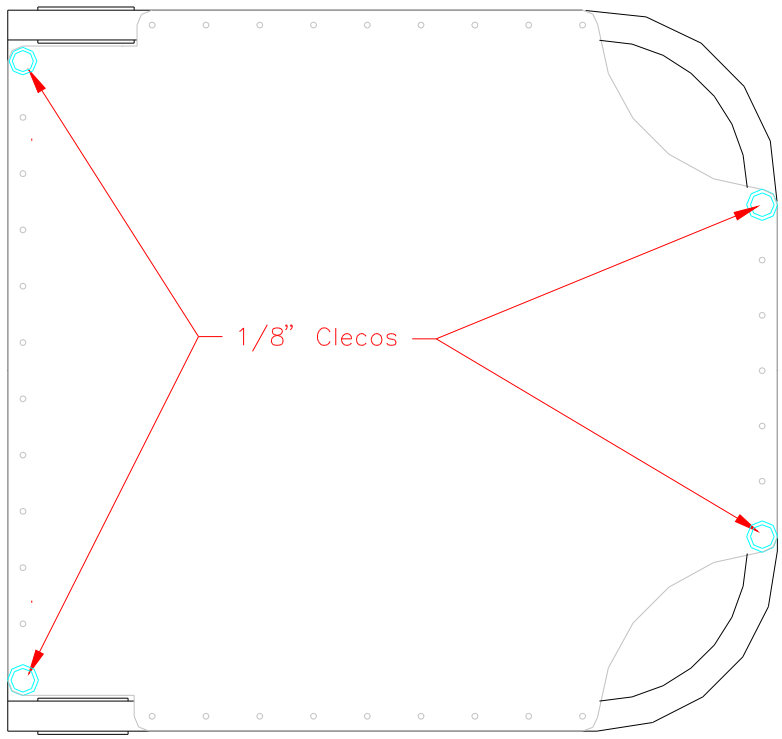



Figure 22.1.4

5) Drill the rest of the #30 holes into the top of the seat bottom. Remove the bottom seat panel and debur.

6) Repeat for the other bottom seat panel.

7) Chromate mating surfaces. Rivet with 1/8" rivets (RV-1410).

8) Place the upright seat panel (SA-47) onto the seat back frame (SA-100). Drill four #30 holes into the seat back frame. Cleco. Figure 22.1.5.

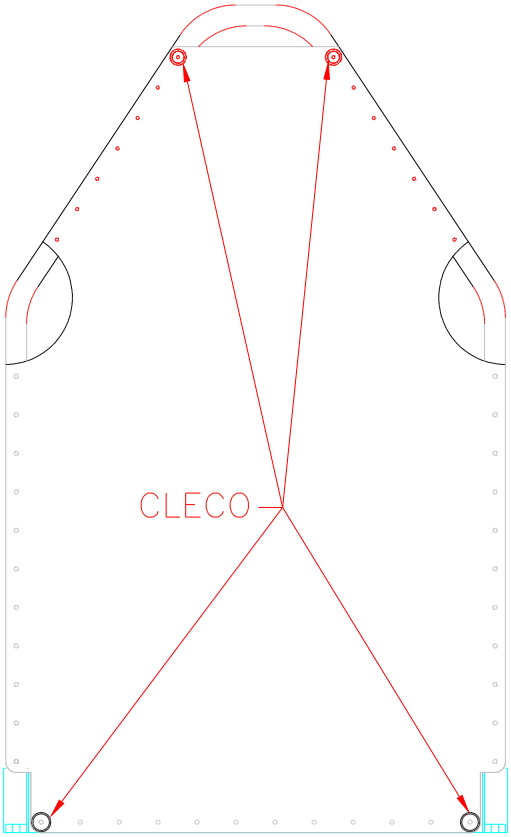



Figure 22.1.5

9) Drill the rest of the #30 holes into the top of the seat back frame. Remove the seat back and debur.

10) Repeat for the other seat back panel

11) Chromate mating surfaces. Rivet together with 1/8" rivets (RV-1410).

12) Install two 5/16" UNC course thread bolts and 5/16" UNC jam nuts into the seat back assembly. Figure 22.1.6.

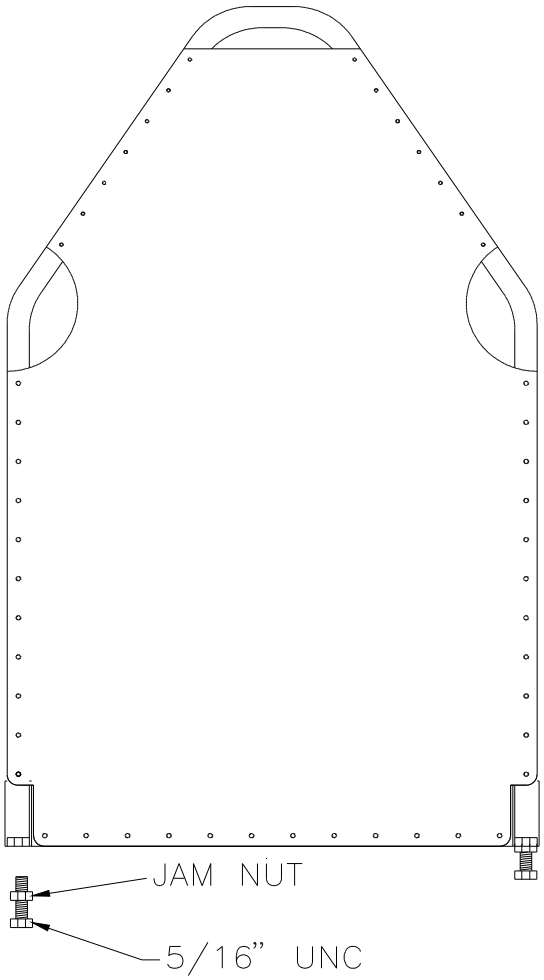



Figure 22.1.6

## *22.2 Seat Base*

1) In the Seat Base SA-19, drill out the eight tabs to 1/4". Figure 22.2.1.

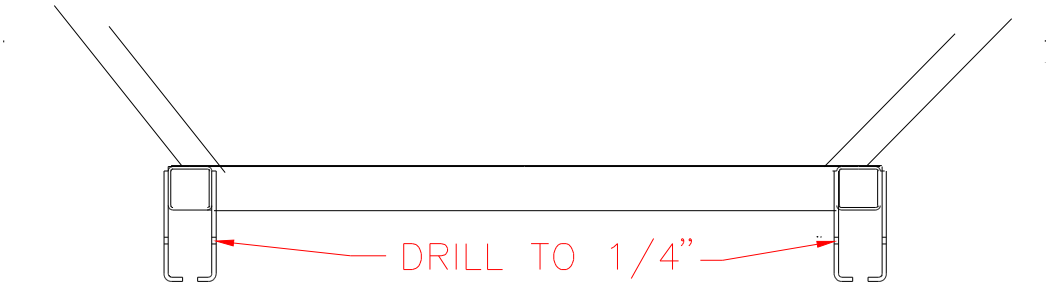



Figure 22.2.1

2) Bolt in the SA-12 Seat Rollers with AN4-11 bolts, AN960-416 washers, AN310-4 castle nuts and cotter pins.

3) Assemble the seat locking pin into the seat base with SA-30, SA-32, SA-33 and SA-34 as in figure 22.2.2.

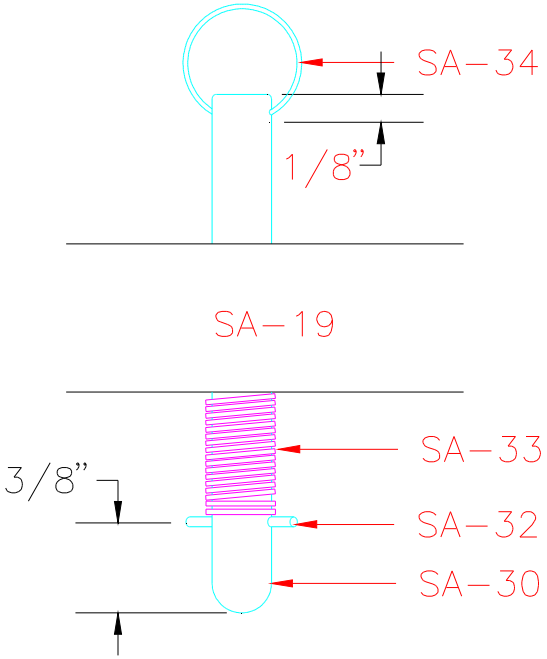



Figure 22.2.2

4) Repeat for the other side.

5) Drill two #11 holes in each of the release levers (SA-31). Figure 22.2.3.

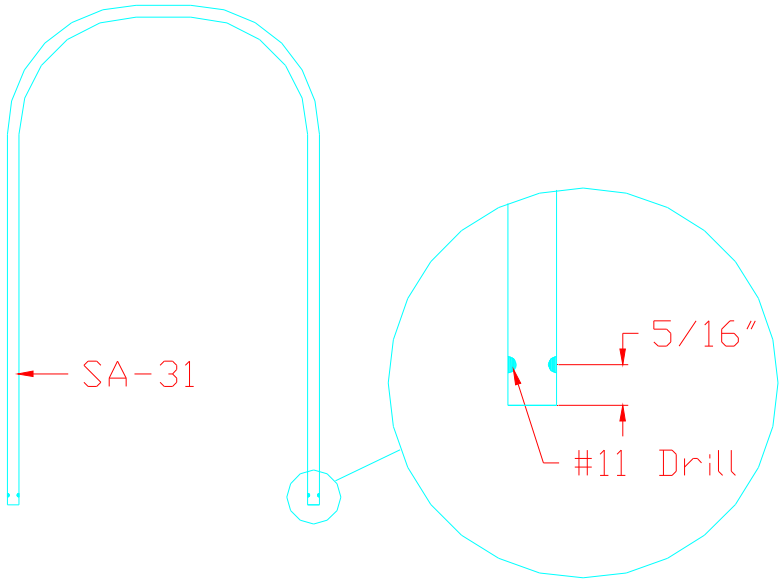



Figure 22.2.3

6) Cut two slots in the ends with a hacksaw. Figure 22.2.4.

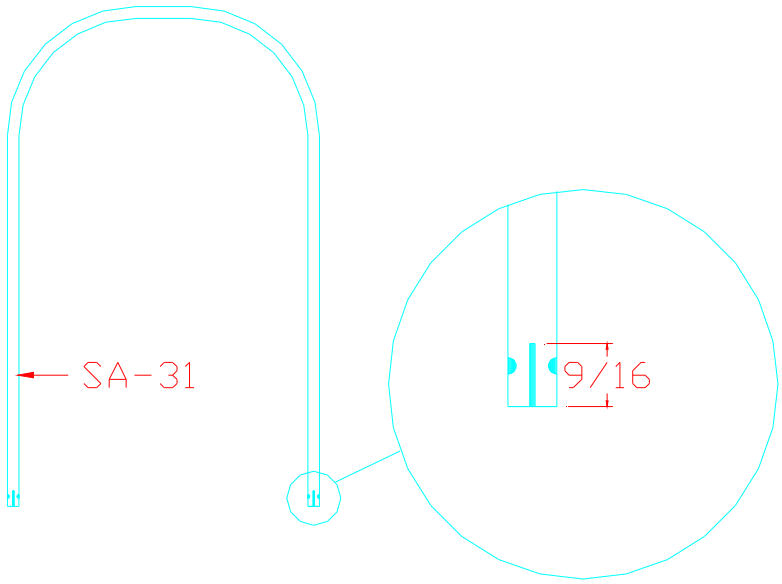



Figure 22.2.4

7) Slip SA-31 through the split rings (SA-34) and bolt SA-31 to the tabs at the rear of SA-19 with AN3-6A bolts. Do not over tighten. Figure 22.2.5.

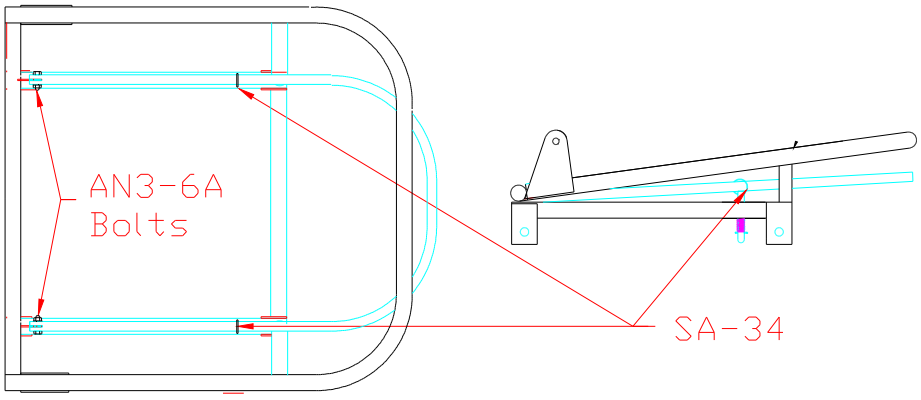



Figure 22.2.5

8) Position seat back SA-100 inside pivot brackets, so the adjustment bolts contact the rear corners of the SA-19 base. Mark through the pivot holes onto the seat back frame and drill to ¼".

9) Attach the seat back to the bottom with AN4-12A bolts. Do not over tighten fiber nuts. Figure 22.2.6.

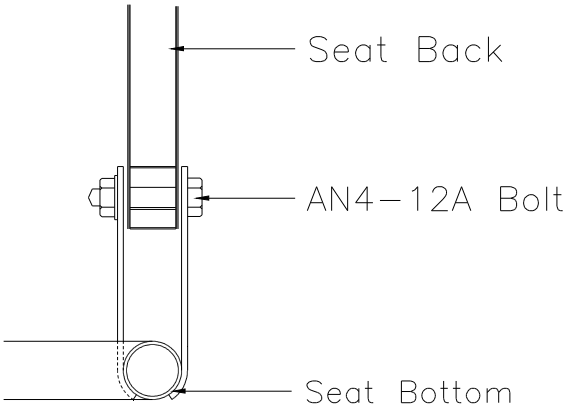


Figure 22.2.6

10) Repeat for the other seat.

## *22.3 Seat Rails*

1) Slide seat rails (SA-27's) into their position under the seat.

**NOTE:** Exact measurement from the control column to seat rails depends on the customer. Also note the pilot side seat rail must be moved inboard 1" to accommodate the push pull tube that runs to the mixer horn.

2) Lock the rail in the same positions on the seat.

3) Position the seat so that the outer flange of the SA-27 track should be aligned with the support channels that were located in the fuselage section. The inside fuselage wrap by the door should be right above the outer channel. (Passenger side only) Figure 22.3.1.

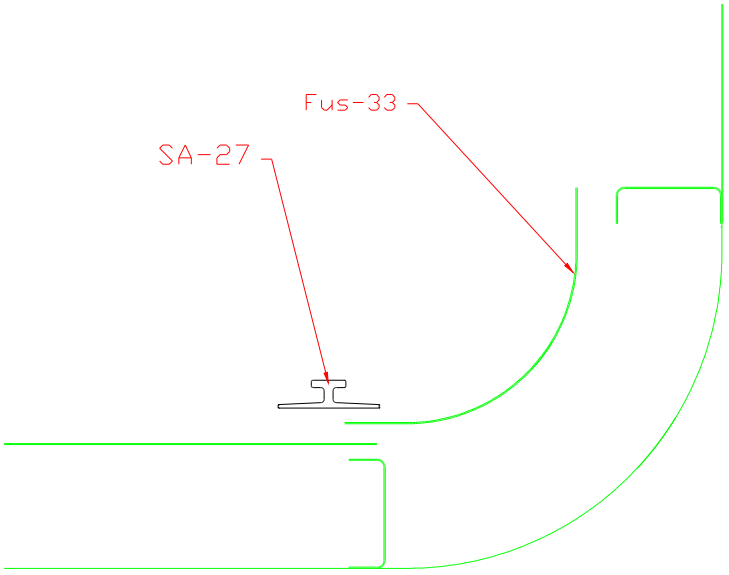



Figure 22.3.1

4) Drill a #30 hole at the front outside flange of SA-27. Cleco. Figure 22.3.2.

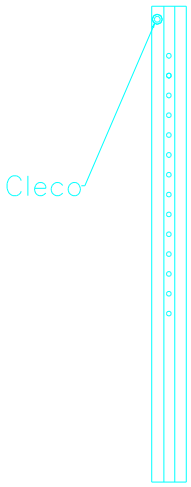



Figure 22.3.2

**NOTE:** Seat left out for clarity.

5) Keep the track parallel to the fuselage. Drill and cleco next to where the track will bend with the floor. Figure 22.3.3. **NOTE:** You will have to mark where the bend will start on the seat rail and bend part in a vise.

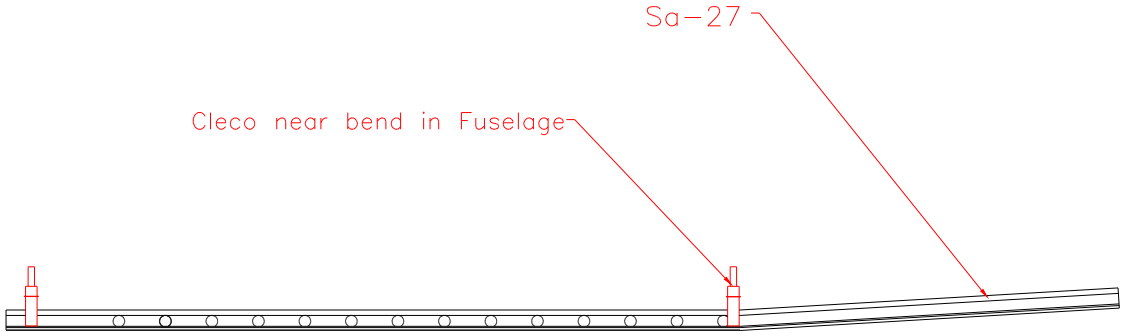



Figure 22.3.3

6) Drill #30 holes into the other track, same as the first track.

**NOTE:** Drilled holes must go through the channels in the floor.

7) Remove tracks and seats.

8) Replace tracks only and cleco into place. Drill #30 holes at 1 1/4" spacing along both flanges of both SA-27 tracks. Figure 22.3.4.

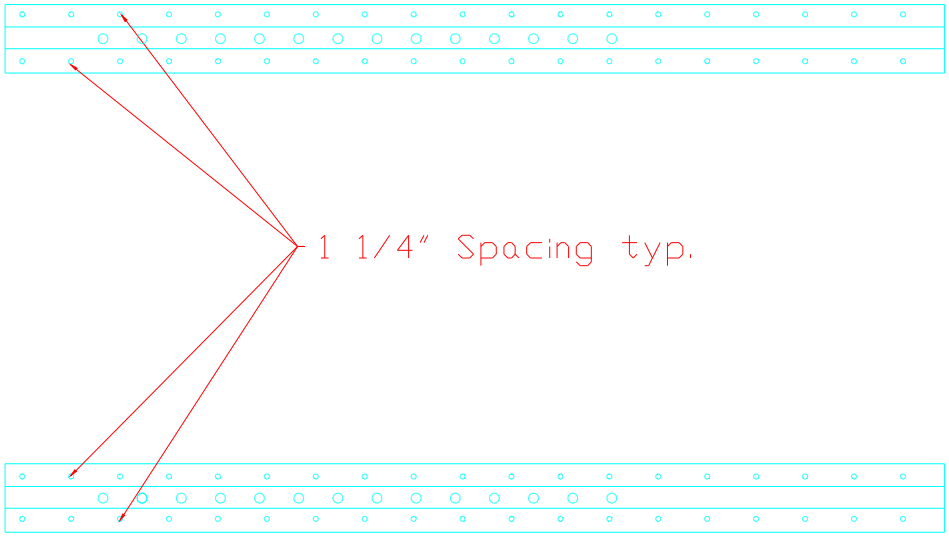



Figure 22.3.4

9) Cut SA-35 into eight 3/4" long pieces.

10) Trim one side off of the SA-35's so that they fit snug on top of the seat rail. Figure 16.

11) Slip four SA-35's over the ends of the rail and butt them up against the backs of the seat frames. Drill a #11 hole through the SA-35 and just mark the top of the rail. Also put four SA-35's over the front of the rails to keep the seats from sliding too far forward. Drill and mark. Figure 22.3.5.

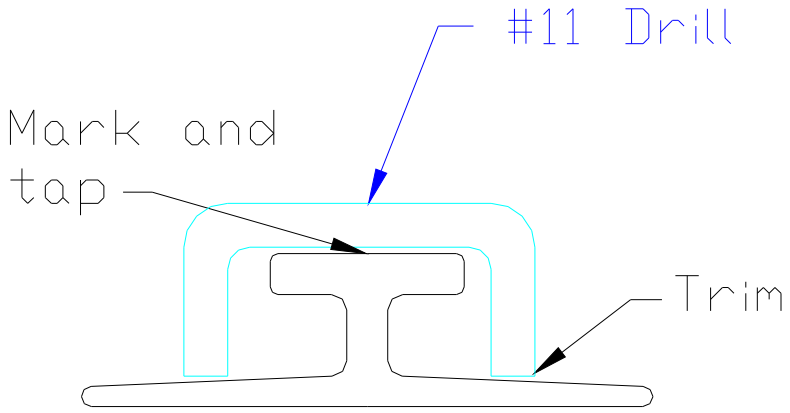



Figure 22.3.5

12) Remove and debur all the SA-35's. Drill and tap the top of the seat rails to take an AN3 bolt.

13) Remove, debur rails and re-install.

14) Bolt the front SA-35's on with AN3-4A bolts and AN960-10 washers.

15) Bolt rear SA-35 when seats are in.

**NOTE:** At this time you can finish riveting down the floor and the seat rails if you do not have any other work to be done under the floor (wiring, fuel lines etc.). If you do have more work to be done you can rivet down the floor any time after it is done.

## *22.4 Seat Belts*

**SPECIAL NOTE:** Even though some pre-made holes in the steel seat belt attachments are 3/8", all bolts used to attach to the airframe are 1/4". This is because it would be impossible to use 3/8" holes in some areas of the airframe without compromising strength or violating minimum edge distances. There should be no concern using 1/4" bolts as the bolts would be under shock loads rather than long term wear. Therefore elongation of the holes or wear of the bolts is not a problem.

Please note however that the larger AN970-4 washers are used as noted at each bolt connection.

The seat belt kit provided with your *Rebel* includes pre-assembled seat belts complete with all latches and adjusters. Therefore only the installation is performed by the builder. Each seat has three separate belt segments as seen in Figure 22.4.1.

Figure 22.4.1

1) Lay the belt harness assembly across the seat as in Figure 22.4.1 to become familiar with the orientation of all fittings.

2) First place the seat in the middle of its range of adjustment. The seat belts have a wide range of adjustment so they should fit any individual.

3) Locate the end fitting for segment #1 on the outside of the gusset at the lower rear of the pilots door. Attach using a AN4-5A bolt. See Figure 22.4.2.

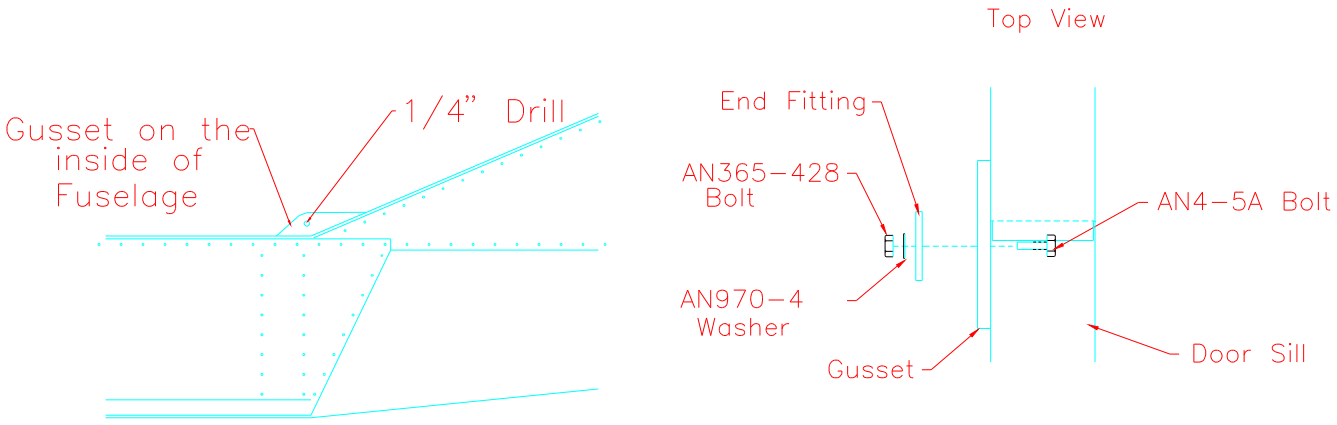



Figure 22.4.2

4) Repeat steps for the passenger seat harness.

5) Secure the end fittings of segment #2 for both sides to the lap belt anchor fitting (FUS-57) which protrudes from the floor just behind the seats. Use a AN4-6A bolt. See figure 22.4.3.

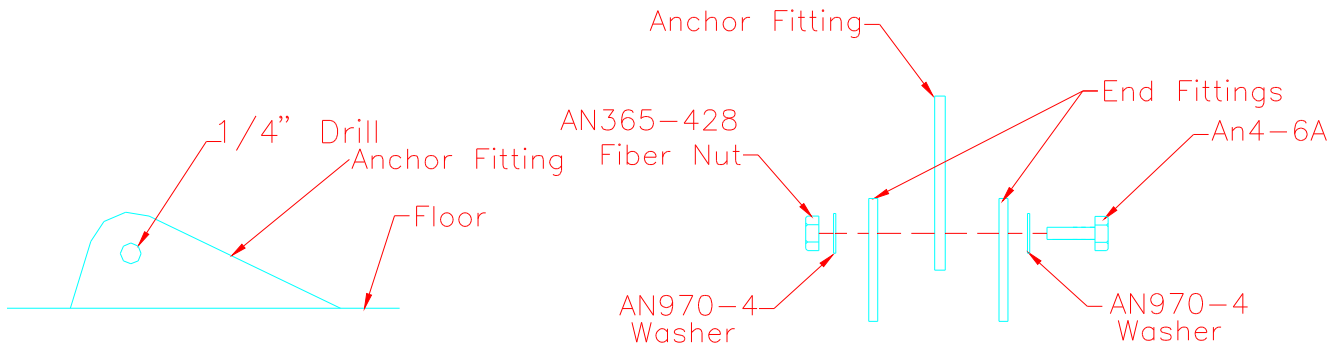



Figure 22.4.3

6) Secure the end fitting for segment #1 (shoulder strap) to the gusset at the top rear of the pilot's door. Use a AN4-5A bolt. See Figure 22.4.4.

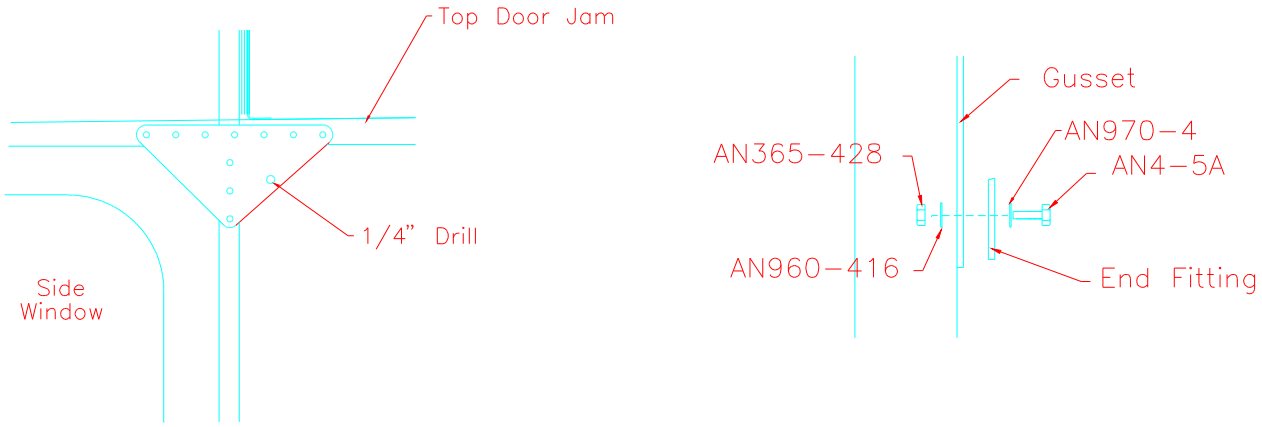



Figure 22.4.4

7) Repeat step for the passenger side.

8) Large adjustments in the lap belt can be made both at the slide adjuster and at the latch buckle. It can be adjusted for a snug fit by adjusting the buckle.

9) Large adjustments in the shoulder harness can be made at the slide adjuster. When getting into the airplane, the shoulder harness is pulled snug by using the spring adjuster.

## *23.1 Door Frame*

1) Using a straight edge mark lines extending from the top and bottom edges of the door frame. Measure the distance between these lines and divide by 2 to find the proper centerline at the front and rear. Figure 23.1.1.

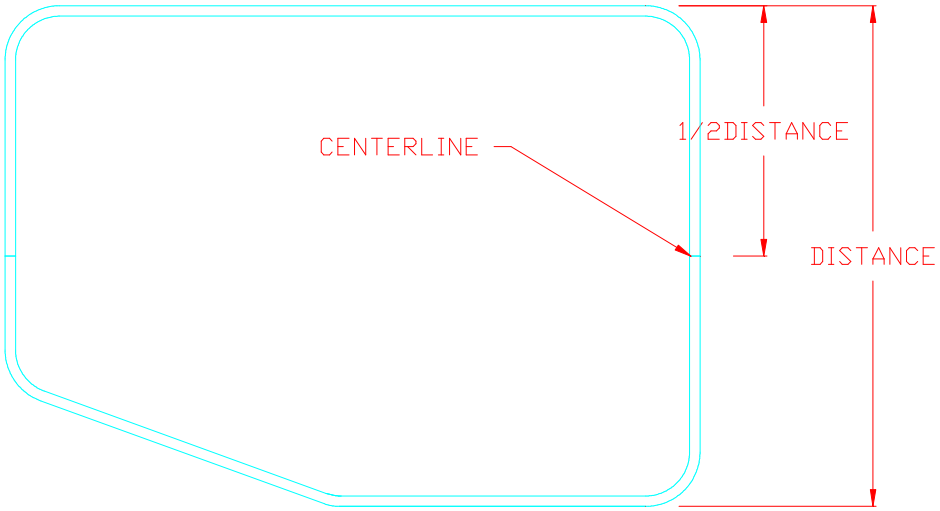



Figure 23.1.1

2) Tape two AN3 bolts to the top and bottom door ledge, so that the heads hang over the edge. These will act as spacers.

3) Place the top door frame (D-1) against the bolts on the top ledge as shown in Figure 23.1.2. Adjust the bend on the part if necessary to match the door ledges.

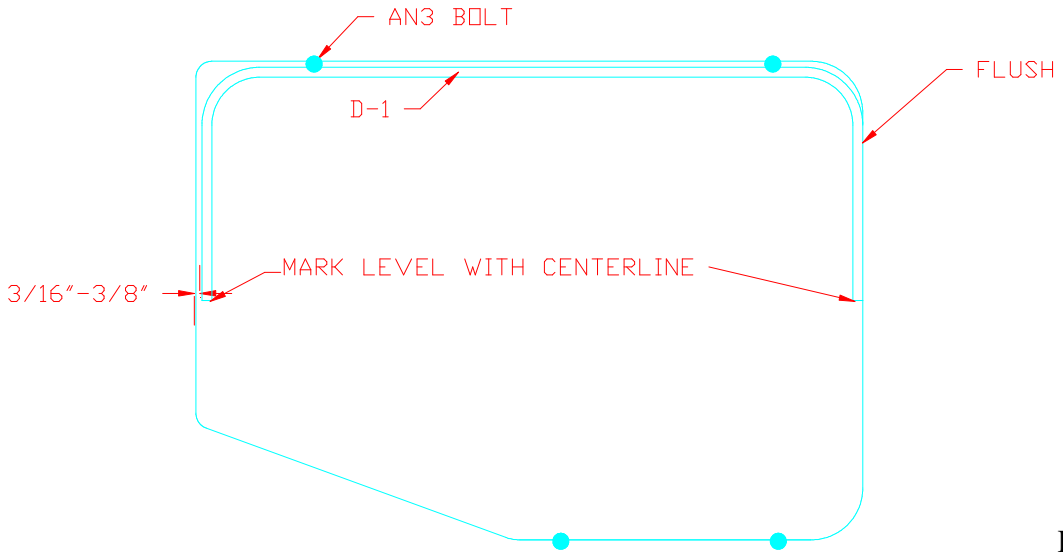



Figure 23.1.2

4) Push D-1 flush against the front door post. This will allow a gap of 3/16" -3/8" at the rear. Mark front and rear side of D-1. Then mark the centerline from the door ledge onto D-1.

5) Remove and trim ends.

6) Repeat steps for the bottom door frame D-2 as shown in Figure 23.1.3

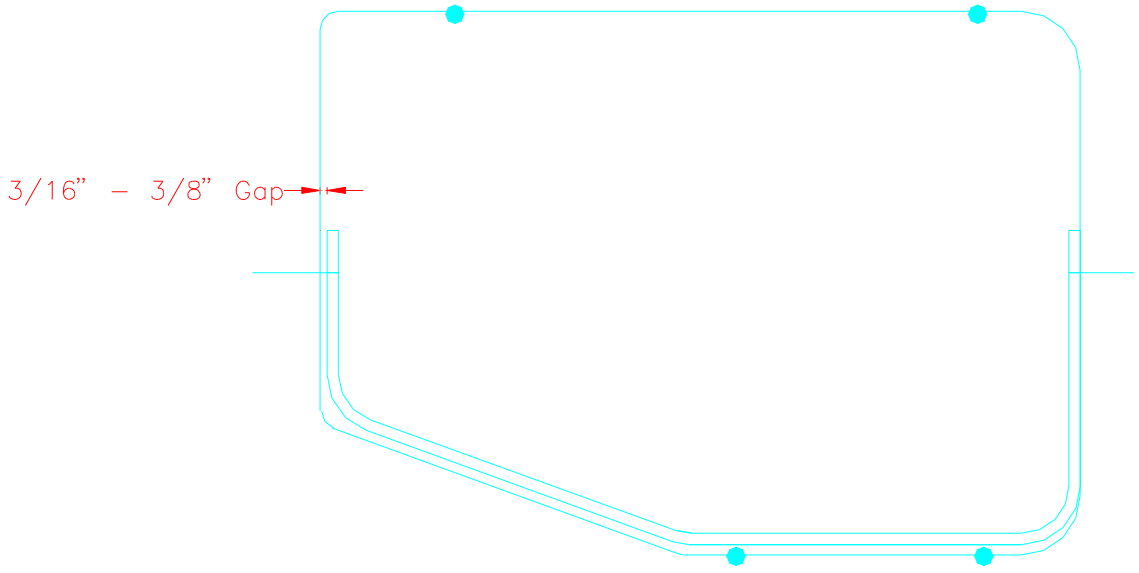



Figure 23.1.3

7) After cutting, lay part D-1 and D-2 upside down on a flat surface with the ends butted together as shown in Figure 23.1.4. (Some minor adjustment of the bends maybe necessary.)

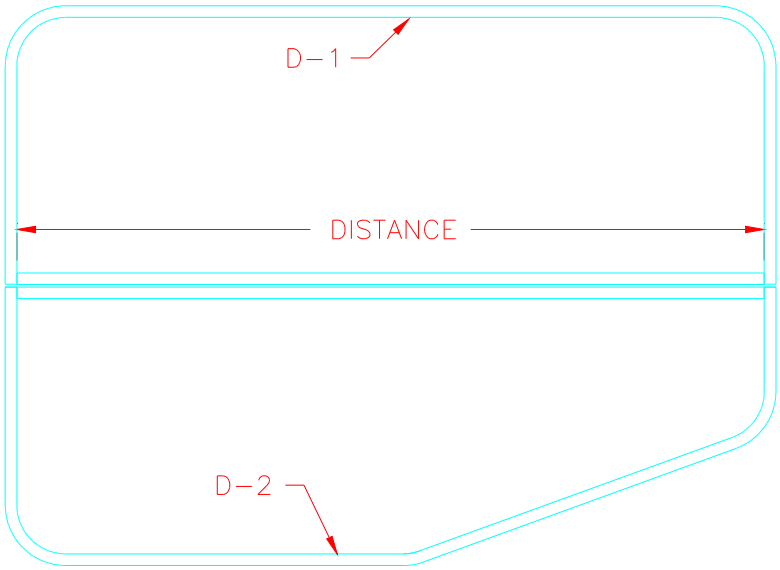



Figure 23.1.4

8) Measure the distance between the ends of parts D-1 and D-2. Cut two equal pieces of 5/8" x 5/8" x .035" tubing from stock supplied in the kit. Fit the pieces between the ends of parts D-1 and D-2 as in Figure 23.1.4.

9) Attach the two pieces to part D-1 and D-2 using door gussets (D-4) as in figure 23.1.5. (The gusset should be set back from the radius on the tube so that it is in full contact with the surface of the tube). Drill and rivet using 1/8" rivets (RV-1410).

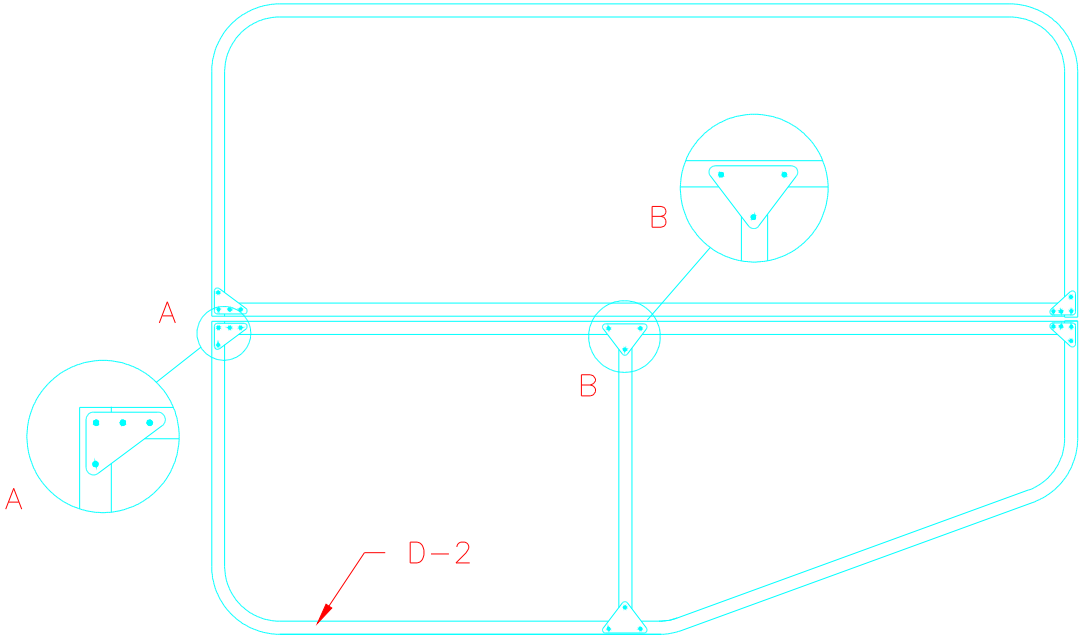



Figure 23.1.5

10) Find the center of the pieces attached and cut one additional piece of tube to fit from the center to the bottom of D-2. Attach using a gusset. (3 1/8" rivets per gusset) Figure 23.1.5.

11) Turn D-1 and D-2 assemblies over with the gussets facing down. Measure the distance between the outside edges of the parts at the center tubes. Subtract 1/8" from this measurement to allow for the radius on each tube and cut one length of aluminum hinge.

12) Center the hinge between D-1 and D-2, drill 6 alignment holes and cleco in place. Drill completely through the tubes, as the holes will be required for location later. Figure 23.1.6.

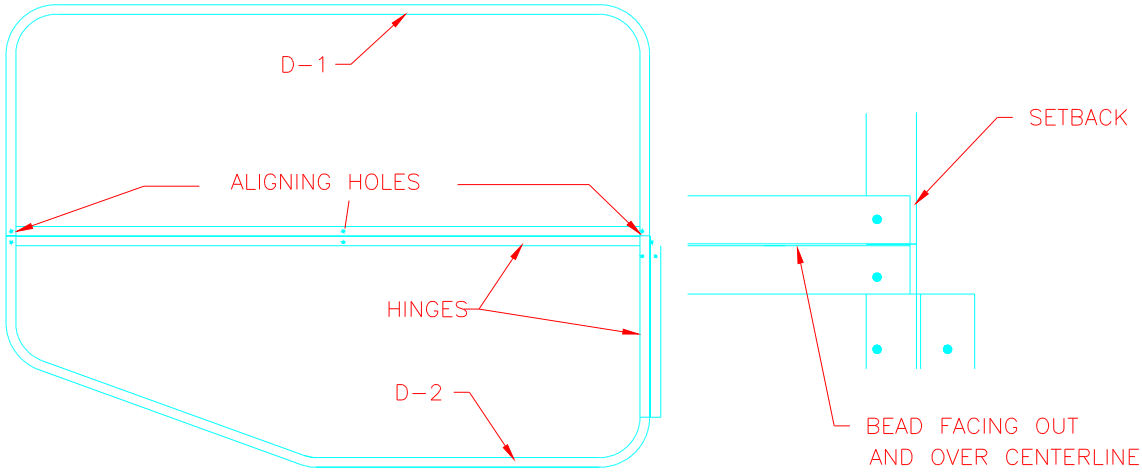



Figure 23.1.6

13) Measure from the bottom of the aluminum hinge to the beginning of the bend at the bottom front of D-2. Cut a piece of stainless steel hinge to this length. Position it as in Figure 23.1.6, with the bead facing outwards and the center of the bead just past the front edge of the frame. Drill two alignment holes and cleco in place.

14) Set the door frame into the door opening, resting it on the two spacing bolts on the bottom, sill. (You may now remove the top bolts as they are no longer required). Slide the frame to the front of the opening. If necessary set it back slightly to allow smooth opening and closing of the window. Drill the top front hinge alignment hole and cleco. See Figure 23.1.7.

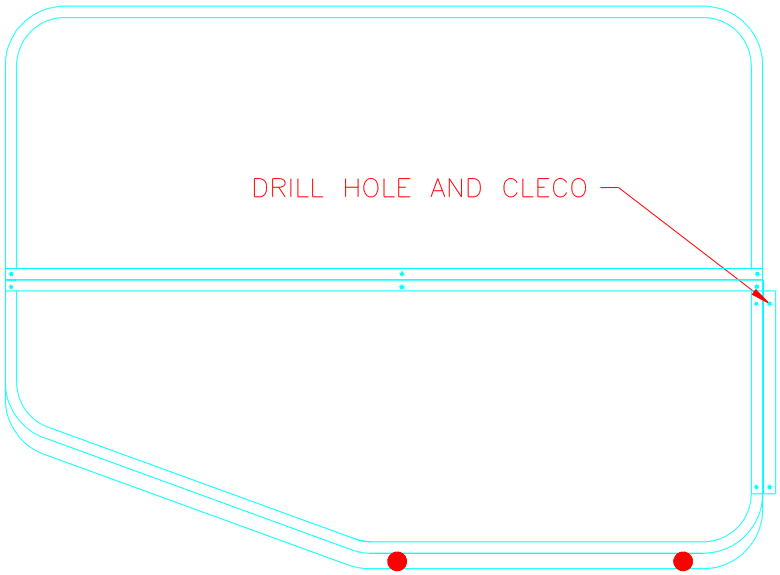



Figure 23.1.7

15) Remove the two bottom spacing bolts. Using the above mentioned hole, cleco as a hinge point, raise the door frame so that it just clears the top of the door opening, while being sure to maintain adequate clearance at the front top half. Drill the second alignment hole through the front hinge and cleco in place. The door should now swing freely on its hinges.

16) Remove the top portion of the door with it's hinge by removing the clecos from the bottom portion.

## *23.2 Door Skin*

1) Position the door skin (D-3) over the bottom half of the door so that the creases align with those on the fuselage skin. Tape the skin in place. (This should be done with the door taped in the closed position). Figure 23.2.1.

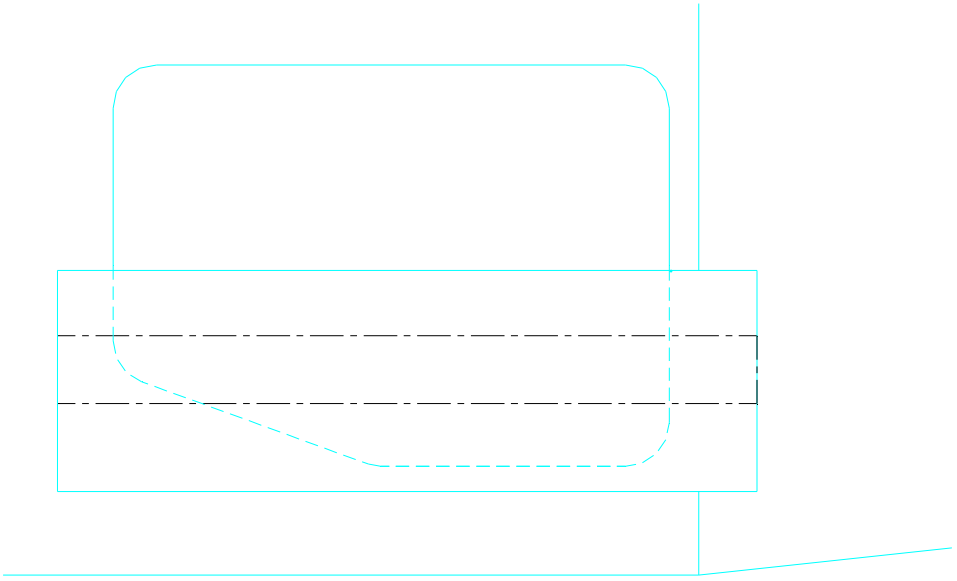


Figure 23.2.1

2) Using a felt marker, from the inside of the cabin, mark lines along the inside of the door frame. Then remove the door frame and skin and place on a flat surface, skin side down.

3) Using the marks to align the skin, mark the outline of the frame on the skin and trim skin to size.

4) Back drill through the frame to locate the hinge alignment holes in the skin. Use the holes drilled earlier.

5) Lay the top door half on the Lexan material supplied and trace the outline to form a window. Cut the window out of the material.

6) Back drill through the frame to locate hinge alignment holes in the Lexan window.

7) The .032" strips (D-6) supplied will be used for gap seals around the doors and windows. You will have to cut each corner piece separately to fit the radius of the frames. **NOTE:** No gap seal is required at the front because of the hinge point. Figure 23.2.2.

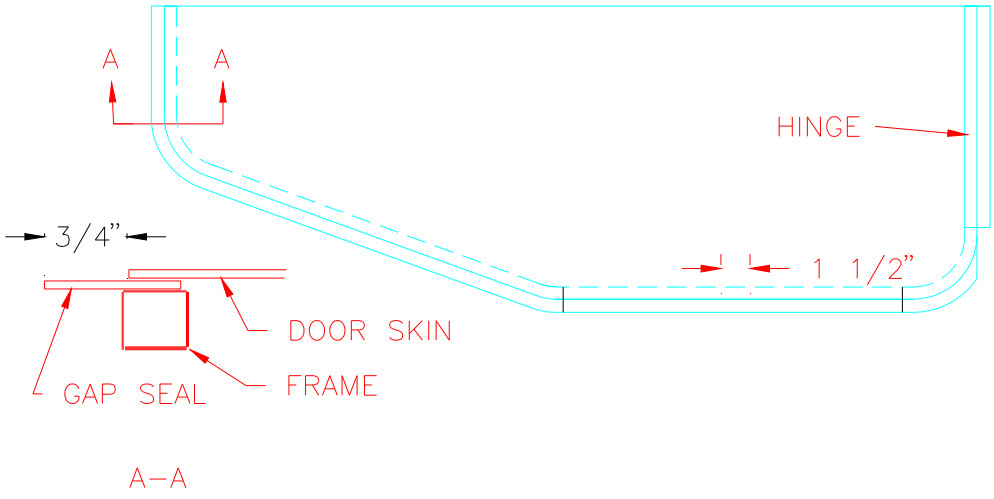



Figure 23.2.2

8) The gap seals will be sandwiched between the skin and the door frame and on top of the window.

9) Locate the strips so that a 3/4" flange remains around the outside edge to act as a gap seal.

10) Drill through the skin, gap seal and bottom door frame as in Figure 23.2.2 using a #30 drill. Hole spacing is 1 1/2".

11) Remove and debur all edges and holes.

12) Chromate mating surfaces.

13) Rivet together with 1/8" rivets (RV-1410).

14) Drill through the gap seal, window and top frame using a #30 drill. Hole spacing is 1 1/2".

15) Rivet together with 1/8" rivets (RV-1410).

16) The top and bottom door halves can now be permanently attached. Cleco the halves together with the hinge and drill #30 holes at 1" spacing along the hinge. Attach using 1/8" rivets (RV-1410). Figure 23.2.3.

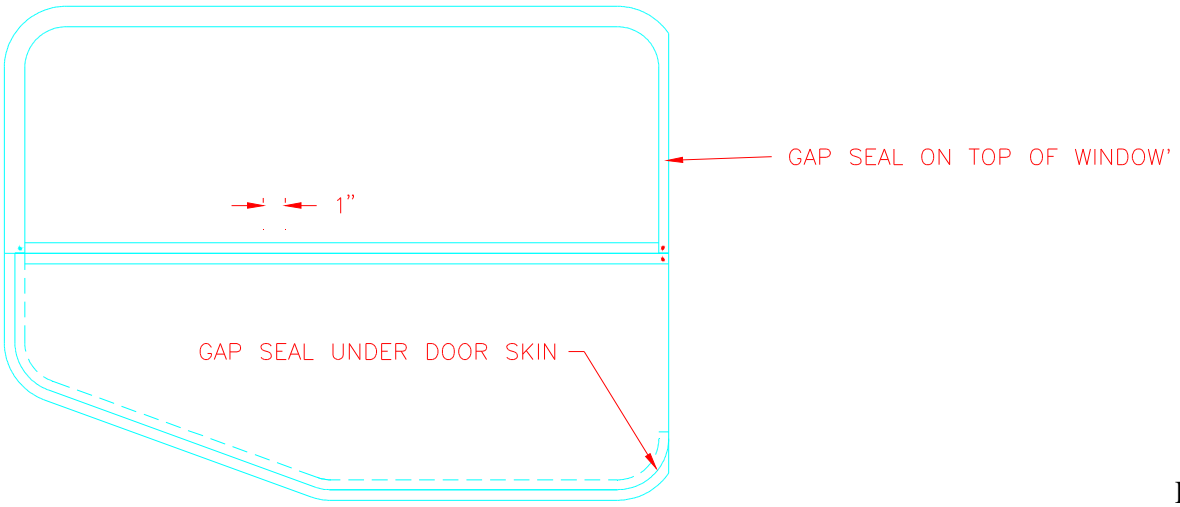



Figure 23.2.3

17) The door can now be attached to the fuselage. Put the door in place and cleco at the hinge. Drill #30 holes at 1" spacing between the clecos and attach using 1/8" x 1/8" stainless steel rivets.

18) The brass stud latch (222041) is used as a window tie-down attachment. The male part of the catch can be located on the window frame as shown in Figure 23.2.4. Tape in place, then lower the window to its open position. Ensure that the catch location will allow you to attach the female part to the door.

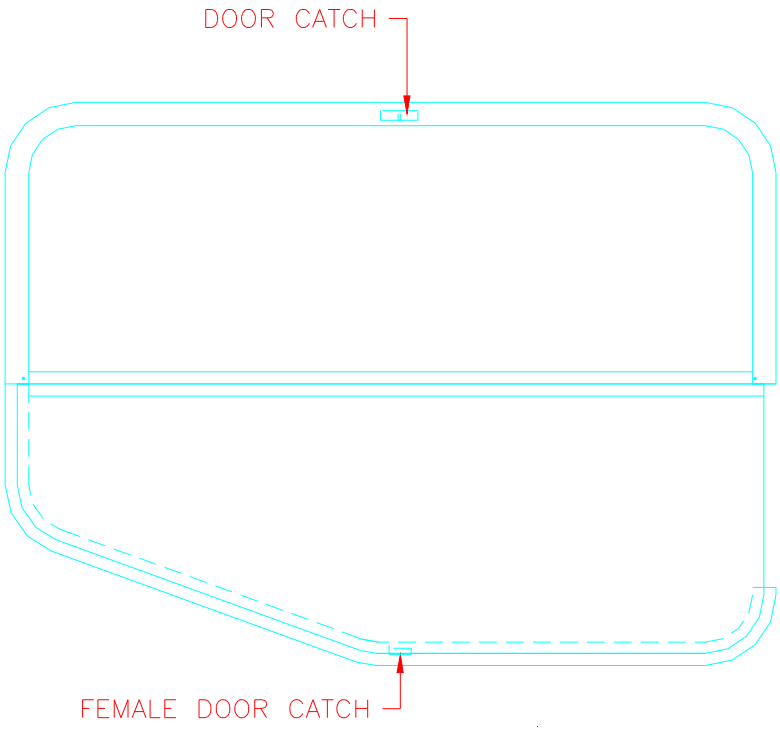



Figure 23.2.4

19) Open the window, then drill and attach the male part of the catch to the window using 1/8" CS rivets (RV-4412).

20) Snap the female part of the catch into place, then lower the door again to the closed position. Using a felt marker, trace the corners of the female catch onto the bottom door.

21) Re-open the door and locate the female catch on the door using the marks as a guideline. Drill and rivet as you did to the male part.

## *23.3 Door Latch*

1) Using a tape measure, mark a line 7 1/2" up from the rear corner of the door opening. This will form the bottom edge of the latch hole. Figure 23.3.1.

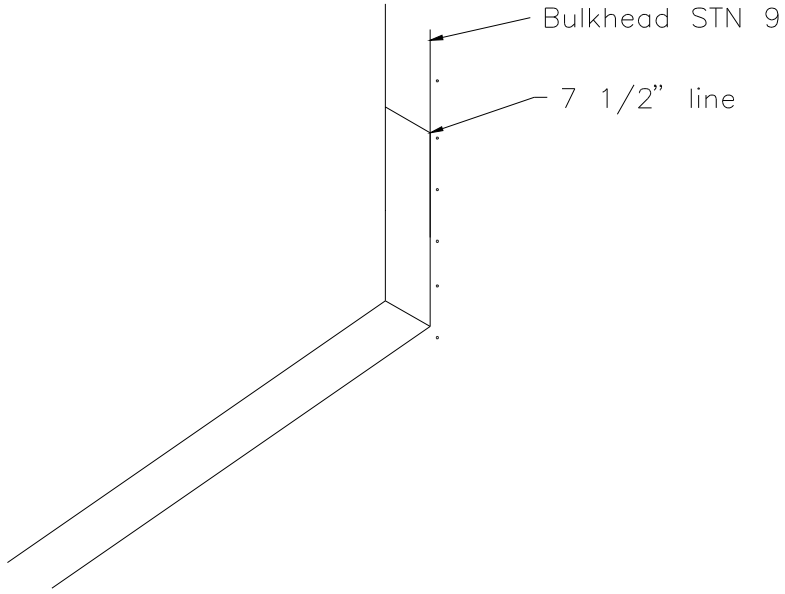



Figure 23.3.1

2) In the center of the door sill, mark a 1/2" square hole as in figure 23.3.2. Drill the corners with a 1/8" drill and cut out using aviation snips. File edges.

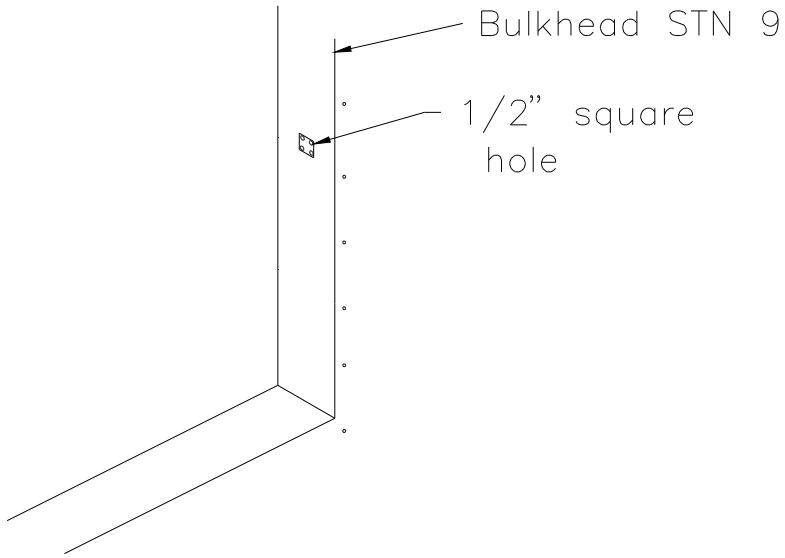



Figure 23.3.2

3) From .063 material (D-16) cut two reinforcing plates as in figure 23.3.3.

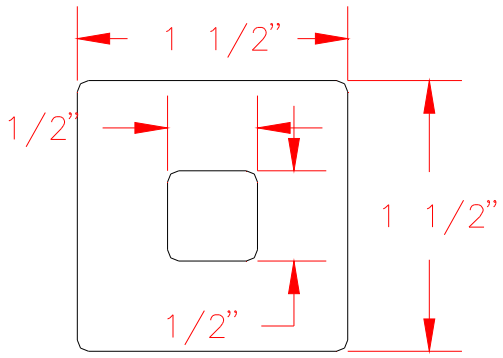



Figure 23.3.3

4) Place one reinforcing plate over the hole and drill through each corner of the plate into the sill with a #30 drill.

5) Cut two 1 1/2" x 1/2" x .063" strips for use as spacers under the reinforcing plate. Drill them using the plate as a template.

6) Debur all holes and edges.

7) Attach using rivets (RV-1410) as in figure 23.3.4. Repeat for opposite side.

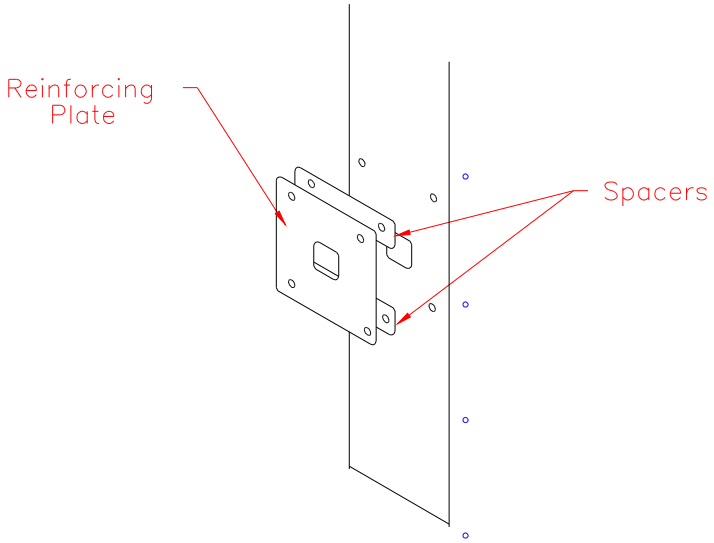



Figure 23.3.4

8) Cut a piece of 5/8" x 5/8" x .050 6063-T5 stock material (D-7) to the dimensions in figure 23.3.5. This part now becomes D-8.

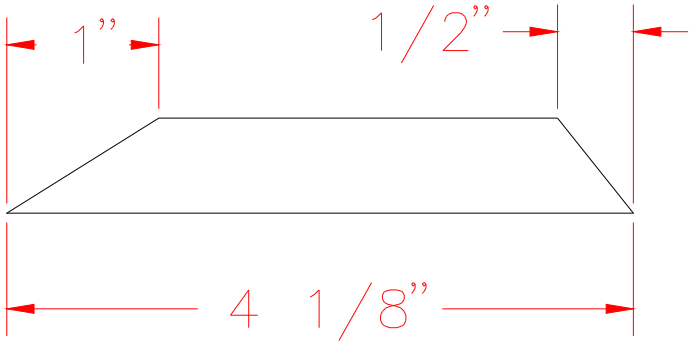



Figure 23.3.5

9) Cut a piece of 5/8" x 5/8" x .050 6063-T5 raw stock (D-7) at 3 1/2" long (this part now becomes D-9). Figure 23.3.6.

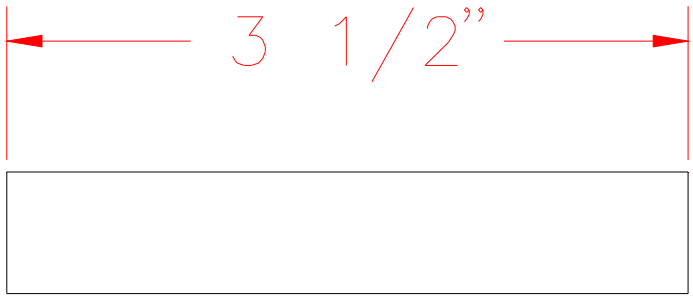



Figure 23.3.6

10) Line up one end of D-8 flush with D-9. Drill a #30 hole through the center of the two tubes. Cleco. Drill a #30 hole at the other end. Figure 23.3.7.

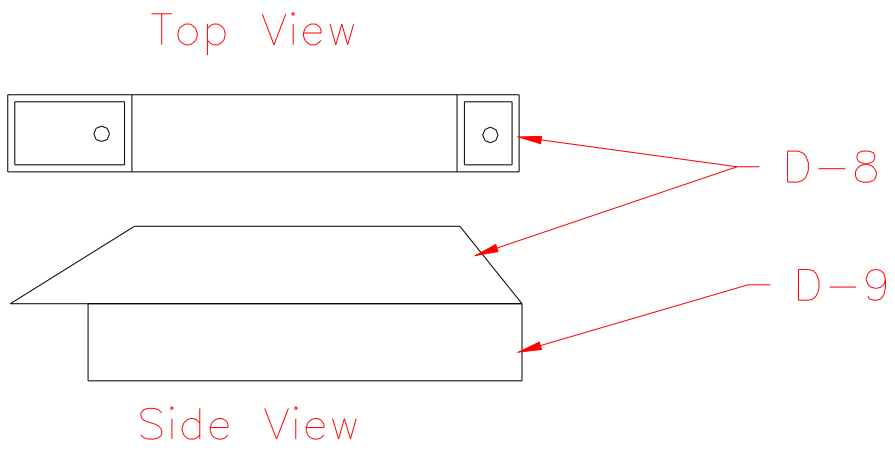



Figure 23.3.7

11) Countersink the holes in D-8 tube so that 1/8" CS rivets (RV-4412) will be flush.

12) Debur and chromate the mating surfaces. Rivet together with 1/8" CS rivets.

13) Using a tape measure, mark a centerline on D-8 Tube. Mark a line 1" from the flush end. Drill a #30 hole in the center of the D-8 tube. Figure 23.3.8.

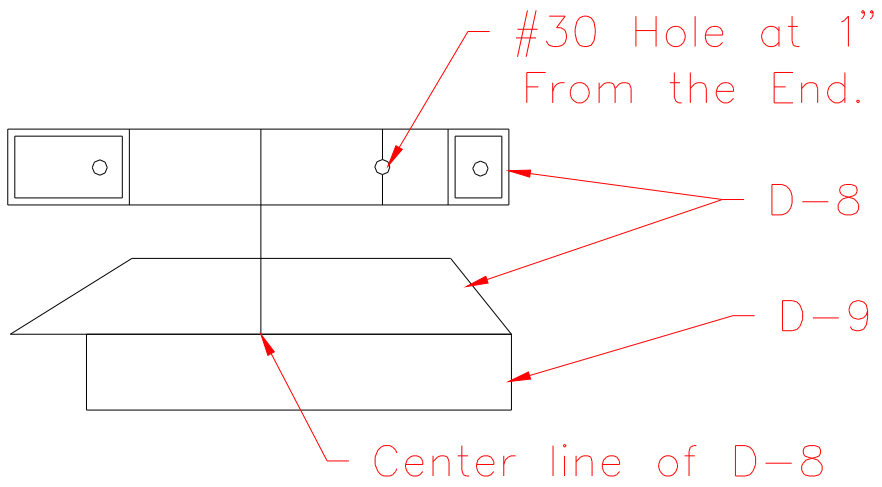



Figure 23.3.8

14) Repeat steps for the other door latch holder.

15) Position the door latch holders on the door where the holes in the door jams are. Drill three #30 holes through the door and door latch holder. Cleco in place. Drill a #30 hole through the door latch holder and door jam. Figure 23.3.9.

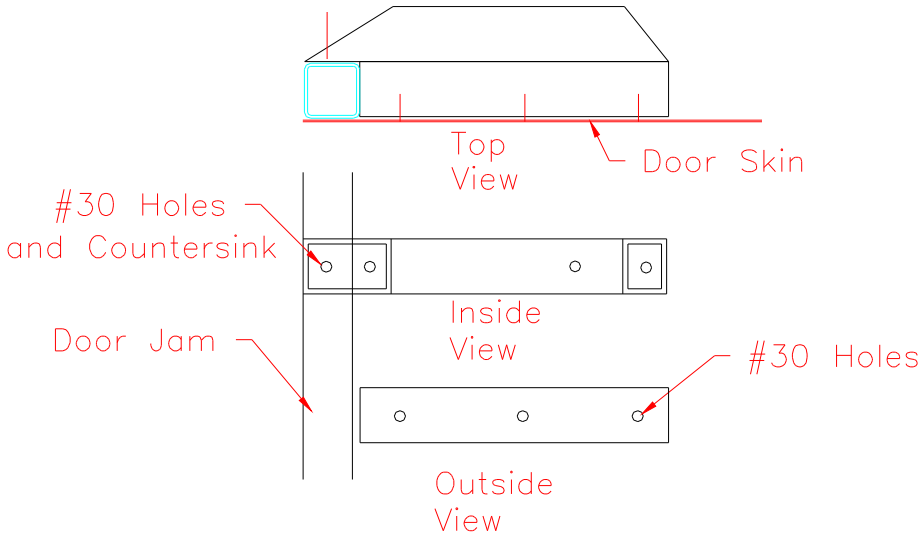



Figure 23.3.9

16) Countersink the hole in the D-8 tube. Figure 23.3.9.

17) Remove and debur all parts. Rivet into place with three 1/8" rivets (RV-1410) and one 1/8" CS rivet (RV-4412) (into the door frame).

18) Cut two 1/4" long pieces (D-12) and two 1/2" long pieces from 3/16" x .035 6061-T6 raw tubing (D-11).

19) Debur all parts.

20) Get the two pieces of 1/2" x 1/2" Delrin material (D-18).

21) Insert door latch springs (D-17) into the slot of the Delrin blocks. Place one D-12 tube (1/4") at the one end of the spring in the slot. Figure 23.3.10.

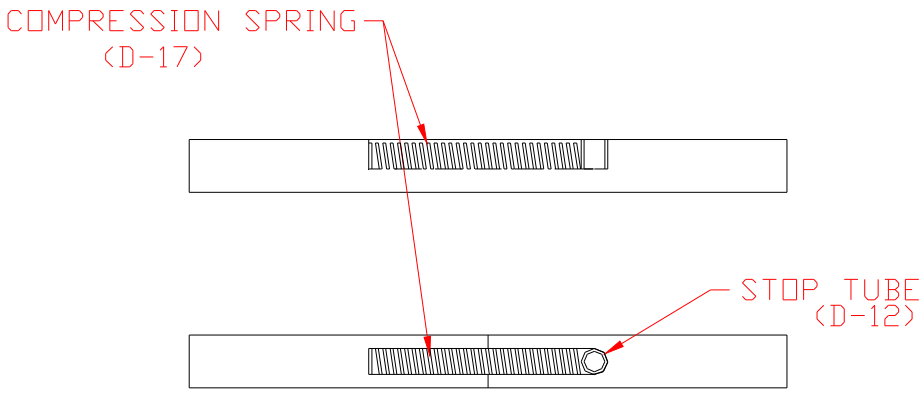



Figure 23.3.10

22) Slide the Delrin block assemblies into the D-8 tubes at the two rear door latch areas as in figure 23.3.11. Align the 3/16" tube with the #30 hole and cleco in place.

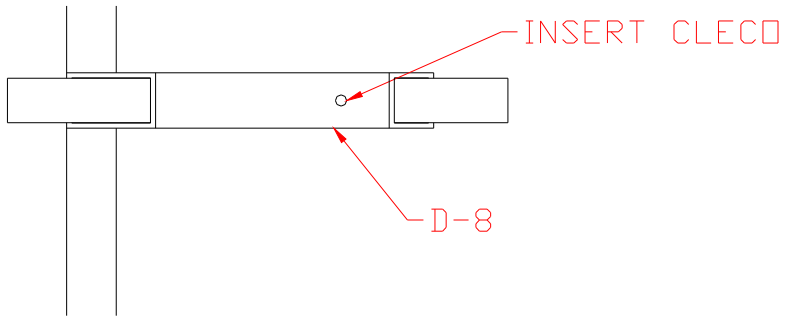



Figure 23.3.11

23) Mark a line on the Delrin block where the bevel will start. Remove the Delrin blocks and cut the bevel in the end.

24) Replace the Delrin blocks and make sure the blocks moves freely.

25) Remove the Delrin blocks and drill a 13/16" hole through the end and insert one of the 1/2" x 3/16" tubes you cut earlier for a handle. Figure 23.3.12.

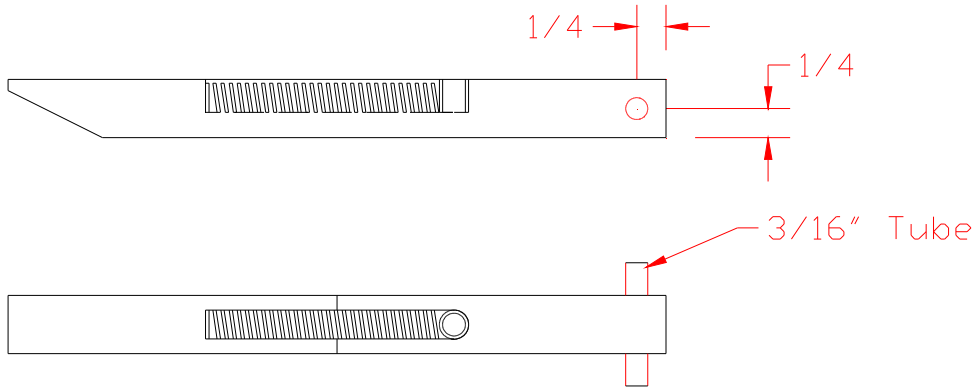



Figure 23.3.12

26) Take scrap .016 material and two strips as in Figure 23.3.13.

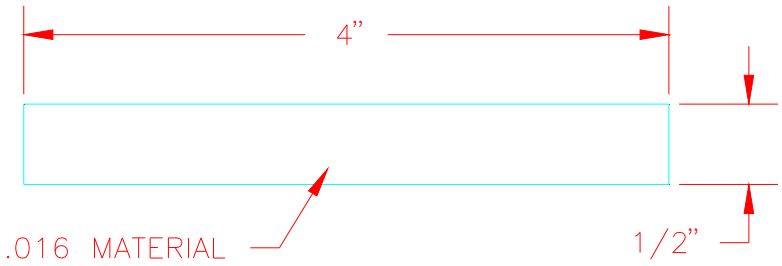



Figure 23.3.13

27) Bend the strips in half around a 3/16" bolt.

28) Drill #11 holes in locations as in Figure 23.3.14.

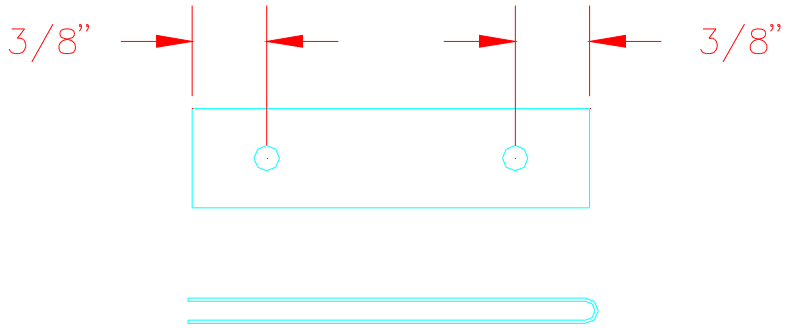



Figure 23.3.14

29) Attach the bracket to the rear door latch.

30) Connect a 1/16" cable to the bracket. Figure 23.3.15.

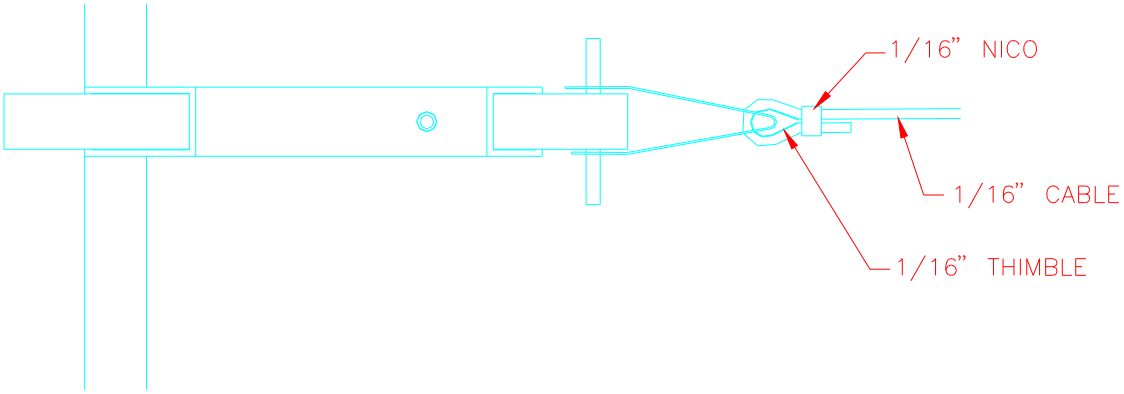



Figure 23.3.15

31) Run the 1/16" cable to just past the front of the door and cut it, allowing extra for a nico and thimble connection.

32) Hold the cable parallel to the door and mark where the cable will pass through the strengthening tubes of the doors. Drill a #11 hole. Figure 23.3.16.

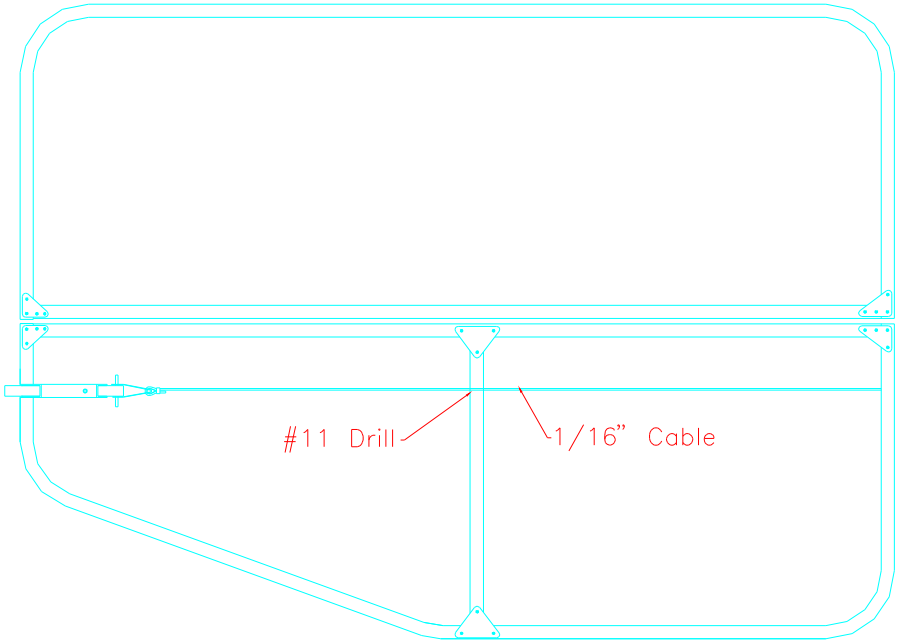



Figure 23.3.16

33) Attach a cable guide to the door as in Figure 23.3.17.

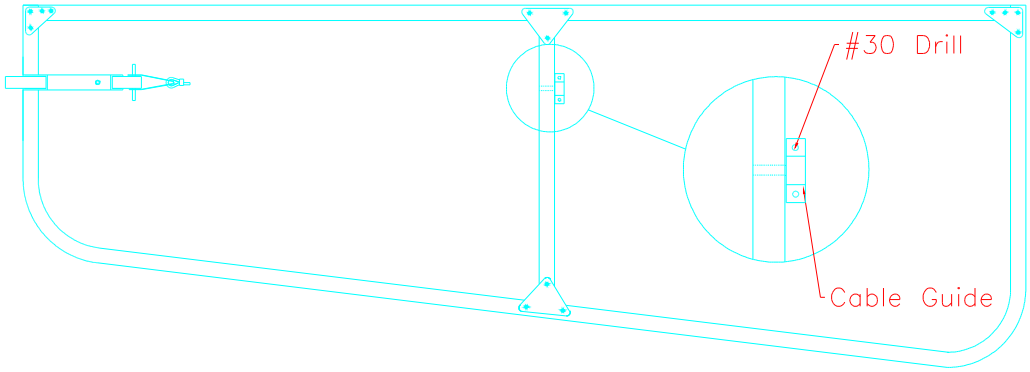



Figure 23.3.17

34) Run the cable, through the door and cable guide.

35) From .016 material make two 1/4" wide strips approximately 2" long. Figure 23.3.18.

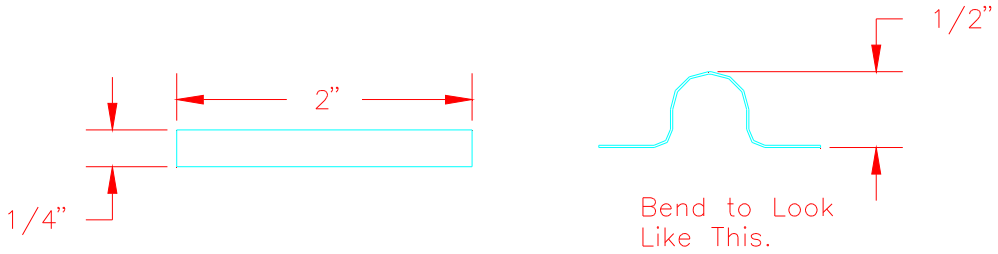



Figure 23.3.18

36) Drill two #30 holes into the flange.

37) Align the bracket to where the cable meets the front of the door. Use the two #30 holes as a guide and drill into the door. Figure 23.3.19.

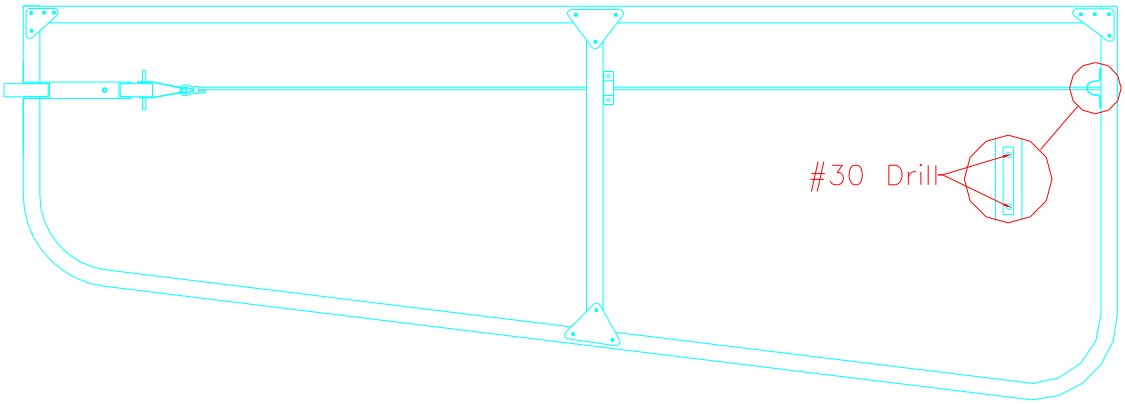



Figure 23.3.19

38) Rivet to the door with 1/8" rivets.

39) Nico the 1/16" cable to the front bracket so the cable is snug. Figure 23.3.20.

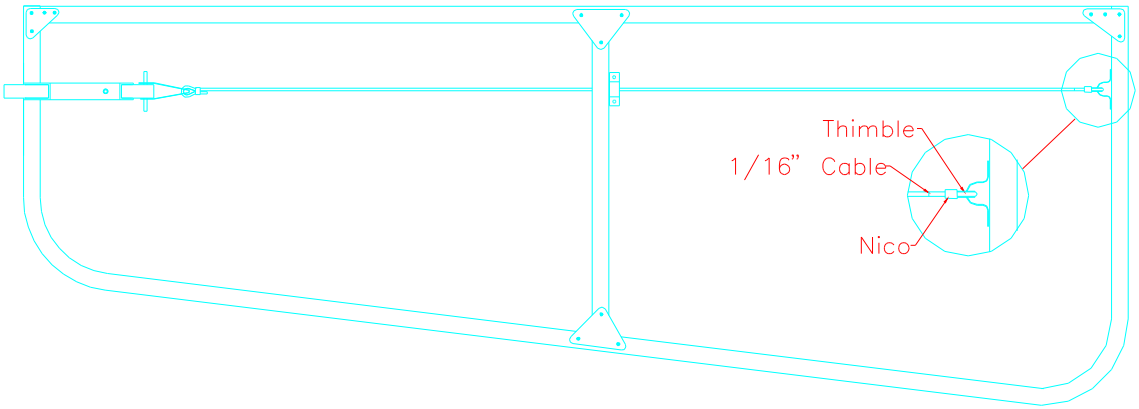



Figure 23.3.20

40) Repeat steps necessary to complete the other door.

## *23.4 Door Lever*

D-403 will have to be drilled and bent as follows, using the D-403 material received in the kit.

1) Locate the center of the holes and drill out to the sizes as shown in figure 23.4.1. Deburr the holes.

2) Mark the bend line location as shown in figure 23.4.1.

3) Bend the part in the vise to the shape shown in figure 23.4.1. Since this is a non-structural part, the part can easily bent in a vise.

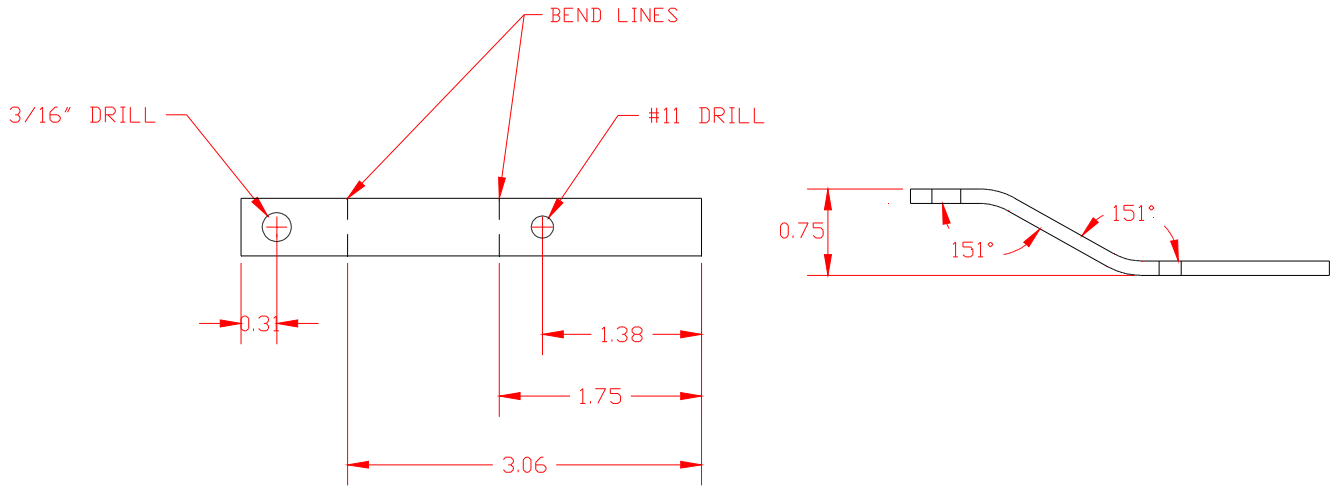



Figure 23.4.1

## *23.5 Door Lock Install*

1) Layout and mark on the bottom of the Fuselage Root Rib flange (FUS-27), 12" from the front edge of the door opening and 5/16" inward from the outside edge of the same flange. Figure 1.

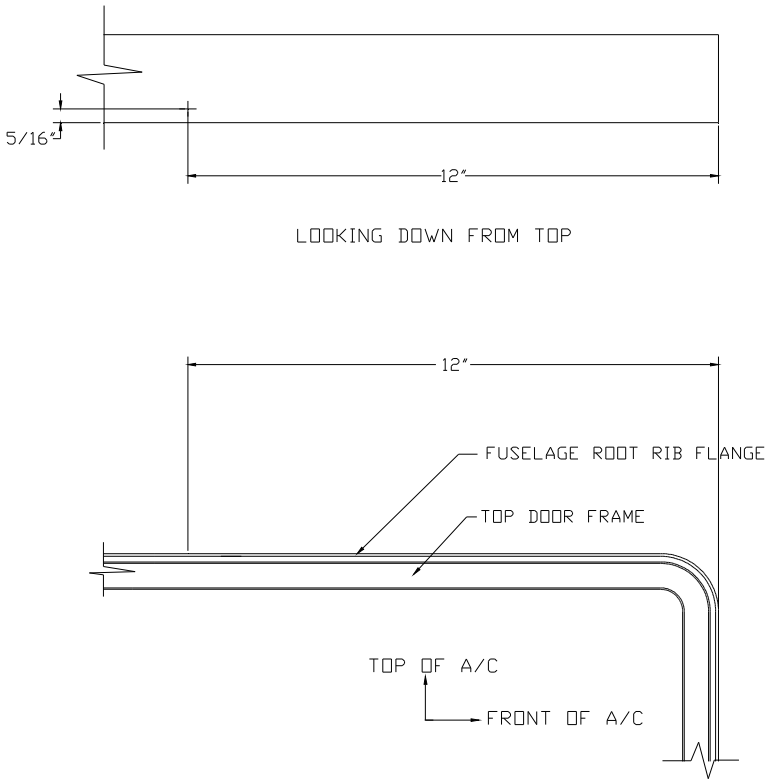



Figure 23.5.1

2) Mark the location on the top side on the upper door frame. Layout the dimensions as per figure 23.5.2 and cut a 1/8" wide slot in the root rib flange on the upper surface of the top door frame. **NOTE:** These dimensions are approximate. The size of the slot may have to be adjusted once all of the parts are in place.

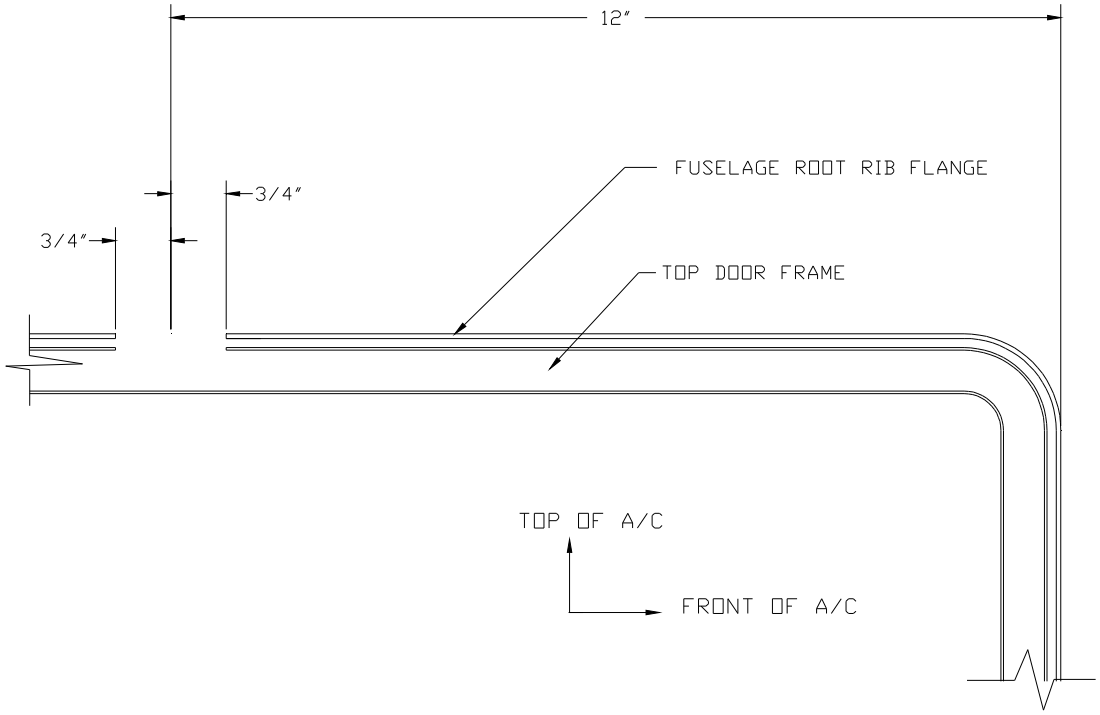



Figure 23.5.2

3) Attach a CS-66D knob to a D-403 with an AN4-13A bolt as in figure 23.5.3.

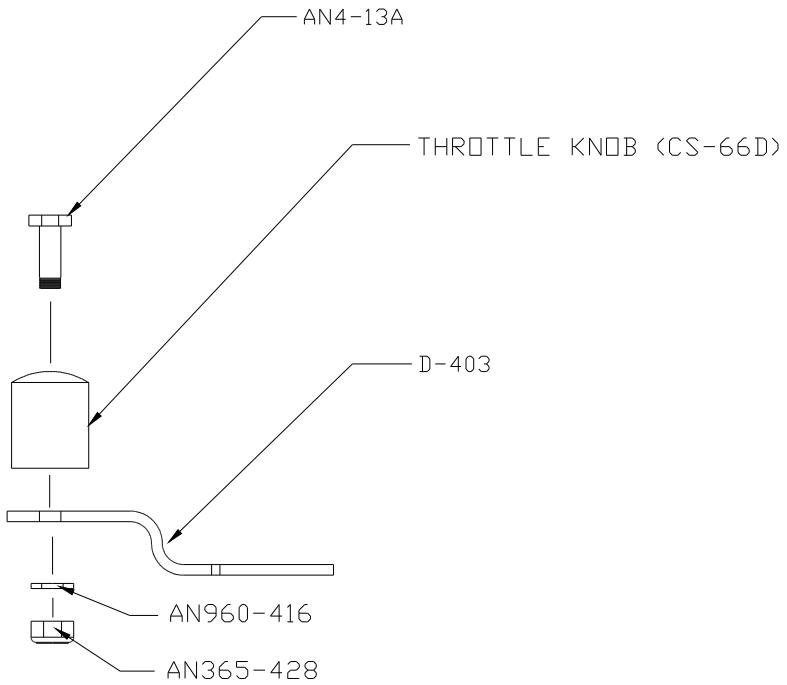



Figure 23.5.3

4) Layout and drill a #40 hole in the location shown in figure 23.5.4.

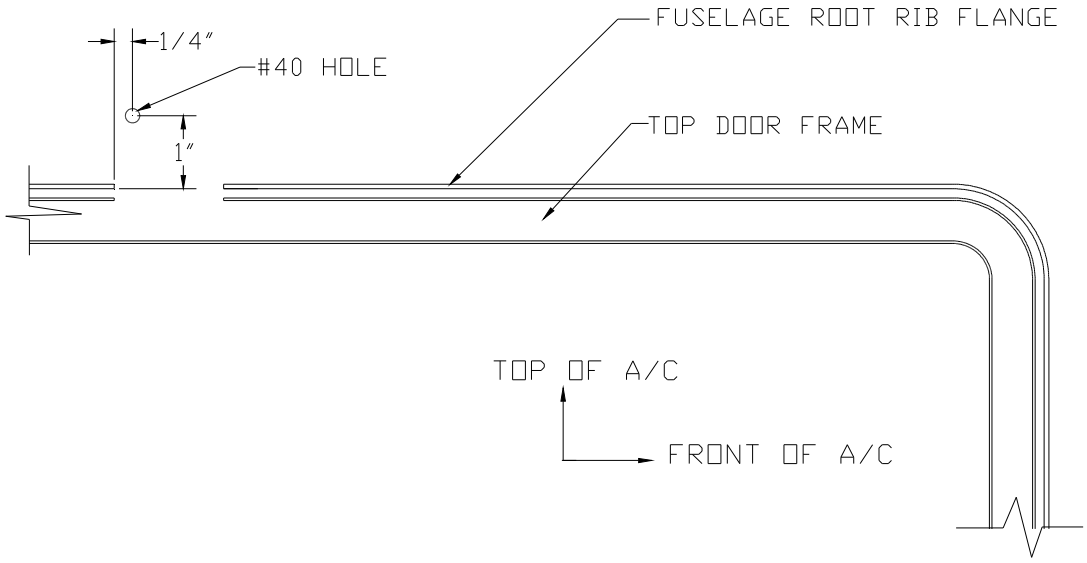



Figure 23.5.4

5) Drill to #11 and debur.

6) Find a piece of ST-40 and cut it to 1". Form the part as per the dimensions in figure 23.5.5.

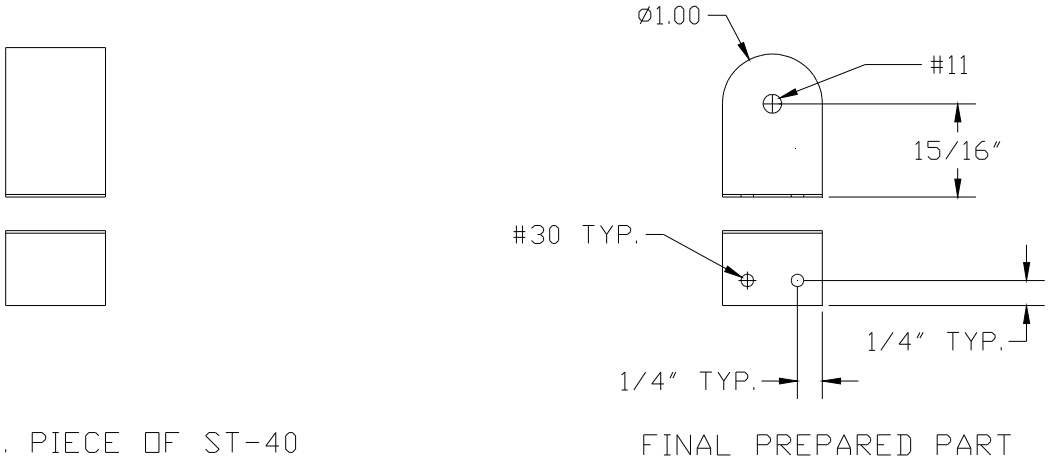



Figure 23.5.5

7) Rivet the prepared ST-40 to the Fuselage Root Rib flange. Attach the D-403 assembly as per figure 23.5.6. **NOTE:** The 3/4" end of the ST-40 is riveted to the flange on the Fuselage Root Rib.

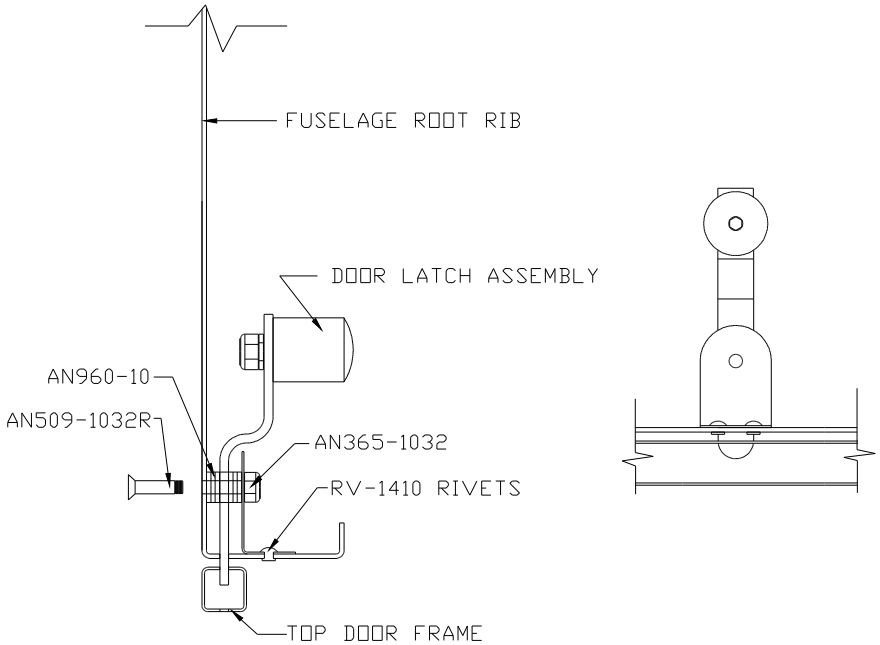



Figure 23.5.6

8) Repeat steps for the other door.

9) Layout and mark on the Lexan window the dimensions shown in figure 23.5.7. **NOTE:** These dimensions may vary slightly as the cam locks may have slightly different dimensions.

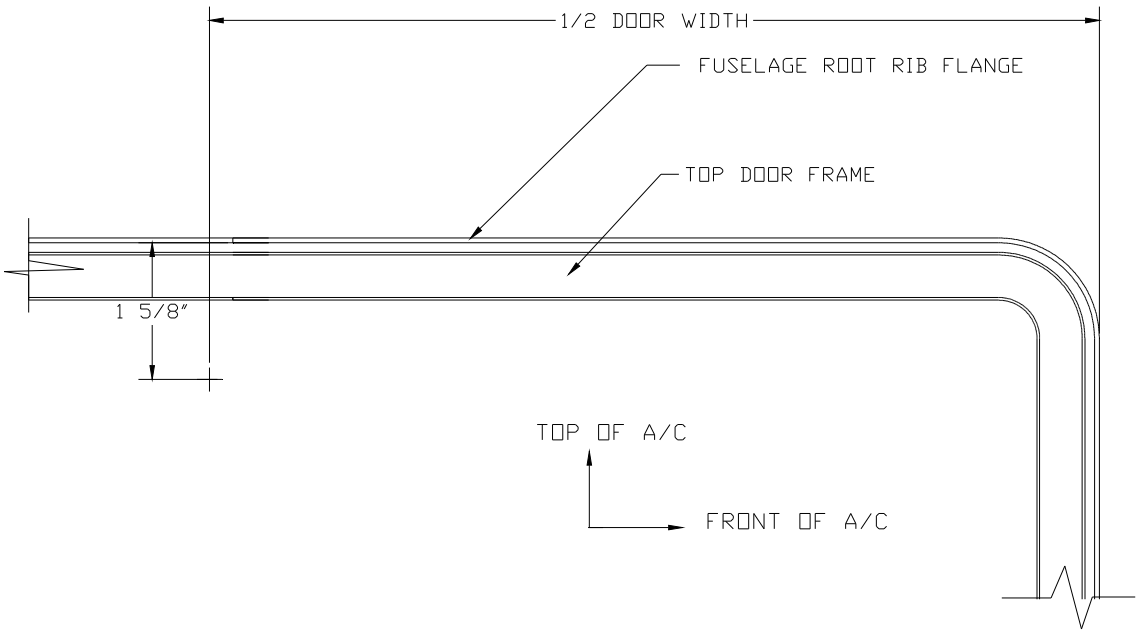



Figure 23.5.7

10) Cut a hole as per the dimensions in figure 23.5.8 in the location on the window you just marked.

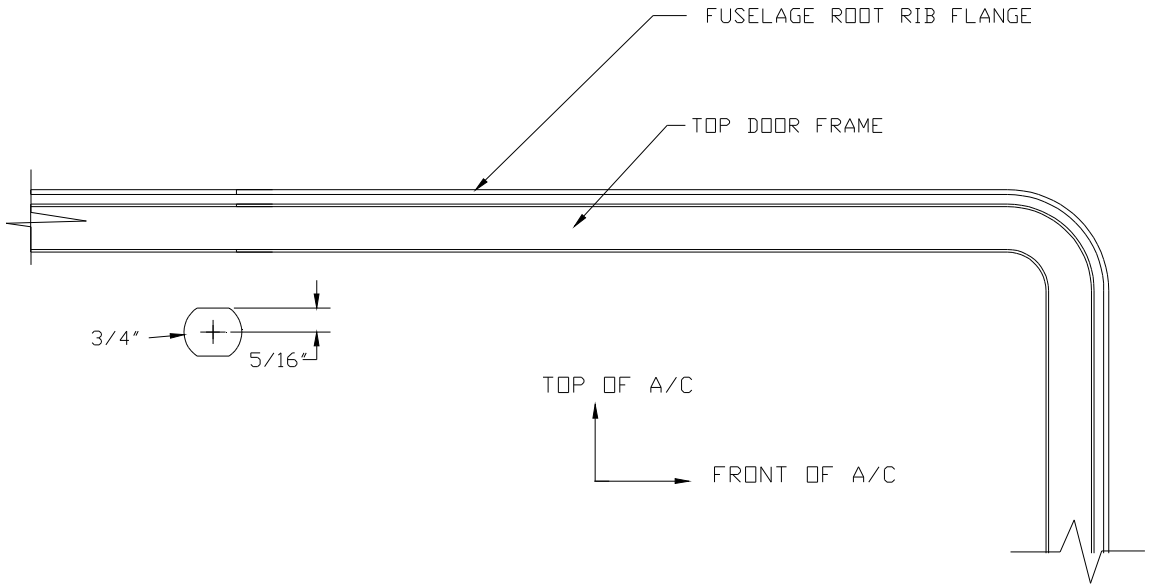



Figure 23.5.8

11) Install the door lock (116-13). Figure 23.5.9.

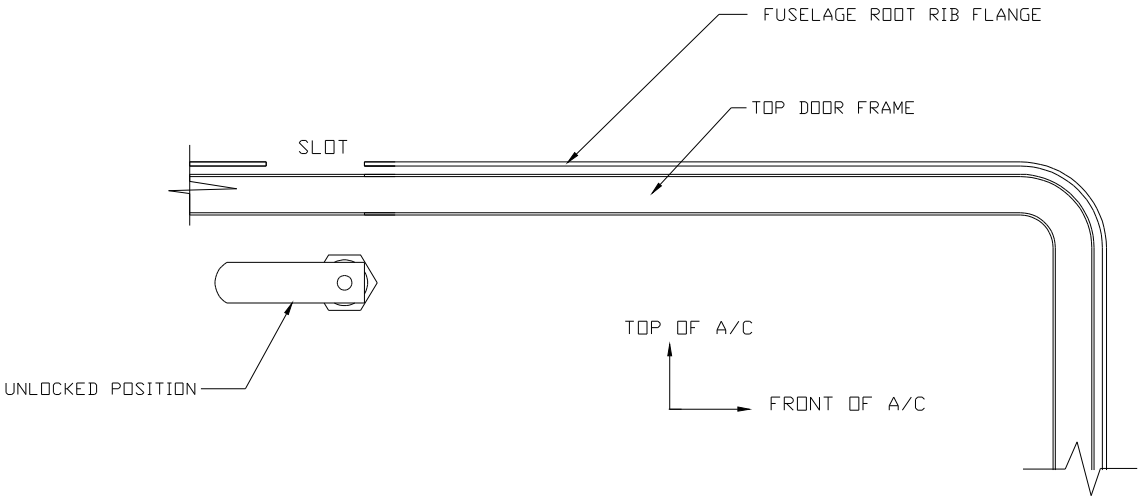



Figure 23.5.9

12) Close the door and latch the window. Rotate the lock until it touches the Fuselage Root Rib (FUS-27). Mark the location on the Root Rib.

13) Cut a 1/8" slot in the FUS-27 using the mark you just made as a guide to accommodate the lock arm. Adjust the slot to suit the arm.

## *24.1 Top Fairing*

**NOTE:** Install the Fairings with the wings mounted to the aircraft.

1) On the top of the wing skin mark a line between existing rivets every four to six inches in the root rib, except in the Wet Tank area. Figure 24.1.1.

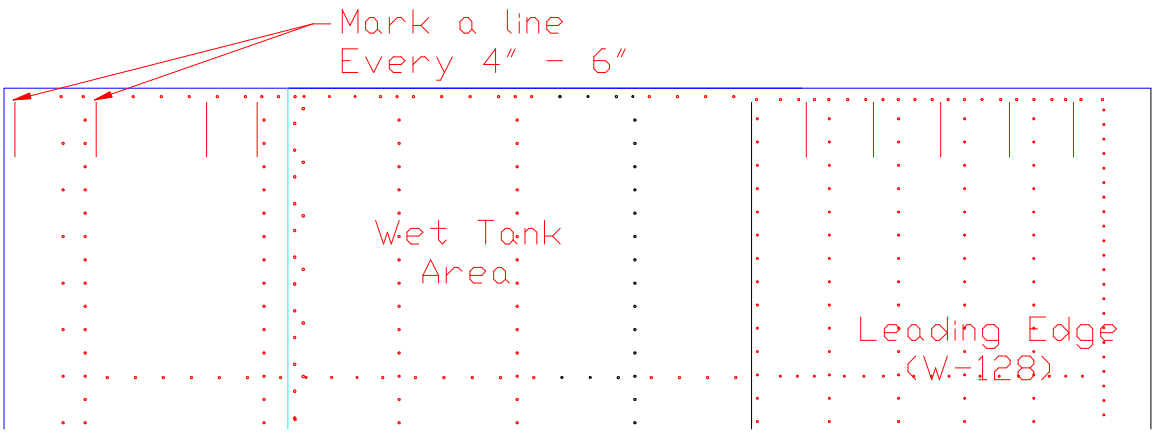



Figure 24.1.1

2) Mark a line 5/16" in from the edge of FA-21-1. Overlap FA-21-1 on the wing skin by 5/8". Mark a line on FA-21-1 flush with the rear of the top skin. Figure 24.1.2.

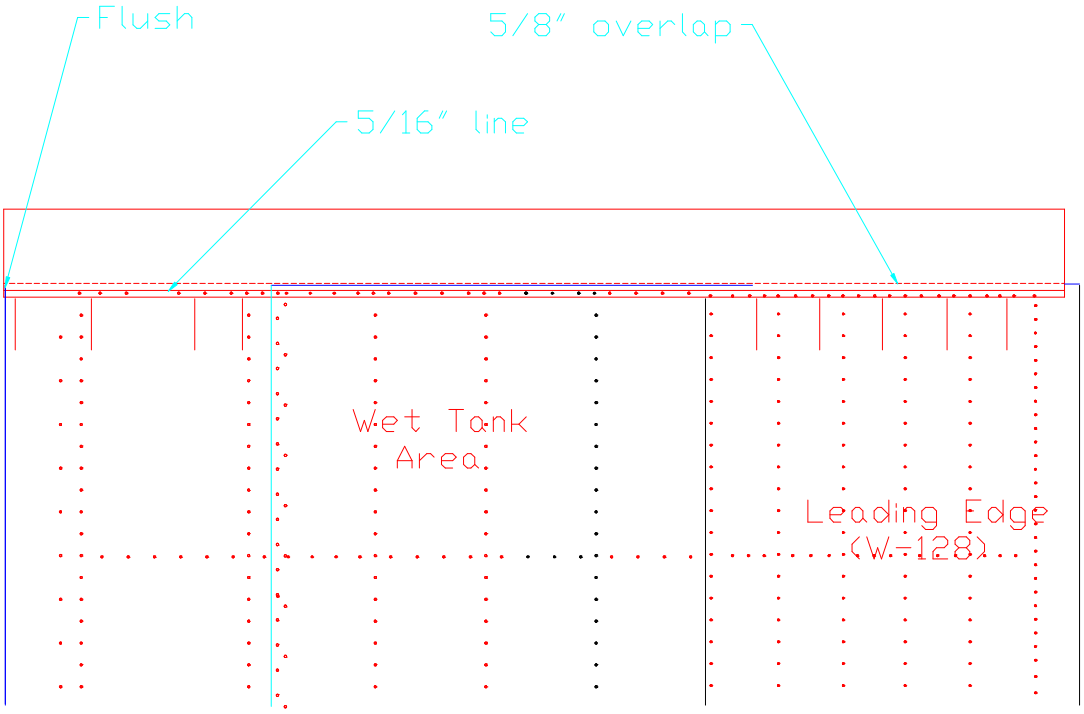



Figure 24.1.2

3) Transfer the lines drawn on the wing skin to intersect with the line on FA-21-1.

4) Drill one #30 hole at the rear spar where the lines intersect. Cleco.

5) Pull forward keeping the fairing tight over the wing. Mark and trim FA-21-1 approximately 1" back from the leading edge of the wing. Figure 24.1.3.

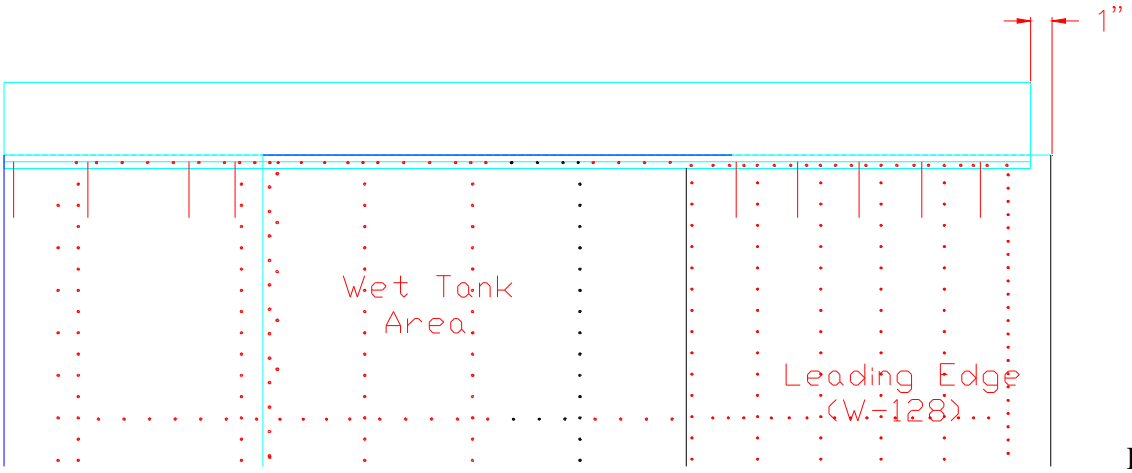



Figure 24.1.3

6) Cleco the trimmed FA-21-1 back on the wing and pull tight. Drill a #30 hole at the front intersecting lines. Cleco. Complete drilling #30 holes at the remaining intersections. Figure 24.1.4.

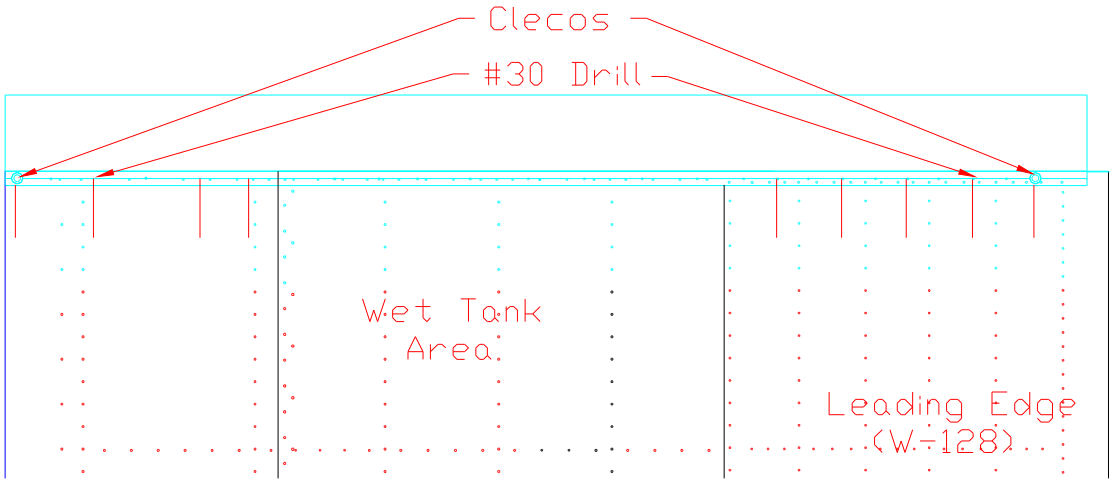



Figure 24.1.4

7) Remove and deburr.

8) Form a 3/16" lip on the bottom of the un-drilled side (bend down). This will provide a better fit against the cabin top. Figure 24.1.5.

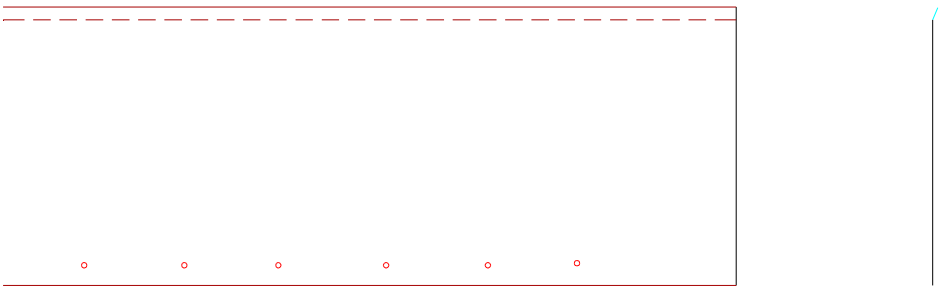


Figure 24.1.5

9) Chromate mating surfaces and rivet FA-21-1 to wing with 1/8" rivets (RV-1410).

10) Repeat steps for the other wing.

## *24.2 Bottom Fairing*

1) trim the FA-26-1 so that it overlaps the spacer box leading edge by 3/4". Figure 24.2.1. **NOTE:** You will need to notch out the flange to fit behind the spacer box. You will also need to trim out the FA-26-1 to go around the push pull tubes.

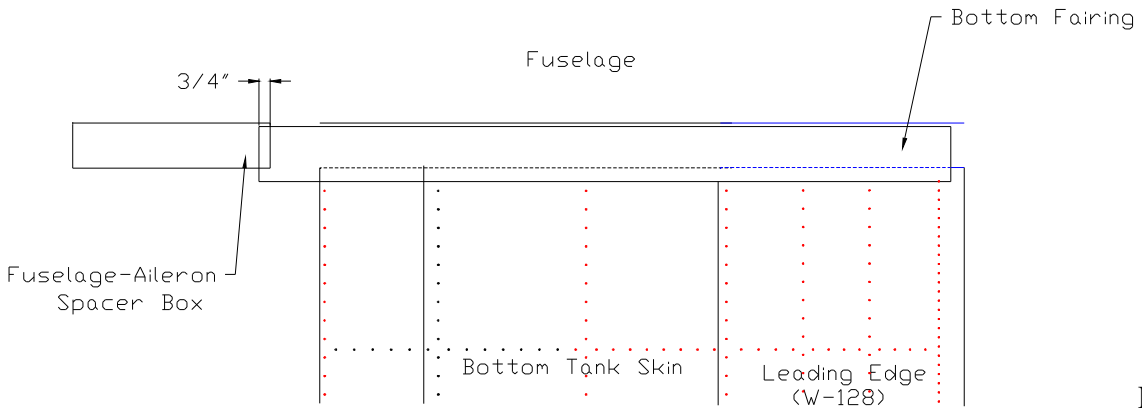



Figure 24.2.1

2) Push fairing tight against fuselage. Drill #40 hole through fairing and wing rib. Cleco. Figure 24.2.2.

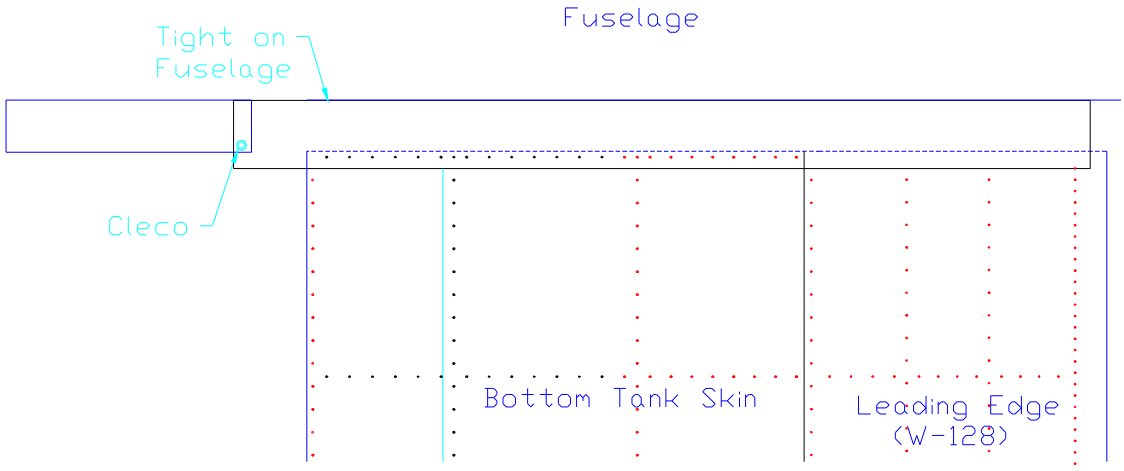



Figure 24.3.2

3) Continue drilling and clecoing every four to six inches, except in the Wet Tank until the fairing will no longer lie flat because of the curve in the wing.

4) Remove the fairing.

5) To allow fairing to bend to the shape of the wing, it will be necessary to crimp or shrink the 90º flange.

6) Once the desired shape is achieved, continue drilling #30 holes to approximately 4" from the leading edge.

7) Trim bottom flange 1" from leading edge of the wing and trim drilled edge approximately 5/16" from holes. Figure 24.2.3.

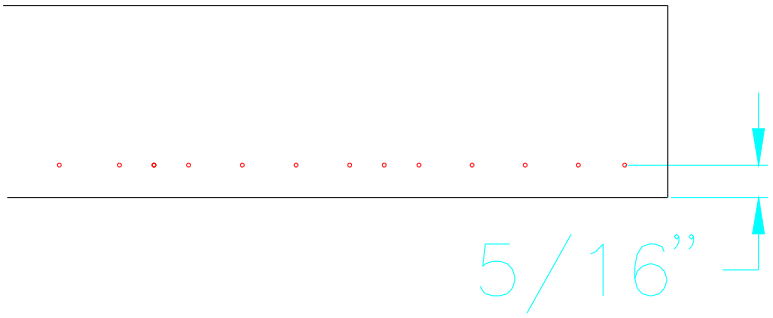



Figure 24.2.3

8) Remove and deburr.

9) Attach with stainless steel screws.

10) Repeat steps for other wing.

## *24.3 Leading Edge Fairing*

1) Using a piece of cardboard, wrap it around the leading edge. Mark and trim until desired fit is achieved around the fuselage. Figure 24.3.1.

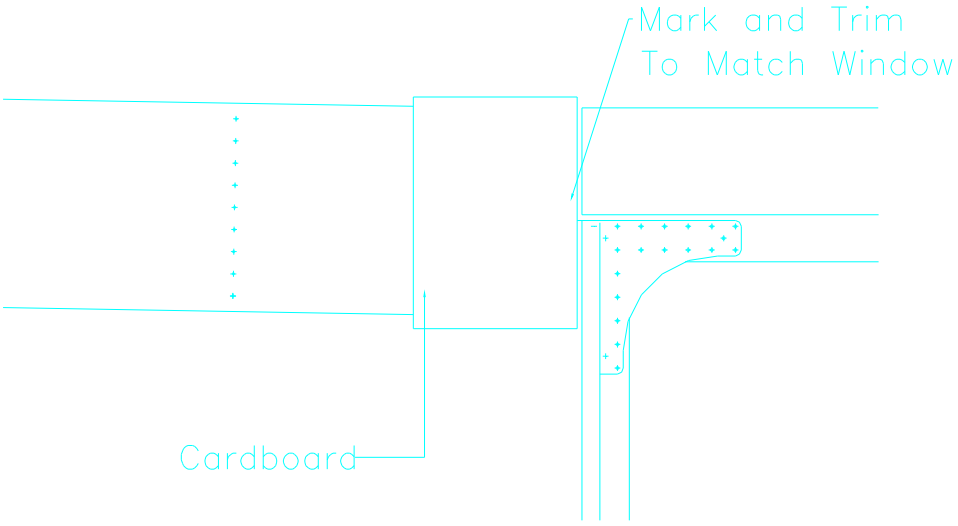



Figure 24.3.1

2) Trace shape onto a piece of aluminum. Trim and shape to wing. Drill where needed with a #40 drill.

3) Remove. Deburr.

4) Attach with stainless steel screws.

5) Repeat steps for the other wing.

## *25.1 Optional Forward Skylights*

**NOTE:** The forward two skylight openings will be covered with the acrylic windshield.

1) Using a fine felt marker mark the outline of the forward skylight. Figure 25.1.1.
2) Use a 3" hole saw to cut out the ends of the front skylights or drill a series of 1/4" holes around the perimeter of each corner radius as in Figure 25.1.2.
3) Cut out along the outer marked line.
4) File all edges and radii until smooth.

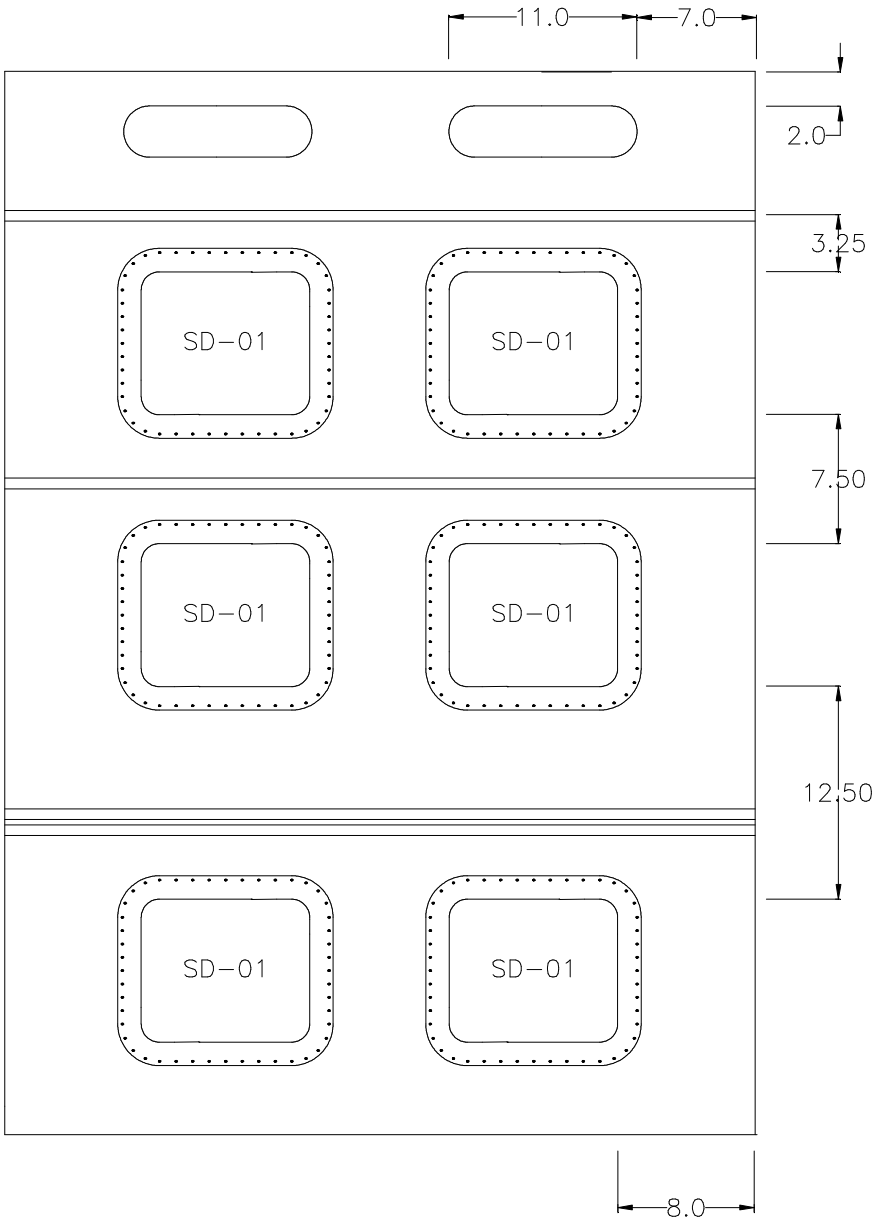



Figure 25.1.1

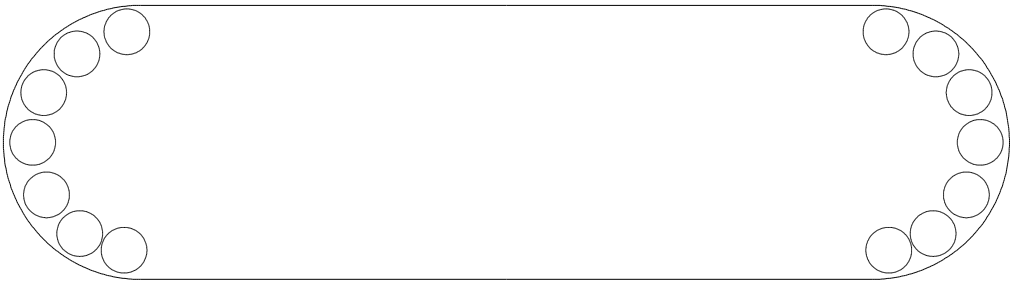


Figure 25.1.2

## *20.2 Optional Skylights*

1) Use the measurements figure 25.1.1 to locate SD-01 doublers.

2) Trace around the inside of the doubler with a fine felt pen.

3) Cut out the material inside the area you traced and file all edges nice and smooth.

4) Use Proseal or similar sealant around the perimeter and install with RV1410 rivets.

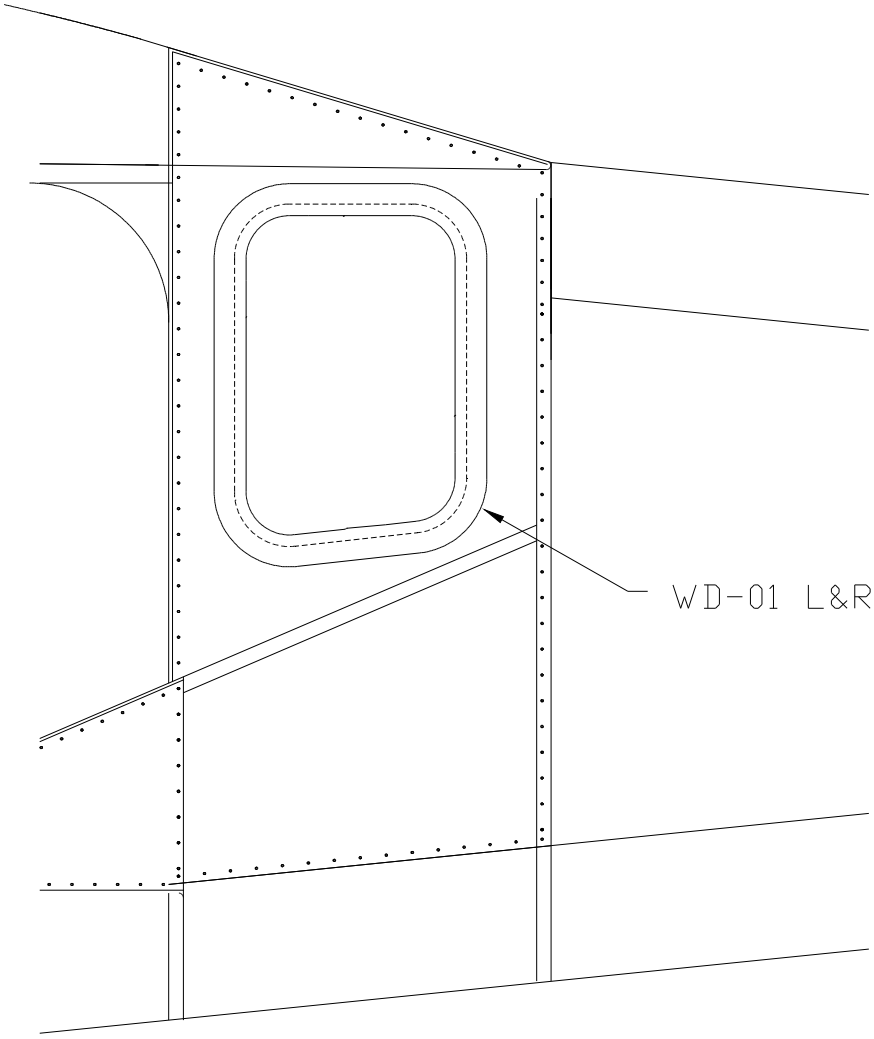
5) Repeat this procedure for up to six skylights.

## *20.3 Optional Side Windows*

1) Adjust the WD-01 doubler to be parallel to the door window. Figure 25.3.1.

2) Installation is similar to the skylights.

Figure 25.3.1



## *26.1 Windshield Trim*

**NOTE:** Before proceeding with the windshield installation, please read through the general information in Appendix A.

**NOTE:** The Forward Skylight hole edges should be rolled before installing the Windshield. This will prevent the edges from cutting into the Acrylic Windshield.

1) Fit the Windshield onto the Aircraft. Trim bottom of windshield so that it is 2" back from cowl line see Figure 26.1.1. Pay careful attention to fit around the Forward Wing Attach Fittings. Radius all corners of the windshield. **NOTE:** **Do not** use a jigsaw as it will damage windshield. A drum sander is preferred for trimming.

2) Attach the black rubber bumper (4511) to the bottom of windshield (this will be trimmed later).
**NOTE:** The rubber bumper will prevent wear of dash and cracking of windshield.

3) The top edge of the Windshield should be immediately ahead of the first bulkhead rivet line on top of Cabin Roof. The Windshield should not cover these rivets. A clearance of 1/8" from rivet line to the rear windshield is preferred.

4) Put Windshield back on (centering it in position) with tape to hold in place. (Masking tape may be used).

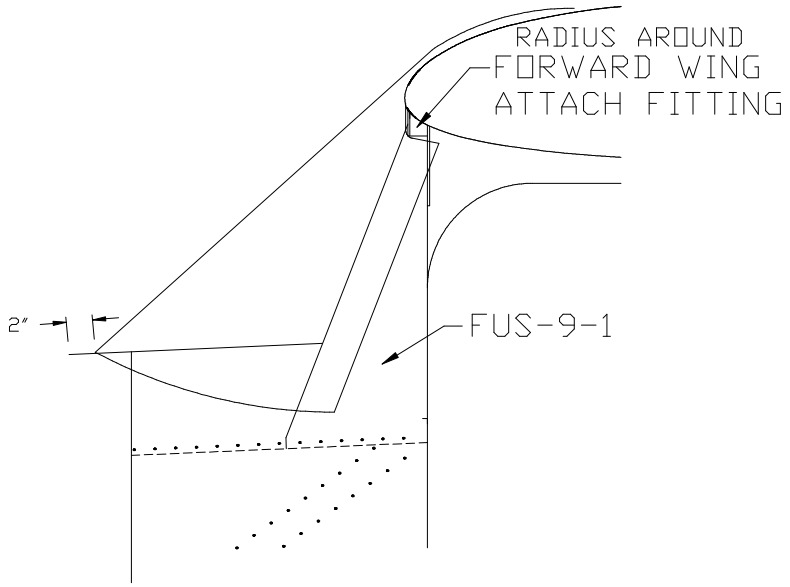



Figure 26.1.1

5) The width at the top of the windshield should be the same as the roof skin.

6) Around the Forward Wing Attach Fittings, trim so that a 1/8" gap is present to prevent rubbing or chaffing.

7) Overlap the windshield onto the Door Post by 1". See Figure 26.1.1.

8) Using Masking Tape, secure the windshield to plane. Check all clearances.

## *26.2 Fiberglass Retainer*

1) Place a second layer of masking tape over the first, lengthwise forming a fillet along edges. Do this along the bottom and up the sides of the window to the forward wing attach fitting. Do this across the top of the window, also. Figure 26.2.1. Protect the windshield and fuselage with wax paper.

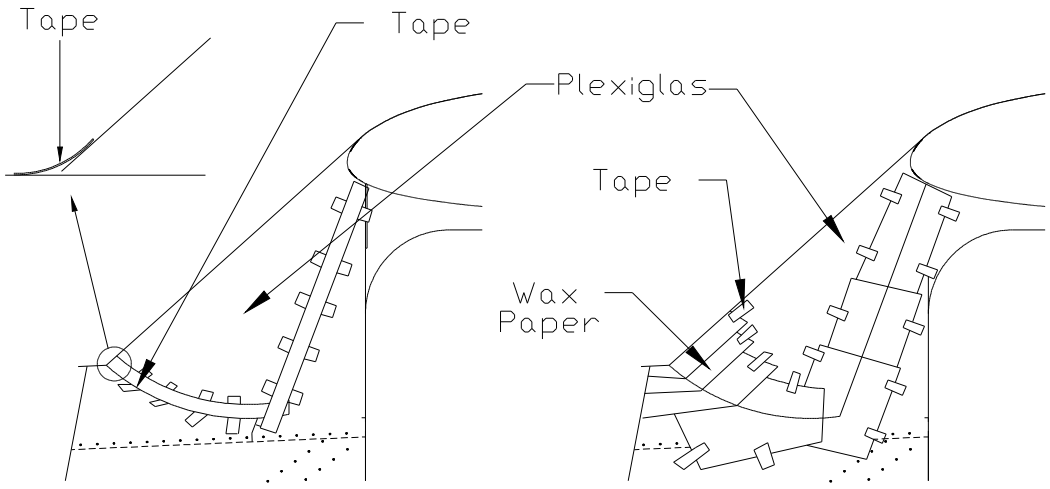



Figure 26.2.1

**CAUTION:** Make sure that no Fiberglass resin comes in contact with the Windshield as the chemicals in it will attack the Acrylic.

2) The provided strips of Fiberglass cloth are cut on a 45º bias. This allows strips to form around the curve of the Windshield and still lay flat to the surface.

3) Mix a small amount of resin to begin.

4) Put the first strip of Fiberglass cloth as shown in Figure 26.2.2.

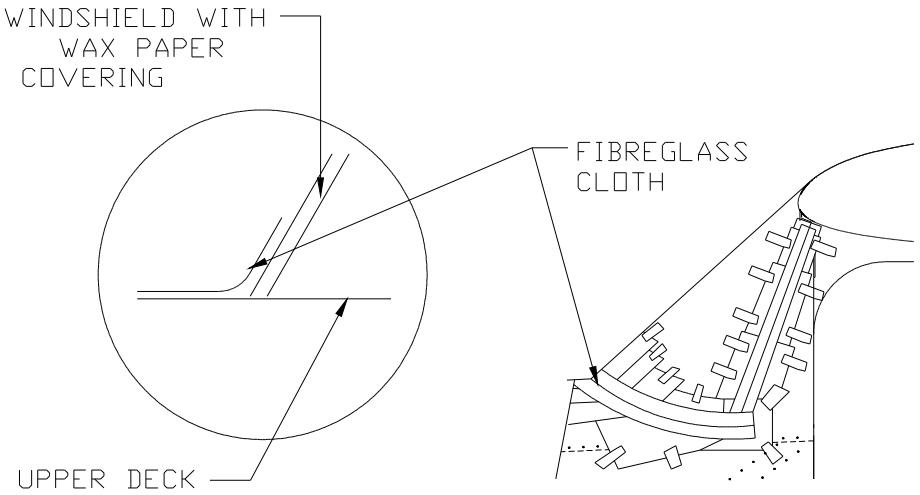



Figure 26.2.2

5) Use brush to wet out and smooth the Fiberglass down. Use a dabbing action with the brush. Work from the center of the Windshield to the sides and roof.

6) Repeat steps for 3 additional layers.

7) After the Fiberglass has cured, sand it down lightly with 80 - 100 grit sandpaper to remove waxy surface.

8) Take felt pen and mark center of Windshield/Fuselage joint. Draw a line 1" up from and parallel to joint line on Fiberglass. To draw the line, measure at several spots along the Fiberglass and join them up. This helps to keep the line parallel to the Windshield/Fuselage joint line. Figure 26.2.3.

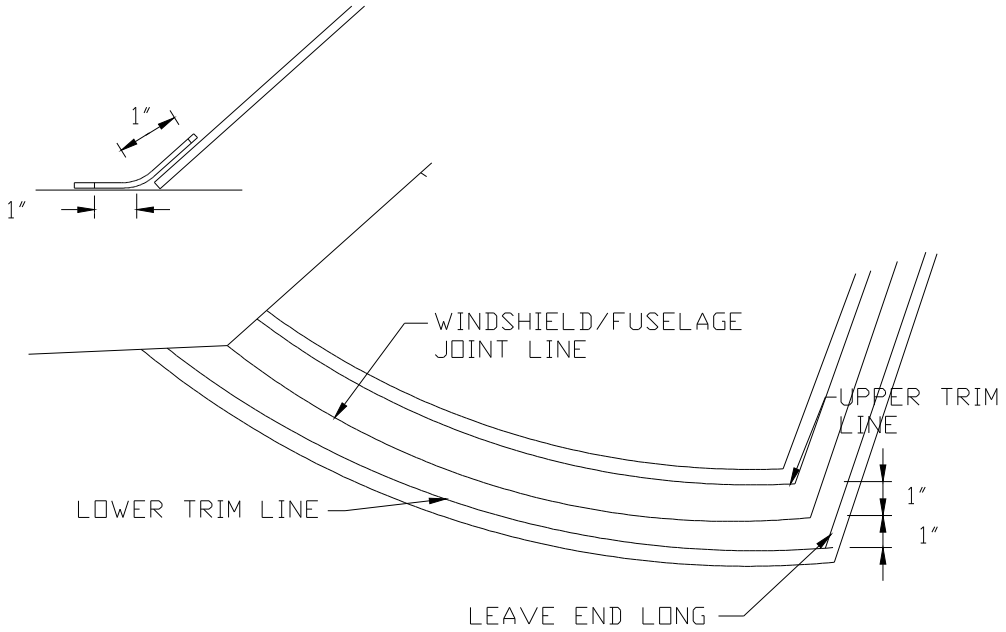



Figure 26.2.3

9) Measure down 1" from the Windshield/Fuselage joint line and draw the lower trim line as you did earlier.

10) Lay out a rivet pattern as shown in Figure 26.2.4 on the outside of the fiberglass molding. Do NOT drill any holes in the molding in the windshield area. No holes are drilled in the windshield at all. **NOTE:** Adjust rivet spacing as required so that the rivets don't end up on top of existing rivets that may be underneath the Fiberglass. Drill 1/8" and cleco.

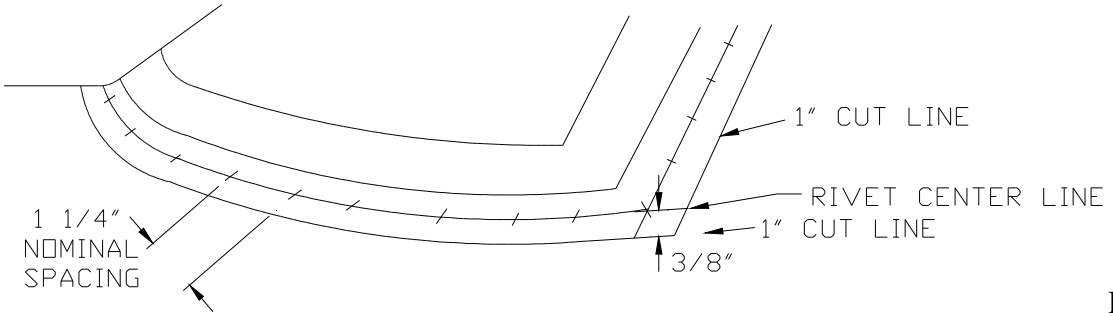



Figure 26.2.4

11) Remove all clecos from Fiberglass Retainer. Coat with body filler. When dry, remove strip from Windshield and trim to trim lines all around. Sand filler and edges smooth. Also radius bottom corners. Apply primer to prepare for painting.

12) Remove all masking tape and wax paper from Windshield.

13) From back side of Fiberglass Retainer, carefully drill filler out of holes.

14) Sand the sides of the Fiberglass Retainer and paint the Retainer black.

15) Prepare the top Retainer as you did the bottom retainer.

16) Remove Windshield from aircraft.

17) Deburr all holes and edges of Windshield retainers and windshield edges.

18) Deburr all holes in Fuselage. Clean and blow away all chips. **NOTE:** Pre paint top of the Cabin Roof where Windshield covers it, before final Windshield installation.

## *26.3 Sealant Tape*

**NOTE:** We recommend the use of Sealant Tape for installing the Windshield as it is less messy. Then use liquid sealant as a final sealer.

1) Apply Sealant Tape to the inside edges of Windshield at the sides and top only.

2) With Sealant Tape in place, install the Windshield.

3) Put liquid sealant on the back side of the Fiberglass strip and windshield edges. Cleco in place on the Fuselage.

4) Rivet Fiberglass Retainer to Fuselage with 1/8" rivets (RV-1410). (Insert all rivets first to align the Retainer, then pull rivets).

5) Check top corners around the Forward Wing Attach Fittings points for gaps. If necessary use wet sealant to fill.

6) Immediately clean all sealant off windshield and fuselage. **NOTE:** Please read the next page carefully before cleaning.

The following page contains general information on the handling and fabrication of parts made from Plexiglas or acrylic materials. It is important to remember that exposure of acrylic sheet and most other polymers to solvents can result in serious damage to the part. Also, Storage in direct sunlight will result in the protective covering bonding with windshield. Keep any cutoffs of windshield material to test cleaners for compatibility.

The windshield is shipped with the protective plastic coating still attached. This film should be left in place until the part is ready to be bolted on to the airframe. This protects the sheet from accidental scratches or abrasions during the installation process.

Please pay special attention to the section on drilling practices and modification of drill bits for use on acrylic sheet. Keep in mind that high-speed drills should be used. Specially ground Plexiglas drills are available from some plastic product distributors or from Murphy Aircraft.

By carefully following these directions, builders can achieve the best possible results and avoid accidental damage to the windshield during installation.

## APPENDIX A

The following page contains general information on the handling and fabrication of parts made from Plexiglas or acrylic materials. It is important to remember that exposure of acrylic sheet and most other polymers to solvents can result in serious damage to the part. Also, Storage in direct sunlight will result in the protective covering bonding with windshield. Keep any cutoffs of windshield material to test cleaners for compatibility.

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. By carefully following these directions, builders can achieve the best possible results and avoid accidental damage to the windshield during installation.

AERO PLASTICS INC.



**PLEASE READ FIRST**

## GENERAL DRILLING, TRIMMING, AND FASTENING INSTRUCTIONS FOR ACRYLIC WINDSHIELDS AND WINDOWS

### DRILLING

There are just a few general principles that must be understood to successfully drill acrylic:

- **DO NOT** use a standard wood or metal cutting drill bit. You will risk cracking and chipping the material. These bits will pull into the material and will bind as they exit, cracking and chipping. Successful holes have been drilled with a standard bit, but the risk is extremely high. LP Aero Plastics Acrylic Drill Bits have been reground to have a 0 degree rake on the cutting edges. They scrape a hole instead of cutting, and will not bind or pull upon exiting the material. If for any reason you elect to use other drill bits, be sure to modify the bit so that the cutting edges have a 0 degree rake angle.

- **DO** use very light pressure when drilling with acrylic drill bits. It is possible to crack or chip the material by forcing the bit with too much pressure. For instance, when drilling a vertical hole, the weight of the drill is all the pressure that is needed. Be patient and give the bit time to do its work. You should see just fuzz coming from the bit - if the bit is pulling spirals from the material, you are using too much pressure. Use higher drill speeds on small hole sizes, and slower speeds as the hole size is increased.

- **DO** drill oversize holes. Acrylic will expand and contract at different rates than the airframe, so oversize fastener holes are required to allow for movement. The general rule is drill a hole at least one and one-third the diameter of the fastener.

- **DO** drill larger holes by step-drilling starting with a smaller size bit. About the largest size hole you can drill easily in one step is 1/4 inch.

- **DO** use a countersink to chamfer the shoulders of all holes. Any sharp edge tends to be a stress riser, so break all sharp edges. This also applies for all window edges. You can use a sanding block and a fine sandpaper (150 grit or finer) to finish the window edges.

- **DO** practice on the old window or a scrap piece of acrylic material.

### TRIMMING

As in drilling and fastening, there are a few rules to follow when trimming:

- **DO NOT** use any type of reciprocating saw, including hand saws or saber saws, to trim acrylic windows. The only safe saw is a band saw with a fine-toothed blade (1/4" or 3/8" wide raker blade with 14 or more teeth per inch). A band saw blade travels in one direction only and runs cool. A reciprocating blade, even a hand saw, will build up heat and bind, quickly cracking the acrylic.

*1086 Boquet Road • Jeannette, PA 15644-4707*
*Phone: (724) 744-4448 • FAX: (724) 744-7372*

AERO PLASTICS INC.



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| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CDN |
|---|---|---|---|---|
| 1 | | REBEL Lycoming O-235<br>Conical Engine Mounting Package<br>March 22/99 | | $17.00 |
| 2 | | | | |
| 3 | E-77 | CONICAL ENGINE Mount<br>(Speed Cowl Doesn't Fit) | 1 | |
| 4 | J6230-1 | Lycoming 0235 Lord Mounts<br>(Conical) | 4 | |
| 5 | AN8-50A | Lord Mount Bolts | 4 | |
| 6 | 20002A | NDM OIL COOLER | 1 | |
| 7 | AN363-820 | Self Lock Nut | 4 | |
| 8 | AN960-816 | Washer | 8 | |
| 9 | AN5-27 | Engine Mount Bolts<br>(For Conical & Dynafocal Mts) | 4 | |
| 10 | AN960-516 | Washer | 8 | |
| 11 | AN310-5 | Castle Nut | 4 | |
| 12 | MS24665-132 | Cotter Pin | 4 | |
| 13 | CO-29 | .032" 5052-H32 Raw Stock 4' x 4'<br>(Baffle Material) | 1 | |
| 14 | | Baffle Material (Rubber)<br>2' x 1' | 1 | |
| 15 | MS35207-267 | 3/16" Pan-Head Machine Screw | 16 | |
| 16 | F5000-3 | Floating Anchor Nut<br>(MS21059-3) | 16 | |
| 17 | | 1/4" Course Thread Bolt<br>1/2" Long | 14 | |
| 18 | AN3-4A | Bolt | 4 | |
| 19 | AN3-5A | Bolt | 7 | |

| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CDN |
|---|---|---|---|---|
| 20 | AN960-10 | Washer | 35 | |
| 21 | AN365-1032 | Fiber Nut | 7 | |
| 22 | 05-08172 | Control, Mixture (FAA) | 1 | |
| 23 | 05-09472 | Control, Throttle (FAA) | 1 | |
| 24 | E-73 | Cable Clevis | 2 | |
| 25 | | Essex Primer | 1 | |
| 26 | CTG-2-50 | 1/8" Primer Line (Copper) | 10' | |
| 27 | 64-2 | 1/8" Tee (Brass) | 1 | |
| 28 | 68-2A | 1/8" T x 1/8" P (Brass) | 5 | |
| 29 | AN914-2D/ 116-6B | 90 Degree Elbow | 1 | |
| 30 | 3748-6B | 3/8" T x 1/4" P Connector | 1 | |
| 31 | 3754-6B | 3/8" T x 1/4" P 45 Degree Elbow | 1 | |
| 32 | 111417-6S02 20 | TSO Hose Assembly 15" long | 1 | |
| 33 | G-500 | 3/8" Grommets | 2 | |
| 34 | G-625 | 1/2" Grommets | 5 | |
| 35 | G-875 | 5/8" Grommets | 5 | |
| 36 | G-1000 | 3/4" Grommets | 2 | |
| 37 | TS17R-4 | 1/4" Insulated P-Clamp | 1 | |
| 38 | TS17R-5 | 3/16" Insulated P-Clamp | 2 | |

| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CDN |
|---|---|---|---|---|
| 39 | TS17R-12 | 3/4" Insulated P-Clamp | 3 | |
| 40 | 10371 | Gascolator Bracket | 1 | |
| 41 | HBS-1 | Gascolator | 1 | |
| 42 | E-27 | 0.032 raw stock for cowl bracket | 1 | |
| 43 | 120-CB | 3/8" x 1/4" Pipe Adapter | 1 | |
| 44 | HH-12 | 3/4" Heater Hose (Oil Line) | 48" | |
| 45 | | | | |
| 46 | | ALTERNATOR KIT | | |
| 47 | | Alternator | 1 | |
| 48 | ALMNT-1 | Alternator Tightener Arm | 1 | |
| 49 | ALMNT-2 | Alternator Case Mount Bracket | 1 | |
| 50 | | Regulator | 1 | |
| 51 | 15355 | Alternator Belt (Dayco) | 1 | |
| 52 | AN5-12A | Bolt | 1 | |
| 53 | AN5-13A | Bolt | 1 | |
| 54 | AN960-516 | 5/16" Washer | 8 | |
| 55 | AN365-524 | Fibernut | 2 | |
| 56 | 5/16x3/4" | Coarse Thread Bolt | 1 | |
| 57 | 5/16" | Lock Washer | 1 | |

| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CDN |
|---|---|---|---|---|
| 58 | A-510-2 | Ignition Switch | 1 | |
| 59 | 11-15900 | Master Switch | 1 | |
| 60 | 11-15910 | Mount for Master Switch | 1 | |
| 61 | 111-226 | Master Relay/Solenoid | 1 | |
| 62 | 22735 | Starter Relay | 1 | |
| 63 | E-28 | 2" Air Inlet | 1 | |
| 64 | RV 1410 | 1/8" x 3/16" Avex Rivets | 500 | |
| 65 | RR-7402L | Fabric Rivets | 80 | |
| 66 | EXT-3 | Lycoming Exhaust Kit Including Carb Heat Muff | 1 | |
| 67 | | Cabin Heat Box Assembly | | |
| 68 | MI-32 | Cabin Heat Box | 1 | |
| 69 | 912A013BA5S 048B | Push Pull Cable | 1 | |
| 70 | Scat 8 | Heat Ducting | 2x18" 1x24" | |
| 71 | E-28 | 2" Air Inlet | 1 | |
| 72 | HC6-32 | 2 1/2" Hose Clamp | 6 | |
| 73 | TS17R-4 | 1/4" Insulated Clamp | 1 | |
| 74 | AN3-4A | Bolt | 1 | |
| 75 | AN970-3 | Washer | 2 | |
| 76 | AN365-1032 | Fibernut | 1 | |

| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CON |
|---|---|---|---|---|
| 77 | | Carburator Heat Box Assembly | | |
| 78 | K1 | Carb Heat Box | 1 | |
| 79 | BA 4106 | Carb Heat Box Filter Assy | 1 | |
| 80 | E-50 | 1/16" Rubber & Cork Gasket | 1 | |
| 81 | Scat 8 | 2" Heat Ducting | 16" | |
| 82 | 912A013BA5S048B | Push Pull Cable | 1 | |
| 83 | TS17R-4 | 1/4" Insulated Clamp | 1 | |
| 84 | HC6-32 | 2" Hose Clamp | 2 | |
| 85 | AN3-4A | Bolt | 1 | |
| 86 | AN3-14A | Bolt | 4 | |
| 87 | AN970-3 | Washer | 10 | |
| 88 | AN365-1032 | Fibernut | 5 | |
| 89 | | LYCOMING COWL KIT | | |
| 90 | | Fiberglass Cowling Nose Piece | 1 | |
| 91 | CO-27 | Cowling Sheet Material .020" 6061-T6 1 sheet 4' x 8' | 1 | |
| 92 | CO-30 | Lower Hinge Support 3 1/2" x 3/4" Channel 30" long | 3 | |
| 93 | CO-31 | Lower Cowling Longeron 3/4" Angle 32" long | 6 | |
| 94 | | Aluminum Hinge | 2 x 6' | |
| 95 | MS35207-267 | 3/16" Pan-Head Machine Screw | 16 | |

| REC# | PART_# | DESCRIPTION | REQ | RETAIL-CDN |
|---|---|---|---|---|
| 96 | F5000-3 | Floating Anchor Nut (MS21059-3) | 16 | |
| 97 | AN960-10 | Washers | 21 | |
| 98 | RV-1410 | 1/8"x3/16" Avex Rivet | 200 | |

# Control Surface Deflection Guide

In response to enquiries from builders for guidance in setting up their control surface deflections, the following guidlines have been established. The following deals with the Rebel aircraft and is applicable to both amatuer (experimental) built and ultrlight built models.

***Elevator***

The elevator is best set up to a 25 degree movement both up and down in travel. Minimum deflection should be 6-1/4" or 20 degrees and maximum deflection is 8-1/2" or 30 degrees.

***Rudder***

Rudder movement, side-to-side, should be minimum 12" and maximum 13-1/2". The ideal arrangement is a 25 degree throw.

***Ailerons*** (Flaperon)

Ailerons need to be setup with differential, more up movement than down, to effect correct handling. The ideal arrangement is for a 4" up movement combined with a 3-1/4" down movement. This will minimize adverse yaw. Minimal up movement is 3" and 2-3/4" downwards.

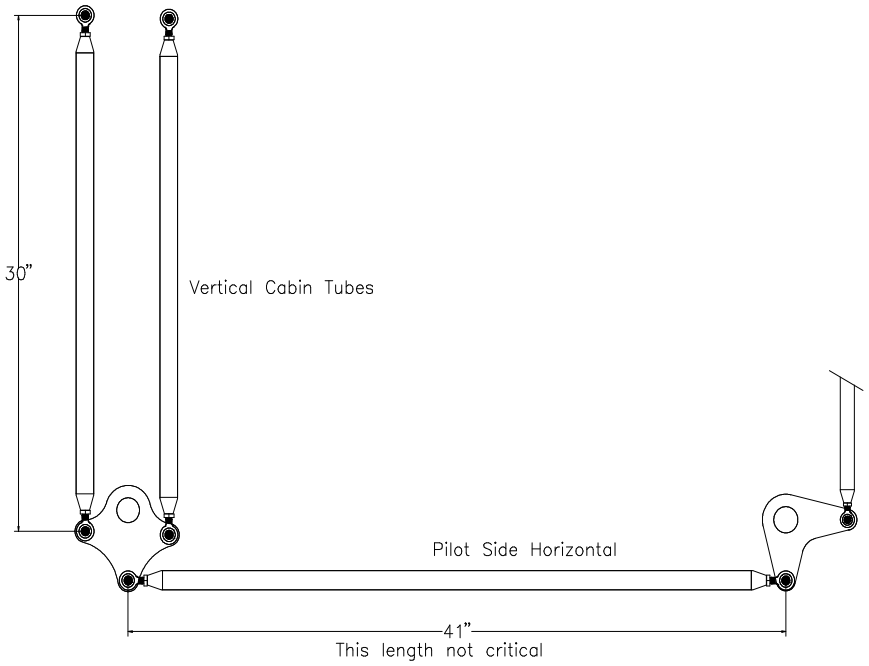
***Flap*** (Flaperon)

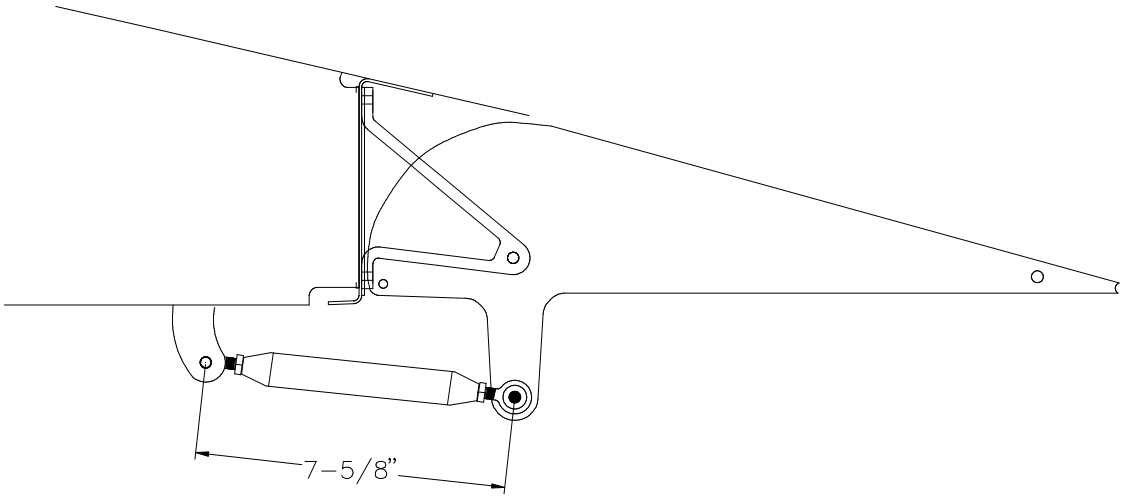
Flap deflection should be restricted to 3-1/2" or 15 degrees. Due to the fact that the Rebel employs flaperons, not flaps, deflection can not be greater than 15 degrees.

The control rod dimensions given in the manual are used on many flying Rebels, and were taken from the company prototypes.

However, these dimensions can vary, and the following control rod dimensions gave a very pleasant handling Rebel. These are given here to indicate the control deflection range that is acceptable.

Using these dimensions, flapperon travel of 31/2” (13 degrees) up and 3” (11 degrees) down were obtained.
Dimensions are bolt hole center to bolt hole center.



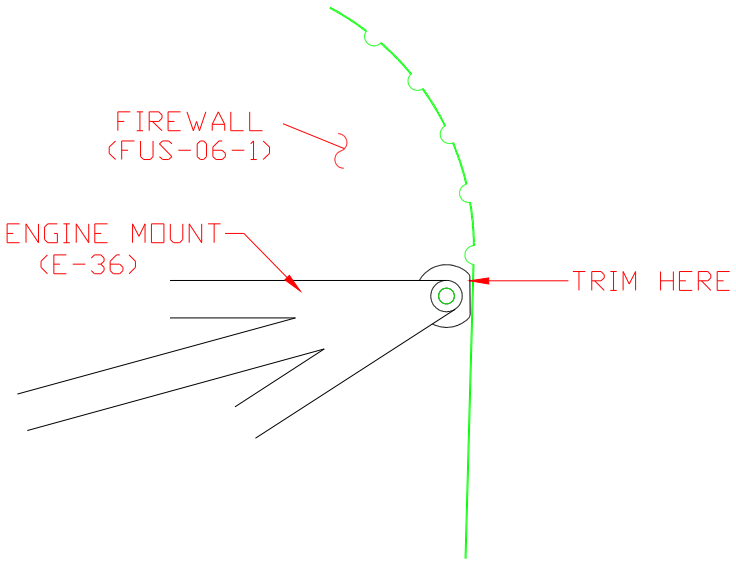
To install a 0320 E2D Lycoming Engine, you will require the following:

1) Variable Speed Drill
2) 3/32", #30, #11, 1/4", 5/16" Drill Bits
3) 3/32", 1/8", 3/16" clecos
4) Cleco Pliers
5) Deburring Tools
6) Felt Marker
7) Riveter
8) Tape Measure
9) Snips
10) Socket Set
11) 3/8", 7/16", 5/16" 1/2", 9/16" Wrenches
12) Hacksaw
13) Files (round and flat)
14) Vice Grips & C-Clamps
15) "A" Frame and Block & Tackle (to lift engine)

Approximate time for this job: 60-80 hours depending upon builder preferences.

**NOTE:** These instructions are based on a "0320 E2D Lycoming" engine. With any 0320 engine we recommend shortening the firewall by 3". On this model, please note, that the Carb is mounted to the front and offset to the left on the oil pan. This may be different on other 0320 Lycomings and may require a change to cowling intakes. This engine uses a Dyno-focal mount. Tony Bingelis Firewall Forward book is a helpful reference for this section.

1) Position the Engine Mount (E-36) on the Firewall. It will be necessary to trim the top attach point washers to allow the mount to fit between the firewall flanges. **Note:** It may be necessary to drill out the attach points to remove any slag that may have accumulated during the welding process. Figure 1.

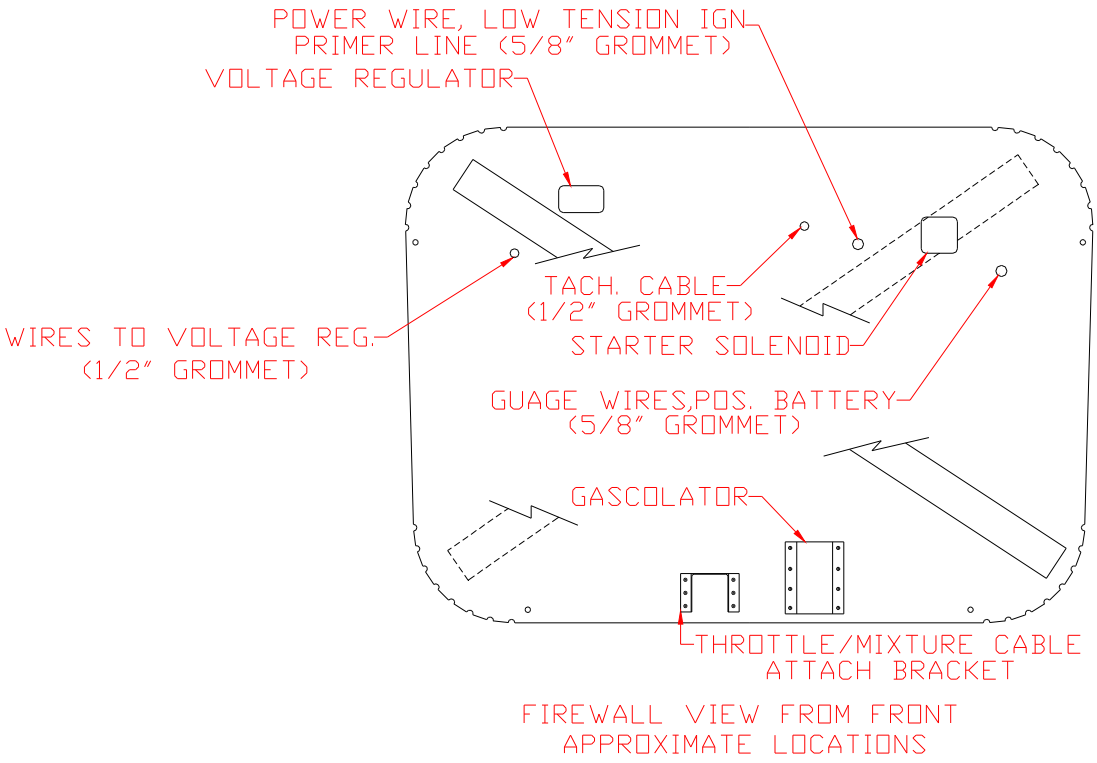



(Figure 1)

2) Attach the engine mount, using two bolts, so that it is in place and won't fall off. Mark out the voltage regulator, starter solenoid and cabin heat locations.. Install the gascolator onto the Main Line Tee (XB3745-6B). Ensure that none of the items interfere with the engine mount.

**NOTE:** The gascolator location will not work with the conical mount. It will be higher on the

firewall. It is recommended to install any accessories that will need to be mounted to the firewall at this time. Use Figure 2 as an example.




(Figure 2)

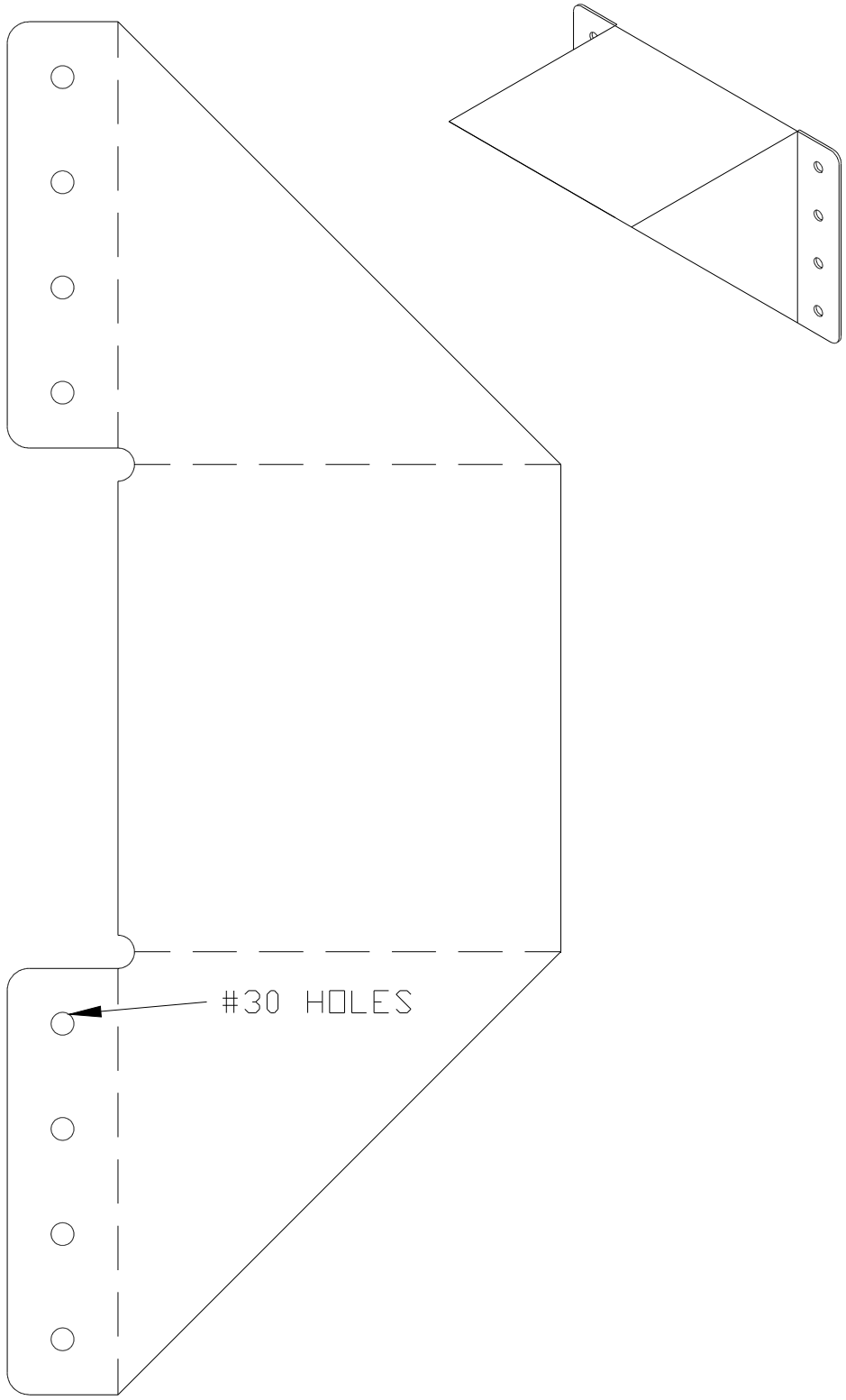
3) Remove the engine mount from the firewall. Attach the voltage regulator and starter solenoid to the firewall using two AN3-4A bolts, four AN960-10 washers and two AN365-1032 fibernuts for each unit.

4) Cut a hole approximately 3 1/4" x 2 1/2" into the firewall for an inlet for the Cabin Heat to enter. Rivet the cabin heat box to the firewall using 1/8" x 3/16" avex rivets (RV-1410).

5) Attach the Gascolator Bracket to the firewall using four AN3-5A bolts, four AN970-10 washers and four AN365-1032 Fiber nuts. Attach the Gascolator to the bracket and wirelock the bowl retainer.

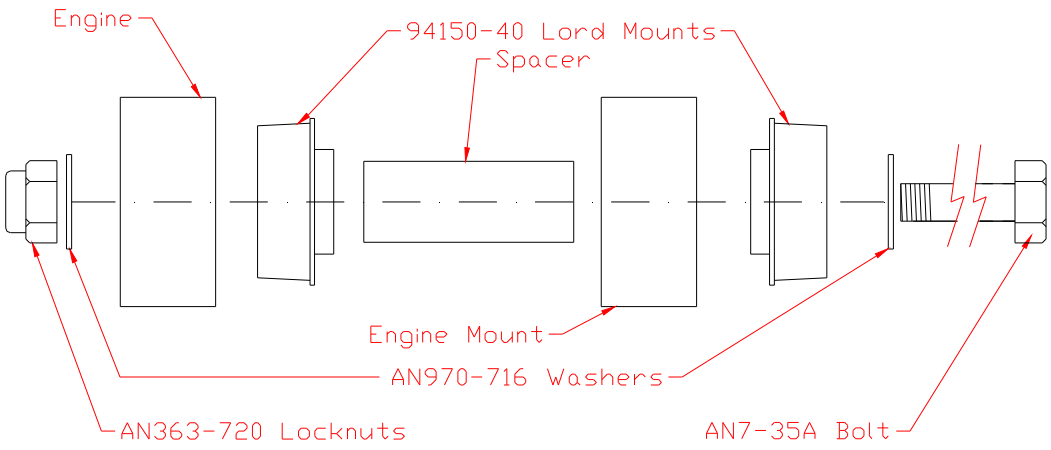
6) Using .032" 6061-T6 Raw Material construct the Throttle/Mixture Cable Attach Bracket. Figure 4. Attach to the firewall using 1/8" x 3/16" avex rivets (RV-1410). **NOTE:** Depending on carb location on your engine, the placement of this bracket may vary.

(Figure 3)




(Figure 4)

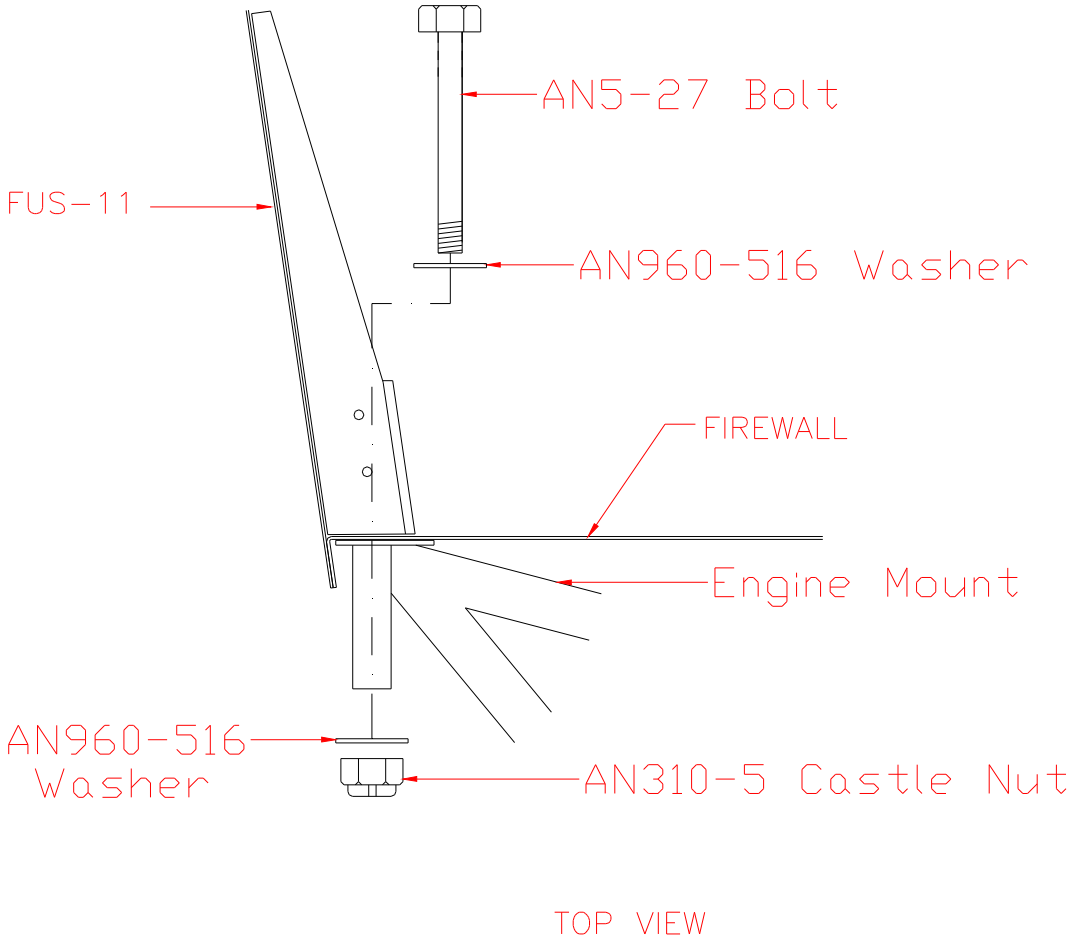
7) Support the engine however you like as long as it will move without the chance of dropping it. Attach the engine mount to the engine with four Lord Mounts (94150-40), four AN7-35A bolts, eight AN970-716 washers and four AN363-720 locknuts. Figure 5.




(Figure 5)

8) Bolt the carb heat box to the carburetor using the drilled head 1/4" bolts supplied with engine. Safety tie these bolts together.

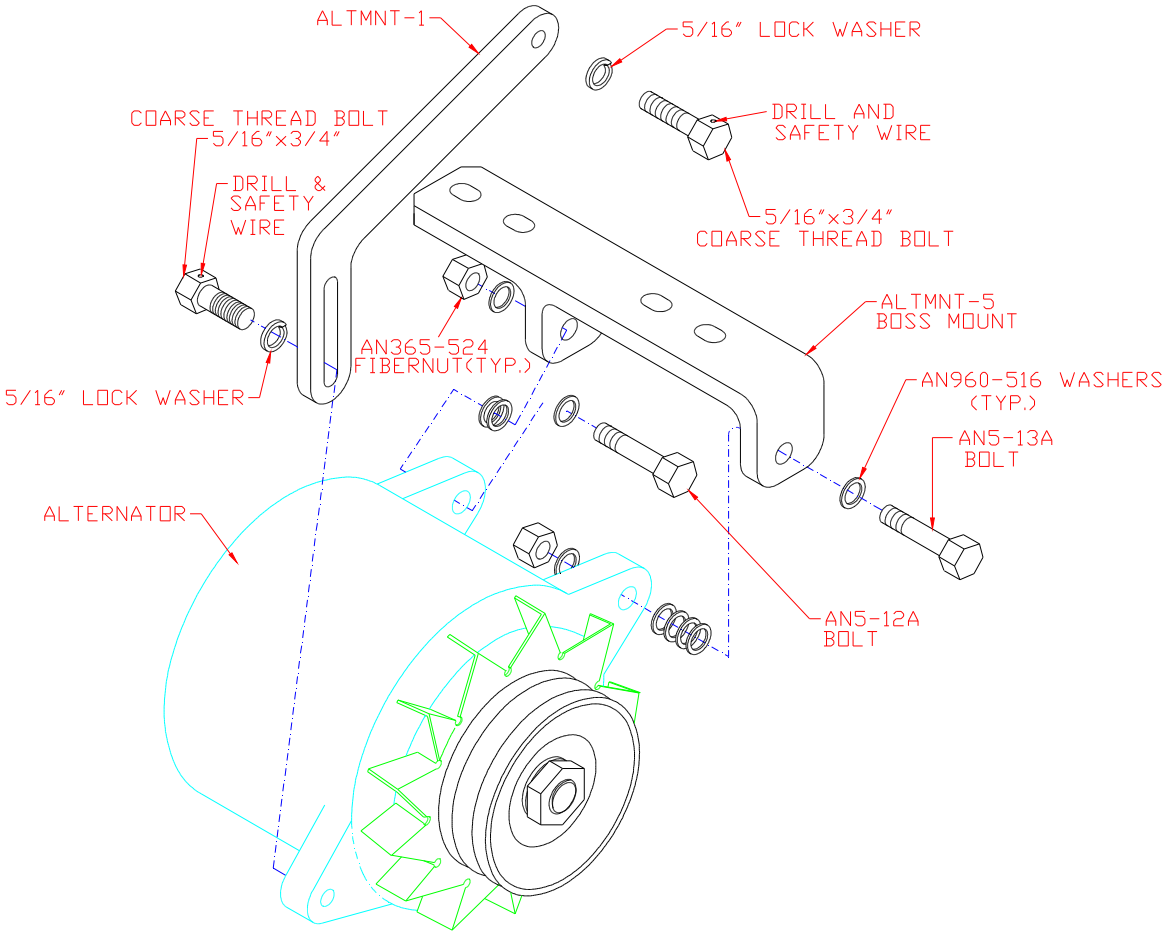
9) Bolt the engine and engine mount to the firewall using four AN5-27 bolts, eight AN960-516 washers, four AN310-5 castle nuts and four MS24665-132 Cotter Pin. Figure 6.




(Figure 6)

10) Bolt the carburetor assembly to the engine using the nuts and lock washers supplied with the engine.

11) Install, if used, the alternator with supplied hardware. Depending on the engine you may require a “Boss” or “Case Mount” attach bracket. We recommend that you drill the head of the two coarse threaded bolts and safety tie. Figure 7. **NOTE:** Install the belt upon final assembly.




(Figure 7)

**NOTE:** The purpose of the interior baffles is to create a plenum (an area to slow and control the incoming air to cool the engine cylinders). The baffles should fit tight against the cooling fins on the cylinders and "hug" the engine block. The patterns given in this kit are designed to fit the fiberglass speed cowling. The height may differ for different cowlings.

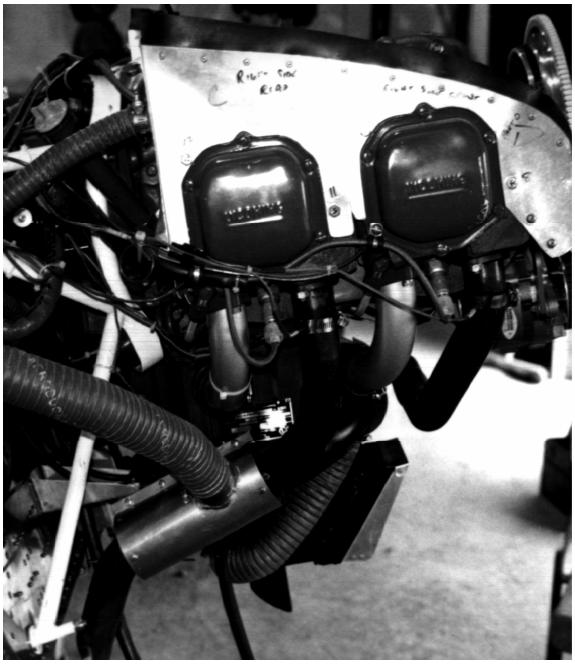
12) Using the patterns supplied, layout and cut cardboard templates. Ensure that the templates fit your engine in the locations that they belong. Trim to fit.

13) When sure of the fit, transfer the cardboard patterns to the .032 5052-H32 Raw Stock (CO-29). Install each panel as in the photographs supplied with the Baffle kit.

14) Cut strips of the Rubber Baffle Material to finish off the top seal of the baffle. These will be held on with fabric rivets (RR-7402L).

**NOTE:** A couple of don'ts to remember: First, if marking the exhaust parts, don't use a pencil, grease pencil or any carbon containing marker. The carbon will cause heat concentration and eventual cracks. Secondly, don't re-use gaskets.

15) Attach the rear cylinder's exhaust, which exits out the left side of the engine, with the nuts, lock washers and gaskets supplied with the engine. Repeat with the front cylinder exhaust which exits out the right side of the engine. Figure 8.






(Figure 8)

16) Engine controls (throttle, mixture, carb heat) are push-pull cables. The placement in the plane aft of the firewall is up to the individual. Our exit locations are only a suggestion. The cables can be anchored to the Cable/Mixture Mounting Bracket. Use Forks (E-73) to attach cables to engine.

17) Wiring requirements are going to vary greatly from individual aircraft due to the different instrument configurations. We highly recommend using Tony Bingelis' Firewall Forward to find and follow proper wiring practices. Because of the differences in aircraft and preferences, it is difficult to supply "THE" wiring diagram for the *Rebel*. We have supplied two general schematics (one for generator equipped aircraft and one for alternator equipped). Wire the engine using these as a guideline. Figure 9 and Figure 10. If you are using a Murphy Aircraft supplied alternator, use Figure 11 as a guide to wire the alternator to the regulator..

**NOTE:** Some Hints on wiring:

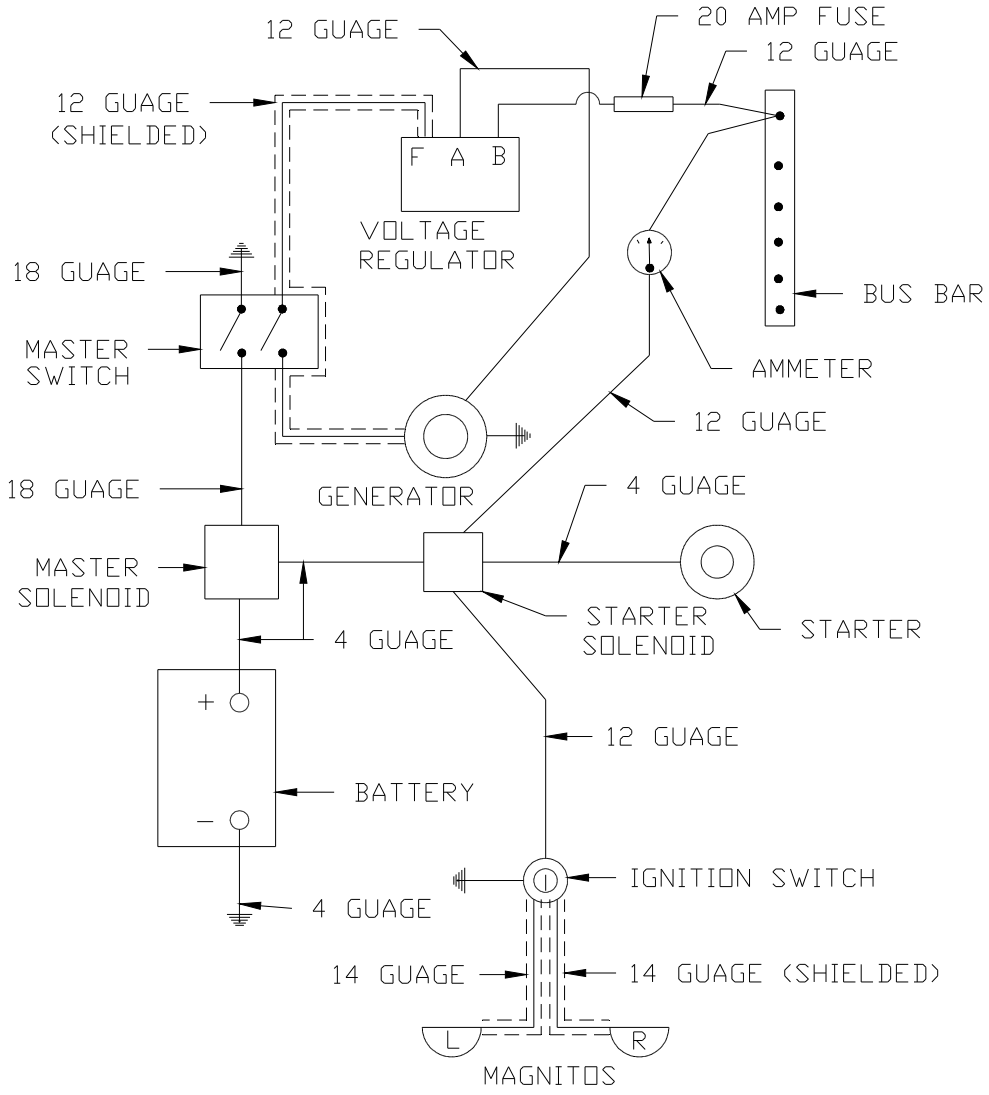
I. Keep it as simple as possible. Work on one circuit at a time.

II. Keep in mind the conditions in which the wiring will be exposed. Sun, rain, high and low temperatures, all may require some kind of protection for wires.

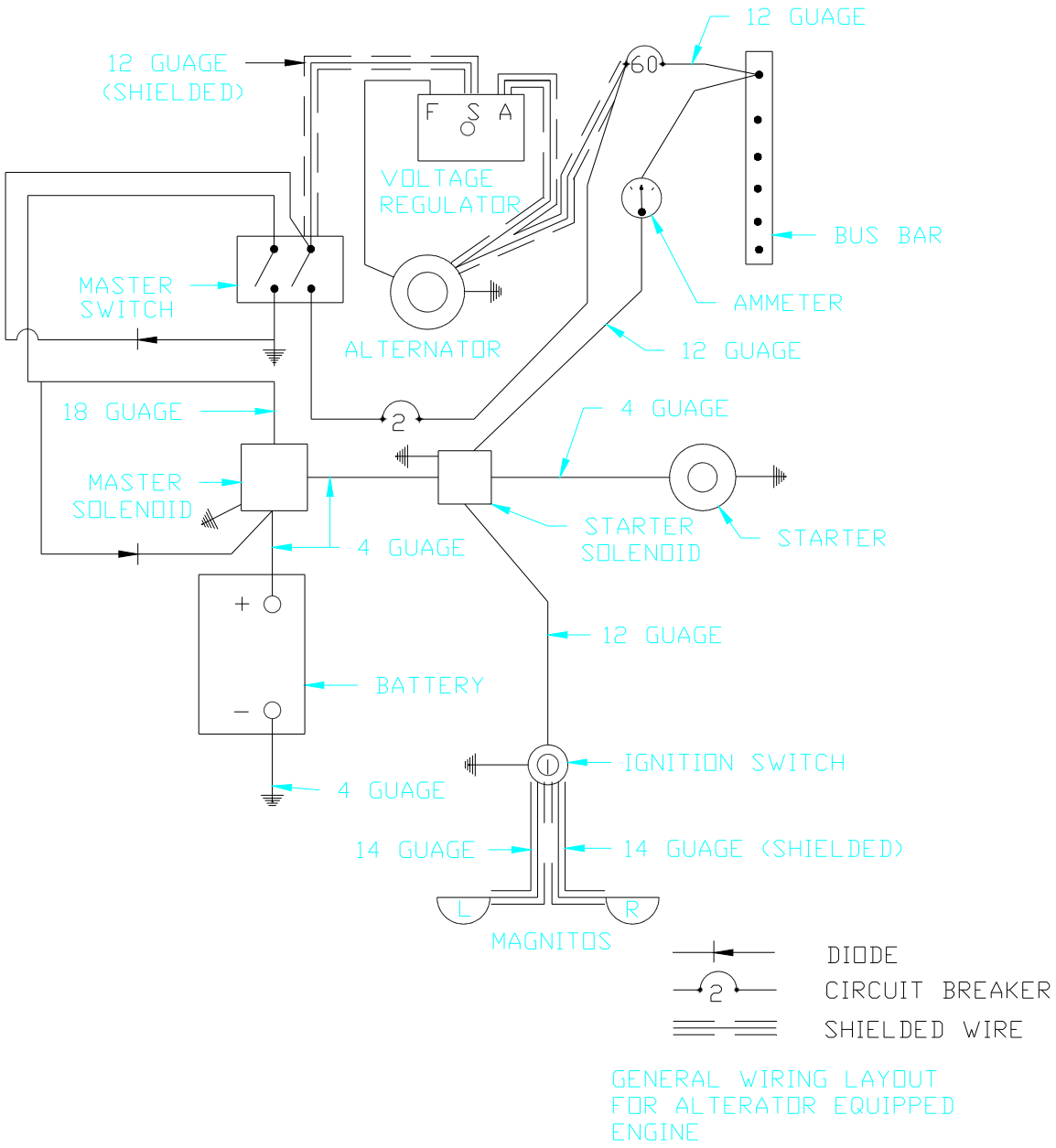
III. Protect wires from possible chafing on metal parts. Use solderless crimp-type connections to limit the chance of breakage.

IV. Keep ground wires one color, preferably black.

V. Anytime two wires are together and are being spliced, offset the splice to prevent and chance of contact between them.

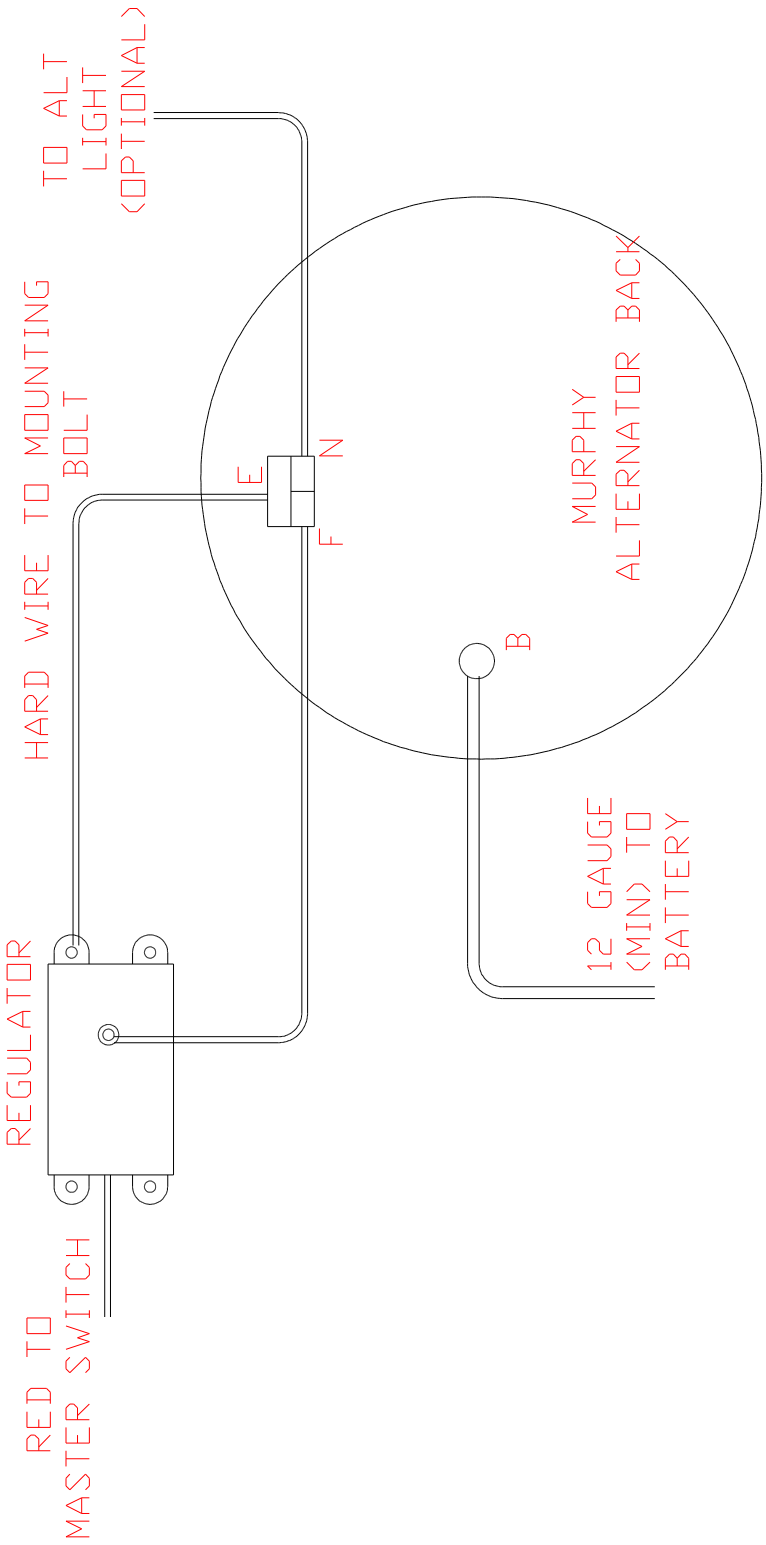



GENERAL WIRING LAYOUT
FOR GENERATOR EQUIPPED
ENGINE (Figure 9)




GENERAL WIRING LAYOUT
FOR ALTERATOR EQUIPPED
ENGINE

(Figure 10)




(Figure 11)

Some general notes to keep in mind:

1) There are two types of batteries: Lead Acid and Gel Cell.

Lead Acid: Widely accepted for aircraft use, the lead acid battery has some characteristics that must be considered while installing.

- It can leak

- It requires maintenance

-It produces gas while charging.

As a result, the battery must be accessible and well ventilated.

Gel Cell: This is a sealed battery that will not leak, doesn't generate gas while charging and needs no maintenance.

2) Master Switch: It's function is to disconnect the battery from all electrical equipment. The "master" controls two circuits so it must be double pole single throw.

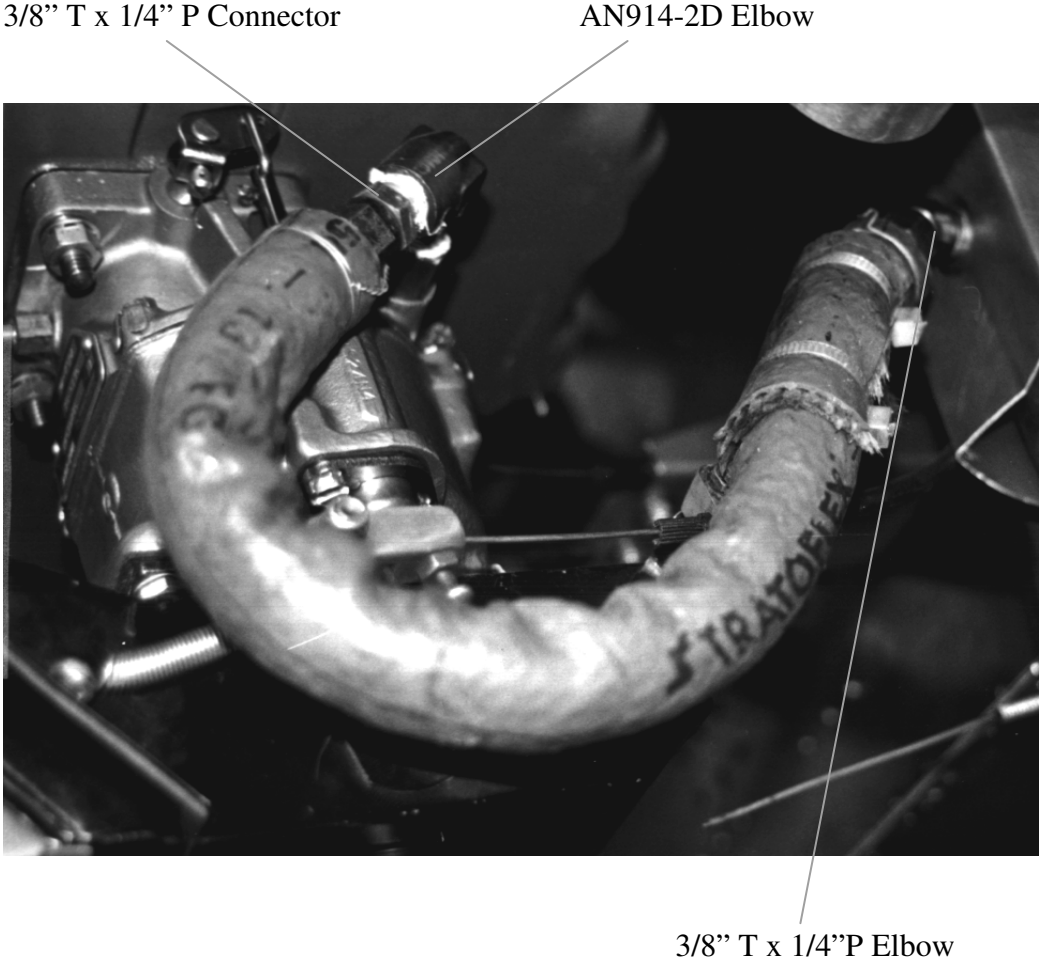
3) Solenoid/Contacter/Relay Switch: All refer to the same thing. It is an electro-magnetic switch that can be remotely controlled (from the cabin) to activate heavy current circuits, such as the battery to starter.

**NOTE:** Keep the wiring neat and direct as possible. Make solid connections. Support wires and keep them from chafing.

18) Install a 45 degree 3/8" T x 1/4" P elbow into the front of the Gascolator. Connect the Stratoflex fuel line (111417-6S0150) to the elbow. Figure 12.

19) Install in the other end of the Stratoflex hose a 3/8" T x 1/4" P Connector (3748-6B). Figure 12.

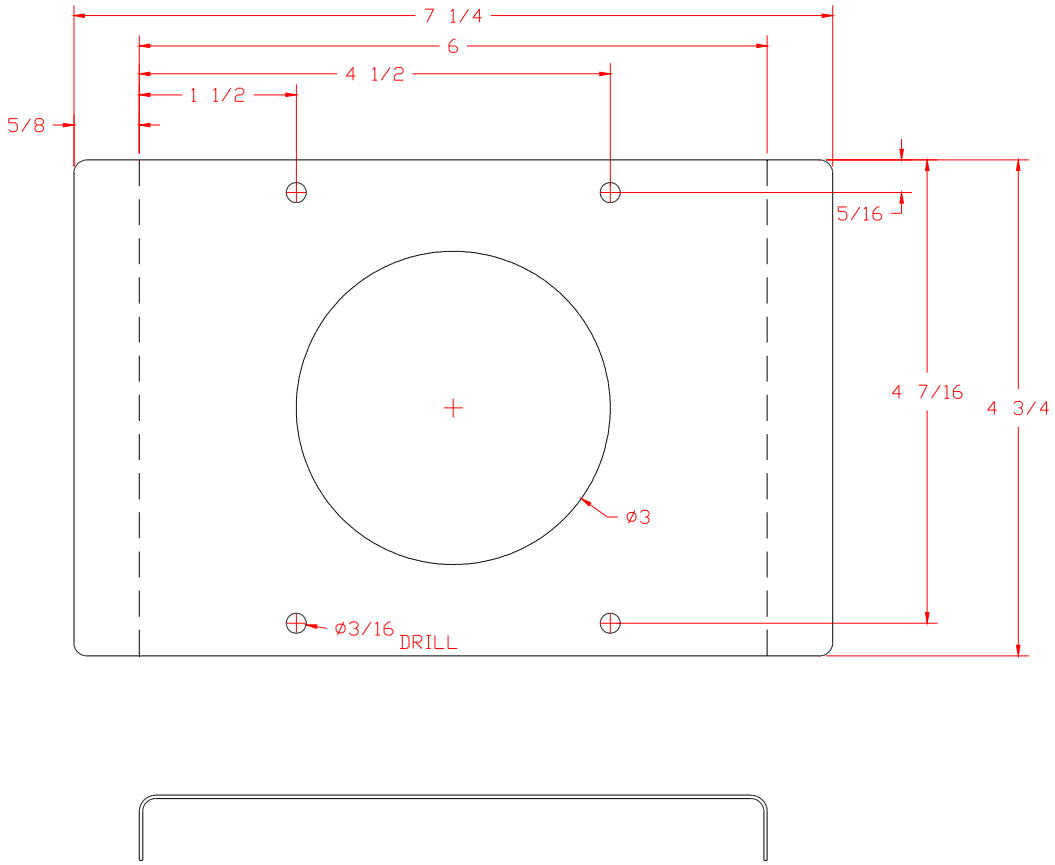
20) Install a 90 degree elbow (AN914-2D) into the fuel inlet of the carburetor. Attach the Stratoflex fuel line to the 90 degree elbow. Figure 12.




(Figure 12)

**NOTE:** It is recommended that a Stewart Warner oil cooler (8406R) be used due to the small area available behind the engine. The following installation is for this oil cooler.

21) From the .020 6061-T6 Raw stock, make the following top bulkhead for the oil cooler. Figure 13



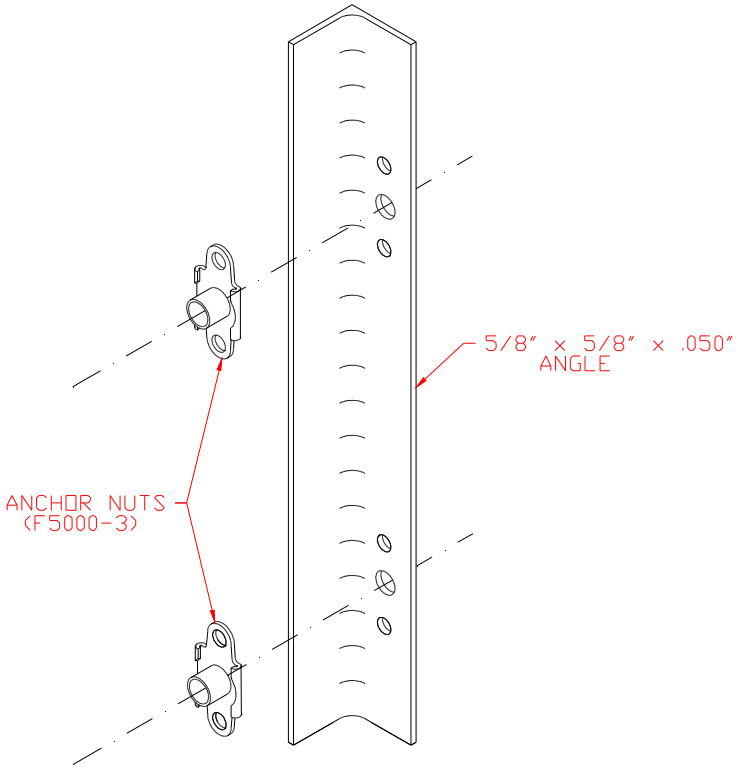

(Figure 13)

22) Using a 3" hole saw, cut out the 3" hole in the Top Bulkhead as shown in Figure 13.

23) Cut two pieces of 5/8" x 5/8" x.035 tube 5 15/16" long. Using the top bulkhead for the oil cooler as a guide, drill two 3/16" holes in each tube. **NOTE:** These holes need to be accurate.

24) Cut two 5/8" x 5/8" x .050 angle material at 5 15/16" long. Locate two 3/16" holes in each angle as you did in step 23.

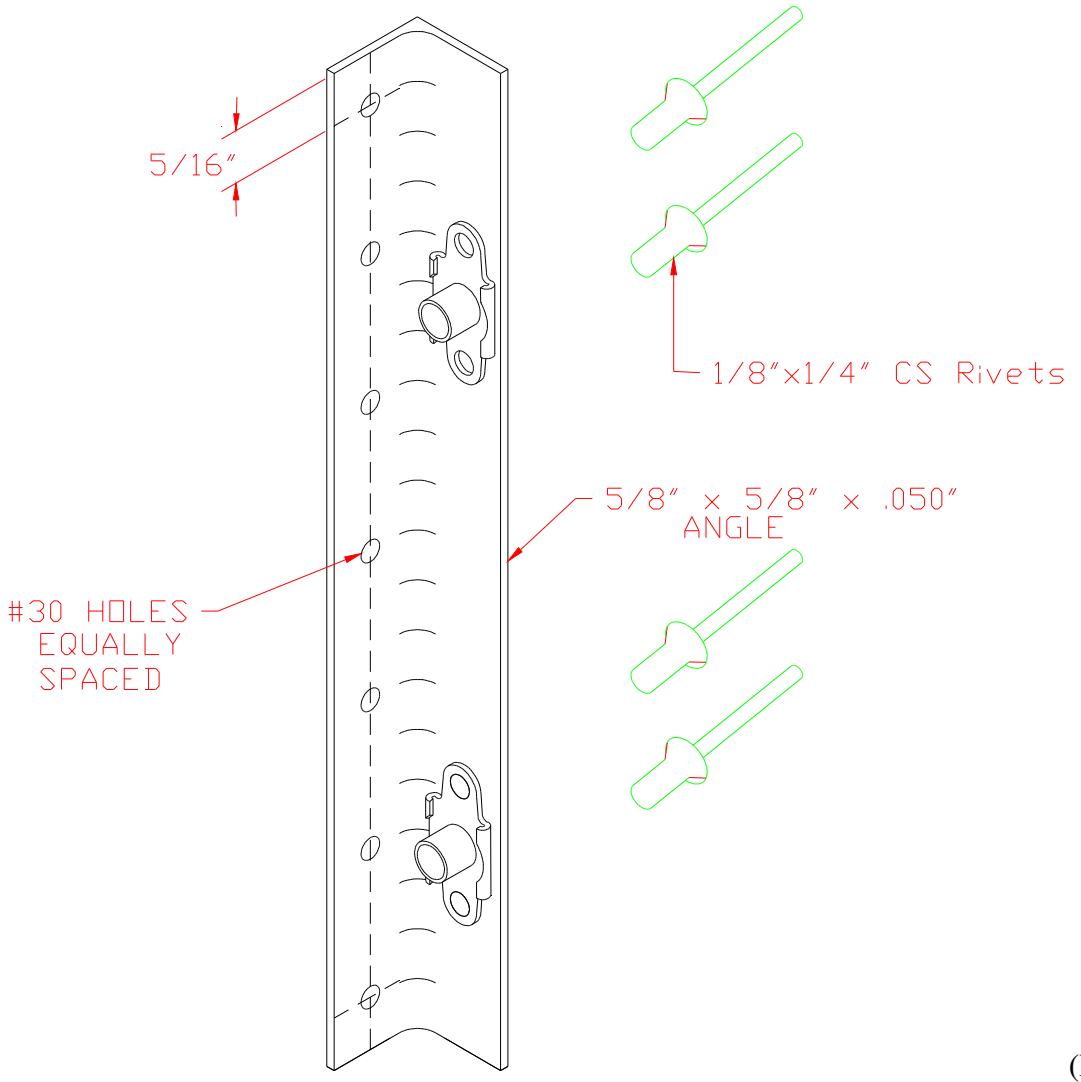
25) Position two Anchor Nuts (F5000-3) on the inside of the two angles. Figure 14. Drill #30 holes to attach the anchor nuts.




(Figure 14)

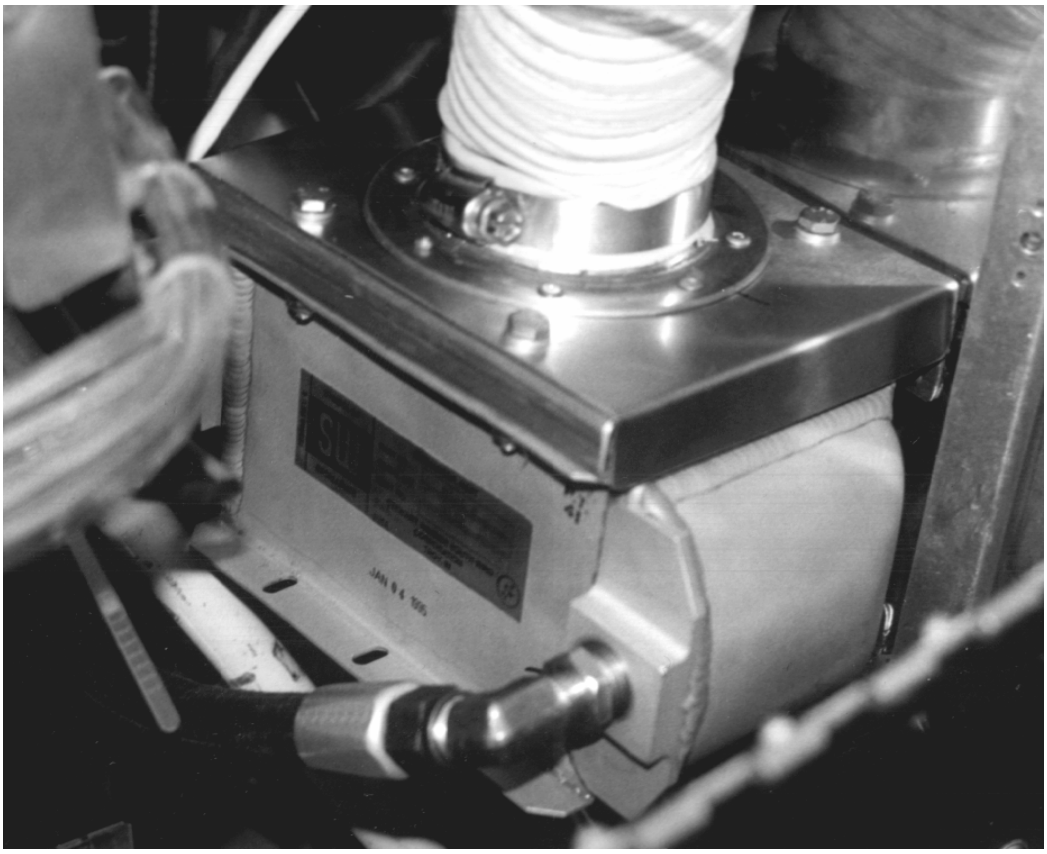
26) Countersink the #30 holes and rivet the Floating Anchor Nuts (F5000-3) to the angle using Countersunk Rivets (RV-4412)

27) Draw a line down the center of the opposite flange of the angle and layout out seven #30 holes evenly spaced. Drill. Repeat for the other angle. Figure 15.




(Figure 15)

28) Position the oil cooler as in Figure 16. Ensure that there will be clearances for the hoses and fittings. **NOTE:** The photo shows the oil cooler in its finished setup. Yours is not at this point of completion.

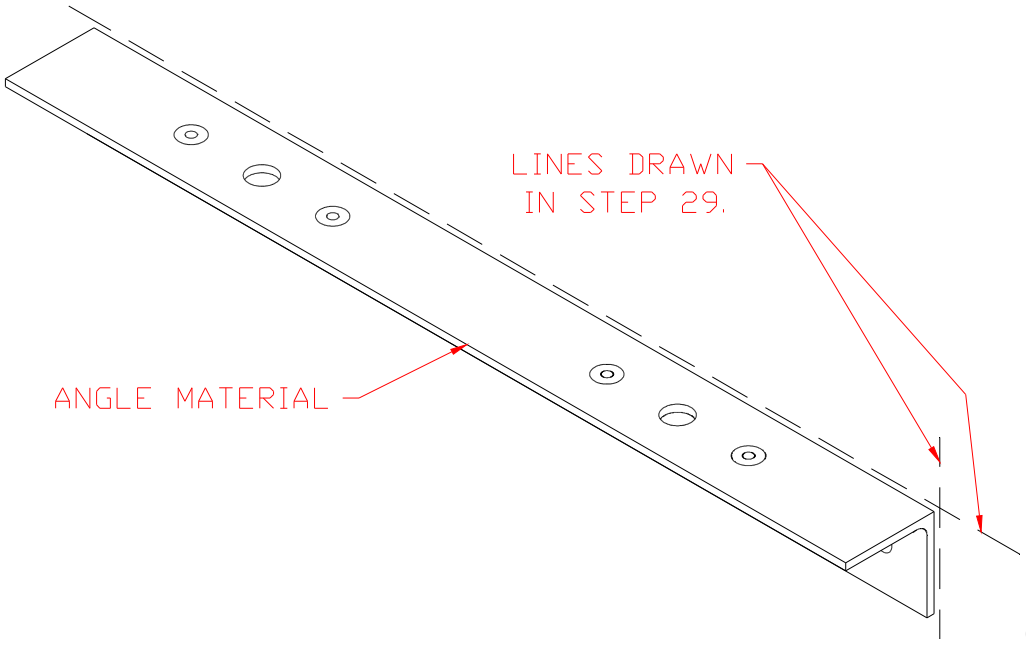


*** Viewed looking rearward on pilot side ***

(Figure 16)

29) Draw a line to mark the top flange of the oil cooler. Also mark the end of the top oil cooler flange.

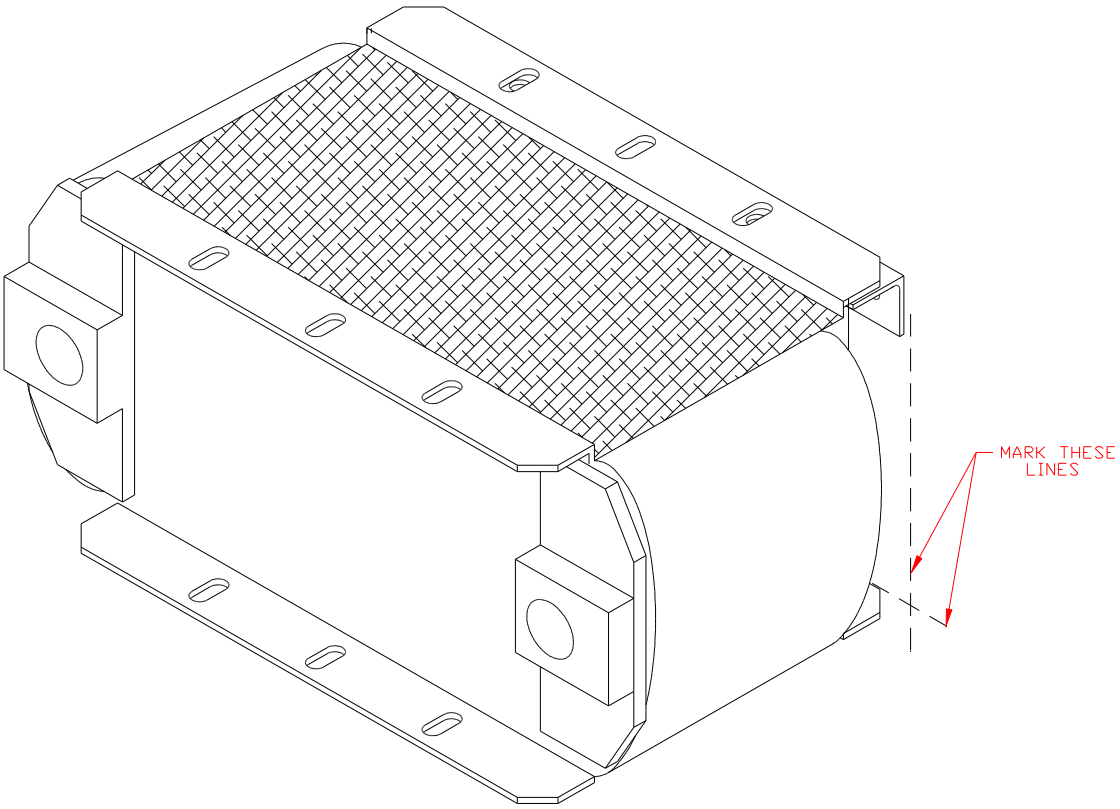
30) Locate one of the angles along the mark drawn in step 29. Drill the seven #30 holes into the firewall. Figure 17.




(Figure 17)

31) Remove and deburr. Rivet the angle onto the firewall with 1/8" x 3/16" avex rivets (RV-1410).

32) Replace the oil cooler so that the top flange is resting on top of the angle. Mark the inside location of the bottom flange of the oil cooler. **NOTE:** Ensure that the floating anchor nuts are lined up with the holes in the top flange of the oil cooler. Figure 18.

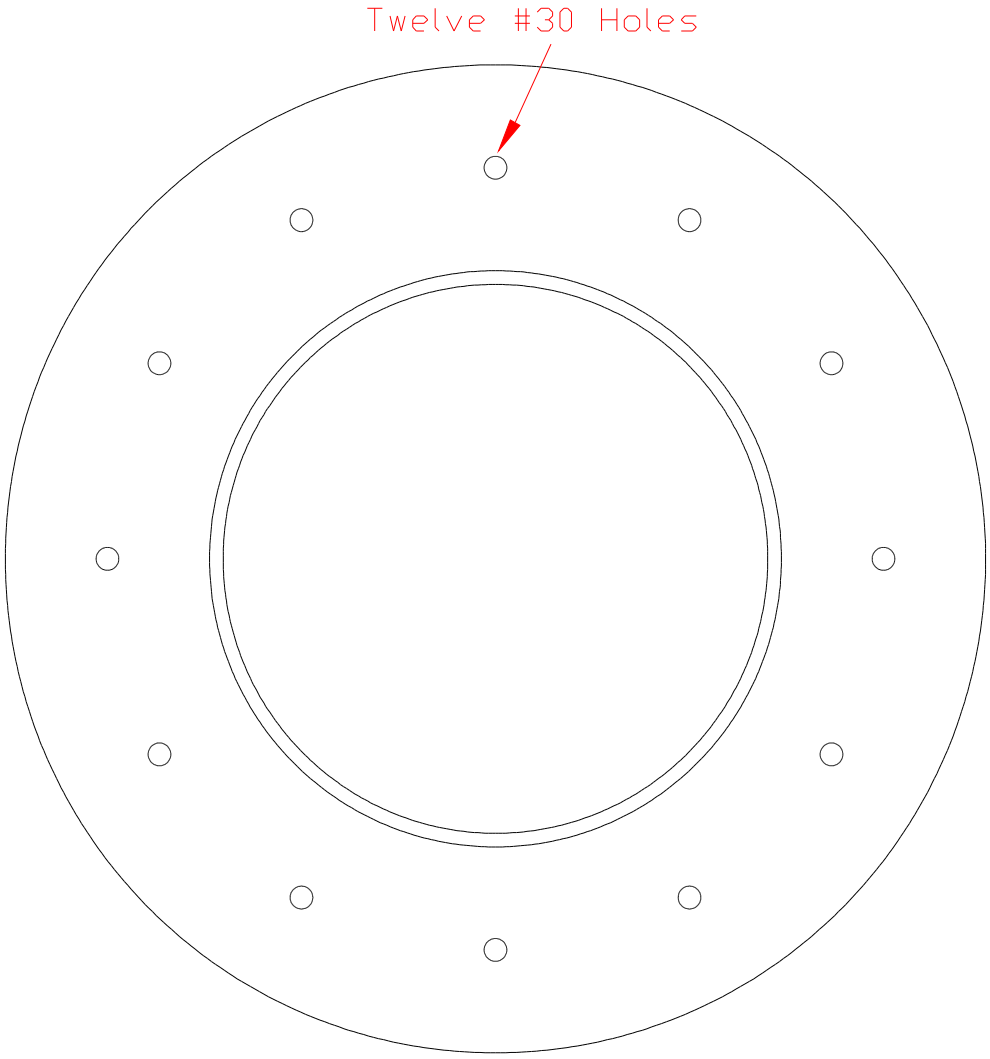



(Figure 18)

33) Remove the oil cooler. Position the other angle onto the firewall using the mark drawn in step 32. Drill the seven #30 holes. **NOTE: The location of the floating anchor nuts have to match the oil cooler.**

34) Remove and deburr. Rivet to the firewall with 1/8" x 3/16" avex rivets (RV-1410).

35) Lay out and drill 12 evenly spaced #30 holes in the flange of the 3" Air Inlet. Figure 19. Center and clamp the air inlet over the 3" hole in the top bulkhead from step 21. Transfer the 12 #30 holes into the top bulkhead. Deburr and round all corners on the parts.




(Figure 19)

36) Attach the 3" Air Inlet to the top using 1/8" x 3/16" Avex rivets (RV-1410).

37) Position the Top Plate and the 5/8" x 5/8" .035 tubes on the top of the oil cooler and place the assembly onto the two angles on the firewall See Figure 16.

38) In the top two rear holes attach the assembly to the angles with AN3-11A bolts. In the top front two holes use AN3-11A bolts, AN970-3 washers and AN365-1032 Fiber nuts. In the lower rear two holes use AN3-5A bolts.

39) In the inboard outlet of the oil cooler install a Reducer (110-CB) and a 90 degree elbow (3749-6D) . Connect a Stratoflex oil line (111417-6S0170) between the inboard outlet of the oil cooler to the lower outlet of the oil pump.

40) In the outboard outlet on the oil cooler, install a Reducer (110-CB), a 90 degree Elbow (3749-6D) and a Stratoflex Fuel line (111417-6S0170). The other end of the Stratoflex fuel line attaches to the upper inlet of the oil pump with a 90 degree Elbow (3749-6D) and a Reducer (110-DB).

41) Install 3" Scat Tubing (Scat-12) between the baffle material to the oil cooler using 3" hose clamps ( HC6-44).

42) Install the 2" scat tubing (Scat-8) to the heat muffs, engine baffles and cabin heat with 2" hose clamps (HC6-24).

43) Install the Cowling as per instructions for the particular cowling used.

44) Install Prop as per manufactures' recommended procedures.

# *MURPHY REBEL RETRO KIT*

## *SPLIT FLAP/AILERON*

***September 9, 1997***

# *SPLIT FLAP/AILERON RETRO-FIT FOR MURPHY REBEL*

## FLAPS

1) Remove left and right Flap Assemblies from aircraft.

2) Remove the Flap Control Horns.

**NOTE:** New Flap Control Horn Plate (Flap-19) is to be attached at the root end of each flap (between flap and fuselage). Changing flaps left to right and right to left allows attachment of Flap-19 to the leading edge rib on which the old Flap Control Horn Plate was previously attached.

3) Cleco a horn plate (FLAP-19) to the root leading edge rib, use the #11 tooling holes. See figure 1.

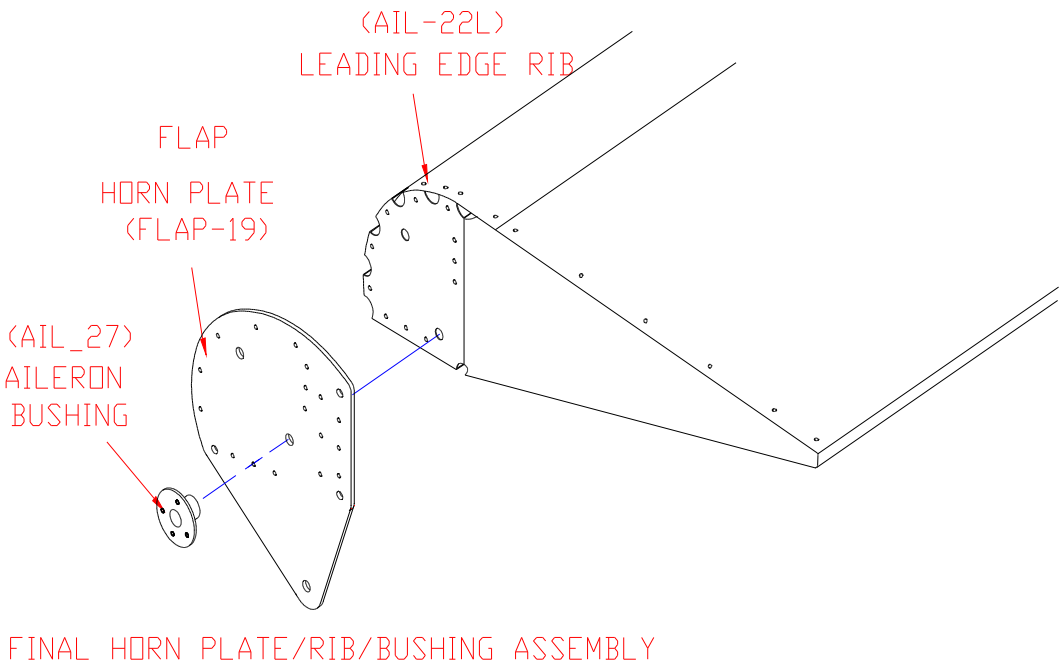



Figure 1

4) Using the horn plate as a drill guide, drill the #30 rivet holes into the rib. With a #11 drill bit, drill through the two tooling holes near the rear of the plate and cleco solidly in place.

5) Remove the cleco from the pivot position hole. Drill this hole out to 1/2".

6) Insert Aileron Bushing Ail-27 into the 1/2" hole. Using the countersunk holes in the bushing, drill #30 holes through the horn and rib.

7) Disassemble, debur, and chromate the mating surfaces and rivet together with 1/8" x 3/16" Avex rivets (RV-1414). In the three #11 holes use 3/16" x 1/4" Avex rivets (RV-1613). In the brass bushing use four 1/8" x 3/16" Avex rivets (RV-4412).

## CONTROLS

1) Cut the left and right Flap Stiffener Ribs (FUS-65R and FUS-65L) to fit between the cage and the first bulkhead and between the first and second bulkhead. Figure1.

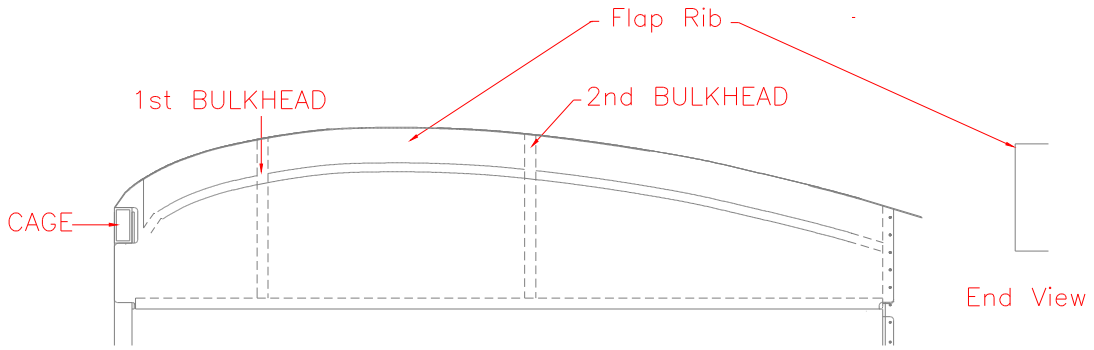



Figure 1

2) Mark a line down the inside of the roof, showing the center of the roof from the cage to bulkhead #2.

3) On the top flanges of the forward two sets of bulkheads draw a line down the center, then mark a line on both ends 5/16" in from the end. Figure 2.




Figure 2

4) Where the two lines intersect drill a #40 hole. Do this to the four bulkheads.

5) Mark a line along the roof 1 5/16" each side of the center line.

6) Position the right front Flap Stiffener Rib so that the center line on the roof is visible through the #40 holes that you previously drilled. Keeping the bulkhead against the cage, drill the two #40 holes into the roof and cleco.

7) On the top of the roof, draw a line connecting the two #40 holes.

8) Along the line mark out evenly spaced holes about 1 1/4" apart and drill to #40.

9) Repeat steps 6 to 8 for the other three ribs.

10) On the back two ribs, build an angle bracket so that the ends are tied into the bulkheads. **NOTE:** Try to build the angles so they use existing rivets in the bulkheads.

11) Using the Interior Delrin Pivot Block (FLAP-11) locate the area that will need to be cut out to clear the Flap Handle Torque Tube. Figure 3.

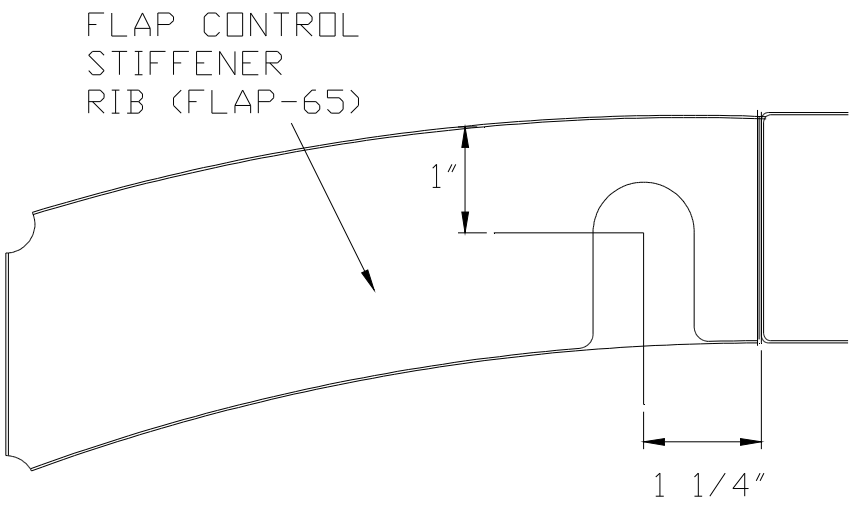



Figure 3

12) Position an Interior Flap Pivot Block over the cut out you just made and drill 3 bolt holes through the Stiffener Rib using the Block as a drill guide. Figure 4.

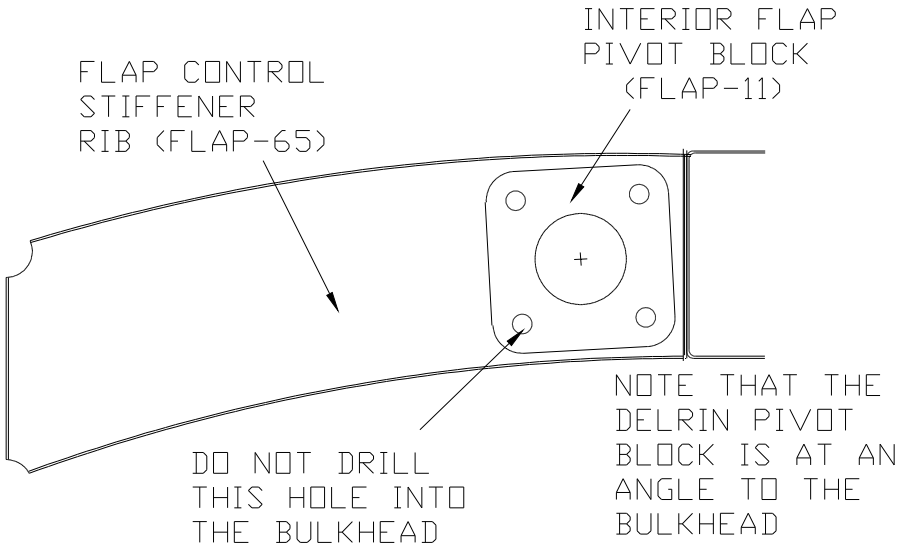



Figure 4

13) Clamp both Stiffener Ribs back to back and mark the second rib for cutting and drilling.

14) Drill and trim the second rib.

15) Make a cardboard template of the Stiffener Rib. (This will be used for locating holes later on. Use the FLAP-11 Pivot Block to eyeball a center point). Figure 5.

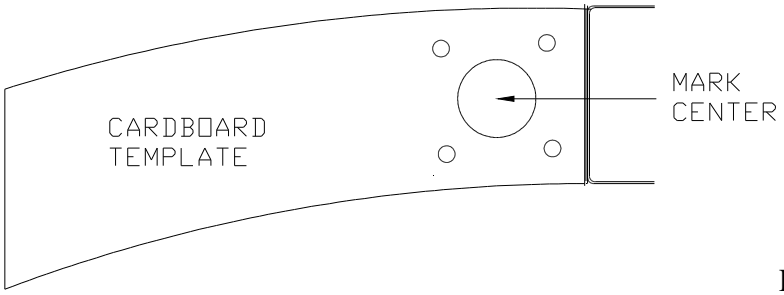



Figure 5

16) From ST-40 angle stock, build two angle pieces that will tie the front ribs to the bulkhead. Try to incorporate the two 3/16" holes in the Pivot Block to attach the angle bracket to the rib.

17) Drill two 1/16" holes. One on each side of the Flap Handle slot". Figure 6.

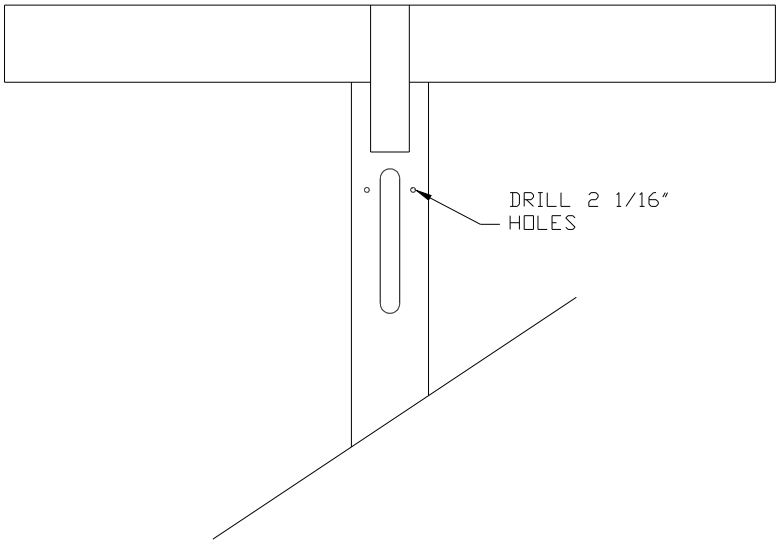



Figure 6.

18) If necessary, flatten the Flap Handle Lock (FLAP-4) so that the two flanges are approximately parallel to each other. You will also want to drill 2 1/16" holes to accommodate the SA-33 spring.

19) Find the SA-33 Spring and bend the last coil on each end 90º to the coils. Figure 7.

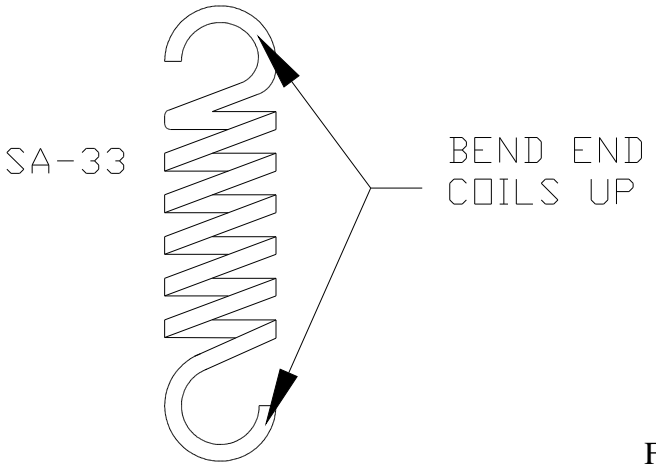



Figure 7

20) Assemble the Flap Handle Lock onto the Flap Pivot Handle as in figure 8. **NOTE:** Do not over tighten the two bolts, it should pivot freely.

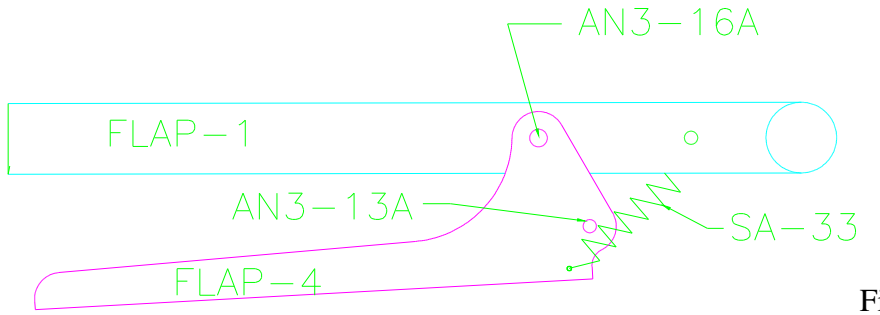



Figure 8

21) Slip the Interior Delrin Pivot Block (FLAP-11) on each end of the Flap Pivot Handle. Position the assembly into place.

22) Cut three compression tubes from FLAP-20 raw stock (3/8" x .058 6061-T6 tube) at 1 3/8" long.

23) With the angle material riveted to the bulkhead, bolt the Interior Delrin Pivot Block to the front Flap ribs. Figure 9.

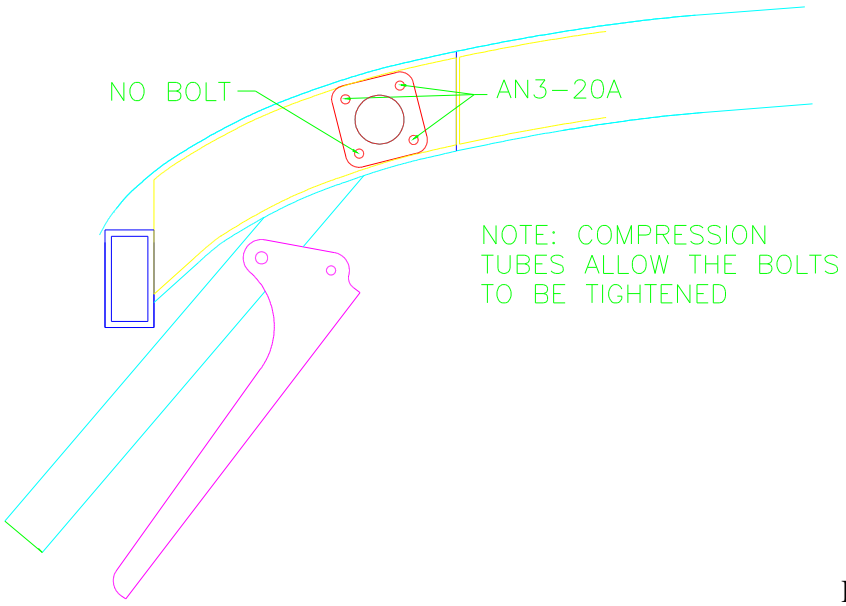



Figure 9

24) Slide the Flap Handle Lock Plate into the slot in the Flap Pivot Handle. Position the Flap Handle Lock Plate in the forward position. Keep the Flap handle Lock Plate toward the center of the slot.

25) Move the assembly forward until the Flap Pivot Handle touches the cage. Position the front hole in the Flap Handle Lock Plate so that it is near the center of the rib. Figure 10.

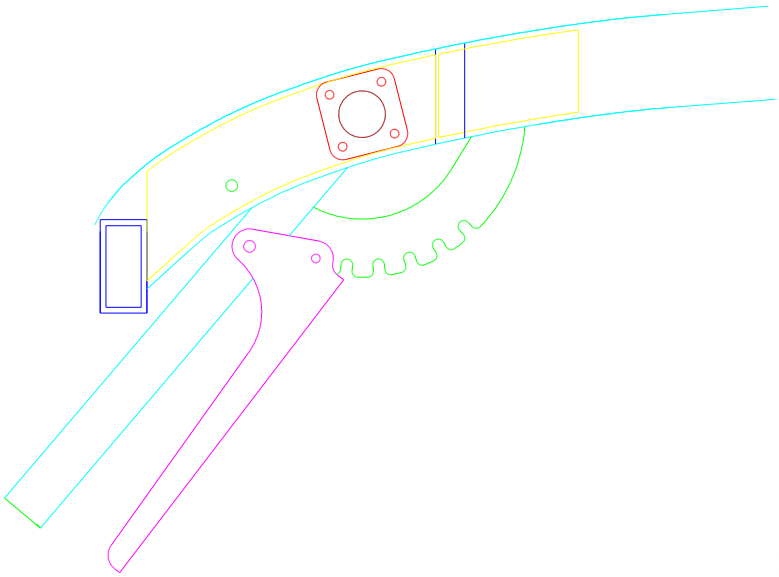


Figure 10

***SPLIT FLAP/AILERON RETRO (CONTROLS) con't***

26) Mark to location of this hole.

27) Remove the assembly. Remove the front Flap ribs.

28) Drill a 1/4” hole in the marked location. Transfer this hole to the other front Flap Rib.

29) Replace the Flap Ribs back onto the roof.

30) Remount the Flap Handle onto the roof.

31) Slip a 1/4” bolt through the holes in the Flap Ribs and the Flap Handle Lock Plate. Locate the rear hole of the Flap Handle Lock Plate onto the rear bulkhead.

32) Repeat steps 27 - 31 for the rear two ribs.

33) Drill the #40 holes out to #30.

34) Remove the Flap Ribs and debur all the holes.

35) Chromate all mating surfaces and re-assemble. Rivet the ribs to the roof and bulkheads with RV-1410 avex rivets.

36) Assemble the Flap Handle onto the Flap Ribs as in figure 11.

37) Using the cardboard template you made earlier, mark the FUS-27 Root Ribs for Torque Tube exit holes. Cut a 1” hole at these locations. Figure12.

***SPLIT FLAP/AILERON RETRO (CONTROLS) con’t***

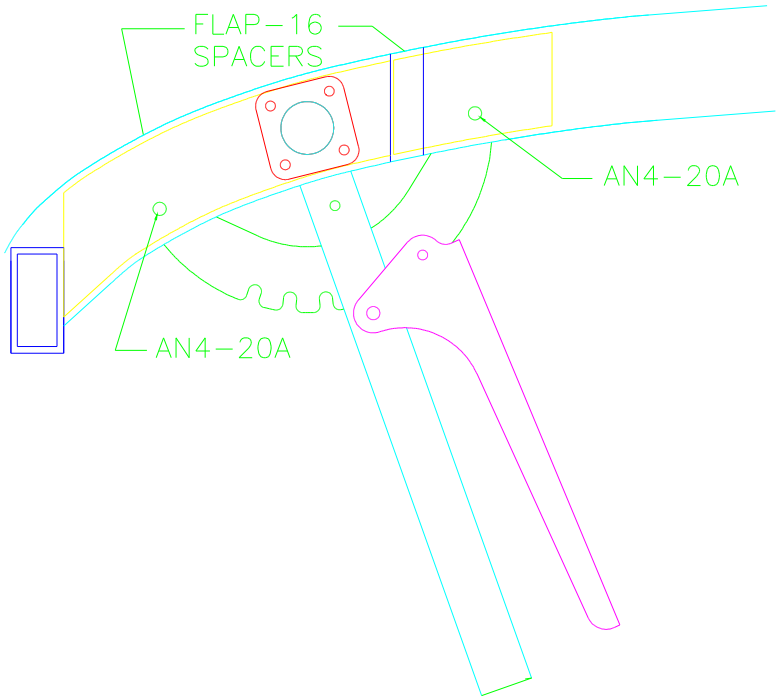



Figure 11

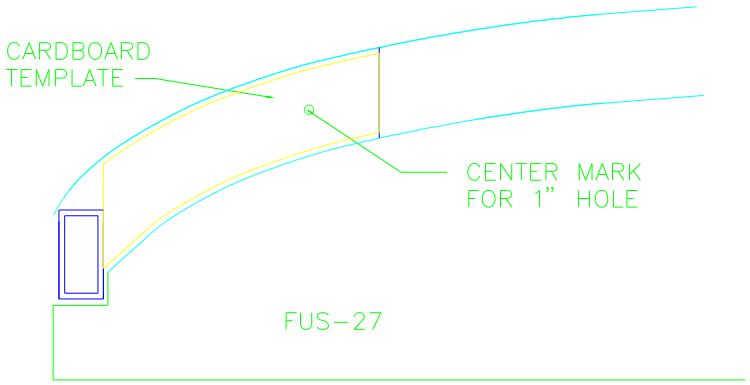



Figure 12

38) Scotchbrite the Interior/Exterior Tube (FLAP-2).

39) Slide an Exterior Delrin Pivot Block (FLAP-12) onto the Interior/Exterior Tube.

40) Slide the tube through the hole in the Root Rib and into the Pivot Tube.

***SPLIT FLAP/AILERON RETRO (CONTROLS) con't***

41) Hold the Exterior Delrin Pivot Block up against the Root Rib and drill each of the four 3/16” holes from the Block into the Root Rib.

42) Bolt the Exterior Delrin Pivot Block to the Root Rib with AN509-1032-10R2 screws, AN960-10 washers and AN365-1032 fibernuts.

43) Measure back from the back surface of the main forward carrythrough on the FUS-27 21 3/4”. Draw a line 90º to the bottom edge of the FUS-27 at this point.

44) Measure down 3 3/8” on this line and mark for drilling. Drill a 5/16” hole. Repeat for the other side of the Cabin. Figure 13.

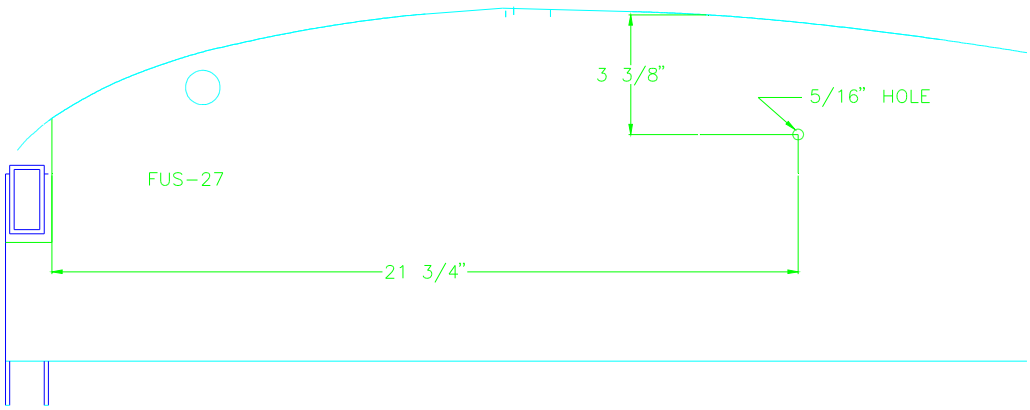



Figure 13

45) Prepare two FLAP-14 Bellcranks (1 left and 1 right). Figure14.

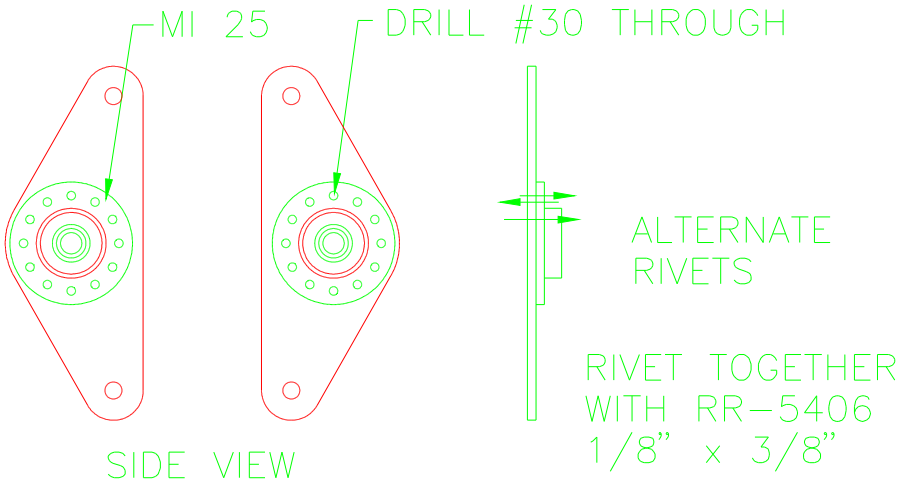



Figure 14

46) Insert an AN5-13A through the 5/16" hole you drilled in the FUS-27. Insert it from the inside.

47) Assemble a Bellcrank and Horn Retainer (FLAP-17) on the FUS-27. Position the Horn Retainer 90º to the vertical line. Drill through the FUS-27 with a #11 drill using the Retainer as a guide. Figure15

**NOTE:** Fabricate two stiffeners for each side of the aircraft to stiffen the FUS-27 rib. Run the channels from the top of the roof to the top of the Door. See figure 15 for locations.

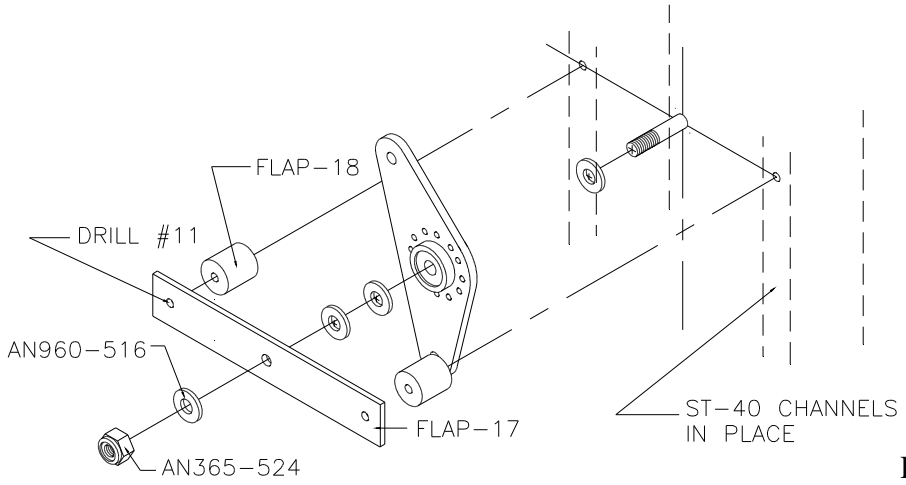



Figure 15

48) Disassemble, debur and bolt the FLAP-17 Retainer in place. Use AN3-5A bolts.

**NOTE:** Just finger tight.

192) Two sets of pushrods will have to be fabricated. Start with the forward set. Locate four (CC-29) End Fittings, four (AN490HT-8P) Rod End Bearings and four (Jamnut14) Jam Nuts. Thread them together. **NOTE:** With the jam nut tight against the CC-29 fitting 7 threads should be visible. Figure 16.

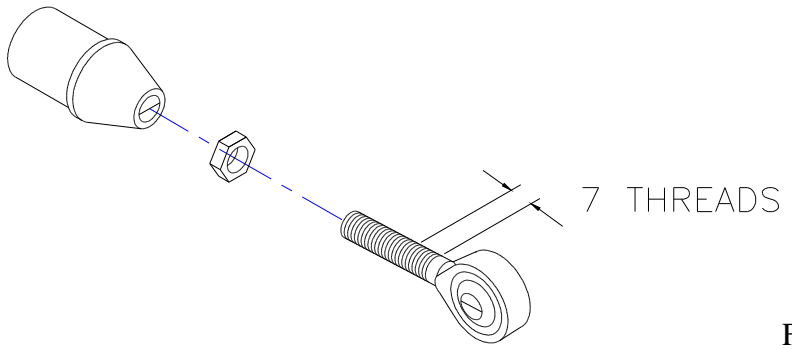



Figure 16

49) Cut two lengths of 3/4" x .035 tubing to 11 3/4" long. Insert a Rod End assembly into each of the tube ends.

50) Drill four #30 holes in each end of the pushrods. Keep each hole 90º to each other. Debur the holes and rivet with 1/8" x 1/4" SS rivets (RR-5404). Adjust the length of the pushrod to 14 3/4". Figure 17.

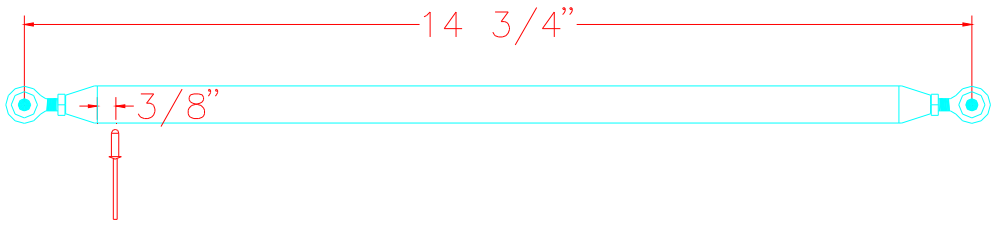



Figure 17

51) Fabricate the aft set of pushrods in exactly the same manner as the forward set with the exception of the length.

52) Cut the pushrod stock to 21 1/8". Once assembled adjust to over all length to 24 1/8" (hole center to hole center). Refer back to figure 86.

53) Draw a vertical line (90º to the bottom of FUS-27). Center it on the 1" hole cut earlier in the part. Mark the bottom of FUS-27 3 1/4" aft of the vertical line (eye ball is close enough). Extend a line down to the mark. Figure 18.

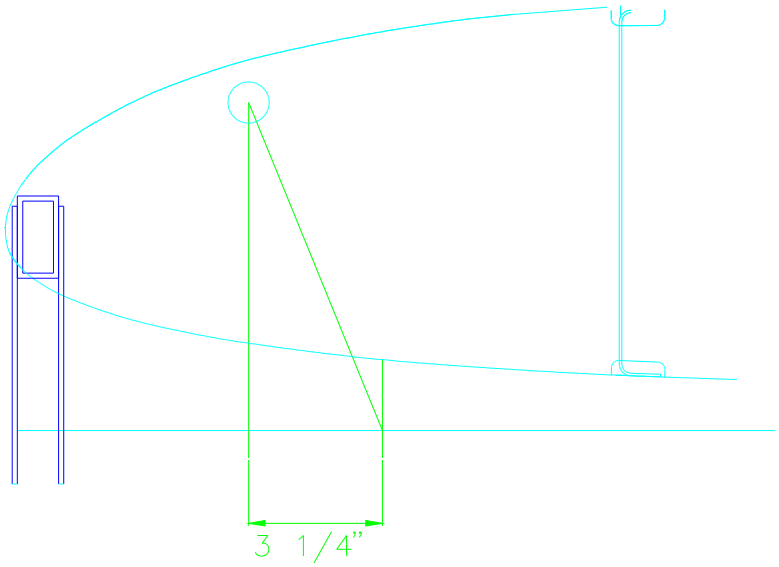



Figure 18

***SPLIT FLAP/AILERON RETRO (CONTROLS) con't***

54) Bolt the forward pushrods to the control arms of the forward Torque Tubes and the top arm of the reversal Bellcrank. See Figure 19 for details. **NOTE:** Tighten the bolts finger tight.

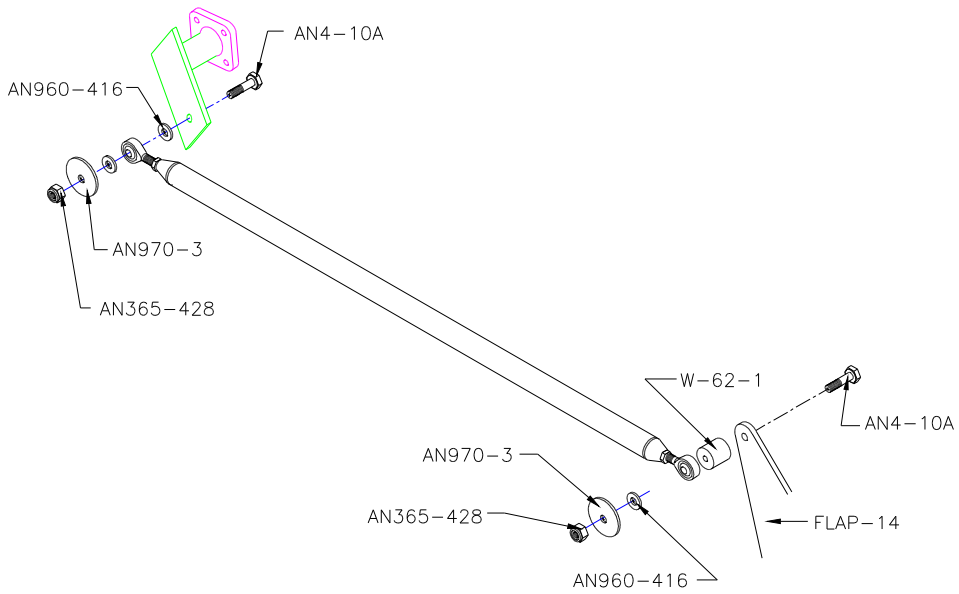



Figure 19

55) Bolt the aft pushrods (finger tight) between the reversal Horn and the Flap Horn. Use the same hardware arrangement as used in the forward pushrods. **NOTE:** Tighten the reversal assembly now.

56) Set the forward Horn on the same line as the diagonal line drawn earlier. Figure 20.

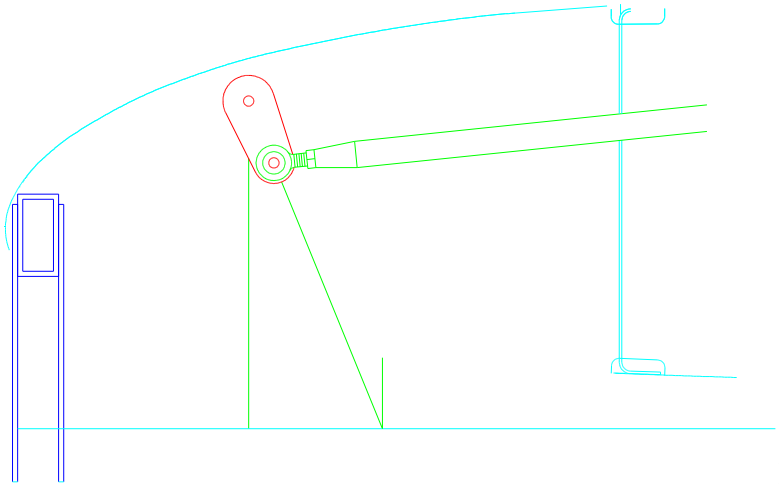


Figure 20

***SPLIT FLAP/AILERON RETRO con't***

57) Set the Flap Handle in the retracted position. (Full forward).

**NOTE:** If you can't use the first notch do not worry.

58) Adjust the pushrods until the reversal Bellcrank and the forward Horn are at the same angle and the Flap is in the full retracted position. Figure 21.

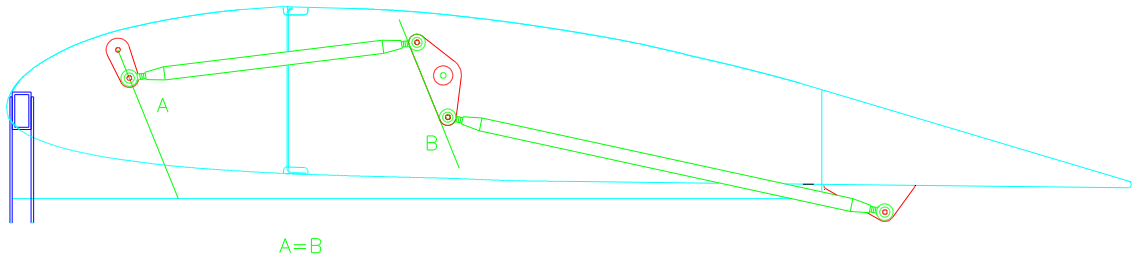



Figure 21

59) Tighten the jam nuts against the CC-29 Rod Ends. Tighten the Rod Ends to the Horns.

60) Drill and rivet the Torque Tubes together using 3/16" x 1/4" SS rivets (RR-5604). Use 4 rivets per joint (2 in front and 2 in back). Figure 22.

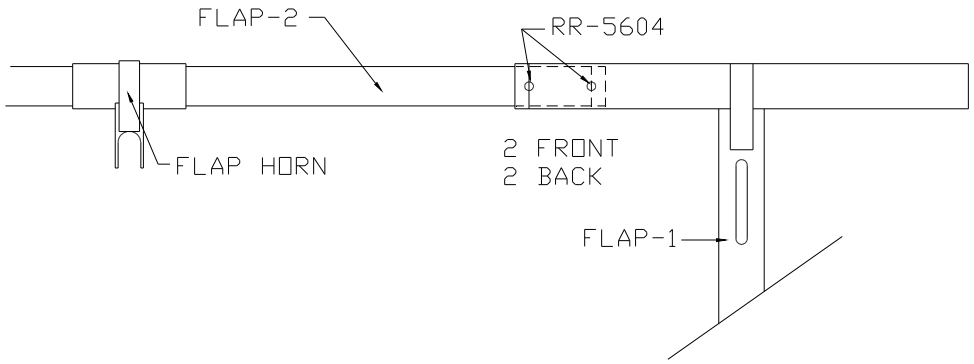



Figure 22

Now you will support the Teleflex cable on the FUS-27 Cabin Rib.

61) Layout and drill #40 rivet lines on the left side FUS-27 Cabin Rib. Figure 23.

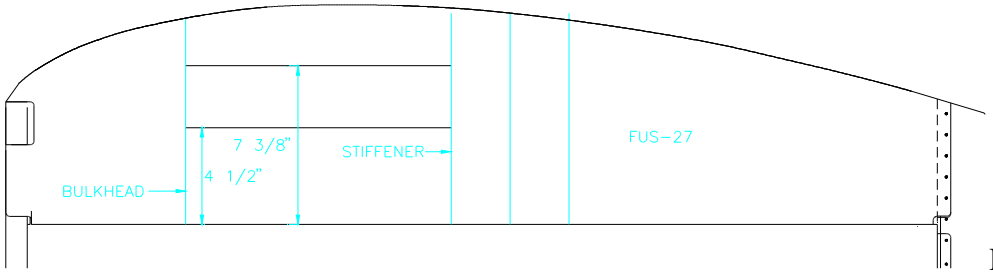



Figure 23

62) Find the FUS-462 Cable Anchor and position it between the first Cabin Roof bulkhead and the forward Bellcrank stiffener channel. Mark for trimming and trim the part. Figure 24.

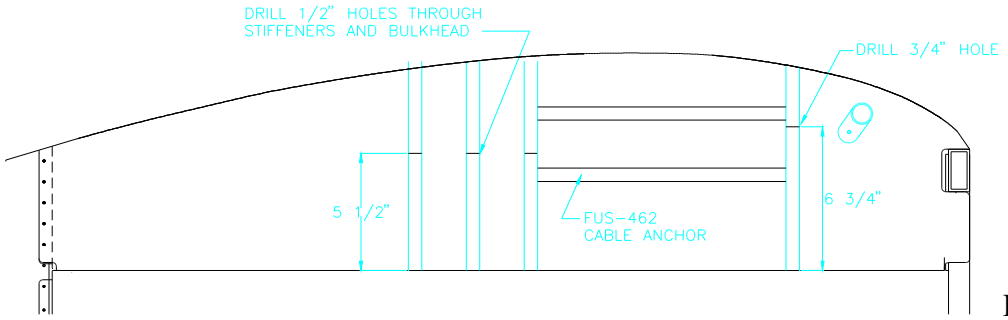


Figure 24

63) Center the FUS-462 Cable Anchor over the two rivet lies previously drilled. Clamp the Cable Anchor in position and drill #40 holes through the Cable Anchor using the FUS-27 as a drill guide. Cleco as you go. Layout and drill 1/2" holes through each of the web surfaces of the bulkheads and stiffener channels. Also layout and drill a 3/4" hole on the bulkhead closest to the Flap controls. See figure 24 for hole locations.

64) Thread the Teleflex Cable through the 1/2" holes you just drilled in the bulkhead and channels.

65) Place both the Flap Handle and the Flap in the retracted position. Rotate the FLAP-3 Control Horn to the same angle as the Flap Handle. Figure 25.

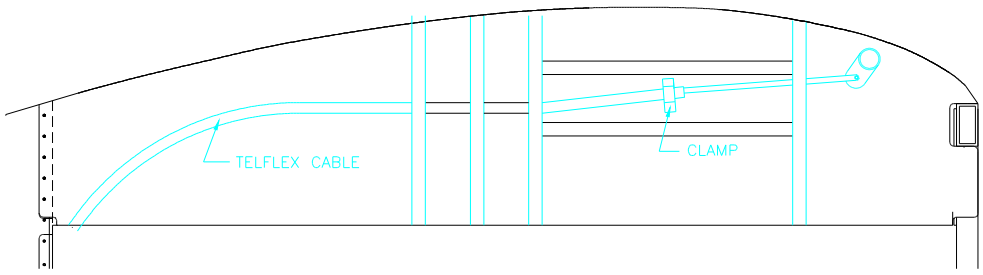


Figure 25

66) Adjust the cable to the correct length and bolt it to the FLAP-3 Horn.

67) Locate the Cable Clamp and position it on the FUS-462 Cable Channel. Mark for mounting holes and drill #11. **NOTE:** Try to keep the cable from having too sharp a bend from the stiffener up to the rod end bearing on the Flap.

68) Drill all the #40 holes to #30. Dis-assemble, debur and chromate. Rivet two F-3000 Floating Anchor Nuts for the Cable Clamp. Re-assemble and rivet.

69) Bolt the Clamp back in place. Check that the Flaps and Flap Handle are still in the retracted position. Drill and rivet the FLAP-3 Horn into place. Use 4 3/16” stainless steel rivets.

# Murphy Ground Handling Handles Rebel

On the side skin at bulkhead E measure back 1.750 inch's (toward the rear ) from bulkhead E rivet line, along the center crease in side skin. Mark that location. Lay .032 doubler on skin with large hole pointing aft and centered over mark. See fig #2. mark outline of doubler on side skin. Drill out 3 rivets on bulkhead E that fall into the doubler pattern. Lay doubler back on side skin.

Line crease in side skin and doubler so it lays tight on side skin. check to make sure the that the mark made previously is centered in the hole in doubler. Drill the #30 pilot hole in front end of doubler through side skin, cleco, then drill the #30 hole on the aft end at center crease line.

Back drill all rivet holes in bulkhead E ( the ones removed when starting). Mark handle hole in side skin, remove doubler and cut out a 1 inch hole.

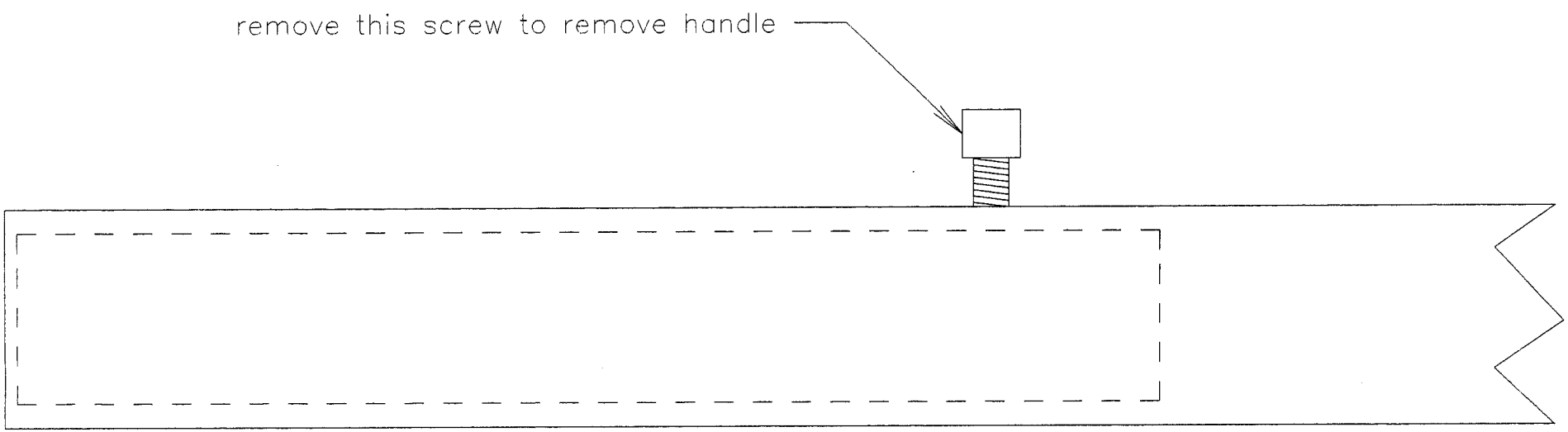
Drill rivet hole pattern around edge of doubler as in fig #4 be careful not to drill into flange of bulkhead E, also at this time drill the 2 extra holes in bulkhead E as shown in fig # 4. While still clecoed in place, drill out the 8 #30 holes around the 1 inch hole.

From inside the fuselage take the mounts and slide them toward the center of the handle. Hold handle tube in place and slide the handles out through the 1 inch holes in each side. Push mount ring to side skin and rotate until they line up properly with side skin. You will now be able to cleco them through both side skin and doubler. With mounts in place check handles for drag on side skin, if they didn't center in the 1 inch hole in side skin you can file the hole out until there is no longer any drag.

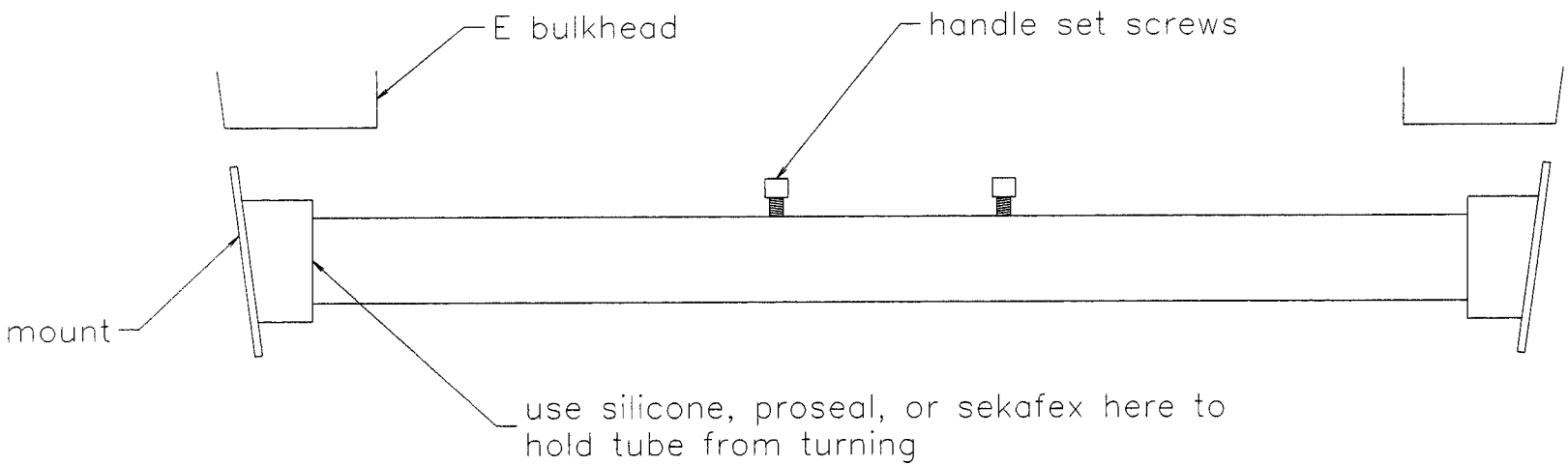
If every thing fits and works properly rivet every thing in place with RV1410 rivets.

After riveting if the handles drag on doubler you can remove the handle from the tube by removing the screw shown in fig 1 and file a little more.

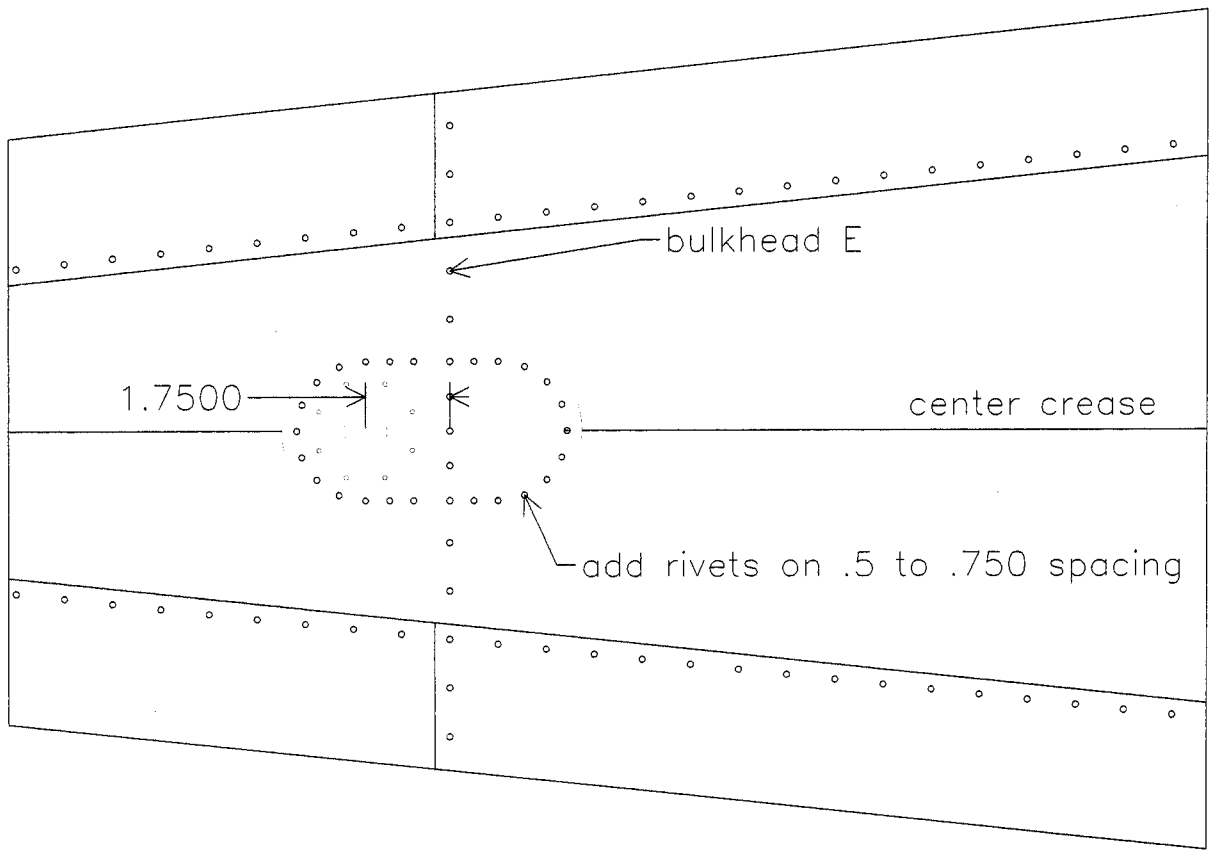
After riveting take a small amount of silicone, proseal or the like and put on handle tube as in fig 1. Don't get any in the handle slots! The handles should be removed while doing this. After allowing drying time (24 hrs) reinstall handles use a small amount of lock tight on the screws. Be carfull not to get any on the handle itself.




Murphy Rebel handles fig 3
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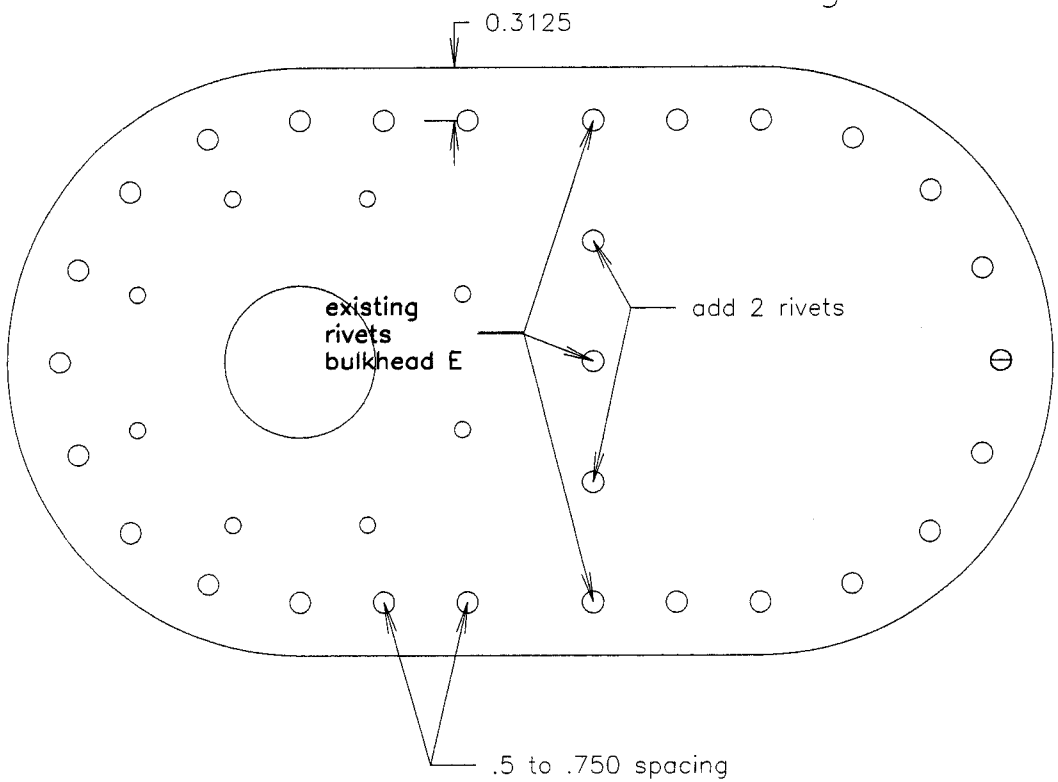



Murphy Rebel handles fig 1
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Murphy Rebel handle fig 2
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Murphy Rebel handles fig 4
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1) Attach two pieces of 3/4" plywood (minimum 14" square) together with wood screws. Draw the center lines on the top piece and drill a #30 center hole as a guide. Figure 1.

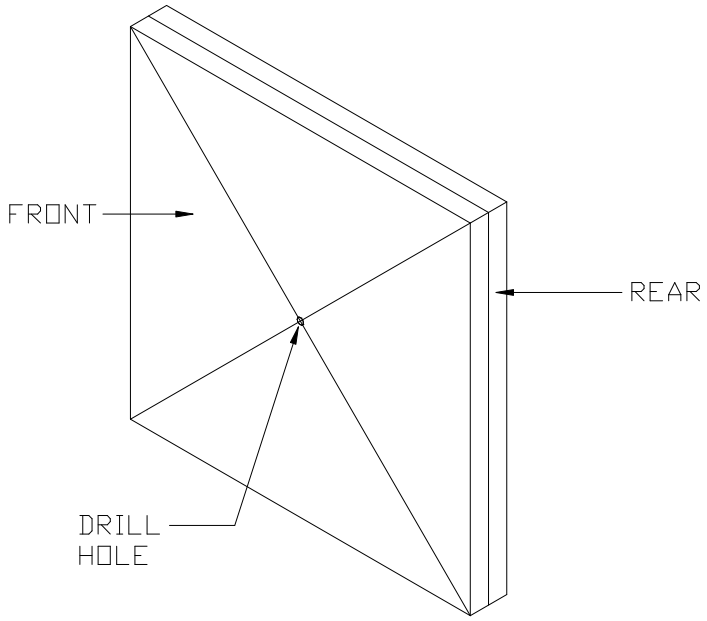



Figure 1

2) Mark a 13 7/8" circle around the center of the plywood spacer. Then cut the excess plywood from the outside of the circle using a bandsaw. Remove one piece from the other. 13 7/8" is the approximate diameter of the front cowl opening. See Figure 2.

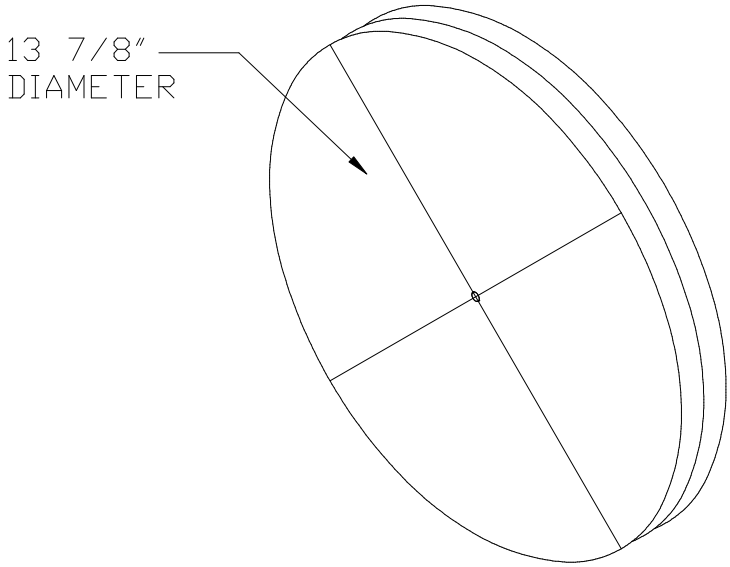



Figure 2

3) Measure the diameter of the center flange of the 2" Prop Spacer, then draw a circle of the same diameter at the center of what will be the front plywood piece. Cut out the hole. Figure 3.

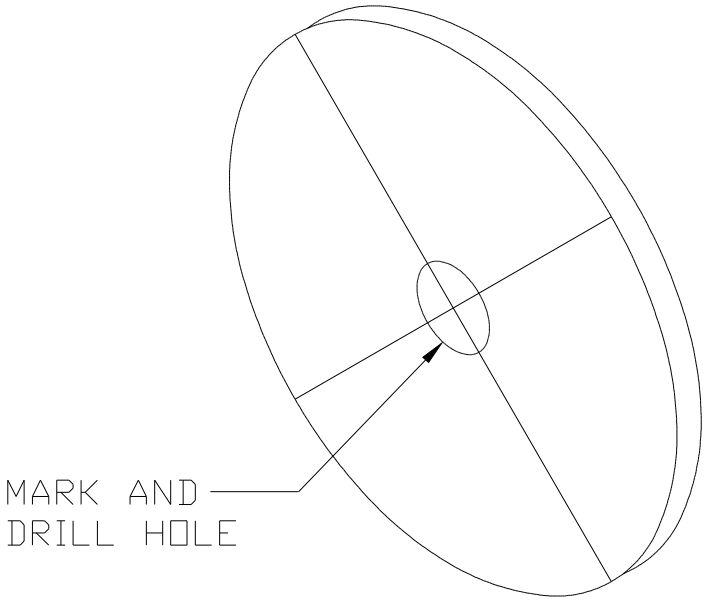



Figure 3

4) Using the aluminum spacer as a guide, mark and drill holes in the plywood to fit over the center flange and the dowels which will stick out from the spacer when it is attached to the engine. Figure 4.

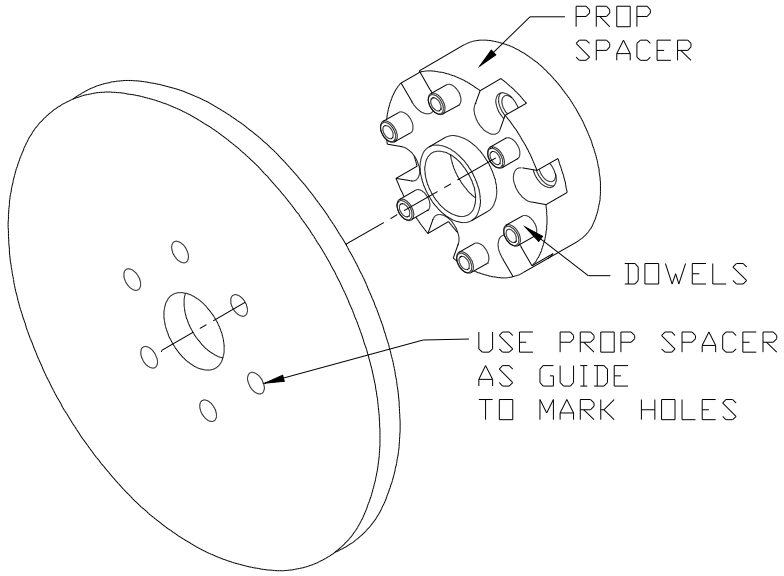



Figure 4

5) Mark horizontal and vertical center lines on the front piece as guidelines, then locate three positions below and three above the horizontal to be used for screwing the plywood spacer to the fiberglass cowl halves. At these locations, drill holes large enough to fit the screw driver through. See Figure 5.

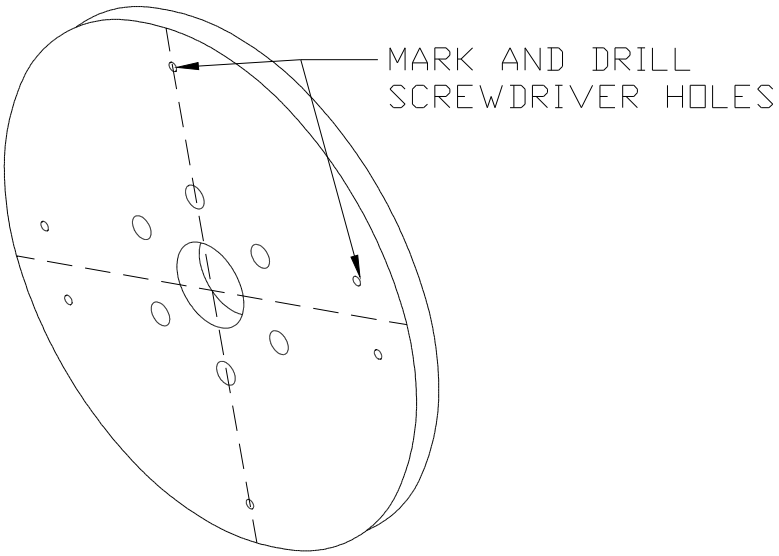



Figure 5

6) Find the rear piece which was cut out in step 2. Mark a circle around the center of the piece, large enough to easily fit over the Prop Spacer and prop flange of the engine. Cut out this circle using the bandsaw. Figure 6.

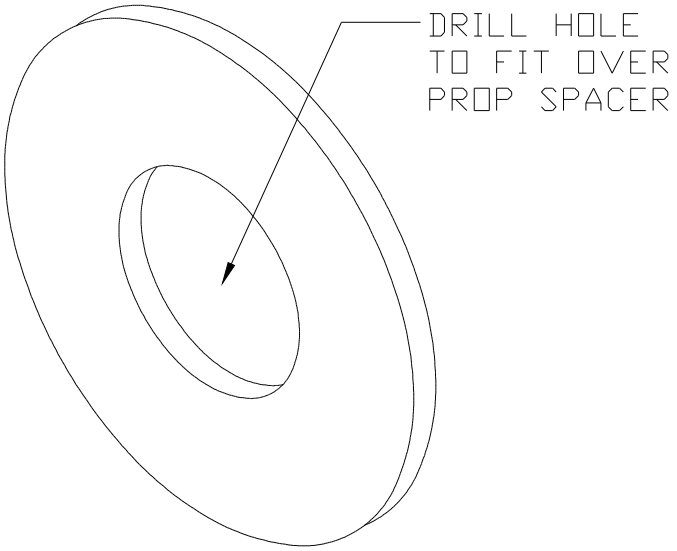



Figure 6

7) Cut three small 3/4" plywood spacer blocks to be placed between the two circular spacers. Use wood screws to attach the front spacer to the back spacer with the wood blocks between. See Figure 7.

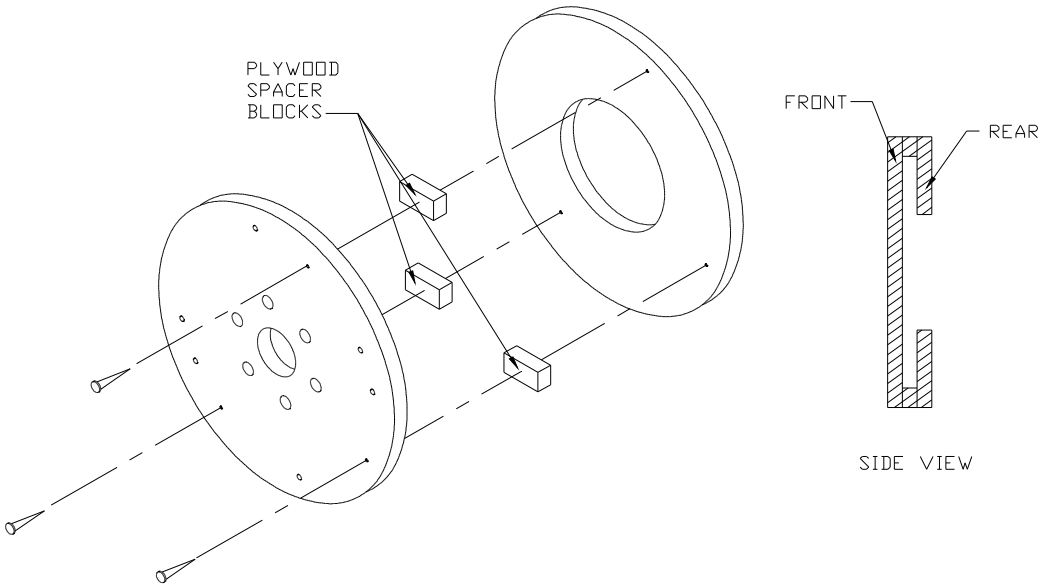



Figure 7

8) Bolt the 2" Prop Spacer to the prop flange of the engine with AN6-15A bolts. See Figure 8.

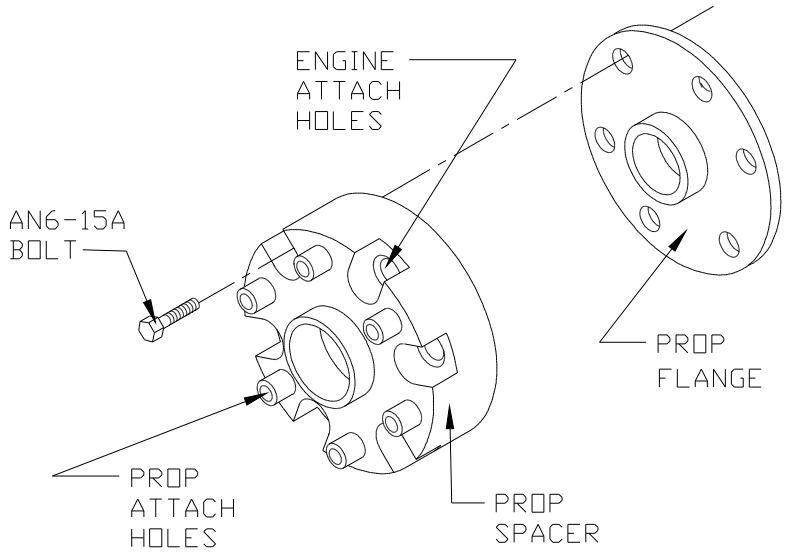



Figure 8

**NOTE:** AN7 bolts may be required on some 0320 engines depending on the Model No. In this case, the holes in the spacer must be drilled out to 7/16".

9) Using three of the Prop attach holes, bolt the plywood spacer assembly to the front of the Prop Spacer. Ensure that the spacer is true and perpendicular to the thrust line of the engine. See photo 1

10) Place the bottom fiberglass cowl half, tightly against the firewall and aligned with the bottom edge of the firewall and aligned with the bottom edge of the plywood spacer. It will be necessary to cut some

allowances in the fiberglass for the exhaust exit. Mark these openings now. Tape the cowl in place with masking tape.

11) Align the bottom cowl so that its sides are level with each other. Attach the rear piece of the wooden spacer to the front surface of the cowl with drywall screws. This can be done through the holes drilled in the front piece in step 5. Figure 9.

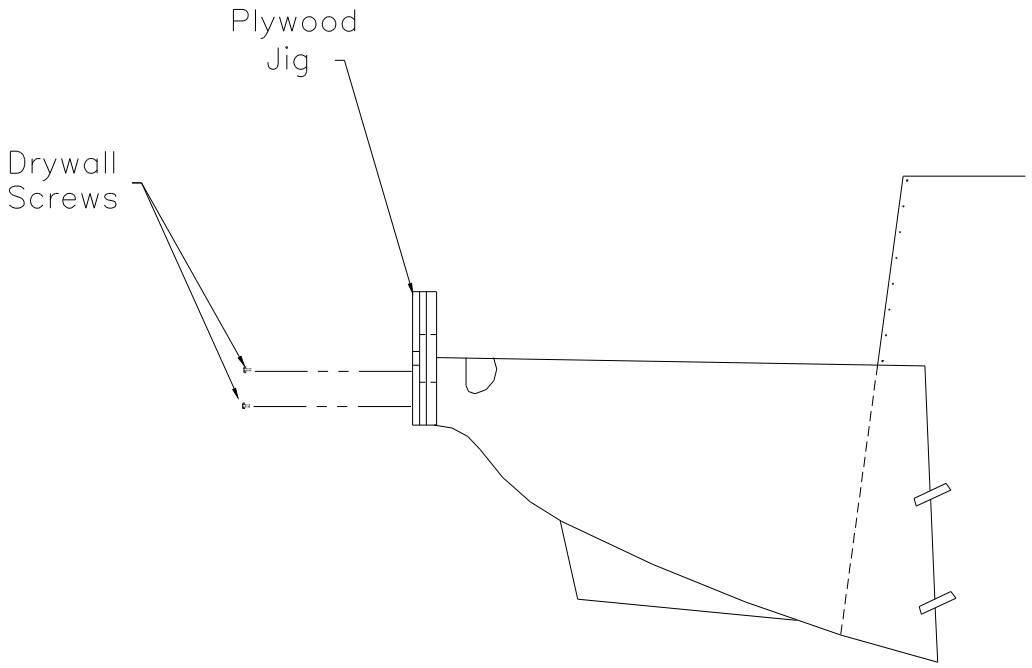



Figure 9

12) Mark a line on each edge of the of the wooden spacer at the vertical midpoint. Transfer this mark to the front portion of the fiberglass and continue the line straight back along this flange to the air intake hole. See Figure 10.

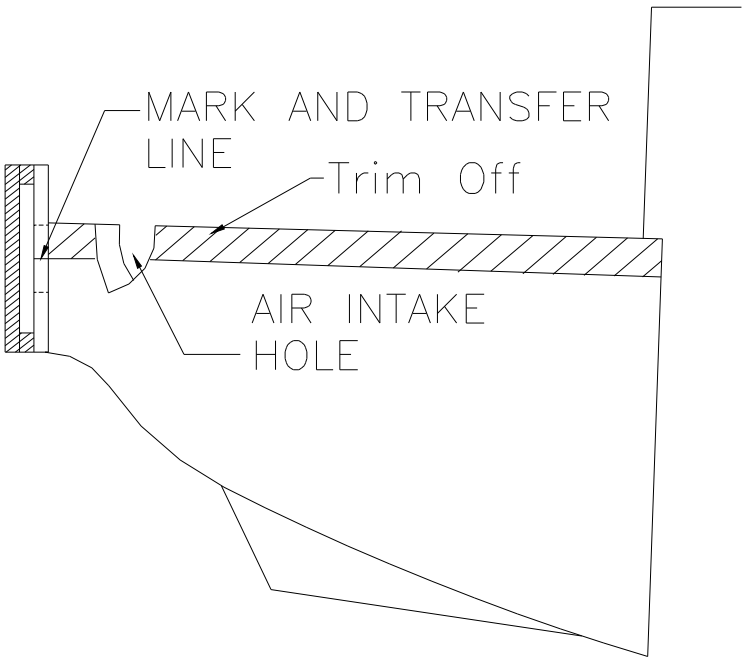



Figure 10

13) On the side of the cowl, from the outside of the air intake to the firewall draw a line for trimming off the excess material. This line will slope down slightly toward the firewall. Figure 10.

14) With a felt pen, trace a line along the edge of the firewall flange, onto the inside surface of the bottom cowl.

15) Remove the bottom cowl from the airplane.

16) Using the line on the inside surface as a guide, mark a parallel line, 3/4" back (towards the firewall). This allows a 3/4” overlap at the firewall.

17) Using a jigsaw or a pair of aviation snips, trim along the line (from step 16) at rear edge of the cowling.

18) Trim the front tab from the prop opening to the air intake hole as marked in step 12.

19) Trim the excess material from the sides of the bottom cowl along the trim line marked in step 13.

20) Select locations for attachment bolts at the firewall. Bolts will be required at the approximate locations shown in Figure 11. At each corner of the firewall, bolts will be required, just clear of the ends

of the radius. Bolts are also required at the split line between the top and bottom cowls. It may be easiest to drill out rivets already installed to hold the firewall to the fuselage top and sides. At each position drill a #30 or #40 hole. (#30 will be required if drilling out existing rivets). See Figure 11.

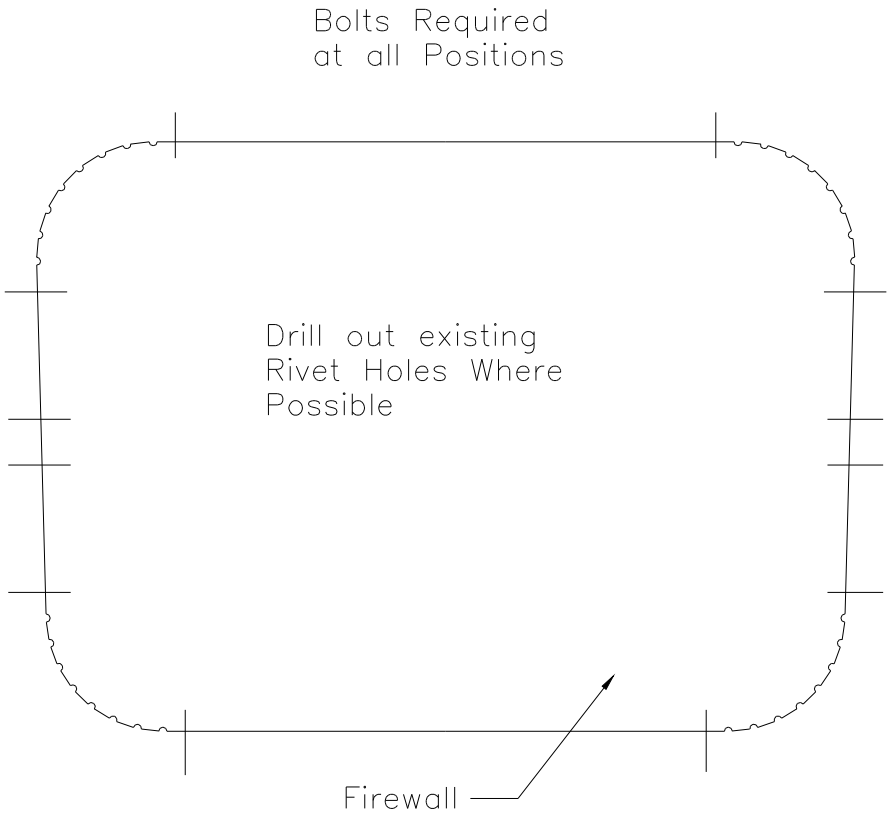



Figure 11

21) Mark a line perpendicular to the edge of the firewall through the center of each hole. On this line, mark a line parallel to the firewall 2" back from the hole. See Figure 12.

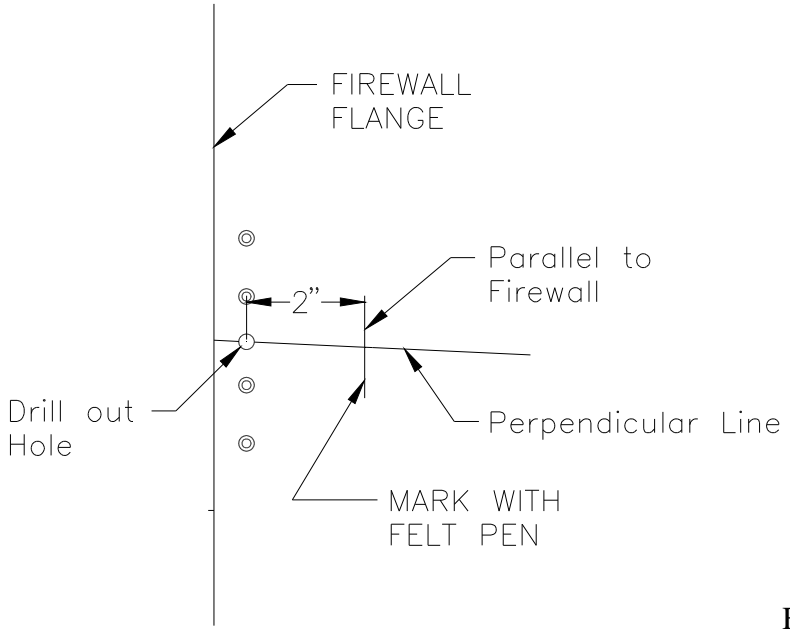



Figure 12

22) Re-attach the bottom fiberglass cowl, screwing onto the wooden spacer and taping the cowl at the back.

23) At each position marked in step 21, continue the perpendicular line onto the fiberglass cowl, then measure 2" forward of the vertical line. This marks the location to drill through the fiberglass into the attachment holes. See Figure 13.

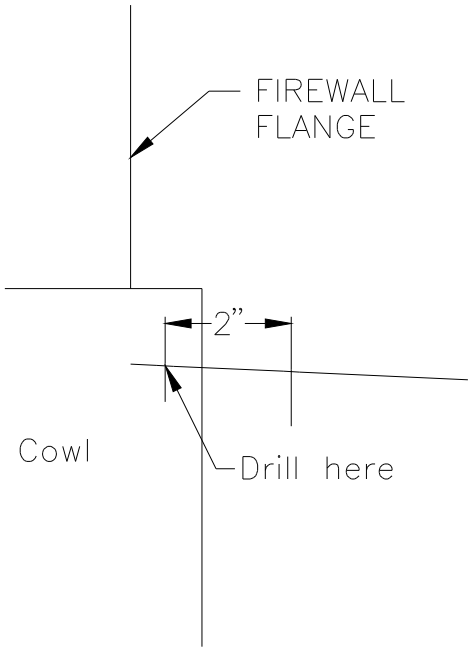



Figure 13

24) At each marked location, drill through the fiberglass into the existing hole in the firewall flange. Cleco each hole after drilling. *** Note:** These holes will be drilled later to 3/16" for bolts, but are drilled at smaller diameter now to allow the drill to center itself in the existing hole.

25) Find the top fiberglass cowl half and place it on top so that it fits inside of the bottom cowl. The top will be forced back slightly. Align the front edge with the top of the wooden spacer and be sure the back of the cowl piece is resting against the top surface at the firewall. Mark the bottom edge for trimming by tracing around the edge of the bottom cowl with a felt pen.

26) Remove the top cowl half and trim as marked.

27) Replace the top cowl as before and realign as above. This time the cowl will slide farther forward. Mark again and trim as necessary. Repeat this process as many times as necessary, until the top cowl sits perfectly (edge to edge) on top of the bottom cowl and aligns properly with the wooden spacer and the firewall.

28) Attach the front flange of the top cowl half to the wooden spacer with drywall or wood screws.

29) Mark, drill and cleco the rear attachment holes as in steps 20-24.

30) On the top and bottom cowls, mark trim lines for installation of the piano hinge. Mark a line parallel to the edge about 3/32" away. When each part is trimmed, there will be a 3/16" total space for the hinge. The opening will start just past the radius at the intake hole and continue to the rear edge of the cowl. See Figure 14.

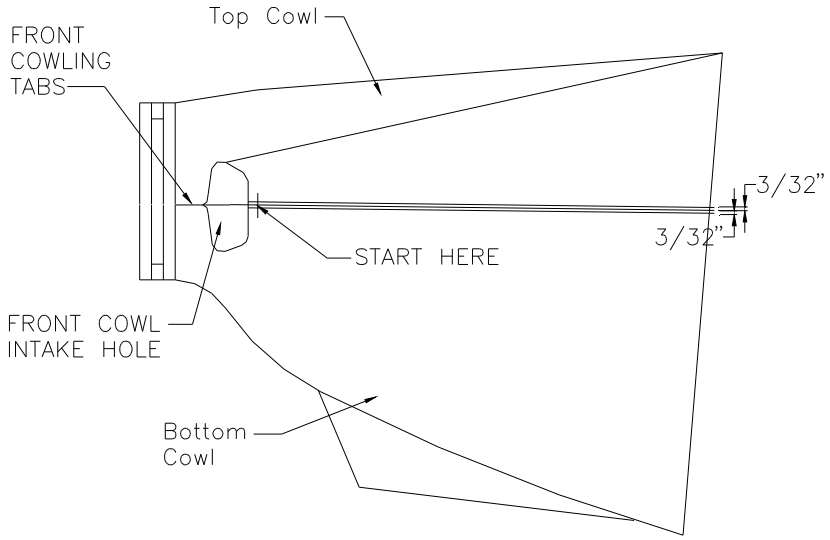



Figure 14

31) Remove the top cowl and trim out the marked areas on both.

32) Replace the top cowl and check the opening to be sure it is big enough to fit the center portion of the piano hinge.

33) Using a felt marker, draw a parallel line 3/8" down from the edge of the groove. Mark hole locations for attaching the hinge to the cowl at 1" nominal spacing. Drill these holes with a # 40 drill bit.

34) Cut two pieces of piano hinge to fit the length of the opening.Also cut 4 pieces of CO-31 Hinge Backing Angle to fit the lengths of the openings. (You may have to shrink to fit).

35) Clamp the piano hinge in place on each side of the bottom cowl on the inside surface with a piece of CO-31 Behind the hinge. Drill and cleco through the holes in the fiberglass into the hinge as you drill, to keep the parts tightly together. This can be done by holding a piece of wood against the back side as you drill. Remove the hinge and CO-31.

36) Cleco the hinge and CO-31 in place, then put the top cowl in place and attach to the plywood spacer.

37) Mark the hole locations for the top cowl hinge attachment as in step 33.

38) Reach in through the air intake hole and brace the top flange of the hinge against the top cowl with a piece of wood. Drill and cleco as many holes as can be easily reached.

39) With the cowl still in place, slide a strip of metal under the rear edge of the fiberglass to brace the hinge against the top cowl. Drill and cleco the rear attachment hole.

40) Remove the clecos holding the hinge to the bottom cowl half, then remove the top cowl half with the hinge attached.

41) Place the top cowl half on the bench to drill and cleco the remainder of the holes.

42) Drill out all hinge holes with a #30 drill.

43) Countersink the fiberglass and parts and rivet the hinge and brace to the lower cowl with RV 4412 countersunk rivets.

44) Remove the hinge pin, then rivet the other piece with its brace to the top cowl with RV 4514 CS rivets.

45) Re-install the top cowl half and insert the hinge pins, then drill the firewall attach holes out to 3/16". Then remove both fiberglass cowl halves.

46) At each firewall attach point, (the positions on the firewall you drilled in Figure 11) install a 3/16" floating anchor nut (F5000-3). To do so at each point, thread a bolt into the anchor nut to hold it. Then back drill through the flange holes on the anchor nut with a #40 bit. See Figure 16.

47) Dimple each of the #40 holes, then attach the anchor nuts to the firewall flange with RV-4412 countersunk rivets. See Figure 15.

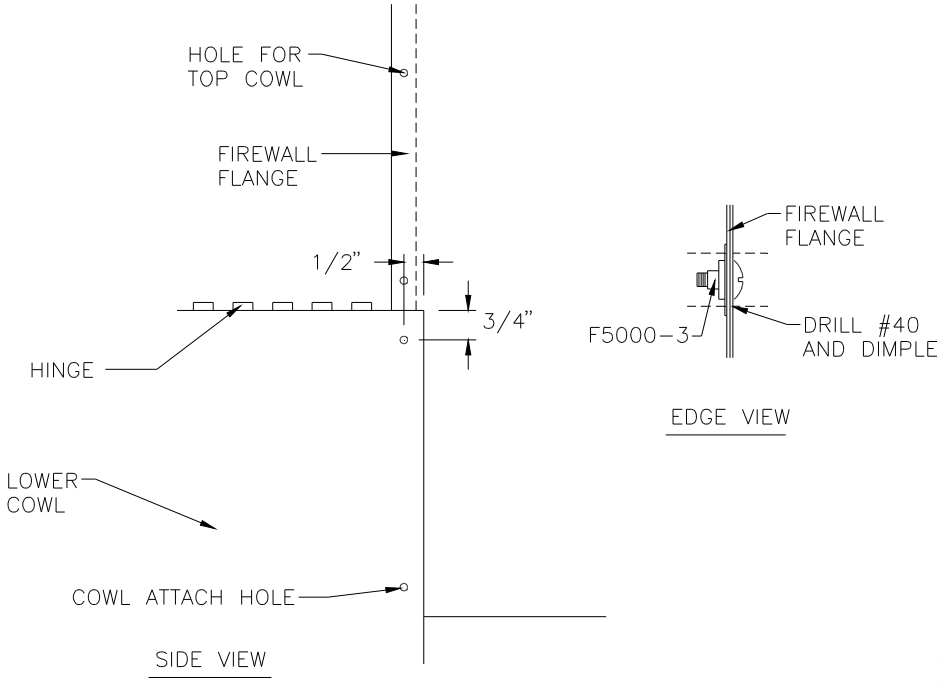



Figure 15

48) Reinstall the fiberglass cowls and bolt in place at the firewall with AN525-1032R8 3/16" Pan Head screws.

49) Cut a piece of .040" material approximately 4" x 2". Draw a center line lengthwise on the piece, then make a slight bend along this line until you match the contour of the front tabs between the prop opening and front intake hole of the fiberglass cowls. Refer to Figure 14 for location of the front tabs.

50) Draw a bend line across the first line and bend to match the bend at the front of the tab. Continue bending and shaping the part along each line until it will fit flush against the inside of the tab, straddling the cut between the two pieces. The edges of the part should be deburred and the corners rounded as necessary to fit. See Figure 16.

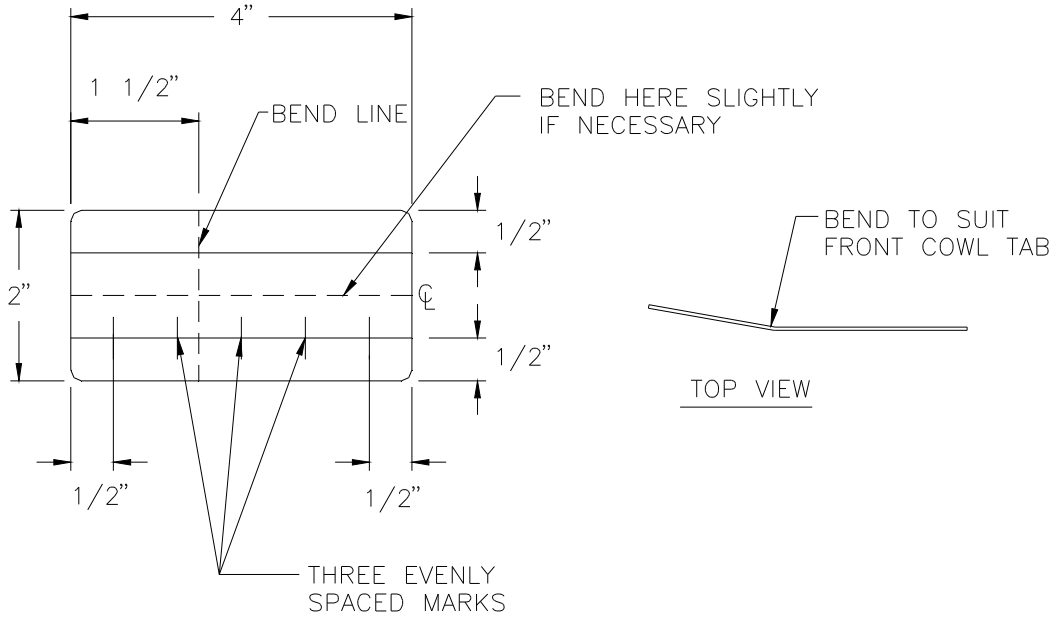



Figure 16

51) Draw lines 1/2" above and below the split in the fiberglass cowling tab.

52) On the lower line, mark end holes 1/2" from each end of the tab. Then mark three more holes, evenly spaced between the end holes.

53) Hold the aluminum tab in place behind the fiberglass tab and drill and cleco the end holes with a #40 drill bit. Then drill the remaining three holes.

54) Open the holes to #30 and countersink on the fiberglass side.

55) Rivet the aluminum tab in place on the bottom cowl tab with five RV-4412 countersunk rivets.

56) On the upper line, mark hole locations 3/4" from each end of the tab. Drill these two holes through the fiberglass and the aluminum tab with a #40 drill. Open these holes to 3/16".

57) Install F5000-3 floating anchor nuts as in steps 50 - 51. See Figure 17.

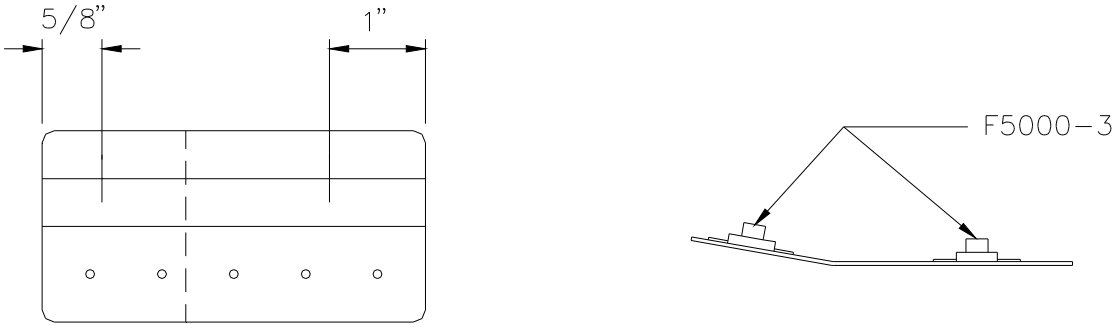



Figure 17

58) Bolt the cowl tabs together with AN525-1032R8 Pan Head screws.

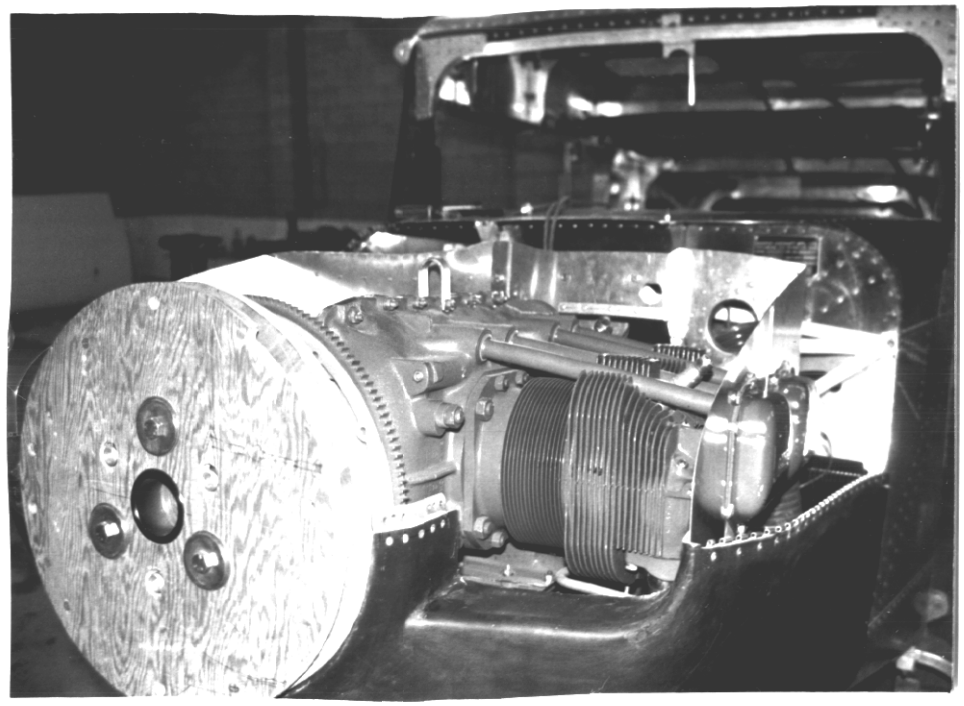
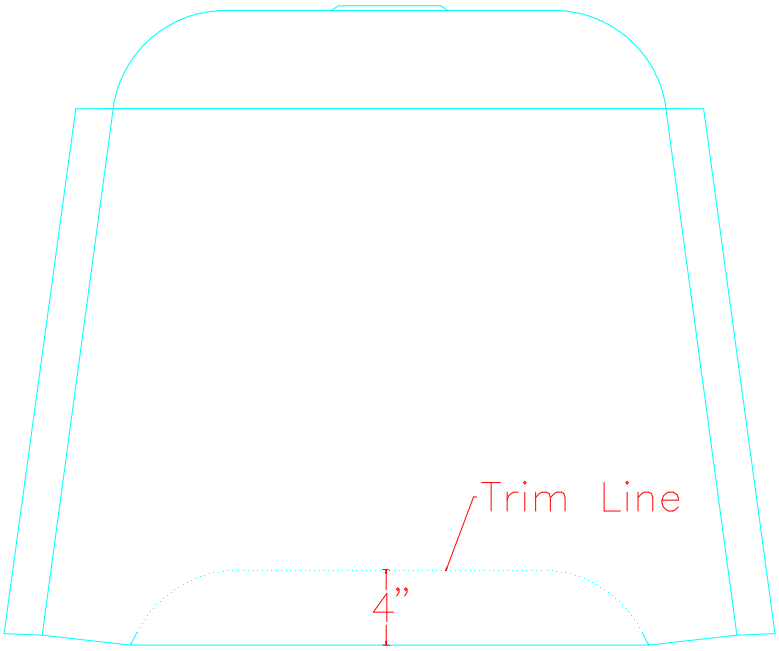


**PHOTO 1**

1) Using aviation snips trim the flat outer flange off of the bottom portion fiberglass cowling (CO-23).

2) Using a felt marker, draw a trim line on the bottom of the part. The line will start from the middle of the radius on one corner to the middle of the radius on the other corner. Figure 1.

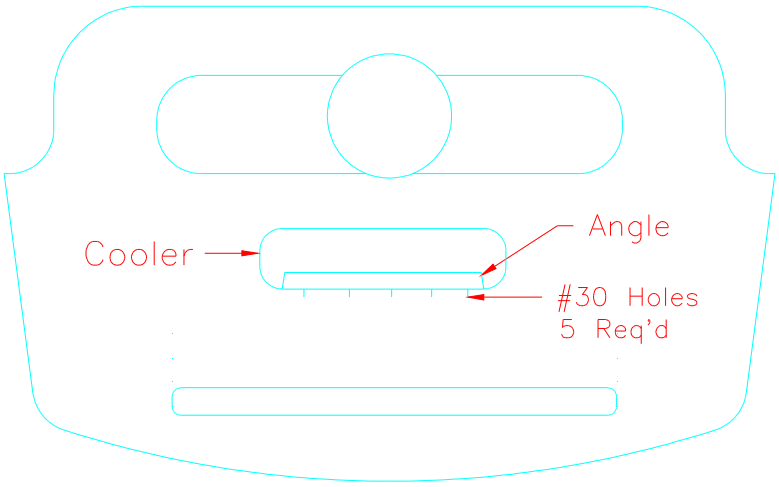



(Figure 1)

3) Trim along the marked line, rounding the cut well as shown. **NOTE:** This provides a air outlet, therefore it can be cut smaller and then trimmed later. If desired this step can be performed after the cowling is mounted on the airplane.

4) Cut a 6” length of 3/4” x 3/4” x .040” angle (FUS-35) to be used to mount the oil cooler.

5) Clamp the angle to the lower flange of the cooler opening in the cowling as in figure 2.



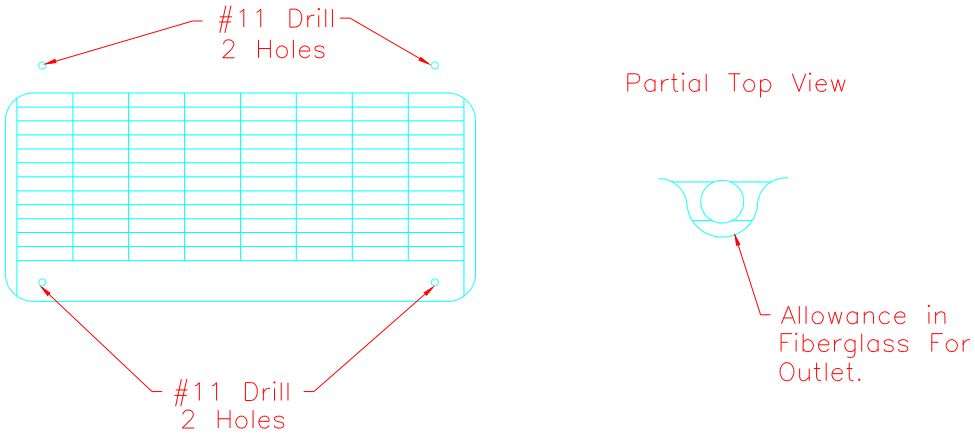

(Figure 2)

6) Through the flange of the angle, drill five equally spaced #30 holes into the fiberglass.

7) Attach the angle to the fiberglass using five 1/8" x 3/16" Avex rivets (RV-1410).

8) Put the oil cooler (B7B) in place behind the angle bracket with the inlet and outlet to the top. Cut relieves out of the fiberglass at the top to allow for inlet and outlet. Figure 3.

9) Drill two #11 mounting holes through the bracket into the bottom flange of the oil cooler. Figure 3.

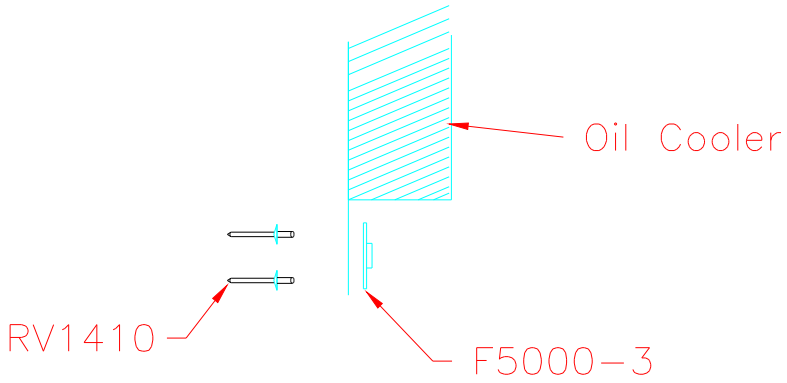



(Figure 3)

10) Drill two #11 holes through the fiberglass into the top flange of the oil cooler.

11) Remove the oil cooler and attach Floating Anchor nuts to the back of each #11 hole. Attach using 1/8" x 3/16" Avex (RV-1410). Figure 4.

**PLEASE NOTE:** If there is adequate fiberglass lip on the bottom, the channel may be excluded and the cooler mounted directly to the fiberglass as it is on top.



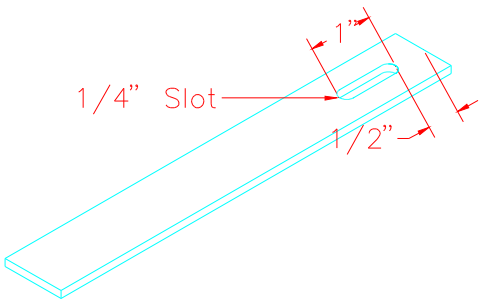

(Figure 4)

12) Put the oil cooler back in place and attach using AN3-5A bolts.

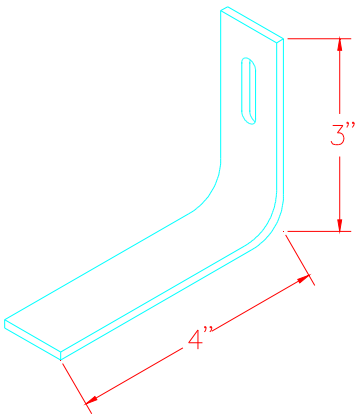
13) Cut two pieces of 1" x 1/8" aluminum strap, 7" long. Cut from (E-22).

14) 1/2" back from one end of the each piece, cut a 1/4" wide slot as in Figure 5a. (Debur edges). The slot should be 1" long.

15) Bend the two straps as shown in Figure 5b. These are the radiator mounting brackets. Use a generous radius to avoid stress cracking.

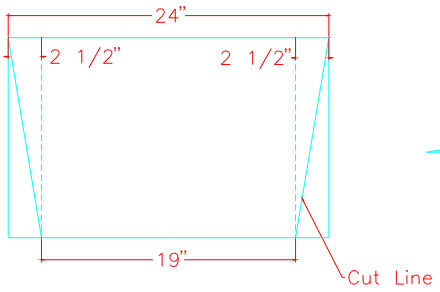



(Figure 5a)

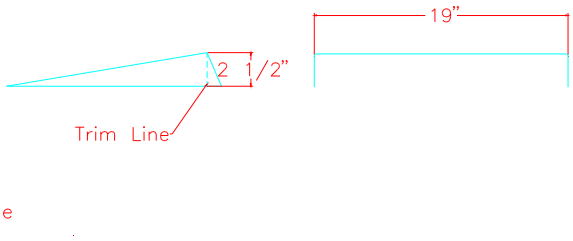



(Figure 5b)

16) Cut a piece for the radiator shroud from (E-23) as in figure 6a. Please note the shroud can be cut slightly larger to allow for trimming.

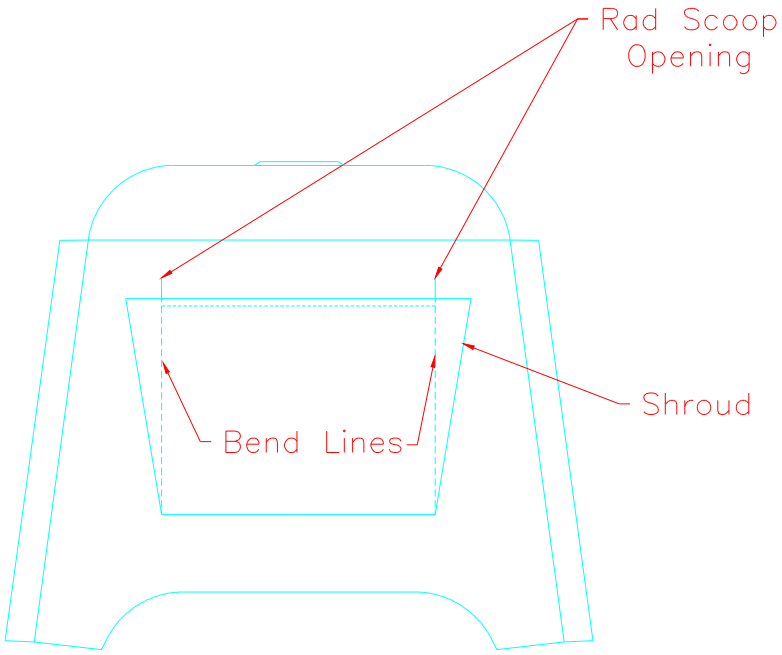



(Figure 6a)




(Figure 6b)

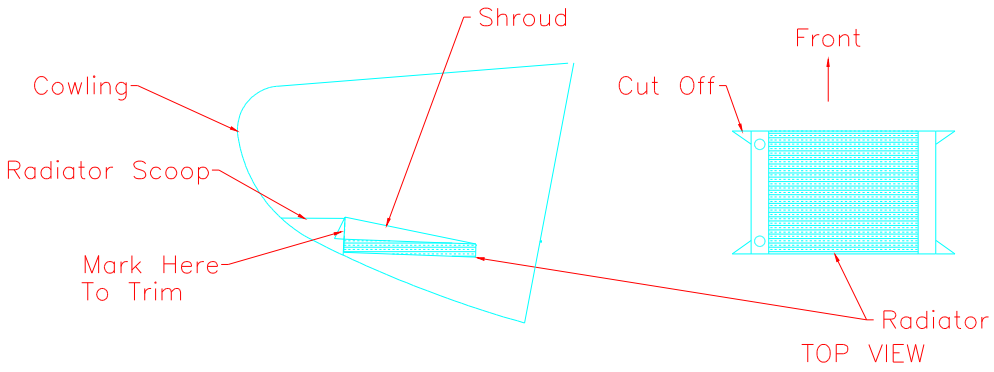
17) Place the shroud in the bottom of the cowling so that the front edge just overlaps the lip of the rad opening. Mark the corners of the opening on the sheet to establish and mark the exact bend lines. See Figure 6b and Figure 7.




(Figure 7)

18) Bend the shroud as in figure 6b.

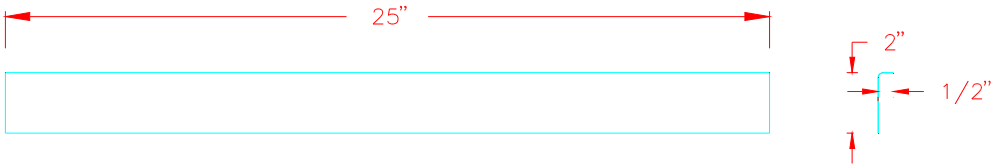
19) Place the bent shroud on the radiator (883-436F) so that the edges sit at the ends of the grill, then place the assembly in the cowling as in Figure 8. (The inlet and outlet of the rad should be on the left side pointing up.) The front tabs on the rad should be cut off. Figure 8.




(Figure 8)

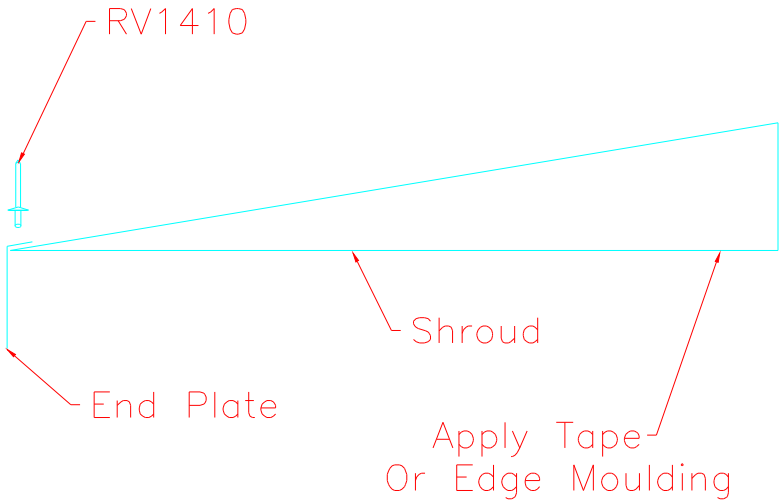
20) Lift the back edge of the rad so that the shroud just overlaps the opening. Mark and trim the shroud as in Figure 8.

21) Cut another piece from E-23 to be used as a shroud end plate. Bend the part as shown in Figure 9.




(Figure 9)

22) Place the end plate against the shroud as shown. Drill #30 holes at 1” nominal spacing and attach using 1/8” 3/16” Avex rivets (RV-1410). Figure 10.




(Figure 10)

23) Apply medical tape, automotive edge molding, or some other anti-chaff material to the edges of the shroud which sits against the rad grill. Figure 10.

24) Put the shroud assembly back on the radiator and drill a 1/4" hole through the tab on the radiator into the end plate

25) Cut two 1" x 2" pieces of blue foam padding.

26) Put the rad and shroud assembly in place inside the cowling with the foam pads under the front corners of the rad to prevent chaffing against the fiberglass. Figure 11.

27) Place a rubber mount (171-121-275E) in each tab of the radiator.

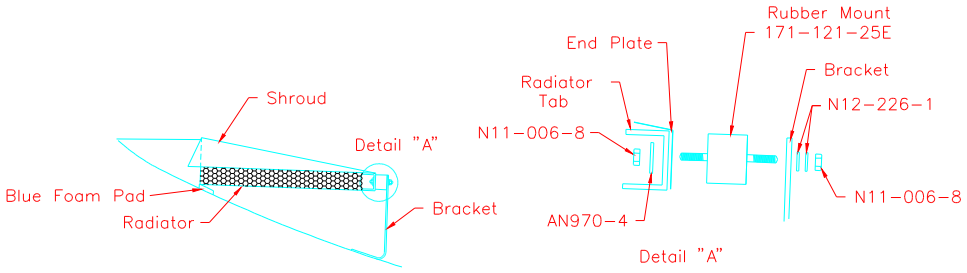
28) Fix the rubber mount to the rad and end plate using an AN970-4 washer and a jam nut (N11-006-8)

29) Repeat for the other side.

30) Place one of the rad mounting brackets from step 15 as shown in Figure 11 with the end of the rubber mount in the slot.

31) Clamp the bracket in place on the fiberglass and drill three equally spaced holes through the bracket into the fiberglass.

32) Repeat for the other side.

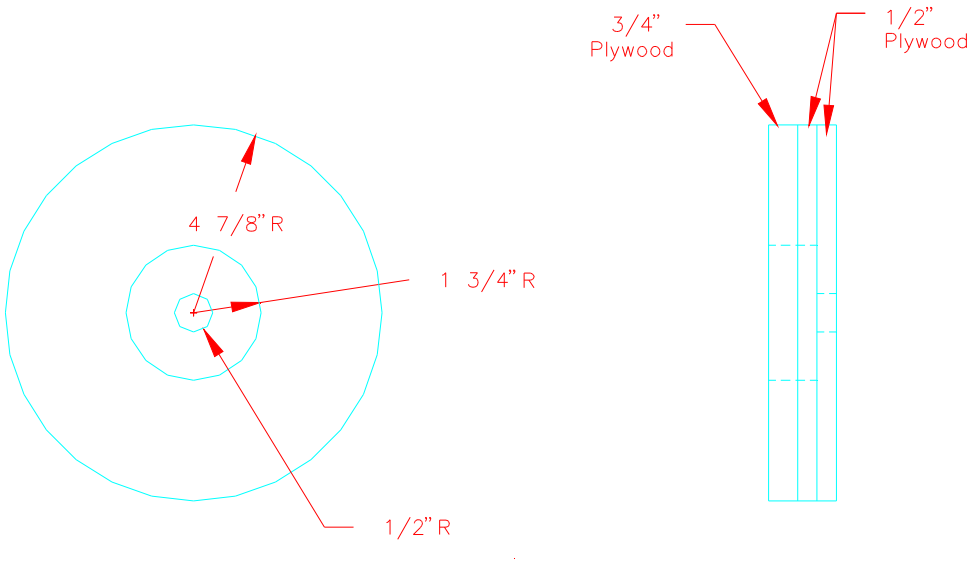



(Figure 11)

33) Attach each rad mount bracket to the cowling with four 3/16" x 1/4" Avex rivets (RV-1613). Rivet from the outside in.

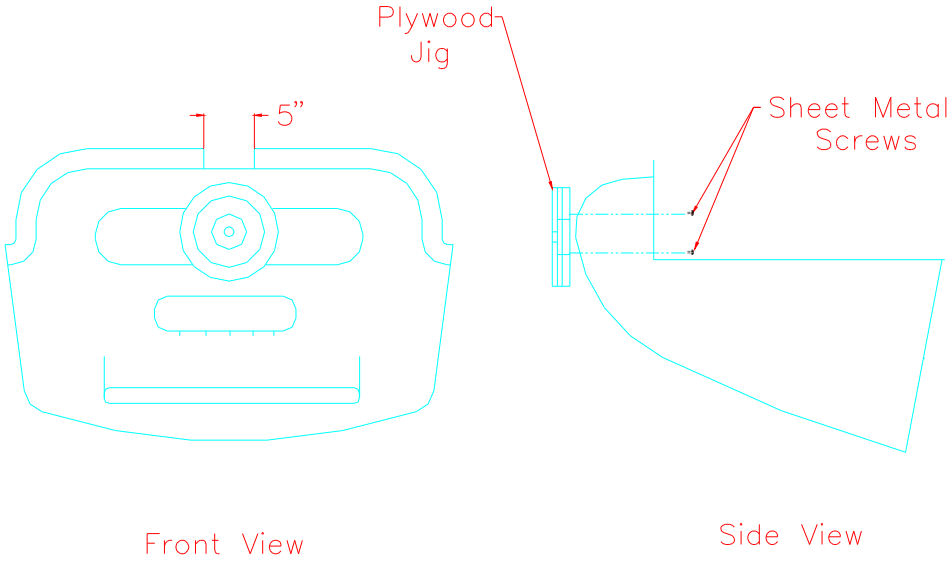
34) Attach the rudder mounts to the brackets with two N12-226-1 Spring washers and one N11-006-8 jam nut.

35) To properly align the cowling on the fuselage, a simple plywood jig should be built. See Figure 12.




(Figure 12)

36) The plywood jig can be attached to the front of the cowling using four sheet metal or wood screws. Figure 13.

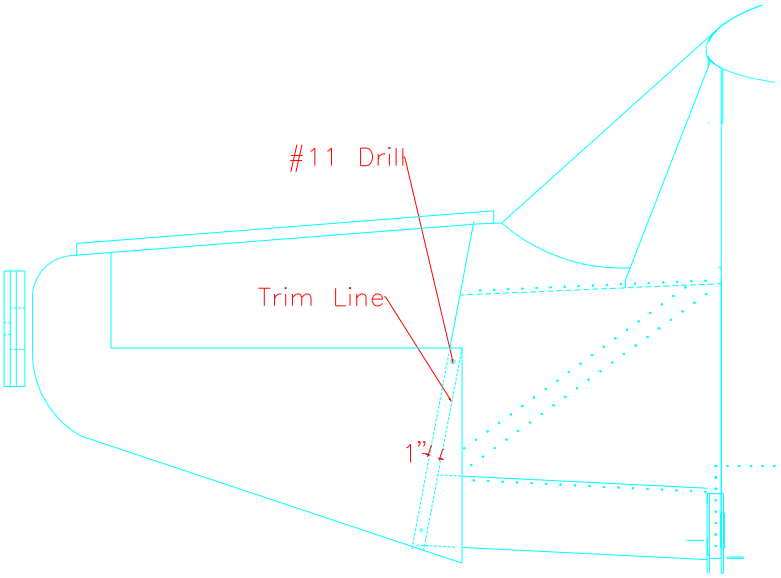



(Figure 13)

37) Place the cowling over the engine with the plywood jig resting on the prop flange.

38) Cut a 5” wide relief in the outer flange at the top of the part as in Figure 13.

39) Level the cowling by placing a level horizontally across the top of the nose, then place a straight edge from the nose to the top of the firewall as in figure 14 to align the cowling with the fuselage. Clamp the cowling in place.



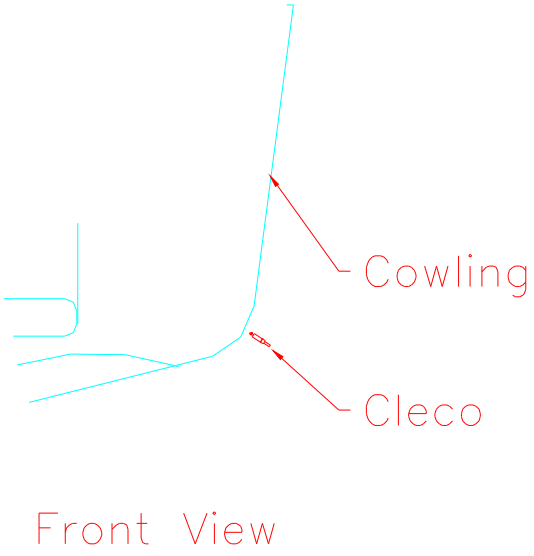

(Figure 14)

40) Mark a trim line along the rear edge of the cowling, allowing a 1” overlap.

41) Drill a #11 hole at the top of the fiberglass cowling into the flange of the firewall. Cleco in place.

42) Repeat step 41 for the opposite side.

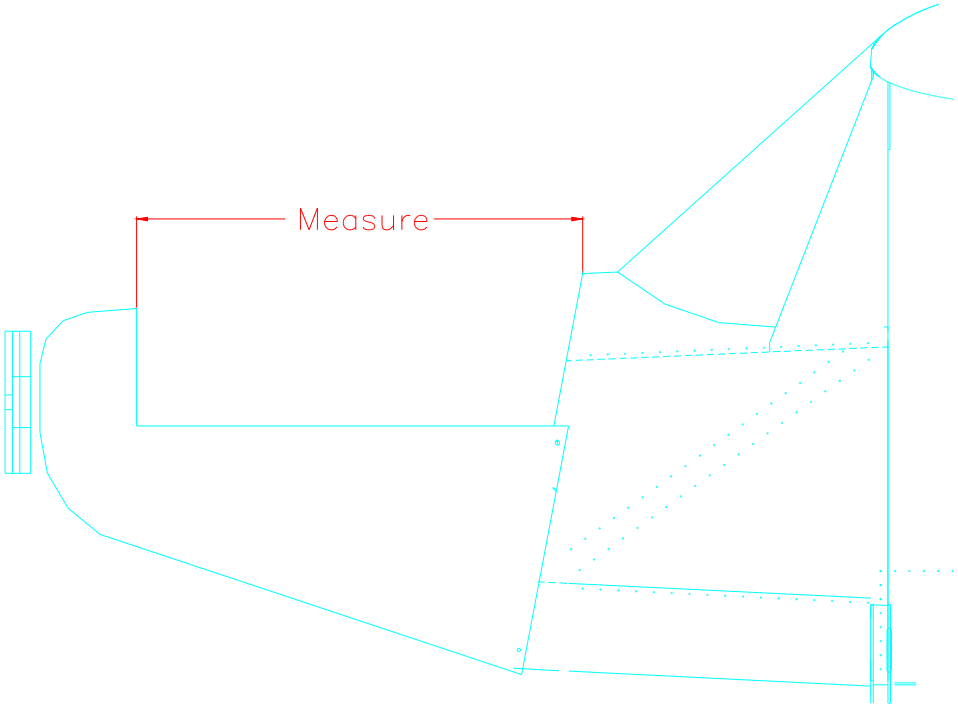
43) Drill a #11 hole nearly midway around the radius at the bottom of the cowling into the flange of the firewall. Cleco in place. Figure 15.




(Figure 15)

44) Repeat for the opposite side.

45) Measure the distance from the trimmed edge of the cowling on top to the edge of the firewall. Figure 16.



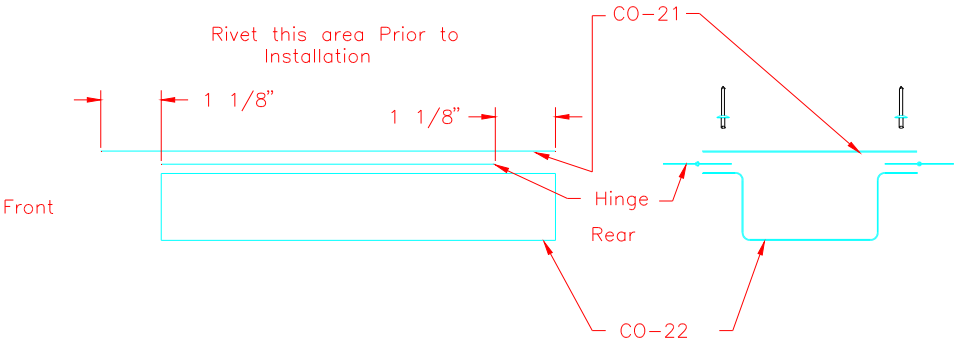

(Figure 16)

46) Cut the cowling center bracket (CO-22) 1" longer than the measurement from step 45.

47) Cut the Cowling Center Brace (CO-21) to 1" longer than the Cowling Bracket.

48) Cut two pieces of Stainless Steel Piano Hinge (1419 D00ss) to 1/4" less than the measurement in step 45.

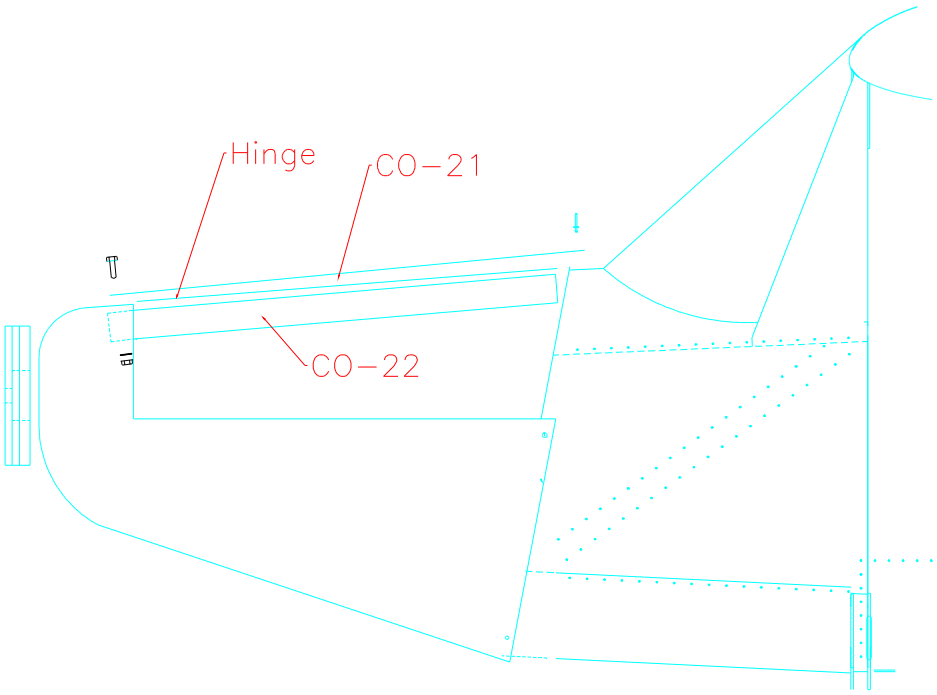
49) Assemble the hinges, center bracket and center brace as in figure 17. Drill #30 holes at 1" spacing through the brace (CO-21) into the flanges of the bracket (CO-22). Figure 17.




(Figure 17)

50) Attach parts using 1/8" x 3/16" Avex rivets (RV-1410).

51) Temporarily install the assembled until between the center of the cowl and the firewall. See figure 18.

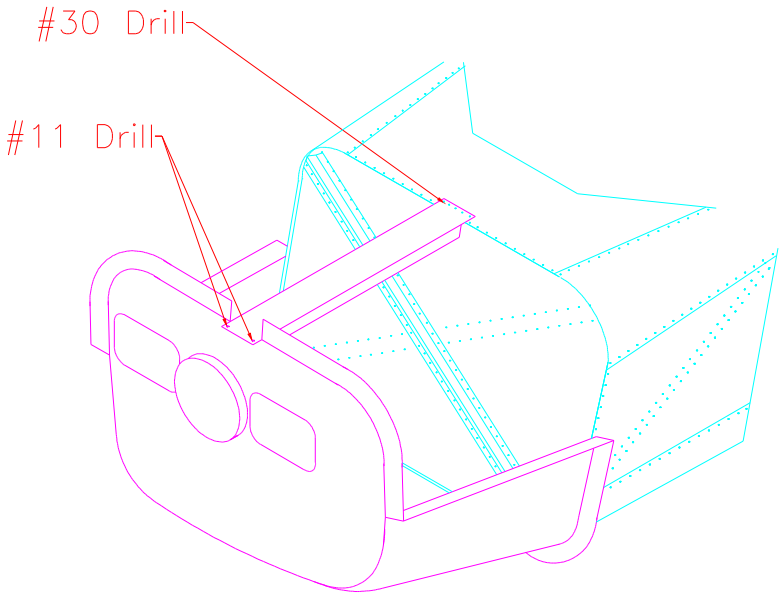



(Figure 18)

**NOTE:** That the center brace (CO-21) overlaps at the firewall by about 1", while the front edge of the fiberglass cowling is sandwiched between the center brace (CO-21) and center bracket (CO-22).

52) With the cowling held firmly in place, drill five equally spaced #30 holes through the center brace into the top flange of the firewall.

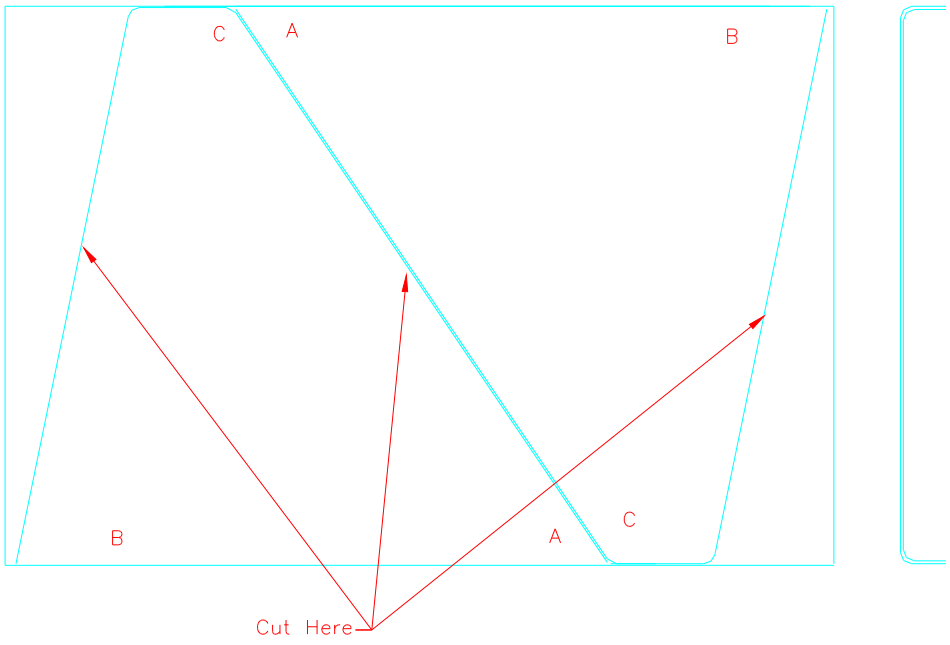
53) Drill one #11 hole through the center brace (CO-21) and the fiberglass cowling into each 1" flange of the center bracket (CO-22). Cleco. See figure 19.




(Figure 19)

54) Cleco in place.

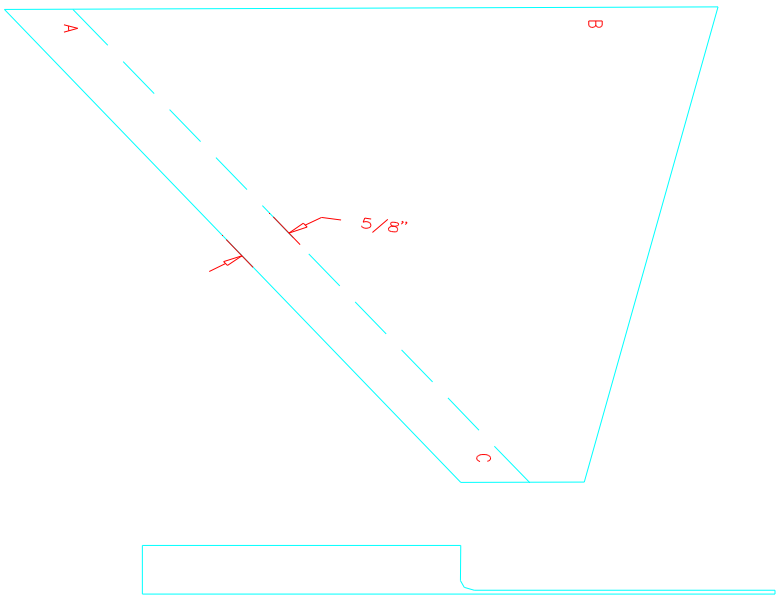
55) Using figure 20a (Full Size - next page) as a template, mark two firewall cowling braces on CO-25. See figure 20. Label the corners of each part and cut out as shown.




(Figure 20)

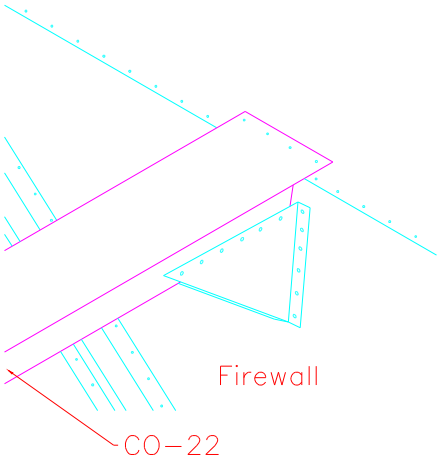
56) Cut off the 5/8" flange at the small end of each part.

57) Bend a 5/8" flange between A and C on each part. You now have on left and one right brace. Figure 21.




(Figure 21)

58) Place the left firewall brace as in figure 22.



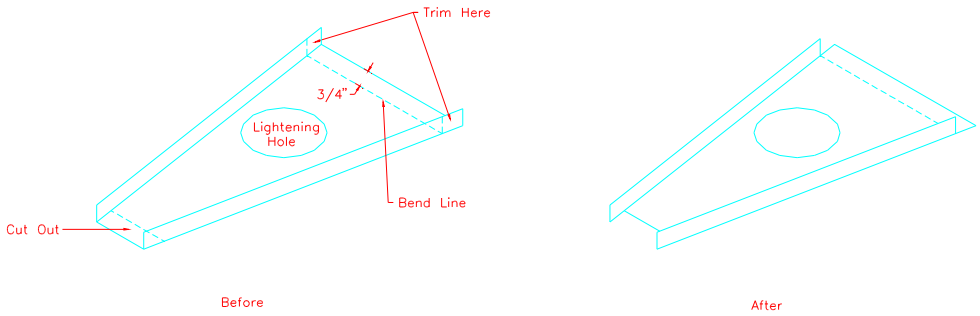

(Figure 22)

59) Drill six evenly spaced #30 holes through the top edge of the brace into CO-22. Cleco.

60) Drill six evenly spaced holes through the rear flange of the brace into the firewall. Cleco.

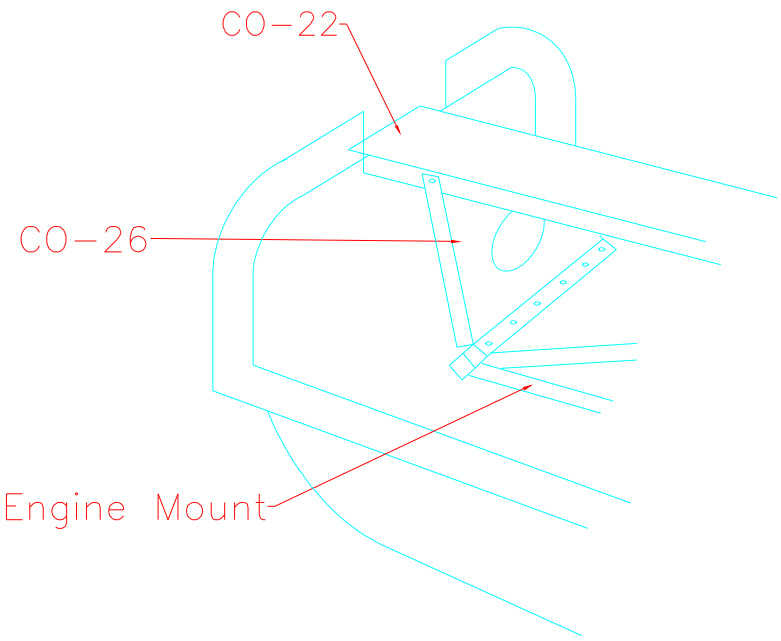
61) Repeat for the other side.

62) Trim the corners of the front cowling brace (CO-26) as in figure 23. Mark a bend line 3/4" from the end. Figure 23.




(Figure 23)

63) Place the end with the bend line on the front top tube of the engine mount. Raise the front of the brace so the tabs fit over part CO-23 bracket. Figure 24.




(Figure 24)

64) Remove the brace and bend the rear flange to the proper angle.

65) Re-install the front cowling brace, clamp in place and drill six evenly spaced holes through the rear flange into the engine mount. Cleco.

66) On each of the top tabs, drill one #30 hole into the center bracket.

67) Debur all holes and edges.

68) Attach the cowling center section as follows:

1) Center Brace (CO-21) to firewall using 1/8" x 3/16" Avex (RV-1410).

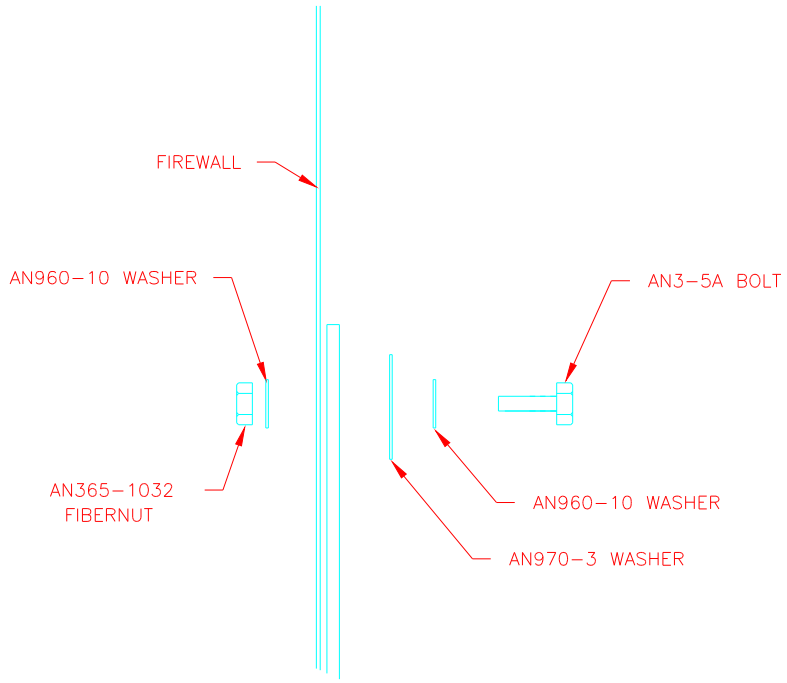
2) Firewall cowling braces (CO-23) to firewall and center bracket (CO-22) using 1/8" x 3/16" Avex (RV-1410)

3) Front cowling brace to center bracket (CO-22) and engine mount using 1/8" x 3/16" Avex (RV-1410).

69) Remove the fiberglass cowling and trim off the outside stiffener flanges.

70) The cowling can be taped off, prepared and painted if desired.

71) Re-attach the fiberglass cowling to the airframe using AN3-5A bolts, AN970-3 washers, AN960-10 washers and AN365-1032 fibernuts at the firewall as in figure 25.

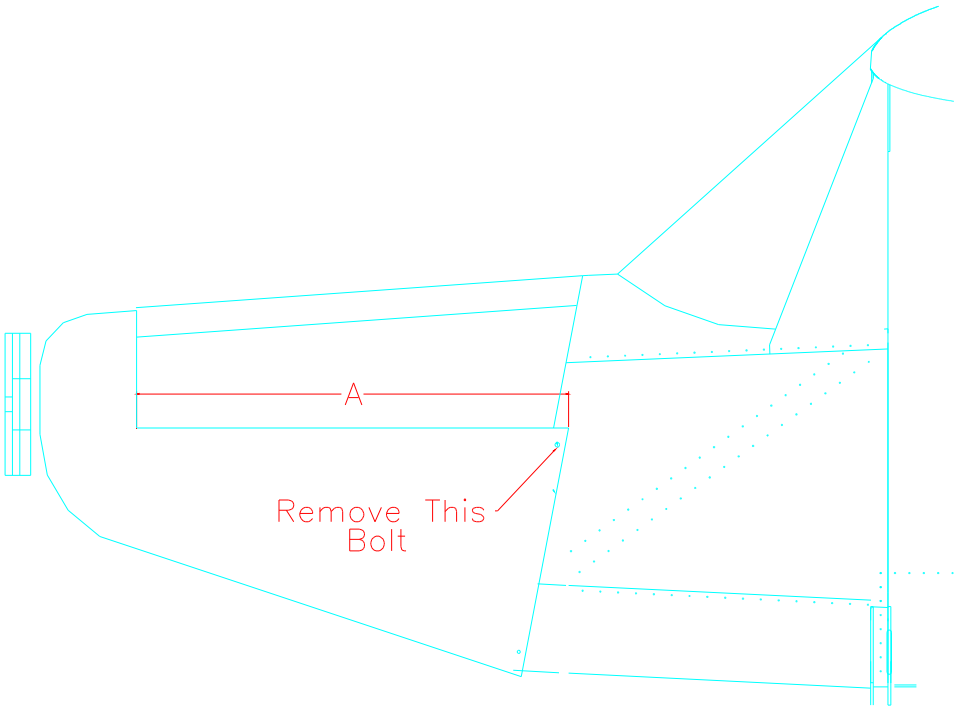



(Figure 25)

72) Attach the front of the cowling to the center brace assembly using the same bolts as in the firewall, however the large size washer is not required.

73) Measure the distance from the trimmed front edge of the cowling to the surface of the firewall.

Measure along the bottom of the door opening. Figure 26.

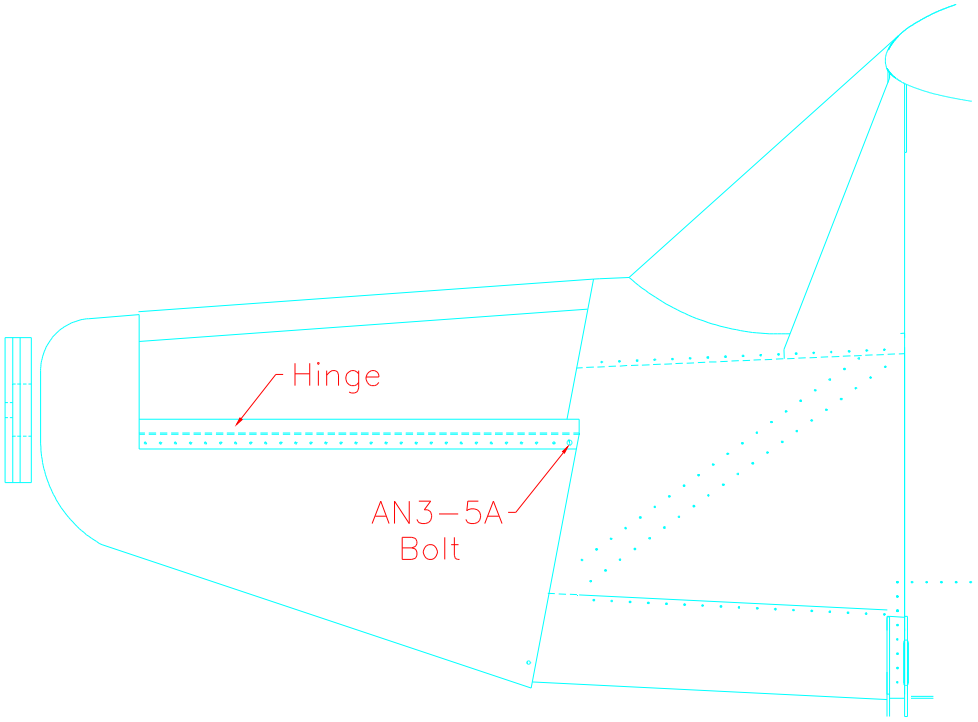



(Figure 26)

74) Cut a length of hinge (1419 D00ss) 1" longer than the distance in figure 26. (Leave the hinge pin at least 3/4" longer than the hinge).

75) Remove the top cowling mount bolt at the firewall.

76) Clamp the hinge on the outside of the cowling so that it is flush with the rear edge of the cowling. See figure 27.




(Figure 27)

77) Drill back through the hole for the top mounting bolt into the hinge with a #11 drill.

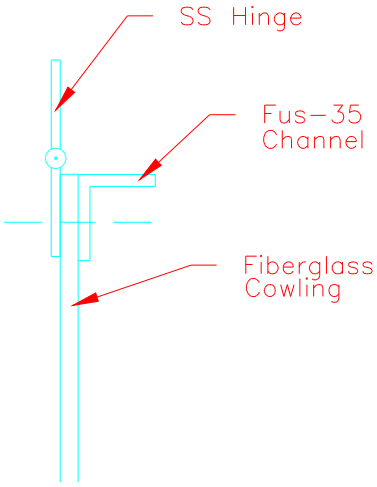
78) Insert the mounting bolt to hold the hinge in position, then drill #30 holes at nominal 1" spacing along the hinge into the cowling. Cleco in place.

79) Remove the outer portion of the top door hinge and lay it along the back side at the top edge of the cowling door. Drill #30 holes at nominal 1" spacing.

79a) Attach the door to the top hinge with 1/8" x 3/16" Avex (RV-1410).

80) Cut a piece of 3/4" x 3/4" x .040" angle (FUS-35) the same length as the bottom hinge. Two pieces can be spliced if necessary.

81) Clamp the angle in place behind the bottom hinge as in figure 28, then drill through the existing holes into the channel stiffener. Figure 28.




(Figure 28)

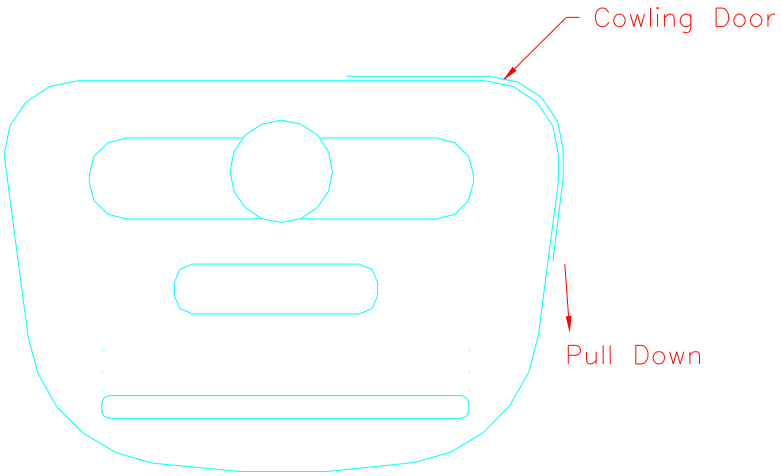
82) Remove the parts and debur.

83) Drill the holes, in the fiberglass only to 5/32".

84) Attach the bottom hinge and channel stiffener using 1/8" x 3/16" Avex (RV-1410).

85) Attach the door at the top hinge by re-inserting the hinge pin.

86) Have someone pull down on the lower edge of the door making sure it lies flush on three sides. See figure 29.




(Figure 29)

87) Using a felt pen, reach in from the other side and trace along the front edge of the cowling, the firewall and the hinge.

88) Trim the door to size, leaving a 3/4" overlap at the cowling and firewall and a 3/8" overlap at the hinge to allow fastening.

89) Drill #30 holes through the bottom hinge and the door at nominal 1" spacing, debur and attach with 1/8" x 3/16" Avex (RV-1410).

90) Repeat for the opposite side.

**PLEASE NOTE:** For a better fit of the cowling doors, use a metal shrinker to shrink the front edge of each door until it fits smoothly on the fiberglass cowling.

***Conventions:** All directions are referred to assuming that you are seated in the cockpit facing forward. (right = starboard, left = port side)

***NOTE:** Before mounting the 912 Engine make sure that the Engine has been drilled at the Rear Top Attach points. If it hasn't, the rear top hole through the crankcase housing must be drilled out with a 13/32" drill bit. This drill bit will have to be approximately 12-13" long to allow proper drilling of the hole. Be sure to feed the drill from the right side as the displacement of the cylinder allows the most room for the drill. Allow the drill to centre and align itself along the length of the hole. Some lubrication will be required. Drilling of this hole in the engine is sanctioned as referred to in the Rotax bulletin dated 09/22/92 (See Appendix A).

1) Remove engine from box and place on a solid surface.

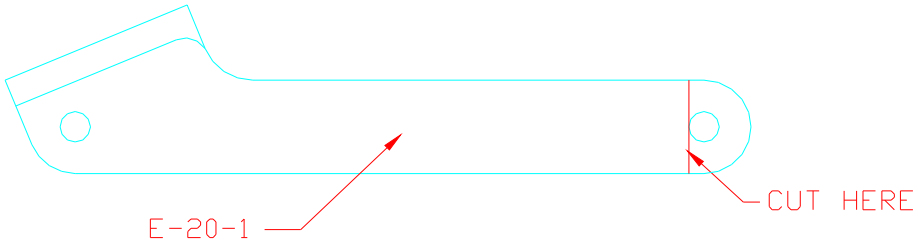
2) Remove Intake Manifolds. Place clean clothes down the intake holes to prevent dirt and chips from entering the cylinders. When replaced later the manifolds will be reversed right to left so they stick outwards.

3) Remove the black Ignition box from the engine.

4) Carefully mark each spark plug wire at the spark plug end. Remove the wire caps. Snip the plastic clips and twist the end cap until it comes free. Remove the black box completely from the engine.

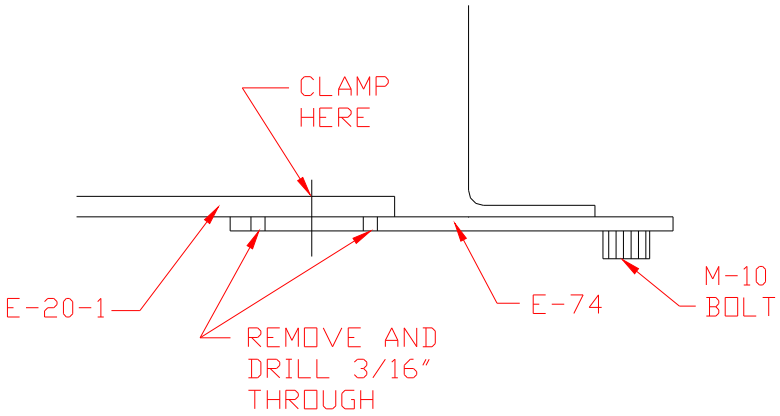
5) Remove the 912 header tank and hoses from the engine.

6) Take one left and one right engine mount bracket (E-20-1) and cut them off at the rear end of the front hole. Figure 2. Debur edges. These are now the Top Attach Brackets.




(Figure 2)

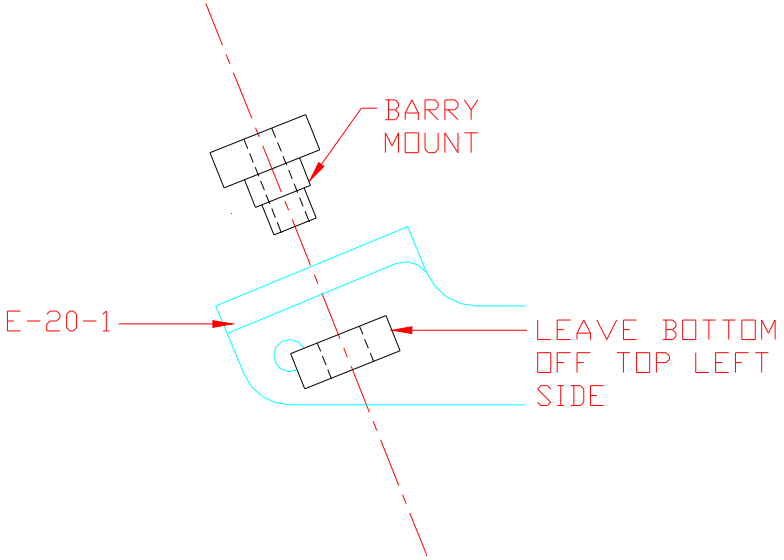
7) Attach the Top Right and Left Attach Brackets to the engine at the rear Attach points. Use the 940-695 M10 stud with 242-091 M10 nuts to hold through the case. Attach the Top Bracket Stabilizers (E-74) to the forward attach points with M10-35 Bolts. Line up the two pieces (E-20-1 & E74) and clamp together as in Figure 3.




(Figure 3)

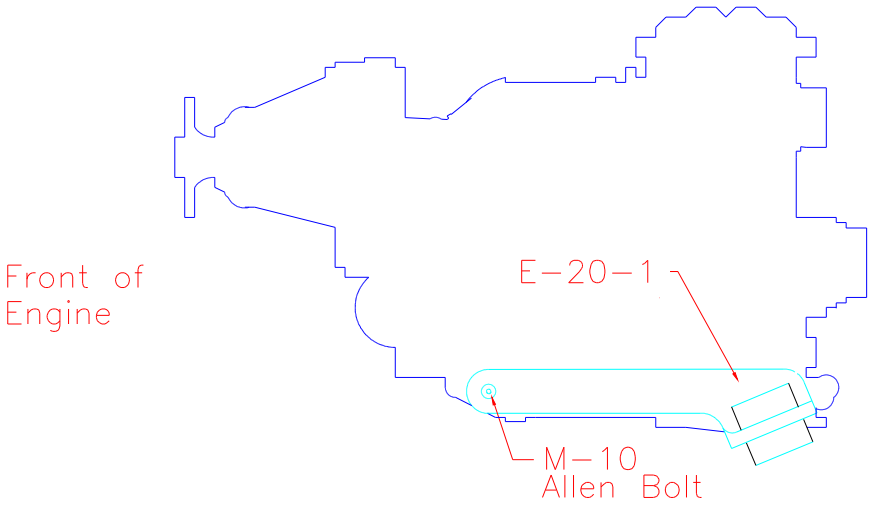
8) Remove the clamped assembly and drill all the way through the #30 pilot holes in FUS-74. Then drill these holes out to 3/16". Debur and bolt together with four AN3-7A bolts, four AN960-10 washers and four AN365-1032 nuts.

9) **NOTE:** To complete the next steps you must make sure that the top rear attach holes have been drilled all the way through the case. Next, install the Barry Mounts (22001-13) on all four Engine Attach Brackets. Leave the bottom rubber on the left Top Bracket off at this time. This is so you can slide the 940-695-M10 stud through the Case. Figure 3A.




(Figure 3A)

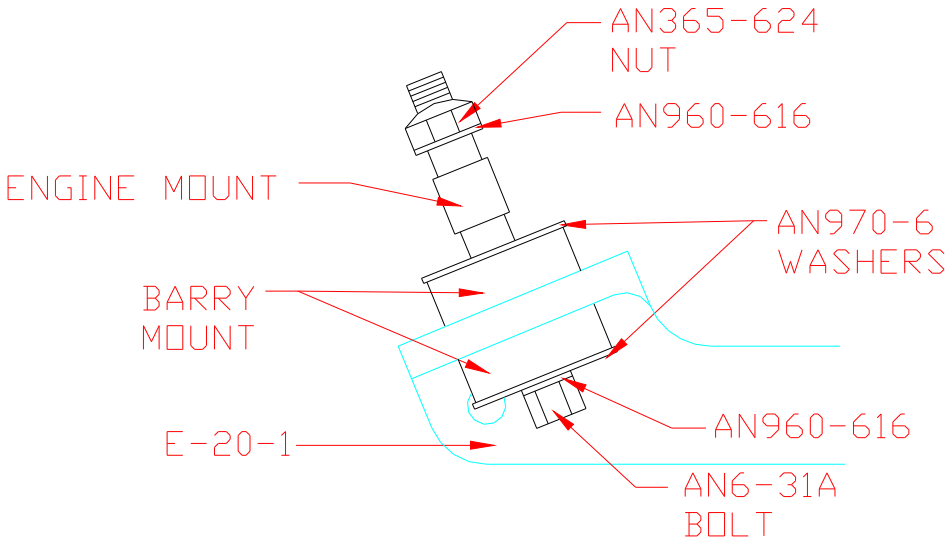
10) Install the two Bottom E-20-1 brackets (L & R) to engine using M-10 bolts and AN960-616 washers. Figure 3B.




(Figure 3B)

11) Remove the two bottom hoses between the Water Pump and the front inlets.

12) Mount the top right rear Bracket Assembly onto Engine Mount with the bolt head at the Bracket end and the nut sticking up. Figure 4.

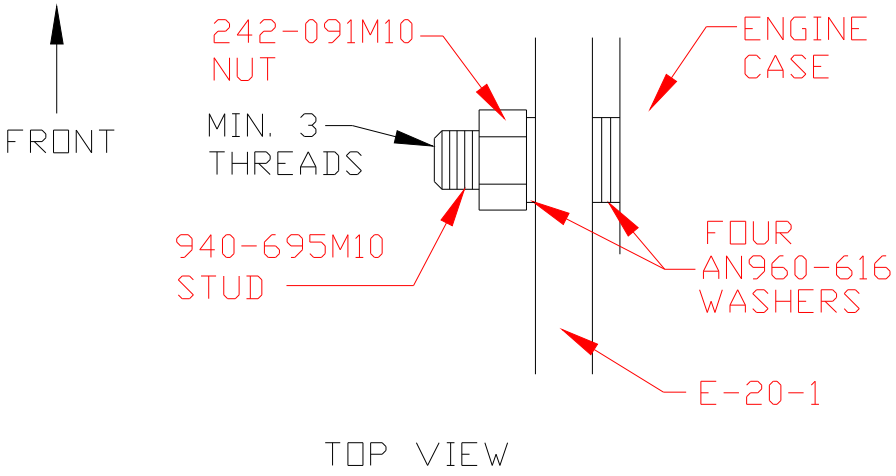



(Figure 4)

13) Attach the top left Bracket Assembly to the Engine. Attach with an M10 bolt at the forward end only. Do not tighten bolt.

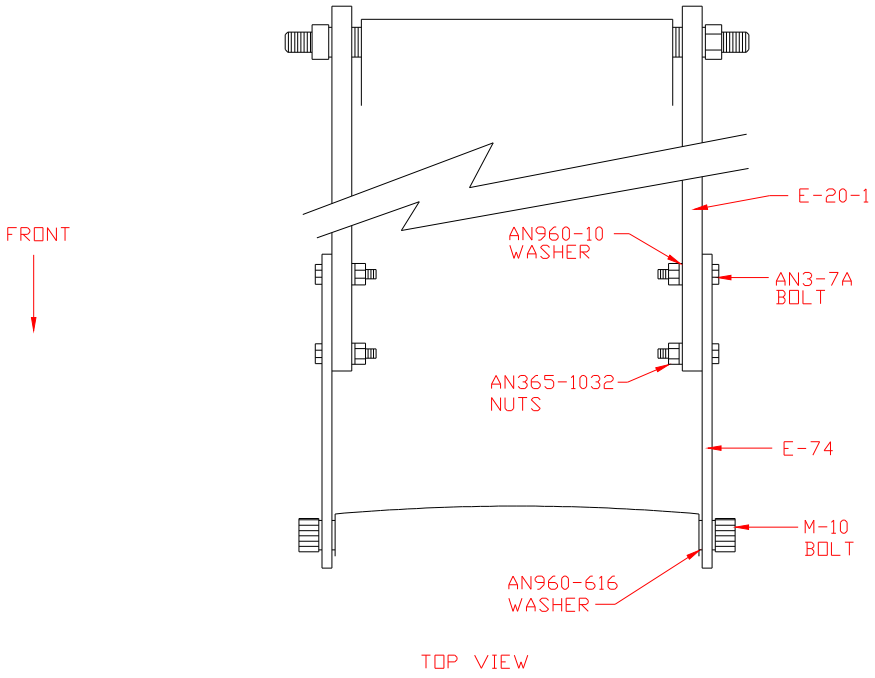
14) With the three Brackets attached to the Engine and one attached to the Engine Mount, slide the engine into the Engine Mount. (It will take three people to accomplish this). Have someone put the bottom two bolt assemblies into place (see Figure 4 for bolt direction and washer placement). Do not tighten fiber nuts at this time, some play is needed to install the top Brackets.

15) Take the long threaded stud (940-695M10) and put a nut (242-091M10) and washer (AN960-616) on one end. Make sure at least three threads are showing past the nut. Slide the stud through the right top Engine Bracket (make sure to place three washers (AN960-616) between the bracket and Engine case at each end). Figure 5.




(Figure 5)

16) Place a washer (AN960-616) and a nut (242-091M10) on the right side of the stud (adjust both nuts so that there are equal number of threads sticking out on both ends). Use an open end wrench on the left side and a socket wrench on the right and tighten. Figure 6.




(Figure 6)

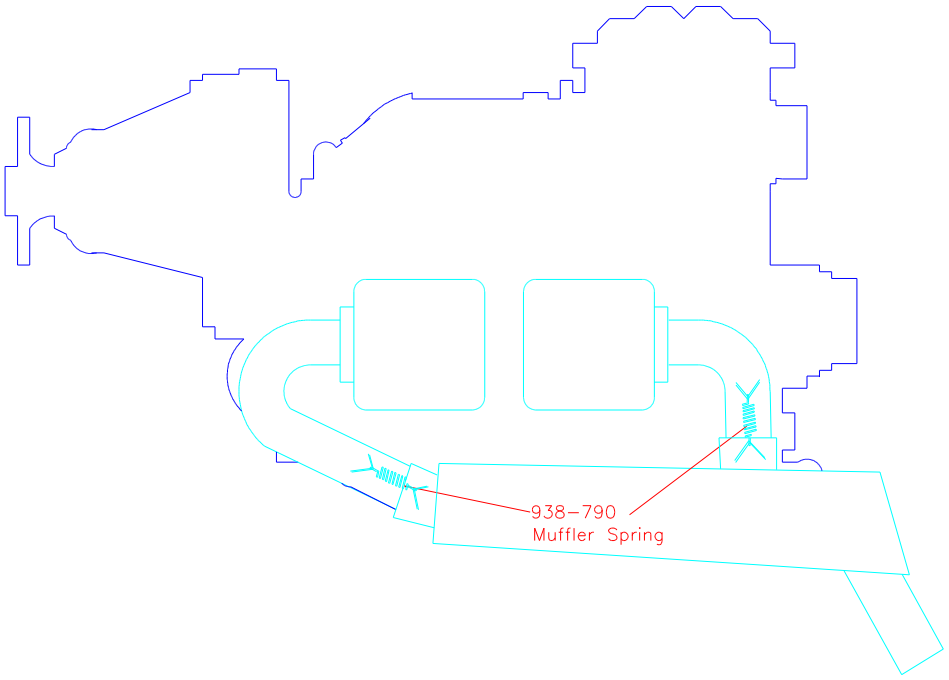
17) Put the bottom rubber on the top left Barry Mount and put the bolt (AN6-31A) and washers (AN960-616 and AN970-6) together with a fiber nut (AN365-624).

18) Tighten all bolts and nuts on all four Engine Brackets.

19) Re-install the water hoses, but **Please Note:** Reverse hoses 2 & 3 on the right side of the Water Pump. This will provide adequate clearance and avoid kinks in the hoses.

20) Attach the 912 exhaust set to the engine as in Figure 7. Note that the spring hooks must be welded in place on the exhaust. Three 938-790 muffler springs are attached to opposite hooks at each connection to the muffler. Gently bend hooks if spring is loose.

21) A 12" flexible exhaust extension is attached to each outlet by a 1 1/2" muffler clamp. If necessary, this can be done after the cowling is installed to ensure a better fit. Figure 7.



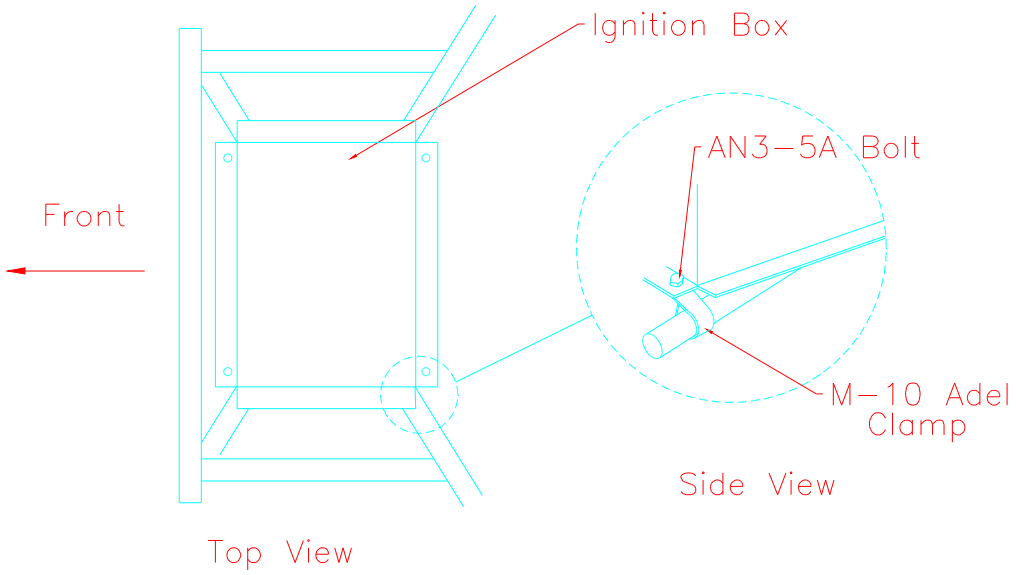

(Figure 7)

21) Install 912 cowling as per '912 cowling Installation'.

It is our experience that most if not all builders have their own preferences and practices for installation of engine systems (electrical, cooling, fuel, etc.). Therefore, rather than give exact step by step instructions for these systems, we provide suggestions and guidelines for the builder to follow at his discretion.

**912 ELECTRICAL SYSTEM**

22) The 912 ignition box can be mounted to the top of the engine mount where the main supports cross. It is attached to the tubes using 5/8" (M-10) Adel clamps with AN3-5A bolts, AN960-10 washers and AN365-1032 fibernuts. Figure 8.



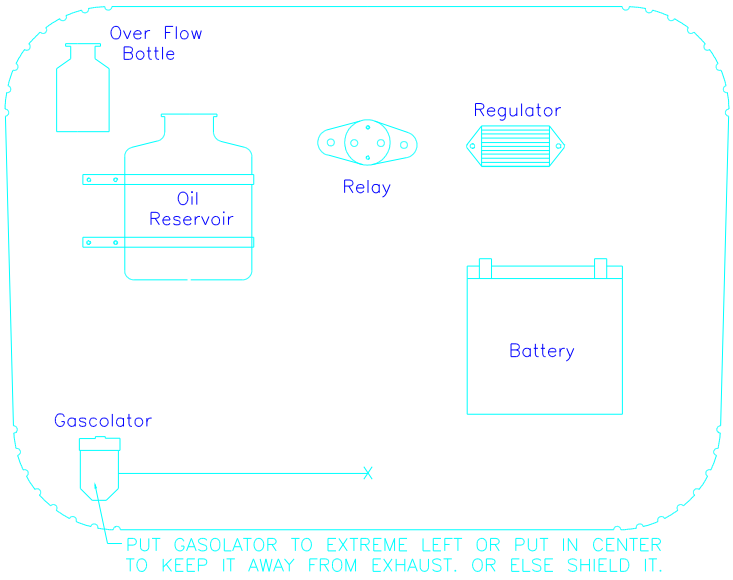

(Figure 8)

23) Re-attach the spark plug wires back to their proper locations. (The wire should still be marked).

**NOTE:** When running any electrical wiring inside the engine compartment the wires should be secured together (possibly with plastic ties) and also secured to the frame, cowling, etc. Anti-chaffing protection such as rubber hose wrapped around the wires or conduit should be used where necessary.

24) A standard 912 circuit diagram is attached for reference when installing the electrical components. Also included is a sample 912 wiring diagram based on the prototype rebel installation.

25) A sample firewall layout for a 912 equipped Rebel is shown in Figure 9.




(Figure 9)

This is only a sample layout. The final location of all components is up to the individual builder. The components should be located according to safety from heat, etc., clearance and access to the engine compartment for maintenance, inspection, etc.

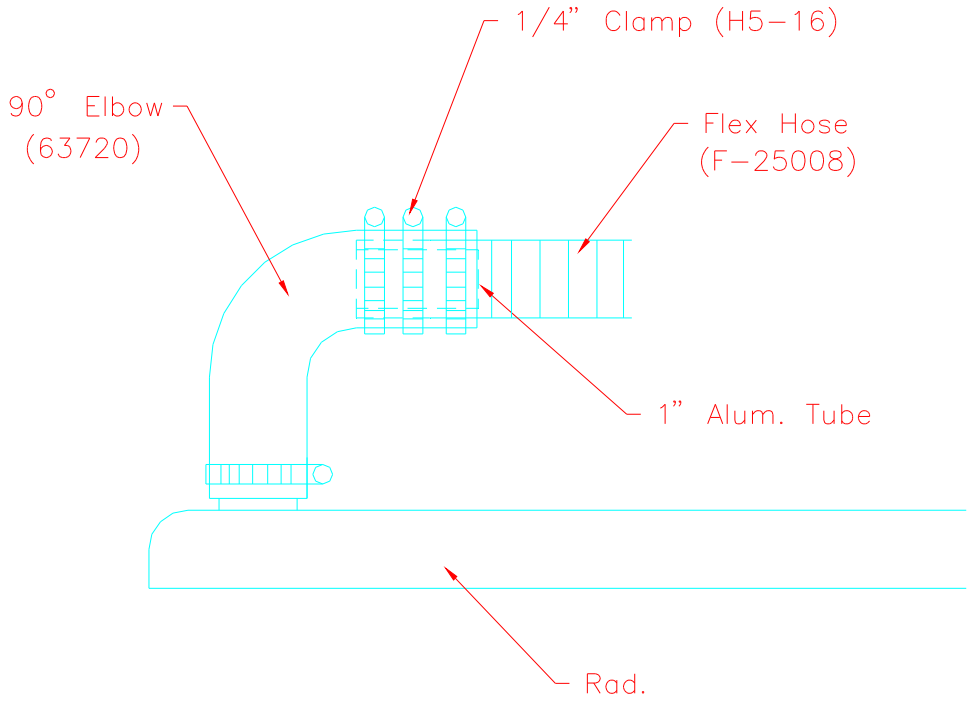
26) Because of the wide array of instruments available and the combinations which are possible, flight and engine instrumentation is the sole responsibility of the builder. However, shown below is a list of the minimum engine instrumentation we recommend for a 912 installation

- Electric oil pressure gauge and sensor
- Tachometer
- Cylinder head temperature
- water temperature
- Oil temperature

**COOLING SYSTEM**

27) Attach the 1 1/4" elbow (63720) to the top inlet of the radiator using a 1 1/4" hose clamp (HS-16).

28) Using a 3" piece of 1" x .035" 6061-T6 tube as a bushing, attach the elbow to a 1 1/4" flexible hose (F-25008) using three 1 1/4" hose clamps (HS-16) as in Figure 10.




(Figure 10)

29) Attach the other end of the flexible hose to the header tank E-31526 which is located at the top of the top of the engine mount near the firewall. Attach with a hose clamp (HS-16).

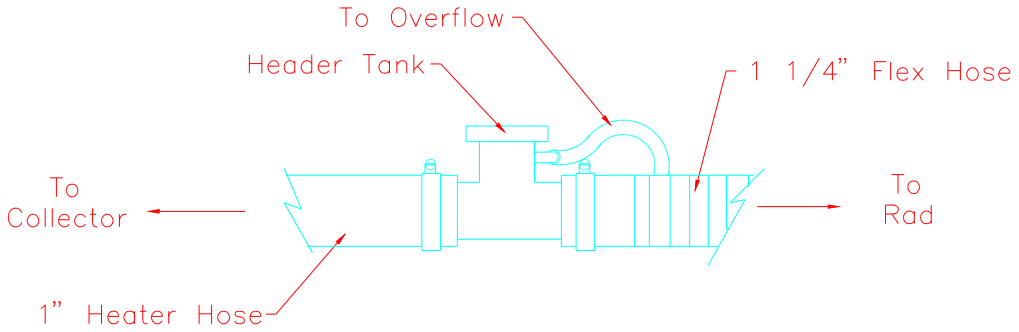
**For recent model Rotax 912 engines**

**Important Note:** Newer Rotax 912 engines are supplied with their own header tank which attaches to the collector hose at the top of the engine. This does make installation easier, however a check should be made to ensure adequate room is available for filling and checking the tank when the cowling centre section is installed.

In this case the 1 1/4" flexible hose (F-25005) can be attached directly between the header tank and the top inlet of the radiator using 1 1/4" hose clamps (HS-16)

**NOTE:** Again the exact location of the header tank and routing of the hoses is up to the individual, however the header tank must be the highest point in the system.

30) The header tank assembly can be secured to the engine mount with plastic ties. Be sure that whenever water, oil, or fuel lines are secured they are to be protected against chafing. Figure 11.




(Figure 11)

31) Attach a piece of 1" heater hose (301-3271-2011) to the header tank, then attach the other end to the collector at the top of the engine.

32) Attach a second piece of 1" heater hose between the bottom outlet of the radiator and the water pump at the bottom rear of the engine.

33) Attach a short piece of 3/8" clear line between the header tank and the overflow bottle.

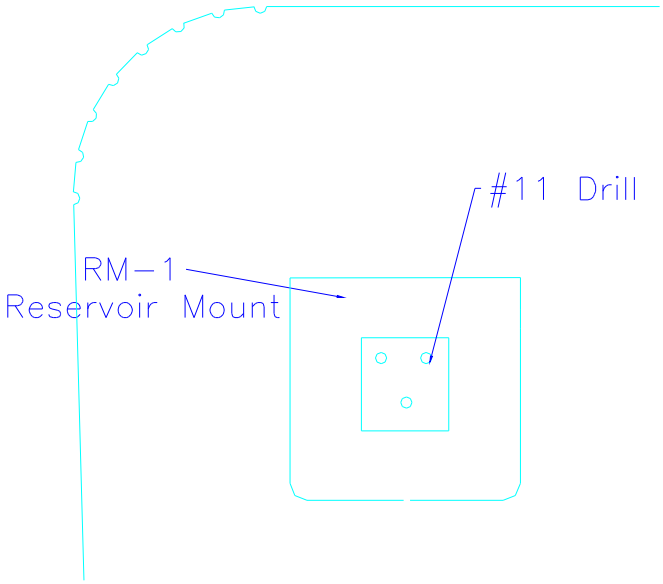
Remember that all lines must be kept a safe distance away from the exhaust.

**OIL SYSTEM**

34) Decide on the exact location of the oil reservoir and mark it on the firewall.

35) Place the fiberglass reservoir mount (RM-1) on the firewall at the appropriate location. Drill three equally spaced #11 mounting holes through the mount into the firewall. Figure 12.

36) Debur.




(Figure 12)

37) Attach to the firewall with AN3-5A bolts, AN960-10 washers and AN365-1032 fibernuts.

38) Attach the reservoir to its mount with a 6" hose clamp (HS-088).

39) On the right hand side of the oil cooler (looking forward) install a 3/8" male pipe to 1/2" hose 90 degree adapter (139-8C) into a brass reducing coupler (119-CB) which threads into the oil cooler.

40) On the left hand side of the oil cooler, install a reducing coupler with a 3/8" male pipe to 1/2" hose barb adapter.

41) As stated, exact routing and alignment of oil lines in the engine compartment is left to the individual builder, however we do provide a schematic diagram along with some general locations basic upon our own installation.

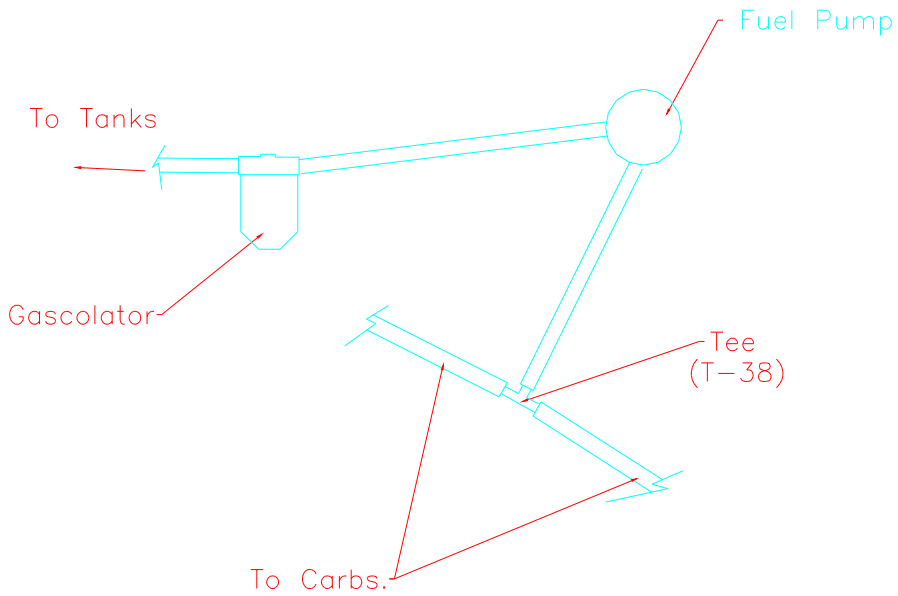
42) Please note that on the original 912 installation, no overflow bottle was used, however the Rotax lubrication circuit show one. Figure 13.

43) Carefully, tightly safe tie all hoses onto their respective barbs and attach lines with anti-chaff protection where necessary.

(Figure 13)

**FUEL SYSTEM**

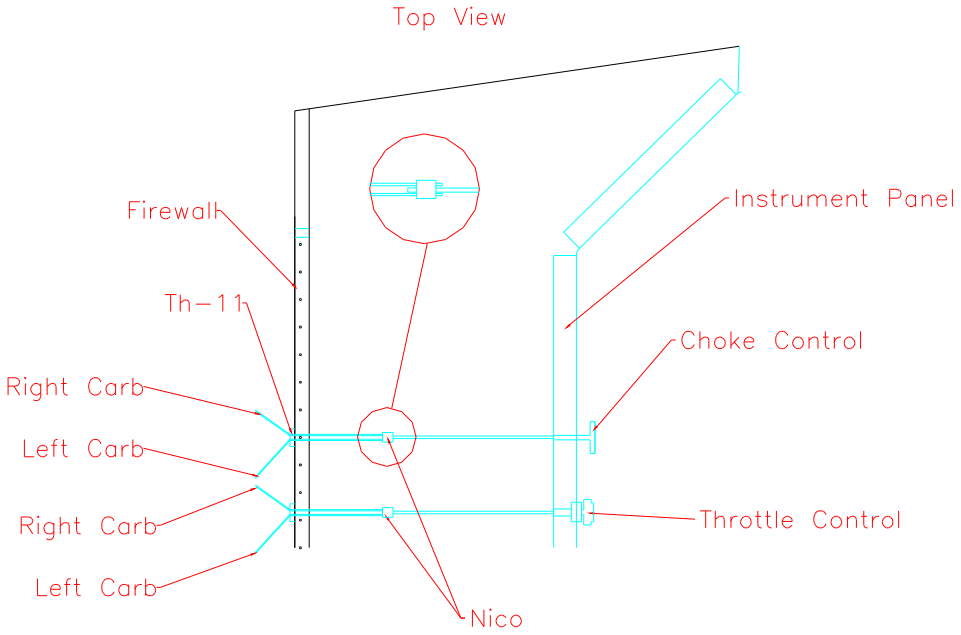
44) Once again specific locations or routing is not provided, however the schematic diagram below does provide general information. Figure 14.




(Figure 14)

45) Choke cables are attached at the carburetors with the supplied anchor lug (R3), then routed to a throttle stop (TH-11) at the firewall.

46) On the other side of the firewall, the cables are attached to a common control cable using a nico sleeve as in Figure 15.




(Figure 15)

47) The throttle cables are attached to the lever mechanism on the carb and then to a second throttle stop (TH-11) and a common control cable as in Figure 15.

A sample loading case is shown below:

| | Wt x Location | inch - lbs |
|---|---|---|
| Pilot & Pass. | 380 lbs @ 15" | = 5700 |
| Baggage | 100 lbs @ 45" | = 4500 |
| Empty Weight | 823 lbs @ 9.86" | = 8115 |
| Fuel (44 gal) | 264 lbs @ 23" | = 6072 |
| | 1567 | = 24387 |

$$\text{Loaded C of G} = \frac{24387}{1567} = 15.56"$$

**Caution:** These numbers are for demonstration purposes only. They are based on a typical 0235 equipped Rebel with a maximum gross weight of 1650 lbs. Empty weight C of G will vary depending on the type of engine installed, number of seats, etc.

The allowable center of gravity limits for the Rebel are shown below:

**Forward Limit = + 12"**

**Aft Limit = + 19.7"**

**Notes:**

The theoretical center of gravity limit for the modified 4415 airfoil is 7.7", however, extensive testing has revealed that 12" is a practical forward limit.

It is recommended that builders choosing larger (heavier) engines, move the firewall back 3 - 4" as detailed in Chapter 14 *0320 Fuselage Mods.* This provides some adjustment for the extra weight of the engine however, the effective forward and aft CG limits remain the same.

# Rebel Center of Gravity Calculation

The empty weight center of gravity for the Rebel can be determined after assembly and attachment of all permanent equipment by the following method:

1) Place the aircraft in level flight attitude with scales under the main wheels and tailwheel.

**Note:** These center of gravity measurements can be made with a single scale, however the process is easier and usually more accurate if three separate scales are used. If using a single scale, the remaining wheels can be supported by blocks of wood, the same height as the scale.

2) Measure and record the weight at each wheel.

3) Measure the horizontal distance from the main wheel to the tailwheel (center to center).

4) Insert the resulting numbers into the following formula to determine the empty weight C of G.

| | | |
|---|---|---|
| Left wheel | _____ | lbs |
| Right wheel | _____ | lbs |
| Tailwheel | _____ | lbs |
| Total Wt | _____ | lbs |

$$\frac{\text{Tail Weight x Distance d}}{\text{Total Weight}} = \text{Empty Weight C of G}$$

The operational Center of Gravity can vary a great deal with each loading situation, therefore it is important that it should be calculated for each unique loading case.

The following distances can be used as a general guideline to determine the operational C of G:

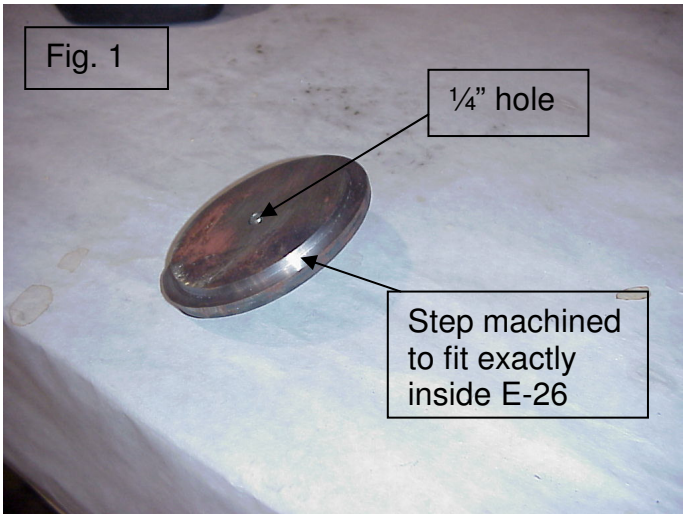
Datum line = Main gear leg

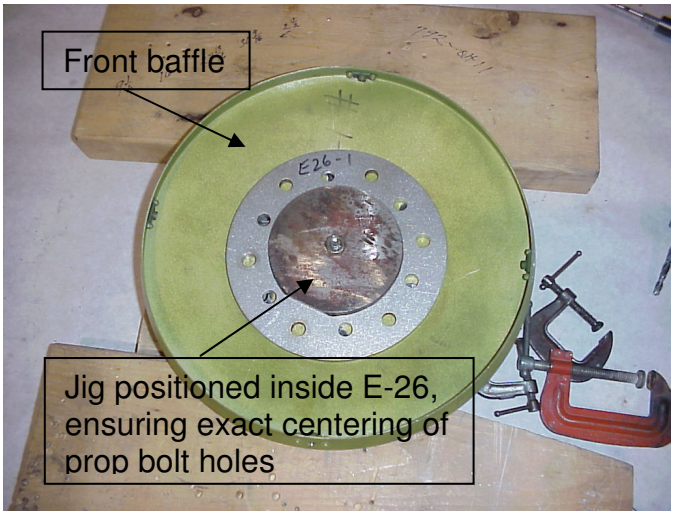
| | | |
|---|---|---|
| Distances: | Pilot and front passenger | - 15" |
| | Baggage | - 43" |
| | Fuel | - 18" |

**13” SPINNER INSTRUCTIONS**

These instructions refer to the 0-320 and 0-360 installations using a Sensenich metal prop.

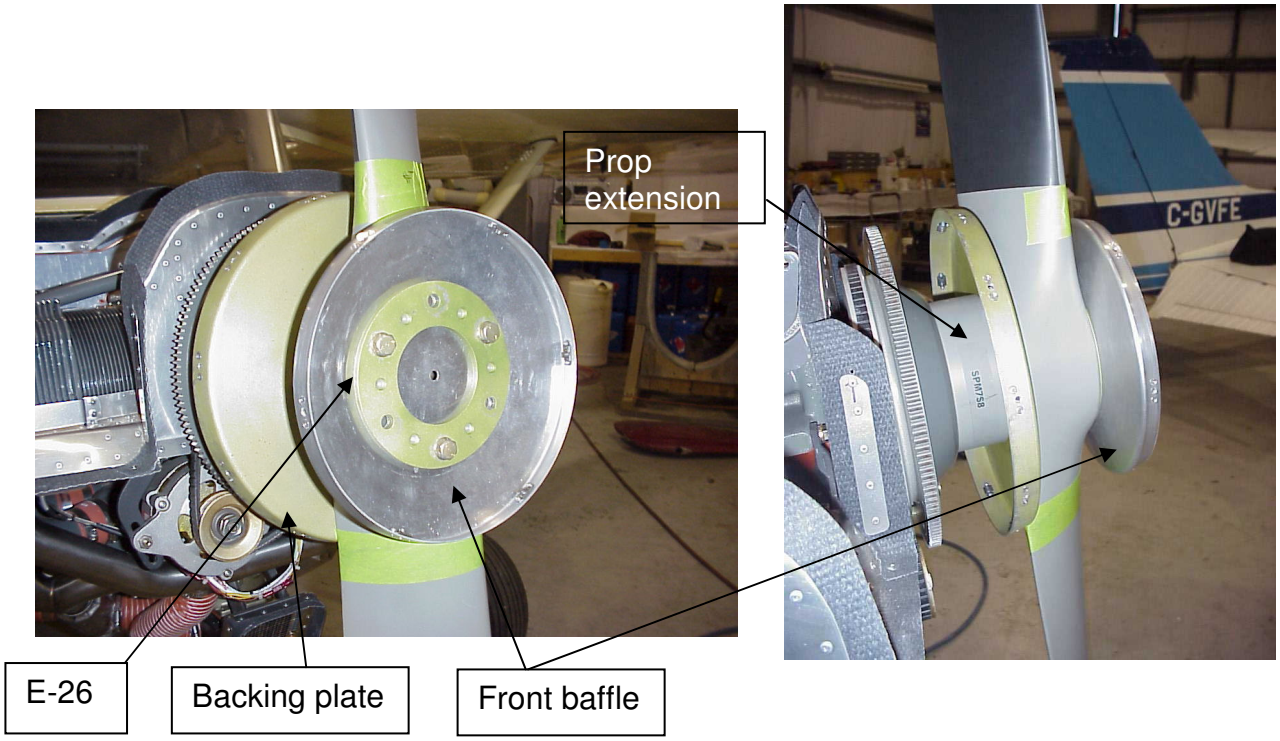
1/You must first drill the holes for the prop bolts in both the backing plate and the front baffle. A simple way of doing this is to have a centering jig made up. The exact center of both the backing plate and the front baffle can be drilled by using the dimple left from the spinning process. Drill this out to ¼”.
Take your E-26 thrust plate, and lay the centering jig into it, bolt it to the part to be drilled, and drill out the appropriate holes for the prop bolts. Fig. 1.




2/ Assemble the prop spacer, backing plate and propeller, following the instructions supplied with the propeller.
3/ Set the propeller assembly on a flat surface, spacer and backing plate down. Slide a short 2” X 6” under each edge of the backing plate.
4/ Lay out the spinner cut outs, making sure to maintain an equal distance between cutouts. Increase the size of the cut outs slowly until the spinner will fit over the propeller and backing plate, flush to the 2” X 6”.
Use some masking tape on the prop blades to prevent scratches. The spinner should clear the prop by at least 1/8”. Remove the spinner.
5/ Place the front baffle plate on top of the propeller, and slide the spinner into place. Check it slides all the way flush with the backing plate. Remove the spinner, and place the E-26 between the front baffle and the propeller. (this position is for fitting purposes only).
6/ Again slide the spinner in place, and see if it slides all the way flush with the backing plate. If not, less shimming is required, if it does, use 0.032 shims on top of the E-26 until the spinner seats on the front baffle just before becoming flush with the backing plate. The shims can be made from scrap using the centering jig described in step 1. The number of shims will vary depending on whether you have an 0-320 or 0-360, as the props vary in thickness.
7/ Measure the amount of shim material used between the front baffle and the propeller face. Block up underneath the propeller extension until you have a clearance between the backing plate rim and the 2” X 6” an equal amount to the shim material used.
8/ Put the front baffle in place on top of the propeller using one .032 shim between the prop. and the front baffle. Place the E-26 thrust plate on top of the front baffle and slide the bolts in place.

9/ Lengthen the cutouts in the spinner to allow it to slide on further to seat snugly on the front baffle with a clearance of 1/8” around the propeller blades.
10/ Attach the assembly to the motor, and snug the bolts up evenly using a torque wrench.

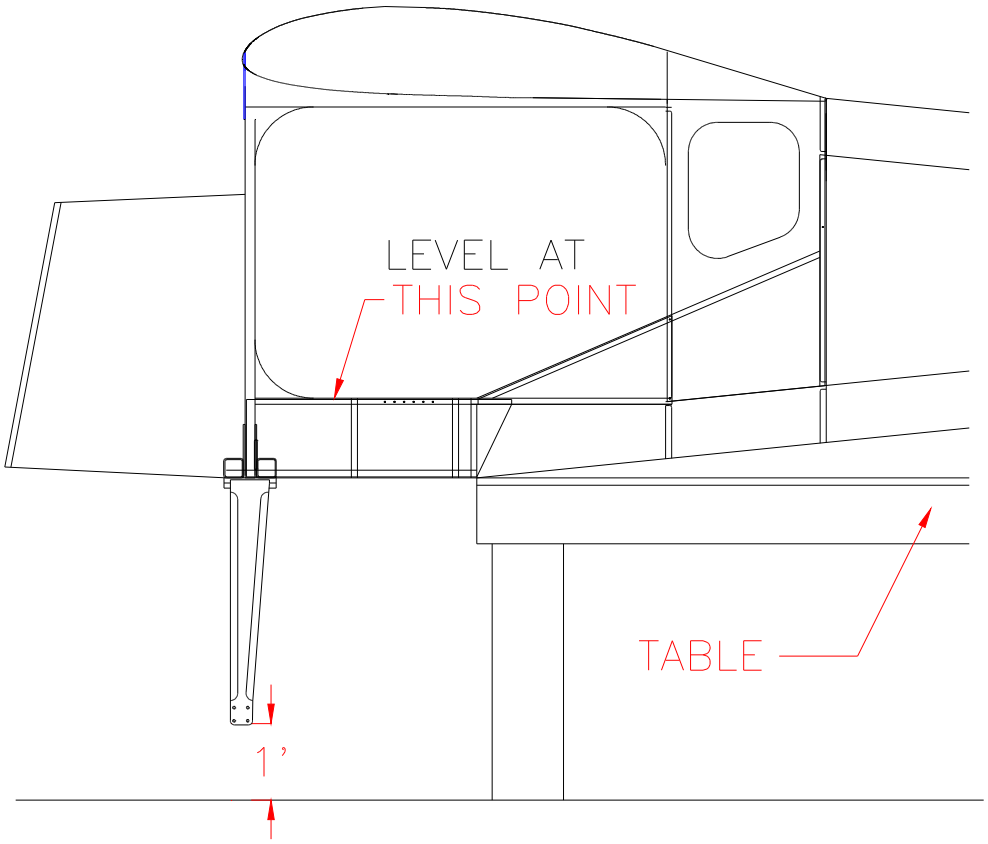



11/ Push spinner on snugly and hold in place with clamps.
12/ Set up a stand with a pointer aligned with the point of the spinner, rotate the propeller and check if the spinner is running true.
13/ Drill for the eight anchor nuts holding the spinner to the backing plate.
14 Remove spinner and measure the distance from the back of the flange of the backing plate to the center of the flange of the front baffle (assuming the spinner sits flush with the back edge of the backing plate). Draw a line down the center of the flange on the front baffle.
15/ Refit the spinner, and mark this distance onto the spinner in several locations. Join these marks, and this line should coincide with the center of the flange of the front baffle.
Drill carefully at #40, and check you can see your line. Drill for the six anchor nuts holding the spinner to the front baffle.

Tools which are required to finish this procedure are:

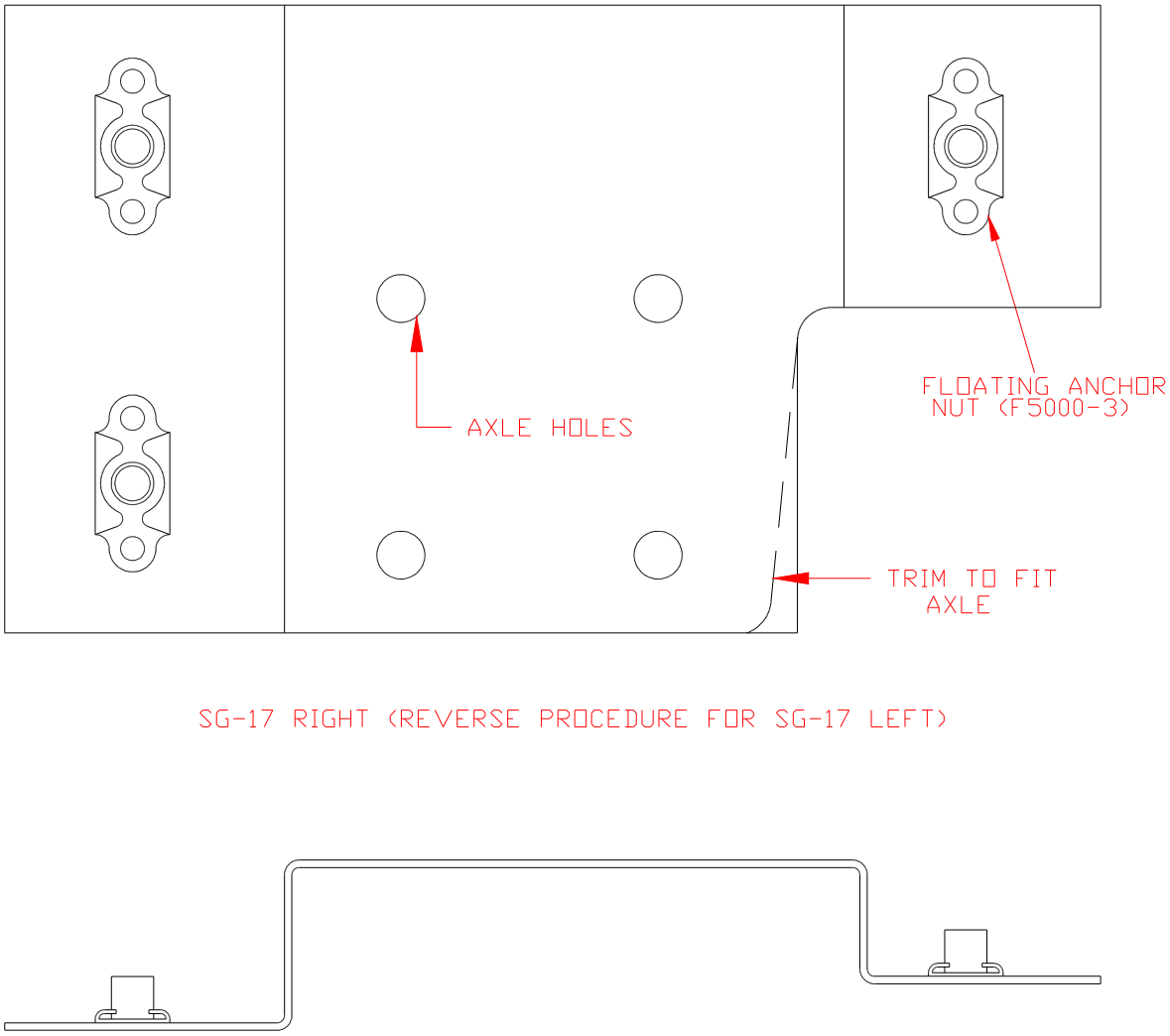
1. Snips
2. File
3. Sand Paper
4. Marking Pen
5. Drill
6. 3/8”, 7/16”, 1/2” Wrenches
7. Riveter
8. Tape Measure
9. Level

1) Place the aircraft in its level position. This done by ensuring that the door sill is level. There should be at least 1 foot between the bottom of the Spring Gear Leg (SG-1) and the floor to provide room to work. Figure 1.




(Figure 1)

2) Center the axle onto the lower half of 3 1/8" Wheel Pant Bracket (SG-17L & R). F drill the four holes using the axle as a guide. Locate three Floating Anchor nuts and drill for the anchor nuts on each bracket. Figure 2.

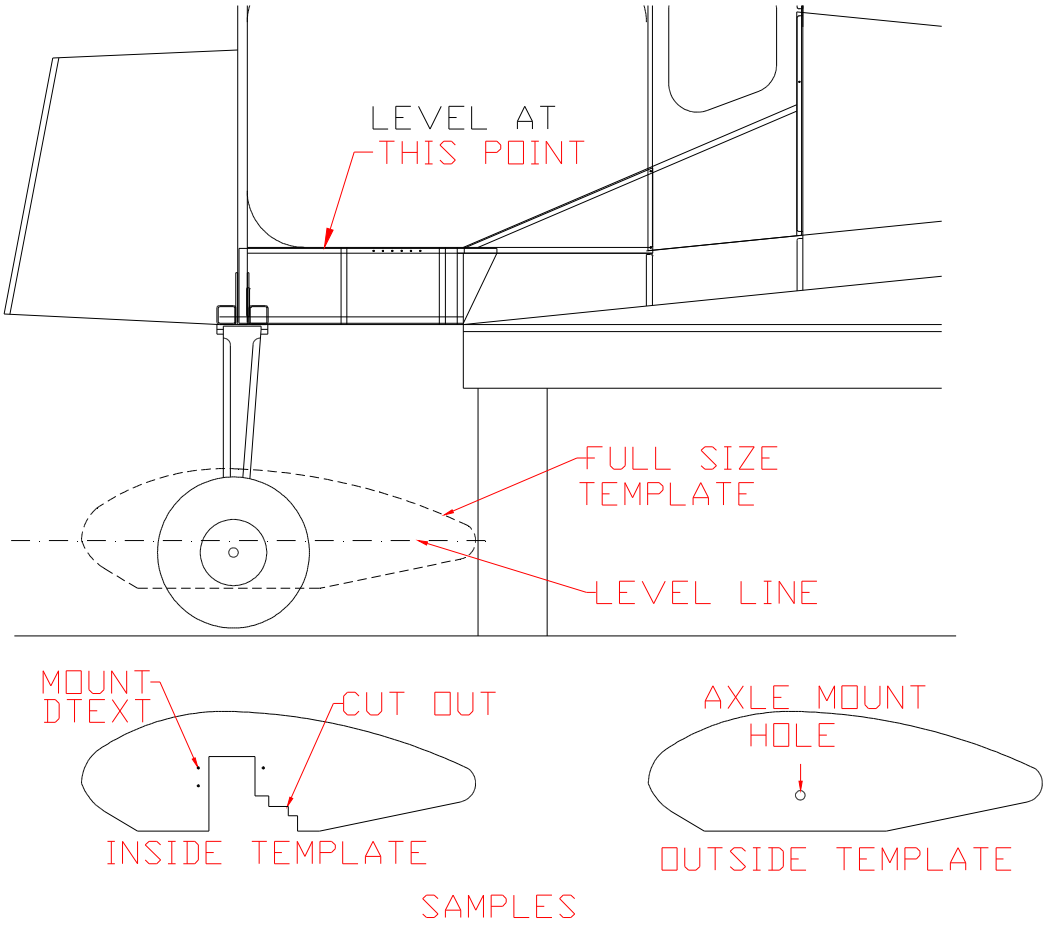



(Figure 2)

3) Install 3 1/8" Wheel Pant Brackets (SG-17L & R) as in the exploded views with axles, rims and tires.

***3 1/8" WHEEL PANT***

4) Make full-size cardboard templates to locate the wheel pant mounting holes. Make an inside and an outside template and transfer to the wheel pants. Figure 3.




(Figure 3)

5) Cut and trim the wheel pants to fit the gear leg.

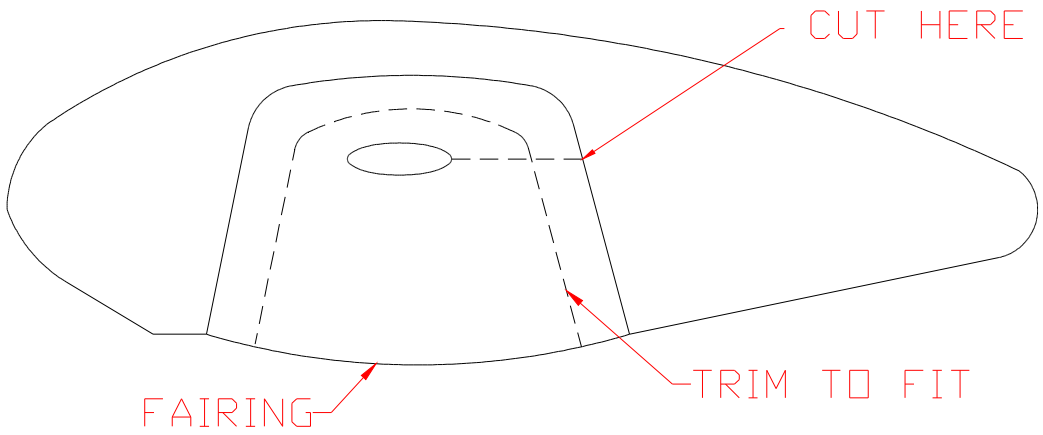
6) Bolt the Wheel Pant to the Wheel Pant Bracket using three AN3-3A bolts and three AN970-3 washers.

7) Bolt the wheel pant to the axle with a AN5-4A bolt and a AN970-5 washer.

**NOTE:** Make sure that the wheel pant clears the wheel.

***3 1/8" WHEEL PANT***

8) Cut a slit in the Wheel Pant Fairing at the back side to allow easy installation. Figure 4.

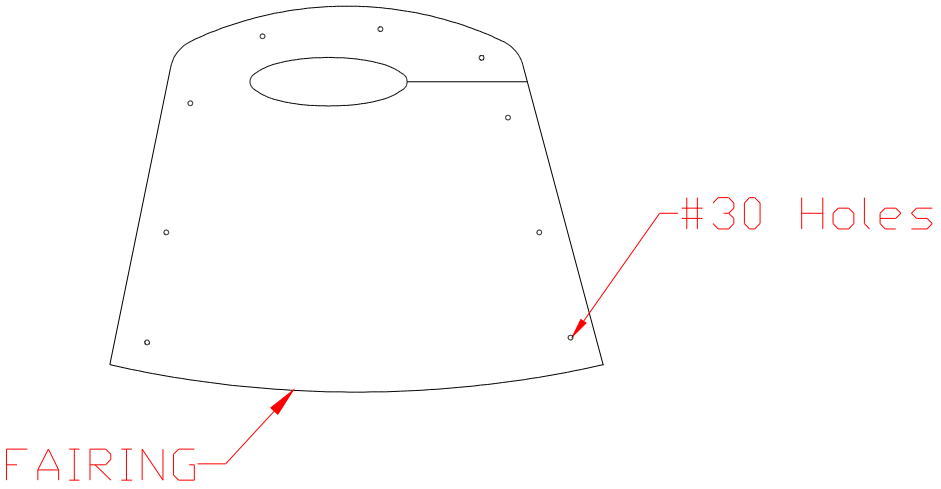



(Figure 4)

9) Trim the Wheel Pant Fairing so that the Wheel pant mounting bolts and brakes are covered. **NOTE:** The size and shape of the wheel pant fairing is a personal preference.

10) After trimming, mark the location of the nine mounting screws onto the fairing and drill with a #30 through the fairing and wheel pant.. Cleco. Figure 5. **NOTE:** The spacing and exact location is not critical..

***3 1/8 WHEEL PANT***




(Figure 5)

11) Remove the Fairing. Remove the wheel pant.

12) On the inside of the wheel well of the wheel pant, install F5000-3 Anchor nuts using 1/8" x 1/4" Countersunk Rivet (RV-4412). **NOTE:** Open the bolt holes with a #11 drill.

13) Repeat for the other fairing.

14) Sand and prep wheel pants and fairings for painting. Paint .

15) Reinstall wheel pant as in steps 6 and 7.

16) Attach the fairing to the wheel pant using 9 screws(AN526-1032 R8).