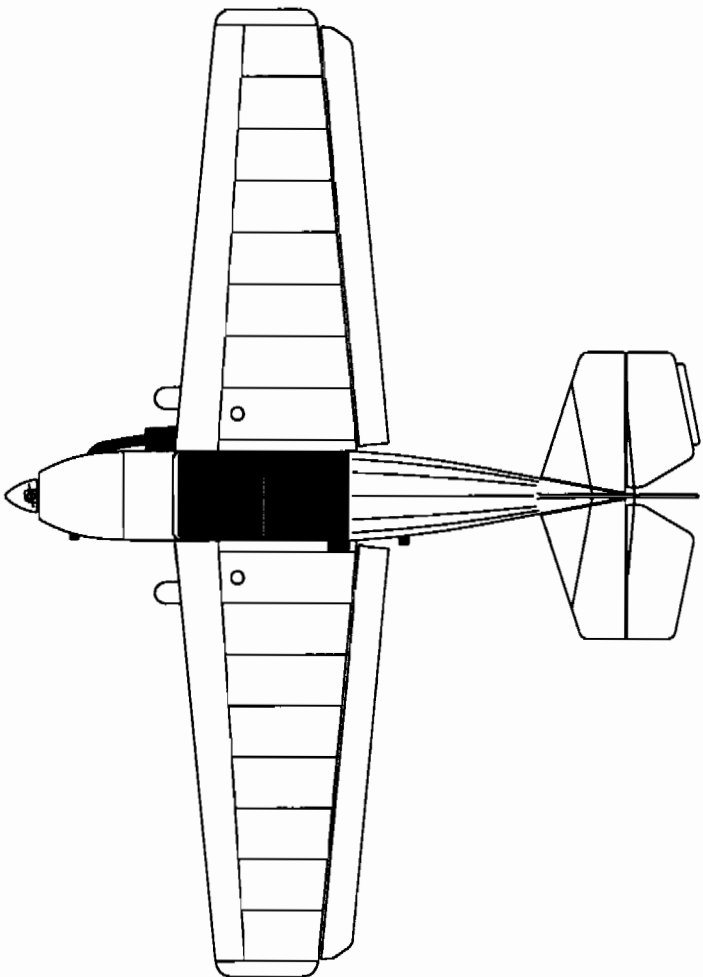
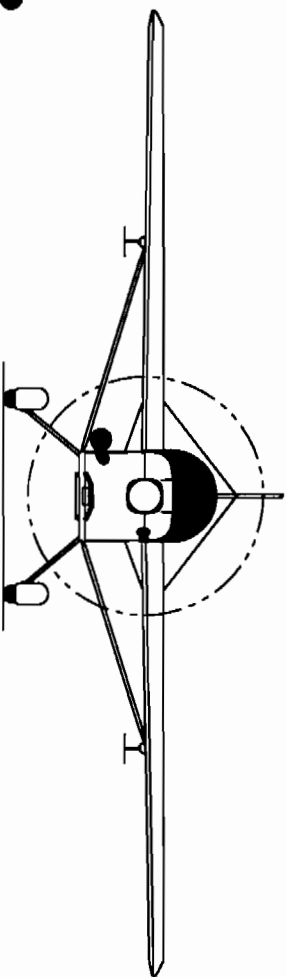
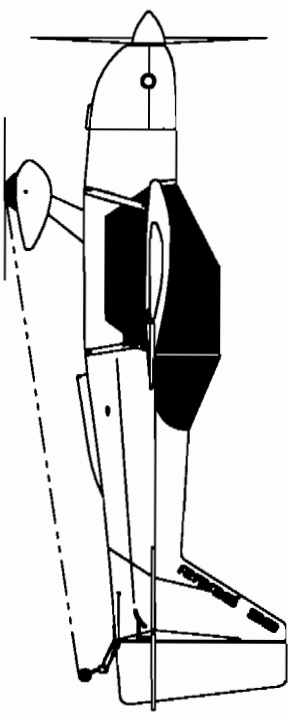
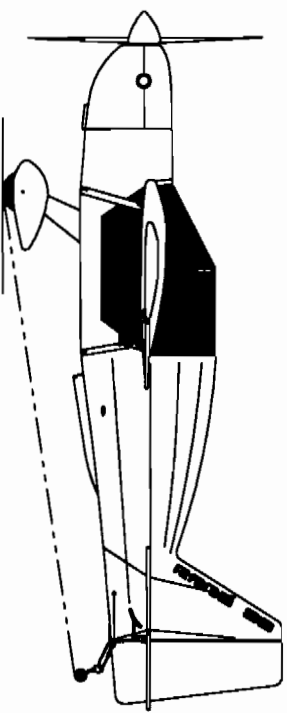


RRMS S-9 CHAOS



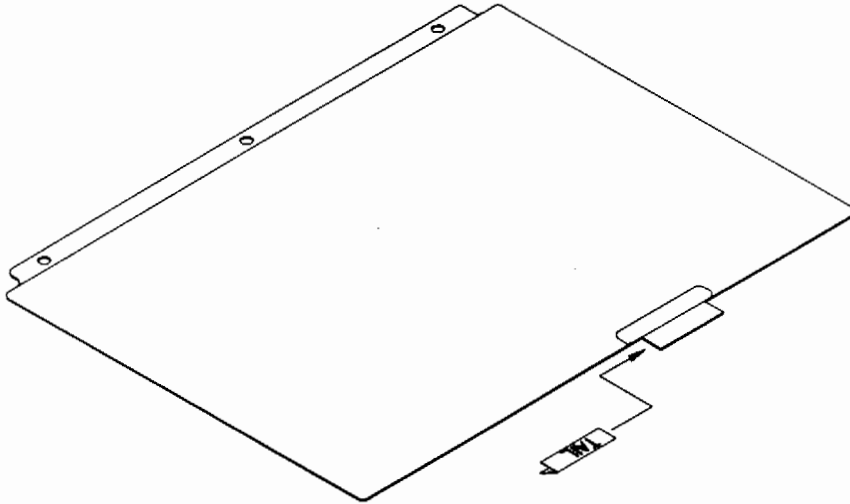
RRMS

4600 HIGHWAY 183 ALTERNATE
HAYS, KS 67601
(785) 625-6346

DESIGNED BY:
RANDY SCHLITZER

S-9 CHAOS

Your manual is ready for assembly. Separate the sections with the tab inserts listed below. Cut out, fold in half, and insert into tabs. Every section begins with the parts pages (exploded view and a part list) followed by text. Parts pages are assigned with the prefix "00", and the text pages are assigned the prefix "0". Follow the table of contents for the order that the manual should follow.



MD1316

GENERAL DATA	MAIN LANDING GEAR	CONTROL STICK	ENGINE 582	RIGID CANOPY
GENERAL DATA	MAIN LANDING GEAR	CONTROL STICK	ENGINE 582	RIGID CANOPY
WING	LANDING /	SEAT/SEAT BELT	ENGINE MOUNT	COVERING
WING	TAILWHEEL	/THROTTLE	ENGINE MOUNT	COVERING
	LANDING /	SEAT/SEAT BELT		
	TAILWHEEL	/ THROTTLE		
WING-AILERONS	BRAKES	TAIL	ENGINE MOUNT	FABRICATED PARTS
WING-AILERONS	BRAKES	TAIL	582	FABRICATED PARTS
			ENGINE MOUNT	
			582	
WING-STRUTS	FLOORBOARD	FUEL SYSTEM- INVERTED	COWLING	OPTIONS
WING-STRUTS	FLOORBOARD	FUEL SYSTEM- INVERTED	COWLING	OPTIONS
FUSELAGE	RUDDER	ENGINE	WINDSHIELD /	CG/OPERATIONS
FUSELAGE	RUDDER	ENGINE	SIDE GLASS	CG/OPERATIONS
			WINDSHIELD /	
			SIDE GLASS	
LOW BACK	INSTR. PANEL /	ENGINE	CANOPY	
LOW BACK	FIREWALL/ELEC.	COOLING SYS.	CANOPY	
	INSTR. PANEL /	ENGINE		
	FIREWALL/ELEC.	COOLING SYS.		

RANS INC.

**4600 Highway 183 Alternate
Hays, KS 67601**

**Technical Support
(785) 625-0069**

**Parts Department
(785) 625-6346**

When calling Technical Support please have the following ready:

- ☐ Aircraft Model
- ☐ Serial Number
- ☐ Engine Model
- ☐ Your Aircraft Assembly Manual

Note: Please make your questions precise and to the point so they we may assist as many customers as possible.

S-9 CHAOS

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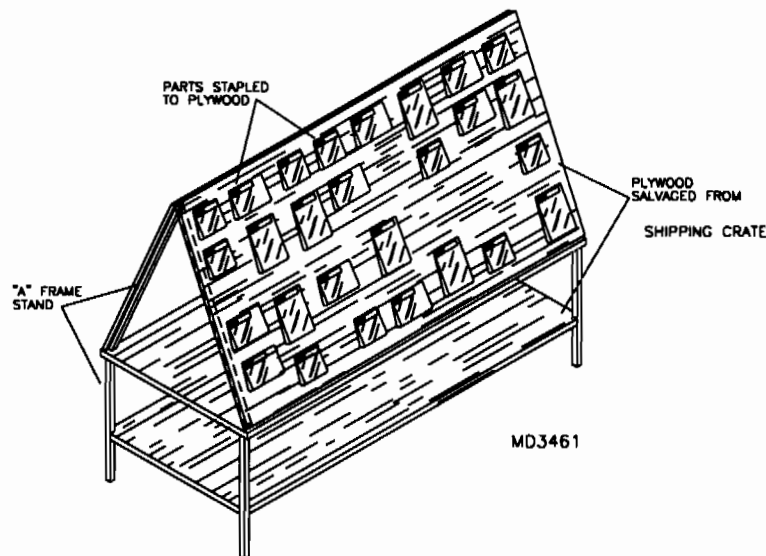
System	Section
General Information	
Wing - Fuel Tanks	001
Wing - Ailerons	001A
Wing - Struts	001B
Fuselage	002
Low Back	002A
Main Landing Gear	003
Landing - Tailwheel	003A
Brakes	003B
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Instrument Panel - Firewall - Electrical	005
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Fuel System - Inverted	009
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S-9 CHAOS

GENERAL INFORMATION

BEFORE BEGINNING:

TAKE INVENTORY: You must complete an inventory within 60 days of receiving your kit. We check and re-check and are 99.9% certain that if we say we shipped it, we did. The first task in building your kit is to inventory the parts using the packing list provided. It's your job to keep all parts organized and accounted for. We can not provide missing parts cost free after 60 days. Use the supplied pack list to verify that everything that we packed is in the box. The fast way to inventory, is to use the Priority Number that appears on the Part Number labels, these will match the pack list in numeric order. Go through the list item by item. If anything is not there that should be, please contact our parts department immediately. ***HINT:** Use sections of plywood from the packing crate to fabricate a part inventory board. As each part is inventoried and checked off on the pack list, staple the bag to the board. This allows for quick identification and part selection during assembly. We fabricate "A" Frame stands to support the plywood. Refer to the figure below. Plywood can also be attached to shop wall.*



PLEASE READ the manual cover to cover. This will speed up your build time considerably.

GET ORGANIZED! Prepare your workshop and be sure that what goes in the shop door will be able to come out!!!

TRIAL ASSEMBLY: We recommend a trial assembly of the airplane before covering. This assures that everything is complete and avoids the expense of re-work. This will require either a nice day for assembly outside or a good sized shop for indoor assembly.

Covering the aircraft requires aircraft covering and painting skills. You can get experience on the landing gear side formers or the elevators. These are small enough to do over without great expense or trouble.

All welded steel parts will require primer and top coating. We recommend a good two part epoxy primer. Final painting of certain components will be done after trial assembly. Include these components when designing your paint scheme. If you assemble the aircraft in a humid environment, it is best to prime everything first. This may be added work if the parts get scratched during trial assembly but it will stop the onset of rust. If you have sea air, consider priming the aluminum parts as well. Internal protection for the aluminum can be affected by pouring tube seal inside and letting it run out coating the inner diameter for the welded steel parts. Tube seal can be injected through a small #40 hole and welded or dabbed shut with a bit of J&B weld.

everything first. This may be added work if the parts get scratched during trial assembly but it will stop the onset of rust. If you have sea air, consider priming the aluminum parts as well. Internal protection for the aluminum can be affected by pouring tube seal inside and letting it run out coating the inner diameter for the welded steel parts. Tube seal can be injected through a small #40 hole and welded or dabbed shut with a bit of J&B weld.

Many small aluminum parts will need to be deburred. This is an **IMPORTANT** step and must be performed. Assembly of parts with burrs can cause stress risers and eventual part failure. Various tools can be used. An official deburring tool is nice, but a 1/2" drill bit can do a good job on most holes. Radius and smooth sharp corners with files or fine grit sanders and grinders. Edges of certain parts also need deburring.....a good file works here.

A few special tools will be needed: An air compressor, spray gun and regulator and a good respirator. These can be rented (or come with the painter). "Clecocos" make trial fitting and assembly go smoother, especially on assemblies such as windows, cowling and firewall. If this proves too expensive, pop rivets can be used and drilled out. We have included extra just for this reason.

When installing rod ends and similar hardware, be certain at least ten threads are engaged, unless directed otherwise within the text.

CLECOS: These are temporary fasteners that will be used to hold things together while fitting and drilling. The clecocos are color coded as to hole size. Silver #40 Copper #30 Gold #11

To use, simply set the cleco in the special pliers, squeeze closed, insert into the hole and release. (Reverse for removal). You will find the clecocos to be extremely useful throughout assembly.

RIVETS: Your kit is supplied with various sizes of aluminum and stainless steel pop rivets. Even though we are careful, there is always the chance of the packages being mis-labeled. So before riveting, be sure to double check that you have the correct aluminum or stainless steel pop rivet for the particular section you are working on.

A RANS aircraft is almost as much fun to build as it is to fly and with a little care and planning your ship could be a show stopper.....Send us a picture of your work in progress or your finished plane. As always, we're here to help so give us a call if you run into a problem.

AN3 - AN8 AIRFRAME BOLTS

AN3-AN8 CADMIUM-PLATED STEEL BOLTS (DRILLED AND UNDRILLED)

A non-corrosion-resistant steel machine bolt which conforms to Specification MIL-B-6812.
Cadmium-plated to Specification QQ-P-416.

Available with or without single hole through shank and/or single hole through head. Examples of part members for a cadmium plated steel bolt having a diameter of 1/4" and nominal length of 1".

AN4-6	For drilled shank
AN4-6A	Designates undrilled shank
AN4H-6	Drilled head, drilled shank
AN4H-6A	Drilled head, undrilled shank

NUT AND COTTER PIN SIZES

AN NUMBER	DIAMETER	PLAIN NUT AN NUMBER	CASTLE NUT AN NUMBER	COTTER PIN MS NUMBER
AN3	3/16	AN315-3R	AN310-3	MS24665-132
AN4	1/4	AN315-4R	AN310-4	MS24665-132
AN5	5/16	AN315-5R	AN310-5	MS24665-132
AN6	3/8	AN315-6R	AN310-6	MS24665-283
AN7	7/16	AN315-7R	AN310-7	MS24665-283
AN8	1/2	AN315-8R	AN310-8	MS24665-283

HOW TO DETERMINE GRIP For Steel and Aluminum Aircraft Bolts (Subtract Fractions Shown Below From Length of Bolt)

AN 3 to AN 8	AN NUMBER, Diameter, and Threads per Inch	AN3 10 -32	AN4 1/4 -28	AN5 5/16 -24	AN6 3/8 -24	AN7 7/16 -20	AN8 ½ -20
	Grip = Length Less	13/32	15/32*	17/32	41/64	21/32	25/32

*Formula does not apply for AN4-3. Grip for AN4-3 is 1/16.

DASH NUMBER -- NOMINAL LENGTH

-3 . . . 3/8	-6 . . . 3/4	-11 . . . 1 1/8	-14 . . . 1 1/2	-17 . . . 1 7/8	-22 . . . 2 1/4	-25 . . . 2 5/8
-4 . . . 1/2	-7 . . . 7/8	-12 . . . 1 1/4	-15 . . . 1 5/8	-20 . . . 2	-23 . . . 2 3/8	-26 . . . 2 3/4
-5 . . . 5/8	-10 . . . 1	-13 . . . 1 3/8	-16 . . . 1 3/4	-21 . . . 2 1/8	-24 . . . 2 1/2	-27 . . . 2 7/8
						-30 . . . 3

PART IDENTIFICATION

Use the above chart to determine lengths of bolts. Diameters are as follows:

AN3 = 3/16" AN4 = 1/4" AN5 = 5/16" AN6 = 3/8"

Use the parts manual for other part identification. The drawings depict a fairly accurate likeness of the real thing. Other parts are labeled by part number. Again, reference the parts manual to confirm part identity.

AN Bolt Gauge

<div>— 3</div> <div>— 4</div> <div>— 5</div> <div>— 6</div> <div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 3</div> <div>— 4</div> <div>— 5</div> <div>— 6</div> <div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 4</div> <div>— 5</div> <div>— 6</div> <div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 5</div> <div>— 6</div> <div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 6</div> <div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	<div>— 7</div> <div>— 10</div> <div>— 11</div> <div>— 12</div> <div>— 13</div> <div>— 14</div> <div>— 15</div> <div>— 16</div> <div>— 17</div> <div>— 20</div> <div>— 21</div> <div>— 22</div> <div>— 23</div> <div>— 24</div> <div>— 25</div> <div>— 26</div> <div>— 27</div> <div>— 30</div> <div>— 31</div> <div>— 32</div> <div>— 33</div> <div>— 34</div> <div>— 35</div> <div>— 36</div> <div>— 37</div> <div>— 40</div> <div>— 41</div> <div>— 42</div> <div>— 43</div> <div>— 44</div> <div>— 45</div> <div>— 46</div> <div>— 47</div> <div>— 50</div>	
AN3	AN4	AN5	AN6	AN7	AN8	AN9	AN10
3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8

KODIAK RESEARCH, INC.
P.O. BOX N7113
MARLBOROUGH HOUSE
CUMBERLAND ST.
NASSAU, N.P. BAHAMAS

CALCULATING WARRANTY

"When does the warranty start?"

1. The final owner should have a six (6) month period of operation to find any proven defective part in his engine or Rotax assembly.
2. There is, however, a one (1) year limit which starts on our invoice date to you. If we sold you an engine today, unless we hear from you, the warranty will end one year from today's date regardless of whether the engine was delivered to a customer of yours or not.

EXAMPLE A: We invoice an engine to you today and two (2) weeks later the engine is sold to your customer and put into service. Six (6) months from date of sale to customer the warranty period is finished. (The customer has owned the engine for six (6) months.)

EXAMPLE B: Engine is invoiced to you today but not put into service (not sold by you) for 3, 4, 5, or up to 6 months later. Your customer still has 6 months warranty as it still falls in the one period to you.

EXAMPLE C: Engine is invoiced to you today, but for some legitimate reason, either at your end or at your customer's end, the engine cannot be put into service until 7 months or up to a maximum of the 12 months after the invoice date to you. Then, before the 12 months from invoice date to you are up, you advise us that the engine still has not been used and ask us for a one time, 6 month extension together with a valid reason. We ask permission from Rotax for a 6 month extension of that particular engine. To this date, we have not been refused a **legitimate** request for extension. In this case, warranty period will elapse 18 months from our invoice date to you.

3. As you can see, it is important to properly rotate your engine stock. Never send out a newly arrived engine if you still have older engines in house.

RANS Aircraft

Tool List

This is a partial list of tools that would be helpful when assembling a RANS airplane.

Hand Tools

Pliers	Safety wire pliers
Needle nose pliers	Linesman pliers
Side cutters	Electrical wire strippers
Aviation snips	Pop rivet tool
Hammer	Click punch
Rubber mallet*	Ball peen hammer
Center punch	Scratch awl
Drift pin and punch set	Screwdriver set
Several small clamps	Safety glasses
Cleco Pliers	12 - #40 Clecos - Silver
24 - #30 Clecos - Copper	6 - #11 Clecos - Gold
Wrench set SAE and metric	Socket set SAE and metric
Ruler and tape measure	2 or 4 ft. Level
Adjustable fly cutter*	Utility knife
Set of drill bits	Hole saw*
Hack saw	Files

Power Tools

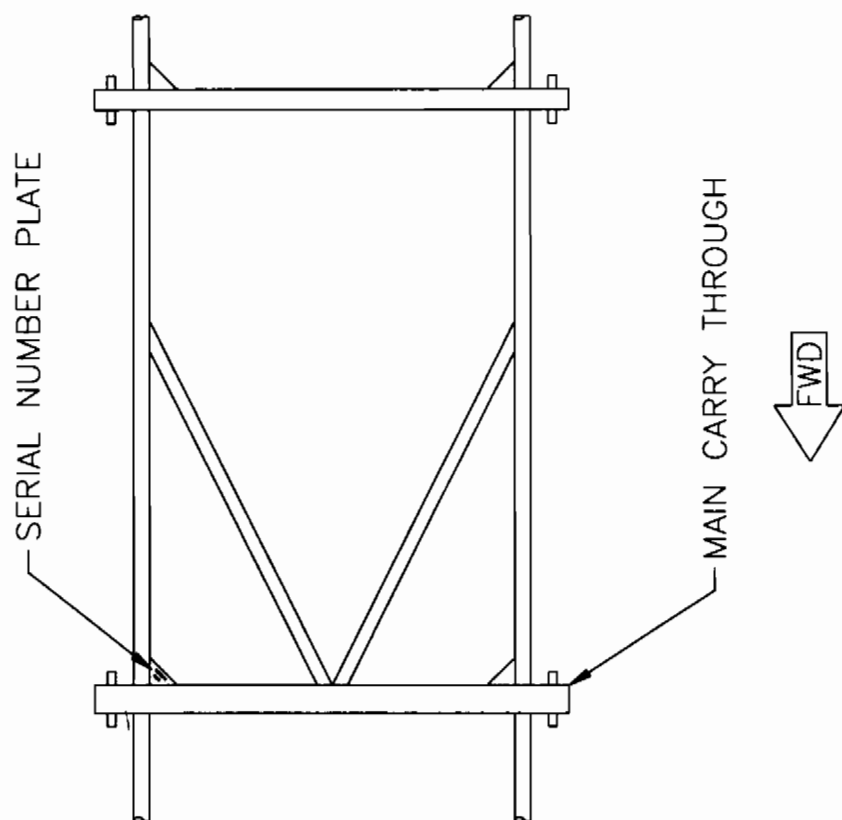
Electric hand drill	Small electric grinder*
Dremel*	Bench disk sander*
Soldering gun	Heat gun*
CD Player*	

Lubricants and Glues

Small can lithium grease	Clear silicone
Contact cement	WD 40
Super glue	

* Not a necessary tool but helpful.

CABIN TOP VIEW



RRRMS S-9 CHAOS
SERIAL PLATE LOCATION

MD153

WARRANTY INFORMATION

KODIAK RESEARCH, INC.
P.O. BOX N7113
MARLBOROUGH HOUSE
CUMBERLAND ST.
NASSAU, N.P. BAHAMAS

PH: (305) 776-9904
FAX: (305) 776-9908

Attn: O.E.M.'s

Date: October 31, 1991

Subject: Warranty Extension Requests

Dear Customer (RANS, Inc.),

- 1) In order for your customers (the builder) to receive their six month full warranty from time of first use, you must submit for extension on the enclosed form (please add your letterhead to this form). If no request is received warranty will begin from the date invoice was sent to your customer (the builder).
- 2) Extension will be required, for any warranty outside the original six month period. This must be submitted prior to any claim or failure and cannot be applied retro-actively.
- 3) Supply a copy of original customer request and reason for same as per guideline, submit with your verification on request form.
- 4) All request must be submitted by manufacturer only. Any request for extensions from retail customers direct will be forwarded to the O.E.M. to process in the above format.

If you have any problem understanding this policy please call for clarification.

FAA PROCEDURES

--Obtaining an "N" Number

--Registration

--Obtaining An Airworthiness Certificate

OBTAINING AN "N" NUMBER

In order to register your plane, it will be necessary to obtain an identification number for the plane. This is referred to as an "N" number.

If any number is acceptable to you, write to the FAA Aircraft Registry, Dept. of Transportation, P.O. Box 25504, Oklahoma City, OK 73125 and ask them to assign you a free U.S identification number of their choice.

If you prefer a number of your own choosing or a smaller number, you may be able to obtain the exact number you want by asking the FAA registry to assign you a specific number of your choice.

NOTE: U.S. identification numbers do not exceed 5 symbols in addition to the prefix "N". These symbols may be all numbers (N55555), one to four numbers and a suffix letter (N5555A or N5A), or one to three numbers and two suffix letters (N555AB).

If you request a special "N" number it would be best to list at least five choices in case your first choice is not available. A special number of your own choosing will cost \$10.00 and you should enclose that fee with your letter.

When To Obtain Your "N" Number

If you plan to complete your kit within a very short time, it is recommended that you obtain your "N" number right away. If your project will be fairly lengthy, you will not need to obtain your number until the last several months of construction. Keep in mind that if you request a special "N" number it can be reserved for no longer than one year. If this number has not been affixed to the fuselage within this time and the registration completed, it will be necessary to pay an additional \$10.00 to reserve that number for another year.

AFFIDAVIT OF OWNERSHIP FORM

Enclosed you will find an Affidavit of Ownership Form. This form should accompany your letter requesting the assignment of an "N" number.

This form must be notarized as it establishes your ownership to the airplane even though you know you did build it. It will be used by the FAA to create a file on your aircraft and will serve as a legal document and a substitute for the Bill of Sale (AC Form 8050-2) that a buyer gets when he buys any existing airplane.

REGISTERING YOUR AIRCRAFT

After you have written the Aircraft Registry requesting an "N" number, you will receive a form letter giving your number assignment. You will also receive a blank Aircraft Registration Form. (Sample Enclosed.) Complete the Application for Aircraft Registration (Form 8050-1) and return it to the Aircraft Registry along with the \$5.00 registration fee.

Retain the **PINK** copy of the Registration and mail both the **WHITE** original and the **GREEN** copy. Your **PINK** copy is your authority to operate the aircraft, when carried in the aircraft with an appropriate and current airworthiness certificate.

RECEIVING AUTHORITY TO FLY YOUR AIRCRAFT

Registration alone does not authorize you to fly your aircraft. The aircraft must, after it has been properly registered, also obtain an Airworthiness Inspection by an inspector of the FAA, at which time the necessary Airworthiness Certificate may be issued. Then, and only then, is your aircraft ready for flight.

WHAT IS THE PROCEDURE FOR OBTAINING AN AIRWORTHINESS CERTIFICATE

Since the final step in obtaining an Airworthiness Certificate is to obtain an inspection of your airplane by an official of the FAA, it is a good idea to make an early contact with the FAA inspector's office nearest your home. Members of the local EAA chapter or a local flying service may be able to help direct you to this office. The purpose of such an early contact would be to discuss with the FAA representative, your proposed home built project and to generally familiarize yourself with the procedures established by the FAA for home built projects. At this time you can establish a tentative plan for inspection of the aircraft upon completion. The typical FAA inspector is interested in your project and wants to help you do a good job.

The FAA requires that everyone building an airplane must maintain a construction log of the work he does on his airplane. You can use a notebook of conventional size and keep a daily diary of the work done on your aircraft. Since all our planes come with assembly manuals, it is a good idea to also make notes in the manual as well as listing dates when certain procedures were done. It is a very good idea to take photographs of work on your plane in various stages. This helps to document that you, the builder, actually completed 51% of this kit. (Advisory Circular 20-27C available from the FAA or EAA describes the procedure used so that your logbook will be a verification of having complete at least 51% of the aircraft yourself.)

WHAT ARE THE SPECIAL REQUIREMENTS AS FAR AS ATTACHING NUMBERS AND PLACARDS TO A HOME BUILT AIRCRAFT?

10-1 DISPLAY OF MARKS (Reference is FAR Part 45.23)

After you obtain the registration for your aircraft, the Registration numbers or marks must be affixed to the aircraft in some permanent fashion. The marks must be legible and have ornamentation. They must contrast in color with the background.

The marks displayed on the aircraft shall include the letter "N" signifying U.S. Registry, followed by the registration number issued for the aircraft.

In addition, amateur-built (Experimental) aircraft must have displayed on that aircraft near each entrance to the cabin or cockpit, in letters not less than 2" nor more than 6" in height, the word, "EXPERIMENTAL"

10-2 LOCATION OF MARKS ON FIXED WING AIRCRAFT (Reference is FAR Part 45.25)

(b)(1) If displayed on the vertical tail surfaces, horizontally on both surfaces, horizontally on both surfaces of a single vertical tail or on the outer surfaces of a multivertical tail. However, an aircraft on which marks at least 3" high may be displayed and in accordance with 45.29(b)(1), the marks may be displayed vertically on the vertical tail surfaces.

(2) If displayed on the fuselage surfaces, horizontally on both sides of the fuselage between the trailing edge of the wing and the leading edge of the horizontal stabilizer. However, if engine pods or other appurtenances are located in this area and are an integral part of the fuselage side surfaces, the operator may place the marks on those pods or appurtenances.

10-3 SIZE OF MARKS

FAR 45.29(b)(1)(iii) states "Marks at least 3" high may be displayed on an aircraft for which an experimental certificate has been issued under 21.191(d) or 21.191(g) for operating as an exhibition aircraft or as an amateur-built aircraft when the maximum cruising speed of the aircraft does not exceed 180 knots Calibrated Air Speed (CAS).

And © characters must be two-thirds as wide as they are high except "1" which must be one-sixth as wide as it is high and the letters "M" and "W" which may be as wide as they are high.

(d) Characters must be formed by solid lines one-sixth as thick as the character is high.

(e) Spacing. The space between each character may not be less than one-fourth of the character width.

10-5 IDENTIFICATION PLATE (Reference is FAR Part 45.11)

In addition to affixing the aircraft's registration number to the sides of the fuselage, the builder must also identify his aircraft by attaching an identification plate to the aircraft's structure.

This identification data required to be inscribed on the plate for amateur-built aircraft shall include the following information:

- a. Builder's name and address
- b. Model designation
- c. Builder's serial number
- d. Date of manufacture

The identification plate containing these essential elements must be of fireproof material and must be secured in such a manner that it will not likely be defaced or removed during normal service, or lost or destroyed in an accident. It must be secured to the aircraft at an accessible location near an entrance, except that if it is legible to a person on the ground it may be located externally on the fuselage near the tail surface.

The identification plate information must be marked thereon by etching, stamping, engraving, or other acceptable fireproof marking.

Metal plates which comply with these requirements may be purchased from the Experimental Aircraft Association for the very nominal fee of \$5.00 per each set.

AIRCRAFT INSTRUMENT MARKINGS & COCKPIT PLACARDS

Your reference is FAR Part 91.31 Civil Aircraft Operating Limitations and Marking Requirements.

8-1 GENERAL

To insure that each person operating an aircraft does so within the operating limitations prescribed for it, the FAA requires that there is available in it a current Flight Manual, appropriate instrument marking and placards, **or any combination thereof**.

The purpose of the flight manual, markings and placards is to detail for the operator of the aircraft, the operational limitations prescribed for the aircraft.

In lieu of a flight manual most amateur builders prefer to mark their instruments and to affix the necessary placards to the instrument panel as the primary means for complying with these requirements.

8-2 MARKINGS AND PLACARDS

The markings and placards necessary for the safe operation and handling of the aircraft should be displayed in a conspicuous place and may not be easily erased, disfigured or obscured. Such placards and markings should include but not necessarily be limited to the following criteria: special emphasis on fuel system markings are very important; such as fuel valves-on-off fuel octane quantity, unusable fuel, minimum fuel for take-off, minimum fuel for inverted flight, etc.

8-3 POWERPLANTS INSTRUMENT MARKINGS

Each required powerplants instrument should be marked to indicate the maximum and, if applicable, minimum safe operating limit with a red radial line.

Each normal operating range is to be marked with a green arc not extending beyond the maximum and minimum continuous safe operating limits.

Each engine speed range that is restricted because of excessive vibration should be marked with a red arc.

8-4 AIRSPEED INSTRUMENT MARKINGS

The airspeed indicator should be marked with a **radial red line** to establish the never-exceed speed (Vne).

The takeoff and any precautionary range should be marked with a **yellow arc**. The normal range is marked with a **green arc**. The flap actuation range is marked with a **white arc**.

8-5 AIRSPEED PLACARDS

There should be an airspeed placard in clear view of the pilot and as close as practicable to the airspeed indicator listing:

- The design maneuvering speed.

- The maximum landing gear operating speed (if applicable).

- The maximum flap extension operating speed (if applicable).

8-6 LANDING GEARS

If a retractable landing gear is used, an indicator should be marked so that the pilot can, at any time, ascertain that the wheels are secured in their extreme positions.

Each emergency control should be **red** and must be marked as to method of operation and identity.

8-7 CONTROL MARKINGS

Each fuel tank selector should be marked to indicate the position corresponding to each tank and to existing cross feed position.

If safe operation requires the use of any tanks in a specific sequence, that sequence must be identified.

8-8 POWERPLANT FUEL CONTROLS

Each fuel tank selector should be marked to indicate the position corresponding to each tank and to existing cross feed position.

If safe operation requires the use of any tanks in a specific sequence, that sequence must be identified.

8-9 FLIGHT MANEUVER PLACARD

For non-acrobatic category airplanes, there should be a placard in front of and in clear view of the pilot stating: "No acrobatic maneuvers, including spins, approved."

For acrobatic category airplanes, there should be a placard in clear view of the pilot listing the approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, the placard must have a notation to this effect.

8-10 BAGGAGE PLACARD

The maximum baggage load permitted should be displayed in a conspicuous place adjacent to the baggage area.

8-11 PASSENGER WARNING PLACARD

A placard must be affixed to the aircraft so that it is readily seen in the cockpit. It will state: "Passenger Warning-This aircraft is amateur built and does not comply with the Federal Safety Regulations for "Standard Aircraft". This placard is part of a set available from EAA. See Section 10-5.

MY AIRCRAFT IS COMPLETED, ALL MARKING AND PLACARDS ARE IN PLACE. WHAT ELSE MUST I DO TO MY AIRCRAFT BEFORE I AM READY FOR MY PRE-CERTIFICATION INSPECTION?

Included in your manual is a weight and balance sheet. This will need to be completed before the inspection.

You will need to purchase a logbook for the aircraft, engine and propeller. These can be separate books or just one.

Have handy a copy of your Sales Invoice from us.

I FEEL I AM READY FOR INSPECTION BY THE FAA INSPECTOR, WHAT DO I DO?

If you have had prior contact with your FAA inspector, you will probably be familiar with the procedures used by that office. Different offices have slightly different procedures. Some inspectors will help you fill out the paperwork at the time of inspection. Others require that you submit the paperwork prior to inspection. If you are not sure and there are no other builders in your area to ask, you could call and ask the local office. Or you can submit the following to the Inspector's Office.

1. A letter requesting a final inspection.
2. Form 8130-12 Eligibility Statement (sample follows).
3. Form 8130-6 Application for Airworthiness Certificate (sample follows).
4. A 3-view drawing of the aircraft or photos of topside and front view. Include with this the following:

Horsepower rating of engine and type of prop.

Empty weight and maximum weight at which the aircraft will be operated.

Number of seats and their arrangement (tandem, side by side).

Whether single or dual controlled.

Fuel capacity.

Maximum speed at which you expect to operate the aircraft.

5. Estimated time or number of flights required. (Usually 25 hours for aircraft equipped with certified aircraft engine and prop combinations and 40 hours for those with non-aircraft engine propeller combinations.)
6. The area over which you will be testing. (Request an area encompassing a 25 mile radius for day VFR operations. Exclude congested areas and airways, but try to include nearby airports even if a few miles beyond the 25 mile radius.

Upon satisfactory completion of the necessary final FAA inspection of the aircraft and whatever ground tests may be required, the FAA Inspector will issue your amateur-built "Experimental" Airworthiness Certificate. Along with the certificate you will be given certain "**OPERATING LIMITATIONS**" under which you must operate the aircraft.

OPERATING LIMITATIONS

13-1 MANDATORY TEST FLIGHT PROVING PHASE

All amateur-built sport aircraft as well as standard aircraft have federally imposed operating limitations.

Upon satisfactory completion of the necessary final FAA Inspection of the aircraft and whatever ground tests may be required, the FAA Inspector will issue your amateur-built "Experimental" Airworthiness Certificate.

He will also issue a form letter establishing the operating limitations applicable to your aircraft during its mandatory flight proving period. These Special Airworthiness Experimental Operating Limitations must be displayed in the aircraft at all times. (See sample Operating Limitations, Figure 13-1).

The operating limitations imposed on the aircraft during its flight proving period will be more stringent than those issued later after the mandatory flight testing phase has been completed.

This phase may begin with the issuance of the aircraft's initial airworthiness certificate and the original operating limitations. At this time the FAA Inspector will acquaint you with the requirement for a mandatory flight test and proving period. This flying will be confined to an assigned flight area approved by the FAA Inspector.

The presence of the FAA Inspector is not required, by regulation, at the initial flight of the experimental amateur-built aircraft. If time permits, however, it is not unusual for him to attend.

If he deems necessary, the inspector could issue a permit for a single flight within the boundaries of the airport and, upon witnessing the safe completion of the test, issue a further permit for more extended flights within the permissible area.

A tremendous responsibility for the safe operation of the experimental aircraft rests on the FAA Inspector. If the plane has any new and unusual features he will naturally tend to treat its first flights with care. Also pilot qualification and skill is a consideration.

13-2 PURPOSE OF THE FLIGHT TEST PERIOD

A flight test period is necessary to show to the FAA that the aircraft is controllable throughout its normal range of speeds and throughout all the maneuvers to be executed. It will also serve to prove that the aircraft has no hazardous operating characteristics or design features.

13-3 DURATION OF MANDATORY FLIGHT TEST PERIOD

For standard aircraft type engines: When an FAA approved aircraft engine/propeller combination is installed the flight test period is usually limited to 25 hours of flight time.

For non-aircraft type or automotive engines: An aircraft equipped with such an engine is required to be flown for a longer test period, usually at least 40 hours, to prove its reliability.

NOTE: It should be understood that the local FAA Inspector has the prime responsibility in determining the extent of the flight test period to be required for your aircraft. He is permitted to exercise considerable discretion in extending or in reducing the number of hours required to be flown during this period.

13-4 FLIGHT TEST AREA

The FAA Inspector will authorize the flight tests to be carried out in a designated and limited test area, usually, within a 25 mile radius of the aircraft's base of operations.

He will insure that the area selected is not over densely populated areas or in a congested airway.

In assigning the flight test area the FAA Inspector may modify the size and shape of the area to suit the best purposes of the flight test program. In some locations, particularly around bigger cities where air traffic is heavy, a flight test area may not be practical. The builder must be prepared to except that an approved flight test area may not be the one chosen to him as the most convenient.

13-5 OTHER LIMITATIONS DURING THE FLIGHT TEST PERIOD

As a rule, the carrying of passengers or other crew members will not be permitted unless necessary to the safe operation of that aircraft.

13-6 AIRCRAFT FLIGHT LOG

During the flight test period, the pilot should record the aircraft flight history in an appropriate log book. This should be in addition to any engine tachourmeter or engine hourmeter that may be installed in the aircraft.

Specifically, the duration of each individual flight should be recorded including the number of landings made.

A full description of any mishaps, however minor, or any experiences not entirely normal that occur during the flight experience period should also be duly recorded.

Although not required, it is strongly recommended that all operating data be recorded flight by flight. Such information as airspeeds, cylinder head temperatures, etc., will be very valuable and may be used to determine or establish the various performance figures and operating characteristics of the aircraft.

Although the FAA Inspector is required by law to apply certain basic restrictions permanently to the amateur-built aircraft he is certificating, he can apply whatever other limitations he deems necessary at his own discretion. Unfortunately, nothing in the regulations states that the initial restrictions are required to be removed after successful completion of the test period...they only may be modified.

After the mandatory flight test period...then what?

AFFIDAVIT OF OWNERSHIP FOR AMATEUR-BUILT AIRCRAFT

U.S. Identification Number: N12344

Builder's Name: John Q. Amateur

Model: RANS S-9 Serial Number: 1288054

Class (airplane, rotorcraft, glider, etc.): Airplane

Type of Engine Installed (reciprocating, turbopropeller, etc.): Reciprocating

Number of Engines Installed: 1

Manufacturer, Model, and Serial Number of each Engine Installed: Rotax 503 3572333

Built for Land or Water Operation: Land

Number of Seats: 1

The above-described aircraft was built from parts by the undersigned and I am the owner.

(Signature of Owner-Builder)

State of: Kansas

County of: Anywhere

Subscribed and sworn to me before this _____ day of _____, 19_____.

My commission expires _____.

(Signature of Notary Public)

THIS PAGE IS ONLY A SAMPLE

REPAIRMAN'S CERTIFICATION

The Repairman's Certificate is applied for using the application from 8610-2, available from the local FAA offices. You should ask for this when you apply for your final inspection on your aircraft. You should also be familiar with the Appendix D of FAR part 43. (Items included in the Annual Condition Inspection.)

The Repairman's Certificate is only available to those who have built 51 % or more of the specific aircraft they are having inspected.

Every twelve calendar months a condition inspection is performed in accordance with Appendix D of FAR part 43. The repairman has to include the aircraft total time in service, the name, the signature and the certificate type number of the repairman or A & P, who does the examination.

A & P mechanics must do the Annual Condition Inspection for those who are non-builders who own an amateur-built aircraft. On those aircraft where the builder has a Repairman's Certificate, it is recommended that from time to time the Annual Condition Inspection of those aircraft be done by an A & P simply as a check on the builder/repairman's work. One legal representative recommends that every other Annual Condition Inspection for a builder holding a repairman's certificate be done by an A & P mechanic.

UNITED STATES OF AMERICA DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION-MIKE MONROEY AERONAUTICAL CENTER AIRCRAFT REGISTRATION APPLICATION			CERT. ISSUE DATE
UNITED STATES REGISTRATION NUMBER N 1234Y			FOR FAA USE ONLY
AIRCRAFT MANUFACTURER & MODEL RANS S-9			
AIRCRAFT SERIAL No. 1288054			
TYPE OF REGISTRATION (Check one box)			
☒ 1. Individual ☐ 2. Partnership ☐ 3. Corporation ☐ 4. Co-owner ☐ 5. Gov't. ☐ 8. Non-Citizen Corporation			
NAME OF APPLICANT (Person(s) shown on evidence of ownership. If individual, give last name, first name, and middle initial.) John Q. Amateur			
TELEPHONE NUMBER: (913) 888-8888			
ADDRESS (Permanent mailing address for first applicant listed.) Number and street: #1 Build-it Road			
Rural Route:		P.O. Box:	
CITY Anytown	STATE KS	ZIP CODE 67601	
☐ CHECK HERE IF YOU ARE ONLY REPORTING A CHANGE OF ADDRESS ATTENTION! Read the following statement before signing this application. This portion MUST be completed. A false or dishonest answer to any question in this application may be grounds for punishment by fine and / or imprisonment (U.S. Code, Title 18, Sec. 1001).			
<u>CERTIFICATION</u>			
I/WE CERTIFY:			
(1) That the above aircraft is owned by the undersigned applicant, who is a citizen (including corporations) of the United States. (For voting trust, give name of trustee: _____), or:			
CHECK ONE AS APPROPRIATE:			
a. ☐ A resident alien, with alien registration (Form 1-151 or Form 1-551) No. _____			
b. ☐ A non-citizen corporation organized and doing business under the laws of (state) _____ and said aircraft is based and primarily used in the United States. Records or flight hours are available for inspection at _____			
(2) That the aircraft is not registered under the laws of any foreign country; and			
(3) That legal evidence of ownership is attached or has been filed with the Federal Aviation Administration.			
NOTE: If executed for co-ownership all applicants must sign. Use reverse side if necessary.			
TYPE OR PRINT NAME BELOW SIGNATURE			
EACH PART OF THIS APPLICATION MUST BE SIGNED IN INK.	SIGNATURE John Q. Amateur	TITLE Builder/Owner	DATE 3/16/88
	SIGNATURE <i>John Q. Amateur</i>	TITLE	DATE
	SIGNATURE	TITLE	DATE
NOTE: Pending receipt of the Certificate of Aircraft Registration, the aircraft may be operated for a period not in excess of 90 days, during which time the PINK copy of this application must be carried in the aircraft.			

AC Form 8050-1 (12/90) (0052-00-628-9007) Supersedes Previous Edition

AC FORM 8050-1 IS A 3-PART FORM

THIS PAGE IS ONLY A SAMPLE

US Department
of Transportation
Federal Aviation
AdministrationAPPLICATION FOR
AIRWORTHINESS
CERTIFICATEINSTRUCTIONS — Print or type. Do not write in shaded areas, these are for FAA
use only. Submit original only to an authorized FAA Representative. If additional
space is required, use an attachment. For special flight permits complete Sections
II and VI or VII as applicable

I. AIRCRAFT DESCRIPTION	1. REGISTRATION MARK N1234Y		2. AIRCRAFT BUILDER'S NAME (Make) John Q. Amateur		3. AIRCRAFT MODEL DESIGNATION RANS S09		4. YR. MFR 88		FAA CODING	
	5. AIRCRAFT SERIAL NO 1288054		6. ENGINE BUILDER'S NAME (Make) Rotax		7. ENGINE MODEL DESIGNATION 503					
	8. NUMBER OF ENGINES 1		9. PROPELLER BUILDER'S NAME (Make) Sterba		10. PROPELLER MODEL DESIGNATION Wood 64 X 44		11. AIRCRAFT IS (Check if applicable) ☐ EXPORT ☒ IMPORT			

APPLICATION IS HEREBY MADE FOR: (Check applicable items)												
A	1	STANDARD AIRWORTHINESS CERTIFICATE (Indicate category)				☐ NORMAL	☐ UTILITY	☐ ACROBATIC	☐ TRANSPORT	☐ GLIDER	☐ BALLOON	
B	X	SPECIAL AIRWORTHINESS CERTIFICATE (Check appropriate items)										
II. CERTIFICATION REQUESTED	2	☐ LIMITED										
	5	PROVISIONAL (Indicate class)	1	☐ CLASS I								
			2	☐ CLASS II								
	3	RESTRICTED (Indicate operation(s) to be conducted)	1	AGRICULTURE AND PEST CONTROL		2	AERIAL SURVEYING		3	AERIAL ADVERTISING		
			4	FOREST (Wildlife conservation)		5	PATROLLING		6	WEATHER CONTROL		
			7	CARRIAGE OF CARGO		0	OTHER (Specify)					
	4	X	EXPERIMENTAL (Indicate operation(s) to be conducted)	1	RESEARCH AND DEVELOPMENT		2	X AMATEUR BUILT		3	EXHIBITION	
				4	RACING		5	CREW TRAINING			MKT SURVEY	
	8	SPECIAL FLIGHT PERMIT (Indicate operation to be conducted, then complete Section VI or VII as applicable on reverse side)	0	TO SHOW COMPLIANCE WITH FAR								
			1	FERRY FLIGHT FOR REPAIRS, ALTERATIONS, MAINTENANCE OR STORAGE								
2			EVACUATE FROM AREA OF IMPENDING DANGER									
3			OPERATION IN EXCESS OF MAXIMUM CERTIFICATED TAKE-OFF WEIGHT									
4			DELIVERING OR EXPORT		5	PRODUCTION FLIGHT TESTING						
6			CUSTOMER DEMONSTRATION FLIGHTS									
C	6	☐ MULTIPLE AIRWORTHINESS CERTIFICATE (Check ABOVE Restricted Operation and Standard or Limited, as applicable)										

III. OWNER'S CERTIFICATION	A. REGISTERED OWNER (As shown on certificate of aircraft registration)				IF DEALER, CHECK HERE ☐				
	NAME John Q. Amateur				ADDRESS #1 Build-it Road Anytown, KS 67601				
	B. AIRCRAFT CERTIFICATION BASIS (Check applicable blocks and complete items as indicated)								
	AIRCRAFT SPECIFICATION OR TYPE CERTIFICATE DATA SHEET (Give No and Revision No.)				AIRWORTHINESS DIRECTIVES (Check if all applicable AD's complied with and give latest AD No.)				
	AIRCRAFT LISTING (Give page number(s))				SUPPLEMENTAL TYPE CERTIFICATE (List number of each STC incorporated)				
C. AIRCRAFT OPERATION AND MAINTENANCE RECORDS									
CHECK IF RECORDS IN COMPLIANCE WITH FAR 91.173 ☐				TOTAL AIRFRAME HOURS		3		EXPERIMENTAL ONLY (Enter hours flown since last certificate issued or renewed) 0	
D. CERTIFICATION — I hereby certify that I am the registered owner (or his agent) of the aircraft described above, that the aircraft is registered with the Federal Aviation Administration in accordance with Section 501 of the Federal Aviation Act of 1958, and applicable Federal Aviation Regulations, and that the aircraft has been inspected and is airworthy and eligible for the airworthiness certificate requested									
DATE OF APPLICATION 3/16/88		NAME AND TITLE (Print or type) John Q. Amateur				SIGNATURE <i>John Q. Amateur</i>			

IV. INSPECTION AGENCY VERIFICATION	A. THE AIRCRAFT DESCRIBED ABOVE HAS BEEN INSPECTED AND FOUND AIRWORTHY BY (Complete this section only if FAR 21.183(d) applies)								
	2	FAR PART 121 OR 127 CERTIFICATE HOLDER (Give Certificate No.)		3	CERTIFICATED MECHANIC (Give Certificate No.)		6	CERTIFICATED REPAIR STATION (Give Certificate No.)	
	5	AIRCRAFT MANUFACTURER (Give name of firm)							
	DATE		TITLE				SIGNATURE		

V. FAA REPRESENTATIVE CERTIFICATION	(Check ALL applicable blocks in items A and B)				THE CERTIFICATE REQUESTED			
	A. I find that the aircraft described in Section I or VII meets requirements for				4 AMENDMENT OR MODIFICATION OF CURRENT AIRWORTHINESS CERTIFICATE			
	B. Inspection for a special flight permit under Section VII was conducted by				FAA INSPECTOR		FAA DESIGNEE	
					CERTIFICATE HOLDER UNDER		FAR 65 FAR 121, 127 or 135 FAR 145	
DATE		DISTRICT OFFICE		DESIGNEE'S SIGNATURE AND NO		FAA INSPECTOR'S SIGNATURE		

THIS PAGE IS ONLY A SAMPLE



U.S. Department
of Transportation
**Federal Aviation
Administration**

ELIGIBILITY STATEMENT AMATEUR-BUILT AIRCRAFT

Instructions: Print or type all information except signature. Submit original to an authorized FAA representative. Applicant completes Section I thru III. Notary Public Completes Section IV.

I. REGISTERED OWNER INFORMATION

Name(s) John Q. Amateur

Address(es) #1 Build-it Road Anytown KS 67601
No. & Street City State Zip

Telephone No.(s) (913 888-8888 ()
Residence Business

II. AIRCRAFT INFORMATION

Model RANS S-9 Engine(s) Make Rotax 503

Assigned Serial No. 1288054 Engine(s) Serial No.(s) 3572333

Registration No. N1234Y Prop./Rotor(s) Make Sterba

Aircraft Fabricated: Plan ☐ Kit ☒ Prop./Rotor(s) Serial No.(s) _____

III. MAJOR PORTION ELIGIBILITY STATEMENT OF APPLICANT

I certify the aircraft identified in Section II above was fabricated and assembled by John Q. Amateur

Name of Person(s) (Please Print)

for my (their) education or recreation. I (we) have records to support this statement and will make them available to the FAA upon request.

— NOTICE —

Whoever in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or who makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than 5 years, or both (U.S. Code, Title 18, Sec. 1001.)

APPLICANT'S DECLARATION

I hereby certify that all statements and answers provided by me in this statement form are complete and true to the best of my knowledge, and I agree that they are to be considered part of the basis for issuance of any FAA certificate to me. I have also read and understand the Privacy Act statement that accompanies this form.

Signature of Applicant (In Ink)

John Q. Amateur

Date
3/16/88

IV. NOTARIZATION STATEMENT

THIS MUST BE NOTARIZED!

THIS PAGE IS ONLY A SAMPLE

FINAL INSPECTION

Listed below are two checklists. One is a sample checklist for condition inspection from the FAA and the other is an EAA safety checklist. These should be very helpful in getting your airplane signed off by the FAA inspector and ensuring that your airplane is safe for operation.

APPENDIX 1. SAMPLE CHECKLIST FOR A CONDITION INSPECTION

AC 90-89

AIRCRAFT IDENTIFICATION:

TYPE/SN. _____

ENGINE MODEL/SN. _____

N NUMBER _____

PROPELLER MODEL/SN _____

A/F TOTAL TIME _____

ENGINE TOTAL TIME _____

OWNER _____

PROPELLER TOTAL TIME _____

GENERAL:	INSPECTOR		BUILDER	
	Sat	Unsat	Sat	Unsat
REGISTRATION/AIRWORTHINESS/OPERATING LIMITATIONS				
AIRCRAFT IDENTIFICATION PLATES INSTALLED				
EXPERIMENTAL PLACARD INSTALLED				
WEIGHT AND BALANCE/EQUIPMENT LIST				
WINGS:				
REMOVE INSPECTION PLATES/FAIRINGS				
GENERAL INSPECTION OF THE EXTERIOR/INTERIOR WING				
FLIGHT CONTROLS BALANCE WEIGHTS FOR SECURITY				
FLIGHT CONTROLS PROPER ATTACHMENT (NO SLOP)				
FLIGHT CONTROL HINGES/ROD END BEARINGS SERVICEABILITY				
FLIGHT CONTROLS PROPERLY RIGGED/PROPER TENSION				
INSPECT ALL CONTROL STOPS FOR SECURITY				
TRIM CONTROL PROPERLY RIGGED				
TRIM CONTROL SURFACES/HINGES/ROD END BEARINGS SERV.				
FRAYED CABLES OR CRACKED/FROZEN PULLEYS				
SKIN PANELS DELAMINATE/VOIDS (COIN TEST)				
POPPED RIVETS/CRACKED/DEFORMED SKIN				
FABRIC/RIB STITCHING/TAPE CONDITION				

Spend some time with your plane and this check list before those first flights. Thirty minutes with a pencil here may be worth the rest of your life.

		Yes	No			Yes	No			Yes	No
PROPELLER				ENGINE & ENGINE COMPARTMENT				FUSELAGE-HULL			
1. Blades				All stacks in good condition-no cracks or rusted-out areas?				All pulleys of proper diameter for bends, proper size for cable, and guarded?			
Laminations not separated?											
Breaks, scratches, nicks tipping?				Carb heat and cabin heat muffs removed and manifold inspected?				All cable of proper size (1/8" min) and condition?			
Loose rivets in tipping?											
Drain holes in tip clear?				5. Controls				Any parts in system subject to rotation for any reason properly secured and safetied?			
				All secured and safetied?							
2. Hub				No excessive play in any linkages?							
Any cracks or corrosion?											
Hub properly seated and safetied?				No interference between any control and the structure throughout the full operating range?				Return springs on rudder pedals?			
3. Control Mechanism				Carb heater gate open & close fully?				No interference between any control part (cable, tube or linkage) and any other part of the structure throughout full control movement?			
Oil leaks?				6. Mount				Adequate room for full control throw when aircraft is occupied?			
Worn bearings?				Secured and safetied?				Controls arranged to minimize danger of blocking by foreign objects?			
Secure?				All joints inspected for cracks?				Grip properly secured to control stick or wheel?			
				Any bends in mount tubes?							
4. Attachment				Bushings in good condition?							
All bolt & nut threads undamaged?				7. Cowlings				4. Electrical System			
All bolts & nuts secured & safetied?				Secured and/or safetied?				All grommets, particularly in firewall, snug fitting and in good condition?			
				All latches or fastenings working properly?				All wires of proper gauge, insulated, and secured?			
5. Spinner				Any cracks properly checked or reinforced?				Wires do not rest on abrasive surfaces?			
Cracks?				Cowlings clean?				Battery installation of sufficient strength?			
Properly secured?				8. Power Plant in General				Battery properly ventilated and drained?			
Is spinner chafing into prop?				All necessary safeties, painuts, locknuts, etc. in place?				No corrosion at or around battery or its vents?			
				No fuel or oil leaks?				Fuses of adequate amperage?			
ENGINE & ENGINE COMPARTMENT				FUSELAGE-HULL				5. Fuel System-Tanks			
1. Fuel System				1. Structure				Drains properly located to discharge clear of aircraft?			
All lines of approved type?				All welds sound?				All outlets properly screened?			
All strainers clean?				All tubing straight and uncracked?				Breather inlets clear?			
All lines secured against vibration?				No rust or corrosion?				Fuel shut-off valve installed?			
Gascolator bowl at low point in system when aircraft is in normal ground position?				All attach fittings sound, no cracks, elongation of holes or worn threads?				Fuel shut-off valve easily reached by pilot?			
Fuel drains operative?				All rivets properly installed?				All fuel lines of proper approved type?			
All connections properly tightened?				Inspection openings for all vital areas?				All fuel lines secured against vibration?			
				Fuselage properly drained, that is, no built-in moisture traps?				Is tank located so that sufficient head is available in maximum climb with minimum fuel? Placard if necessary?			
2. Oil System				Firewall of proper fireproof material?				Has tank sufficient expansion area?			
All lines of approved type?				2. Cover				Any tank overflow discharge clear of hazardous areas on aircraft?			
All lines secured against vibration?				Properly attached?				Is tank support sufficient to meet strength requirements?			
Oil tank has no cracks or leaks?				No tears, distortions, or abrasions?				Does tank clear surrounding structure?			
Tank properly secured & safetied?				Any breaks or ruptures properly repaired?				Do tank supports minimize strain and chafing?			
All plugs & strainers cleaned & safetied?				3. Control System							
				Properly secured and safetied?							
3. Ignition-Electrical System				Controls stops provided & adjusted?							
All wiring proper type and gauge?				All fittings of proper thread & size?							
All fastenings secured & safetied?											
Magnetos properly grounded?											
Spark plugs cleaned & undamaged?											
Spark plugs properly torqued?											
Engine grounded to airframe?											
Starter/generator secured?											
4. Exhaust Manifold											
Secured and safetied?											
All gaskets in good condition?											

To insure its safe construction and operation, and to further emphasize the vital necessity for thorough consideration of every item which goes into your airplane, the following working check-list should be used, and it is suggested that it be made a part of the aircraft records.

	Yes	No		Yes	No		Yes	No
EXITS			6. Heating-Ventilation			Fuel overflow drains clear of aircraft - no tendency for overflow to soak into aircraft structure?		
1. Can aircraft be cleared rapidly in case of emergency?			Is cabin or cockpit in negative pressure area and liable to suck in exhaust fumes?					
Are special precautions available during test period, such as jettisonable doors or canopy?			Is any provision made for ventilating cabin other than normal leakage?			LANDING GEAR		
If parachute is to worn, does it clear all controls?						Properly lubricated?		
Baggage Compartment			7. Windshield-Windows			Proper oleo inflation?		
1. Are walls and floors of sufficient strength to withstand flight loads?			Are windshield and windows of recognized aeronautical materials?			Shock cords or springs in good condition?		
Can anything escape from baggage compartment by accident?			Is windshield braced against positive or negative pressures in flight, either by design or extra bracing?			All attach fittings uncracked and sound?		
Cabin-Cockpit			WING-TAIL SURFACES			All bolt holes not elongated?		
1. Instruments			Fixed Surfaces			All attach bolts secured and safetied?		
Are all instruments functioning and accurate?			Are all interior fastenings secured and/or safetied?			Brake lines in good condition?		
Are all instruments marked, max pressures, temperatures, speeds?			Is interior properly weatherproofed?			Brakes operating properly?		
Are all vital instruments easily visible to pilot?			Have any mice been inside lately?			Correct hydraulic fluid in lines?		
2. Flight-Engine Controls			Movable Surfaces			Wheels uncracked?		
Are all engine controls marked or easily identifiable?			Are stops provided, either at wing or somewhere else in the control system?			Tires unworn & properly inflated?		
Are all engine controls smooth in operation, without excessive resistance, and easily available to pilot?			Are all hinges and brackets sound?			Excessive side play in wheel bearings?		
Are all flight controls arranged so that jamming by dropped gloves, etc. is impossible?			Are all hinge pins secured and safetied?					
3. Fuel Systems			Is there any excessive play in hinges?			GENERAL		
Are all gas valves easily reached by pilot?			Is there any excessive play in control cables or tubes?			ALL BOLTS WHEREVER POSSIBLE, HEAD UP AND FORWARD.		
Are all gas valves marked ON, OFF, LEFT, RIGHT?			External Bracing			All exterior fastenings visible from cockpit or cabin should have safetied end toward pilot, wherever possible.		
Are all gas valves in such a position that accidental operation is impossible or guarded in such a way that accidental operation is impossible?			Is the interior of all struts weather protected?			A complete walkaround inspection of the aircraft should be accomplished to check that every bolt visible on the exterior is secured and safetied. That there is no visible structural damage. That all inspection panels and covers are in place and attached. That all parts of the aircraft are in proper alignment.		
4. Seats			Are all adjustable fittings locked, secured, and safetied?			DON'T FORGET TO PUT IN ENOUGH GAS PRIOR TO THAT FIRST FLIGHT - GROUND RUNNING AND TAXI TESTS CAN USE UP A LOT MORE THAN YOU THINK!		
Are seats of sufficient strength for maximum flight loads contemplated?			Are struts undamaged by bends or dents?			OK - Kick the tires, add another coat of paint and AWAY WE GO!		
Does seat "flex" enough at any time to interfere with flight controls?			Are all wires serviceable with proper end fittings?					
5. Safety Belts and Shoulder Harness			Attach Fittings					
Is installation and attachments of sufficient strength to meet 9G forward load minimum?			Are bolts of proper size installed?					
Does attachment connect directly to primary structure?			Are all bolts secured and safetied?					
Are belts and harness in top condition?			Have all bolts been examined for wear?					
Is belt of correct size, that is, no long over-tongue?			Flight Control Mechanism					
Is a separate belt and shoulder harness supplied for each occupant?			All cables and tubes unbroken or unbent & with proper end fittings?					
			All control attachments secured and safetied?					
			All pulleys free from interference and guarded?					
			All torque tubes and bell cranks in good condition?					
			No interference with fuselage or wing structure throughout full control travel?					
			Fuel Tanks					
			(See Fuselage Section Also)					
			Are drains supplied at low point in tank when aircraft is in normal ground position?					

CHECK MAGNETO TIMING/POINTS/OIL SEAL/DISTRIBUTOR				
INSPECT ENGINE MOUNT/BUSHINGS				
CHECK LANDING LIGHT OPERATION				
CHECK POSITION LIGHTS OPERATION				
CHECK ANTI-COLLISION LIGHT FOR OPERATION				
INSPECT ALL ANTENNA MOUNTS AND WIRING FOR SECURITY				
CHECK ALL GROUNDING WIRES (ENGINE TO AIRFRAME, WING TO AILERON/FLAP, ETC)				
INSPECT RADIOS/LEADS/WIRES FOR ATTACHMENT & SECURITY				
INSPECT CIRCUIT BREAKERS/FUSES PANELS FOR CONDITION				
OPERATIONAL INSPECTION:				
VISUAL INSPECTION OF THE ENGINE/PROPELLER				
ALL INSPECTION PANELS AND FAIRINGS SECURE				
PERSONNEL WITH FIRE BOTTLE STANDING BY				
BRAKE SYSTEM CHECK				
PROPER FUEL IN TANKS				
ENGINE START PROCEDURES				
OIL PRESSURE/OIL TEMPERATURE WITHIN LIMITS				
VACUUM GAUGE CHECK				
MAGNETO CHECK/HOT MAG CHECK				
IDLE RPM/MIXTURE CHECK				
STATIC RPM CHECK				
ELECTRICAL SYSTEM CHECK				
COOL DOWN PERIOD/ENGINE SHUT DOWN				
PERFORM OIL, HYDRAULIC, AND FUEL LEAK CHECK				
PAPERWORK:				
AIRWORTHINESS DIRECTIVES				
RECORD FINDINGS AND SIGN OFF INSPECTION AND MAINTENANCE IN LOGBOOKS				

LUBRICATION				
WING ATTACH POINTS				
FLYING/LANDING WIRES/STRUTS FOR SECURITY				
CORROSION				
FLIGHT CONTROL PLACARDS				
INSPECT FIREWALL FOR DISTORTION AND CRACKS				
INSPECT RUDDER PEDALS AND BRAKES FOR OPERATION AND SECURITY				
INSPECT BEHIND FIREWALL FOR LOOSE WIRES AND CHAFFING LINES				
CHECK CONTROL STICK/YOKE FOR FREEDOM OF MOVEMENT				
CHECK FLAP CONTROL OPERATION				
CHECK CABLE AND PULLEYS FOR ATTACHMENT AND OPERATION				
PERFORM FLOODLIGHT CARBON MONOXIDE TEST				
ENSURE THE COCKPIT INSTRUMENTS ARE PROPERLY MARKED				
INSPECT INSTRUMENTS, LINES, FOR SECURITY CHECK/CLEAN/REPLACE INSTRUMENT FILTER				
INSPECT COCKPIT FRESH AIR VENTS/HEATER VENTS FOR OPERATION AND SECURITY				
INSPECT SEATS, SEATBELTS/SHOULDER HARNESS FOR SECURITY AND ATTACHMENT				
CORROSION				
EMPENNAGE/CANARD:				
REMOVE INSPECTION PLATES AND FAIRINGS				
INSPECT CANARD ATTACH POINTS FOR SECURITY				
INSPECT VERTICAL FIN ATTACH POINTS				
INSPECT ELEVATOR/STABILIZER ATTACH POINTS				
INSPECT HINGES/TRIM TABS/ROD ENDS FOR ATTACHMENT AND FREE PLAY(SLOP)				
INSPECT EMPENNAGE/CANARD SKIN FOR DAMAGE/CORROSION				
INSPECT ALL CONTROL CABLES, HINGES AND PULLEYS				
INSPECT ALL CONTROL STOPS				
ENGINE:				
PERFORM COMPRESSION TEST #1 _____ #2 _____ #3 _____ #4 _____ #5 _____ #6 _____				
CHANGE OIL AND FILTER (CHECK FOR METAL)				
INSPECT IGNITION HARNESS FOR CONDITION AND CONTINUITY				
CHECK IGNITION LEAD CIGARETTES FOR CONDITION/CRACKS				
CLEAN AND GAP SPARK PLUGS				

ORIENTATION

We highly recommend that you completely read through these instructions before beginning assembly of your **RANS KITPLANE**. It will help you immensely to understand the code we have used to label parts. As you can see from your packing list, each part is assigned a number. Some parts supplied by other manufactures are given the manufacturer's part name such as all the AN-Hardware and other fittings. For parts of our own manufacture, we have used word abbreviation and condensing.....Example: W-DB-1 is Wing - Drag Brace One. Some of the abbreviations used are: TG-Tail Group; W-Wing or Windshield; LG-Landing Gear; CS-Control Stick; FC-Fuselage Cover; ST-Seat, etc.

Station One (S-1) is the first structural member starting at the nose of the plane (see drawing below). As you progress towards the tail, you pass all the stations.

When a left side part is called it refers to the plane's left and your left if you were sitting in the cockpit looking forward. Fwd means toward the front; Aft means toward the tail.

Again, it is highly recommended that you study the entire instruction manual before beginning assembly. If there is any procedure that you do not fully understand, please give us a call.

FUEL CAP ASSEMBLY

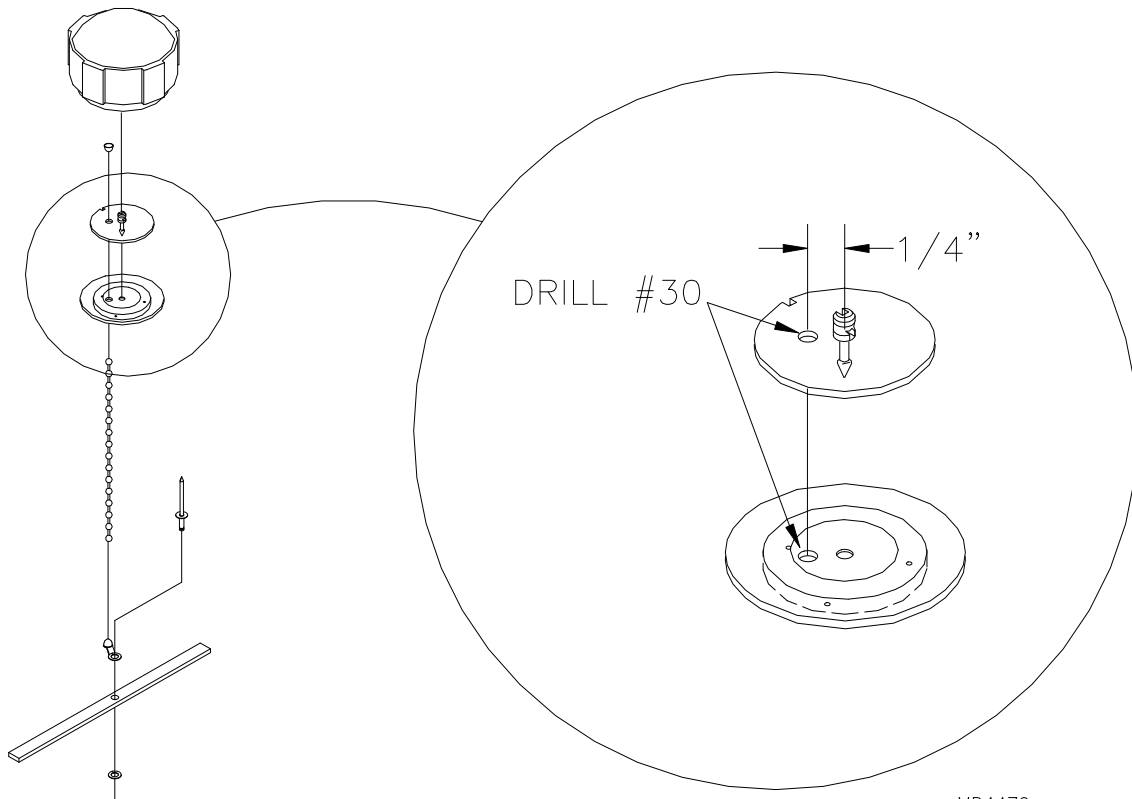
1. Remove the Rubber Gasket and Plastic Baffle from the Fuel Cap. The Plastic Baffle will “snap” out of the Fuel Cap. A screwdriver works well for the removal.

Locate and drill a #30 hole, 1/4” from the center of the plastic baffle. Refer to **FIGURE 01-01**. Drill through the Plastic Baffle and Rubber Gasket. Deburr. Detach the Rubber Gasket from the Baffle. Note the orientation of the Rubber Gasket.

Assemble the Bead Chain to the Bead Chain Retainer Sleeve. Install the Bead Chain and Retainer Sleeve through the topside of the Baffle and pull tight. Push the Chain through the drilled hole in the Rubber Gasket. Re-install the Rubber Gasket to the Baffle. Be sure the Chain is pulled tight. “Snap” the Rubber Gasket and Baffle back into the Fuel Cap.

Install the Bead Chain End Coupling onto the Bead Chain. Find the center of the Plastic Retainer and drill a #30 hole. Using the 1/8” Small Brass Washer, rivet the Plastic Retainer to the Bead Chain End Coupling.

FIGURE 01-01



MD4479

FUEL TANK FITTING INSTALLATION

2. Locate and drill the $\frac{1}{2}$ " diameter holes for the fuel fittings at the locations shown in **Figure 01-02**. **IMPORTANT NOTE:** On the **optional right hand tank**, drill only one hole next to the filler neck for venting. See **Figure 01-02A**. Locate and drill the tank sump valve hole as shown in **Figure 01-02B**. Debur all holes. Place a wire in the fitting hole and up through the filler neck and attach a withdrawal fitting and o-ring to the wire. Make a loop in the end of the wire to keep the parts from falling off, then pull the fitting through the hole with the threaded portion out of the tank. Remove the wire. Hold the fitting with the threaded portion extended out of the tank and slide on the two washers. Apply loctite to the nut and install. **NOTE:** Use a $\frac{1}{4}$ " allen wrench to hold the tank withdrawal fitting while tightening the nut. Apply thread sealant or loctite to the straight or 90 degree fuel line fittings and screw into the tank withdrawal fitting until snug. **CAUTION:** Do not tighten to the point the tank withdrawal fitting turns into the tank. After tightening, drill up through the withdrawal fitting on the **sump valve hole only** with a $\frac{5}{16}$ " bit to allow the sump valve to be inserted. Remove **ALL** shavings and loose debris from the interior of the tank. Use a vacuum to assist in the removal.

Install the sump valve **after** covering, use loctite to seam. Use the fuel sampler cup provided to drain any accumulated water in the tank(s) prior to flight.

FIGURE 01-02

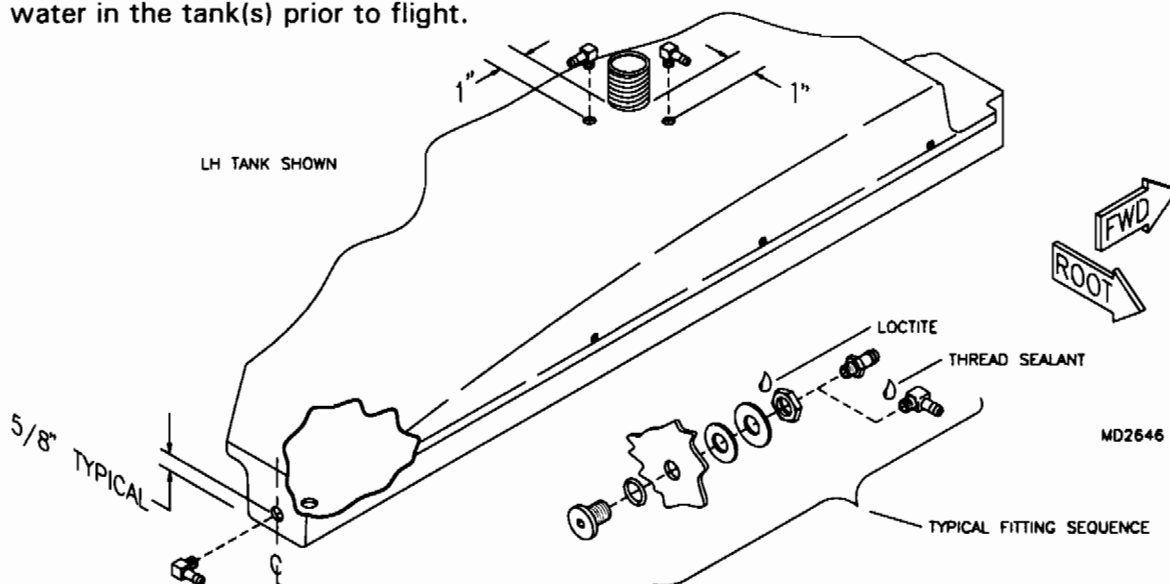


FIGURE 01-02A

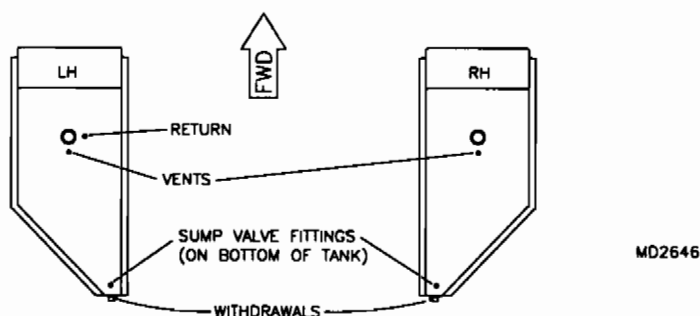
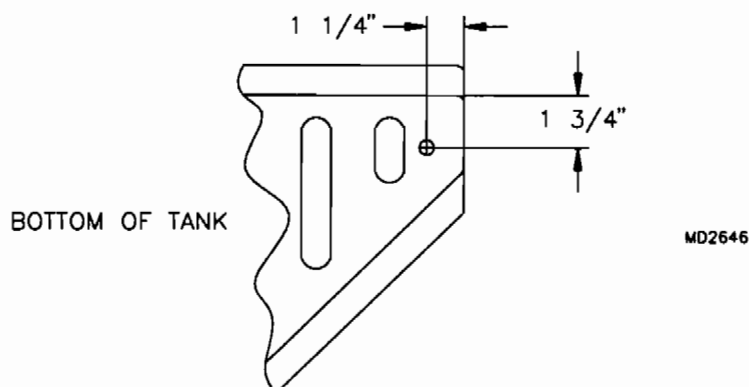


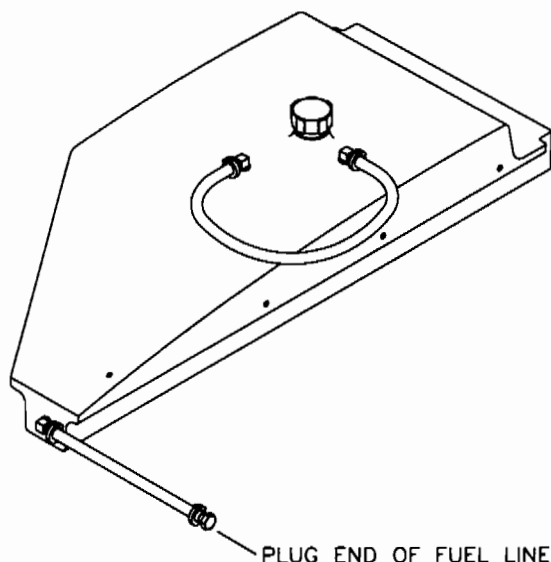
FIGURE 01-02B



LEAK TESTING

3. This method has the advantage of rinsing out the inside of the tank. Install short segments of fuel line to the tank as shown in **Figure 01-03**. Fill the tank with water and inspect for leaks. Drain and let dry.

FIGURE 01-03

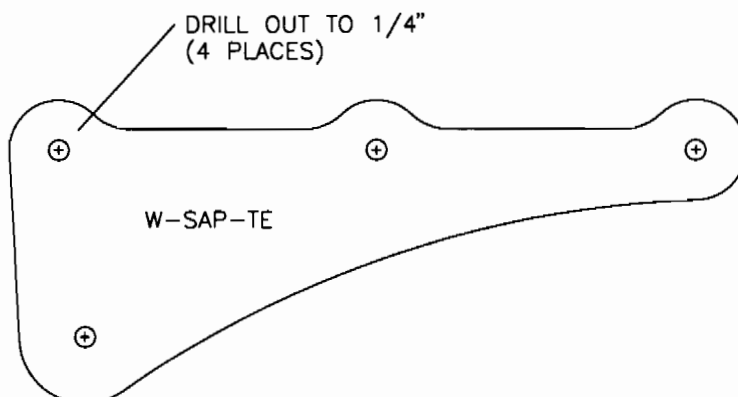


S-9 CHAOS WING ASSEMBLY

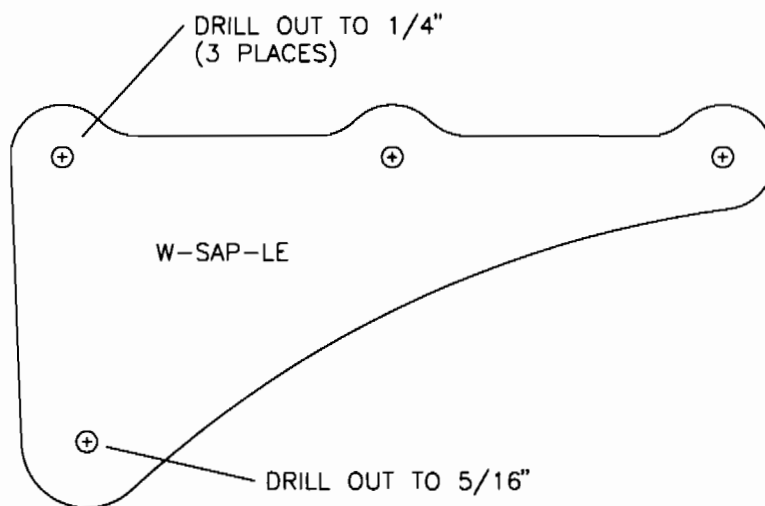
Before starting you will need two working height saw horses to support the wing assembly. Saw horses of about 36" seem to work the best.

4. Insert the root doublers flush with the spar root ends. Position the leading edge spar root doublers with the gap 90 degrees to the pre-drilled holes.
5. Drill through only the root doublers of each spar with a 3/16" drill bit. The 3/16" hole located 2 7/8" out from the root end is for bolting the S2-SAB on the **INSIDE** and riveting the doubler on the **OUTSIDE**. See parts book for details.
6. Drill out the three holes approximately midway on each spar with a 3/16" bit.
7. Manually debur all the holes using a 1/2" drill bit or a deburring tool.
8. Smooth the edges of the strut attach plates with sand paper or a file. Drill out the plates as per **Figure 01-08**.

FIGURE 01-08

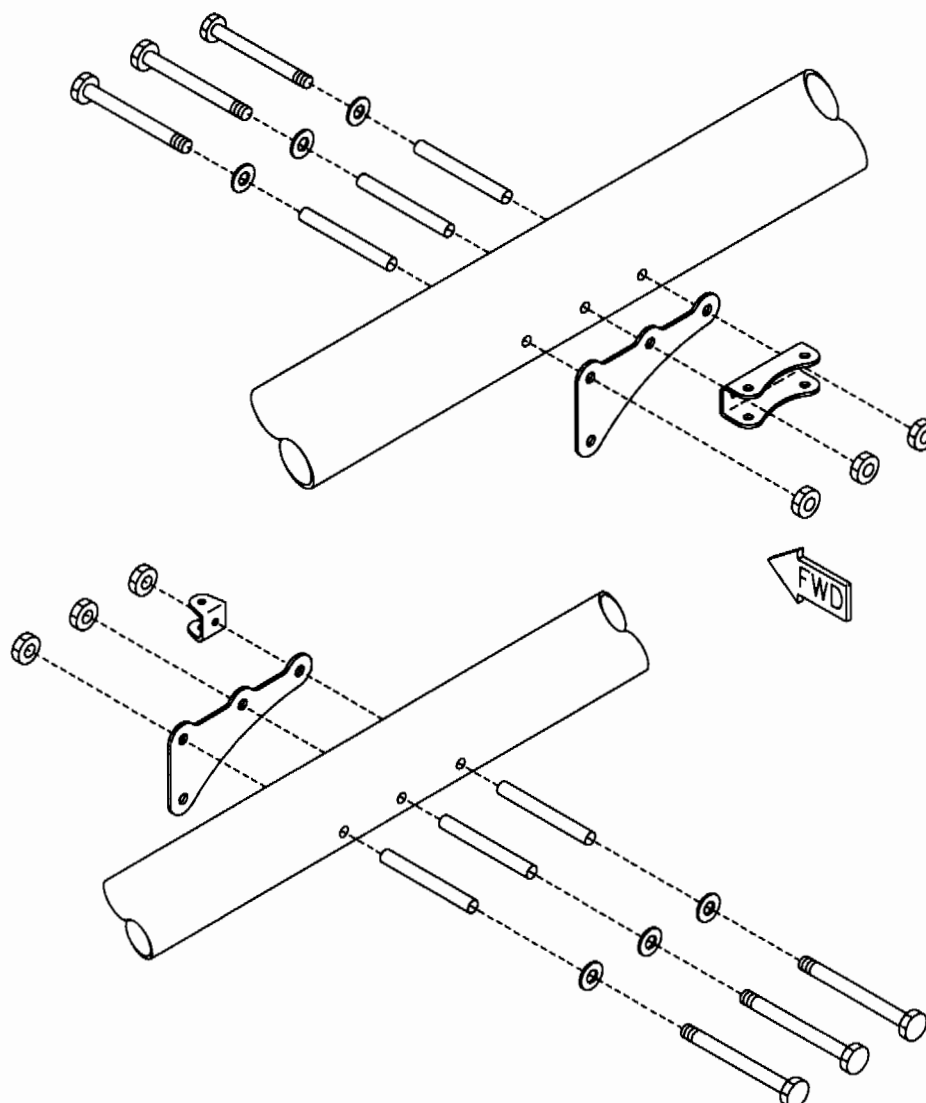


IMPORTANT: DO NOT DRILL W-SAP-TE. LEAVE 1/4" DIAMETER TO MATCH STRUT FITTINGS.



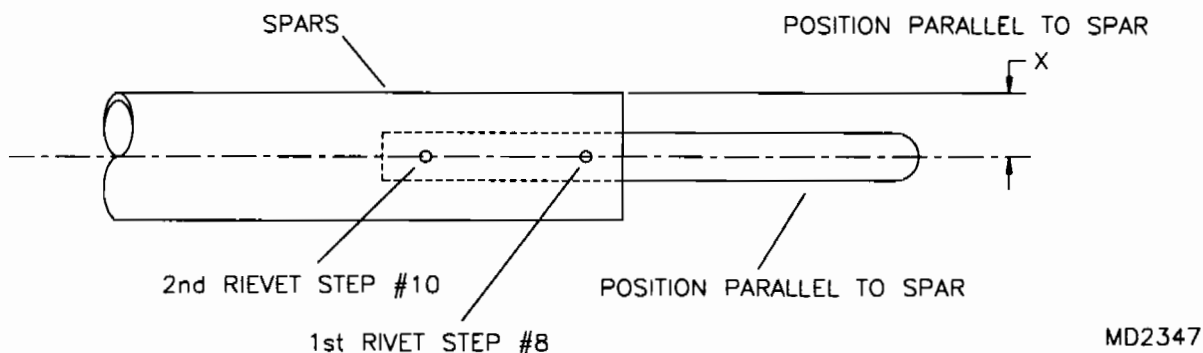
7. Assemble the finished components to each spar as shown in the parts book. **NOTE:** Parts ^{MD1382} must be bolted to the inside of each spar. The holes drilled near the tip are used for riveting on the tip bow indicate the outside edge of the spar. Double check that the spars are correctly orientated. Refer to **Figure 01-07** for assembly details. When installing the wing bushings it will be necessary to drill out the spars to 3/8" diameter.

FIGURE 01-07



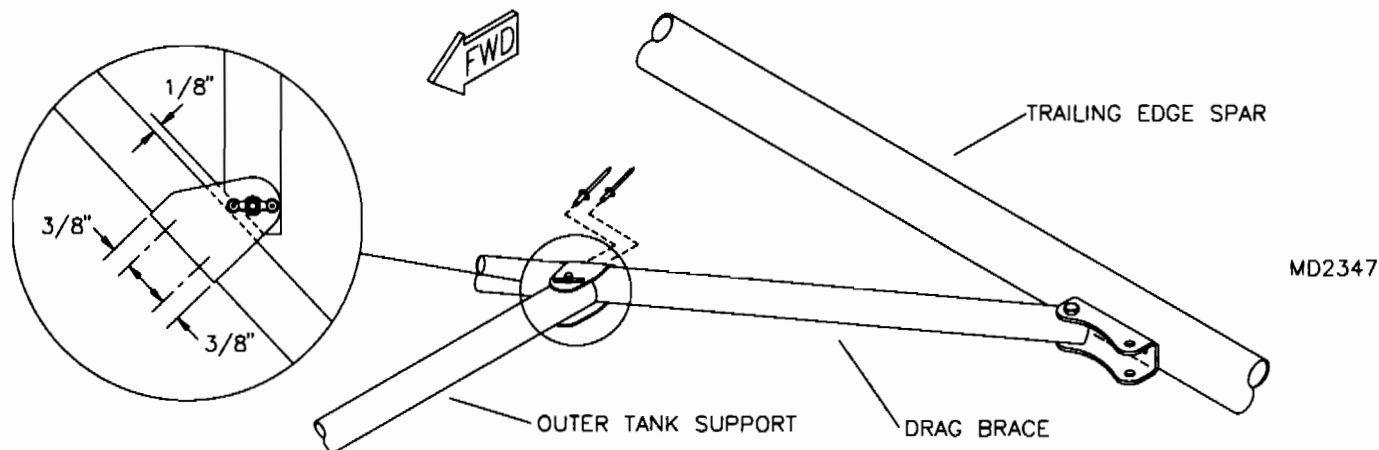
MD1383

8. The four 3/16" holes through the rear spar are for attaching the bolts used for attaching the hinges. The 3/16" nut plates are riveted to the spar. Use a bolt to hold the nut plates in place while drilling. Position the nut plates in line with the spar.
9. Use 3/16" stainless steel rivets to attach the tip to the spars. Use the pre-drilled outermost holes only!
10. Bolt the anti-drag tubes in place as per the parts book. **NOTE:** The tubes will require drilling out to 1/4" diameter as well as the attach channels on the spars. **NOTE:** Do not install the nuts on the 1/4" bolts until after riveting on the nut plates and rib clips.
11. Line up the tip bow parallel to the spars. Drill and install the second rivet. See **Figure 01-11**.

FIGURE 01-11

FUEL TANK MOUNTING

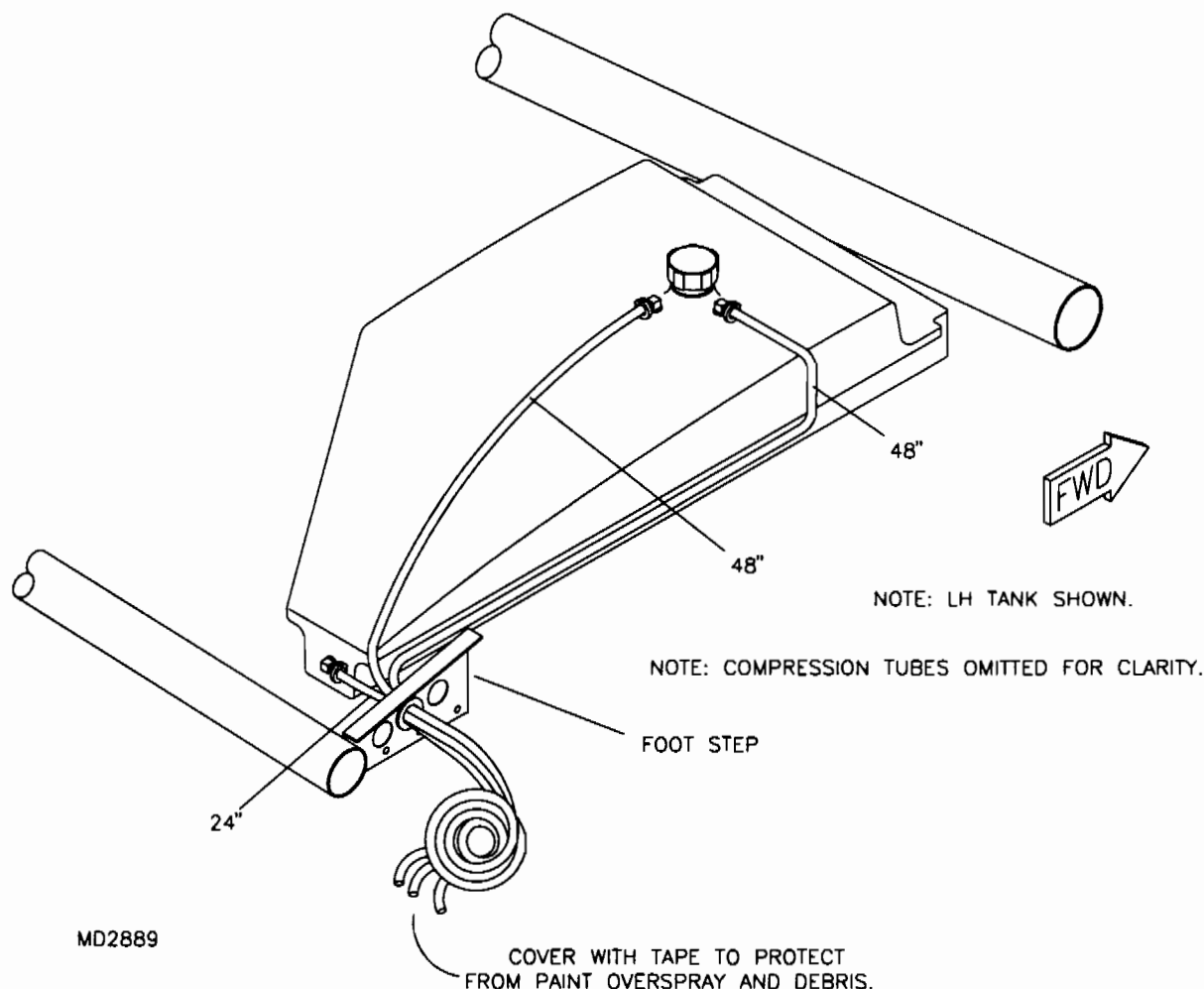
12. Drill a #11 hole 17 3/16" from the center of the inboard S2-SAB on center line with the other S2-SAB. Rivet with a 3/16" stainless steel rivet. Bolt but do not install the nut on the forward end of the outer tank support in place to the S2-SAB. Pull the outer tank support in place against the edge of the tank. Trim the outer tank support to fit against the drag brace. Drill a 3/16" hole in the aft end of the outer tank support using the "U" bracket as a guide. After bolting in the outer tank support tube, mark and drill two 1/8" holes in the aft edge of the "U" bracket and rivet. See **Figure 01-12**. Apply self-adhesive foam tape to the top of the fuel tank support tube and compression tubes.

FIGURE 01-12

13. Apply loctite to the bolts that retain the fuel tank and bolt the forward tank mount brackets to the fuel tank. Place the fuel tank in the wing on the mount and compression tube. The fuel tank's outer forward corner should be touching the forward spar. Using the tank mount brackets as a guide, drill through the brackets and tubes to #30. The holes should line up on center line of the tubes, if not the foam tape may need compressed. Pop rivet as per the parts drawing.

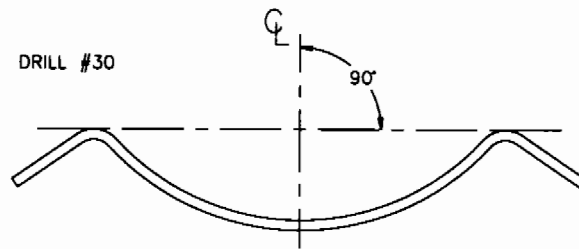
14. Install the fuel line segments to the tanks and route the lines through the grommet or grommets in the foot step. Coil and tape the lines to prevent entry of debris. See **Figure 01-14**. These lines will be connected to the other lines via straight barbs.

FIGURE 01-14



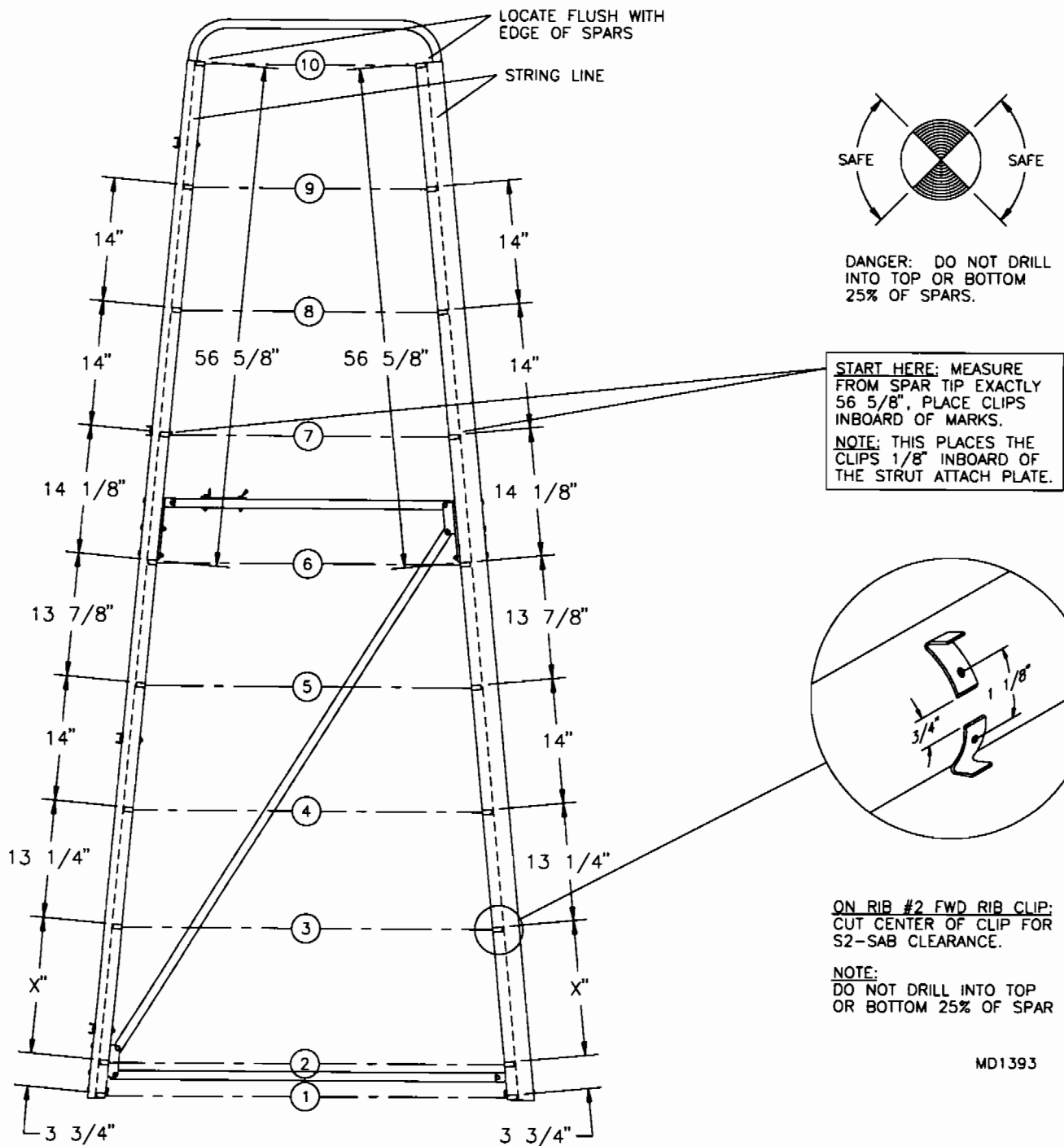
15. Drill 18 of the leading edge clips and 16 of the trailing edge clips to #30 as shown in **Figure 01-15**. Locate and cleco to the spars as shown in **Figure 01-15A** and **Figure 01-15B**. Some builders have looked at **Figure 01-15** and **ASSUMED** they are to put (4) pop rivet in **ALL** the rib clips. This is not the case. Doing this will destroy the spars strength. Please only one rivet per clip unless it is the two root clips.

FIGURE 01-15



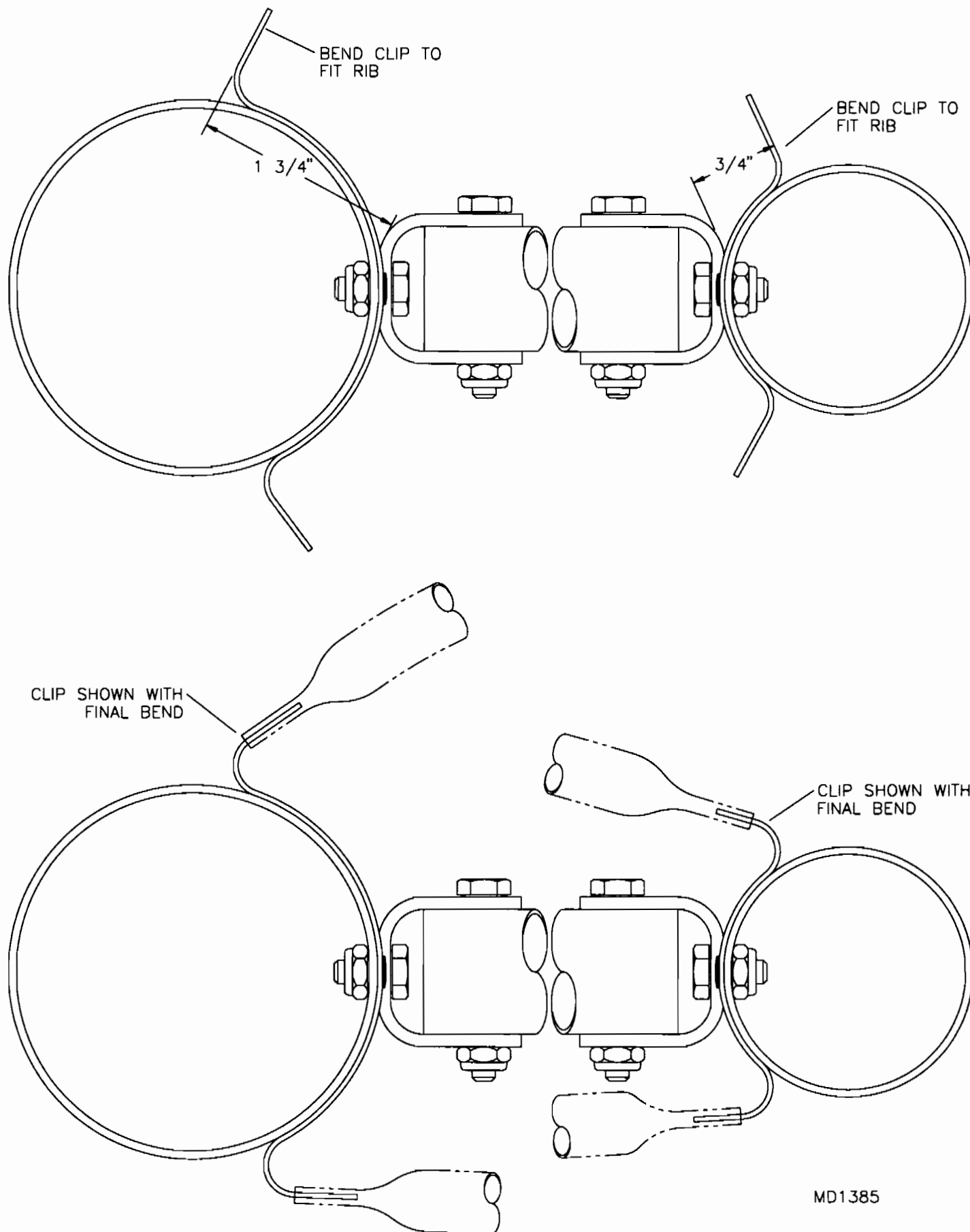
MD1384

FIGURE 01-15A



MD1393

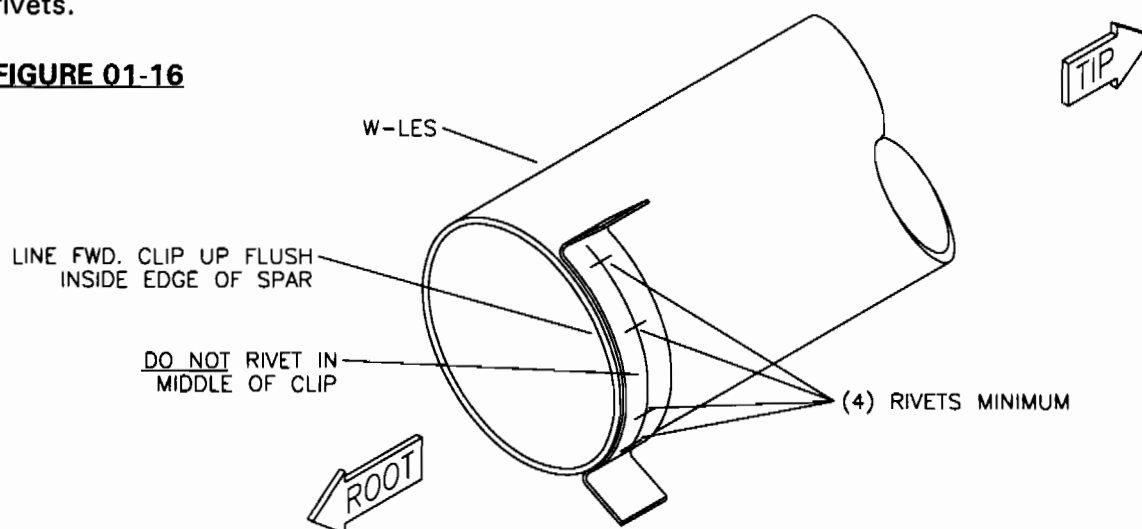
FIGURE 01-15B



MD1385

16. Locate and drill #30 holes in the 2 remaining leading edge clips as shown in **Figure 01-16**. Line the clips up flush with the inside edge of the spar. Rivet a minimum of (4) 1/8" aluminum pop rivets.

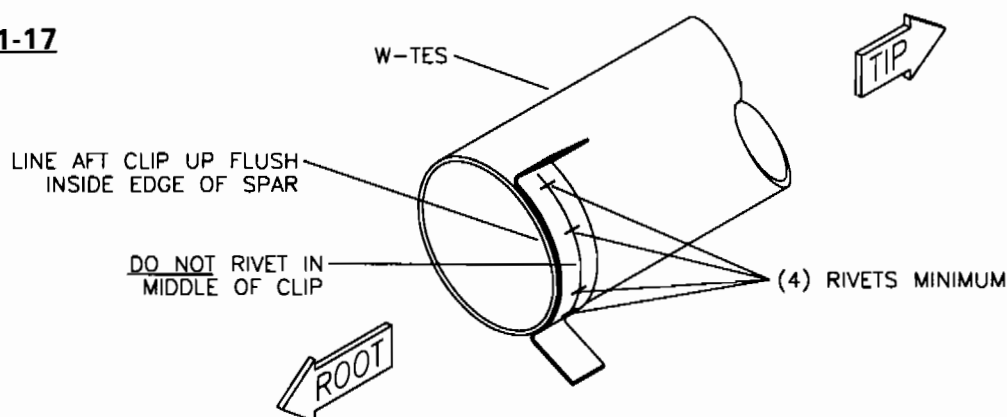
FIGURE 01-16



MD1386

17. Following the procedure in step #14, locate, drill and rivet the inboard most trailing edge clip. Use **Figure 01-17** to locate.

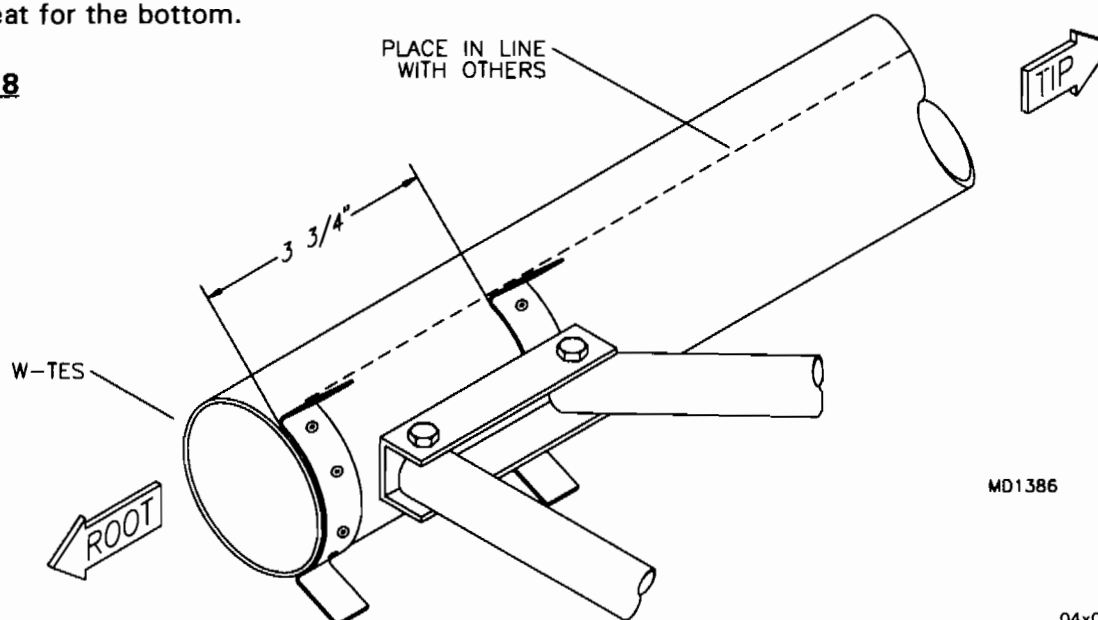
FIGURE 01-17



MD1386

18. Cut, locate and rivet the next most inboard trailing and leading edge clips as shown in **Figure 01-18**. Repeat for the bottom.

FIGURE 01-18

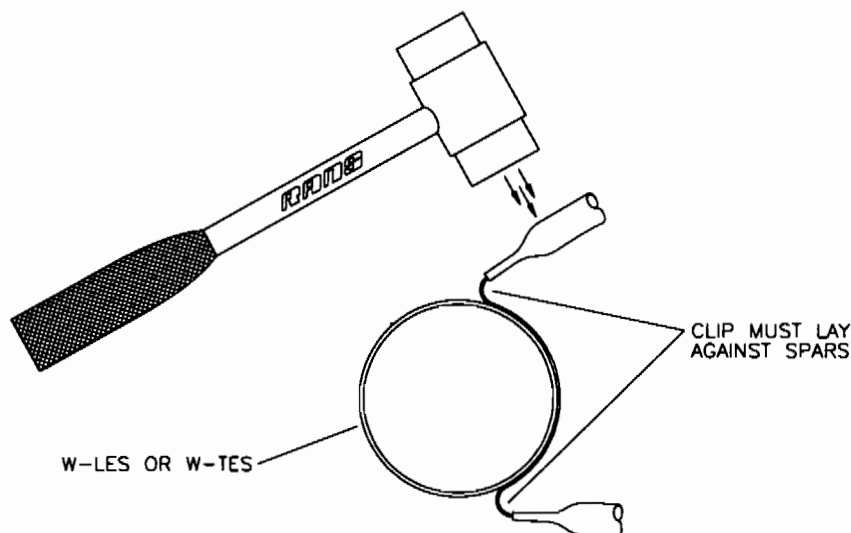


MD1386

19. Install the drag anti-drag tube using the proper hardware.

20. After all the clips are located and clecoed in place, insert the corresponding rib by removing the cleco and assembling the rib to the clips. Pop rivet after the ribs are in place. For the clips riveted in place at the root, the ribs can be "bowed" slightly to install onto the clips. Trying to "bow" the other ribs may bend them because they get shorter toward the tip. **NOTE:** If you do not have clecos, it works to drill out the rivets and just re-rivet. After installing all the ribs, gently tap them down against the spars with a mallet. See **Figure 01-20**. The bottom ribs are marked to designate the forward end. Place the ribs with the mark **FORWARD** and the "bow" of the rib **DOWN**.

FIGURE 01-20

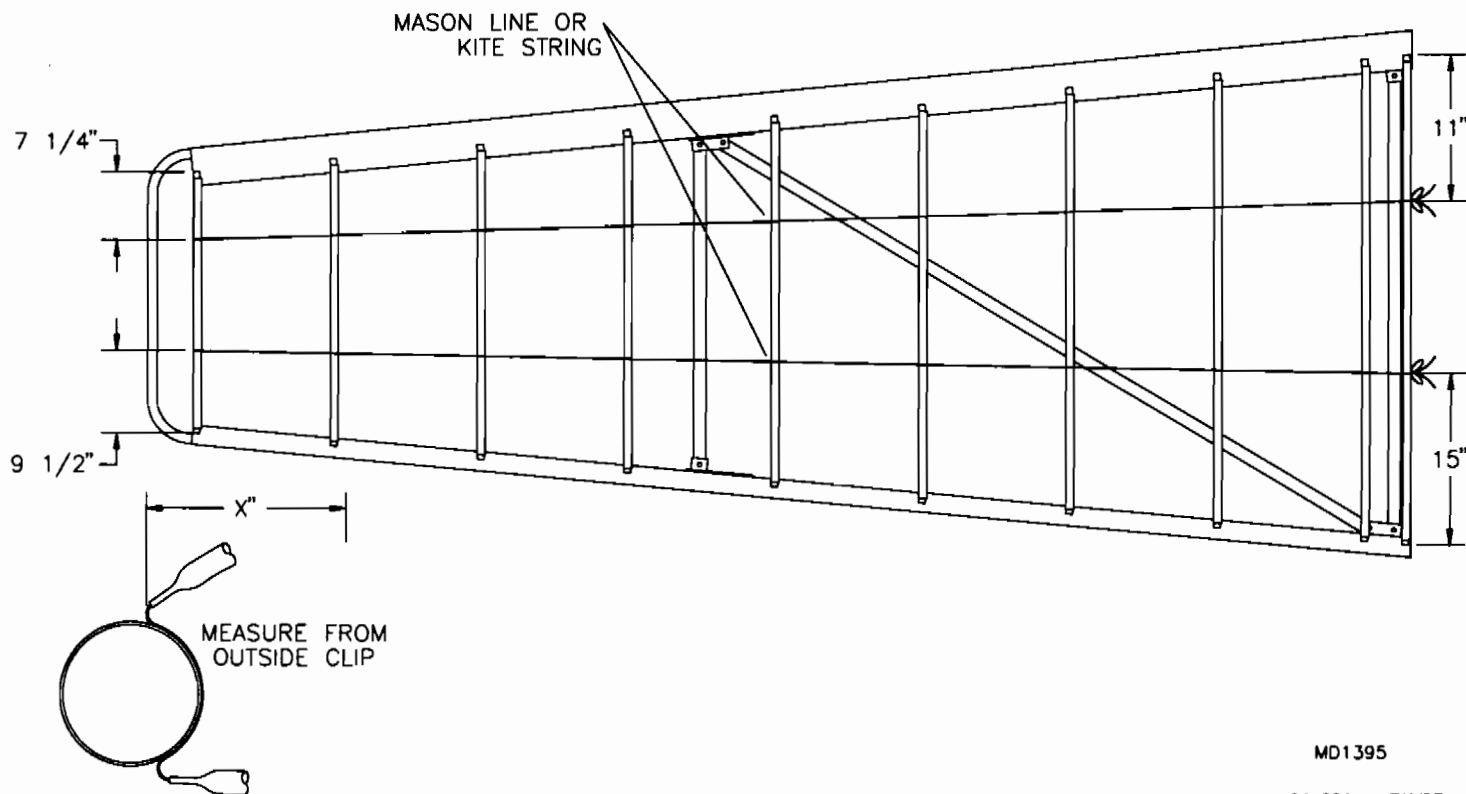


MD1395

21. Check and adjust the rib profiles by sighting from the tip to the root. Ribs that rise above the others may require more mallet work or hand forming.

22. String a mason line or kite string as shown in **Figure 01-22** to aid in installing the vertical rib tubes. The rib compression tubes will be located centered underneath the lines. The lines will also indicate the high and low ribs.

FIGURE 01-22



MD1395

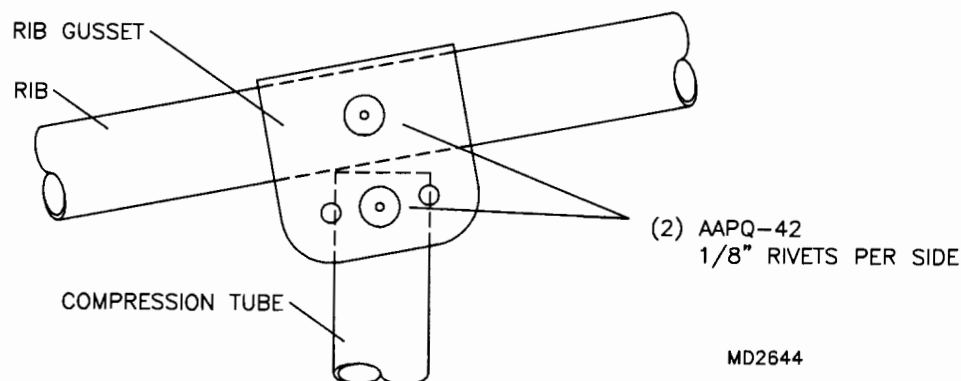
23. Cut the rib compression tubes to the lengths as specified in the chart below. Use the ½" x .035 aluminum tube stock. There is a little extra material in case you cut it off twice and it is "still too short". The dimension is critical for airfoil profile accuracy.

TOP RIB #	(A) FWD TUBE	(A) AFT TUBE
1	6 ½"	5 1/8"
3	6 3/8"	4 7/8"
4	6 1/4"	4 3/4"
5	6 1/8"	4 3/4"
6	6"	4 5/8"
7	5 5/8"	4 ½"
8	5 3/8"	4 3/8"
9	5 1/8"	4 1/4"
10	4 11/16"	4 1/8"

NOTE: Rib #2 does not use forward compression tube due to the location of the fuel tank. Special instructions to follow.

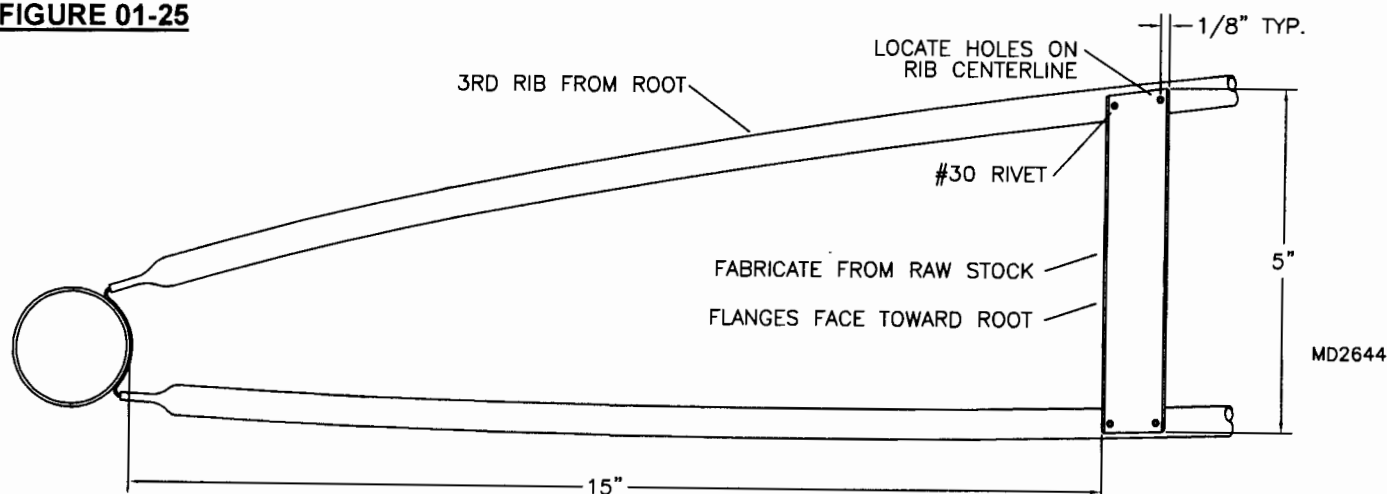
24. Place each wing rib compression tube centered and vertical under the string line. Make sure the rib tubes actually rest against the rib. **Figure 01-24** shows details of the rib gusset installation. **HINT:** For holding the rib gussets in place, use masking tape. Drill and rivet the rib gussets in place.

FIGURE 01-24

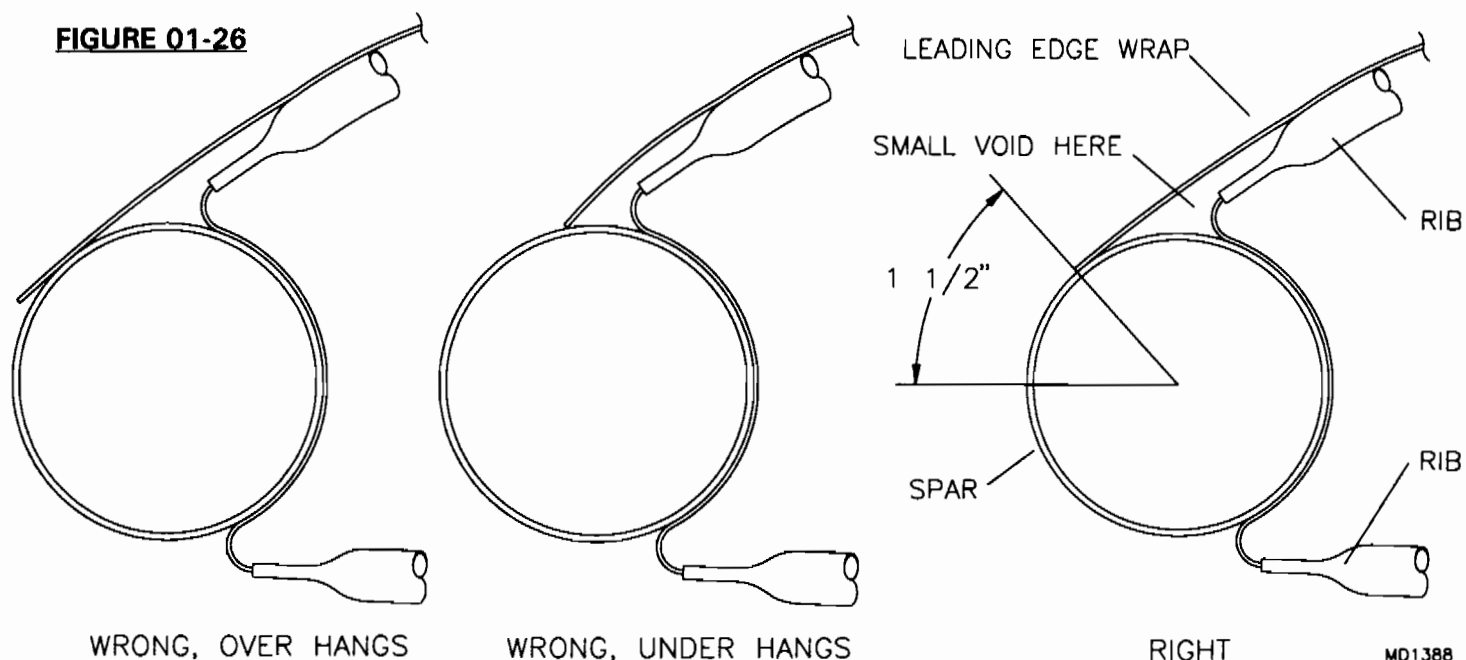


25. On the 3rd rib from the root, locate the rib channels and cut, fit, drill and rivet in place. The channels install on the **ROOT** side of the rib. See **Figure 01-25**.

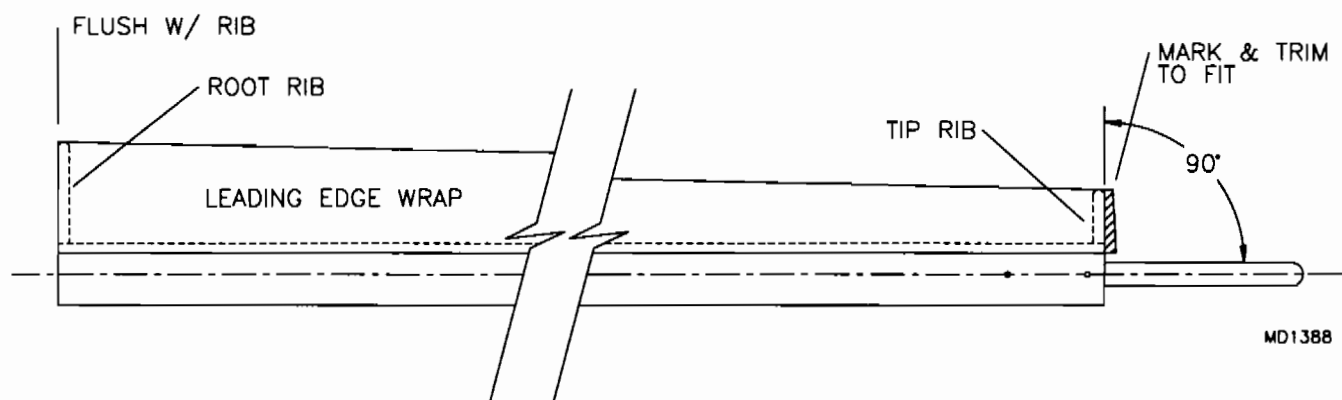
FIGURE 01-25



26. Carefully unroll a leading edge wrap and position on the wing with an even amount of overhang on each end. **Figure 01-26** details the proper positioning on the leading edge spar. Use masking tape or lightly clamped vise grips to hold the leading edge wrap in place. Be careful when working with sheet metal. **BE SUPER CAREFUL!!!** These sharp edges can cut quick and deep. Also, handle the sheet metal gently to prevent wrinkles.

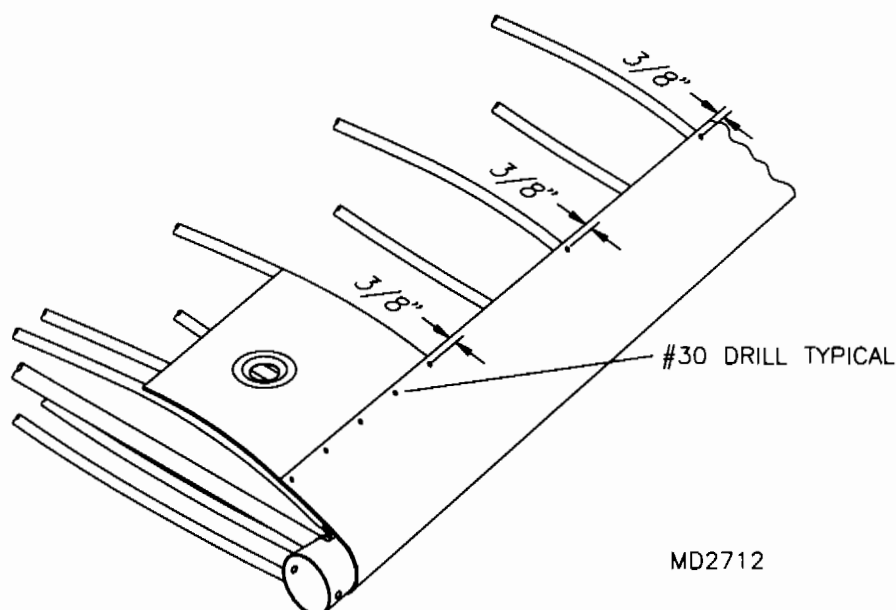
FIGURE 01-26

27. Rotate the root rib and the tip rib perpendicular to the spar. See **Figure 01-27**. Mark the wrap from the underside with a flair pen. Remove and trim the ends with an aviation tin snips. File the edges of the wrap smooth by draw filing with a file. Tape the rear edge of the wrap with electrical tape. Re-position the wrap where it will be installed and temporarily tape in place. Select parts as per the parts drawing to build the root ribs.

FIGURE 01-27

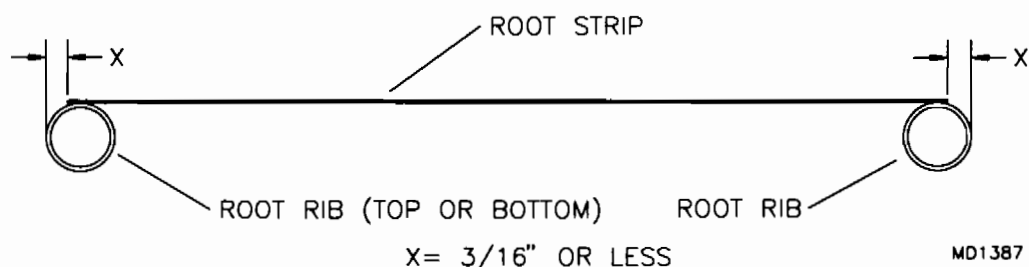
28. Locate and drill #30 holes at $3/8"$ from the top edge of the wing at each rib. Before drilling make sure all ribs are 90 degrees to the spar. Drill and cleco. See **Figure 01-28**.

FIGURE 01-28



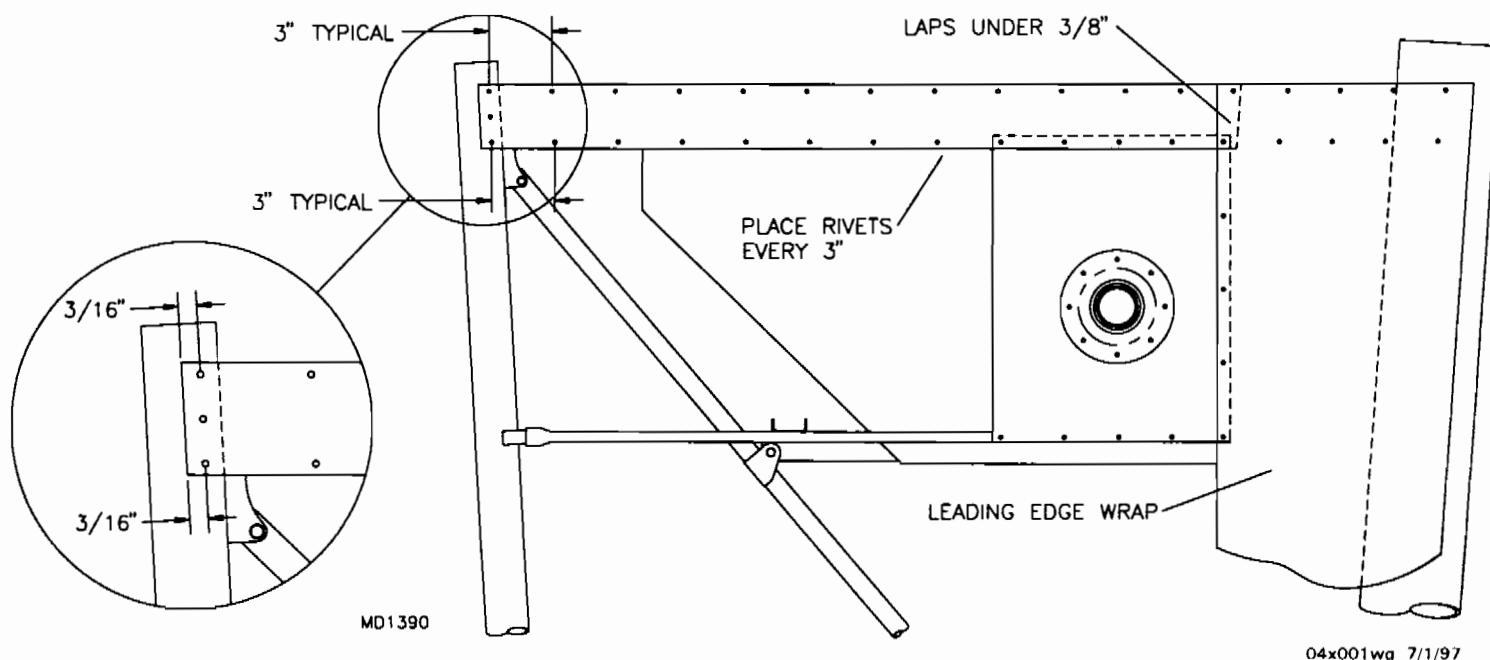
29. Position the top root strip on top of the two root ribs with $3/8"$ tucked under the leading edge wrap. See **Figure 01-29**.

FIGURE 01-29



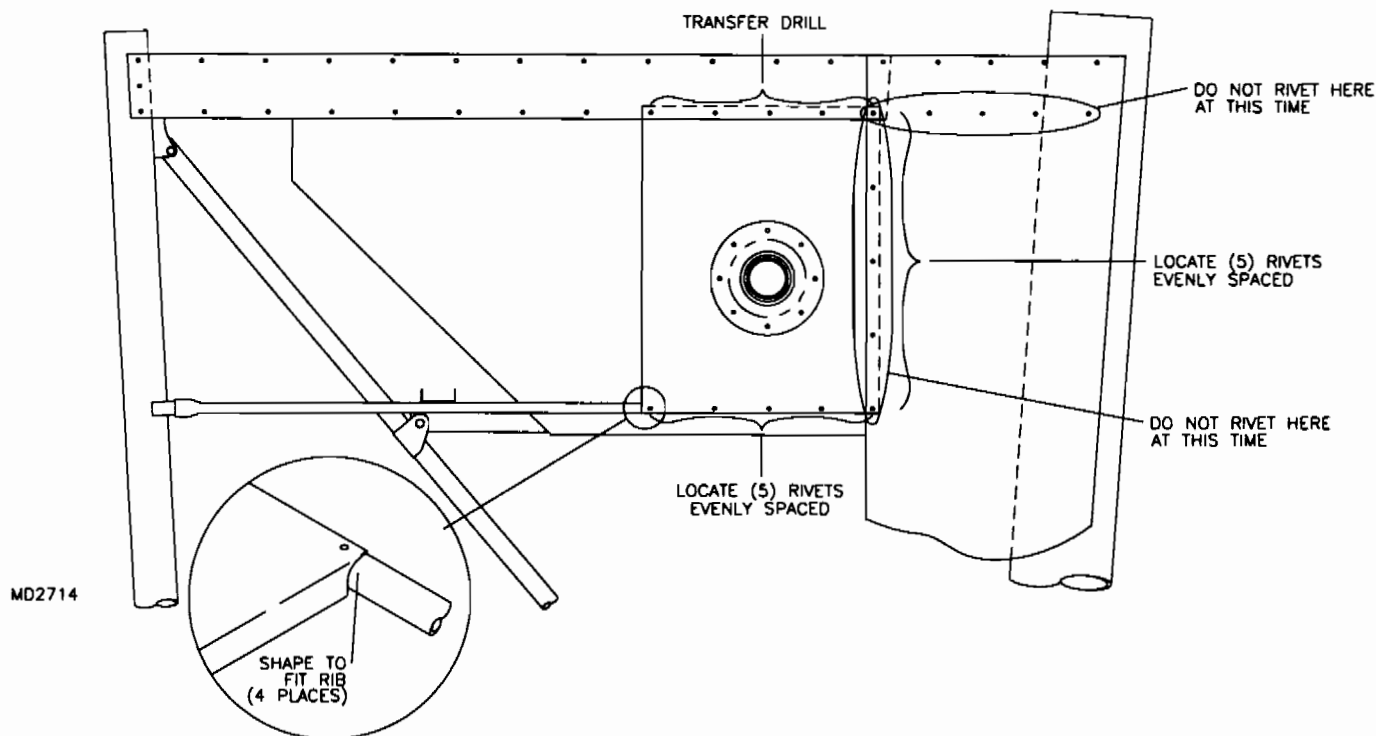
30. Trim the top root strip to the taper of the wing. Lay out holes every 3" on the center of the rib tubes. Center punch and drill to #30. Cleco in place. See **Figure 01-30**.

FIGURE 01-30



31. Rivet with 1/8" aluminum pop rivets the filler neck scupper to the scupper panel. Place the assembly over the filler neck. The edges against the root strip and leading edge wrap lap **UNDER**. Locate and drill holes as per **Figure 01-31**. Trim the aft flange of the scupper panel to clear the ribs. Rivet everywhere **BUT** the leading edge wrap. It will need to be removed to prepare the bonding zone on the spar.

FIGURE 01-31



FOOT STEP INSTALLATION

INSTALL ON BOTH WINGS

32. Position the foot web in place on the underside of the root strip. See **Figure 01-32**. Use **Figure 01-32A** to lay out and drill the sub plate and the wear plate. Position the wear plate to be even with the root strip on the spar. **DO NOT** rivet the wear plate on until the wing is covered and painted. Glue the sub plate in place with JB weld.

FIGURE 01-32

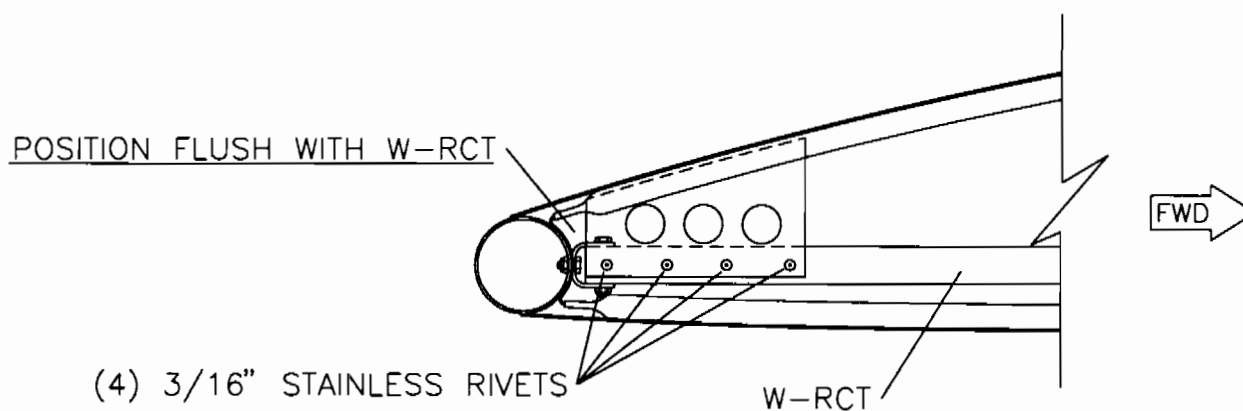
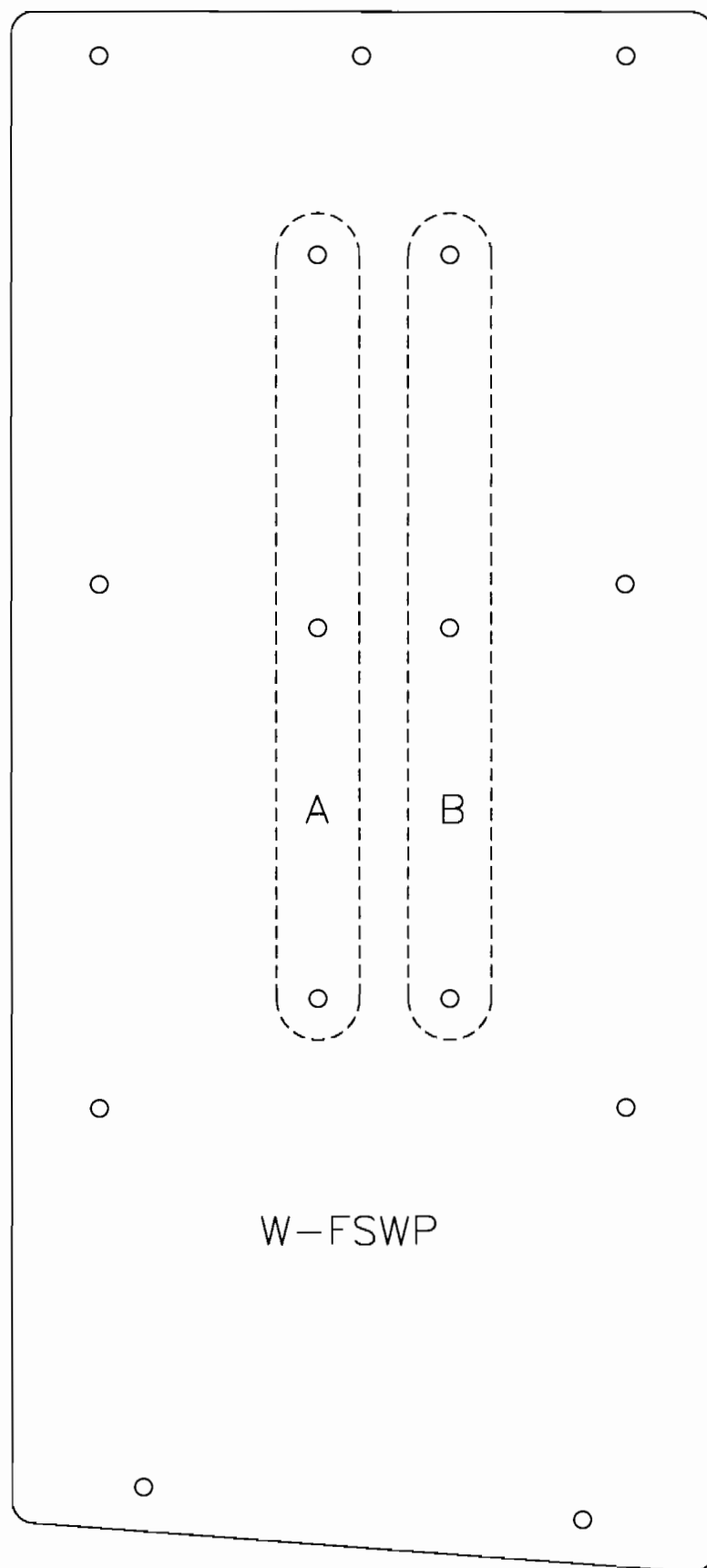


FIGURE 01-32A

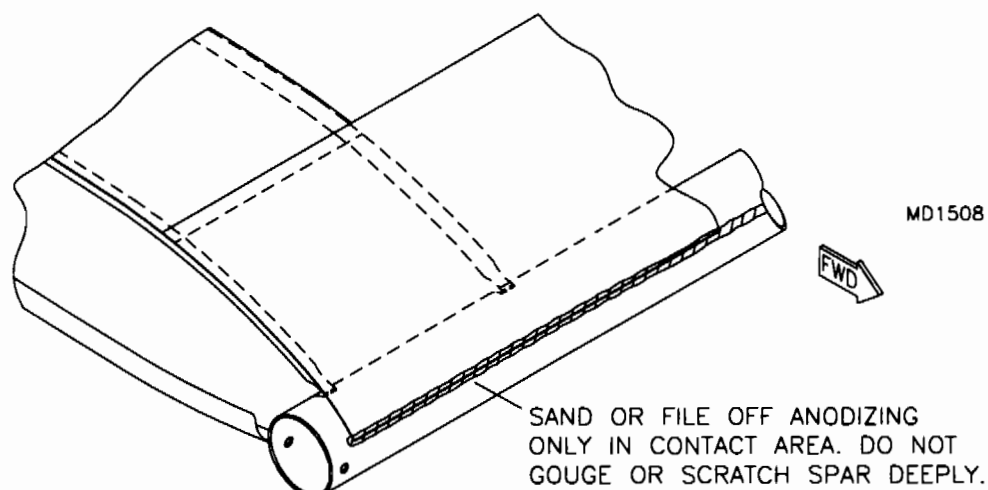
MD1389

LEFT HAND WING, DRILL HOLES "B" OMIT HOLES "A"
RIGHT HAND WING, DRILL HOLES "A" OMIT HOLES "B"

33. With the foot step web in place, mark the location of rivets. Remove the center, punch and drill the web. Re-position, drill and rivet with 3/16" stainless steel pop rivets. **HINT:** Snap in the grommet before permanently installing.

34. Carefully sand or file away the anodizing where the wrap bonds to the spar. After preparing the bonding zone, re-install the leading edge wrap. Rivet the wrap to the ribs and scupper panel prior to bonding. See **Figure 01-34**.

FIGURE 01-34



35. Prepare the clamps and boards and use the J&B epoxy to glue the wrap. Clamp with a long straight board and several "C" clamps. See **Figure 01-35**. After the J&B weld cures, body putty the jog between wrap and spar. Sand smooth. **HINT:** Put putty mix in a plastic bag. Squeeze out of a small hole (like icing on a cake). Smooth out with a putty knife. Apply the body putty so it rolls around the leading edge for a smooth blend of leading wrap and spar. See **Figure 01-35A**.

FIGURE 01-35

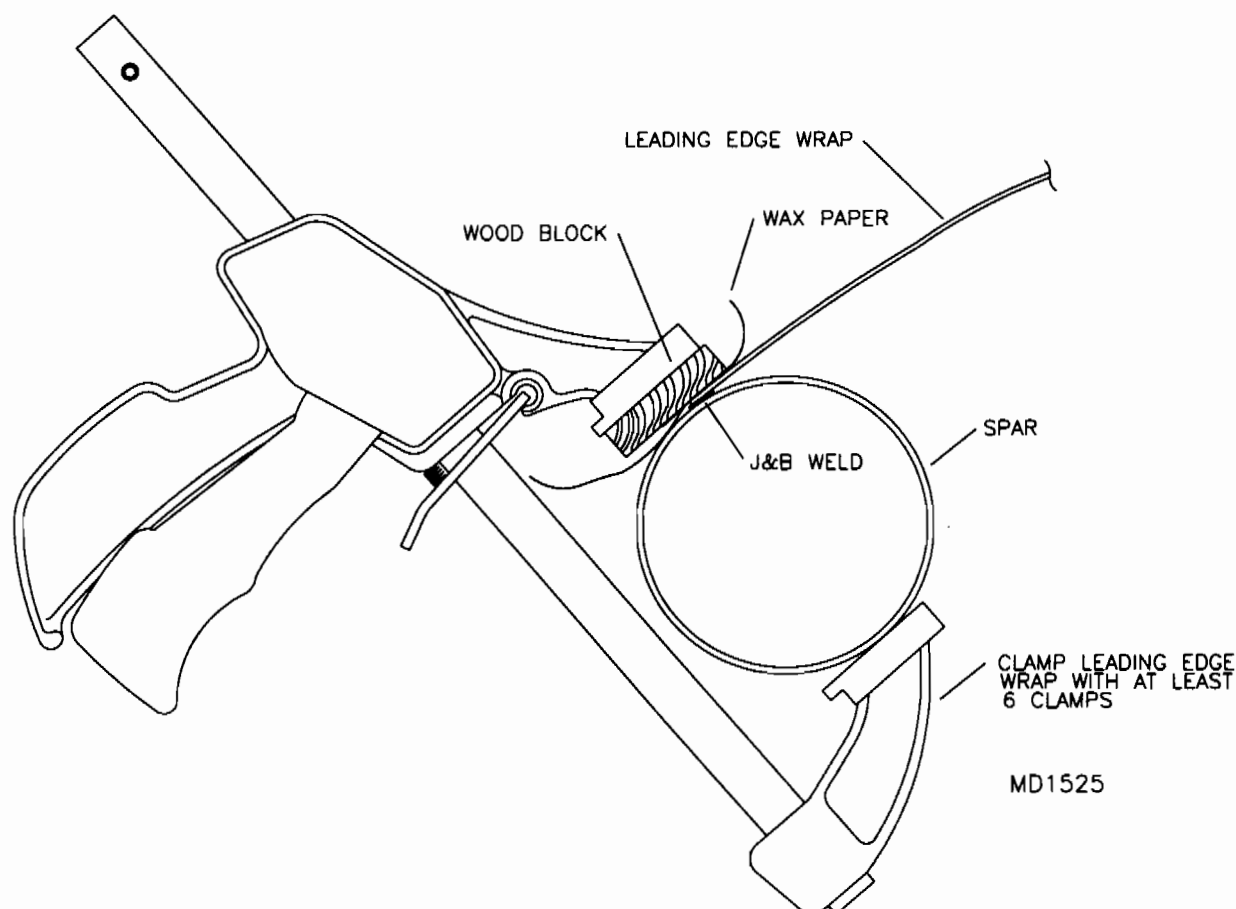
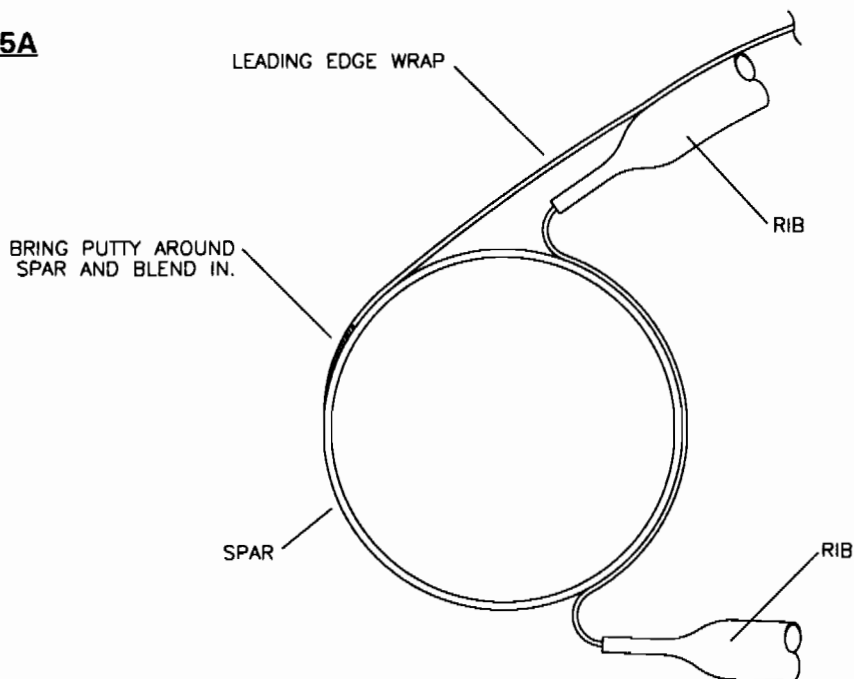
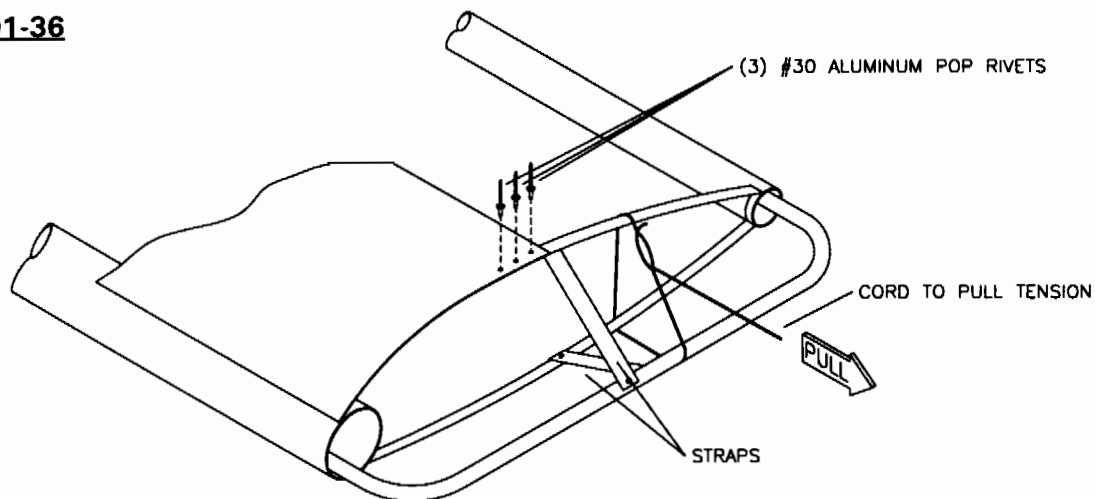
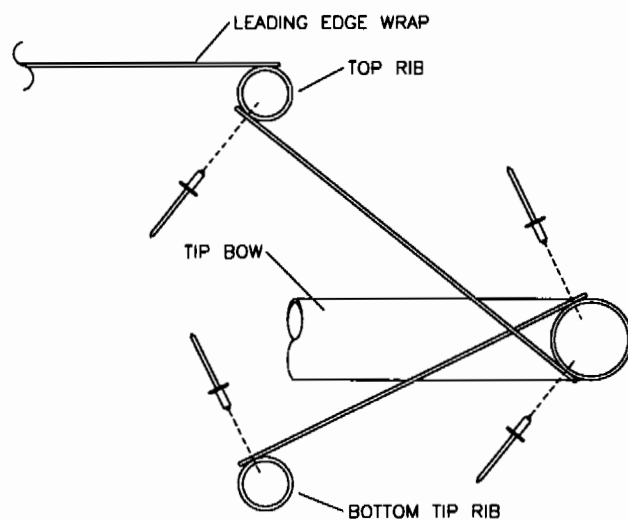


FIGURE 01-35A

MD955

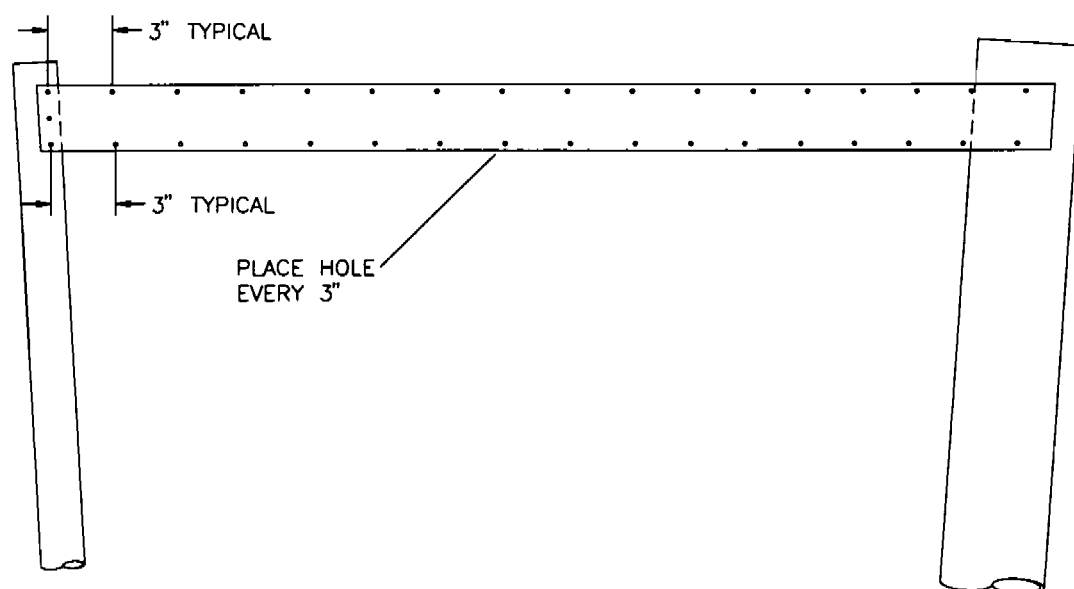
36. Install the two "tension" straps at the wing tip as per **Figure 01-36 & 36A**. The straps are riveted in place after pulling tension of the leading edge wraps top edge. Use a small rope or cord wrapped around the tip and rib to apply and hold the tension. Rivet the leading edge wrap top tip corner with (3) rivets after straps are installed.

FIGURE 01-36**FIGURE 01-36A**

MD1400

37. Flip the wing inverted then layout, drill and rivet on the root strip to the bottom side of the root ribs using 3" spacing. See **Figure 01-37**.

FIGURE 01-37



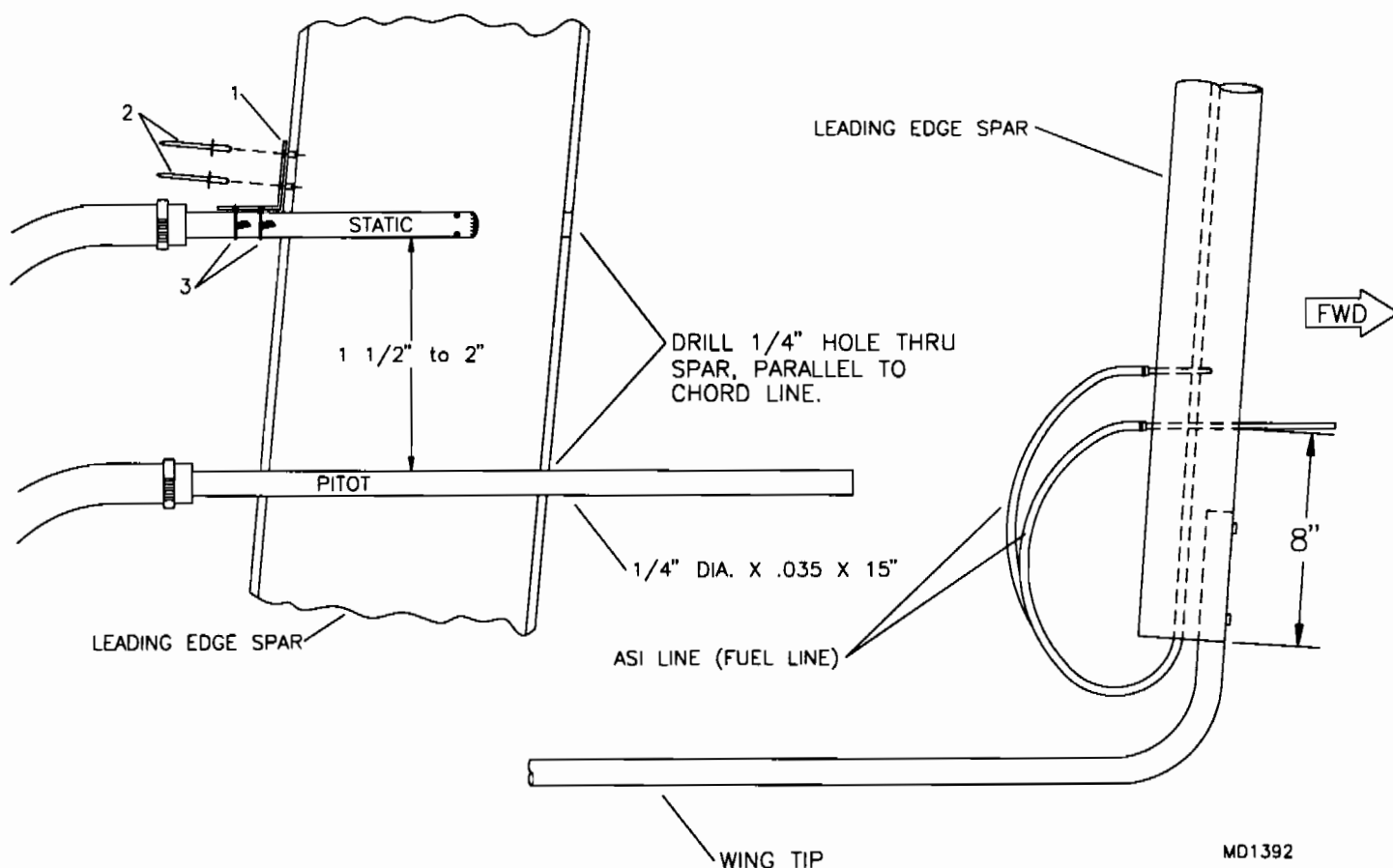
MD1391

INSTALLING THE AIRSPEED PITOT AND LINE

NOTE: Reference the parts catalog. **PLEASE NOTE:** Static and Pitot are options that come with airspeeds.

38. Drill through the right wing's leading edge spars as shown in **Figure 01-38** with a 1/4" bit for the pitot. Push the ASI line to the root end of the front spar and loop it around and connect it to the pitot with a nylon zip tie.

FIGURE 01-38



MD1392

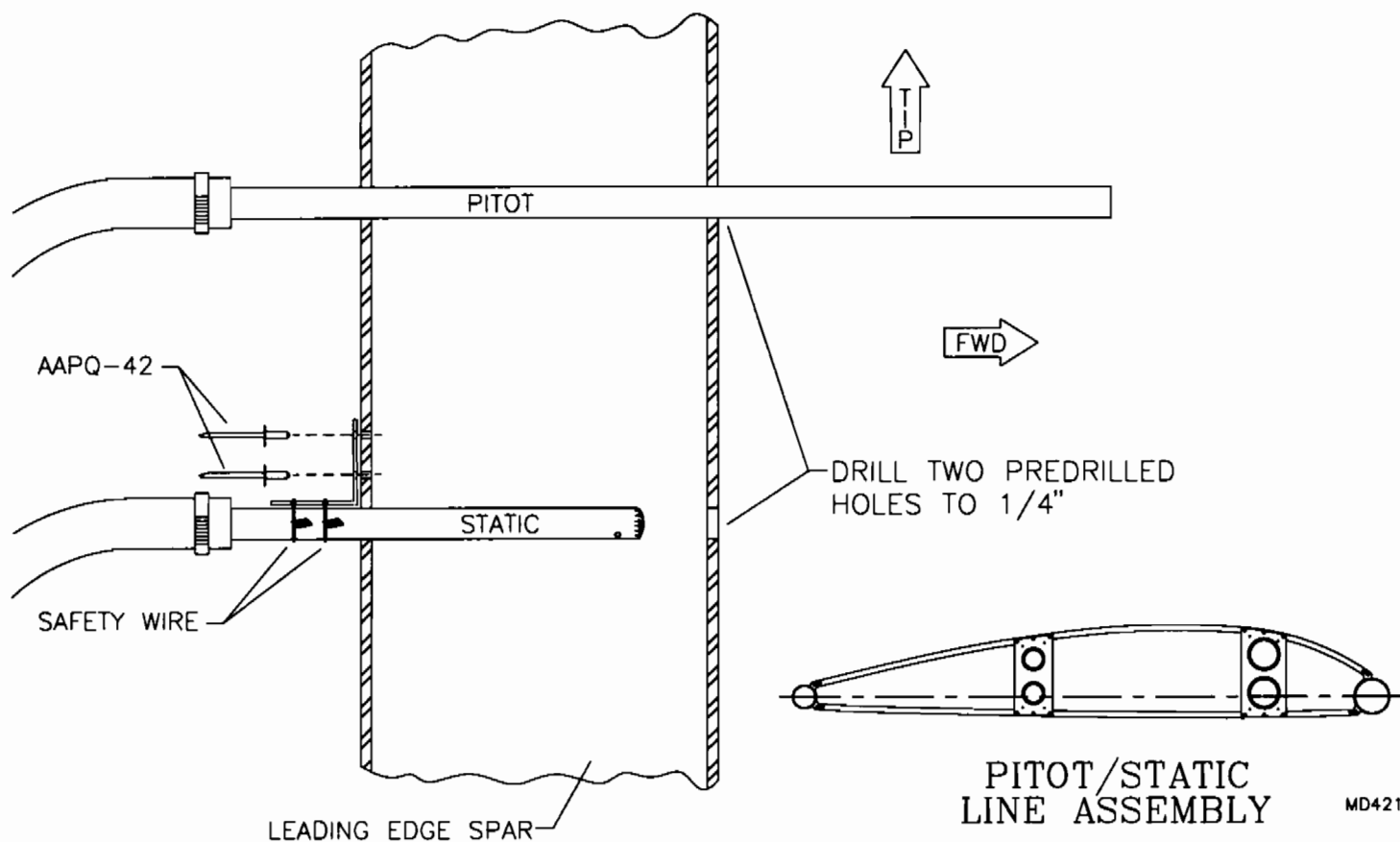
39. Inspect the wings and review all the assembly steps. If everything is proper, the wings are ready for covering. If you do not plan on covering the wings now, place extra masking tape on the leading edge wrap to hold the front edge down. Remove this extra tape prior to covering. **PLEASE NOTE:** Teleflexes will not be installed until **AFTER** covering.

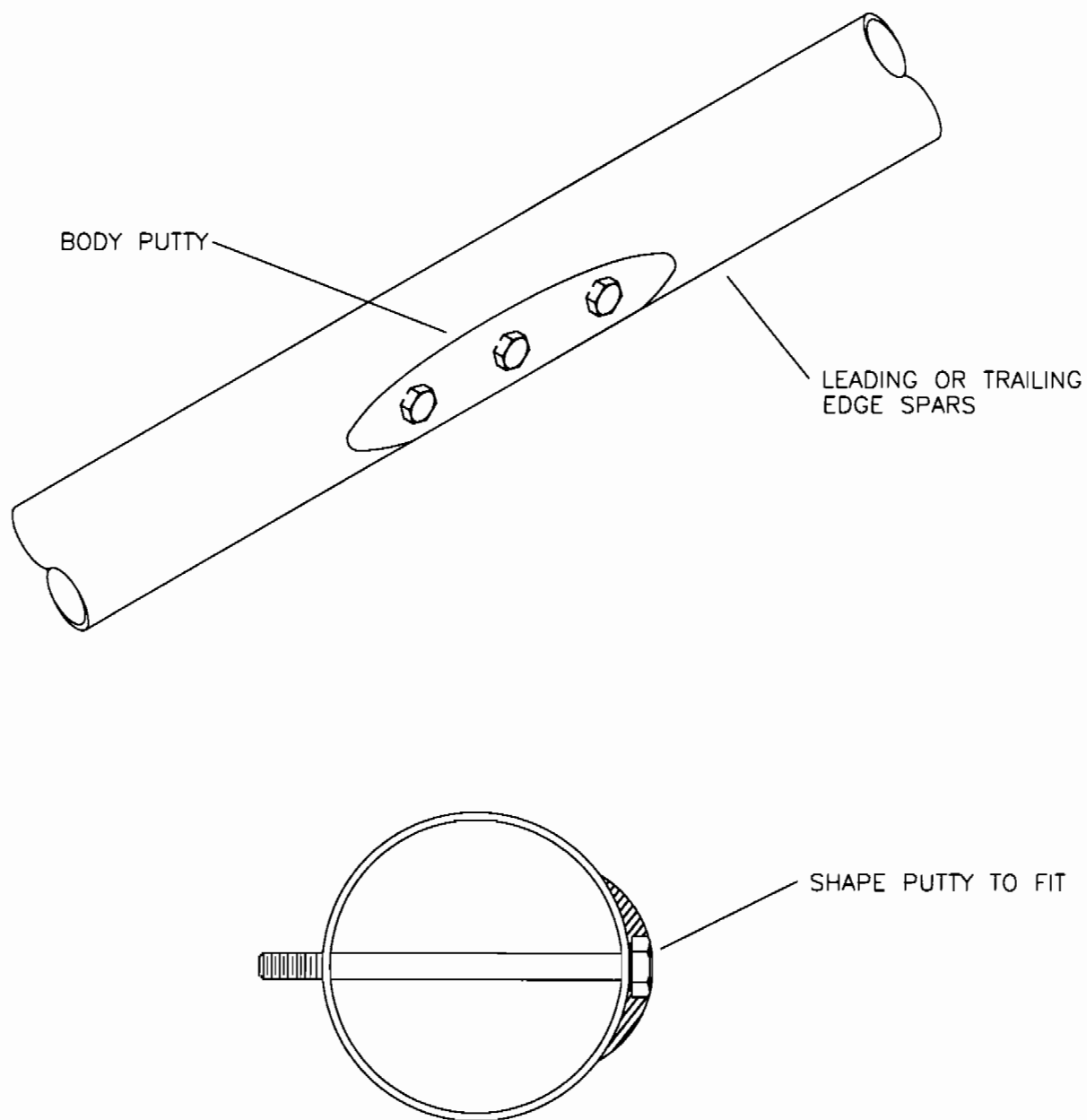
OPTIONAL PITOT STATIC INSTALLATION METHOD

Recessing the static line into the wing will not adversely affect the airspeed reading. Flight testing of the RANS aircraft with this setup has given acceptable performance at all airspeeds. To attach the static line as shown use the following parts:

1. Angle, .050 X 1.00" X 1.00"
2. #30 pop rivets
3. Safety wire **NOTE:** These are builder obtained items.

Make an aluminum angle from .050 raw stock. Drill two holes for the pop rivets, in one side of the angle. Drill four #40 holes (two per side) for safety wiring to the static tube in the other angle.



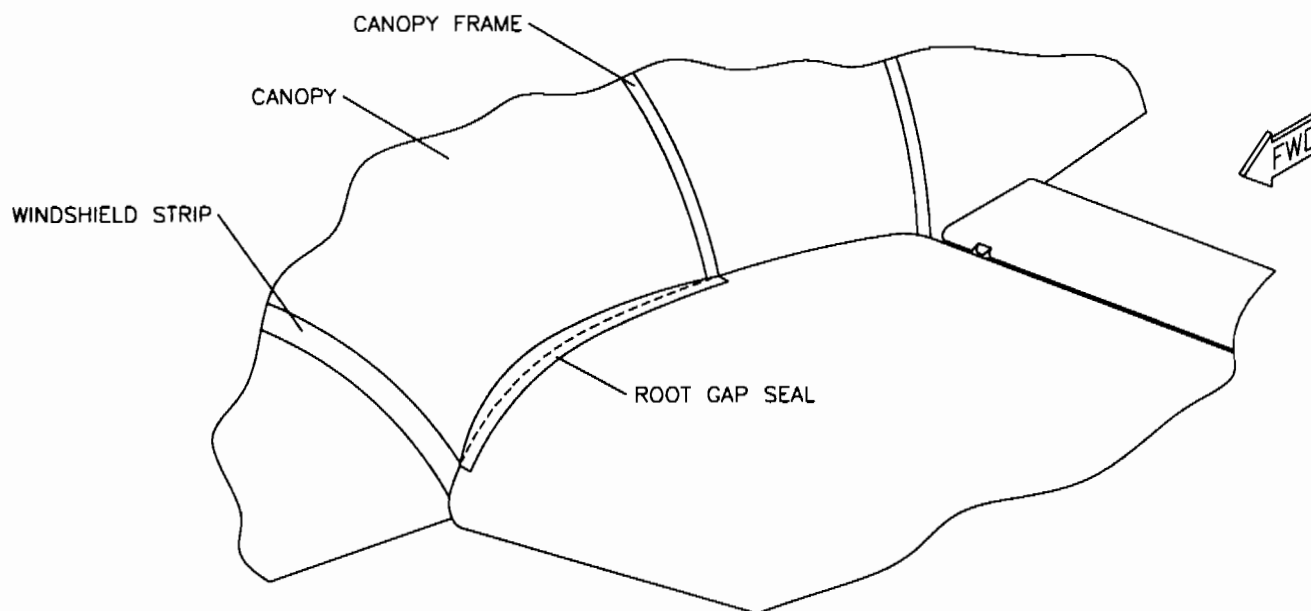
BODY PUTTY METHOD OF FAIRING IN BOLT HEADS

WING ROOT TOP SIDE GAP SEALS FOR THE S-9 CHAOS

Provided in the kit are two strips of $\frac{1}{2}$ " x .020 x 26" aluminum. These are used to gap seal the wing roots top side. The wings must be covered (although they do not need to be painted) and attached to the fuselage with the canopy in place.

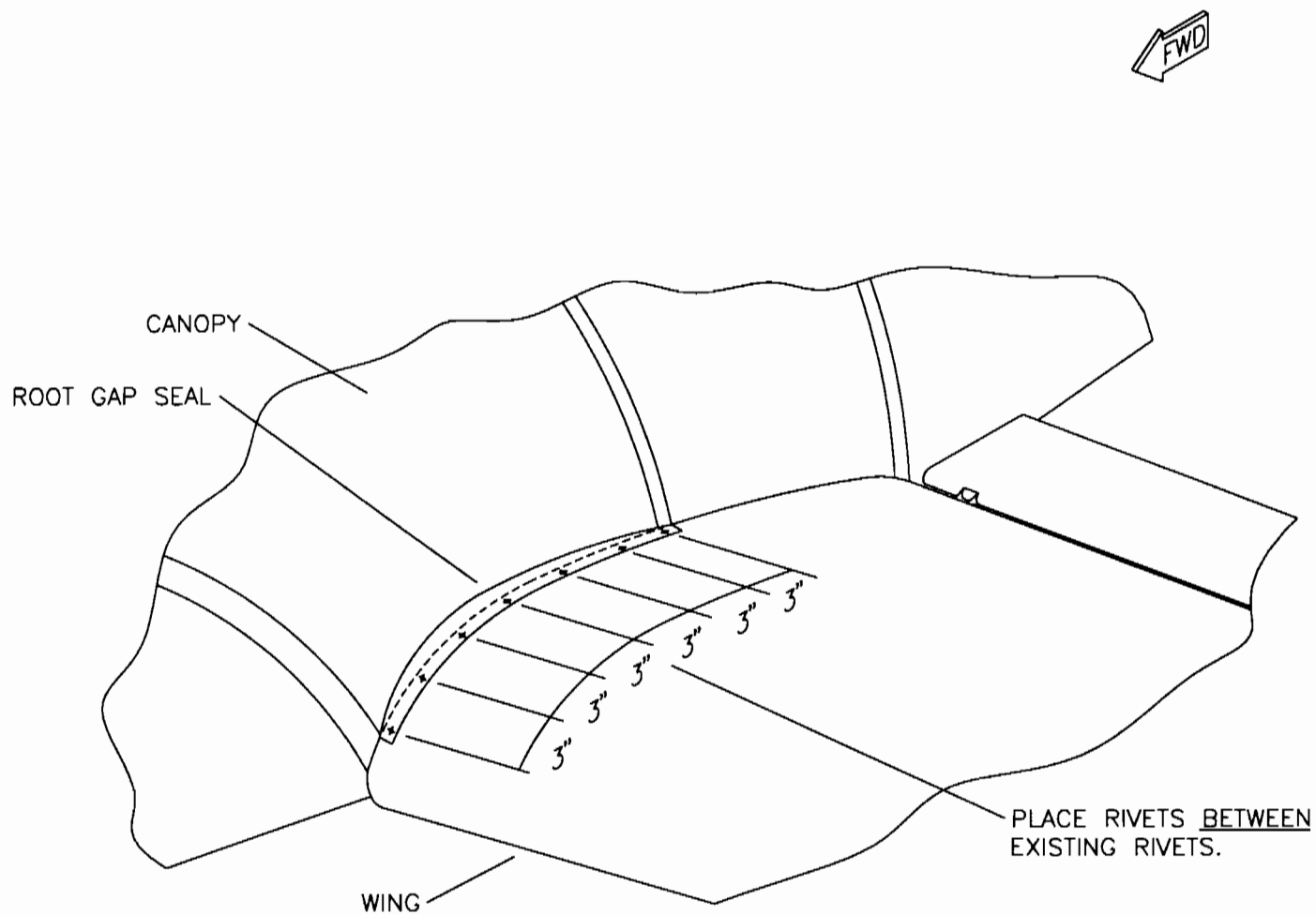
40. The strips are located from the windshield strip to the canopy frame. See **Figure 01-40**. Tape them in place with masking tape parallel to the wing ribs and touching against the canopy lexan. You will note the inboard edge of the strip does not touch the lexan along its length. The strip needs to be trimmed to contour. To mark the contour, tape a flair or similar marker to a $\frac{3}{4}$ " thick wood block. Trace the contour by placing the block against the windshield with the marker to the outside and touching the strip. Remove and trim.

FIGURE 01-40



MD1397

41. After the gap strips are trimmed, tape them in position. Locate, drill and cleco the strips in place as shown in **Figure 01-41**. **BE CAREFUL:** The holes must go through the top of the root rib, it is easy to get off to the side. Mark the root ribs top line by locating off the rivets used to hold on the root strips. The root gap rivet holes should fall exactly "**BETWEEN**" the existing root strip rivets. Remove for painting and apply trim loc to the root gap inside edge prior to riveting to the wing.

FIGURE 01-41

MD1398

S-9 CHAOS AILERON ASSEMBLY & COVERING PREPARATION

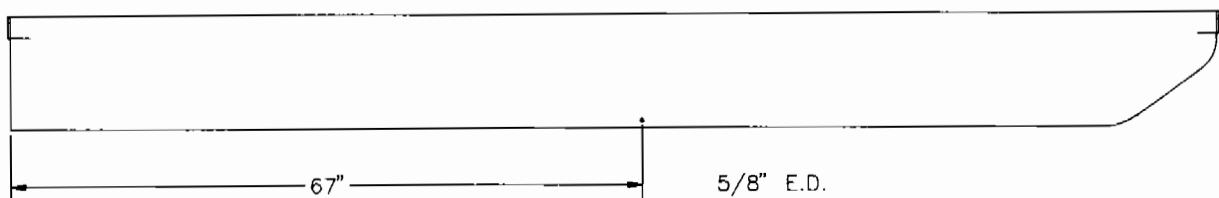
1. Select the parts depicted in the parts drawing. Fabricate the aileron horn attach angles as per the print FAB 3. Make sure to make left and right's. Also, make up (2) 1/4" X 1/2" spacer bushings.
2. Drill and rivet in place (4) of the K-1000-3 nut plates to each of the aileron spars at each hinge hole. Place the nut plates on the spar's backside, use #40 aluminum pop rivets.
3. Using a file or disc sander, profile the aileron's rib tubes to the spar tube. The rib tube should be flush with the spar. Take care not to gouge the spar.
4. Assemble the horn parts and eyebolts to the aileron and trial assemble it to the wing. **NOTE:** Locate the aileron clip approximately 67" from the 90 degree end. See **Figure 01A-01**.
5. With the aircraft fully assembled, wings and ailerons, set up the ailerons as described in this section. Chances are this preliminary rigging will be near the settings you will fly on, so accuracy is important.
6. Mark the left hand aileron teleflex with a colored tag such as blue or yellow. Mark the control sticks' right side horn with the same colored tag. Now during assembly you will have a color coded marker telling you they must **CROSS** in order to function properly. Always check for proper aileron movement prior to flight. Push the stick to the left, the left hand aileron should be up, etc.

AILERONS

ATTACHING AND INSTALLING THE AILERONS

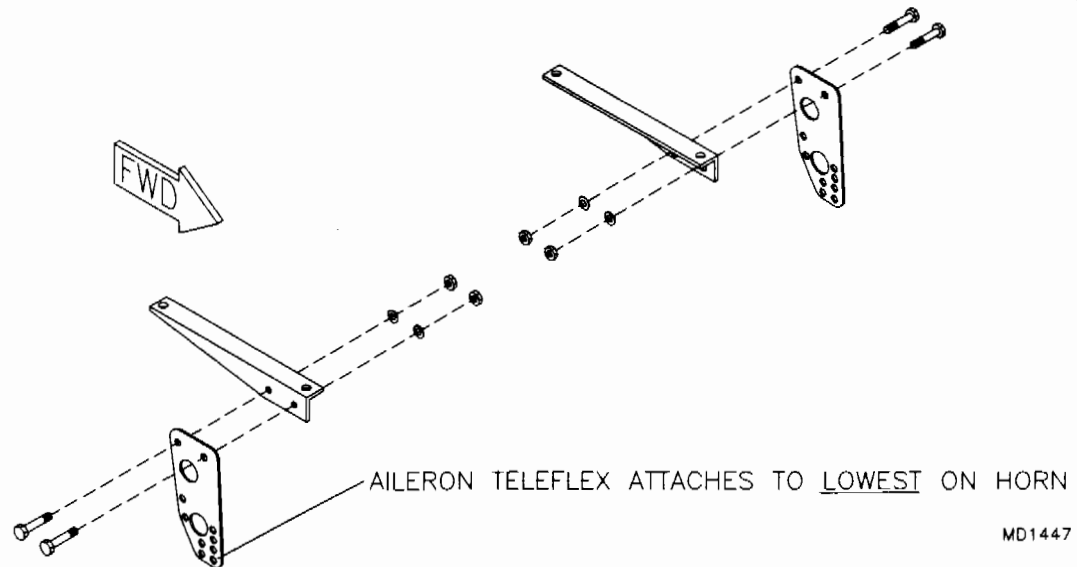
1. Using an awl or ice pick punch a hole through the fabric as shown in **Figure 01A-01**. For fabric covered only.

FIGURE 01A-01

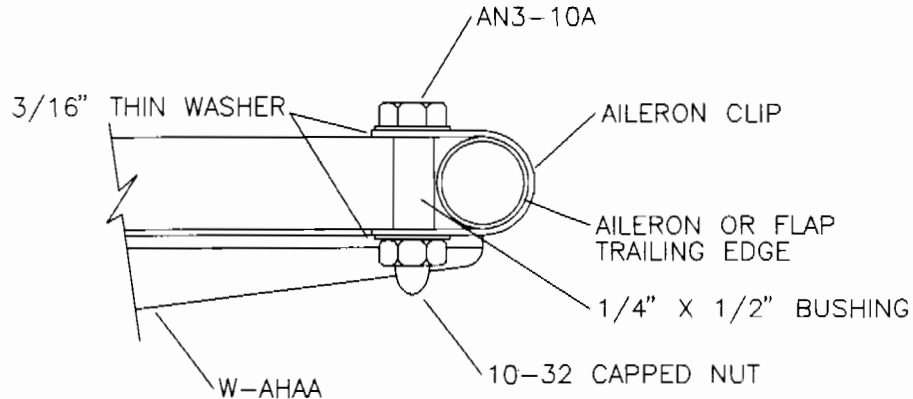


MD1446

2. Fabricate a pair of aileron horn attach angles as per print FAB 3.
3. Make 2 bushings 1/4" diameter X 1/2" long. Drill out the inside diameter to #11.
4. Bolt the horns to the angles as per **Figure 01A-04**.

FIGURE 01A-04

5. Attach the horn assembly to the proper aileron as per the parts drawing. Slip the 1/4" X 1/2" bushing into the hole, slip the aileron clip over the trailing edge and bolt as per **Figure 01A-05**.

FIGURE 01A-05

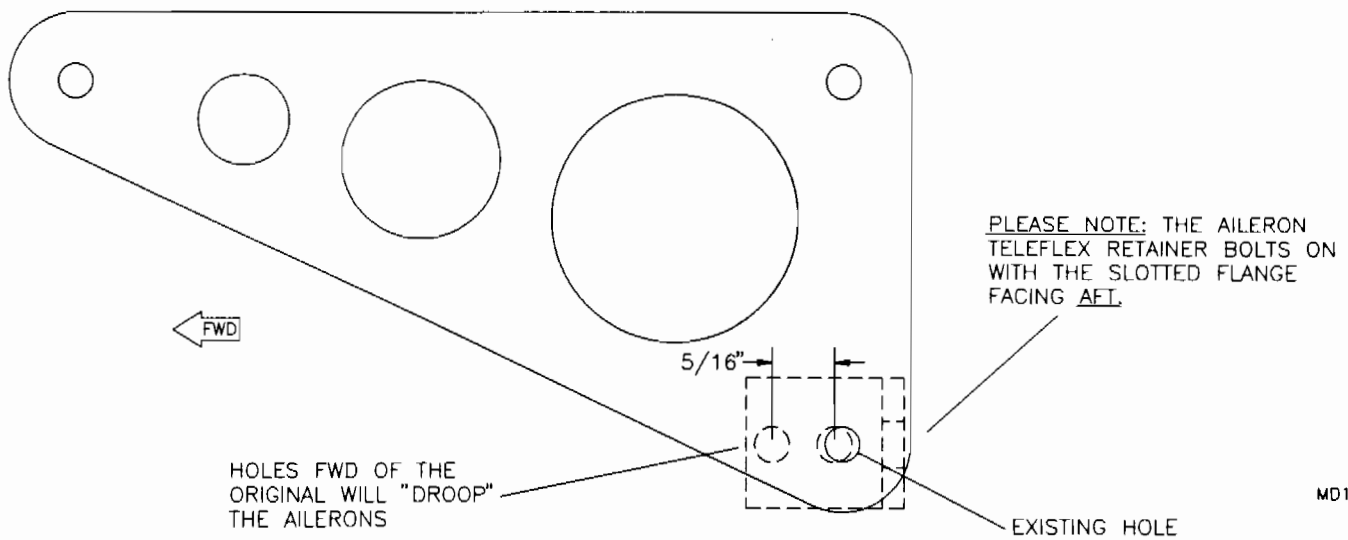
6. Bolt the ailerons to the wing with the hardware shown in the parts drawing. Do not use the cotter key if this is not the final assembly.
7. Bolt the rod end coming from the wing to the outside of the horn.

SETTING UP AND ADJUSTING THE AILERONS

8. Assuming the aileron teleflex retainer has been properly fabricated, installed and the teleflexes are in place, screw the four female rod ends onto the teleflex ends. Bolt the rod ends to the appropriate horns in the control system. **DANGER:** Aileron teleflexes **CROSS** the teleflex coming from the left wing, attaches to the right hand horn on the torque tube and vice versa. **DANGER II:** Be sure to use the PW-3 plastic washers on the outside of the rod end. In event of a rod end bearing failure this washer will not allow disconnection.

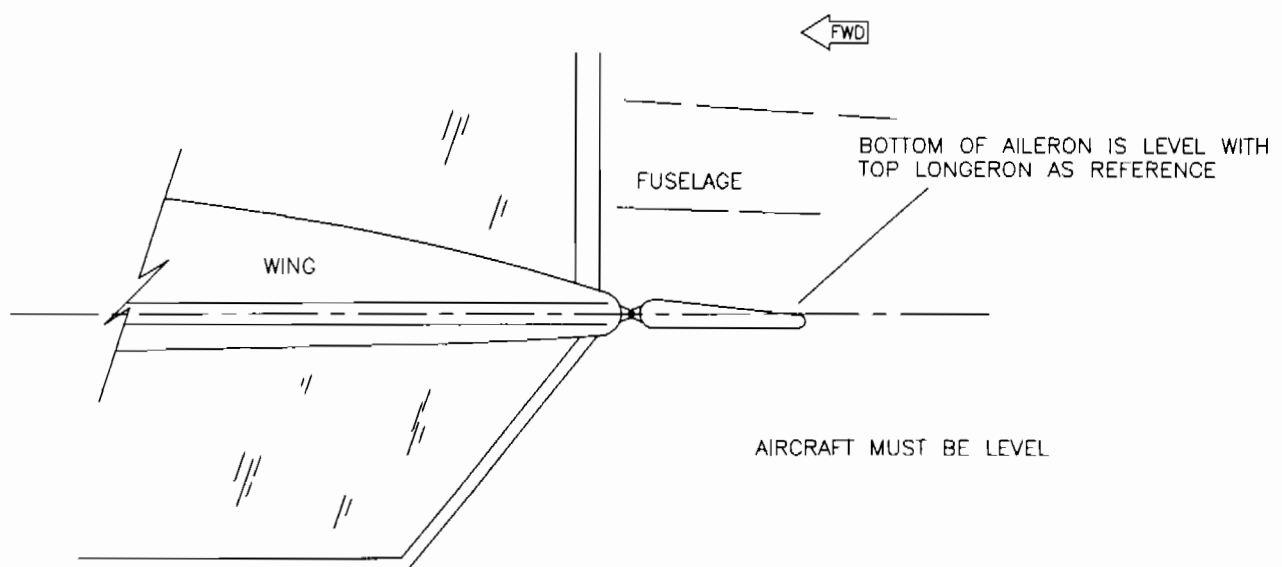
9. Hold the stick centered, each aileron should be neutral. Fly with this setting if the stick is not centered. Adjustments can be made three ways; (1) drill another hole on the mount bracket at the aileron teleflex wing exit, see **Figure 01A-09** or (2) cut off 1/4" of threaded portion of each teleflex rod or (3) screw in or out the rod end.

FIGURE 01A-09



10. The aileron setting we use is illustrated in **Figure 01A-010**. This gives the best roll and cruise without hurting the stall. The tendency is to droop the ailerons too much. This can induce a slower cruise, lower stall and sluggish roll. Experiments can reveal the setting that suits your type of flying.

FIGURE 01A-010

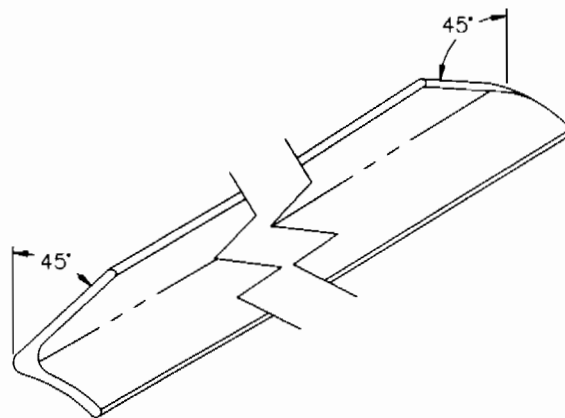


S-9 CHAOS PVC GAP SEAL

The wings should still be on the wing stands. If not, please set the wings on the stands for convenient assembly of the gap seals. The PVC gap seal material can be used in it's natural white color or painted. Use the same paint and primer as used on the fabric. If you plan on painting the gap seals, use small self tapping screws to fit. The screws can be used in place of the rivets for permanent assembly. If you want to use rivets for final assembly, be sure to use a screw smaller in diameter than the rivet.

1. Install the ailerons and the flaps. Locate the control surface to the side of the hinge that allows clearance between them. Use washers as needed to shim the surface side to side.
2. Measure the distance between the hinges. **NOTE:** A handy way to figure required length is to measure center to center of the bolt hole. With the hinge bracket subtract 1 1/4" from the total length between bolt centers.
3. Cut the gap seal to this length with 45° miters on each end. This will open the gap seal so it can be riveted to the spar. See Figure 01A-03.

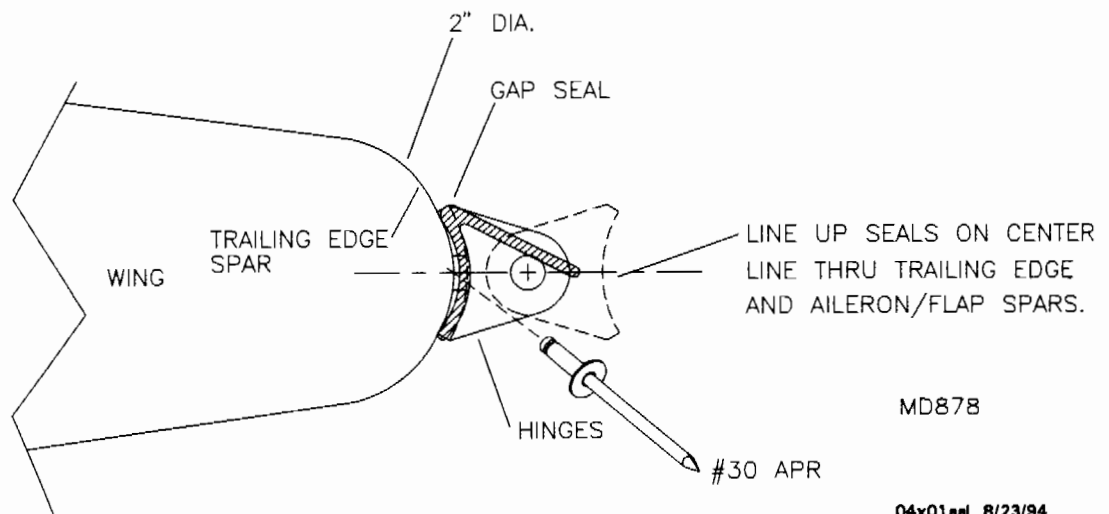
FIGURE 01A-03



MD878

4. Unbolt the control surfaces linkage and let the surface hinge out of the way. Position and pre-cut gap seal centered between hinge points and lined up with the hinge line. See Figure 01A-04. **HINT:** If you have two-way tape apply it to the gap seal and use it to hold it in position.

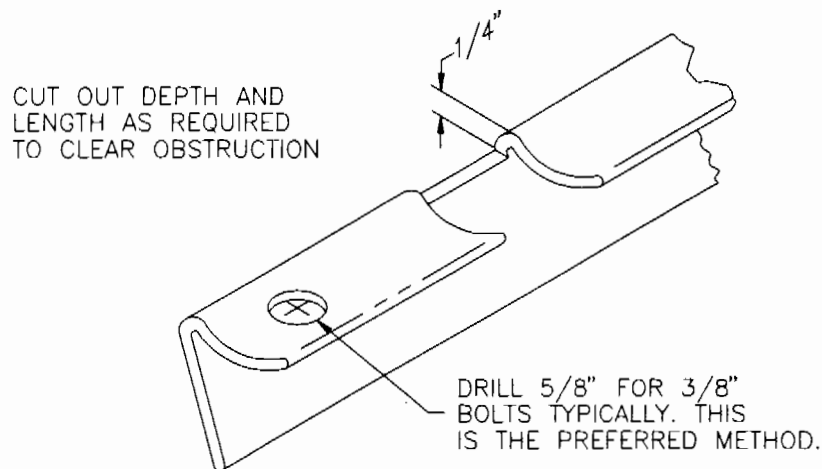
FIGURE 01A-04



MD878

5. Cut away the concave side of the gap seal where the bolt heads prevent installation. Either drill a 5/8" diameter hole where the bolt heads contact or cut out the area. See **Figure 01A-05**.

FIGURE 01A-05



MD1001

6. With the gap seal fitted and taped or held in position, drill each end and center #30, remove any burr's and fasten with #30 aluminum pop rivets.
7. Install the gap seal even in the short segments at the wing root and tip. It will increase performance, which is always worth the hassle.
8. The surfaces must move freely without rubbing the gap seals. Fit the gap seal by filing, sanding or plane until proper clearance is obtained. A miniature wood plane works great to shave off excess material. Do not tighten the hinge bolts. They must turn freely for best feel. Install the castladed nuts and **COTTER PIN** all hinge bolt nuts.

INSPECTION OF THE AIRFOIL LIFT STRUTS

RANS airfoil lift struts are made of extruded aluminum. Extrusions of this nature are sensitive to deformation. Cracks and splits can occur along the length of the strut if the ends are compressed beyond the material limits. Over tightened bolts can cause cracking. A compression bushing or fitting large enough to equal the struts inside diameter should be used. Remove any of the burrs that may be on the ends of the tubing before cutting bushings to fit.

Each and every piece of airfoil strut material is inspected two times before shipment to assure you of a quality product. However, we are not infallible, therefore, we encourage you to inspect the material for any form of deformation and surface imperfection. Deeply grooved struts should not be used and returned to the factory for replacement. The surface should look and feel smooth.

Dents and nicks can occur during shipping. The strut material is very thick skinned and resistant to dents. If dents are present they will usually be large enough to require rejection of the material.

Minor nicks and scratches can and should be sanded out with 250, 350 and then finally 400 grit wet or dry sandpaper. Sanding out such defects is an effective way of restoring the strut to a safe full strength status. Any nicks or scratches that need more than light sanding are cause for rejection.

Once the struts are in service, continued inspection is the only required maintenance action. Anodized strut material is resistant to corrosion and needs little care. However, non-anodized material will corrode in a salt air environment and it should be protected inside and out. External protection can be effected using epoxy paints or other high grade finishes. The inside of the strut can be protected with paint by pouring a quantity of paint inside the tube and rotating to cover the entire surface.

Include strut inspection in your pre-flight check.

S-9 CHAOS AIRFOIL STRUT, WING INSTALLATION & RIGGING

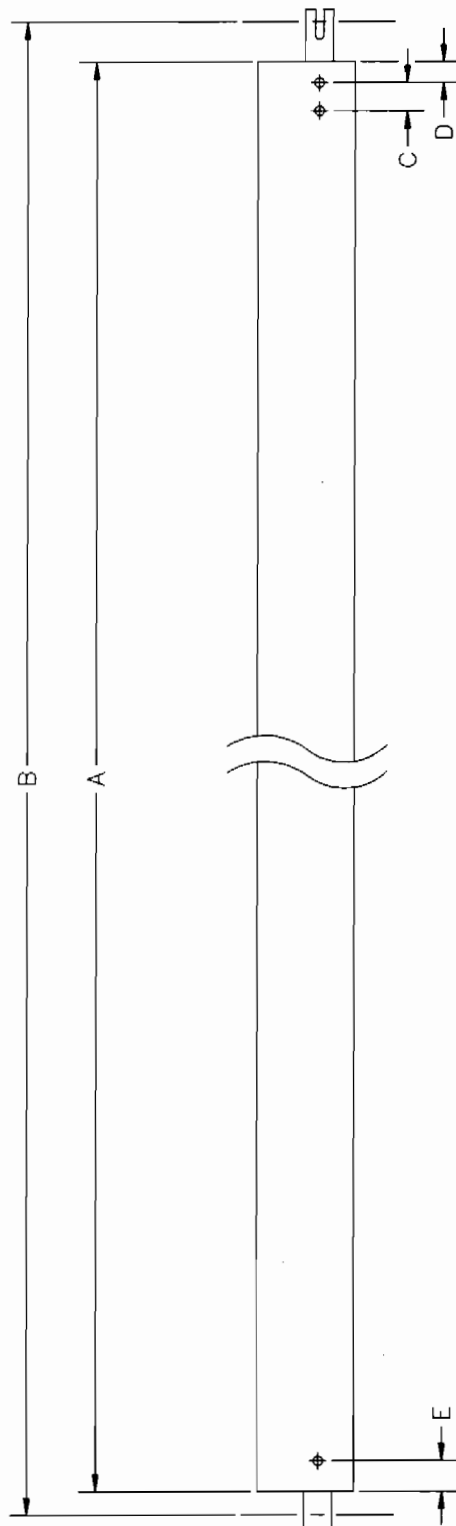
NOTE: First build the tool illustrated in the back of this section. The tool shown allows rigging before or after covering.

The S-9 and S-10 need to be rigged exact, in order to fly straight and fall wings level in stalls. **NO** wash out is used. The high lift airfoil at the tips is the sole means of preventing tip stalls. This method is quite successful and results in no performance loss due to "wash out". However, be careful to assure the wings are rigged zero degrees and not washed in. Make your rigging tools carefully to assure accuracy and check and re-check your work before drilling.

1. Chock the wheels and level the fuselage side to side and nose to tail. Once leveled, pin the wings to the fuselage using the (4) 3/8" diameter clevis pins. Install pins from the inside so the lock rings will be on the outside. The carry through connectors must be ground and fitted to the inside of the spars. Grind or file a little at a time and test fit often. Once spars slip over these "T-Bones" drill 3/8" through the spars. The T-Bone tube will act as a guide. Drill through the front spars forward edge. Pin it with a 3/8" clevis pin, then drill all the way through the aft spar. Now finish drilling the front spar. **IMPORTANT:** Support the tip or hole elongation may occur.

2. Refer to **Figure 01B-02**. Drill the front strut (the large one) as per the diagram. Please note the difference in length between the S-9 and the S-10. Be sure you are making the right type of strut for your model. Struts must be cut to the right length **BEFORE** drilling. Use the templates to locate the holes chordwise on the struts as per **Figure 01B-02A**. The aft struts wing to strut fitting will be used to adjust the wash out. Cut the strut to proper length and drill only the lower end. Due to dimensional variation in extruded material, it may be required to shim the fittings. No gap should exist between the fittings and struts. The struts should not be tightened down with the bolts. If a gap exists this may crack the struts. Use the shim material to make a tight fit. See **Figure 01B-02B**. Shim only as required. Bolt the forward struts in place. This will automatically set the dihedral. Bolt the aft struts in place with the strut to wing fitting inserted loosely inside the end of the strut.

FIGURE 01B-02



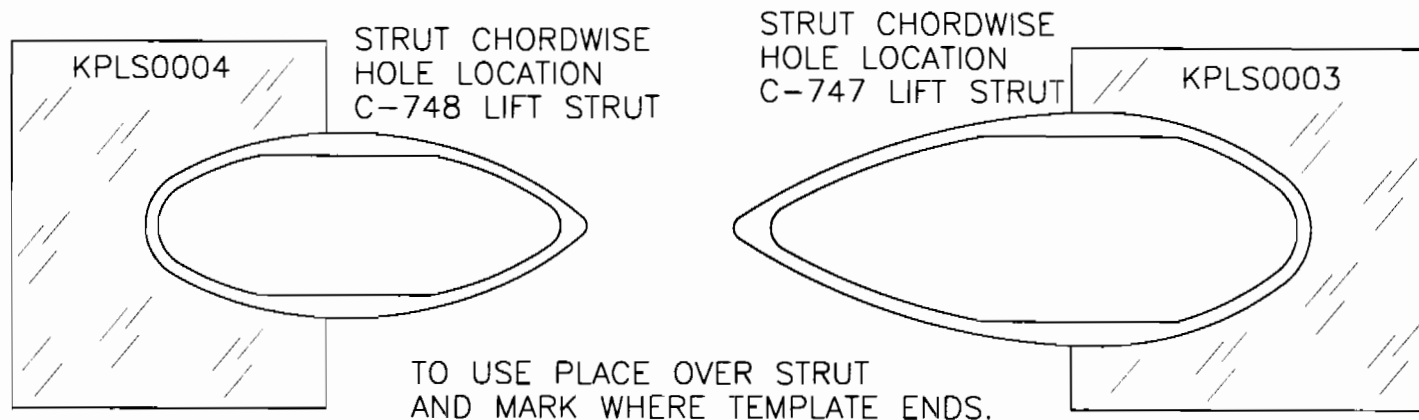
IMPORTANT: PRIOR TO DRILLING THE STRUT CHECK DIMENSION B. THIS MUST BE VARIATIONS OF A, D, AND E MAY BE REQUIRED TO HOLD B.

DIM.	S-9 FWD.	S-9 AFT	S-10 FWD.	S-10 AFT
A**	62 1/8"	62 3/8"	62 1/8"	62 1/4"
B	63 9/16"	LOA*	63 7/16"	LOA*
C	1"	LOA*	1"	LOA*
D**	3/8"	LOA*	1/2"	LOA*
E**	5/8"	5/8"	5/8"	5/8"

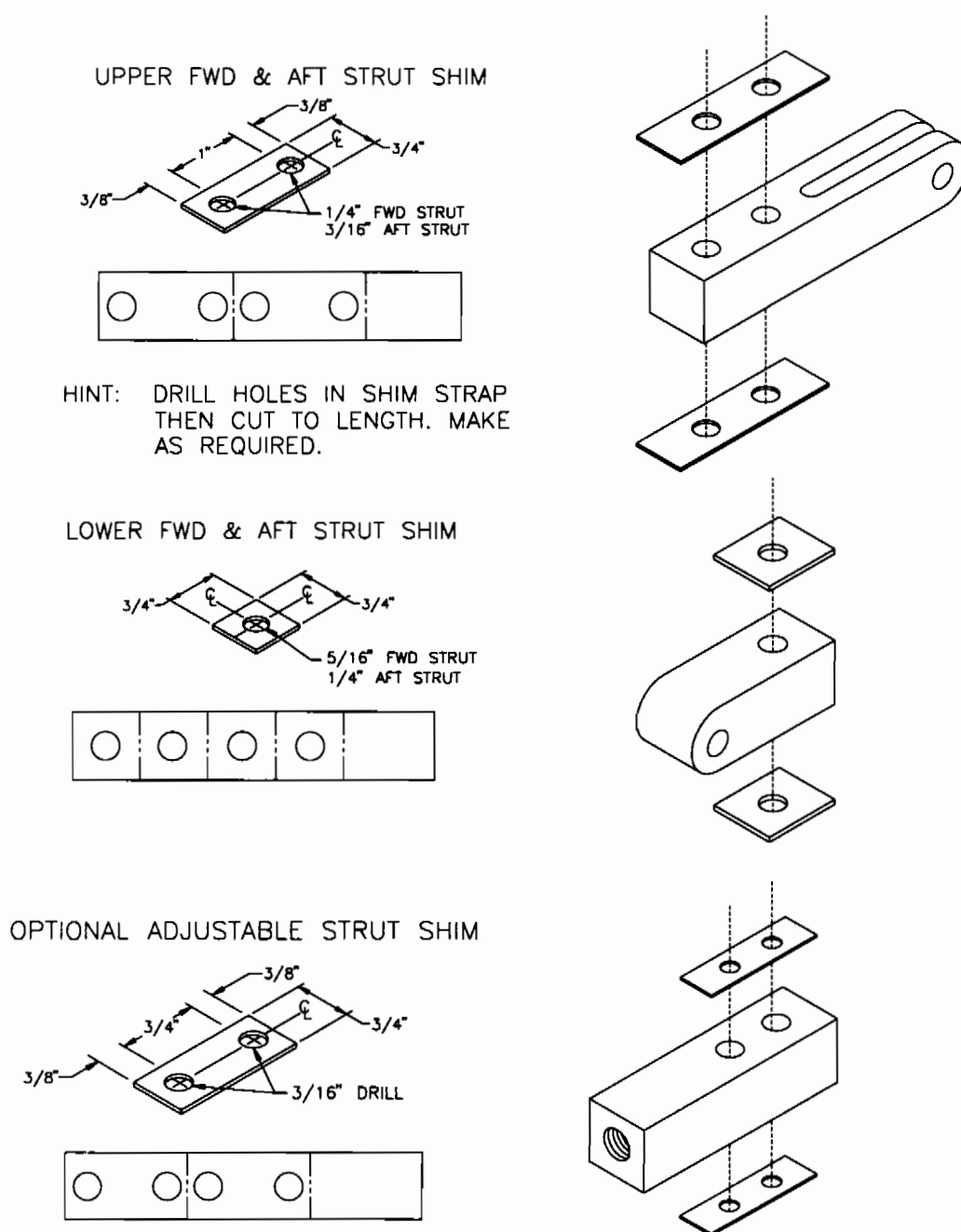
STRUT LENGTH
TOTAL DISTANCE
BETWEEN HOLE
CENTERS

* LOCATE ON ASSEMBLY, REFER TO INSTRUCTIONS FOR PROCEDURE.
** CHECK BEFORE DRILLING, THESE MAY VARY. ALLOW NO E.D. LESS THAN 1/4" FROM EDGE OF HOLE TO THE END OF STRUT.

MD1604

FIGURE 01B-02A

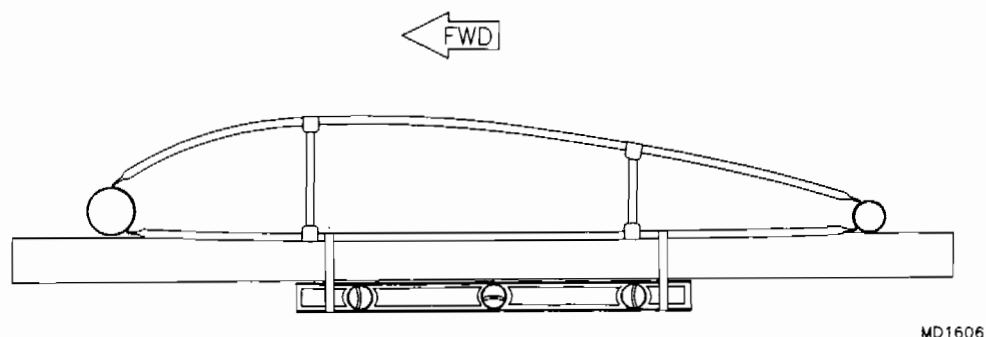
MD1605

FIGURE 01B-02B

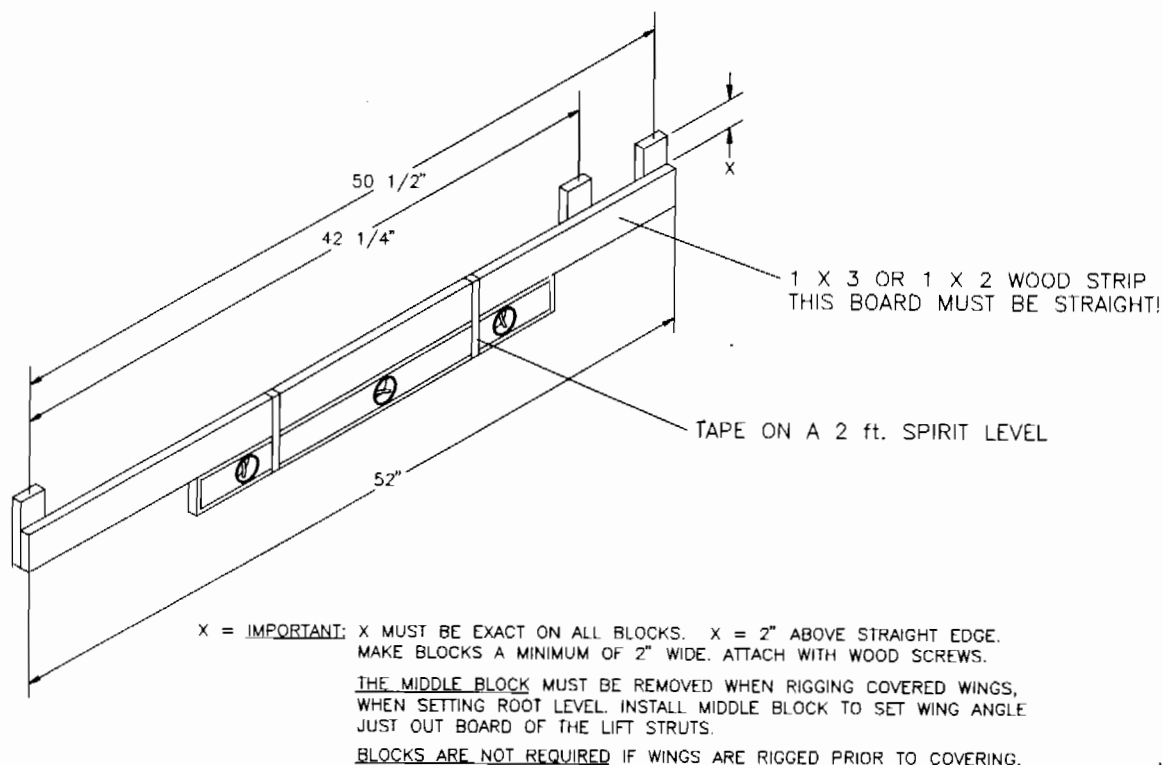
MD1605

3. Re-check for level by placing your rigging device under the RH wing root spar to spar. See **Figure 01B-03**. (A slight lowering of the tail should be required.)

FIGURE 01B-03



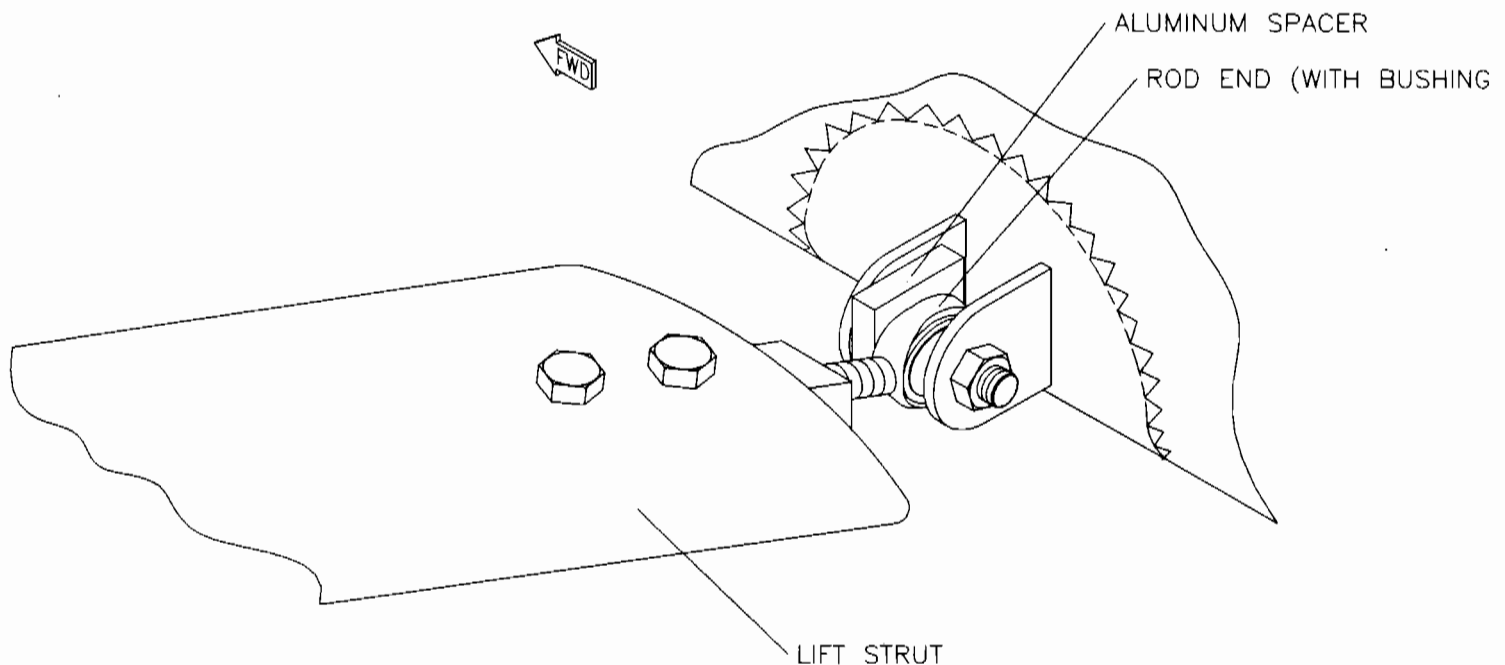
4. Place the rigging device just outboard of the right wing's struts. Move the aft spar up or down as required to obtain a level reading. Use a vice grip type "C" clamp to hold the setting. Mark on the fitting with a pencil* where the end of the strut is. Remove and use the fitting to line up on the mark and the chordwise marks to drill the bolt holes. Drill #11, then assemble and drill 1/4". Check the setting. If you happen to botch it, order a blank fitting from us for a second chance. *Remove the pencil marks afterwards or the graphite will cause corrosion.
5. Go directly to the left wing's outboard strut location and set the wing to level, same as RH side. It is not required and can even result in an improper setting if another level reference is taken from the LH wing root.
6. If everything was done accurately the aircraft will not have any tendency to drop a wing in a stall or not hold heading. If these bad manners are prevalent and it is discovered that the wings are not set at zero degrees, then it's a simple matter of installing and drilling a new aft lift strut connector.



MD1606

S-9 CHAOS ADJUSTABLE LIFT STRUT

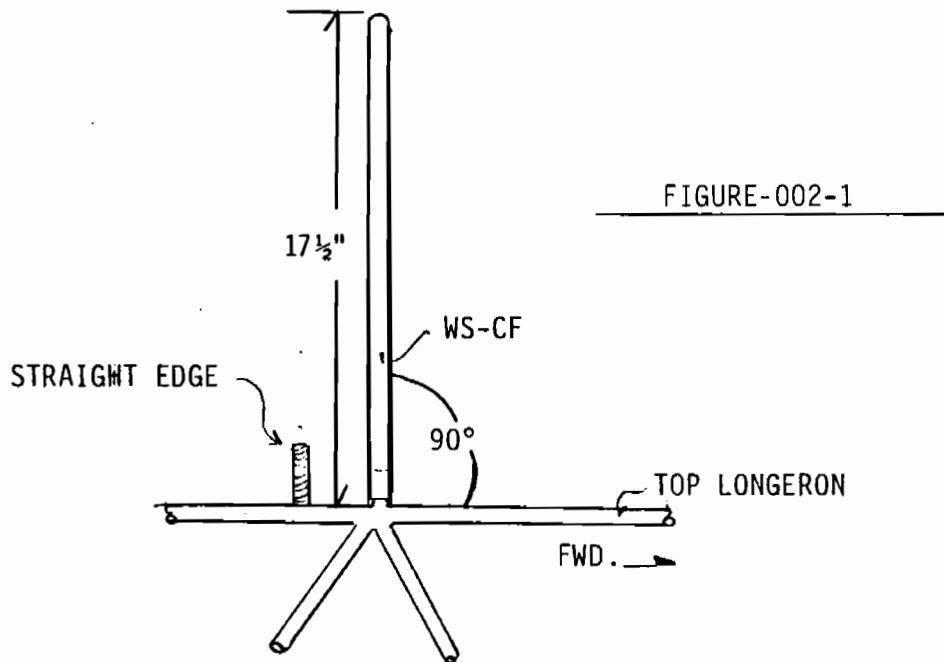
1. Set up the forward strut as per the instruction for the standard struts.
2. On the AFT strut locate the upper lift strut connectors first hole (measurement "D" in **Figure 01B-02**) 1/2" in from the end of the strut. Using the strut connector as a drill guide, drill the second hole and bolt in place.
3. Cut and install the 3/8" X 1/2" bushings in the rod ends. Screw the rod ends into the adjuster end 15 turns.
4. Level the wings as per the manual instructions. Attach the adjuster set up to the plane. Slide the strut onto the adjuster end and bolt the strut to the wing. Recheck for zero wash out. There should be an 1/8" gap between the strut and the strut attach point on the plane, it not cut or sand the end of the strut. **NOTE:** The square spacer may need to be sanded to fit exactly.
5. Measure the depth of the adjuster block from the end of the strut. Disassemble the strut and center the adjuster block on the strut that distance from the end of the strut. Use the block as a drill guide. Reassemble and recheck wash out. Readjust if necessary by turning the rod end in or out.
6. Repeat this process for the other wing.



S-9 TURTLE DECK ASSEMBLY

Refer to Parts Catalog drawing of the fuselage.

1. Insert each WS-CF over the 3/4" diameter stubs welded to the fuselage's topside. Trim if necessary to obtain the required dimension of 17 1/2" between the top of the former and the top of the longeron. Use a straight edge placed across the top longerons to measure from. See Figure 002-1. HINT: Tap formers on the top to get them all the way down. IMPORTANT!!! Check to make sure formers are 90 degrees to the longerons.



2. With formers correctly positioned, drill #30 holes into each end from the INSIDE. Rivet in place with 1/8" aluminum pop rivets. NOTE: If you elect to polish rather than paint the forward WS-CF cleco in place at this time.

3. Rivet formers (F-TDF-A and F-TDF-B) in place with stainless steel pop rivets.

4. Find the top center of the aft WS-CF by measuring as shown in Figure 002-4.

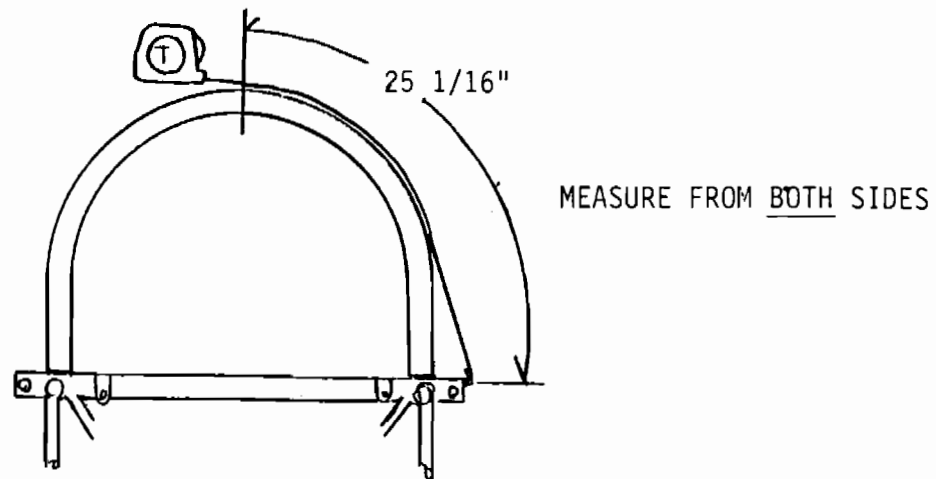


FIGURE 002-4

5. Center punch and drill with a #11 hole on the WS-CF's backside. Rivet with a 3/16" thick washer in place using a 3/16" aluminum pop rivet. See Figure 002-5.

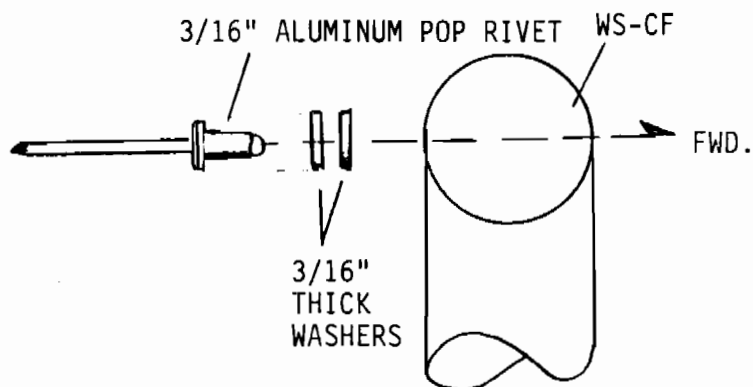


FIGURE 002-5

6. Locate, drill and rivet the (4) other "button" locations on the aft WS-CF as per Figure 002-6.

7. From the 1/2" tube provided, cut a top former 52 3/4". Drill #30 holes in the top former (Part #2) as shown in Figure 002-7.

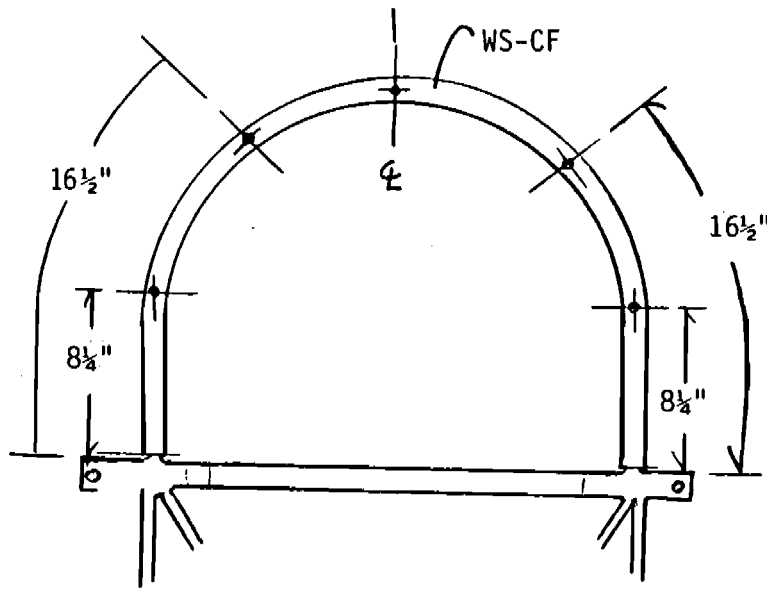


FIGURE 002-6

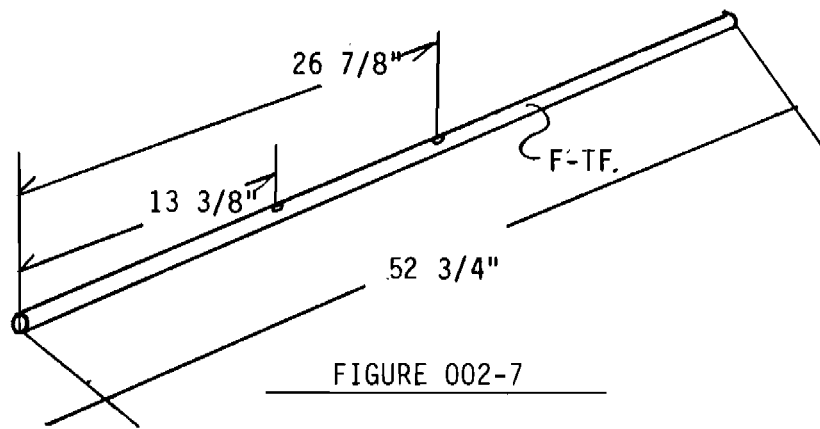
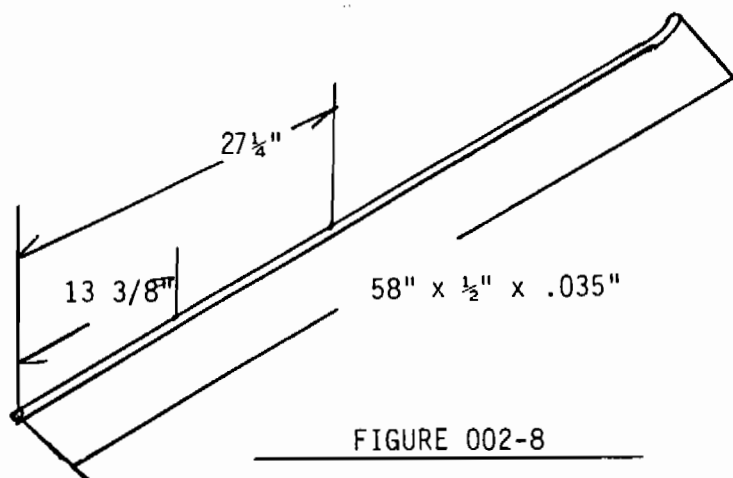
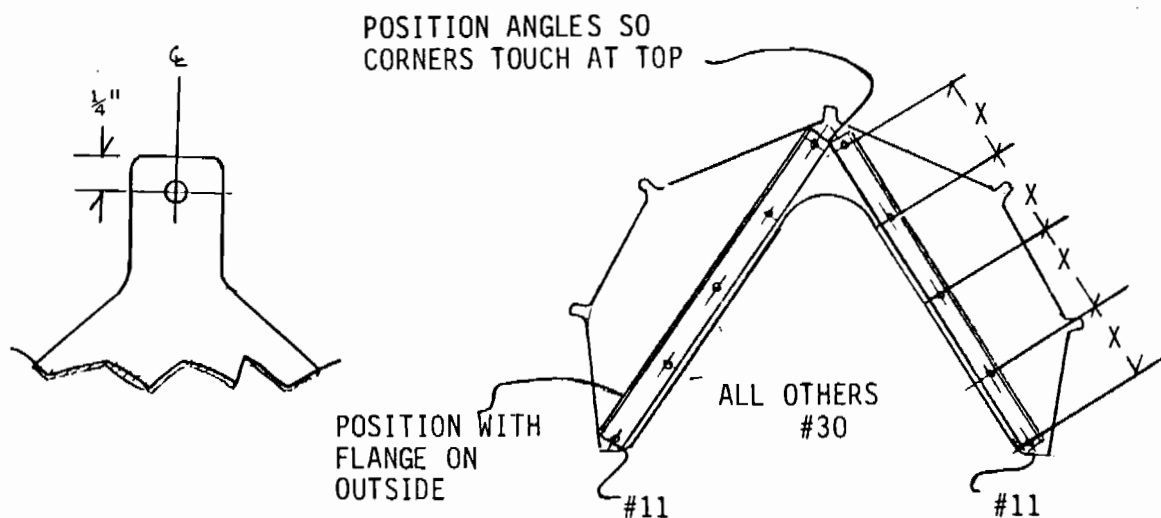


FIGURE 002-7

8. Make the (6) side formers by cutting the 1/2" aluminum tube to 58". Locate and drill #30 holes in (4) of the side formers (F-SF) as shown in Figure 002-8. NOTE: Smash and curl end to clear fabric. See Figure 002-17.



9. Rivet reinforcement angles (F-AA-14, F-AA-18) to turtle deck formers A and B and pre-drill tabs as shown in Figure 002-9. Rivet turtle deck formers A and B in place with 3/16" stainless steel pop rivets to the front side of the tabs.



10. Bend tabs over forward with your fingers. DO NOT USE A PLIERS!! TABS ARE DESIGNED FOR HAND BENDING ONLY!

11. Insert splice tube (Part #6) into top former (Part #2) and vertical fin leading edge. Snap other end onto the button on the backside of the WS-CF. The pre-drilled #30 holes in the top former should face down. Rivet the top former to the turtle deck former tabs with 1/8" rivets.

12. Rivet the other former tubes with 1/8" rivets.

13. Clamp former tubes to the tabs at the tail. Bend and align tubes and tabs as required. Drill through #30 from INSIDE and rivet with 1/8" pop rivets.

NOTE: It may be necessary to tape the former tubes to the canopy former to assure that they stay on their "buttons". Use 3/4" masking tape.

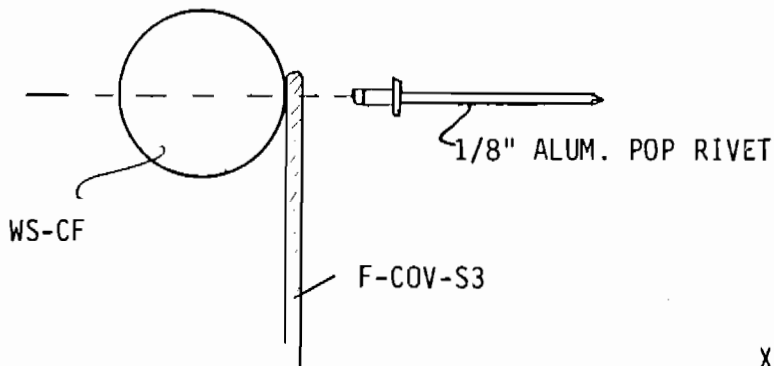
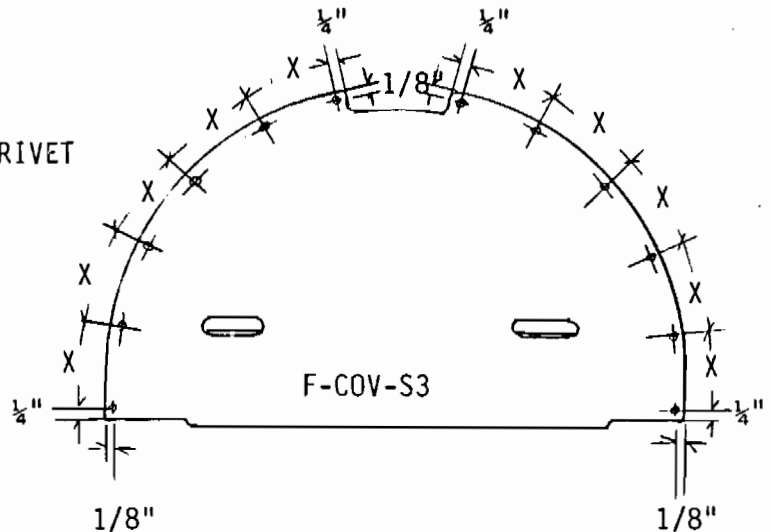


FIGURE 002-14



HINT: USE SELF TAPPING SCREWS IF YOU WANT TO REMOVE FOR INSPECTION

FIGURE 002-15

14. Position the F-COV-S3 (Part #9) on the WS-CF so that it is centered on the airframe. Establish an overlap of approximately 1/8" over tube center. See Figure 002-14.

15. Evenly space and drill for (6) rivets per side of the F-COV-S3. Cleco or rivet in place as per Figure 002-15.

16. This completes the turtle deck assembly for now. The F-COV-S3 will be removed for covering the fuselage and be re-installed during final assembly. After that time, trim lock (Part #15) will be applied.

17. Crimp the uncurled end of each of the (2) remaining F-SF tubes. One end should be curled as the other F-SF in step #8. See Figure 002-17. The other end should slip OVER the tab welded midway on the S3 uprights. Rivet with the bend inward to each rear tab. The tubes are riveted to only the rear tabs with 1/8" aluminum pop rivets.

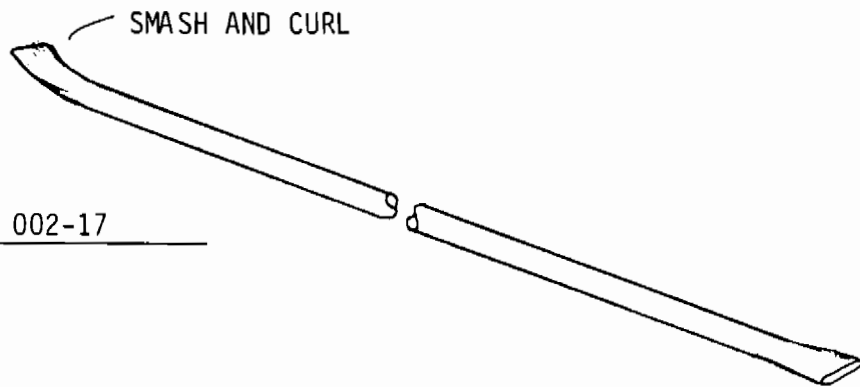


FIGURE 002-17

S-9 LOW BACK ASSEMBLY/SPEC

1. Cut 1/2" x .035 tube into stringers, (1) - 51 3/8" long and (4) - 56" long.
2. Mark and drill one (1) #30 hole in each tab prior to bending on ALL three (3) formers, F-S3FA, F-FB, F-FC as shown below.

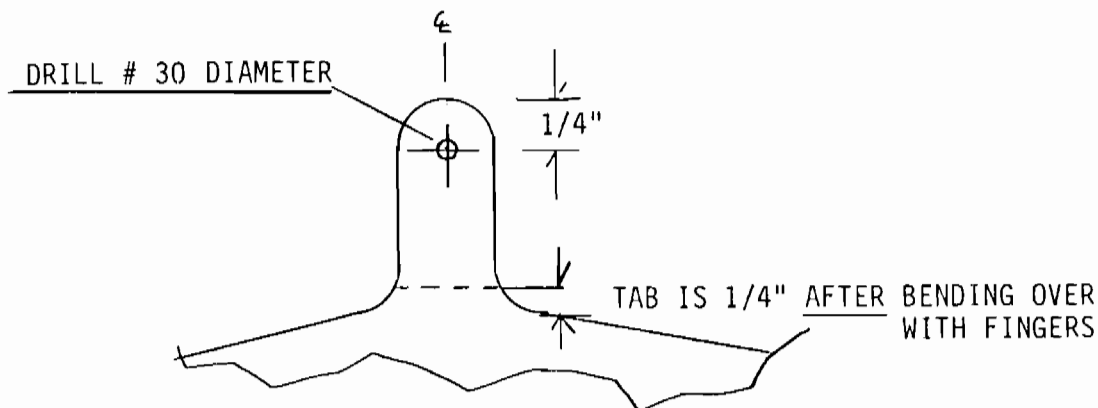
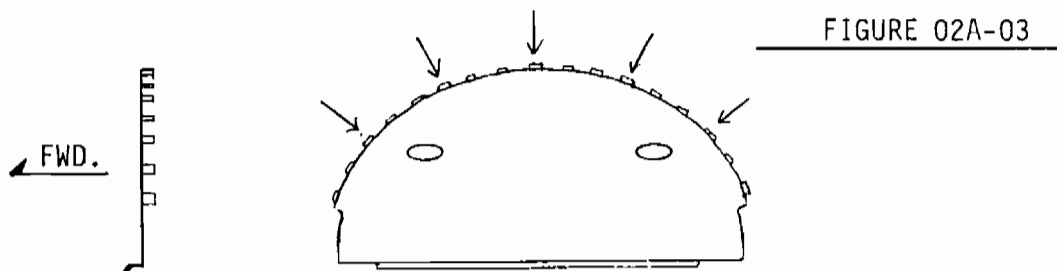


FIGURE 02A-02

3. Using your fingers bend the tabs over center line AWAY from flange (see below). DO NOT use a pliers to bend tabs. Tabs are designed so 1/4" sticks up after bending. See Figure 02A-02. Drill and rivet on cap strip (F-S3-WRAP) to F-S3FA using #30 aluminum pop rivets. Drill through but DO NOT rivet where stringers will be attached. See below.



IMPORTANT!!!! If your fuselage is primed or painted, use rivets as called for. Otherwise use temporary fasteners (clecos).

4. Temporarily install the canopy former to the S-3 stubs and position F-S3FA on center with the flange resting on the top carry through facing forward. Rivet with two (2) $\frac{3}{16}$ " stainless steel pop rivets as shown below. Figure 02A-04.

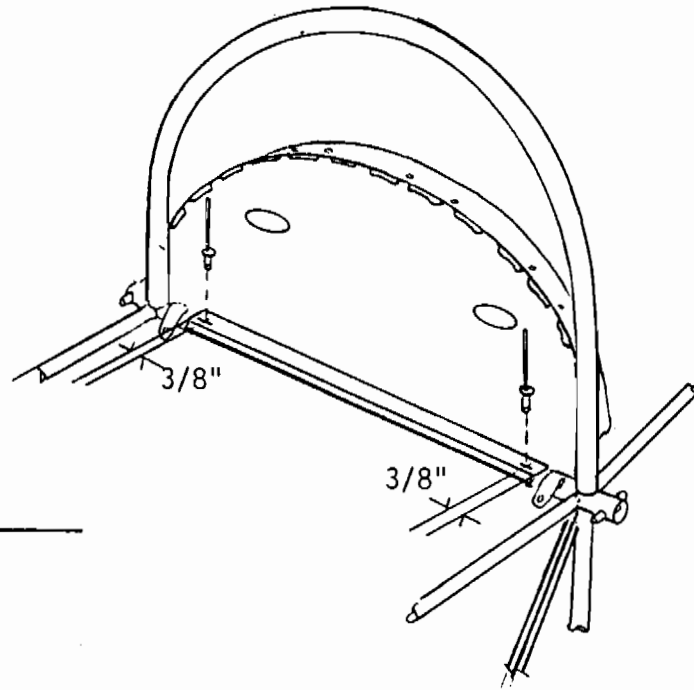


FIGURE 02A-04

5. Drill #30 holes in top stringer as shown in Figure 02A-05. Insert splice tube into the open lower end of the vertical stabilizers leading edge. NOTE: Oval the splice tube to eliminate up and down slop insert with oval vertical. Fabricate a stringer $51 \frac{3}{8}$ " x $\frac{1}{2}$ " x .035, Figure 02A-05. Slip stringer into the splice tube and slip it under the F-S3FA's center tab and over the center tabs of former B and C. HINT: File the stringers to fit the F-S3FA tabs inside radius. See Figure 02A-05.

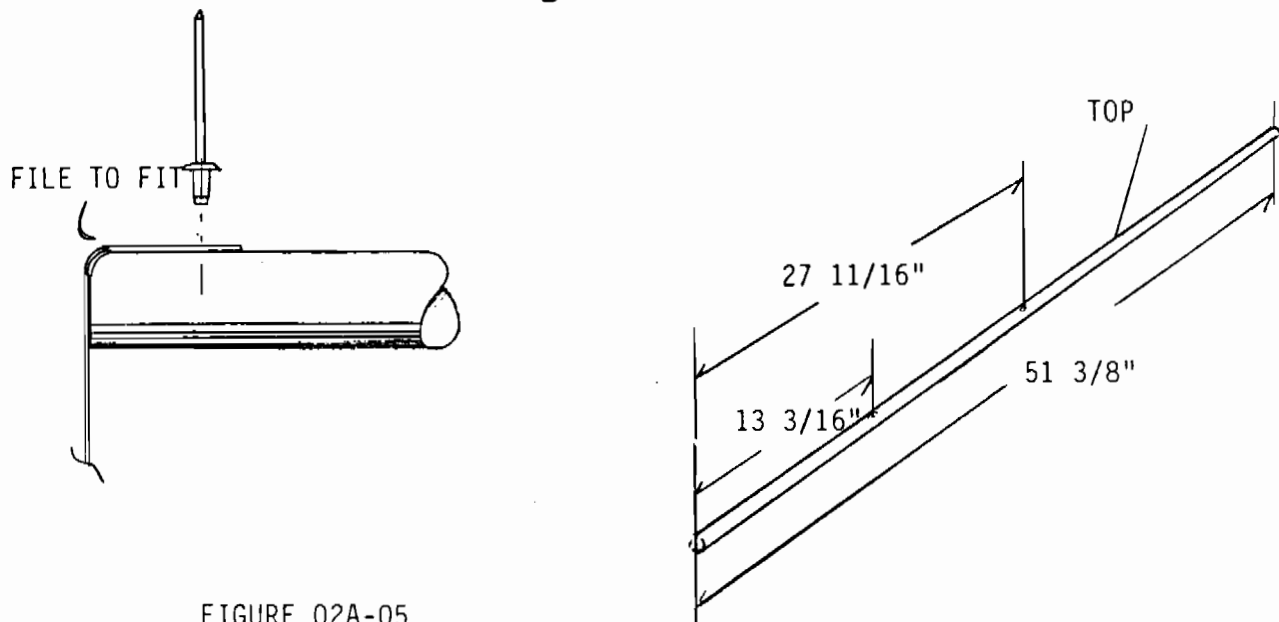


FIGURE 02A-05

6. Cut, drill and end radius the other stringers as shown.

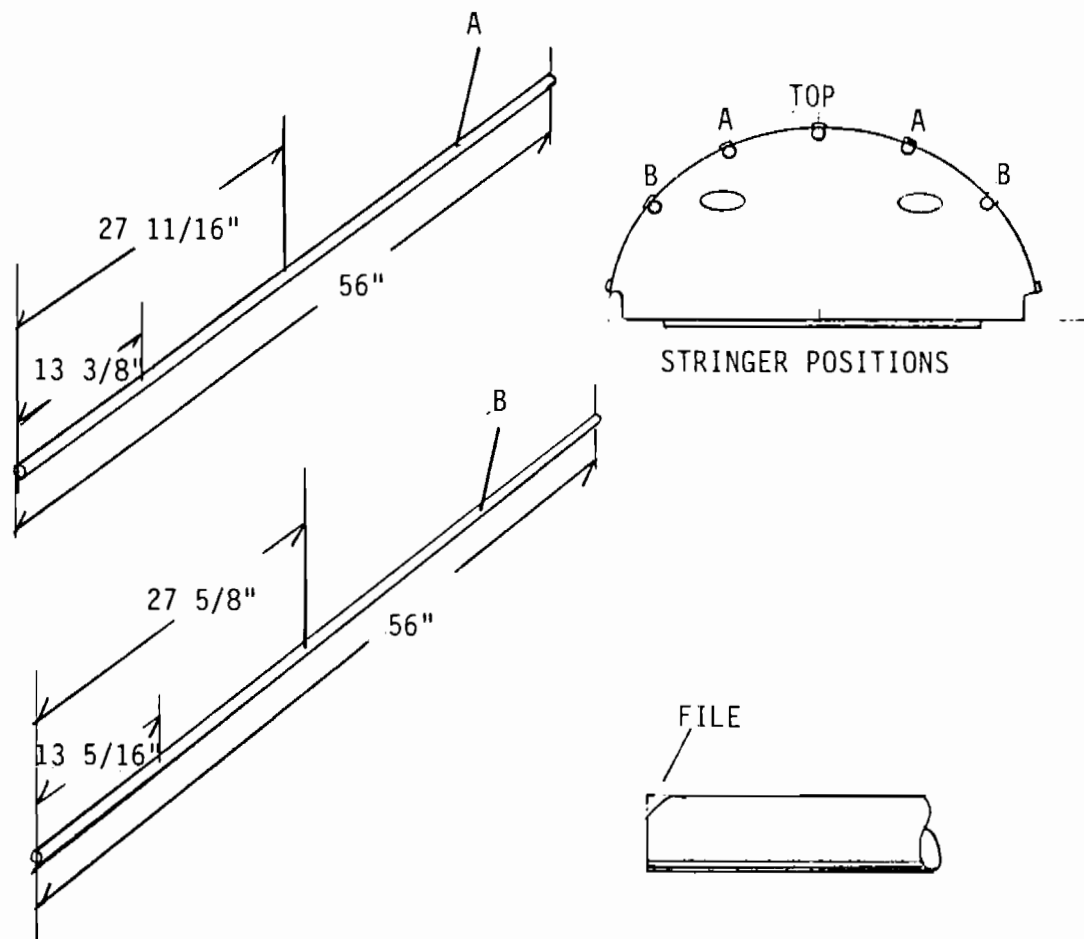


FIGURE 02A-06

IMPORTANT!!! All formers must be on center line. Check prior to riveting or "crooked" stringers may result.

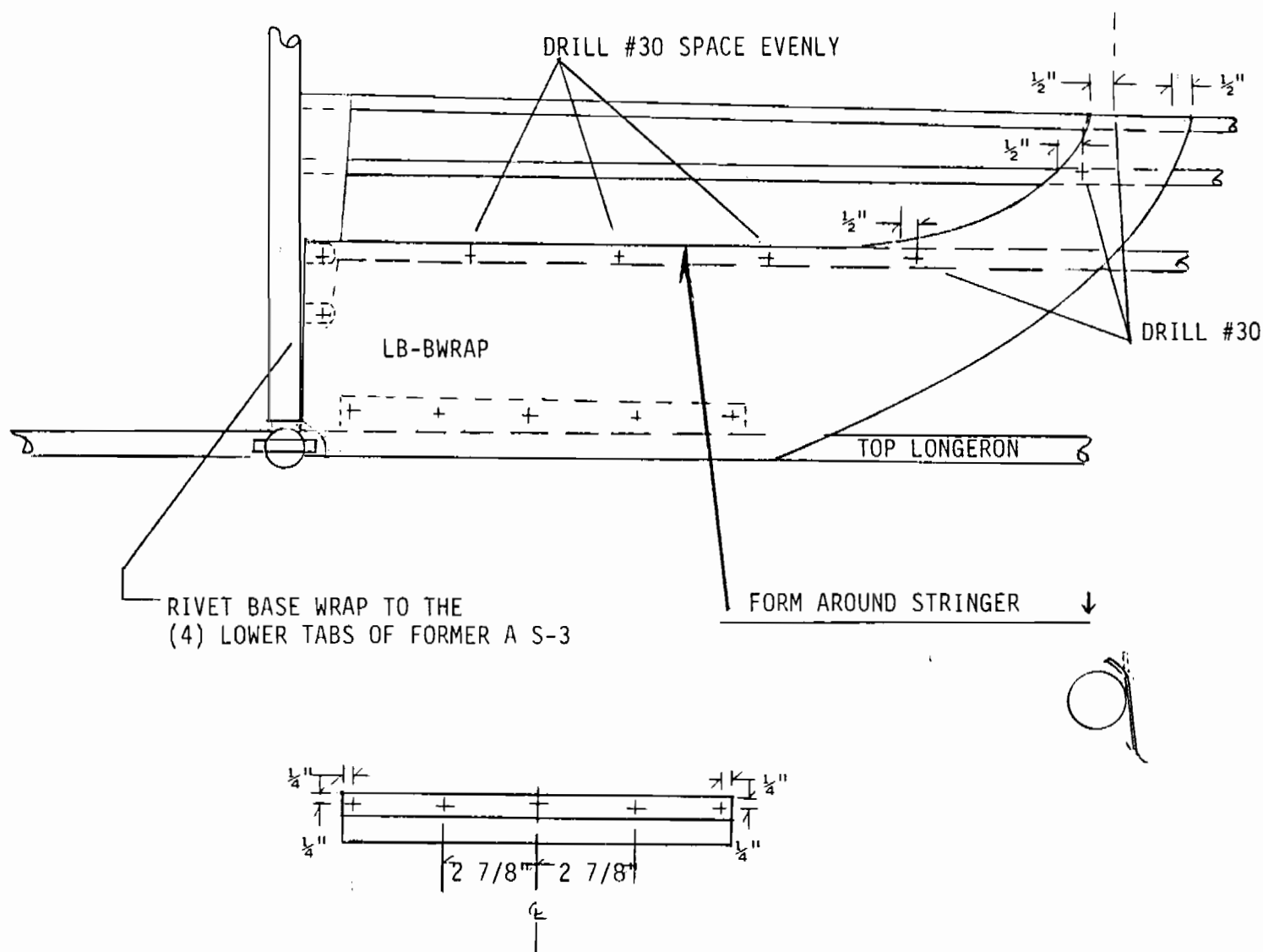
7. Rivet the formers B and C in place using 3/16" stainless steel pop rivets. Position so tabs face forward.

8. Rivet the stringers in place on top of B and C formers and under the F-S3FA. Be sure the S3-WRAP, tab and stringer are flat against one another before riveting. DO NOT rivet the four lower tabs on the F-S3FA until step 10.

9. Center the A and B stringers on the welded on tabs at the tail and drill and rivet from underneath.

10. Position and rivet each base wrap as shown in Figure 02A-10. HINT: To help base wrap conform, bend over stringer as shown. Match up overlaps and trim to same contour. Rivet both base wraps in the center with a single rivet.

FIGURE 02A-10



11. Clamp the rear window in place centered on the canopy former. NOTE: Window must land about midway on the base wrap and over half way on the former. See windshield, page 13-3, Figure 013-04. From the top center of the rear window locate a #30 hole every 3" along the canopy former. Drill and cleco. Make sure the canopy former is 90 degrees to the top longeron. See Figure 02A-11. DO NOT rivet the rear window in place. See step 013B-2.

HINT: If the canopy former is not 90 degrees, brace with a board placed between the main spar carry through and the top of the canopy former.

12. Lay out, drill and install the seal strip as shown in Figure 02A-12. Again trim to match at center overlap.

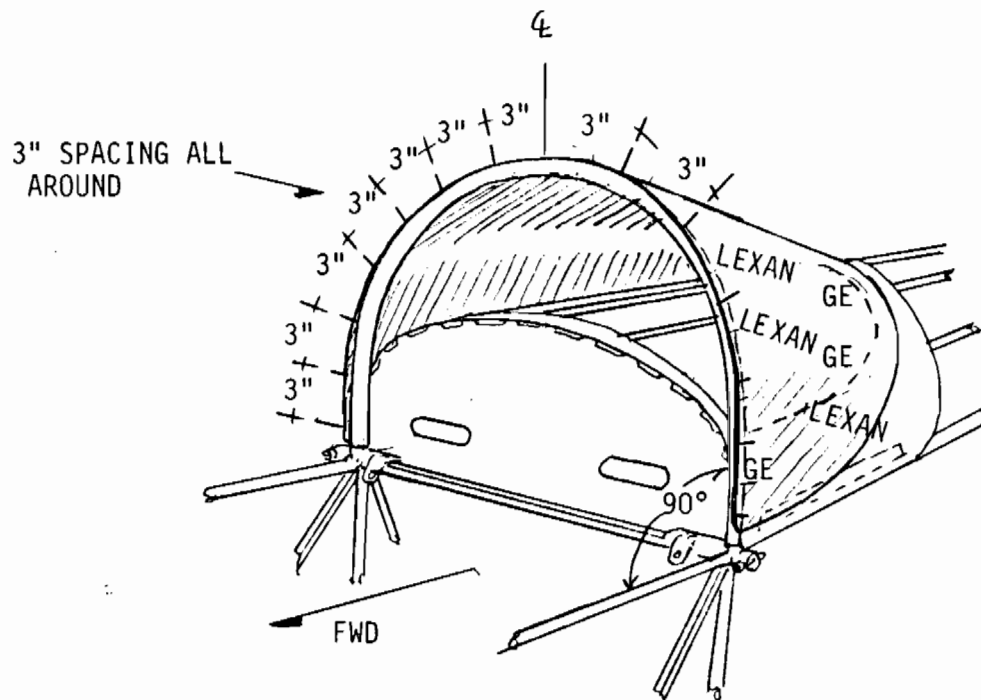


FIGURE 02A-11

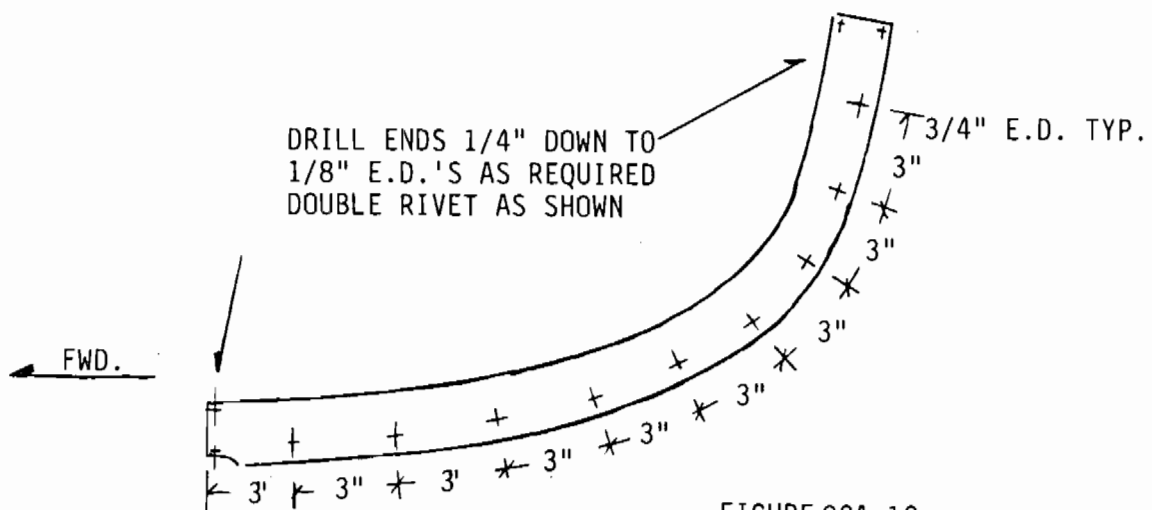
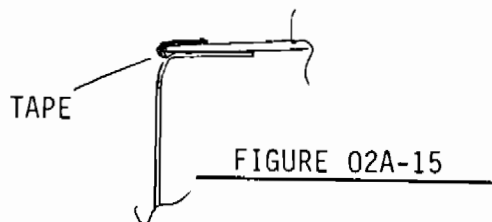


FIGURE 02A-12

13. If the seal strip does not fit tight with no gaps against the rear window, roll the edge just enough for a tight fit. To do this it's best to cut a wood scrap 1/8" to 1/4" under size of the parts contour along the edge to be rolled. Remember to flip the wood block to make them opposites!!

14. Leave base wrap riveted to stringer and cover fabric OVER the base wrap. During final assembly seal the edges of the window and seal strip with silicon caulk.

15. To finish the low back assembly, masking tape the WRAPS edges as shown in Figure 02A-15 to prevent chafing the fabric.

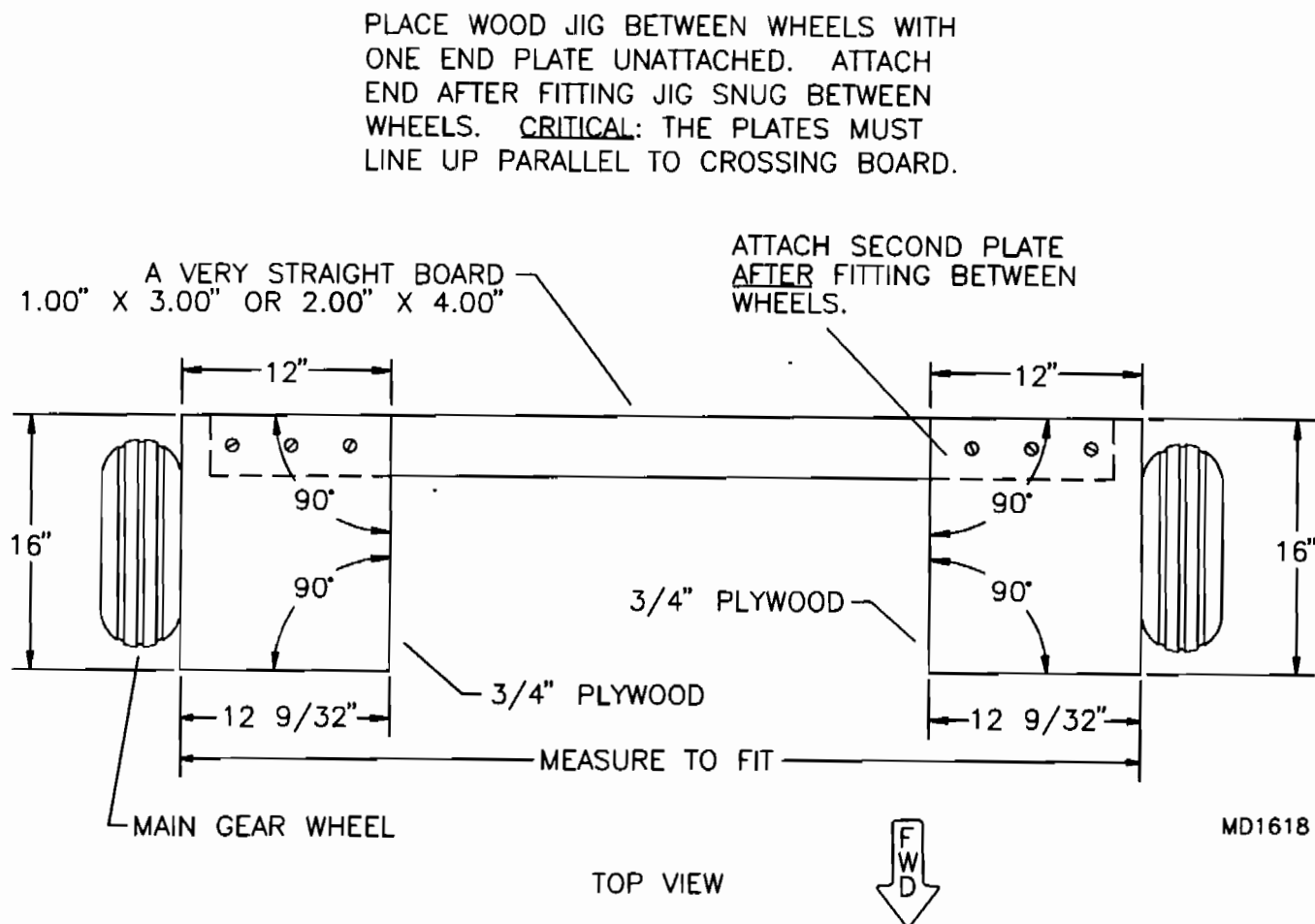


S-9 CHAOS MAIN GEAR ASSEMBLY

NOTE: It is recommended that the landing gear be assembled prior to any additional assembly or covering.

1. Using the parts drawing and parts list, collect the required components for main gear assembly.
2. Observe the gear legs closely. You will notice a slight curve to the tubes. The tubes must be placed so that they bow upwards. To mark the tubes for proper orientation, lay on a flat surface and affix a strip of masking tape to the curved out side. At this time, mark one LH (Left Hand) and one RH (Right Hand) to prevent later confusion.
3. With the fuselage cage upside down, insert the gear legs into each socket (with the curves toward the airplane's top). Measure each gear leg. If the tubes are completely inserted, the measurements should be equal. Mark each leg from both sides using the pre-drilled holes in the sockets for a guide. Remove the gear leg and drill from each side. Bolt the gear leg into the socket. **NOTE:** During final assembly apply clear silicon to the inserted portion of the gear leg. **HINT:** A coat of wax applied to the gear leg will allow easier removal of a damaged gear leg if the need arises.
4. Good design practice states that a taildragger should have a slight amount of **TOE IN**. However, actual experience has shown that 1° of toe out is best. Do so by building the plywood jig as shown in **Figure 03-04**, and aligning the gear with the jig. **PLEASE NOTE:** When installing the axle sockets and setting the toe out, measure from a common point on the fuselage to a common point on the axle sockets. Both right and left hand sockets must be the same distance from the fuselage. This completes the main gear assembly. For wheel and brake assembly turn to **BRAKES**.

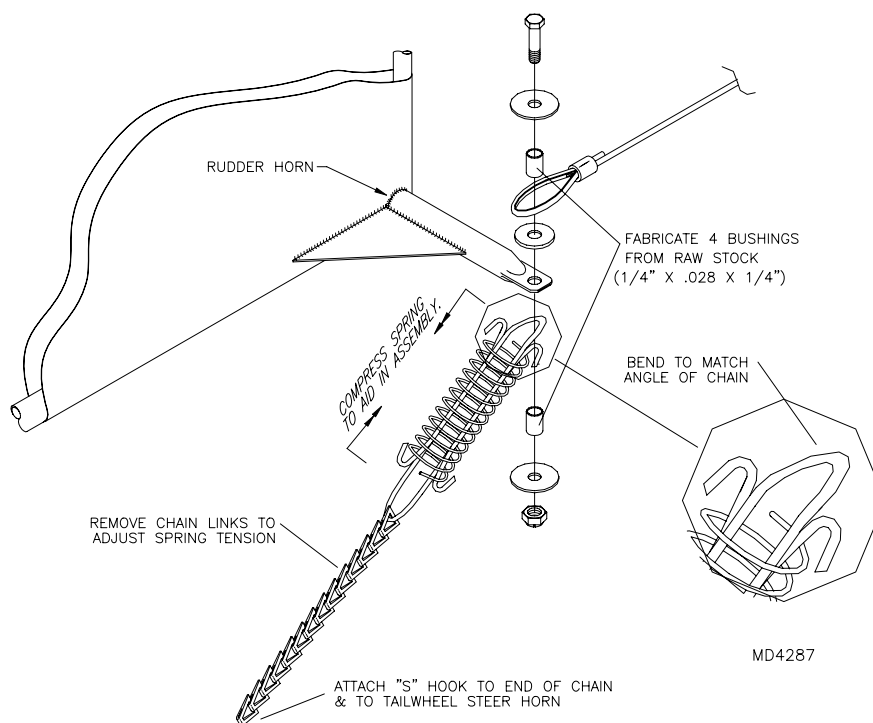
FIGURE 03-04



S-9 CHAOS TAILWHEEL ASSEMBLY

1. Select the parts depicted in the parts drawing.
2. Assemble the Tailwheel components as shown in the parts drawing. **IMPORTANT:** Space centerline of Tailwheel even with centerline of Fork pivot tube. Use 5/8" Washers as shims.
3. Line up Steer Horn parallel to Fork axle, drill through #11, and bolt. **NOTE:** Trimming off the top of the Fork pivot tube may be required. Trim flush with top of Steer Horn. Break off 2 adjacent tabs on the 7/8" End Cap to allow clearance with the Steer Horn bolt. The Tail Spring may need grinding to allow it to slip into the Swivel Stub groove. Use Loctite to retain Grease Fitting.
4. After the Tailwheel is assembled to the aircraft, check it for proper steerage and alignment. The Return Springs should be connected with approximately 4 chain links per side (depending on the tension desired and link size) and move with Rudder inputs. Bend the end of the Return Spring to help align with the Steer Horn. Refer to **FIGURE 03A-04**. The Return Springs should be about half their resting length when installed. In addition, the Wheel should line up with the Rudder both from the top and vertically. Any lean will cause a slight tendency to drift into the lean during taxi. Correct this by removing the Tail Spring and Swivel Stub and twisting it into proper alignment in a vise. Use a large adjustable wrench set to the Tail Spring thickness as a lever.

FIGURE 03A-04

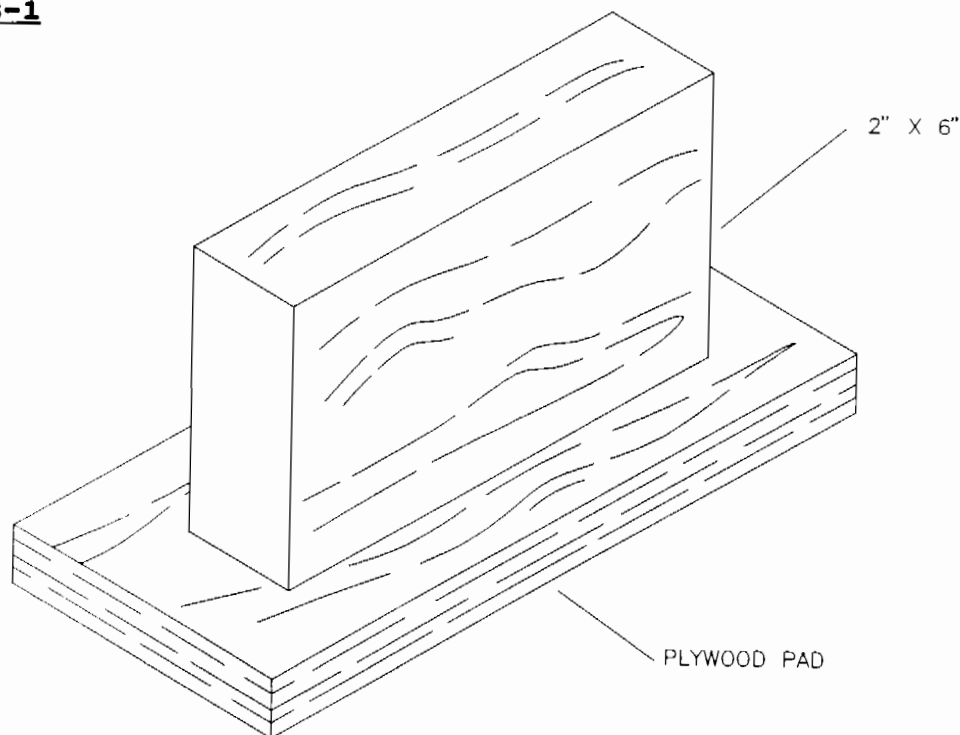


5. Keep the Fork well greased. Any common grease gun and grease will suffice. Work the Tailwheel side to side to allow the lubrication to spread.
6. After an hour of flight operations it may be required to re-torque the Tail Spring mounting bolts to 15 to 20 ft/lbs. **CAUTION:** Be sure this assembly uses **1/4" Tensile Nuts**.

S-9 CHAOS DRUM BRAKE INSTALLATION

NOTE: A scrap of 2" X 6" nailed to a small square of plywood makes a good gear rest. See **Figure 03B-1**.

FIGURE 03B-1



MD1028

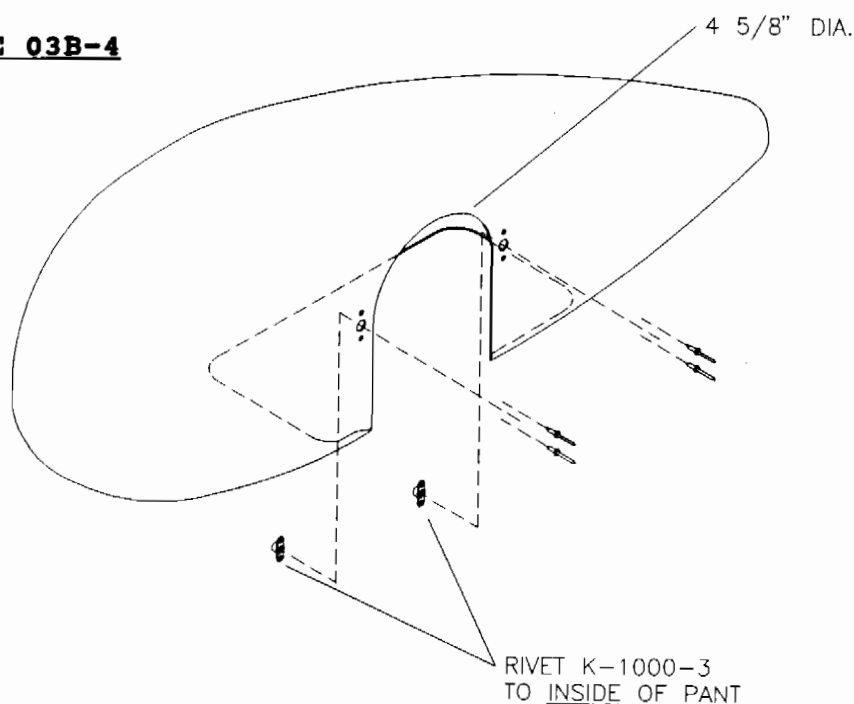
1. Deflate both the main gear tires and remove the existing wheel bolts. Save the nuts. Using the 2 1/2" X 5/16" bolts provided, bolt the drums to each wheel using the spacers and shoulder bolts.
2. Bolt each respective brake assembly to the tabs welded to the gear pylons. **NOTE:** Brake units should have actuator arm and cable stop facing AFT. Slip the valve stem through the hole, then while pulling on the cap end push on the large end. **For Wheel Assembly:** We recommend using a 1/4" allen wrench and pushing it down the center of the valve. A small amount of silicone sealer may be used around the sealing neck of the stem to insure against leakage, since the valve stem is a permanent installation and never needs to be removed. To install the tire on the rim, sandwich the tire between the two rim halves, with the tubeless kit between the halves. From the back side of the wheel, install 3 of the 5/16" allens provided in alternate holes to hold the rim halves together. **WARNING:** Do not use the gold washers under the heads of these 3 allens. The washers are to be used on the outside of the wheel **UNDER THE NUTS ONLY**. Otherwise, the wheel will not seat properly and damage will result. Tighten the nuts with the wheel secured on one side of the wheel hubs. This will center the rims and align the bolts. Assemble the nose wheels, main wheels, tires and drums to the wheels. Look closely at the main wheel hubs, there is a small machined edge where the drum will rest against. Install the valve stems to three of the wheel halves. Mount the drums to the hubs with the tire in place. Inflate the tires to the recommended

pressure of 30 PSI. **CAUTION:** Make sure all bolts are secure before inflating the tires.

3. Slide the wheel (drum first) followed by a 3/4" X 2 1/8" aluminum spacer. Test spin the wheel to check for alignment between the brake and the drum. If the wheel does not turn freely it may be required to oversize or slot the mounting holes as needed.

4. Trim out each wheel pant as per the markings on **Figure 03B-4**. Test fit as you go. Once the pants fit as desired, drill through the tabs welded to the brake to locate the inside mount holes. Rivet the K-1000-3 nut plates to the inside of each wheel pant.

FIGURE 03B-4

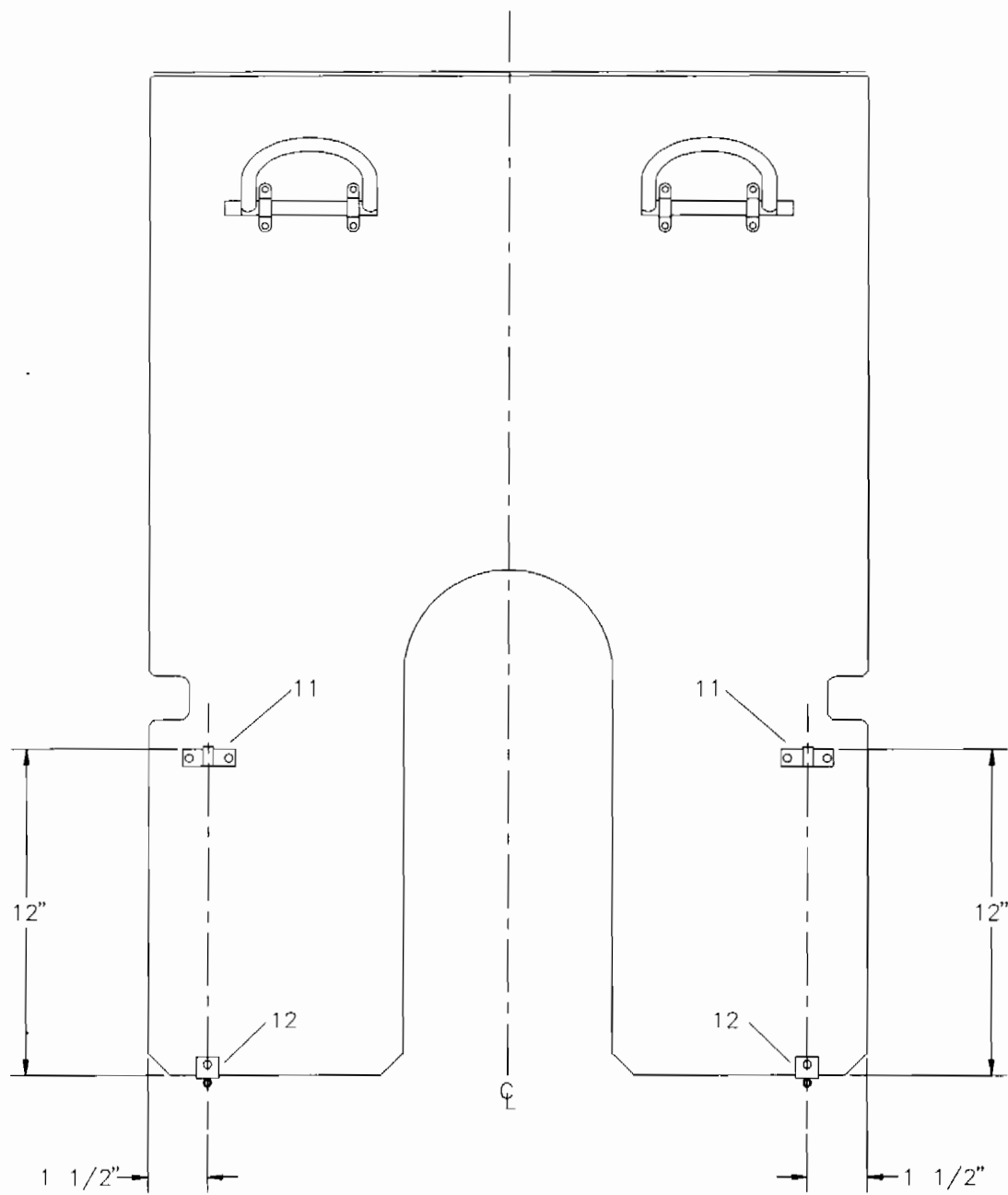


MD1029

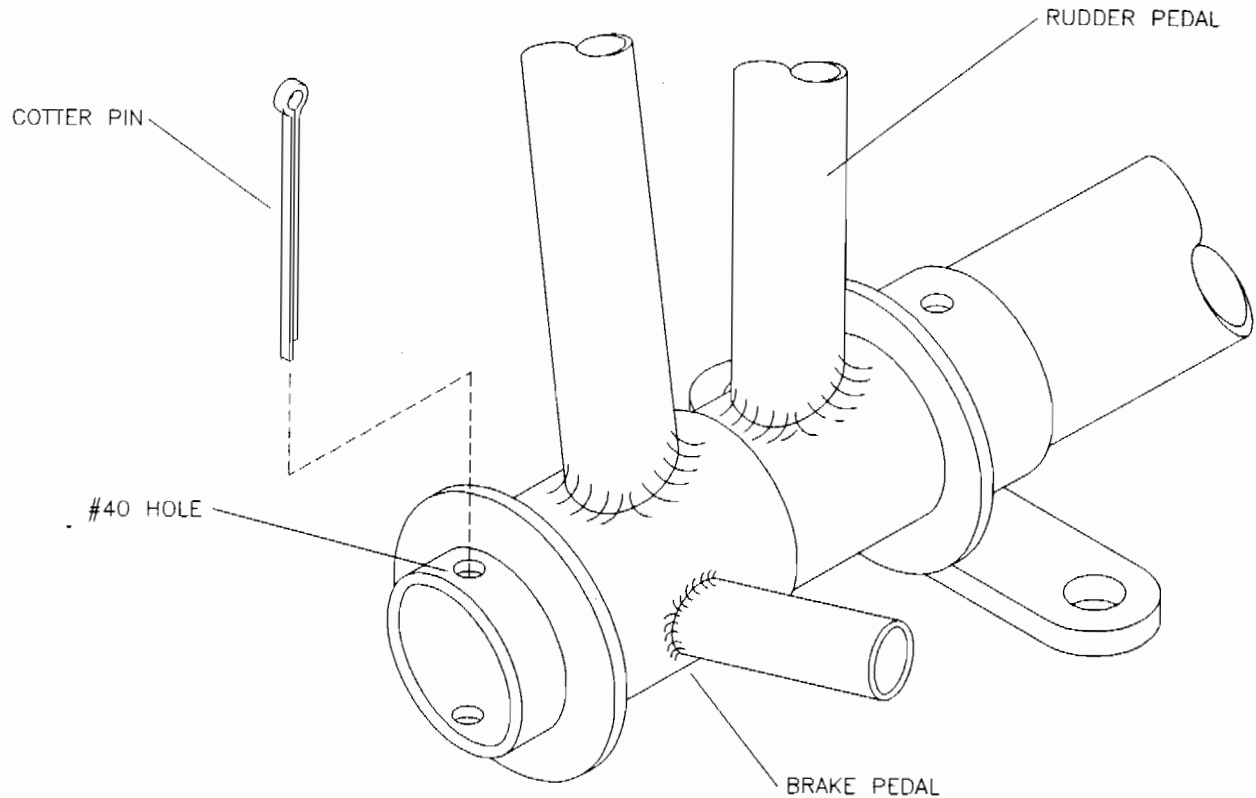
5. Locate items 11 and 12 on the floorboard as per **Figure 03B-5**.

HINT: Use an awl or ice pick to make a starter hole for the screws. The conduit guide will protrude through the bottom skin, on a covered aircraft use the inspection hole cut outs to make a glue on patch.

6. Lubricate the brake pedal with grease and slip the 1/2" washer and pedal over the pivot tube extension on the rudder pedal. Drill a #40 hole through the extension tube for the cotter key as per **Figure 03B-6**.

FIGURE 03B-5

MD1031

FIGURE 03B-6

MD1032

7. Bolt the brake cable and return bungee to each pedal as shown in the parts drawing.

8. Thread the cable and housing through the appropriate fittings and connect to the brake arms. Adjust the brakes so the pedals lean back slightly. Use the wood stand to jack up the gear to check for free spin and even braking between left and right sides. Further adjustment may be required after initial taxing.

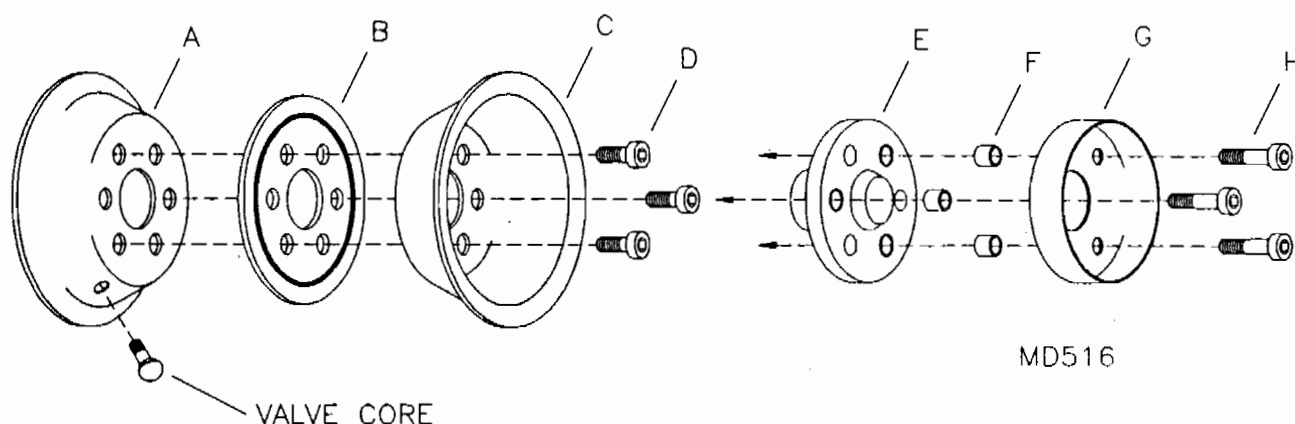
HEGAR WHEEL/BRAKE ASSEMBLY

Assembly of the wheel is as follows:

- 1) Obtain parts depicted in drawing
- 2) Position rubber "O" ring into machined groove. (Part B)
Be sure to place rings on both sides of the spacer.
- 3) Insert valve core into outside rim. (Part A)
- 4) Using the short fasteners (Part D) insert each into the inside rim through the seal. (Be sure to use every other hole when positioning the bolts) At this time place the tire over the inside rim/seal assembly, and place the outer rim over the fasteners and hand tighten bolts using the washers, and nuts provided.
- 5) Notice the larger holes which have been drilled into the wheel hub. (Part E) Dark circles have been placed on the drawing, to denote each of these holes, and to indicate the path for the short fasteners. Place the hub inside the inner rim. Position the hub so the heads of the fasteners are located inside the larger holes, and tighten the bolts.
- 6) Using the large fasteners (Part H), the brake drum (Part G), and the spacer bushings* (Part F) carefully thread the fasteners into the tapped holes on the wheel hub (Part E). Be sure to tighten the Lg. fasteners so to secure permanently.
- 7) Next, position the hub into the inner rim assembly. (Be sure the hub seats itself correctly) Finally, secure the longer fasteners using the washers and nuts provided.
- 8) Inflate the tire by standing the tire upright, and pressing downward so to spread the bead and create an air lock. (Repeat procedure for other wheel)

NOTE: DO NOT USE SILICONE ON THE "O" RING TO FORM A SEAL...

*Spacer bushings are only required when using wheel pants, or the Hegar 5" wheels.



FLOORBOARD AND RUDDER PEDAL INSTALLATION. (REFER TO
SECTIONS 002, 004 AND 004A IN THE PARTS CATALOG)

1. Sand, stain and varnish the floorboard prior to installation. (This pre-finish will avoid smudges that are practically impossible to sand out later.)
2. Slip the floorboard, finish side up, into position. The notches for the lift strut attachments should even gaps on each side. The floorboard should be centered side to side as well. Clamp into position for drilling.
3. Using the floorboard tabs welded to the airframe, locate and drill from the bottom up the (6) 3/16" holes. Use a block of wood positioned over the hole and pressed firmly against the plywood to prevent splitting.
4. Remove the floorboard and select (6) K-1000-3 (3/16" nut plates) and (12) 3/32" aluminum pop rivets (refer to section 002). Install the nut plates to the floorboard tabs undersides, transfer drill the rivet locations by placing a 3/16" bolt through the tab hole to hold the nut plate in position. Debur all holes and rivet the nut plates on from the top side.
5. Slip in the floorboard and bolt in place using (6) AN3-6A's and (6) AN970-3's (refer to section 004). If the alignment is a problem drill out the holes through the floorboard's 1/4" diameter.
6. Locate, drill and bolt the rudder pedals in place as shown in Figure 004-6. HINT: Use a straight board to help align the pedals with each other.
7. Fabricate (6) 1/4" x 1/4" bushings from the 1/4" aluminum tube provided (refer to section 004A). Drill out I.D. of tube prior to cutting to length so 3/16" bolts will pass through.
8. Assemble the rudder cables, guides and rudder to fuselage as per parts catalog drawing on page 004A-1 and 004A-2. NOTE: Plastic guides will need to be drilled out for 3/16" bolts. Additionally, guides on S-3 use a .020 aluminum "keeper" strap. (#15 R-GK, page 004A-2) Cables must be installed in the guide prior to the keeper.

This completes the rudder pedal, cable and floorboard installation. Please note the rudder pedals will be held upright by the bungees (FB-RRB) once the firewall is in place. Remove the floorboard rudder pedal system prior to covering.

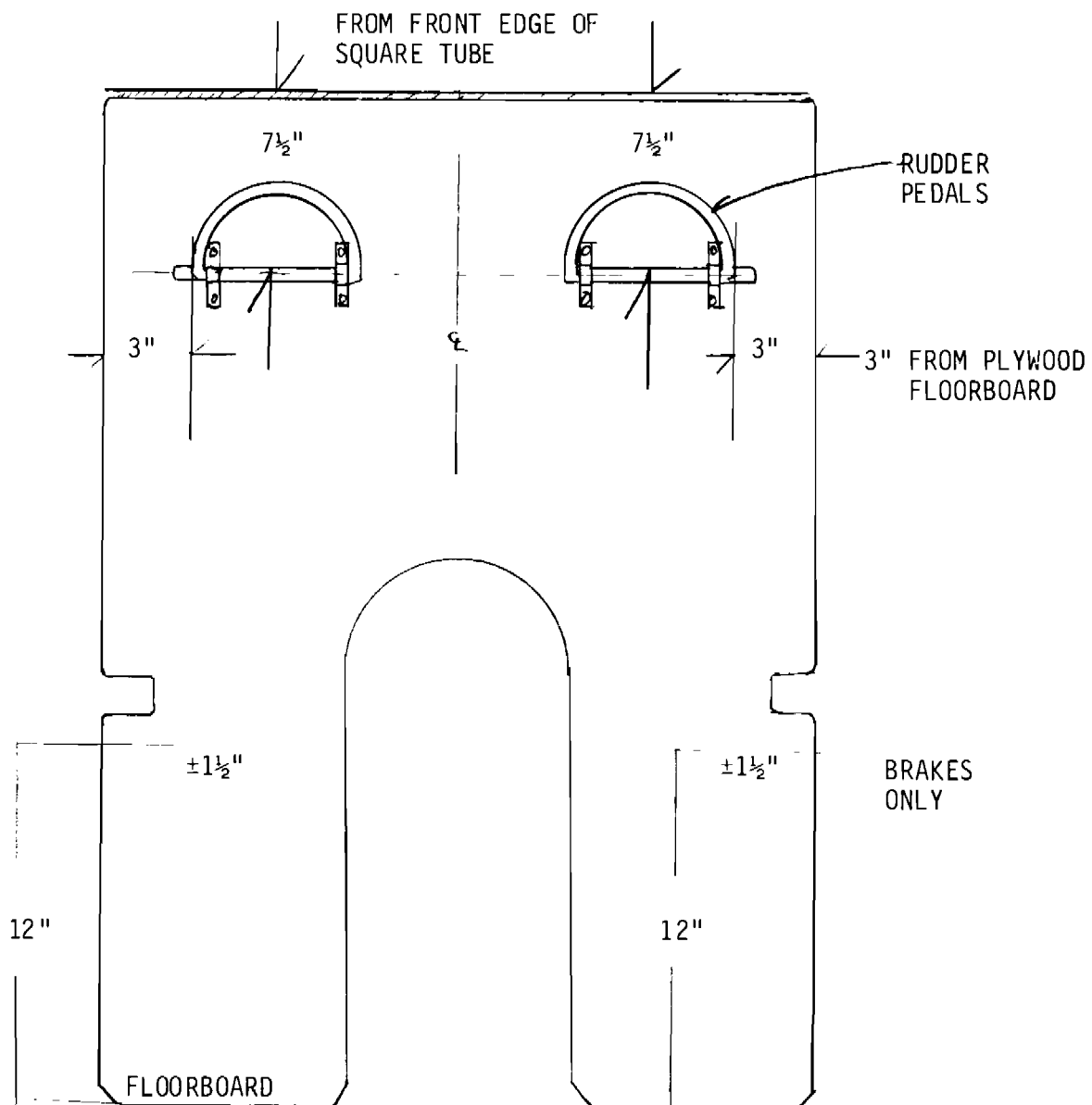
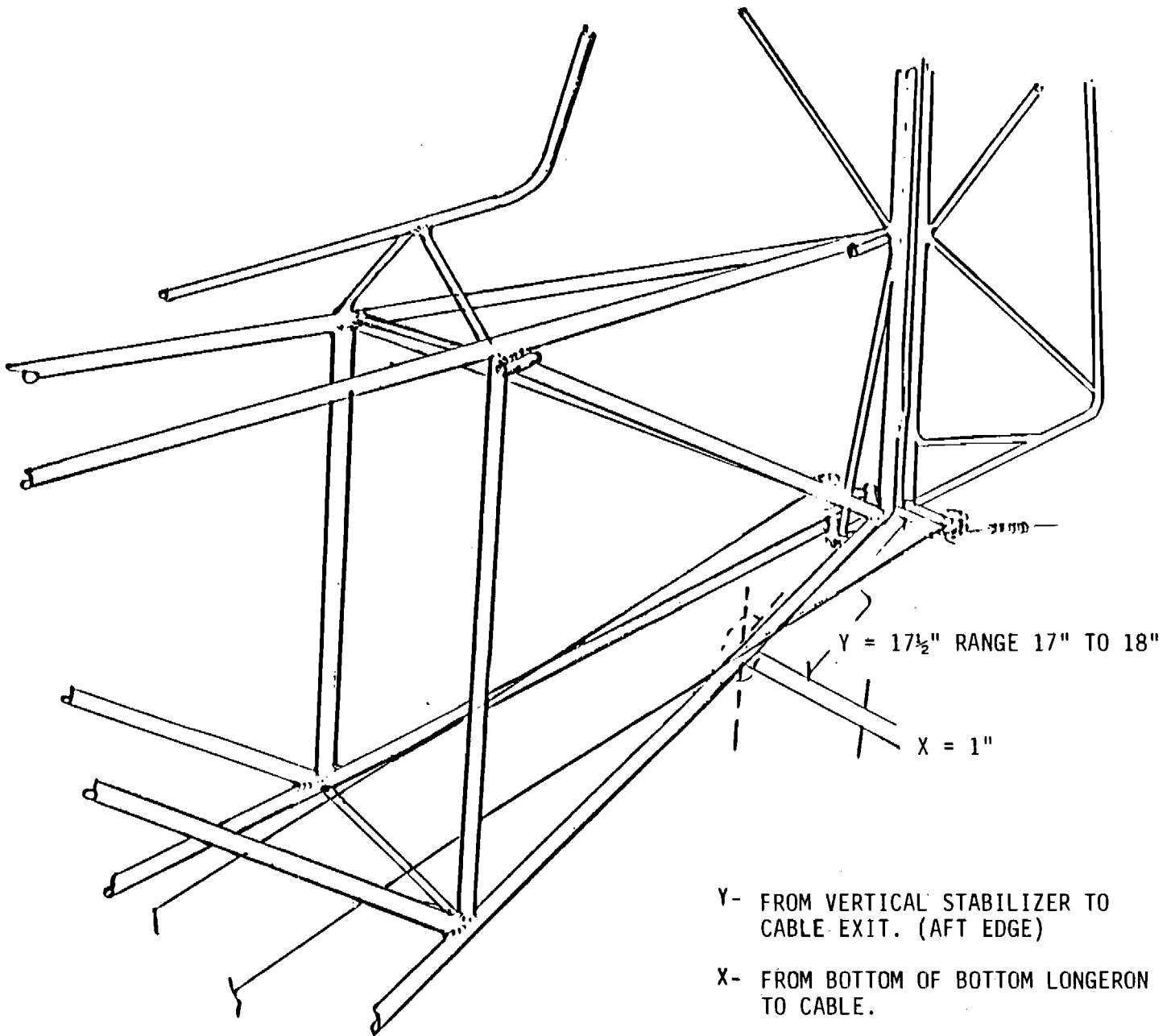


FIGURE 004-6



Y- FROM VERTICAL STABILIZER TO
CABLE EXIT. (AFT EDGE)

X- FROM BOTTOM OF BOTTOM LONGERON
TO CABLE.

MEASURE AND RECORD RUDDER EXIT FOR
LOCATION OF PATCH ON FABRIC.

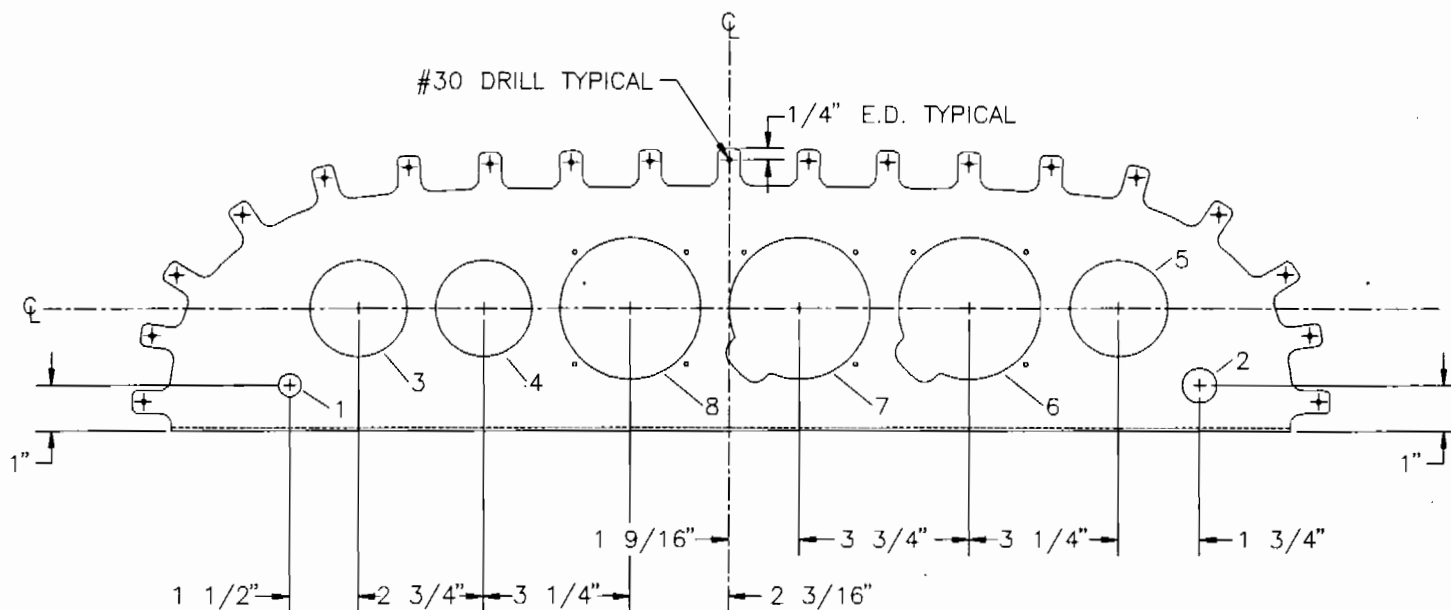
S-9 AND S-10 RUDDER ASSEMBLY

1. Select the parts illustrated on the parts page for the rudder. PLEASE NOTE: Fabricate #15 from the 1/2" x .020 x 12" strip of aluminum provided in the raw materials. This is a "keeper" strap and strengthens the cable guide. Cable guide failure will result if this is not installed at the designated locations. Fabricate by cutting to a length of 3", drill a #11 hole in one end. Drill through the guide's bolt hole #1. Wrap the strip around with the drill inserted and drill through. The strap should fit tight. Try again if this is not so (You'll have enough material for 4 attempts).

S-9 CHAOS INSTRUMENT PANEL & FIREWALL ASSEMBLY

1. Before bending any of the instrument panel tabs, lay out, cut and drill the holes for your particular instrument package. See **Figure 05-01**. Be sure to pre-drill all the tabs.

FIGURE 05-01

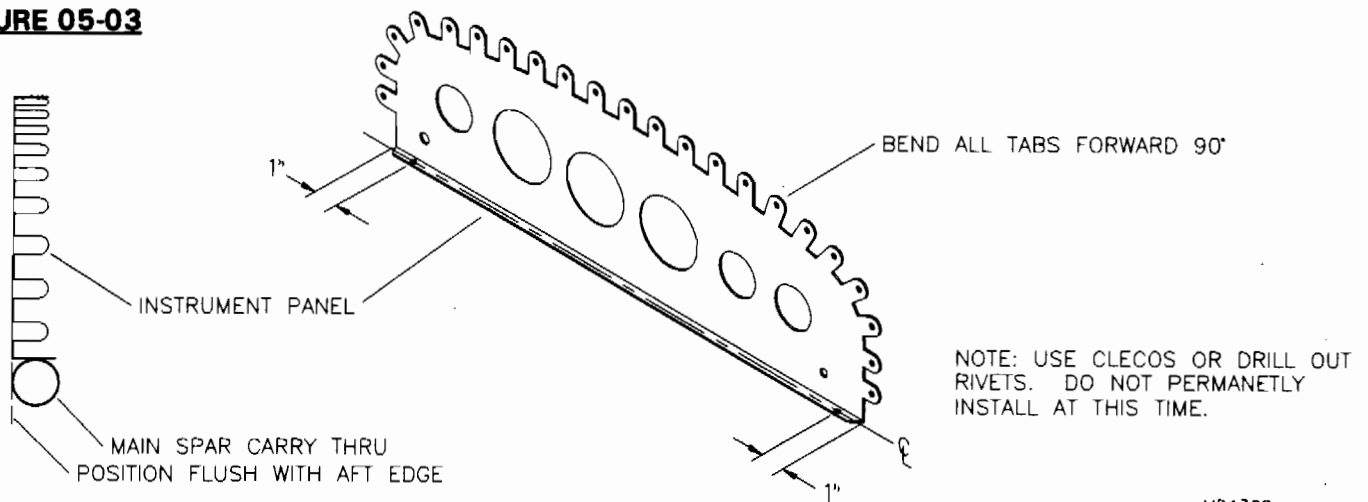


S-9 CHAOS RECOMMENDED INSTRUMENT PANEL LAYOUT		
1.	IGNITION SWITCH* (2 REQ'D.)	N/A
2.	PRIMER KNOB	3/4" DIAMETER
3.	EGT	2 1/8" DIAMETER
4.	RPM	2 1/8" DIAMETER
5.	HOUR METER	2 1/8" DIAMETER
6.	VSI	3 1/8" DIAMETER
7.	ALT	3 1/8" DIAMETER
8.	ASI	3 1/8" DIAMETER

MD1306

2. Using only your fingers, bend the instrument panel and firewall tabs approximately 90 degrees.
3. Center the instrument panel on the main spar carry through as shown in **Figure 05-03**. Drill and rivet (or cleco) #30 on center, 1" from each outside end.

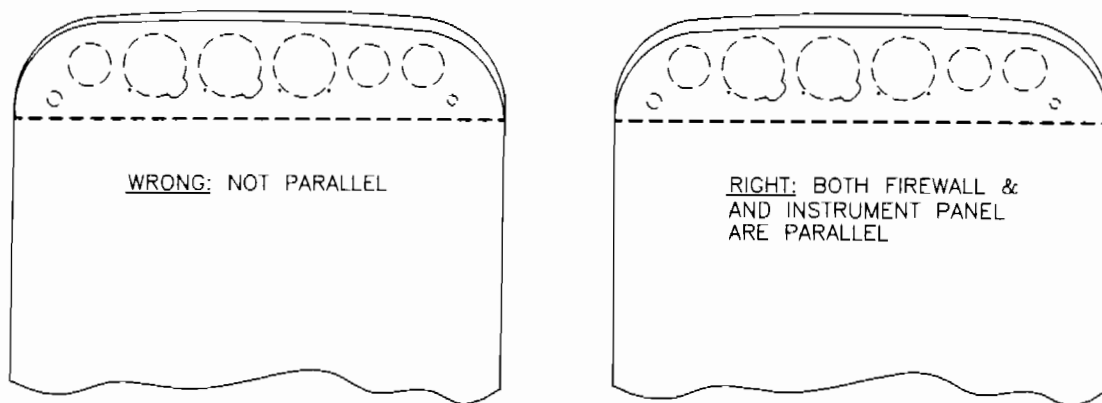
FIGURE 05-03



MD1308

4. Clamp the firewall in place with the sides and bottom square and flush with the airframe. Check the firewall alignment by viewing it head on. It should look level with the instrument panel as shown in **Figure 05-04**. Adjust accordingly. **IMPORTANT:** For proper cowling fit, the firewall must be flush on the bottom with the steel tube.

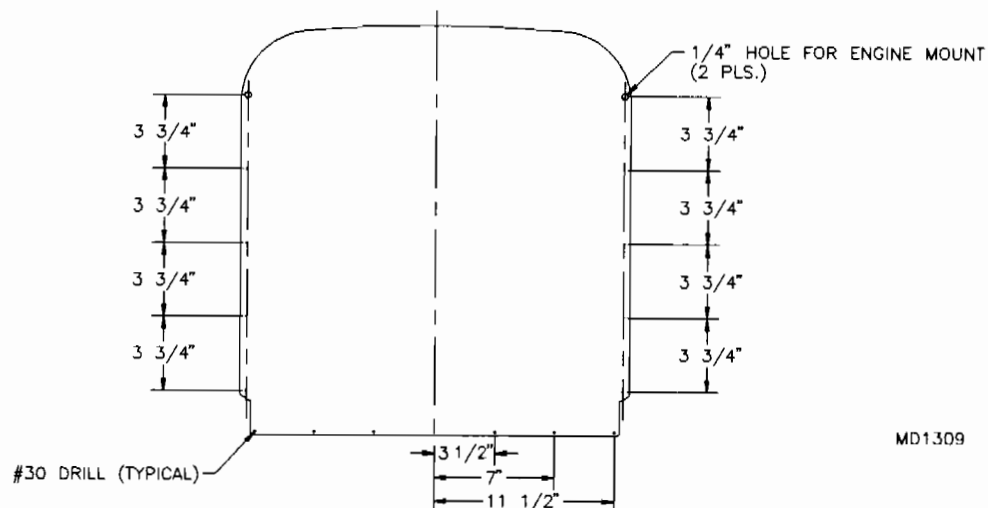
FIGURE 05-04



MD1308

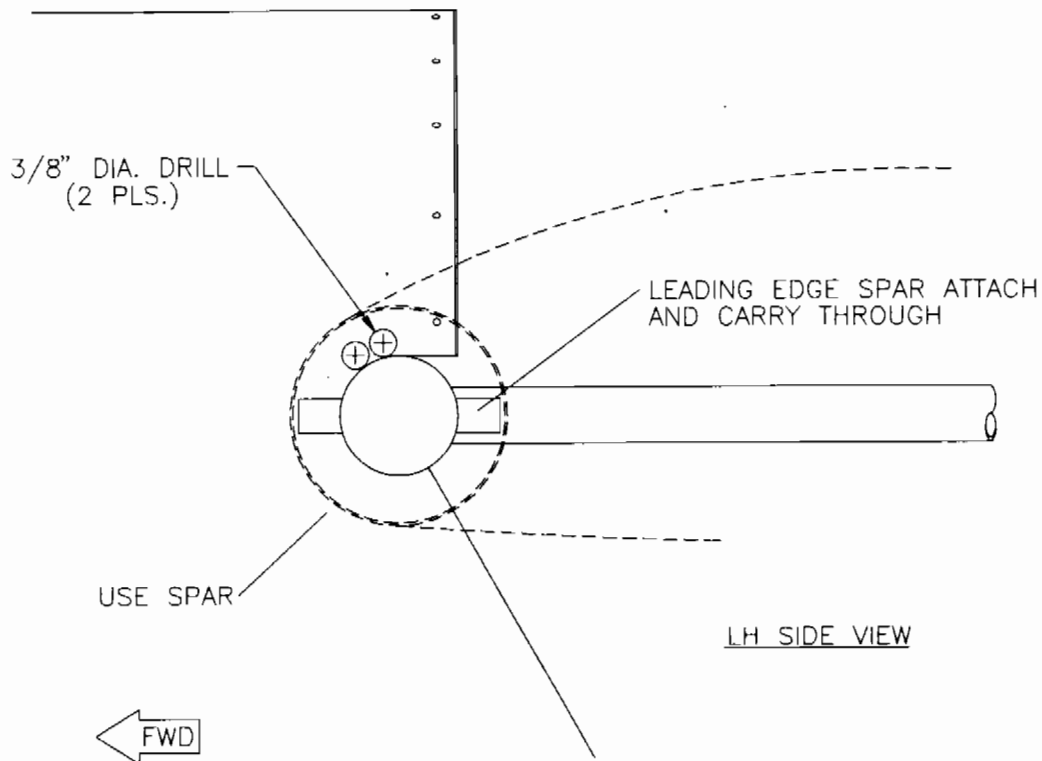
5. When the firewall is properly aligned, locate and drill #30 holes, then cleco or sparsely rivet in place as shown in **Figure 05-05**. **DO NOT** final rivet the firewall until final assembly. See **Figure 05-05**. The firewall must be removed to cover the fuselage.

FIGURE 05-05



MD1309

9. Starting at the center tabs, drill through and cleco or temporarily rivet the FWD top wrap to the instrument panel and the firewall. Center the drill on the tabs by viewing from the edge. Locate the holes approximately 3/8" from the FWD top wrap's edge.
10. Drill from the inside out all of the top longeron tabs welded to the fuselage with a #11 bit. Use a wood block to support the outside of the sheet metal at the tab when drilling through. Cleco or temporarily rivet the top wrap in place.
11. Drill a 3/8" hole in the location shown in **Figure 05-011** for the ASI pressure and static line exit. Keep them inside of the spar diameter.

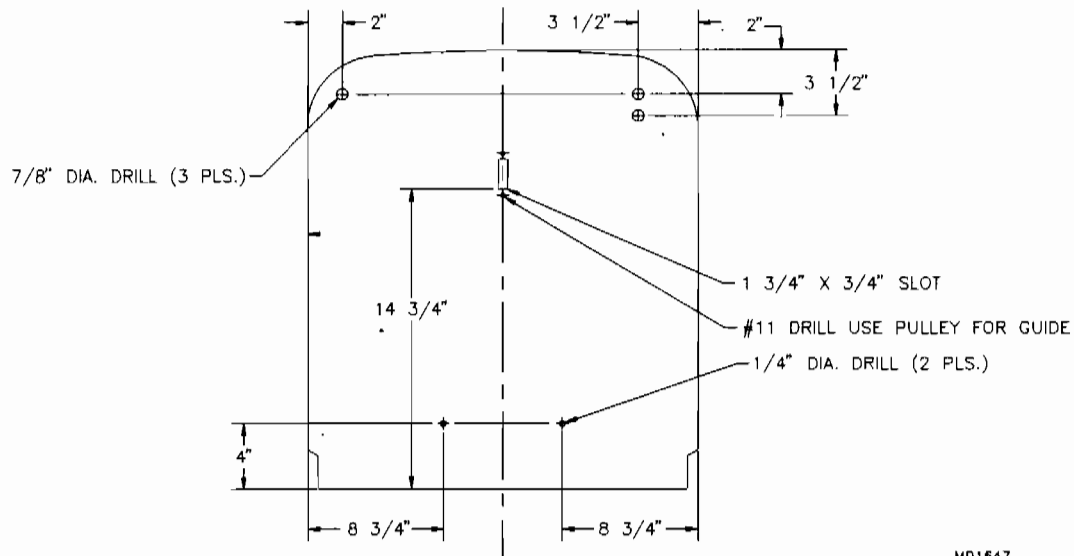
FIGURE 05-011

MD1307

This completes the installation of the instrument panel, FWD top wrap, and the firewall. Remove for covering after the test assembly is complete. **NOTE:** Rivet the starter pulley in place during final assembly. At that time the firewall soundproofing material will also be sandwiched between the fuselage and firewall.

6. Locate and drill all of the other holes in the firewall as per **Figure 05-06**.

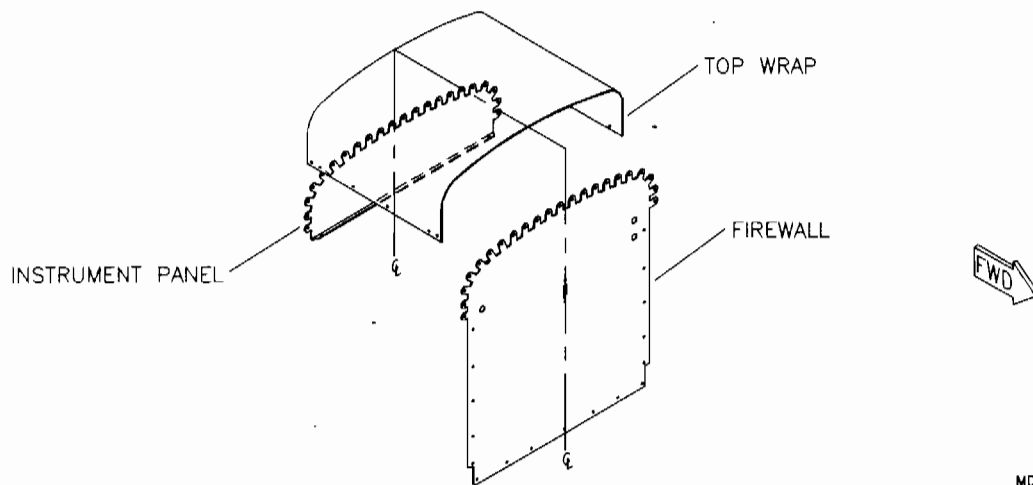
FIGURE 05-06



MD1647

7. Use a straight edge to mark the exact centers of the firewall and instrument panel. Locate and mark the forward top wrap's exact center of the front and back edges. See **Figure 05-07**.

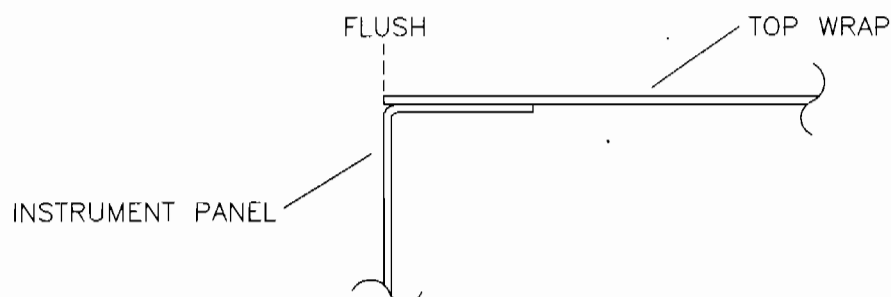
FIGURE 05-07



MD1647

8. Center the FWD top wrap on the firewall and instrument panel with each edge flush. See **Figure 05-08**. Pull the FWD top wrap down against the firewall and instrument panel, then clamp in place with small vise grips to the top of the longeron tabs.

FIGURE 05-08



MD1647

S-9 CHAOS BATTERY BOX INSTALLATION

1. The battery box is located on the AFT side of the S-3. The box is mounted to the diagonal tubes with 1/2" cushioned clamps and to the dual teleflex retainer.
2. Position the battery box so the top is approximately 1/2" above W-AIL-TEL-R. Drill holes through the box flanges and into W-AIL-TEL-R. Make two spacer bushings, 1" X 1" X 1/2" PVC. Drill a #11 hole and bolt with the proper hardware. Locate the cushioned clamps on the diagonal braces and drill holes into box flanges. Bolt together with the proper hardware.
3. Install the battery and connect the cables.

CONTROL STICK ASSEMBLY
(PLEASE REFER TO SECTION 006 IN PARTS CATALOG

1. Assemble the control stick by referring to the Control Stick Diagram in the Parts Catalog. **NOTE:** Stack (3) 3/16" washers on each side of the 5/8" push pull tube to center the tube on the S2-SAB. **CAUTION:** Make sure the 1/4" nut used is a castle nut. **DO NOT** over tighten. The (2) S2-SAB's must swivel freely, but not be loose or the elevator will have "play". Also, note that **the head** of the 1/4" bolt inserts into the end of the **5/8" push pull tube**. Be sure to cotter pin or safety wire the bolt after assembling the swivel joint. If this nut works loose and comes off the bolt, loss of pitch control will result.....so be sure it is safetied.

2. Find the control stick torque tube (CS-TT). Inspect it, then assemble the following:

- (2) Stop Rings (CS-SR)
- (1) Pillow Block Fwd. (CS-PB)
- (1) 1" End Cap (1"-CAP)
- (3) 1/8" Aluminum Pop Rivets

Install the parts as shown in Figure 006-02. There must be 2" of torque tube extending beyond the forward edge of the pillow block (not the stop ring). Grease the pillow block and tube **BEFORE** sliding over the torque tube. Rivet the stop rings in place without binding against the pillow block. Also rivet in place the 1" end cap.

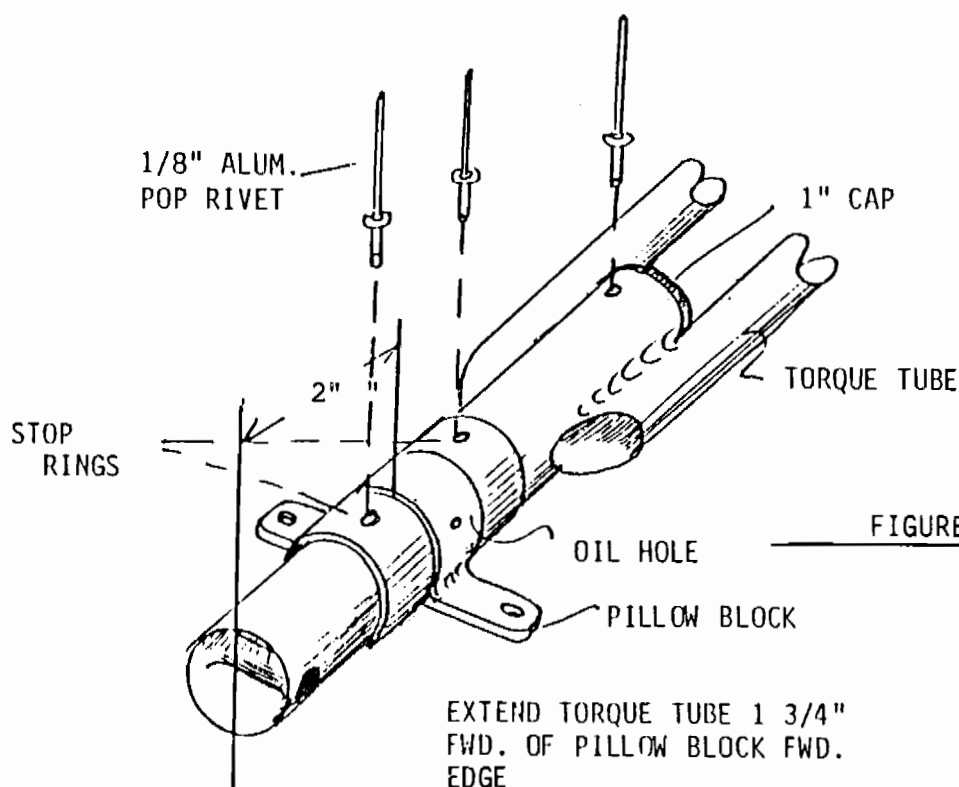


FIGURE 06-02

3. Slip the rear pillow block (CS-PB) over the opposite end of the torque tube.

4. Insert the gray plastic glides (CS-GL) into the ends of the torque tube. The forward glide may need to be ground to clear the 5/8" tubes adjacent to the insertion point. Use a chunk of wood and a hammer to drive the glides in place. Safety the glides by drilling #40 holes and inserting a cotter key. Make sure the keys do not rub on the 5/8" push pull tube (Figure 006-04). **DANGER:** The 5/8" push pull tube must slide freely in the glides. File or ream until this is the case. If the 5/8" PPT does not slide freely it may **JAM** with dirt or swell with moisture.

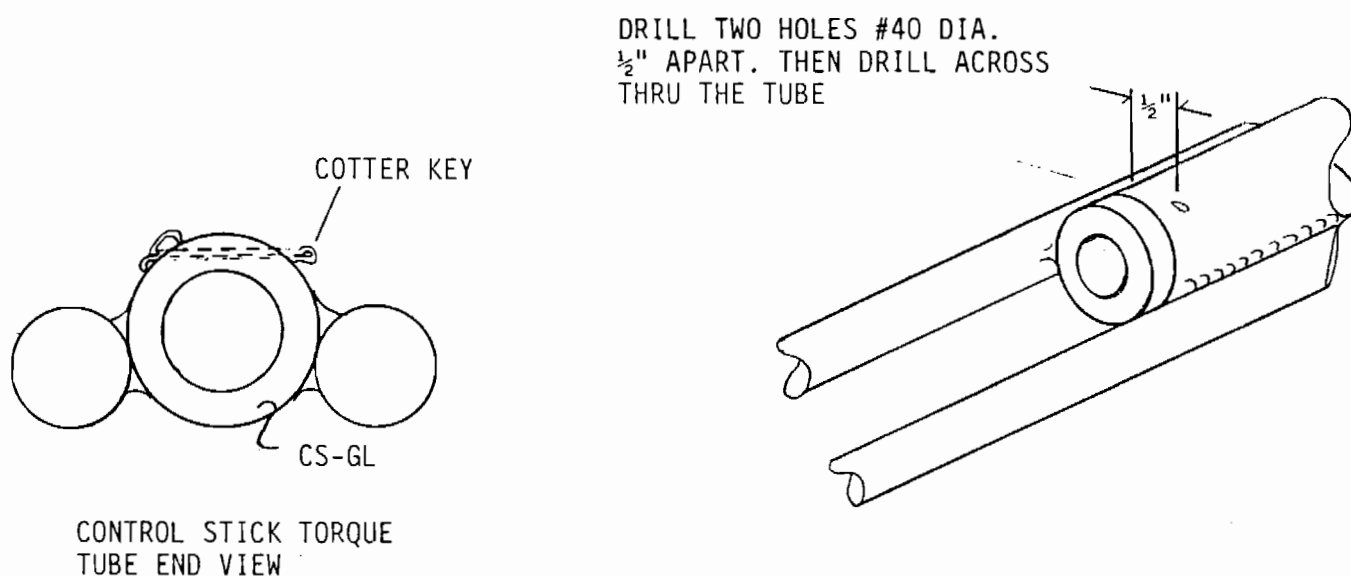


FIGURE 006-04

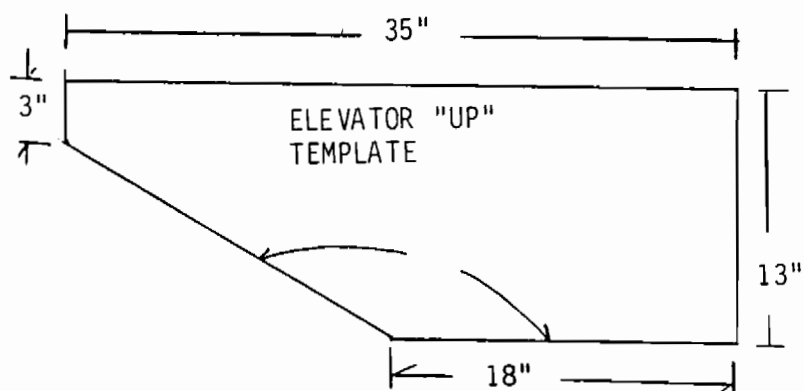
5. Slip the 5/8" push pull tube into the aft glide and out through the forward glide with the swivel joint facing aft.

6. Insert the control stick into the connector with the control stick lined up 90 degrees to the 1/4" bolt hole bushings. Insert until stick clears cockpit structure when moved full travel range. Drill through the stick 1/4" at the top of the connector. Using a 1/4" bolt (AN4-25A) and (2) 1/4" thin washers and (1) 1/4" shear nut, fasten the control stick connector to the torque tube. Coat the bolt and wear bushing with a heavy oil before installing. Snug down the bolt so there is no play between parts but is free to pivot. **HINT:** Paint may have accumulated in the connector tube's 1/4" wear bushing.....Use a 1/4" drill to clean out.

7. Attach the linkage to the control stick and 5/8" push pull tube eyebolts using the appropriate hardware. Refer to the parts catalog for the assembly sequence. Safety tie the bolt with the cotter pins after tightening.

8. Install the control stick assembly to the fuselage. Check for freedom of movement. **NOTE:** Over tightening may cause binding of the pillow block.

9. Using rope or seat belt (if installed) tie the stick back in the full up position. Be sure the stick is against the aft stop. (Glide touching eyebolt). Make a cardboard template as shown in Figure 006-09 to set elevators in full up position. **HINT:** Clamp the elevators in the full up position.



LAY OUT AND CUT FROM CARDBOARD OR WOOD - USE ON TOP SIDE OF ELEVATORS

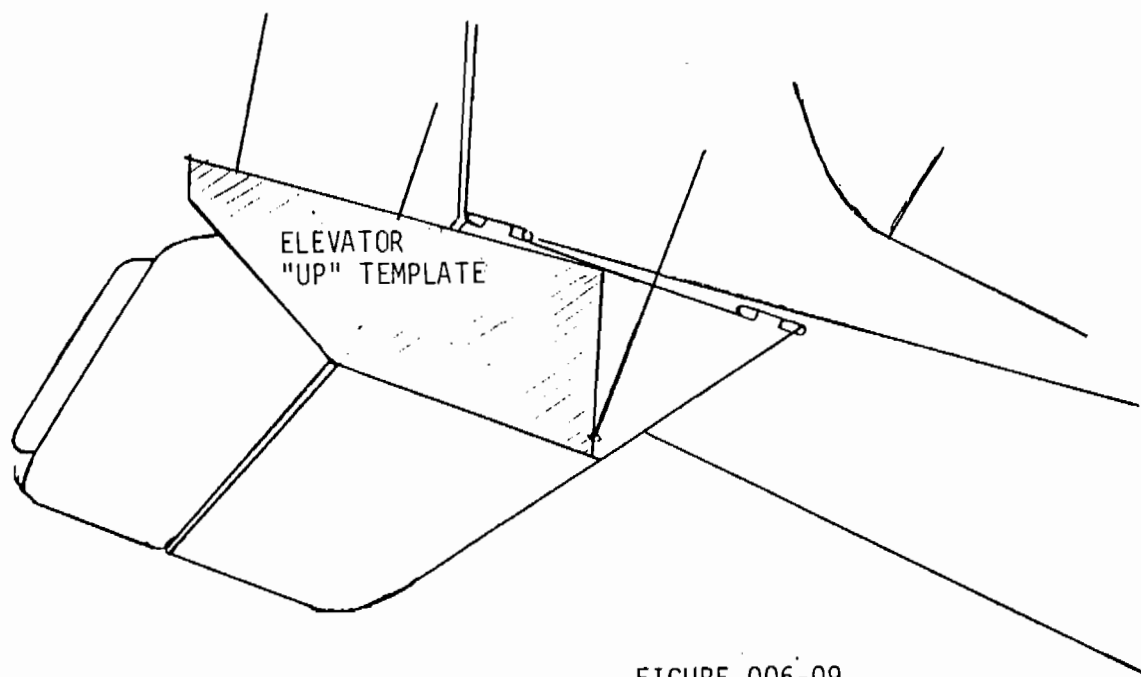


FIGURE 006-09

10. Drill the elevator horns remaining #11 hole out to 1/4" diameter. Bolt the yoke assembly in place with approximately 1/2" to 5/8" of threaded portion of rod end showing. Bolt the rod ends to the inside of the elevator horns with AN4-7's. Use a 1/4" castle nut and loc rings to secure.

11. Insert undrilled end into the yoke, bolt the opposite end into the control stick. Re-check the elevator and stick settings, cut off 1" tube as required, then drill through the yoke #11 from top and then from the bottom and bolt. The elevator should move up and down freely and return to full down when stick is released. The bolt must be placed vertically or it will not allow free movement of the push pull tube.

12. Remove primer and paint components as desired. Re-assemble post covering and painting.

S-9 CHAOS SEAT ASSEMBLY

1. Using the Parts Catalog as a list, select the necessary parts to assemble the seat and quadrant. Also, study the drawing to sequence assembly.
2. Begin by assembling the (2) seat spreader tubes.
3. Insert the seat top into the side tubes. NOTE: Position tube with the (2) 3/16" vertical holes for mounting the throttle quad on the left. PLEASE NOTE: 1992 models of the S-9 have a built in throttle and will not use the holes in the seat tube.
4. Attach a spreader tube to the front of the seat using (2) AN4-14A bolts, (2) 1/4" thin washers and Loctite. Position the bolt heads on the spreader tube facing forward.
5. Attach the second spreader tube to the side tubes along with the hang strap. See Figure 07-05. Loctite these bolts also. Use (2) AN4-17A bolts.

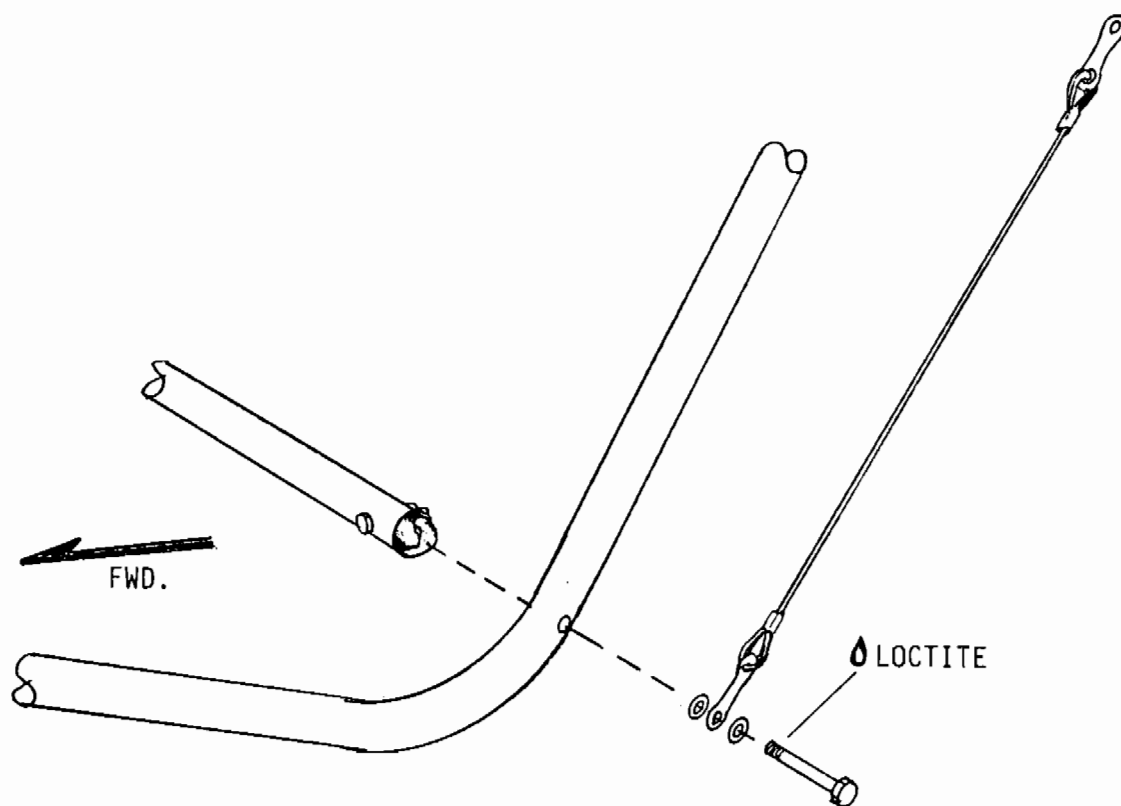


FIGURE 07-05

6. With the seat frame assembled slip the seat sling over the top of the frame. Work it down the frame until it is fully on. The bottom of the seat will need to be laced with two lengths of 1/8" rope. The top side flaps should be laced VERY tight and the front and back flaps need to be laced LOOSE. If you overtighten the front and back flaps it will cause the seat to hump at the small of the back and be very uncomfortable. Begin lacing by doing the sides first. Use the same circular pattern described in the fuselage lacing instructions. After lacing the sides, re-positioning of the sling may be needed. Do so before going further. Inspect your work...the seat sling should be drum tight across the bottom and set evenly on the frame. Re-tightening may be required after 5 to 10 hours of flying (depending on your landings!).

S-9 CHAOS TAIL ASSEMBLY

1. From 1/4" x .035 aluminum tube bushing stock, cut (7) 1/2" long bushings.

2. Lay the horizontal stabilizers flat on the floor and tap the bushings into place with a hammer. Drill through with a 3/16" bit once they are installed. The holes in the welded on bushings may need reaming out to 1/4" for ease of installation. See **Figure 08-02**. If the bushings slide in without force, use J & B Weld to hold them in place, then drill out to #11.

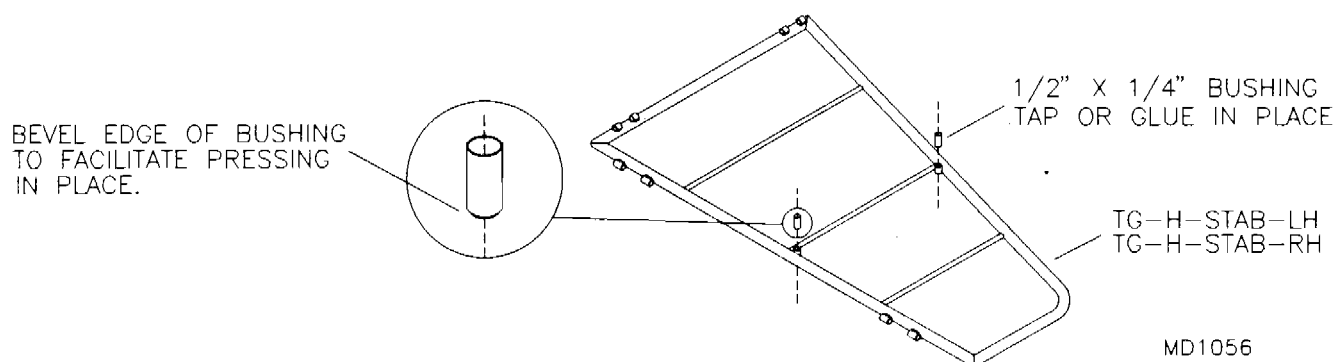


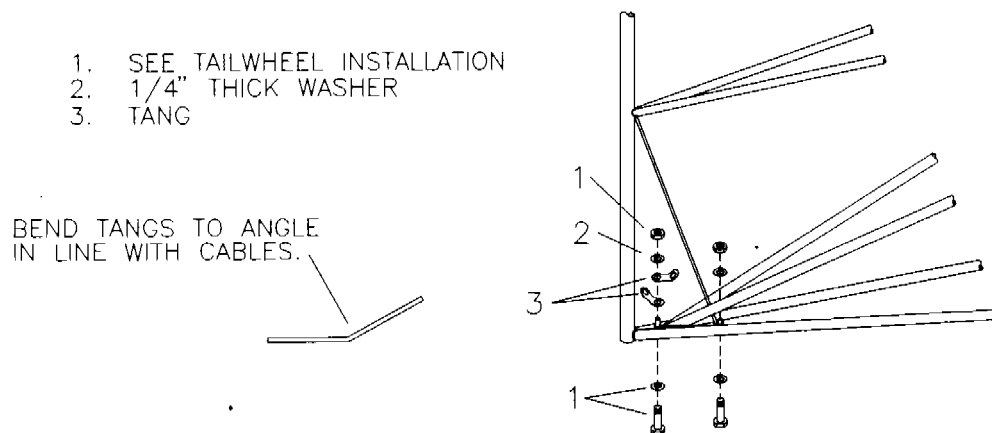
FIGURE 08-02

3. Repeat for the other three locations on the vertical fin, except use a backing bar, such as another hammer. **HINT:** A small C-clamp and a shot of lubricant can also be used to set the bushings in place.

4. Hinge stabilizers to the fuselage with 1/4" x 3 1/8" clevis pins. **DO NOT** install cotter pins until final assembly. Check for freedom of movement. It is necessary to ream all hinge points on the tail assembly. Use a 1/4" diameter drill bit 7" to 8" long. Reducing the pin diameter will also help the hinges work better.

5. Drill one hole in each stainless steel tang to 1/4" diameter and place on the rear tail wheel. Bolt as shown in **Figure 08-05**. Bend the tang to match the angle of the cables as they come off the stabilizer.

FIGURE 08-05



MD1056

6. The S-9 tail cables use a custom made cable tang that has several holes in one end. These holes are used to adjust the set of the tail and tension the cables. Bolt the cables to their proper locations using the same washer stacking as shown in Figure 08-05. Before the tail cables can be set and tensioned you will need to bend the tangs so they line up with the cables. Do so by bolting them on using the inner most hole and bending to the exact angle with your hand. Avoid using a pliers this may cause stress risers. **IMPORTANT:** Attach the cables with the adjustor tangs bolted to the horizontal tail and **NOT** the fuselage or vertical fin. The reason is when you fold the tail the single hole tang is disconnected from the two lower attach points on each side. If the multi-hole tang was used you would have to remember which hole was used to set the rigging of the tail.

7. With the tangs bent to the proper angles loosely bolt the cables in place using the outer most hole on the adjustor tangs. The aft lower attach point uses a 3/16" bolt in the horizontal position. When this bolt is tightened it will tension the aft wires. The forward lower cable is tensioned by applying pressure at the cable attach point on the tail. About a hundred pounds of pressure can be applied by simply pressing down on the tail with your hand.

8. With cables under mild tension the horizontal stabilizer tips will be approximately 1/2" higher than the root. An acceptable setting is level to 1/2" dihedral. If more adjustment than what the tangs allows is required, try using more washers and the next length of bolt. See Figure 08-08. If your tail requires more than (3) thick washers under any top side cable tang return cables for longer ones. The cable tension should be enough they have a nice ring to them when strummed. If you are installing plastic cable fairing the tension is critical to insure the fairings will not flutter. The tail is in rig when the cables are tight and the tail is straight. It is best to check for straightness once the wings are installed.

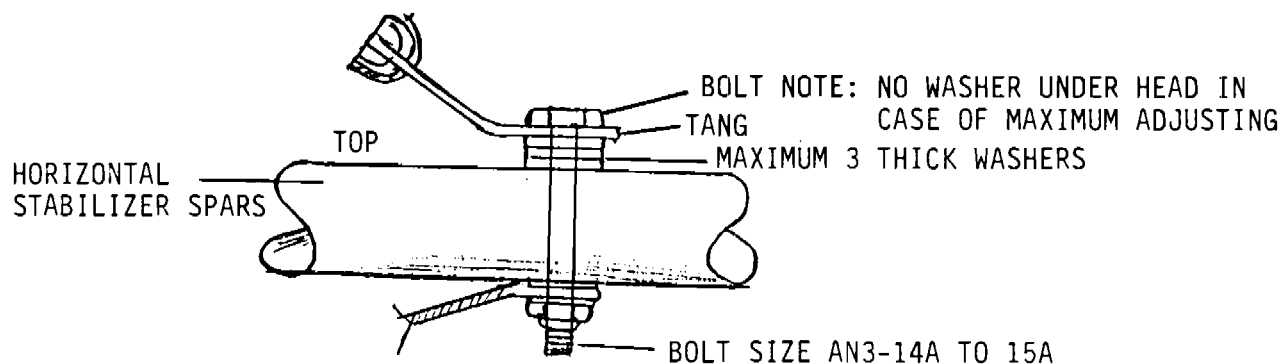
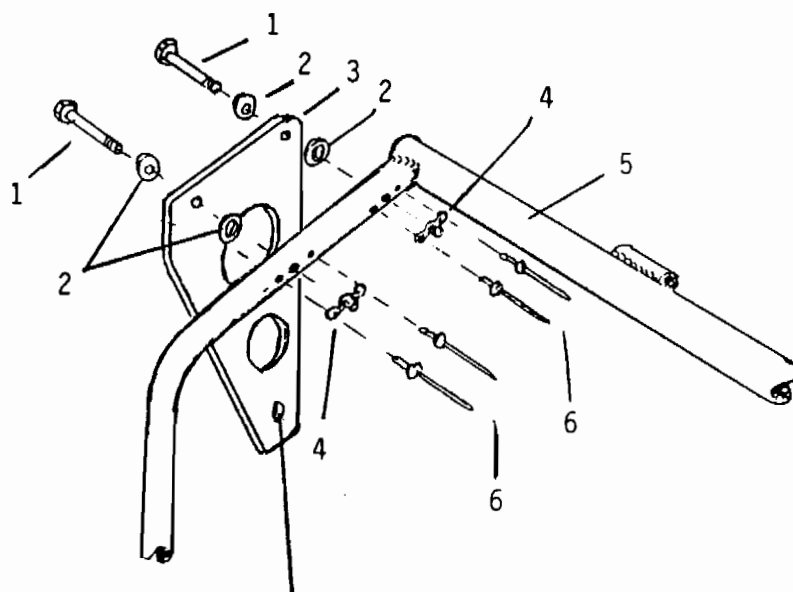


FIGURE 08-08

9. Drill and rivet the K-1000-3 nut plates to the inside of each elevator. Then attach an elevator horn to each side as shown in Figure 08-09.



DRILL OUT TO 1/4" DIAMETER

FIGURE 08-09

#	PART NAME	PART NO.	QTY
1.	3/16" BOLT	AN3-10A	4
2.	3/16" THIN WASHER	AN960-10L	8
3.	ELEVATOR HORN	TG-EH	2
4.	3/16" NUT PLATE	K-1000-3	4
5.	ELEVATOR FRAME	TG-EF (LH/RH)	2
6.	3/32" ALUMINUM POP RIVET	40 APR 1/8"	8

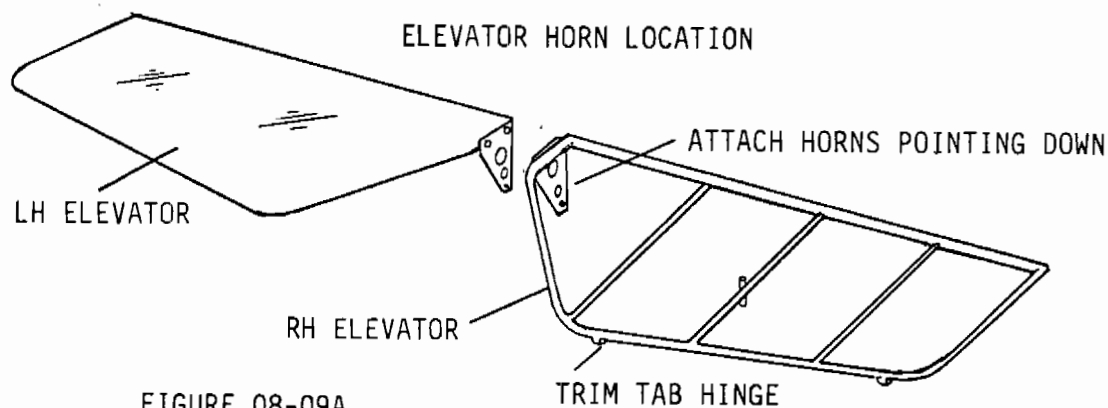


FIGURE 08-09A

10. Pin the elevator to the horizontal stabilizers using (4) 2 3/8" pins. Do not cotter pin until final assembly.

TRIM TAB AND TRIM WHEEL ASSEMBLY

11. Attach trim tab to the right elevator as shown in Figure 08-011. Insert small cotter pins. Drill out the trim cable stop tube to allow cable housing to insert. Please note the inside diameter of the trim tab spar is greater than the hinge pin. Make a shim to take out this gap from a soda pop can, or use brass shim stock. Wrap the shim around the pin after drilling the cotter pin hole, and insert into the trim tab spar. See Figure 08-011 and Figure 08-011A.

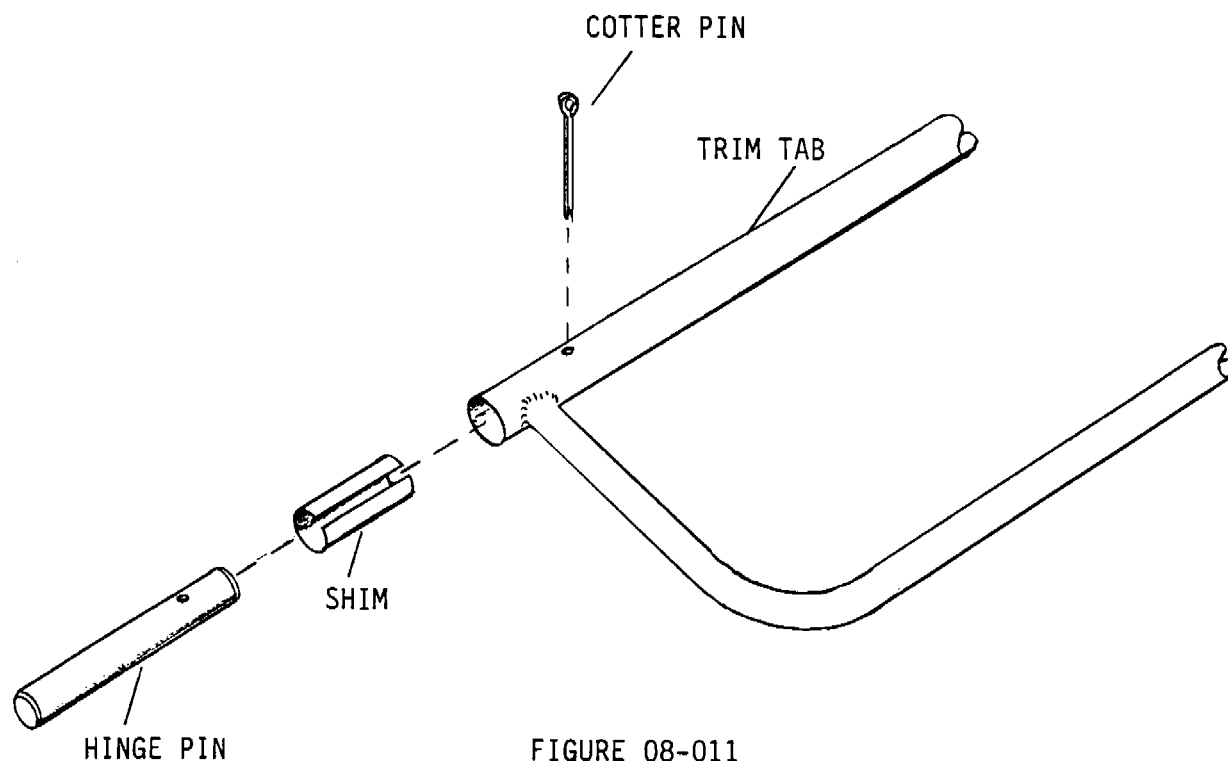
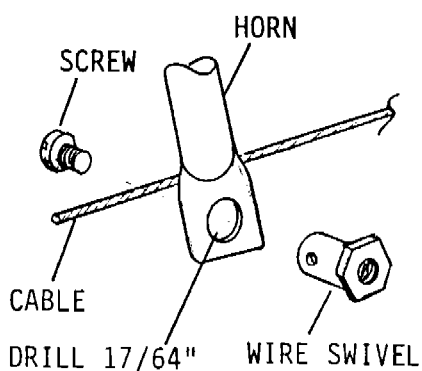
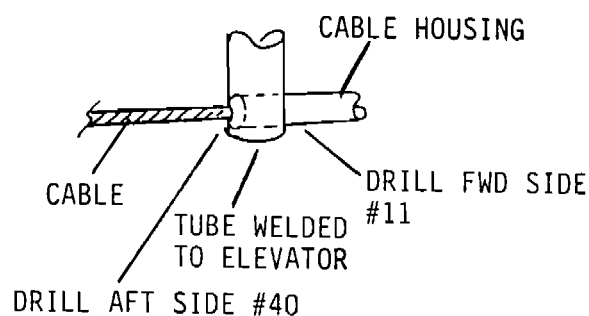


FIGURE 08-011



DETAIL FOR TRIM TAB CABLE ROUTING

FIGURE 08-011A

12. The trim tab is articulated by turning the trim wheel in the cockpit. On the trim wheel is a small plastic drum that a single strand of cable wraps around approximately 4 times. Bolt the trim wheel to the tab welded to the square tube on the left side of the cockpit just aft of the throttle. Use the parts drawing for assembly sequence. Tighten the bolt through the trim wheel so it has a fair amount of friction but is still easy to operate.

13. Drill out the horns on the trim tab to receive the wire swivels as shown in Figure 08-013. Insert the cable on the bottom horn and route to the trim wheel. **IMPORTANT:** To properly operate the trim tab the lower cable must wrap from the **BOTTOM** side of the drum. Wrap the cable tight around the drum without overlapping the other wraps and route back to the trim tabs top horn. Use the parts drawing for proper cable routing. Tension the system at the trim tab horns using the wire swivels. Test the operation of the tab by rotating the trim wheel. The tab should displace **DOWN** when the wheel is rotated **BACK**.

IMPORTANT

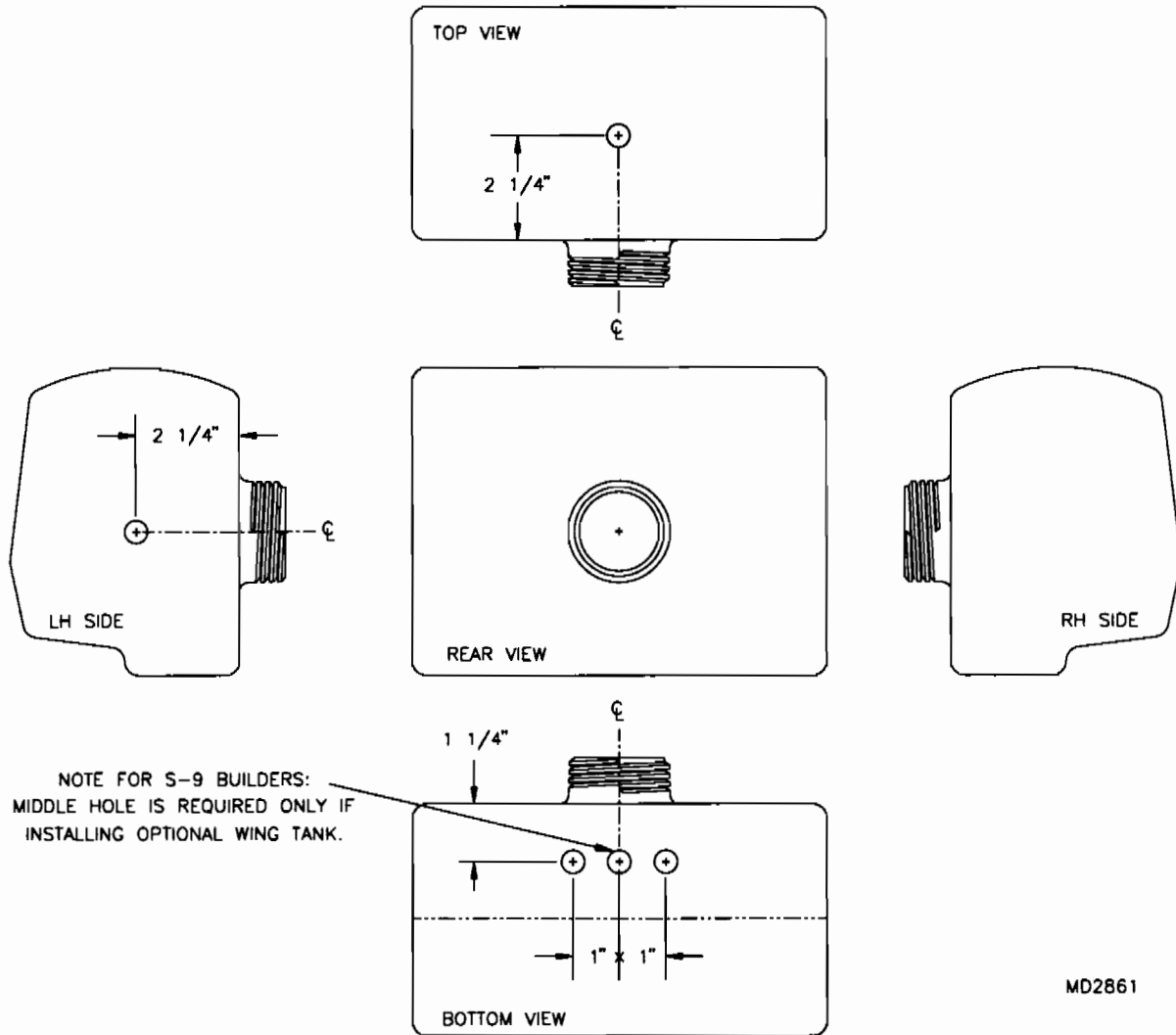
Before flying your S-9 for the first time make sure the trim system is ready to go. Check the cable housing to make sure they are seated in the stops. Check to make sure there is not slack or play in the system. A slack trim tab will flutter and may cause loss of pitch control. Trim tab flutter has occurred on the spring type trim systems when the spring tension was too light. Thank fully it is a low grade flutter and does not cause structural failure, however it can be very nerve racking! Check the cable tension on your trim system before every flight.

12. Refer to Control Stick Assembly for rigging elevator.

S-9 HEADER TANK & FUEL LINE ROUTING INSTALLATION

1. Refer to **Figure 09-01** for locations of the holes for the withdrawal fittings. Drill the holes with a 1/2" diameter bit. Remove the burrs from drilling prior to installing the fittings. **IMPORTANT:** On the S-9, if installing a single wing tank only refer to the parts drawing for the correct number of holes to drill for the fittings.

FIGURE 09-01

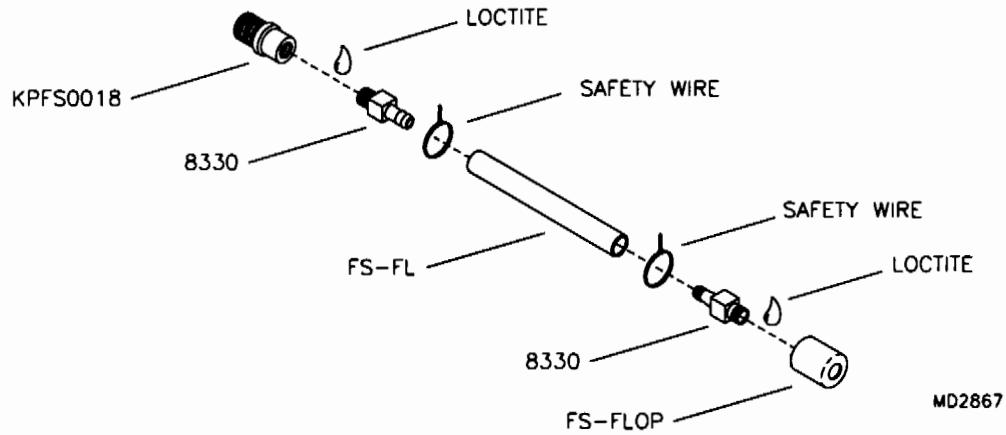


HEADER TANK FITTING INSTALLATION

2. Placing a wire in the fitting hole and up through the filler neck, attach a withdrawal fitting and o-ring to the wire. Make a loop in the end of the wire to keep the parts from falling off, then pull the fitting to the hole with the threaded portion out of the tank. Remove the wire. Holding the fitting with the threaded portion extended out of the tank, thread on the rubber washer, 1/2" washer and nut with loctite. **NOTE:** Use a 1/4" allen wrench to hold the tank withdrawal fitting while tightening the nut. Apply loctite to the straight or 90 degree fuel line fittings, and screw into the tank withdrawal fitting until snug. **CAUTION:** Do not tighten to the point the tank withdrawal fitting turns in the tank.

3. Assemble the klunker as per **Figure 09-03**.

FIGURE 09-03

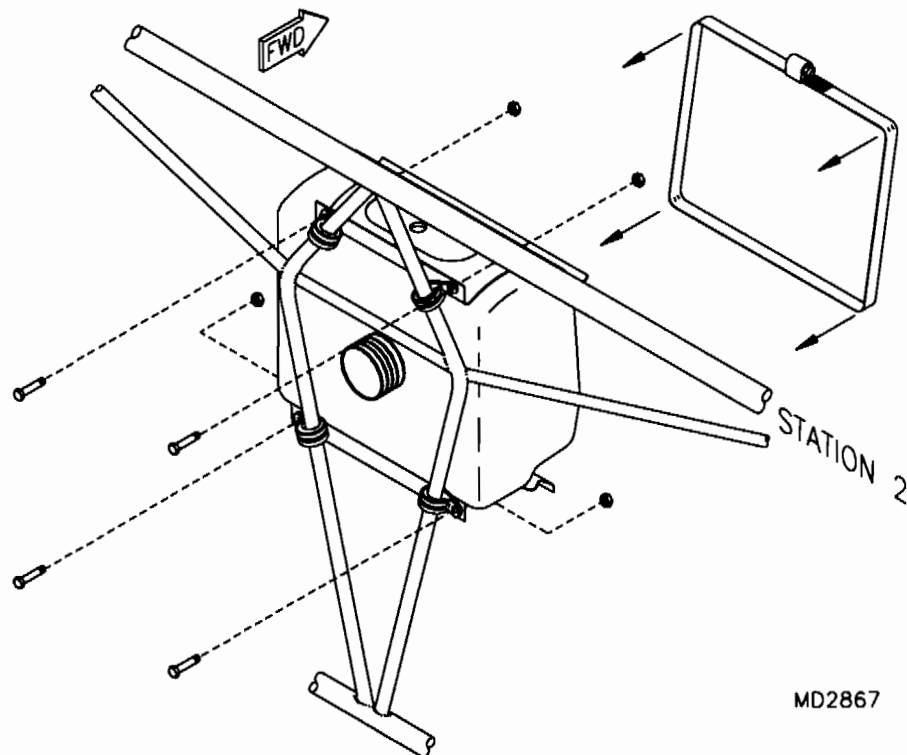


4. After installing the fittings, thoroughly clean the inside of the header tank with a vacuum cleaner.

5. Drill a #40 hole in the edge of the cap. Screw on the cap and tighten. Using the hole in the cap, safety wire the cap against rotation to the airframe after the header tank is installed.

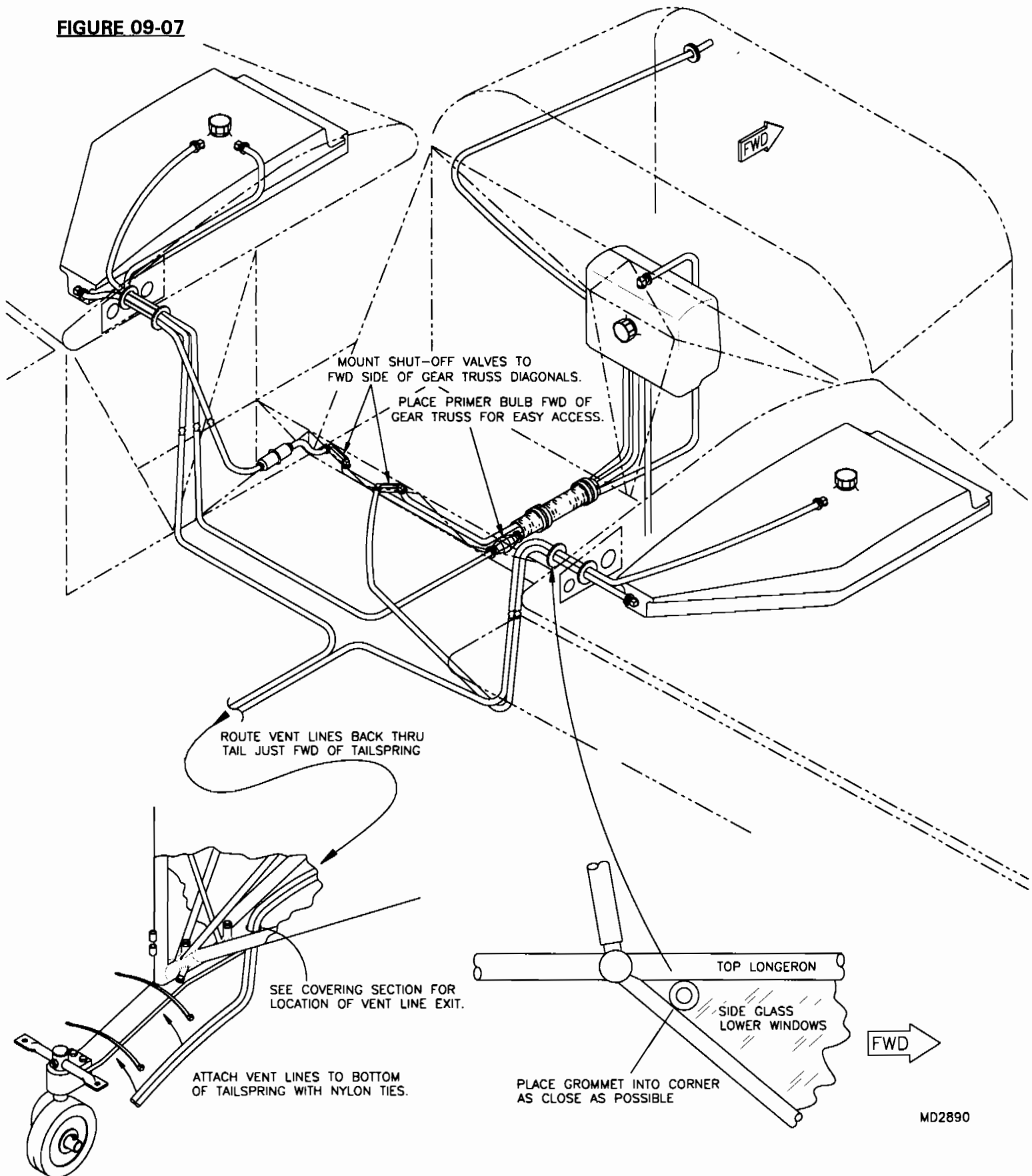
6. The header tank mount is made from two formed sheet metal parts. Paint or finish as required prior to mounting. Assemble the mounts to the header tank by holding the assembly up to the airframe as shown in **Figure 09-06**. Install the hose clamp to retain the tank to the mounts.

FIGURE 09-06



7. Route the fuel lines to the proper fittings to plump in header tank to the fuel system as per **Figure 09-07**. During operations, use the header tank drain as a sump valve to void water from the system.

FIGURE 09-07



MD2890

S-6, S-7, S-9 & S-10 ENGINE INSTALLATION

CARBURETION AND EXHAUST FOR 503'S AND 532'S. DUAL AND SINGLE CARBS.

1. The carbs should come with a primer nipple installed. However, if not, drill and tap the carbs for the small brass nipple. Locate the nipple on the filter side of the carb at about a 3:00 o'clock position on the side to the rear. Be careful not to get aluminum particles in the carbs.
2. Remove the choke levers from the carbs. (Leave the plunger assembly intact).
3. Install carbs to the engine. Secure 90 degrees to the crankcase split line.
4. Route primer lines to nipples, pump and "T's" as required. Keep all fuel lines away from heat sources such as the muffler. Safety all connections to prevent leakage. Plastic tie lines to prevent movement.
5. Bolt the fuel pump in close to the engine so the impulse line is no longer than 15". S-7's and S-9's use tube clamps, the S-10's have tabs welded to the mounts. Run fuel lines in a manner so they are far from heat sources and secured but not crimped to prevent shifting or kinking. Clamp or safety all fuel line connections.
6. Follow the Rotax manual for throttle and other carburetion installation tips.

MUFFLERS

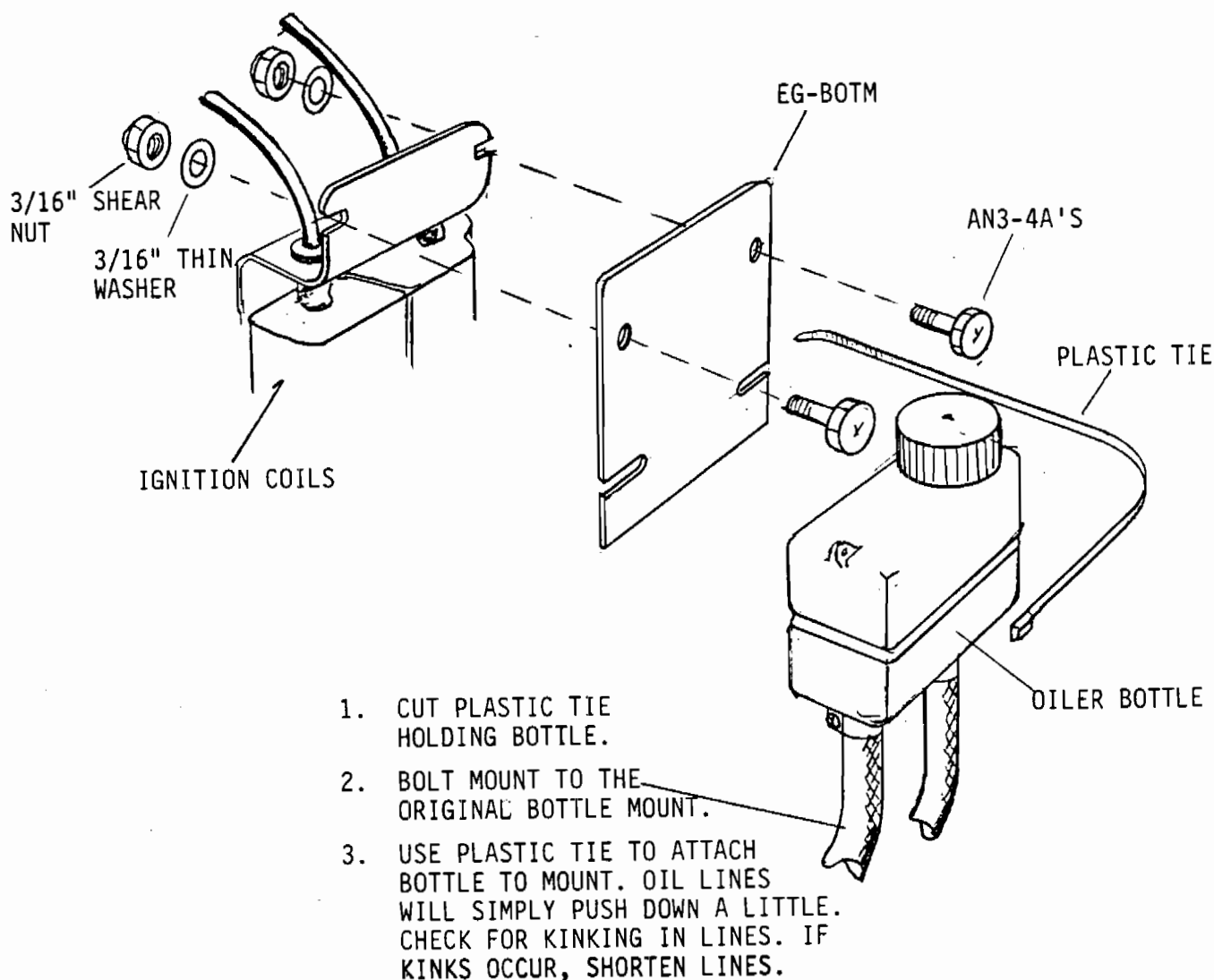
7. Install the muffler and manifolds appropriate to model type and cowlings cut outs. Torque down the exhaust "Y" pipe evenly. Adjust spring tension by bending the loops wider or narrower. Try not to over tension the springs or they will break. Safety wire the springs to the loops. If spring breakage becomes evident first try less tension, then run a bead of silicon lengthwise along the springs.

The muffler's rubber mountings vary from model to model but the concept is the same. To allow enough freedom of movement so the engine vibration is absorbed without damaging the muffler. Regular inspections of the muffler should be conducted. Cracks may develop and should be welded. A severe loss in performance may occur when a muffler comes apart!

Keep the engine compartment clean! New sources of dirt, oil and grime can be early warnings of trouble. EXAMPLE: Fuel oil mix on the engine could mean a split crankcase seal which eventually could cause a seizure. Look for trouble and correct it ASAP!!!!

SPECIAL INSTRUCTIONS FOR 582 ENGINE INSTALLATIONS FOR S-10'S ONLY
(ALL OTHER MODELS DO NOT REQUIRE MOVING OF THE OILER BOTTLE)

The oiler bottle must be moved on the 582 in order to allow cowling clearance. This is done by removing the bottle and installing the bottle mount as shown in the figure below. This will lower the bottle enough to gain cowling clearance.



THIS PHOTO ILLUSTRATES HOW TO SAFETY AND SILICON THE MUFFLER SPRINGS. THE SILICON WILL ABSORB VIBRATION THAT CAN CAUSE SPRING BREAKAGE. THE LOOP OF SAFETY WIRE IS THERE IN CASE OF SPRING BREAKAGE. ALSO PLEASE NOTE THE EXHAUST GAS TEMPERATURE PROBE LOCATION.

PROPELLER INSTALLATION FOR MODELS
S-4, S-5, S-6ES, S-7, S-9 & S-10

1. Check the propeller for balance by inserting a 1" tube through the prop center. Open a bench vise slightly wider than the prop. Position the prop horizontal with tube resting on the vise's jaws. If it is balanced it will remain level or any position it is set at. (Provided your vise is level across the prop and the jaws are smooth.) If the prop drops at tip balance by coating the light tip with a urethane spray varnish. **PLEASE NOTE:** According to the F.A.A. a propeller is still within acceptable balance if the difference is no more than the weight of a nickel. If you tape a nickel to the light end and the other tip still drops, the prop needs balancing.

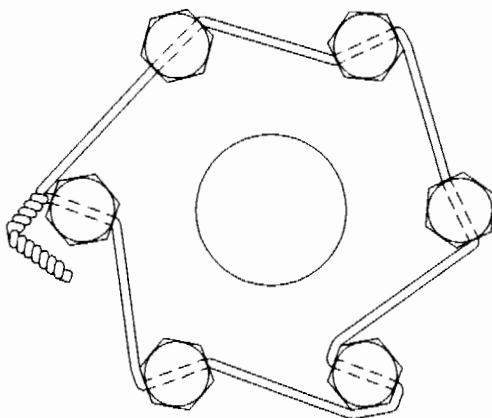
2. Bolt the prop to the engine using the (6) drilled head bolts called out on the parts page. Get all the bolts started before tightening. **NOTE:** Be sure the bolts are not bottoming out on the prop flange! Check bolt length by inserting through prop and crush plate, the shank of the bolt should not be visible if so use washers under the head to prevent this, a maximum of three is permissible any more require using a shorter bolt.

3. Torque the bolts in a crossing pattern to 10 ft. lbs. Re-check the torque.

4. Check for prop tracking by measuring from a reference point on the fuselage such as the fwd. strut attachment to the prop tip (prop horizontal). Turn the prop over and check the other tip. If there is a difference loosen the bolts and re-torque. Check again. If you cannot get it to "track" equal check first: Was prop positioned the same each time?

Debris between the prop and flange?
Are you measuring to the same place on
each prop tip?

5. Safety the bolts with the wire provided in the kit. The method shown is the simplest way to safety and is recommended if you plan on experimenting with different props. **PLEASE NOTE:** In order for a safety wire job to work the wire must be "turning" the bolt clockwise. See Figure 05.



MD227

FIGURE 05

09-29-92

S-9 CHAOS THROTTLE ASSEMBLY
FOR 503 AND 582 MODELS

The following instructions include assembly information for both the 503 and 582. If you are installing the 503 ignore the references made to the oil lines and second carb. If you are installing the dual carb 503, hook up the second throttle cable accordingly.

1. The S-9 throttle is the lever built into the lower left side of the cockpit. A small tab is welded just ahead of the lever. Use this tab to mount the friction block. Study the parts drawing for assembly details. Assemble the friction and stop system. The friction can be adjusted by tightening the bolt through the block. Move the throttle to check friction. The proper amount of friction will be set once the cables are routed. The cable stops will also be adjusted once the cables are routed.

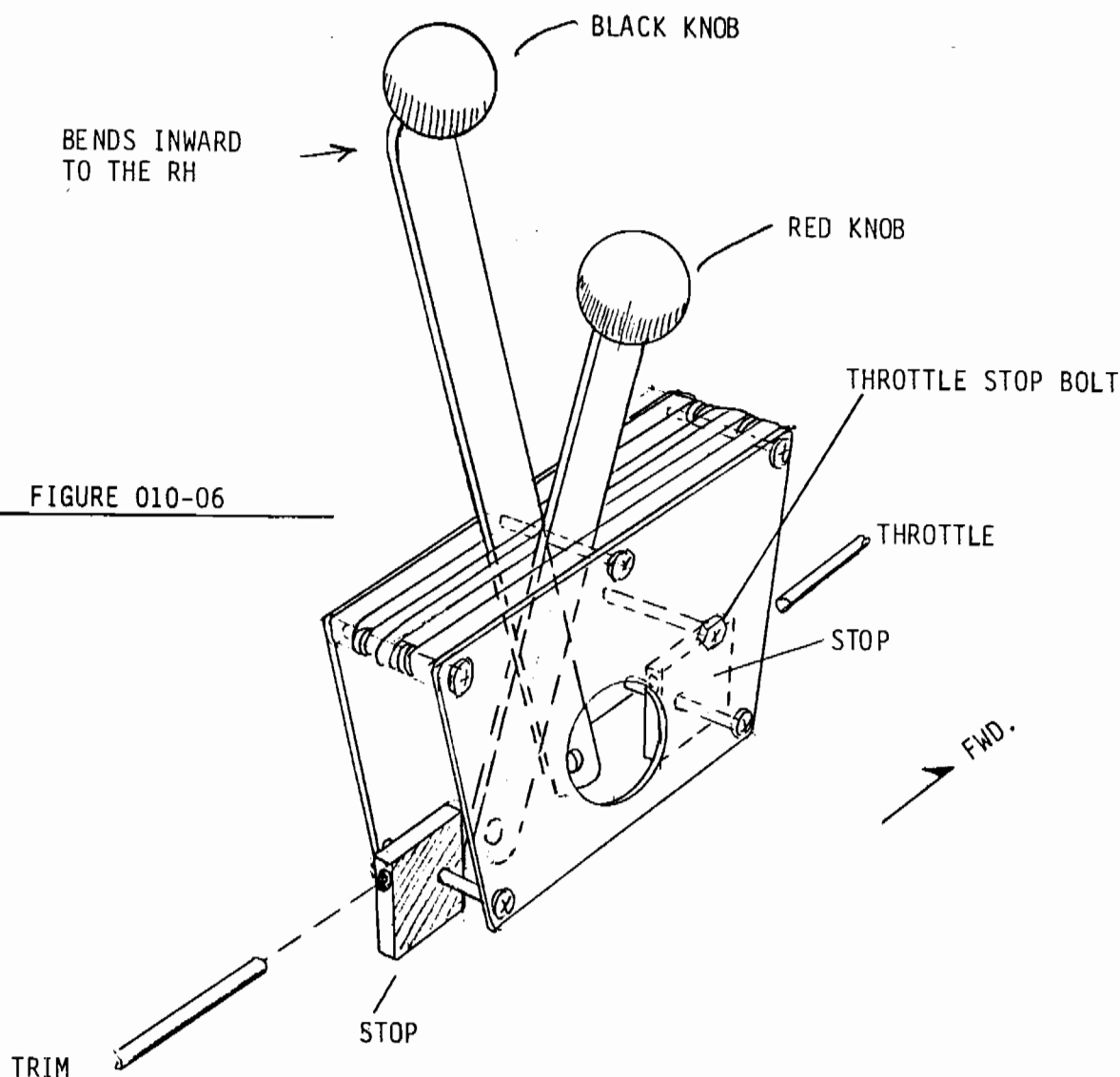
2. With the engine installed run the throttle and oil cables to the stop. The cable stop is a small tube welded to the airframe a few inches ahead of the throttle lever. There should be three holes in this tube. The cable housings will fit into the holes snug. If they are too tight strip off the plastic coating on the housings just enough to insert into the stop.

3. Run the cables from the stop to the lever. Retain them with cable stops. Adjust the cables so there is no slack when against the throttle in the closed position.

4. Aft of the throttle is a small tab welded to the frame. Use this tab to hook the throttle spring. The other end of the spring hooks to the open end of the throttle. The throttle spring is used to help overcome the friction of the three cables. It is very possible the single carb 503 systems will not need this spring.

5. Test the operation of the throttle. It should move freely with medium effort. The throttle should stay in position. If it slides closed, adjust the friction block. **IMPORTANT:** Check the throttle before flight for proper function. The cable housings can slip out of the stop if there is slack. This will cause a high idle. Check to make sure the cables are in the stops.

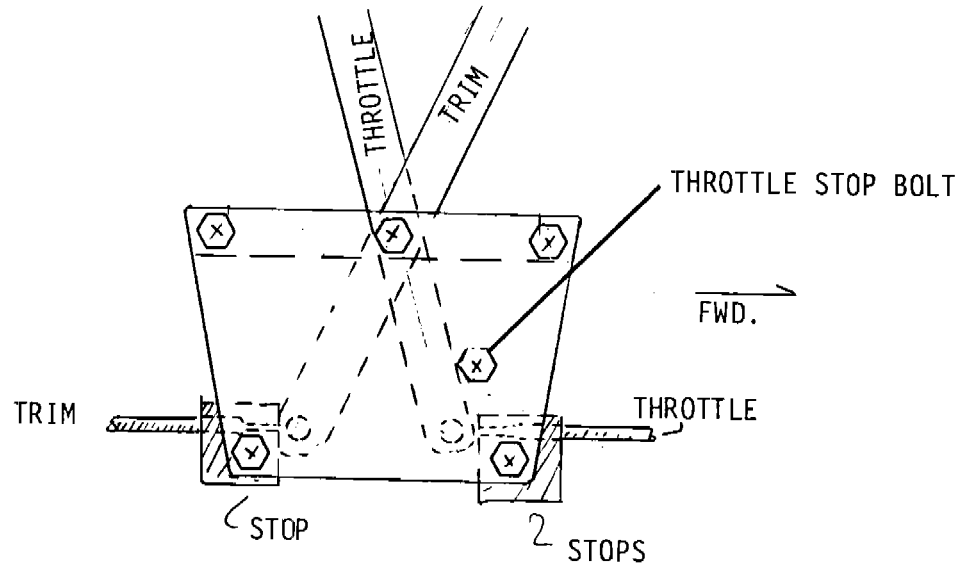
6. Notice the bolt heads are positioned on the LH side of the quad. Loosen the top two outer bolts and re-bolt with a quad attach angle under each nut. See Figure 010-06.



7. Unbolt the forward lower bolt and re-fasten after slipping on two STOPS (gray plastic square) in the position shown in Figure 010-07.

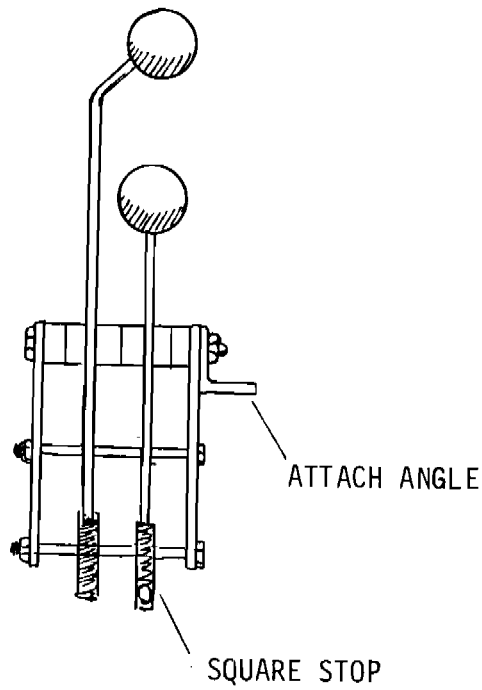
8. Check the levers for smooth easy movement. Check the positioning of the levers, stops, bolts and attach angles.

9. Bolt the quad to the left outer side of the seat frame using two (2) AN3-12A's and two (2) 3/16" shear nuts. NOTE: Install both heads down. The seat is now ready to install into the aircraft.



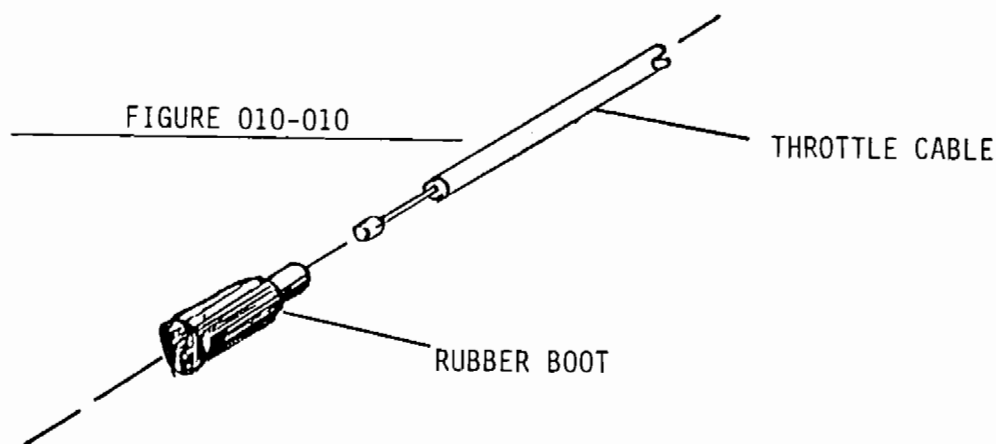
SIDE VIEW

FIGURE 010-07



AFT VIEW

10. To hook up the throttle cable you need to unscrew the carb's top plate. Take care not to let the spring inside jettison the plate onto the floor. Remove the spring and cap and place aside. Look closely at the slider...see the white plastic fitting on the bottom? Underneath this should be the cer-clip that holds the fuel metering pin. Be sure when re-assembling, the cer-clip is UNDER the white plastic. Close examination will reveal where the cable terminates, but before hooking up the throttle cable, slip that little rubber boot over the end first. See Figure 010-010. During the re-assembly note where the throttle exits the cap is not on center. Position the cap so the cable is directly over its slider position.



11. Pull on the free end of the cable to seat the housing into the fitting on top of the carb plate. Then route the cable as follows; Out the top of the carb and down over the forward side under the carb straight back to the firewall; gently curve along the firewall and into the upper grommet, down along the inside of the forward cockpit lacing and into the throttle quad. Double check to see if everything is curving gently, no sharp turns allowed....that will bind the cable. Check to see if the housing is into the carb's top plate fitting. Mark the housing length at a point where it will enter the throttle stop and still have slack to adjust the seat either front or back. Then pull the housing away from the carburetor so the cable's free end will be inside past your cut-off mark. Now cut off the excess housing and push the cable back through the open end. Check closely the housing where you've cut it. A clean cut is a must....the metal coil inside the housing can rub the cable and cause it to break. An unclean cut of either throttle or choke cable housing can also result in sticking of the controls due to the added friction. Slip a wire swivel through the throttle lever from the right side of the lever. See Figure 010-011.

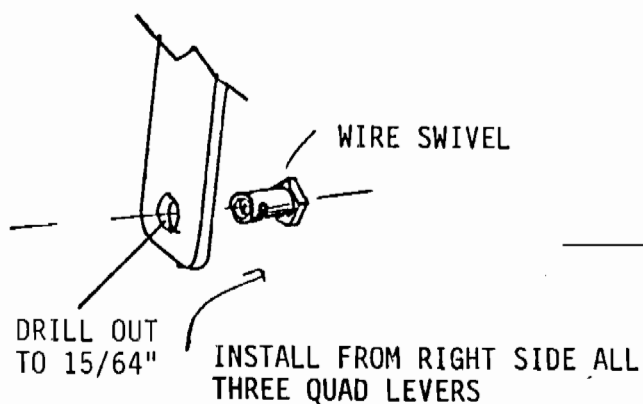


FIGURE 010-011

Next slide the cable through the lever stop then through the wire swivel. Put a drop of Loctite on the stop screw before inserting. **HINT:** Use a small piece of scrap lacing rope to tie up the seat so access to the quad is possible. **ALSO:** Use a needle nose to hold the screw to thread it to the swivel. Once the screw is started use the needle nose to hold the hex shape end of the swivel while tightening the screw.

S-9 532 COOLING SYSTEM

RADIATOR INSTALLATION

1. Before installing the cooling system remove the head outlet fitting and pump housing on the engine. File and sand the casting ridges smooth and re-install. See Figure A.

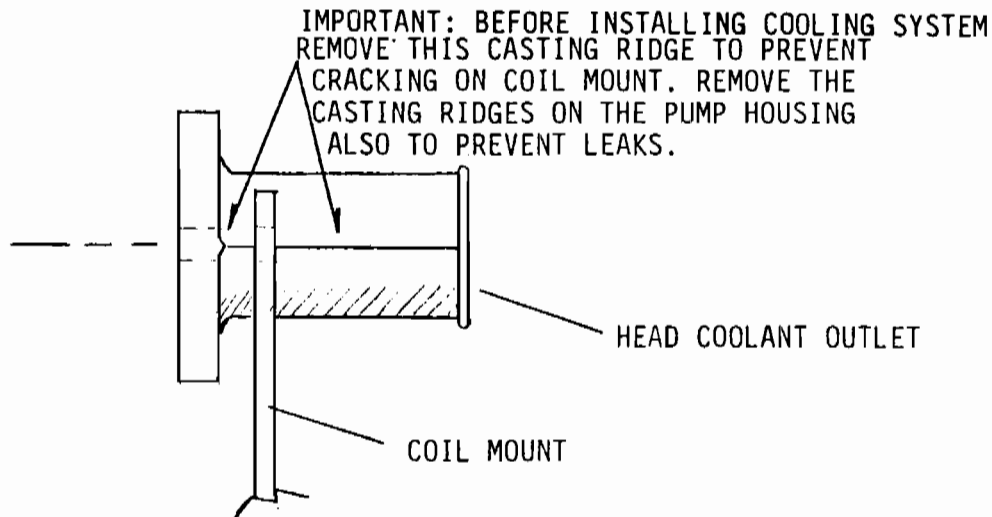


FIGURE A

2. The S-9 radiator scoop both holds the radiator at a critical angle to the slipstream as well as fences in the ram air. The ram air enters the scoop and is forced to flow THROUGH the radiator. Two factors allow this to happen; (1) A low pressure on the radiator bottom side (Due to it's critical angle to the slipstream) and (2) The ram air effect. See Figure 010A-01.

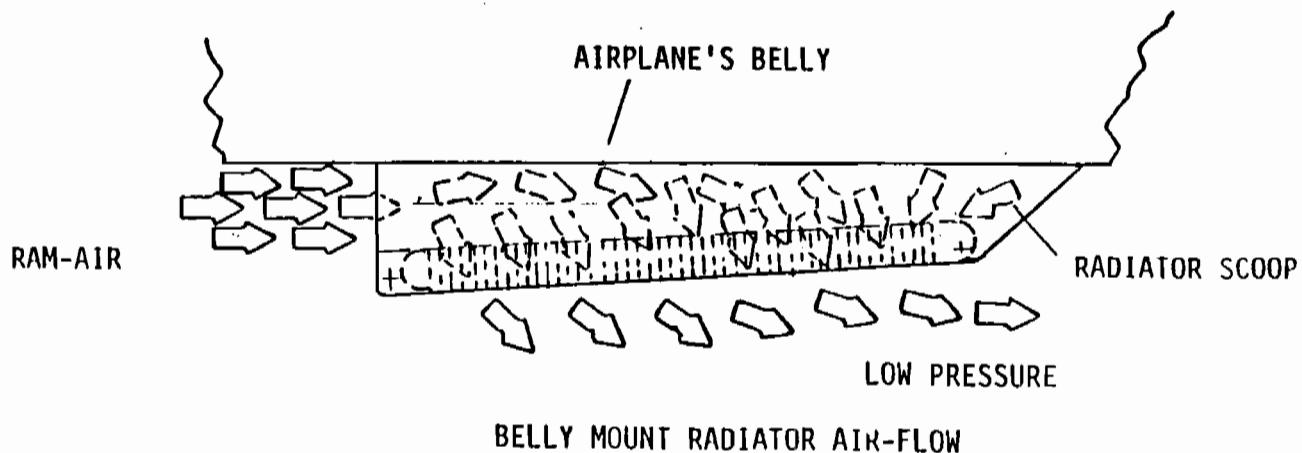


FIGURE 010A-01

3. Refer to the cooling system parts drawing and bolt the radiator to the air scoop as indicated.

4. With the fuselage turned upside down, position the RAD-SCOOP assembly over the tabs as shown in Figure 010A-03. Clamp the RAD-SCOOP assembly in place so the tabs are centered on the flanges. Drill through #11 from the inside out using the tabs as guides.

5. Remove RAD-SCOOP assembly and nut plate the tabs with (4) K-1000-3's. Place nut plates on the INSIDE!!

6. Bolt the RAD-SCOOP assembly in place with the proper bolts.

7. Our 532 equipped S-9 has the hoses on the outside, tucked up close to the belly. The hardware provided allows such a routing. The advantages of external lines are obvious, burst protection, additional cooling and more serviceable. Route lines and locate fittings as per Figure 010A-06. Some builders prefer routing the lines inside. If you choose to do so please provide pilot protection from line burst. This can be done with oversized hose.

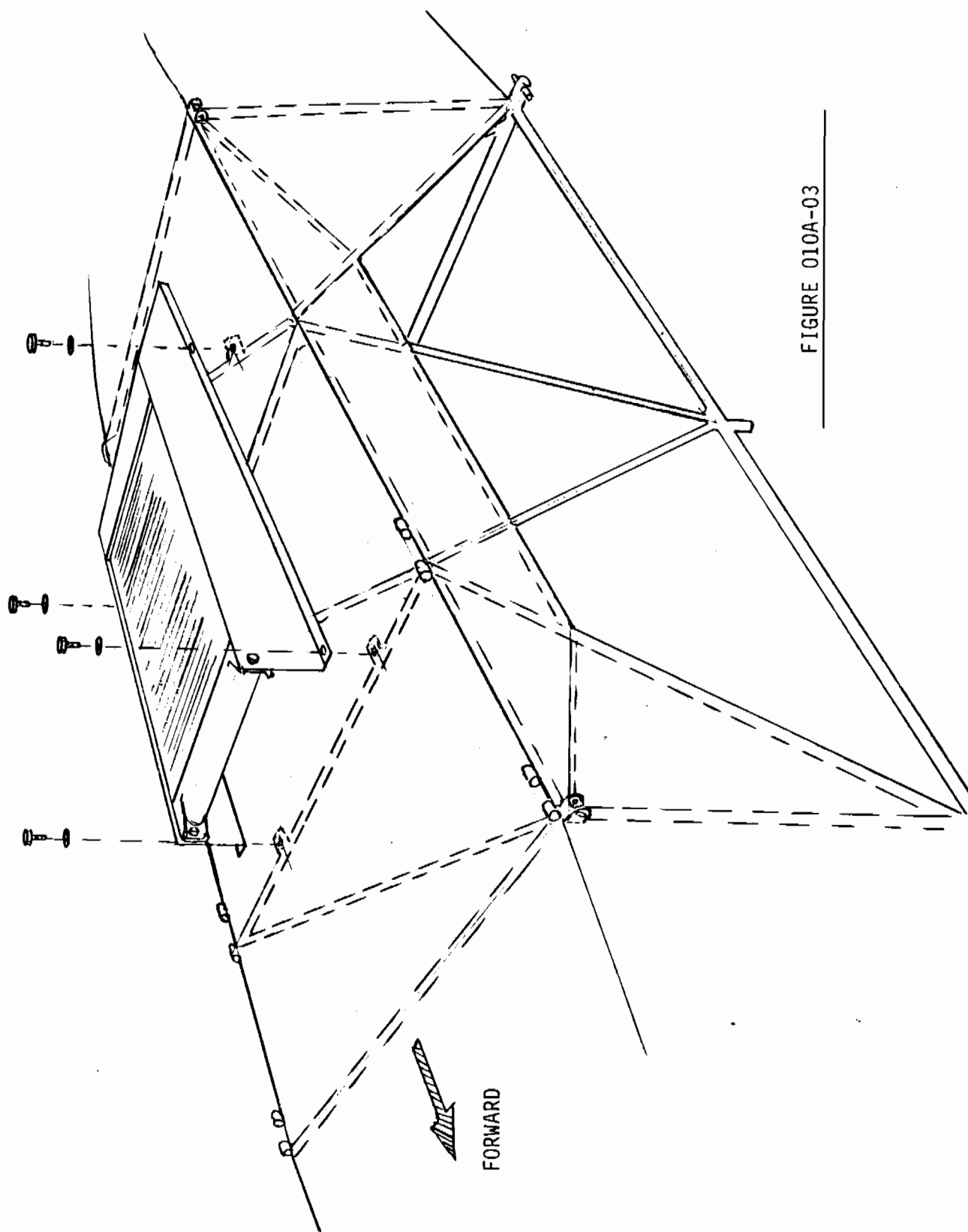


FIGURE 010A-03

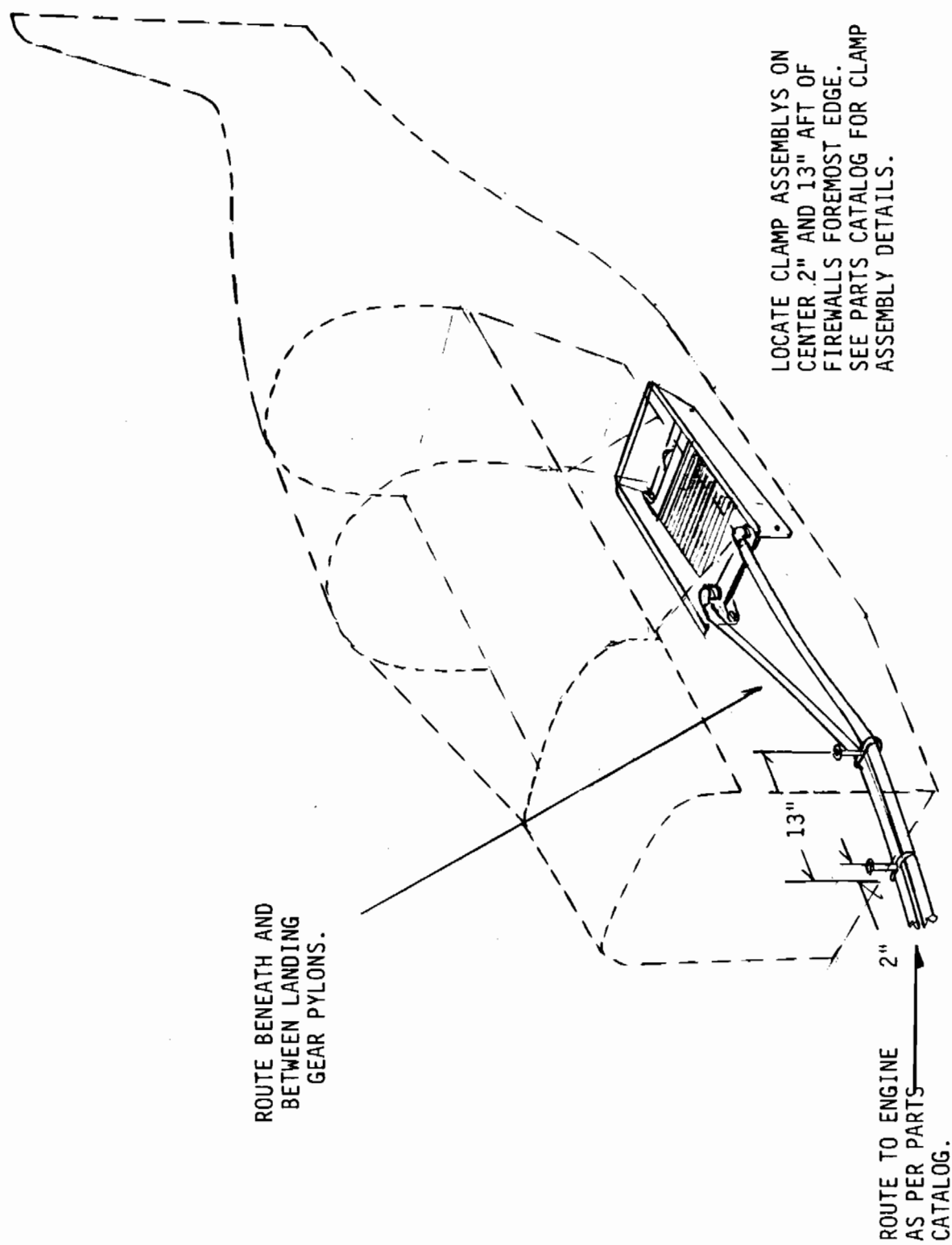


FIGURE 010A-06

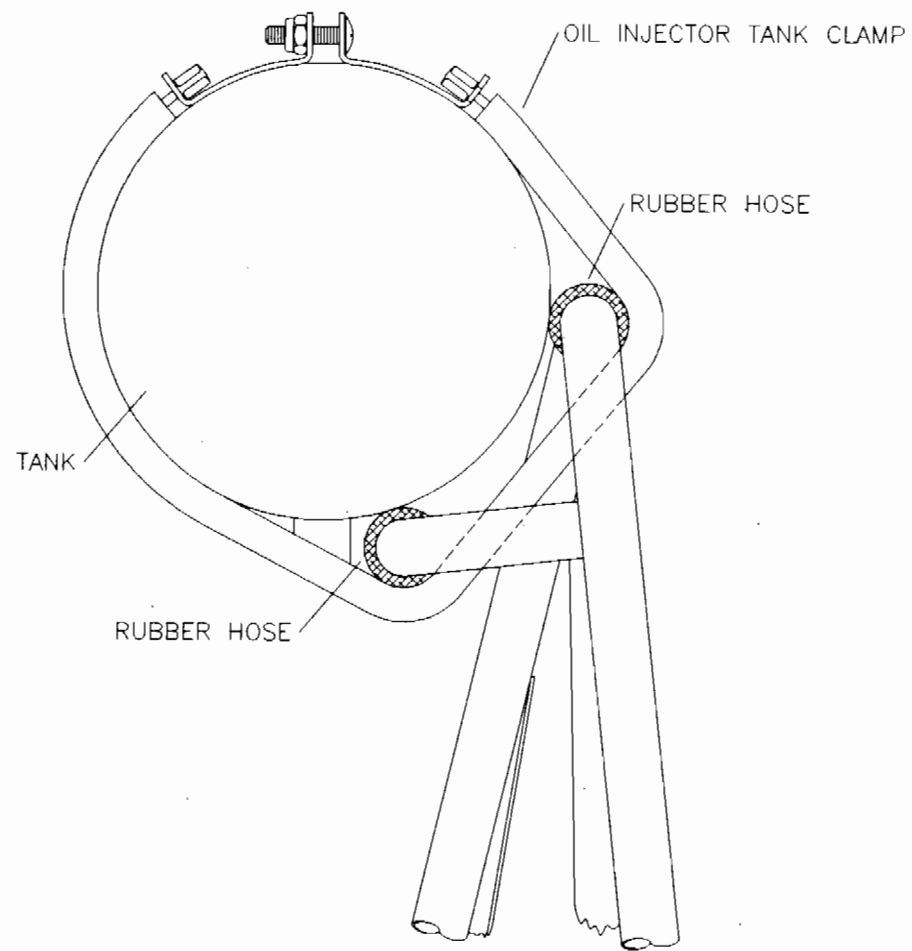
S-9 CHAOS OIL INJECTION TANK INSTALLATION USING THE ROTAX 582

The Rotax 582 features oil injection. The obvious advantage to this system is you no longer have to mix the oil into the fuel. So now once and for all you can re-fuel just like all the other planes. Only now you must remember to check the oil level in the injector tank! You may want to fabricate an access door over the oil cap. We simply remove the cowl, and check everything including the oil.

The tank gravity feeds to the pump. The pump is a metering pump and is not capable of drawing in the oil without the gravity feed. As you can see in all cases the tank is mounted **ABOVE** the oil injection pump. Someday we may have an aerobatic oil injection tank with its own pump. Until then those wanting to fly inverted will have to continue to pre-mix the oil into the fuel.

1. The oil injection tank mounts to the magneto side of the 582 engine. Look closely at the engine housing, you will see two sets of two holes on each side. These are threaded to 8mm and used to attach the mount.
2. Cut the rubber hose provided into four 1" segments. Slip these into each of the mounting holes. Place the mount in position on the engine. Apply loctite to the 8mm bolts. Slip a washer over the bolts and insert them into the mount and engine holes. Tighten the 8mm bolts to 10 to 15 ft. lbs.
3. Apply a drop of blue loctite to the oil tank fittings and install as per the parts drawing.
4. Cut the black rubber hose in half to form two 6" lengths. Split the hoses length wise and place over the mount where the tank would contact.
5. Place clamp as shown in **Figure 010B-05**.
6. Install the oil filter between the bottom fitting of the oil tank and oil pump using 5/16" line. The top fitting on the tank is the vent.
7. Check all the lines and fittings for security before filling the tank. Be sure to check the oil level before each flight. Replenish the oil with each fill up. **IMPORTANT:** Always check the security and the oil level of the oil tank and mount before each flight.

FIGURE 010B-05



MD965

S-6ES, S-7, S-9, & S-10 ENGINE MOUNT GENERAL INSTRUCTIONS

INSTALLING THE ENGINE MOUNT AND ENGINE

NOTE: Install engine mount prior to painting mount.

1. Select the proper hardware and components depicted on the parts page.
2. Deburr the (2) mount plates and smooth the edges on each end with a file and sandpaper.
3. Debur the 1 1/4" x 3/8" x .058 bushings.
4. Lightly oil the (4) 1/4" bolts used to hold the mount to the firewall. Insert these with a single thick washer under the head into the mount lugs. Line up the mount in its proper position and insert the (4) bolts into the receivers on the fuselage. PLEASE NOTE: The mount may need some "encouraging" in order to fit. Hold the mount in position over the receiver bushing in the fuselage. Use the engine mount's bushings as a drill guide.
5. Install nuts and washers and tighten to 5 to 7 ft. lbs.
6. Assemble the barry mounts and plates as illustrated. Torque these bolts 5 to 7 Ft. lbs.

SPECIAL INSTRUCTIONS FOR INSTALLING S-10 582 MOUNT PLATES

7.

Look closely at the mount plates you will notice the two holes in the center are not located in the center of the plate. The plate is installed with the holes to the front. This will move the engine approximately 1/4" forward. If the plates are installed the wrong way the muffler will not fit.

8. Set the engine into the mount with the proper number of washers between the engine and plates (if required). See chart 013-08. Torque the four metric engine stud nuts to 20 ft. lbs.

Number of 3/8" washers between engine and mount plates. Not req. on 912.

Number of 1/4" thick washers between RH side of mount and firewall. Not Req. on 912's offset built in.

S-6ES		S-7		S-9		S-10	
FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT
BD	BD	BD	BD	2	2	3	3
RH	LH	RH	LH	RH	LH	RH	LH
3	0	2	0	2	0	2	0

CHART 011-08

NOTE: Specific quantities may be required to fine tune.
BD= Builder determines. 912 Engine mounts have this angle built in.

9. Bolt on the propeller (see ENGINE for correct hardware). **Note:** Some installations have large spinners, refer to **SPINNER INSTALLATION** for details to complete prop attachment. Use 10 ft. lbs. for proper propeller torque.

10. Check the angle between the prop flange and the firewall with a protractor. Zero degrees of down thrust is used on S-6ES, S-7, S-9 and S-10's aircraft's firewall. Adjust by adding or removing the shims between the engine and mount plates.

11. Next check prop tracking by measuring from a reference point on the fuselage to the prop tip. Have the prop positioned level when measuring. Turn the prop through (ignition off?) and check the other tip. Both should read the same distance from the reference point. **NOTE:** (use the same reference point). If they don't try re-torquing the prop bolts until the prop is in track.

12. Check for offset by using a reference point on each side of the fuselage such as the wings leading edge on the S-9 or S-10 or the strut attachments on the S-6ES or S-7. With a 582 engine the right side should measure 1/4" MORE than the left to add a little left thrust. With a 912 engine the thrust is pre set into the engine mount. The exact amount can only be determined by flight testing. Start out with 1/4", add washers between the mount and firewall on the RH side to adjust. The right amount is when the plane flies straight in level flight at its normal cruise speed.

Other factors such as wing set (wash out), aileron, flap and tail rigging will affect the aircraft's ability to fly straight. Consider these factors when rigging offset. You'll know it's not the engine angle if the offset exceeds 5/8 of an inch. **IMPORTANT:** the firewall engine bolts must have (3) threads or more showing after torquing to be acceptable.

INSTALLING THE S-9 COWLING FOR THE 503

NOTE: These are general locations. Start cutting and fitting in the middle and work out. Have the engine mounted and make cowling to fit.

1. Trim cowls up to gel coat line on the aft vertical edge. Sand smooth. Trim the top to the trim line on the seam overlap. Trim the bottom to the gel-coat edge of seam joggle.

2. Locate and drill on the overlapping top a series of #30 holes. Space the screws so there is 7 per side. **NOTE:** If cowl fits loose to firewall, cut down the top overlapping edge.

3. Locate a 3/16" hole on the side of the bottom, 12 1/2" up and 1 1/4" over. See Figure 012-03. Slot as required to center at prop. Make sure prop is in proper thrust line. Locate carb and exhaust holes as per Figure 012-03 and Figure 012-03A. See template sheet 012-503.

4. Trim out the bottom by starting with a small hole and enlarging as you go. The final opening should have at least 1/2" clearance all around where the engine projects beyond the cowl.

5. Bolt the RH half cowl on with a single AN3-4A bolt to the side tab welded to fuselage. **NOTE:** A K-1000-3 nut plate should already be installed.

6. Locate and drill top holes 5 1/2" from center and 3/8" E.D. Cowl must be 14 3/4" to 14 7/8" from instrument panel. See Figure 012-06. Drill #11 and nut plate with K-1000-3's. **NOTE:** Install nut plates on S1.

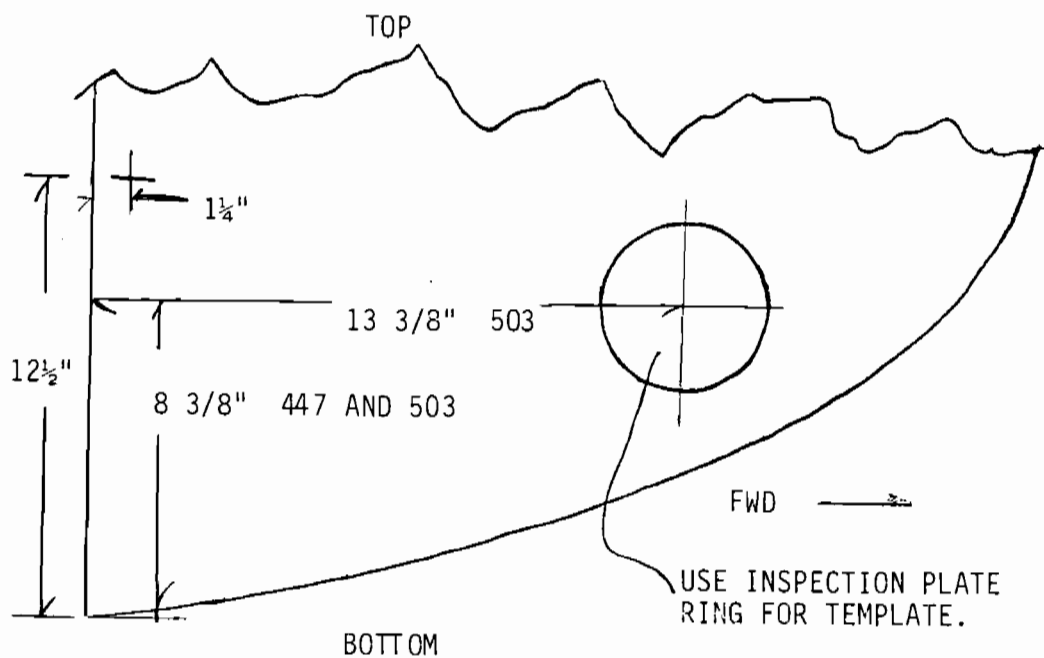


FIGURE 012-03

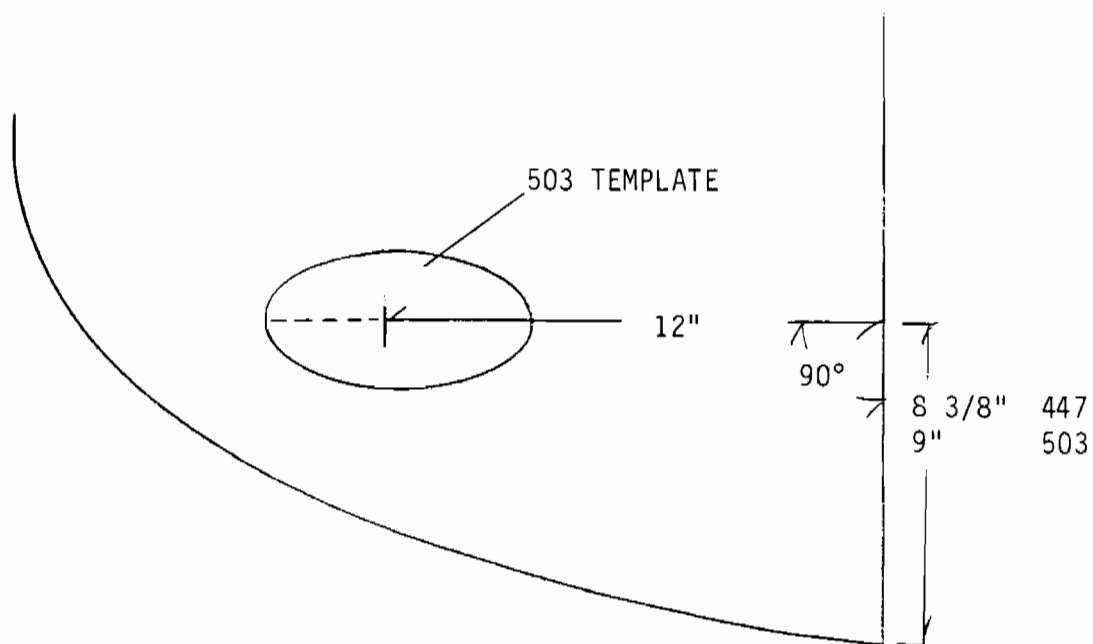
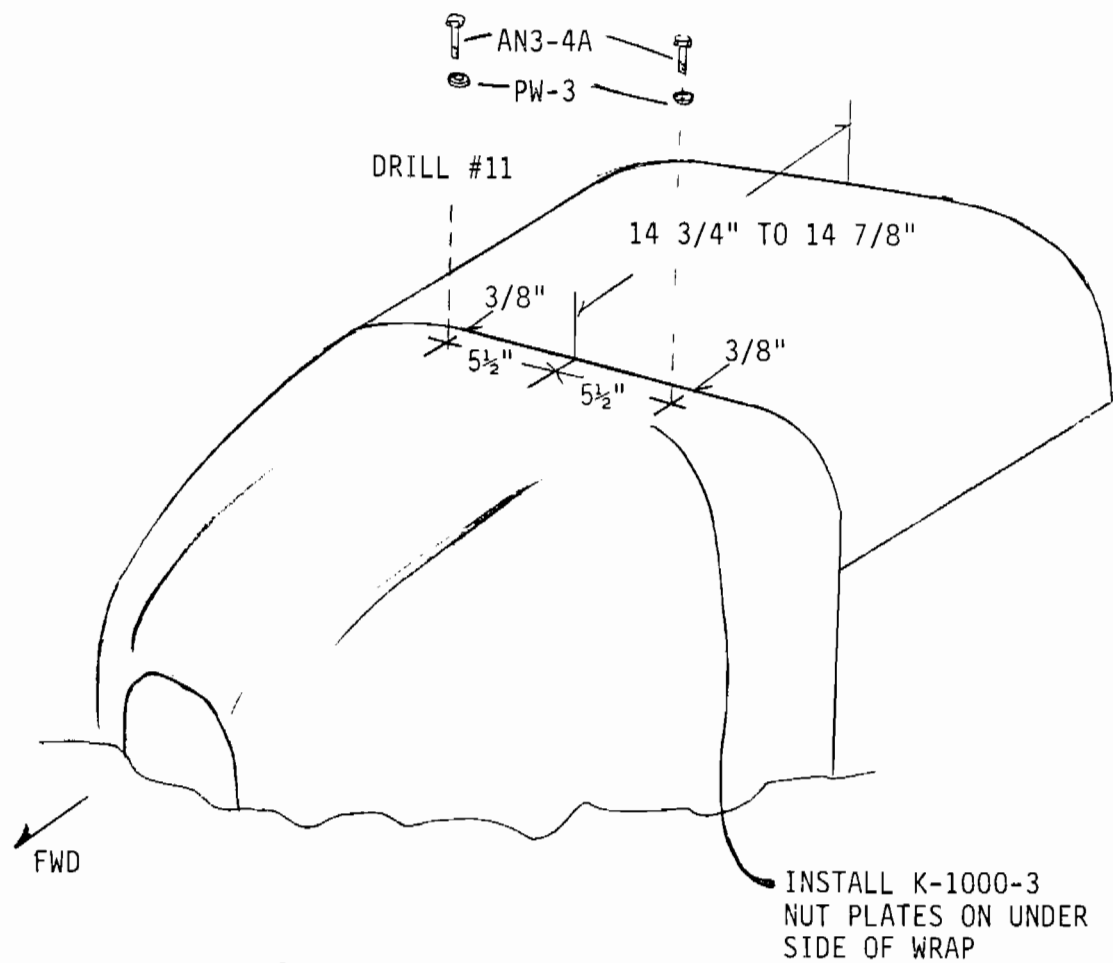
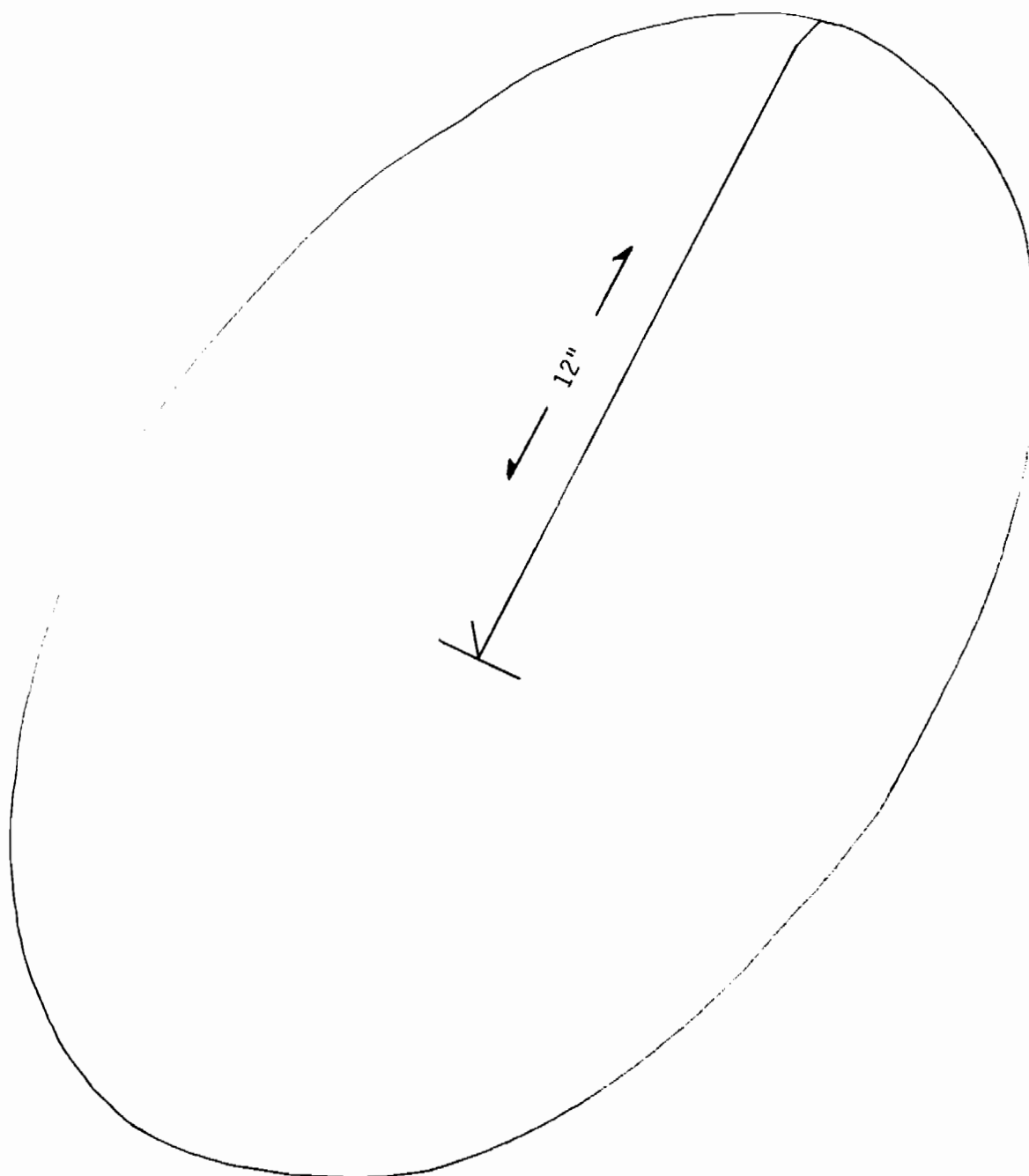


FIGURE 012-03A

FIGURE 012-06

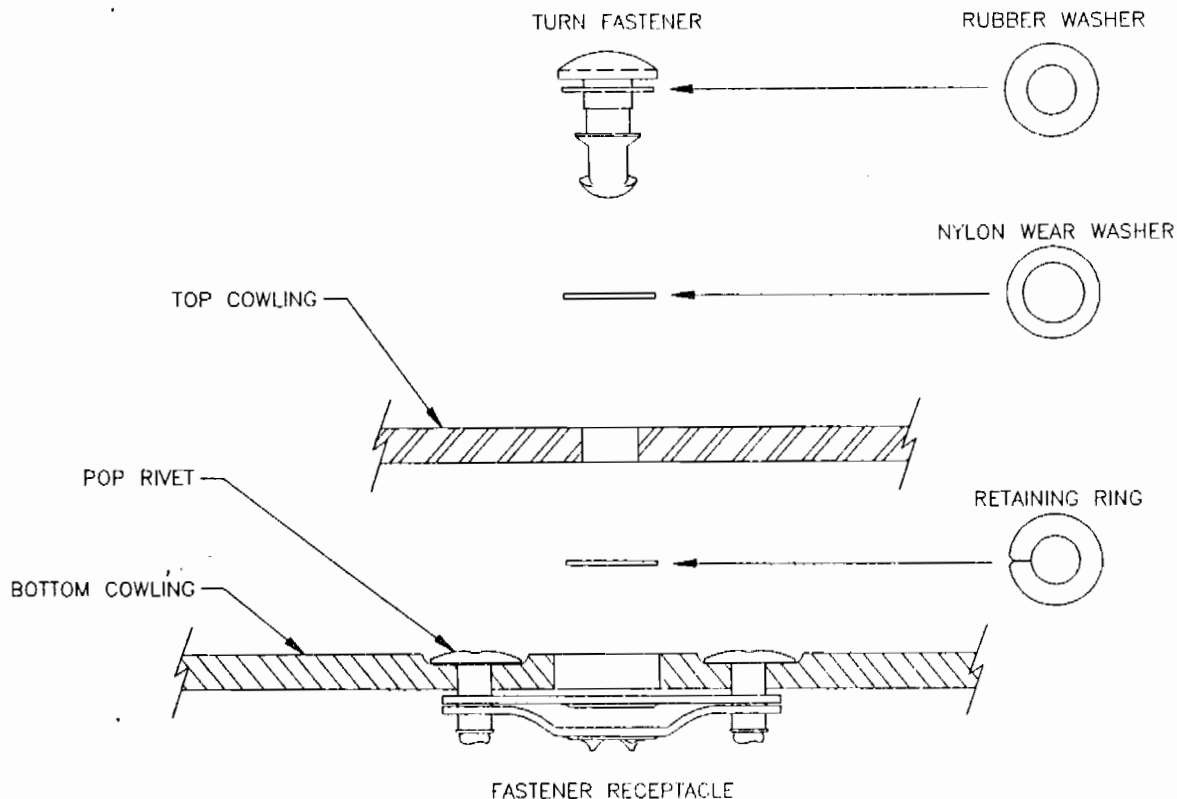


SUBJECT: 503 EXHAUST CUT OUT TEMPLATE		NO. SEE DRAWING	MODEL: S-9
MATERIALS: PAPER		FINISH N/A	
DATE: 6-7-91	DRAWN BY: RJS		SCALE:
PROPERTY OF:	RANS 1104 E. Highway 40 By-Pass Hays, Kansas 67601 (913) 625-6346		PAGE: 012-503

S-9 CHAOS COWLING FASTENERS ASSEMBLY

1/4 TURN INSTRUCTIONS

1. Select parts as per parts drawing.
2. Align and drill cowling to #30 and cleco.
3. Disassemble and drill lower cowling holes out to #11.
4. Cleco a 1/4 turn receptacle into the holes and use as a drill guide for the 3/32 rivets. **NOTE:** Do not rivet at this time.
5. Drill out the fastener or middle hole to 5/16" and rivet in the receptacles.
6. Drill the holes in the top cowling out to 1/4" and install 1/4 turns as per figure 012-6.



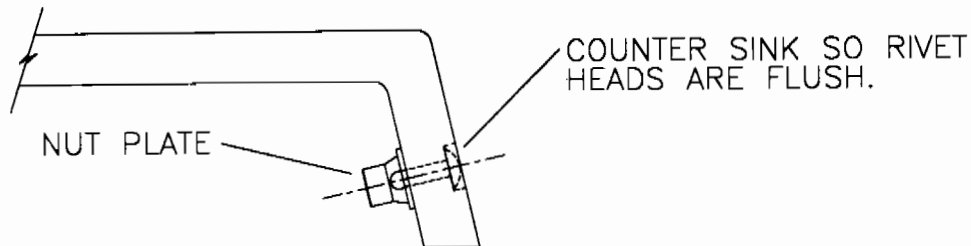
MD449

S-9 CHAOS 9" SPINNER ASSEMBLY

Refer to the parts page for selection of components and hardware.

1. The spinner and backing plate comes ready to trim and drill. Observe the scribe lines and trim to these lines. Be especially careful to trim and sand the edges evenly. Check for trueness by setting on a flat surface. Drill the backing plates center with a 1" hole saw. It may need a little sanding to fit over the prop flange. Test fit as you go. Wet sand with 350 grit paper.
2. Insert the 1" aluminum tube scrap into the prop then install on the backing plate. Prop **MUST** be flat against the plate. Drill (6) 1/4" holes through the backing plate using the prop as a drill guide. **IMPORTANT:** After drilling the first hole, insert a 1/4" bolt to prevent shifting. **NOTE:** The slight dip in the plate is used to "pre-load" the plate against the prop.
3. Set the prop and backing plate on a flat surface. **NOTE:** To assure accuracy bolt the backing plate to the prop with (3) bolts. (AN4-32A will work if washers are used.)
4. Set the spinner on the prop/backing plate assembly. Set it so an even amount of space is on either side of the prop openings. Mark the hole locations on the spinner's perimeter every 3" with (5) screws evenly spaced on each side. Drill through at these locations with a #30 bit, cleco as you go. Be sure the spinner and backing plate are flat against the table.
5. Disassemble and drill out the #30 holes to #11. Install the nut plates using a bolt to hold the nut plate in place and drilling from the inside. The rivets' heads need to be "counter sunk", do so by drilling a slight depression with a #11 bit. See **Figure 025-05**. Set the rivets by resting the head against a vise and tapping the driven end with a small hammer and check for tightness. The nut plates must be snug.

FIGURE 025-05



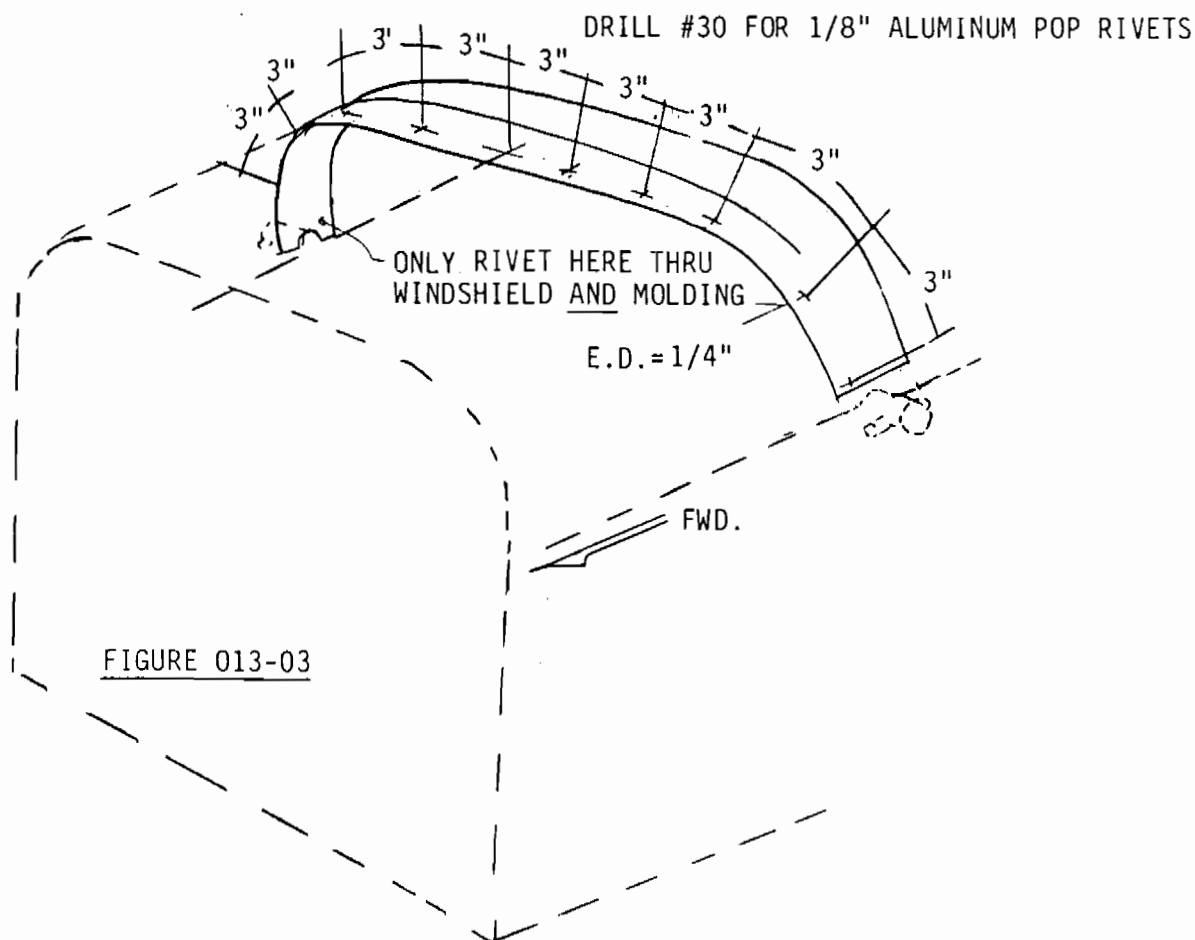
MD1372

6. Sand the spinner with 350 wet/dry paper. Paint to match aircraft.
7. The spinner and prop should be balanced and no adjustment required. However, the ultimate test is in the running. If you have a lot of vibration it could be caused by out of balance or misalignment. Use a good prop balancer such as the one LEAF sells. (Available through them or us for \$20.00.) Check both the prop and the backing plate, if the misalignment is not correctable then a new spinner may be required. Misalignment occurs through improper trimming of the parts. A slight amount of "wobble" is acceptable and may disappear at higher RPM's. Always pre-flight your spinner. Although our tests shows great promise it is still an experiment so be watching for cracks. Every 50 hours remove the spinner and prop to inspect the backing plate where it contacts the prop flange.

WINDSHIELD AND SIDE GLASS INSTALLATION. (REFER TO SECTION
013 IN THE PARTS CATALOG)

1. Lay out, drill and cleco two (2) WS-SGZ in position on the windshield as shown in Figure 013-01. NOTE: You may want to radius, debur and paint the WS-SGZ's prior to permanently riveting.
2. Temporarily attach the WS-SGZ's to the windshield using clecos. Peel the paper on both sides along the canopy former edge at least 2" back. Snap the windshield in place by slipping "Z" strips over the longerons.
3. Place the WS-MOL into position on the windshield's front edge. The molding should fit centered and tight against both the windshield and sheet metal with no gaps. There should be approximately 1" overlap on the windshield. Hold in correct position, drill and cleco as shown in Figure 013-03.

NOTE: Later after painting, during the final assembly use some silicon sealant between the windshield and molding for a water proof seal.



5. Peel back the paper for 2" on all edges both sides. Clamp the side glass panels in place so the bottom and rear edges line up flush with the 1/2" square tube. Locate, drill and cleco #30 holes as in Figure 013-05. IMPORTANT: DO NOT drill into the top longerons. The use of "Z" strips eliminates holes in the structure except for the 3/4" diagonal tubes and 1/2" square.

SLIP SIDE GLASS UNDER
WINDSHIELD

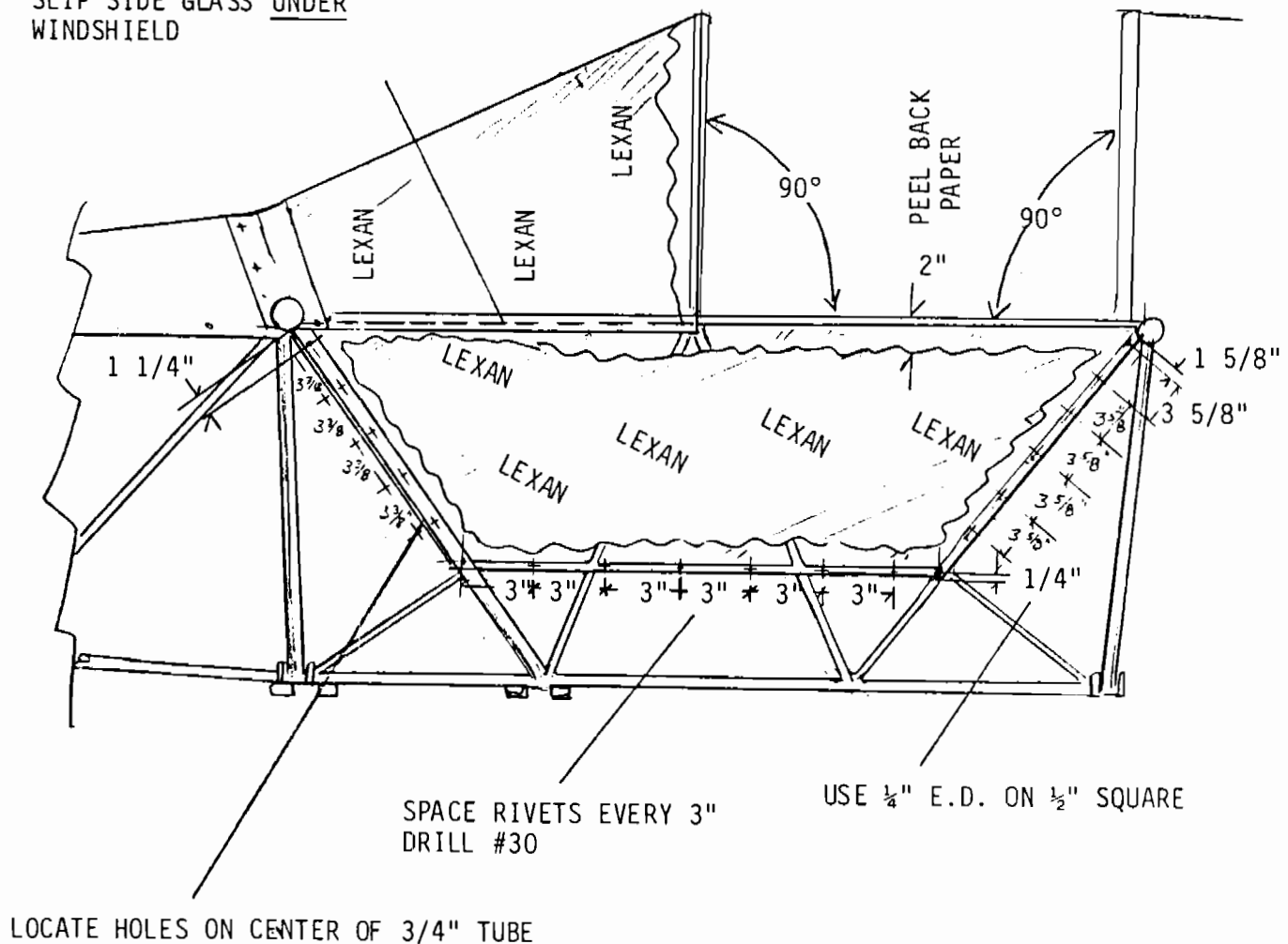
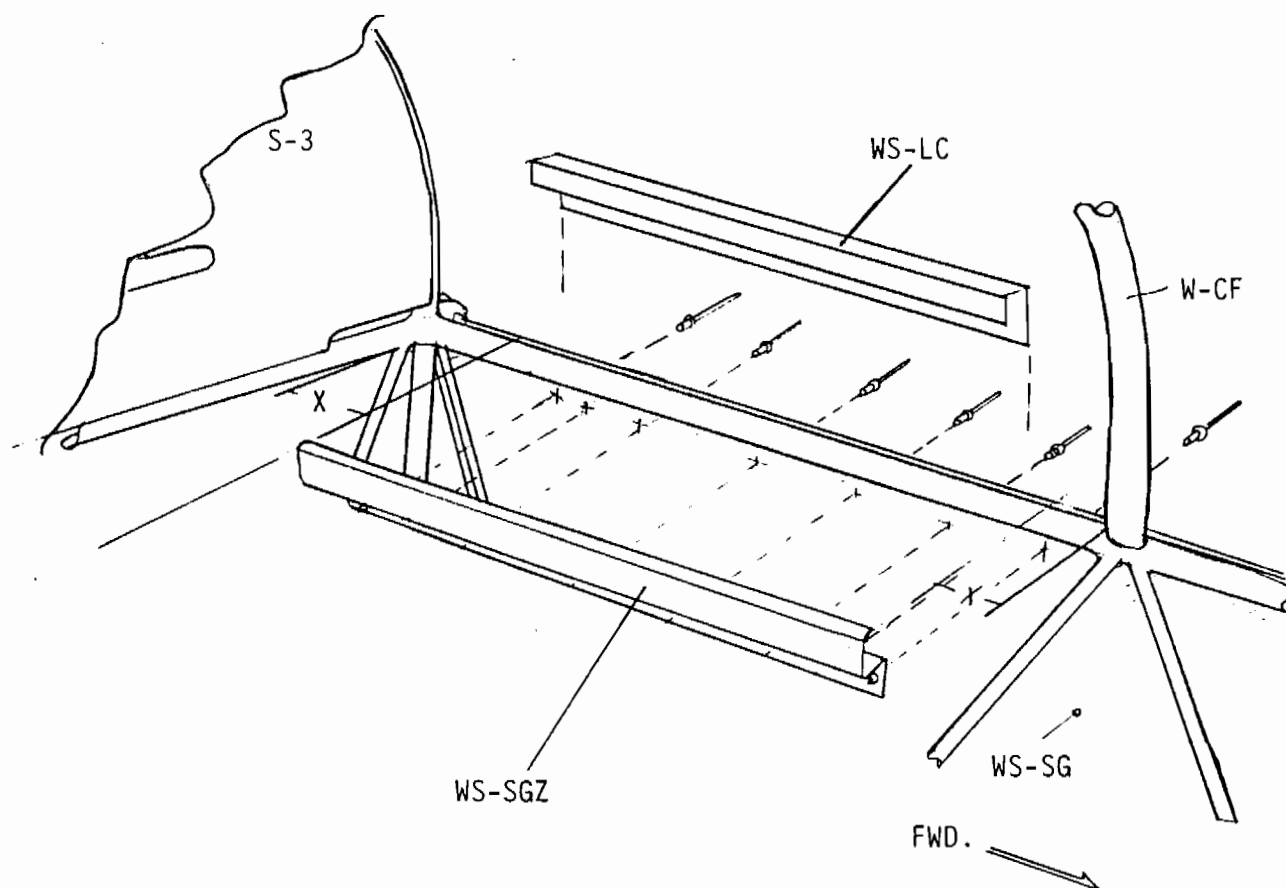


FIGURE 013-05

6. Clamp in place the two remaining "Z" strips and canopy latch channel on the left side. See Figure 013-06A. Transfer drill, cleco or rivet. Use a single 1/8" pop rivet at each end of the "Z" strip instead. See Figure 013-06. IMPORTANT!!!! All rivets install from the outside.

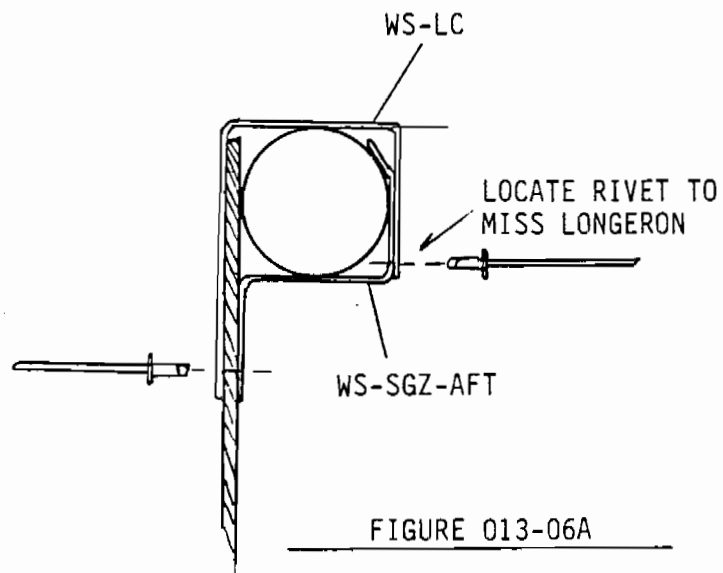


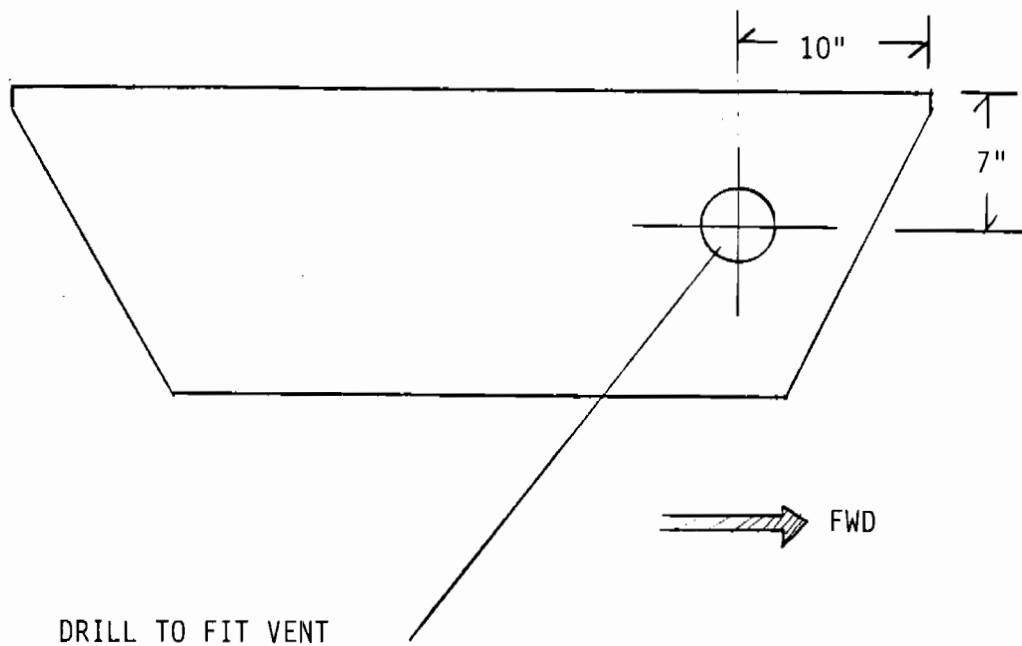
X-EQUAL DISTANCE

FIGURE 013-06

7. For a quieter cabin, prior to final assembly apply foam tape between the structure and the glass.

8. This should complete the installation of the windshield and side glass panels. Remove moldings, Lexan, formers and "Z" strips for sanding and final finish.





VENT IS STANDARD AND CAN BE PURCHASED
THROUGH RANS OR ANY OF THE AIRCRAFT
SUPPLY HOUSES. (2) RECOMMENDED ON S-10.
(1) RECOMMENDED ON S-9.

SUBJECT: 3 1/4 AIR VENT LOCATION SIDEGLASS		NO.	MODEL: S-9 S-10
MATERIALS: NONE		FINISH: NONE	
DATE: 3-2-88	DRAWN BY: RJS	SCALE: NONE	
PROPERTY OF: RANS		1104 E. Highway 40 By-Pass Hays, Kansas 67601 (913) 625-6346	
		PAGE:	

S-9 RIGID CANOPY INSTALLATION

BEFORE YOU START: Wings should be removed for ease of access. REFER TO PARTS CATALOG 013B-01, 02.

1. Lay out and cut clearance notches in one end of the canopy Lexan as shown in Figure 013B-01. This will become the RH side of the canopy where the frame hinges.

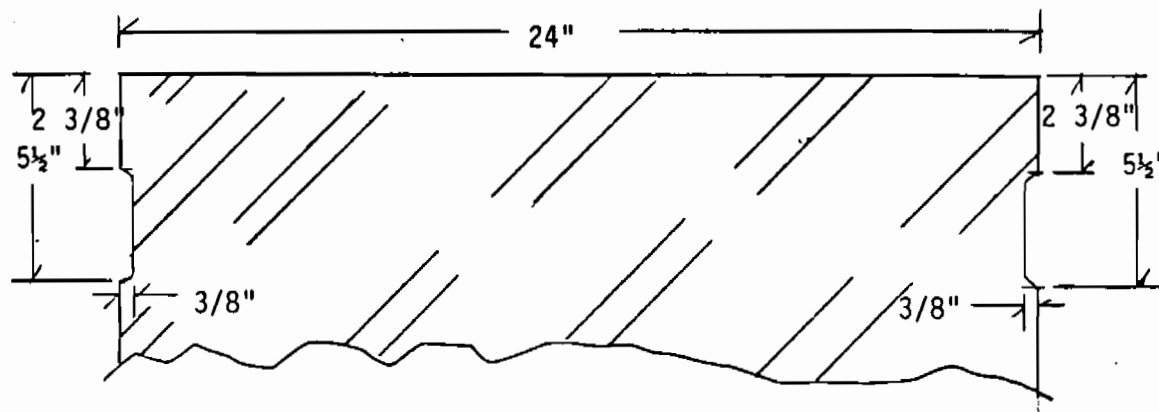


FIGURE 013B-01

2. Please check to see if windshield and rear window (if applicable) are trimmed to proper tolerance. The Lexan should be trimmed to meet flush with the edge of the clecos. This allows a "step" for the canopy to lay flush in (Figure 013B-02). Mark with a utility knife at each cleco, remove and scribe a line between marks. Continue scoring this line with the knife until a deep groove is made. Take a pliers to grip the edge and snap off the excess. Sand or file smooth and re-install.

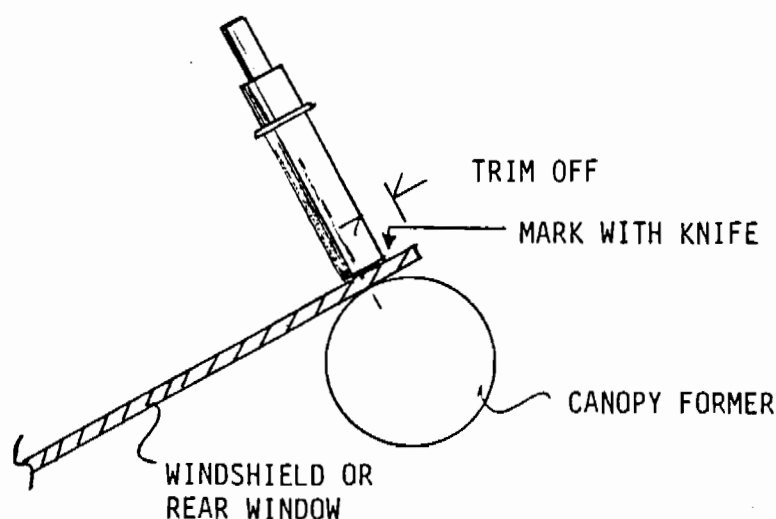


FIGURE 013B-02

3. Peel the paper back 2" on each long edge of the canopy glass. Mark the exact top center of the canopy glass on each edge. (use a Flair or grease pen to mark on the Lexan). Place the canopy glass centered on the formers with the right side properly placed. Allow the front edge to "drop in" to the step. Bend the canopy glass around the formers and tape into place (wings should be removed) with masking tape. It will now be easy to see where the canopy glass needs trimming to fit exactly between the rear window and windshield. If you have no rear window (Standard razor back) only trim the front edge to match. Remove and trim as required. Set aside the canopy glass and install the canopy frame next.

4. Clamp the canopy frame in place with 1/4" thick spacers between frame and formers (use plywood). Be sure the frame is level across the cockpit. Check this by measuring from the 1/2" aluminum tubes on the canopy frame to the top longerons. Frame and formers should be flush at the top. Once the canopy frame is positioned correctly take a 3/16" transfer punch or #11 drill bit and insert into the hinge holes (RH side of frame) and mark the hole location on the formers. Remove the frame and drill through the formers #11. Make these holes straight by lining up the drill parallel with the longerons both in top and side view. Failure to do so will cause binding of the hinge bolts. NOTE: Some hand bending of the frame may be required to gain exact fit.

5. Attach nut plates (K-1000-3's) to the front side and the rear formers rear. Cut (2) bushings 1/4" long from the 1/4" aluminum tube stock. Ream them out to accept 3/16" bolts. Attach the canopy frame to the formers with (2) AN3-22A bolts as per the parts book.

6. Lay the canopy glass in position centered with the frame and windshield. Tape down as before. Starting at top center, mark off every 3" and drill a #30 hole where the Lexan and canopy frame formers meet. Cleco as you go. (13 holes per former required).

7. Locate the hinge on the outside directly across from the hinge bolts. Drill the hinge as in Figure 013B-07. Cleco in place.

8. Lay out and drill the outer strip, left "Z" strip and right "Z" strip as shown in Figure 013B-08.

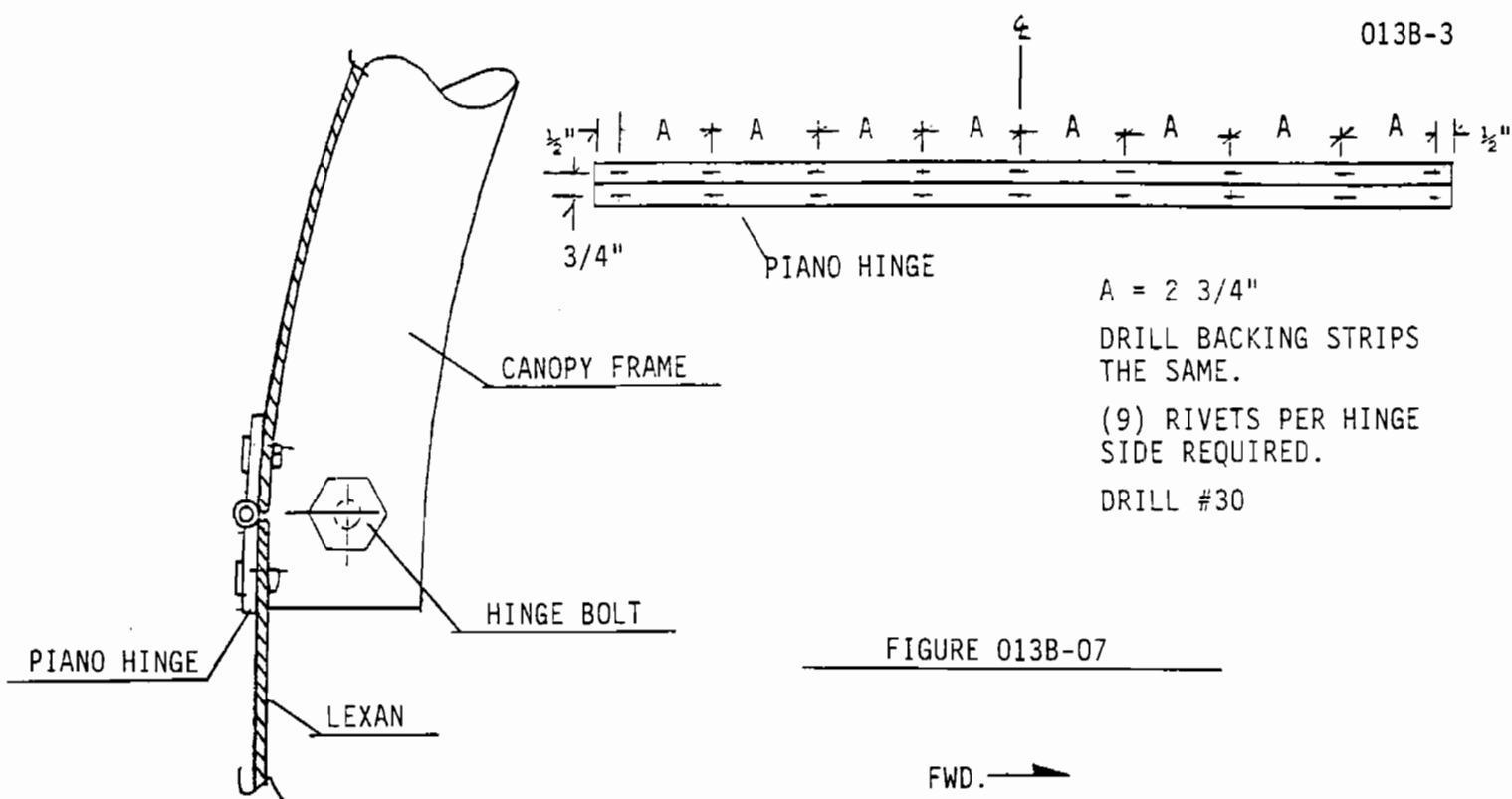


FIGURE 013B-07

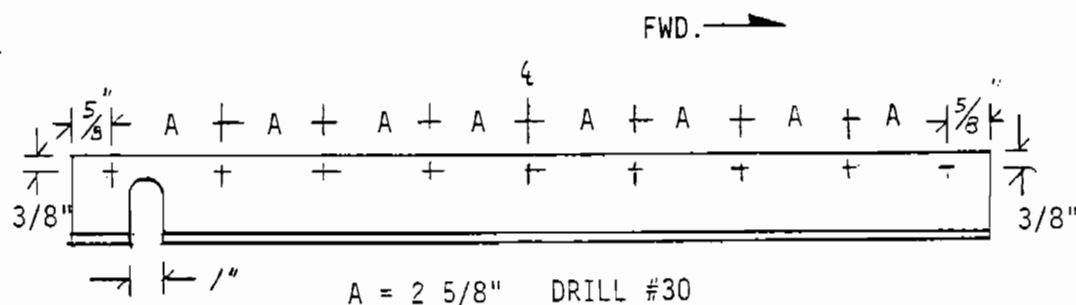


FIGURE 013B-08

9. Center the "Z" strips on the inside between the canopy formers. Space off the RH "Z" strip $\frac{3}{4}$ " from the longeron. Place the LH "Z" strip with a $\frac{1}{4}$ " gap between the longeron. Drill through and cleco #30. See Figure 013B-09.

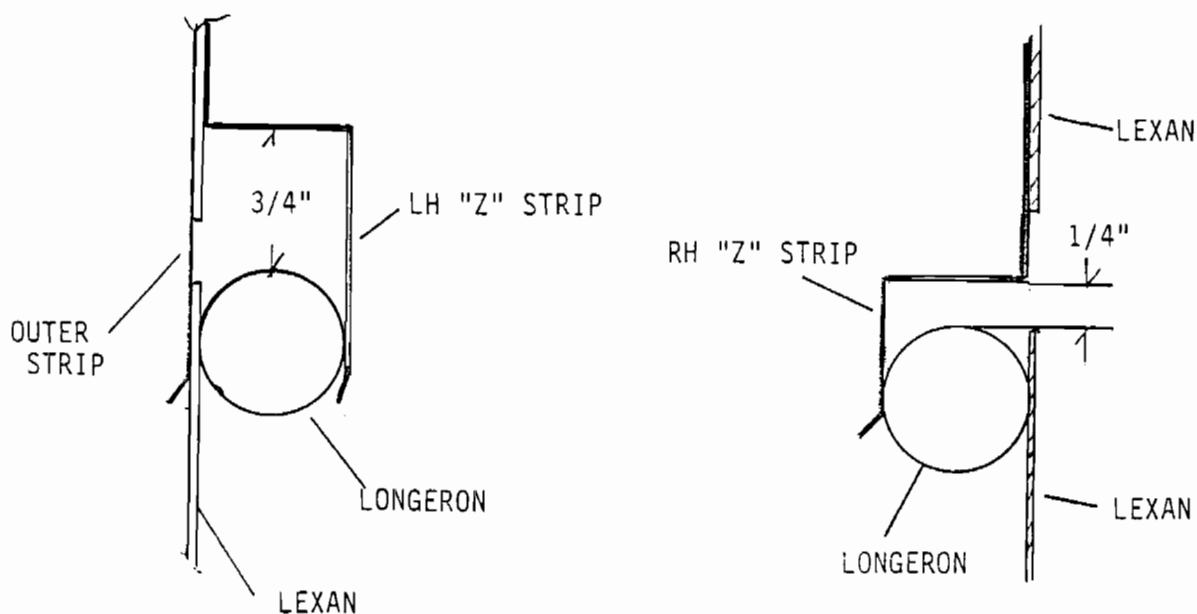


FIGURE 013B-09

10. Drill through the center of the canopy frame's top forward former #11 and bolt in place the latch handle as per the parts catalog. Cut, grind, drill and fit the latch block to the windshield former. See Figure 013C-10). Use washers as required to get a snug latch fit.

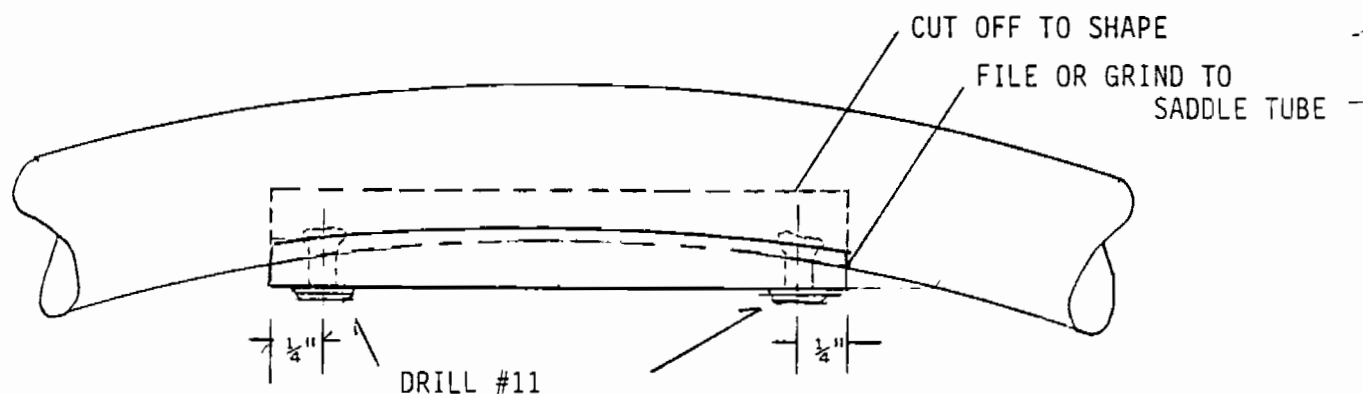


FIGURE 013B-10

11. Remove canopy glass and mark and cut Lexan at piano hinge line. Re-assemble and test open.

12. Cut the Lexan on the LH side for teleflex clearance. The aileron teleflexes will enter the cockpit OVER the top longerons and CRISS CROSS into their respective retainers. Please check for proper aileron function prior to flight.

13. The canopy should hinge over 90 degrees and rest against the wing. The rubber bumper should be installed to contact the outer root rib. Drill a hole to allow the self tapping screw to work.

14. Check hinge action and latch fit. It should require a slight down push. Install the trim lock on the LH "Z" strip to protect finish on wing.

15. Avoid leaving canopy open in high winds. Be careful to line up LH "Z" strip when closing. Maintain latch pressure to assure positive closure. NOTE: The rivet heads on the latch block act as safetys to keep latch on the block. Replace if heads wear down. DO NOT open in flight except in emergencies.

COOPER PAINTING PRODUCT USEAGE FOR THE S-9 CHAOS

ITEM	S-9 CHAOS
PRIMER DPU 35 (A)	1 1/2 GALLON
PRIMER THINNER DTU-803 80 DEGREES ABOVE	1 GALLON
PRIMER CATALYST DPU-301	3/4 GALLON
FLEX DX 369	2 PINTS
PAINT DU 8000	1 GALLON
THINNER DTU	1 GALLON
CATALYST DU-5	1 GALLON
FLEX DX 369	1 PINT
RED DU-72355	2 QUARTS
THINNER DTU	2 QUARTS
CATALYST DU-5	2 QUARTS
FLEX DX 369	1 PINT
POLY BRUSH	2 GALLON

STITS PAINTING PRODUCT USEAGE FOR THE S-9 CHAOS

MODEL	POLY BRUSH	POLY SPRAY	POLY TONE	PT-100
S-9 CHAOS	4 GALLON	5 GALLON	5 GALLON	4 GALLON

Thinners: 3 gallons per job is typical.

NOTES:

1. First coat of Poly Brush is hand brushed.
2. Poly Spray allows for 2 coats.
3. Poly Tones may vary as much as a gallon due to color selection.
4. PT-100 is a clear coat. These quantites are 2 light coats "fogged" on.
5. Thinner type varies with temperatures in the paint booth. Use a low cost lacquer thinner for gun clean up to save poly thinners for the paints.

S-9 FUSELAGE COVERING CHECK LIST

1. _____ Elevator Exits - See Template
2. _____ Rudder Exits - See Template
3. _____ Trim Cable Exit - 2" Square
4. _____ Vertical Fin Hinges - GP-1
5. _____ Foot Peg Patch - 4" Square
6. _____ Stabilizer Hinge Patches - GP-1
7. _____ Strut Attach Lexan and Patch - See Template
8. _____ Aft Carry Through Exit - See Template
9. _____ Forward Carry Through Exit - See Template
10. _____ Muffler Exit Patches - 2" Square
11. _____ Bungee Exit Lexan and Patch - See Template
12. _____ Cowl Tab Patch - GP-1
13. _____ Radiator Tab Patch - 2" Square
14. _____ Sea Plane Exit Patch (If Applicable)
15. _____ Side Former To S-3 Patch - 2" Square
16. _____ Surface Tapes On All Seams: 4" On Top Turtle Deck
17. _____ 2" Tape On Front Wrap Tabs
18. _____ Vertical Fin Seam 2" Tape
19. _____ 2" On Bottom Seam
20. _____ 2" Around Ballastic Exit
21. _____ Drain Grommets
22. _____ Inspection Hole On Bottom and Side of Tail Cone
 . See Location Drawing.
23. _____ Bottom Cable Hole On Vertical Fin - GP-1
24. _____ 2" Tape From Radiator to Nose for Bushing Exits

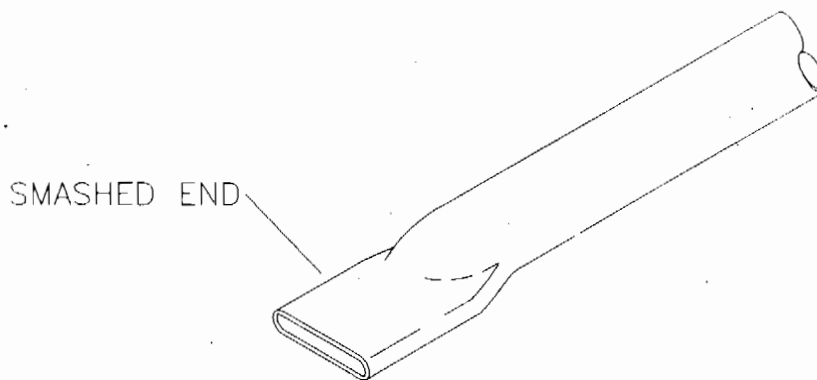
S-9 CHAOS COVERING THE FUSELAGE

IMPORTANT: Before covering the fuselage, the wing fabric must be cut from the roll. See section on wing covering, page 014-8 step #14.

1. Rivet the turtle deck formers and tubes in place as per the directions. Be sure to use the stainless steel pop rivets to fasten the A and B formers to the airframe.

2. **NOTE:** The fuselage side former tubes need to have the end smashed flat. This is done so it will slip OVER the tab welded midway up on Station 3. Tap with a mallet against a hard surface to flatten. See **Figure 014-02**.

FIGURE 014-02



MD1217

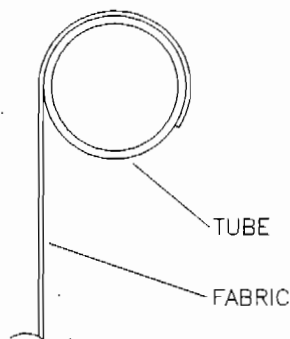
3. Bolt the two rudder cable guides to the tab in the AFT most point in the tail cone. (It's much harder with the covering on.)

4. Cut (2) sections of cloth the length of the aircraft plus 4".

5. Drape one piece of fabric from the tail to the firewall as per **Figure 014-05** (depending upon material width). Hold in place with the oversized plastic clothes pins. Trim to fit with at least 1 1/2" over hang after both sides are cut. Place them aside. The sides will be covered after the bottom.

6. Turn the fuselage upside down. Using scraps from the side cuts, trim, fit and glue the bottom fabric in place. Start at the rear and work forward. Make seams as needed by wrapping fabric around the nearest crossing or diagonal tube. As with any first fabric being glued to a frame, make sure the cloth wraps at least more than halfway around the tube. See **Figure 014-06**.

FIGURE 014-06

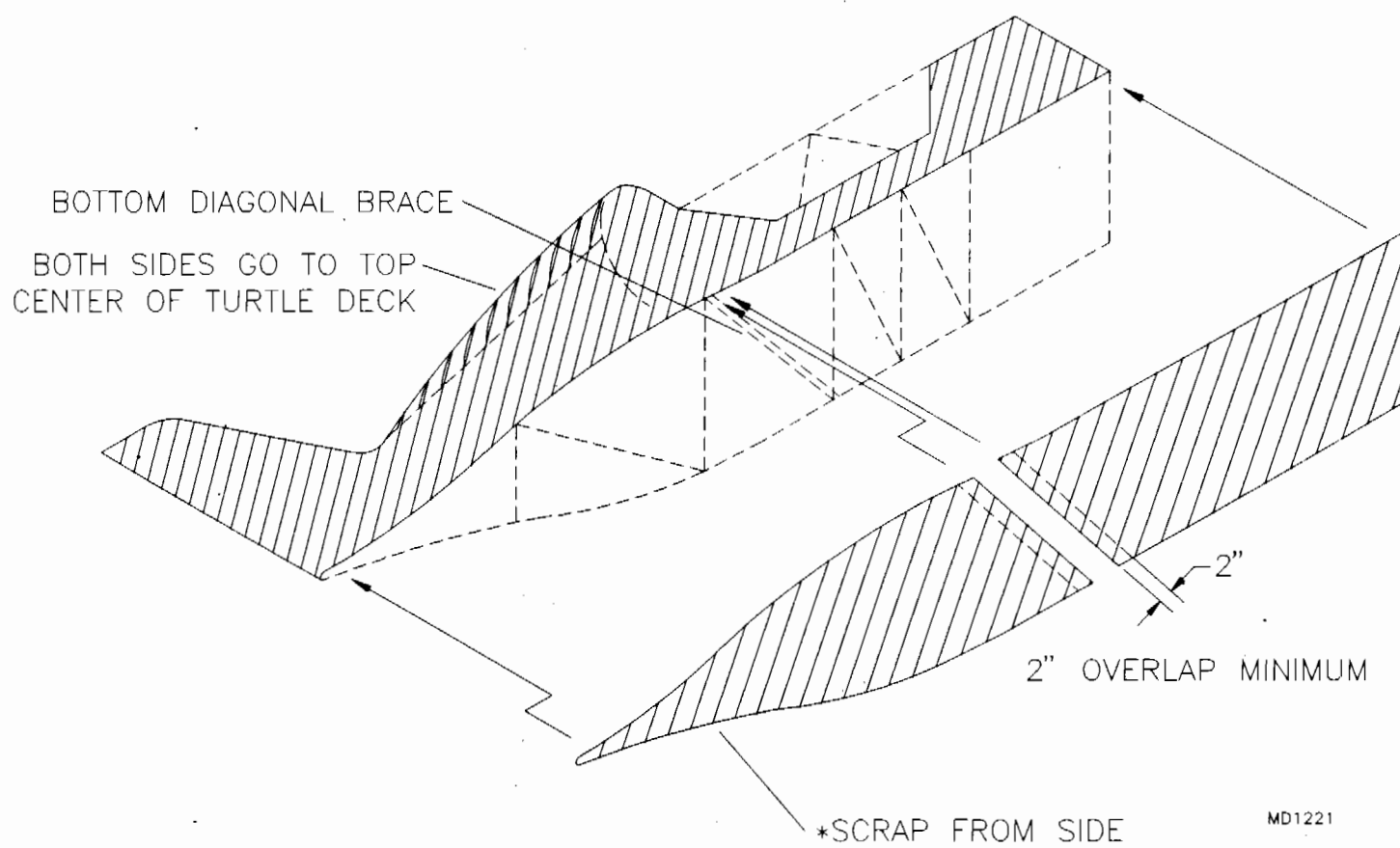


MD1218

040140cv 6/8/94

FIGURE 014-05

CUT OUT 54" FABRIC WIDTH

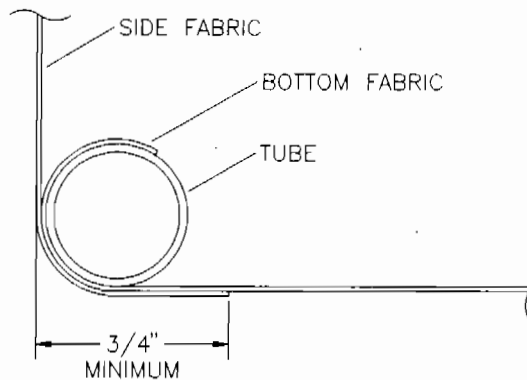


MD1221

7. After the bottom fabric is glued in place and dry, heat shrink it tight (275°) with an iron (final heat of 350° is used when all fabric is on). **NOTE:** Hot air guns can be used but be careful to move on as you see the material shrink. Also, try to use a heavy iron. The aluminum units tend to loose so much heat when used continuously.

8. Next glue a side panel in place. Let dry, then shrink very lightly. **CAUTION:** Do not over shrink where the fabric is attached to the turtle deck top stringer or it will become crooked. Look at **Figure 014-08** for bottom longeron joint details.

FIGURE 014-08



MD1218

9. Glue on remaining side panel to the very top of the stringer. Do not attempt to glue down the 2" overlap. Wait till the glue dries, then shrink the overlap portion (which should be dry and loose) to accomplish a pucker free lay down. Cement in place with Poly Brush. Be careful not to soften the area previously glued.

10. When dry, final shrink skin (350°).

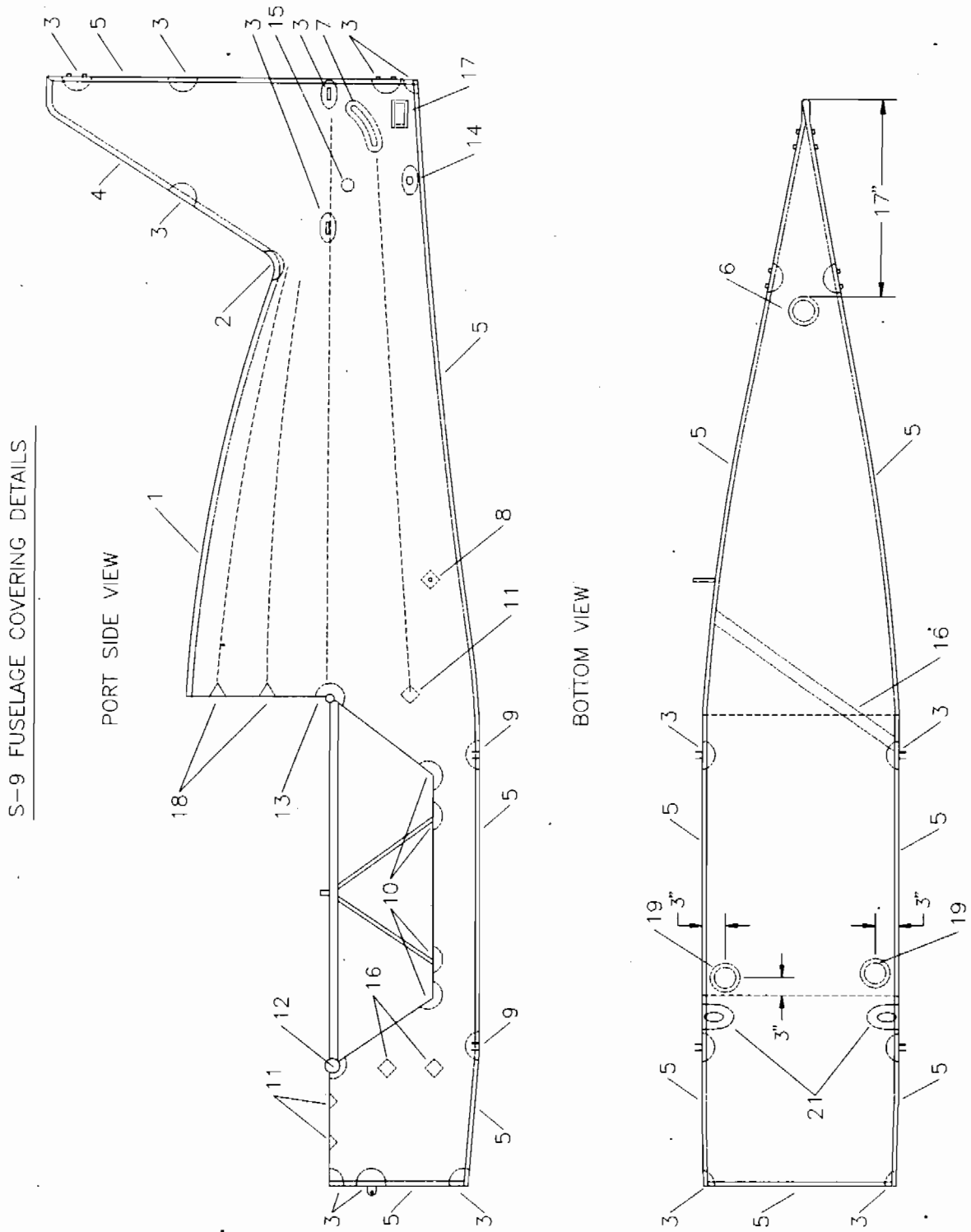
11. Using the locator chart on page 014-11 and the template prints located on page 014-11, A, B, C, D, E, F, G, GA. Refer to nomenclature chart following **Figure 014-011** to apply detail work to the fuselage.

12. When all the details are completed re-check your work using the nomenclature chart.

13. The next step is painting, starting with sealing the fabric. Following the STITS manual will yield excellent results but only for STITS products. Whatever system you've chosen be sure everything is compatible and the directions are followed to the letter...unless you have experience on your side, deviations will be costly.

FIGURE 014-011

MD1219

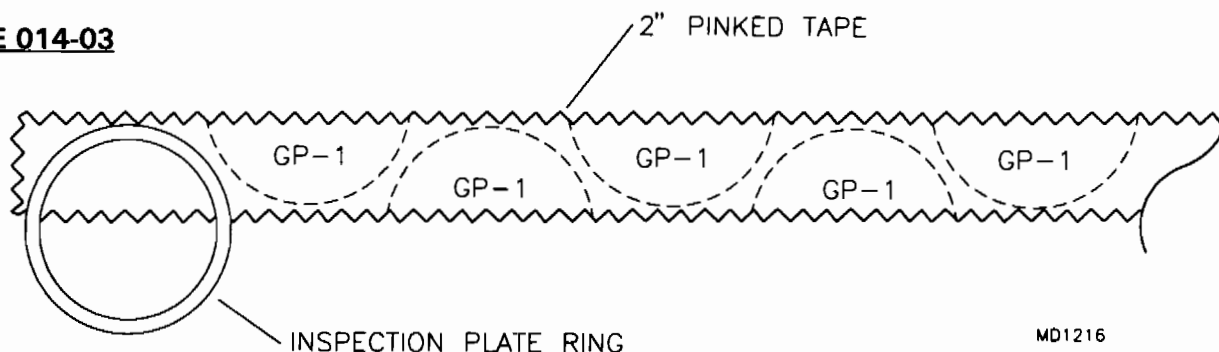


S-9 CHAOS FUSELAGE COVERING TAPES, EXITS AND REINFORCEMENT LOCATIONS

See the diagram showing details. **PLEASE NOTE:** All patches of fabric should be cut out with a pinking shears unless otherwise noted.

1. **2" Tape Covers:** Overlap the seam of each side panel. Place offset on one side of top stringer.
2. **Bias Tape:** Make 6" X 2" cut fabric scraps 45 degrees to wrap/weave of fabric.
3. **GP-1 (See Prints):** This is a common patch used in many places. The patch is cut from 2" pinked tape. Use an inspection plate reinforcing ring as a template. See **Figure 014-03**. About 80 will be required.

FIGURE 014-03



4. **2" Pinked Tape:** Glue centered edge on the edge using a small amount of Poly Tak. Poly Brush the areas where the tape will lay. When this is dry, press the tape down with a hot iron (moderate heat) on either side of the bend. Use this method on all outside corners on the tail group.
5. **2" Pinked Tape:** These tapes should be glued on with Poly Brush on one side and left to dry. Be sure tapes are glued on so they wrap the edges evenly. Glue down the other side when the first edge has dried. This method eliminates the "spring back" tendency of the tape when trying to glue it all down at once. Use this trick throughout the covering process.
6. **Inspection Plate Rings:** See print for exact locations.
7. **Elevator Exit:** See print for exact locations and fabrication template. It is made from .060 lexan scrap. Cut a fabric cover patch 1" larger all round.
8. **4" X 4" Square Patch:** Cut from lexan scrap material. Center hole should fit tight over the foot peg.
9. **Strut Tang Exits:** It is made from the thin lexan sheet provided. Simply tape down the print, peel off the plastic coating on the lexan, tape down the lexan over the print and cut out with a razor. A deep score with a razor knife is sufficient to simply "snap" the part out. Cutting clear through with the razor is not only difficult but unnecessary.

Once the lexan part is cut out, check it for fit. Next, cut a patch of fabric approximately 1" larger (see print). Soften and glue the lexan to the tang exits with Poly Brush. Then Poly Brush down the fabric patch.

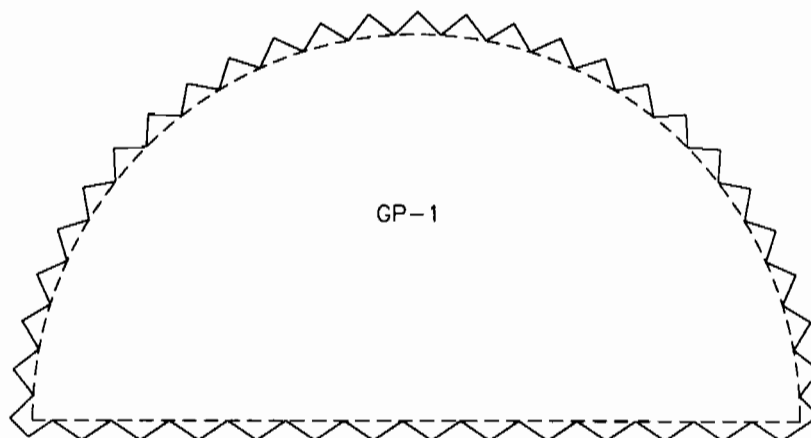
10. **2" Circle Patch:** These are 2" diameter circles cut in half or to fit and Poly Brush on at the side window junctures. (6 required)

11. **2" Square Patch:** Cut from 2" pinked tape, then cut in half. Lay over tabs for attaching the top wrap and where the side stringer ends forward. (6 required)
12. **S-2 Wing Attach:** Use print for pattern. Poly Brush in place.
13. **S-3 Wing Attach:** Use print for pattern. Poly Brush in place.
14. **Rudder Cable Exit:** Rudder cable exit cover. Glue direct to the fabric. Cut a patch 3/4" larger with center out for exit "bump". Locate the center of the slot 16" from the end and 1" up.
15. **Trim Exit:** This is on the aircraft's starboard side and is simply a 2" X 2" patch. Poly Brush in place.
16. **Muffler Attach Bushings:** These are 2" X 2" patches. Poly Brush in place on **BOTH** sides of fuselage.
17. **Tail Spring Bolt Access:** See print. 5" X 7".
18. **4" Square Patch:** For S-10's only. Apply to reinforce stringer to former intersections. See print 014-11G.
19. **Brake Cable Exits S-9 and S-10's:** Locate 3" inboard and 3" AFT of forward seat truss. Use a 2" diameter lexan disc sandwich with fabric.
20. Wrap the fabric to a convenient tube to make the fabric scraps work for covering the belly.
21. **Gear Socket Patch:** Cut a fabric patch 2" greater than the gear socket hole, apply to the bottom over the hole.

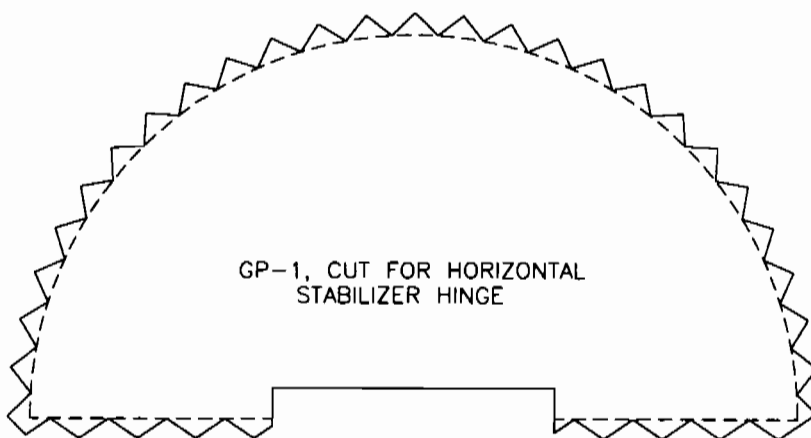
*Poly Brush is a STITS product used to seal the fabric. A similar material is ok if it heat bonds.

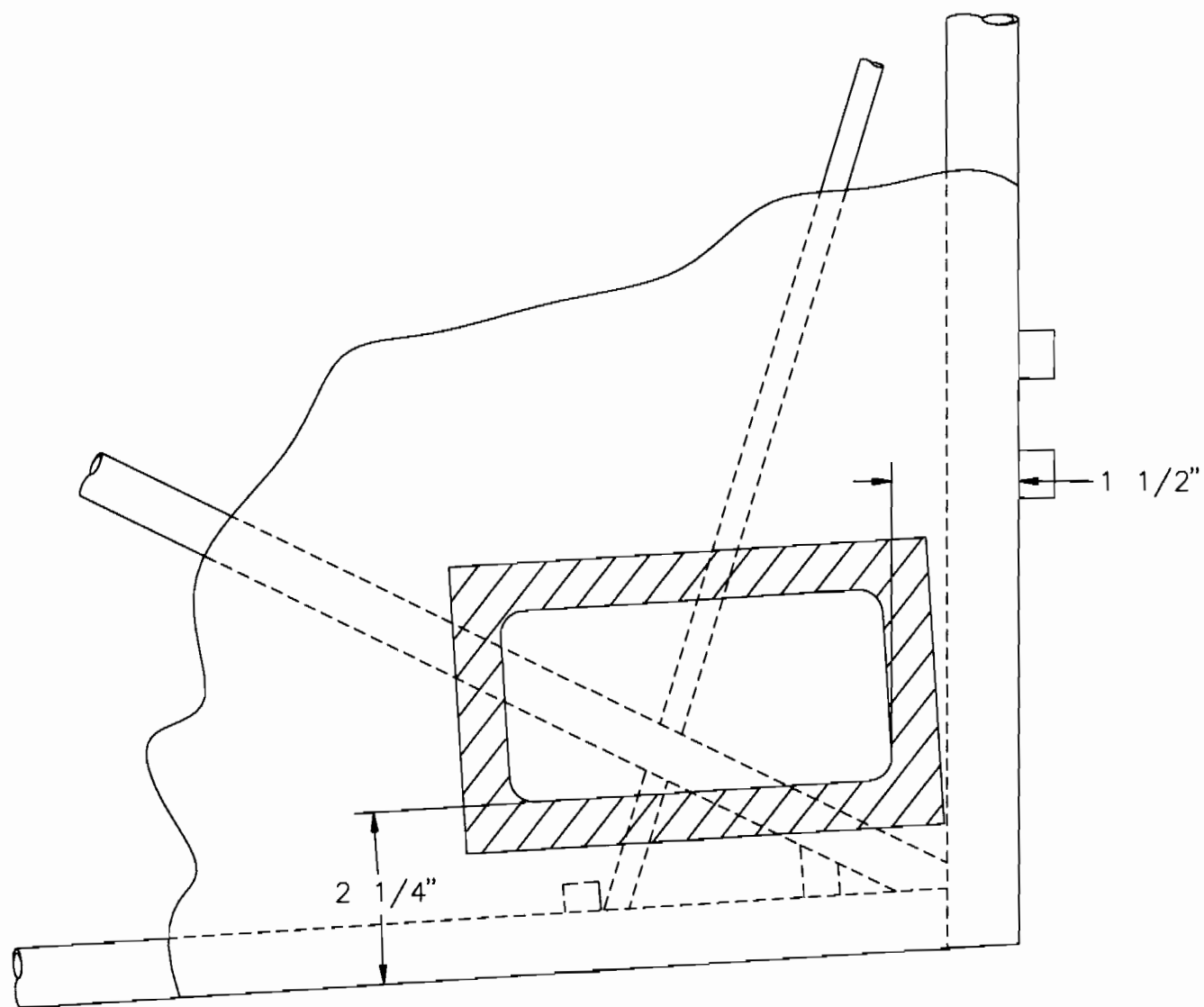
GENERAL NOTES:

1. Poly Brush **ONLY** where the patches and tapes will lay. Excess will show up even with the final clean coat.
2. Melt in loose pinked edges with the iron.
3. Typically pink all edges of patches.
4. Do not "over brush", it can cause roping, the rolling up of the Poly Brush or Poly Tak into a gooey mess!
5. Make sure all tapes and patches are evenly top coated with Poly Brush or whatever sealer you are using prior to spraying.

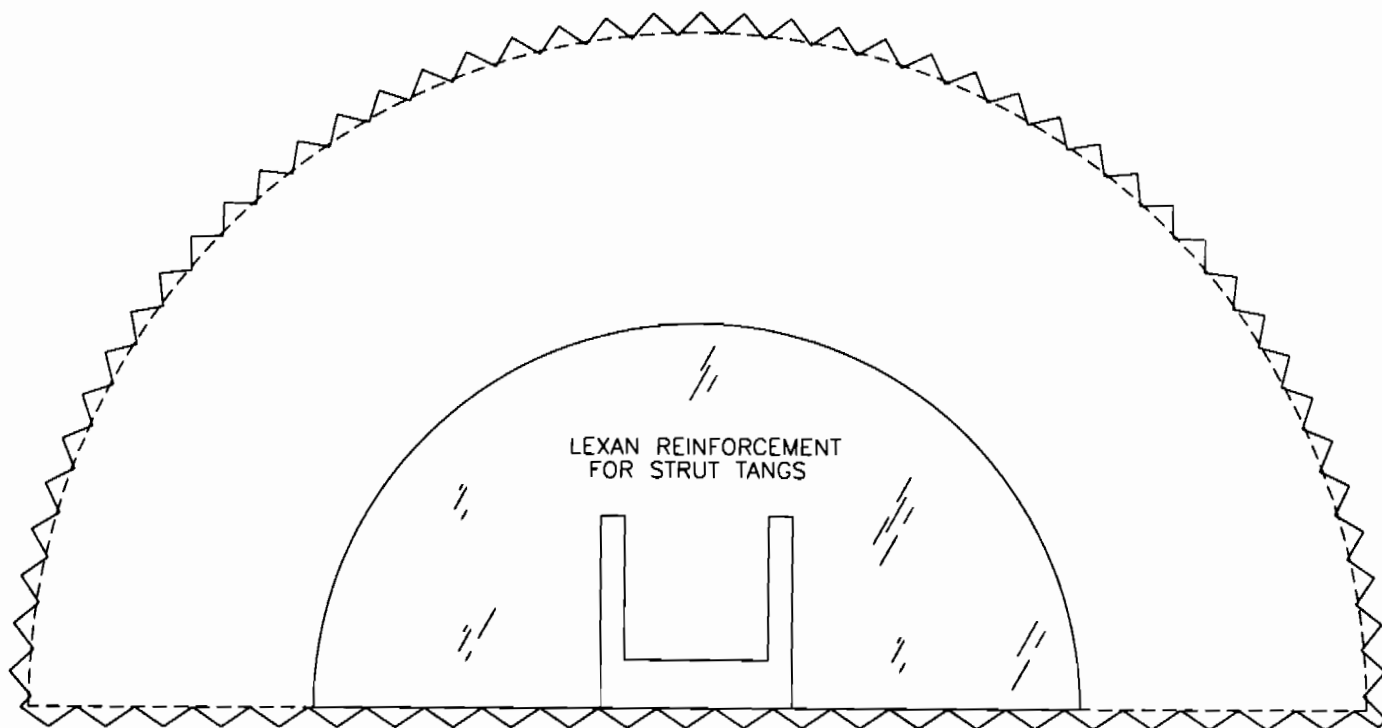
FABRIC COVERING DATA

NOTE: MAKE AT LEAST 86 GP-1'S

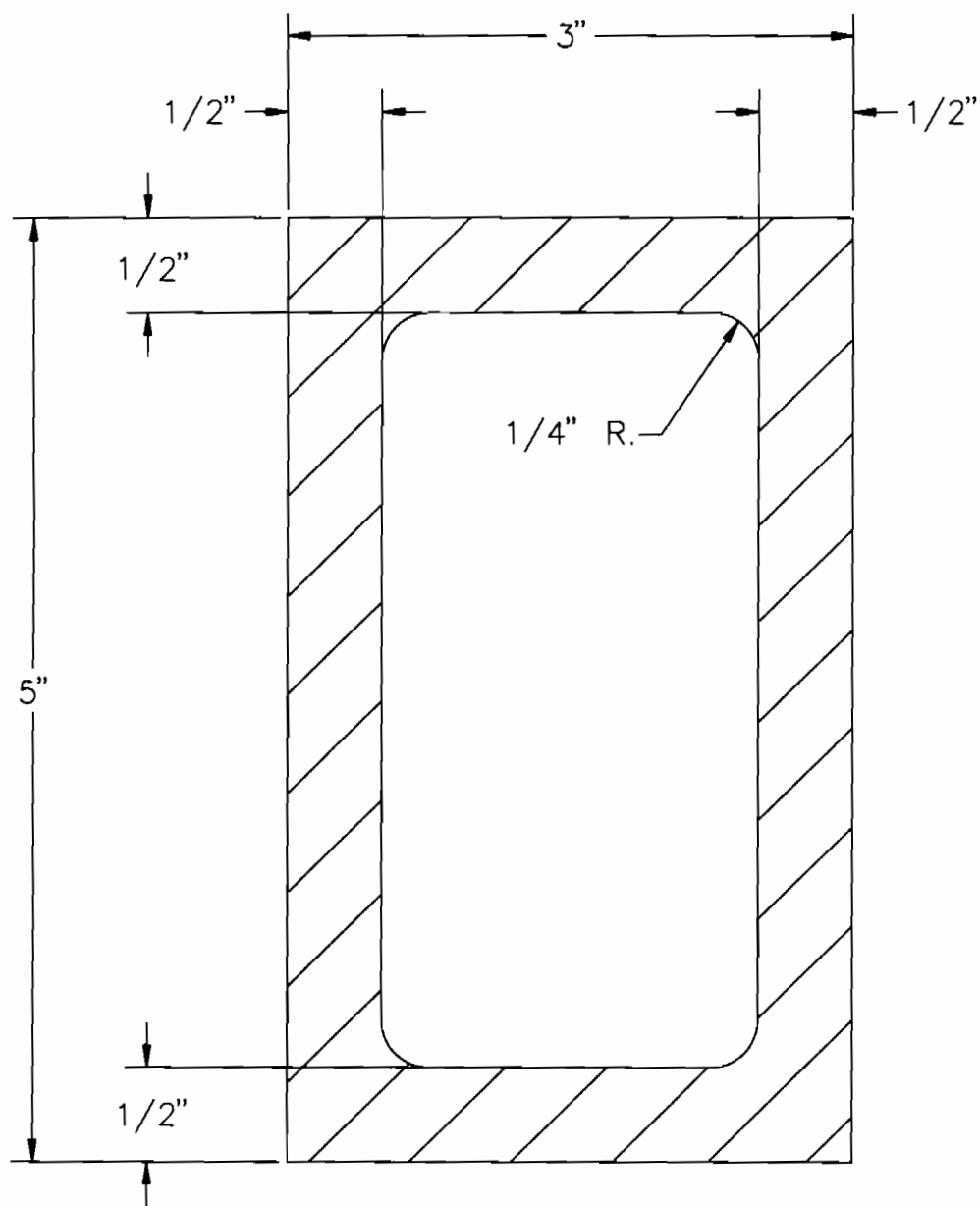


TAIL SPRING BOLT ACCESS LOCATION

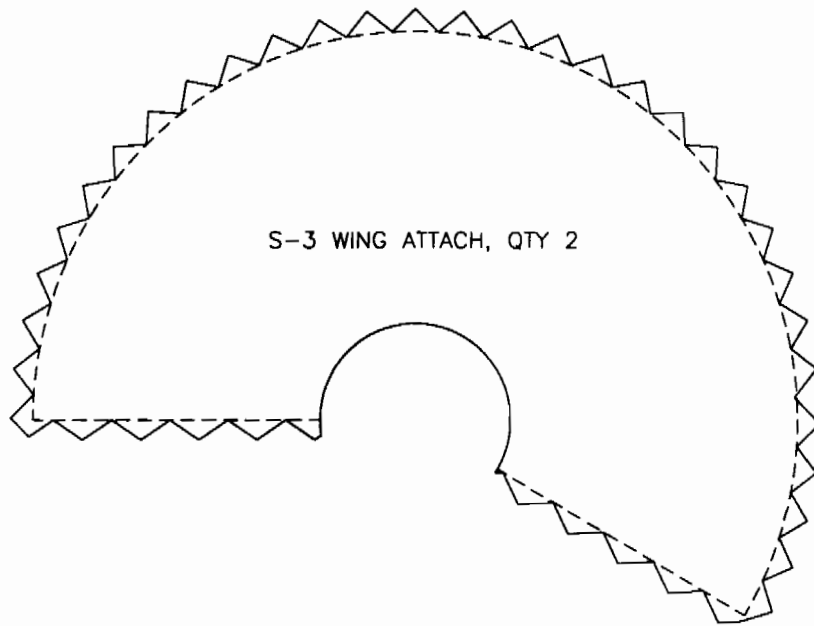
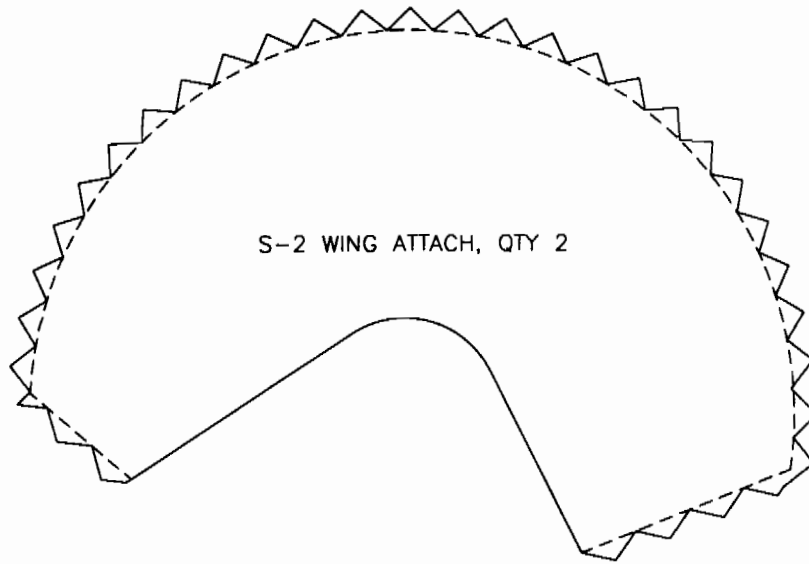
LOCATE INSPECTION HOLE ON LH
SIDE OF TAIL AS SHOWN ABOVE.



NOTE: MAKE FROM .020 LEXAN
QTY. 4

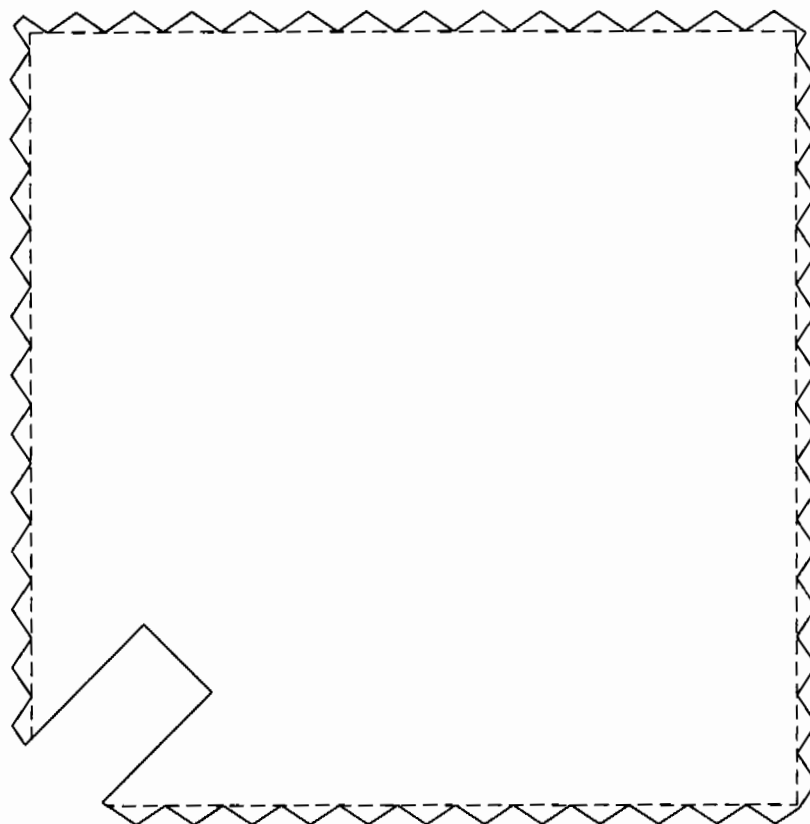
TAIL SPRING BOLT ACCESS

.06 SCRAP LEXAN

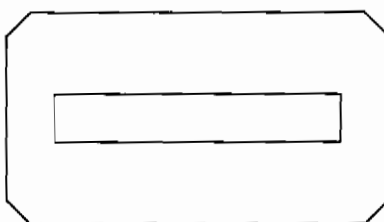


NOTE: MAKE FROM SCRAP CLOTH

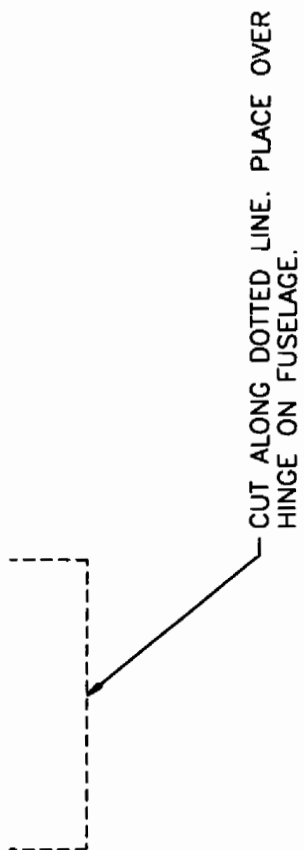
MD1358



TURTLE DECK PATCH, 4" SQUARE TAPE



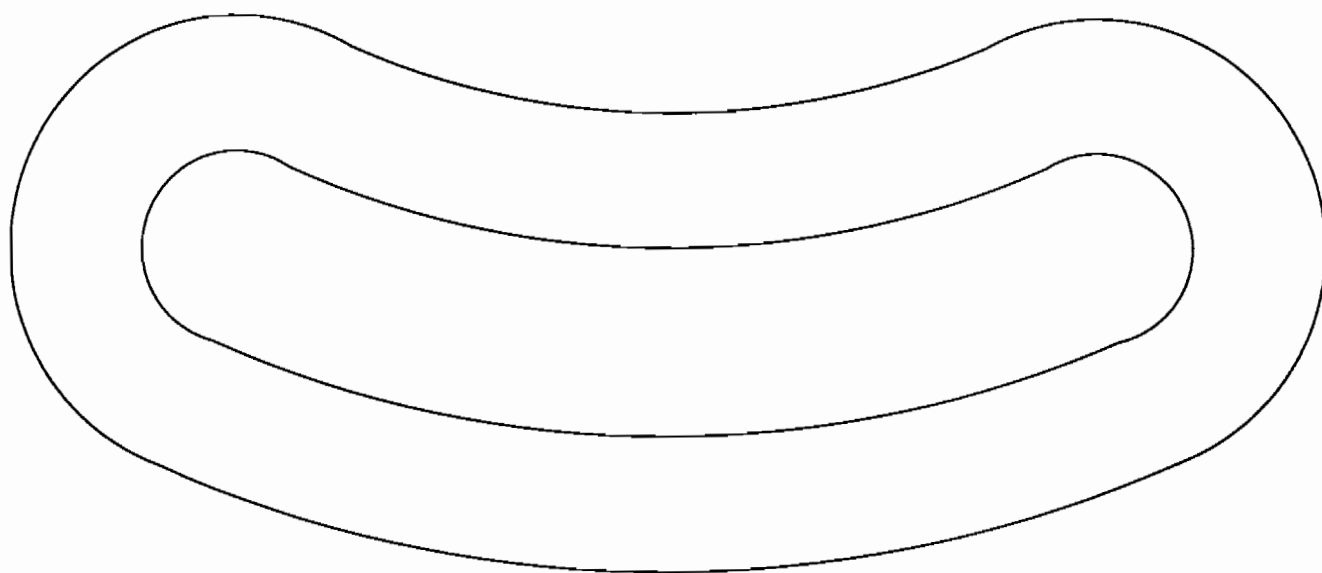
RUDDER CABLE EXIT, .020 LEXAN, QTY.2



CUT ALONG DOTTED LINE. PLACE
PARALLEL TO VERTICAL FIN SPAR.



MD1376



ELEVATOR YOKE EXIT
2 REQ'D. .060 LEXAN SCRAP

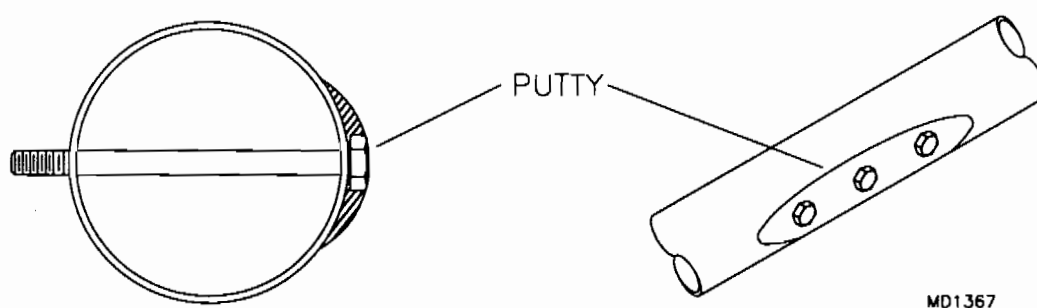
MD982

COVERING THE S-9 CHAOS WING

HINT: Drill a hole horizontally through the middle of the tip bow, use a pivot point.

1. The very first thing before covering any part of the aircraft is to cut (4) 125" lengths of cloth from the roll. These will be used to cover the wings and the ailerons.
2. Prior to covering, it is recommended to body putty over the 1/4" bolt heads protruding through the spars at the strut plates. Shape and sand smooth as in **Figure 014-02**.

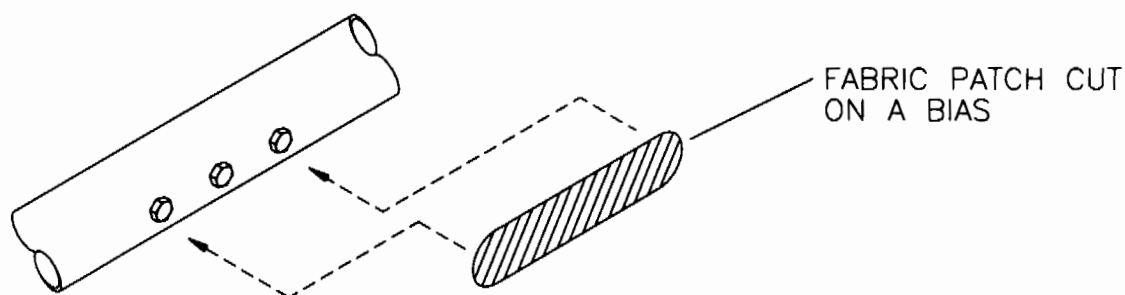
FIGURE 014-02



MD1367

CAUTION: Use 80 grit or finer sandpaper. Avoid sanding aluminum. An alternate method is to cut a fabric patch on the bias. This will shrink smoothly around the bolt heads. See **Figure 014-02A**. Apply the patch first, **THEN** cover the wing.

FIGURE 014-02A



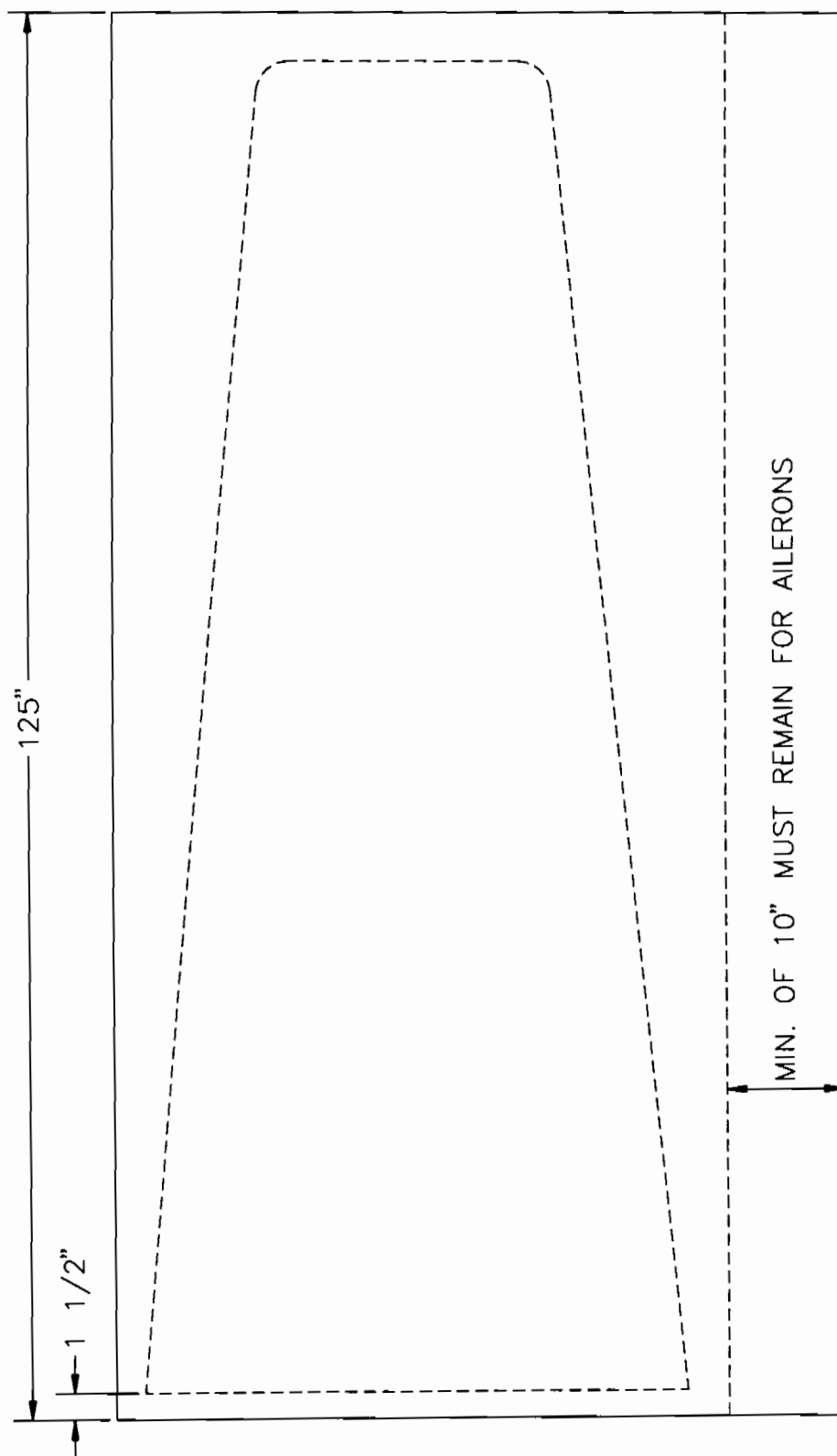
FABRIC PATCH CUT
ON A BIAS

MD1367

3. Using big plastic clothes pins position a pre-cut fabric panel on the top of the wing as shown in **Figure 014-03**. Pay close attention to overhangs. Remember the ailerons are covered from these scraps.

FIGURE 014-03

MD1366



4. Below is a pre-covering inspection. Perform this inspection and compliance before proceeding to Step #5.

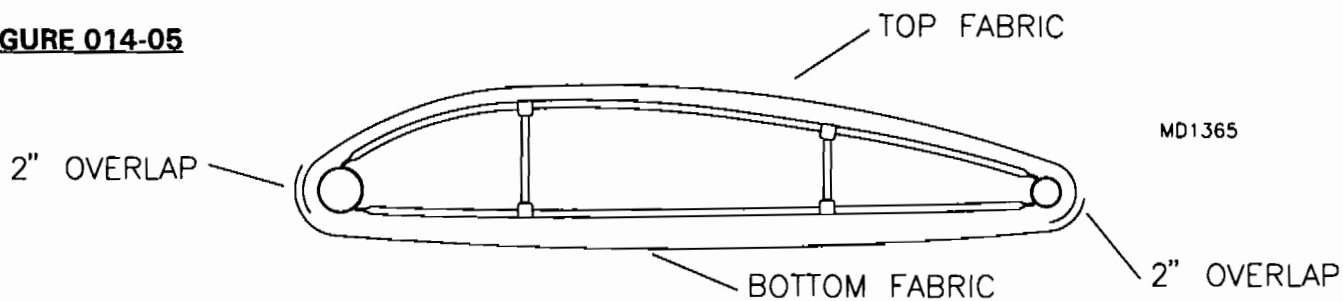
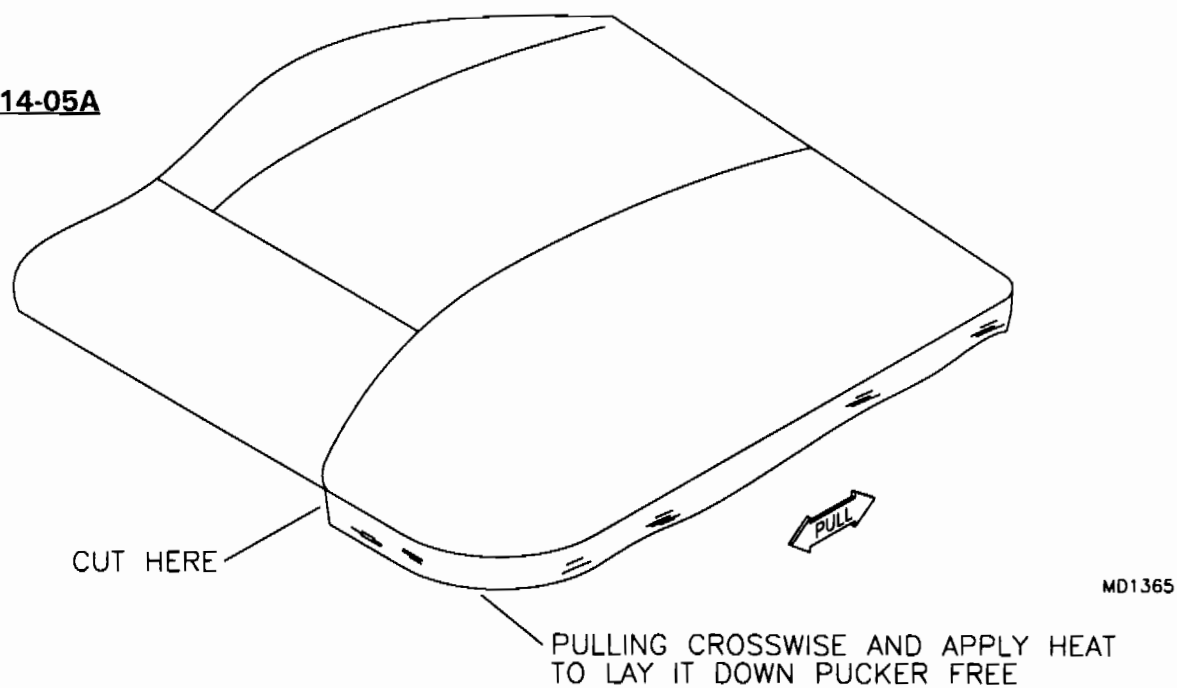
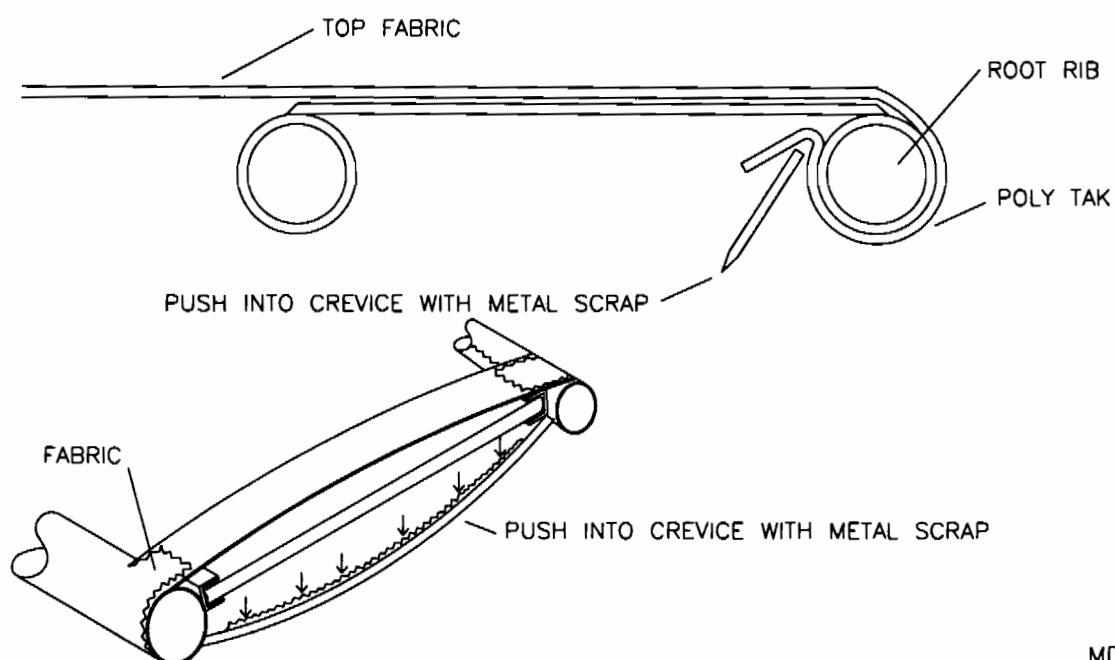
S-9 CHAOS WING PRE-COVERING INSPECTION & CHECKLIST

- ☐ Root Rib Clips (4) Rivets?
- ☐ Step Web, Sub Plate in Place?
- ☐ Nut Plates on Aileron Hinge Points?
- ☐ Bolt Heads Puttied & Shaped?
- ☐ All Bolts Properly Secured?
- ☐ All Rivets Seated?
- ☐ All Rib Compression Tubes in Place & Secure?
- ☐ Safety Wires in Place and not Protruding?
- ☐ Tip Bow Riveted?
- ☐ ASI Line in Place?
- ☐ Pitot in Place?
- ☐ Tip Rib Tension Straps Installed?
- ☐ Leading Edge Wrap Riveted, Taped Down & Puttied?
- ☐ Root Strips Riveted?
- ☐ Fuel System Installed?
- ☐ Vent Line Run?
- ☐ Tank Fittings Glued In?
- ☐ 1/4" Bolts in Anti-Drag Tube?
- ☐ Wing Channels Secured?
- ☐ Teleflex Bracket Installed?
- ☐ Wipe Off Any Paint That Could Come Through Fabric?

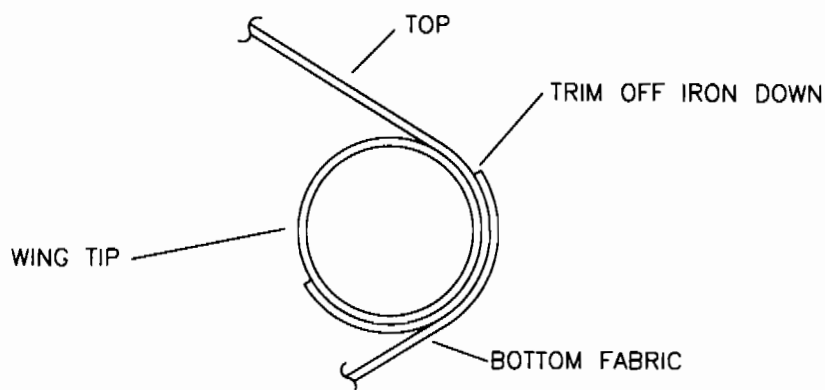
If the wing has passed inspection, clean off with a dust cloth, then proceed to covering.

NOTE: The aileron teleflexes are installed **AFTER** covering and painting. This allows for replacement in the future when they are worn (500 to 1,000 hours). **DO NOT** tie in place.

5. Attach the fabric to the top first. Establish overlaps as shown in **Figure 014-05**. Shrink around the edges when glue is dry. Cut reliefs on wing tip corners as shown in **Figure 014-05A** (both the top and the bottom). Wrap the root ends (both the top and the bottom) as shown in **Figure 014-05B**.

FIGURE 014-05**FIGURE 014-05A****FIGURE 014-05B**

6. Cover the bottom of the wing. Refer to **Figure 014-06** for overlaps.
7. Neatly trim excess off wing tip as per **Figure 014-07**.

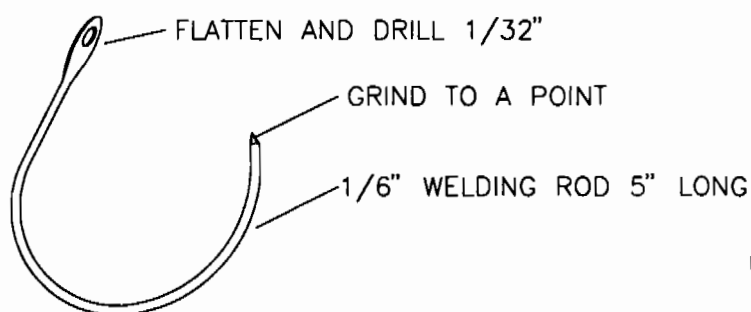
FIGURE 014-07

MD1377

8. Check the areas of overlaps and iron out any puckers and/or wrinkles. Shrink to final tautness, cut with a razor where strut plates and fuel tanks protrude.

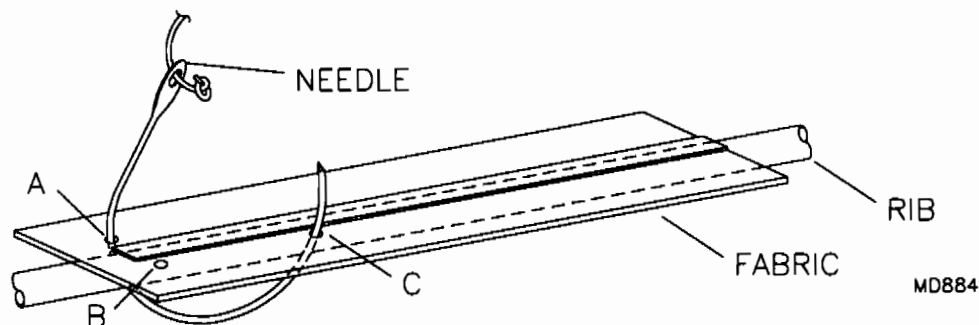
9. Apply the 1/4" wide rib stitching reinforcing tape to the very peak of the ribs. Start at the leading edge wrap and trim off within 3" of the AFT spar. For the bottom run tape from 4" back from the leading to 3" from the trailing edge. Mark off every 2" and fabricate. Needle and stitch as described and illustrated in **Figure 014-09, 014-09A, 014-09B & 014-09C**.

PLEASE NOTE: Do not use this rib stitch method if you plan on cruising over 110 mph. In this case use the traditional rib stitch method. More lacing cord will be required. Refer to a STITS manual for details.

FIGURE 014-09

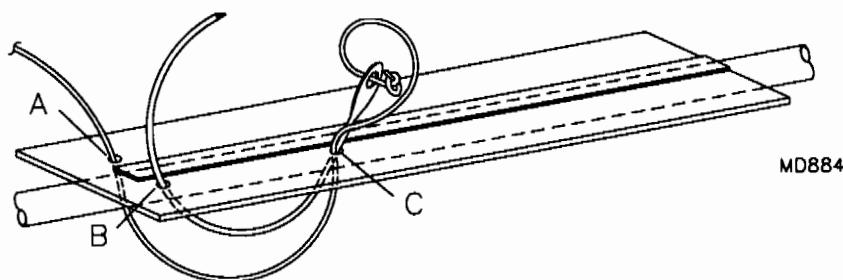
MD884

A. Route the needle through pre-punched holes from one side of the rib to the next.

FIGURE 014-09A

MD884

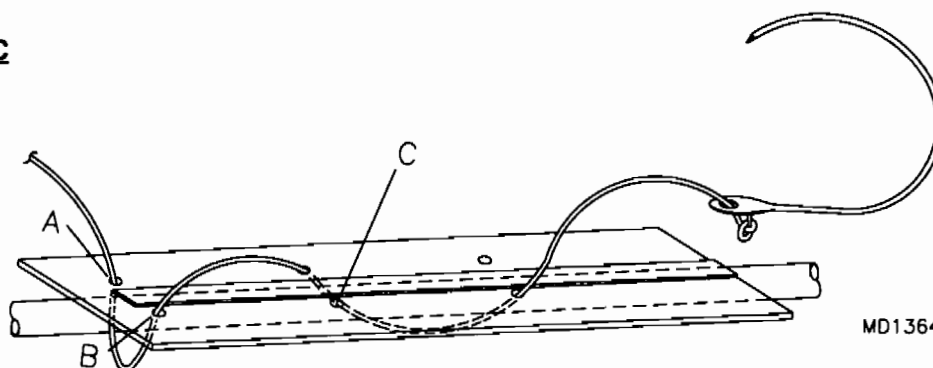
B. Re-insert the needle into hole "C" then back out through "B".

FIGURE 014-09B

MD884

C. Lace up rib spacing as required. First stitch should enter across from hole "C".

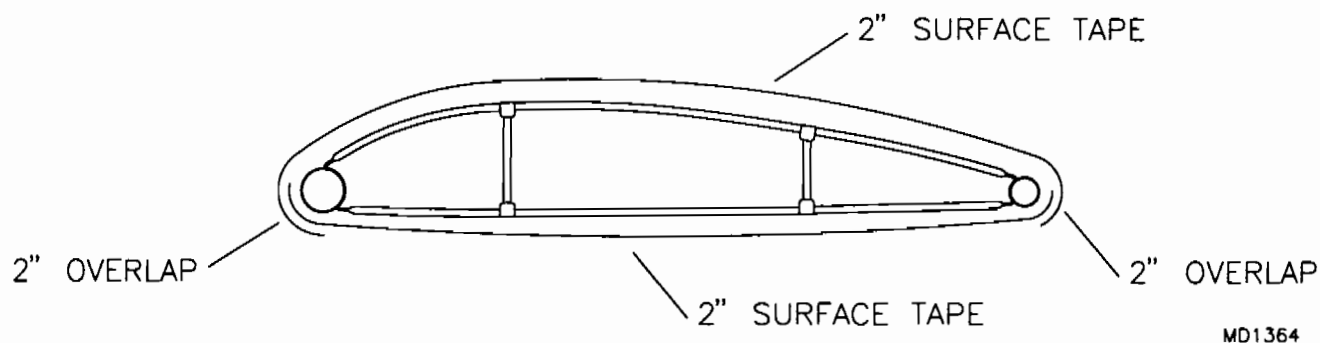
FIGURE 014-09C



D. Use the same technique of entry and re-entry (X) to tie off end of lacing. Pull lacing tight back to start and tie off. Snip lacing cord close to knots.

10. Apply 2" surface tape centered over the AFT edge of the leading edge wrap running spar wise. Next apply 2" surface tapes as per **Figure 014-010** to cover up rib stitching. Cover the bottom ribs first.

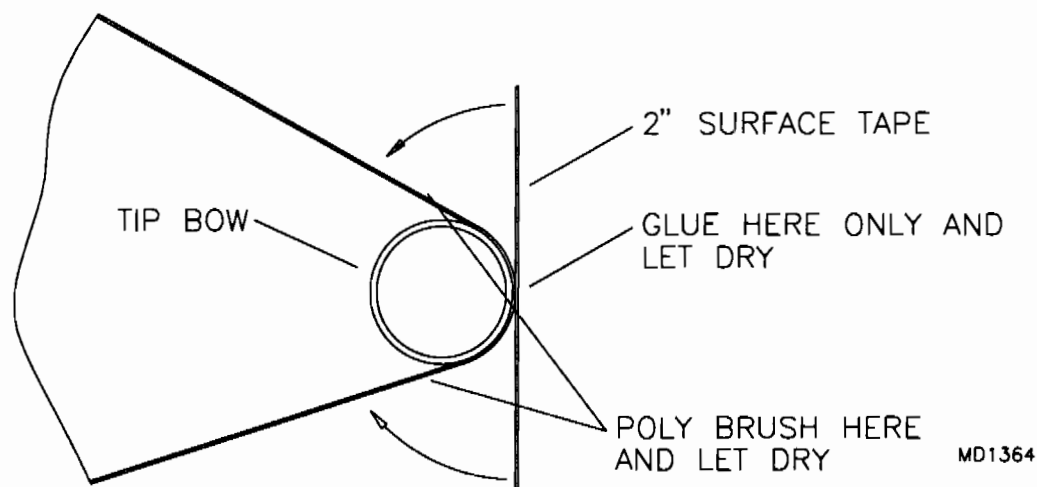
FIGURE 014-010



11. Apply 2" surface tape over the root rib edges and second outboard rib to cover the rivets. Do top and bottom.

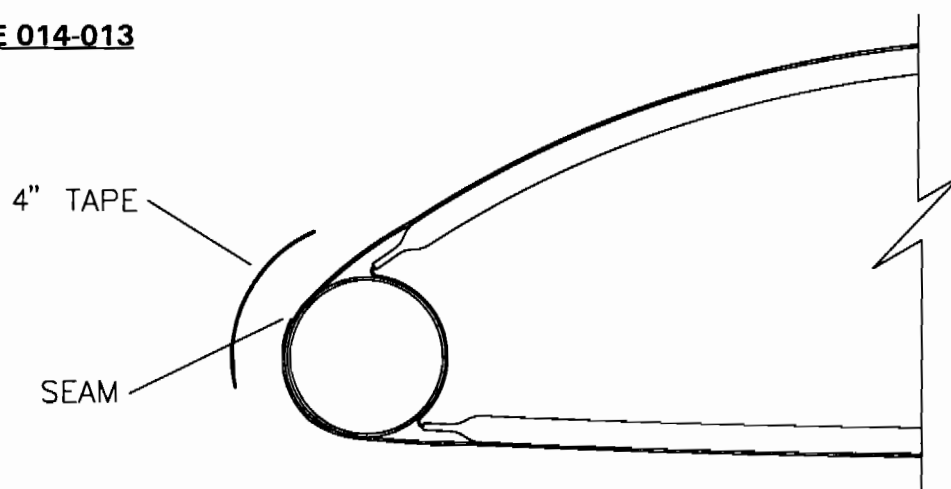
12. Glue with Poly Tak, 2" surface tap to the middle of the tip bow. Apply Poly Brush 1" on either side. When dry, iron down flat. See **Figure 014-012**. Overlap the 2" tape at least 2" onto the front and rear spars.

FIGURE 014-012



13. Apply the 4" wide surface tape across the leading edge seam. From the root up to, but not including, the tip bow. See **Figure 014-013**.

FIGURE 014-013



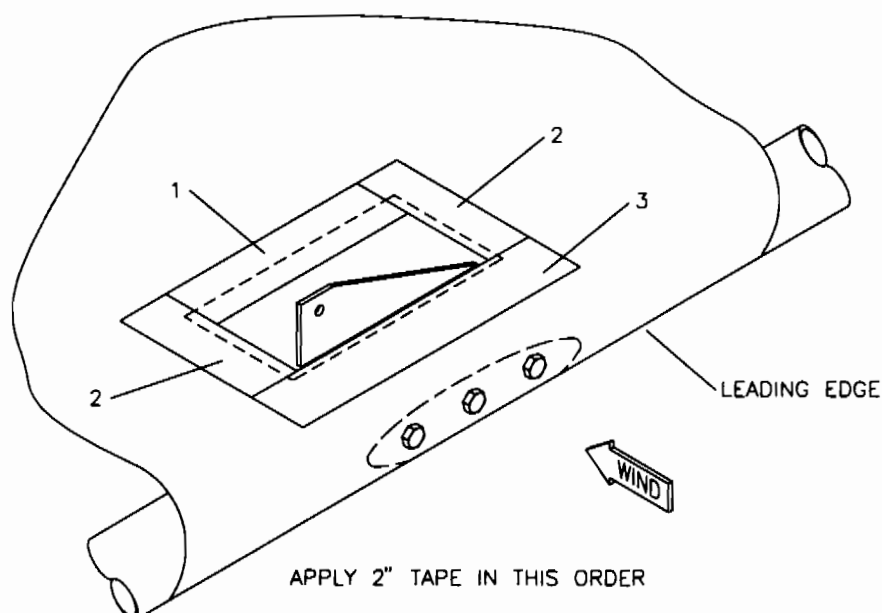
MD1368

14. Apply 2" surface tape over the seam on the trailing edge spar.

15. At this time, it is a good idea to punch through the 6 eyebolt holes along the rear spar. Once the paint is on, they are hard to find.

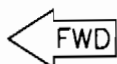
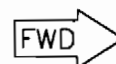
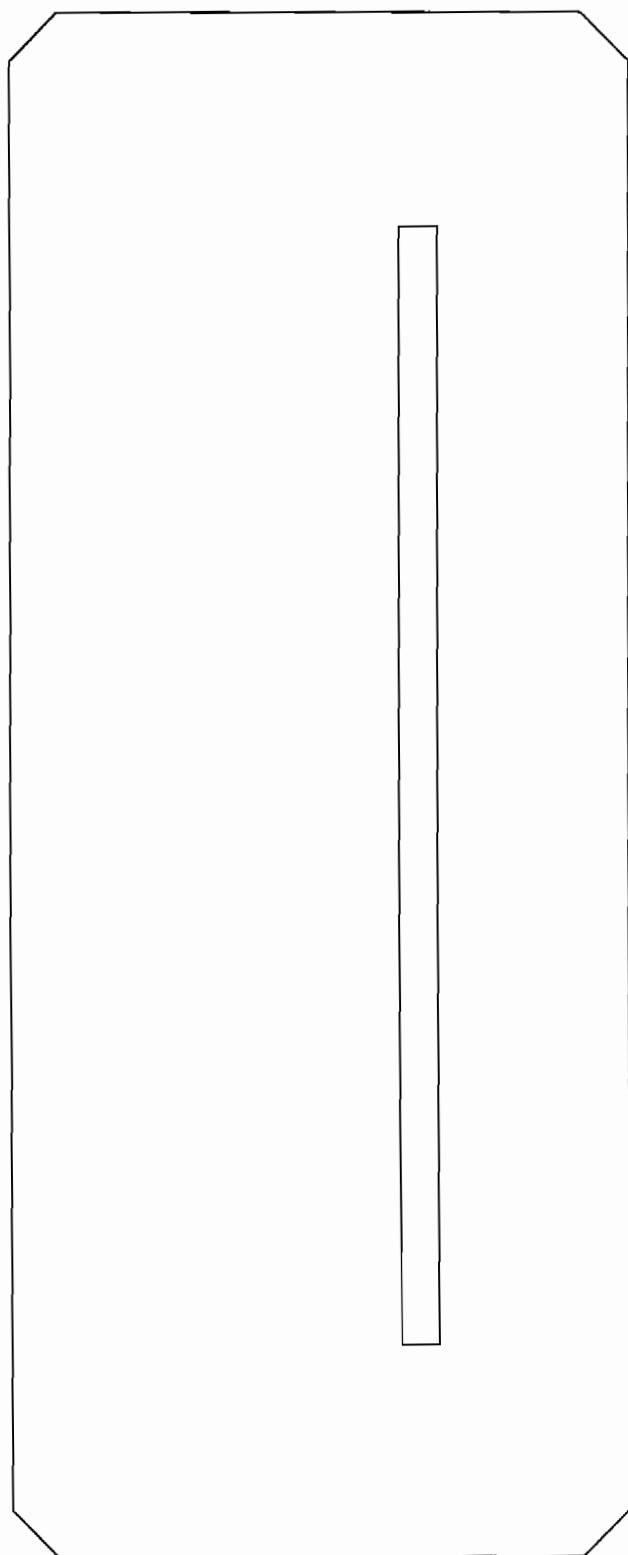
16. Cut from the thin lexan (2) each of the strut attach plate reinforcements. Use a razor and snap apart. See **Figure 014-016** and **Figure 014-016A**.

FIGURE 014-016A

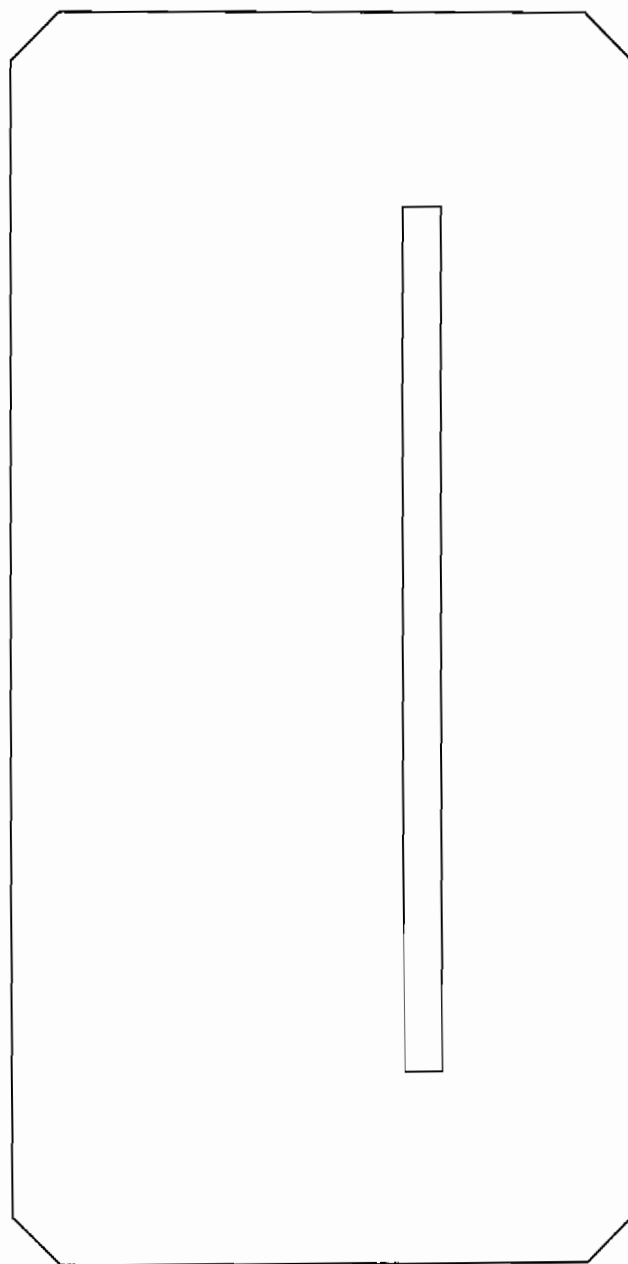


MD1368

APPLY 2" TAPE IN THIS ORDER

FIGURE 014-016

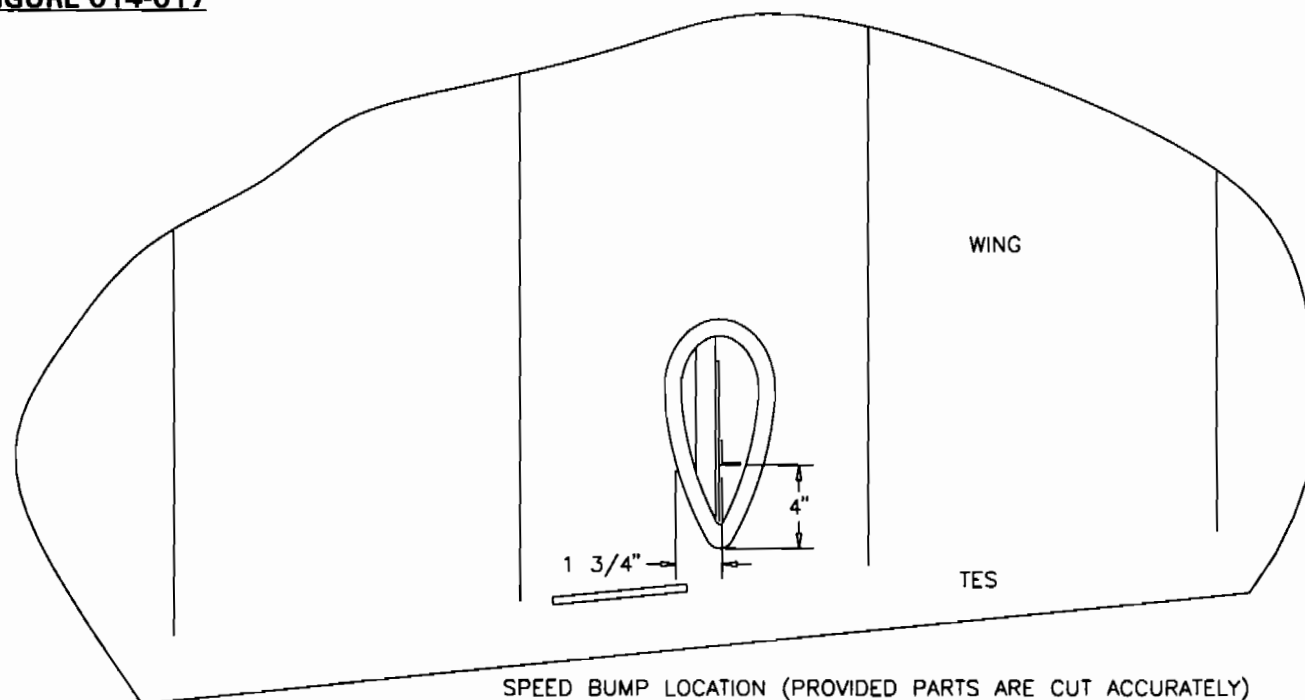
TRAILING EDGE STRUT EXIT
2 REQ'D.



LEADING EDGE STRUT EXIT
2 REQ'D.

17. Sand the speed bump reinforcements to rough up for gluing. See **Figure 014-017**. Also, cut from scrap cloth a patch approximately 1" to 2" bigger than the rings. Remember all patches should be pinked. The lexan is used as a base to screw the speed bump in place. Use the small screws provided to attach the speed bumps. Space the screws so at least 8 to 10 screws are used per bump. Cover over the lexan with a patch of cloth at least 1" to 2" wider than the lexan to secure the fabric.

FIGURE 014-017



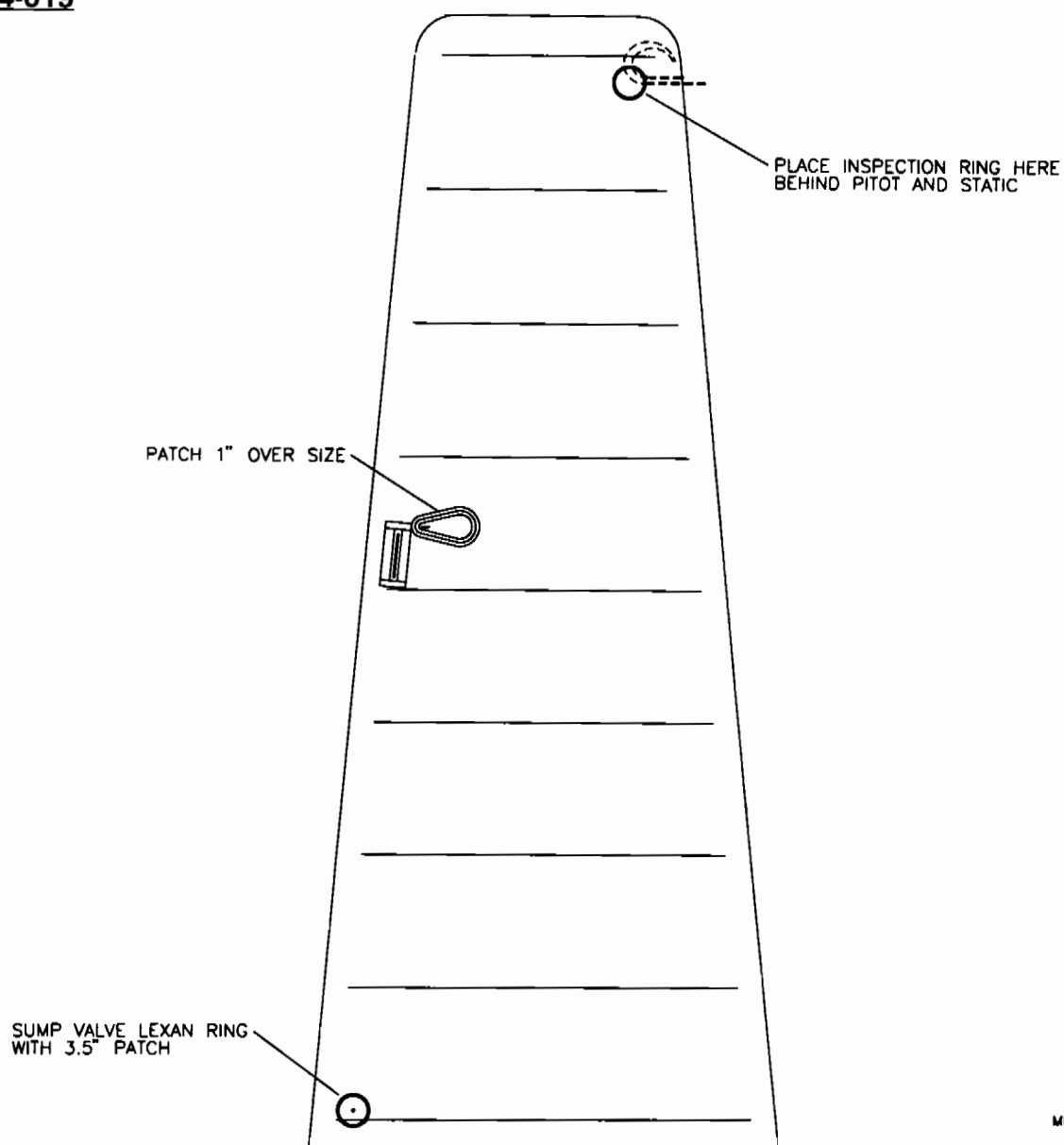
MD1378

18. Cut 2 circles from .020 lexan 2" in diameter with a 3/4" hole for the fuel sump valve grommet. Cut a 3 1/2" diameter fabric patch to attach the grommet. Cut open the sump valve after painting.

19. Apply Poly Brush to the areas where these parts will be placed. Let dry. Glue parts in positions followed by the cloth patches with Poly Brush. **HINT:** Poly Brush the lexan parts and let them "tack up" a bit prior to applying. See **Figure 014-019** for locations of inspection rings.

20. Second coat all tapes and patches with Poly Brush, being careful not to brush anywhere but on the patch or tape itself. Apply a generous amount of Poly Brush on the pinked edges to assure saturation.

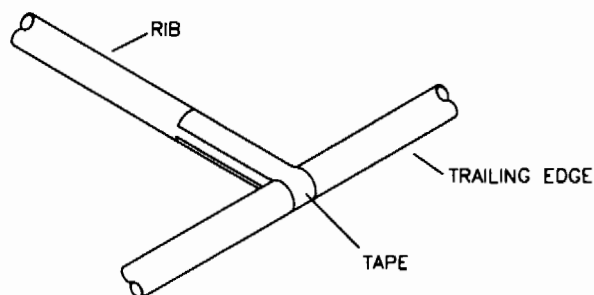
21. Iron down any puckers, wrinkles or dry pinked edges once the Poly Brush is dry. This should ready the wing for painting. Store in a dust free room or wrap in plastic until it is time to paint.

FIGURE 014-019

MD1374

COVERING THE AILERONS

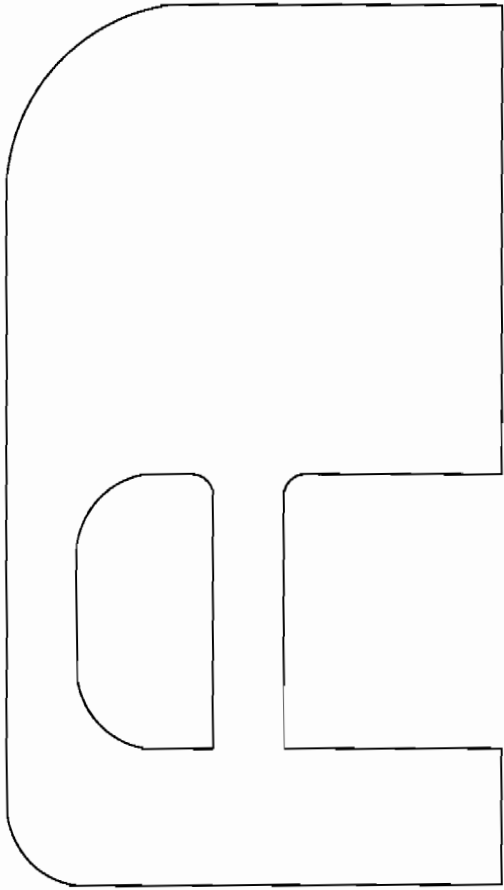
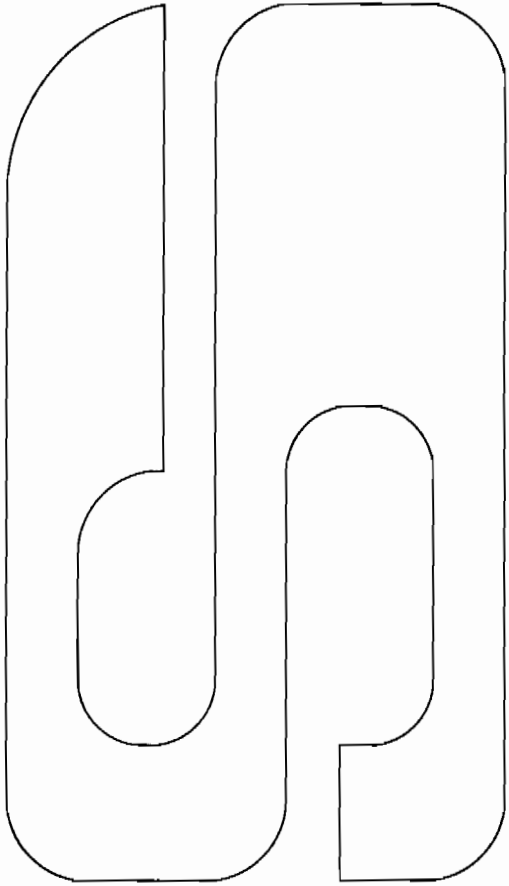
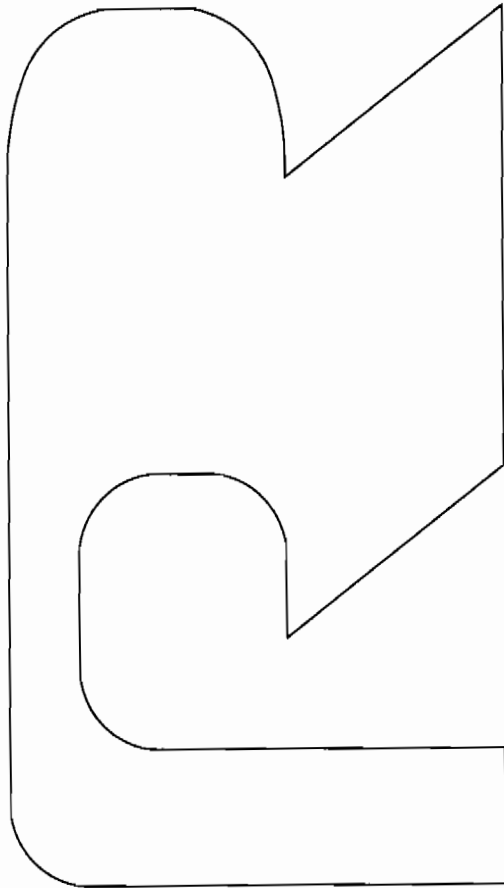
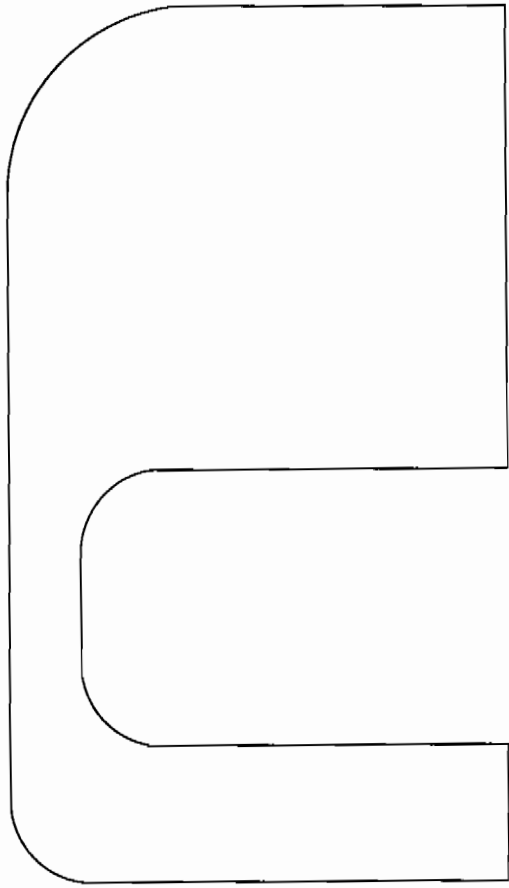
22. Prepare the aileron frames for covering by filing the rib tubes to contour the leading edge spars. Then rivet the K-1000-3, 3/16" nut plates to the inside of each spar. Align with the hinge holes. Use a #40 pop rivet and a 3/16" bolt through the hole to line up. Use masking tape to tape the "buttons" on the trailing edge to the ribs. See **Figure 014-022**. Check for burrs and clean.

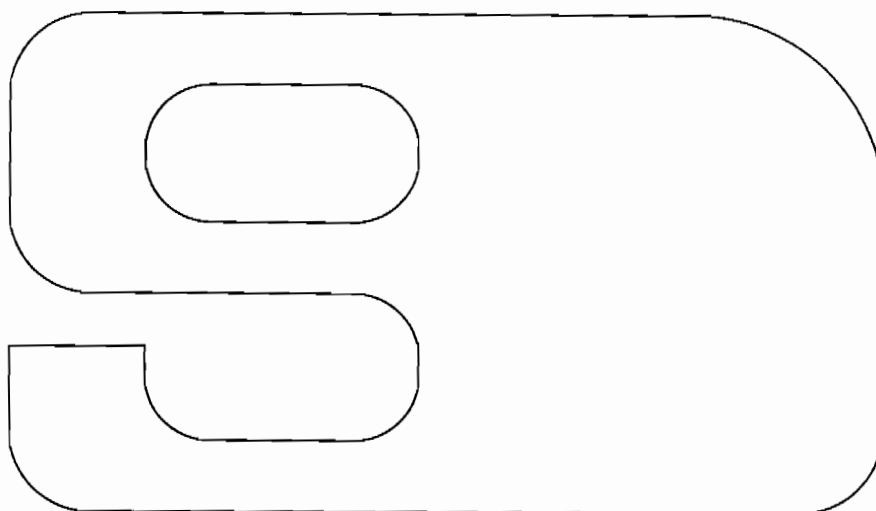
FIGURE 014-022

MD1374

23. On a clean table lay out the scraps of fabric from the wing. Lay an aileron frame over the fabric. Trace an outline at least 1" bigger all around. Cut and glue the fabric to the frame, wrapping around at least halfway. Let the glue dry.
24. Trim off excess and shrink lightly to pull out edge puckers.
25. Glue another parcel of fabric to the other side with at least 3/4" to 1" overlap. Trim neatly and shrink.
26. Iron out any puckers and final shrink the fabric. Apply Poly Brush and 2" surface tapes centered over the seams. Glue the round corners with tapes on edge as done on the wing tips. Poly Brush tapes with a final top coat to complete. The ailerons are now ready to paint.

RANS LOGO LAYOUT SHEET

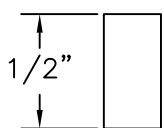




USE AS A TRACING TEMPLATE FOR CLEAR "CONTACT" PAPER
AS A MASKING FOR PAINTING ON THE LOGO.

WHITE DECALS OF THE RANS S-9 ARE PROVIDED FOR USE AS
A SURFACE GRAPHIC. DO NOT USE THESE AS A MASKING.
THEY ARE TOO THIN AND STICKY AND WILL NOT PEEL OFF WHEN
PAINTED OVER.

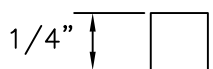
MATERIAL: $1/4"$ X $.028"$ 6061-T6 ALUMINUM TUBING
(DRILL OUT TO #11)



8 PIECES

2 - PART #19 AILERONS

6 - PART #28 TAIL

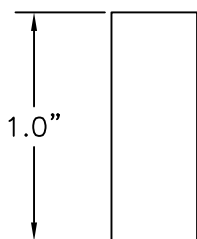


10 PIECES

8 - PART #6 RUDDER

2 - PART #11 CANOPY

MATERIAL: $3/8"$ X $.058"$ 6061-T6 ALUMINUM TUBING

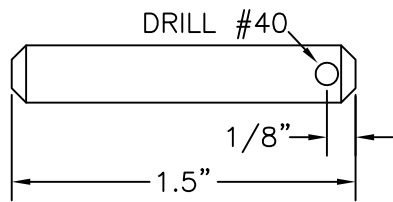


2 PIECES

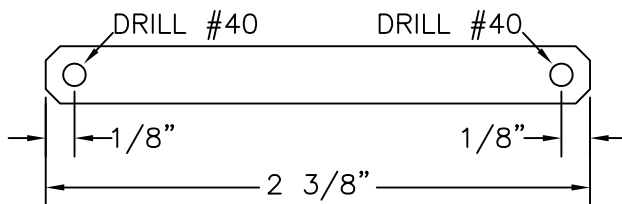
2 - PART #30 CONTROL STICK

RANS S-9 CHAOS
FABRICATED PARTS
SPACER BUSHINGS

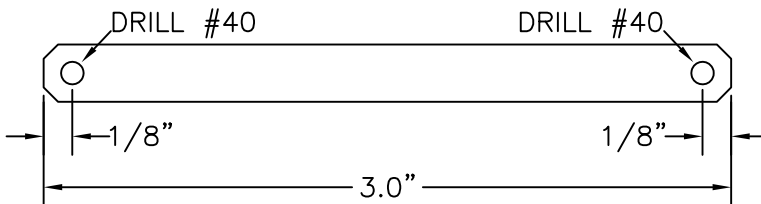
MATERIAL: 1/4" STAINLESS STEEL ROD



2 PIECES (BEVEL ENDS)
PART # 16 - TAIL

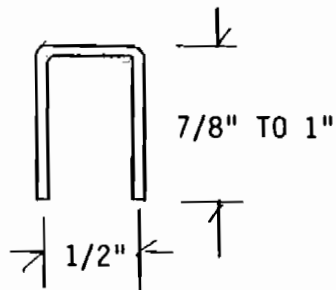


4 PIECES (BEVEL ENDS)
PART # 18 - TAIL



4 PIECES (BEVEL ENDS)
PART # 26 - TAIL

RANS S-9 CHAOS
FABRICATED PARTS
STAINLESS STEEL PINS



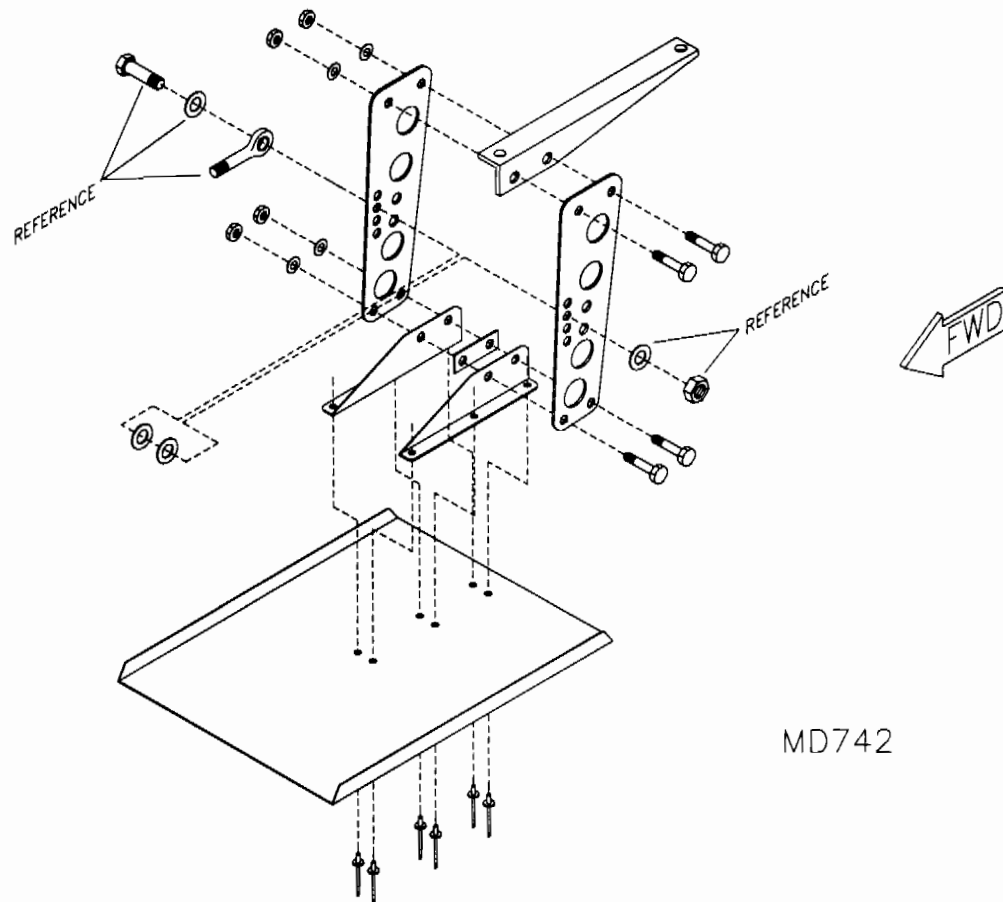
2/AC

SUBJECT: RETAINER CLIP		NO. TEL-CLIP	MODEL: ALL
MATERIALS: 1/16" BRASS WIRE		FINISH N/A	
DATE: 11-3-88	DRAWN BY: RJS		SCALE: FULL
PROPERTY OF:	RANS <small>1104 E. Highway 40 By-Pass Hays, Kansas 67601 (913) 625-6346</small>		PAGE: FAB-5

S-9 CHAOS - OPTIONAL AILERON SPADE ASSEMBLY & INSTALLATION

1. Assemble the aileron spade assembly as per **FIGURE 016-01**. Attach the spade assembly to the aileron using the hardware called out in the parts drawing. The spade is designed to allow a $\pm 3^\circ$ angle adjustment. The spade will be adjusted during initial flight tests. Extra holes for the push tube attach allow various feels. Use lower holes for light feel, slower roll.

FIGURE 016-01



Thread the male rod end and jam nut onto the end of the push pull tube. Attach the push pull tube to the aileron control horn. Remember to install the 2 plastic washers between the control horns. **HINT:** tape the washers to a piece of masking tape to allow easy insertion between the horns.

S-9 CHAOS GEAR LEG FAIRING INSTALLATION

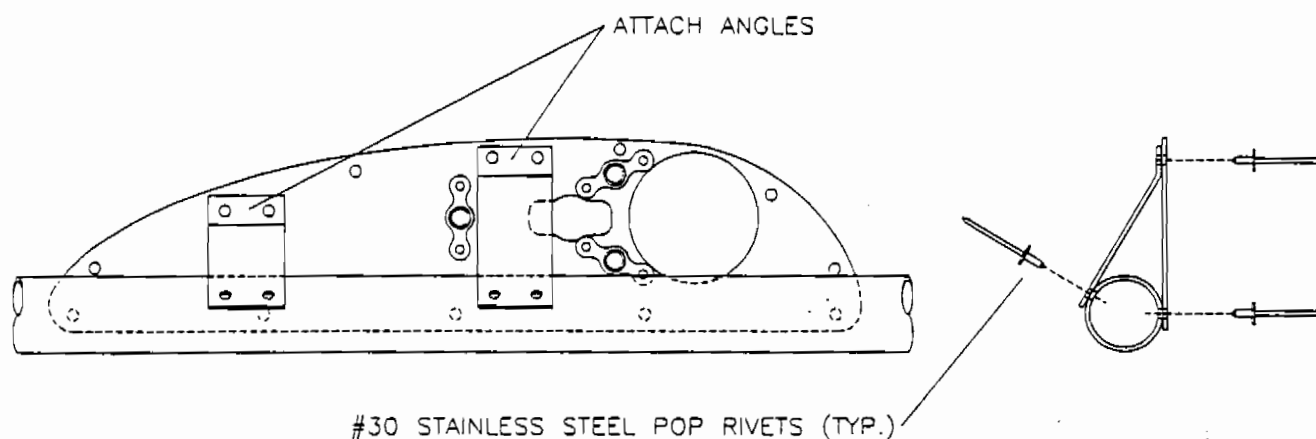
Refer to the parts page for selection of the components.

1. Cut the rubber trim to fit over the designated areas clearly illustrated on the parts page. This must be done to both gear leg fairings.
2. Remove the gear leg assembly from the fuselage (gear leg sockets).
3. Gently slide each fairing over the gear leg in the proper orientation.
4. Install gear leg assembly into fuselage (gear leg sockets).
5. Check for a snug fit against the airframe, some trimming of the top edge may be necessary.

S-9 CHAQS STROBE INSTALLATION

1. Collect the parts depicted in the parts drawing for assembly.
2. Attach the three nut plates to the light mount plate using the 40APR1/8 pop rivets. The light will be screwed to the mount plate after covering. Drill 3 #11 holes in the back plate of the light and test fit against the mount plate. **NOTE:** On the S-9 and S-10's with fiberglass wing tips, nut plate the fiberglass wing tip and mount the light directly to it.
3. Locate the mount plate on the tip 6" back from the leading edge using #30 stainless steel pop rivets. Rivet the attach angles in place with #30 stainless steel pop rivets; trim the angles as required to join plate and bow properly. See **Figure 016C-03**.

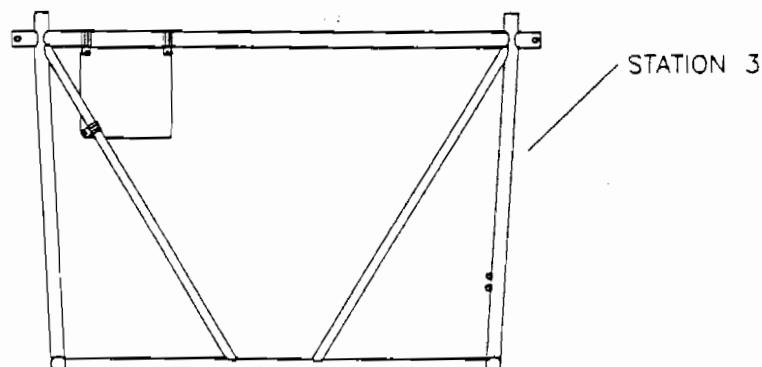
FIGURE 016C-03



MD1602

4. Unroll the gray strobe wire, then cut it in half. Cut two 20' pieces of the 14 gauge yellow wire. Run the gray and yellow wire thru the trailing edge spar to the mount plate. Tape the wires to the inside edge of the wing tip to keep them secure while covering. Be sure to leave enough to work with while wiring.
5. Mount the strobe power box on the Station 3 crossing tube and diagonals using 3 tube clamps. The box is generally mounted with the connections pointing down. See **Figure 016C-05**. The strobe box has high voltage and should be kept clear of the fuel lines.

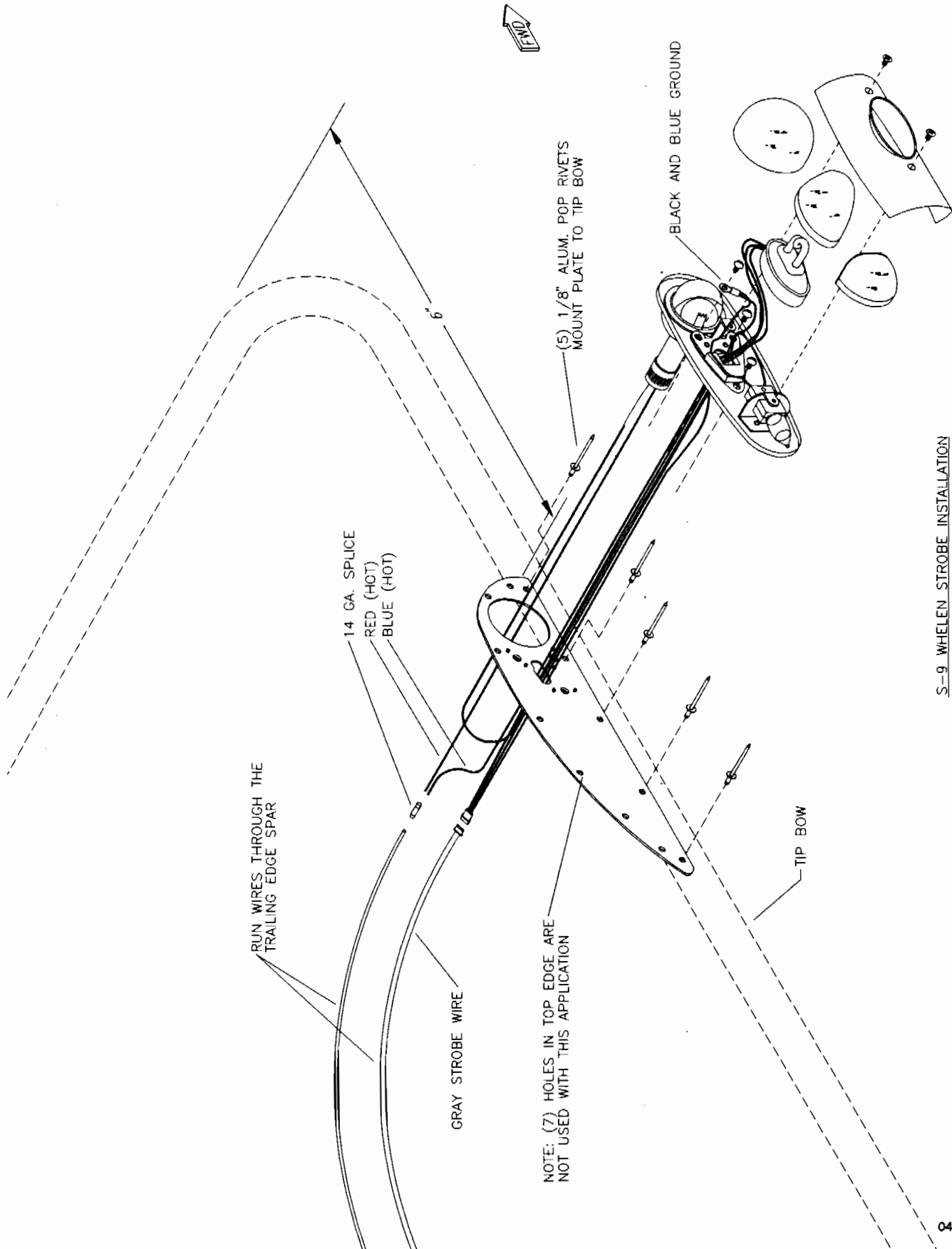
FIGURE 016C-05



MD1602

6. Run a 14 gauge yellow wire from the nav. switch to the strobe box. Connect a brass "Y" to the end of the wire. The yellow wire from each wing will connect to the "Y". Run a 14 gauge red wire from the strobe switch back to the strobe box, then connect it to the red wire coming out of the box. Run the black wire coming out of the box to ground.
7. Connect the ends (provided in the strobe kit) to the 3 wires coming out of the gray wire. The kit has instructions on how they go into the connector. The unprotected wires are run to a brass "Y" and then connected to ground using a short piece of 14 gauge black wire.
8. With the wings finished, cut out the 2 large holes and the 3 nut plate holes in the strobe mount. Connect the wires on the strobe light to the ones in the wing. Connect one of the blue wires and the black wire to ground using a single "I" connector placed under one of the mount screws. Connect the other blue wire and the red wire to the yellow wire in the wing using a 14 gauge butt connector. Connect the 2 plastic connectors together. Wrap the two wing connections with electrical tape to prevent disconnection due to vibration. See **Figure 016C-08**.
9. Attach the strobe to the mount plate and reassemble the strobe. Check all connections and test the lights.

FIGURE 016C-08



S-9 WHELEN STROBE INSTALLATION

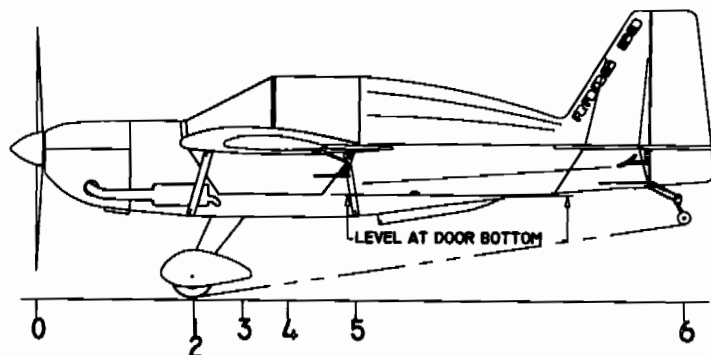
S-9 OPTIONAL WING TANK SYSTEM

Refer back to the wing section for the instructions to install the optional wing tank system. The installation for the optional tank is the same as done previously with the standard tank.

S-9 CHAOS GEAR LEG FAIRING INSTALLATION

Refer to the parts page for selection of the components.

1. Cut the rubber trim to fit over the designated areas clearly illustrated on the parts page. This must be done to both gear leg fairings.
2. Remove the gear leg assembly from the fuselage (gear leg sockets).
3. Gently slide each fairing over the gear leg in the proper orientation.
4. Install gear leg assembly into fuselage (gear leg sockets).
5. Check for a snug fit against the airframe, some trimming of the top edge may be necessary.



MD2313 REV A 03.09.98

~~RAFS~~ S-9 CHAOS
WEIGHT AND BALANCE

N _____	
DATE WEIGHED	
ENGINE TYPE	
C.G. CONDITION	
EMPTY WEIGHT	
MTOW (503)	670 LBS.
MTOW (582)	710 LBS.

ACCEPTABLE C.G. 53" TO 62" FROM DATUM O.
DATUM = BACKSIDE OF PROP. AIRCRAFT IN
LEVEL ATTITUDE. (LEVEL REFERENCE TO
BOTTOM OF DOOR.)

#	ITEM	WEIGHT	ARM	MOMENT
1	LH MAIN	181	42.5"	7692
2	RH MAIN	174	42.5"	7395
3	FUEL	108	57"	6156
4	PILOT	205	72"	14760
5	BAGGAGE *	0*	94"	2.820
6	TAILWHEEL	30	177"	5310
TOTAL=		698	TOTAL=	41313

TOTAL MOMENTS
TOTAL WEIGHT = C.G.

$\frac{41313}{698}$ 59.2"

#	ITEM	WEIGHT	ARM	MOMENT
1	LH MAIN		42.5"	
2	RH MAIN		42.5"	
3	FUEL		57"	
4	PILOT		72"	
5	BAGGAGE *		94"	
6	TAILWHEEL		177"	
TOTAL=			TOTAL=	

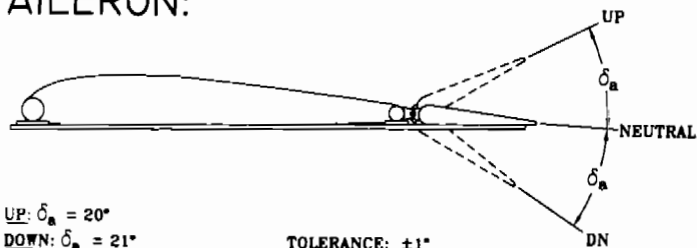
TOTAL MOMENTS
TOTAL WEIGHT

_____ =

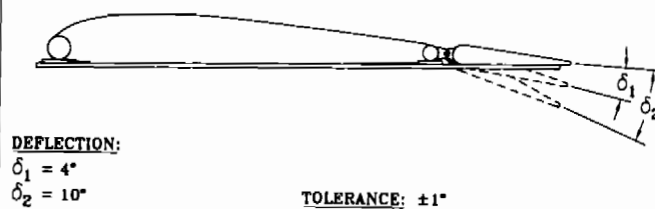
* 30 LBS. MAXIMUM BAGGAGE

S-9 CHAOS

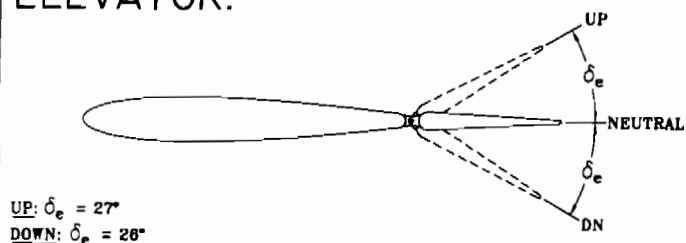
AILERON:



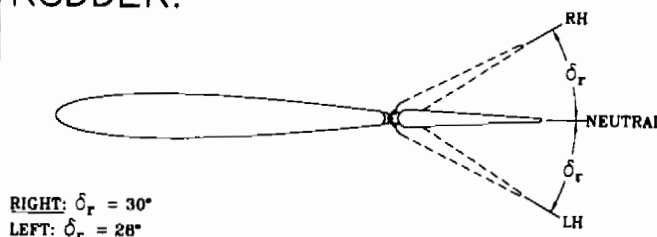
FLAP:



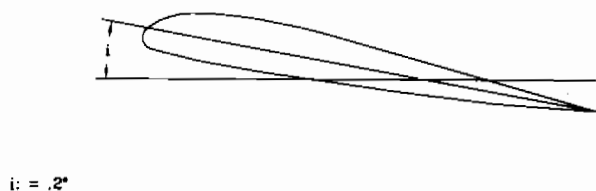
ELEVATOR:



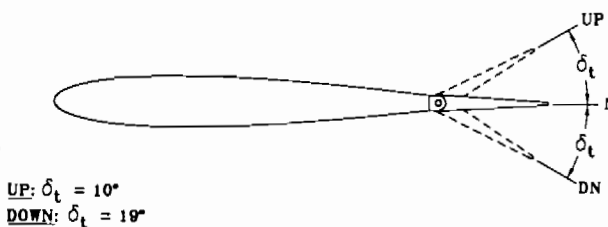
RUDDER:



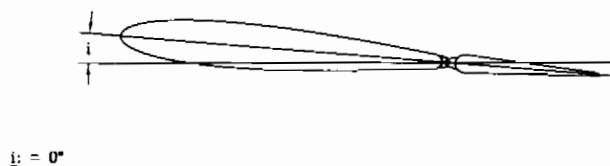
WING INCIDENCE:



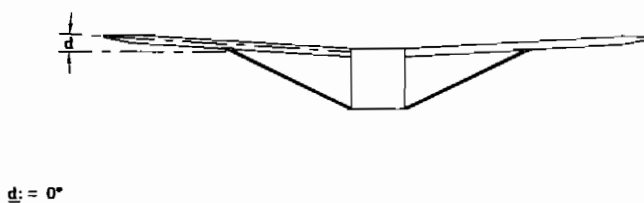
TRIM TAB:



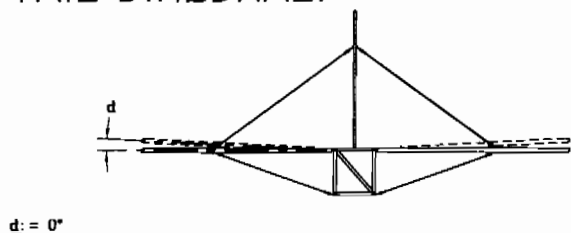
TAIL INCIDENCE:



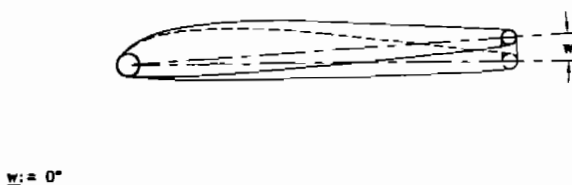
WING DIHEDRAL:



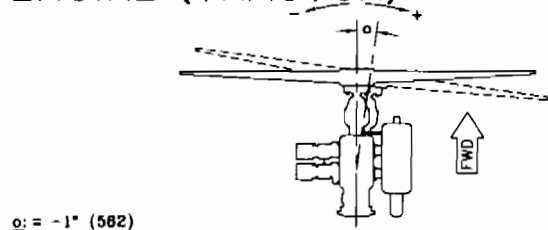
TAIL DIHEDRAL:



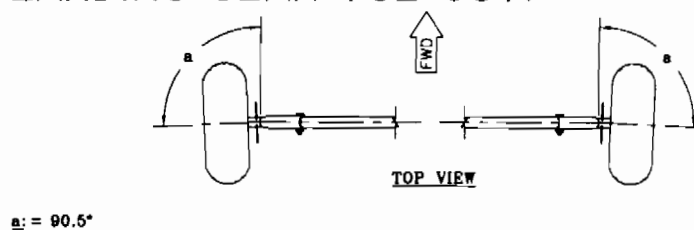
WING WASH-OUT:



ENGINE (TRACTOR):



LANDING GEAR TOE-OUT:



S-9 CHAOS FUEL SYSTEM OPERATIONS

Drain the tank's sump valve and header (if applicable) prior to each flight. Use a clear plastic cup to catch the fuel for inspection. Always store your aircraft with full fuel to eliminate water contamination due to condensation.

Inspect the fuel filter prior to each flight. Depending on how much debris is in the system, it may require replacement in less than 20 hours. As careful as you may have been debris still may accumulate in the fuel filter and severely restrict or shut off fuel flow.

Inspect the fuel system for leaky fittings and wear on lines prior to each flight. Replace fuel lines every 2 years or sooner if exposed to sunlight often.

Always mix the oil into the fuel immediately after fueling. In the case of two tanks and only one if topped, the one fuel tank will slowly drain into the other creating an undetermined amount of fuel in the other tank. Adding the oil right away to the just filled tank eliminates any possibility of flying on fuel without oil added.

NON-INVERTED FUEL SYSTEMS

Operation of either single or dual wing tank fuel system is quite simple. Fill the tank(s) to within ½" of being topped off. Add the required 2 stroke oil for the fuel and close the fuel cap. Open the main fuel valve and pump the primer bulb until the bulb feeds full of fuel. The system is now charged and ready. Use the panel mounted pump to prime the engine for start up.

The optional dual system will probably feed unevenly. Usually the RH tank empties first down to about 1" of fuel then the LH tank starts feeding. This, however, may differ in your aircraft. The point is there is no need for valves to switch tanks and the system will use all but a pint or so of the onboard fuel.

INVERTED FUEL SYSTEMS: SINGLE AND DUAL TANKS

The single or dual tank inverted fuel system used in the S-9's is of a random feed design requiring no fuel tank switching. As in the non-inverted system, the tank of least resistance feeds first (usually the RH). The header tank does, however, introduce an operational caution. Due to the negative attitudes occurring during aerobatics the header vent line will fill with fuel and cause a hydraulic lock of the vent. This results in a pressure in the header tank that does not allow it to fill completely. The primer bulb is installed to clear out the line and allow the pressure to vent, then the header will refill. This is more prone to occur when fuel levels in the main tanks are low. **IMPORTANT:** Prior to each take off the header tank must be full. Use a vent line primer bulb to clear the system. **NOTE:** Please install the bulb so the fuel is pumped **AWAY** from the header tank to the main tank.

GENERAL DESCRIPTION AND OPERATION

The S-9 and S-10's are equipped with one or two wing tanks. These tanks hold 9 gallons per side. The fuel systems gravity feeds into a header tank. Individual shut off valves control the flow of fuel to the header tank from each tank. Inside the header tank is a "klunker", which keeps the end of a short segment of flexible fuel line in the fuel no matter the aircraft's attitude. The header also features a fuel drain. This drain is the lowest point in the fuel system and makes it handy to drain any water that may have collected in the fuel. The header is barely lower than the main tanks in level flight. This makes for very low head pressure. The low head pressure is sometimes overcome by a fluid lock in the header tank vent line. Fuel can randomly enter these lines during flight due to negative flight or turbulence. When this happens, the fuel flow into the header tank can stop. To assure a positive fuel flow to the engine during aerobatics, an electric boost pump is recommended. A boost pump in the left tank withdrawal line and a shut off on the right tank will allow the header to fill and stay full.

NORMAL AND AEROBATIC OPERATIONS

Put 5 to 6 gallons in the LH tank and 2 gallons in the RH. Make sure the fuel caps are tight.

Turn on the boost pump and open the LH tank valve and close the RH tank valve. Prior to take off, check the header tank for the fuel level. It should at least be within 1" to 2" from the top for normal flight and full for aerobatics. During aggressive aerobatic operations, it is advised to periodically check the level of fuel in the header tank. In the event of a boost pump failure, the header tank will show an increasingly lower level. If such occurs, switch to the RH tank.

If you are performing at an aerobatic competition or air show, you will most likely have the least amount of fuel on board as possible. Even in this case, if the boost pump fails it will not be a problem. The header tank will provide enough time to get back to the runway.

During normal cruise, it is best to feed from both tanks and monitor the fuel level in the header tank. Be careful when barnstorming around the neighborhood. Watch the fuel situation closely. It is easy to forget about the fuel when in the throws of a mock dog fight or a buzz job (neither of which I encourage, but beware the S-9 or S-10 can be quite the temptress).

AEROBATICS S-9 STYLE

Doing aerobatics in the S-9 is a curious blend of conventional and unique properties. We call it low energy aerobatics which is an excellent name. The low wing loading and gross weight contribute to the high energy bleed, providing a structural and physiological safety valve. Try as you may it is rare to pull over 4 G's in even botched maneuvers, yet the fairly clean aerodynamics allows for acceptable vertical penetration. The net result is a airplane that can perform a routine in an extremely small "box" (Loops are 300' or smaller in diameter!).

Good aerobatics in an S-9 requires a smooth precision as well as authority. The exact execution of some maneuvers will vary as with gross weights. Anticipate this with "altitude insurance", it's cheap and pays big dividends. 3,000 feet AGL is a good starting point.

Be extremely thorough with your pre-flight and equipment checks. Because of its low cost your S-9 will bring you a unique opportunity to perform aerobatics. Do not abuse this opportunity by short changing your maintenance program. **STAY ON TOP** of the **FLYING** and the **FIXING**.

PLEASE NOTE: If you're using a bowl carb and not a pumper, fly with 2,000 to 3,000 feet AGL with a landing site below. Your engine will quit is sustained negative G's occur. The restart will require time for the bowl to fill (20 seconds) or pump the primer. **CAUTION: FLOODING MAY OCCUR:** 4 point rolls, Cuban 8's, Hammerheads and vertical down rolls can induce brief negative G's that cause a momentary power "skip". Pull throttle back to idle and smoothly open to let power return.

ASI MARKINGS

Apply the appropriate colored arcs on your ASI for the following speeds:

White Arc	35 mph to 80 mph (stall to maximum flap extension speed)
Green Arc	45 mph to 100 mph
Yellow Arc	100 mph to 130 mph
Red Line	130 mph

ENTRY SPEEDS AND TECHNIQUE

CHANDELLE: 90 mph

Execution: Normal, smooth stick required to maximize altitude gain

LAZY 8: 90 mph

Execution: Normal, watch RPM on the down side

"RANS ROLL": 95 mph

Execution: This is an excellent roll to start with. It is a safe roll due to the almost impossible tendency to split "S". At entry speed, smoothly pull the aircraft vertical or nearly so (anything above 60 degrees works). Push brisk RH stick and rudder. Hold slightly up stick too. Feed out as horizon appears. The plane will do a combo barrel snap. It is very gentle and easy. Properly done the nose will drop through and you will end up slightly nose high. Of course, the higher the nose on completion the better!

AILERON ROLL: 110 mph

Execution: Dive to entry speed. Pull 30 degrees nose up neutral pitch, neutral rudder, hard over RH aileron (LH is a little slower). Feed down stick as you go inverted as required. **CAUTION:** This requires an invert fuel and restraint system.

BARREL ROLL: 110 mph

Execution: Normal

SLOW ROLL: 95 mph

Execution: Normal

VERTICAL ROLL: 120 mph

Execution: Dive to speed. Pull up without excess speed to loss to vertical. Must have 85 mph when vertical. Neutral pitch, hard RH aileron. Push over at the top to prevent tail slide or flop over.

SNAP ROLL: 45 to 50 mph

Execution: Slow to 45 mph. Add full power at 50 mph. Apply brisk RH rudder and full up pitch. Feed out at 3/4 roll or roll may continue.

SPLIT "S": 45 mph

Execution: Normal

CUBAN 8: 100 mph

Execution: Normal

HAMMERHEAD TURNS: 80 to 110 mph

Execution: Normal

SPINS: Stalled

FALLING LEAF: Stalled

S-9 OPERATIONS

PRE-FLIGHT

See following page

PRE-TAKE OFF CHECK LIST

Fuel on?
 Oil mixed in fuel?
 Lap belt secure?
 Altimeter secure?
 Canopy latched and safetied?

STARTING

Brakes on?
 Prime system 3 solid pumps
 Mags on?
 Pull starter through until engine fires
 Pump primer if engine starts to drop RPM until it picks up fuel.
 Advance throttle to 3,000 RPM for 20 to 30 seconds
 Clear to taxi?

TAXIING

Taxi slowly with light brake pressure and minimum power. Avoid high speed downwind taxiing! Keep stick forward downwind and up into the wind.

TAKE-OFFS

Add power evenly. Do not "jab" the throttle. Hold slight up elevator. Aircraft will auto-rotate at 50 mph.
 Climb out at 70 mph IAS for best cruise climb;
 at 55 mph IAS for best rate
 at 50 mph IAS for best angle

STALL SPEED

35 mph is typical stall speed

CRUISE DATA (NOTE: These are cold weather values)

<u>RPM</u>	<u>SPEED</u>	<u>RANGE*</u>
5500	75	3 HOUR
5750	80	2.2 HOUR
6100	90	1.75 HOUR

*1/2 hour reserve excluded.

LANDING

Normal approach @ 64 mph
 Best glide speed, engine off 60 mph
 Short field 45 mph
 DANGER!!! When braking above 50 mph, directional control is difficult.

S-9 PRE-FLIGHT

LH WING & RH WING

- _____ Inspect all control surface hinges
- _____ Control linkages
- _____ Integrity of wing spars (bend, dented?)
- _____ Look under wing for missing inspection plates
- _____ Check if fuel vent lines are open
- _____ Pitot clear?
- _____ Strut bolts secure?
- _____ Fuel cap secure? Desired fuel on board?
- _____ Oil in fuel?

ENGINE CHECKS

- _____ Cowling secure?
- _____ Prop tight? Check gear box. (See note below)
- _____ Shake engine by moving prop to check for "normal" feel. This checks the integrity of the engine mount.
- _____ View inside exhaust port for
 - A) Coolant leaks
 - B) Fuel leaks
 - C) Exhaust leaks
- _____ Check under belly for radiator condition as well as coolant hoses.

TAIL

- _____ Check control surface motion and hinges
- _____ Check tailwheel. Springs okay?

COCKPIT

- _____ Seat, seat belts and controls secure?
- _____ Freedom of movement on stick, rudders, throttles and trim?

NOTE: A routine inspection of the prototype S-10 at 250 hours revealed a black residue about the gear box to engine seam. This is a sure indication of movement. Disassembly revealed a broken shoulder bolt. Extraction was made using an improvised easy out and the bolt replaced.

It is possible the extensive amount of aerobatics, especially snap rolls, have caused this failure. Please inspect for the tell tale sign of movement in the form of black residue between surfaces. Also, during pre-flight check for abnormal gear box movement.

RANS S-9 CHAOS: GENERAL DESCRIPTION AND FLIGHT PROPERTIES*

(*Flight properties are unique to each aircraft. Use this information as a guideline of what to expect, not as a rule.)

DESCRIPTION

The RANS S-9 is a mid-wing tractor mono-plane with conventional landing gear. It's strut braced wings utilize aluminum tubes for spars, compression, anti-drag, tip bows and ribs. The fuselage is of welded 4130 chromoly steel. The design features aerobatic capability, fully enclosed cockpit, bungee landing gear, steerable tailwheel, in-flight elevator trim tab and full span ailerons.

FLIGHT PROPERTIES

The S-9 flight properties are conventional in respect to general aviation aircraft in the areas of control and response. There is a slightly higher rate of speed decay in zero thrust mode and potential for high sink rates due to the 7 lb. wing loading.

STALLS

Are preceded by a pronounced buffet cause by the wings root section turbulent air flow over the tail. During this root stall the plane will continue to fly indefinitely with good control in all axis. Additional power will be required to maintain attitude. A very slight pitch over occurs once the wing stalls, if entered in no greater than 20 degrees nose high. The nose will drop through the approximate equivalent angle of entry above 20 degrees as in whip stalls or tail slides. Tip stalls do not occur even though the tapered wing is a 0 degree wash out. This is due to the air foils gradual change from **13%** thick at the root to **17%** thick at the tip. With the aircraft stalled it can be held in a "Falling Leaf" with authoritative rudder work. Simply holding neutral rudder will produce a tight spiral to the RH or LH (usually RH because of "P" factor). During a falling leaf, the aircraft will pitch gently in 10 degrees to 15 degrees nose high attitude. If left to a rudder free state, the S-9 will enter tight spiral again, either LH or RH. This spiral will, however, be more quickly entered than the rudder held neutral spiral. Power on stalls result in much buffet, no altitude loss (sometimes a gain) and good control in all axis.

SPINS

Are possible in the S-9 only after fully stalling. Once fully stalled, full rudder is applied. Anything shy of full deflection of elevator and rudder will result in a spiral or flattened spin. The spin itself is 70 degrees nose down with 180 degrees to 240 degrees per second rotation at 1700 to 2500 FPM sinks. Recovery is crisp with 90 degrees to 180 degrees of lead out. Attempts to flat spin have been conducted with little success. No inverted spins have been attempted.

SNAP ROLLS

Also are performed with authoritative brisk stick work, but entry speed on snaps is crucial for precision. A speed between 60 to 70 produces a tight quick snap. Slower and there is considerable vertical loss. Faster and it tries to barrel roll, ending with an abbreviated second half.

INVERTED FLIGHT

The S-9 has been flown inverted with power. The attitude is about 3 degrees nose high with forward stick at a minimum. Control is good.

TAKE OFFS

The S-9 departs in the 3 point attitude. This yields the shortest ground roll. The power loading on the S-9 is around 13 lbs per hp at gross (47 hp 600 gross). This results in S.T.O.L. like performance. The rapid acceleration leaves little time to go astray on the roll out. This makes the S-9 a low demand taildragger, but not unsensitive. The effective controls can lead to over control but pitch is properly damped so PIO's are rare and to date unwitnessed.

LANDINGS

If touch down speeds are modest (below 40 mph) the landing is very undemanding. At above 40 mph, if the S-9 is forced onto the runway the excess energy will cause moderate demand on directional control. Fortunately the energy is quickly dissipated once wheels have touched and the "twitchy" moment will be brief. Again, no "twitchyness" is evident when the proper touch down speed is allowed. To set up a normal landing, an approach speed of 60 to 65 mph is maintained down to the threshold. The aircraft is then allow to slowly sink into the runway in the 3 point attitude. No flare is recommended as the energy retained is high enough to cause a swoop up to 20 feet and then a tail first mush into the runway results! Even 50 mph approaches are possible but it is flying on the prop (usually 5,000 RPM) and not recommended unless required for landing field access.

CROSSWINDS

The S-9 has little difficulty operating in 25 plus crosswinds even at 90 degrees. Proper technique and authoritative flying is required.

SUMMARY

The S-9 demonstrates acceptable handling in all areas and performance is consistent in varied conditions.

The aircraft is not high demand or unwilling to forgive. The margins for error are above average, perhaps due to the airfoil, low drag, lightness and low power loading.

As a learner's mount, only if the instructor has gone before. As with any plane, one should not teach thyself to fly but be rightly guided.

The S-9 yields a type of flying sought after, respected and cherished. It is a high performance machine with the manners of a saint!

S-9 ENGINE OPERATIONS

Provided with the aircraft is an engine manual authorized by the engine distributor. This is a well written manual explaining many specifics for continued safe and reliable operation of your engine. We urge you to read and fully understand this manual. In addition, please find the data below helpful in obtaining the most out of your aircraft.

STARTING

Position the aircraft into the wind and chock the main wheels to prevent rolling. To maneuver the aircraft into position, lift the tail at the strut connect points. Avoid lifting at the tips of control surfaces. **CAUTION:** Winds above 20 mph may cause the aircraft to lift off when empty. Have an assistant sit in the plane or help hold it down at the wing strut connect points. Never hold a strut in the middle!!!

It is best to start the plane from inside the cockpit. The S-9 can be entered easily by standing on the seat then sitting down.

Drain the fuel sump. Prime (if first start or if it has been 30 minutes since the last start) 3 solid pumps. Close the throttle (pull back to close). Flip ignition switch up for on. Move the control stick to the left. Grab the start handle and pull briskly. Several pulls may be needed. Be sure the ignition is on (switch up). Let it idle a moment and then advance the throttle slowly. **NOTE:** After the engine warms up (2 minutes), close the throttle. It should idle at 2,000 RPM. If not, refer to the engine manual for details on setting the idle. If you encounter starting difficulties, refer to the engine manual for probable cause and solutions. **CAUTION:** In cold weather, allow at least a 2 minute warm-up before applying take-off power.

Check throttle action. There should be no sluggish response from mid-range to top end. Don't rapidly pump the throttle. This is not a motorcycle. It is a airplane with a big fly wheel, the propeller. Jockeying the throttle will only accelerate wear on the engine and make its reliability questionable. Be smooth with the throttle and it will respond when you need it.

REASONS FOR POWER LOSS

Never take off if a **PLUG IS FOULED**. This will be indicated by a sluggish throttle, lack of RPM and rough running. Two strokes do not unfoul their plugs. They only get worse. So flying to "clear it out" may result in a power loss and a forced landing.

WORN PLUG

Again, throttle and RPM are not normal. Replace with a fresh, properly gapped plug. Plugs should be replaced every 25 hours.

CLOGGED AIR FILTERS

Spit back--The tendency at low RPM's for the engine to throw fuel out of the carb and into the air filter causing the engine oil to eventually clog the filter. The situation worsens rapidly because the more clogged the air filter becomes the more fuel that spits back. This can occur on an S-9 about every 40 hours. Therefore, it is recommended to clean and re-oil (with air filter oil only) the filter on a periodic basis. Soak the filter in clean, raw gas. Then rinse and let dry thoroughly. Re-oil when dry as per the air filter oil instruction. **NOTE:** The filter oil is K & N brand and it available at most motorcycle shops.

CHECKING STATIC RPM

Prior to the first flight, determine the engine's static RPM; this is the speed it develops when stationary and fully throttled. An acceptable static RPM indicates that the engine is operating at or near full potential and should not over-speed during the first flight.

First, calibrate the engine tachometer to make certain it's accurate. Determine the propeller's RPM with a *light tach* (a hand-held device which measures propeller rotation with infrared pulses) and compare the reading to the tachometer's, taking into account the engine's gear reduction ratio. The tachometer supplied with your RANS kit is equipped with a calibration knob; refer to the manufacturer's instructions.

Once satisfied with the tachometer, run the engine with the throttle fully open; be certain the tail is tied down and the main gear is chocked. For the two-stroke Rotax 503 and 582, acceptable static RPM is usually about 6000 to 6200; for the four-stroke 912, it's usually 5000 to 5200. (A number of factors influence this, including the number of propeller blades, their length and pitch.) Ideal static RPM would render an *in-flight* RPM just below red line with the throttle fully open at sea level.

A high static RPM may indicate that the propeller is pitched too finely (the blades take too small a bite of air). This prevents the propeller from performing most efficiently and may allow the engine speed to exceed red line in flight. If the blades are adjustable, increase pitch; refer to the manufacturer's instructions. If the blades are fixed, contact the manufacturer.

A low static RPM may indicate that the propeller is pitched too coarsely (the blades take too large a bite). This also prevents the propeller from performing most efficiently and induces excessive load on the engine. If the blades are adjustable, decrease pitch; if fixed, contact the manufacturer. If finer pitch does not raise maximum engine speed to an acceptable RPM, another problem may be indicated.

WARNING: Attempting flight with too much or too little propeller pitch may have severe consequences. Conduct flights only with sufficient power output!

Knowing the ideal static RPM allows you to check the health of the engine during a full-throttle run-up prior to takeoff. Once you've become familiar with the in-flight performance of the engine and have adjusted the propeller, you'll know better what the tachometer should indicate during run-up.

CREATING A PILOT OPERATING HANDBOOK

Most pilots are accustomed to flying light planes with comprehensive pilot operating handbooks. This is a result of the standardization required by FAA certification, the fruit of which is fleets of identical aircraft for which specific checklists, procedures and performance figures may be published.

This section includes much information on the operation, limitations and performance of RANS aircraft; however, the nature of kit-built aircraft makes it impossible to publish *specific* checklists and procedures applicable to *all* examples of a particular model. This is because the builder, as manufacturer of the aircraft, has the freedom to assemble, equip and modify his machine as he wishes. The result is fleets of aircraft that share the same name and designation, but vary somewhat in operation and performance.

The builder should consider carefully all aspects of the engine, airframe and equipment when developing checklists and procedures for his plane. For example, he might begin the preflight inspection by opening the cabin and checking that the magnetos are off; this would ensure the engine cannot start if the propeller were moved. With the cabin open, he also might drain fuel from the sump, allowing any water trapped in the system to escape. He then might begin a walk-around, moving about the ship in a logical, straightforward manner, checking the presence, security and condition of hardware and components.

With the walk-around completed, he might seat himself in the aircraft and consider the checks necessary for a safe and mechanically sound engine start. This will depend largely on the specifics of the engine, fuel, ignition and electrical systems he has installed. Again, a straightforward, logically-flowing checklist should be developed that addresses the particulars of his machine.

The same care should go into development of a pre-takeoff checklist. Of particular importance is a proper engine run-up to check the health of the power plant. An essential checklist item often given short shrift is that of free and correct movement of control surfaces; this is particularly important for aircraft that fold or disassemble.

Considerable forethought should be given to potential emergencies. What steps should be taken to deal with balked landings, engine failures or fires? How might these steps vary according to the phase and conditions of flight? Consideration of contingencies now is likely to mean faster, more appropriate reaction to urgent or emergency situations, should they arise.

Since each kit-built aircraft is unique, each builder should expect his aircraft's performance to be unique. The prudent builder will determine carefully the weight and balance parameters of his plane before its first flight. He'll familiarize himself with its flying characteristics during the flight test phase, cautiously exploring its capabilities and limitations while heeding the designer's words of advice. The U. S. Government, the Experimental Aircraft Association and other publishers offer a wealth of information on flight preparation and testing. As a first step, the builder might refer to the FAA's AC-90-89A, "Amateur-Built Aircraft Flight Testing Handbook."

By applying suitable checklists and procedures to his plane and operating it within reasonable limits, the builder helps ensure his safety as well as the reliability and longevity of his airframe, power plant and components.

CORROSION and WASHING YOUR PLANE

Using the garden hose to wash the outside of your plane may seem like a great idea, however this is a practice avoided at the factory. We simply never let the plane get to the point it needs hosing. Instead, the exterior of the plane is cleaned using a product called Brilliance. This mild cleaner works great on all surfaces including the Lexan. For the oil or exhaust stains, we use 409 or Fantastic. These clean very effectively without apparent damage to the paint.

If your plane is open air like an Airaille or Stinger and you do use a hose to wash it down, you may be causing a future corrosion problem. In the case of any open cockpit plane with the tail sitting low, it is possible for water to collect inside the elevator push pull tube. This will rust away the elevator yoke and corrode the push pull tube also.

Even leaving the plane in the rain can allow moisture to collect in the elevator yoke. Please avoid the practice of spraying water into the cockpit area of your plane, open cockpit or not, this is a practice that will lead to corrosion problems and part replacement.

If you suspect your aircraft of corrosion problems, inspect all areas where water may collect, such as the elevator yoke area.