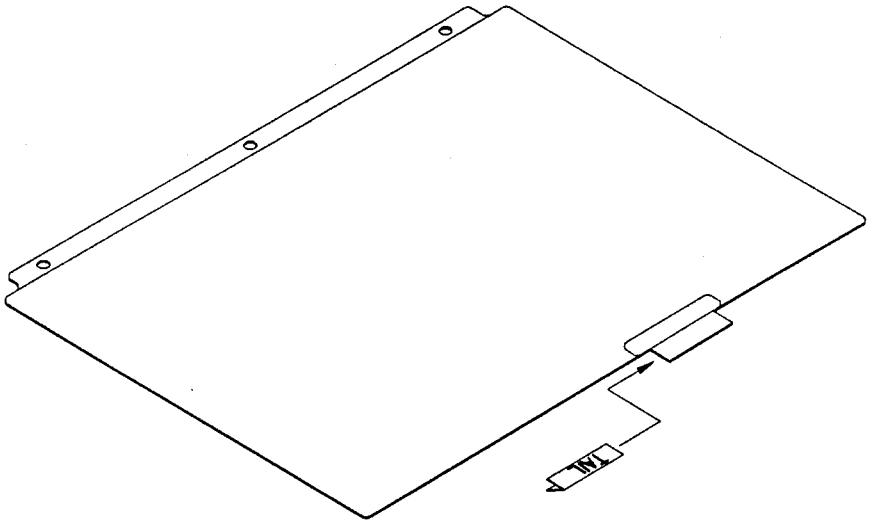
S-12 AIRAILE

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 GENERAL DATA	CONTROL STICK CONTROL STICK	ENGINE SYSTEM ENGINE SYSTEM	WINGS WINGS
LANDING GEAR / COCKPIT CAGE LANDING GEAR / COCKPIT CAGE	FUSELAGE FUSELAGE	INSTR. PANEL INSTR. PANEL	CG/OPERATIONS CG/OPERATIONS
RUDDER SYS. / FLOORBOARD RUDDER SYS. / FLOORBOARD	TAIL GROUP TAIL GROUP	SEATS SEATS	OPTIONS OPTIONS

RANS, Inc.
4600 Highway 183 Alt.
Hays, KS 67601

Technical Support
(913)625-0069

Parts Department
(913)625-6346

When calling Technical Support or the Parts Department please have the following ready:

- Aircraft Model
- Serial Number
- Engine Model
- Part Number Needed (Parts Department Only)
- Your Aircraft Assembly Manual

NOTE: Please make your question precise and to the point so that we may assist as many customers as possible.

RANS Aircraft
tool list

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

Hand Tools

Pliers
Needle nose pliers
Side cutters
Aviation Snips
Hammer
Rubber mallet*
Center Punch
Drift Pin and Punch set
Several small clamps

Safety wire pliers
Linesman pliers
Electrical wire Stripers
Pop Rivet tool
Click Punch
Ball peen hammer
Scratch awl
Screwdriver set
Safety glasses

Wrench set SAE and metric
Ruler & Tape Measure

Socket set SAE and metric
2 or 4 ft. level

Adjustable fly cutter*
Set of Drill bits
Hack Saw

Utility Knife
Hole saw*
Files

Power Tools

Electric hand drill
Dremel*
Soldering gun
CD Player*

Small Electric Grinder*
Bench Disk sander*
Heat Gun*

Lubricants and Glues

Small can lithium grease
Contact Cement
Super glue

Clear Silicone
WD 40

* Not a necessary tool but helpful.

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

Small Airplane Directorate
601 E. 12th Street
Kansas City, MO 64106

FEB 26 1991

Mr. Randy Schlitter
Rans Company
1104 E. Highway 40 By-Pass
Hays, KS 67601

Dear Mr. Schlitter:

In response to your request of January 17, 1991, we have evaluated your amateur built kits for the S-6ES Coyote II and S-12 Airaile to determine their eligibility for meeting the "Major Portion" requirement of FAR 21.191(g). The configuration of these aircraft is described in your assembly manual dated 2/91.

Based on our evaluation, we have determined that the builder will have to fabricate and assemble the major portion of the aforementioned aircraft kits. Accordingly, we will request our Washington Headquarters to add these aircraft to the FAA's list of eligible amateur-built kits for sale to the public.

Sincerely,

Gerald W. Pierce, Manager
Manufacturing Inspection Office

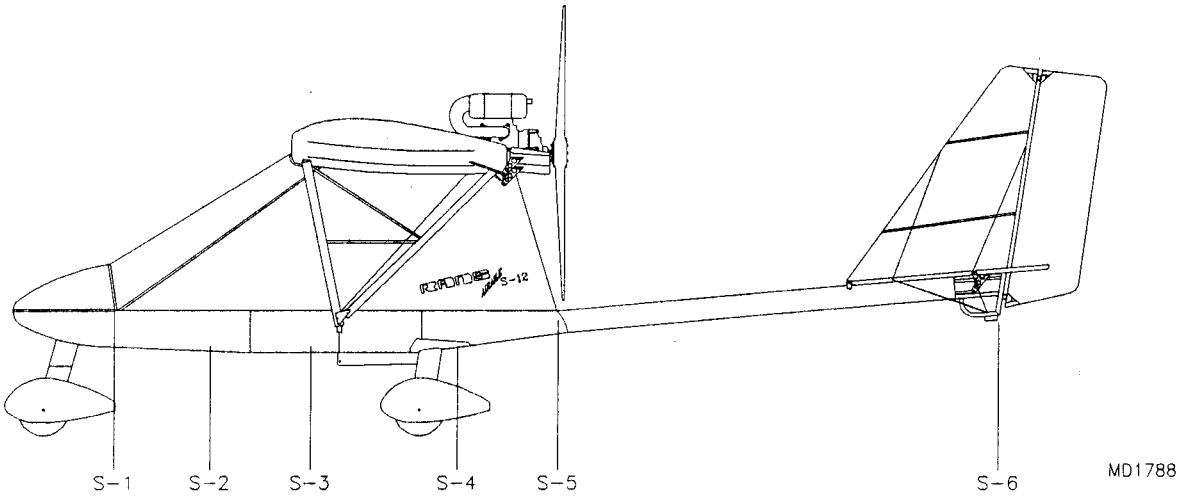
ORIENTATION

We highly recommend that you completely read through these instructions before beginning assembly of your RANS KITPLANE. For this reason, we have not supplied a separate list of tools needed. They are called out for in each step as they are needed.

It will help you immensely to understand the code we have used to label parts. As you can see from the picking sheet, each part is assigned a number. Some parts supplied by other manufacturers are given the manufacturer's part name, such as all the AN-Hardware and other fittings. For parts of our own we 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). As we progress towards the tail, we pass all the stations.

When a left side part is called this means the plane's left and your left if you were sitting in the cockpit looking forward. Fwd. means towards the front; aft means towards the tail.



During assembly you will be referred to drawings in the Parts Catalog, Assembly Manual, Engine Manual, etc. Have all of these handy during assembly.

There are two other things you will need to have during assembly. Certain bolts such as the engine cylinder head studs of the 532 and 582 will need to be secured with "Loctite". We use #242. You will also need to have some .032 stainless steel safety wire.

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.

KODIAK RESEARCH, INC.
1575 W. COMMERCIAL BLVD. #33B
FT. LAUDERDALE, FL 33309

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

Atten: O.E.M.'s

Date: October 31,1991

Subject: Warranty Extension Requests

Dear Customer,

1) In order for your customers 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.

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 reto-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.

FORM APPROVED
OMB No. 2120-0042

UNITED STATES OF AMERICA DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION-MIKE MONRONEY AERONAUTICAL CENTER
AIRCRAFT REGISTRATION APPLICATION

CERT. ISSUE DATE

UNITED STATES REGISTRATION NUMBER N 1234Y

AIRCRAFT MANUFACTURER & MODEL

RANS S-9

AIRCRAFT SERIAL No.

1288054

FOR FAA USE ONLY

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	STATE	ZIP CODE
Anytown	KS	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).

CERTIFICATION

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	TITLE	DATE
John Q. Amateur	Builder/Owner	3/16/88
John Q. Amateur		

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

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 **subsititute 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 homebuilt project and to generally familiarize yourself with the procedures established by the FAA for homebuilt 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.)

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.

WHAT ARE THE SPECIAL REQUIREMENTS AS FAR AS ATTACHING NUMBERS AND PLACARDS TO A HOMEBUILT 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 no 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 (c) 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 surfaces.

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 And 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, unuseable fuel, minimum fuel for take-off, minimum fuel for inverted flight, etc.

8-3 POWERPLANT INSTRUMENT MARKINGS

Each required powerplant 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.

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 expect that an approved flight test area may not be the one chosen by 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, oil temperatures and pressures, altitudes and free air 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?

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.

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

AC Form 8050-88 (9-75) (0052-00-559-0002) Supersedes previous edition

Form Approved
O.M.B. NO. 2120-0018

US 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 (No. & Street) Anytown (City) KS (State) 67601 (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 STATMENT 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

Form Approved
O.M.B. No. 2120-0018

US Department of Transportation
Federal Aviation Administration

APPLICATION FOR AIRWORTHINESS CERTIFICATE

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

II. CERTIFICATION REQUESTED

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)														
	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					
				0		TO SHOW COMPLIANCE WITH FAR											
	8		SPECIAL FLIGHT PERMIT (Indicate operation to be conducted, then complete Section VI or VII as applicable on reverse side)	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	ADDRESS
John Q. Amateur	#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	NAME AND TITLE (Print or type)	SIGNATURE
3/16/88	John Q. Amateur	John Q. Amateur

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)

A. I find that the aircraft described in Section I or VII meets requirements for:

		THE CERTIFICATE REQUESTED				
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	4	DESIGNEE'S SIGNATURE AND NO.	1	FAA INSPECTOR'S SIGNATURE

THIS PAGE IS ONLY A SAMPLE

FAA Form 8130-6 (11-88) SUPERSEDES PREVIOUS EDITION

APPENDIX 1. SAMPLE CHECKLIST FOR A CONDITION INSPECTION

AIRCRAFT IDENTIFICATION:

TYPE/SN. _____

N NUMBER _____

A/F TOTAL TIME _____

OWNER _____

ENGINE MODEL/SN. _____

PROPELLER MODEL/SN. _____

ENGINE TOTAL TIME _____

PROPELLER TOTAL TIME _____

GENERAL:

	Builder/inspector			
	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				
LUBRICATION				
WING ATTACH POINTS				
FLYING/LANDING WIRES/STRUTS FOR SECURITY				
CORROSION				
FLIGHT CONTROL PLACARDS				
_____				
_____				
_____				
_____				
_____				
_____				

APPENDIX 1---CONTINUED

	Builder/inspector			
	Sat	Unsat	Sat	Unsat
INSPECT FIREWALL FOR DISTORTION AND CRACKS				
INSPECT RUDDER PEDDLES 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 SPARKPLUGS				
CHECK MAGNETO TIMING/POINTS/OIL SEAL/DISTRIBUTOR				
INSPECT ENGINE MOUNT/BUSHINGS				

APPENDIX 1—CONTINUED

	Builder/inspector			
	Sat	Unsat	Sat	Unsat
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 AIRCRAFT LOGBOOKS				

EAA Safety Check List

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.

PROPELLER	Yes	No
1. Blades		
Laminations not separated?		
Breaks, scratches, nicks tipping?		
Loose rivets in tipping?		
Drain holes in tip clear?		
2. Hub		
Any cracks or corrosion?		
Hub properly seated and safetied?		
3. Control Mechanism		
Oil leaks?		
Worn bearings?		
Secure?		
4. Attachment		
All bolt & nut threads undamaged?		
All bolts & nuts secured & safetied?		
5. Spinner		
Cracks?		
Properly secured?		
Is spinner chafing into prop?		
ENGINE & ENGINE COMPARTMENT		
1. Fuel System		
All lines of approved type?		
All strainers clean?		
All lines secured against vibration?		
Gascolator bowl at low point in system when aircraft is in normal ground position?		
Fuel drains operative?		
All connections properly tightened?		
2. Oil System		
All lines of approved type?		
All lines secured against vibration?		
Oil tank has no cracks or leaks?		
Tank properly secured & safetied?		
All plugs & strainers cleaned & safetied?		
3. Ignition-Electrical System		
All wiring proper type and gauge?		
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?		

ENGINE & ENGINE COMPARTMENT	Yes	No
All stacks in good condition-no cracks or rusted-out areas?		
Carb heat and cabin heat muffs removed and manifold inspected?		
5. Controls		
All secured and safetied?		
No excessive play in any linkages?		
No interference between any control and the structure throughout the full operating range?		
Carb heater gate open & close fully?		
6. Mount		
Secured and safetied?		
All joints inspected for cracks?		
Any bends in mount tubes?		
Bushings in good condition?		
7. Cowlings		
Secured and/or safetied?		
All latches or fastenings working properly?		
Any cracks properly checked or reinforced?		
Cowlings clean?		
8. Power Plant in General		
All necessary safeties, palnuts, locknuts, etc. in place?		
No fuel or oil leaks?		
All accessories secured & safetied?		
FUSELAGE-HULL		
1. Structure		
All welds sound?		
All tubing straight and uncracked?		
No rust or corrosion?		
All attach fittings sound, no cracks, elongation of holes or worn threads?		
All rivets properly installed?		
Inspection openings for all vital areas?		
Fuselage properly drained, that is, no built-in moisture traps?		
Firewall of proper fireproof material?		
2. Cover		
Properly attached?		
No tears, distortions, or abrasions?		
Any breaks or ruptures properly repaired?		
3. Control System		
Properly secured and safetied?		
Controls stops provided & adjusted?		
All fittings of proper thread & size?		

FUSELAGE-HULL	Yes	No
All pulleys of proper diameter for bends, proper size for cable, and guarded?		
All cable of proper size (1/8" min) and condition?		
Any parts in system subject to rotation for any reason properly secured and safetied?		
Return springs on rudder pedals?		
No interference between any control part (cable, tube or linkage) and any other part of the structure throughout full control movement?		
Adequate room for full control throw when aircraft is occupied?		
Controls arranged to minimize danger of blocking by foreign objects?		
Grip properly secured to control stick or wheel?		
4. Electrical System		
All grommets, particularly in firewall, snug fitting and in good condition?		
All wires of proper gauge, insulated, and secured?		
Wires do not rest on abrasive surfaces?		
Battery installation of sufficient strength?		
Battery properly ventilated and drained?		
No corrosion at or around battery or its vents?		
Fuses of adequate amperage?		
5. Fuel System-Tanks		
Drains properly located to discharge clear of aircraft?		
All outlets properly screened?		
Breather inlets clear?		
Fuel shut-off valve installed?		
Fuel shut-off valve easily reached by pilot?		
All fuel lines of proper approved type?		
All fuel lines secured against vibration?		
Is tank located so that sufficient head is available in maximum climb with minimum fuel? Placard if necessary?		
Has tank sufficient expansion area?		
Any tank overflow discharge clear of hazardous areas on aircraft?		
Is tank support sufficient to meet strength requirements?		
Does tank clear surrounding structure?		
Do tank supports minimize strain and chafing?		

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
EXITS		
1. Can aircraft be cleared rapidly in case of emergency?		
Are special precautions available during test period, such as jettisonable doors or canopy?		
If parachute is to worn, does it clear all controls?		
Baggage Compartment		
1. Are walls and floors of sufficient strength to withstand flight loads?		
Can anything escape from baggage compartment by accident?		
Cabin-Cockpit		
1. Instruments		
Are all instruments functioning and accurate?		
Are all instruments marked, max pressures, temperatures, speeds?		
Are all vital instruments easily visible to pilot?		
2. Flight-Engine Controls		
Are all engine controls marked or easily identifiable?		
Are all engine controls smooth in operation, without excessive resistance, and easily available to pilot?		
Are all flight controls arranged so that jamming by dropped gloves, etc. is impossible?		
3. Fuel Systems		
Are all gas valves easily reached by pilot?		
Are all gas valves marked ON, OFF, LEFT, RIGHT?		
Are all gas valves in such a position that accidental operation is impossible or guarded in such a way that accidental operation is impossible?		
4. Seats		
Are seats of sufficient strength for maximum flight loads contemplated?		
Does seat "flex" enough at any time to interfere with flight controls?		
5. Safety Belts and Shoulder Harness		
Is installation and attachments of sufficient strength to meet 9G forward load minimum?		
Does attachment connect directly to primary structure?		
Are belts and harness in top condition?		
Is belt of correct size, that is, no long over-tongue?		
Is a separate belt and shoulder harness supplied for each occupant?		

	Yes	No
6. Heating-Ventilation		
Is cabin or cockpit in negative pressure area and liable to suck in exhaust fumes?		
Is any provision made for ventilating cabin other than normal leakage?		
7. Windshield-Windows		
Are windshield and windows of recognized aeronautical materials?		
Is windshield braced against positive or negative pressures in flight, either by design or extra bracing?		
WING-TAIL SURFACES		
Fixed Surfaces		
Are all interior fastenings secured and/or safetied?		
Is interior properly weatherproofed?		
Have any mice been inside lately?		
Movable Surfaces		
Are stops provided, either at wing or somewhere else in the control system?		
Are all hinges and brackets sound?		
Are all hinge pins secured and safetied?		
Is there any excessive play in hinges?		
Is there any excessive play in control cables or tubes?		
External Bracing		
Is the interior of all struts weather protected?		
Are all adjustable fittings locked, secured, and safetied?		
Are struts undamaged by bends or dents?		
Are all wires serviceable with proper end fittings?		
Attach Fittings		
Are bolts of proper size installed?		
Are all bolts secured and safetied?		
Have all bolts been examined for wear?		
Flight Control Mechanism		
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?		

	Yes	No
Fuel overflow drains clear of aircraft - no tendency for overflow to soak into aircraft structure?		
LANDING GEAR		
Properly lubricated?		
Proper oleo inflation?		
Shock cords or springs in good condition?		
All attach fittings uncracked and sound?		
All bolt holes not elongated?		
All attach bolts secured and safetied?		
Brake lines in good condition?		
Brakes operating properly?		
Correct hydraulic fluid in lines?		
Wheels uncracked?		
Tires unworn & properly inflated?		
Excessive side play in wheel bearings?		

GENERAL

ALL BOLTS WHEREVER POSSIBLE, HEAD UP AND FORWARD.

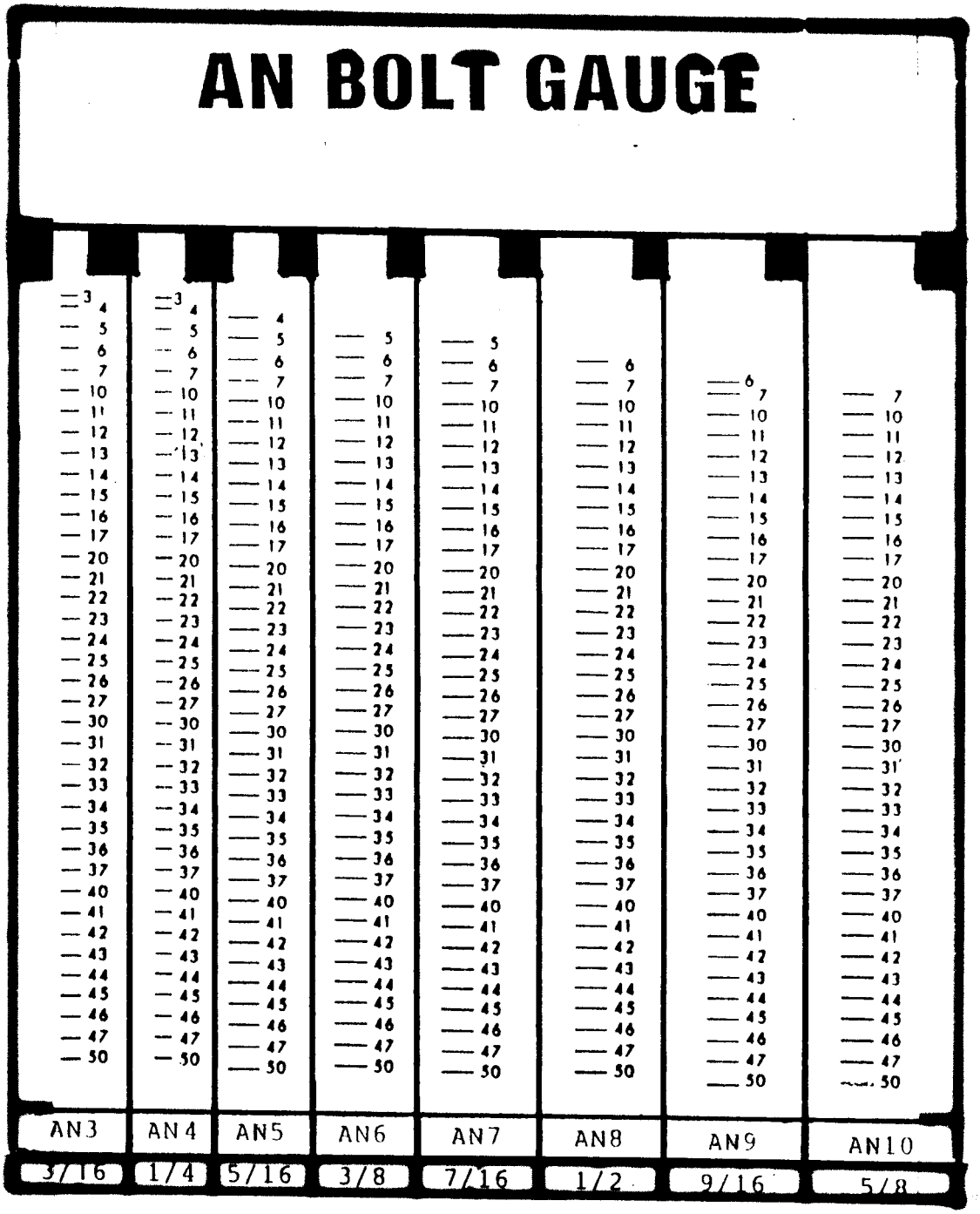
All exterior fastenings visible from cockpit or cabin should have safetied end toward pilot, wherever possible.

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.

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!

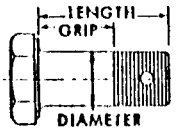
OK - Kick the tires, add another coat of paint and AWAY WE GO!

AN BOLT GAUGE



AN3-AN8 AIRFRAME BOLTS

AN3-AN 8 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)
AN4H6 (Drilled head, drilled shank)
AN4H6A (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) *Formula does not apply for AN4-3. Grip for AN4-3 is 1/16

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 1/2 -20
	Grip = Length Less.....	13/32	11/32 *	17/32	41/64	21/32	25/32

DASH NUMBER — NOMINAL LENGTH

-3... 3/16 -4... 1/4 -5... 5/16	-6... 3/8 -7... 7/16 -10.. 1	-11..1 1/16 -12..1 1/8 -13..1 3/16	-14..1 1/4 -15..1 5/16 -16..1 3/8	-17..1 7/16 -20.. 2 -21..2 1/8	-22..2 1/4 -23..2 3/8 -24..2 1/2	-25..2 5/8 -26..2 3/4 -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 catalog for other part identification. The drawings depict a fairly accurate likeness of the real thing. Other parts such as tubes and certain brackets are labeled by part number. Again, reference the code to catalog to conifm part identity.

S-12 AIRAILE COCKPIT CAGE INSPECTION

The S-12 Airaile cockpit cage comes pre-painted and ready to inspect. Conduct an inspection of the cage prior to assembly to be sure shipment has not inflicted damage. Follow the inspection guide below.

1. View the cage from the front for any twist. All the crossing members in the cage such as the seat and gear truss should be in parallel. Very minor misalignment is probable from the welding process but unlikely. The super structure is designed to compensate for this small amount of twist if it exists. If the frame has been damaged in shipment there may be obvious signs such as cracks in the paint or ruptured tubes.

2. Inspect the frame for bent tabs. If such is present, correct by gently pulling back into original alignment. The most likely place for bent tabs will be the four AFT triangle shaped tabs welded to the gear truss. Insertion of the tail boom during assembly will further conform alignment.

3. Inspect the frames' paint job. As hard as we try to paint the cage completely there may be a light spot here and there. If this is the case, use a quality brand spray aerosol to touch up. We use flat black lacquer so nearly any flat black paint will match and be compatible.

4. Inspect the frame for general condition. If your cockpit cage has come through inspection with flying colors you are ready to begin assembly of one of the best pusher planes around!

5. Thread the 1/4" plain nuts all the way onto the (2) 1/4" bolts and screw these bolts into the nose gear steer arm stops.

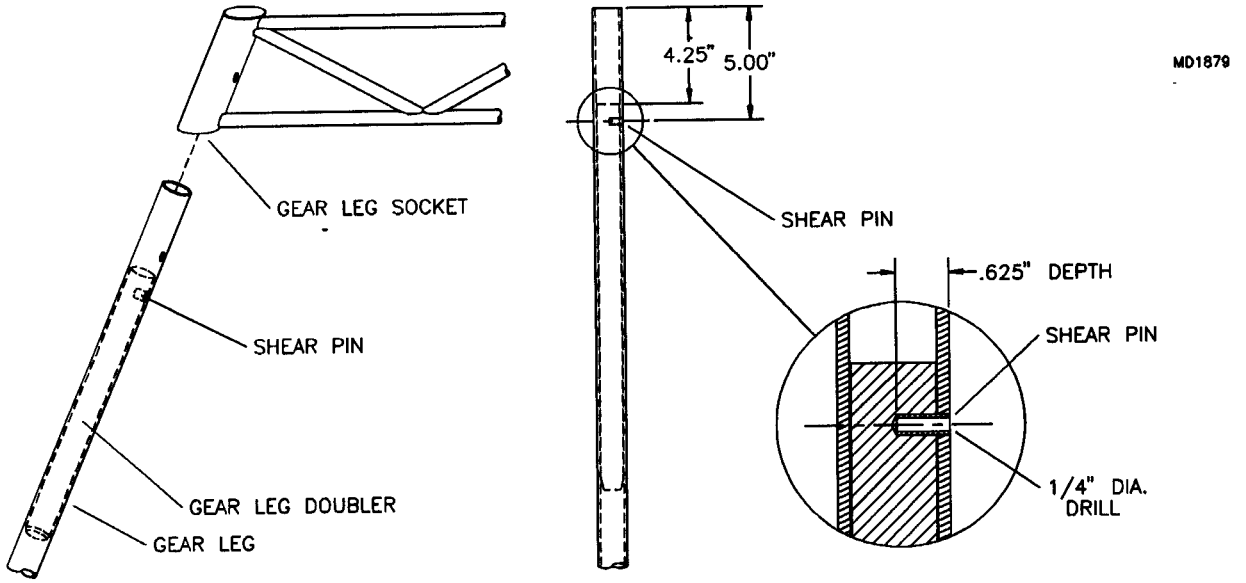
S-12 AIRAILE MAIN GEAR ASSEMBLY

1. Collect the parts depicted in the parts drawing for assembly of the main gear.

2. Observe the gear legs very closely. Notice a slight curve to the tubes. This curve must be placed so it is up. To help mark the tubes, lay a flat surface and affix a strip of masking tape to the curved side. This will assure proper orientation. Also, mark one LH and one RH so after drilling they will not get switched.

3. Insert the solid gear leg doubler 4.25" from the top of the gear leg as shown in **Figure 01A-03.** Measure 5" down from the same top edge of the gear leg and mark location with a center punch. Drill a 1/4" diameter hole 5/8" deep into the gear leg and the solid doubler. See **Figure 01A-03.** Insert the roll pin into the hole. Make sure to completely insert the roll pin into the hole. Grind excess off flush with outer surface of the gear leg. 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.

FIGURE 01A-03



4. Turn the fuselage cage upside down onto cardboard to protect the finish. Insert the gear legs into each socket (with the curves to the plane's top). Measure each gear leg, they should be of equal length to assure complete insertion. Mark from each side, remove and drill through the gear legs with a 1/4" bit. Use the pre-drilled holes in the sockets for location and guides. Drill from each side and bolt. **NOTE:** During final assembly apply a "ring" of clear silicon to the opening of the fuselage gear socket.

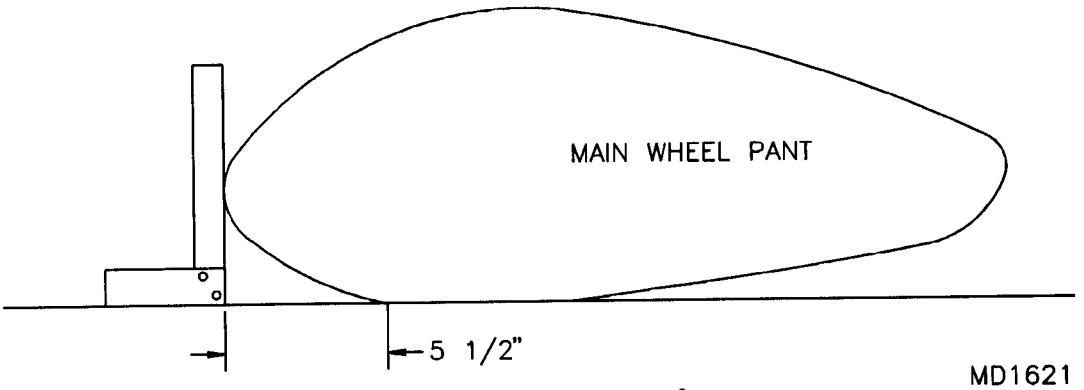
5. Insert the main gear axle sockets onto the gear legs. Measure the total length to assure each socket is equally inserted. If the legs are not of equal extension it is okay to move in/out the main gear axle sockets accordingly. Before drilling and bolting the sockets must be aligned. Temporarily insert the wheel axles into the **INNER** ends of the axle sockets. Clamp a straight board or angle of 56 1/4" length on the sides of the axles to align the two axle sockets. Install the wheels, brake assembly onto the axle and cut off excess inboard. Mark and remove to drill through 3/16". Disassemble the sockets from the legs, apply a ring of silicon to the inside of each socket, insert onto legs and bolt with 1/4" bolts with the heads facing forward.

This completes the main gear assembly. For wheels and brake assembly turn to Brakes.

MAIN WHEEL PANT INSTALLATION

1. Use the same template as the nose wheel to locate the bottom hole for proper tire clearance. Locate the bottom hole 5 ½" AFT of the tip of the wheel pant as shown in **Figure 01A-01**. Do not use the dimple molded into the wheel pant.

FIGURE 01A-01



2. Layout a cardboard template as shown below. Use this template to mark the brake cut outs. See **Figure 01A-02.** Look closely at the sides of the wheel pant. A small X on the dimple marks the location of the proper axle location through the wheel pant. If your wheel pants are not marked or the X on the dimple is not visible, locate the template on the inside of the wheel pant flush with the bottom at 12 1/4" AFT of the top to hole center. See **Figure 01A-02A.** Mark around the outside of the template on the outside of the part and cut this section out. Place the template on the outside of the wheel pant in the same location on the opposite side and drill a #11 hole through the hole in the template. If your wheel pant is marked with the X on the dimple you will need only to drill through #11 at that location for the outside axle location. **PLEASE NOTE:** It is sometimes necessary to locate the #11 hole ½" down from the small X on the dimple to allow for proper tire clearance in the top of the wheel pant. Please check for proper tire clearance before locating this hole. This may also affect the inboard side cut out. It is best to leave extra material through the radiused area until proper clearance is reached, then trim accordingly.

FIGURE 01A-02

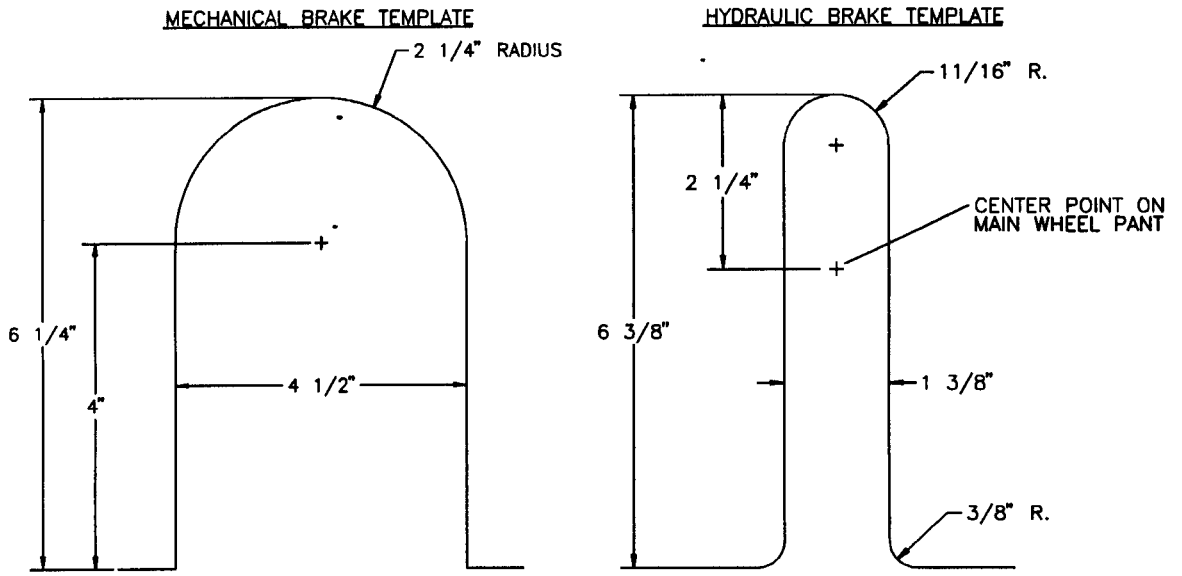
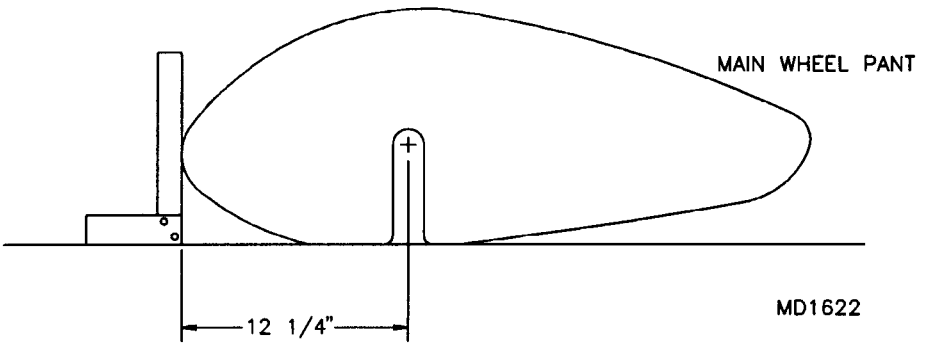


FIGURE 01A-02A



3. Install the longer axle in the socket using the same procedure outlined in the main gear section of your manual. Make sure the drilled and tapped end is facing out. Slide the wheel pant over the wheel assembly with the tabs on the **OUTSIDE** of the wheel pant and loosely install a bolt into the end of the axle.

4. To align the wheel pant you will need to rotate it so that it matches the nose wheel's angle. If you are working on a level floor you can measure up to a common point on each wheel pant to get the level location. Once you are happy with it's location use the tabs to mark the hole locations in the wheel pants. Slip the wheel pant off and drill the tab holes.

5. Install the nut plates to the outside side if the tabs with the rivet heads to the inside. Slip the wheel pant over the wheel spreading it enough to slip **OVER** the tabs. Install the bolts to check fit. Remove, sand and paint to match.

6. Final installation of the wheel pant requires blue loctite on the axle bolts. Inspect the wheel pants for loose bolts every pre-flight.

S-12 AIRAILE NOSE GEAR ASSEMBLY

1. Select the parts depicted on the parts page for the nose gear assembly.

2. Locate and clean the unpainted end of the nose gear assembly with a Scotch Brite pad or 400 grit sandpaper. Clean the inside of the swivel tubes located on the cage, where the nose fork strut pivots. This will ensure smooth operation of the nose fork after installed.

3. Lightly grease the bearing assembly and install on the nose gear strut. Insert the fork assembly and steer horn cage. Look closely at the steer horn, you will notice the arms of the horn are welded on at an angle. Install the steer horns so the arms of the horns are level with the top longerons of the cage. Before drilling through the nose gear strut square the steer horn to the nose gear axle. Drill a 3/16" hole through the fork and steer horn assembly. For best accuracy drill from each side pinning one side with the bolt. Remove the fork assembly and steer horn.

4. Apply grease to the nose gear strut and inside the swivel tubes. Slide the steer horn on the fork assembly and place the 3/16" bolt in the hole through the steer horn.

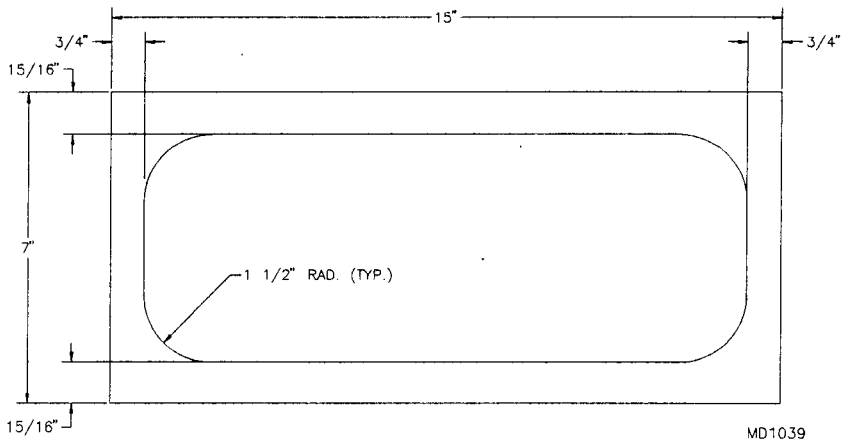
5. Assemble the steering system as per the parts drawing. Final adjustment of the steer rods will come after the rudder cables are installed. The steer rods should be approximately 12 1/4" from bolt to bolt. Apply loctite to the 1/4" nuts to secure against vibration.

6. If the nose spring becomes "sticky" it will most likely be from dirt or lack of grease. To service remove the strut, disassemble and clean and apply fresh grease. Use the weight of the aircraft to depress the spring to install the bolt. Inspect the bolt for wear. Replace the bolt if it shows signs of grooving.

NOSE WHEEL PANT INSTALLATION

1. Fabricate the illustrated template from a piece of cardboard or poster board as shown below in **Figure 01B-01**.

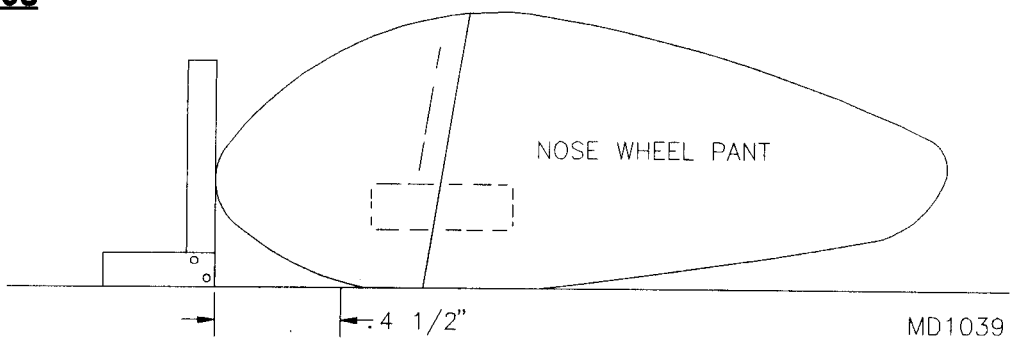
FIGURE 01B-01



2. Trim both the FWD and AFT pieces of the nose wheel pant down to their gel coat line along the joggle and overlap seam.

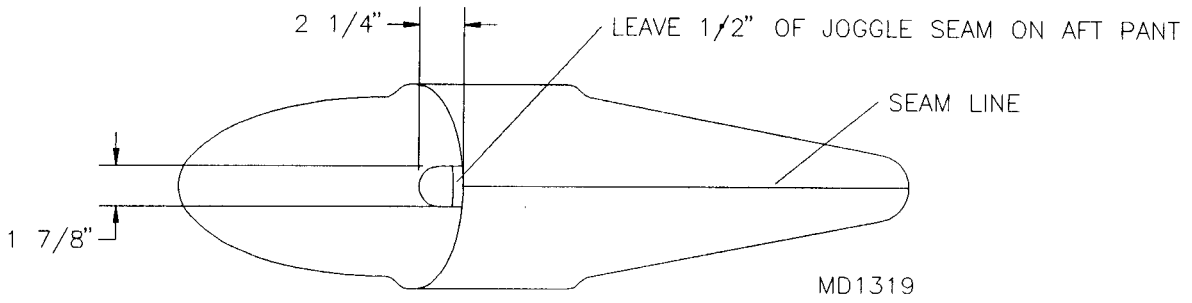
3. Slip the AFT section of the wheel pant inside the FWD section and tape together with wide masking . Use this template to mark and trim the wheel hole in the wheel pant for proper tire clearance. The wheel hole will need to begin 4 1/2" AFT of the tip of the wheel pant as shown in **Figure 01B-03**.

FIGURE 01B-03



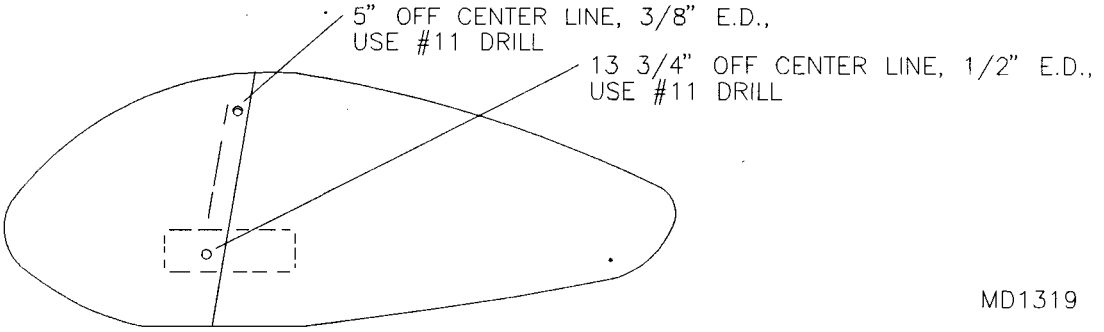
4. Using the seam line on the AFT pant for the center line mark and cut out as shown in **Figure 01B-04.** A good tool to use for cutting is a portable jig saw. Finish trimming is made easy with a drum sander on a power drill. See **Figure 01B-04.**

FIGURE 01B-04



5. Locate four #11 holes in the pant while they are taped together. Mark and drill as shown in **Figure 01B-05.** Install nut plates to the inside of the top AFT section to retain the upper bolts.

FIGURE 01B-05



6. Pull the cotter pins out of the nose gear fork and tap the two attach sleeves into each end of the axle with the threaded ends facing out. Drill through the inserts and install new cotter pins.

7. Refer to the parts drawing and cut out and install the rubber edging as shown. Use a quick setting super glue to retain the rubber parts to the wheel pants.

8. Sandwich the two halves around the tire and slip them into place. Locate hardware and check fit carefully and trim if necessary.

9. To paint the wheel pant it will be required to sand, fill and prime the parts. Start sanding using a good grade of wet or dry paper of at least 320 grit. After sanding you may notice a few imperfections appearing in the gel coat. These can be filled with lacquer putty or a two part body putty. Prime the parts using a two part epoxy primer. Finish coat with the color of your choice.

S-12 AIRAILE BRAKE ASSEMBLY

The toe brake system is cable operated. These cables enter the brake pedals from the **BOTTOM.** Some builders have pointed out that the brakes work by pushing against the cable housing because the stop for the cable housing is on the pivoting brake lever. This is opposite of the norm, however, the function is just the same. If the cable housing was retained in a stationary stop it would still push against the housing to operate, that is simply how cable brakes work no matter how they are hooked up.

1. Select the parts depicted in the brake parts drawing. **NOTE:** The Hegar wheel system is a tubeless system.

2. Slip the valve stem through the hole, then while pulling on the cap end push on the large end. 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 need 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 of the wheel hubs. This will center the rims and align the bolts. Assemble the nose and 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. Cut the cable housing to the following lengths: make two of each, 20", 38", and 72". Consult the parts drawing for cable housing locations. A good side cutters can be used to cut the cable and cable housing to length. The cut should be clean so no burrs will cause wear and eventual failure of the cable. To clean up the end of a poorly cut housing grind the end on a bench grinder or similar tool. Look closely at the end of the cables. The end with the pill shaped stop is the end that will insert into the mixer ring. Cut off the other end and insert the cables through the holes in the ring.

4. The brake pad assembly will need to be located on the tabs welded to the axle socket. The assembly should ride with the cable stop about 90 degrees to the gear leg, this will allow the brake cable to run into the stop with the least bending. The brake pad assembly must be located centered on the axle to allow the drum assembly to spin freely when the brakes are not applied. To accomplish this you will have to improvise a centering devise. The hole in the brake pad assembly is 1" and the wheel axle is 5/8". We use a bushing 1" in O.D. with a 5/8" I.D. This is slipped over the axle then the brake pad assembly is positioned on over the bushing and against the tabs. Clamp it in place and drill through the tabs to locate the holes. Debur and bolt on the brake pad assembly.

5. Fit the wheel and drum assembly over the brake pads. **NOTE:** Supplied in the kit are some 5/8" I.D. shims. Use two or three per axle to space the wheel out from the brake. Without the shims the brake drum will make contact with the brake assembly. The drum should spin freely if the pads are centered. If this is not the case a little work with a file can free up the drum. Force the drum over the pads and rotate the wheel several times. This action will mark where the high spots are on the pads. File these down with a metal file until the wheel spins freely. **CAUTION:** Wear a dust particle mask when filing on the brake pads. The pads may contain asbestos.

6. Install the cable housing into the stops on the frame and route them to the toe pedals and wheels. The toe pedals will need to have the bottom side of the tube drilled out to 15/64" to accept the cable housing. Feed the cables into the housing and extend them through the toe levers and actuator arms on the brakes. Use the proper hardware to fix the ends and adjust the tension.

7. The brake system will need fine tuning after the aircraft is complete. Adjustments to the cables can be made at each stop and at the adjusting barrel on the brake. Adjust the brakes so the pedals feel even without excessive travel before actuation.

HEGAR WHEEL/BRAKE ASSEMBLY

Assembly of the wheel is as follows.

1. Obtain the parts depicted in the drawing.

2. Position the rubber "O" ring into a machined grooved (Part B).

3. Insert the valve core into the outside of the 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 the 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.

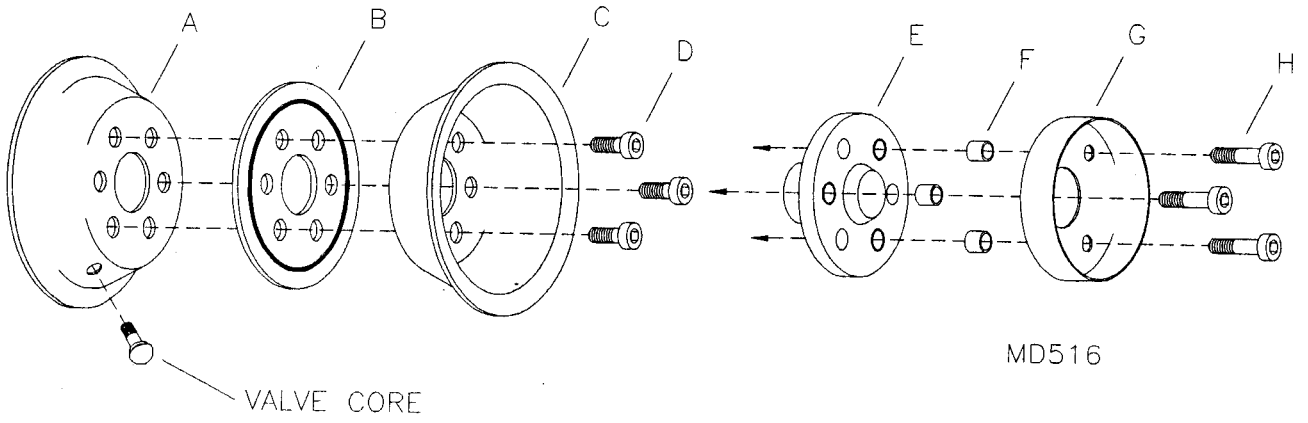
6. Using the large fasteners (Part H), the brake drum (Part G) and the spacer bushings* (Part F) carefully thread the fasteners into the tapped holes on the wheel hub (Part E). Be sure to tighten the large fasteners so to secure permanently.

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 the procedure for the 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.



HEGAR HYDRAULIC BRAKE INSTALLATION

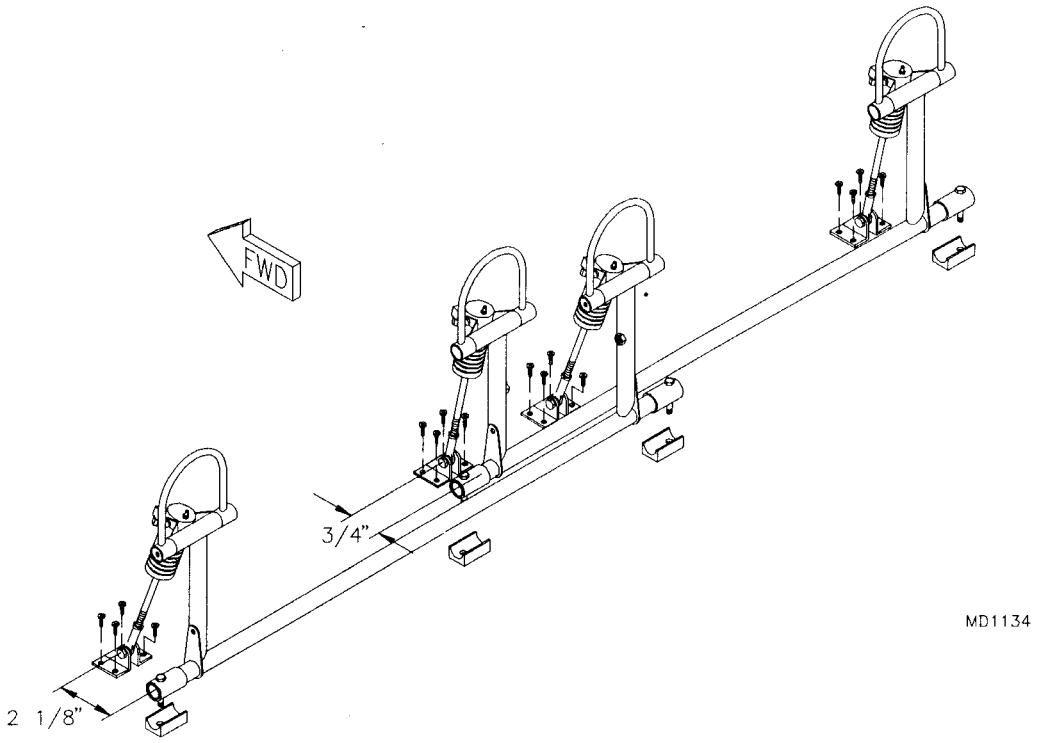
1. Assemble the rod ends to the cylinders. Screw in. (6 turns minimum.)

2. Bolt the cylinder attach angles to each cylinder.

3. Bolt the cylinder to the brake pedals.

4. Locate the cylinder attach angles as shown in **Figure 01C-04** and pilot drill to #40 for the screws. Install screws.

FIGURE 01C-04



WHEEL ASSEMBLY

5. Position rubber "O" rings into machine grooves on the hub.

6. Insert the valve core into outside rim.

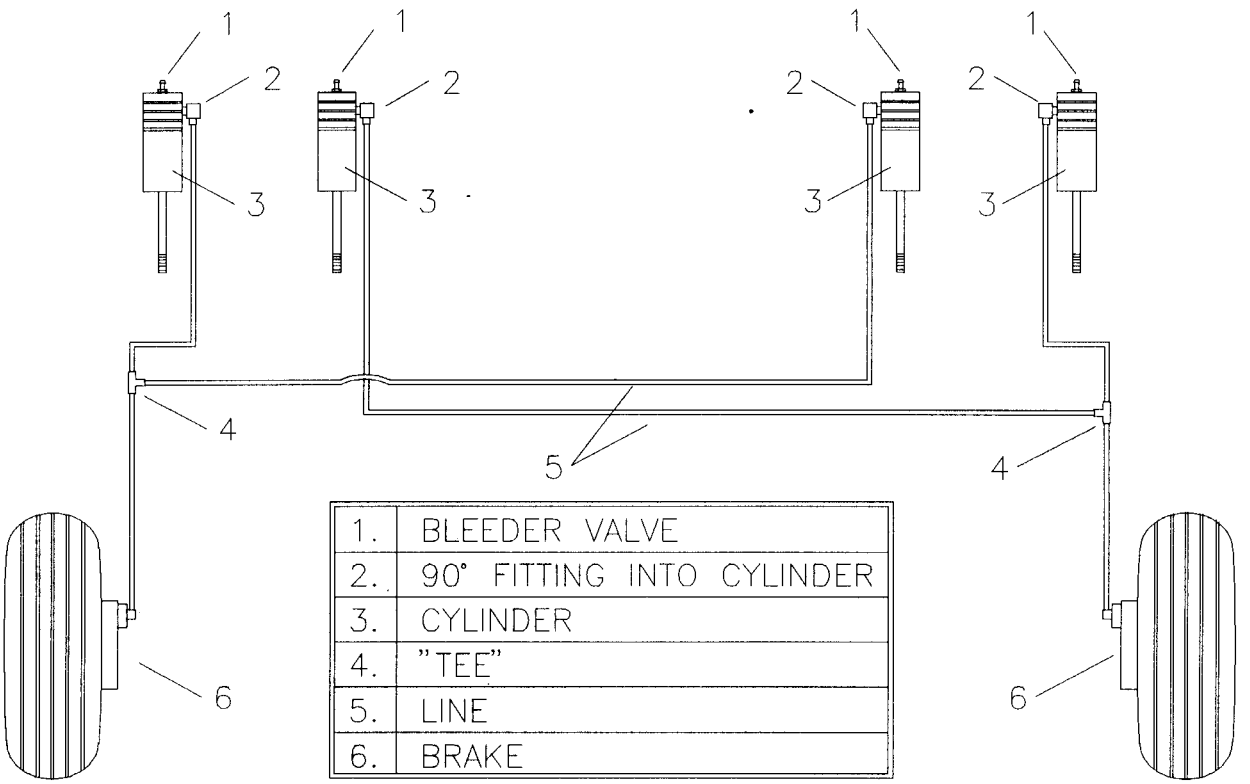
7. The hub comes assembled with the disc and caliper in place. Remove the locnuts and washers and install the hub assembly to the wheel rims. Tighten the nuts to at least 10 ft.lbs.

8. Inflate the tire by standing the tire upright, and pressing downward to spread the bead and create an air lock.

9. When mounting the axles provided onto the aircraft it is important to be certain that the woodruff keys milled in the axle are located on **BOTTOM**. This in turn will locate the caliper bleed screw on top allowing all of the air in the system to escape during bleeding.

The axles provided are extra long and in most cases will have to be shortened. With the caliper, brake hub, and nut installed on the axle, insert the axle into the axle socket. Once the axle is in place, mark the location of the axle or cross hole. Proceed by drilling through the axle and bolt in place.

10. Route the fluid lines as shown in the schematic.



1.	BLEEDER VALVE
2.	90° FITTING INTO CYLINDER
3.	CYLINDER
4.	"TEE"
5.	LINE
6.	BRAKE

MD750

11. Route lines with enough length to allow full movement of pedals. Locate lines not to rub/chafe or tangle with any other controls. On gear leg fairing equipped aircraft, route the line inside the fairing. The exit hole provided is **NOT** used for hydraulic brakes, only cable type. You can close the hole with tape; clear book tape or a matching color plastic tape.

12. Charge the system with fluid.

BRAKE BLEEDING

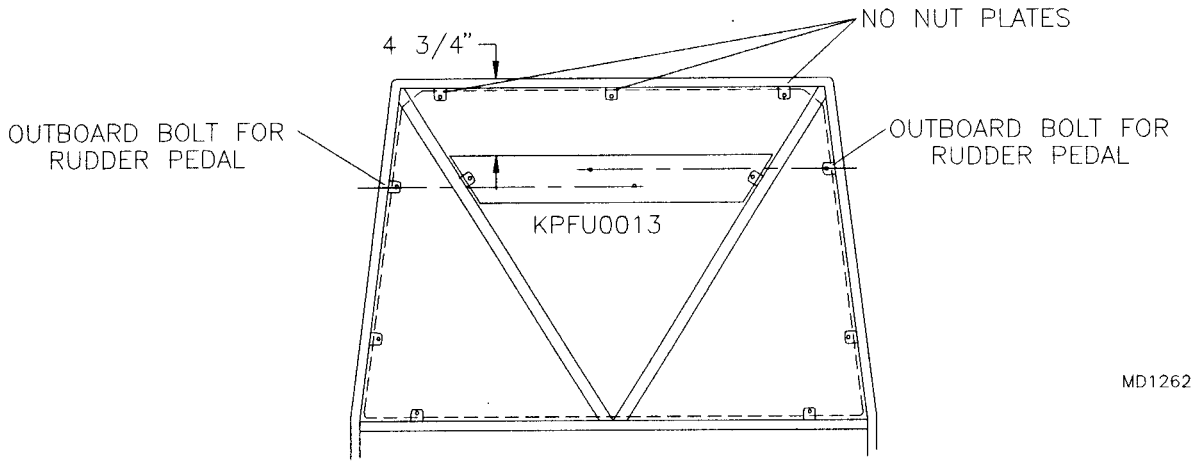
Brake bleeding can **ONLY** be accomplished by filling the system from the master cylinder down to the caliper. Attach the filler bottle provided to the master cylinder. **NOTE:** The master cylinder must be tipped at 45° angle, so that the line and fitting coming out of the cylinder is the highest point of the cylinder. This allows the air trapped in the cylinder to escape up and out the line as the cylinder is filled with fluid. Open the bleed screws on the master cylinder and calipers 1/2 turn and begin slowly filling the master cylinder. As the cylinder is filled the air will be expelled out of the master cylinder and down the line to the caliper. Once all the air is out of the cylinder clear fluid will fill the line down to the wheel caliper. As the wheel caliper is filled the air in it will be pushed up and out of the bleed screw at the top of the caliper. Once clear fluid comes out of the caliper bleed screw the system is bled. Close the bleed screw on that caliper and repeat this for the other caliper.

NOTE: All Hegar brakes use type "A" automatic transmission fluid or Dextron II automatic transmission fluid.

S-12 AIRAILE FLOORBOARD INSTALLATION

1. Locate the floorboard support channel as per **Figure 02-01**. The ends will be trimmed at an angle to fit between the diagonal tubes. Drill up from the bottom through the tabs. Debur and rivet in place with a 3/16" stainless steel pop rivet.

FIGURE 02-01



2. The floorboard comes pre-cut, finished and ready to position and bolt in place. Locate and clamp the floorboard in place. The floorboard should be placed so it is centered and the front edge even with the back edge of the S-1 bottom crossing tube. Drill up from the bottom through the tabs with a #11 drill bit. **HINT:** Use a wood block placed over the top to prevent splinters. Remove the floorboard and install the nut plates on the bottom side of the tabs. Reinstall the floorboard temporarily.

RUDDER PEDAL INSTALLATION

3. Assemble the brake pedals to the rudder pedals with the proper swivel bushing. The bushing with the 3/16" hole will go to the outboard rudder pedal to connect the rudder cables. Drill out 3/16" thread with a 3/16" drill bit. Insert the AN3-12 bolt into the swivel bushing. See **Figure 02-03B**. Lock the bushing in place by drilling a #30 hole through the rudder pedal and swivel bushing, rivet with a 1/8" stainless steel pop rivet. If you want to make the pedals removable for maintenance drill a #40 hole and cotter pin. See **Figure 02-03**. Determine the left and right rudder pedal assembly. Using the proper hardware bolt the outboard saddles into the holes drilled in Step #1. Slide the pedals into the saddles and line up the pedals with measurements given in **Figure 02-03A**. With the inboard saddles in position, mark and drill the hole for the saddle bolt in the floorboard and through the channel.

FIGURE 02-03

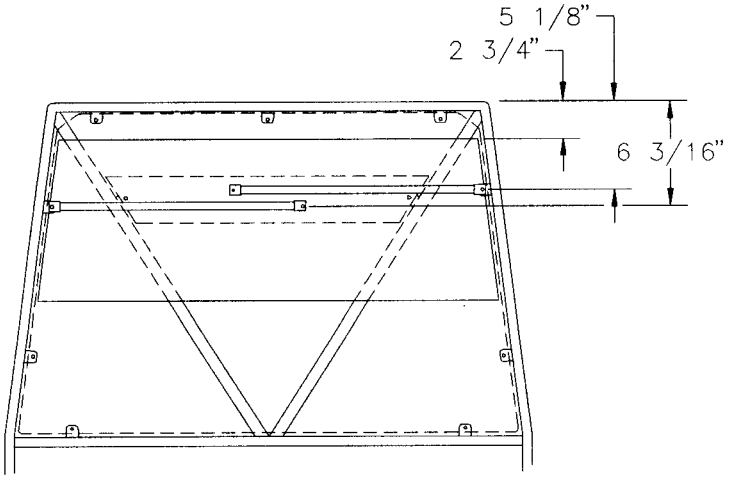


FIGURE 02-03A

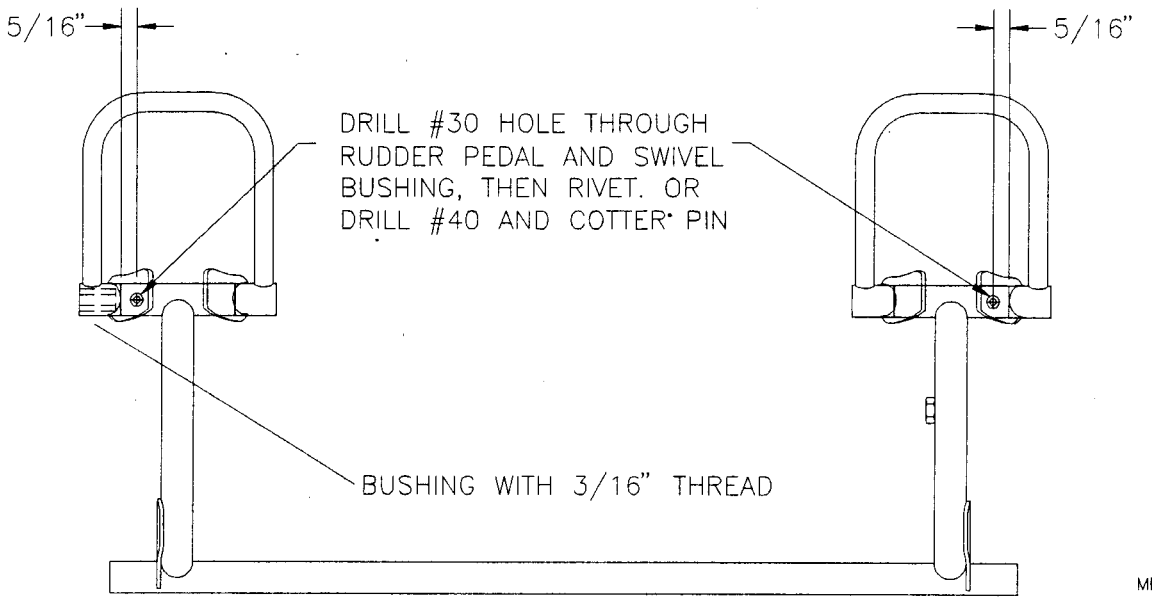
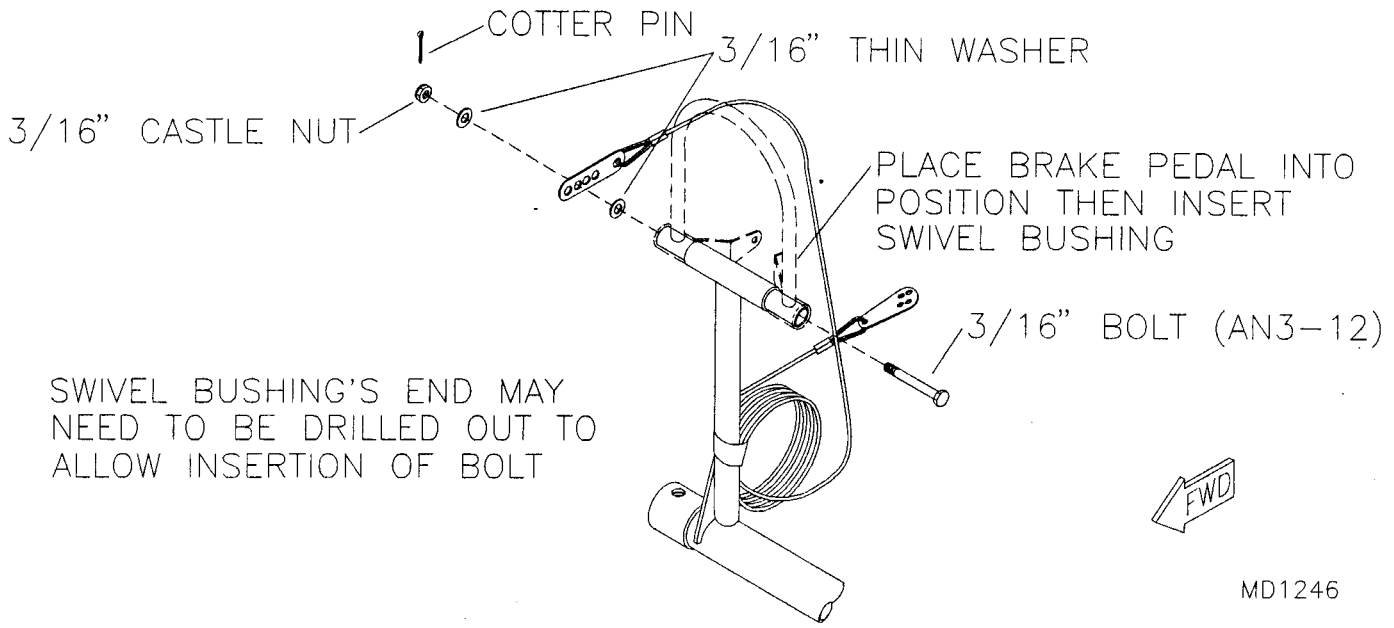


FIGURE 02-03B



4. Remove the rudder pedals and floorboard, then install the 3/16" nut plates on the bottom side of the channel. If installing optional hydraulic brakes now is the time to install the wear plate, position as per **Figure 04-03A**. Drill up from the bottom side to locate holes in the wear plates for the bolt holes. Debur plate and install with #4 pan head screws. Reinstall the floorboard and bolt down the rudder pedals.

5. Assemble the steer rods and the linkage. The linkage is connected to the **BOTTOM** of the steer horn and to the nut welded to the inboard rudder pedals. Final adjustments will be made upon rudder installation.

S-12 AIRAILE CONTROL STICK ASSEMBLY

At this point the superstructure and landing gear should be assembled in order to assemble the control sticks.

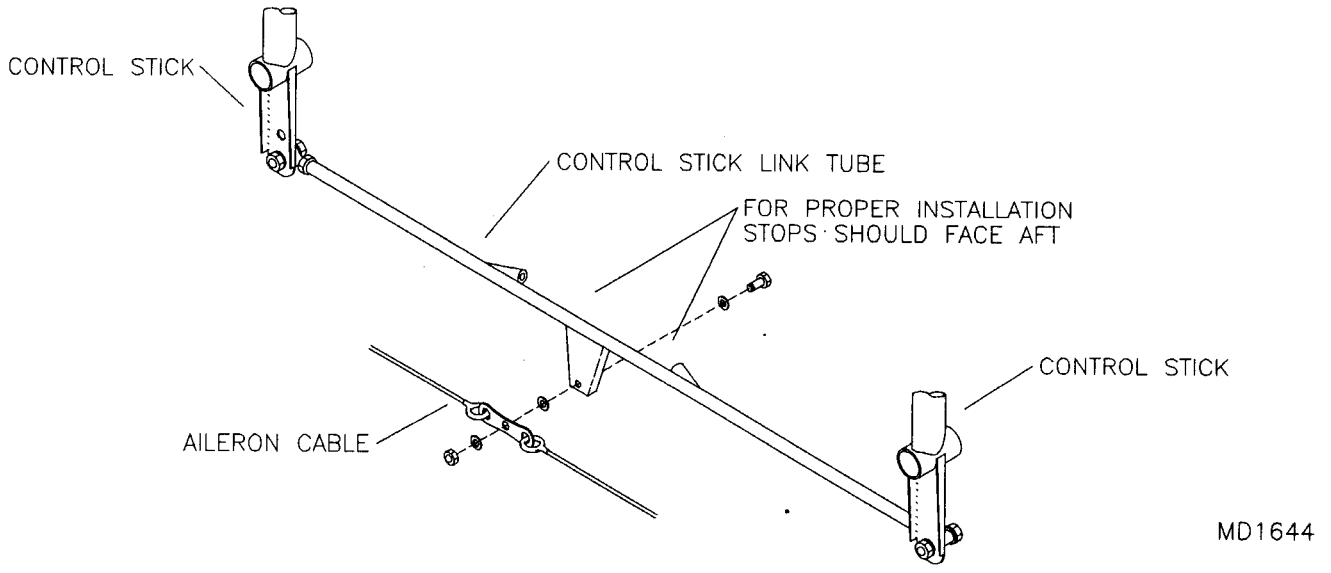
1. Refer to the parts catalog and select the required components for assembly.

2. Drill out **ONE** of the control sticks to 1/4" diameter. The other control stick has a 3/16" bolt inserted and does not need to be drilled.

3. Grease the inside of the connect tube pivot bushing, the bearings and the outside of the control stick torque tube's pivot stubs. Slip the control sticks onto the torque tube with the washers and bearings in the order shown in the parts drawing. Run on the 3/4" nut until it takes out all the play in the stick but is not too tight to cause binding.

4. Assemble the control stick link tube as per **Figure 03-04**. Assemble the unit to the control stick connector tubes. Adjust the sticks parallel using the rod end. The fixed end of the link tube uses a 1/4" diameter bushing slightly taller than the link tubes bushing to allow the bolt to be tightened and not bind the bushing. Fabricate the bushing using the 1/4" aluminum tube provided. For easy fabrication, drill out the inside diameter to 3/16" before cutting to length. Measure the link tube bushing and add 1/32" for the inner bushing cut length. It should measure approximately 21/32". Apply grease to this bushing prior to assembly. The 3/16" bolt must be tight to hold the alignment to obtain proper cable clearance and the link tube must swivel freely.

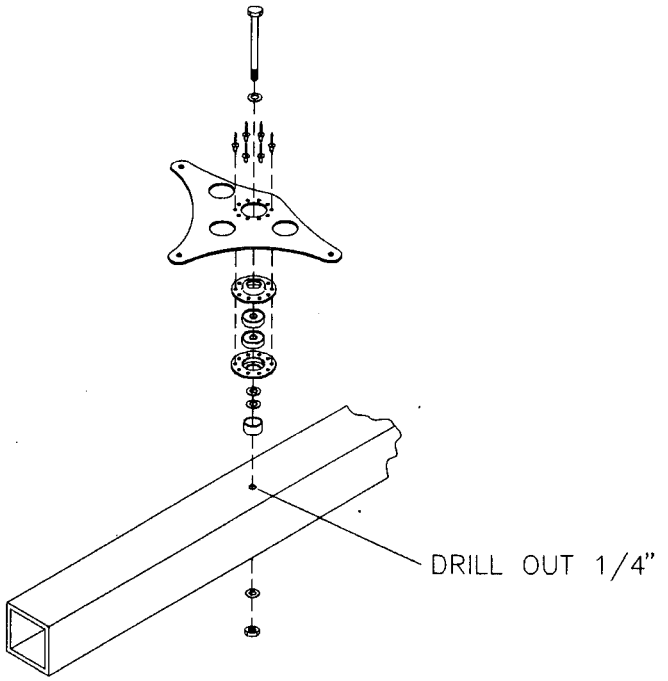
FIGURE 03-04



5. Bolt the control stick torque tube to the square tubes welded into the cockpit cage so the pre-drilled hole is on the **FRONT** side of the torque tube. Use the pillow block's second hole as a guide to locate and drill through the 1/2" square tube for the second hole.

6. Grease the inside of the control tee and roller bearing. Assemble the control tee to the keel tube at the vertical hole located in the keel tube 10.5" from the front. Drill out the hole to 1/4". See **Figure 03-06**.

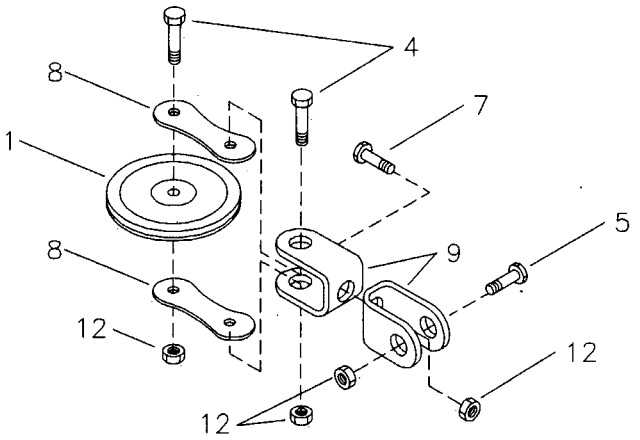
FIGURE 03-06



MD1645

7. Bolt together six pulley assemblies as per **Figure 03-07**. **PLEASE NOTE:** The small shackles go on the outside of the tangs coming off the pulleys. Leave the bolt through the pulley unnutted so the aileron cables can be inserted as per the next step.

FIGURE 03-07



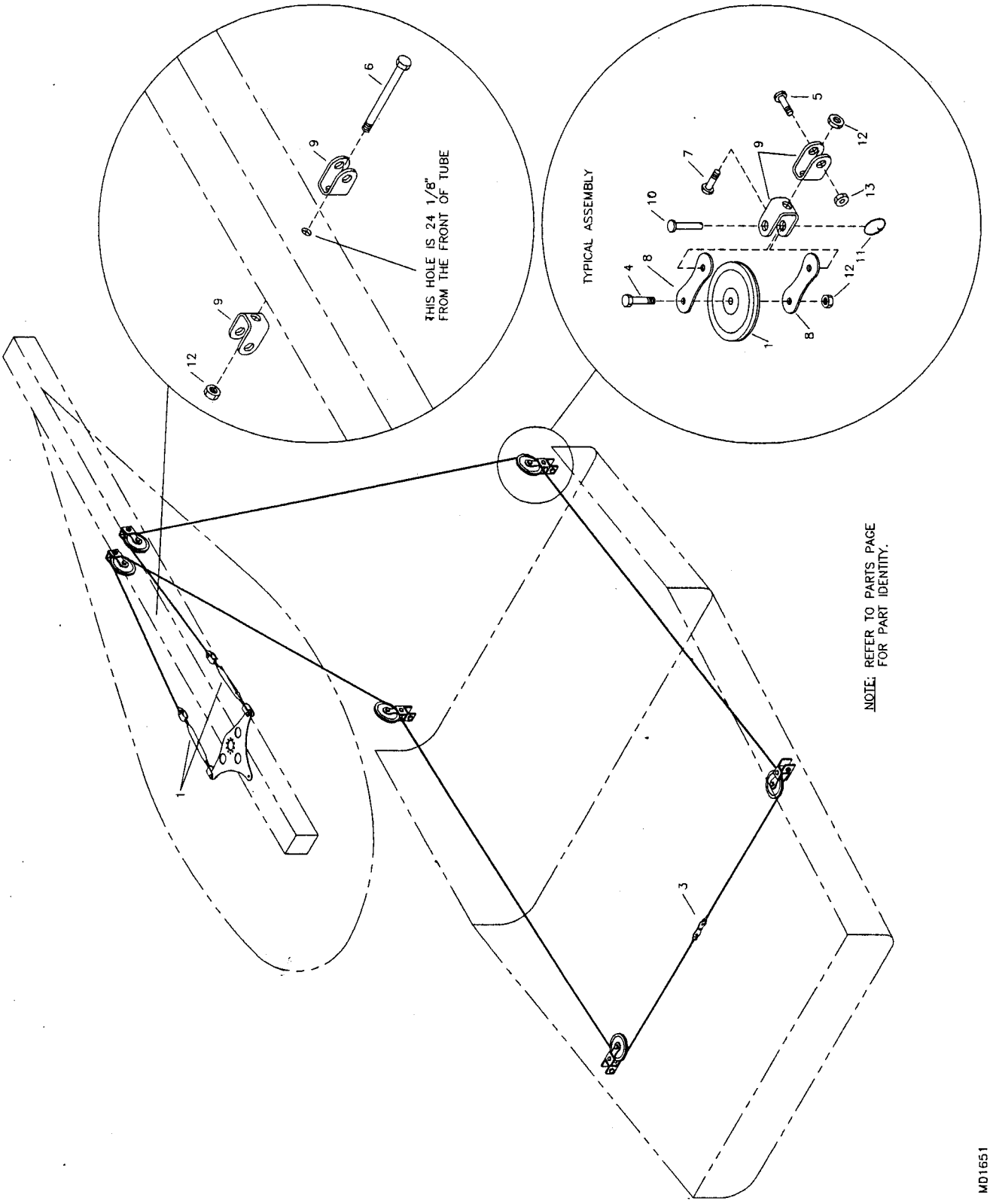
REFER TO PARTS PAGE
FOR PART NUMBERS

MD1645

8. Route the aileron cables as per **Figure 03-08**. Tighten the turnbuckles slightly and test run the system. Check for smooth, free movement. If everything is lined up it will operate with very little friction. If you have binding or catching inspect the system for a dragging pulley or gross misalignment. Once you are satisfied the system is running properly, tension the cable to have a low mellow note when strummed. Too much cable tension will be indicated by high system friction. Too little tension will result in play in the system. Find the middle ground by experimenting with the turnbuckles.

9. Make sure when you are experimenting with the control system you pre-flight all connections before flying. **DANGER:** Check control function before flight for proper movement. The right aileron should go up when the stick is pushed right and left stick = up left aileron.

FIGURE 03-08


THIS HOLE IS 24 1/8" FROM THE FRONT OF TUBE
TYPICAL ASSEMBLY
NOTE: REFER TO PARTS PAGE FOR PART IDENTITY.
MD1651

10. Locate the elevator up stop sleeve. It is a piece of 3/4" X .058 aluminum tube 3/4" in length. Slip it over the unbent end of the 5/8" push pull tube. Location and riveting of this stop sleeve will be covered in the tail assembly. Slip the unbent end of the 5/8" push pull tube through the guide welded to the lower S-3 carry through. Be sure the guide is positioned below its pivot tube. Bolt the 5/8" push pull tube to the right hand side of the torque tube arm using a 1/4" male rod end and (1) AN4-22A. This bolt also retains the trim block. **DO NOT** tighten this bolt until installing the pitch trim system which comes later. **NOTE:** The rod end must be at least 6 threads into the 5/8" push pull tube. Oil the guide for smooth operation.

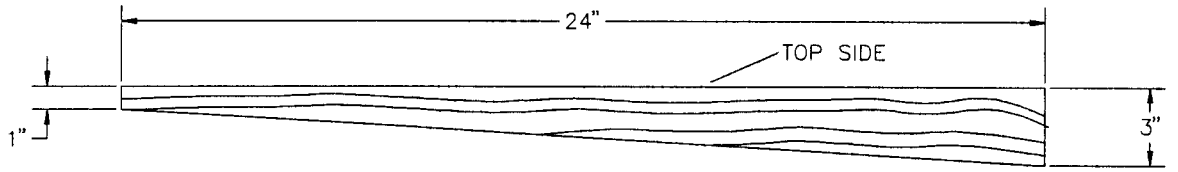
11. Check the elevator push pull tube for smooth operation. Check by moving the control stick FWD and AFT. It should move freely. Oil all pivot bushings and pillow blocks with a light machine oil. Keep these areas clean and well lubricated.

12. Insert the push pull tube end fittings into their respective 3/4" diameter aileron push pull tubes. Drill through the #40 pilot holes with a #30 bit and rivet with 1/8" stainless steel rivets.

13. Completion of the aileron control system can only be done after the wings are installed. It is not absolutely required to attach the wings.

S-12 AIRAILE BOOM & SUPER STRUCTURE ASSEMBLY

At this point the cockpit cage is on its gear. We are now ready to insert the boom into the cage. For your reference the boom and keel are set at five degrees from level at the cockpit cage longerons. Make a wood wedge. This will be used with a two foot level in order to set the five degree tail boom incidence. See the figure below for details on constructing the wedge.

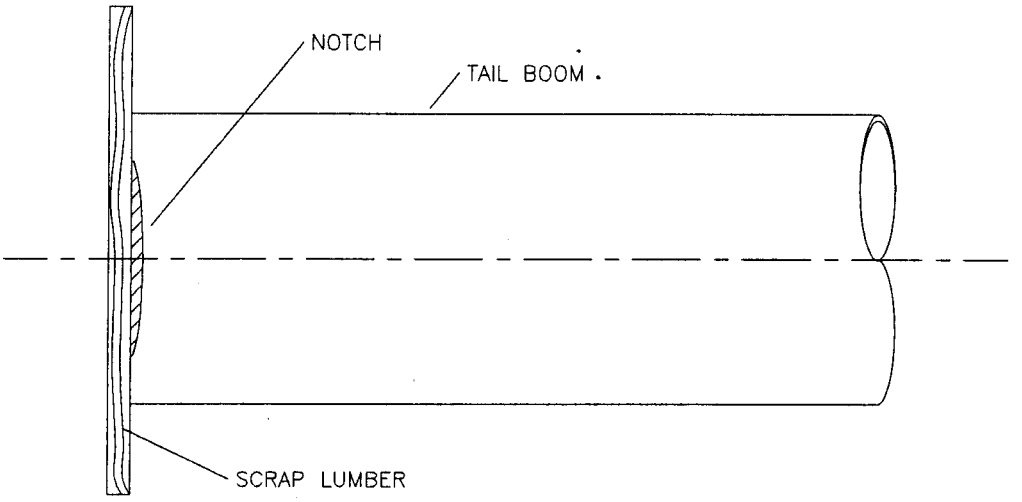


S-12 5° BOARD, TAPE A
2' LEVEL TO TOP SIDE

MD1652

1. Look at the boom very closely. You will notice one end has a slight notch. Take a small flat board approximately 7" X 7" in size. Place this board over the notched end of the boom tube. The flat surface of the board will show the notch to be 1/4" deep. With the board held against the notched end, mark the boom where the middle of the notch occurs. This mark will be used to line up the top of the boom to the cage. See **Figure 04-01**. **HINT:** Apply a small piece of masking tape to the notched end to make the mark more visible.

FIGURE 04-01



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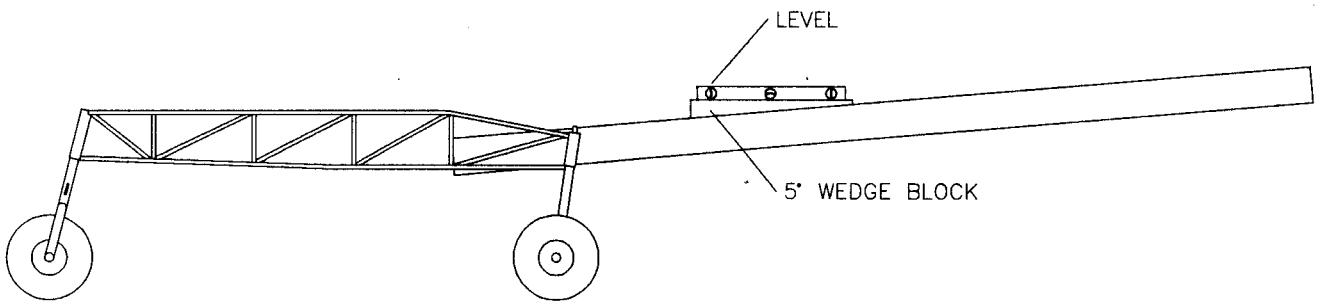
2. For the tail boom to be set at the proper angle the cockpit cage must be set level across the cage and length wise. The level reference is the top longeron at the seat. Use wood blocks under the main wheels as needed to obtain the required level reading at the longeron. The longerons are the top **OUTSIDE** tubes that make up the frame's top perimeter. Block the wheels so they will not roll.

3. Have a saw horse or similar stand ready with a soft cloth ready to support the tail end of the boom. Use the cloth to protect the paint finish on the boom. The stand should be a height of at least 34". Carefully insert the boom into the cage structure. Be sure the boom is inserted with the notched end up and to the front. The boom should be inserted so it touched against the AFT seat truss tube. Move the stand back and forth to achieve the correct angle. The angle will be correct when the wood wedge reads level. It is very important to do this step accurately. This will determine the incidence angle the tail will fly in relation to the wing. See **Figure 04-03**.

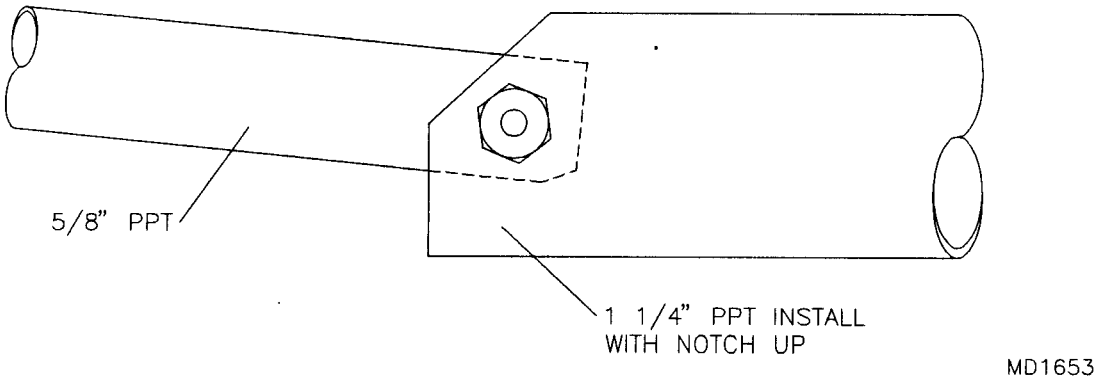
FIGURE 04-03



4. Once you are satisfied with the tail boom's angle setting check for center line alignment. This is done by measuring from the strut attach tangs to the end of the boom tube on each side. The dimension should be equal. Move the boom side to side to accomplish this. With the tail boom properly in center line drill through the tangs at the forward end of the boom. Bolt with (2) AN3-4A bolts with thick washers under head and nut.

5. The tail boom is retained to the gear truss with (4) AN3 bolts. Nut plates are installed inside the tail boom for assembly ease. Locate and drill the holes in the boom through the gear truss tabs. Carefully slide the tail boom out so that it is possible to reach in to install the four nut plates. **IMPORTANT:** Before the boom can be re-installed the elevator push pull tube must first be bolted in place. The 1 1/4" diameter tube attaches to the 5/8" push pull tube at the double end. Place the notch up. See **Figure 04-05.** Bolt with an AN4-15A with a thick washer under the nut and bolt. After bolting on the push pull tube, slip the black foam rubber insulator. Glue the foam in place with contact cement in the center of the push pull tube.

FIGURE 04-05



6. Locate tail boom bracket and the plastic strip. Use super glue to secure the plastic strip on the inside of the tail boom bracket. This will allow you to slide the tail boom bracket into position without scratching the paint on the tail boom, it is also needed to prevent dissimilar metal corrosion between the tail boom bracket and the tail boom. Slide the tail boom bracket onto the tail boom approximately 26" plus from the gear truss to the front edge of the bracket.

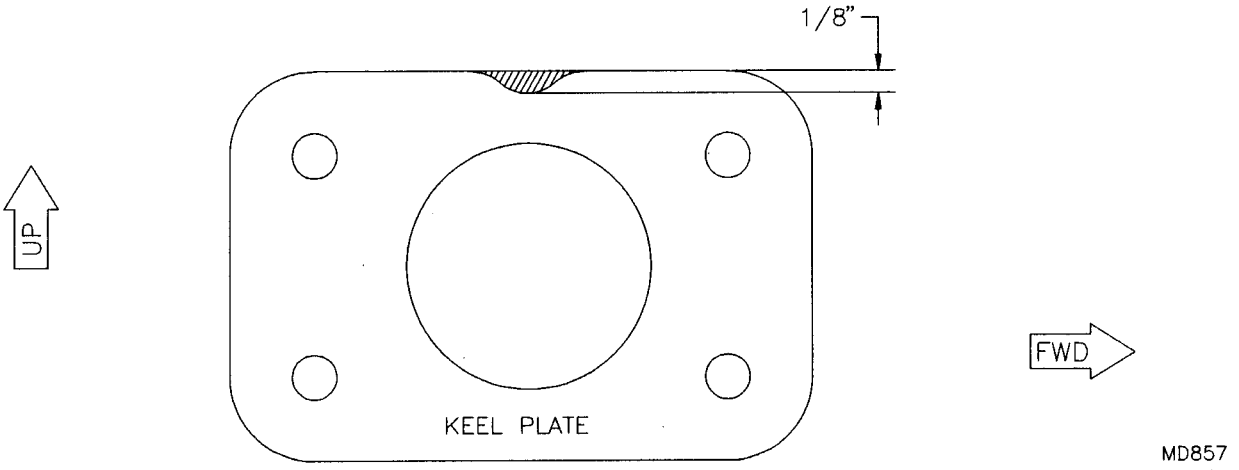
7. Refer to the super structure parts page to select the hardware and lower tail braces. The lower tail braces come with only one hole drilled on one end. Bolt this end to the gear truss. **NOTE:** You will not be able to install the AFT bolts through the tail braces until the bracket is clamped together. The bolts should be inserted at least partially through the lower tail tubes to help align the bracket. The bracket will now need to be tightened around the boom tube. Do so by squeezing the collar together with a vise grip or a smaller diameter bolt through one of the brackets' bushings. Place a pencil mark at 1/2" in from the end on the left tubes end that will bolt to the collar. Line this mark up centered over the hole in the bracket. Drill through with 1/4" from each side and bolt.

8. Before drilling and bolting the right lower tail boom brace the tail boom must be checked for alignment. The boom must be in line with the centerline of the aircraft. This is determined by measuring from the tail end of the boom tube to the lift strut attach points. The measurement must be equal. To adjust move the bracket forward or backwards as required. When the tail boom is straight with the cockpit cage drill through the right lower tail brace and bolt.

SKIP NEXT STEP IF BUILDING A 912 INSTALLATION

9. Assemble the keel as shown in **Figure 04-09**. **PLEASE NOTE:** For 503 & 582 models only. Trim (4) of the keel plates as shown in **Figure 04-09A**. The 912 models do not need this since the engine mount replaces the plates. Drill all holes in keel and keel plates to the diameter required for the bolt size shown in the parts drawing. Bolt the trimmed down keel plates with the trimmed edge up and the narrow end forward. Bolt the larger U-brackets to the front of the keel. Include the forward brace by inserting it **INSIDE** the keel. (For details of assembly turn to 912 Engine Section.)

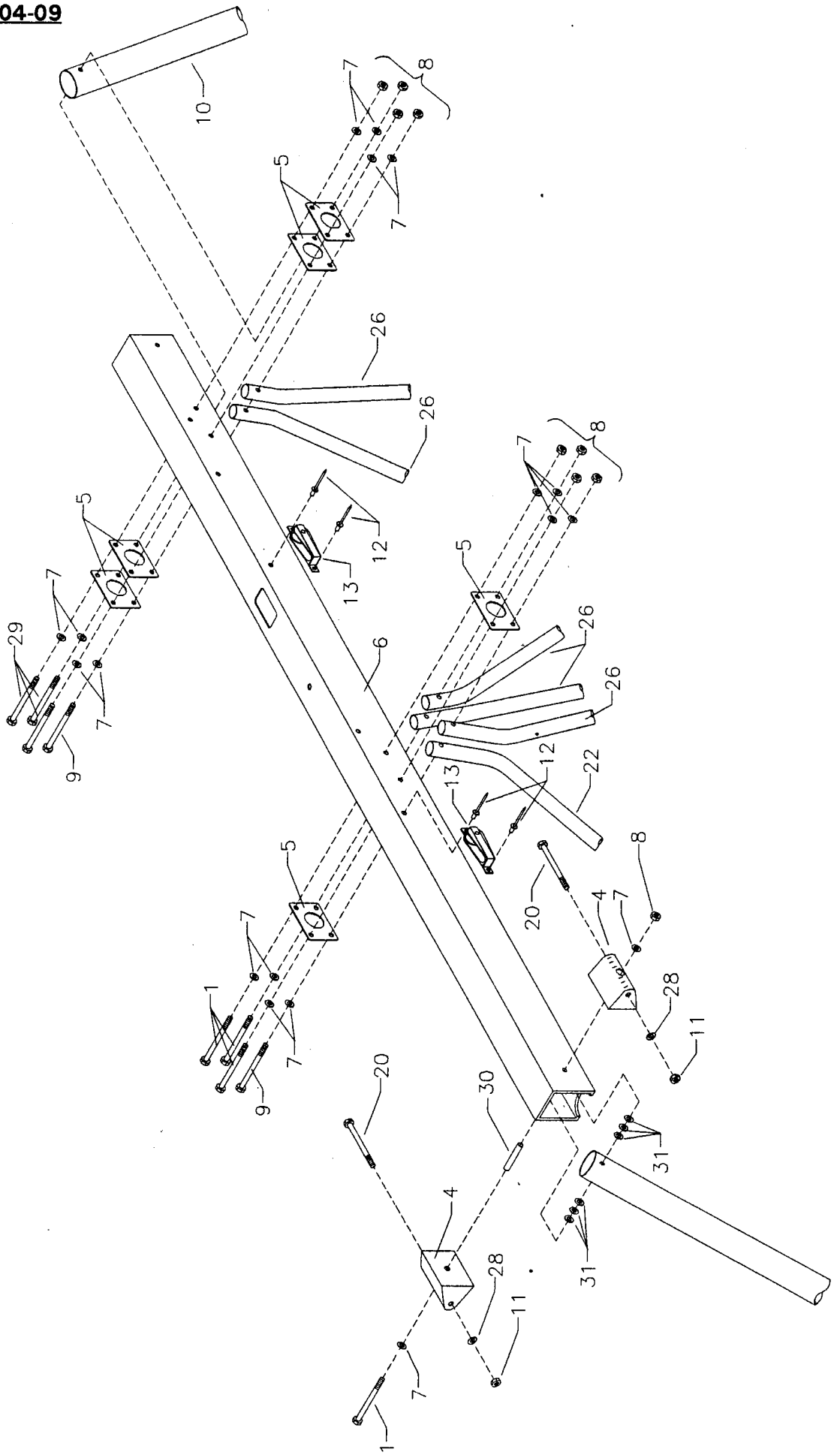
FIGURE 04-09A



10. Locate the hardware for the AFT strut. The top washers, the plastic saddles, and the top of the AFT strut will need to be filed down to clear the keel for installation. Remove the bolt and mount the hardware on the strut so that it can be filed to match. Install the AFT strut to the keel. After the super structure assembly is placed on the cockpit cage, then the AFT strut will be bolted on the tail boom bracket.

11. Bolt the safety belt shoulder harness to the forward cabaine's 1/4" bolt. This bolt is sized slightly longer to allow for the belt tangs. Coil up the belts and retain with a rubber band to hold the belts out of the way.

FIGURE 04-09



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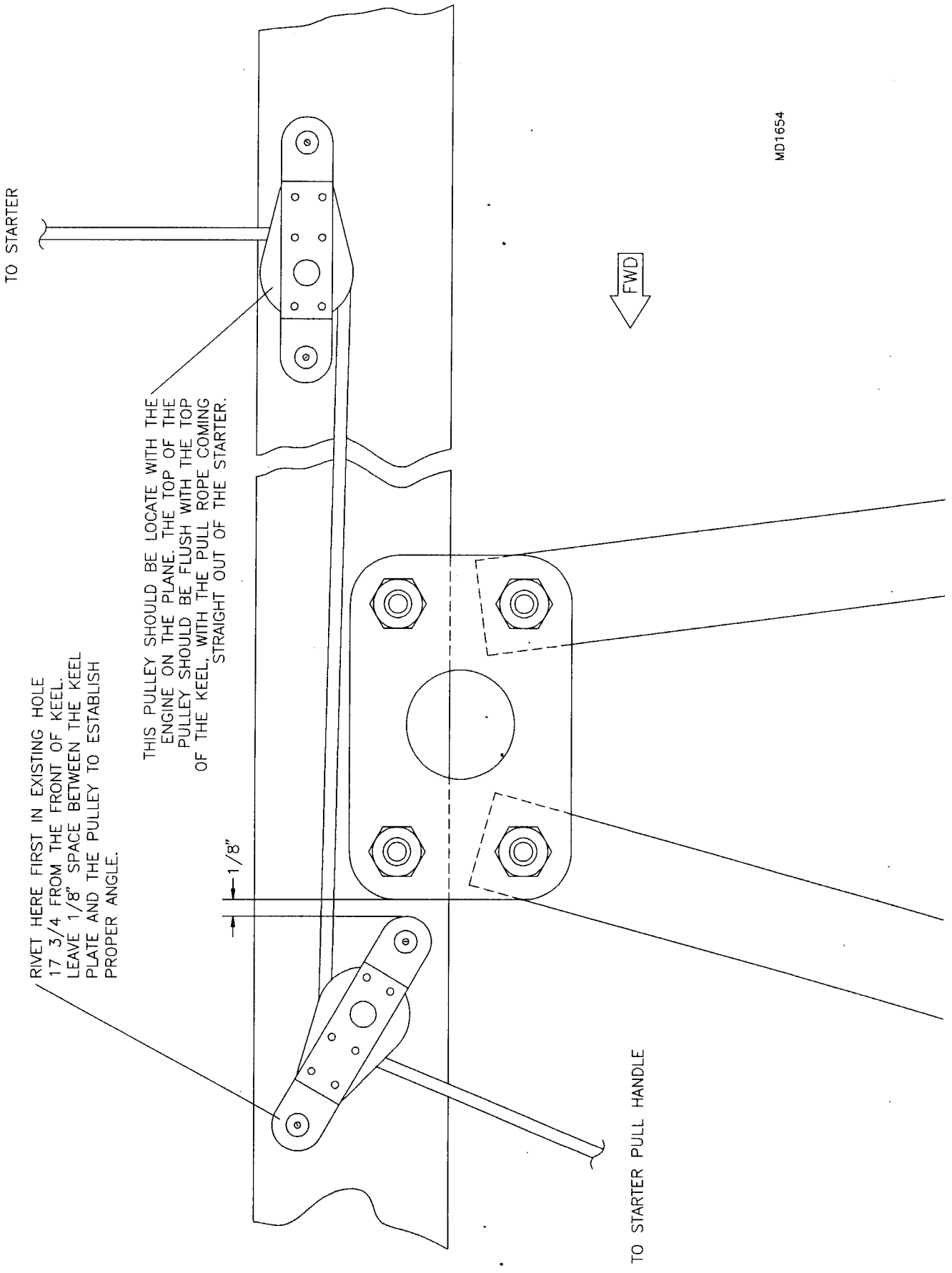
RAMS S-12 AIRAILE SUPER STRUCTURE DETAIL

FIGURE 04-09B



12. Carefully position the cabaine and keel assembly on the cockpit cage. Even though the tubes will fit snug between their appropriate tangs, be careful not to knock off the assembly. Bolt the forward strut in place with the notched end down and forward. **HINT:** Glue together (2) stacks of three 1/4" thick washers with super glue. This will make the task easy of inserting the washers between the keel and the strut.

13. Mark an edge distance of 11/16" on the lower end of each forward cabaine. See **Figure 04-013.** Bolt the AFT strut to the tail boom bracket. All the cabaines should at this point be placed between the tangs. Clamp the forward cabaines in place using vise grip type "C" clamps, padded with masking tape to prevent damaging the paint. Before drilling, check for symmetry by measuring from the strut attach fitting to the lower edge of the keel. See **Figure 04-013A.** Each side should measure within 1/8" of 42 7/8" but be equal side to side. When you have perfect symmetry, mark the hole centers with a pencil for future reference and reclamp the two cabaines in place. The forward cabaines will be drilled after the keel has been set at the proper angle.

FIGURE 04-013

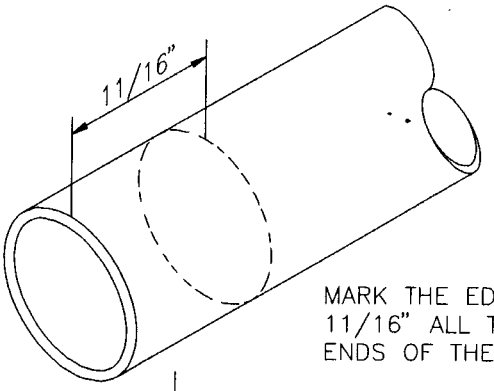
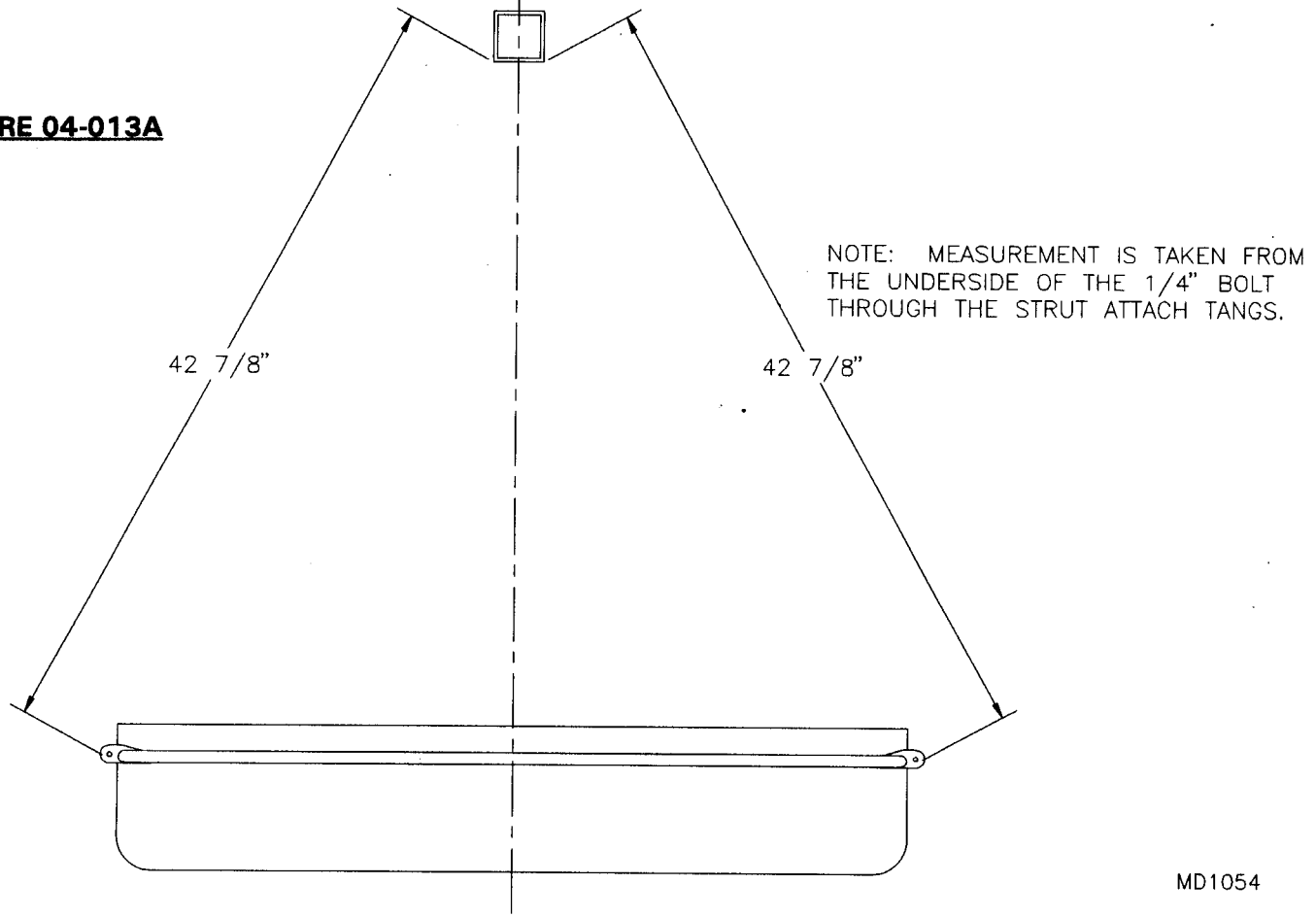


FIGURE 04-013A



14. The keel will need to be set at a 5 degree angle. Make sure the cockpit cage is level before setting the keel. This is a critical setting and must be done accurately. This is easily accomplished by moving the mid cabaines up and down in the triangle brackets. **PLEASE NOTE:** The forward cabaines must be clamped in place, and the FWD and AFT struts must be bolted in place. Line up the ends of the (2) mid cabaines centered over the holes in the tangs. Clamp the tubes in place using vise grip type "C" clamps, padded with masking tape to prevent damaging the paint. Before drilling, check for symmetry by measuring from the strut attach fitting to the AFT 3/16" engine mount hole. Each side should measure within 1/8" of 55 7/8" but be equal side to side. Check for at least a 3/8" edge distance. This means there must be at least 3/8" from center of the hole to the end of the tube. When you have perfect symmetry, drill through #11 from the **OUTSIDE** tangs and cleco with gold clecos or a 3/16" bolt. After drilling the outside hole on each middle cabaine, mark the inside hole with a short pencil. Then drill the inside hole and bolt with the proper bolts and washers.

15. Bolt the AFT cabaines to the keel and swing the lower ends into the triangle plates. The AFT cabaines will need to be notched to allow the hole in the triangular plate to be aligned with the center of the cabaine. Check the keel once more for symmetry by measuring from the strut attach tangs to the AFT 3/16" engine mount hole on the keel. The measurement should be the same as before. Position the tubes centered on the plates and drill through with a #11 bit and install proper hardware.

16. Now the tail boom extension can be installed. Check to see if the cockpit cage is still level from side to side. Once level, the exact bottom of the tail boom must be found. Do so by placing a scrap piece of aluminum tubing into the end of the tail boom. Gravity will pull the tubing to the bottom center (provided the frame is level). Place a mark on the bottom of the tail boom. See **Figure 04-016**. Measure 3/8" edge distance on the bottom of the tail boom and drill with a #11. Measure two inches from the first hole center and drill another hole in the exact bottom of the tail boom. To assure center line alignment of the second hole use a segment of small angle stock laid against the boom tube. See **Figure 04-016A**. The two holes will be used to secure the tail boom extension to the tail boom. Also measure 23" forward from the aft edge of the tail boom on the exact bottom. Mark and drill a #11 hole and install a 3/16" nut plate using 3/32" aluminum pop rivets. This hole will be for the forward lower cable attach point of the horizontal stabilizer. See **Figure 04-017.**

FIGURE 04-016

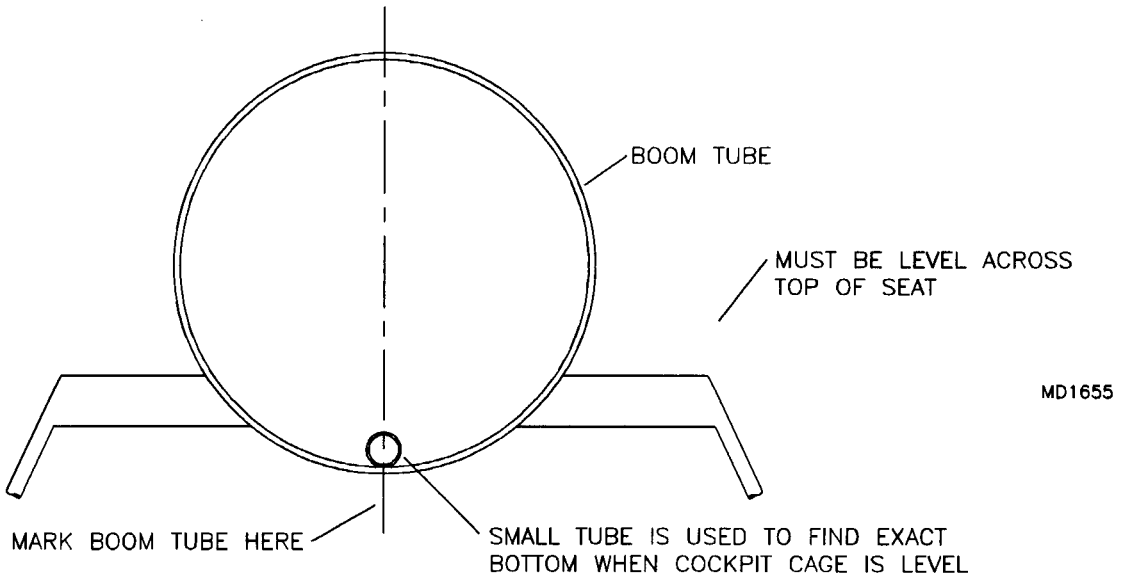
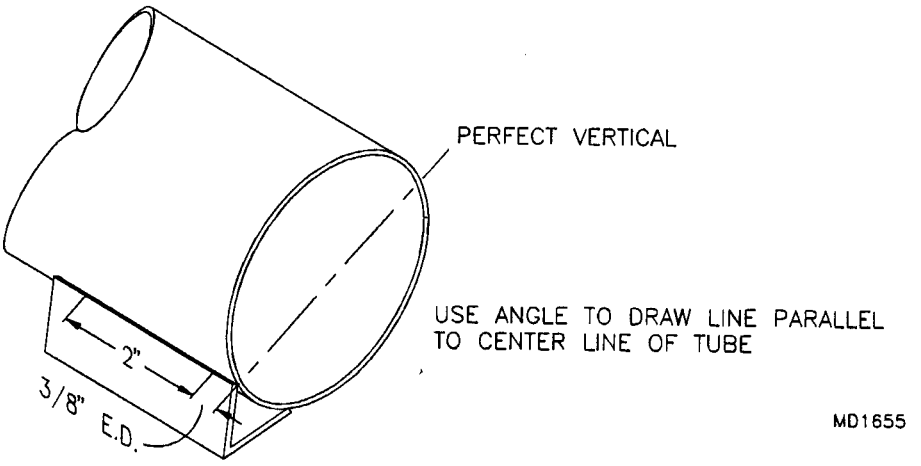
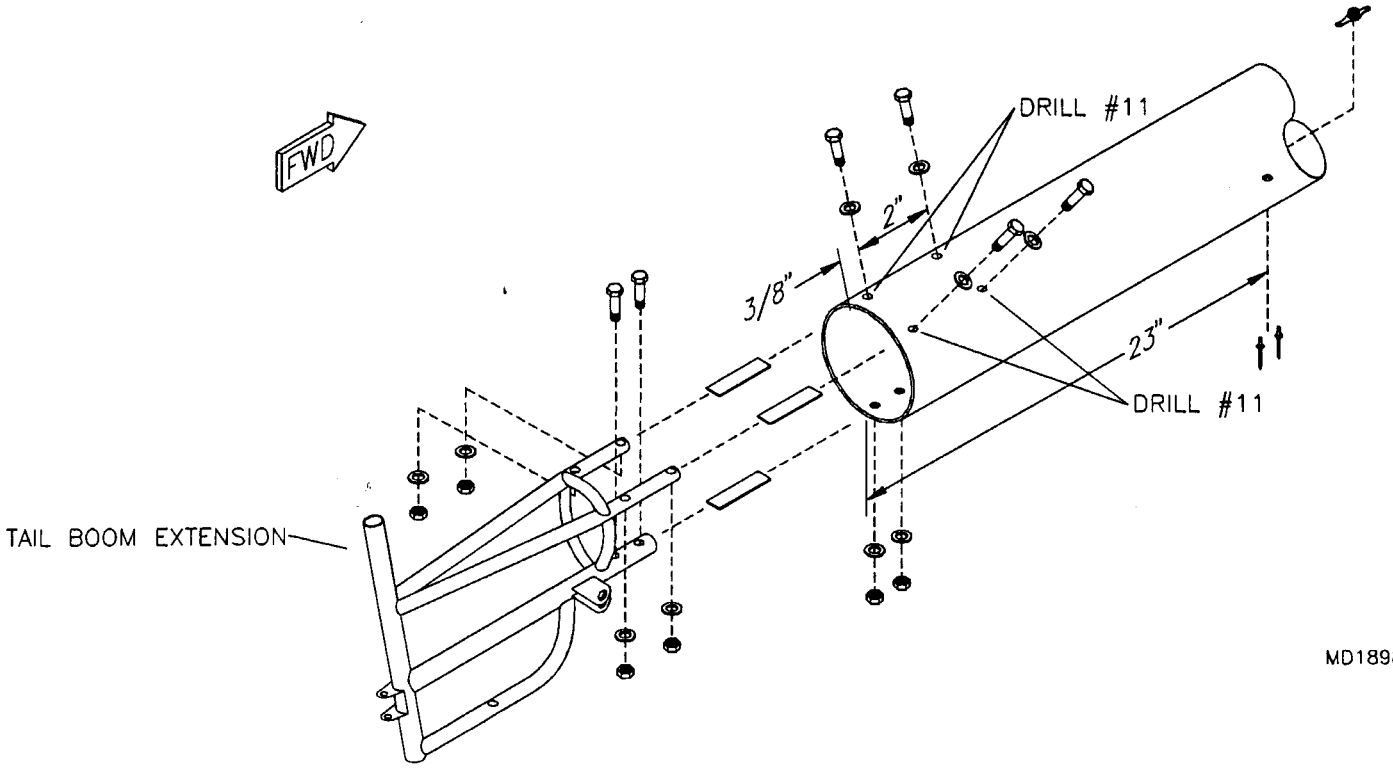


FIGURE 04-016A



17. Insert the tail boom extension and install the hardware in the bottom two holes. Sight down the tail boom to ensure the alignment of the tail boom extension is square with the rest of the airplane. **HINT:** Place the vertical stabilizer spar in place to enhance sight alignment. Clamp one of the top two 5/8" tubes with a small vise grip type "C" clamp. Re-check the vertical alignment after clamping. Drill the other 5/8" tube using the same dimensions used to drill the bottom of the tail boom. Be sure you are drilling through the center axis of the 5/8" and not off to one side. Refer to **Figure 04-017**. Install the proper hardware then drill and bolt the other side. This completes the tail boom assembly.

FIGURE 04-017



NOTE: PLEASE BE EXTRA ACCURATE WHEN LOCATING THE TAIL BOOM EXTENSION. IF NOT INSTALLED CORRECTLY THE HORIZONTAL TAIL INCIDENCE WILL BE EFFECTED.

S-12 AIRAILE PARTIAL POD ASSEMBLY

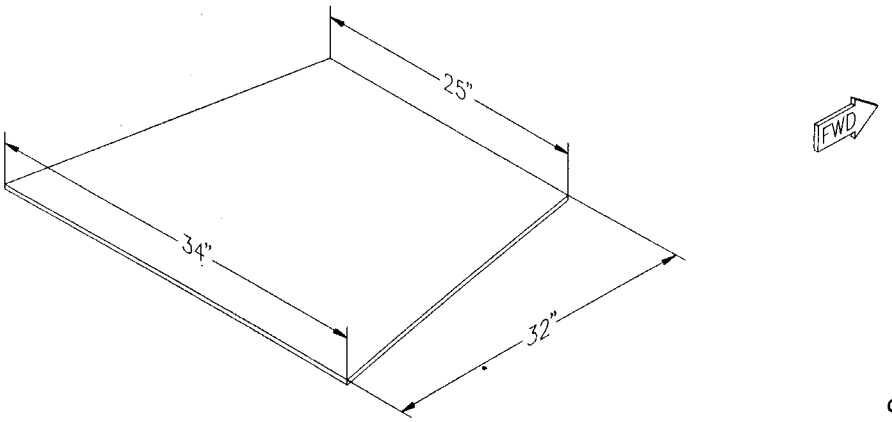
The Airailes' pod is constructed of G.E. Lexan. This polycarbonate material is darn near bullet proof, however, it does not like solvents. Lacquer thinners and acetones will pretty much destroy Lexan in a matters of seconds. So please be careful when working and maintaining your Lexan. A coating of protective material has been applied to save it from scratches while cutting and fitting the pod. This coating will either peel or wash off with warm water and a mild soap. If the film doesn't peel or wash off use the sticky side of masking tape to remove. Use a very soft cloth such as a clean baby diaper to towel off the moisture. Your Airaile fuselage should be completely assembled with instrument panel installed and on its gear. Do not attach the wings, the windshield is easier to install with them removed. In your kit was included 12 copper colored clecos. Clecos are little cylinder shape objects about 2" long. They are used to temporarily hold things in place through the rivet holes before installing the rivet. You will find that these will come in handy when assembling the pod.

1. Carefully unpack the parts in the package containing the pod kit. Inventory them against the parts packing sheet before beginning assembly.

2. Before installing the belly pan remove the three front floorboard bolts. Save the three large 3/16" washers. They are used when installing the longer bolts. These holes will be used to attach the front of the pan and Lexan nose cone using longer bolts and spacer bushings. Drill out the floorboard and tabs to 1/4". Make three 13/16" long spacer bushings from the 1/4" aluminum tube provided. **HINT:** Drill out the inside of the tube #11 before cutting the bushings to length. The bushings will be installed later during nose cone and belly pan final assembly.

3. The belly pan is fitted to the frame by clipping the edge with the top channel to one side and pulling it up against the other side. To attach the pan tight against the cockpit cage a plywood "table" will help. Cut a piece of 1/2" to 3/4" plywood to the rough dimensions shown in **Figure 04A-03**. This will be positioned under the belly pan and used to press the pan against the cockpit cage. Use five gallon pails and various blocks of wood to set under the plywood. Another way of holding the plywood against the bottom is to use "C" type vise grips. The platform must be tight against the frame with the belly pan sandwiched flat in between. Drill a hole in the plywood platform where the pitot and static lines will exit the belly pan. Before clamping the plywood in place make sure you route the pitot and static lines through the belly pan hole. Install the rubber grommet after the plywood platform is removed. Use carpet or towels to protect the surface of the pan. With the belly pan firmly against the bottom of the cockpit cage roll the side up into position on the frame and slip the top channel in place. The top channel is pilot drilled #40. The belly pan should be pushed up into the channel as far as possible. Check everything before you drill. Once you are happy with the position drill and cleco. Hold the top channel and belly pan in place with clamps while drilling #30. Use the clecos to hold the parts in place after drilling before riveting. The channel should be flush with the aft edge of the belly pan. The front end of the belly pan is retained to the frame using three 3/16" bolts and two 1/8" pop rivets. Drill from the top through the floorboard and belly pan. **HINT:** Make a drill guide from a block of 1 1/2" thick wood. Drill in a drill press for accuracy. Use as a portable drill guide to drill straight through the belly pan from the floorboard's top side. Support the belly pan from the bottom with a block of wood over the hole location while drilling. Do not bolt at this time, the nose cone also will use these bolts to attach.

FIGURE 04A-03



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4. The Lexan parts to the pod are thermal formed and arrive rough trimmed. The top nose cone half fits **OVER** the bottom, look closely you will notice there is a step molded into the top nose cone. Trim the top nose cone 1" **BELOW** the step. **HINT:** Use an aviation tin snips to trim the nose cone parts. The top nose cone has a built in bulkhead on the aft side. When trimming this face of the nose cone leave 2" of material for the bulkhead. Look closely and you will see a trim line. The top nose cone overlaps onto the cockpit cage and attaches to the tab on the side using 3/16" bolts. Where this overlap occurs the flange on the top nose cone will need to be removed so it will fit as nearly flush on the side as possible.

5. The bottom nose cone has a very slight step. Trim off the bottom nose cone 1/2" above the molded in step line. Trim off the bottom nose cone's back edge flush with the edge leaving no turned flange. See **Figure 04A-05**. Locate and drill #30 holes in the mating strips as shown in **Figure 04A-05A**. Do not drill a 12th hole at the very end of the strip. A 12th hole will not allow the nose cone to slip between the belly pan and frame.

FIGURE 04A-05

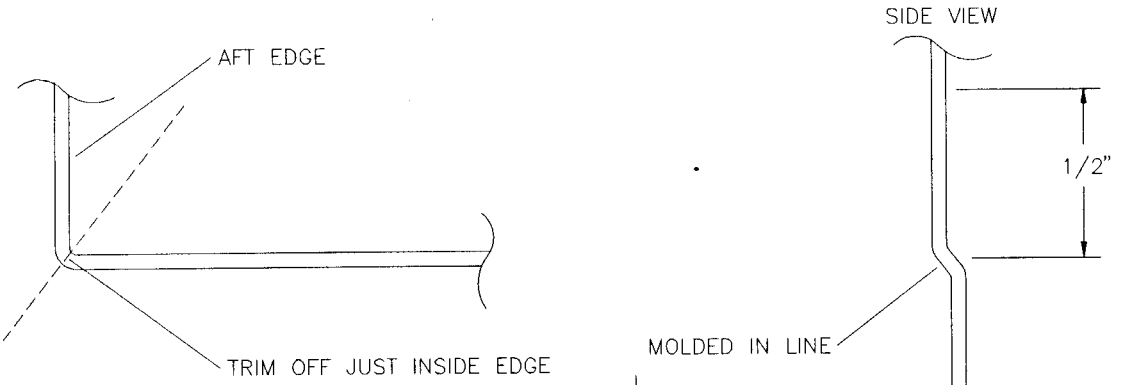
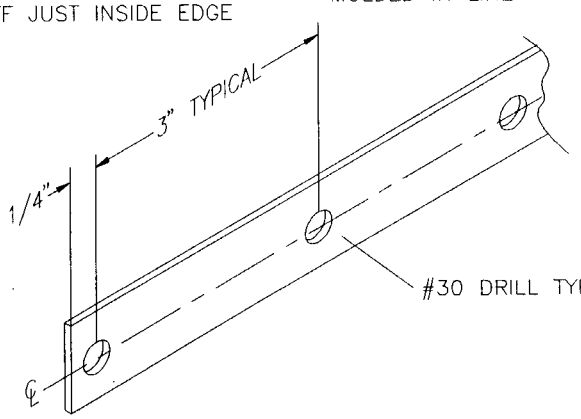
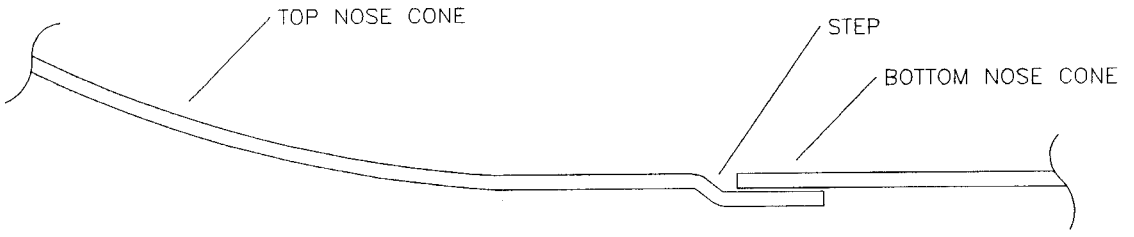


FIGURE 04A-05A



6. Clamp or tape the two halves together. Start at the front center drilling and installing clecos. Pull on the strip as you work it around. This will reduce the chance of bulges between the rivets. When the nose cone is fully fitted and drilled, remove the clecos and clean away any debris. Rivet the halves together with #30 aluminum pop rivets. See **Figure 04A-06.**

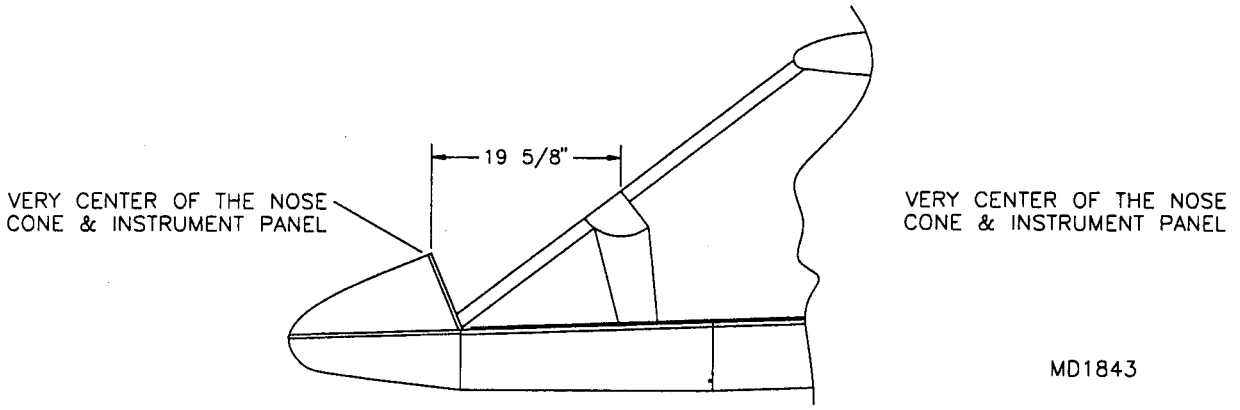
FIGURE 04A-06



7. Remove the nose gear. The nose cone slips onto the cockpit cage between the belly pan and frame. The nose cone inserts onto the frame until the bottom half is flush with the aft edge of each side tab. The nose cone should be level by the way it is installed on the frame. However, it is possible for a slight shift to occur when inserting. Check for level by viewing the from the front and adjusting accordingly.

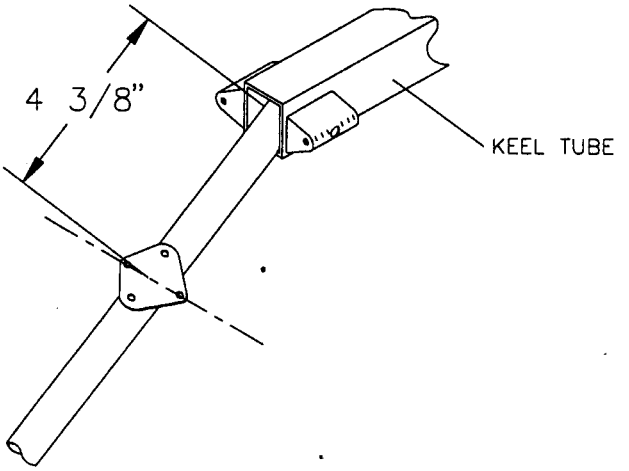
8. With the nose cone in position drill from the inside out through the side tab holes #11. Slip a bolt into the hole but do not install a nut at this time. Use a gold cleco if you have one. After the bolts are installed the nose cone can be tilted up and down to adjust its side view alignment. Set the nose cone to the proper angle by establishing the measurement between the nose cone's top edge and instrument panel. See **Figure 04A-08**. Once the measurement is set drill through the bottom three belly pan holes and bolt. Locate two #30 holes 1/2" from the belly pan's forward edge and halfway between the bolts and drill. Rivet with a 1/8" pop rivet. When pulling these rivets it is easy to not catch the Lexan. Be sure you have riveted both the belly pan and the Lexan.

FIGURE 04A-08



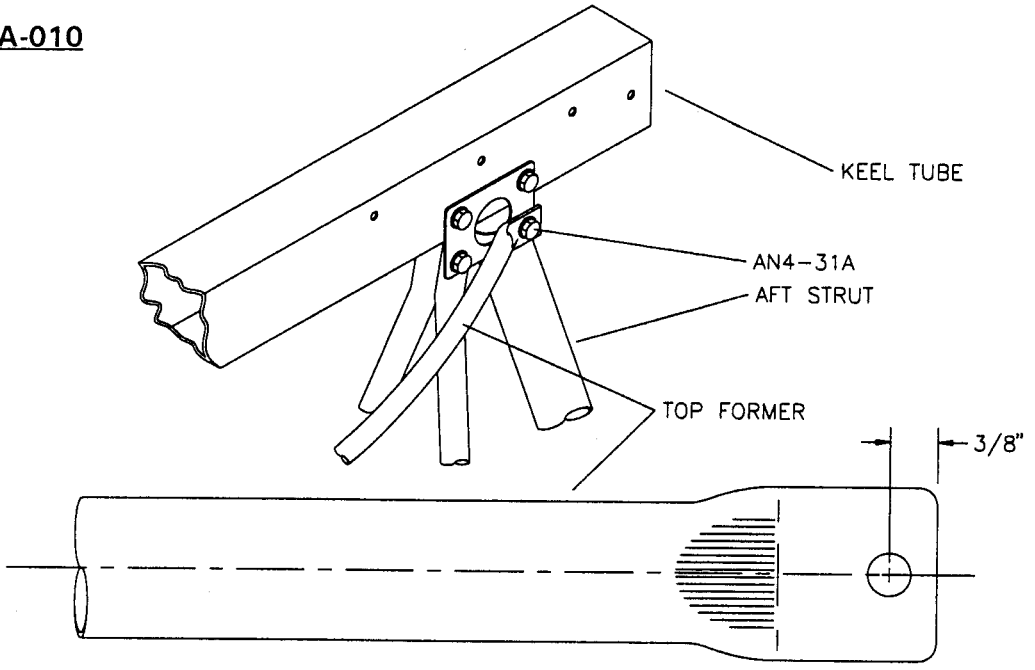
9. The top formers attach to the forward strut and the aft most 1/4" bolt. Locate the diamond gusset as shown. See **Figure 04A-09**. Drill and rivet on the diamond gusset with two 1/8" stainless steel rivets.

FIGURE 04A-09



10. Drill the ends of the top former tubes as shown in **Figure 04A-010**. Replace the existing bolt with an AN4-31A and bolt the top formers to the keel in the place shown.

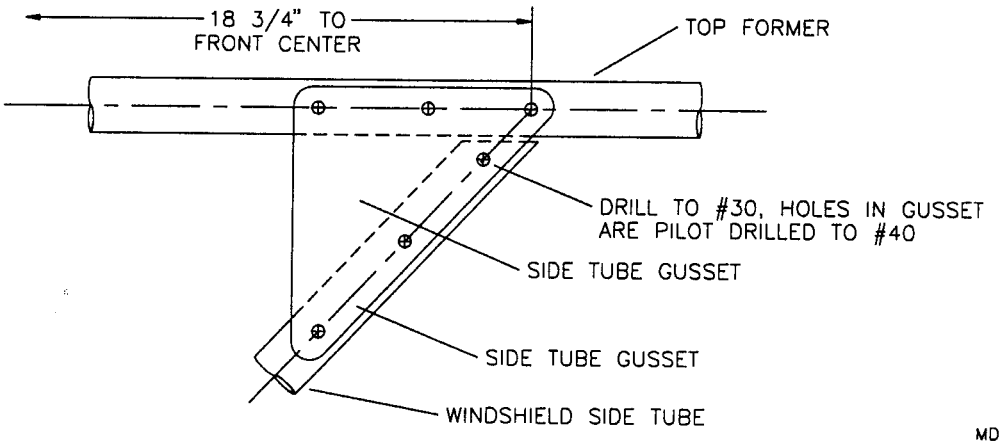
FIGURE 04A-010



11. The splice tube is 2 1/2" long. Place a mark on each top former tube 1 1/4" from the end. The marks are used to keep the joint in the middle of the splice tube. Insert the top formers into the splice tube. Use masking tape to hold the tubes together while fitting. Set the top former tube assembly across and centered on the holes of the diamond gusset. Make sure the tubes are centered from side to side then drill from the bottom. Rivet with 1/8" stainless steel rivets.

12. Find and mark the exact forward center of the top former. From the center mark measure **AROUND** the outside of each top former and mark where 18 3/4" occurs. Use a cloth tape measure like tailors use for accuracy. At the 18 3/4" drill a #30 hole on the top former tubes center. This is where the top most aft hole to attach the side tube gusset plate. See **Figure 04A-012.** Cleco the gusset to the top former tube and line it up with the tube's centerline and drill the other holes. Use the gusset as a guide. Do not rivet the **OUTSIDE** of the gusset. This will be done **AFTER** the windshield is installed.

FIGURE 04A-012



13. Insert the end of the windshield side tube as shown in **Figure 04A-013.** Rivet the lower end with (2) 1/8" stainless steel pop rivets on the **INSIDE**. Place the tube under the gusset at the top and measure, mark and cut as required to fit tube to the top former. Refer back to **Figure 04A-012**. Once the tube is properly fitted drill and cleco. Rivet with 1/8" aluminum pop rivets on the **INSIDE** only.

FIGURE 04A-013

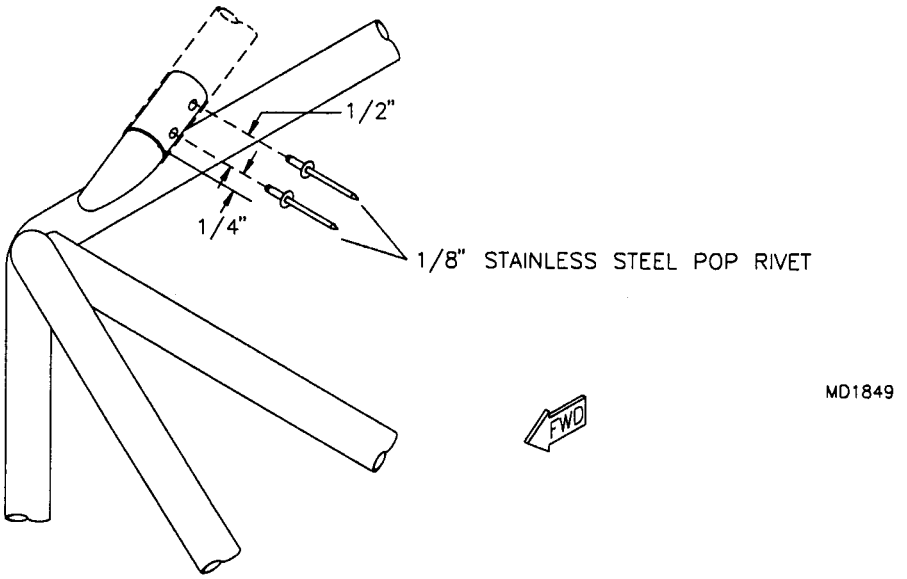
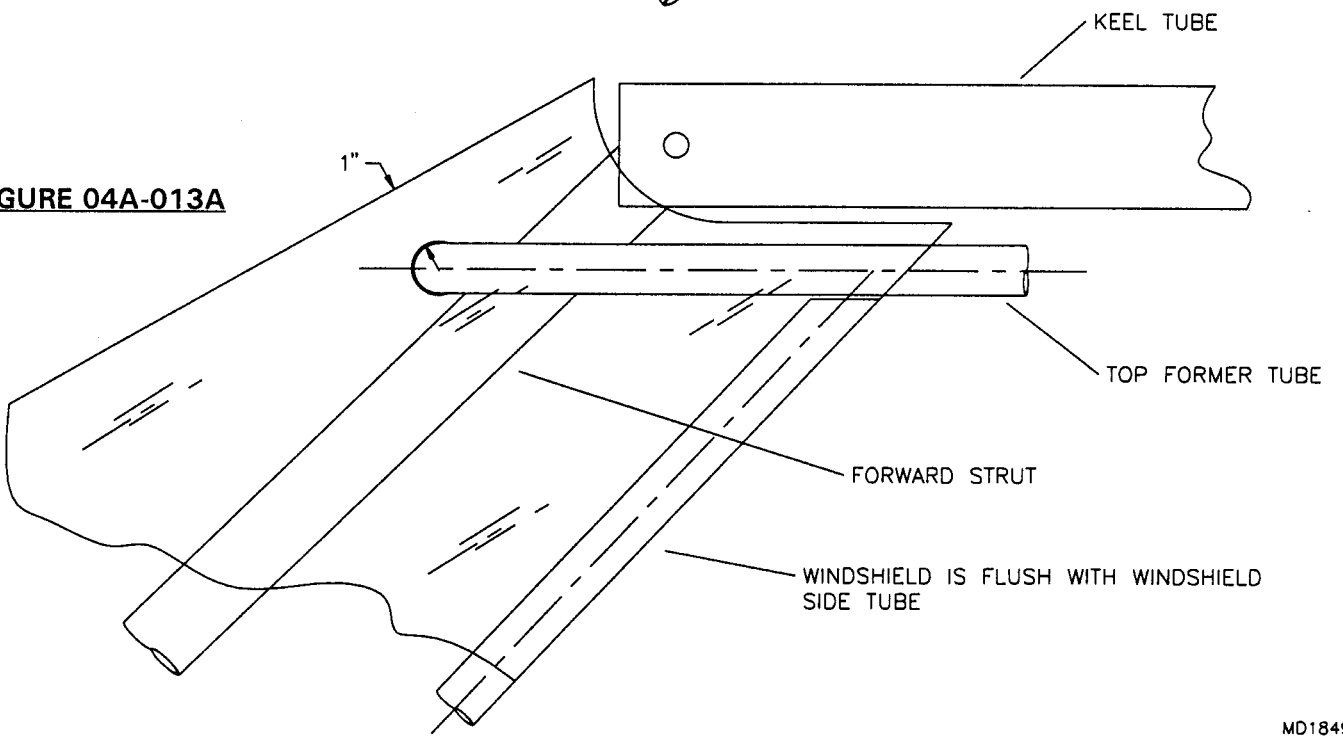


FIGURE 04A-013A



14. The windshield comes pre-cut to shape. A protective paper is applied to the windshield to protect it during shipping and fitting. Do not peel this paper off until riveting, and then only the outer edges. Leave the bulk of the paper on until just before flight. The sides of the pre-cut windshield will need to be lined up with the edge of the windshield side tubes. **NOTE: DO NOT RIVET THE WINDSHIELD TO TOP FORMER,ALLOW WINDSHIELD TO SHAPE ITSELF.** If done correctly there should be at least a one inch space between the windshield and the top former in the center as shown in the illustration. Accurate positioning of the windshield is determined by the way it matches with the nose cone and top former. To install, position the windshield centered on the frame. The top edges should fit flush with the top of the top former tube at the gusset location. See **Figure 04A-014.** Clamp the windshield to the frame in as many places as possible. Once the windshield is firmly in place on its perimeter structure mark off the rivet locations every 3". Start in the front lower center. Work up the side tubes by starting at the bottom bolt. Space the top former every 3" starting at the gusset rivet on each side of the forward strut. See **Figure 04A-014A** for spacing and edge distance. Use a brass backing washer on the rivets through the windshield and nosecone.

FIGURE 04A-014

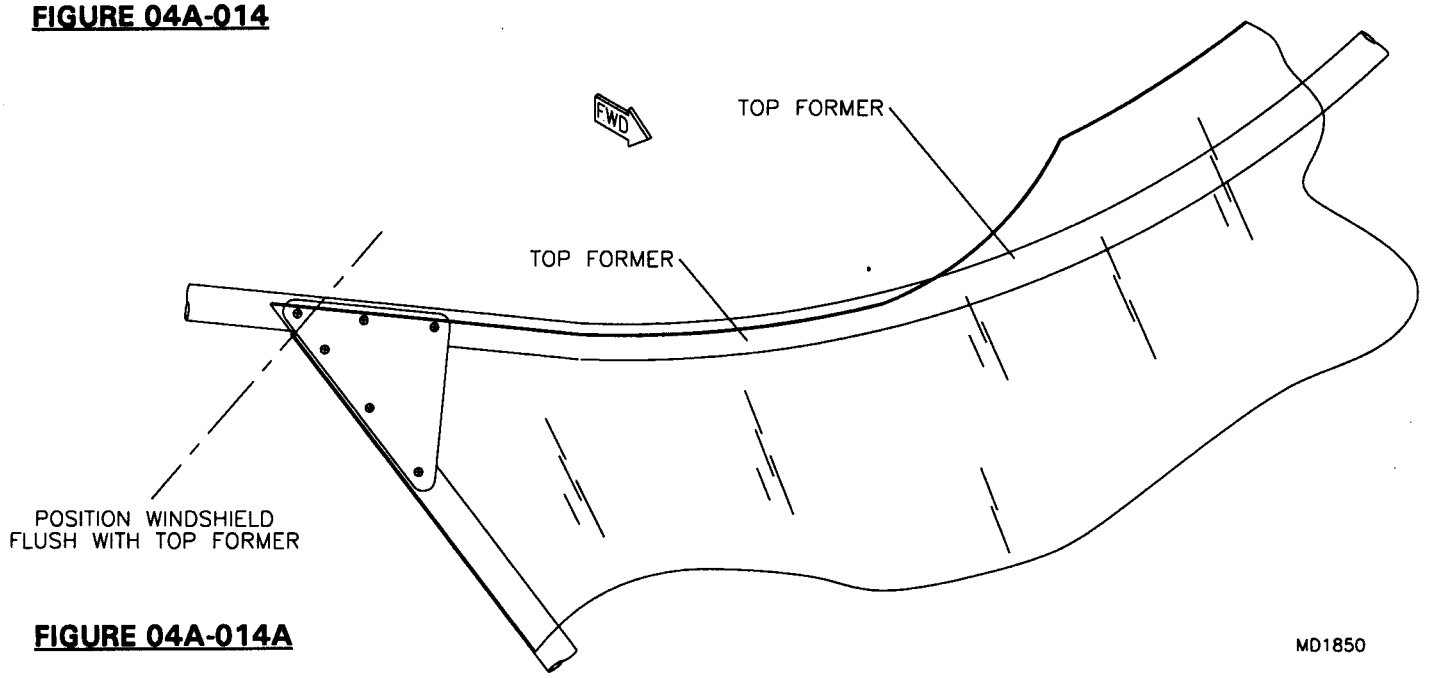
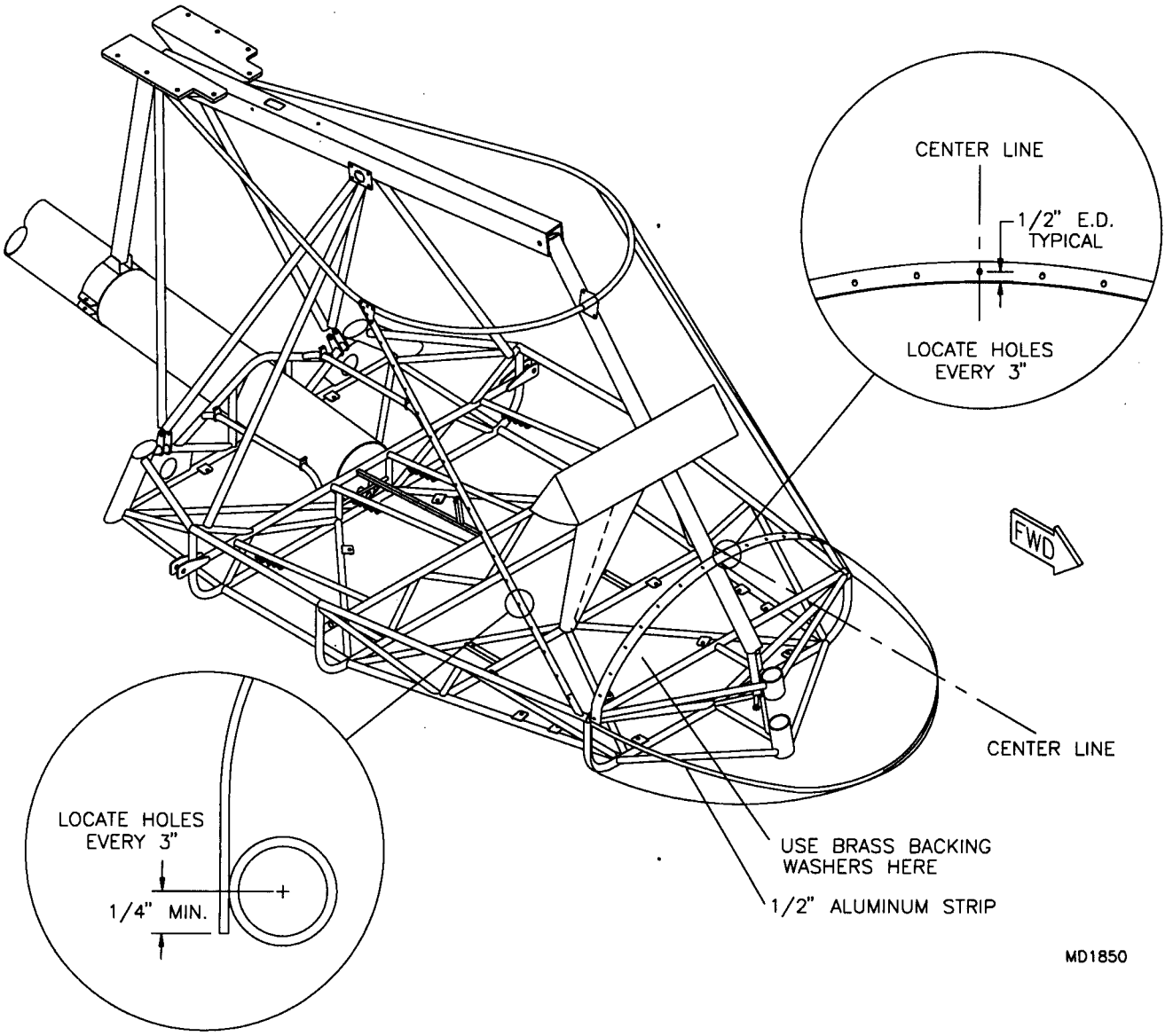


FIGURE 04A-014A



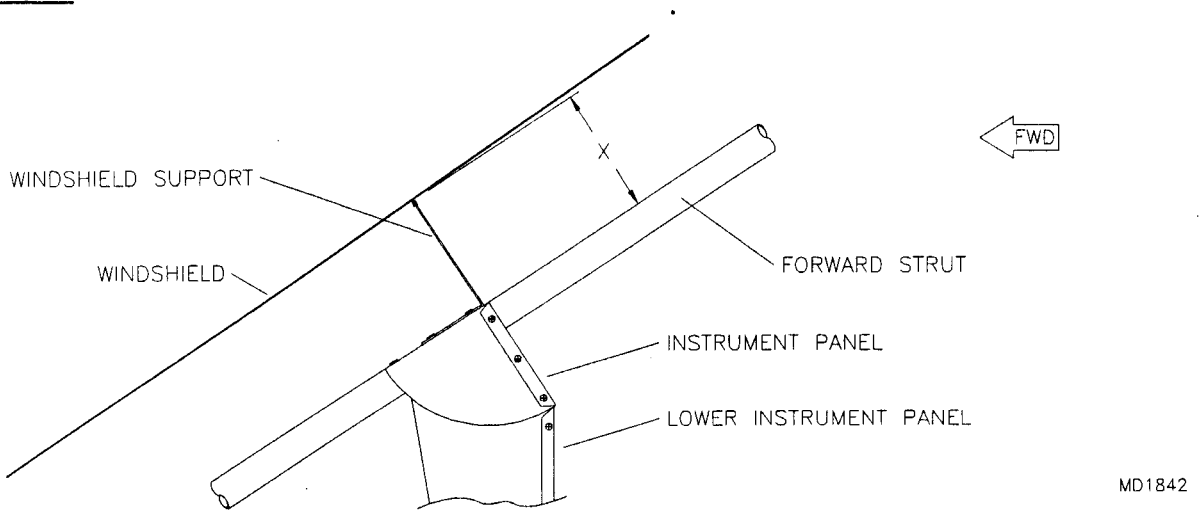
X

15. Drill #30 and cleco. Move the clecos along as you drill. Once all the holes have been drilled mark the edges on the side tubes for trimming the Lexan. Leave at least 1/4" from rivet center to edge of Lexan. **HINT:** The best way to trim Lexan is to mark where to cut, remove and lay on a flat surface. Score the trim line several times with a utility knife and snap off the excess. For very narrow edges use square jaw plier to grip and snap off the excess. Smooth the edges with a file or sanding block.

16. Peel the paper away from the edges just enough to clear the rivets. Cleco the windshield in place and rivet the windshield in place.

17. To install the windshield support first measure the distance from the panel to the windshield. See **Figure 04A-017**. Cut off the support to this height. Glue the rubber trim (same as used on the top of the windshield) to the top of the support. Unscrew the aft two screws in the top of the instrument panel. Install the support, use blue Loctite on the two screws.

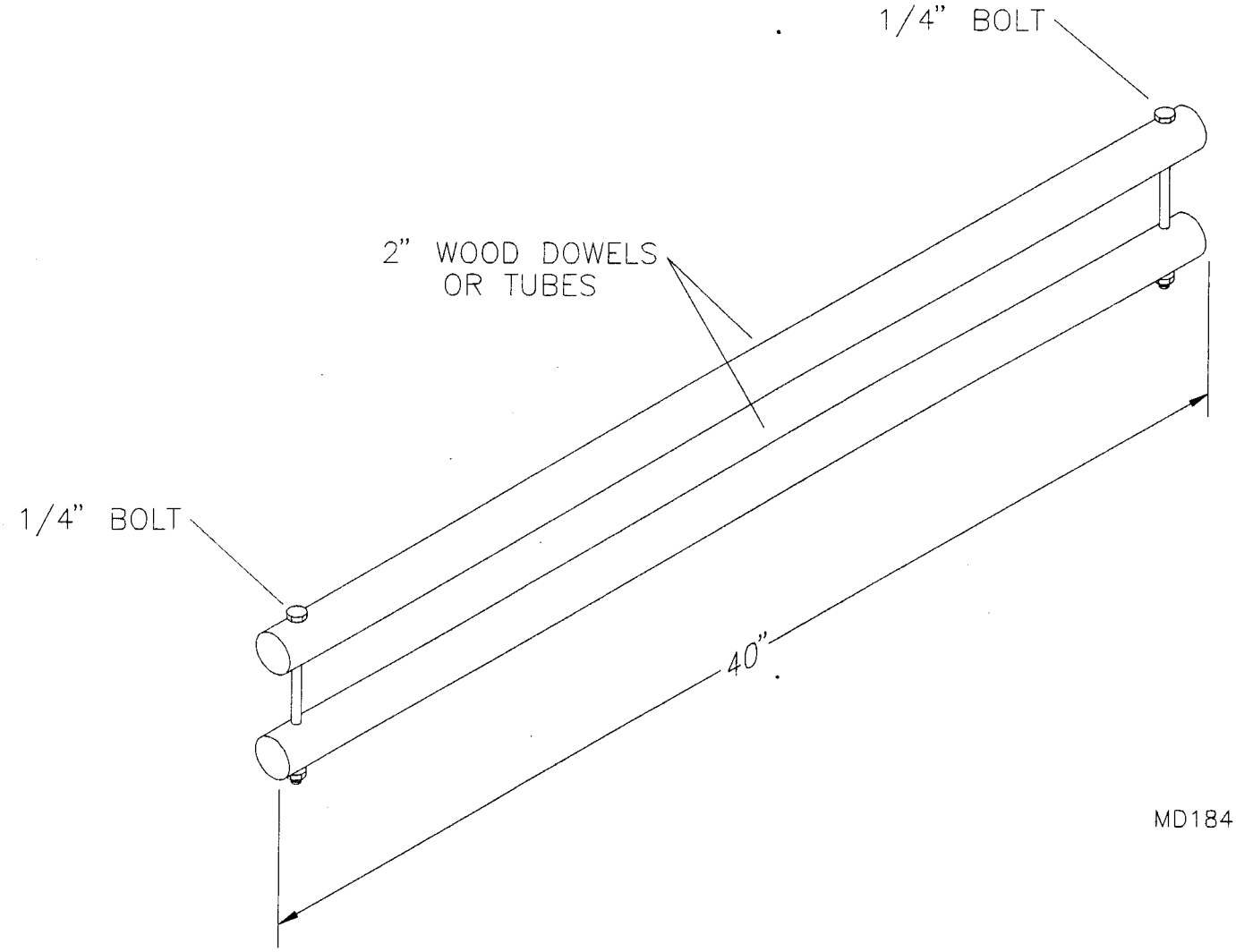
FIGURE 04A-017



18. Apply the rubber trim to the top edge where it meets with the wing. **HINT:** Use super glue to permanently attach the rubber trim to the Lexans' edge. Peel off the paper just prior to flight!

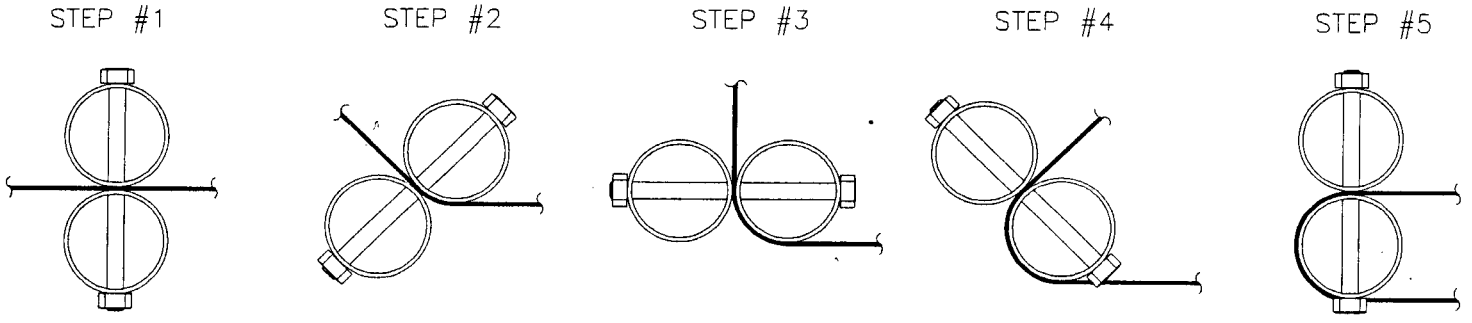
19. Use a 2" hole saw to drill an opening for the nose gear. Drill from the bottom looking through the Lexan to locate the hole. Install the nose gear with a thin coat of grease.

20. Install the pitot to the front right bolt. Use a 3/16" rivet to secure the pitot mounts aft hole to the belly pan. Make sure the pitot is lined up straight before drilling.

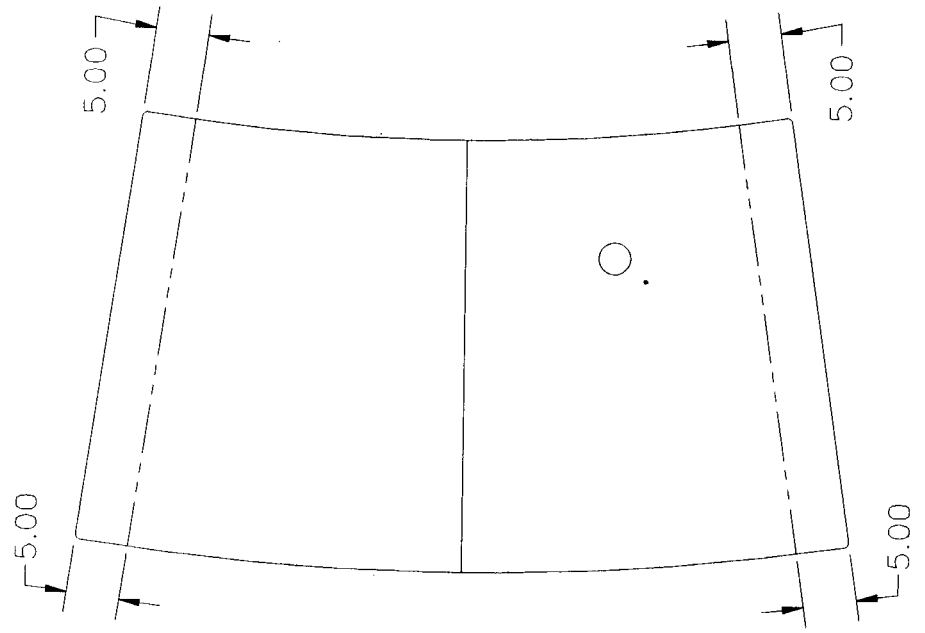


MD1841

BEND BELLY PANS 180° AS SHOWN

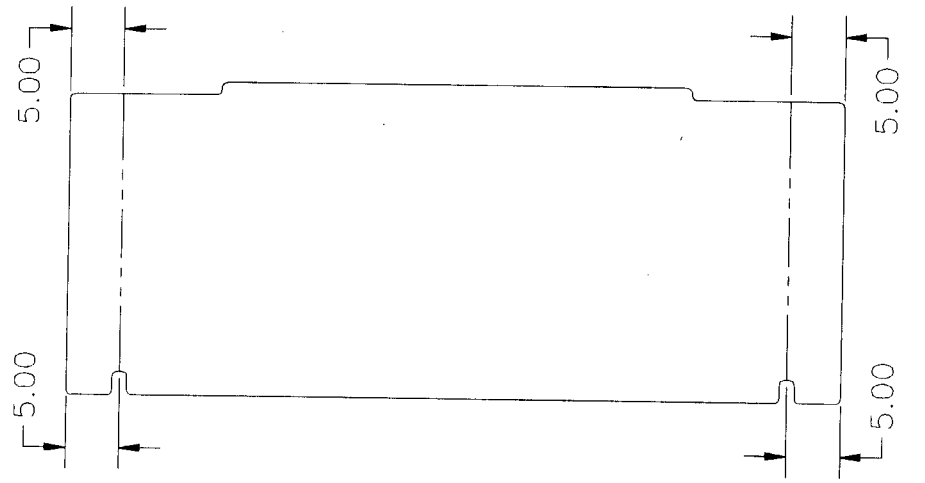


MD1841

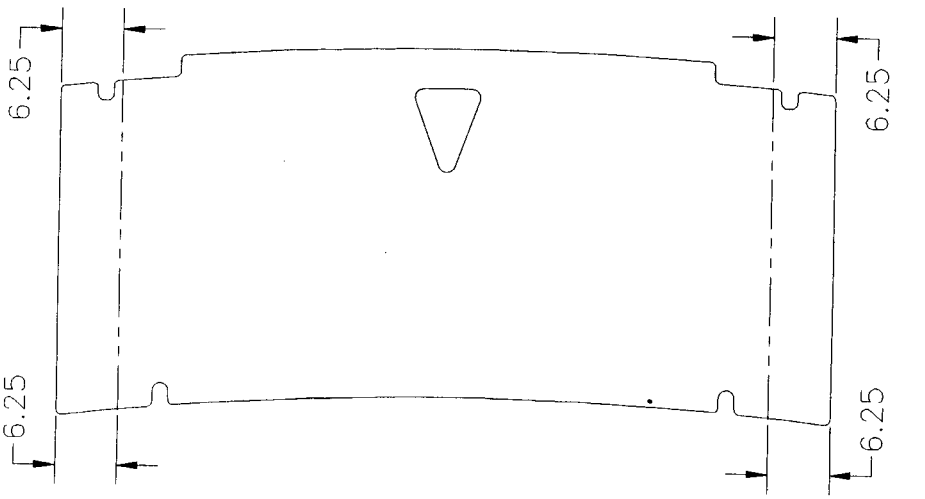


BELLY PAN 1

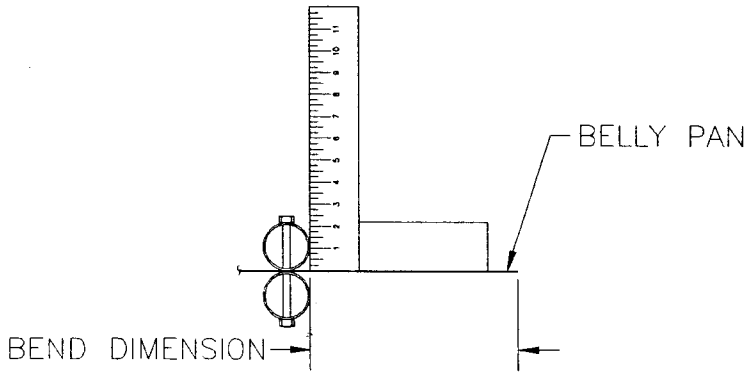
MD194

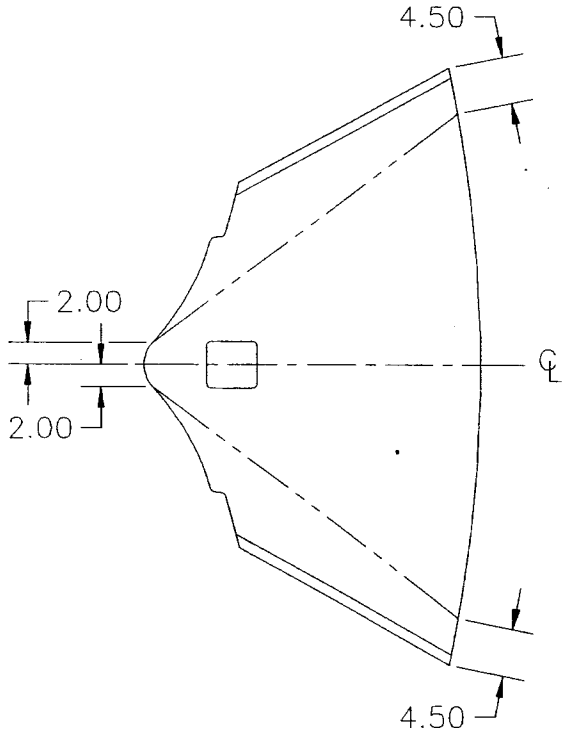


BELLY PAN 2

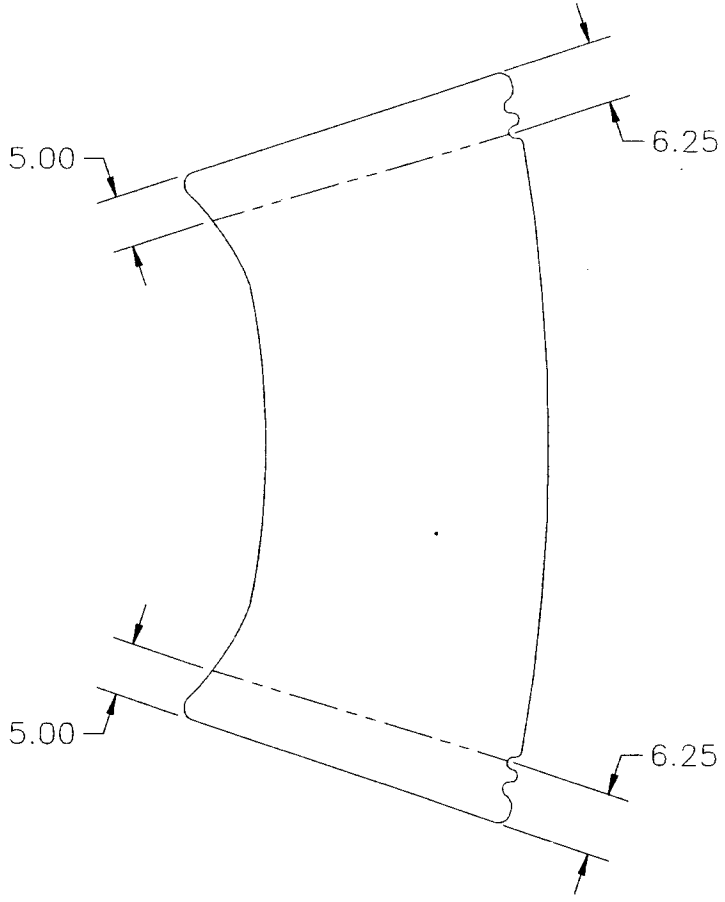


BELLY PAN 3





BELLY PAN 5



BELLY PAN 4

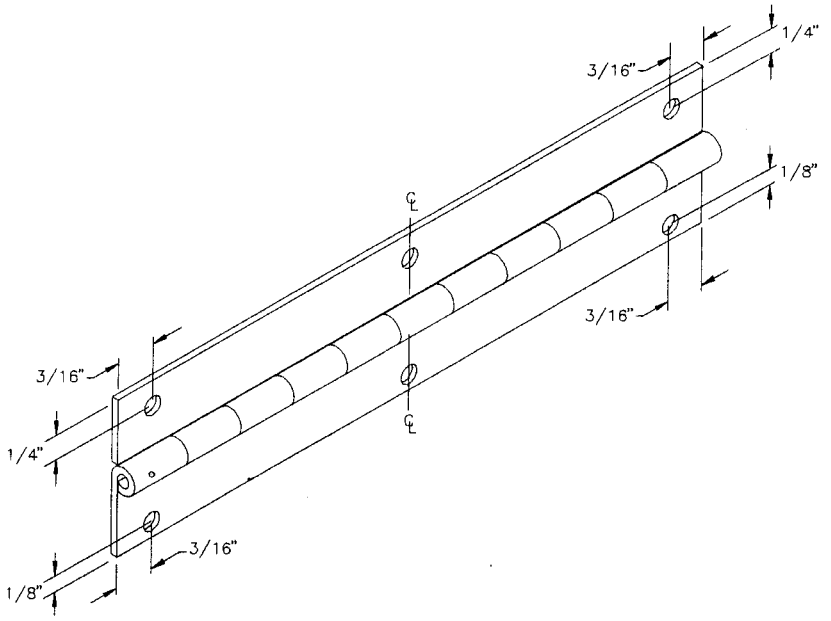
MD194

S-12 AIRAILE DOOR ASSEMBLY

1. Select the parts depicted in the parts drawing. It is assumed at this time the aircraft is fully assembled including the wings. This is required to get an exact position on the door up catches.

2. Cut the 36" piece of piano hinge stock into six 6" lengths. File a small radius on the corners to prevent the hinge from snagging your clothing while entering or departing the cabin. Drill the hinges for three rivets into each hinge flange. Locate the hole as shown in **Figure 04B-02**. Remove the hinge pin from each hinge and cut it 1/8" shorter than the hinge. Slip the pin back into the hinge so it is flush with one end. Using a sharply pointed punch make a deep dimple in end of the hinge that the pin is not flush with. This will prevent the hinge pins from slipping out. Gravity keeps the pin in the hinge. To remove the pin for flying with the doors off, take a small stiff piece of wire and push out the pin from the dimpled end.

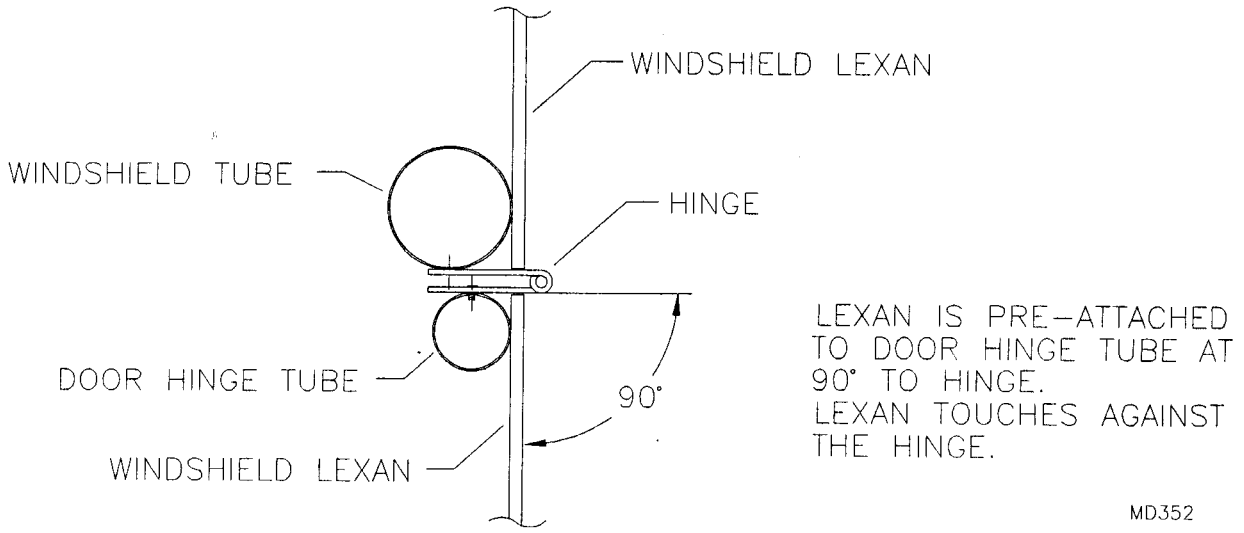
FIGURE 04B-02



MD350

3. Locate and drill the door frame hinge tube for the hinges as shown in **Figure 04B-03, 04B-03A** and **04B-03B**. Be careful to locate these holes accurately on the hinge as this will determine the door fit. Attach the hinges using 1/8" stainless steel pop rivets.

FIGURE 04B-03



MD352

FIGURE 04B-03A

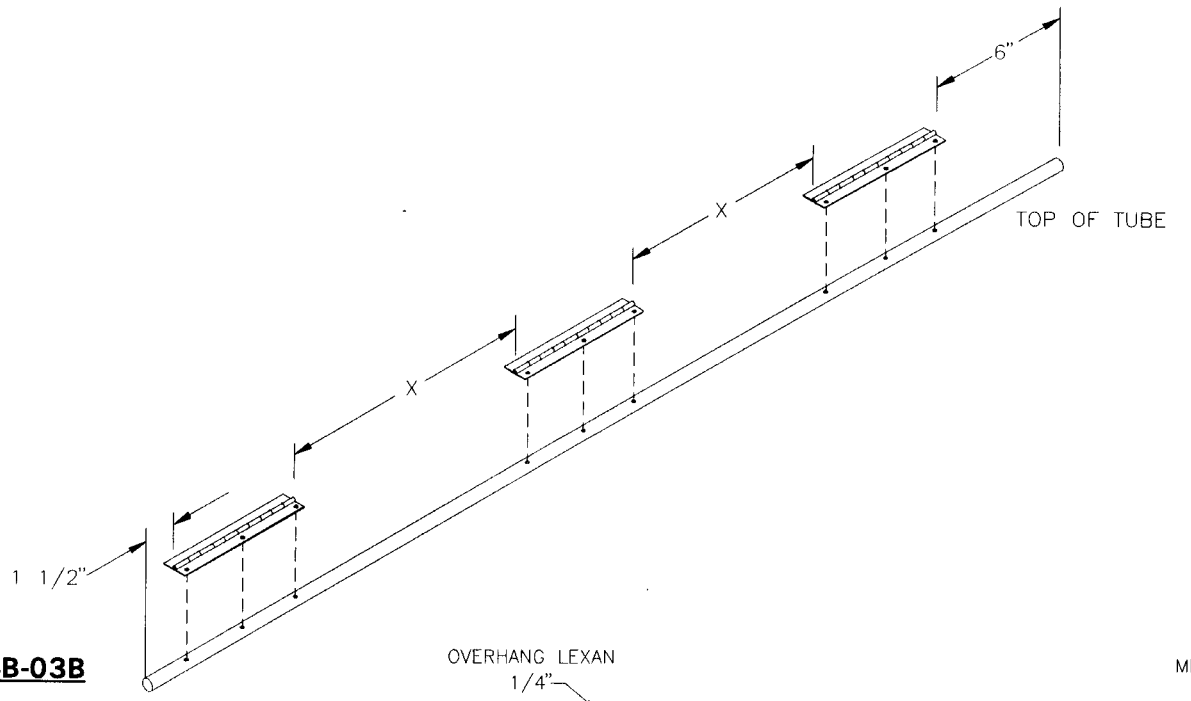
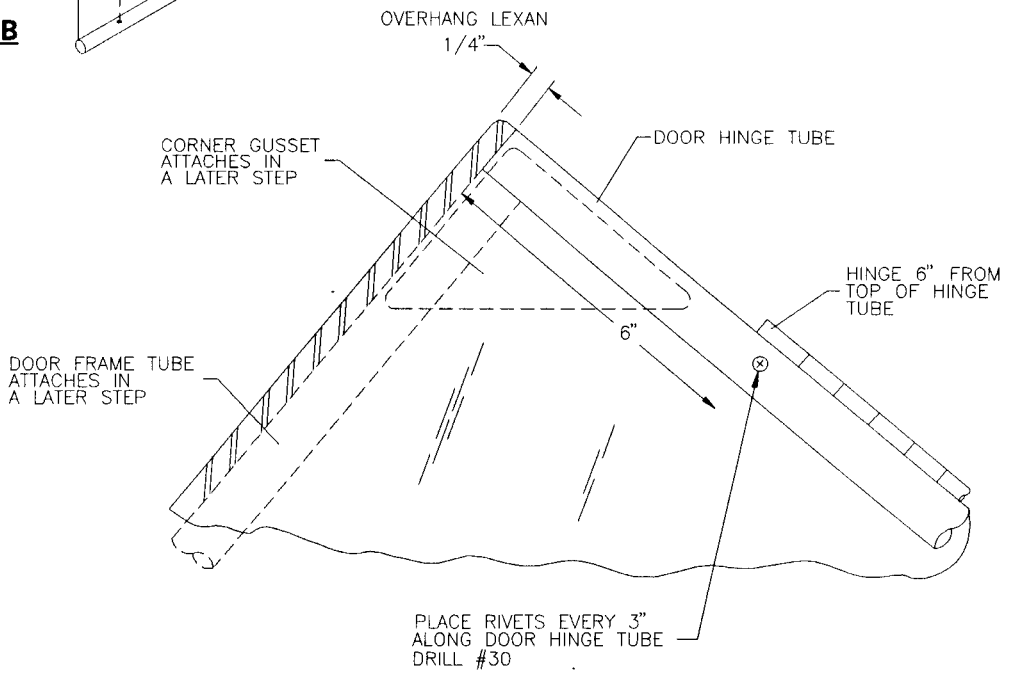


FIGURE 04B-03B

MD353



4. Peel back the protective paper from the edges on both sides. Attach the lexan as shown in **Figure 04B-03B**. Note how the lexan fits up against the hinges and overhangs the top edge by 3/16". Start by locating a #30 hole 3" from the top of the hinge tube. Continue down the hinge tube with this 3" spacing. Install the 1/8" aluminum pop rivets along the hinge tubes length but do not rivet the ends until the corner gussets are in place.

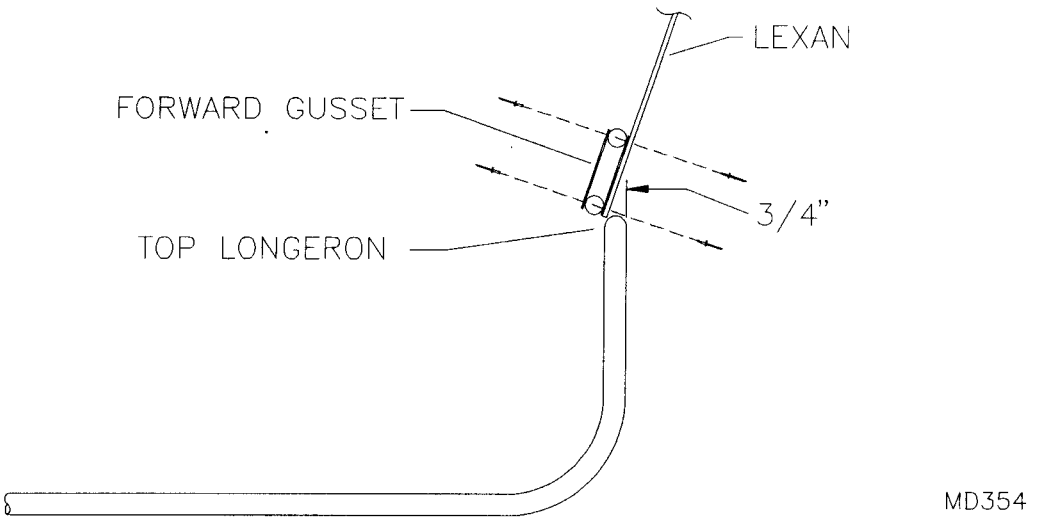
5. Place the door frame tube as shown by the hidden line in **Figure 04B-03B**. The door frame tube should touch against the hinge tube and be flush with it's end. The door frame tube should be placed to run parallel with the top of the lexan and maintain the 3/16" lexan overlap. Place the upper corner gusset over the lexan and tubes to place the holes over the tubes centerline. Drill through and cleco with a copper cleco. Use 3" spacing across the door top (see the parts drawing for door top and other reference notes). Do not continue past the doors top. The door must be hung from the windshield before placing and drilling the hole for rivets in the rest of the door frame.

6. Hold the door up against the windshield tube so the door just misses the wing from 1/8" to a 1/4". If the door clears the wing leading edge spar by more than a 1/4" the door up catch will not work. So please take care locating the door on the windshield tube. Once you are satisfied with the position of the door, drill and rivet the hinges to the windshield tube. Be sure to use stainless steel 1/8" diameter pop rivets.

7. The unattached part of the door frame tube can now be drilled and clecoed. Use the top longeron of the cockpit cage to line up the bottom of the door frame tube parallel to the cage. The door frame tube should be parallel to the AFT vertical and top edges of the door. Match the tube parallel to these edges before drilling. Use a 3" spacing between the rivets. Cleco the lexan to the frame, do not rivet till after the lexan has been marked and trimmed. The bottom of the door lexan should be parallel to the top longeron of the cockpit cage. The top and AFT vertical edges of the door will serve as guides to line up the tubes for framing the AFT enclosure.

8. To seal tight against the side of the cabin, the door frame will need a slight twist set into the front lower corner. This is accomplished by twisting the door bottom 3/4" **INWARD**. Lock in the twist by riveting the forward corner gusset in place. See **Figure 04B-08**. The forward gusset simply slips over the end of the door hinge and door frame tubes. Locate and drill at least two rivets into the end on each side of the gusset.

FIGURE 04B-08

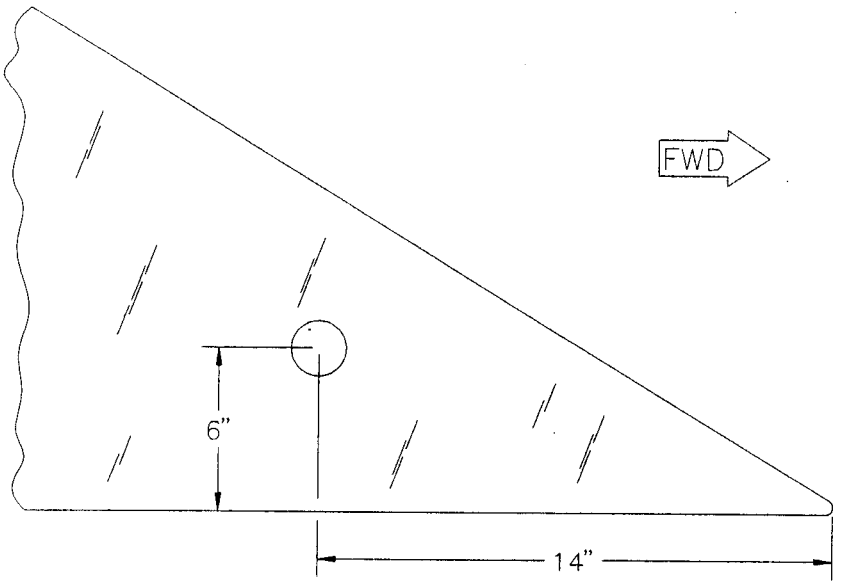


9. With the door hung in place mark the edges for trimming using masking tape. The only edges that should need trimming are the top edge that swings by the wing and the bottom. Remove the lexan from the door frame and trim the edges. For straight trimming use a straight edge and a utility knife. Score the lexan several times then snap off the excess using a pliers to grip the edge. Smooth the edges with a file or sanding block. Round the corners with a fine tooth file or sanding block.

10. Cleco the lexan to the door frame and rivet with 1/8" aluminum pop rivets.

11. If you have opted for the air vents read directions included in the package. We use an adjustable fly cutter, so it is real important to make a practice hole in scrap material prior to cutting the door. We locate the vents in the lower corner of each door. This location seems to work the best because air circulates over the legs and torso. Locate by measuring 14" back and 6" up from the forward most tip of the lexan. See **Figure 04B-011**.

FIGURE 04B-011



12. The door up catches must be located exactly to work properly. The catch works by depressing the "button" to let the door pass. Release the button to retain the door in the up position. To lower the door depress the button. The amount the button extends over the door frame tube determines how reliable and easy it is to use. The door should be clearing the wing by no more than a 1/4" to make for the best up catch operation. The up catch is critical in both the location out from the center and in placement on the spar. The location on the spar we have found to work is in direct line with the level line of the wing chord (see **Figure 04B-012**). Locate the up catch around 12 9/16" from the aircraft centerline. See **Figure 04B-012A**. You will need to drill into the spars #30 for the screws to attach the up catch body. Use the up catch body as a guide to locate the holes. After locating and drilling the holes in the spars, drill the up catch body to the screw shank size and counter sink. The screws must fit flush so take care to get a good countersink. The screws are self tapping but will take a good effort to screw in. Insert the button into the up catch body and slip the spring inside. Install each assembly to the spars. Use blue loctite on the screws to secure against vibration.

FIGURE 04B-012

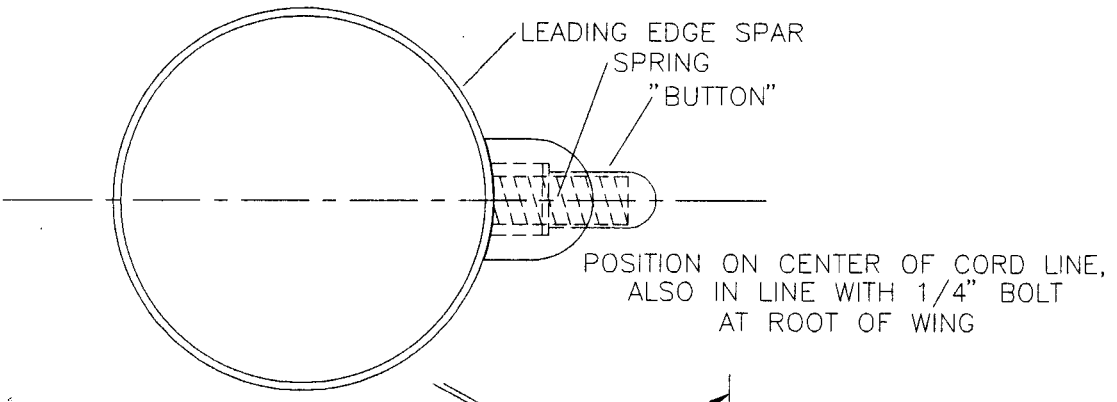
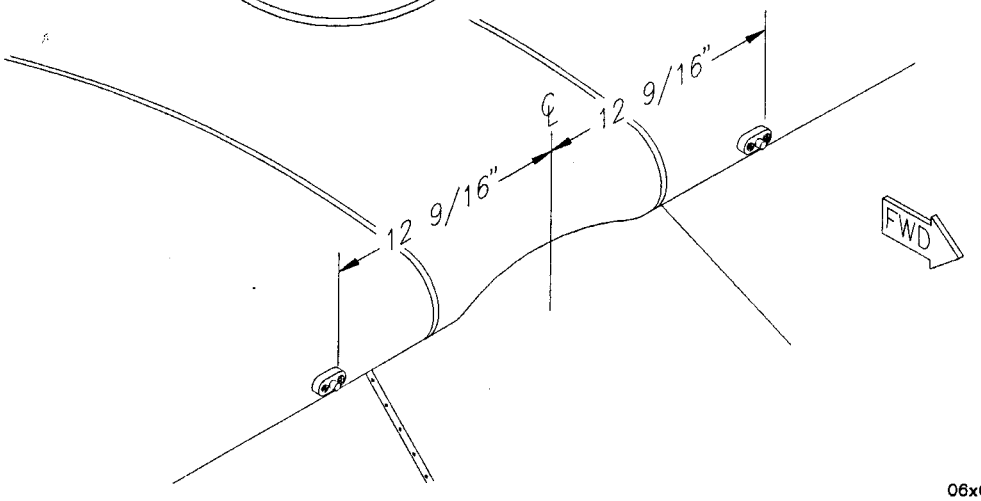


FIGURE 04B-012A



13. To help with closing the doors an upper door handle is installed 8" down on the door top edge. This small 1/4" diameter loop of tubing is tapped 10/32 on each end. To install the upper door handle drill through the door frame at the location shown in **Figure 04B-013**. If this location interferes with the rivets either drill out the rivet or move the handle to either side. Drill through the tube so the handle screws match. See **Figure 04B-013A**. Install the upper door to angle AWAY from the edge of the door. **CAUTION:** If you use blue loctite to secure the screw from vibration, do not allow the loctite to come in contact with the lexan or crazing will result. **OPERATIONAL CHECK OF THE DOOR UP CATCH:** Open the door and depress the button to let the door pass. Enter the plane. Reach up and depress the button to allow the door to close. **CAUTION:** The potential to pinch one's fingers exists. To avoid such injury **USE THE UPPER DOOR HANDLE** when closing the door.

FIGURE 04B-013

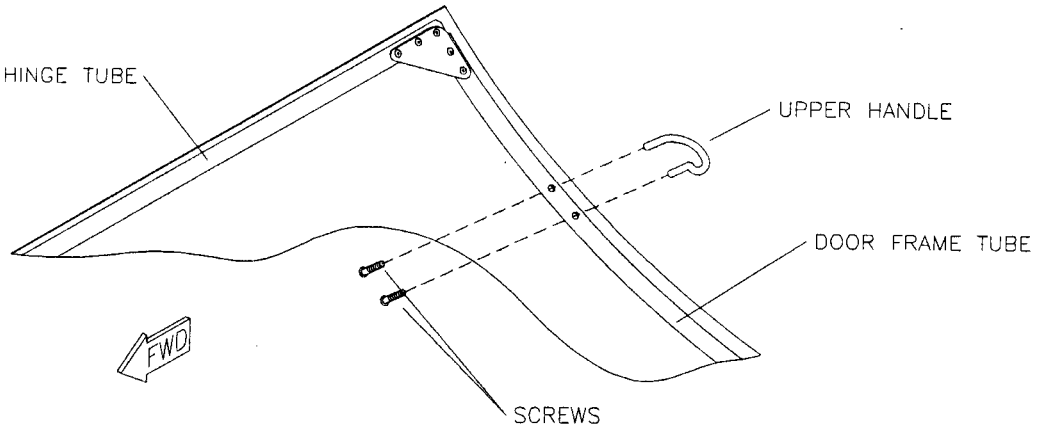
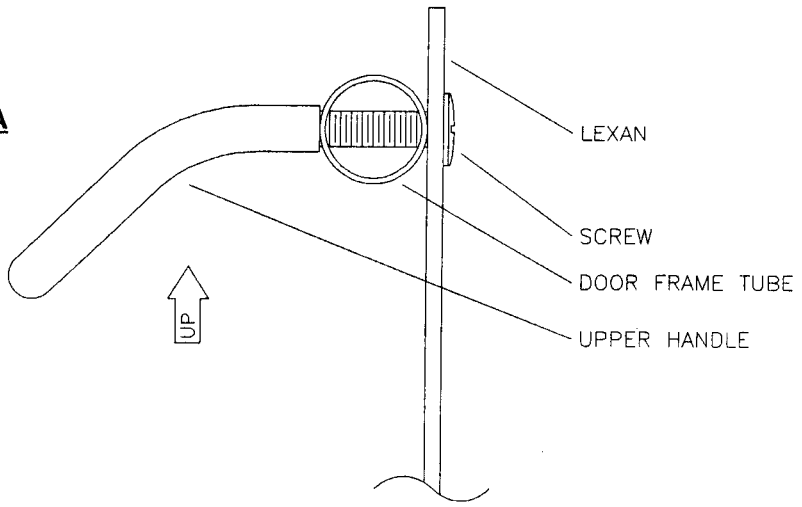
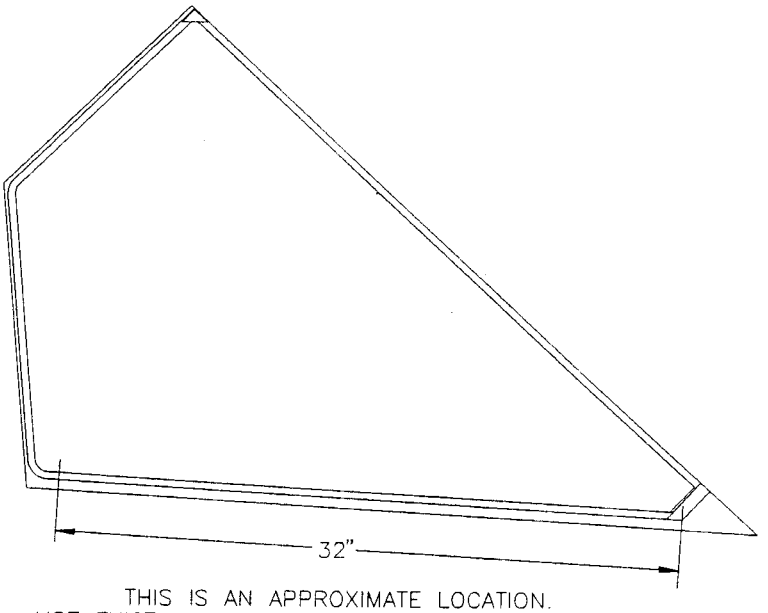


FIGURE 04B-013A



14. The lower door handle is attached to the frame using two small door handle gussets. The door handle operates best when installed 90 degrees to the face of the lexan. Locate the outside door gusset first by drilling a #30 hole 32" from the **FRONT** of the tube, see **Figure 04B-014**. This will locate the hole for the **FORWARD** rivet of the door handle gusset. Rivet the first hole and then align the gusset straight with the door frame. Drill the second hole and rivet. Drill through the lexan and the top hole of the gusset with a 3/8" diameter drill.

FIGURE 04B-014



MD355

15. Insert the outer door handle through the gusset. Place at least two 3/8" washers between the lexan and handle. After the handle is through the door slip on the spacer bushing and the remaining gusset plate. Line up the inside gusset plate so the handle is 90 degrees to the lexan. Drill and rivet the gusset plate once you are satisfied with the position.

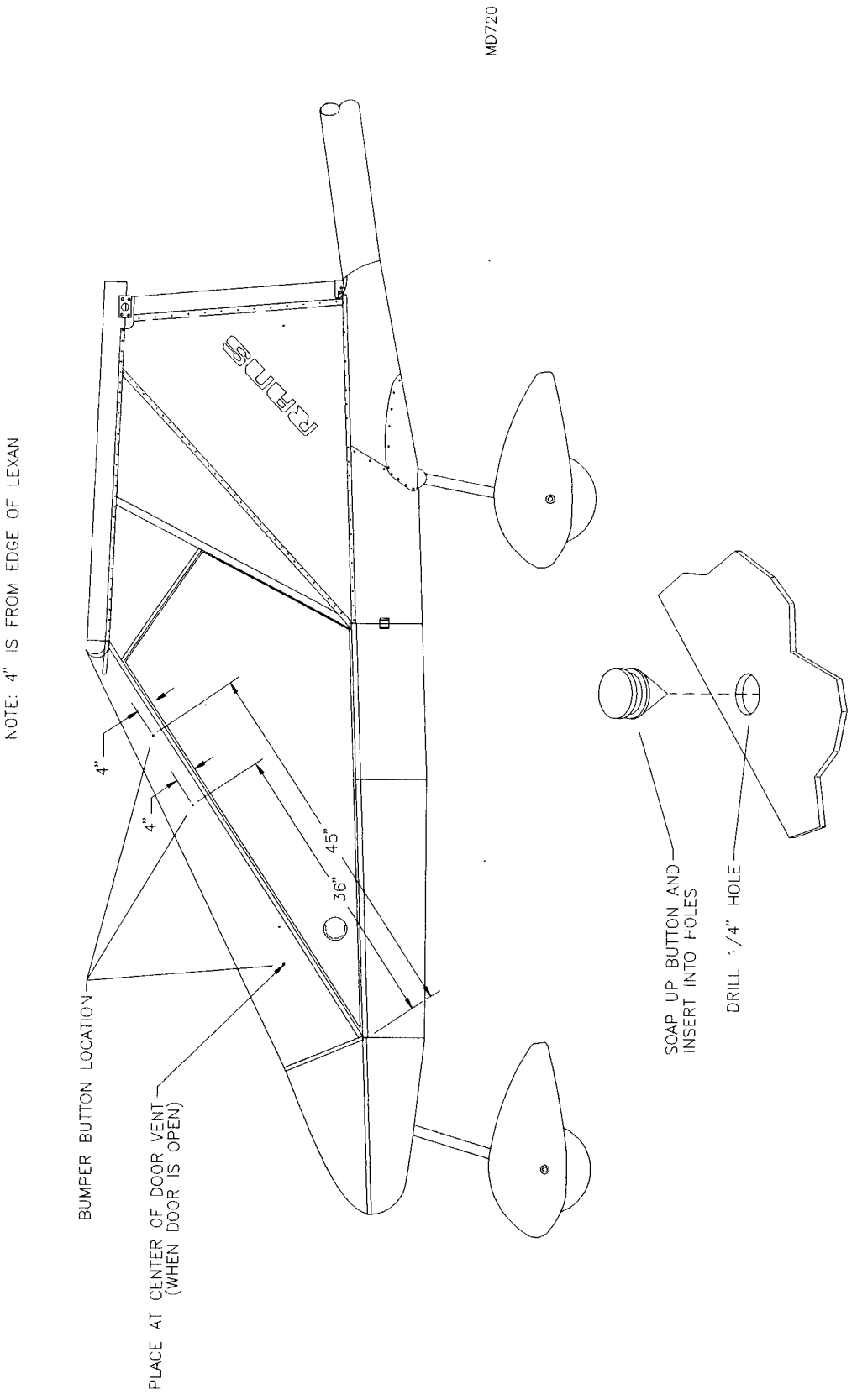
16. Insert the inner door handle into the outer door handle. Place the inside handle in a straight down position while the outer handle is pointing AFT and level with the top longeron of the cage. Drill through the handle assembly and bolt.

17. On the inside of the cabin where the handle strikes against the longeron a rub block needs to be installed. The rub block is a short segment of formed 1/4" diameter tubing. Locate the rub block so the middle depression is on the inside handle when in the vertical position. Drill #30 and rivet with 1/8" stainless steel pop rivets. With the rub block in place the door should fit tight against the sides of the cabin. If the handle is loose there is too much slack between the handles. The handle should turn with a slight amount of friction. Use 3/8" washers to adjust the friction.

18. Apply the foam rubber strip to all the edges with the exception of the hinge tube side.

19. Drill 1/4" holes in the locations on the doors and windshield as shown per side. Deburr and insert bumper buttons. Use a little soapy water to help the buttons slip into place. The buttons locate in reference to the 3/16" bolt at the lower end of the windshield tube. The edge of the windshield is used as a reference to establish the location of the bumpers from the edge. See **Figure 04B-019**.

FIGURE 04B-019

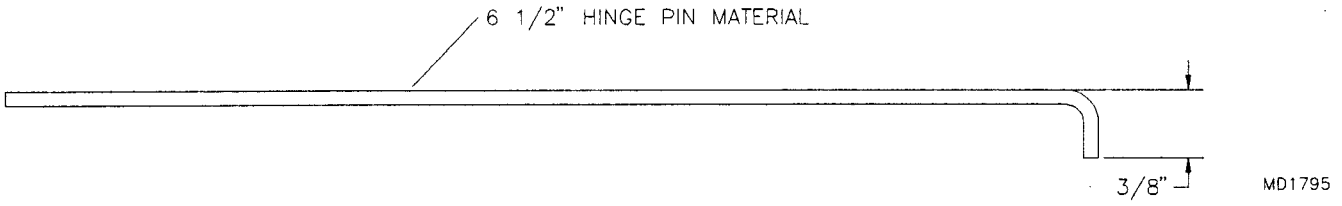


S-12 AIRAILE HALF DOOR ASSEMBLY

1. Collect the parts depicted in the parts list.

2. Locate the 24" length of hinge material and cut into four 6" pieces. Cut the stainless steel hinge pin material into four 6 1/2" pieces and bend as shown in **Figure 04B-02A.**

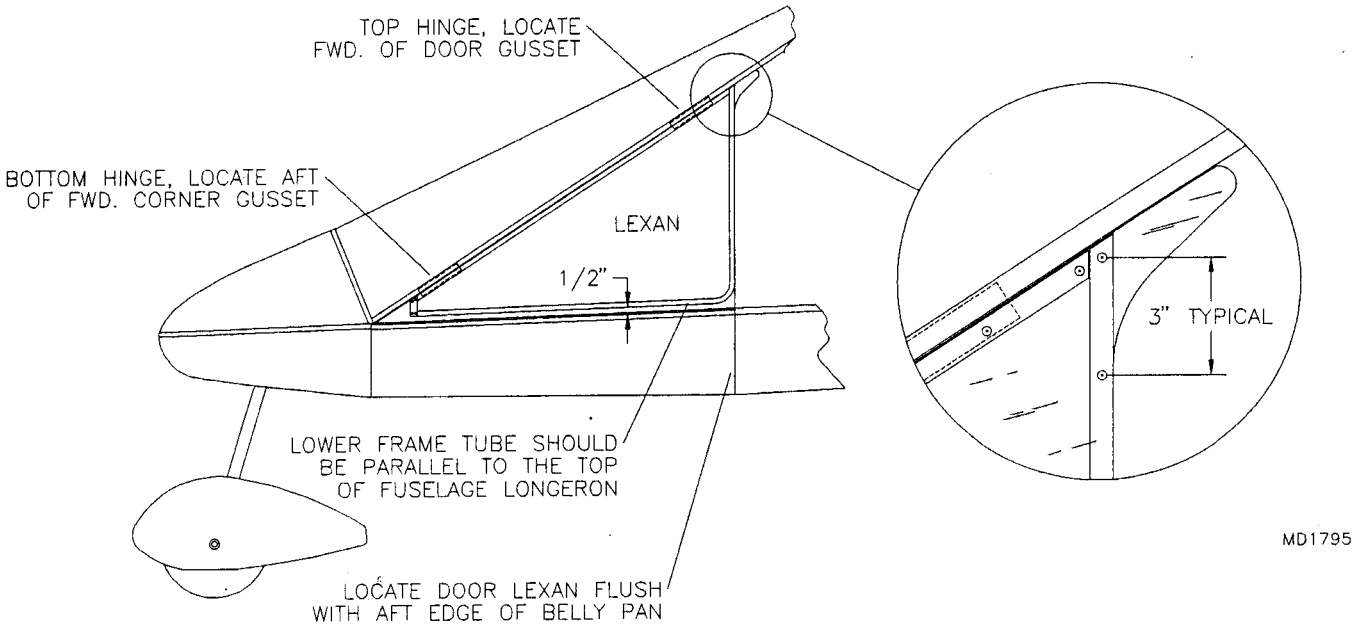
FIGURE 04B-02A



3. Remove the aluminum hinge pin material from the hinges and replace with the stainless steel hinge pin.

4. Locate the hinge tube by placing the lexan piece on the airplane as shown in **Figure 04B-04A.** Rivet the hinges to the WSST and hinge tube with stainless steel pop rivets.

FIGURE 04B-04A



5. Tape the lower frame tube in place leaving a 1/2" gap along the top longerons as shown in the illustration.

6. Locate the door gusset on both sides but only rivet on the inside. The outside will be riveted after the lexan is in place.

7. Locate the forward sleeve as shown in **Figure 04B-08** in the **Door Section**.

8. Now that the frame is in place, tape the lexan in place and layout 3" rivet spacing along the perimeter as shown in the illustration.

9. Install the latch as shown in the parts drawing 3" forward of the AFT edge of the door.

10. Stick the foam strip along the hinge tube and also to the bottom edge of the lexan as a door seal.

S-12 AIRAILE FULL ENCLOSURE ASSEMBLY

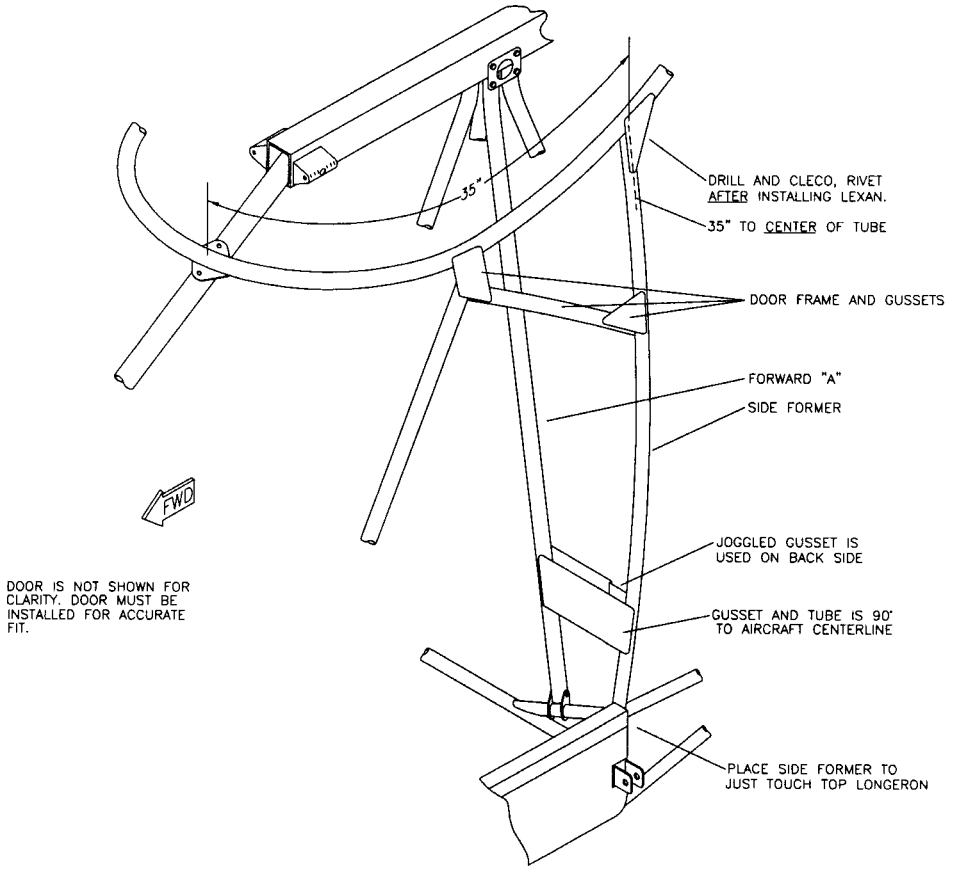
In order to install the full enclosure with the proper fit the partial enclosure and the doors must be installed. Turn to the appropriate section for instruction on these assemblies if this is not the case. If your plane is already completed and you are adding the enclosure please modify the cooling system as per the revised instructions. The coolant lines must run **INSIDE** the enclosure. This means the line must route in **FRONT** of the engine.

PLEASE NOTE: Most of the rivets in this assembly are 1/8" stainless steel. They are tough to pull with the normal hand pop rivet guns. We have tried several riveters and found one for $25.00 that will hold up through the building process. Call us if you are in need of a lasting hand riveter. You will need to buy a quart of contact cement to glue the soundproofing in place. We use the Liquid Nail brand, but just about any brand will work.

1. Collect the parts depicted in the parts drawing for assembly.

2. The side former attaches to the top windshield former tube using triangle shaped gussets. Drill and cleco the top outer gusset. The top outside gusset is riveted after the lexan is installed with the gusset on the outside. Refer to Photo #1 for details on alignment jig used to locate the side formers. The photo shows two tubes taped across the forward most "A" frame. These tubes must be long enough to more than span the width of the cockpit. Use masking tape to hold the tubes in place. The dimensions given in **Figure 04C-02** is an **ESTIMATE** and may not be the exact location. The tubes alignment jig is the best manner of locating the side formers. The bottom of the side former tube is retained using special joggled and flat gussets. The point at which this tube originates from the bottom is even with the superstructures forward "A" frames lower bolt point. **PLEASE NOTE:** The parts drawing shows exactly where to use the 1/8" stainless steel pop rivets. Please pay close attention to rivet type, size and location throughout the full enclosure assembly.

FIGURE 04C-02

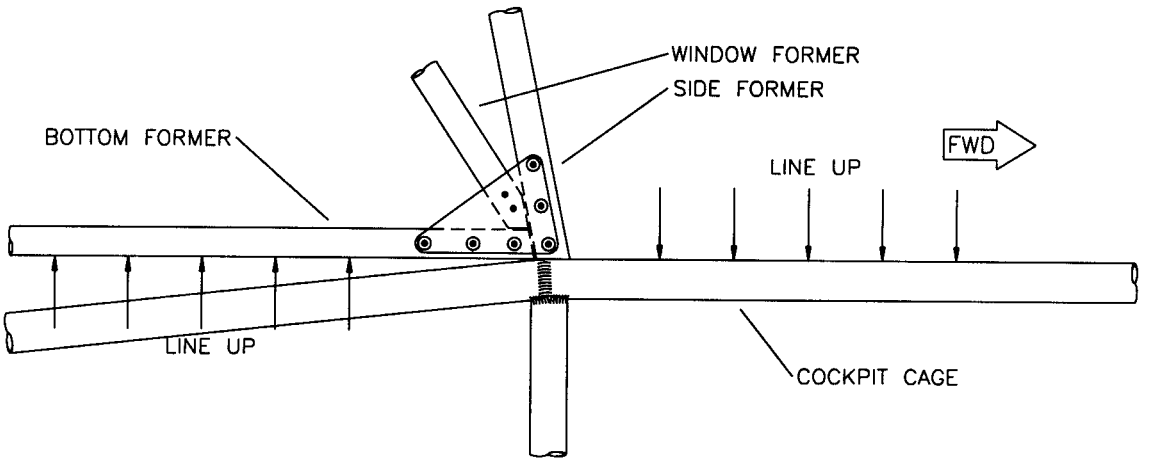


MD1863

3. If you have already installed the partial windshield the inside top gusset will need to be drilled out and removed. This gusset is replaced with the side formers door gusset. Install the door former using the door to locate. It should fit parallel to the doors top edge with an 1/8" gap between the door frame and former tube. Do not rivet the outside gussets until after the lexan has been installed. Refer to **Figure 04C-02** for location information.

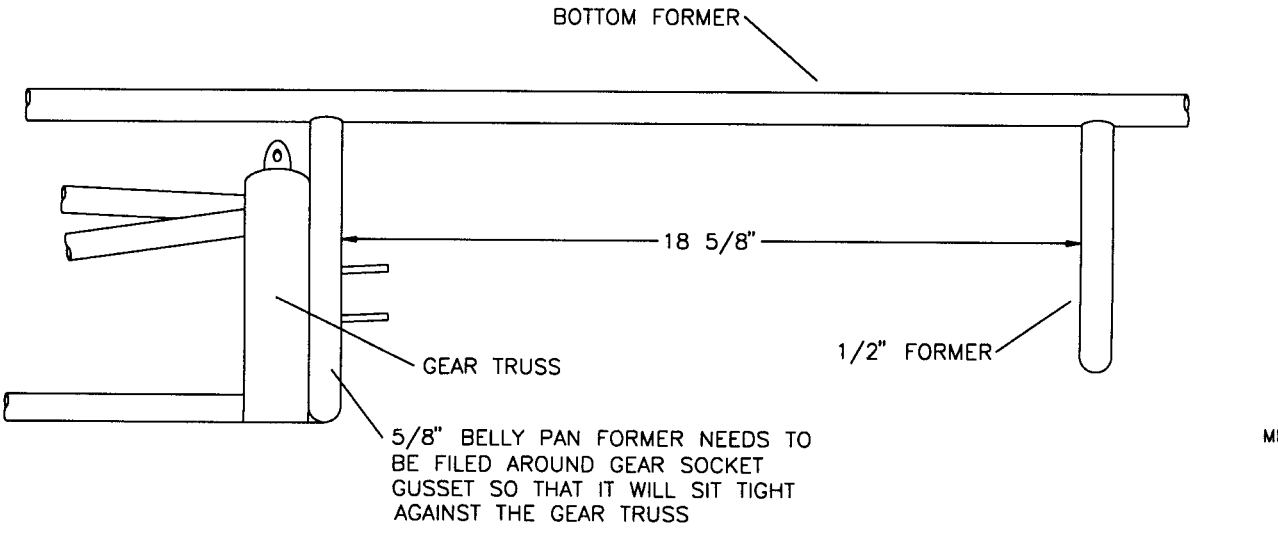
4. Next we install the bottom formers. These act as extensions of the cockpit cage top longerons. The bottom formers attach to the newly installed side former using special gussets. The rear end of the bottom formers bolt to the 1/4" bolt through the lower end of the AFT strut. **CAUTION:** When removing the 1/4" bolt through the AFT strut, support the tail boom. The bolt will resist removal if the weight of the boom is not relived and damage may result. Install the bottom former so it lines up with the top longeron of the cockpit cage as shown in **Figure 04C-04**. **IMPORTANT:** This alignment is critical to the way the skins will fit, make sure the bottom former is installed as per the drawings. No outside gusset is used to retain the bottom former, the skin will serve this purpose. Photo #2 shows the bottom formers and side formers gusset installations.

FIGURE 04C-04



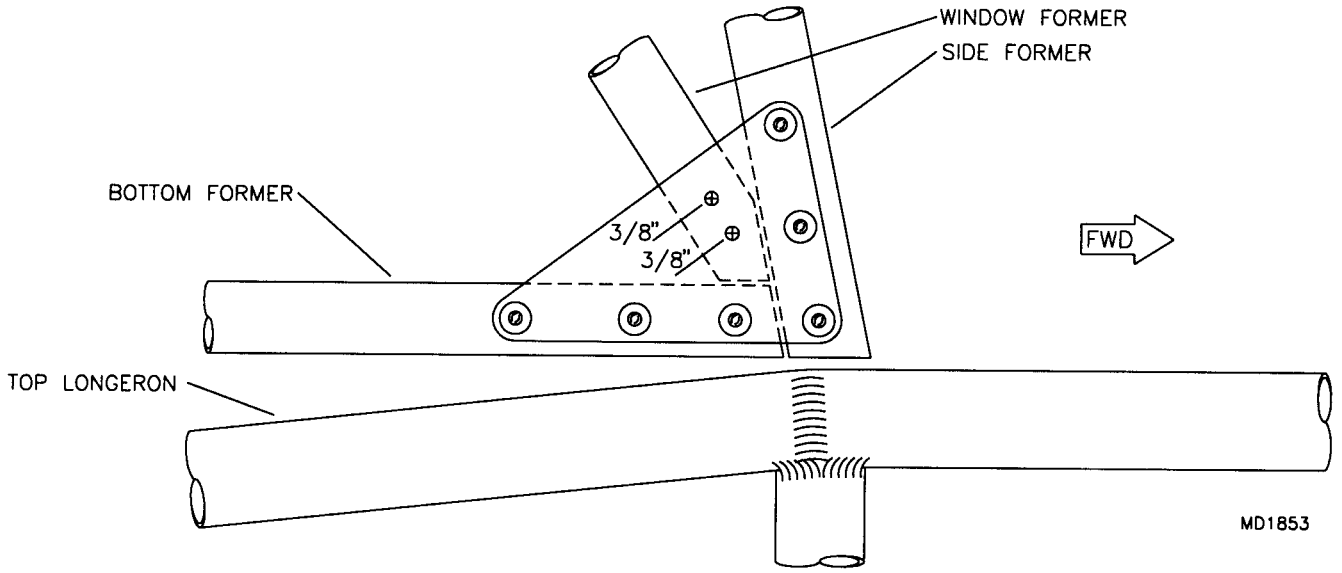
5. Locate the 5/8" belly pan former to touch against the AFT side of the main landing gear truss. See **Figure 04C-05**. Locate the 1/2" belly former with 18 5/8" between it and the 5/8" former. **HINT:** Cut two pieces of scrap lumber to 18 5/8" and use them to space the 1/2" former from the 5/8" former. Use masking tape to hold the parts in place while locating, drilling and riveting the gusset plates.

FIGURE 04C-05



6. Take the window lexan and tape it into position on the upper formers. Set the window former in place along the AFT edge of the window. Overlap the lexan onto the former at least 3/4". Locate the upper gusset, drill and rivet on the inside only. The sheet metal skin will overlap on the top of the lexan window and form the other half of the gusset. See **Figure 04C-06** for details on the lower end of the window former. The sheet metal tailcone piece overlaps on top of the lexan and is used to retain it to the window former tube. Therefore, it is not required to drill any rivet holes for the window lexan until after the sheet metal is installed.

FIGURE 04C-06



7. At this point all the formers are in place and the structure is ready for covering with the special panels of lexan and sheet metal. The bottom is covered first starting with the AFT most #5 belly pan progressing forward to the front most belly pan. All panels overlap with the next panel forward overlapping the last panel AFT with the exception of the lexan window. Trial fit the #5 belly pan to the formers by holding it in place and taping. Pre-bend and shape the #5 belly pan by bending it over a 3" tube (use for the leading edge spar). It should be tight against the formers and boom tube. After checking the panel fit, remove and apply the 1/4" wide two way tape to the outer 1/2" belly pan former. Apply the rubber trim to the AFT edge that contacts the boom tube. **CRITICAL:** The rubber trim **MUST** be used to prevent the belly pan from cutting into the boom tube. **PLEASE NOTE:** The two way tape will be used as a sound insulator between all sheet metal parts and the frame. Mix a small amount of quick setting epoxy and apply it to the bottom former tube. Tape the AFT belly pan in place and let the epoxy glue cure at least 10 minutes before removing the tape and going on to the next belly panel. Be sure the glue has set before removing the tape. Remember the glue will take longer to cure in cool temperatures.

8. Check the fit of the #4 belly pan. Once you are satisfied with the fit, drill #30 through at the pilot hole locations and cleco. Start at the middle of the bottom and work up. Mix another small amount of epoxy glue and apply it to the bottom former tube. Do not cleco the belly pan near the top, this will allow you to pull the skin away enough to apply the epoxy. While the glue is curing install the 1/8" stainless steel pop rivets.

9. Repeat the process for the #3 belly pan. Be sure to get the pan to fit tight against the formers before gluing and riveting the pan in place.

10. **PLEASE NOTE:** Refer to the parts drawing for the #2 belly pan for parts selection. Before installing the #2 belly pan the #1 belly pan must be partially unassembled to allow it to fit between the frame and #1 belly pan. If this is a new assembly and the #1 belly pan is not installed ignore the

following. Drill out the rivets retaining the belly pan top channels but leave the very front bolted. Also, drill out the four "Z" strips used to retain the pan to station two. This will allow the #1 belly pan to be "pulled" out of the way for the #2 belly pan. Apply two way tape where the #2 belly pan will contact the frame. Open your manual to the first two pages of the partial pod assembly instructions. Therein, is described how to make a plywood platform used to press the #1 belly pan against the frame. This same device is to be used to install the #2 belly pan. Place the pan on the frame to check the fit. Place the plywood plate under the #2 pan. Tape in place once the best location is determined. Place the #2 bellypan top channels in place and rivet the #2 and #3 pans together. Rivet on the top channels. **PLEASE NOTE:** The rivets used to attach the top channels are 1/8" **ALUMINUM**. Find the 8" "Z" strips and locate the holes evenly spaced for four 1/8" rivets in each strip. Remove the plywood pressure platform and locate the two "Z" strips centered on the front side of each seat bay on station three. Station three is the bulkhead at the strut attach point. If the seats are installed they will have to be removed for this step. Use the "Z" strips to locate the holes through the belly pan. Use 1/8" aluminum pop rivets to retain the "Z" strips. Install the #1 belly pan as per instructions in the partial pod section.

11. Tape the lexan window in place on the frame so the edges are lined up with the frame. Locate the top and lower gussets on the outer surface of the lexan. Drill #30 and cleco. Locate a #30 hole every three inches along the top and front edge of the lexan starting at the top gusset. Do not locate holes on the AFT edge, the AFT sheet metal is pilot drilled and will locate these holes when it is installed. Remove the lexan, debur and clear the debris away between the frame and the lexan. Cleco the lexan window back in place.

12. Tape the upper rear panels in position using masking tape. Place the panels so the left panel overlaps the right panel. Drill through all pilot hole locations #30 and cleco. Before removing the rear upper panels mark around the inside perimeter with a felt tip marker. This is to outline where the fabric soundproofing panels will be glued in place. Remove the panel, debur and remove debris. Apply the contact cement with a wide putty knife to both the fabric back side and inside of the rear upper panels. Keep the glue within the marked edges of the rear upper panels. Once the cement is dry, very carefully lay the fabric panels is place. Smooth out with your hands to assure an even contact throughout the surface. The small pocket is provided as a convenient place to display the airworthiness certificate.

13. Install two way tape to the edges where the rear upper panels will contact the frame. Peel the backing off the two way tape and install the panels using the 1/8" stainless steel pop rivets.

14. Install the upper rear panel stabilizer tubes as shown in **Figure 04C-014** and **Figure 04C-014A.** These are used to keep the upper rear panels from drumming in the slipstream. The stabilizer tubes are retained to the formers with a single 3/16" rivet.

FIGURE 04C-014

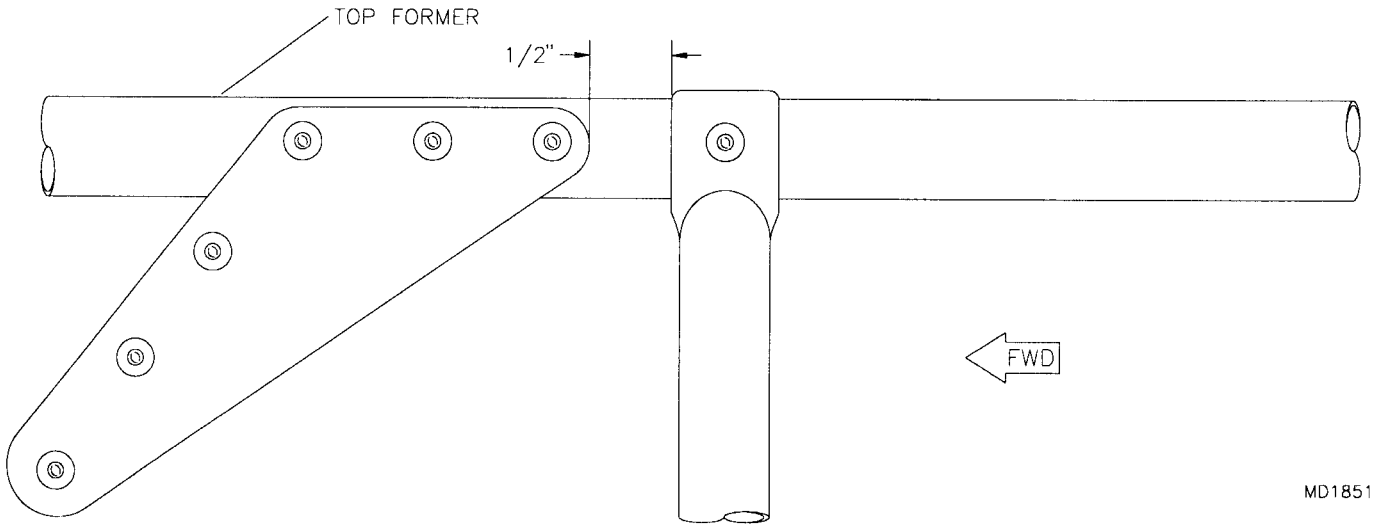
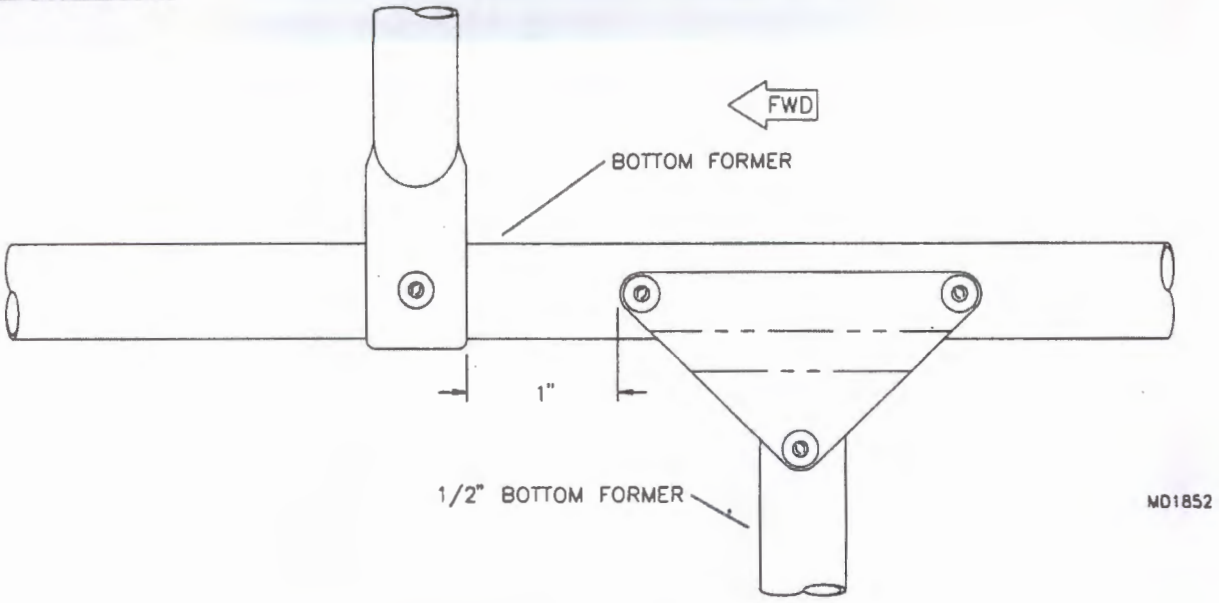


FIGURE 04C-014A



15. At this point the full enclosure should be complete with the exception of a paint job. The sheet metal used in the full enclosure is alclad aluminum and can be left in the natural form. If you decide to paint be sure you select a finish that is recommended for aluminum.

Photo 1
Build an alignment jig from straight tubes or boards. This will assure perfect alignment of the side tubes.

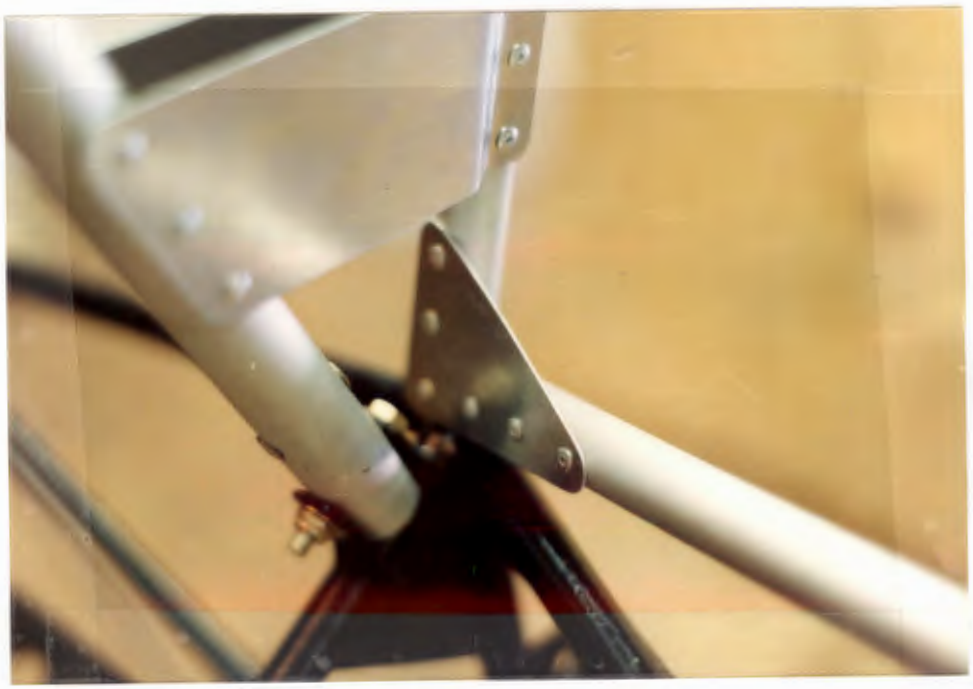


Photo 2

This is a view of the side former bottom gusset and bottom former tube. Note the gusset must be riveted **BEFORE THE JOGGLED GUSSET**.

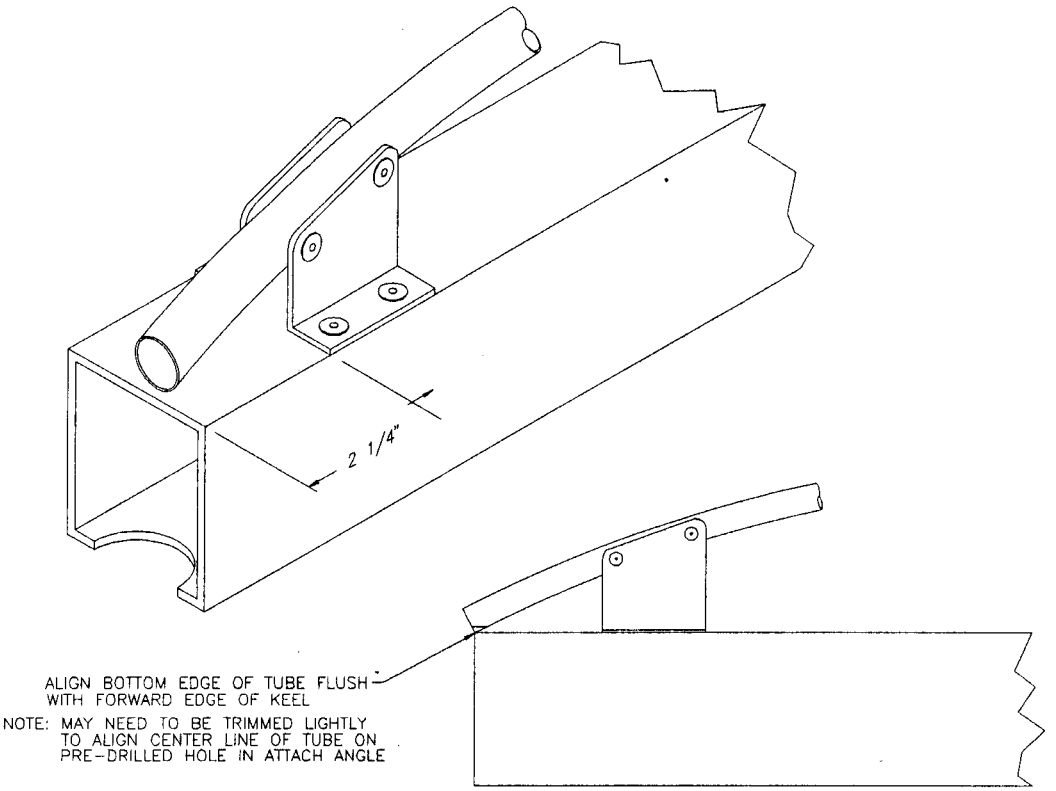
S-12 AIRAILE CENTER COVER INSTALLATION

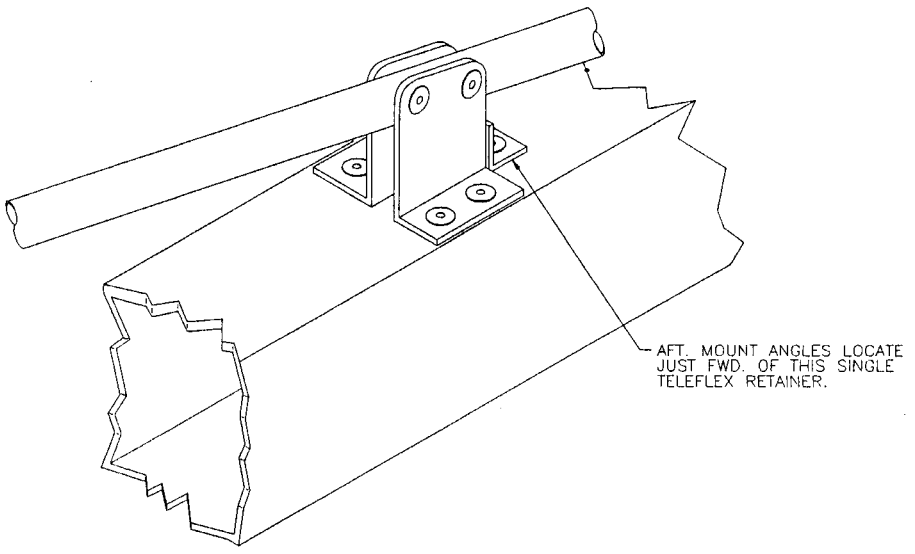
1. Collect the parts depicted in the parts drawing of the center cover.

2. Locate the four mount angles as shown in the parts drawing. Locate and pop rivet the rib in place as shown, flush with the FWD edge of the keel.

3. Locate the forward center cover. (**HINT:** It will be a great help when placing the center cover if you have a mock up spar a foot long or so), or if the room is available use the wings. The cover needs to be trimmed to fit up against the top tube former side tube gusset. Use the brass backing washers when riveting. Use 1 1/2" spacing.

4. Locate the AFT center cover, rivet the center rib along the pre-drilled holes. The AFT center cover is left long for trimming for engine installation





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S-12 AIRAILE VERTICAL STABILIZER ASSEMBLY

PLEASE NOTE: The tail boom must be assembled to the fuselage prior to this step. The rudder must also be assembled with or without the covering installed. Refer to the applicable sections for assembly instructions.

1. Begin assembly by selecting all the parts shown in the parts drawing. You will be working with the fabric covering for the vertical stabilizer. The fabric can be soiled by sweaty hands and dirty tools. Once it is soiled it will be **VERY** hard to clean the fabric. Make sure your hands and tools are **REALLY** clean before installing the fabric cover. Some builders use white gloves, which makes it a little more trouble but the end result is clean. We stress to clean the tools used in skinning. Spray them down with a strong degreaser type cleaner such as "409". Do it twice, just in case! Handle the fabric by the velco gap seals when you really need to pull.

2. Insert the 1" end caps into the forward end of the vertical stabilizer leading edge and into the top of the vertical stabilizer spar. Drill out the #11 hole to 1/4" at the top of the spar for the 1/4" hinge bolt. See the parts drawing for hole location. Rivet the cap with a single 3/32" aluminum pop rivet. Locate the rivet about 1/8" from the tube's edge on the left or right side.

3. Locate and rivet a 3/16" nut plate onto the **INSIDE** edge of the vertical stabilizer's leading edge at the 3/16" hole located 35 3/8" from the lower end. Use 3/32" rivets for all nut plate attachments. Locate the second nut plate on the **FORWARD** edge of the vertical stabilizer spar at the hole located 16" from the top. Now rivet the 3/16" thick washers to the leading edge tube, spreader tube, and spar using 3/16" aluminum rivets to form the "buttons". See the parts drawing for button locations. The buttons (along with the nut plate on the AFT side of the leading edge tube) are used to hold the 1/2" internal brace tubes in place.

4. Install the 1" compression fitting to the top end of the leading edge by inserting a 1/4" bolt through from the saddle side. Use the 1/4" bolt to hold the insert nut in position while attaching to the leading edge tube. Screw the I-Nut onto the bolt and insert the I-Nut into the tube and bolt in place with an AN3-13A bolt. Once the 3/16" bolt is through the I-Nut, push on the TC-1. Make sure the TC-1 is in a vertical position to accept the spar. Remove the 1/4" bolt.

5. Locate an AN4-15A bolt and stainless steel hinge. Drill out the hinge mounting hole to 1/4". Apply a small dab of loctite to the threads and bolt the spar, hinge, and leading edge together as shown in the parts drawing. Apply a light coat of grease over the stub on the tail boom extension. Attach the rudder to the vertical fin spar using 3/16" bolts, but do not use rivets at this time. You may notice the spar will need to be moved up or down over the stub to get the hinges spacing perfect. Once you have found the best position, clamp the vertical spar tube at the base with a welder's vise grip type "C" clamp. Drill out the 1/8" pilot hole to 3/16". Remove the rudder assembly. Install an S2-SAB to the front side of the vertical fin spar. Bolt the spreader tube to the S2-SAB with two-holed end to the AFT. Bolt the long wing channel to the front end of the spreader tube, but only finger tighten the nut. Take the four remaining S2-SAB attach brackets and drill out the 3/16" holes to 1/4" diameter. Attach the S2-SAB's to the bottom spreader tube on the vertical stabilizer.

6. With the channel and spreader tube laying flat and centered on the boom, drill through the two open holes on the bottom of the channel. Rivet with stainless steel pop rivets. Unbolt the spreader tube from the channel and drill and rivet the remaining hole in the bottom of the channel.

7. Put the leading edge tube in place on the forward hole in the channel. The plastic lower end cap will have to be filed slightly to insure a good fit. Re-bolt the spreader tube into the long wing channel. Install a boom strap on each side of the long wing channel where the leading edge tube is bolted. With the boom straps in place, drill and rivet with 3/16" stainless steel pop rivets. **PLEASE NOTE:** Remove any burrs between the boom tube and boom straps prior to riveting.

8. Cut and fit the internal brace tubes from the 1/2" aluminum tube stock provided as follows:

PART #	LENGTH	QTY
TG-IB-FV	26"	1
TG-IB-V	19 1/8"	1
TG-IB-VL	12 7/8"	1

Crimp the 19 1/8" TG-IB-V forward end in a vice so it will fit better onto the nut plate. See **Figure 05-08.** File the required angle into the opposite end for the best fit over the "button". "Fish mouth" the top end of the 26" tube to fit into the top joint. See **Figure 05-08A.** File the correct angle to match fit on the bottom button.

FIGURE 05-08

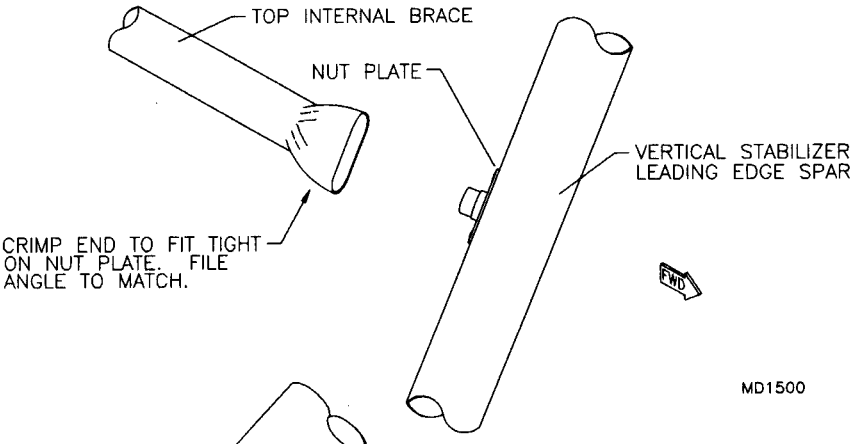
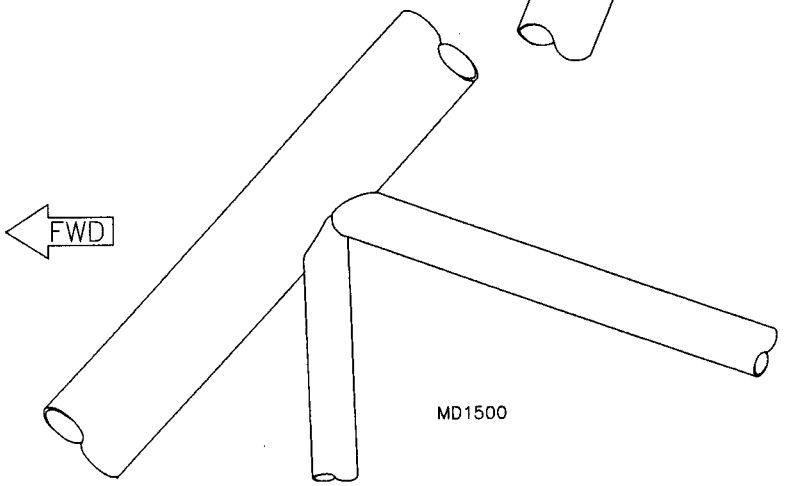


FIGURE 05-08A



9. To better shape the vertical stabilizer, pre-formed ribs of ABS plastic are provided. Trim out each rib leaving a 3/4" flange, being careful not to trim off the attach tab on the trailing edge of each rib, see **Figure 05-09.** For clearance of the 1/2" internal braces cut out the oblong and circular depressions in the bottom rib leaving a 1/4" flange on each. Aircraft snips, files and sanding blocks work well for trimming out and finishing out each rib. Locate each rib according to the dimensions shown in **Figure 05-09A.** **NOTE:** It is important that the ribs are located parallel to the spreader tube and snug against each tube while ensuring clearance for the 1/2" internal braces. Once the ribs are in place, locate (1) #30 hole in each end of each rib and rivet as shown in **Figure 05-09A.** **NOTE:** Since the pre-formed ribs are made of black plastic it is a good idea to cover the edges of the ribs with vinyl tape similar to the color of the sailcloth covers. This will keep the ribs from leaving a dark line on the skin which is especially noticable after clear coating.

FIGURE 05-09

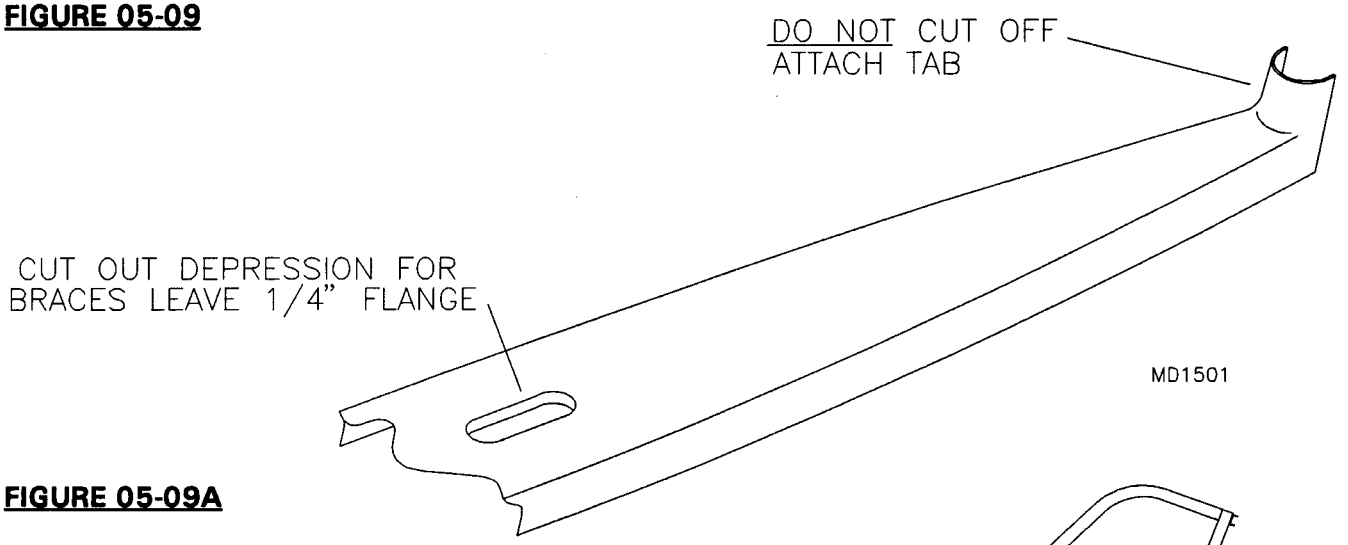
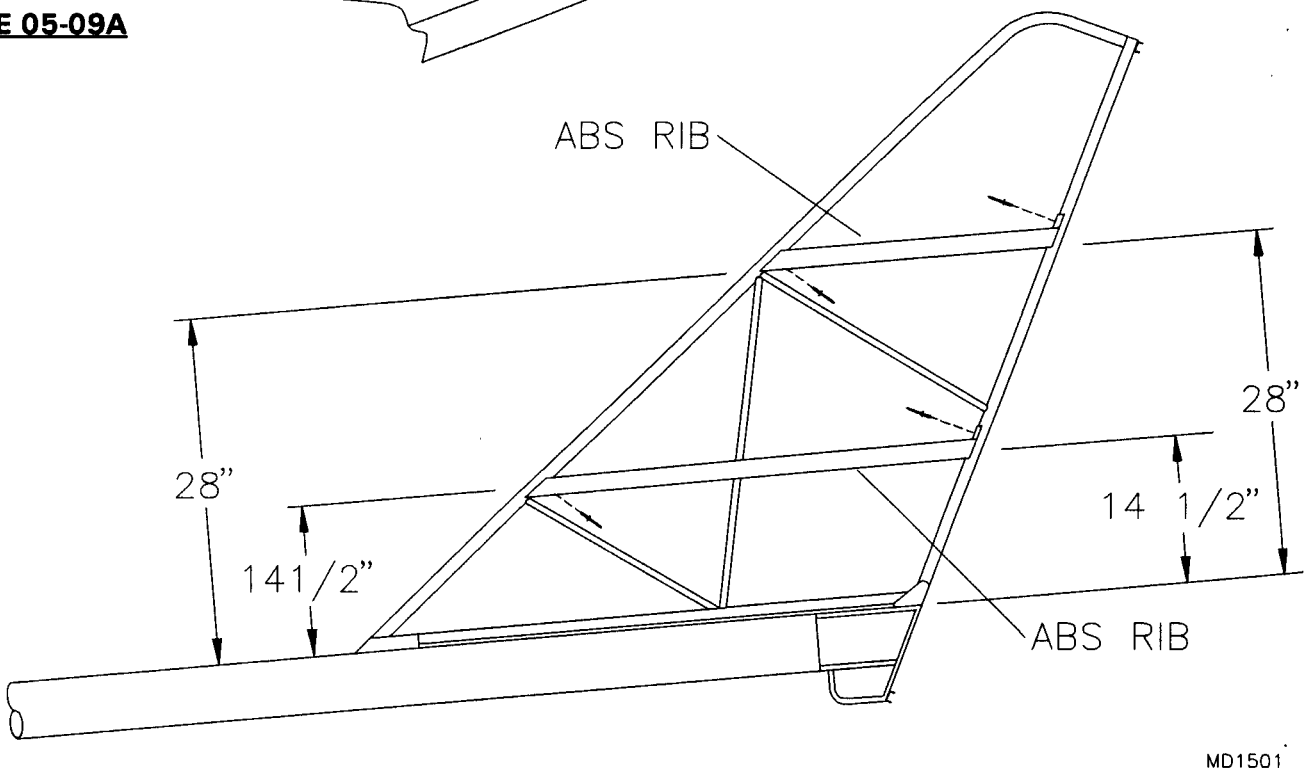


FIGURE 05-09A



10. At this point you are ready to cover the vertical stabilizer. For the cleanest results, wash your hands and dust off the vertical fin frame work prior to covering.

11. Slip the cover over the top of the fin, gently pulling it into place. The cover will not go all the way down until the small rope is laced and drawn tight. Slip the lacing wire into the pockets sewn into the bottom of the covering from the front. Trim the wires after the lacing is complete. With the wires in place mark out where to melt through as shown in **Figure 05-011**. Use a flat tipped soldering iron to make holes about 1/16" X 5/16" placed vertically and just touching the wire as it rests in the bottom of the sleeve. Lace the rope as shown in **Figure 05-011A**. **HINT:** Use the soldering iron to melt the rope's tip into a flat shape for easier insertion into the slots. Once the rope is laced you can start pulling out the wrinkles and working the skin into its proper position. The skin should end up smooth and wrinke free with about a 1/16" to 1/8" space at the bottom. Once you are happy with the position of the skin, cover up the lacing by closing the flaps sewn into the skin.

FIGURE 05-011

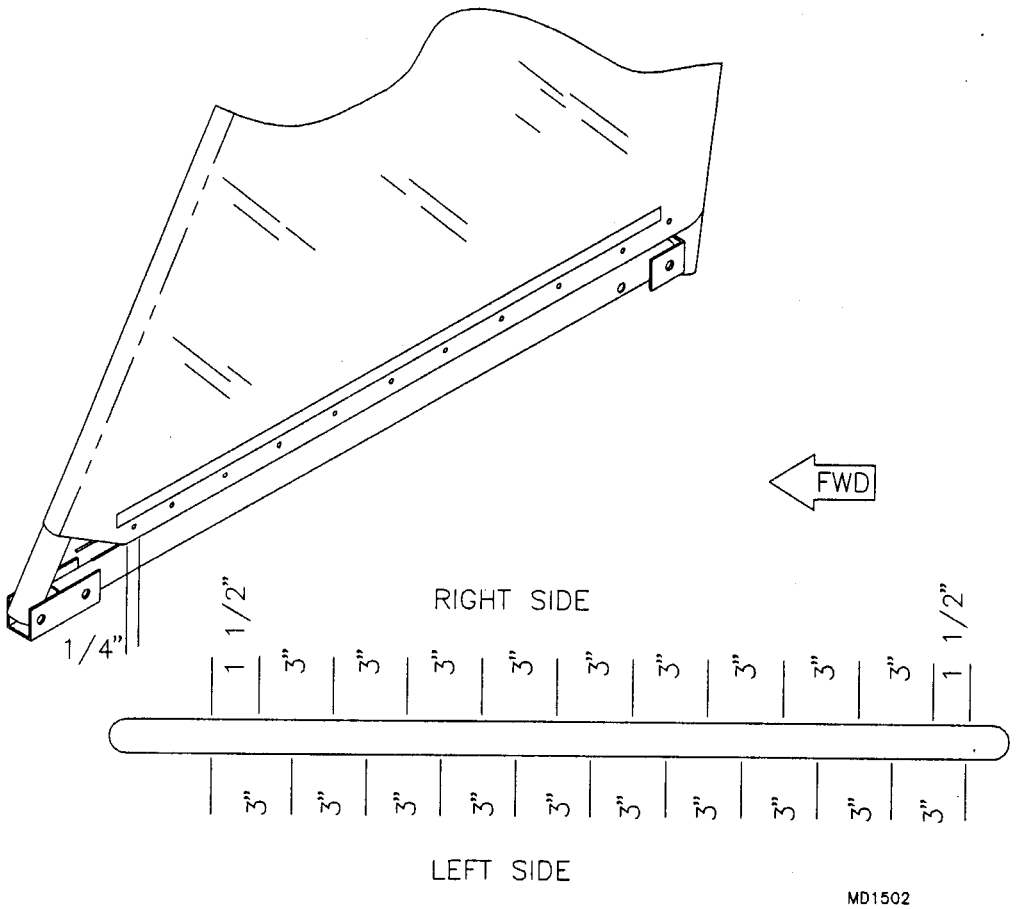
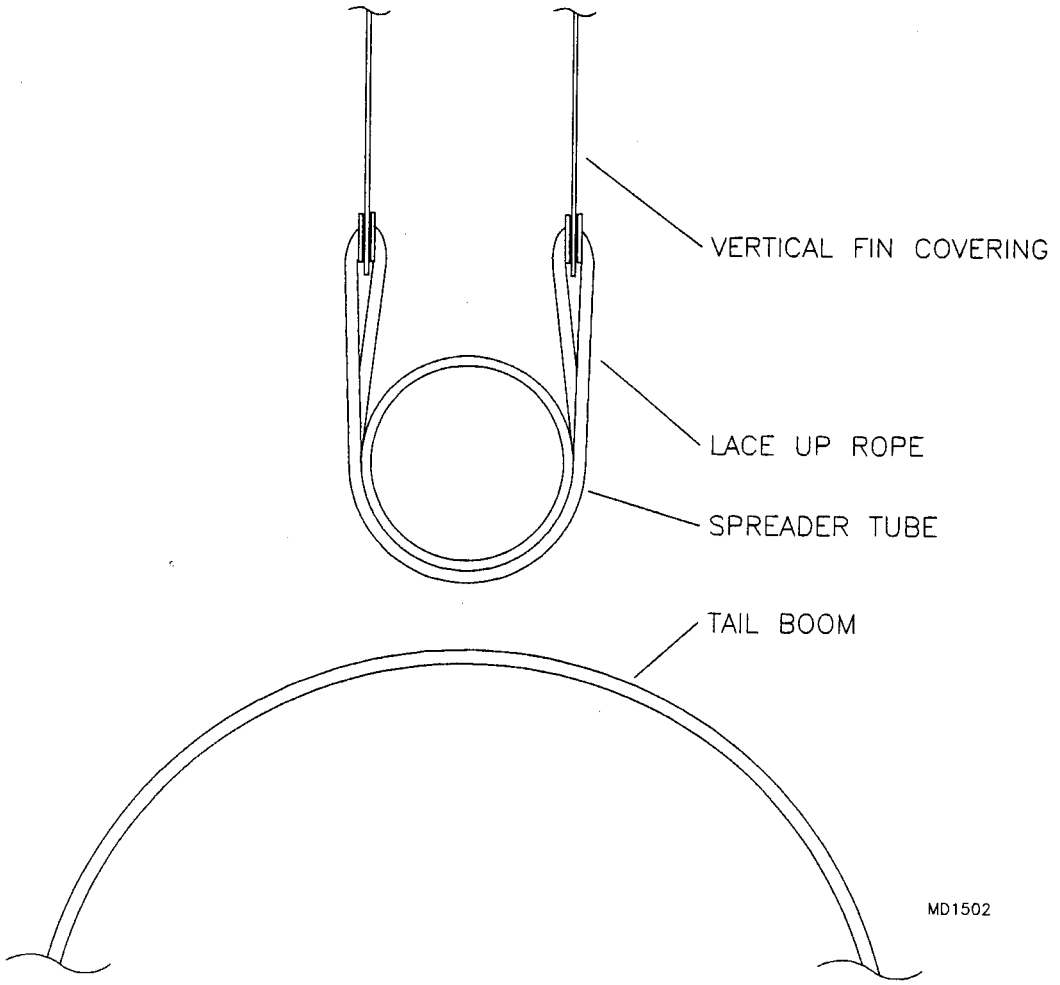


FIGURE 05-011A



S-12 AIRAILE HORIZONTAL STABILIZER & ELEVATOR ASSEMBLY

1. Select the parts depicted on the parts page for assembly.

2. Rivet the 3/16" nut plates to the elevator trailing edge (for the horn attachment) and to the horizontal stabilizer spar and leading edge.

3. Pre-assemble the TC-1's to their respective locations. Pay close attention to the bolt head orientation. Drill the leading edge and spar tubes out to 1/4" in the locations shown in the parts drawing. Assemble the frame and cut and fit the internal bracing tubes. Cut and fit the internal brace tubes from the 1/2" aluminum tube stock provided.

PART #	LENGTH	QTY
TG-IB-D	22 1/4"	2
TG-IB-H15	21"	2
TG-IB-E	13"	2

Refer to details on fitting tubes in the vertical stabilizer section.

4. The horizontal stabilizer features an inverted airfoil. This airfoil is made by pre-formed ABS plastic ribs. Trim out the ribs as shown in **Figure 05A-04A**. For clearance of the 1/2" internal brace tubes, make sure to cut out the oblong depression in the inboard ribs leaving a 1/4" flange. Locate each rib according to the reference dimensions shown in **Figure 05A-04**. **NOTE:** The airfoil shape should be on the bottom of the stabilizer with the flange of the rib facing inboard. As stated in the vertical stabilizer section it is more important that the ribs are located parallel to the spreader tube and snug against each tube than to hold these exact dimensions. Once happy with the fit of each rib, locate (1) #30 hole in each end of each rib and rivet as shown in **Figure 05A-04**.

FIGURE 05A-04

Ⓐ = TG-IB-D 22.5"
Ⓑ = TG-IB-H-15 21.0"

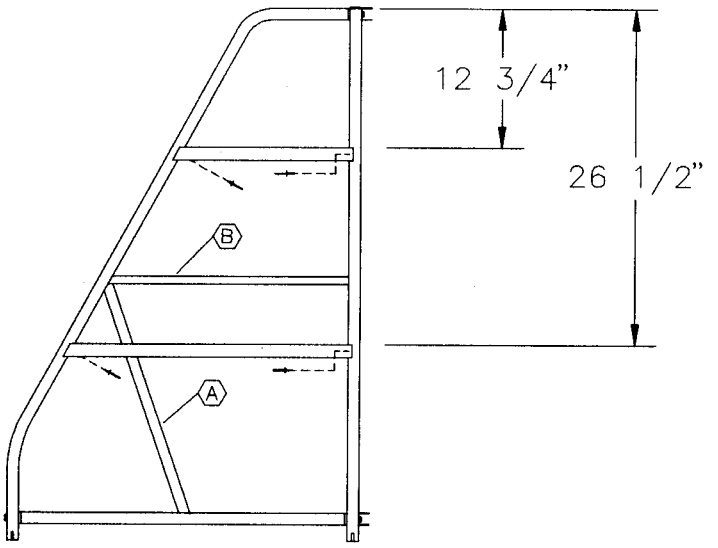
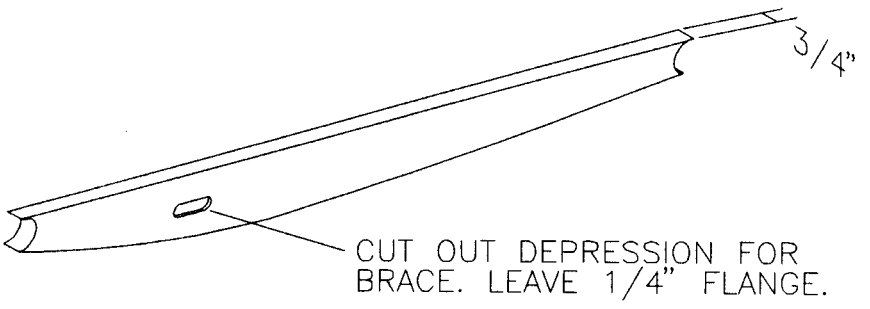


FIGURE 05A-04A



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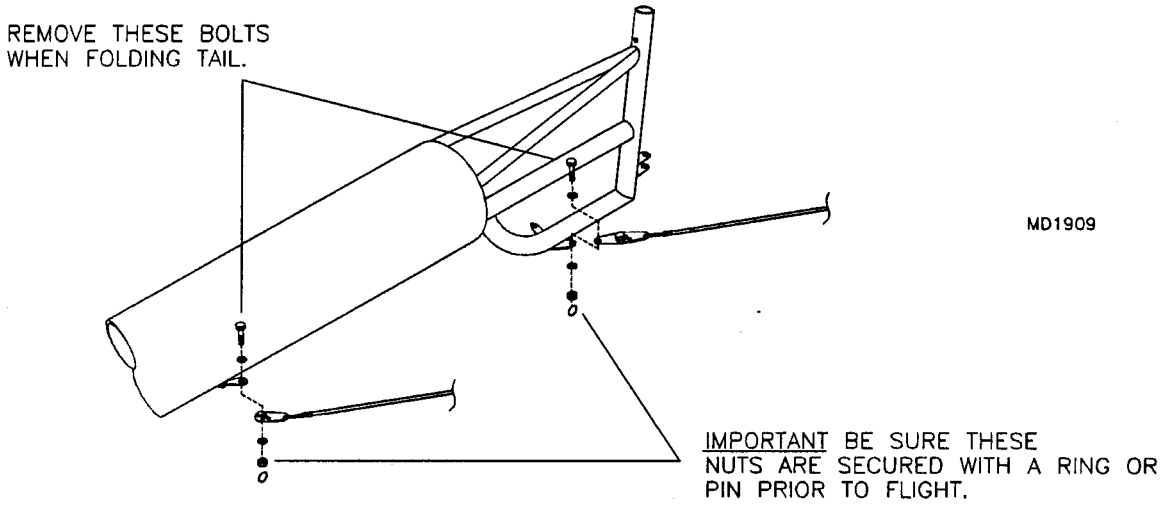
5. Clean everything; your tools, the table and your hands. Use a carpeted floor or work bench for tail covering. Cover the elevator using the methods shown in the rudder section. Keep the elevator horn installed and insert the internal brace from the elevator top side. Install the lacing cord and wire to the horizontal stabilizer using the same methods discussed in the vertical stabilizer section. Locate holes for the lacing rope about every three inches. **NOTE:** Be sure to install elevator horns LH and RH with the correct edge forward.

6. Poke through the fabric with a hot knife at the cable bolt locations. The tail should be complete and ready for assembly to the fuselage.

7. Install the horizontal stabilizer on the two S2-SAB's on the vertical fin. They should fit between the brackets without forcing. If they do not align it is okay to slot the 1/4" holes FWD and AFT as required.

8. The S-12 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. 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 after bolting them in place and bending them to the exact angle with your hand. The tang will have a tendency to bend at the inner most hole. Try to bend the tangs beyond the holes. Avoid using a pliers, as this may cause stress risers. Refer to **Figure 05A-08** for exact set up details. The cable tension on the tail cables is set by pushing down at the intersection of the cable and tail. The tension should be enough to yield a nice low note when strummed. With this system you probably cannot get the cables too tight, too loose is more likely. This will be apparent during flight. The cables will tend to vibrate and shake. **PLEASE NOTE:** Tension the cables so they are stable in flight.

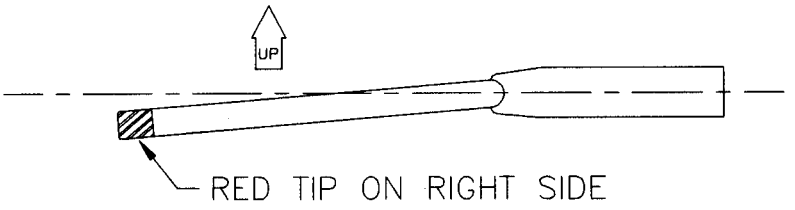
FIGURE 05A-08



9. With the horizontal and vertical stabilizers fitted to the aircraft, you are now ready to attach the elevator to the tail. Bolt the elevators to their respective sides with the elevator horns pointing down. Check for freedon of movement, the elevator should move up and down freely.

10. Now the 1 1/4" push pull tube (PPT) needs to be installed and the yoke bolted in place. Install the yoke so the red tip is on the **RIGHT** side of the aircraft. This is important because the yoke has a slight bend in it when viewed from the side. See **Figure 05A-010**. Check your yoke so the red end is definitely on the right. It is possible we could have painted the wrong end so please verify. The bend is required to lift up the push pull tube so it will clear the tail boom extension. Apply a light film of grease to the push pull tube and bolt the yoke to the tube. **NOTE:** It may be required to chase out the bolt hole with a #11 drill to get the bolt to fit.

FIGURE 05A-010



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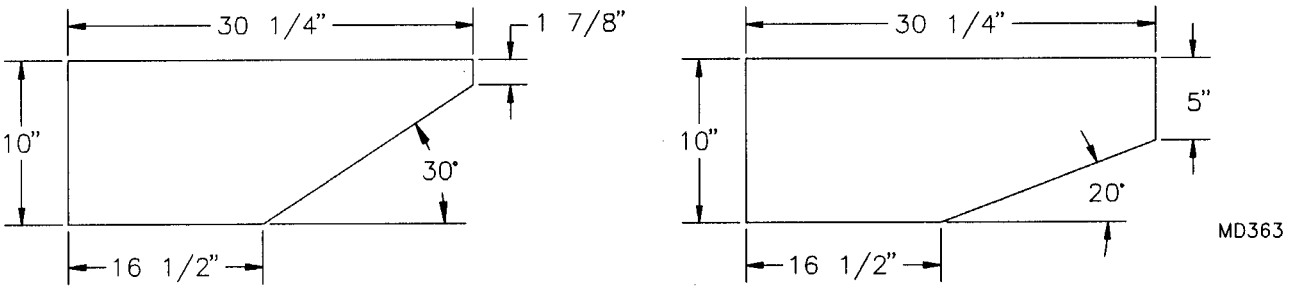
11. Cut out the (2) templates from cardboard. See **Figure 05A-011.**

FIGURE 05A-011



12. Hold the 20 degree template under the elevator flat against the horizontal stabilizer (be sure the control stick is against the stop). Adjust the rod ends until the template fits with both horizontal stabilizer and elevator flat against the template. Check for evenness of the elevators. They should be flat across each other and not one lower or higher than the other.

13. The 3/4" X .058 X 1 1/2" aluminum tube that was slipped over the 5/8" push pull tube during step #12 of the control stick assembly, will now be used as an up elevator stop. Using the #30 template, hold the elevator in position with the safety belts. Slide the stop against the swivel tube (built into the S-3) and drill and rivet with the rivet positioned on the top side. **IMPORTANT:** Please use a 1/8" stainless steel rivet. Check the system for proper movement. Be sure the **loc rings** are through the 1/4" bolt attaching the horns to the yoke. (Check this prior to each flight.)

S-12 AIRAILE RUDDER INSTALLATION

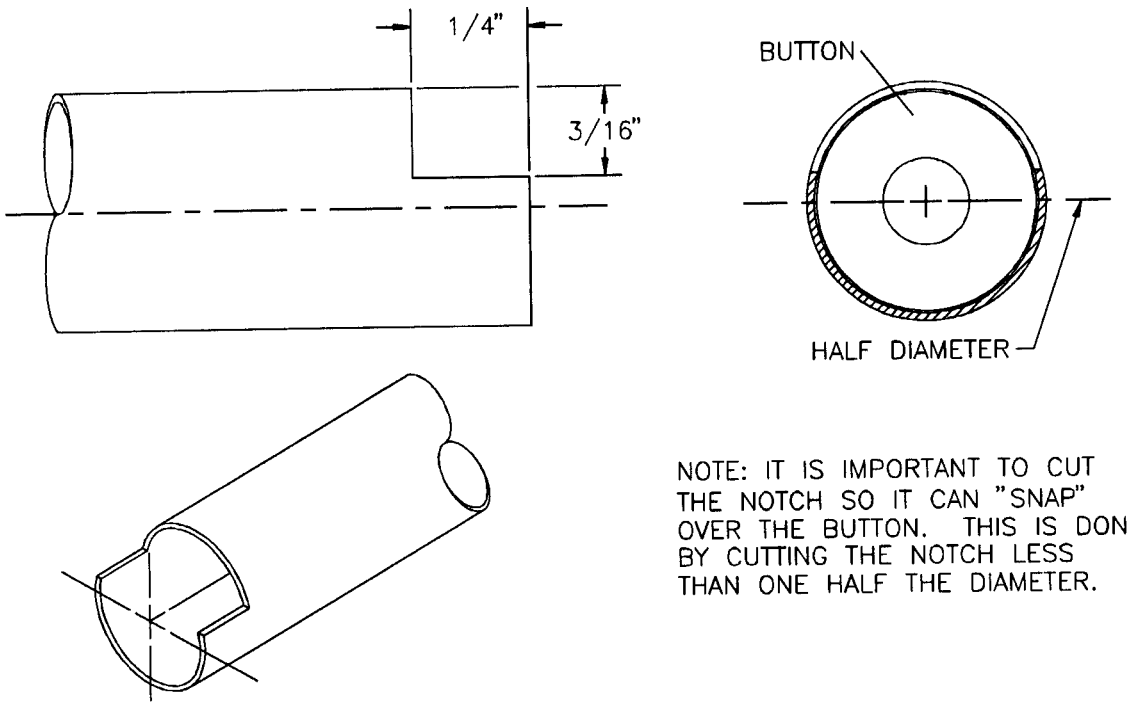
1. Assembly and skinning of the rudder is shown in the following diagrams. (The tools illustrated can be very helpful in assembly. Build these if you plan on doing more than one aircraft. Otherwise sticks and ropes can be used to the same effect.) Pre-assemble the TC-1's to their respective locations. Pay close attention to the bolt head orientation. Drill the rudder spar tube out to 1/4" in the locations shown in the parts drawing and rivet the 3/16" nut plate to the spar.

2. Assemble the frame. Cut and fit the internal bracing tubes after installing the rivet buttons. Cut and fit the internal brace tubes from the 1/2" aluminum tube stock provided as follows:

Part #	Length	Qty
TG-IB-R	15"	2

Notch one end of each tube as shown in **Figure 05B-02.**

FIGURE 05B-02

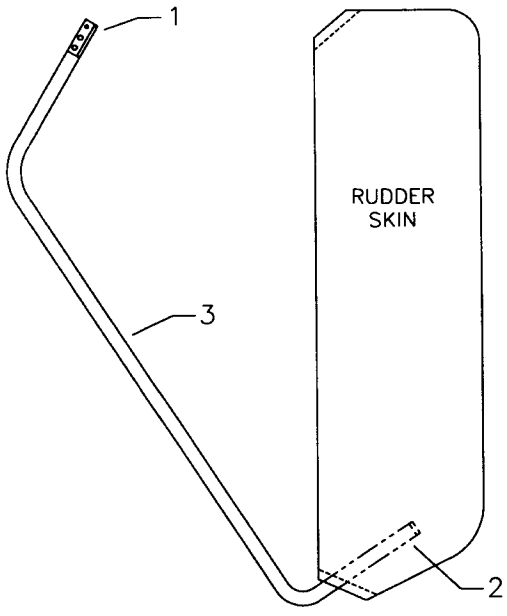


3. Assemble the completed rudder to the vertical stabilizer, **AFTER** the vertical stabilizer is attached to the tail boom.

4. Attach the rudder cable tangs to the rudder horns in the best hole for rudder and rudder pedal alignment. **IMPORTANT:** Bend the rudder cable tangs midway to angle toward the cable pulley. Check for smooth operation. **DO NOT** over-tighten the tangs to the horns.

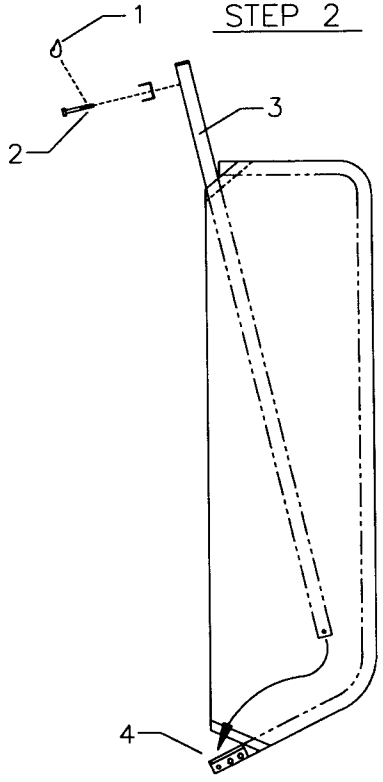
WARNING: Check the cotter pin in the rudder control horn bolt before each flight. Flying off of grass could cause the cotter pin to dislocate.

STEP 1



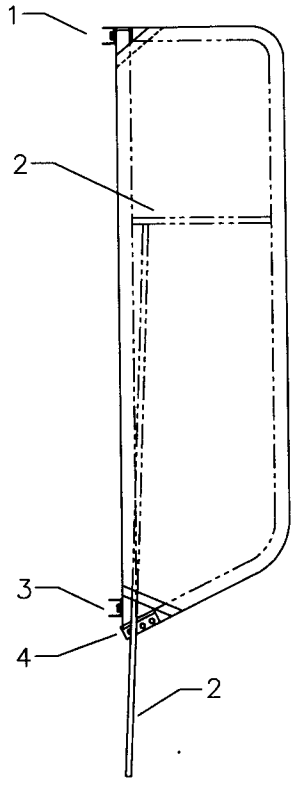
1. ASSEMBLE ONE HALF OF RUDDER HORN.
2. ASSEMBLE END FITTING TC-1.
3. RUDDER TRAILING EDGE

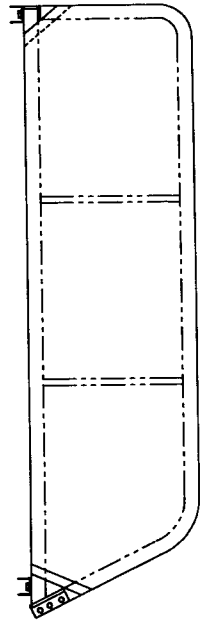
STEP 2



1. LOCTITE THE 1/4" HINGE BOLT.
2. HINGE BOLT AND HINGE
3. RUDDER SPAR
4. INSERT SPAR, POP OVER LOWER END OF TRAILING EDGE USING A LARGE FLAT HEAD SCREWDRIVER FOR A LEVER.

STEP 3



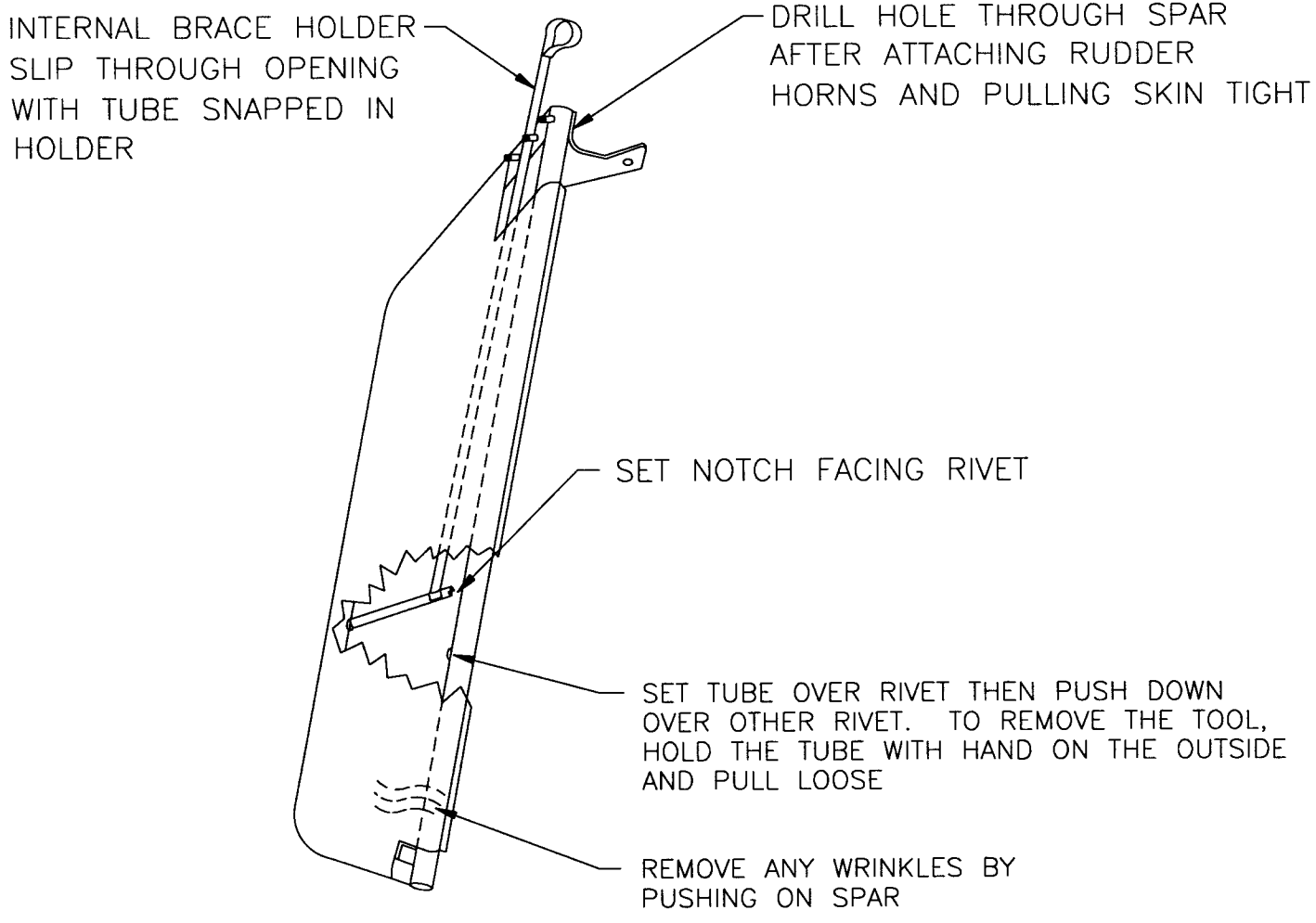


COMPLETED RUDDER

1. TIGHTEN TOP HINGE AND BOLT.
2. PUSH THE INTERNAL BRACES IN PLACE WITH THE NOTCHED END OPEN TO THE "BUTTON". TAPE THE BRACE TO A STICK OR METAL STRAP TO AID INSTALLATION.
3. INSTALL LOWER HINGE AND BOLT.
4. POSITION SPAR FLUSH WITH TRIALING EDGE TUBE AND DRILL. USE HORN AS A GUIDE. INSTALL BOLT TO COMPLETE ASSEMBLY.

MD368

RANS RUDDER ASSEMBLY PROCEDURE

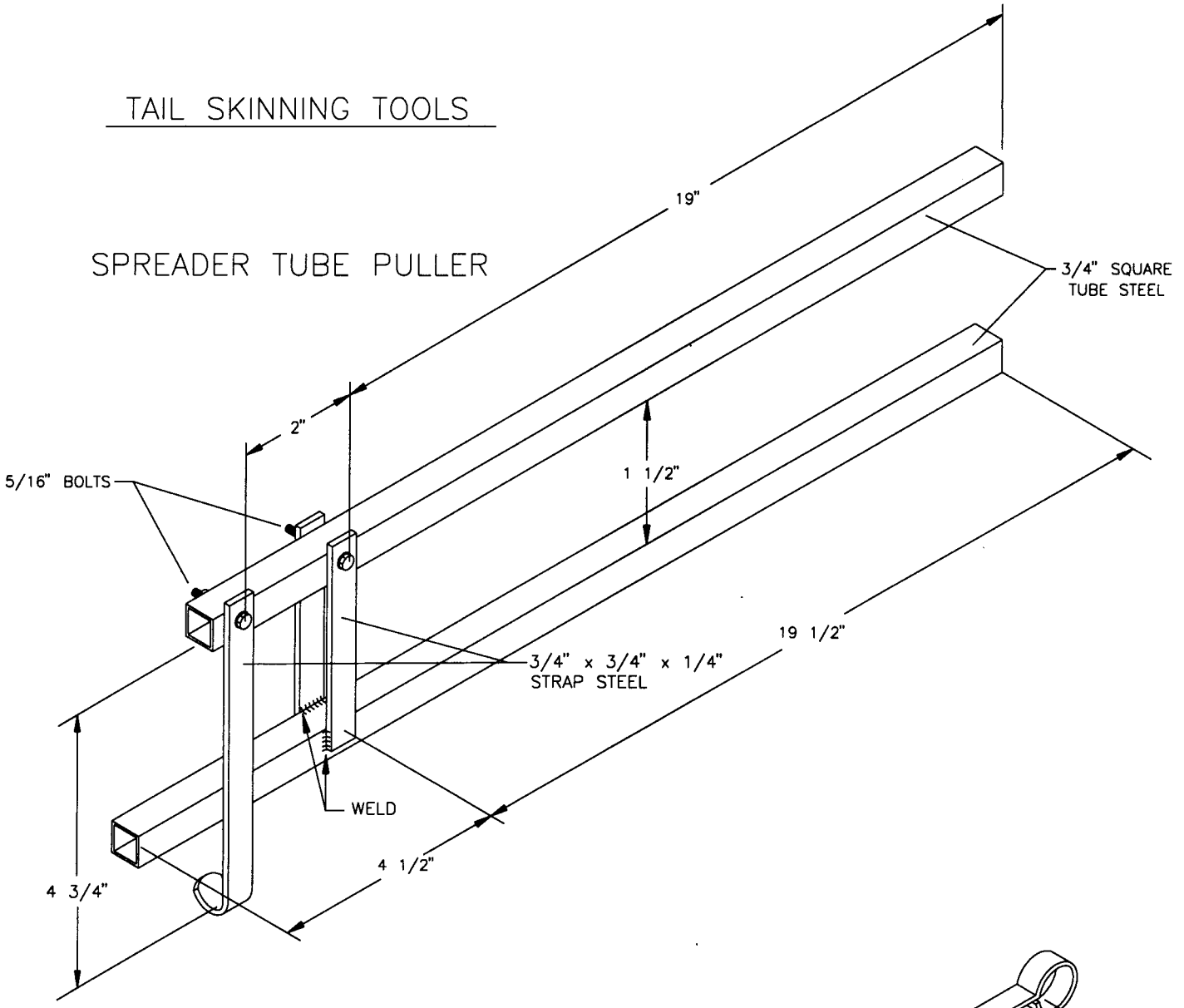


RUDDER AND ELEVATOR: INSTALLING BRACES FOR THE S-12 AIRAILE

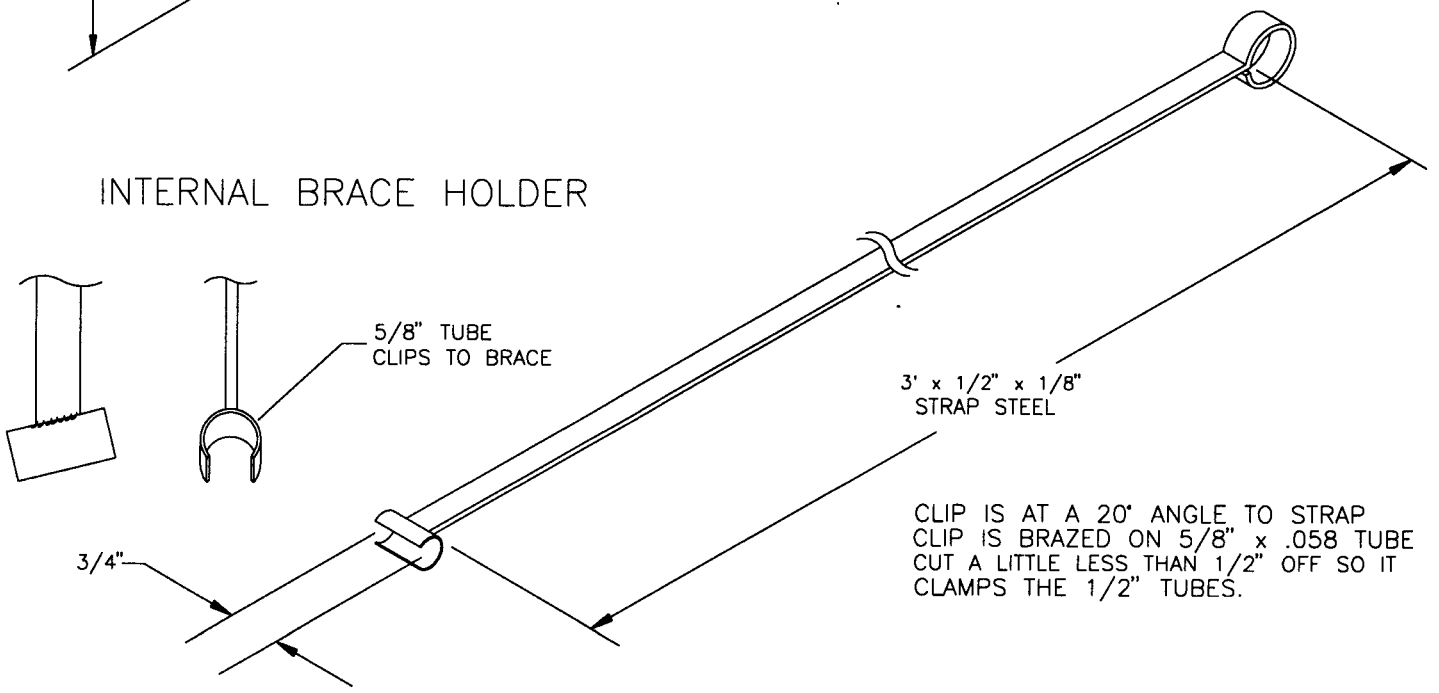
MD110

TAIL SKINNING TOOLS

SPREADER TUBE PULLER



INTERNAL BRACE HOLDER



CLIP IS AT A 20° ANGLE TO STRAP
CLIP IS BRAZED ON 5/8" x .058 TUBE
CUT A LITTLE LESS THAN 1/2" OFF SO IT
CLAMPS THE 1/2" TUBES.

MD377

ENGINE MOUNT ASSEMBLY & ENGINE FUEL PUMP INSTALLATION

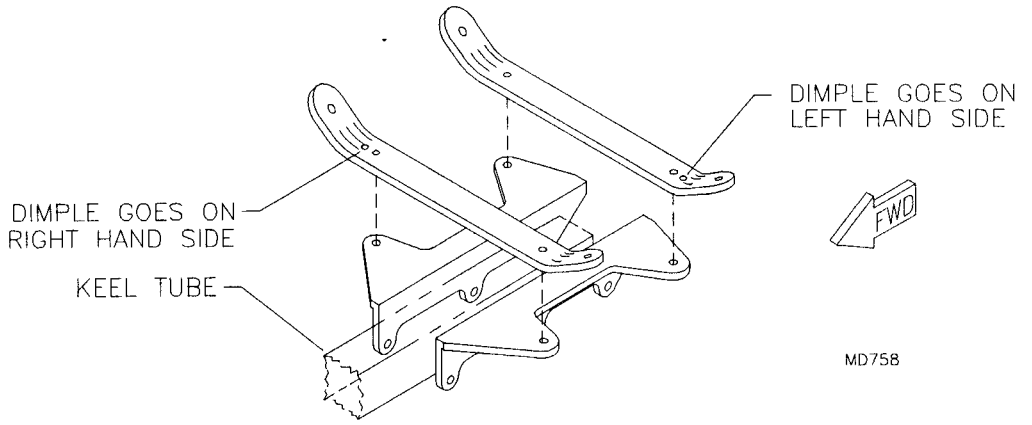
At this point the fuselage should be complete with the super structure and keel in place.

1. Select the parts as shown in the parts drawing.

2. Drill out the three holes to 5/16" in the keel where the mount attaches. Bolt the left and right engine mount angles to the keel with the narrow end facing forward. The engine is installed with down thrust to minimize pitch up and down with power changes. Do not tighten the 5/16" bolts until later.

3. Bolt the lower focal mount plates to the engine mount angles as per **Figure 06-03.**

FIGURE 06-03



4. Assemble the barry mounts and mount plates to the mount angles as per the parts drawing. Use a silicon spray lube to help install the mounts.

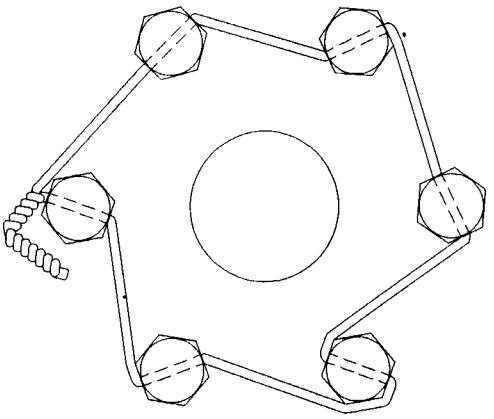
5. Install the engine mount plates to the angles. Be sure you assemble the mount with the right number of spacers and washers as per the parts drawing. Tighten down all the bolts and inspect the mount.

6. Before setting the engine on the mount, turn to the section on assembly of the muffler mount. The muffler mount and muffler are much easier to install if done on the bench prior to lifting the engine into place. The exhaust manifold will almost always leak at the point it attaches to the engine. It seems the seals alone are not adequate, so we recommend applying a good gasket sealant such as Permatex Ultra Copper high temp silicone gasket material. Apply a very thin layer to each side of the gaskets before installing. The muffler's ball joints are held together with small springs that attach to hooks welded to the muffler. Try to install these with even tension. They should not be stretched more than 50% of their length. The tension can be adjusted by bending the hooks up or down. After the springs are installed run a loop of safety wire through the spring. This will save the spring from going into the prop should the spring ever break. Also, to prevent spring breakage from vibration we recommend applying a bead of silicon caulking along the length of the spring.

7. Put a three stack of 3/8" washers over each mount hole where the engine studs will insert. Use super glue to hold the washers in place. With the muffler installed to the engine use the help of a strong friend to lift the engine into place. Having a friend help you will make this step much safer! Place the engine onto the mount and run on the loc washers and nuts. Torque the engine mount nuts to 15 ft/lbs.

8. Inspect all the bolts on the engine mount for security. Check the engine for security. Bolt on the propeller using the proper hardware. Torque the prop bolts to 12 ft/lbs and safety wire as in **Figure 06-08.**

FIGURE 06-08



MD227

912 ENGINE MOUNT INSTALLATION

Before installing the 912 engine to your S-12 Airaile refer to the Fuel/Choke/Carb Hookup and do the modifications to the carb, safety wire the oil pickup on the bottom at this time.

9. On the forward side of the engine mount install the forward mount strap, drilling out the #11 holes to 1/4". Place a drop of blue loctite on the 1/4" bolt and install the bolt, strap and torsion strut to mount as shown in parts drawing. Mount the bottom of the torsion strut to the top hole of the mid cabaine triangle plate on the inside.

10. With the mount angles installed to the engine (See engine). Select the parts pertaining to the 912 engine, mount the bolts and rubber isolators then install on the engine. Use a solution of soapy water on the barry mount (rubber isolators) to aid insertion. Make sure the barry mounts are installed with the "donuts" topside. When installing the 3/8" bolts make sure you invert the bolts (**HEADS DOWN**) with the low profile bolt in the forward most hole for wing clearance. **PLEASE NOTE:** The rear mount strap serves as the washer spacer.

11. Bolt the 912 mount angles to the engine as shown in the engine mount drawing. **NOTE:** The engine mount is at a 1 1/20 degree offset to compensate for engine torque. Use loctite on the bolts. Insert the bolts and washers then tighten to 10 ft/lbs.

12. Once the engine has been bolted in place it is time to run all the wiring, fuel lines and cables. Turn to the specific section for the details. **SPECIAL NOTE:** The S-12 912 propeller is not safety wired, instead jam nuts are used in the forward side of the flange. Snug these nuts after torquing prop bolts.

912 MUFFLER INSTALLATION

1. Select the parts depicted in the parts drawing.

2. Remove the nuts from the engine and install as per the parts drawing. The nuts may be close to the weld and may in some cases even hit the weld. Carefully grind or file a minimum amount to give the clearance. Tighten the retaining nuts after the canister is in position.

3. The muffler's ball joints are held together with small springs that attach to hooks welded to the muffler. Try to install these with even tension. They should not be stretched more than 50% of their length. The tension can be adjusted by bending the hooks up or down. After the springs are installed run a loop of safety wire through the spring. This will save the spring from going into the prop should the spring ever break. Also, to prevent spring breakage from vibration, we recommend applying a bead of silicon caulking along the length of the spring. See photo below.

S-12 AIRAILE 503 MUFFLER MOUNT INSTALLATION

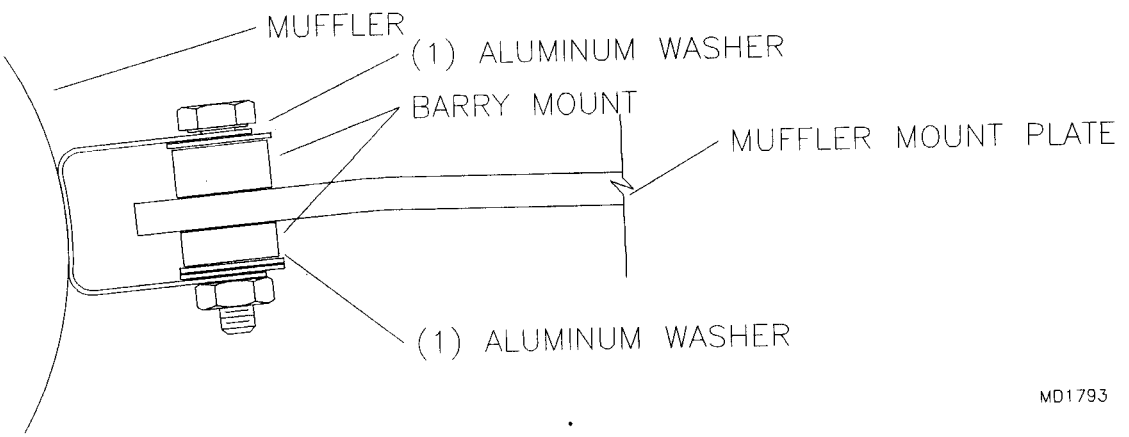
At this time the engine should have been installed and the exhaust manifold "Y" pipe has been attached to the engine.

1. Select the parts depicted in the parts drawing. The muffler mount uses three of the top 8mm bolt locations to mount the plates. Look at the parts drawing to determine these locations.

2. Unscrew the three existing 8mm bolts that will be replaced by the longer 8mm bolts. Install the FWD and AFT muffler mount brackets. Use loc washers and apply a drop of blue loctite to each bolt before insertion.

3. Check the 3/4" holes in the ends of the mounts for burrs. Remove any burrs around the holes edge to prevent wearing of the rubber muffler barry mounts. Insert the barry mounts into the 3/4" holes and assemble the muffler to the mount as shown in **Figure 06B-03**. The muffler comes with tabs welded to the canister for mounting. Be sure to slip the 3/8" spacer into the barry mount centers before slipping the assembly between the welded on tabs.

FIGURE 06B-03



4. The muffler is a part under constant stress while in use and under the attack of time and the element otherwise. It will not last forever, in fact, they don't seem to last much past 100 hours before needing welding or some care. Mufflers can develop cracks and shed chunks of metal that will shatter the prop. That is never a welcome event! Therefore, it is vital to always inspect the condition of the muffler and springs before flying. Really learn to **LOOK** at the muffler as well as other items on and around the engine that could break off the damage the prop.

S-12 AIRAILE THROTTLE LEVER INSTALLATION

NOTE: Rotax 912 owners see Installation of the 912 Accessories.

1. Refer to the parts diagram and select the components required for assembly.

2. Insert the throttle knobs over each end of the throttle levers. Position the throttle knobs so the small horizontal hole in the knob is 90 degrees to the center line of the aircraft. Be sure the knobs are inserted all the way onto the throttle lever. Drill through the knob from each side with a number 30 drill. Press in the roll pin to retain the knob to the lever.

3. Use a Scotch Brite pad or 400 sandpaper and clean the paint off the ends of the throttle lever where it fits into the bushings on the cage. Also, clean the bushings on the frame where the throttle installs. The left side of the throttle is the side with the arm extending below the lever to receive the friction rod and throttle retention block and cables. When installing the throttle make sure it is orientated correctly.

4. Make a bushing from the 5/8" X .058 stock 1/2" long. Slip this bushing over the right end of the throttle.

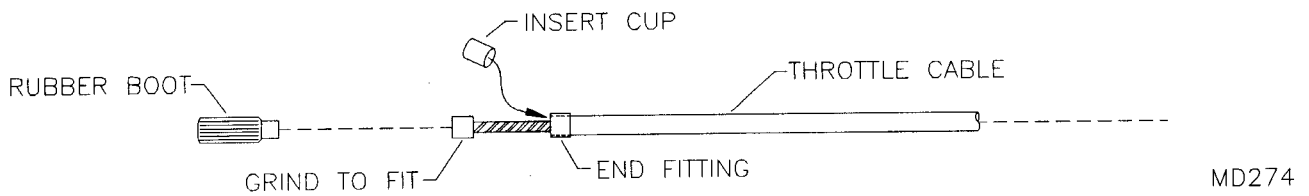
5. Grease bushings on the cage and the ends of the throttle lever. Install the throttle lever by sliding the right end of the lever far enough onto the right bushing to get by the left bushing. Slide the stop ring on the right side against the right bushing and hold and drill with 3/32" bit. Install a small cotter pin.

6. Install the nut plate on the inside of the mount tab. The mount tab is a 1" square tab welded to the small diagonal tube just ahead of the throttle. Check this tab for proper alignment, it should be 90 degrees to aircraft centerline. If the tab is not aligned it can be tweaked a little using an adjustable wrench.

7. Assemble the friction rod assembly as shown in the parts drawing. The friction block may need a little filing of the friction rod hole in order to work smooth. Use a 1/4" round file to clean up the hole. Test the throttle action, it should be smooth, requiring minimal effort to operate. Loosen or tighten the bolt through the block to adjust the feel.

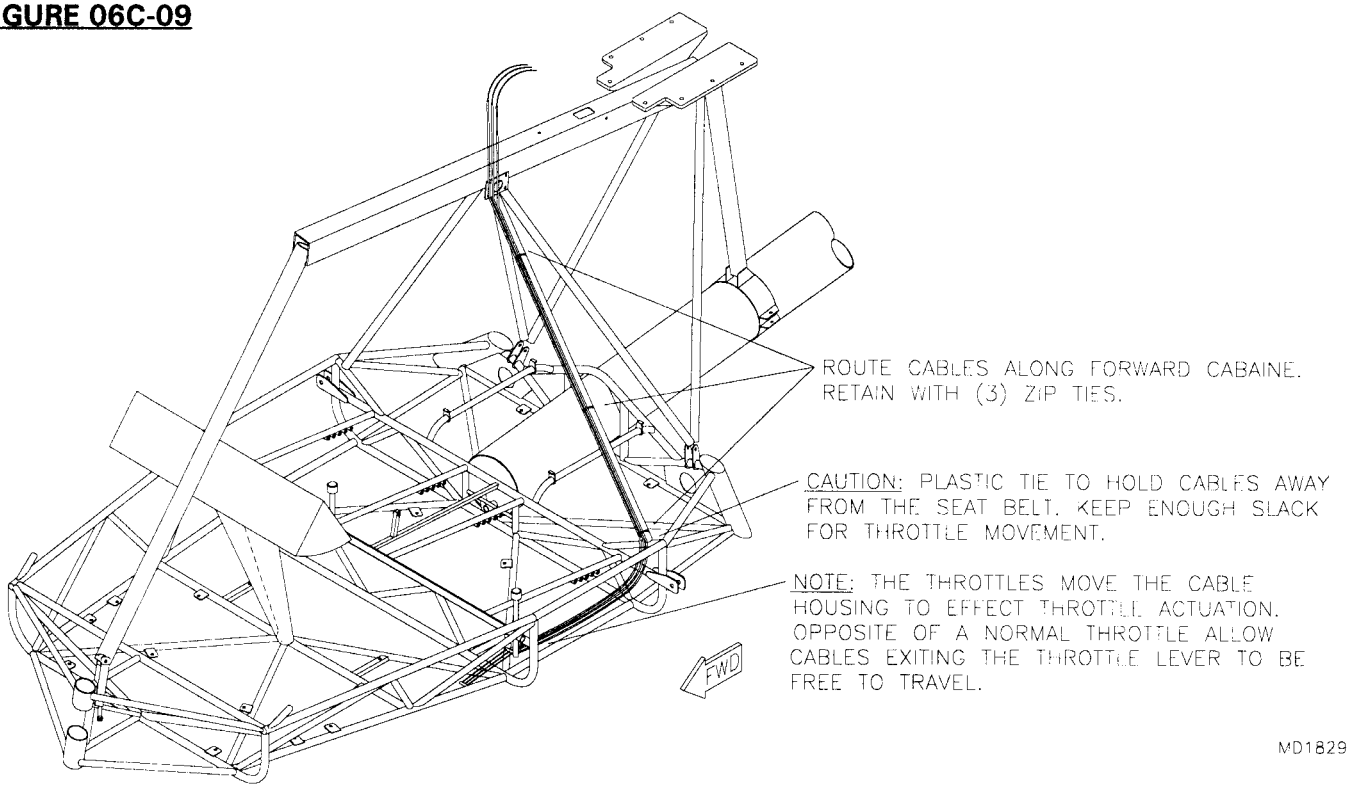
8. To hook up the throttle cable you need to unscrew the carb's top plate. Take care not to let the spring jettison the plate onto the floor. Remove the spring and cap and place aside. Look closely at the slider, see the white plastic fitting on the bottom? Underneath this should be the cer-clip that 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, slide a metal ferrule (a small metal cup-shaped object) over the exposed end of the housing. Now slip the little rubber boot over the end. See **Figure 06C-08**. During re-assembly, note that the position where the throttle exits the cap is not on center, Position the cap so the cable is directly over its slider position.

FIGURE 06C-08



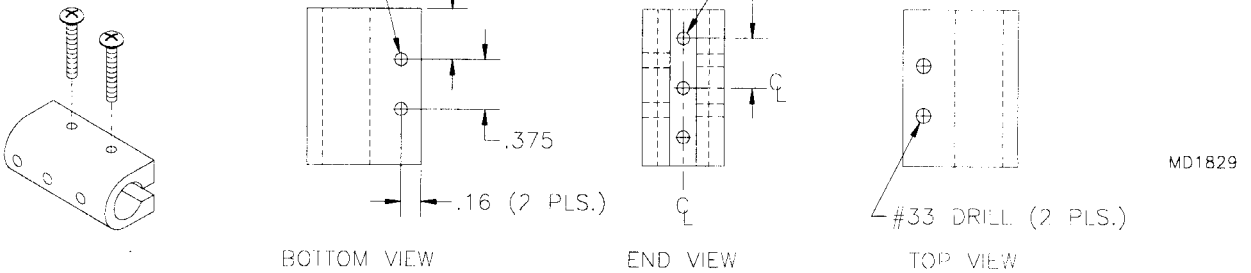
9. Pull on the free end of the cable to seat the housing into the fitting on top of the carb plate then route the cable as shown in **Figure 06C-09**. **IMPORTANT:** Closely examine the housing where you've cut it. A clean cut is a must, the metal coil inside the housing can rub the cable and cause it to break. An unclean cut of the throttle cable housing can also result in sticking of the controls due to the added friction.

FIGURE 06C-09



10. Drill the throttle retention block as shown in **Figure 06C-010**. Now slide the block onto the stub on the throttle lever and tighten the machine screws so that the holes in the retention block are 90 degrees to the throttle lever. Transfer drill through the retention block and through the stub on the throttle lever. Next, slide the cable through the stop and then insert and clamp the cable housings into the throttle retention block. See **Figure 06C-010** for instructions on how to drill the holes. The machine screws will self tap if done properly. **NOTE:** Make sure the holes in the throttle retention block line up with the holes in the throttle lever. Insert the cable through the throttle lever and attach a wire stop. **NOTE:** The big hole is on the throttle's forward stop side to eliminate wear. Use loctite to safety. Adjust throttles to be in perfect sync. They must move exactly the same to insure smooth operation. Assemble the friction rod assembly to the throttle lever as shown in the parts drawing. Rivet a 3/16" nut plate to the **OUTSIDE** of the tab for the friction block. Set the stops to allow full carb slider travel, but no more than full travel. Run one cable for each carburetor and one more cable for oil injection systems if so equipped.

FIGURE 06C-010

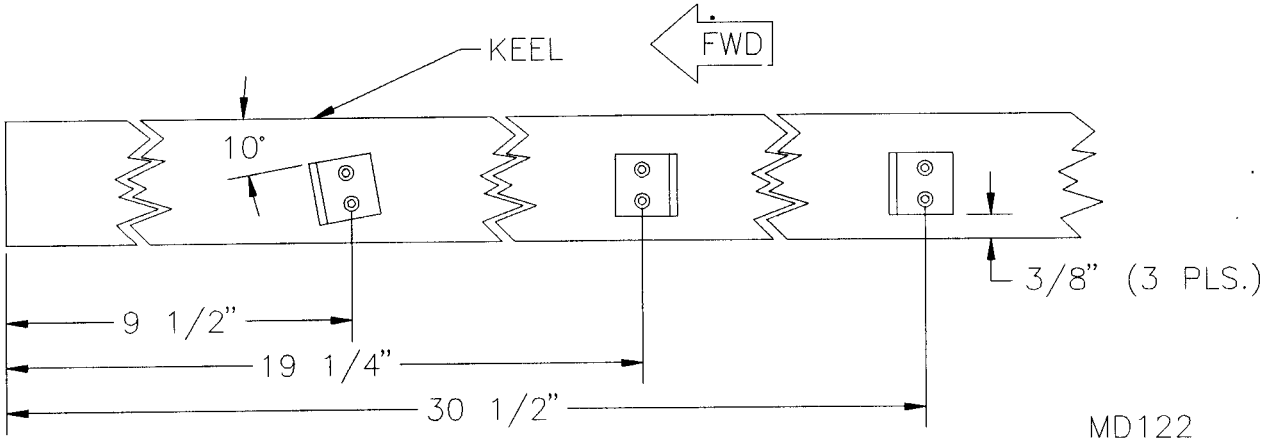


S-12 AIRAILE 912 CHOKE ASSEMBLY

1. Select the parts as shown in the parts drawing.

2. Measure as shown in **Figure 06C-02** from the front of the keel tube 9 1/2" for the first angle bracket, measure 3/8" up from the bottom of the keel tube and mark at each bracket location.

FIGURE 06C-02



3. Rotate the first angle 10 degrees down on the cleco. Drill the top hole and rivet.

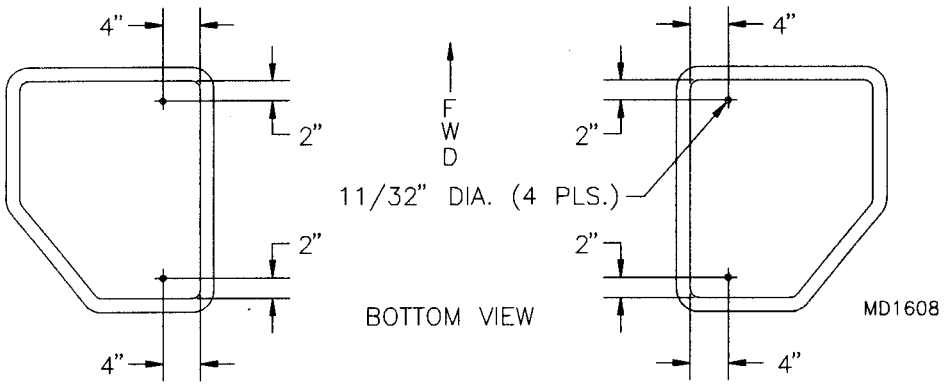
4. Measure, drill and rivet the remaining two brackets parallel with the keel tube 3/8" up from the bottom of the keel.

5. Assemble the rest of the choke system as shown in the parts drawing. **HINT:** To keep the trimmed end of the choke cables from fraying use a dab of super glue. This works well on all cables, brakes, throttles, etc.

S-12 AIRAILE WING TANK FITTING INSTALLATION

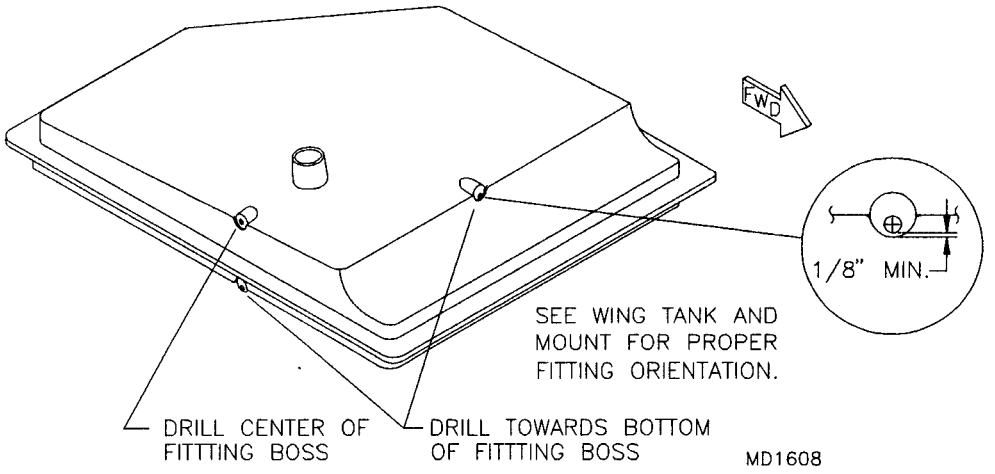
1. Carefully locate and drill the 11/32" holes indicated in **Figure 06D-01**. Make sure to measure from the edge of the **FUEL TANK** and not the **FUEL TANK FLANGE**.

FIGURE 06D-01



2. Use **Figure 06D-02** as a guide for locating the holes for the vent line and sight gauge. The offset holes are to allow clearance for the compression tube and wing skins. **NOTE:** Clean all the fittings with alcohol or an appropriate non residue leaving chemical before bonding. Read the mixing/use instructions on the J&B Weld.

FIGURE 06D-02



3. Mix approximately 2 tablespoons of J&B Weld. Apply a bead of J&B Weld to the threads of all fittings before installing into fuel tanks. Carefully screw in the appropriate fittings into the holes, making sure the direction of the fitting is properly oriented. The fittings will self tap, but using a 1/8" pipe tap is recommended.

S-12 AIRAILE FUEL SYSTEM INSTALLATION

The standard S-12 Airaile fuel system consists of two 7.5 gallon tanks in each wing. Fuel from each tank flows from FWD and AFT withdrawls. These meet in "y's" about 12 inches below the wing. From the "y's" the lines meet at the fuel mixer block, low on the "A" frame. From here a single line returns to the fuel valve and primer bulb near the top of the middle "A" frame. The low point junction is required to assure fuel flow from either tank, with no matter to the fuel levels. Study the fuel systen schematic for more details.

1. Select the parts as shown in the fuel tank mount drawing.

2. Locate and drill #30 holes into the vertical flange of the forward mount angles. See **Figure 06D-02.** Line up the forward angles so they are even with the top of root compression tube. Drill and rivet the angles to the spar. See **Figure 06D-02A.**

FIGURE 06D-02

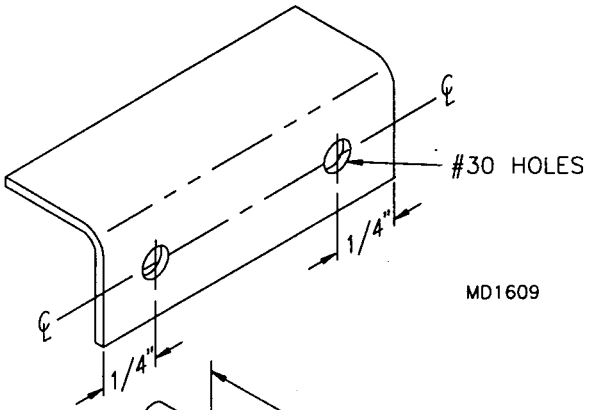
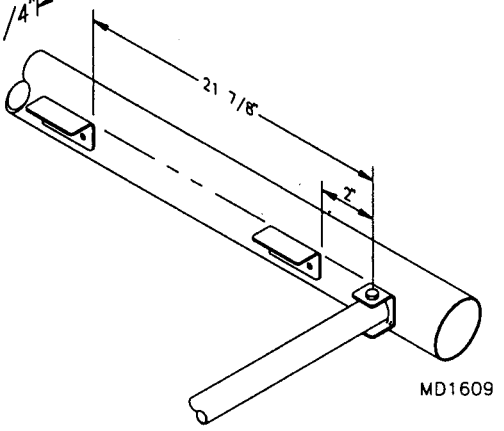
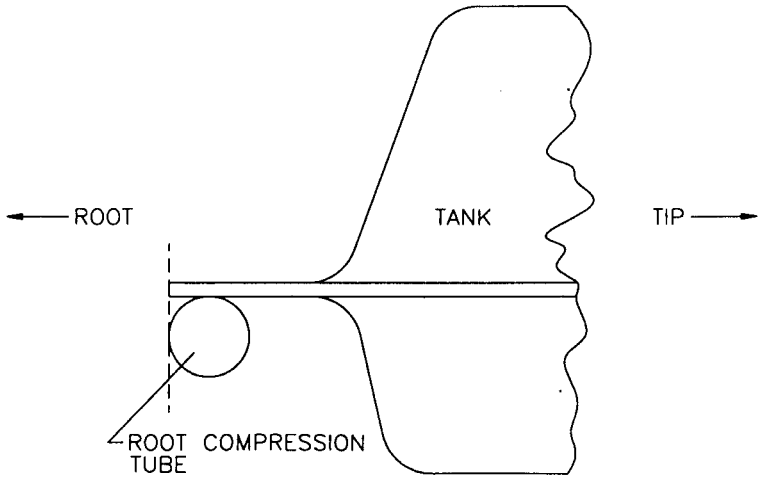


FIGURE 06D-02A



3. Notch out the forward inboard corner of the tank to fit around the S2-SAB. **WARNING:** There must be at least ½" of flange left between the notch and the tank. Inboard edge of tank should be flush with inboard side of root compression tube. See **Figure 06D-03.**

FIGURE 06D-03



4. Locate the other two holes in the forward flange; one in each corner of the angles. Hold the outer mount angle underneath the forward angle while drilling through the corner. Use a wood block to back, and save your fingers! Bolt the forward flange to the angles with the proper bolts.

5. Slip a 1" cushioned clamp over the anti-drag tube. Position the outer mount angle against the tank, trim it to length and drill #11 holes for the tank mount bolt and cushioned clamp bolt.

6. Place the AFT mount angle along the back edge of the tank. It helps to clamp it in place to the tank with a needle nose vise grip. Locate the hole in the flange for the cushioned clamps and tank flange as shown in the parts drawing. Trim the angles to fit as required.

7. Check all the tank mounting bolts. Tighten the bolts only enough to snug down the tank or crush the fiberglass.

8. Place the rubber trim strips over the bottom edge of the AFT mount angle. These rubber strips are to prevent chafing of the fuel lines, move into place as required. **HINT:** Use super glue to fix in place permanently.

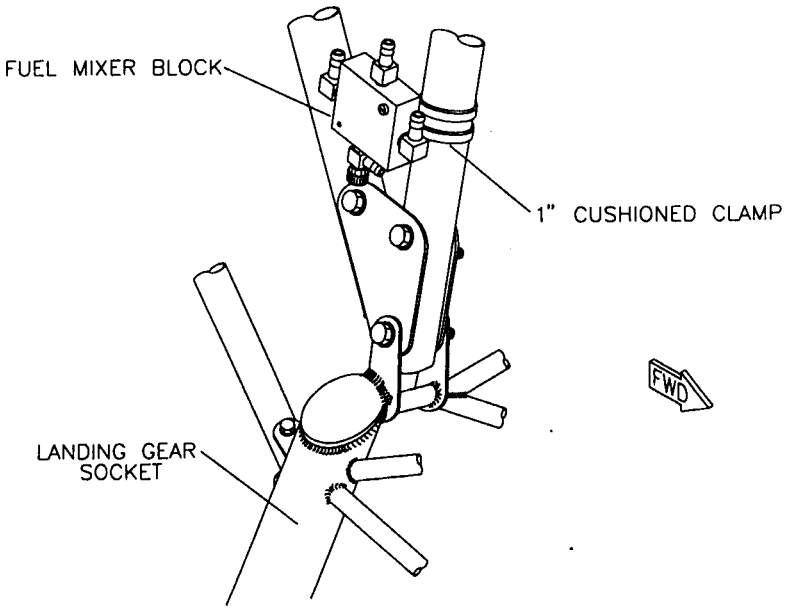
9. It is best to set up the fuel lines with the uncovered wings on the fuselage. If this proves impractical, refer to the fuel system schematic and legend. Install lines to the fuel tanks leaving at least 5' on the FWD and AFT feed lines. This will be enough to reach down into the cabin to the "y's". See the fuel system schematic in this section. Install the vent with at least 11' of line, this will allow routing down the "A" frame and to each gear leg. Install the sight gauge with enough line to allow the root rib to bottom out against the "2" brackets.

10. Prior to covering the wings it is wise to test the tanks for leaks. The best way is with the tanks mounted into the wings, with the wings placed on saw horses. Plug the FWD and AFT feed lines into the "y" and slip a 2" segment of fuel line over the remaining "Y" nipple. Plug a 1/4" bolt into the 2" segment of the fuel line and clamp.

11. Fill the fuel tanks with fuel. Close the fuel cap and let sit for 10 minutes. Inspect for leaks around the fittings and line connections. Drain fuel by removing 1/4" bolt. Kink the line to prevent full flow while removing the bolt. **CAUTION & HINTS:** Perform the leak test in a well ventilated area, away from open flame or sources of combustion. Use appropriate fuel containers. Strain fuel while draining if you plan to re-use. Leave fuel caps off and dry out leaks.

12. Bolt the sump valve/fuel mixer block to the bracket. See **Figure 06D-012.**

FIGURE 06D-012



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INSTALLING THE 11.5 GALLON COCKPIT TANK FUEL SYSTEM

13. Set the fuel tank on the rails with the fuel cap facing forward. The fuel tank rails are the two 5/8" tubes running parallel to aircraft center line. The rails have pear shaped tabs that are bent over into hooks. The fuel tanks fits to the frame with its grooves on the rails between the hooks. Use the two straps to secure the tank to the fuselage.

14. Apply loctite to the threaded fittings and assemble as shown in the parts drawing. Position the fuel valve high up on the "A" frame with the handle facing forward. The valve needs to be placed high so cargo will not limit access. Mark the valve so it will not be confused with the wing tanks fuel shut off.

15. Cut (2) pieces of fuel line into 1" lengths. Install the fuel filter followed by the primer bulb. Be sure the arrows on both filter and primer bulb point up. Install the line clamps by twisting them open with the pliers once in position. To remove a clamp, twist open with the pliers.

16. Run the fuel line from the cabin tank to the fuel mixer block sump drain. See Fuel System Schematic a few pages back. Route the line in the most direct manner without kinking. Attach the line to the airframe using zip ties. Bolt the fuel mixer block bracket to the outside lower cabaine on the passenger side.

17. Check the fuel system over looking for chafing or pinching. Check the line for security to the airframe, use the plastic zip ties as needed to retain. **PLEASE NOTE:** There is a small bulb located at the end of the pick up tube in the auxiliary tank. Within this bulb is a small filtering screen. This screen becomes plugged easily so we recommend removing this screen. It is not required since the fuel system has other filters. It is also important to inspect the "O" ring seal at the base of the pick up assembly which mounts to the tanks top. If this "O" ring is not properly sealed the system will draw both air and fuel.

FUEL SYSTEM VENTING

IMPORTANT: A vent is incorporated into the top of each tank. Check the vent for open position before flying or running engine. A closed vent will result in fuel starvation and impending engine stoppage! The vent is closed when using the tank removed from the aircraft to transport fuel.

FUEL SYSTEM DRAINING

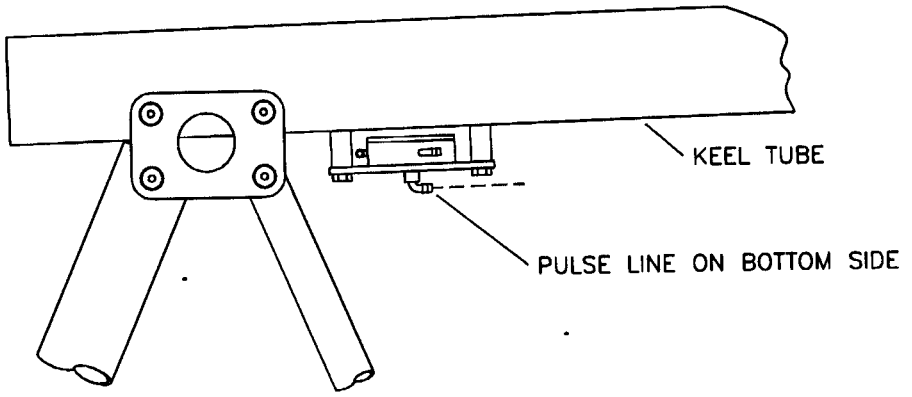
Water can enter a fuel system and cause dangerous contamination. To prevent this from happening on the S-12 it is recommended to filter the fuel through a chamois or a funnel filter designed to separate and filter out water.

Draining the sump on the S-12's fuel system is only a partial measure against water contamination. In either the standard wing tanks or the optional cabin tank the fuel withdrawls and drains extend up into the tank about a 1/4". Therefore, the drain is not flush with the bottom of the tank. A small amount of water can remain below this level. The S-12 fuel system can tolerate small amounts of water with no operational hazard due to the fuel pickups' distance off the bottom of the tank. However, in the case of a large amount of water a special method of removal is required. Fashion a siphon hose from 1/4" fuel line. Install a hand primer bulb in the line to start the siphon. Insert the hose into the tanks low point and siphon. This method is to be used in event of excessive water contamination.

FUEL PUMP INSTALLATION FOR THE ROTAX 503 SINGLE AND DUAL CARBS AND THE 582 ENGINES

1. Locate the fuel pump on the bottom side of the keel, 6 ½" FWD of the AFT edge of the keel. See **Figure 06D-01**. The mount holes should be located on the centerline of the keel. Cut the spacer bushings, install the rivnuts and bolt in place.

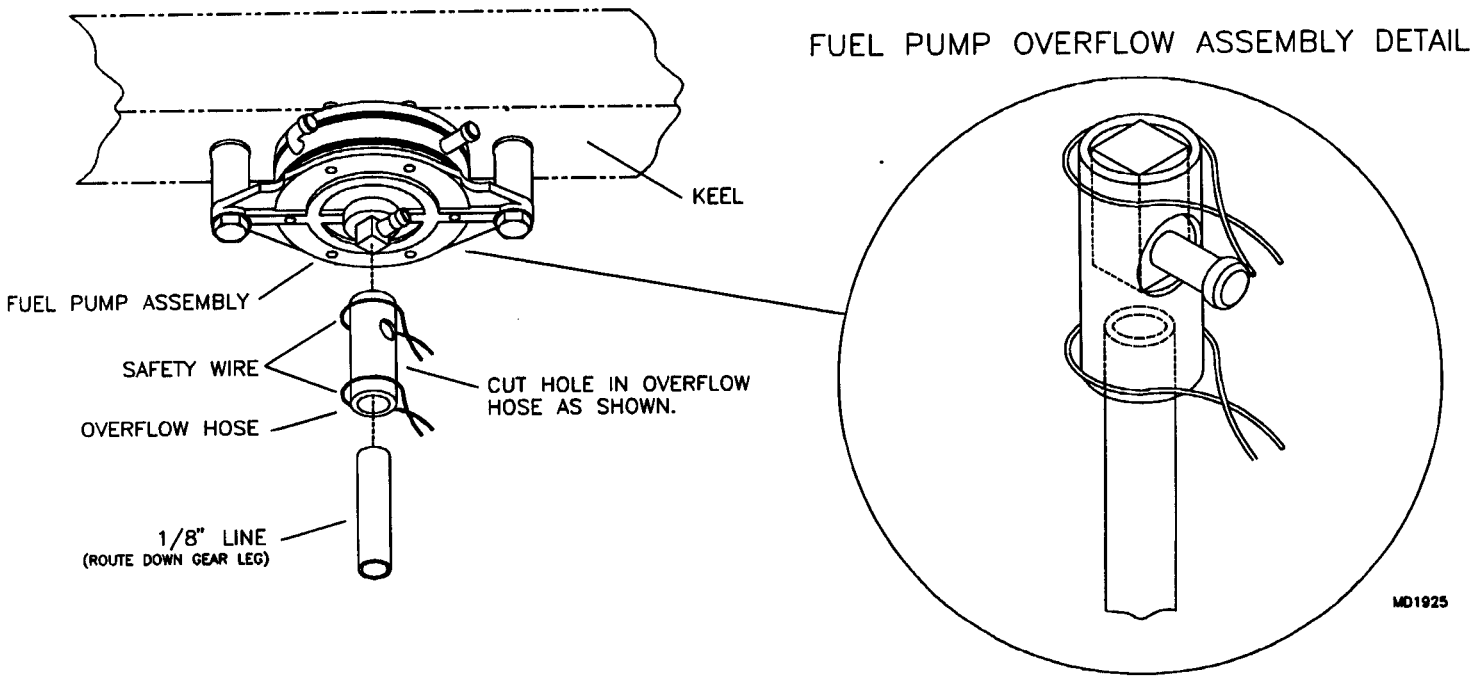
FIGURE 06D-01



2. On the single carb, "Y" the two outputs together that run to the carb. Route the fuel lines accordingly.

3. Fabricate fuel pump overflow drain as shown in **Figure 06D-03.** Cut a hole in the overflow hose similar to the one shown below. Install the overflow hose onto the 90° fitting. Insert the 1/8" primer line into the overflow hose and safety wire in place. Route primer line down gear leg using zip ties. **HINT**: Zip tie the fuel pump overflow line and the sump drain line to the gear leg at the same time.

FIGURE 06D-03



FUEL SYSTEM LINE ROUTINGS

The following legend has important information on installing the fuel system. Refer to **Figure 06D-010.**

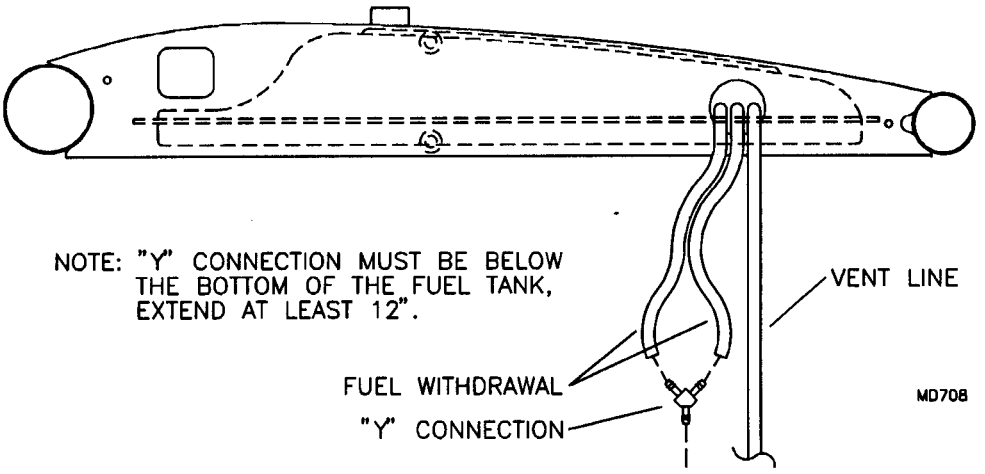
1. **PRIMER PUMP:** Mounts on dash in the hole provided. Install 1/8" lines and wrap with safety wire to effect a clamp. The line **IN** the primer pump goes to the angles nipple. The straight nipple is the **OUT** side of the primer pump. Check this prior to closing the system (not included 912 installation).

2. **OVERFLOW LINE:** The vent line routes along the front edge of the tank, through the rib grommet, down the "A" frame and gear leg. Do not route the line between the top of the tank and wing skin.

3. **FUEL TANK:** See **WING TANK & MOUNT** for mounting instructions.

4. **REAR FUEL WITHDRAWAL:** Run the fuel lines through the rib down the "A" frame to 12" below the wing to the "Y", then to the fuel mixer block. See **Figure 06D-04.** Apply the coil wrap around the fuel lines at rib exit to prevent chafing.

FIGURE 06D-04



5. **FUEL PUMP:** Dual carb style is shown. Use on the 582. Pump comes in the engine box. **(912 engines see 912 FUEL/CARB/PUMP HOOKUP.)**

6 & 7. **CARB FUEL SUPPLY:** Run lines from pump to each carb. **(912 engines see 912 FUEL/CARB/PUMP HOOKUP.)**

8. **PUMP PULSE LINE:** Run a line from the pump to the pulse nipple on the engine crankcase, right side to the front. This line should not exceed 15". **(Not used on the 912 engine.)**

9. **FORWARD WITHDRAWAL:** This line runs from the forward withdrawal through the rib down the "A" frame into the "Y" then the fuel mixer block.

10. **FUEL GAUGE LINE:** This short line runs from the top of the fuel tank to the bottom of the fuel tank, passing through the rib on it's way around. After installing the fuel tanks use the fittings in the side of the fuel tank as a guide to locate and drill a 3/8" hole in the rib for the sight gauge. Keep the sight gauge as close as possible to the rib. If the gauge protruded to much it will interfere with the aileron control tee. See installation of the root rib for the 3/8" hole location.

11. **PRIMER BULB:** Install above the fuel shut off valve. Use plastic zip ties to hold the valve and bulb in location.

12. **FUEL SHUT OFF:** Place the valve high on the "A" frame to keep it accessible when the baggage

is piled high. Use plastic ties to secure the valve and line to a frame tube.

13. **LEFT & RIGHT FORWARD FEED LINES:** These lines meet at the fuel mixer block on either side of the center fitting.

14. **FUEL MIXER BLOCK:** Feeds from both the right and left tanks meet here. The center fitting returns the fuel to the fuel pump. Run lines so left lines are on the mixer blocks left, and the right lines likewise.

15. **SUMP DRAIN VALVE:** Install valve with a drop of loctite and run line down the gear leg. Retain with plastic zip ties.

16. **VENT OVERFLOW LINE:** Run lines down gear legs, face into slipstream.

17. **PRIMER LINE:** **"IN"** (Except 912).

18. **PRIMER LINE:** **"OUT"** (Except 912).

19. **COIL WRAP:** Use to protect fuel lines from chafing.

20. **FUEL FILTER:** Place in system above the primer bulb.

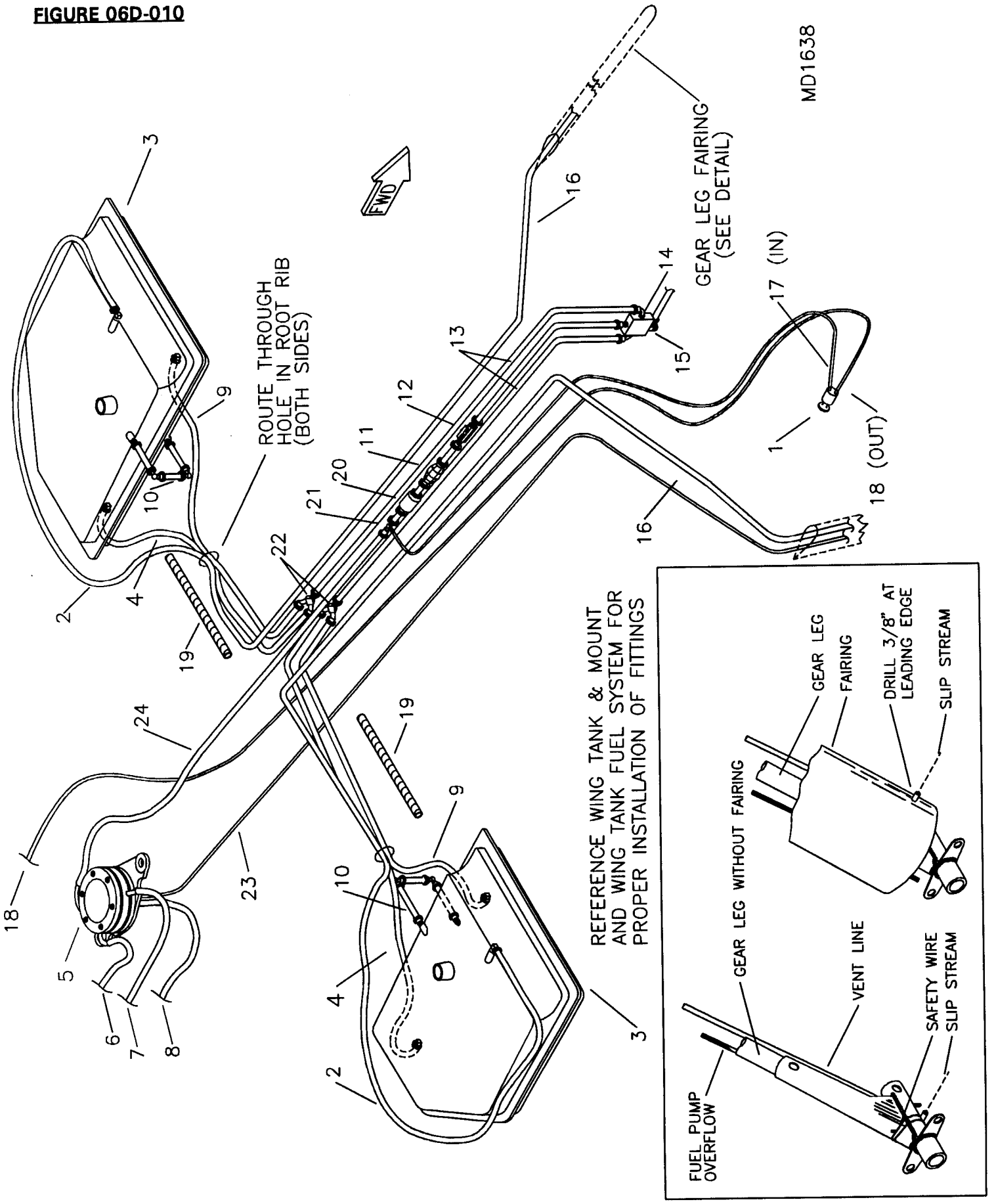
21. **PRIMER LINE TEE:** This fitting comes in primer kit. Install in main fuel line just above the fuel filter. **(Not used in the 912).**

22. **FUEL LINE "Y":** Locate at least 12" below the wing.

23. **FUEL PUMP OVERFLOW:** Route with vent line down gear leg.

24. **FUEL LINE:** Route from primer tee to "IN" side of fuel pump.

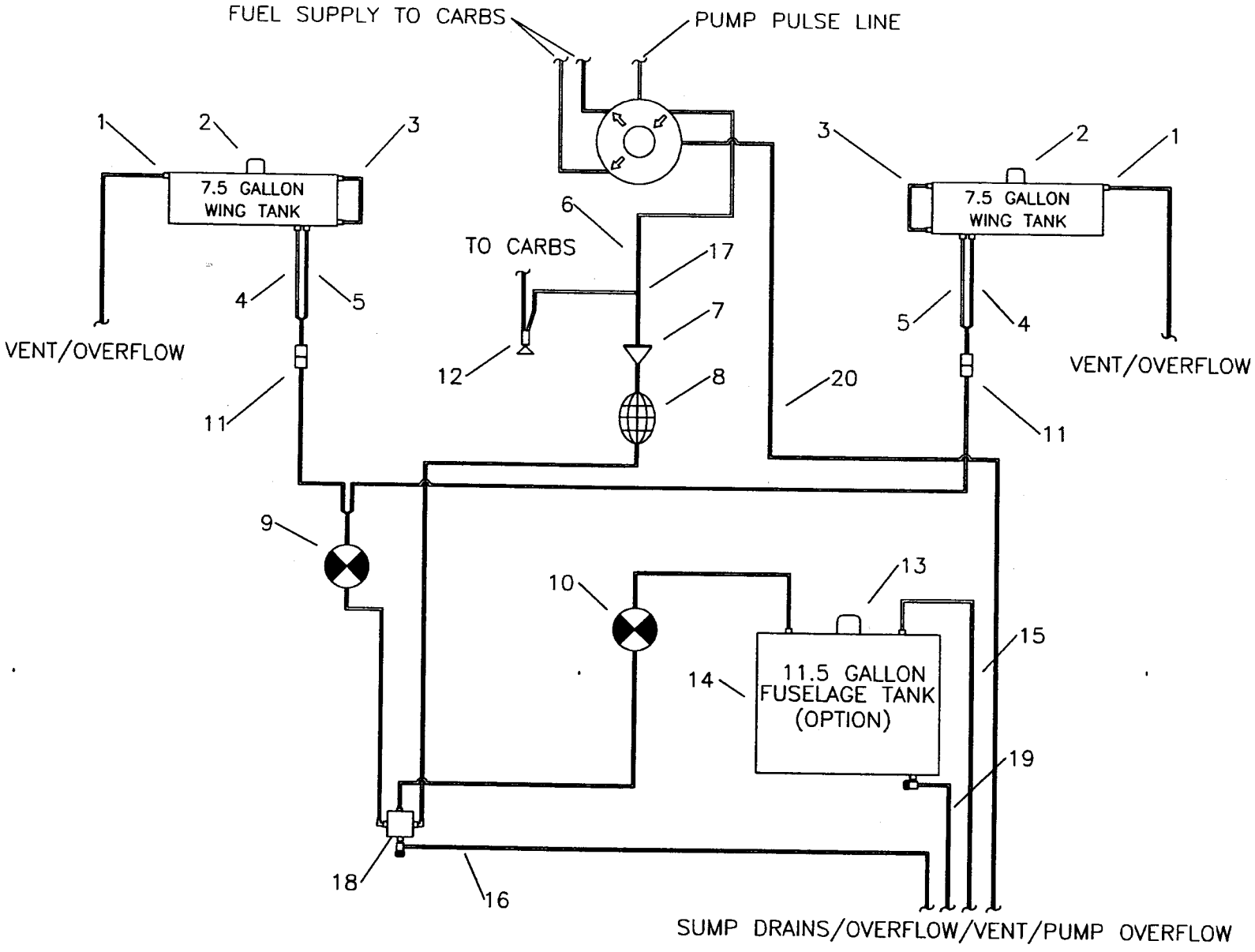
FIGURE 06D-010



S-12 AIRAILE FUEL SYSTEM SCHEMATIC WITH AUXILIARY FUEL TANK

1. Vent Overflow Line
2. Fuel Filler Neck/Cap
3. Fuel Gauge Line
4. AFT Withdrawal
5. Forward Withdrawal
6. Fuel Line to Pump
7. Fuel Filter
8. Primer Bulb
9. Wing Tanks Shut Off Valve
10. Fuselage Tank Shut Off Valve
11. Quick Disconnect (Optional)
12. Primer Bulb
13. Fuselage Tank Neck/Cap
14. Fuselage Fuel Tank, 11.5 Gallon (In Cabin)
15. Fuel Tank Vent Line
16. Fuel Sump Drain
17. Primer Line Tee
18. Fuel Mixer Block
19. Fuselage Tank Sump Drain
20. Fuel Pump Overflow

SEE AUXILIARY FUEL TANK SCHEMATIC NEXT PAGE.



RANS S-12 AIRAILE
FUEL SYSTEM SCHEMATIC

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S-12 AIRAILE 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! Always check oil level prior to flight.

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 tank with its own 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.

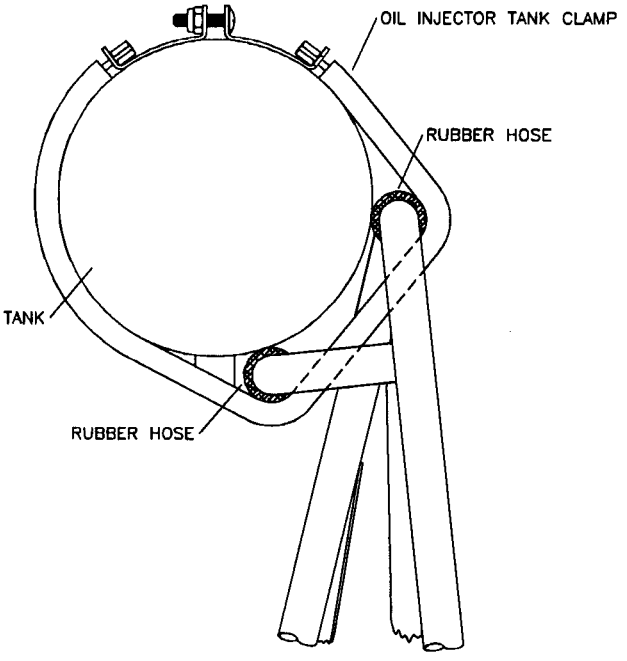
2. Cut the rubber hose provided into four 1" segments. Slip these into each of the mounting holes. Place the mount in position on the engine. **APPLY LOCTITE** to the 8mm bolts. Slip a washer over the bolts and insert them into the mount and engine holes. Tighten the 8mm bolts to 10 to 15 ft. lbs.

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 lengthwise and place over the mount where the tank would contact.

5. Place clamps as shown in **Figure 06E-05.**

FIGURE 06E-05



6. Install the oil filter between the bottom fitting of the oil tank and oil pump using the 5/16" line. The top fitting on the tank is the vent. Install the 1/4" vent line with approximately 3" of hose coming straight out of the top of the tank as shown on the oil injection tank assembly drawing. This will help keep dirt and dust from collecting in the line.

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 oil level of the oil tank and mount before each flight.

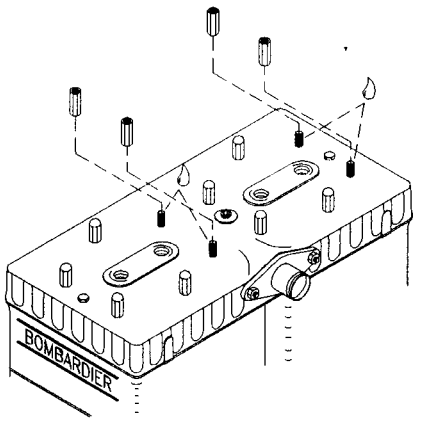
S-12 AIRAILE 582 MUFFLER MOUNT

At this time the engine should have been installed and the exhaust manifold "Y" pipe attached to the engine.

1. Select the parts shown in the parts drawing.

2. Remove the four head nuts shown in **Figure 06F-02.** Install the stand offs in place of the original nuts. Use a drop of loctite on each of the stand offs. Torque the stand offs to 160 to 220 in/lbs.

FIGURE 06F-02

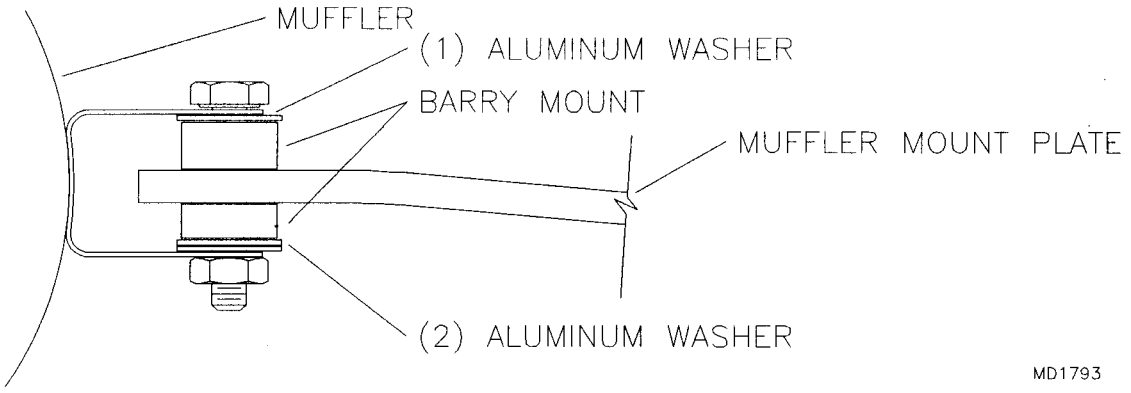


3. Bolt the two muffler mount plates to the four stand offs. Use both loctite and loc washers. Torque these bolts to 160 to 220 in/lbs.

4. Bolt the filler tee and overflow bottle angle mount to the muffler mount plates. Position the angle mount so its bottom flange points to the engine. During cooling system assembly you will attach the filler tee and overflow bottle.

5. Install the barry mount to the ends of the muffler mount plates. Slip the 3/8" diameter aluminum spacer inside each of the barry mounts. Install the muffler to the barry mounts as shown in **Figure 06F-05.**

FIGURE 06F-05



6. Place the small muffler elbow pipe between the "Y" pipe and muffler. Retain with the muffler springs provided. You can adjust the fit and tension of the muffler springs by bending the loops welded to the muffler up or down. Install the springs with moderate tension. Over tight springs will have a tendency to break and go into the prop. Also, safety wire the springs to the loops. To help dampen vibration apply a bead of silicon lengthwise along the spring.

7. Always inspect the muffler and springs for wear and cracks. Spring or muffler fragments can instantly destroy a prop.

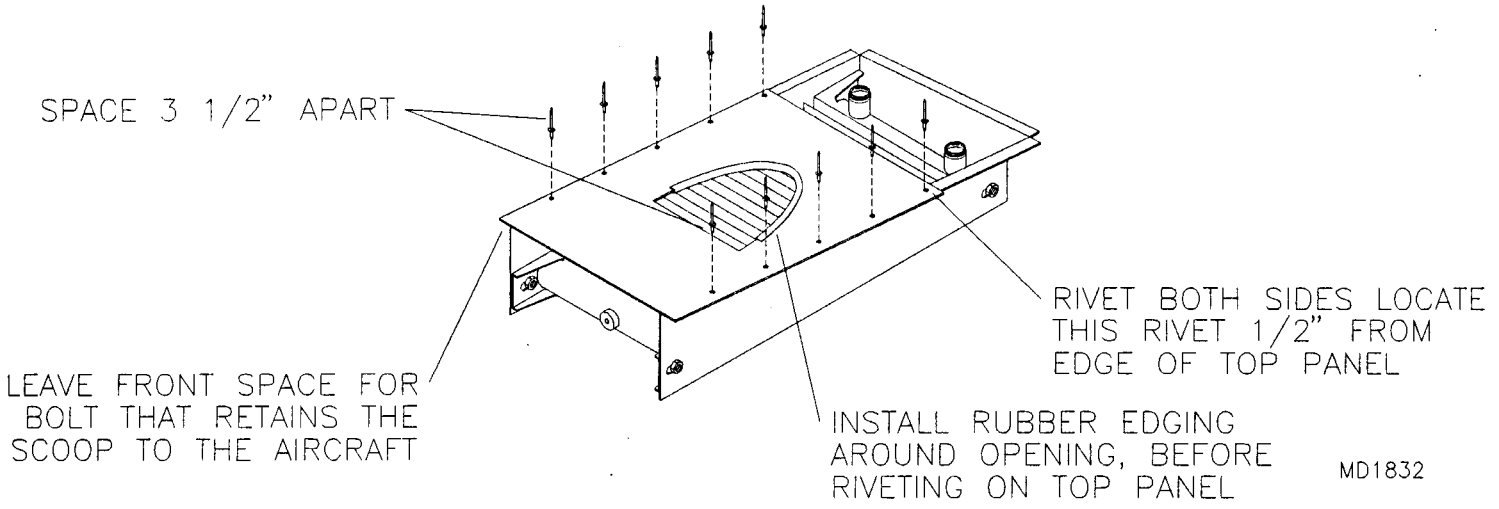
S-12 AIRAILE COOLING SYSTEM

The cooling system can be installed on the Airaile after the fuselage is completed and the engine mounted. The wings can be off for the cooling system installation, however, you must allow for the coolant hose to route to the **FORWARD** side of the rear spars.

1. Select the parts shown in the parts drawing. Assemble two of the short lengths of radiator hose to the inlet and outlets on the radiator. **HINT:** Apply a drop of blue loctite to the hose clamps then tighten.

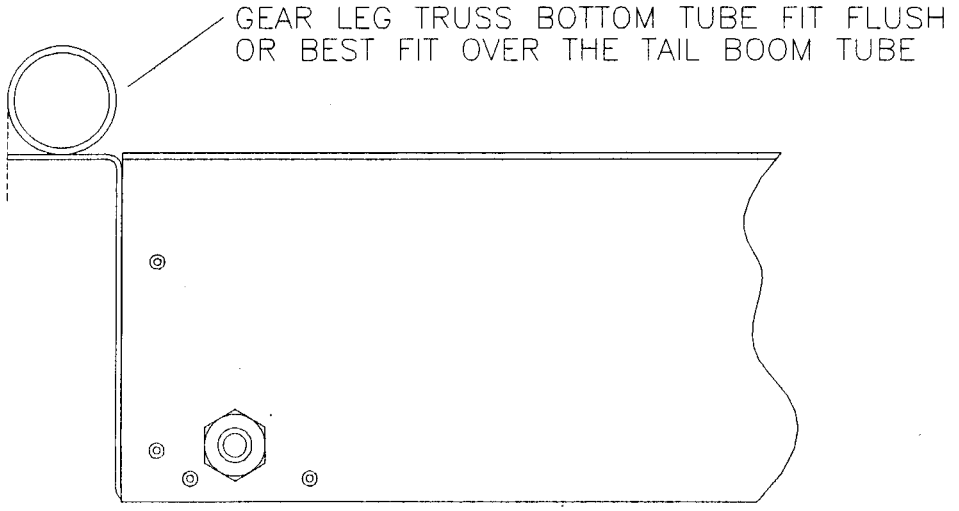
2. Assemble the radiator cooling scoop by first bolting the radiator to the scoop as shown in the parts drawing. The top panel attaches to the scoop with (5) 1/8" aluminum pop rivets evenly spaced on each side. See **Figure 06G-02**. Be sure to install the rubber edging onto the top panels AFT flange and around the edges of the tail boom hole. This rubber edging helps seal and protect the radiator and tail boom from chafing.

FIGURE 06G-02



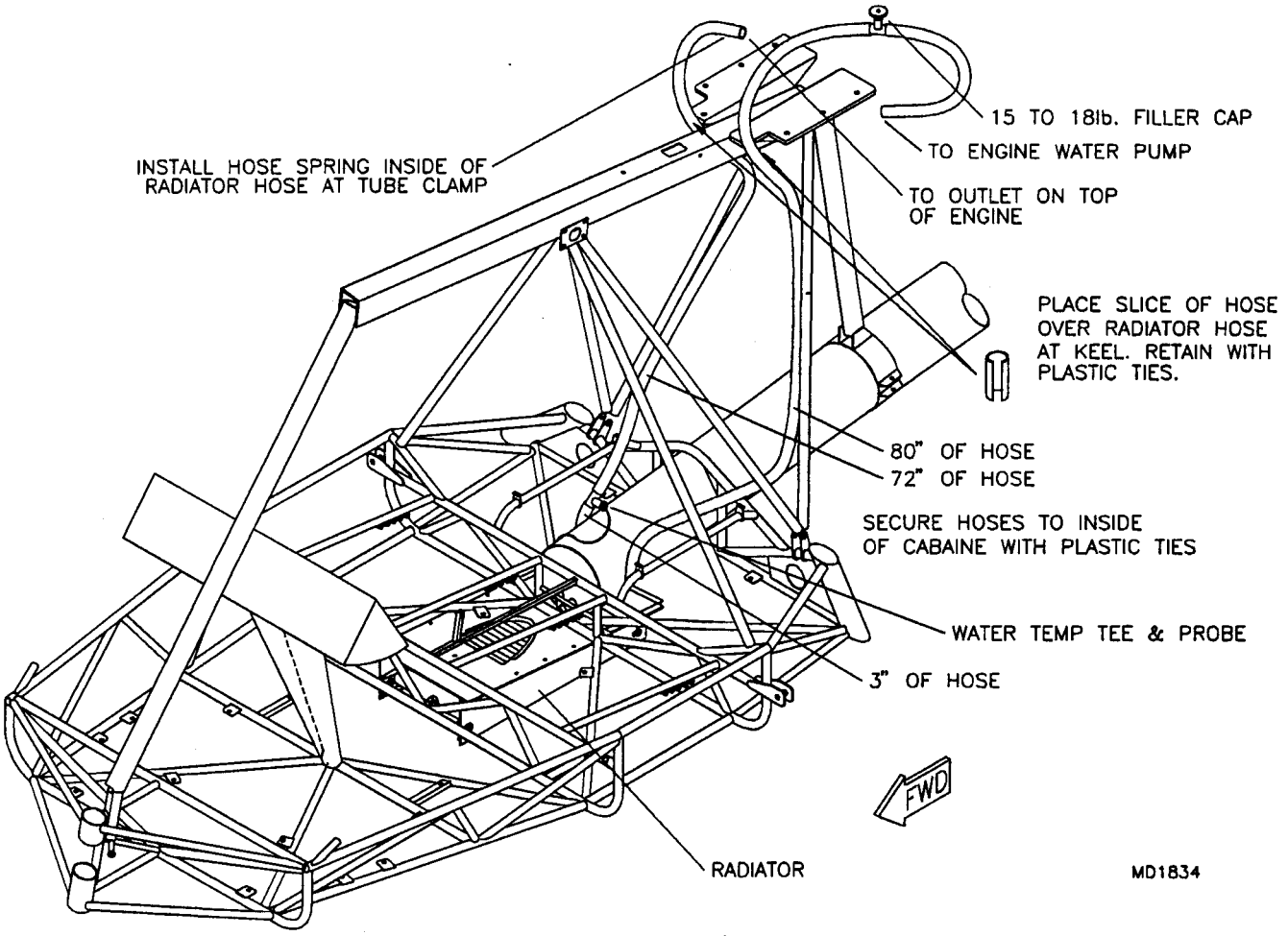
3. Clamp the radiator in place on the belly centered on the tabs provided. Position the radiator assembly FWD and AFT as shown in **Figure 06G-03**. Drill up from the bottom through the tabs to locate the holes in the scoop's flange. Bolt the radiator scoop assembly in place using the proper hardware.

FIGURE 06G-03



4. Cut the radiator hose into the lengths for specific engine type (582/912). Install the hoses to the airframe in the manner shown in **Figure 06G-04**. **PLEASE NOTE:** The hose run up each side of the AFT cabaine and are retained with plastic zip ties. The hoses route around the **FRONT** side of the rear spars. If you are installing the partial or full enclosure the radiator hoses must be included **INSIDE** the windshield top former. At the point where the hoses pass by the keel, install the remaining two short segments of rubber hose. Split this lengthwise and retain them to the hoses with plastic ties.

FIGURE 06G-04



5. Install the temperature probe tee in the right line on the end of the 7" hose coming off the radiator. Position the tee to point forward to help with routing the probe line. Route the lines as direct as possible. The temperature probe **DOES NOT** route with the electric wires.

6. When installing the water pressure gauge, run the small 1/8" I.D. line from the barbed nipple on the pressure tee fitting down to the instrument in the panel. Another line routes from the filler tee to the purge vent on top of the 582 engine, see **Figure 06G-07A**. Route the line inside the plastic line housing with the wiring. The pressure gauge is highly recommended. It not only acts as an indicator for coolant quantity and pressure, it also serves as a surge protector. Units with pressure gauges can go to 20 lbs pressure without jettisoning coolant.

7. Bolt the filler tee and overflow bottle mount angle to the muffler mounts. See Figure 06G-07 for location and position. 912 models refer to the **912 Accessories Figure 06G-07A**.

7. Bolt the filler tee and overflow bottle mount angle to the muffler mounts. See Figure 06G-07 for location and position. 912 models refer to the **912 Accessories Figure 06G-07A.**

FIGURE 06G-07

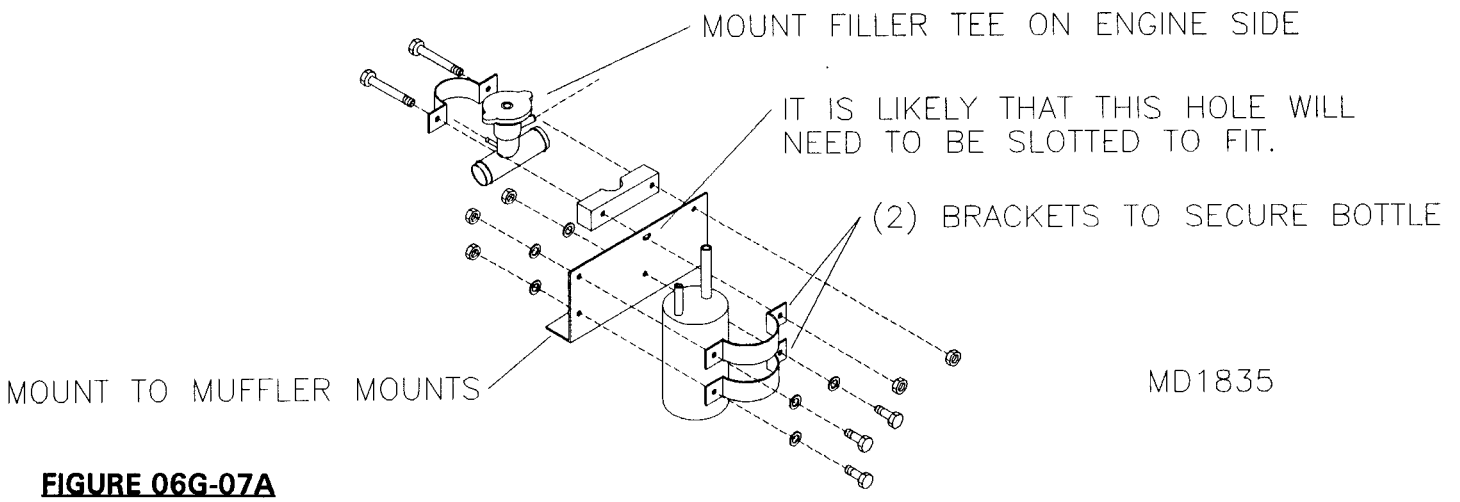
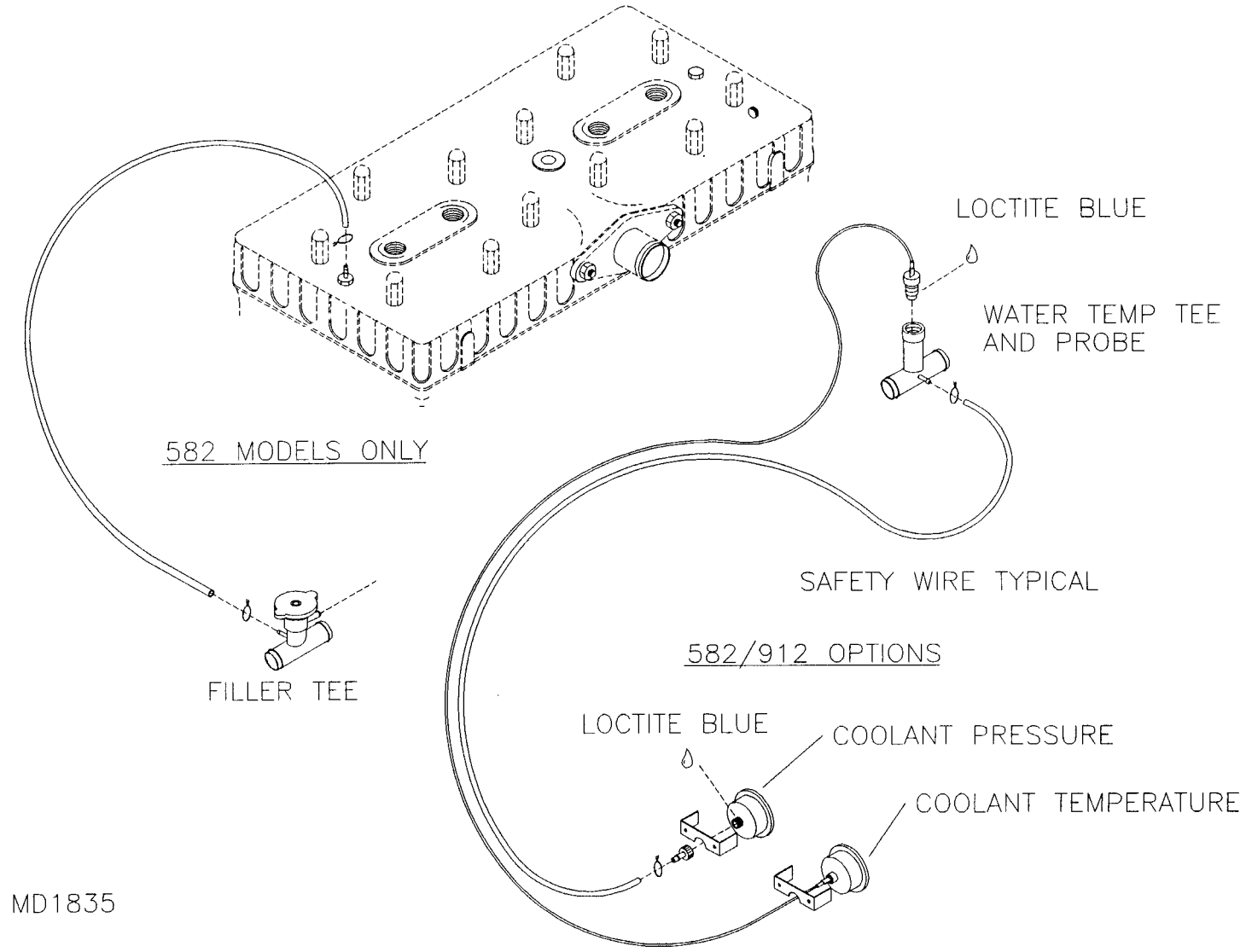


FIGURE 06G-07A



8. Bolt the coolant recovery bottle to the bracket that also mounts the filler tee, see **Figure 06G-07**. Run the overflow line from the filler tee to the coolant recovery bottles' larger tube. The smaller tube is used for overflow from the recovery bottle. Since the bottle will rarely overfill it is not required to route an overflow line, however, if you want to do so, fuel line works great. Route the line down along a cabaine then along a gear leg. Install safety wire or small hose clamps to secure the line to the fittings. **PLEASE NOTE:** Look under electrical for a schematic of the cooling system. For 912 installations the overflow bottle fastens to the keel tube. See drawing 912 accessories section.

COOLING SYSTEM FILLING & OPERATIONS

FILLING

Prior to filling the system check all connections and hose clamps for a tight secure fit. Fill the system with 50/50 mix of water and anti-freeze. Air in the cooling system will be your biggest concern. Air is easily purged from the system by unscrewing the 6mm bolt at the top of the engine and filling the fluid until it runs out. Also, the water pump needs to be purged of air by loosening the small hex headed screw on its top side. Tighten the clamp and fill to the top of the filler tee.

BREAK IN & OPERATIONS

IMPORTANT: Use a 30" box fax to circulate the air over the radiator during break in. We usually run our S-12's with quite a breeze, that's Kansas you know, but other parts of the world are less windy. The fan will assure proper cooling during break in. Once broke in, normal operations should not exceed 200 degrees even in a long slow taxi. During the break in run of the engine it is normal for some coolant to overflow. This may be due to air bubbles or excessive fluid. Watch your temperature and pressure gauge. Temps should be around 160 to 170°F with pressure under 16 lbs. Feel the hoses, if you can hold your hand on them for 30 seconds you are getting proper cooling. If you are running 200 or above and not overflowing do the hand test, it may be your gauge is in error. The 912 engine cylinder head temperature should not exceed 300°F. According to Rotax the coolant temperature is monitored by the CHT.

REASONS FOR POOR COOLING

1. **LOW COOLANT LEVEL:** Check level and fill. Inspect for leaks. Look around the pump, they are famous for leaking through the drive shaft. Make it a habit to check the coolant before every first flight of the day.

2. **AIR IN THE SYSTEM:** Purge by venting the top hose or 6mm bolt on the head of the engine.

3. **KINK OR RESTRICTION IN THE HOSES:** Check for kinks, collapsed hose or broken pump impeller.

4. **DIRTY OR CLOGGED AIR FLOW THROUGH RADIATOR:** The under belly position of the radiator allows debris to collect in the scoop. This will reduce the amount of air flow through the radiator and thus reduce its cooling ability. Inspect for debris as part of your pre-flight.

5. **IMPROPER FILLER CAP PRESSURE:** Using anything less than a 15 to 18 lb cap will allow fluid to overflow and drain down the coolant level. Check to make sure your cap is rated for 15 to 18 lbs.

912 COOLANT SYSTEM

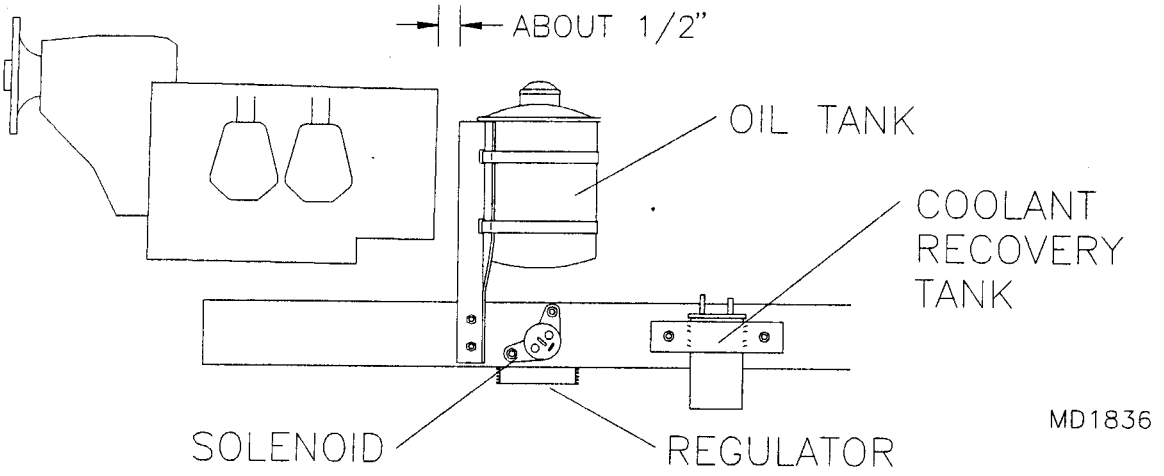
1. The cooling system on the 912 engine is slightly different. Refer to the 912 Cooling System drawing for an exploded view that should help in hooking up your system. When installing the aluminum tubes make sure to fasten them to the cabaines with the 1" cushioned clamps, leave these loose until you have adjusted the entire system. Check clamp tightness on all of the coolant lines before filling with coolant. **NOTE:** For technical data on the 912 operating speeds and limits refer to the Rotax Operators Manual for Rotax 912UL.

INSTALLATION OF 912 ACCESSORIES

1. Gather the parts for installing the oil tank. The regulator, coolant recovery bottle, and solenoid are attached using 3/16" stainless steel pop rivets. The bottle and clamp are called out in the cooling system. See **Figure 06G-01.**

FIGURE 06G-01

A. Mount the oil tank 1/2" forward of the engine flywheel.
B. Attach the solenoid on the right side (facing forward).
C. Attach the regulator on the left side (facing forward).
D. Mount the coolant recovery bottle on the right side of the keel beam (facing forward), centered vertically on the keel beam centerline.



2. To begin the installation of these parts, measure from the flywheel side of the engine forward 1/2" to allow clearance between the flywheel and the oil tank. Install the mounts for the oil tank in this location, flush with the bottom of the keel tube.

3. Next, install the regulator on the left side of the keel butting up against the oil tank mount angle. The opposite end of the regulator gives you the distance for installing the oil tank mount brackets (please make sure that the mounts are parallel and 90°). Install the solenoid on the right side of the airframe. (This configuration makes wiring easier and cleaner.)

4. When installing the oil tank make sure the lip of the tank rests on the mount to help relieve the tank weight. Also, be sure to leave enough clearance for the flap teleflex cable and for the oil drain.

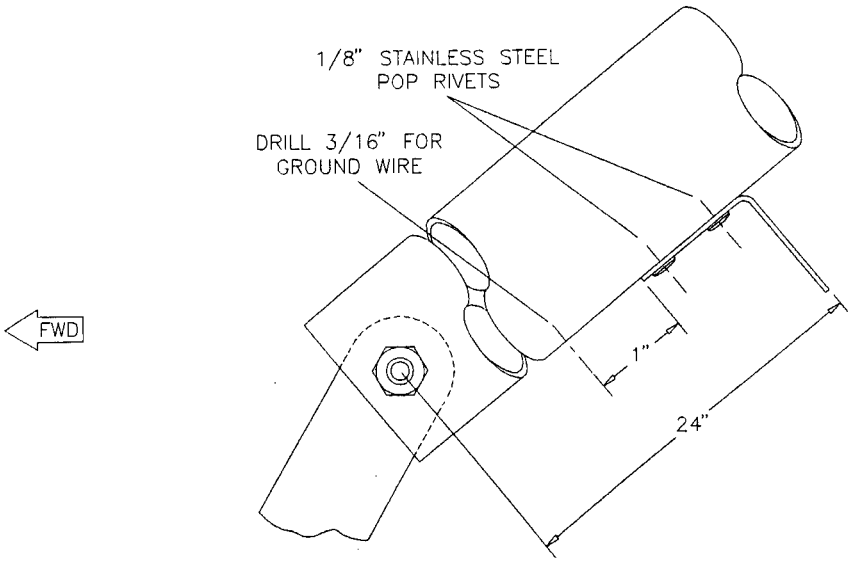
S-12 AIRAILE INSTRUMENT PANEL & ELECTRICAL SYSTEM ASSEMBLY

At this point the upper structure must be assembled but without the forward strut bolted in place.

1. Select the parts depicted in the parts drawing.

2. Using the 1/8" stainless steel pop rivets attach the instrument mounting angle to the forward strut at 24" from the lower bolts center. Face the brackets with one leg AFT. See **Figure 07-02.** **PLEASE NOTE:** The ground wire is riveted to the forward strut with a 3/16" aluminum pop rivet. Drill the hole for this in the location as shown in **Figure 07-02.**

FIGURE 07-02



3. Clamp the upper instrument panel to the mounting angle with a small vise grip type "C" clamp. Use masking tape on the ends of the clamp to protect the paint job on the panels. View the panel from the front to determine if it is level with the fuselage. **HINT:** Line up the panel with one of the gear or seat carry through tubes. Once you are satisfied with the position of the panel drill through the mounting angle with a #30 sized drill. Cleco with copper clecos.

4. Clamp the lower panel to the upper panel and to the AFT side of the tab welded to the fuselage. Check with a tape measure to verify if the panel is on the center of the upper panel. Check for center position of the lower panel at the lower tab. Once everything is center and on the mark drill, rivet and bolt the lower panel in place.

5. Fit the instrument panel dust cover onto the back side of the panels. The dust cover should fit on the inside of the flanges. Once the cover is in position drill through the flange holes with a #30 or 1/8" drill. Install the self tapping screws then remove for installation of the instruments.

6. Refer to the parts drawing depicting the instruments and electrical system for your engine installation. Select the components shown. Refer to the wiring schematic for details on wire routing. This drawing can be used to complete the standard electrical system and instrument hook-ups. If your craft features electric start or an engine requiring special wiring please refer to the specific option information. In the case of accessories refer to the engine manual for further wiring information.

7. Prior to installing the ignition switch the wire leads to the switch need to be fabricated. Do so by taking the two long lengths of black or blue wires. Bare one end of each wire 3/8". Crimp the eye shaped terminals to the bared ends. A good tool for this is a needle nose pliers if you do not have the

official electricians tool. After crimping please check for security by giving the terminal a firm pull.

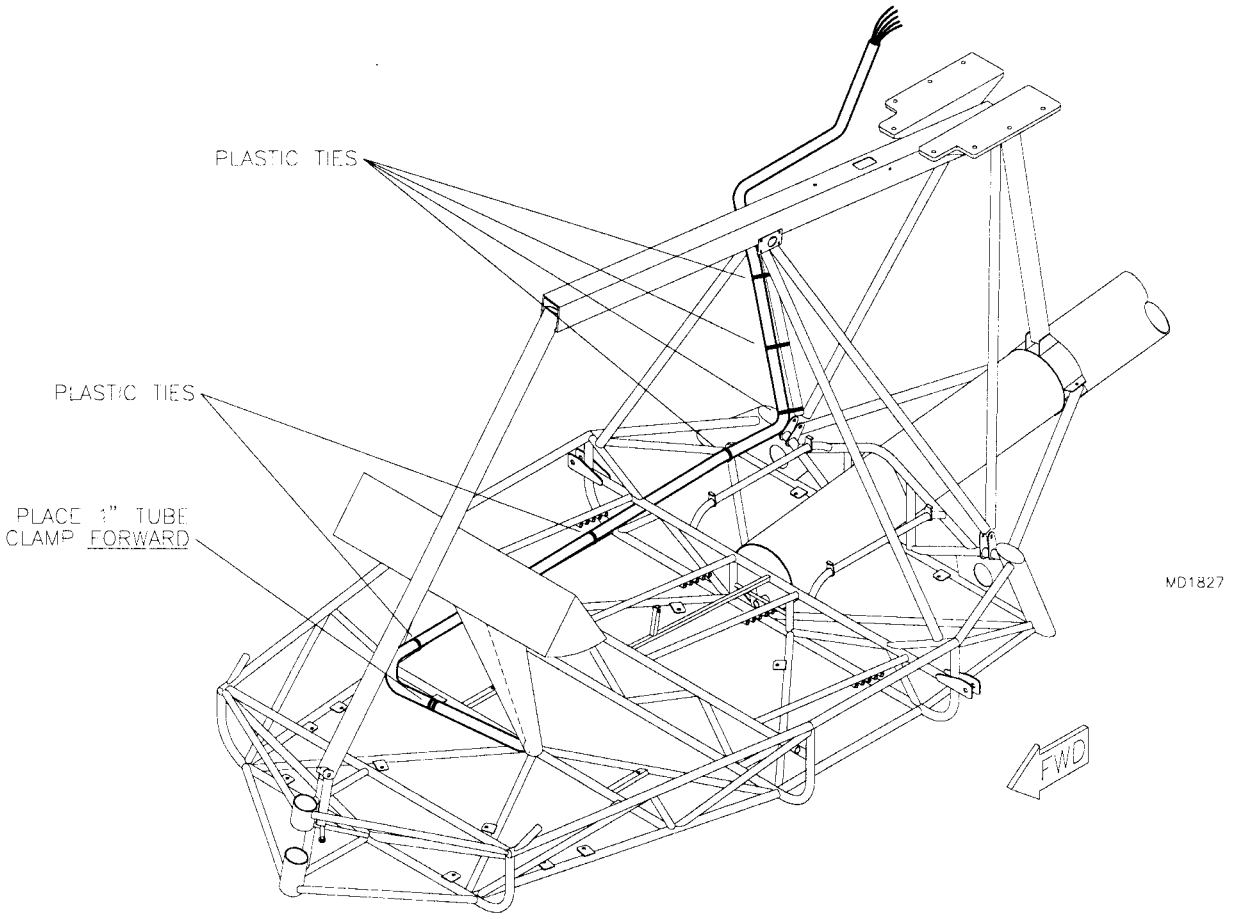
Remove the terminal screws and install the wires to the switch. Remove the ring nut off the switch and put a small dab of loctite on the threads.

An ignition switch works opposite of a normal switch by the fact when it is on, the circuit is actually open and not closed. Therefore, it is required to install the switch so when it is in the up position it is actually closed. To correctly install the switch provided, position it so the rounded terminal is up. Check with a voltage meter if one is available for correct action. The switch should be open when it is up and closed when it is down.

8. Next, install from left to right the following instruments: hour meter, cylinder head temperature, tachometer, and airspeed. The empty holes can be used for optional altimeter and vertical speed. Holes can be drilled into the lower panel for more instruments such as water temp and pressure. **NOTE:** The 912 option comes with a different hole pattern instrument panel.

9. Make up the ends of the wires as required and shown in the wiring diagram of your specific engine installation. Connect the wires to the appropriate instrument. After plugging in the wires to the "Y" connectors use black electrical tape to protect them from shorting. Use small plastic ties to secure the wire bundle together and route the bundle down to the exit hole in the dust cover. Slip the bundle through the hole and install the dust cover. The wire bundle is put inside the black plastic shroud and routed to the engine. Secure with plastic ties every 12" at the points suggested in **Figure 07-09**. **PLEASE NOTE:** The 1" tube clamp is bolted in place using the right side AFT floorboard bolt. Make sure the tube clamp is on the **FORWARD** side of the bolt to avoid in hitting the control stick.

FIGURE 07-09



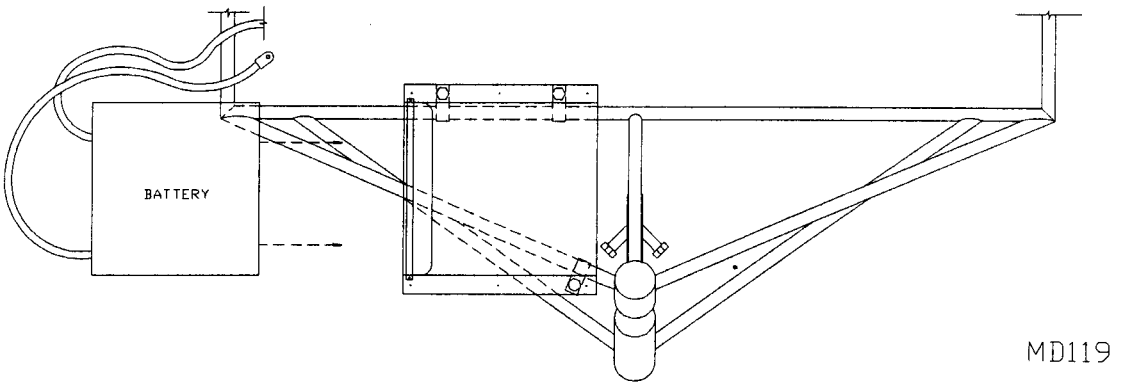
10. To ground the electrical system drill a 3/16" hole in the forward strut 1" ahead of where the instrument mounting angle is located. Crimp a blue eye terminal to a 12" length of white wire and rivet it to the forward strut. **IMPORTANT:** Be sure the ground contact is good. If the ground is not good the ignition switched may fail to kill the engine.

11. The pitot and static probes attach to a mount to the forward right floorboard bolt. For S-12's with fairings attach the mount after the fairing is installed. See the section on fairing installation for details. Install the mount so it points directly into the slipstream. The two probes clamp to the mount with 1/2" extending out the back. Run the static and pressure lines to the probes by drilling a 3/4" hole through the floorboard inside of the plastic dust cover. In the case of fairing equipped craft the lines can run between the floorboard and belly pan. See fairing instructions for details on the hole location for the lines.

S-12 AIRAILE BATTERY BOX INSTALLATION

1. Install the battery box on the forward right side of the cockpit cage. Refer to **Figure 07C-01.**

FIGURE 07C-01



2. Attach the battery box using the cushioned clamps, 3/16" bolts and washers as shown in the parts drawing.

3. Fasten a cable to the positive side of the battery. Route up to starter solenoid using the best path available.

S-12 AIRAILE SEAT ASSEMBLY

1. Select the parts as shown in the S-12 parts drawing.

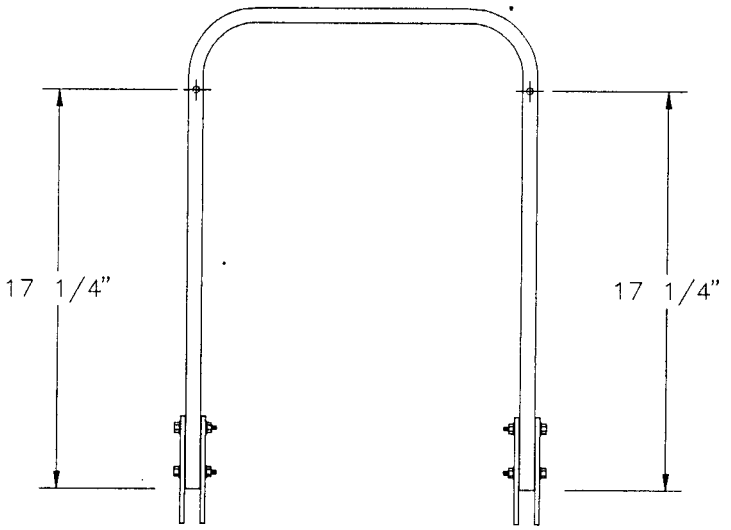
2. The doublers have been installed in the seat prior to lumbar bend but they need to be drilled. Drill through with a #11 bit using the frame as a guide. Bolt a set of seat back gussets to each seat back frame. Please orientate bolts so the nuts are facing inward towards each other.

3. Set the seat back frame assembly onto the fuselage seat frame. Position the frame assembly so the gusset's lower open hole is lined up with the bushings welded to the bottom of the built in seat frame. Drill out the gusset to 1/4" diameter. Take a 1/4" clevis pin and test fit through the newly drilled hole. If it is tight, drill out the welded in place bushings with a 1/4" bit.

OPTIONAL HEADREST ASSEMBLY

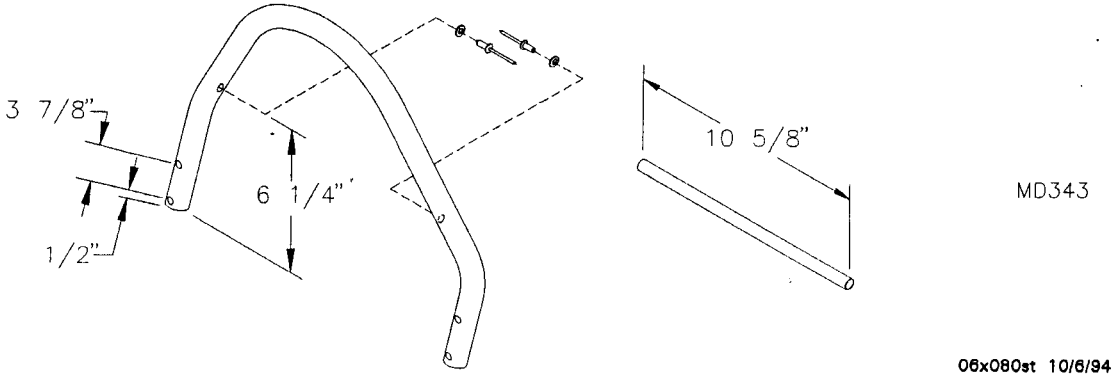
4. Remove the seat, measure and mark up from the lower ends 17 1/4" on the seat frames' **BACK SIDE**. Drill a 1/4" hole through only the tubes one side on each side. See **Figure 08-04.**

FIGURE 08-04



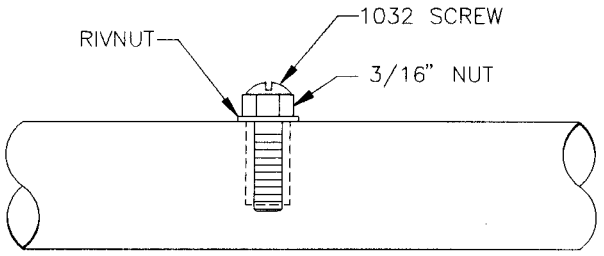
5. Lay out, mark, and drill the headrest frame as shown in **Figure 08-05**. Install 3/16" aluminum pop rivets with thick washers to form "buttons". The "buttons" will serve to hold the headrest internal brace. The Headrest internal brace will need to be cut to length and filed to fit after the headrest tube is fitted to the seat back frame. **NOTE:** Cut tube to 10 5/8".

FIGURE 08-05



6. Install the rivnuts to the two 1/4" holes in the seat back frame. Refer to **Figure 08-06** for details. Bolt the headrest frame to the seat back frame with 3/16" bolts. Drill into the seat frame where the two upper #11 holes are drilled out to 1/4" and install two more rivnuts. Fit the headrest internal brace by filing a slight angle to match the headrest frame. Remove the headrest frame.

FIGURE 08-06



PROCEDURE:

1. FINGER TIGHTEN NUT AND RIVNUT ONTO SCREW.
2. INSERT RIVNUT INTO 1/4" HOLE.
3. TURN NUT THREE TURNS CLOCKWISE WHILE HOLDING SCREW STATIONARY.
4. BACK NUT OFF HALF A TURN AND REMOVE SCREW.

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7. The lower nuts at the bottom of the seat back frame serve to hold the seat back lower tube. Cut two tubes to 14" and install the seat back lower tube to the seat frame assembly by spreading the frame apart just enough to slip the tube over the lower bolts and nuts. If the tube does not bottom out against the washers lay the assembly on its side and tap it gently with a mallet.

8. Slip the seat back cover over the frame with the map pocket to the back. Lace the straps around the bottom tube and through the buckles. Pull the straps tight.

FOR OPTIONAL HEADREAST ONLY

9. Find the locations of the four rivnuts on the seat back frame andmelt through with the tip of a soldering iron. Bolt on the headrest frame with the 1/2" tube in place. Slip the headrest cover over the frame and close the velcro. The seat back is ready to install to the airframe, do so after the seat bottom is installed.

10. Take the seat bottom and position it on the fuselage frame. Lace the crossing straps first followed by the front to back straps. Pull these straps as tight as possible without tearing them. **NOTE:** You may need to tighten these straps after a few hours of flying. Loop the extra strap back into the buckle and trim off the excess so only 2" to 3" remain.

11. Attach the seat back to the fuselage frame in the desired location using the 1/4" clevis pins provided.

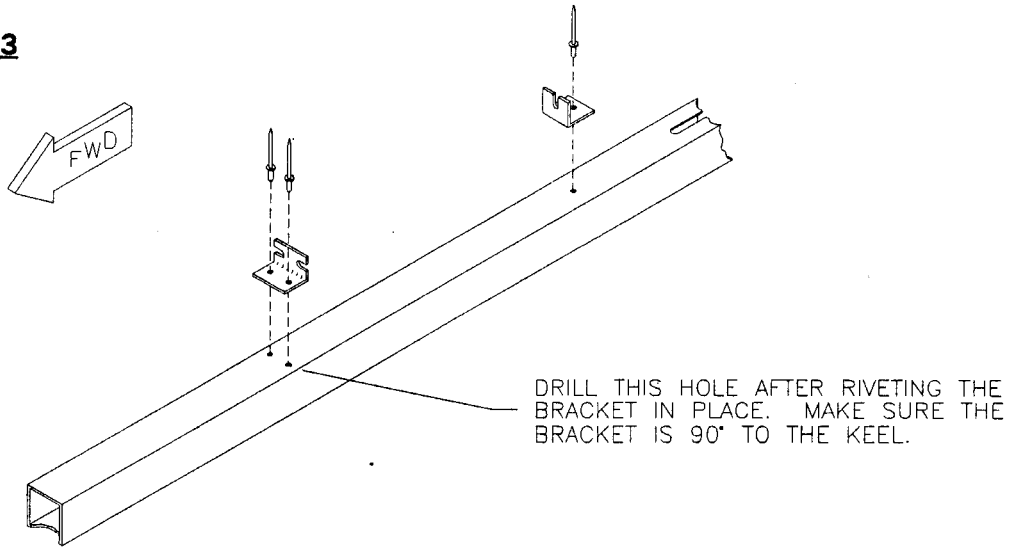
S-12 AIRAILE AILERON & FLAP ASSEMBLY

1. Select the parts depicted on the parts page, then turn to covering for selection of the skins.

2. Bolt the flap lever unit in between the seat to the mount provided. **PLEASE NOTE:** The forward bolt inserts from below for elevator push pull tube clearance.

3. Locate the single and double slot teleflex retainers in the locations shown in **Figure 09-03**. **NOTE:** Only one of the two holes required to mount the double slot teleflex retainer is pre-drilled.

FIGURE 09-03

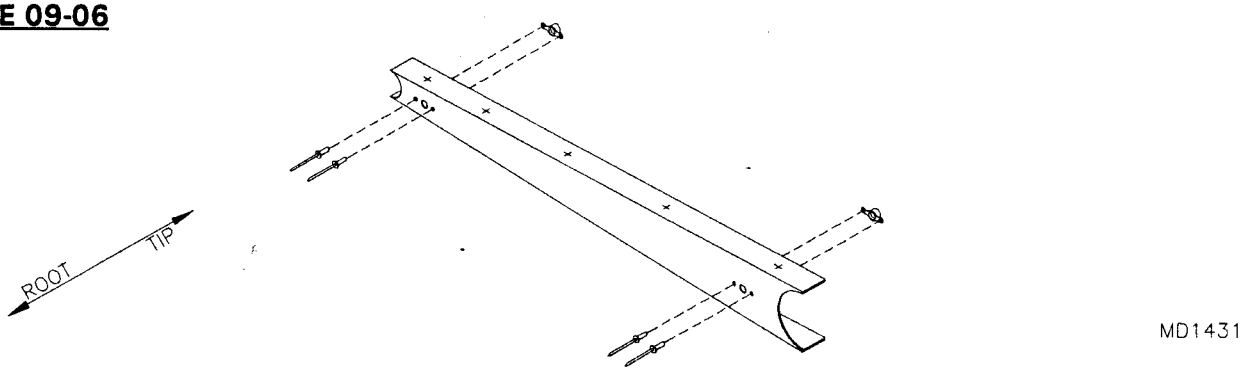


4. Route the teleflex from the flap lever so it loops up between the two AFT cabaines and into the retainer. Safety wire it in place with a figure 8 loop of wire. Bolt the dual teleflex retainer AFT to the teleflex.

5. Assemble the flap return springs as per the parts drawing.

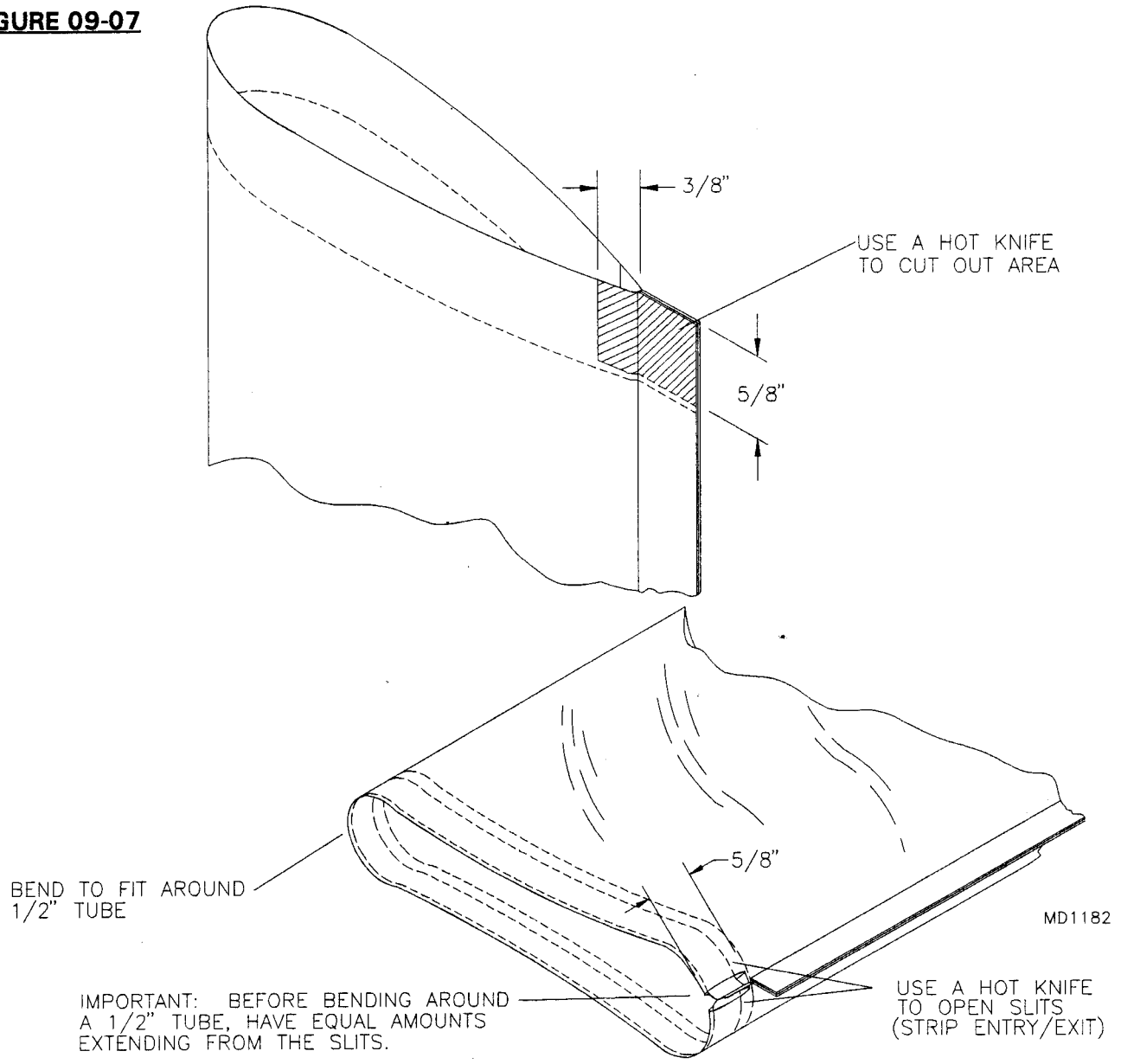
6. Rivet the 3/16" nut plates to all hinge holes in the flaps and ailerons. Rivet two 3/16" nut plates to the inside of each aileron flap root rib. See **Figure 09-06.**

FIGURE 09-06



7. Cut a small notch in the pocket end of the cover. Cut back from the velcro on each side a notch a little less wide than the pocket. Do not cut into the stitches. See **Figure 09-07** detail A. This will allow entry and exit of the aluminum strip. With the strip inserted with equal amount extending out of the fabric, bend it at the point where the trailing edge of the aileron will contact.

FIGURE 09-07



8. Slip the pre-sewn skins over their respective frames. The skins will fit tight but they will go on. Some helpful methods follow. If your skins are really tight, try a very small amount of silicon lubricant spray.

9. Brace the opposite end against a wall to push against as you pull on the skin (A). After about half way on, pull the skin down from the top. This will scrunch it up but now you will have less tension to pull against (B). In extreme cases where the skin is too tight (it will be evident by the bowing in of the trailing edge between ribs) file off the ribs at the buttons a little. **CAREFUL** it is real easy to remove too much.

10. With the fabric pulled down as far as possible, install the tension rib in the full extended position. Rivet fabric to each side of the rib with five evenly spaced rivets. See **Figure 09-010**. Turn the screws tight to tension the fabric. The proper amount of tension is reached when the rib bottoms against the 1/2" tube. See **Figure 09-010A** for a view of the finished product. Note how the metal strip is trimmed and formed around the spar. Rivet to the spar with two #40 aluminum pop rivets.

FIGURE 09-010

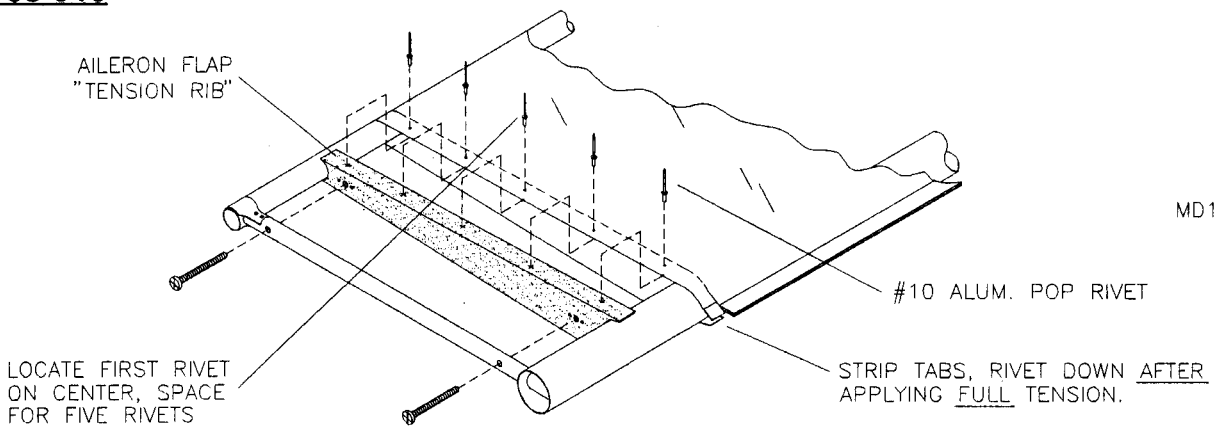
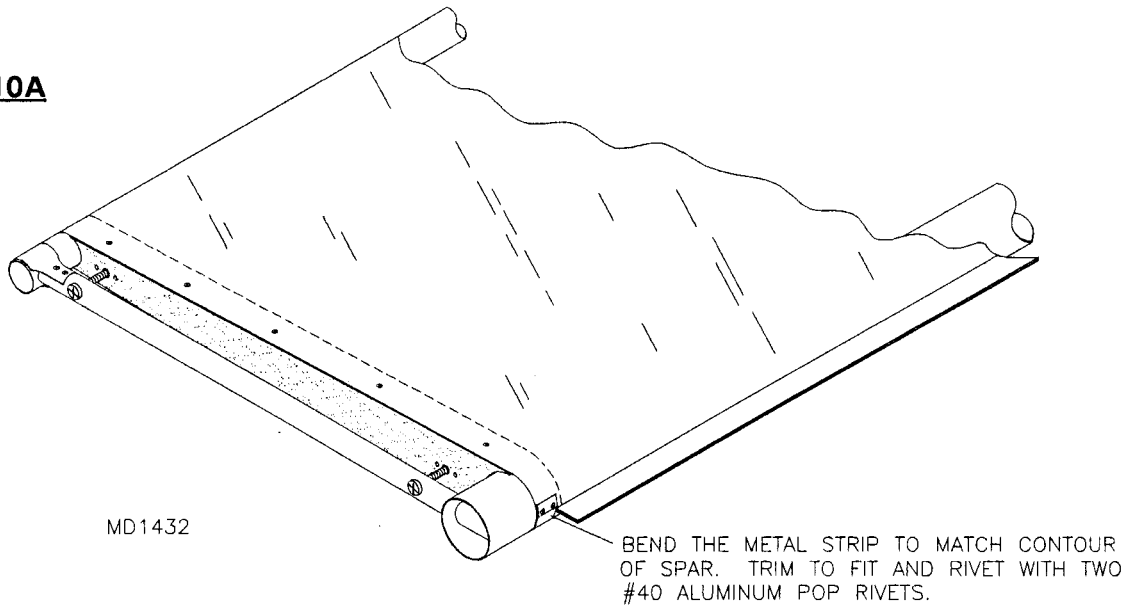
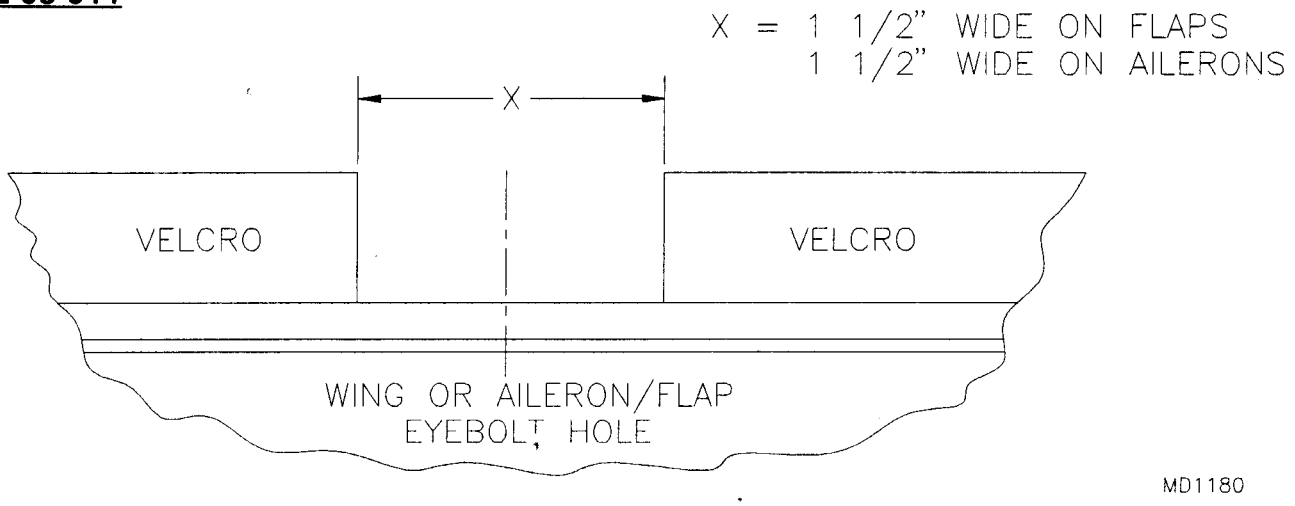


FIGURE 09-010A



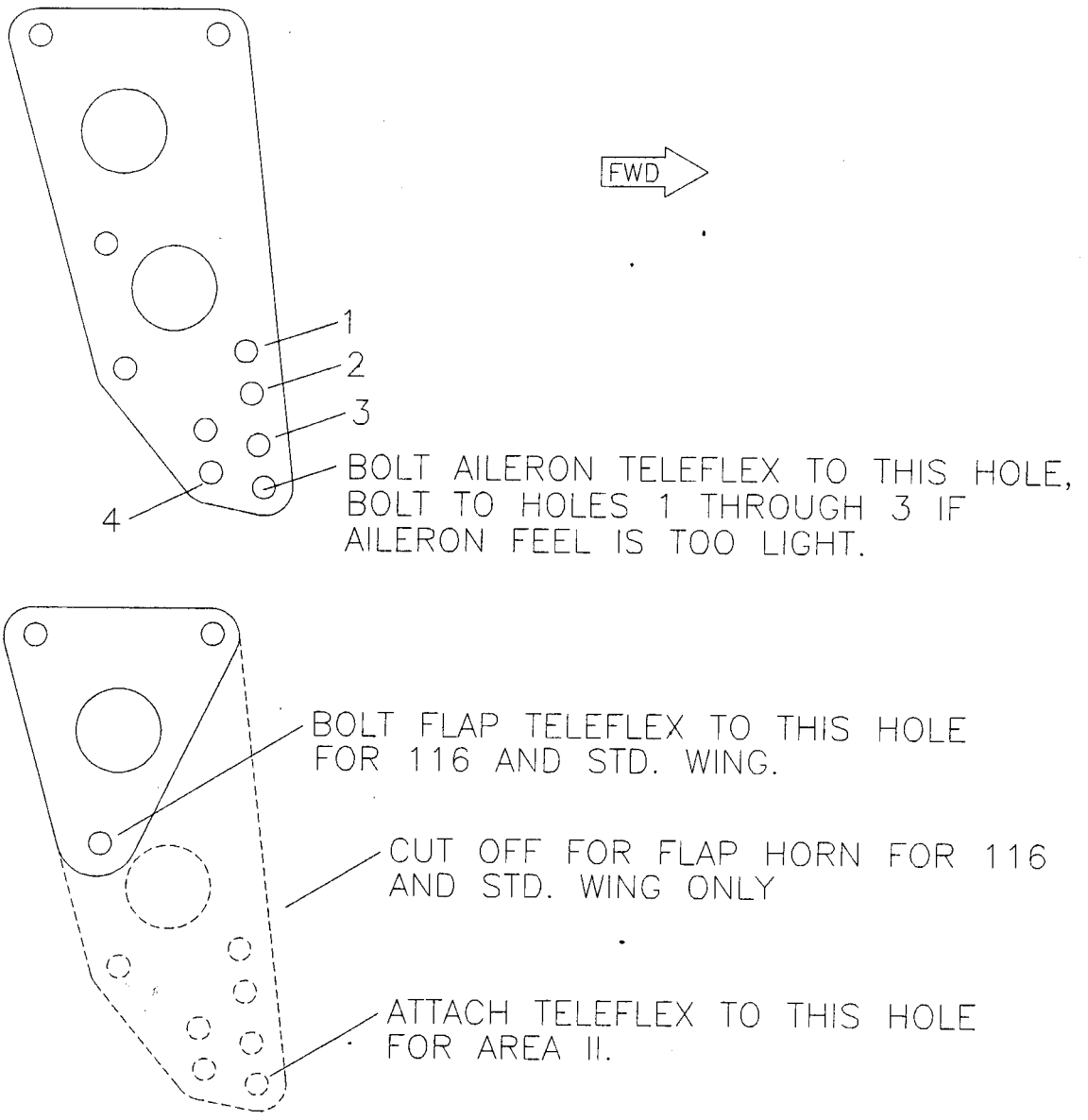
11. Melt through the hinge points and horn attach angle bolt holes. At each hinge point cut out as shown in **Figure 09-011**. **BE CAREFUL** not to cut into the stitching.

FIGURE 09-011



12. Bolt the horn attach angles to each surface. See **Figure 09-012** for part orientation. Set angles 90 degrees to the spars. Slip the aileron clip over the trailing edge. Melt a hole through the skin where the bolt will pass. Locate the hole in the angle by inserting a #11 drill through the clip and drilling the angle. **HINT:** To avoid damage to the clip after the drill has started into the angle, remove the angle to drill through. Insert the 1/4" X 1/2" spacer bushing between the clip (inside the skin) and bolt. Bolt the horns to the angles as per the parts drawing.

FIGURE 09-012



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S-12 AIRAILE WING ASSEMBLY

LEADING EDGE SPAR ASSEMBLY

NOTE: Assemble both spars the same but make one **LEFT** and one **RIGHT**.

1. Select the necessary parts as shown in the parts drawing.

2. The leading edge spar comes with all but one of the holes pilot drilled. The final hole sizes are called out during assembly. **PLEASE NOTE:** The front side of the spar has four (4) holes for the tip bow rivets. Disregard the 5th hole in from the tip, it is used for the static and pitot probes on the S-6ES Coyote II.

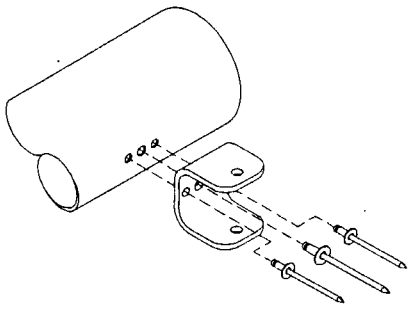
3. Drill out the root hole of the leading edge spar to 1/4" to accept the wing attach bolt. (Drill from each side). In the next hole outbound rivet an S2-SAB to the spar with a single 3/16" stainless steel pop rivet.

4. Bolt the long wing channel to the first hole 55" outboard of the root using the parts shown on the leading and trailing edge spar drawing. Position the channel so the unbolted end points to the **root.** Line up the channel parallel with the spar and then drill and rivet with a 3/16" stainless steel pop rivet through the remaining hole. (Only drill through one side of the spar.)

5. Drill out the three holes in a row (approximately 107" from the root) to 3/8". For best accuracy, lay the strut attach plate against the spar holes and use it as a template. In fact, it is best to drill through with a 1/4" drill, bolt the plate to the spar, then drill the other two holes out to 1/4". Remove the strut plate and drill existing 1/4" holes out to 3/8". **NOTE:** Drill from each side, not from one side through to the other. Debur and install the 3/8" X 3" bushings, 1/4" bolts, strut attach plate and wing channel as shown in the parts drawing.

6. Locate the #11 hole on the leading edge spar's inside (or AFT side), 3 3/4" inboard of the tip end of the spar. This hole should be radially in line with the other holes. Rivet the S2-SAB to the spar using a single 3/16" stainless steel pop rivet. Drill a #30 hole on each side of a 3/16" rivet. Rivet with a #30 stainless steel pop rivet. See **Figure 09A-06.** **NOTE:** The outboard compression tube (W-IO) will bolt to this bracket and another S2-SAB rivets to the AFT spar's forward side in the same location after the tip extension is installed.

FIGURE 09A-06



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TRAILING EDGE SPAR ASSEMBLY

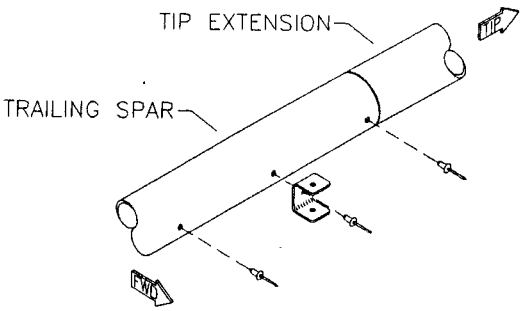
7. Bolt a long wing channel to the #11 hole drilled through the trailing edge spar, 6 3/4" from the root end. The unbolted end should point toward the **root.** Line up the channel parallel and drill and rivet with a 3/16" stainless steel pop rivet.

8. Bolt a long wing channel to the trailing edge spar at the hole 53" outboard of the root on the same side as the inboard channel. Position the unbolted end to the **TIP** side. Line the channel up parallel, drill and rivet with 3/16" stainless steel pop rivets.

9. Drill the three holes in a row, starting at approximately 107" from the root, for the aft strut plate out to 3/8". Debur and install the 3/8" X 2" bushings, 1/4" bolts, strut attach plate and S2-SAB as shown in the parts drawing.

10. Slip the trailing edge spar tip into the spar. Be sure that the hinge holes in the tip extension are radially in line with the holes in the trailing edge spar (Make sure that the large hole in the end of the tip extension is pointing foward). Drill the holes in the tip extension using the holes in the T.E. spar as guides. It is wise to cleco each hole as you go. Rivet the tip extension to the spar with three 3/16" stainless steel pop rivets. The middle hole is used to attach the S2-SAB at this time. See **Figure 09A-010**. **CAUTION:** These rivets must be stainless steel pop rivets. DO NOT use aluminum pop rivets.

FIGURE 09A-010



11. From the parts drawing determine the location of the inboard most hinge location and rivet a 3/16" nut plate on the forward side of the spar. **NOTE:** This is the hole closest to the long wing channel at the root end of the T.E. spar (The hole at approximately 8 3/4" distance from the long wing channel is not used in the construction of the S-12). Refer to the parts drawing to determine the location of the remaining hinge locations and rivet a 3/16" nut plate to each. **(Hint:** Use the flap and aileron frames to verify each location.) Also, rivet two (2) nut plates to each trailing edge spar tip extension on the side with the 1 3/8" hole.

12. Collect the parts shown in the universal hinge drawing. Make and insert the bushings into the bushings' fittings. Press the bushings into the ends of the bushings on the spar fitting. Test fit the fitting into the end of the spar. It most likely will need to be ground to contour the spar's inboard end. Use the first and second bolts at the spars root to attach the fitting. The bolt that attaches the hinge cube is used to attach one "L" bracket. The "L" bracket is used for the root rib tensioning system. Only finger tighten the bolt at this time. The "L" bracket will be attached in a later step.

13. Refer to **WING INTERNAL BRACE TUBES** part drawings and select the parts for assembly.

14. Install (4) compression tubes. Before bolting the middle compression tube in place, slip on the compression tube doubler. The compression tube doubler is a 4" tube 1 1/8" in diameter. The inboard compression tube uses a AN3-16A to bolt the forward end to the S2-SAB. The bolt is not too long, it is sized to allow for the fuel tank in a later step. Bolt the flap compression tubes with the hole for mounting the teleflex retainer closest to the trailing spar. **PLEASE NOTE:** The shorter tube (W-MC) bolts to the outer position.

15. Install the drag braces. **NOTE:** Filing may be necessary on W-DBR at the trailing edge end to clear the bolt coming through the long wing channel (Repeat if necessary on the W-DB).

16. Install the W-WC-51 and W-WC-59 cables used to stabilize the wing tip's last two bays. The W-WC-51 is installed by bolting the shorter cable between the AFT spar's S2-SAB at the AFT strut plate, and the S2-SAB bracket at the outboard compression tube. The W-WC-59 cable is also bolted to the S2-SAB bracket on the outboard compression tube and to the wing-tip corner gusset. See **Figure 09-016**. First, bolt the thimble end of the **SHORT** cable to the S2-SAB at the AFT strut plate using an AN3-16A bolt, a plastic washer, a 1/4" X .028 X 3/16" bushing and a 3/16" shear nut. Fabricate the bushings from raw stock. See **Figure 09-016A.** Now insert the AN3-16A bolt up through the S2-SAB on the leading edge spar and the compression tube (threads up) and place the adjustable tang of the short cable on the bolt (Adjust cable to be tight). Place the adjustable tang of the LONG cable on the bolt using the hole nearest the tang end and leave the thimble end hanging loose at this time.

FIGURE 09-016

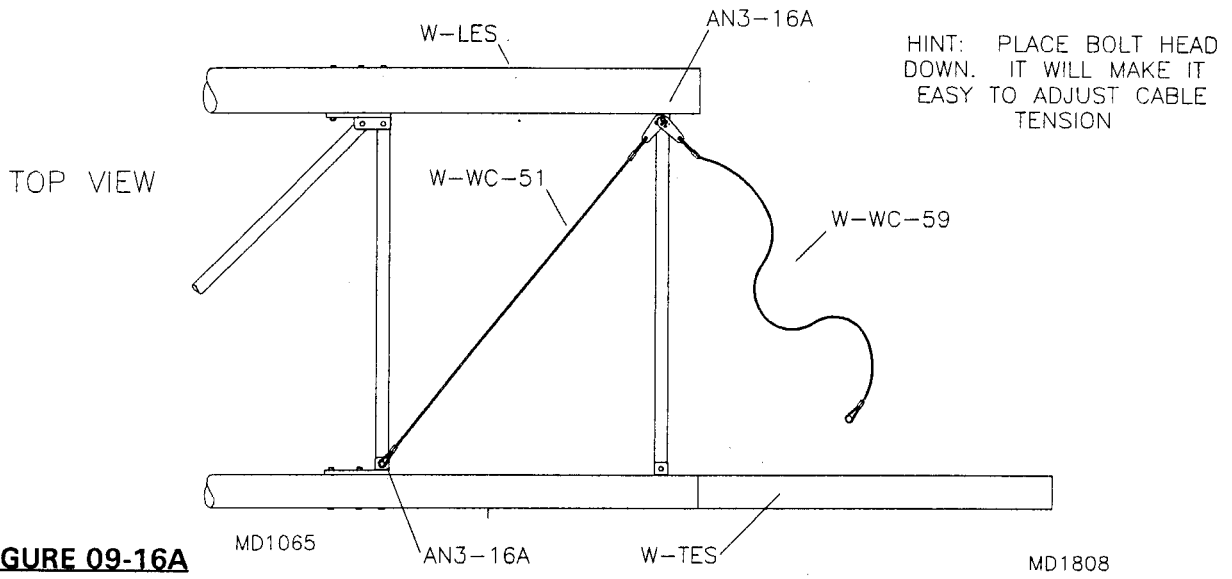
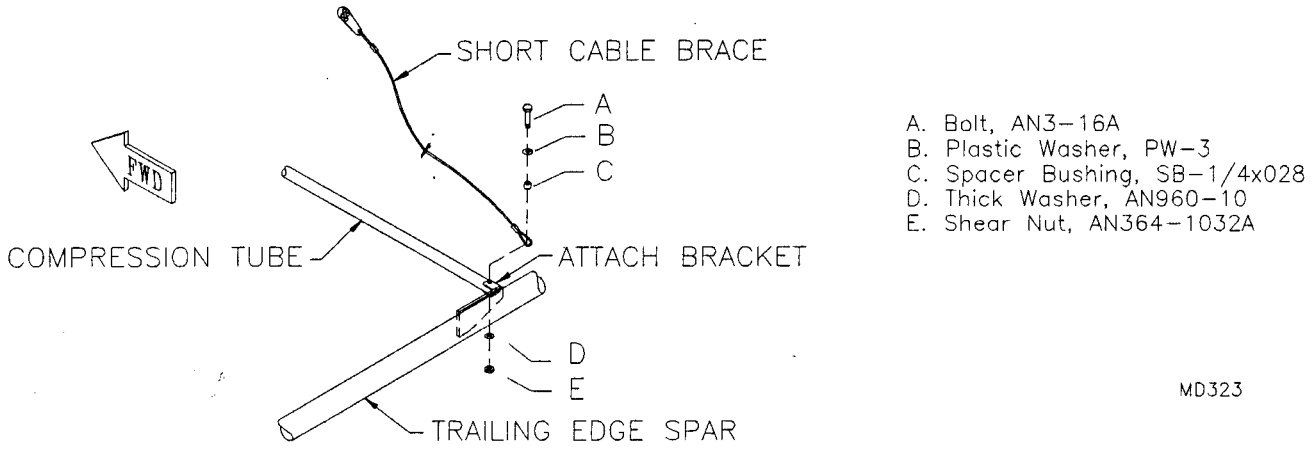


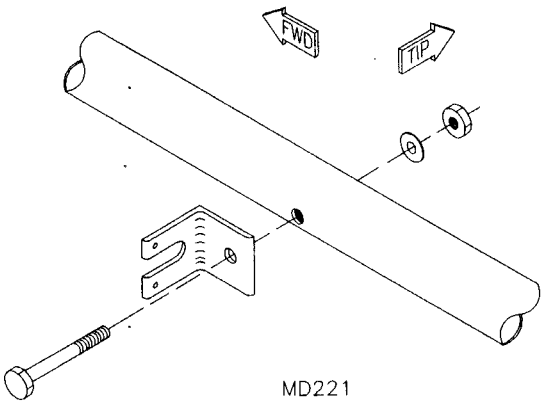
FIGURE 09-16A



17. Install the jury strut bracket. The bracket is attached to the long wing channel's outboard hole on the LES. Look closely at the drawing of the spars for location and position. **IMPORTANT:** Double check the position of the jury strut bracket before slipping on the wing covering!

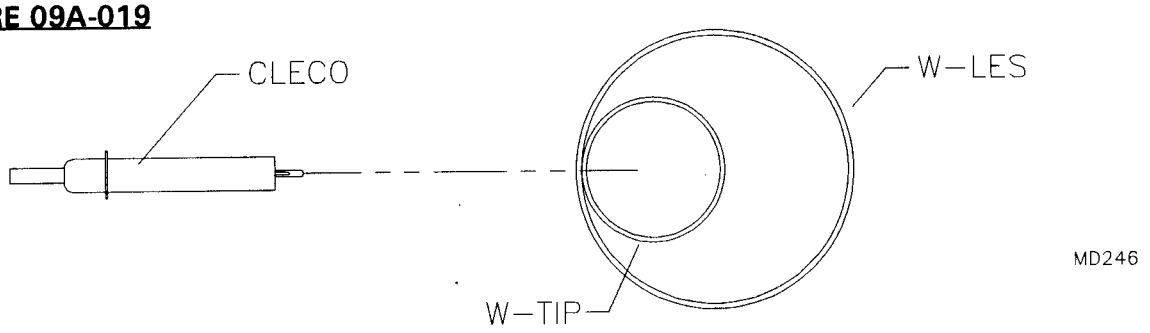
18. Install the teleflex retainer on the W-FCT tube to the root side. See **Figure 09A-018** for details.

FIGURE 09A-018



19. Insert the tip bow's drilled end into the leading edge spar so that the tip bow's first hole lines up with the **FOURTH** inboard hole on the LES and cleco. **IMPORTANT:** The tip bow must be flat against the spar on the inside. See **Figure 09A-019**.

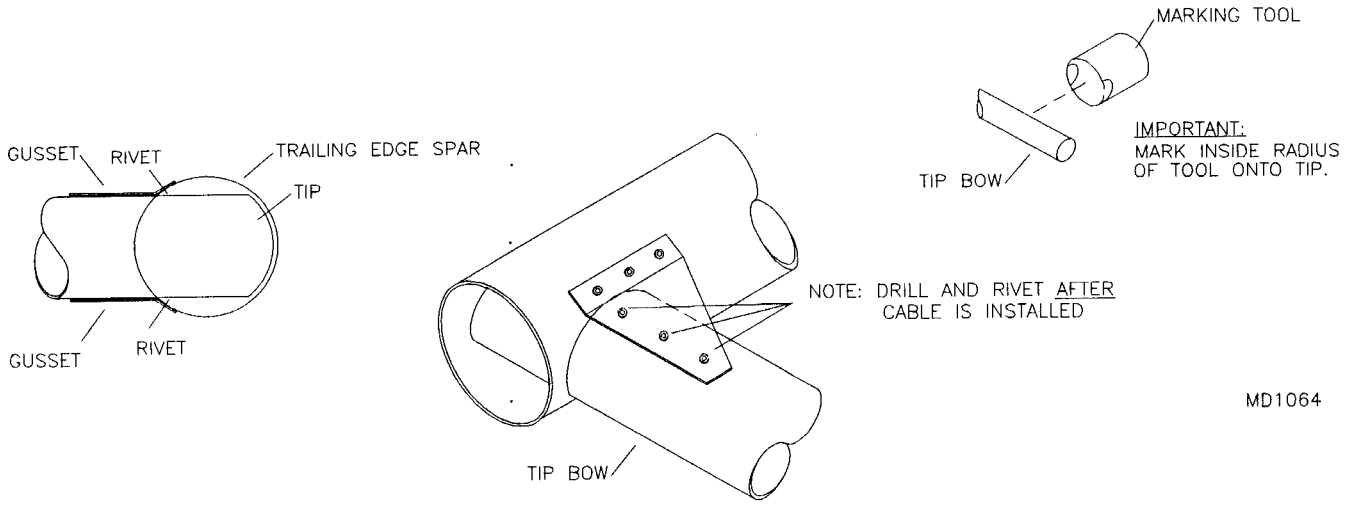
FIGURE 09A-019



20. Line up the bow parallel to the spar and drill through the remaining three (3) holes. Cleco each hole before drilling the next..

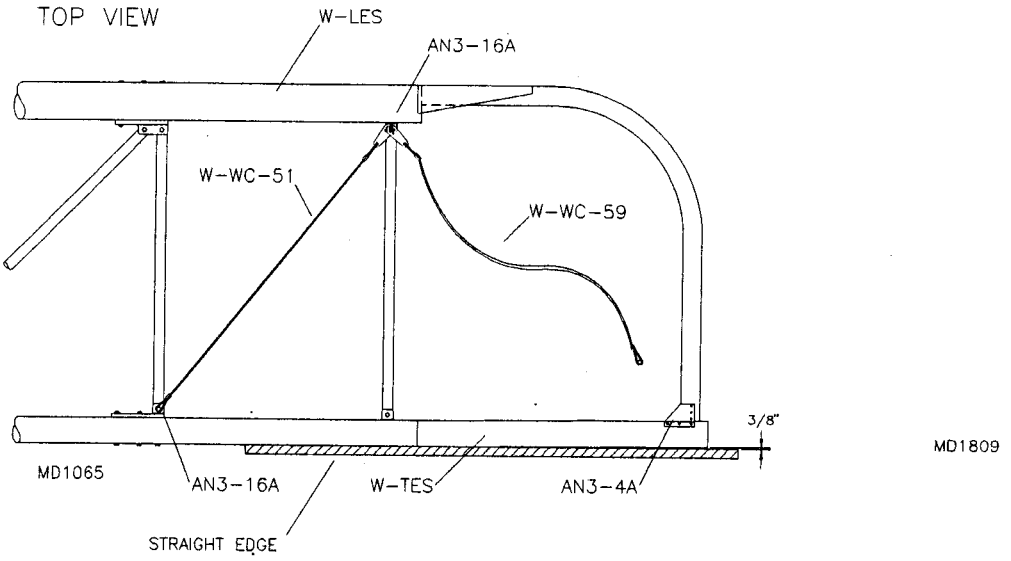
21. File and fit the tip bow's other end into the trailing edge spar's tip extension. See **Figure 09A-021**. Use the 2" tube with the 1 3/8" half hole to mark the tip end. The tip should exit the rear spar at 90 degrees. About 1 1/2" of the tip bow will have to be trimmed off. Rivet the top gusset to the trailing edge spar with (3) 1/8" **stainless steel** pop rivets. **DO NOT** drill or rivet the tip tube to the gusset until the tip cable is installed. If done prior to cable installation the wing tip skins will not fit properly.

FIGURE 09A-021



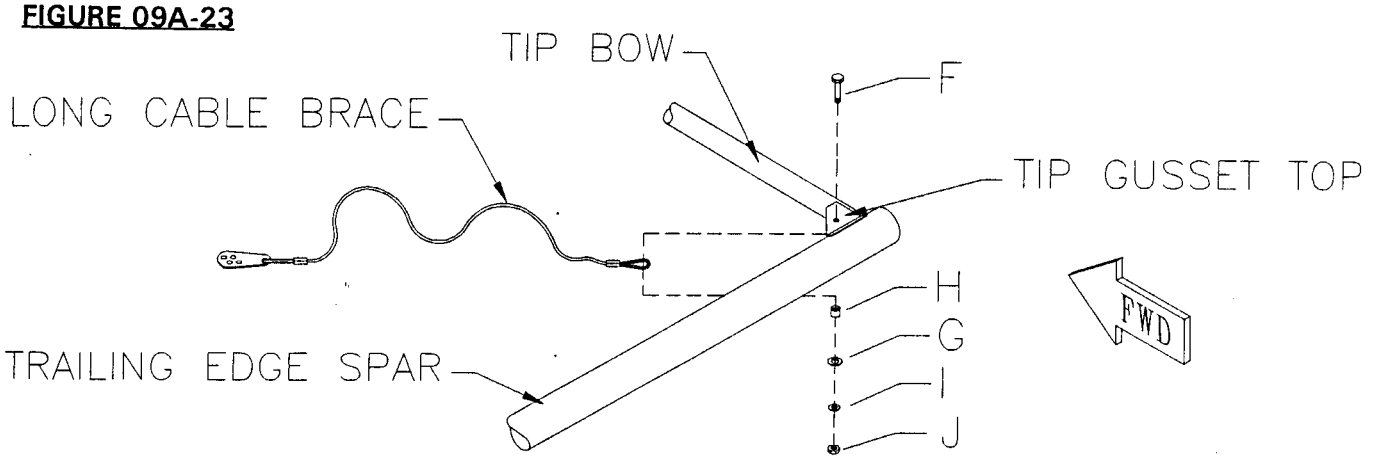
22. Establish approximately a 3/8" forward bow in the trailing edge tip extension. The bow will be straightened by the wing skin. See **Figure 09A-22.** Clamp or tape a straight edge in place before drilling the gusset for the cable attach nut. Cable tension can be adjusted at the tang's end or by twisting the cable. Sight down the front of the LE spar and tip bow to ensure that they are in line. After double checking proper alignment, drill and rivet the (3) 1/8" **stainless steel** pop rivets into the gusset and tip bow. Make sure that the tip bow is not allowed to move during the drilling process.

FIGURE 09A-022



23. Pull tight the thimble of the outer cable toward the gusset and mark the hole location. **NOTE:** Make sure to locate the hole in the gusset with enough distance from the trailing edge and tip bow to allow for the bolt and nut assembly to fit freely. Cable length can be adjusted at the tang end. Drill a 3/16" hole in this location. Using an AN3-4A bolt, a plastic washer, a 1/4" X .028 X 3/16" bushing and a 3/16" shear nut attach the long wing cable to the gusset. See **Figure 09A-23.** Set proper tension by using the multi-hole tang or twisting the cable. The cable should be as tight as possible without effecting the 3/8" tip bow set earlier. Now flip the wing over and attach the bottom wing tip gusset using (6) 1/8" stainless steel pop rivets.

FIGURE 09A-23



F. Bolt, AN3-4A
G. Plastic Washer, PW-3
H. Spacer Bushing, SB-1/4x028
I. Thin Washer, AN960-10L
J. Shear Nut, AN364-1032A

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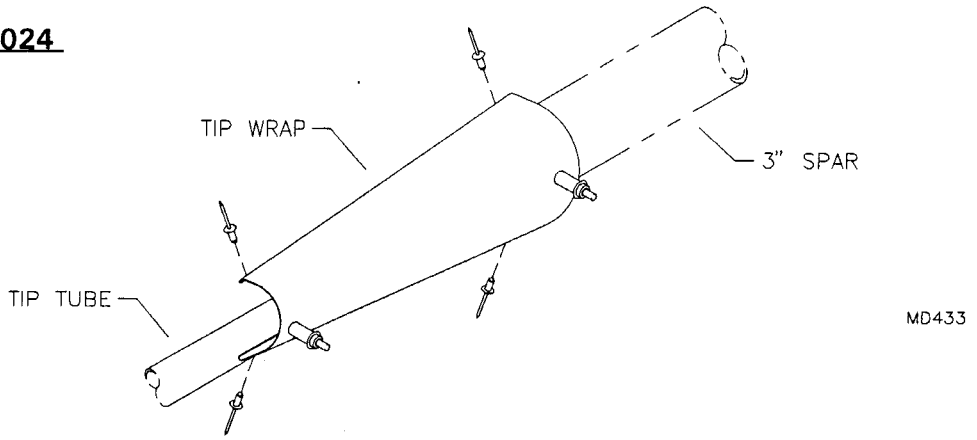
24. The tip wraps are shaped into half round curves. Overlap the tip wrap onto the spar about 3/8". See **Figure 09A-024**. Center the tip wrap and drill to #40 hole size. Cleco the tip wrap in place. This is only to assist in alignment, do not rivet the outside two holes of the tip wraps. Be careful when working the tip wraps, the sheet metals edges are very sharp. The wraps should be formed close enough to shape so that they lay against the spar without springing back. Working from the middle, pull the wrap together using tape to hold everything together. Rivet the tip wraps to the leading edge spar and tip bow with four (4) 1/8" stainless steel pop rivets. **NOTE:** After removing the tape a slight amount of bending may be necessary to achieve a pleasing shape.

FIGURE 09A-024



AILERON PUSH PULL TUBE ASSEMBLY

Refer to the control stick for selection of parts.

25. Drill out the 3/4" hole on the bellcrank to 7/8". It will be necessary to bevel the hole's inside edge to allow the bearing to fit flat against the bellcrank. Place the flange bearing in the bellcrank hole. **NOTE:** It may be necessary to place a washer between the bearings to remove play in the bellcrank assembly. Test fit washers of different thickness to determine the least amount of play. Drill and rivet **EVERY OTHER HOLE** in the flange bearing for **A TOTAL OF SIX HOLES** (see Control Stick). Pay close attention to which side of the bellcrank the bearing rivets to and make one for the left and one for the right. See **Figure 09A-025**. Install the aileron bellcranks as shown in **Figure 09A-025A**. The bellcrank gusset bolts to the long wing channel's two bolts, the other hole is located over the compression tube doubler. Starting from the bottom, drill out to 1/4" through the compression tube, gusset, and doubler. From this 1/4" hole drill a #30 hole 1 13/16" FWD towards the channel bracket and rivet the gusset to the tube and doubler using a 1/8" stainless steel pop rivet. **IMPORTANT:** Install the bellcrank gussets with the small flange pointing **DOWN**. Install the aileron bellcrank with the bearing on the **UNDERSIDE** of the bellcrank. The longer arm of the bellcrank should be to the wing tip side of the compression tube for attachment to the short aileron push-pull tube.

FIGURE 09A-025

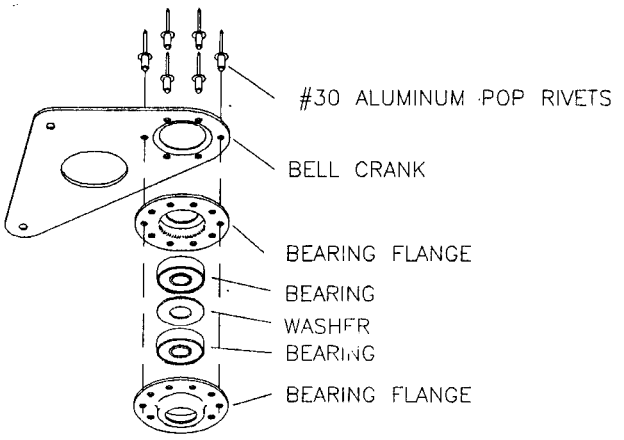
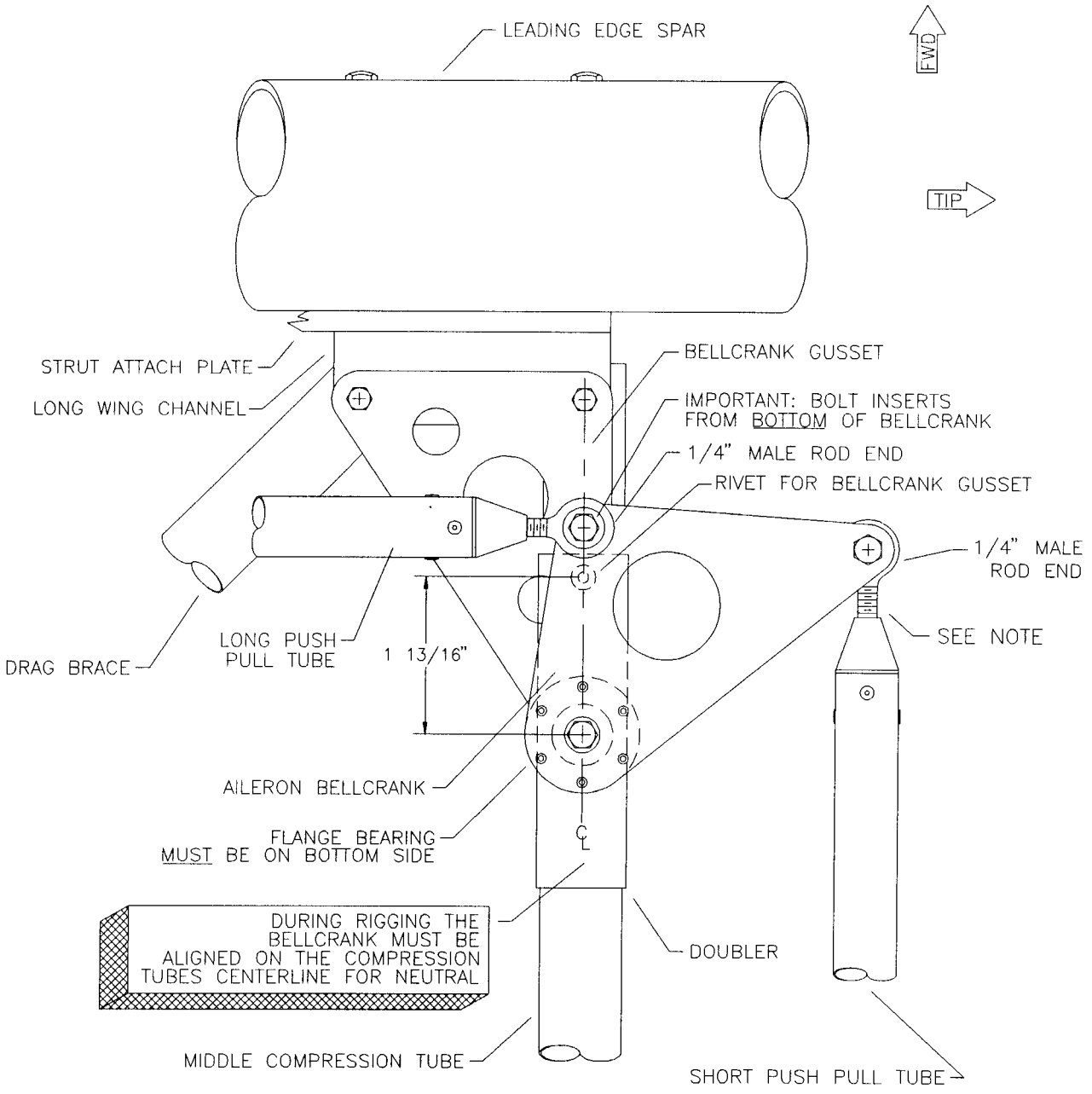


FIGURE 09A-025A



INSTALLING THE ROOT RIB TENSIONING SYSTEM

26. The wing skin is attached to and tensioned span-wise using a **CARBON AND GLASS FIBER** root rib. The root rib comes ready to install with the exception of some small holes for the bolts and fuel sight gauge. Please be careful when drilling the root rib that the carbon fiber is not breathed. Wear a dust or particle mask while drilling these holes. Clean up the dust with a vacuum cleaner. This rib is attached to the wing through two "L" brackets and bolts. These bolts are threaded into the root rib. When the bolts are tightened the root rib moves inboard pulling the wing fabric tight.

27. Collect all the parts depicted in the parts drawing for the root rib.

28. The four tensioning angles come with one leg drilled with two holes. This is the leg that the tensioning bolt will pass through. Bolt the tensioning angle to the universal hinge so the double holed end is pointing to the forward spar. The single holed end bolts to the hinge. Include the hinge cube in this assembly. See **Figure 09A-028**. Locate an "L" bracket on the forward spar in the position shown in **Figure 09A-028A**. Remember to bolt the angle on with the two holed end to the rib. Set the root rib on the wing between the spars. Install the bolt with the head on the **INSIDE** when attaching the forward "L" bracket. Be sure the doubler is placed in the spar before drilling and bolting.

FIGURE 09A-028

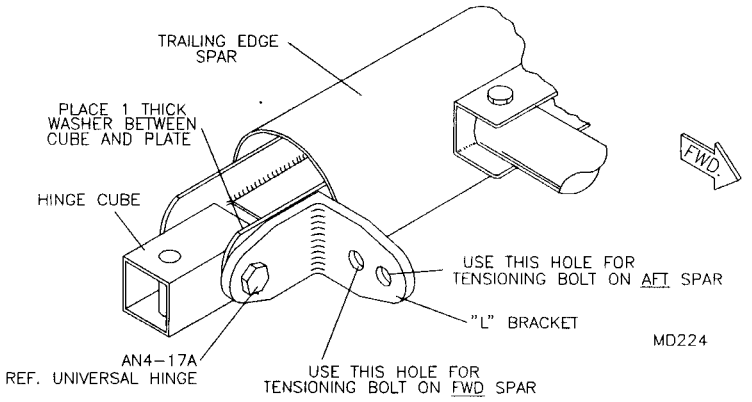
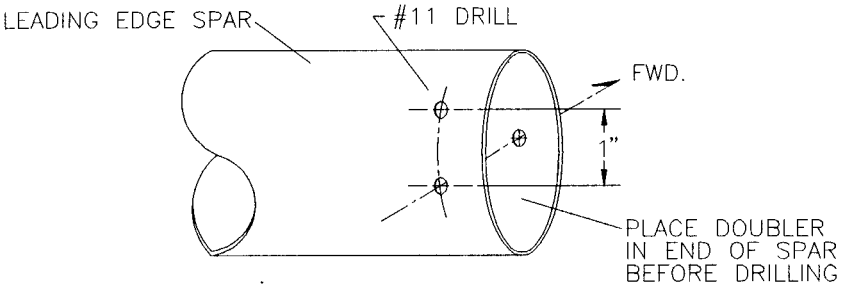


FIGURE 09A-028A

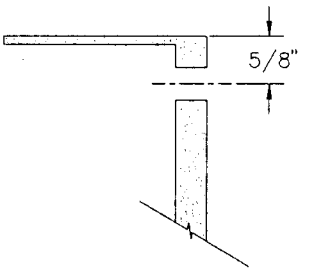


29. With the root rib against the "L" brackets drill through the rib for the 1/4" bolt holes. Use the "L" brackets to locate the holes.

30. Lay the root ribs down with the inside face up. Two 3/8" diameter holes will need to be drilled for the fuel sight gauge. These are located at approximately the camber of the root rib.

31. For best accuracy it is best to locate these holes after the fuel tank has been installed to ensure proper alignment. **Figure 09A-031** shows edge distance details. Location of the fuel sight gauge at the camber is not critical.

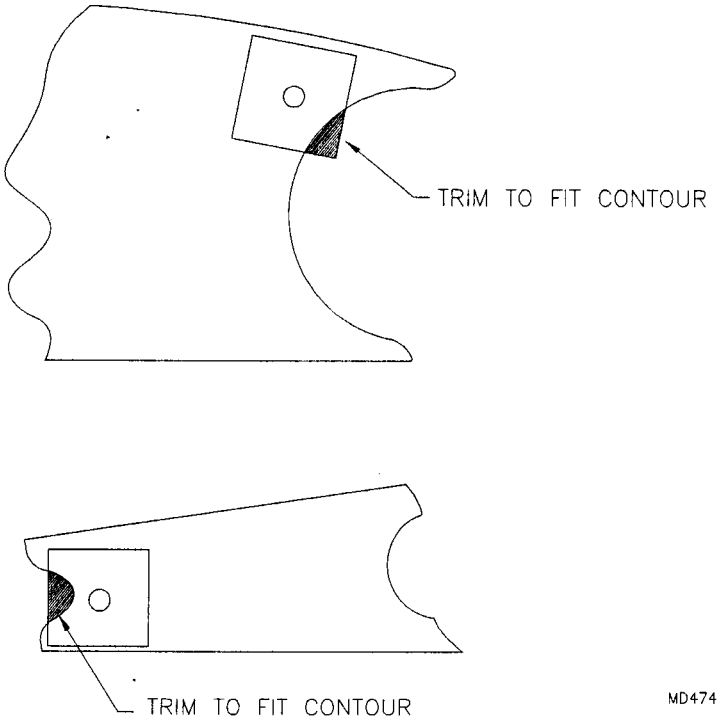
FIGURE 09A-031



MD225

32. Drill out the ears on each 1/4" nut plate to 1/8". Use one piece of .050 square backing plate under the nut plate for reinforcement. The backing plate must be drilled through the center with a 1/4" hole to allow the rib tensioning bolt to pass through. Drill #30 holes through the backing plate where the nut plate will be fastened to the rib. Screw on the nut plate with the small screws provided. Trim away any part of the plate that sticks out into the cut out, see **Figure 09A-032.**

FIGURE 09A-032



MD474

33. Place the root ribs on the wing and install the forward tensioning angles. Install the 1/4" bolts that are threaded almost their whole length. Do not tighten until the wing skins are attached.

At this time turn to fuel system for details on installing the fuel tanks. Return here after installing the fuel tanks.

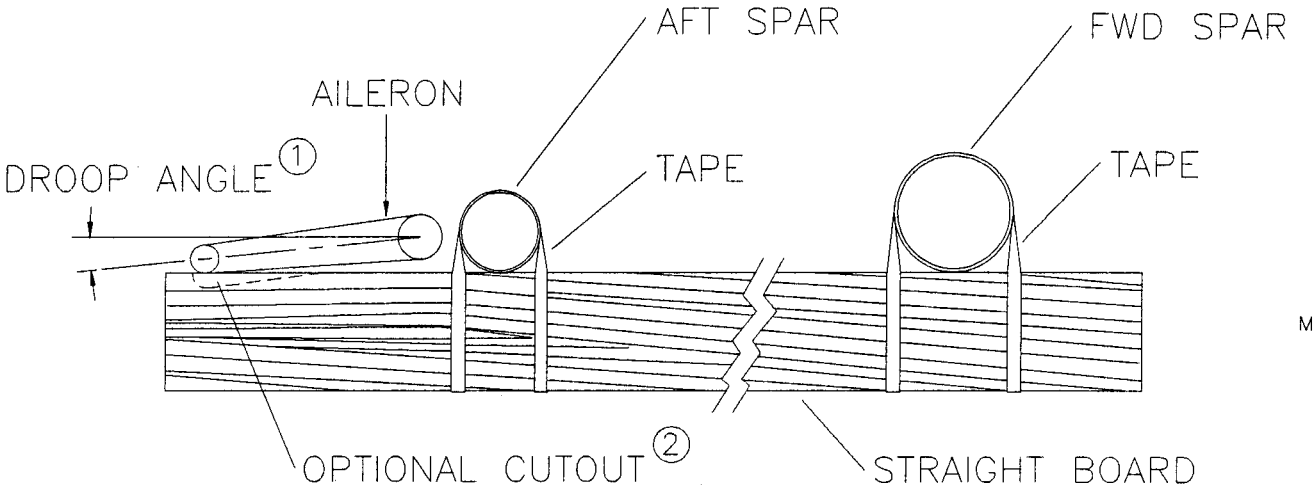
RIGGING THE FLAPS & AILERONS

34. To set up the aileron rigging, attach the ailerons and flaps to the wing using the hinges. Put the ailerons and flaps on the side of the hinge that gives the best matched fit. Only finger tighten the nuts to the hinge bolts at this time.

35. Apply a drop of blue loctite and screw the male rod ends into the ends of the push pull tubes until 1/2" of the thread is exposed. Do not install a stop nut on the bellcrank end of the short push pull tube. The short push pull tube is screwed into the rod ends attached to the bellcrank after covering the wing. Install the aileron push pull tubes using the hardware depicted in the aileron push pull tube parts drawing. **IMPORTANT:** The long push pull tube bolts to the **TOP** of the aileron bellcrank. Slip a push pull tube guide over the long push pull tube before bolting to the bellcrank. The guide will be riveted to the second outboard compression tube in a later step. The short push pull tube bolts to the **BOTTOM**.

36. Before beginning rigging of the ailerons check the control stick and control tee. The control tee must be centered when the sticks are in neutral. If this is not the case, review rigging instructions for the control stick and control tee under the control stick assembly. With the control tee centered adjust the long push pull tubes so the bellcranks are in the neutral position. Refer back to **Figure 09A-025A.** Find two very straight boards at least 60" in length. These will be used to set the droop angle of the flaps and aileron. The droop angles is shown in **Figure 09A-036.** Firmly tape the boards on the bottom of the wing spars. Let the boards overhang off the AFT spar at least 8". The aileron trailing edge should rest on the board to set the proper angle of droop. Adjust the rod ends on the short aileron push pull tube until the aileron is set. **IMPORTANT:** The rod ends must be screwed into the ends of the push pull tubes a minimum of 6 full turns to have acceptable strength for flight loads. Remove the boards once both ailerons are set. Test the system by displacing the control stick side to side. The aileron bellcranks are set up to displace twice as much up as down. You can check this very simply by measuring the difference from the neutral position up and down. If this is not the case it means the bellcrank was not at the neutral point. Refer back to **Figure 09A-025A** to check for the neutral bellcrank position. Use blue loctite to keep the push pull tubes on setting. The short push pull tube will be removed to allow installation of the wing covering. After the wing covers are attached apply a drop of blue loctite to the end of the forward push pull tube. Screw it into the rod end that was left attached to the aileron bellcrank.

FIGURE 09A-036



① Drop angle of the aileron and flaps is established when the aileron's trailing edge rests on the board.

PLEASE NOTE: This is the recommended "start" setting. After flight test you may want to droop more for low speed or raise for cruise.

② Cut out guide board 1/4" to 3/8" if lower stall speed is desired.

37. Because of the length of the long push pull tubes a guide is placed on the second compression tube outboard of the wing root. Fabricate the two guides as shown in **Figure 09A-037**. Locate the guide to the **OUTSIDE** of the compression tube. Place the controls in neutral. Clamp the guide so an equal amount of space is on either side of the push pull tube. Work the controls side to side to check for adequate clearance. Move the guide until it is in the best position. Locate, drill and rivet the guide to the compression tube with three #30 aluminum pop rivets. **PLEASE NOTE:** The left guide will be 3/4" longer than needed, trim off as required. See **Figure 09A-037A**.

FIGURE 09A-037

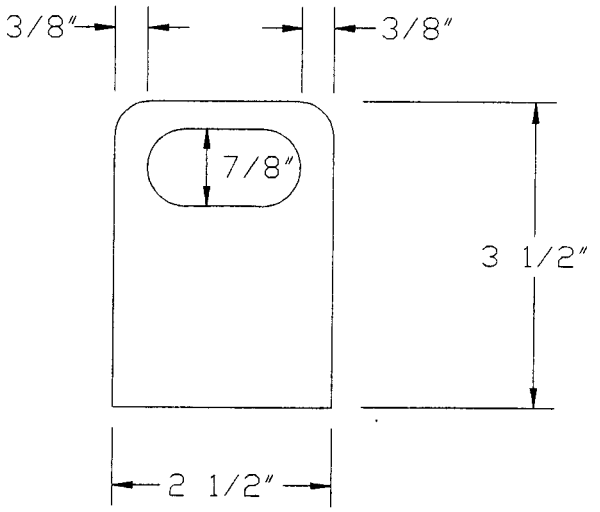
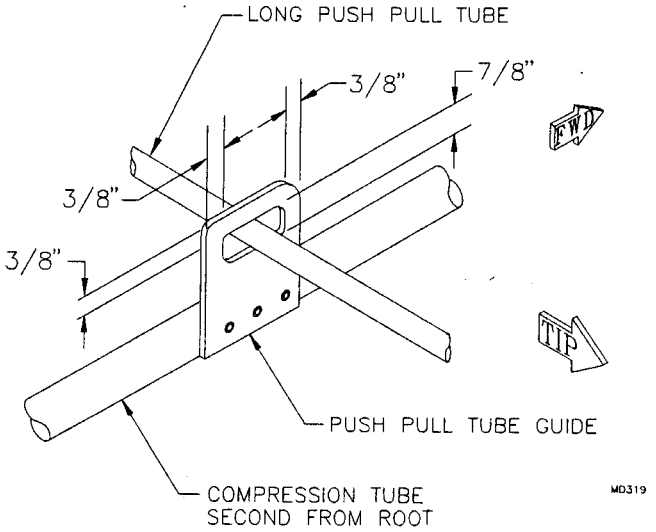


FIGURE 09A-037A



The wings are now ready for covering. Check everything before covering the wings. Check the controls, the fuel system, every nut and bolt. You will want to cover the wings, confident everything was done and done right so now is the time to check.

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.

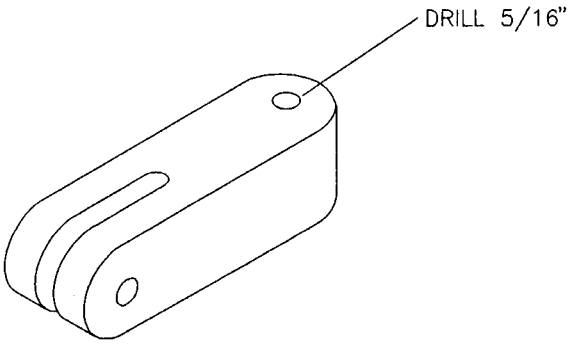
S-12 AIRAILE STRUT INSTALLATION & SETTING WING WASH OUT

PLEASE NOTE: It is assumed the wings are assembled but not covered and the fuselage is sufficiently complete.

1. With the help of a friend and two step ladders or similar devices about the height of the main spar carry through, bolt the wings to the fuselage. Hold up the tips with the ladders. **PLEASE NOTE:** The forward "U" brackets fit **INSIDE** the forward spar. If the "U" bracket does not extend deep enough into the spar, align with the hole. Check the edge distance. This is the edge distance between the holes center and the edge of the spar tube. If the edge distance is greater than 3/4" trim off the excess. With the correct edge distance the "U" bracket should insert properly.

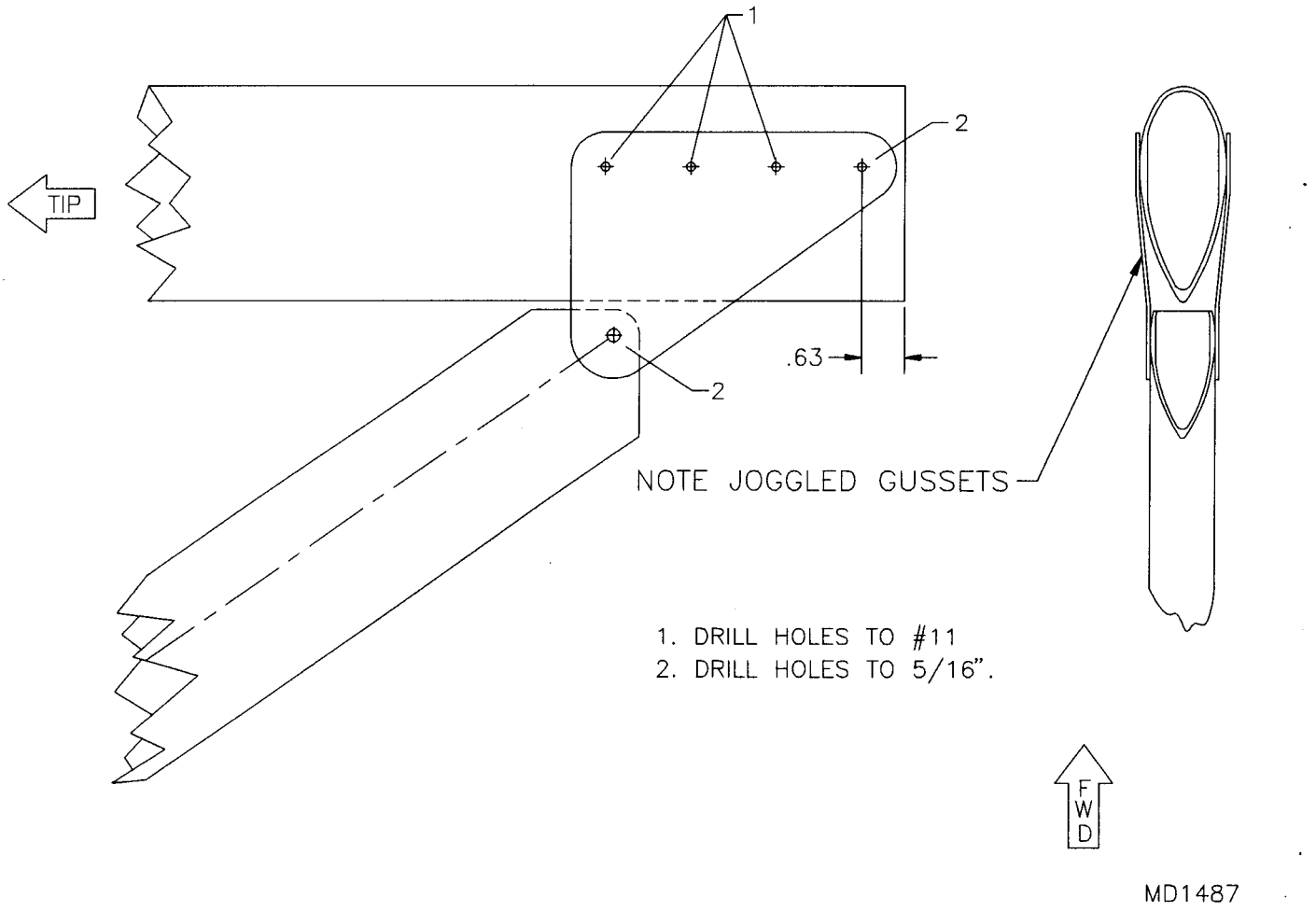
2. Drill the radius and debur the (4) AFT lift strut gussets as per **Figure 09B-02.** Drill the four lift strut connectors LS-ACU-2 as shown in **Figure 09B-02A.**

FIGURE 09B-02A



MD1486

FIGURE 09B-02



3. Take the two 95 3/16" long forward struts and locate and drill a 5/16" hole 5/8" in from one end and a 5/16" hole 5/8" from the other. Drill a 1/4" hole for the jury strut 48 1/8" from the 5/16" hole end. Use the template to locate and drill from each side. See **Figure 09B-03.** Assemble the fittings to each end as per the parts drawing. Use the solid round aluminum fitting for the main strut attach. Look closely at these parts, there is a left and right. Install the corresponding fitting to the appropriate strut. Assemble the strut as shown in **Figure 09B-03A.**

FIGURE 09B-03

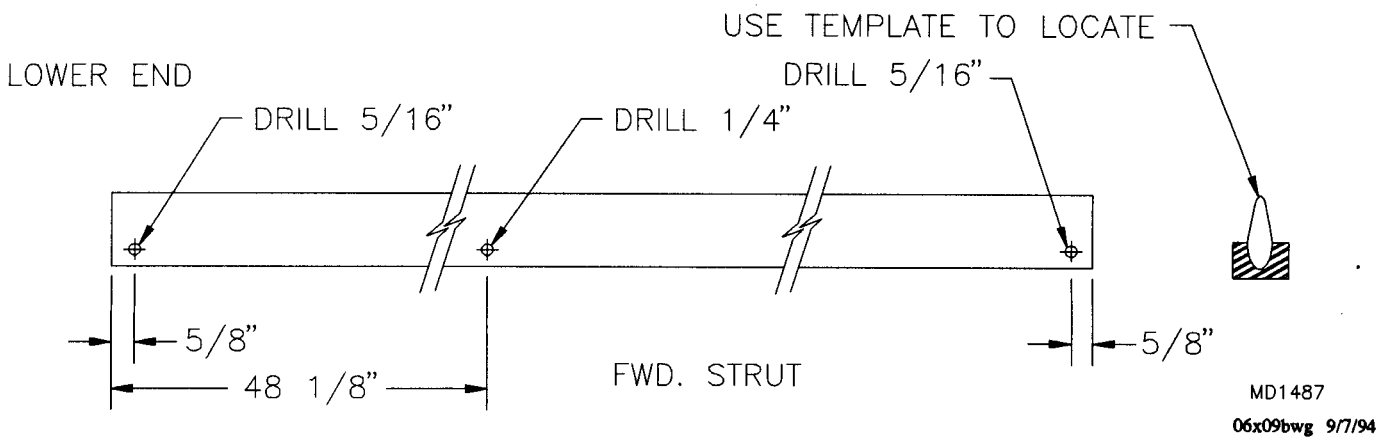
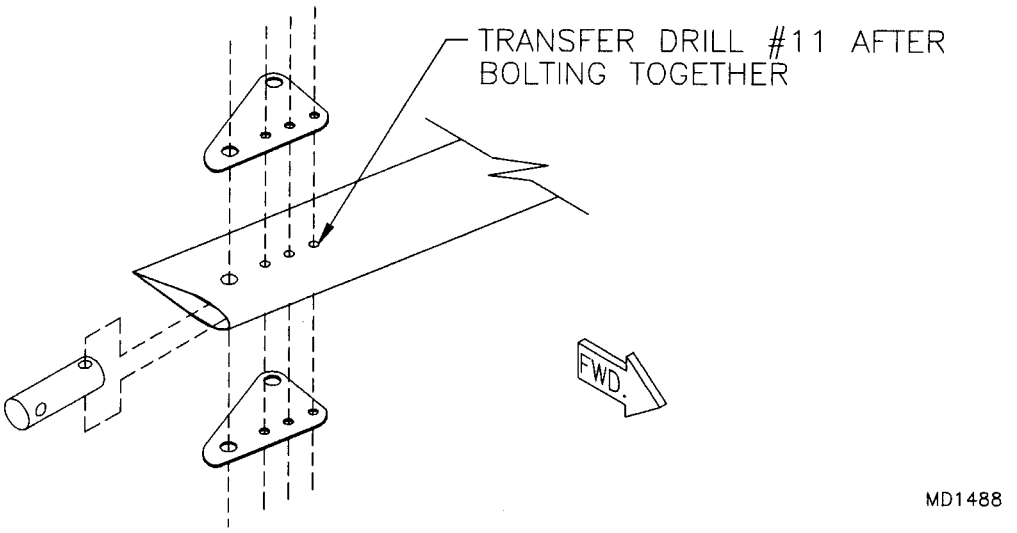
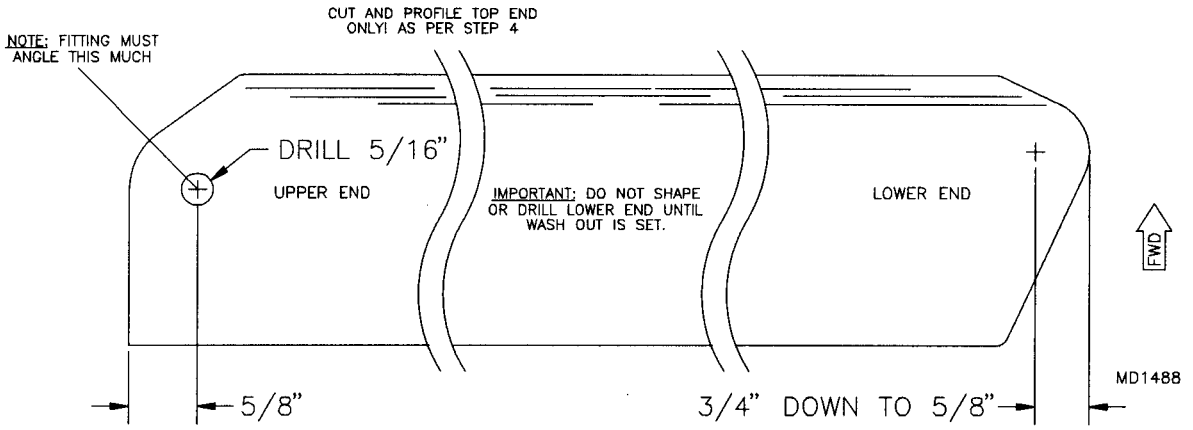


FIGURE 09B-03A



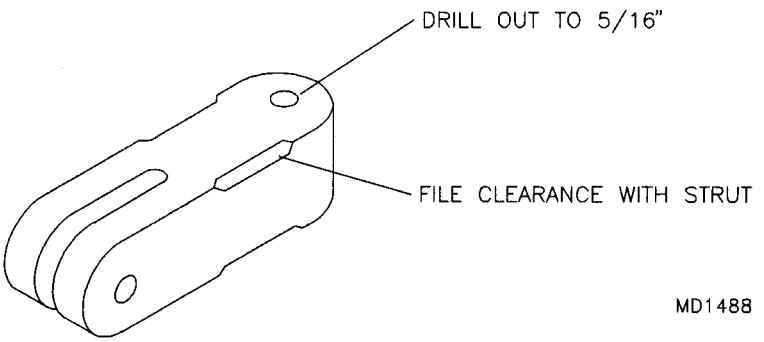
4. Cut, profile and drill the AFT lift struts on one end only to the **TOP** end profile as per **Figure 09B-04. PLEASE NOTE:** Some rough cutting of the lower end will be required to allow the strut to fit deep enough into the gussets.

FIGURE 09B-04



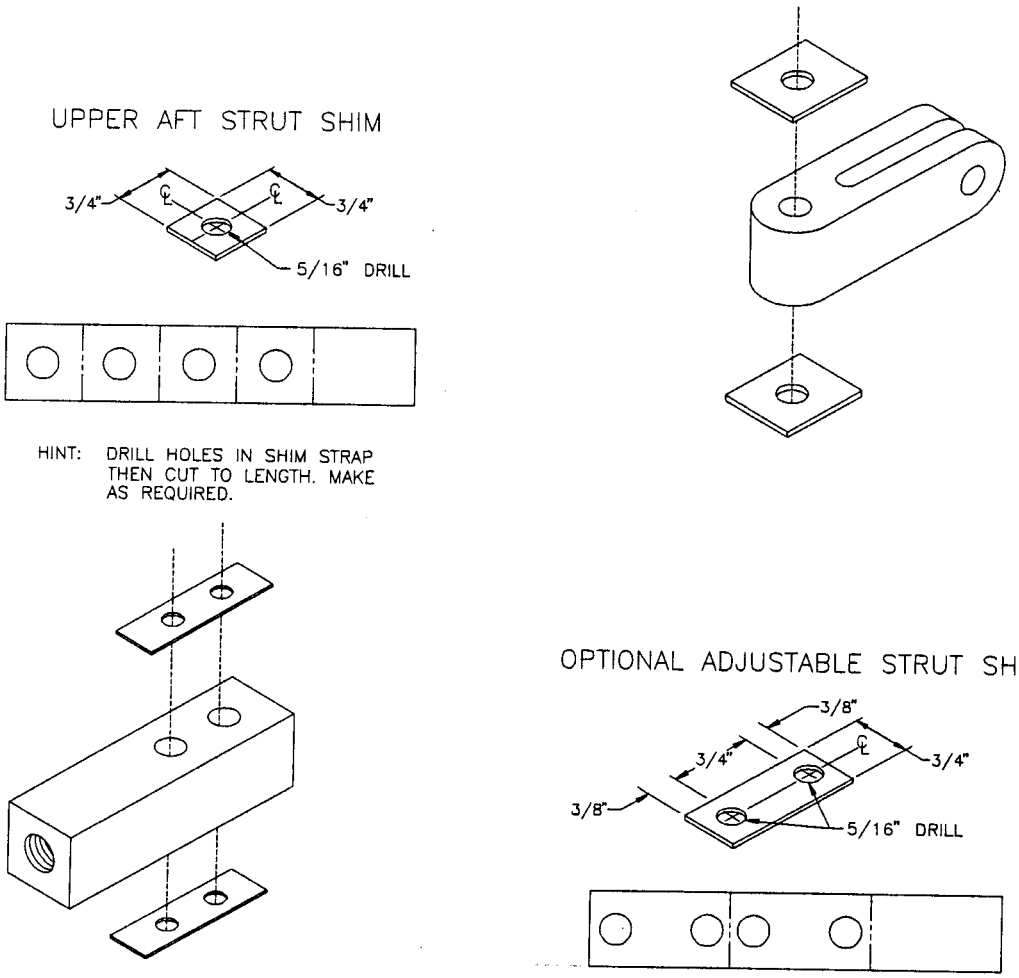
5. Take the remaining (2) slotted lift strut connectors and file clearance into the fitting as required to fit into the strut at the required angle. Angle the line as shown in **Figure 09B-05**. Drill the holes in the fitting out to 5/16".

FIGURE 09B-05



6. Bolt the fittings into the AFT lift strut top ends. Bolt to the wing and check for clearance. The strut must angle to the forward strut without binding the fitting. Due to dimensional variation in extruded material it may be required to shim the fittings. No gap should exist between the fittings and the struts. If there is a gap, it should not be eliminated by tightening down the bolts. If a gap exists this action may crack the struts. Instead, use the .020 shim material to insure a tight fit. At the root fittings of the lift struts, washers or shims may be required. See **Figure 09B-06**. Bolt the struts to the wings and fuselage.

FIGURE 09B-06



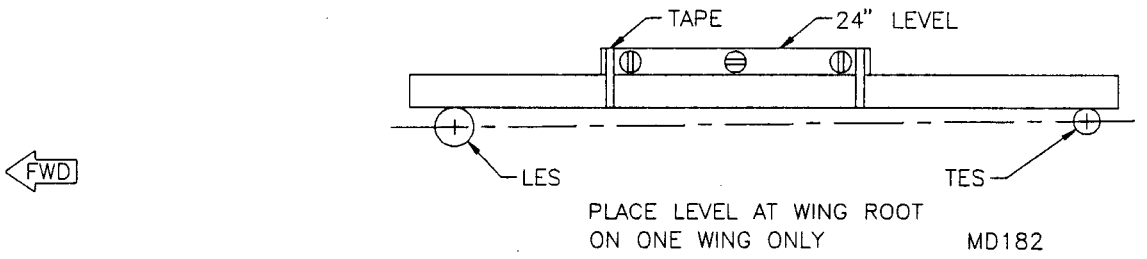
MD1493

7. Bolt the forward lift struts in place with the AFT lift strut gussets pointing AFT. This will automatically set the dihedral.

8. Bolt the AFT lift struts to the wing and place the unshaped and undrilled end between the gussets. **PLEASE NOTE:** The wash out will be set by twisting the wing and **RAISING THE REAR SPAR**. The AFT strut will be clamped and drilled at the gusset once the wash out is set. The gusset will act as a drill guide. Mark a line for several inches at the strut's lower end showing chordwise location for the hole.

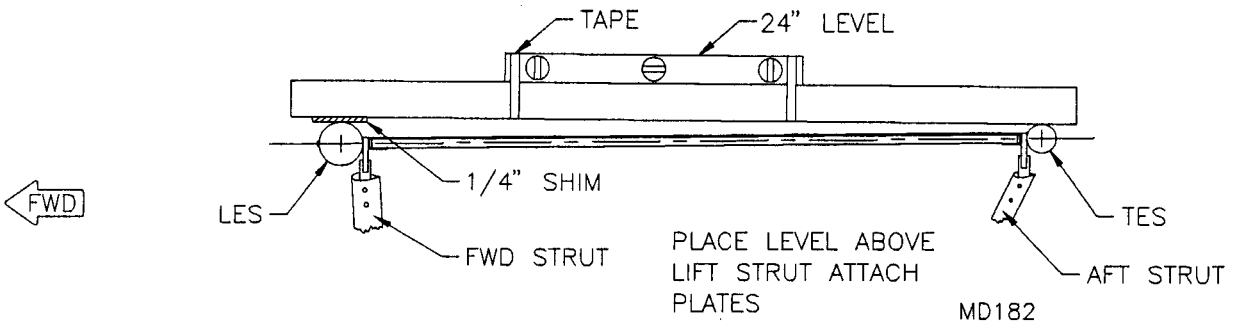
9. Make a rigging level by taping a 2 foot level to a straight 50" long, 1" x 3/4" board. Place the level on the top of the spars at the wing root. Raise the mains or remove the nose wheel to obtain a level reading at the root. See **Figure 09B-09**. **CAUTION:** Block wheels to prevent rolling. Double check the level prior to actually setting the wash out.

FIGURE 09B-09



10. Cut out a scrap of 1/4" plywood 6" X 2" and nail or screw it to one end of the straight edge. Place the rigging device above the lift strut attach plates. The 1/4" block is placed between the level and forward spar. See **Figure 09B-010**. This will set the "wash out". Move the AFT spar up or down as required to obtain a level reading. Use a vise grip type "C" clamp to hold the setting. Check for accuracy before drilling. Use the gusset fitting to the line up on the mark and the chordwise marks to drill the bolt hole. Drill 5/16", then assemble. **CAUTION:** When using a pencil to mark be sure to remove the pencil marks afterwards or the graphite will cause corrosion.

FIGURE 09B-010



11. Go directly to the other wings' outboard strut location and set the wing. It is not required and can even result in an improper setting if another level reference is taken from the other wing root.

12. If everything was done accurately, the aircraft will fall straight through in a stall. If one wing has a tendency to drop, the wings may not be set evenly. It is a simple matter of installing and drilling a new AFT lift strut connector. Otherwise, it could be unequal flap or aileron settings. Raise or lower the flaps as required. **EXAMPLE:** If the plane pulls to the right, lower the right hand flap slightly or raise the left. Do not forget to consider engine alignment if the plane does not fly straight. See engine.

13. Locate a 1/4" hole through the AFT lift strut for the jury struts eyebolt 45 7/8" from the **LOWER** 5/16" **BOLT CENTER**. Use the template to locate chordwise on the strut. See **Figure 09B-013**.

14. For the adjustable lift strut option refer to **Figure 09B-014** for dimensions to use as a guide in setting up the rear lift strut.

FIGURE 09B-013

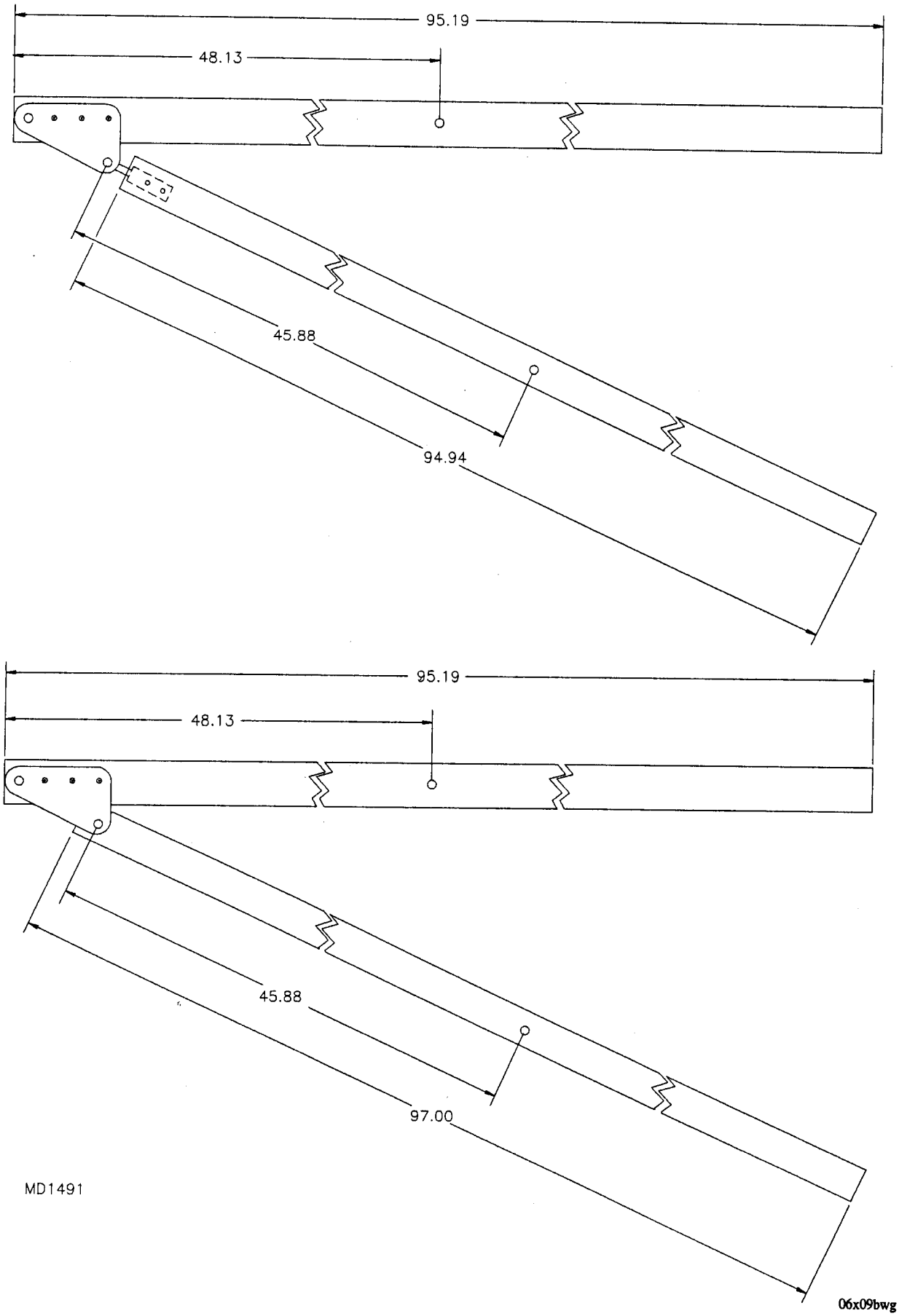


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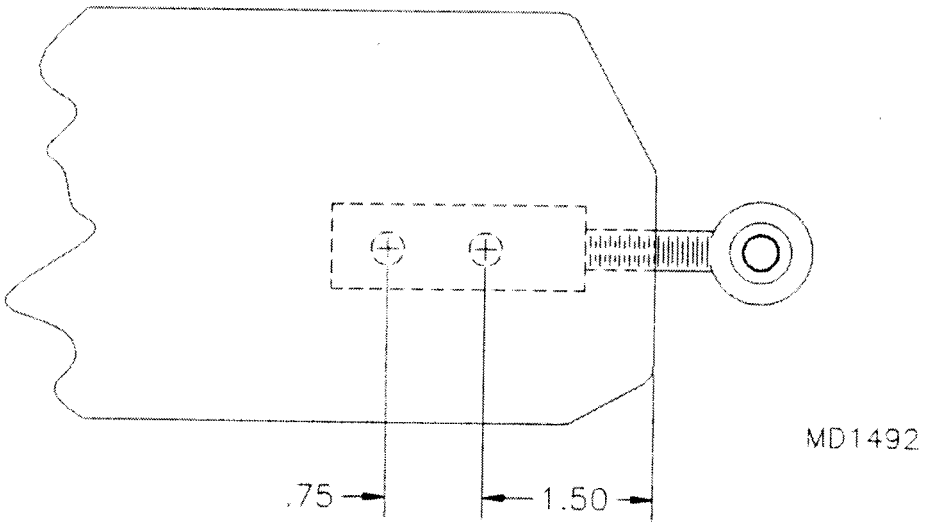
FIGURE 09B-014



NOTES:

1. Forward strut sets up with the same fittings as standard. Must have joggled gussets.
2. Cut AFT strut to length.
3. Install upper strut connector as normal.
4. Install adjustor block as shown.
5. Hook up strut and adjust eyebolt.

JURY STRUT INSTALLATION

1. Collect the parts depicted in the parts list. It is assumed the aircraft is assembled with the wings and struts on.

2. Cut the tubing provided for the jury struts to the lengths designated in **Figure 09B-02**. Deburr the ends.

3. Drill out the holes to #30 as shown in **Figure 09B-03**.

FIGURE 09B-03

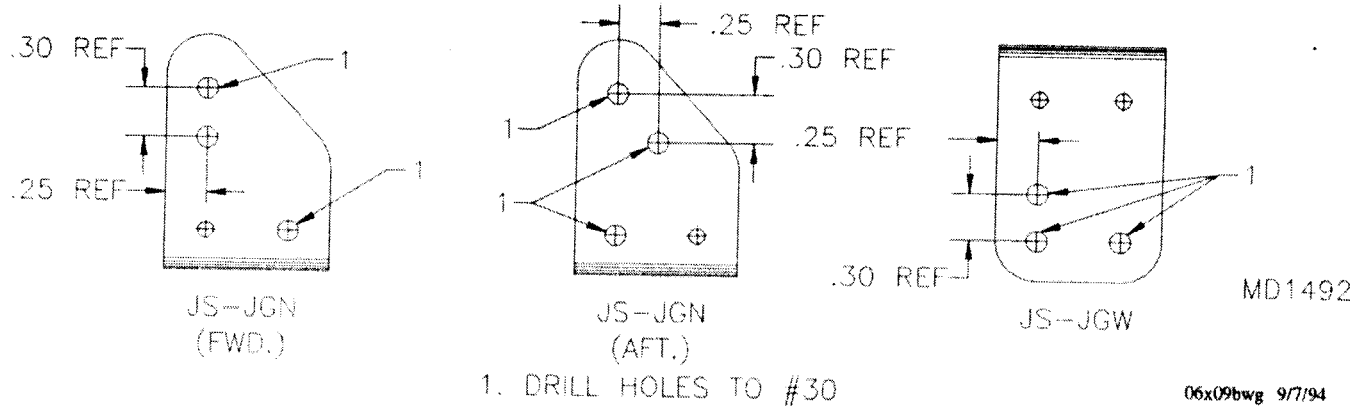
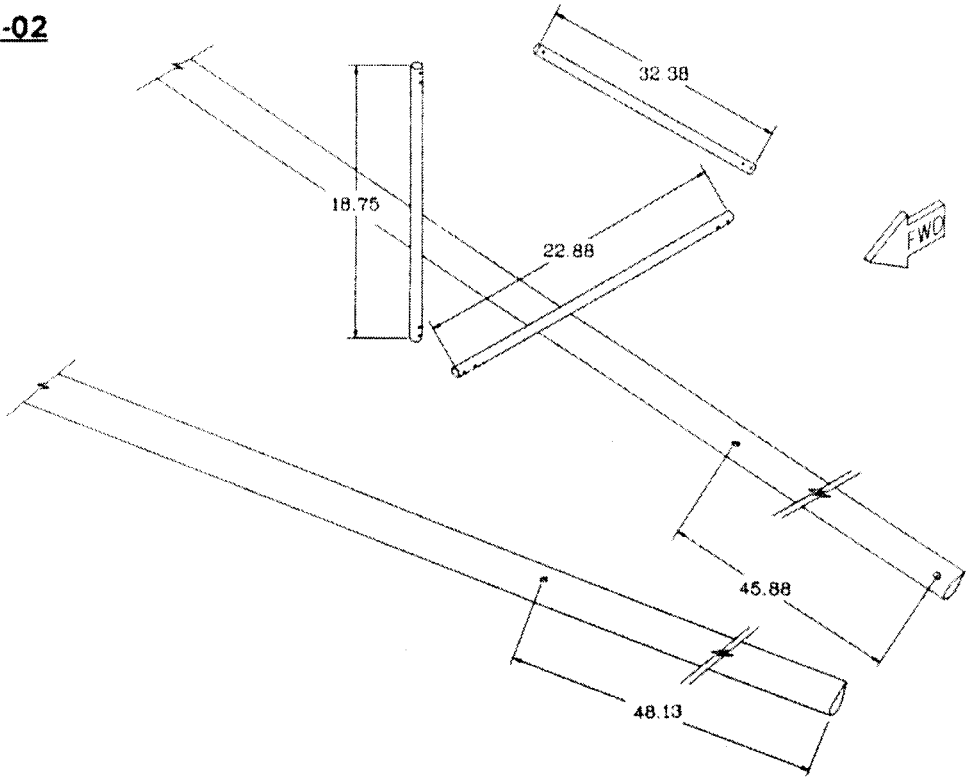


FIGURE 09B-02

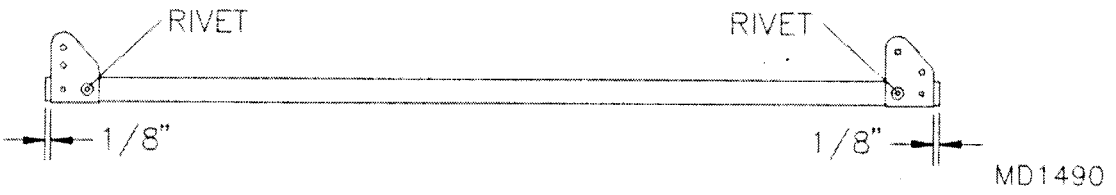


4. Measuring from the root (fuselage) end of the lift struts, mark and drill a 1/4" hole for the eyebolts (do not drill the holes in the rear lift strut until the wing washout has been set). See **Figure 09B-013** for locations. See **Figure 09B-08A** for a template to measure center of strut. Bolt the eyebolts to the struts with the flanges 90 degrees to aircraft centerline. Be careful not to overtighten.

5. Insert the bushing into the ends of the two crossing tubes. Retain the bushing by making a slight dimple on the tube with a punch.

6. The gussets will need to line up with each other on the crossing tubes. Lay the assembly on a flat table. Extend the ends of the tubes 1/8" from the gussets. See **Figure 09B-06**. Rivet the gussets to the tube via the #30 holes using #30 stainless steel pop rivets.

FIGURE 09B-06



7. Cotter pins are used to retain the clevis pins to the crossing tube via the smaller undrilled holes in the gussets. Drill through the bushing and insert with a #40 bit.

8. Install the top jury strut bracket, do this by locating the bolt above the jury strut cross tube. This bolt head protrudes from the leading edge of the forward spar directly above the cross over tube and retains the inboard long wing channel. Use the inboard 3/16" AN3-15A bolt to attach the JS-BK to the channel. Because of the tensile load on the jury strut, you must use a tensile nut instead of a shear nut. See **Figure 09B-08** and **Figure 09B-08A**. Place the top jury strut gusset in the bracket. Use the quick pin to retain the JS-JGW to JS-BK. Insert the jury strut tubes into the gussets. Align, drill and rivet. **NOTE:** You may have to trim part of the jury strut ends for clearance.

FIGURE 09B-08

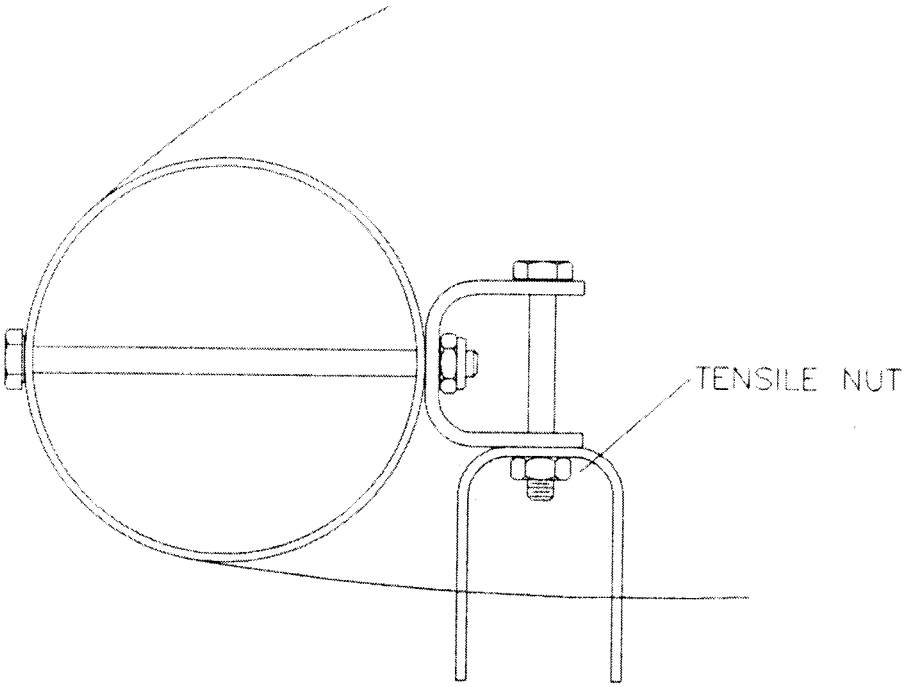
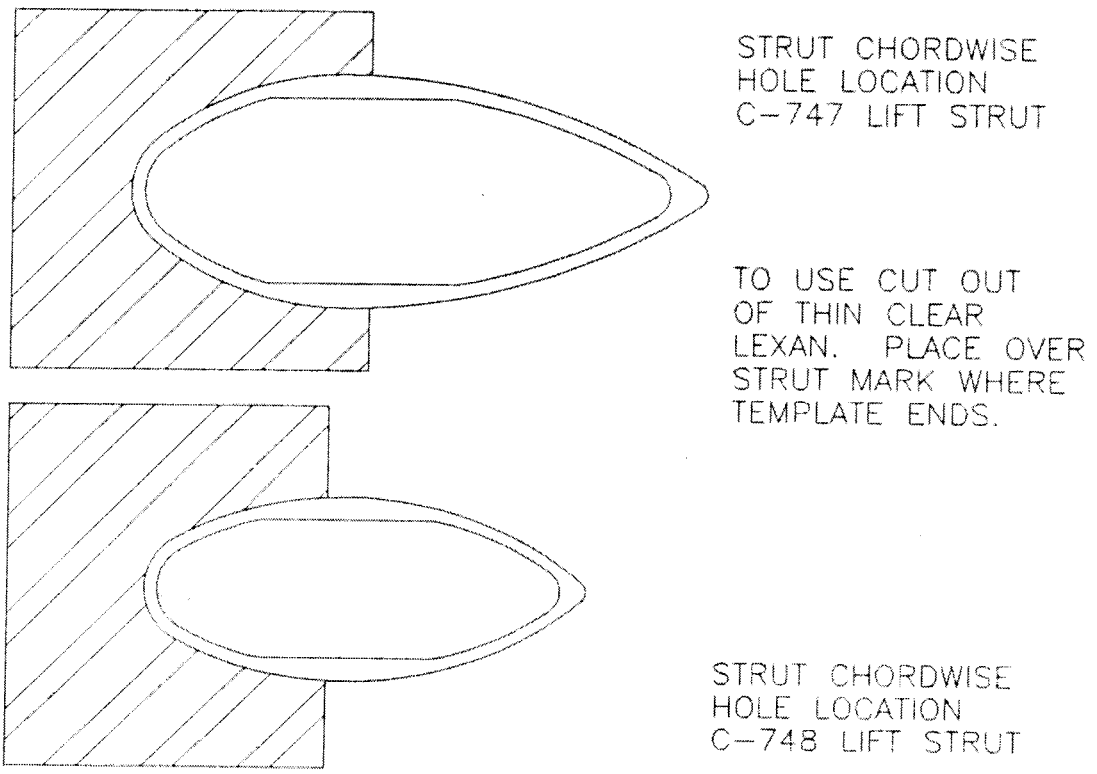


FIGURE 09B-08A



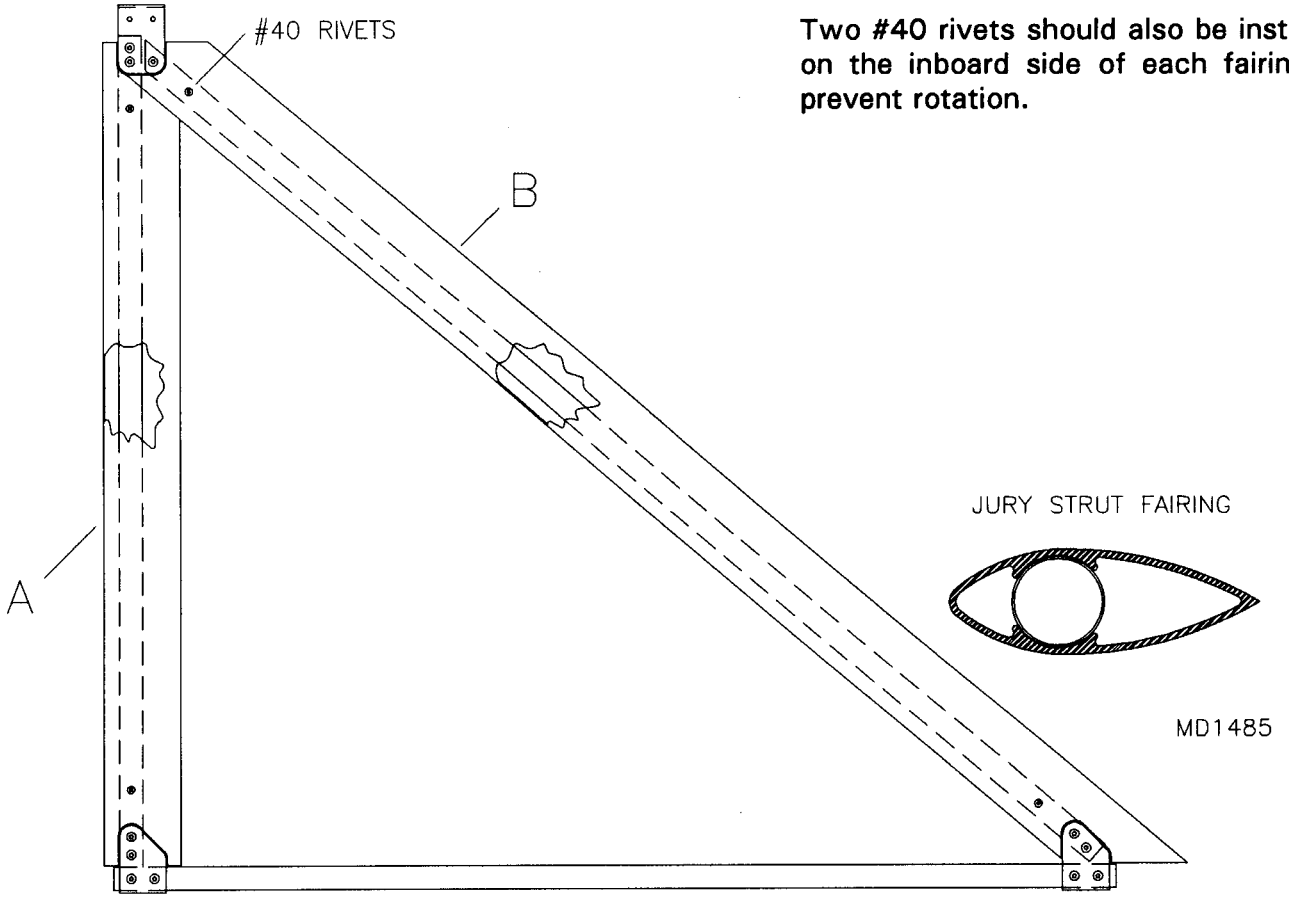
9. To fold: remove the quick pin and fold toward tip.

10. Turn to covering the wings in the covering section.

JURY STRUT FAIRINGS

The builder will cut the fairings to length and trim to fit, the tighter the better. Consult the adjacent drawing and Table 1 to determine the proper fairing length for your aircraft.

Two #40 rivets should also be installed on the inboard side of each fairing to prevent rotation.



RANS AIRCRAFT	A	B	TOTAL PER SIDE
S-12 Airaile	20"	34"	54"

COVERING THE S-12 AIRAILE WINGS

The wings should be removed from the fuselage for covering. Set the wings on saw horses. Use the saw horses about 30" to 32" high. This makes the job less of a back bending effort! The wings should be complete including the root rib installation.

1. Remove the flap teleflexes. **DO NOT** attatch them to the retainers or they will protrude and inhibit slipping on the covering. You can install the flap teleflex cables after the wing is covered. An access zipper is located near the flap cables exit. Use these zippers to reach inside to place the flap cable on the retainer. Safety wire or use a zip tie wrapped around the flap cable and compression tube to safety the cable to the retainer.

2. The short aileron push pull tubes should be removed, leaving the rod end attached to the bellcrank. Do not use a jam nut on the rod end for the short push pull tube. It is not required and would be quite difficult to install after covering. Leave the long push pull tube connected and inside the wing. If you have not already, loctite the jam nut on the long push pull tube at the bellcrank. After the wing is covered and the short push pull tube at the bellcrank. After the wing is covered and the short push pull tube opening is cut into the wing, we will loctite the end of the short push pull tube and screw it to the bellcrank.

3. Assemble the top and bottom ribs by inserting the tips as shown in **Figure 09C-03** on the top ribs. Insert the contour fittings to point away from the curve of the rib. Insert the duck bill shaped tips into both ends of the bottom ribs. Dimple the tube with a prick punch to lock the contour and tip fittings in place. Reshape the top ribs contour fitting as shown in **Figure 09C-03A**. This will greatly ease the rib insertion and removal process.

FIGURE 09C-03

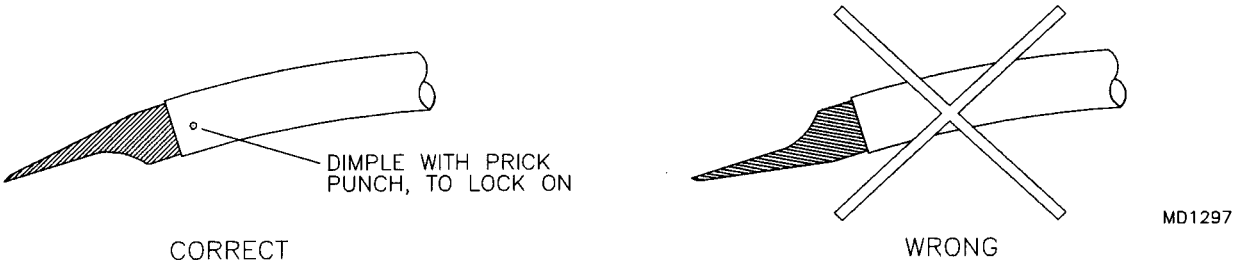
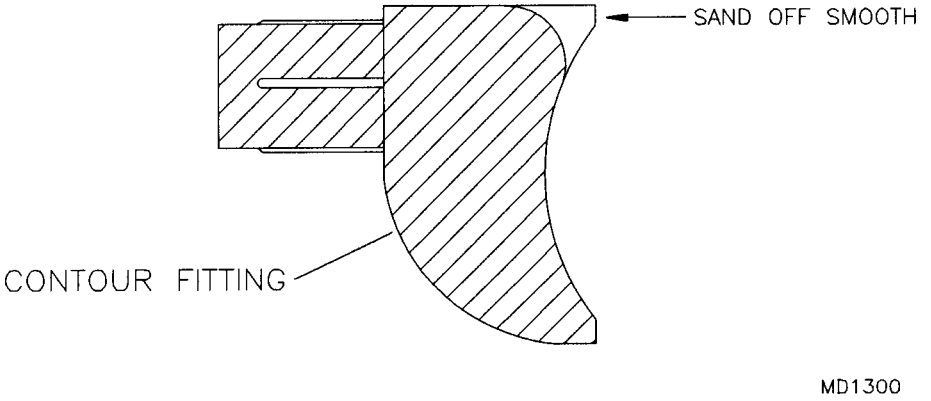
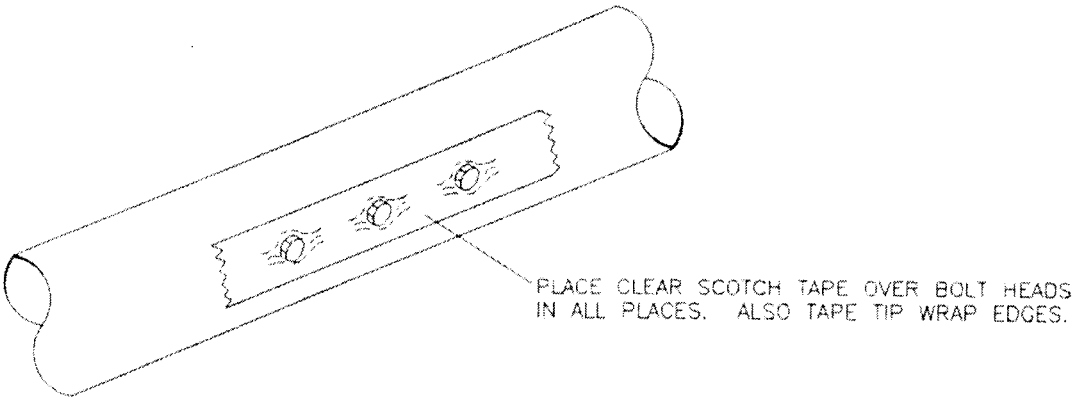


FIGURE 09C-03A



4. Tape over all bolt heads with a good grade of plastic tape. See **Figure 09C-04.** This will make it easier to slip on the wing covers.

FIGURE 09C-04



Before skinning the wing please inspect for completion and proper assembly. Use the following MD1300 check list, please note some items will apply to other models:

A. Are the pitot, static lines and probes installed? These will be poked through the leading edge after skinning by reaching inside the wing through a zipper. It is only required that the probes are inserted into the spars but not through them.

B. Are the teleflexes for the ailerons or flaps installed? **IMPORTANT:** Do not tie wrap the teleflex cables to the wing tubes. These must be allowed to lay loose inside the wing for best operation and make replacement less effort.

C. Are all the bolts properly installed with the nuts tight?

D. Inspect all rivets, fittings, and nut plates. Make sure all hinge point nut plates are installed.

E. Inspect the push pull tubes for proper installation. On the push pull tube systems the rod end for the bellcrank to the aileron push pull tube must be installed before covering. It is best to have set up the wing less skins and rig the flaps and ailerons on the push pull tube models.

5. Remove the wing cover (LH or RH) from the box and lay it on top of the wing frame, bottom side up, leading edge forward and the root end at the tip. Pull the open end over the frame. Have a helper feed it over the end while you pull it on. Go slowly **DO NOT** force it on. If it becomes stopped or hard to pull, look to see where it is hung up. Stop pulling about 12" from the root rib, slit the first rib pocket on the bottom from the root as per **Figure 09C-05** and install a top rib. Now pull the skin on the frame as far as possible to install it on the root rib. Back out the 1/4" bolts that retain the root rib so the skin will reach the rib. If the skin does not reach the rib make some "skin pullers" out of the plastic strips supplied. The ribs are a white milky color and measure approximately 3" X 19 1/2". See **Figure 09C-05B**. **IMPORTANT:** Pre-drill the screw holes #40 in the root rib. Locate the screws on the center or near the inner edge. Placing the screws too close to the outside edge will cause the root ribs to split. Space the screws every two inches, see **Figure 09C-05** and **Figure 09C-05A**. It will not be needed to countersink for the screws, the thick webbing sewed into the edges of the skin will accommodate the screw head. Once the screws are installed the bolts are tightened until the proper tension is achieved. The root rib should be within a 1/4" or touching the "L" brackets when the skin is fully tightened.

FIGURE 09C-05

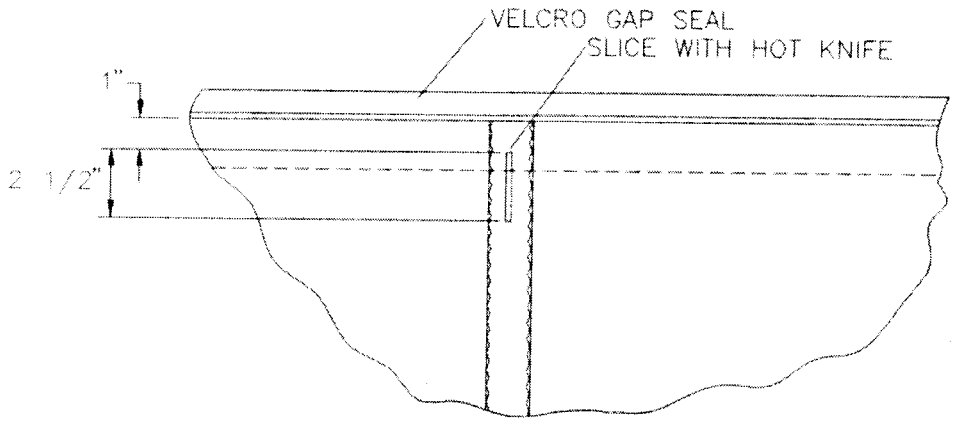


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FIGURE 09C-05A

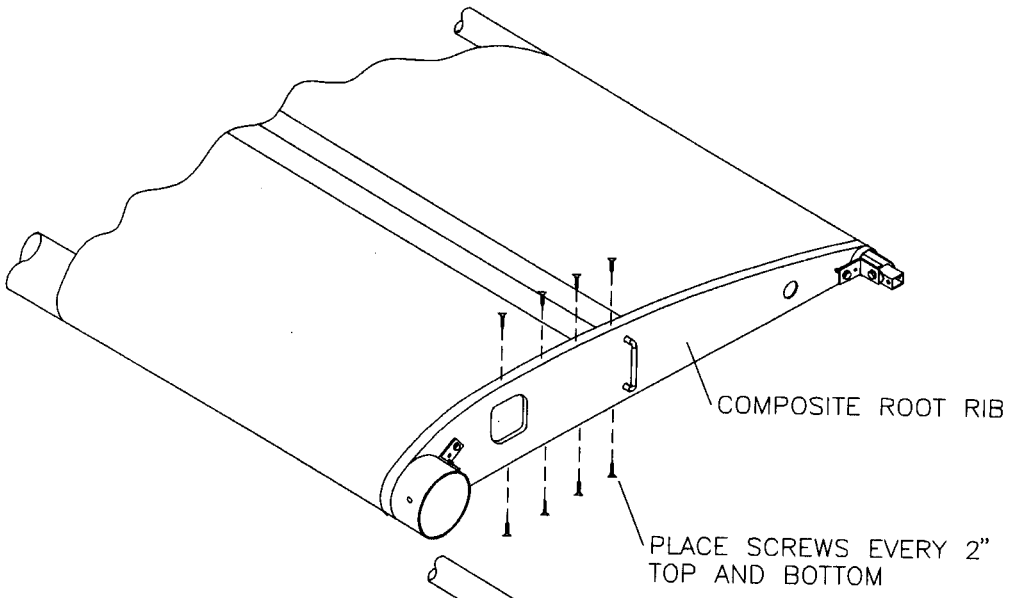
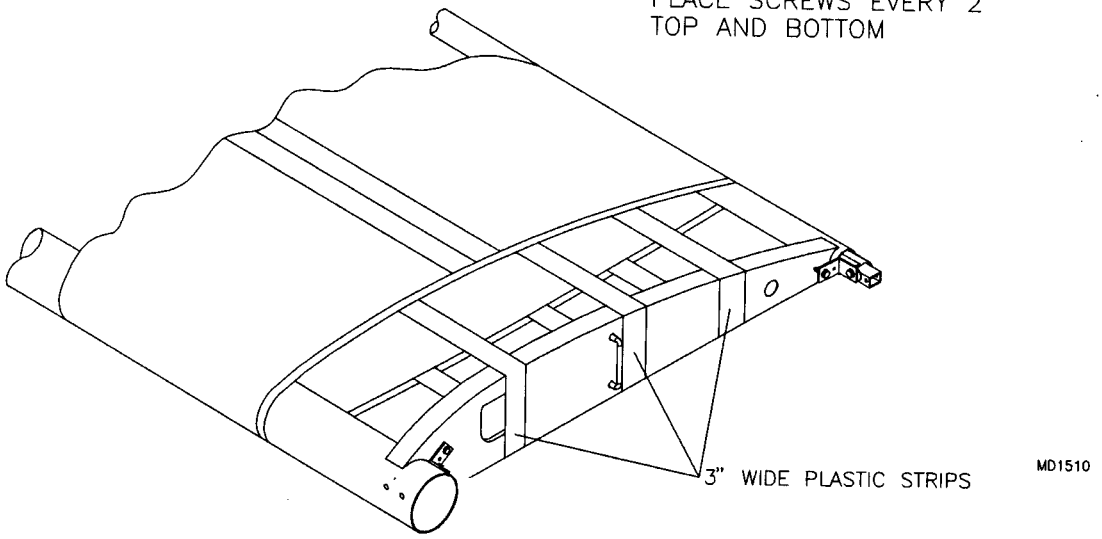


FIGURE 09C-05B



6. Make a slit for each rib pocket as shown in **Figure 09C-06**. Make cut outs around the strut attach plates and jury strut tabs by following around the protrusion with a hot knife. Locate and cut additional holes for the flap and aileron exits as shown in **Figure 09C-06A**. Cut open each zipper.

FIGURE 09C-06

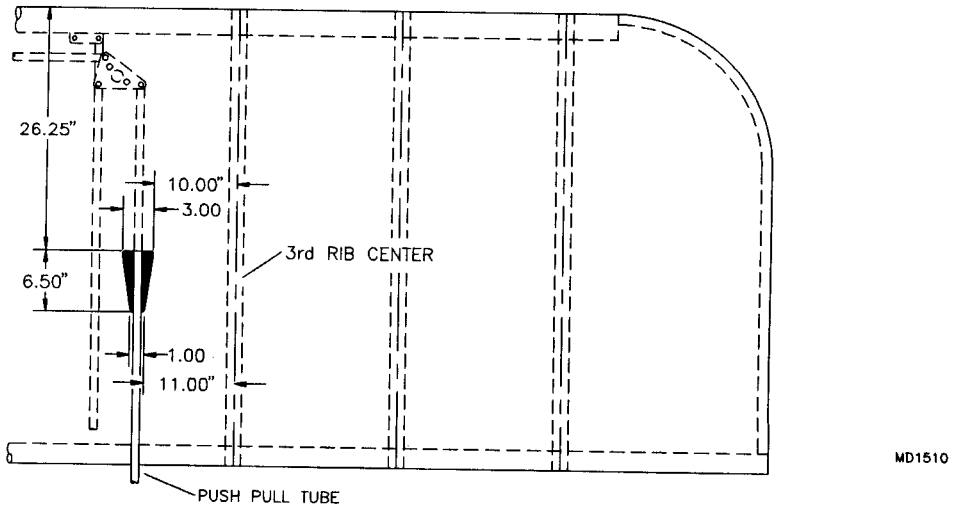
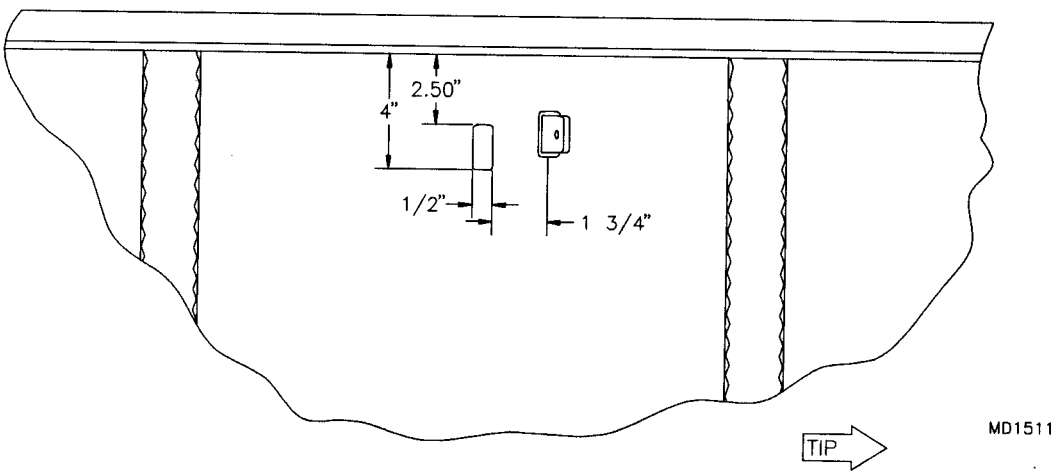


FIGURE 09C-06A

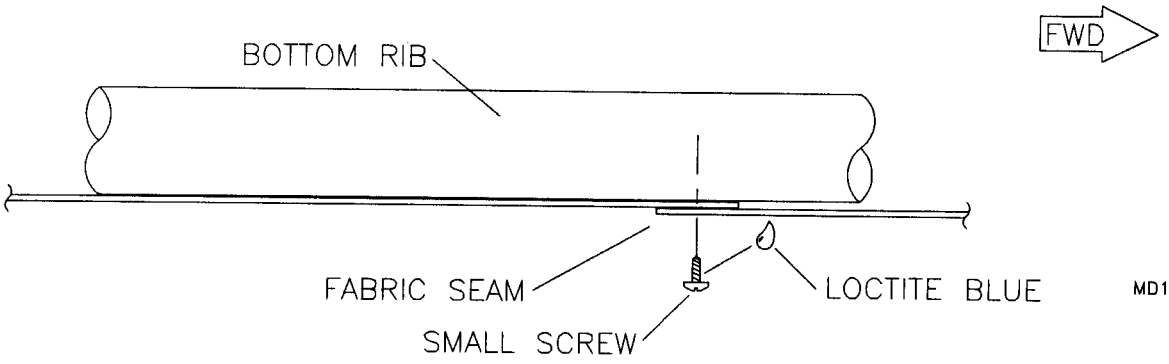


7. Install the top ribs through the slits made in the bottom pockets. **NOTE:** They should push in with a good degree of pressure. Use a mallet and gently tap into place. A short scrap of lumber works as an excellent driving ram. That sound you're hearing is not the stitches ripping but the two way tape popping loose. This is perfectly normal and does not effect the strength of the skins. The ribs do drive in hard but be careful of the last one near the wing tip. It may try to jam under the tip wrap. If it does, push the fabric from the bottom at the leading edge to help it line up. Install the bottom ribs the same except to get them started insert the rib upside down this will help the tip slip into the pocket, then turn it right side up (curve down). The bottom rib tip will lay against the bottom of the trailing edge spar sealing shut the slit made for rib insertion. **PLEASE NOTE:** In some places rivets or nut plates will hang up the rib contour fittings. Simply move the rib to either side to clear. Rib removal is done by making a tool from an old screwdriver. Heat and bend the end into a 90 degrees hook. Use the tool to reach up inside the slit to grap a rib and pull it out. Always remove the bottom rib first. Melt holes for the static and pitot tubes. Push them out by reaching inside through the zippers. Poke holes with the hot knife for aileron and flap hinge bolts. Cut away the velcro gap seals the same as it was done on the flaps and ailerons.

8. You can smooth out any wrinkles or fold lines in the wing skins with a hot air gun. Be careful not to melt the skins. 350 degrees is the maximum temperature used. After 350 degrees the cloth will stop shrinking and start stretching. A model airplane heat gun used for shrinking mono-coat works great. An electric iron works also but can leave areas discolored. Also, be careful of the heat setting.

9. To prevent the bottom rib from sliding out it is required to install a small screw. Locate this screw through the bottom fabric on a seam where the fabric is doubled, such as one of the stripes. Drill a #40 hole through the fabric and rib. Place a small amount of loctite on the screw and install. See **Figure 09C-09**.

FIGURE 09C-09



AIRCRAFT COVERING SAFETY TIPS FOR DACRON SKINS

Safety is a personal responsibility. You, as the owner, operator, and chief pilot are responsible for the airworthiness of your aircraft. Ultimately you control the life and monitor the level of safety through preflight inspections. During preflight check for the following:

A. Fabric rot.
B. Thread wear and broken stitches. (Open ends lead to premature seam separation.)
C. Chafing and hangar rash.
D. Fading.

Watch your fabric for signs of fading. The number one sign of ultraviolet damage is a lightening in the color of the fabric. The Dacron used to cover your aircraft was originally designed for sailboats. Sailors typically stow away their sails after a hard days sailing. Extend your fabric life by using a field storage cover or hangar.

Life expectancy varies with latitude. The closer to the equator you are, the more intense UV rays you get. Also, there are indications that due to environmental factors, like ozone depletion, the amount of solar radiation penetrating the atmosphere is increasing. A conservative estimate on the life span of untreated 3.9 Dacron is 350 exposure hours. Controlled exposure can extend life of untreated sailcloth to 10 years.

Coatings can help extend useful life. Clear coating can double the life of a covering. The disadvantage of this type of process is that the skins become a permanent part of the aircraft. Should a skin need removing for repairs, etc. the coatings may crack and peel giving you a molting snake skin effect.

As metioned earlier, storage methods can increase life. Tarps and fitted covers are recommended for outside storage. If available, shade hangars are better and fully enclosed hangars are best.

Extend the life of good fabric by making repairs.

A. Check for growth of minor rash and pin holes.
B. For small cuts or holes 2" or less, sew with a baseball stitch then apply sail tape or a glue patch.
C. Medium sized cuts or holes 2" to 6" can be repaired by applying an adhesive patch and hand stitching.
D. Large rips and holes and/or blown out panels 6" or larger should be examined by a professional repair service.

TESTING FABRIC

A. **FADE FACTOR:** Compare the top and bottom surfaces of your wing. Top surfaces of a considerably lighter shade are a cause for concern.

B. **FINGER POKE TEST:** Poke the top surface of your wing. A finger poke won't go through good fabric.

C. **FABRIC TESTER:** This involves standardized testing with a calibrated scale.
Max: The maximum value for new fabric is 25#.
Min: The minimum safe values are 12# or 15# depending on surface tested.

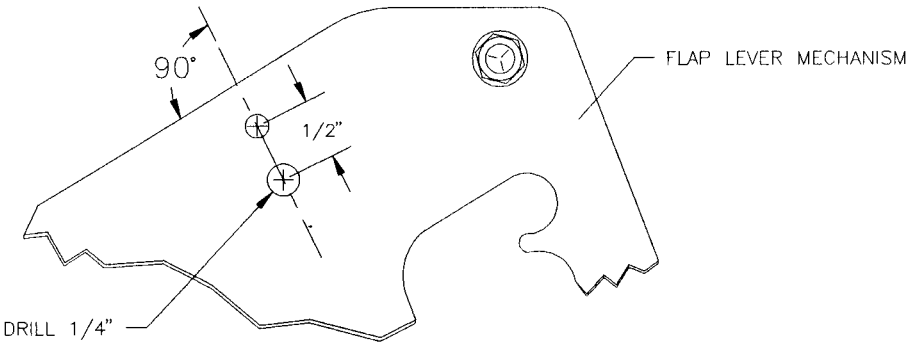
WHEN IN DOUBT, THROW IT OUT, LIVE TO FLY AGAIN TOMORROW!

S-12 AIRAILE PITCH TRIM SYSTEM

PLEASE NOTE: In order to assemble the trim system the instrument panel and flap lever must be installed. Refer to the Instrument Panel and Flap Assembly details.

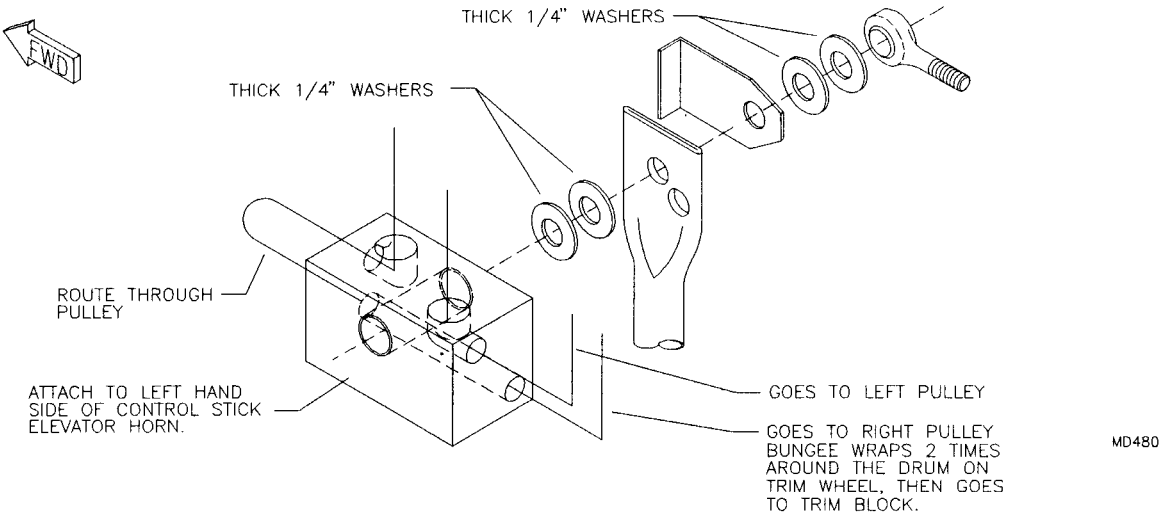
1. Locate and drill a 1/4" diameter hole through the flap lever side plates 1/2" below the existing #11 hole. See **Figure 09D-01**. **HINT:** Use the trim wheel's center hole as an alignment jig to accurately locate the 1/4" hole across the side plates. Slide the flap lever cover down over the flap handle and onto the flap lever assembly. Secure the velcro strip on the bottom for a tight fit. Burn 1/4" and 3/16" holes on the left side only, for pitch trim wheel and idler pulleys.

FIGURE 09D-01



2. Bolt the trim block to the left side of the elevator horn on the control stick. Refer to **Figure 09D-02**. Look very closely at this figure to correctly position the trim block.

FIGURE 09D-02



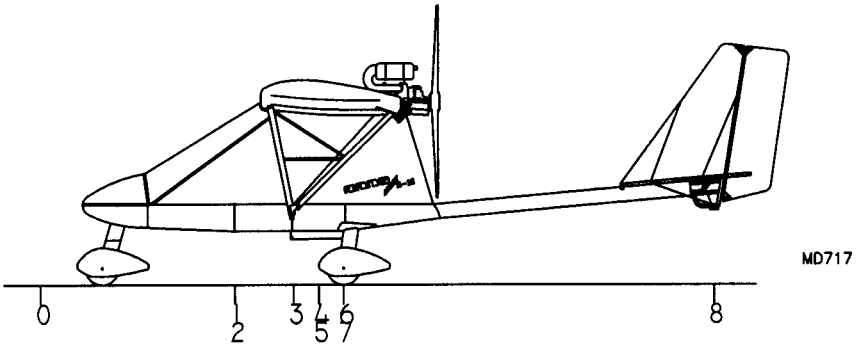
3. Bolt the two small plastic pulleys to the flap lever as shown in the parts drawing. Carefully tighten the bolt so the pulleys are not bound.

4. Assemble the pulley bracket. Rivet the pulley assembly in place centered over the slot in the lower panel. Place the pulley on the FWD side of the lower panel.

5. Slip one end of the bungee through the 3/16" hole on the AFT ends of the trim block and pull it up through the 3/8" hole. Tie this off with a single knot. Run the other end of the bungee to the left pulley, then wrap it around the drum (4) times. The bungee cord should come around the drum on the **FRONT** side, this will tighten the bungee when the trim wheel is rolled back causing up trim. Run the end of the bungee over the other pulley below the trim wheel to the trim block. This bungee should run clear through the trim block to the pulley in the lower instrument panel. Both bungees run under seat truss. Route the bungee into the pulley from the bottom, then back to the trim block. Slip the bungee into the 3/16" hole on the front side of the trim block, then up through the 3/8" hole. Tie off in a single knot to retain.

6. The trim system works by exerting tension on either side of the elevator horn on the control stick torque tube. The bungee loops around the trim wheel drum and must be tight in order to work. Tension the system enough so the bungee is not slipping on the drum. The bolt that holds the trim wheel to the flap lever must be tight enough to hold against the bungee at any setting. Cut off the extra bungee at the trim block with a hot knife.

7. Other factors affect trim such as C.G. and horizontal incidence. See tail section for setting incidence and C.G. operation for C.G.



N_____	
DATE WEIGHED	
ENGINE TYPE	
C.G. CONDITION	
EMPTY WEIGHT	
MTOW (503)	920 LBS.
MTOW (582)	960 LBS.
MTOW (912/912S)	1010 LBS.

RANS S-12 AIRAILE
WEIGHT AND BALANCE

ACCEPTABLE C.G. 99" TO 106" FROM DATUM O.
DATUM = 24" AHEAD OF CENTER OF NOSE WHEEL
AIRCRAFT IN LEVEL ATTITUDE.

BECAUSE THE S-12 IS A PUSHER THE TAIL WILL REST ON THE GROUND WHEN EMPTY. TO PROPERLY DETERMINE THE CENTER OF GRAVITY THE TAIL MUST BE ELEVATED TO SIMULATE LEVEL FLIGHT. SET THE TAIL ON A SAW HORSE OR STAND HIGH ENOUGH TO BRING THE NOSE WITHIN 1" OF THE FLOOR. ASSUMING THE FLOOR IS LEVEL THIS WILL PUT THE S-12 IN THE REQUIRED FLIGHT LEVEL ATTITUDE. THE DATUM OCCURS 24" AHEAD OF THIS POINT. OTHERWISE USE THE ARM MEASUREMENTS FOR THE ITEMS SHOWN ON THE WEIGHT AND BALANCE TABLE. THE CHART INCLUDES A LOCATION FOR BAGGAGE EVEN THOUGH THE S-12 IS NOT CURRENTLY EQUIPPED WITH A BAGGAGE COMPARTMENT. IF SUCH A CARGO SPACE IS DESIRED PLEASE LOCATE AS RECOMMENDED.

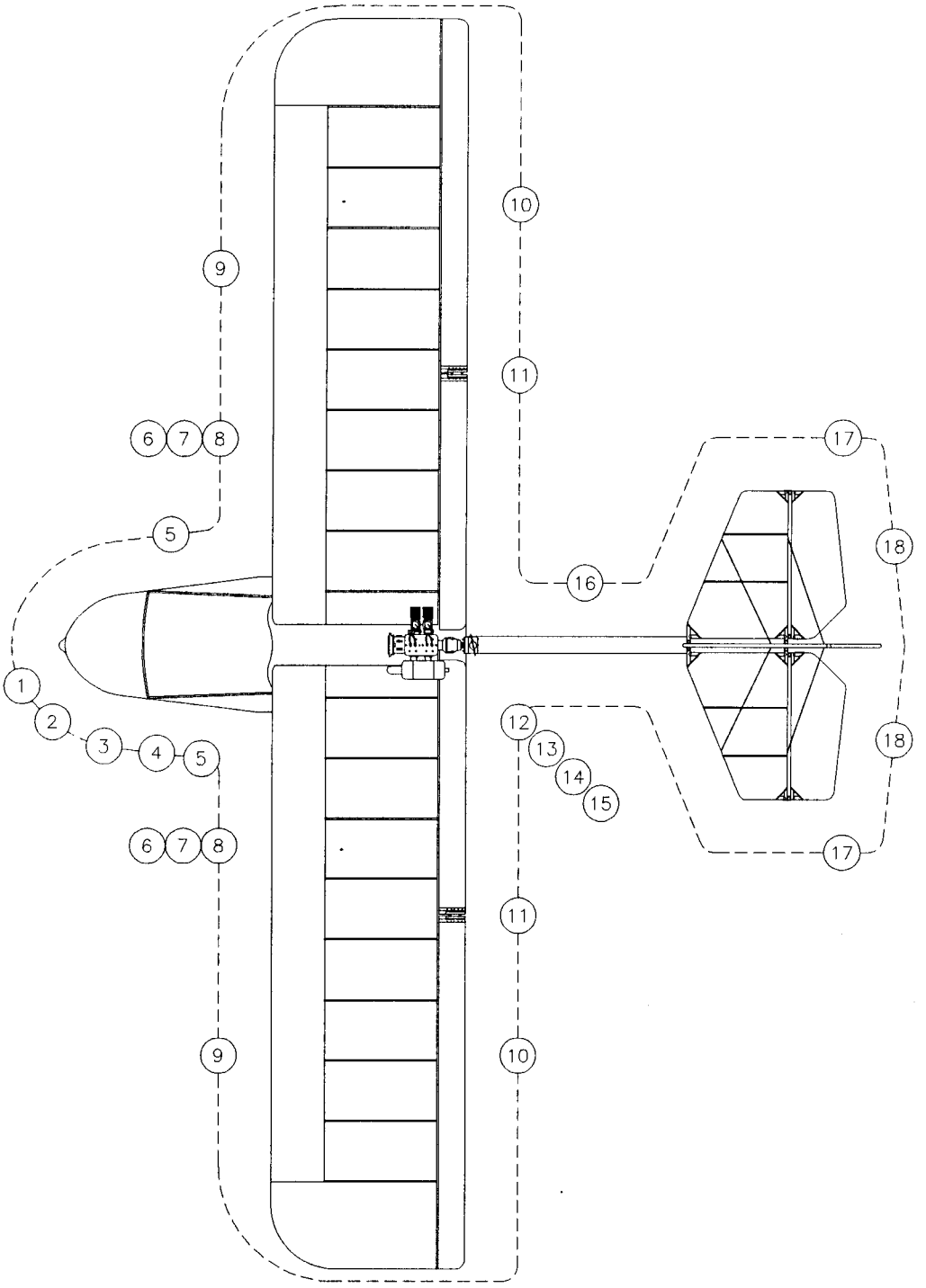
#	ITEM	WEIGHT	ARM	MOMENT
1	PILOT	140	85"	11900
2	PASSENGER	0	85"	0
3	WING TANK 15 GAL. *	90	96"	8640
4	AUX. FUEL	60	100"	6000
5	BAGGAGE	25	100"	2500
6	MAIN GEAR LEFT	245	108"	26460
7	MAIN GEAR RIGHT	242	108"	26136
8	TAIL	10	248"	2480
	TOTAL=	812	TOTAL=	84116

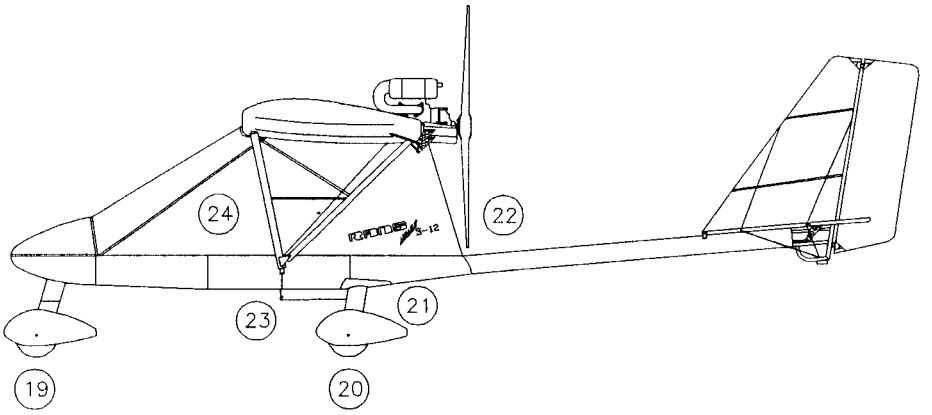
$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}}$ = C.G. $\frac{84116}{812}$ = 103.59"

#	ITEM	WEIGHT	ARM	MOMENT
1	PILOT		85"	
2	PASSENGER		85"	
3	WING TANK 15 GAL. *		96"	
4	AUX. FUEL		100"	
5	BAGGAGE		100"	
6	MAIN GEAR LEFT		108"	
7	MAIN GEAR RIGHT		108"	
8	TAIL		248"	
	TOTAL=		TOTAL=	

$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}}$ _____ =

S-12 AIRAILE PRE-FLIGHT INSPECTION





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1. Start the inspection in the same place every time to develop a pattern. This will lead to a more thorough pre-flight. Starting with the nose, check the nose gear for proper inflation and movement. Try to jiggle the wheel side to side to gauge bearing wear.

2. Inspect the nose gear steering linkage for play or looseness.

3. Check the floorboard and rudder pedals for freedom of movement. Oil the pedals with a light machine oil.

4. Move the throttle and check for proper movement and friction. Adjust the friction by tightening the bolt through the friction block.

5. Check the seats for secure attachment to the frame.

6. Check center cover for a tight fit to the wing.

7. Inspect the starter rope for wear.

8. Look over the cabaines for dings, bends, cracks or deformation.

9. Check the wing spars for bends, dings or deformation.

10. Inspect the aileron for movement and hinge condition. Oil hinges with a light machine oil. Check the hinge bolts for security and cotter pins. Check the rod ends, be sure the rod ends are threaded on at least six (6) turns.

11. Check flaps for function and condition of hinges. Check the rod ends, they must be threaded on at least six (6) turns.

12. Check the condition of the prop, look for cracks, nicks and dings. Keep the prop clean and the finish up.

13. Inspect the engine mount for integrity, look over the rubber mounts for wear. Keep clean of oil and fuel. Check all bolts for tightness.

14. Check the carbs for security. Check the clamps around the rubber boots. Check the throttle connections and fuel lines. Safety wire on the air filters. Clean the filters with raw gas and re-oil **LIGHTLY** with a recommended oil.

15. The muffler is a source of worry on a pusher. If any parts break off they take out the prop. So be extra careful, really look over all the items in the engine area.

16. Check the tail boom for nicks, dings and dents (dings are smaller than dents, therefore, deserve their own word).

17. Look over the tail for wear, tears and freedom of movement. Oil the hinges with a light machine oil.

18. Check the tail cables for tightness. Look closely at the thimbles for wear. Sometimes the thimbles will wear through and start cutting into the cables.

19. Check the tire pressure, 30 lbs.

20. Check the tire pressure, 30 lbs.

21. Check the main landing gear leg for bends and broken bolts. Inspect the gear socket for damage. Look for bent or compressed tubes.

22. Check the collar for a tight fit. Look for cracks in the small tabs welded to the collar. Check bolts for tightness. Look for hole elongation in the struts by moving the boom up and down and looking at the bolt connections.

23. Check the strut connections and the integrity of the fittings. Check for hole elongation on all these fittings and rivets.

24. Check for general condition and function of all items in the cockpit. Check the trim wheel bungee, flap lever, oil it with a light machine oil on the small rollers.

ENGINE OPERATIONS

Provided with the aircraft is an engine manual authorized by the engine distributor. This is a well written manual explaining may 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 check 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 15 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.

Drain the fuel sump. Squeeze the primer bulb until it is solid and pump the primer at least 6 pumps (if first start or if it's been 30 minutes since the last start). Close the throttle (pull back to close). Flip the ignition switch up for on. Grab the start handle and pull briskly. The best position to pull start the Airaile is standing on the left front side facing the engine. Try to pull the rope straight. Pulling to the side wears out the rope. If you flood the engine it will feel "soft". Open the throttle 1/4 way and pull through. Several pulleys may be needed. Be sure the ignition switch 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 causes and solutions. **CAUTION:** In cold weather allow at least a 2 minute warm-up before applying take-off power.

Check the throttle action. There should be no sluggish response from mid range to top end. Do not rapidly pump the throttle. This is not a motorcycle! It is an 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 sluggish throttle and 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 FILTER

Spit back the tendency at low RPM's for the engine to throw fuel out of the carb and into the air filter causes 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 a Airaile 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 is available at most motorcycle shops.

OBTAINING MORE RPM

Due to variations in propellers and engines you may not obtain proper T.O. RPM's. We recommend at least 6000 plus RPM's. If this is not the case a simple modification to the prop can be made which will usually gain 300 RPM. Cut the tip profile to the shape shown in the tip modification pattern.

INSPECTION OF THE ENGINE SYSTEM

Inspect the following:

Cracked parts.
Missing or bent bolts and loose nuts.
Elongated holes or cracks at mount plates.
Deteriorated rubber mounts.
General condition.

Carburetor & Throttle Quad:

Position (90 degrees to cylinder).
Clamp tightness.
Throttle and choke cable wear.
Smooth throttle and choke action.
Loose or missing bolts or screws.
General condition.

Muffler:

Spring tension.
Cracks in the manifold and welds.
Worn or broken hanger bracket.
Clearance from the airframe and gear cables.
General condition.

Fuel System:

Leakage anywhere in the system.
Cracked, worn or ruptured fuel lines.
Firm connections.
Fuel pump integrity.
Leaky primer pump/lines.
Fuel tank integrity.
Fuel filter clogs.
General condition.

S-12 AIRAILE OPERATIONS

PRE-FLIGHT

Refer to the pre-flight section of this manual.

STARTING

Refer to the engine operations section of this manual.

TAXIING

Taxiing the S-12 Airaile is easy and even in a 25 mph wind. The direct linkage to the steerable nosewheel enhances the ground handling making tight turns a snap.

If the wing is strong learn to use it to your advantage. Taxiing into the wind with forward stick will increase nosewheel traction and enhance steering. Taxi slow or you may start flying.

During downwind taxiing hold the stick neutral. Make small steering corrections and taxi slow.

In the hands of a skillful pilot the S-12 Airaile can taxi in winds up to 25 mph. Operations in 35 mph winds have been conducted with two on board.

Flying in high winds above 35 mph is also possible. However, this capacity should be used only as a means to get out of a situation not to invite one.

Recommended take off cruise and landing procedures for 582 equipped Airailes. (Reduce climb by 40% and cruise by 10% for 503 equipped units.)

FLYING A HIGH THRUST LINE PUSHER

The S-12 Airaile exhibits special characteristics due to its pusher configuration. Because of the high thrust line there is a tendency for the nose to pitch **DOWN** with application of power. This presents no problem if you are aware of it. Get in the habit of adding a slight amount of back pressure when applying power. The tendency will be more noticed at low speeds. **CAUTION:** During approach to landing avoid high rates of sink, usually a result of flying slow. If you are to slow and the sink rate is to high, a sudden burst of power will be required to recover, at this point the tendency to pitch down will be the greatest. The danger is if you are to low you may not have room to recover from the pitch over. Fly the approach at adequate speeds and you will avoid any problems associated with a high thrust line.

The other side of the pitch up tendency is the pitch **UP**. This occurs at **ANY** airspeed when **SUDDEN** reduction on throttle is made. Again, the only phase of flight where this would be critical is during landing. The proper action is to add the right amount of **FORWARD** pressure.

As you fly the Airaile it soon will become second nature to you about these little handling quirks. Just remember to tell your buddy before you turn him loose with your plane, especially if he has not flown a pusher. As pushers go the Airaile is average in these thrust line related properties. As you will see it is a very easy trait to live with, and one that is hard to design out completely without making some other major trade offs, like prop diameter for one.

TAKING OFF

A normal take off in the S-12 is performed with no flaps. Hold the control stick in neutral, apply full power at around 35 to 45 mph, apply just enough up to rotate the plane to fly off. Avoid over rotation, this will only scrape the tail skin and will not enhance the take off. If you are near gross there will be considerable back pressure required. Use the trim wheel to ease the work load.

Add one notch of flaps to the normal take off and you have the short take off procedure. We have tried other methods such as dumping in full or partial flaps right before rotation, and two notched or full flaps before rolling. None has done better then simply one notch of flaps before applying take off power.

A soft field take off in the S-12 is performed with full flaps and back stick. This however will not result in a short ground roll. The need for a soft field take off will be very rare because of the Airaile's low gross weight. Our testing shows the short field take off can be used for all take offs.

CLIMBING

BEST RATE OF CLIMB

To gain the best climb out of the S-12 slowly retract the flaps and let the plane obtain its best climb speed. This should be between 45 and 55 mph.

BEST ANGLE OF CLIMB

The S-12 has such a steep angle of climb when climbing at the best rate that it will be a rare case to use best angles of climb. In any case the best angle of climb is accomplished with full flaps and an airspeed between 35 and 45 mph. CAUTION: The angle of climb is around 40 to 45 degrees, a power loss within 200 to 300 ft above ground level in this attitude may be unlikely to recover from. It is recommended to use a lesser angle until a safe altitude is reached.

CRUISE FLIGHT

By nature of design the S-12 will exhibit a wide range of power settings at which one can cruise. Typically loaded with a gross of 785 lbs the best cruise should come in around 5500 with an indicated airspeed of 60 to 65 mph. This is for a partial fairing equipped plane. The open cockpit will reduce all cruise speeds by 5 to 7 mph. 5500 rpm would be considered the middle cruise and will yield the best fuel burn to airspeed ratio. The gallons per hour should be around 4.3 at this setting. Bumping the rpm up to 6200 should yield a 70 to 75 mph cruise with a 5.5 gph.

At the other end of the cruise scale is the slow cruise. Because of the higher angle of attack the fuel to mph ratio is not so good. This is more of a loitering speed then a cruise because it really is too slow to get anywhere. Slow cruise is around 50 mph with the power at 5000 rpm. An interesting way to use the slow cruise is in conjunction with thermals, this can net a lot higher speed then the 50 mph and it is a lot more fun! When you feel a thermal lifting the plane, apply a little forward stick and take advantage of the "down hill" effect the thermal affords. Try to hold your altitude within 500 ft in consideration of VFR FAR's.

STALLS

The S-12 Airaile has a very mushy mellow dramatic power off stall. The power on stall is even more indefinite. It is highly recommended to take your S-12 Airaile to a safe altitude to explore the stall. Because the stall is so docile you will need to learn the feel of the plane in the stalled mode in order to be proficient in stall recognition. Learn the other signs of a stall such as mushy or limp control feel and high sink rates.

If held in the power off stall the craft will develop a healthy sink rate, which is easily checked with a release in back pressure. If solo the power on stall may never happen, the plane will simply assume a very nose high attitude and mush along level or even climb at 200 to 300 feet a minute. At gross it is a different story, the plane still will not exhibit a sharp break, but it will enter a high sink rate mush. All types of stalls in the Airaile are quickly recovered from with very little loss in altitude.

SPINS

When flown solo fully developed spins past 3 turns can be performed in the S-12 Airaile. The recovery is typical opposite rudder, break the stall and smoothly pull up. The attitude is 70 to 80 degrees nose down. Rotation is a slow six seconds per turn even after fully developed. The spin will be fully developed after the second turn.

Flight tests show spins at or near gross will not sustain. Our tests shown the Airaile self recovers from the spin after 2 to 3 turns and cannot be held in the spin at gross or near gross weights. At this point the aircraft is in a high speed dive usually right at the red line. Because of this trait any spin training at or near gross should not be allowed to go past 2 turns.

NORMAL & STEEP BANKS

The Airaile's 31 foot span wing retains energy very well in turns. It is easy to perform well coordinated 60 degree steep banks. The only real trick is to learn to lead in and out of the bank with the rudder. That is why the Airaile is sometimes referred to as a rudder airplane. This is common in planes that fly slow and have a span of 30 ft. The reaction to adverse yaw is much more pronounced because of the span.

Normal banks up to 30 degrees will yield the fast roll rate. After 30 degrees the roll rate will start to slow due to the pendulum stability.

LANDINGS

The Airaile is one of the easiest to land planes around, but only if you understand it! What is special about landing an Airaile over conventional aircraft is the fact it is a pusher with low weight and high drag. That means there is a lot less energy in the bank for the approach and flare. A normal landing is done with no flaps at an approach speed of 45 to 50 mph. The plane is flown right down to the runway at a fairly shallow angle of descent. Once established over the runway at about one to two feet power is reduced and the plane is allowed to settle onto the runway. In other words the S-12 Airaile is landed without a big flare. There is a couple of good reasons for this. One is rotation clearance is close and the beginning Airaile pilot will have a tendency to scrape the tail. Good thing we provide a tail skid! The other reason is related to the low energy, high drag nature of the beast, there simply is not a lot of speed. A flare landing can be performed but the chances of a smooth landing are less. Plus the touch down speed is not reduced enough to mean anything to tire wear.

CROSSWINDS

Crosswind landings with the Airaile have been performed in winds up to 20 mph at 90 degrees. To successfully operate in high crosswinds authoritative action is required from the pilot. In other words do not be afraid to use the rudder and ailerons to the stops to get the results.

The recommended crosswind take off is to hold full aileron into the crosswind and rudder as required. It is always better to have all the aileron in and have to take it out then to try and bring a wing down once it has started up. Hold the nose down until the rotation speed is reached, this will increase directional control. Holding the nose down is especially important when flying solo because there is less weight on the nose gear. Once air born let the controls neutralize and obtain and hold best climb speed.

Landing in a crosswind requires a little airmanship as well. The recommended method is to fly the approach at the crab angle caused by the wind. Just before touch down line up the aircraft to the runway holding the upwind wing down. The Airaile's trike gear is very forgiving in crosswinds. Touch downs off of center line up to 10 degrees have been conducted without problems.

We can not tell you everything about flying your Airaile. You will learn your machine as you build time. Each machine is a little different. This information is intended as a guide line and not to be taken as the Bible. Please approach the flight testing of your Airaile with the common sense and respect it deserves. Be careful and fly safe and **ALWAYS** do a thorough preflight.

APPROVED MANEUVERS

Stalls, all types except Whip Stalls.
Falling Leaf at low power settings (below 4,000 rpm).
Chandelles.
Lazy Eights.
Spins up to 3 turns at low power settings and without flaps only!

ALL AEROBATIC MANEUVERS EXCEPT THOSE APPROVED ARE PROHIBITED!

ASI MARKINGS

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

White Arc	28 mph to 65 mph (stall to maximum flap extension speed)
Green Arc	40 mph to 70 mph
Yellow Arc	70 mph to 100 mph
Red Line	100 mph

SPECIAL OPERATIONAL CONSIDERATIONS

POSITION IGNITION SWITCH

Up is for on, down is for off.

FLIGHT MANEUVERS THAT INDUCE NEGATIVE LOAD

Flight maneuvers that induce negative load may cause fuel leakage through the vent cap and momentary fuel starvation due to the negative G's on the float style carburetor. Avoid low level abrupt pull ups followed by an abrupt dive.

WARNING: SECURE ANY FORM OF CARGO

Secure any form of cargo and be careful of clothing articles falling into any part of the aircraft's working mechanisms. Jamming of the controls may result. Always wear the safety belt and shoulder harness to be sure these also do not interfere with the controls.

CHECK THE CARBURETOR

Check the carburetor during pre-flight for clamp security. After a few hours the fuel/oil mix will lubricate the rubber intake manifold. It is then possible for the carburetor or carburetors to rotate into a position that may cause fuel overflow and possible fuel starvation. Remove, clean and reclamp.

FUEL SHUT OFF VALVE

The fuel shut off valve must be **ON** for flight. **ALWAYS** check it. There's enough fuel retained in the system past the valve to permit a take-off followed by a deadstick landing! For fully enclosed Airailes be sure the fuel filler cap vent is **CLOSED** and the vent line is **OPEN**.

SLOW TO 50 MPH

Slow to 50 mph in severe turbulence. **AVOID** descending at high rates of speed from high altitudes into unknown conditions. A shear layer may be present at a lower lever causing turbulence. Remember, high speeds and severe turbulence may accelerate airframe fatigue and shorten your aircraft's effective service.

AIRSPEEDS

Maximum turbulent air penetration speed is 50 mph.
Maximum flap extension speed is 65 mph.

Keep all the control surface hinge points and other moving parts well oiled. Use a light machine oil. Aileron hinges need oil too. Your ailerons may feel "heavy" if not oiled.

SPECIAL SECTION ON FLAP OPERATIONS

IN GENERAL

The flap equipped S-12 Airaile has a wider speed envelope but this is only realized through proper flap usage. Please take the time to become thoroughly familiar with the aircraft and procedures before attempting any maximum performances, take offs or landings. The aircraft functions well without using flaps only take off/landing distances are longer and speeds are higher. Pay close attention to the recommended flight speeds called out in this section.

The first notch of flaps is used to moderately shorten take off rolls. Our tests show (1) notch for T.O. is the best. Further flaps have a tendency to increase T.O. distance. The maximum flap extension speed is 65 mph. Although it is allowable to extend to full flaps at 65 mph, it is actually better technique to extend a notch at a time. **EXAMPLE:** 65 mph-1st notch, 55 mph-2nd notch, 45 mph-3rd notch. You'll find this gives you much smoother approached with less flap lever pressure. For reference 1st notch/11 degrees, 2nd notch/30 degrees, 3rd notch/43 degrees.

The second flap setting is used more or less as a transition to full flaps on landing. The third notch of flaps is going to yield steeper, slower approaches and the shortest landing roll. Typically a 45 mph approach speed in a 20 degree nose low attitude is desired. **CAUTION:** It is very easy to exceed 65 mph, the maximum flap extension (vfe) speed during such approaches...be wary of this!

POWER OFF STALLS		BANK		
FLAPS		0	30	60
	0	33	39	45
	11	34	38	44
	30	32	36	42
	43	27	35	40

POWER ON STALLS		BANK		
FLAPS				
	0	22	25	27
	11	20	23	26
	30	20	23	24
	43	20	23	24

Performance based on standard day gross weight of 875 lbs.

CAUTION: Inspect flap lever catches for wear every 100 hours. Keep roller lubricated.

PROHIBITED: Spins with flaps extended any degree but 0.

TRAILERING & TOWING PRECAUTIONS

When towing long distances on an open trailer remove the tail surfaces. Highway speeds and gust loads can cause undue loads on the tail group.

Make certain the wings and tail components are secure and will not catch the wind underneath. Tie down the wing at the ends about 2 ft in and in the middle.

CAUTION: If you must tow tail first with the tail group assembled lock the rudder and the elevators with a control lock. Haul like this only in moderate surface winds and drive below 35 mph. This method works fine for a few miles like to the flying site but is not suited for long hauls.

DISASSEMBLY FOR TRANSPORT

The distance, terrain, weather and type of trailer will determine how much disassembly you must do to transport your S-12 Airaile. Usually we simply remove the wings and hang them on the wall of an enclosed trailer.

Naturally, disassembly is reverse of the assembly with the exception of those items you decide to leave assembled (tail group, etc.).

CAUTION: Be **VERY** careful when disassembling and transporting your craft not to gouge, scratch or bend the wing struts. The bolts that retain the jury struts can gouge the struts if no packing is used between them. Avoid any method of dismantling or packing that can cause such damage to any part.

MAINTENANCE

COVERING

The S-12 Airaile is covered with a 3.9 ounce per square yard Dacron Sailcloth. This dyed to color material will last several years if the plane is stored out of direct sunlight while not in use. Ultraviolet light is the main reason for loss of skin strength. The telltale signs of an aging skin are;

1. Color fading
2. Embrittlement
3. Easily torn with rips likely to enlarge

To preserve your covering there is now a clear coating (Stits Aerothane) that can be sprayed on. The effectiveness on life span extension is considerable. However, the best preservative is indoor storage out of weather and sunlight.

CLEANING

For a major cleaning we've used power washers that spray hot, soapy water and have achieved excellent results. This is mainly for the exterior, although if you are willing to wipe dry the intricate interior detail and avoid directing the spray in the instrument panel it works well for the inside. For small gas spills and other isolated stains, we use acetone. The aluminum tubing needs little more than a damp cloth followed by a dry cloth to prevent water spotting. **IMPORTANT:** If you conduct flight operations near or on salt water such as landing on beaches or float activity a thorough fresh water washing is a must after each final flight of the day. This should be done as soon after the flight as possible. Saltwater can be the cause of serious corrosion problems for key structural elements. Internal rinsing of spars, struts and fuselage members with fresh water is required if the plane has been excessively wetted or submerged in salt water. During cleaning of any type inspect the craft for signs of corrosion and any other abnormalities.

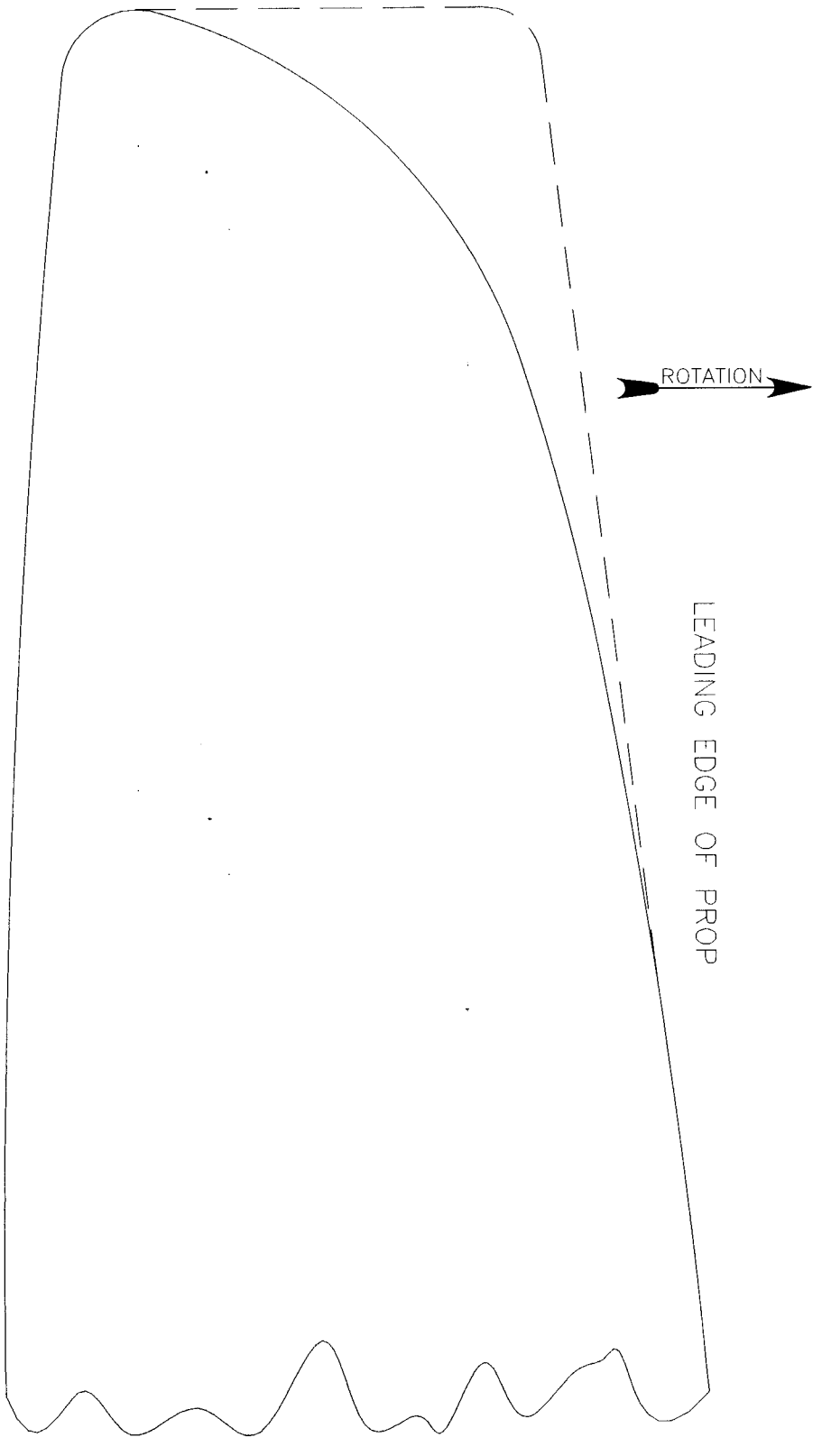
AIRFRAME UP KEEP

The aluminum and steel structure is designed to last for many years. However, constant abuse through hard landings and high speed flight in rough air could fatigue key structural elements. To inspect the airframe, look for cracks, hole elongation, flecking of anodizing (indicating bends or overloads), bent, dented or corroded tubing and any signs of misalignment or distortion. Consult your dealer or the factory if your inspection reveals trouble or in the event of accidental damage beyond your capabilities of repair.

KEEPING YOUR ROTAX ENGINE CARBON FREE

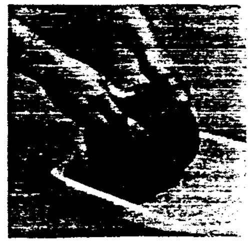
The Rotax manual as well as the following information outlines some excellent procedures to assure reliable operations. However, in the real world the method suggested for carbon removal is only a half-way measure. True removing the cylinder heads and scraping the dome and piston top will prevent carbon from fouling the plugs. But we go one step further by removing the cylinders and then the pistons. Why? To clean the ring grooves. Yes, for the first 200 hours it is **VERY** important to clean the rings and pistons every 50 hours. Sounds tough but it is not bad if you're careful (and easier than fixing airframes). Use an aluminum scraper and be careful when removing the rings not to bend them or get them mixed up. Do one piston and reassemble it to the rod **THEN** do the other. You'll be surprised at the carbon build! Now if you don't see stuck rings or carbon **DO NOT** clean it! You're a lucky one but do inspect it regardless. After 200 hours you may opt to go to 65 hours instead of 50. You will know by the condition of the engine from previous inspections. A ring stuck by carbon build can cause seizures because of blow by and localized hot spots. The piston skirt heats and swells until it sticks. Carbon free rings will assure this potential failure is eliminated.

CUT AWAY AND RE-PROFILE AIRFOIL. THIS MODIFICATION CAN YIELD AS MUCH AS A 300 RPM INCREASE.



MD618

K&N SERVICE INSTRUCTIONS

ENGLISH

IMPORTANT!
READ BEFORE USING YOUR K&N AIR FILTER. K & N AIR FILTERS MUST BE OILED BEFORE USE.

NEW FILTER PREPARATIONS

For maximum filter life and protection of your engine, use K&N Air Filter Oil Part No 99-0504 or 99-0516 Aerosol or 99-0533 Squeeze Bottle
With Aerosol. Spray along the full length of each pleat. Wait 5-10 minutes for oil to wick, yielding a uniform, red color.
With Squeeze Bottle: Lay one bead of oil along the full length of each pleat. Wait 15-20 minutes for oil to wick, yielding a uniform, red color. Retouch any white spots.
Note: Excessive over oiling is not recommended.
Optional: To assure proper filter sealing, apply K & N Air Filter Sealing Grease. Part No. 99-0702
Note: Do not use on hose clamp type filters

CLEANING REUSABLE K & N FILTER

First, lightly tap off surface dirt and wet with cold water.

Roll filter in a shallow amount of K & N Filter Cleaner & Degreaser (Part No 99-0621) (3/4 the depth of one pleat). Do not let dirty solution run to inside of filter. Let filter sit for 5 minutes to dissolve dirt.

From the inside out, rinse your K&N Filter with cold water. Shake and allow to air dry. Do not use air hose! And . . .

Re-oil as a new installation

CAUTION: DO NOT BLOW DRY WITH AIR HOSE

ESPAÑOL

¡IMPORTANTE!
LEA LAS INSTRUCCIONES ANTES DE USAR SU FILTRO DE AIRE K&N. LOS FILTROS DE AIRE K&N TIENEN QUE SER ACEITADOS ANTES DE USARSE.

PREPARACIONES PARA UN NUEVO FILTRO

Para máxima vida del filtro y protección de su motor use aceite para filtros K & N Parte No. 99-0504 y 99-0516 en aerosol y botella plástica No 99-0533
Con aerosol: Aplique aceite a lo largo de cada pliegue. Espere de 5-10 minutos hasta que el aceite se riegue por la superficie del filtro y se observe un color rojo uniforme
Con la botella plástica: Aplique una capa de aceite a lo largo de cada pliegue. Espere de 15-20 minutos para que el aceite se riegue mostrando un color rojo uniforme. Retoque cualquier mancha blanca que aparezca
Nota: No se recomienda aceitar en exceso.
Opcional: Para asegurar un buen sellado aplique Grasa para Sellar los Filtros de Aire K & N Parte No 99-0702
Nota: Nunca use la grasa en filtros equipados con mangueras con grampas

LIMPIEZA DE FILTROS K & N REUSABLES

En primer lugar golpeé suavemente el filtro para sacudir el polvo; luego humedezca la superficie con agua fría

Haga rodar el filtro en una pequeña cantidad de líquido limpiador y desgrasador para filtros K & N (Parte No 99-0621). (3/4 partes de profundidad de un pliegue). No permita que la solución sucia penetre en el interior del filtro. Deje reposar el filtro por 5 minutos para que la suciedad se disuelva

De adentro hacia afuera, enjuague su filtro K & N con agua fría. Sacúdalo y déjelo secar al aire. ¡No use la manguera de aire! Y

Aceítelo otra vez como si fuera una nueva instalación

FRANCAIS

IMPORTANT!
LISEZ LES INSTRUCTIONS SUIVANTES AVANT D'UTILISER LE FILTRE A AIR K & N. LES FILTRES A AIR K & N DOIVENT ÊTRE GRAISSÉS AVANT UTILISATION.

COMMENT PRÉPARER UN FILTRE NEUF

Pour vous assurer de longue durée de votre filtre et pour la protection de votre moteur, utilisez l'huile à filtre à air K & N. Pièce numéro 99-0504 ou 99-0516 avec aérosol, ou 99-0533 avec bouteille plastique
Avec aérosol, vaporisez le long de chaque pli du filtre. Attendez 5-10 minutes pour permettre à l'huile d'imprégner et pour le filtre de prendre une couleur rougeâtre uniforme.
Avec la bouteille plastique: appliquez une quantité modeste d'huile le long de chaque pli. Attendez 15 à 20 minutes pour permettre à l'huile d'imprégner et pour le filtre de prendre une couleur rougeâtre uniforme. Retouchez les taches blanches s'il y en a
Notez qu'un graissage excessif n'est pas recommandé
Facultatif: pour garantir l'étanchéité parfaite de votre filtre, faites une application de Graisse Étanche K & N pour Filtre à Air. Pièce numéro 99-0702
Notez qu'il ne faut pas utiliser cette graisse sur les filtres équipés d'un tuyau en caoutchouc avec pinces

COMMENT NETTOYER LE FILTRE K & N AVANT DE LE RÉUTILISER

Tapotez tout d'abord le filtre de façon à le débarasser des poussières et saletés, puis mouillez le filtre avec de l'eau froide

Roulez le filtre dans un peu de dégraisseur à filtre K & N. Pièce numéro 99-0621, environ trois quarts de la profondeur du pli. Ne permettez pas à la solution sale d'imbiber l'intérieur du filtre. Attendez 5 minutes jusqu'à dissolution complète de la saleté

Rinsez votre filtre à l'eau froide en faisant couler l'eau de l'intérieur vers l'extérieur. Secouez et laissez sécher. N'utilisez pas de tuyau à air! Et

Graissez à nouveau comme un filtre neuf

ITALIANO

IMPORTANTE!
LEGGERE PRIMA DI UTILIZZARE IL VOSTRO FILTRO ARIA K & N. I FILTRI ARIA K & N DEVONO ESSERE LUBRIFICATI PRIMA DELL'USO!

COME PREPARARE UN FILTRO NUOVO

Per la massima durata del vostro filtro K & N e per la protezione del vostro motore, usate l'Olio Filtro Aria K & N No. 99-0504 oppure 99-0516 Aerosol oppure 99-0533 Bottiglia Plastica a Pressione
Con Aerosol: Applicate una piccola quantità per tutta la lunghezza di ogni piega. Attendete 5-10 minuti finché l'olio si stende, assumendo un colore rosso uniforme
Con Bottiglia Plastica: Applicate una goccia di olio lungo tutta la lunghezza di ogni piega. Attendete 15-20 minuti finché l'olio assume un colore rosso uniforme. Ritoccate qualsiasi punto bianco
Attenzione: Si sconsiglia una eccessiva lubrificazione.
Facoltativo: Per assicurare una perfetta sigillatura del filtro, applicate Grasso per Sigillatura Filtro Aria K & N No 99-0702
Attenzione: Non utilizzare su filtri del tipo con fascetta stringitubo

COME PULIRE IL FILTRO K & N RINNOVABILE

Prima di tutto, scrollate lo sporco dalla superficie e bagnate con acqua fredda

Rotolate il filtro in una piccola quantità di Pulitore e Sgrassatore K & N No 99-0621 3/4 della profondità di una piega. Non permettere che la soluzione sporca entri nell'interno del filtro. Lasciare il filtro fermo per 5 minuti perchè la sporcizia si dissolva

Dal dentro verso il fuora risciacquate il filtro K & N con acqua fredda. Scuotete e lasciate asciugate all'aria. Non usare manica d'aria

Lubrificate di nuovo come per nuovo montaggio

DEUTSCH

WICHTIG!
VOR GEBRAUCH DES K & N LUFTFILTER MUESSEN DIE FOLGENDEN GEBRAUCHSANWEISUNGEN BEACHTET WERDEN. DER K & N LUFTFILTER MUSS VOR GEBRAUCH GEOELT WERDEN

VORBEREITUNG FUER NEUEN LUFTFILTER

Fuer groessere Lebensdauer des Filters und maximalem Motorenschutz soll nur K & N Luftfilteroel benutzt werden No 99-0504 oder 99-0516 Aerosol oder No 99-0533 in Druckflaschen
Mit Aerosol: Jede Filterrippe muss mit Oel bespritzt werden. 5-10 Minuten werden gebraucht um das Oel aufzusaugen. Anschliessend hat der Filter eine gleichmaessig rote Farbe
Mit Druckflasche: Man legt eine Spur von Oel ueber die Ganze Laenge jeder Rippe. In 15-20 Minuten nachdem das Oel aufgesaugt ist soll eine gleichmaessige rote Farbe auf der Filteraussenseite entstehen. Eventuelle weisse Stellen muessen nachgeoelt werden
Zur Beachtung: Zuviel Oel ist nicht ratsam.
Nach Wahl kann der K&N Luftfilter noch weiter abgedichtet werden durch Benutzung von No 99-0702 Filterfett. Dieses Fett soll nicht an Schellenverschluss-Filtern benutzt werden

REINIGUNG FUER GEBRAUCHTE K & N LUFTFILTER

Erst muss der Oberflaechen-Schmutz leicht abgeklopft werden, dann mit kaltem Wasser anfeuchten

Man rollt den Filter in K&N Filterreinigungs und Entfettungsfluessigkeit (No 99-0621). Die Hoehe der Reinigungsfluessigkeit soll ungefaehr 3/4 der Filterrippengroesse sein. Die schmutzige Fluessigkeit darf nicht in die Innenseite des Filters laufen. Zur Aufloesung des Schmutzes soll man den Filter 5 Minuten in der Reinigunsfluessigkeit stehen lassen

Mit kaltem Wasser wird der K & N Filter von innen nach aussen ausgespuehlt. Ausschuetteln und an der Luft trocknen lassen. Druckluft darf zum Trocknen nicht benutzt werden

Vor dem Wiedereinbauen muss der Filter erneut wie No 1, eingeoelt werden

NEDERLANDS

BELANGRIJK!
LEES DEZE INSTRUCTIES VÓÓR HET GEBRUIK VAN DE K & N LUCHTFILTER. K & N LUCHTFILTERS MOETEN VÓÓR GEBRUIK GEOLIED WORDEN

VOORBEREIDINGEN VOOR EEN NIEUWE FILTER

Om verzekerd te zijn van een lange levensduur van uw K & N filter en ter bescherming van uw motor, gebruik luchtfilterolie K&N No 99-0504 of 99-0516 in aerosol-spuitbus, of 99-0533 in zacht plastic flacon.
Met Aerosol-spuitbus: Sproei langs de volle lengte van iedere vouw in de filter. Wacht 5 tot 10 minuten zodat de olie volledig kan worden geabsorbeerd waardoor de filter een gelijkmatige roodachtige kleur krijgt
Met zacht Plastic flacon: Spuit een kleine hoeveelheid olie langs de volle lengte van iedere vouw in de filter. Wacht 15 tot 20 minuten zodat de olie volledig kan worden geabsorbeerd en de filter een gelijkmatige roodachtige kleur krijgt. Eventuele witte plekken met een klein beetje olie bewerken
N. B. Teveel olie gebruiken is niet aanbevolen
Naar keuze kan de K & N luchtfilter nog beter afgesloten worden door gebruik van K & N luchtfilter afsluitvet No 99-0702
N. B. Niet te gebruiken op filters die met een klem bevestigd worden

HET SCHOONMAKEN VAN DE K & N FILTER VÓÓR HERGEBRUIK

Begin met het vuil voorzichtig kloppende van de buitenkant te verwijderen. Dan de filter met koud water nat maken

Rol de filter in een ondiep bakje met K&N filter reiniger No 99-0621, tot ongeveer 3/4 van de diepte van de vouw. Zorg ervoor dat de vuile oplossing niet in de binnenkant van de filter komt. Wacht 5 minuten tot al het vuil volkomen is opgelost

Spoel de filter af met koud water van de binnenkant naar de buitenkant. Uitschudden en laten drogen. Vooral geen luchtslang gebruiken! En

Opnieuw oliën als een nieuwe filter

SVENSKA

VIKTIGT!
LÄS INNAN ANVÄNDNING AV K&N FILTER. K&N FILTER MÅSTE OLJAS FÖRE ANVÄNDNING

FÖRBEREDELSEN FÖR DET NYA FILTRET

För maximalt filterliv och beskydd av motorn använd K&N luftfilter olja. Del Nr. 99-0504 eller 99-0516 aerosol eller 99-0533 plastflaska
Med Aerosol: Spruta över hela längden av varje veck. Vänta 5-10 minuter tills oljan uppsugs och man ser en jämn röd färg
Med plastflaskan: Klämm oljan ut över hela längden av varje veck. Vänta 15-20 Minuter tills oljan uppsugs och man ser en jämn röd färg. Retuschera eventuella vita fläckar
Obs! Omåttlig påoljning rekommenderas inte.
Valfritt: För att försäkra att filtret tätas ordentligt, använd K&Ns tätningsfett för luftfilter Del Nr 99-0702
Obs! Använd den inte på filter med slangklämmor

RENGÖRNING OCH ÅTERANVÄNDNING AV K & N FILTER

Först, slå lätt bort yttersmutsen och fukta med kallt vatten.

Rulla filtret i en grund mängd K&N filterrensare och avsmörjare (Del Nr 99-0621) (3/4 djupet av ett veck). Låt inte den smutsiga lösningen rinna in i filtrets insida. Låt filtret stå i 5 minuter så att smutsen kan upplösas

Från insidan ut skölj K & N-filtret med kallt vatten. Skaka det och låt det torka i luften. Använd inte någon luftslang! Och .

Olja om filtret som vid en nymontering

日本語

新しいエア フィルターの使用方法

御使用前に必ず下記をお 読み下さい。

K & N エア フィルターを再使用する場合

F-234

K&N ENGINEERING, INC., RIVERSIDE, CALIFORNIA 92502, U.S.A.

Printed in U.S.A.

MAINTENANCE SCHEDULE FOR ROTAX ENG 377, 447, 503, 532

ACTION TO BE DONE			First 2	Every 12	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
Ignition timing	check	(1	X		X	X	X		X	X	X		X	X	X		X	X	X	
Cylinder head & manifuld	retorque	(2	X																	
Spark plugs	clean			X	X		X		X		X		X		X		X		X	
Spark plugs	replace					X		X		X		X		X		X		X		X
Fan belt tention	check				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fuel filter	check				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fuel line	check				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fuel pump	check				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carborator	check & abjust				X		X		X		X		X		X		X		X	
Carborator	clean					X		X		X		X		X		X		X		X
Air filter	clean & oil				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cylinder	remove & check	(4				X		X		X		X		X		X		X		X
Pistones	remove & clean	(5				X		X		X		X		X		X		X		X
Small & bearings	replace											X								X
Ignition point set and condencer	replace							X				X				X				X
gear drive oil	change	(3						X				X				X				X
Gear tortional shook spring	replace											X								X
Engine overhaul		(7																		X

(6.

1. After every point set replacment.
2. After every head or Cylinder removing.
3. First 12 hrs of new gear
4. Cylinder check A. condition B. taper: max 0.08 m.m C. out of round max 0.05 m.m
5. Piston check A. ring end gap: new ring: min 0.20 m.m
   max 0.35 m.m. used ring 1.00 m.m
   B. ring / piston groove clearance (rectangular ring only): min 0.04 m.m
   max 0.11 m.m wear limit: 0.20 m.m
6. piston / cylinder clearance: min 0.08 m.m max 0.10 m.m - wear limit 0.20 m.m
   (measured at cylinder 5/8" below top. measured at piston 1/4" above buttom for piston skirt)
7. on 532 eng"s overhaul at 500 hrs.

KEEPING YOUR ROTAX ENGINE CARBON FREE

The Rotax manual as well as the following information outlines some excellent procedures to assure reliable operations. However, in the real world the method suggested for carbon removal is only a half-way measure. True removing the cylinder heads and scraping the dome and piston top will prevent carbon from fouling the plugs. But we go one step further by removing the cylinders and then the pistons. Why? To clean the ring groves. Yes, for the first 200 hours it is **VERY** important to clean the rings and pistons every 50 hours. Sounds tough but it's not bad if you're careful (and easier than fixing airframes). Use an aluminum scraper and be careful when removing the rings not to bend them or get them mixed up. Do one piston and reassemble it to the rod **THEN** do the other. You'll be surprised at the carbon build! Now if you don't see stuck rings or carbon **DON'T** clean it! You're a lucky one but do inspect it regardless. After 200 hours you may opt to go to 65 hours instead of 50. You will know by the condition of the engine from previous inspections. A ring stuck by carbon build can cause seizures because of blow by and localized hot spots. The piston skirt heats and swells until it sticks. Carbon free rings will assure this potential failure is eliminated.

ROTAX GENERAL FACTS

9) EXHAUST. The exhaust system is tuned to the engine to give the correct performance and should not be modified. If you do have to make changes the length of the pipe between the exhaust manifold and the muffler must be maintained. If changes are necessary, call LEAF for technical assistance. The exhaust system must remain flexible. If the joints do not maintain freedom they may weld together because of high temperature. Also some should use a high temperature lube, LEAF part # to keep flexibility.

The propeller and engine generate noise; (the propeller from shape, tip speed and distance from the engine.) The air intake silencer (p# 999-510) and exhaust silencer (p# 999-505) help reduce engine noise.

Leaf recommends the use of a lighting coil type tachometer. For checking engine temperature the EGT probe is located 3.92 inches from the center of the probe to the piston face exhaust port. The probe on a liquid cooled is mounted between the heads.

MAIN TORQUING SPECIFICATIONS*	NM	In.Lbs	Ft.Lbs
Cylinder head nuts M8	24	210	17
Crankcase screws M6	10	88	7
Crankcase screws M8	24	210	17
Magneto housing nut: M18 x 1.5	80	700	58
Magneto housing nut: M22 x 1.5	90	800	66
Fan nut: M16 x 1.5	70	620	51
Crankcase nuts (or screws) M10	40	354	29
Exhaust manifold screws M8	24	210	17

*Specifications subject to change without notice.

NOTE: M8 refers to the diameter of the shank of the fastener

TROUBLE SHOOTING. In trouble shooting your engine the most important questions to ask yourself are:

a) Is the engine running at the proper RPM?
b) Is the jetting correct?
c) Have the heads been retorqued after the break-in period?
d) Have you retimed the engine after 25 hours?
e) Are you mixing gas and oil at 50-1 ratio?
f) Did you tighten the fan belt before 10 hours running time?
g) Did you clean the air cleaner after every 10 hours of operation?

MAX RPM. It is important to know the maximum RPM's for your engine: 227 - 6,250; 377, 447, 532 - 6,500; 503 - 6,250, 503DC - 6,500. NOTE: Idle is 1,800 RPM to 2,000 RPM

MAX TEMPERATURES. The CHT Temperature range is 325 to 425 degrees: maximum is 482 degrees. The EGT range is 1,100 to 1,225 for all engines. The maximum is 1,225. NOTE: It is very important to get the proper reading form the calibration of the probe which should be 3.92 inches from the piston edge.
Water temp- 140% to 195% normally, 205% max.

MAINTAINING INTERNALS. The cylinder heads should be retorqued after the break-in period or a maximum of 10 hours. On the 532 LC, retorqued the top nuts only WITH THE ENGINE COLD.

MAINTAINING FAN. Do tighten the fan belt after the engine break-in or a maximum of 25 hours.

MAINTAINING TIMING. Also re-time your engine after break-in or a maximum of 25 hours.

FUEL OIL REQUIREMENTS. The fuel must be unleaded or 85 octane or better regular. You should use a lubricant designed for premixed fuel suitable for running in air cooled engine under sever operation, mixed at 50 to 1 or better with low carbon production. Do not add more oil during break-in period or anytime. Do not use ratio mix designed for liquid cooled engine in air cooled engines. Do not use a ratio mix other than 50 to 1. Do not use any 100% synthetic oil. If you use synthetic oil it must be 80% synthetic and 20% mineral oil to leave a film of oil. (AV2,Bel-Ray Ultra I) Do not use pre-diluted type oils.

STORAGE. If the engine is left for more than 30 days, the fuel system should be drained. Refer to storage procedure in the Operator's Manual.

AIR CLEANERS. You must always pre-oil the K & N non-polyester type air cleaner. This type of air cleaner is hydroscopic. It absorbs moisture as air passes, collecting water. The velocity of air passing through the filter freezes the water vapor causing a complete shut-down or loss of power.

RESISTOR PLUGS & CAPS. Use B8ES spark plugs on all models of Rotax engines. Do not use resistor plugs with resistor plug protectors or resistor plug wires. The plug gap should be .015 to .020. Torque it down to 240 inch lbs. or 20 feet lbs.

FUEL LEVEL IN CARB. The fuel level in the carburetor should be less than half way up the flat portion of the bowl wall with the floats removed.

SHROUDS 377FA & 447FA. Free air engines require a shroud or a cowl, if one has not been provided by Rotax. The air should come in at the exhaust side front, and out at the intake side rear.

GEAR BOX. On 447's, 503's and 532's current boxes are supplied with 12 heavy washers, part numbers 939-020.

532LC. If the 532LC engine boils over you must replace the o-rings in the heads.

FUEL PUMP. You should isolate the fuel pump from heat and vibration, but the pulse line should not be over 15" long. Fuel pump pressure is 3 lbs.

BREAK IN COMPLETE. Your engine should be completely broken in after approximately 50 hours.

IMPROPER ENGINE OPERATION. If gas spits-back through the carburetor under load (6500) the engine is improperly tuned (incorrect jetting) or the load is incorrect and not turning the correct RPM's. HIGH OR LOW RPM.

JET CORRECTION. The main jet correction with altitude is not as affected because as altitude increases the temperature decreases.

LEAN BURN. Lean-burn, long, fast descents where the wind-mill effect of the propeller at 100 to 200 mph will overheat the engine because of the partial throttle setting. You can cure this problem by backing off the throttle more or cycling the throttle on decent.

PISTON WALL TOLERANCES. The standard piston to wall tolerance is 2 1/2 thousands to 6 thousands maximum. If it is 6 to 8 thousands, you must re-bore.

COIL OPERATION. Short the lighting coils together when not in use. Typically wired the yellow (110 watts) is the tachometer, strobe or any other a/c requirement. The green (30 watts) wire is the regulator rectifier.

LIQUID COOLED ENGINES. The header tank filler must be above the cylinder head (engine up right) and on the inlet side of the engine (for air evacuation). On a 532 it must be above the base of the engine when the engine is inverted.

ANTIFREEZE LIQUID COOLED. High quality anti-freeze should be used with the aluminum block at a 50/50 mixture of antifreeze and water.

INVERTED 532 ENGINE. If the 532 is running upside down (heads down) the receiver tank must be elevated 2" above the base of the engine to create head pressure. Rotate tube (924-240) 45% counter clockwise. (This eliminates mild trap that burns up engine).

GENERAL TROUBLE SHOOTING. Rotax engines require two essentials to run: spark and correct fuel/air mixture. Most problems relate to one of the two!

a) Fuel: Check tank, fittings, filter, float chamber.
b) Spark: Ensure switch functions properly on and off. Check the ground wire on the coil.
c) Proper Engine Load: Check maximum RPM.

RING GAP. .008 to .010 min., .035 max. Decarbon only if build up is .040 or more. Use something soft like aluminum to scrape it off.

ROTAX'S OPERATOR'S VIDEO
(see back page)

TROUBLE SHOOTING

Some people think Trouble shooting is an art, but in fact, it is a logical step-by-step procedure that should be followed to determine the cause of trouble before performing any service work. This procedure is "TROUBLE-SHOOTING." When servicing a Rotax engine to correct a problem, this "Trouble shooting" procedure should be followed, such as, engine will not start, is hard to start, etc. The following procedures, as related to problems with Rotax engines, have proven to be a satisfactory method for quickly determining the cause of trouble in most situations.

IF THE ENGINE WILL NOT START OR IS HARD TO START

1. Pull the engine through slowly with the pull starter rope. As the engine piston is coming up on the compression stroke, definite resistance to turning should be felt on the rope. This resistance should be noted on every revolution of a two-cycle engine crankshaft. If alternate hard and easy tuning is noted, the engine compression is not the cause of trouble at this time.

   On engines having electric starters, remove the spark plug and check the engine compression with a gauge: if a gauge is not available, hold your thumb so that the spark plug hole is partly covered. An alternating blowing and suction action should be noted as the engine is cranked.

   If very little or no compression is noted, we recommend you take your engine to a Rotax Service Center to be repaired. If engine is developing compression, proceed to step 2.

2. Remove the spark plug wire and hold the wire terminal about 1/8" away from cylinder. While cranking the engine, a bright blue spark should snap across the 1/8" gap. If the spark is weak or yellow, or if no spark occurs while cranking the engine, refer to IS THERE A SPARK AT THE SPARK PLUG PROTECTOR in our Trouble-Shooting guide.

   If the spark is satisfactory, remove and inspect the spark plug. If in doubt about the spark plug condition, install a new plug. NOTE: Before installing the plug, be sure to check the electrode gap with a proper gauge, and if necessary adjust to .015 to .020 (.018 is optimum). Do not guess or check the gap with a "thin dime", a few thousandths variation from the correct spark plug electrode gap run unsatisfactorily, or under some conditions, not start at all. SEE FIGURE 1.

   If the ignition spark is satisfactory and the engine will still not start with the new plug, then proceed to step 3.

3. If the engine compression and ignition spark seem to be ok, trouble within the fuel system should be suspected. Remove and clean or replace the air filter. Check the fuel tank and be sure it is full of fresh gasoline and two cycle oil mixed 50 to 1. Refer to FIGURE 2 for the proper fuel-oil mixture. If equipped with a fuel shut-off valve, be sure the valve is open.

   If the engine has a remote choke, check to be sure that when the choke is engaged it is fully closed.

   If not, then adjust the control linkage so that choke will fully close; then, try to start engine. If the engine does not start after several turns, remove the air filter. The carburetor throat should be wet with gasoline. If not, try to determine why the fuel is not getting to carburetor.

   Remove the fuel line at the carburetor and crank the engine through several turns; fuel should spurt from open line. If not, disconnect the fuel line from the tank to the fuel pump at the pump connection. If the fuel will not run from the open line, remove and clean the fuel tank, line and if so equipped, fuel filter and/or shut-off valve. If the fuel runs from the open line, then remove and overhaul or replace the fuel pump.

   After making sure that clean, fresh fuel is available at the carburetor, again try to start the engine. If the engine will not start, then refer to the recommended initial adjustments for the carburetor in the ROTAX Operators manual and adjust the carburetor idle and/or main jets.

   If the engine will not start when the compression and the ignition test ok and clean, fresh fuel is available to the carburetor, then remove and clean or over haul the carburetor.

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TROUBLE SHOOTING

4. The preceding troubleshooting techniques are based on the fact that to run, an engine must develop compression, have an ignition spark and receive the proper fuel-air mixture. In some instances, there are other factors involved. Refer to the special Trouble-shooting sequence following this section for service hints on finding common causes of engine trouble that may not be discovered in normal troubleshooting procedure. All these components can be checked with LEAF's buzz box.

IF ENGINE STARTS, THEN STOPS

This complaint is usually due to fuel starvation, but may be caused by a faulty ignition system. Recommended Troubleshooting procedures follow:

1. Remove and inspect the fuel tank cap; The fuel tank is vented through a breather in the fuel tank so that air can enter the tank as fuel is used. If the engine stops after running several minutes, a closed breather should be suspected. If it is possible to let the engine run with the fuel tank cap removed and if this permits the engine to run without stopping, open or replace the cap. Caution: Be sure to observe safety precautions before attempting to run engine without the fuel tank cap in place. If there is any danger of fuel being spilled on engine or spark entering the open tank, do not attempt to run engine without fuel tank cap in place. If in doubt, try a new cap.
2. If the closed breather in the fuel tank cap is eliminated, a partially clogged fuel filter or fuel line should be suspected. Remove and clean the fuel tank and line and if so equipped, clean the fuel shut-off valve.
3. After cleaning the fuel tank, line, filters, etc., if trouble is still encountered, a sticking or faulty carburetor inlet needle valve, or float may be the cause of the trouble. Remove, disassemble and clean the carburetor.
4. If the fuel system is eliminated as the cause of the trouble by performing the procedure outlined in steps 1, 2, and 3, then run a tester on the ignition coil if this equipment is available. If not, check for ignition spark immediately after engine stops. Replace the coil, condenser and breaker points if no spark is noted.

Once your ROTAX engine starts and runs fine, you will have to do some routine preventative maintenance, such as torquing the heads, tightening the fan belt and check and setting the timing to keep it running this way. Should a problem develop, it needs to be corrected immediately. What follows is a logical sequence to follow that covers the most common ROTAX problems. If after using this Troubleshooting Sequence you still can not isolate your problem please feel free to give us a call on our customer service line.

CUSTOMER SERVICE 1-719-632-4959

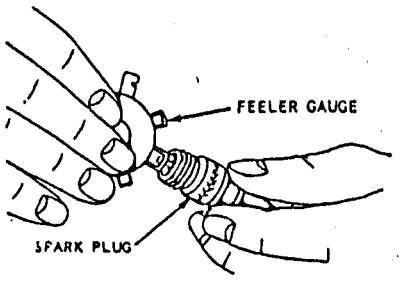

FIG. 1

FIG. 1-Be sure to check SPARK PLUG electrode gap with proper size FEELER GAUGE and adjust gap to .015 to .020.

MIXING RATIO

50:1 RATIO OF GAS TO OIL

FOR 1 GALLON OF GAS USE 2.56 OZ (75.6 CC) DEL-RAY ULTRA 1
2 - - - - - 5.12 OZ (151.6 CC) - - - -
3 - - - - - 7.60 OZ (227.4 CC) - - - -
4 - - - - - 10.24 OZ (303.2 CC) - - - -
5 - - - - - 12.80 OZ (379.0 CC) - - - -
6 - - - - - 15.36 OZ (454.8 CC) - - - -
7 - - - - - 17.92 OZ (530.6 CC) - - - -
8 - - - - - 20.48 OZ (606.4 CC) - - - -
9 - - - - - 23.04 OZ (682.2 CC) - - - -
10 - - - - - 25.6 OZ (758.0 CC) - - - -

FIG. 2

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TROUBLE SHOOTING SEQUENCE—ROTAX ENGINES

	Probable fault
OPEN THE FUEL COCK	
DOES GASOLINE REACH THE CARBURETOR? — no	1. Gasoline tank empty 2. Blockage in tank cap 3. Blockage in fuel cock 4. Blockage in fuel line 5. Needle valve blocked 6. Blockage in fuel filter 7. Inoperative or improperly installed fuel pump
DOES GASOLINE REACH THE ENGINE? — no	1. Blockage in carburetor
DOES THE CARBURETOR KEEP FLOODING? — yes	1. Float stuck 2. Float leaks 3. Needle valve does not seat properly
HAS THE ENGINE BECOME WET WITH FUEL? — yes	1. Too much use of choke or primer 2. Faulty ignition system 3. Incorrect fuel mixture
IS THERE A SPARK AT THE SPARK PLUG PROTECTOR? — no	1. Poor contact between ignition coil and ignition cable 2. Ignition cable broken or short-circuiting 3. Faulty ignition coil 4. Ignition switch in off position or faulty wiring
IS THERE A SPARK AT THE SPARK PLUG? — no	1. Spark plug gap too large 2. Bridging between electrodes 3. Insulator broken or wet 4. Spark plug oily
	Change the spark plug
IS THE ENGINE DIFFICULT TO START? — yes	1. Faulty ignition timing 2. Float needle does not seat properly 3. Air cleaner blocked 4. Fault in carburetor 5. Defective spark plug 6. Water in fuel 7. Engine flooded 8. Choke lever is not on 9. Throttle lever should be closed if using choke circuit 10. Improper adjustment or pilot air regulating screw 11. Air leaks in crankcase or intake system 12. Leaking or blown head gasket 13. No compression 14. Spark plug is fouled, inoperative, or has improper gap 15. Excessive propeller loading 16. Improper preload in gear box
DOES THE ENGINE KICK BACK AND BACK FIRE AND WILL NOT START? — yes	1. The flywheel key is missing or sheared 2. Improper ignition timing
DOES THE ENGINE HAVE GOOD SPARK BUT ONLY RUNS ON ONE CYLINDER? — yes	1. Faulty ignition timing 2. Broken spark plug cap 3. Spark plug is fouled, improperly gapped 4. Low or no crankcase pressure 5. Blown head gasket 6. Leaking cylinder head 7. Cylinder wall-cracked 8. Low or no compression 9. Air leak in crankcase or intake system
DOES THE ENGINE CRANK OVER EASILY ON ONE OR BOTH CYLINDERS? — yes	1. Scored piston 2. Blown head gasket 3. Spark plug is loose 4. Head bolts not torqued 5. Excessive ring end gap

(continued on next column)

WILL THE ENGINE NOT CRANK OVER AND THE FLYWHEEL NOT ROTATE? — yes	1. Piston seized 2. Engine was improperly assembled after repair 3. Foreign material in crankcase 4. Connecting rod broken 5. Crankshaft seized to bearing 6. Piston rings rusted to cylinder 7. Flywheel seized to stator plate
AFTER ENGINE STARTS WILL IT NOT IDLE OR DOES IT MISS AT LOW SPEED? — yes	1. Spark plugs improperly gapped (15 - 20 degrees) fouled or inoperative 2. Improper fuel mixture (50 to 1) 3. Dirty carburetor or plugged jets 4. Carburetor improperly adjusted. Idle speed too low 1800 - 2000 and pilot air regulating screw out of adjustment 5. Worn piston, rings, or cylinder which cause low or loss of compression 6. Blown or leaking head gaskets 7. Air leaks in crankcase or air intake 8. Improper ignition timing
DOES THE ENGINE IDLE WELL BUT DIE DOWN WHEN APPLYING THROTTLE, NO ACCELERATION? — yes	1. Improper slide without notched window and drilled bottom 2. Fuel level in float bowl is set too low 3. Improper ignition timing 4. Spark plugs improperly gapped fouled, or inoperative 5. Improper adjustment of pilot air regulating screw too lean 6. Fuel line obstructed 7. The fuel pump is inoperative due to punctured diaphragm check valve inoperative or impulse line leaking
IS THE ENGINE SLOW TO ACCELERATE/LOW TOP RPM? — yes	1. Improper slide without notched window and drilled 2. Spark plugs improperly gapped, fouled or inoperative 3. Main jet is too rich 4. Excessive propeller loading 5. Float level is too high 6. Scored piston and cylinder 7. Blown or leaking head gasket
DOES THE ENGINE SURGE, SLOW DOWN, COUGH OR SPIT, RUN LEAN AT ALL SPEEDS? — yes	1. Float level is too low 2. Carburetor is dirty 3. Pilot jet or main jet is top lean 4. Carburetor inlet needle and the seat are obstructed 5. Carburetor is loose on flange or the rubber flange leaks 6. Fuel line is obstructed 7. Fuel line is obstructed 8. Air leaks in the fuel lines 9. The fuel pump is inoperative due to punctured diaphragm check valve inoperative or impulse line leaking 10. Crankcase or intake system has air leaks.
DOES THE ENGINE RUN ROUGH, VIBRATES EXCESSIVELY AND SMOKES? — yes	1. Main jet is too rich 2. Chokes is not fully off 3. Water in fuel 4. Float level is too high 5. Carburetor is obstructed 6. Exhaust system obstructed 7. Engine mount or engine mount bolts not secured 8. Propeller out of balance

(continued on next page)

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TROUBLE SHOOTING SEQUENCE - ROTAX ENGINES

DOES THE ENGINE RUN WELL AT HIGH R.P.M.? — no ---->
1. Engine "four-stroking"
   a) Air cleaner dirty
   b) Needle jet worn
   c) Jets too large
   d) Too much oil in the gasoline
   e) Improper ignition timing
   f) Exhaust port and exhaust pipe blocked
   g) Needle position too high
2. "Spitting" in carburetor
   a) Fuel filter blocked
   b) Dirt in carburetor
   c) Dirt in needle valve
   d) Carburetor not secured properly
   e) Needle position too low
   f) Improper ignition timing
   g) Spark plug loose or dirty
   h) Incorrect spark plug gap
   i) Incorrect heat range of spark plug
   j) Ignition cable loose or poorly insulated
   k) Piston rings stuck
   l) Crankshaft oil seal worn

yes

3. Engine "knocks"
   a) Improper ignition timing
   b) Poor fuel supply
   c) Heavy carbon deposits in cylinder ports (glow ignitions)
   d) Play in gudgeon pin
   e) Big-end bearing or cylinder bore worn
4. Engine misses under load
   a) Spark plugs improperly gapped, fouled or inoperative
   b) Improper ignition timing
   c) Spark plug heat range to cold
   d) Spark plug connector broken
   e) Carburetor either too rich or too lean
   f) Excessive propeller loading

DOES THE ENGINE OVERHEAT? — yes ---->
1. Fan belt loose
2. Excessive propeller loading
3. Improper engine timing
4. Fuel mixture too lean
5. Fuel octane rating too low
6. Fuel line or fuel filter obstructed or dirty
7. Carbon build up on combustion chamber, exhaust port, or piston dome

no

8. Carburetor out of adjustment
9. Engine is dirty or cooling fan is clogged
10. Engine monitoring instrument are defective

DOES THE ENGINE LOSE POWER IMMEDIATELY AFTER TAKE OFF (5 MINUTES) OR WILL NOT ACCELERATE BACK TO FULL AFTER THE THROTTLE IS REDUCED? — yes ---->
1. Improper slide in carburetor without notched window or drilled bottom
2. Piston mini seizure
3. Main jet is too rich
4. Excessive propeller load

no

DOES THE ENGINE ALL OF A SUDDEN JUST STOP? — yes ---->
1. Piston seizure
2. Carburetor icing

no

DOES THE ENGINE CONTINUE TO RUN AFTER THE SWITCH IS SHUT OFF? — yes ---->
1. Improper wiring
2. Spark plug heat range is too hot
3. Carbon combustion chamber, exhaust port or piston dome

ROTAX GENERAL FACTS AND OPERATIONAL INFORMATION

The information in this section is intended to help the ultralight aircraft owner to achieve the correct operating conditions for the best performance and reliability of the Rotax Engine. These engines have been specifically developed for ultralight aircraft. Leaf, an authorized Rotax service center offers accessories and service recommended by Rotax. Correct installation will help to prevent problems and help insure safe operation. For any operational limitations or questions call Customer Service. In addition to these installation instructions please refer to the Operators Manual, the engine data sheet, and the power torque and fuel consumption curves. Page #6, 08 CAT.

(continued on next column)

1) INSTALLATION. For standard installation, the crankshaft of the engine must be in a horizontal position with the cylinders up putting the spark plugs at the top. For installation with the cylinder down and the spark plugs at the bottom please refer to the Operators Manual. If you are not sure, contact Leaf for technical advice to install the engine. If crankshaft is in a vertical position, contact Leaf for more information.

2) MOUNTING. There are four bosses with 10 mm thread on, the bottom of the crankcase. We recommend a Rotax reduction gear box; however, if you don't use a gear box there are additional bosses available on the PTO end of the engine. These bosses can only be used as additional mounting points, but not by themselves. For mountings on the cylinder head contact Leaf for technical assistance. It is very important to have rubber anti-vibration mountings between the engine and the fuselage to absorb vibrations which can cause a great deal of damage to the airframe.

3) PROPELLER REDUCTION DRIVE. Do not mount the propeller directly on crankshaft. We recommend a propeller reduction drive. If the reduction drive is not supplied with the engine it can be ordered as a separate item. Refer to page 5 for more information. Note: If the gear box is supplied with the engine, there is no oil in it! — See operator's manual for filling instructions. You must balance the propeller to prevent vibration problems and over- working of the drive system; You must match the propeller to the engine power curve for full power in take off climb. If the RPM is too high there will be a power loss that will result in engine overspeed and possible damage to the engine. If matching RPM, it too can cause power loss (low RPM at ground full load test) and problems in acceleration.

4) COOLING. Fan cooling of the engine provide sufficient cooling as long as the air has free access and the hot air is not recirculated. If the engine has a cowling the exit must be 1/3 larger than the entrance which creates a flow of air.

With the tractor propeller the air is being forced over the engine for cooling. On two-cylinder engines the air stream must be directed from the Exhaust side toward the Carburetor side with suitable ducting. Note: Refer to cowling for the 377 and 447 Free Air Engines

5) TEMPERATURE MAXIMUM. Maximum cylinder head temperature must not exceed 480 degrees, for twin cylinder engines, each cylinder must not vary by more the 20 degree F. Note: Pusher propellers should not be used with free air cooled engines.

Liquid cooled engines must have a water pump. The cooling circuit must be arranged as shown on the diagram on page 23. The radiator must be large enough and the air stream of sufficient force to maintain the cooling liquid temperature below the maximum of 95 degrees C - under the most severe conditions such as in the summer of full load operation. Note: A pusher propeller will require a larger radiator than a tractor type. Do keep in mind that antifreeze additives considerably reduce the cooling effect. The cooling system must be under pressure to avoid pump cavitation. Use a pressure cap with and opening pressure of 7 - 9 lbs. Note: The radiator must be as close to the propeller as possible. The close proximity draws air through the radiator at an improved rate. The water head tank must be installed so that steam bubbles can escape from a point in the system towards the expansion chamber or header tank.

6) A CLEANER. The carburetor air intake must be protected against the ingestion of water. Equal air pressure must prevail in the vicinity of the carburetor air intake and the carburetor float chamber vent pipes. If you have an intake silencer you can not operate without it unless the carburetor is recalibrated. Note: Refer to Jetting chart and catalog page #29.

7) FUEL PUMP. The carburetor(s) are supplied with fuel by the fuel pump provided with the engine. This pump is activated pneumatically by an impulse line leading form the connection on the crankcase to the fuel pump. This line should not be longer than 15 inches. To check the fuel system for free flow, fit a piece of transparent tube in the fuel system and do a check run. At full load operation and high all around temperature only a few gas bubbles should be seen. The fuel pump must be installed in a cool place (not on the engine); it should also be located below the fuel tank. An electric pump can be used if the fuel tank is considerably lower than the engine. The pump must produce a minimum of 3 pounds psi. Fuel level should be checked in the carburetor bowl.

8) ELECTRICAL. Connect the wires as shown on the wiring diagram on page #58. Make sure the ignition starting wire is connected to the switch and working. The ignition and lighting cables, as well as all engine cables must not touch the cylinder or cylinder head to avoid chafing or burning. It is important to have a kill switch; we recommend this on all twin cylinder engines. To ground ignition shorting wire, ground through a double pole single throw switch (DPST) and the brown wire on the engine wiring harness.

(continued on next page)

TROUBLE SHOOTING

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OR IS HARD TO START

1. Pull the engine through slowly with the pull starter rope. As the engine piston is coming up on the compression stroke, definite resistance to turning should be felt on the rope. This resistance should be noted on every revolution of a two-cycle engine crankshaft. If alternate hard and easy tuning is noted, the engine compression is not the cause of trouble at this time.

   On engines having electric starters, remove the spark plug and check the engine compression with a gauge: if a gauge is not available, hold your thumb so that the spark plug hole is partly covered. An alternating blowing and suction action should be noted as the engine is cranked.

   If very little or no compression is noted, we recommend you take your engine to a Rotax Service Center to be repaired. If engine is developing compression, proceed to step 2.

2. Remove the spark plug wire and hold the wire terminal about 1/8" away from cylinder. While cranking the engine, a bright blue spark should snap across the 1/8" gap. If the spark is weak or yellow, or if no spark occurs while cranking the engine, refer to IS THERE A SPARK AT THE SPARK PLUG PROTECTOR in our Trouble-Shooting guide.

   If the spark is satisfactory, remove and inspect the spark plug. If in doubt about the spark plug condition, install a new plug. NOTE: Before installing the plug, be sure to check the electrode gap with a proper gauge, and if necessary adjust to .015 to .020 (.018 is optimum). Do not guess or check the gap with a "thin dime", a few thousandths variation from the correct spark plug electrode gap run unsatisfactorily, or under some conditions, not start at all. **SEE FIGURE 1.**

   If the ignition spark is satisfactory and the engine will still not start with the new plug, then proceed to step 3.

3. If the engine compression and ignition spark seem to be ok, trouble within the fuel system should be suspected. Remove and clean or replace the air filter. Check the fuel tank and be sure it is full of fresh gasoline and two cycle oil mixed 50 to 1. Refer to **FIGURE 2** for the proper fuel-oil mixture. If equipped with a fuel shut-off valve, be sure the valve is open.

   If the engine has a remote choke, check to be sure that when the choke is engaged it is fully closed.

   If not, then adjust the control linkage so that choke will fully close; then, try to start engine. If the engine does not start after several turns, remove the air filter. The carburetor throat should be wet with gasoline. If not, try to determine why the fuel is not getting to carburetor.

   Remove the fuel line at the carburetor and crank the engine through several turns; fuel should spurt from open line. If not, disconnect the fuel line from the tank to the fuel pump at the pump connection. If the fuel will not run from the open line, remove and clean the fuel tank, line and if so equipped, fuel filter and/or shut-off valve. If the fuel runs from the open line, then remove and overhaul or replace the fuel pump.

   After making sure that clean, fresh fuel is available at the carburetor, again try to start the engine. If the engine will not start, then refer to the recommended initial adjustments for the carburetor in the ROTAX Operators manual and adjust the carburetor idle and/or main jets.

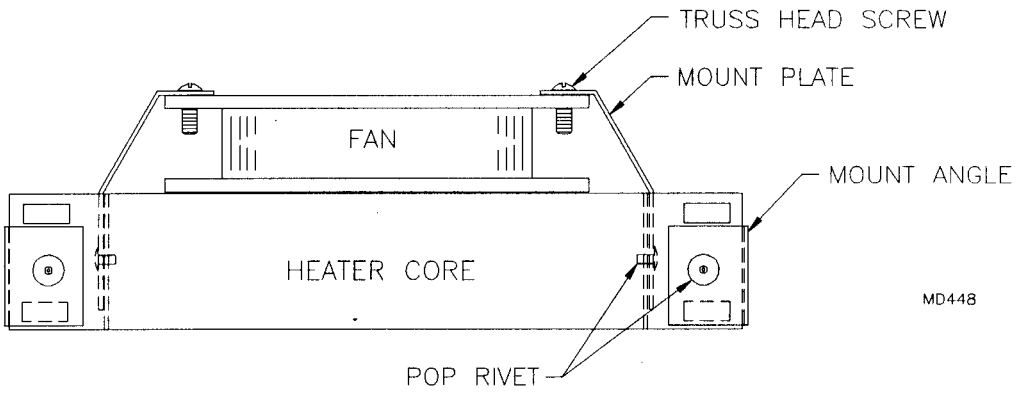
   If the engine will not start when the compression and the ignition test ok and clean, fresh fuel is available to the carburetor, then remove and clean or over haul the carburetor.

S-12 AIRAILE HEATER INSTALLATION FOR LIQUID COOLED ENGINES

1. Assemble the fan to the radiator unit. The fan will have arrows showing the direction of air flow and the rotation. Make sure the arrow is pointing toward the heater core.

2. Attach the heater fan mount plates using the four truss head screws. The screws will self tap into the plastic housing of the fan. Orientate the fan so the wires come out on the same side as the heater core nipples. Drill two #30 holes into the mount plate and heater core sides. Rivet with two 1/8" aluminum pop rivets. **CAUTION:** Be careful not to drill into the heater core. See **Figure 011B-02.**

FIGURE 011B-02



3. Attach the nipples to the radiator core. To do this you just simply screw them on. They are compression fittings that automatically center and create a water tight seal.

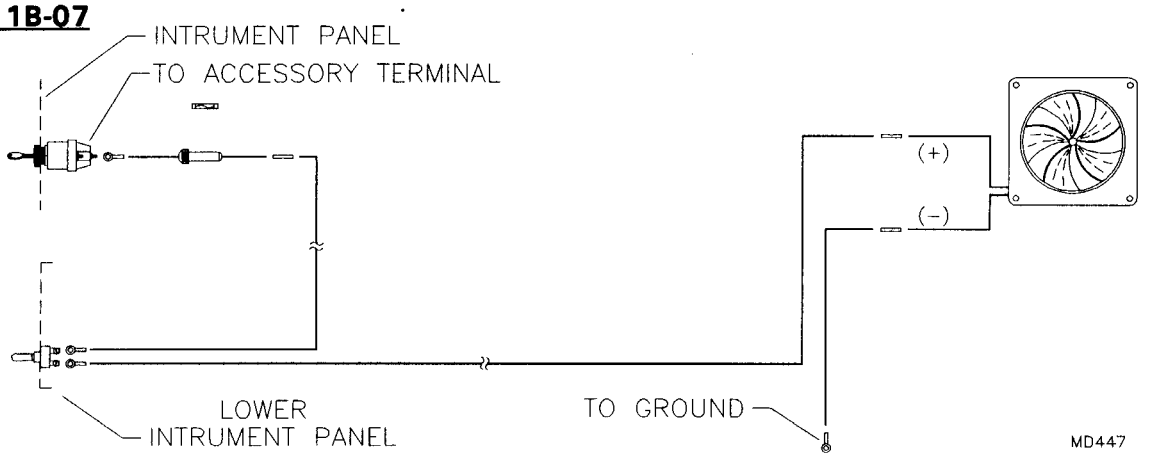
4. Locate the T's for the heater system. Both T's are located on the hoses that come out of the radiator. Locate the water valve along the left hand line in a near vertical location. Make sure you are installing the valve in the "hot" line out of the top of the engine. Route the line to the heater core from the valve.

5. The heater core is attached to the two mid cabaine tubes. Place the heater core so the fan is blowing air forward into the cabin. Use four 1" tube clamps to secure the heater core to the tubes.

6. With the heater mounted, slip the heater hoses onto the nipples of the core and tighten all the hose clamps. Check all hoses and fittings for security and chafing.

7. Connect the wires to the fan and route them to the switch and power source as per the schematic in **Figure 011B-07.** Route the wires into the wire casing. Run the switch wires inside the casing leading to the panel.

FIGURE 011B-07



8. Fill the system with coolant and check for leaks. Test run the engine and inspect for leaks and operation. The heater should produce noticeable heat within a few minutes of starting the engine. Depending on how well your cabin is sealed and the outside air temps, the heater should be able to keep the cabin warm enough for extended flying on winter days, or at altitude. Do not expect the heater to keep up if you have a lot of air leaks in your cabin, or if it is extremely cold (below 20°F). Installing the AFT cabin wall interior system will seal the air leaks and increase the heater comfort level. Consider this option if you fly in cold weather a good part of the time.

TROUBLE SHOOTING

4. The preceding troubleshooting techniques are based on the fact that to run, an engine must develop compression, have an ignition spark and receive the proper fuel-air mixture. In some instances, there are other factors involved. Refer to the special Trouble-shooting sequence following this section for service hints on finding common causes of engine trouble that may not be discovered in normal troubleshooting procedure. All these components can be checked with LEAF's buzz box.

IF ENGINE STARTS, THEN STOPS

This complaint is usually due to fuel starvation, but may be caused by a faulty ignition system. Recommended Troubleshooting procedures follow:

1. Remove and inspect the fuel tank cap; The fuel tank is vented through a breather in the fuel tank so that air can enter the tank as fuel is used. If the engine stops after running several minutes, a closed breather should be suspected. If it is possible to let the engine run with the fuel tank cap removed and if this permits the engine to run without stopping, open or replace the cap. Caution: Be sure to observe safety precautions before attempting to run engine without the fuel tank cap in place. If there is any danger of fuel being spilled on engine or spark entering the open tank, do not attempt to run engine without fuel tank cap in place. If in doubt, try a new cap.
2. If the closed breather in the fuel tank cap is eliminated, a partially clogged fuel filter or fuel line should be suspected. Remove and clean the fuel tank and line and if so equipped, clean the fuel shut-off valve.
3. After cleaning the fuel tank, line, filters, etc., if trouble is still encountered, a sticking or faulty carburetor inlet needle valve, or float may be the cause of the trouble. Remove, disassemble and clean the carburetor.
4. If the fuel system is eliminated as the cause of the trouble by performing the procedure outlined in steps 1, 2, and 3, then run a tester on the ignition coil if this equipment is available. If not, check for ignition spark immediately after engine stops. Replace the coil, condenser and breaker points if no spark is noted.

Once your ROTAX engine starts and runs fine, you will have to do some routine preventative maintenance, such as torquing the heads, tightening the fan belt and check and setting the timing to keep it running this way. Should a problem develop, it needs to be corrected immediately. What follows is a logical sequence to follow that covers the most common ROTAX problems. If after using this Troubleshooting Sequence you still can not isolate your problem please feel free to give us a call on our customer service line.

CUSTOMER SERVICE 1-719-632-4959

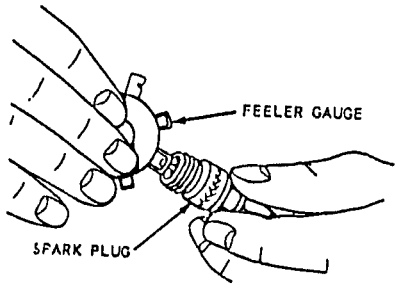


FIG. 1

FIG. 1-Be sure to check **SPARK PLUG** electrode gap with proper size **FEELER GAUGE** and adjust gap to .015 to .020.

FIG. 2

MIXING INSTRUCTIONS

50:1 RATIO OF GAS TO OIL

FOR 1	GALLON	OF	GAS	USE	2.56	OZ	(75.8 CC)
" 2	"	"	"	"	5.12	OZ	(151.6 CC)
" 3	"	"	"	"	7.68	OZ	(227.4 CC)
" 4	"	"	"	"	10.24	OZ	(303.2 CC)
" 5	"	"	"	"	12.80	OZ	(379.0 CC)
" 6	"	"	"	"	15.36	OZ	(454.8 CC)
" 7	"	"	"	"	17.92	OZ	(530.6 CC)
" 8	"	"	"	"	20.48	OZ	(606.4 CC)
" 9	"	"	"	"	23.04	OZ	(682.2 CC)
" 10	"	"	"	"	25.6	OZ	(758.0 CC)

TROUBLE SHOOTING SEQUENCE—ROTAX ENGINES

OPEN THE FUEL COCK

Probable fault

DOES GASOLINE REACH THE CARBURETOR? — no ---->
1. Gasoline tank empty
2. Blockage in tank cap
3. Blockage in fuel cock
4. Blockage in fuel line
5. Needle valve blocked
6. Blockage in fuel filter
7. Inoperative or improperly installed fuel pump

yes

DOES GASOLINE REACH THE ENGINE? — no ---->
1. Blockage in carburetor

yes

DOES THE CARBURETOR KEEP FLOODING? — yes ---->
1. Float stuck
2. Float leaks
3. Needle valve does not seat properly

no

HAS THE ENGINE BECOME WET WITH FUEL? — yes ---->
1. Too much use of choke or primer
2. Faulty ignition system
3. Incorrect fuel mixture

no

IS THERE A SPARK AT THE SPARK PLUG PROTECTOR? — no ---->
1. Poor contact between ignition coil and ignition cable
2. Ignition cable broken or short-circuiting
3. Faulty ignition coil
4. Ignition switch in off position or faulty wiring

yes

IS THERE A SPARK AT THE SPARK PLUG? — no ---->
1. Spark plug gap too large
2. Bridging between electrodes
3. Insulator broken or wet
4. Spark plug oily

yes

Change the spark plug

IS THE ENGINE DIFFICULT TO START? — yes ---->
1. Faulty ignition timing
2. Float needle does not seat properly
3. Air cleaner blocked
4. Fault in carburetor
5. Defective spark plug
6. Water in fuel
7. Engine flooded
8. Choke lever is not on
9. Throttle lever should be closed if using choke circuit
10. Improper adjustment or pilot air regulating screw
11. Air leaks in crankcase or intake system
12. Leaking or blown head gasket
13. No compression
14. Spark plug is fouled, inoperative, or has improper gap
15. Excessive propeller loading
16. Improper preload in gear box

no

DOES THE ENGINE KICK BACK AND BACK FIRE AND WILL NOT START? — yes ---->
1. The flywheel key is missing or sheared
2. Improper ignition timing

no

DOES THE ENGINE HAVE GOOD SPARK BUT ONLY RUNS ON ONE CYLINDER? — yes ---->
1. Faulty ignition timing
2. Broken spark plug cap
3. Spark plug is fouled, improperly gapped
4. Low or no crankcase pressure
5. Blown head gasket
6. Leaking cylinder head
7. Cylinder wall-cracked
8. Low or no compression
9. Air leak in crankcase or intake system

no

DOES THE ENGINE CRANK OVER EASILY ON ONE OR BOTH CYLINDERS? — yes ---->
1. Scored piston
2. Blown head gasket
3. Spark plug is loose
4. Head bolts not torqued
5. Excessive ring end gap

no

(continued on next column)

WILL THE ENGINE NOT CRANK OVER AND THE FLYWHEEL NOT ROTATE? — yes ---->
1. Piston seized
2. Engine was improperly assembled after repair
3. Foreign material in crankcase
4. Connecting rod broken
5. Crankshaft seized to bearing
6. Piston rings rusted to cylinder
7. Flywheel seized to stator plate

no

AFTER ENGINE STARTS WILL IT NOT IDLE OR DOES IT MISS AT LOW SPEED? — yes ---->
1. Spark plugs improperly gapped (15 - 20 degrees) fouled or inoperative
2. Improper fuel mixture (50 to 1)
3. Dirty carburetor or plugged jets
4. Carburetor improperly adjusted. Idle speed too low 1800 - 2000 and pilot air regulating screw out of adjustment
5. Worn piston, rings, or cylinder which cause low or loss of compression
6. Blown or leaking head gaskets
7. Air leaks in crankcase or air intake
8. Improper ignition timing

no

DOES THE ENGINE IDLE WELL BUT DIE DOWN WHEN APPLYING THROTTLE, NO ACCELERATION? — yes ---->
1. Improper slide without notched window and drilled bottom
2. Fuel level in float bowl is set too low
3. Improper ignition timing
4. Spark plugs improperly gapped fouled, or inoperative
5. Improper adjustment of pilot air regulating screw too lean
6. Fuel line obstructed
7. The fuel pump is inoperative due to punctured diaphragm check valve inoperative or impulse line leaking

no

IS THE ENGINE SLOW TO ACCELERATE/LOW TOP RPM? — yes ---->
1. Improper slide without notched window and drilled
2. Spark plugs improperly gapped, fouled or inoperative
3. Main jet is too rich
4. Excessive propeller loading
5. Float level is too high
6. Scored piston and cylinder
7. Blown or leaking head gasket

no

DOES THE ENGINE SURGE, SLOW DOWN, COUGH OR SPIT, RUN LEAN AT ALL SPEEDS? — yes ---->
1. Float level is too low
2. Carburetor is dirty
3. Pilot jet or main jet is top lean
4. Carburetor inlet needle and the seat are obstructed
5. Carburetor is loose on flange or the rubber flange leaks
6. Fuel line is obstructed
7. Fuel line is obstructed
8. Air leaks in the fuel lines
9. The fuel pump is inoperative due to punctured diaphragm check valve inoperative or impulse line leaking
10. Crankcase or intake system has air leaks.

no

DOES THE ENGINE RUN ROUGH, VIBRATES EXCESSIVELY AND SMOKES? — yes ---->
1. Main jet is too rich
2. Chokes is not fully off
3. Water in fuel
4. Float level is too high
5. Carburetor is obstructed
6. Exhaust system obstructed
7. Engine mount or engine mount bolts not secured
8. Propeller out of balance

no

(continued on next page)

TROUBLE SHOOTING SEQUENCE - ROTAX ENGINES

DOES THE ENGINE RUN WELL AT HIGH R.P.M.?

no ---->

1. Engine "four-stroking"
   a) Air cleaner dirty
   b) Needle jet worn
   c) Jets too large
   d) Too much oil in the gasoline
   e) Improper ignition timing
   f) Exhaust port and exhaust pipe blocked
   g) Needle position too high
2. "Spitting" in carburetor
   a) Fuel filter blocked
   b) Dirt in carburetor
   c) Dirt in needle valve
   d) Carburetor not secured properly
   e) Needle position too low
   f) Improper ignition timing
   g) Spark plug loose or dirty
   h) Incorrect spark plug gap
   i) Incorrect heat range of spark plug
   j) Ignition cable loose or poorly insulated
   k) Piston rings stuck
   l) Crankshaft oil seal worn
3. Engine "knocks"
   a) Improper ignition timing
   b) Poor fuel supply
   c) Heavy carbon deposits in cylinder ports (glow ignitions)
   d) Play in gudgeon pin
   e) Big-end bearing or cylinder bore worn
4. Engine misses under load
   a) Spark plugs improperly gapped, fouled or inoperative
   b) Improper ignition timing
   c) Spark plug heat range to cold
   d) Spark plug connector broken
   e) Carburetor either too rich or too lean
   f) Excessive propeller loading

yes

DOES THE ENGINE OVERHEAT?

yes ---->

1. Fan belt loose
2. Excessive propeller loading
3. Improper engine timing
4. Fuel mixture too lean
5. Fuel octane rating too low
6. Fuel line or fuel filter obstructed or dirty
7. Carbon build up on combustion chamber, exhaust port, or piston dome
8. Carburetor out of adjustment
9. Engine is dirty or cooling fan is clogged
10. Engine monitoring instrument are defective

no

DOES THE ENGINE LOSE POWER IMMEDIATELY AFTER TAKE OFF (5 MINUTES) OR WILL NOT ACCELERATE BACK TO FULL AFTER THE THROTTLE IS REDUCED?

yes ---->

1. Improper slide in carburetor without notched window or drilled bottom
2. Piston mini seizure
3. Main jet is too rich
4. Excessive propeller load

no

DOES THE ENGINE ALL OF A SUDDEN JUST STOP?

yes ---->

1. Piston seizure
2. Carburetor icing

no

DOES THE ENGINE CONTINUE TO RUN AFTER THE SWITCH IS SHUT OFF?

yes ---->

1. Improper wiring
2. Spark plug heat range is too hot
3. Carbon combustion chamber, exhaust port or piston dome

PART #	STOCK	DISC	CODE DOT	ENGINE	CONVERTED BY FORMULA	PISTON DIMENSIONS .000 INCH	CYLINDER DIMENSIONS
994-970	*	61.92	Red	377 Std	2.44	2.438	2.4405
994-970	*	61.93	Green	377 Std	2.44	2.439	2.4415
994-971	*	62.17	Red	377 1st	2.45	2.448	2.4505
994-971	*	62.18	Green	377 1st	2.45	2.449	2.4505
994-972	*	62.42	Red	377 2nd	2.46	2.458	2.4605
994-972		62.43	Green	377 2nd	2.46	2.459	2.4615
996-035	*	67.42	Red	447 Std	2.65	2.654	2.6565
996-035		67.43	Green	447 Std	2.65	2.655	2.6575
996-036	*	67.67	Red	447 1st	2.66	2.664	2.6665
996-036	*	67.68	Green	447 1st	2.66	2.665	2.6675
995-280		71.93	Red	503 Std 532 A	2.83	2.832	2.8345
995-280		71.94	Green	503 Std 532 A	2.83	2.833	2.8355
995-286		72.18	Red	503 1st 532 A	2.84	2.842	2.8445
995-286		72.19	Green	503 1st 532 A	2.84	2.843	2.8455
995-287		72.43	Red	503 2nd 532 A	2.85	2.852	2.8545
995-287		72.44	Green	503 2nd 532 A	2.85	2.853	2.8555
996-490		71.93	Red	532B Std	2.83	2.832	2.8345
996-490	*	71.94	Green	532B Std	2.83	2.833	2.8355
996-491		72.18	Red	532B 1st	2.84	2.842	2.8445
996-491		72.19	Green	532B 1st	2.84	2.843	2.8455
996-492		72.43	Red	532B 2nd	2.85	2.852	2.8545
996-492		72.44	Green	532B 2nd	2.85	2.853	2.8555

PISTON TO WALL TOLERANCES

Below is a brief outline on how to measure the piston wall tolerances. The standard piston wall tolerance is .0025 (2 1/2 thousandths). If it is .008 (8 thousandths), then you must re-bore. Decarbon the piston if the build-up is .040 (40 thousandths) or more.

Measuring pistons

A. Piston skirt measure
   1. 90° to piston pin
   2. Bottom of pin area
   3. 68° - 70° recommended temperature
B. Measure top cylinder
   1. 5/8" down from top of cylinder
   2. Across at the exhaust and intake sides
C. Measure bottom cylinder
   1. Between transfer ports
   2. Area 5/8" down
D. Max difference is .003 in taper
E. Out of round measure
   1. Take another measurement 90° to first ones taken in B and C above
   2. Maximum .002 out of round

Piston Ring End Gap

A. Measure with temp at 68° to 70
B. Rub ends to eliminate carbon
C. Push ring down 5/8" from top of cylinder
   1. Measure with feeler gauge
   2. Minimum .008 to .010
   3. Normal is .012
D. If max of .035, need to rebore to next over
E. Measure if one of following occurs
   1. New piston
   2. High hours
   3. Overheated

RECOMMENDED OPERATING TEMPERATURES

OPERATIONAL VALUES	AIR COOLING	LIQUID COOLING
CHT: (CYL HEAD TEMP)		
NORMAL	355-430°F (180-220°C)	280-270°F (110-130°C)
MAXIMUM	480°F (250°C)	300°F (150°C)
DIFFERENCE BETWEEN 2 CYL.	36°F (20°C)	18°F (10°C)
EGT: (EXH. GAS TEMP)		
NORMAL	860-1080°F (460-580°C)	930-1150°F (500-620°C)
MAXIMUM	1200°F (654°C)	1200°F (654°C)
DIFFERENCE BETWEEN 2 CYL.	45°F (25°C)	45°F (25°C)
CRANKCASE TEMPERATURE	175°F (80°C)	175°F (80°C)
COOLING LIQUID TEMP Normal	— —	140-176°F (60-80°C)
MAX	— —	203°F (95°C)

MAINTENANCE SCHEDULE FOR ROTAX ENG 377, 447, 503, 532

This article is reprinted with permission from Pash, the General Manager of Omni Horizon.

The first item of importance on the Rotax Maintenance Schedule is ignition timing. Though the need for constant attention to the points has been eliminated by the new CDI ignition, there are over 30,000 Rotax engines in use today which have the older-type ignition and still require this attention On the schedule, ignition timing is checked two hours after the engine is first started and two hours after the engine is reassembled following overhaul. Thereafter, the point gap and timing are checked at each 25-hour inspection. At each 100-hour inspection, the point set and condenser are replaced.

Every 12 hours, the spark plugs are cleaned and re-gapped. They are replaced every 50 hours.

At the 25-hour inspection, along with the ignition timing and spark plugs, the fan belt tension is checked, the fuel filter is inspected and replaced (if necessary), the fuel line and fuel pump are checked for free flow and the correct volume output, the carburetor is checked for correct adjustment and the air filter is cleaned, oiled, (or replaced, depending upon the type of filter).

During the 50-hour inspection, all of the previously mentioned items are completed and the heads are removed for inspection of the bore and piston wear. The pistons are removed and decarbonized and the carburetor is disassembled and cleaned.

The 75-hour inspection is a duplicate of the 25-hour inspection and the 100-hour inspection is a duplicate of the 50-hour inspection, except that at each 100-hour inspection the gear drive oil is changed and magnetically inspected for metal. Of course, two hours after each 50 and 100-hour inspection, the timing and torque are re-checked.

The cycle of 25-hour inspections continues until 200 hours when the gearbox is disassembled. inspected, and the gear box washer spring is replaced.

After 400 hours on the air-cooled engines, or 500 hours on the water-cooled engines, it's time for a complete major overhaul which brings every component in the engine.

This maintenance schedule is a suggestion only. It does not supersede any suggestions made by your airframe manufacturer or Bombardier.

MAINTENANCE SCHEDULE FOR ROTAX ENG 377, 447, 503, 532

ACTION TO BE DONE			First 2	Every 12	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
Ignition timing	check	(1	x		x	x	x		x	x	x		x	x	x		x	x	x	
Cylinder head & manifold	retorque	(2	x																	
Spark plugs	clean			x	x		x		x		x		x		x		x		x	
Spark plugs	replace					x		x		x		x		x		x		x		x
Fan belt tension	check				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fuel filter	check				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fuel line	check				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fuel pump	check				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carburetor	check & adjust				x		x		x		x		x		x		x		x	
Carburetor	clean					x		x		x		x		x		x		x		x
Air filter	clean & oil				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Cylinder	remove & check	(4				x		x		x		x		x		x		x		x
Pistons	remove & clean	(6 (5				x		x		x		x		x		x		x		x
Small & bearings	replace											x								x
Ignition point set and condenser	replace							x				x				x				x
Gear drive oil	change	(3						x				x				x				x
Gear box washer spring	replace											x								x
Engine overhaul		(7																		x

1. After every point set replacement.
2. After every head or Cylinder removing.
3. First 12 hours of new gear.
4. Cylinder check A. condition B. taper: max .003" C. out of round max .002"
5. Piston check A. ring end gap: new ring: min .008" B. ring/piston groove clearance (rectangular ring only): min .002" max .005" wear limit: .008"
6. piston/cylinder clrarance: min .0025" max .004" — wear limit .008"
   (measured at cylinder 5/8 in. below top. measured at piston 1/4 in. above bottom for piston skirt)
7. on 532 eng's overhaul at 500 hrs.

THE HOW AND WHY OF ROTAX SERVICE TOOLS

THIS LISTING IS IN RESPONSE TO THE MANY REQUESTS FOR INFORMATION ABOUT THE TOOLS THAT ARE AVAILABLE FROM ROTAX FOR USE ON THEIR TWO CYCLE AIRCRAFT ENGINES. EVERY ATTEMPT HAS BEEN MADE TO MAKE THIS LISTING AS COMPLETE AS POSSIBLE AT THE TIME OF PUBLICATION AND EACH TOOL IS DESCRIBED AS COMPLETELY AS POSSIBLE.

ALL OF THE FASTENERS ON A ROTAX ENGINE ARE METRIC EXCEPT THE THREADS ON THE PTO CRANKSHAFT ASSEMBLY WHICH IS 1/2 INCHES NATIONAL FINE. IF YOU HAVE THE FOLLOWING WRENCHES YOU WILL BE ABLE TO DO MOST OF THE FASTENERS.

WE WILL DIVIDE THIS ARTICLE INTO FOUR AREAS- 1.) ENGINE TOOL KIT 2.) PREVENTIVE MAINTENANCE TOOLS (TORQUE HEADS, FAN BELT, AND TIMING) 3.) ENGINE REPAIR AND, 4.) GEAR BOX TOOLS. EACH AREA WILL BE BROKEN DOWN SHOWING THE TOOLS, THEIR PURPOSE AND HOW EACH TOOL WILL BE USED.

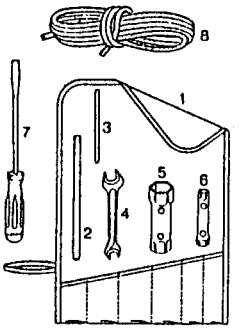
1. TORQUE WRENCH (UP TO 880 INCH POUNDS)
2. 5 MM ALLEN SOCKET
3. 6 MM ALLEN SOCKET
4. 8 MM ALLEN SOCKET
5. 10 MM SOCKET
6. 13 SOCKET
7. 19 MM SOCKET
8. 22 MM SOCKET
9. 27 MM SOCKET

OTHER BASIC TOOLS NEEDED:
- INSERT 27 MM, FITTING TORQUE WRENCH
- INSERT 30 MM, FITTING TORQUE WRENCH
- FORK WRENCH 22 MM
- RUBBER HAMMER
- SCREW DRIVER
- PHILLIPS BLADE SCREW DRIVER
- CIRCLIP PLIERS

ENGINE TOOL KIT

EACH ENGINE IS SOLD WITH AN ENGINE TOOL KIT (#876-631) WHICH SHOULD BE KEPT WITH YOUR ENGINE AND USED TO HELP PERFORM EMERGENCY REPAIR WHILE IN THE FIELD. ONE OF THE MORE IMPORTANT TOOLS IS THE FIXATION BOLT (#876-640) WHICH IS USED WHEN REMOVING THE FAN PULLEY BOLTS. WE WILL DISCUSS THIS FURTHER WHEN WE DISCUSS THE ENGINE REPAIR TOOLS. THE FOLLOWING TOOLS ARE LOCATED IN THIS KIT

IN THIS KIT YOU USE THE SCREW DRIVER (#876-200) TO ADJUST THE IDLE JET AND AIR MIXTURE SCREW IN THE CARBURETOR. THE COMBINATION OF BOLT 8 x 130 (#977-420) AND SOCKET WRENCH (#876-210) CAN BE USED AS A SPARK PLUG WRENCH TO REMOVE AND INSTALL THE SPARK PLUGS. BY COMBINING BOLT 8 x130 (#977-420) AND SOCKET WRENCH (#876-225) YOU CAN REMOVE AND INSTALL THE MAIN JET WHICH MAY BE REQUIRED WHEN FLYING CROSS COUNTRY AND YOU ARE LANDING AND TAKING OFF FROM HIGHER OR LOWER FIELD ELEVATIONS THAN YOU STARTED FROM. A SPARE STARTER ROPE (#852-091) IS INCLUDED AND COULD BE INSTALLED USING THIS KIT IF NEEDED. ALL OF THE TOOLS ARE VERY IMPORTANT PARTICULARLY AS EMERGENCY SUPPORT IN THE FIELD.

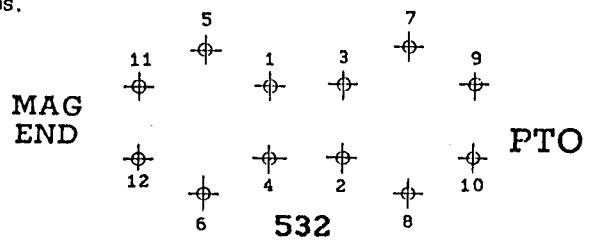


	PART NUMBERS	DESCRIPTION
1.	876-195	TOOL BAG
2.	977-420	BOLT 8 x 30
3.	876-640	CRANKSHAFT FIXATION BOLT
4.	276-065	FORK WRENCH 10/13 MM
5.	876-210	SOCKET WRENCH 21/26 MM
6.	876-225	SOCKET WRENCH 10/13
7.	876-200	SCREW DRIVER
8.	852-091	STARTER ROPE 5.5 x 2110 MM

TORQUE THE HEADS

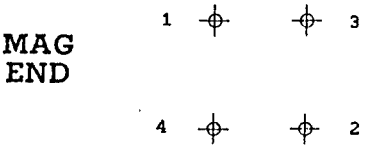
AFTER BREAKING IN YOUR ENGINE AND PRIOR TO TEN HOURS THE FOLLOWING PREVENTIVE MAINTENANCE MUST BE PERFORMED. THESE THREE STEPS WILL ELIMINATE MOST PROBLEMS THAT ARE RELATED TO POOR MAINTENANCE
1.) TORQUE THE HEADS 2.) TIGHTEN THE FAN BELT AND 3.) CHECKING AND SETTING THE TIMING.

TORQUING THE HEADS MUST BE CHECKED AND ADJUSTED IF NECESSARY TO PREVENT POSSIBLE AIR LEAKS AROUND THE CYLINDER BASE AND HEADS. THIS IS PERFORMED BY USING A TORQUE WRENCH THAT IS CALIBRATED IN INCH POUNDS. A DEFINITE PATTERN MUST BE FOLLOWED IN ORDER FOR THE TORQUING SEQUENCE TO BE CORRECT. EACH HEAD NUT MUST BE TORQUED IN SEQUENCE, FIRST TORQUE TO 75 INCH POUNDS STARTING AT THE # 1 NUT AND GOING THROUGH EACH NUT. THE SECOND ROUND EACH NUT WILL BE TORQUED TO 150 INCH POUNDS AND ON THE LAST ROUND TORQUE TO THE CORRECT SETTING OF 210 INCH POUNDS. THIS GRADUAL TORQUING SEQUENCE WILL ELIMINATE ANY UNNECESSARY STRESS ON THE HEADS.

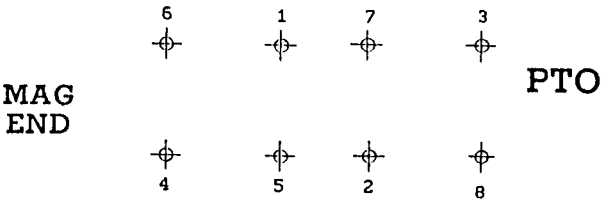


532

On the 532 LC, retorque the top nuts only WITH THE ENGINE COLD!



277



377/447/503

Retorque only WITH THE ENGINE COLD.

NEW IN '88

Preventive Maintenance Video for Rotax Operators

Leading Edge Air Foils has a 2-hour video that takes the Rotax user through the operators manual and preventive maintenance procedures.

According to LEAF, the purpose of this video is to help the customer get acquainted with his/her engine. It covers the three manuals for the five Rotax engines. The first manual covers the Rotax 277, which is a 2-stroke, 2-cycle, single cylinder, light aircraft engine. The second manual covers the Rotax 377, 447, and 503 engines. These engines are twin cylinder and all but the 503 are available in both a fan-cooled and free air version. Single or dual carbs are also available. The last manual is for the Rotax 532 which is a 2-stroke, 2-cycle, twin cylinder, available as liquid-cooled either single or dual carburetor.

In the video, LEAF shows how to break in the engine, set the idle, starting procedures, check and set the timing, torque the heads, trouble-shooting, tightening the fan belt, and much more.

LEAF recommends the video to any Rotax engine owner to help maintain the engine in proper running condition and prolong its life.

A 2-hour video from Leading Edge Air Foils takes the Rotax user through the operator's manual and preventive maintenance of his engine.

B3100.....VHS
B3101.....BETA

$45.00 each

LEADING EDGE AIR FOILS, INC.

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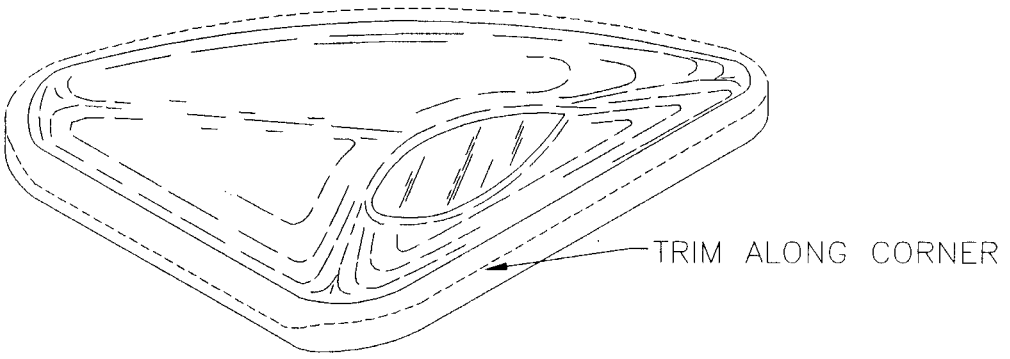
S-12 AIRAILE FILLET FAIRINGS INSTALLATION INSTRUCTIONS

TRIMMING

1. The fillet fairings are made of a thermal formed lexan and need to be trimmed out carefully before beginning installation. The trim line for these fairings is actually molded into the fairings by trimming right along the corner where the mold drops straight down. See **Figure 011-01**. Use a pair of aviation snips to rough trim, then a file or small sanding block to clean up the edges.

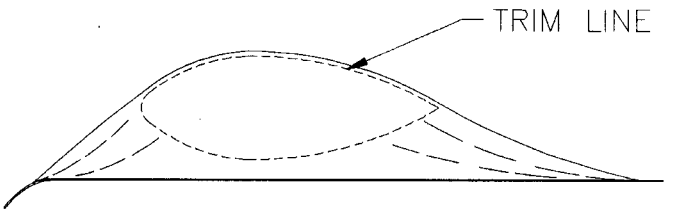
FIGURE 011-01



MD317

2. There is also an airfoil shape that matches the strut material molded into the fairings. This will need to be trimmed out to fit snug over the strut. See **Figure 011-02**. Do this by first trimming slightly inside the line, then test fit over the strut and file out accordingly until a nice snug fit is achieved.

FIGURE 011-02



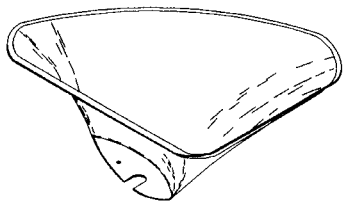
MD317

3. Also, molded into the fairing is a small indentation that is the location for the small screw that will later secure the fairing. This needs to be drilled to #40.

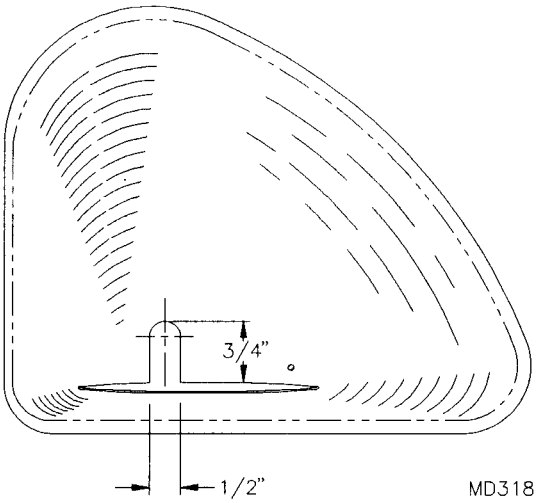
INSTALLING THE FAIRINGS

4. You are now ready to begin the installation process for the fairings. First unbolt the strut fitting from the strut attach plate and let the strut drop down. Next, slip the fairing over the strut and slide it down until it hits the bolt that attaches the strut fitting to the strut. Mark an approximate centerline of this bolt, then remove the fairing and cut out a slot as shown in **Figure 011-04**.

FIGURE 011-04



NOTE: LEFT SIDE SHOWN



5. After the slot has been cut out and filed neatly, reinstall the fairings and slide it down past the bolt. Bolt the strut back in place but do not tighten until the fairing has been fit and the foam tape applied, tape application will be covered later. Push the fairing back up past the top bolt until it fits tight against the wing. Check the fit of the fairing to make sure there are no gaps around the perimeter. It is possible that the fairing may need to be twisted slightly to align with the leading edge of the wing. This can be accomplished by removing the fairings and opening up the strut hole just slightly. Once you are happy with the fit of the fairings, drill through the pre-located #40 hole into the strut. Install the screw and tighten to check fit. If everything checks out, remove the fairing and apply the foam tape provided to the perimeter of the fairing and install. **IMPORTANT:** Do not use any form of loctite to secure the screw. Loctite attacks lexan and will destroy your fairing.

TROUBLE SHOOTING

6. If the fairing does not want to fit tight against the leading edge spar, a simple fix is to add an extra screw on the forward side of the bolts in order to push the fairing up tight.

7. If the fairing seems to be sticking forward of the leading edge you will need to remove the fairing and file out the strut hole along its forward point, reinstall the fairing and slot the #40 hole accordingly. Remove the fairing, apply tape and reinstall.

S-12 AIRAILE NOSE WHEEL STRUT FAIRING

1. Slide the upper nose wheel strut fairing into the lower nose fairing. **NOTE:** The bends on both sets of fairings may need to be tightened up so they will fit together. Also, note there is an inner bend on the lower nose fairing. It is marked with an "I" on the inside by the bend. Use some vaseline to help the parts slide together.

2. After the fairings are together check to see if the holes line up with the slots. If not, file the holes slightly until they line up. If the holes are way off, check to make sure the lower fairing is assembled correctly.

3. Drill two #40 holes in the upper nose fairing. The first one is located 1/2" from the top centered on the 1/2" bend. The other is located 3 1/2" down from the first. **NOTE:** The S-12 does not need the second hole.

4. Super glue the rubber edging to the top of the fairing. Have both ends meet at the back of the fairing.

5. You will need to sand the inside bend on the lower nose fairing. (If painted, sand down to aluminum.) But do not go past the overlap of the outer bend. You will also need to sand the inside edge of the outer bend.

6. Remove the bolt from the nose strut. Slip the lower fairing around the strut, J&B Weld the fairing together. A piece of masking tape around the fairing will hold it together. **NOTE:** Be careful not to get J&B Weld inside where the upper fairing slides.

7. Lubricate the inside of the lower fairing with a generous amount of vaseline. Slip the upper fairing onto the strut. Rivet and assemble. Line up holes and re-install the bolt. **NOTE:** You will only use 1 washer per side. Do not overtighten! **HINT:** If the strut has moved up have a friend pull down on the front of the engine and push back on the wheel with their feet. This will collapse the spring enough for you to insert the bolt.

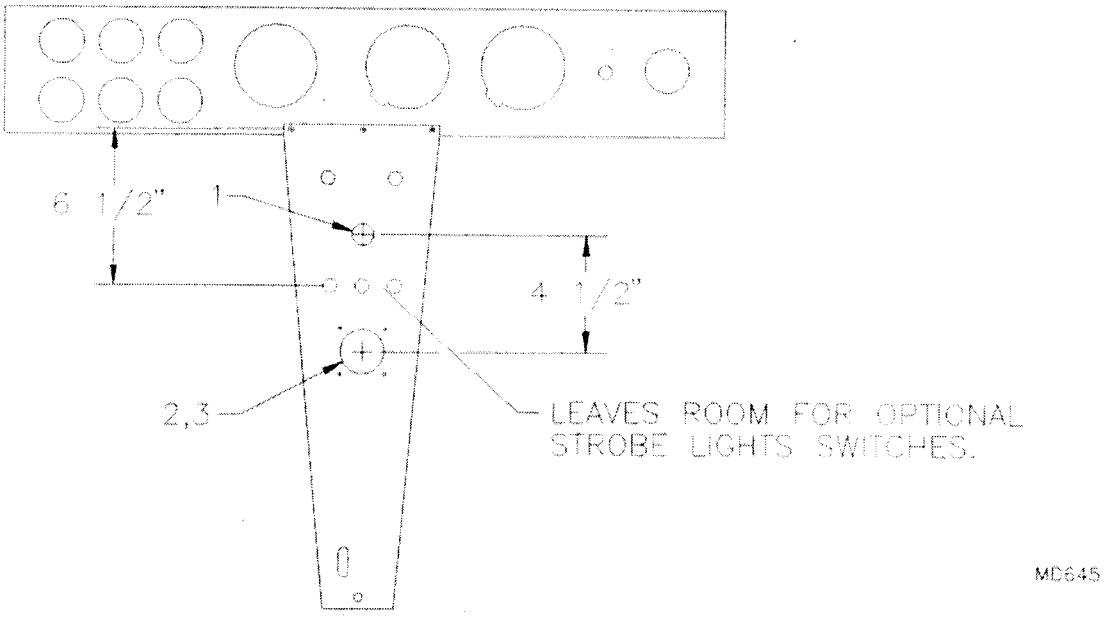
8. The nose wheel pant must be attached to install the lower fairing mount angles. Align the fairing so that it is parallel to the strut. The nose fairing mounts will slip **UNDER** the wheel pant's joggle seam on the **INSIDE** of the fairing. The top slips inside the lower fairing. It will be just behind the strut. Drill and rivet the mounts to the fairing.

PANEL MOUNT COMPASS INSTALLATION

NOTE: Make sure the compass has no interference before installing.

1. Measure down 4 1/2" from the center of the ignition switch. See **Figure 011C-01**. Drill a #30 pilot hole, cut a 2 1/4" hole for the compass. A fly cutter works well.

FIGURE 011C-01



2. Place the compass on the outer side, level and mark holes. Drill (4) #28 holes.

3. Install the compass from the back and tighten the bolts.