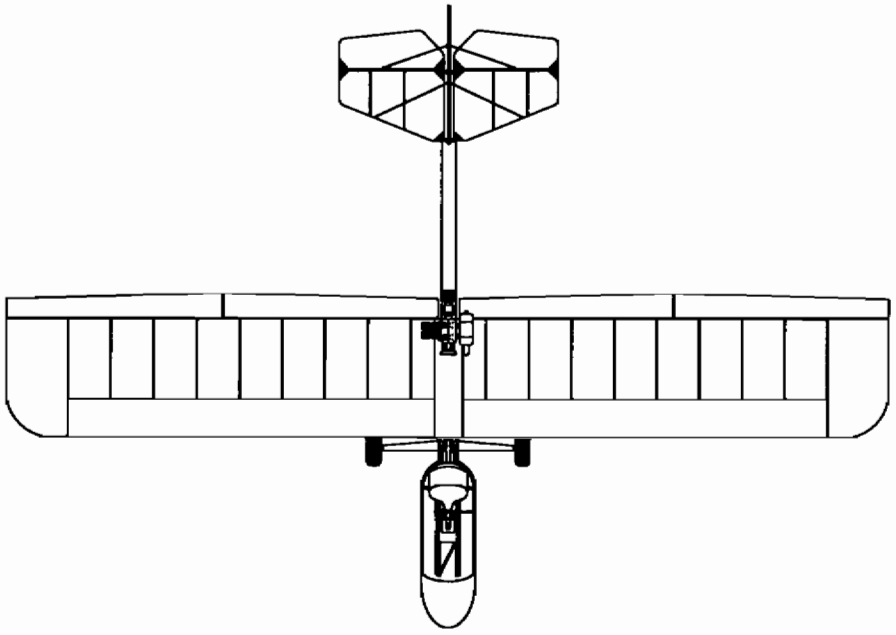
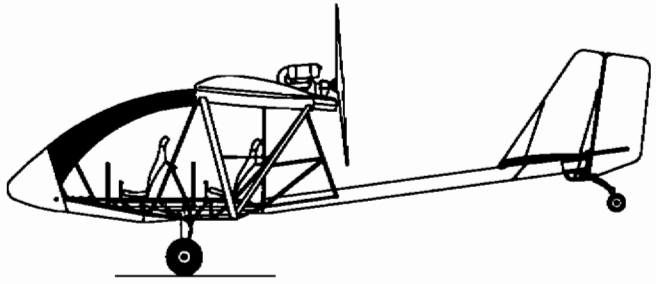
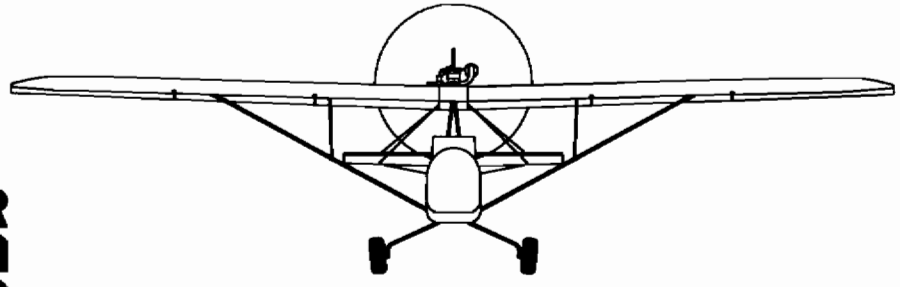
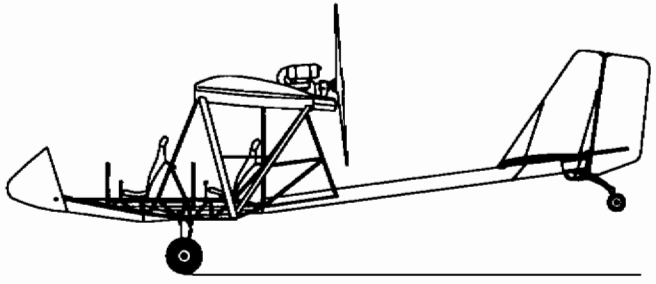
RANS S-18 STINGER II









RANS
4600 Highway 183 Alternate
Hays, KS 67601
(785) 625-6346

DESIGNED BY:
RANDY SCHLITTER

RANS INC.

4600 Highway 183 Alternate
Hays, KS 67601

Technical Support
(785) 625-0069

Parts Department
(785) 625-6346

When calling Technical Support please have the following ready:

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

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

TEXT MANUAL - TABLE OF CONTENTS

TO USE MANUAL, OPEN PARTS & FIGURE DRAWING BOOKS TO APPLICABLE SECTION FOR PART IDENTIFICATION AND ORIENTATION.

THE SECTIONS ARE LISTED IN ORDER OF APPEARANCE.

GENERAL INFORMATION

BEFORE BEGINNING:

TAKE INVENTORY: You must complete an inventory within 60 days of receiving your kit. We check and re-check and are 99.9% certain that if we say we shipped it, we did. The first task in building your kit is to inventory the parts using the packing list provided. It's your job to keep all parts organized and accounted for. RANS *cannot provide missing parts free of charge after 60 days from receipt of the kit.* Use the supplied pack list to verify that everything that we packed is in the box. The fast way to inventory, is to use the Priority Number that appears on the Part Number labels, these will match the pack list in numeric order. Go through the list item by item. If contents are determined to be missing, contact RANS' parts department *immediately.*

Keep the assembly area well organized. Use sections of plywood from the packing crate to fabricate a part inventory board. As each part is inventoried and checked off the pack list, staple the bag to the board, grouping like items together. This allows for quick identification and part selection during assembly. Refer to **FIGURE 0-1**.

PLEASE READ & STUDY the manuals cover to cover; this will speed up your build time considerably.

GET ORGANIZED. Prepare your workshop and be certain that what comes *in* the shop door will be able to go *out*!!!

KEEP IT CLEAN. *Dacron skins soil easily; w*ash hands, tools work surfaces and floor as needed during assembly. You'll notice many parts are marked with part numbers; these wipe away with acetone or lacquer thinner. ***Do not allow acetone, lacquer thinner or loctite to contact lexan glazing; these and other solvents will destroy it.***

PREP & FINISHING WORK. This is important and must be performed.

Many components are pilot-drilled and require further drilling prior to assembly or installation. Aluminum is soft; when drilling, use sharp bits, high speed and moderate pressure. Drill larger holes in steps to avoid drifting.

Dress holes and edges by carefully deburring; ½" drill bit works well as a deburring tool on most holes. Burrs can cause stress risers and lead to failure.

When drilling or trimming, maintain adequate distances between holes and edges.

Unless directed otherwise in manuals, use a #40 bit when drilling for 3/32" rivets, a #30 bit when drilling for 1/8" rivets and a #11 bit when drilling for 3/16" rivets and bolts.

Radius and smooth sharp corners with files, grinders or fine grit sand paper. Edges of certain parts also may need deburring.

Some components may require sanding, filing or grinding to remove powder coating from holes, bushings, sockets or other surfaces prior to installation of hardware or final assembly.

Denting and scaping aluminum or steel can result in corrosion and stress risers. Damaged components should be replaced; if marred, powder coating or painted finishes should be retouched with suitable paint.

When installing bolts, turnbuckles and rod ends, be certain threads are sufficiently engaged, be certain at least ten threads are engaged, unless instructed otherwise within the text. When we say install a bolt, it means to use the required washers and nut as per the parts drawing, and tighten to a "snug" condition. Torque values are called out for specific bolts. Discard damaged hardware.

CLECOS, are temporary fasteners or pins which hold components in position when drilling and riveting. You'll find clecos extremely helpful throughout assembly, on assemblies such as cowling, firewall and windows. Available in #40 (silver), #30 (copper) and #11 (gold). They are placed in holes with special pliers. While not required, Clecos are very convenient aids and their use is highly recommended.
To set a cleco, place it in the special pliers, squeeze, insert the tip in the desired hole and release.
To remove, grasp the cleco with the pliers, squeeze and lift from the hole.

RIVETS. The Stinger kit contains aluminum and stainless steel rivets of various sizes: be certain to use the proper rivet for the job at hand. Be certain rivet holes are free of burrs, parts to be joined are in contact and rivet heads are fast against surfaces when pulled.

FABRICATED PARTS: The builder is required to fabricate some small parts within the kit from raw stock provided.

RECOMMENDED TOOLS & MATERIALS LIST

Not all tools and materials are essential for assembly, but all are helpful. The builder is cautioned to use appropriate tools, materials and methods during assembly.

pliers
pop rivet tool
center punch
wrench set SAE & metric (3/8" to ½")
socket set SAE & metric (3/8" to ½")
drill press with v-block*
dust mask
rubber mallet
needle nose pliers
screwdriver set
ruler & tape measure
carpenters 2 or 4 ft. Level or SMART LEVEL®
sand paper & emery cloth
hack saw
safety glasses
¾" drum sander
tube cutter (for up to 1 1/8" diameter tube)

power drill (a 90° drill may also be helpful*)
hot knife
power screwdriver
disc sander
utility knife
small clamps (Stanley quick clamps work well)
round & flat files
masking tape
lithium grease
Loc-tite®
WD 40®
Dremel® tool*
Cleco® pins (Quantity determined by builder)
torque wrench up to 350 /in lbs
¼-24 NF tap
5/16-24 NF tap
uni-bit ¼" to ¾"

*Not a necessary tool, but helpful.

TECHNICAL BUILDING GUIDES & INFORMATION

Please note the following helpful guides & information:

FIGURE 0-2: 2-View, Top & side View of the S-18 Stinger II

FIGURE 0-3: Serial Number Plate Location on the S-18 Stinger II

TECHNICAL SUPPORT

RANS, Inc. has taken care to provide clear, comprehensive and straightforward instructions for assembly, maintenance and operation by reference to manuals alone. In the event a question arises for which no answer seems apparent, feel free to contact RANS, Inc. headquarters.

Physical and mailing address:.....RANS, Inc.
4600 Highway 183 Alternate
Hays, KS 67601
Voice:.....785-625-6346
Fax:.....785-625-2795
E-mail:.....rans@media-net.net
Internet site:.....www.rans.com
Technical Support:.....785-625-0069
Parts Department:.....785-625-6346

When calling for technical assistance, have the aircraft model and serial numbers, engine model number and assembly manuals at hand.

Questions about propeller care and adjustment and about engine break-in, operation and maintenance should be directed to respective manufacturer's or supplier's technical support personnel. Refer to manufacturer's or supplier's literature for instructions and contact information.

S-18 STINGER INSTRUCTION MANUALS

The Stinger is assembled by reference to three manuals: text, parts and figure. Instructions in the text manual refer to exploded views in the parts manual. The parts manual identifies all kit components and illustrates assembly and installation. For clarification, the text often refers to detail drawings found in the figure manual.

Where drawings are sufficient, little or no text is provided. Have all three manuals open to the appropriate pages during assembly. For fast, easy assembly, carefully study all manuals prior to starting.

1. Place the text manual in the larger 3 ring binder, the figure drawing manual in the smaller 3 ring binder and the parts manual in the other smaller 3 ring binder. Every page has a section number then a page number within that section. (Example: parts page 13-02, section 13, page 02)

2. Follow the table of contents for the order that the manual should follow.

3. Separate the sections with the tab inserts listed below. Buy stick on tabs. Cut out and slip in the labels to corresponding sections.

PARTS MANUAL	FLIGHT CONTROL SYSTEM	WINGS	STRUTS TRIAL ASSY & RIGGING	FINAL ASSEMBLY
PARTS MANUAL	FLIGHT CONTROL SYSTEM	WINGS	STRUTS TRIAL ASSY & RIGGING	FINAL ASSEMBLY
GENERAL DATA	ENGINE MOUNT ELECT & INST	FUEL SYSTEM	COVERING	
GENERAL DATA	ENGINE MOUNT ELECT & INST	FUEL SYSTEM	COVERING	
FUSELAGE GEAR/TAILWHEEL	TAIL	AILERONS & FLAPS	OPTIONS	
FUSELAGE GEAR/TAILWHEEL	TAIL	AILERONS & FLAPS	OPTIONS	

TEXT MANUAL	FLIGHT CONTROL SYSTEM	WINGS	STRUTS TRIAL ASSY & RIGGING	FINAL ASSEMBLY
TEXT MANUAL	FLIGHT CONTROL SYSTEM	WINGS	STRUTS TRIAL ASSY & RIGGING	FINAL ASSEMBLY
GENERAL DATA	ENGINE MOUNT ELECT & INST	FUEL SYSTEM	COVERING	OPERATIONS MAINTENANCE
GENERAL DATA	ENGINE MOUNT ELECT & INST	FUEL SYSTEM	COVERING	OPERATIONS MAINTENANCE
FUSELAGE GEAR/TAILWHEEL	TAIL	AILERONS & FLAPS	OPTIONS	
FUSELAGE GEAR/TAILWHEEL	TAIL	AILERONS & FLAPS	OPTIONS	

S-18 STINGER TEXT MANUAL

AN3 - AN8 AIRFRAME BOLTS

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

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

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

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

NUT AND COTTER PIN SIZES

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

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

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

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

DASH NUMBER -- NOMINAL LENGTH

-3 . . . 3/8	-6 . . . 3/4	-11 . . . 1 ⅛	-14 . . . 1 ½	-17 . . . 1 7/8	-22 . . . 2 1/4	-25 . . . 2 5/8
-4 . . . ½	-7 . . . 7/8	-12 . . . 1 1/4	-15 . . . 1 5/8	-20 . . . 2	-23 . . . 2 3/8	-26 . . . 2 3/4
-5 . . . 5/8	-10 . . . 1	-13 . . . 1 3/8	-16 . . . 1 3/4	-21 . . . 2 1/8	-24 . . . 2 ½	-27 . . . 2 7/8
						-30 . . . 3

PART IDENTIFICATION

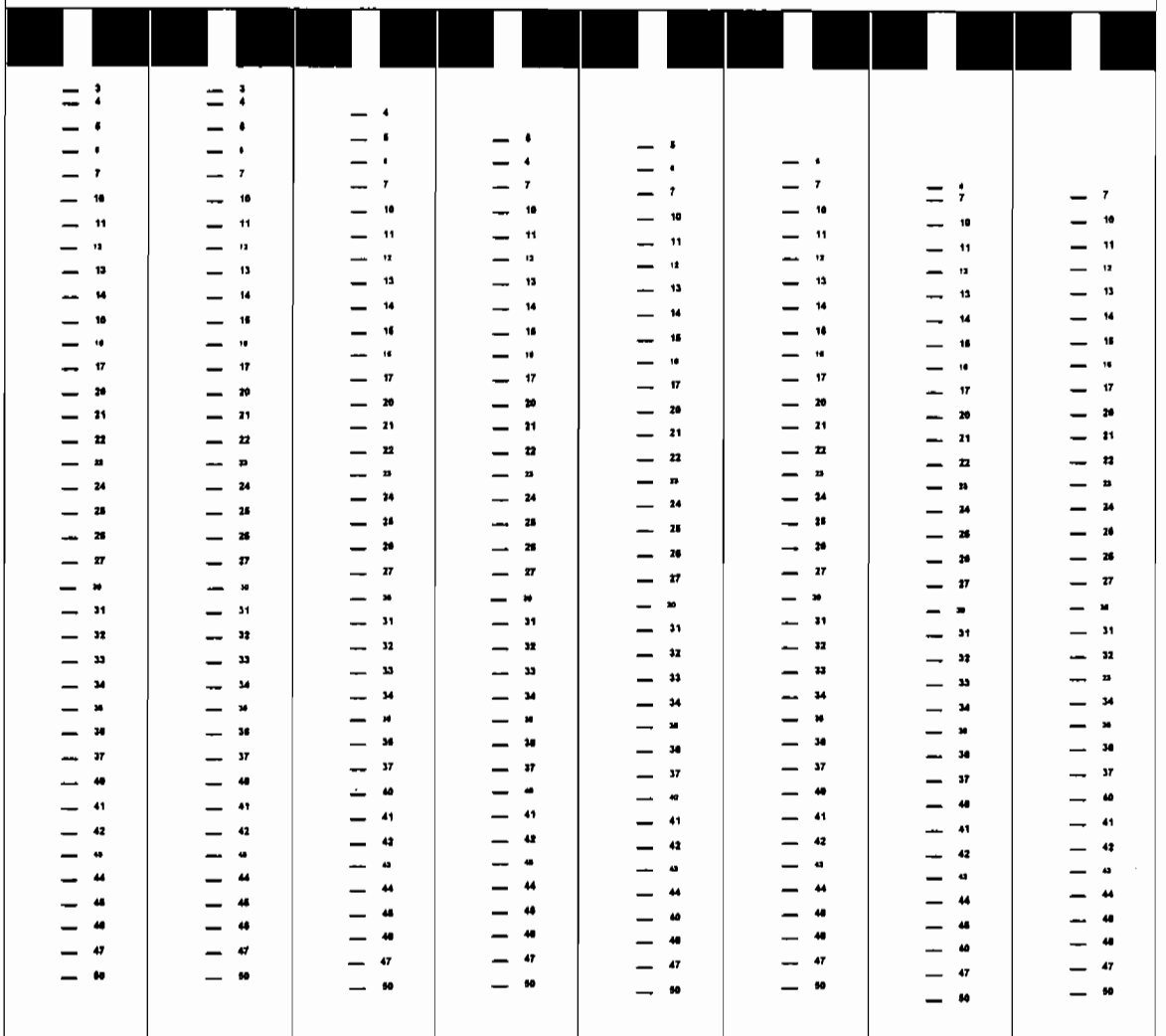
Use the above chart to determine lengths of bolts. Diameters are as follows:

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

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

EF-84

AN Bolt Gauge



AN3	AN4	AN5	AN6	AN7	AN8	AN9	AN10
3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8

EF-116

RIVETS CROSS REFERENCE LIST

DIA.	RANS	POP RIVET				CHERRY Q			
	NO.	NO.	SHEAR	TENSILE	GRIP	NO.	SHEAR	TENSILE	GRIP
3/32 (#41)	40APR1/8	AD32ABS	85	135	.031-.125	--	--	--	--
3/32 (#41)	40APR1/4	AD34ABS	85	135	.126-.250	--	--	--	--
3/32 (#41)	40APR3/8	AD36ABS	85	135	.251-.375	--	--	--	--
1/8 (#30)	30APR1/16	--	--	--	--	AAPQ-41	225	250	.0-.062
1/8 (#30)	30APR1/8	AD42ABS	155	235	.063-.125	AAPQ-42	225	250	.063-.125
1/8 (#30)	30APR1/4	AD44ABS	155	235	.188-.250	AAPQ-44	225	250	.126-.250
1/8 (#30)	30APR3/8	AD46ABS	155	235	.313-.375	AAPQ-46	225	250	.251-.375
1/8 (#30)	30SSPR1/16	--	--	--	--	CCPQ-41	700	600	0-.062
1/8 (#30)	30SSPR1/8	SSD42SSBS	550	700	.031-.125	CCPQ-42	700	600	.063-.125
1/8 (#30)	--	--	550	700	--	CCPQ-44	700	600	.126-.250
1/8 (#30)	30SSPR1/4	SSD44SSBS	550	700	.188-.250	CCPQ-45	700	600	.188-.312
1/8 (#30)	30SSPR3/8	SSD46SSBS	550	700	.251-.375	CCPQ-46	700	600	.251-.375
3/16 (#11)	12APR1/8	AD62ABS	315	500	.063-.125	AAPQ-62	500	450	.062-.125
3/16 (#11)	12APR1/4	AD64ABS	315	500	.126-.250	AAPQ-64	500	450	.126-.250
3/16 (#11)	12APR3/8	--	--	--	--	AAPQ-66	500	450	.251-.375
3/16 (#11)	12APR1/2	AD68ABS	315	500	.375-.500	AAPQ-68	500	450	.376-.500
3/16 (#11)	12SSPR1/8	--	--	--	--	CCPQ-62	1650	1300	.062-.125
3/16 (#11)	12SSPR1/4	SSD64SSBS	1000	1375	.126-.250	CCPQ-64	1650	1300	.126-.250
3/16 (#11)	12SSPR3/8	SSD66SSBS	1000	1375	.251-.375	CCPQ-66	1650	1300	.251-.375
3/16 (#11)	--	--	--	--	--	SSPQ-68	1050	825	.376-.50
3/16 (#11)	--	--	--	--	--	SSPQ-610	1050	825	.501-.625
						AVEX RIVET			
1/8 (#30)	--	--	--	--	--	1691-0410	165	230	.031-.187

EF-39G

WARRANTY INFORMATION

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

PH: (809) 356-5377

Attn: O.E.M.'s

Date: October 31, 1991

Subject: Warranty Extension Requests

Dear Customer (RANS, INC),

1) In order for your customers (the builder) to receive their six month full warranty from time of first use, you must submit for extension on the enclosed form (please add your letterhead to this form.) If no request is received, warranty will begin from the date the invoice was sent to your customer (the builder).

2) Extension will be required, for any warranty outside the original six-month period. This must be submitted prior to any claim or failure and cannot be applied retroactively.

3) Supply a copy of the original customer request and reason for same as per guideline, submit with your verification on the request form.

4) All requests must be submitted by the 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.

CALCULATING WARRANTY

"When does the warranty start?"

1. The final owner should have a six (6) month period of operation to find any proven defective part in his engine or Rotax assembly.

2. There is, however, a one (1) year limit which starts on our invoice date to you. If we sold you an engine today, unless we hear from you, the warranty will end one year from today s date regardless of whether the engine was in the customers hand or dealer inventory.

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

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

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

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

FAA PROCEDURES

--Obtaining an "N" Number

--Registration

--Obtaining An Airworthiness Certificate

OBTAINING AN "N" NUMBER

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

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

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

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

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

When To Obtain Your "N" Number

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

AFFIDAVIT OF OWNERSHIP FORM

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

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

REGISTERING YOUR AIRCRAFT

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

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

RECEIVING AUTHORITY TO FLY YOUR AIRCRAFT

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

WHAT IS THE PROCEDURE FOR OBTAINING AN AIRWORTHINESS CERTIFICATE

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

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

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 FOR ATTACHING NUMBERS AND PLACARDS TO HOME BUILT AIRCRAFT?

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

After you obtain the registration of 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" not 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 surface.

(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 that comply with these requirements may be purchased from the Experimental Aircraft Association for a very nominal fee.

AIRCRAFT INSTRUMENT MARKINGS & COCKPIT PLACARDS

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

8-1 GENERAL

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

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

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

8-2 MARKINGS AND PLACARDS

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

8-3 POWERPLANT INSTRUMENT MARKINGS

Each required powerplant instrument should be marked to indicate the maximum and, if applicable, minimum safe operating limits 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 **red radial line** to establish the never-exceed speed. (Vne).

The takeoff and any pre-cautionary 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 operating 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 for 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.

The operating limitations imposed on the aircraft during its flight proving period will be more stringent than those issued later after 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 requirements 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 the area selected is not over densely populated areas or in a congested airway.

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

13-5 OTHER LIMITATIONS DURING THE FLIGHT TEST PERIOD

As a rule, the carrying of passengers or other crewmembers 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 logbook. This should be in addition to any engine tachourmeter or engine hourmeter that may be installed in the aircraft.

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

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

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

Certain V speeds will require a log entry. Consult the restrictions and limitations provided in your airworthiness paper provided by the FAA inspector for details on flying off restrictions.

REPAIRMAN'S CERTIFICATION

The Repairman's Certificate is applied for using the application form 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.

BOOM to FUSELAGE CAGE ASSEMBLY

PLEASE NOTE: *Later in this section the tailboom extension will be installed. The uncovered vertical stabilizer is used to set this properly in place. Please jump ahead to tail assembly and build up the vertical stabilizer before installing the tail boom extension.*

Refer to **Fuselage** and **Tail Boom Assembly** parts pages.

1. The boom comes with critical holes drilled, see **Figure 1-1**.

2. Locate boom external doublers, burnish with Scotch Brite. Cleco to boom holes, as per **Figure 1-1** and drill holes through boom #30. Remove, deburr and rivet the fwd doubler with CCPQ-42 stainless steel pop rivets in all holes, and do the same to the aft with CCPQ-44 stainless steel pop rivets. Rivet all holes **except** bolt hole location "A", see **Figure 1-1**.

3. Using (3) saw horses, one at the end of the boom and two under the cage, lay cage on side. Test drill 5/16" into scrap metal and insert bolt to check fit. Bolt should fit tight in hole. If not, find a suitable drill bit. Drill only the aft cage attach points out to 5/16". **HINT:** Step drill up to 5/16" starting with ¼". Drill slowly using a good cutting oil. The steel may be very hard. Deburr and clean away metal chips. Drill the boom 5/16" at the aft cage attach points, deburr and remove debris. Place boom between aft fuselage attach points, lining up the holes in the cage to the boom. Be sure the rudder cable guide holes are down! Do not insert forward end of the boom into the cage to allow access to place bolts. **NOTE:** Squeeze boom tube with a padded bar clamp, if difficult to place into cage. Insert 5/16" bolts with proper washers. Tape a ½" wrench to a short stick and reach inside the boom and washer and nut the bolts. See **Figure 1-2.**

4. Swing tailboom into forward attach points. Use the clamp to squeeze the boom if required. Line up over the holes as centered as possible, drill through with ¼" followed by 5/16". **HINT:** Pin one side after drilling with the 5/16" bolt to prevent movement of the boom while drilling the other side. Swing boom away from the forward attach points, deburr and remove metal chips. Swing back into attach points and bolt. Tighten to 160 in/lb. Drill rudder cable guides to #11 and bolt to inside of boom. **NOTE:** Paint the inside of attach point socket, to prevent rusting.

MAIN LANDING GEAR ASSEMBLY

Refer to **Main Gear** parts pages.

1. Place cage/boom assembly bottom up on saw horses.

2. Hold gear pinning plate over gear bushings and drill out 5/16" through one corner and pin in place with 5/16" bolt (AN5-31A) and thin washer. **HINT:** Tape bolts in place to prevent falling. Drill and pin all other holes. Mark on bottom of plate, an arrow pointing fwd to serve as a reference when installing after deburring. Burnish the top side of plate with Scotch Brite for a nicer look. Remove and deburr, then slide back over bolts.

3. Slip anti-chafe strips onto bolts on each side of cage.

4. ***CAUTION: Main gear is heavy, DO NOT DROP or injury may result.*** Place gear on the frame. Center the gear between the bolts with swept edge forward. Slip spacer(s) into place, file to fit if too tight.

5. Drill through center of main gear with a #11 drill bit, to drill through gear pinning plate. Tilt the main gear enough to remove debris from drilling between main gear and pinning plate. Set gear flat and over hole in pinning plate and install 3/16" bolt through gear and plate. Install clamp plates with the more radiused edges against the gear. See **Figure 1-2A**. If plates do not slip over bolts, file holes into slots to fit. Tighten main gear bolts to 200 in/lbs. Bolt center with 3/16" bolt.

WHEEL ASSEMBLY - MECHANICAL BRAKE

Refer to **Mechanical Brake and Wheel Assembly** parts pages.

1. Assemble wheels with tire/tubes, being careful not to pinch the tube while tightening wheel hub bolts. Inflate tundra tires to 9 PSI. ***DANGER: Over inflation may cause tire failure or landing gear axle damage.***

2. Assemble each wheel assembly as per the parts drawing. Clean and pack bearings with a good lithium base grease.

   CAUTION: *1. When assembling wheel, be careful **NOT** to pinch tube between rims.*
   2. Double check bolt tightness prior to inflating tire.
   3. Inflate to 9 PSI for hard surface, and 10 to 15 PSI for soft fields.

   PLEASE NOTE: *Low air pressure will extend Take Off Roll dramatically.*

3. Remove brake cam and brake shoes from each brake assembly and modify, as per **Figure 1-3**. To gain clearance of drum attach/wheel bolts. Failure to perform this step will allow bolts to contact brake arm and shoes. Install the bolt for the insert nut into the brake assembly. Re-assemble after modification is complete.

4. Bolt brake assembly and axles to main gear, see **Figure 1-4** and parts drawing. **NOTE:** *Beveled edge of brake spacer goes **INBOARD**.* Torque the 5/16" bolts to 120 in/lb. Torque the 3/8" bolts to 175 in/lb. Brake arm must be re-positioned to the next place lower to avoid contacting landing gear, see **Figure 1-4**.

5. An insert nut is used to retain the brake cable housing. Drill the insert nut, as per **Figure 1-5**. Install with Loctite.

6. Jack up one side of the aircraft, so axle is at least 10" off the floor. Slide wheel onto axles. Install nut so there is no endplay, but wheel still spins freely. ***CAUTION: Over tightening wheel nuts will cause excessive wheel bearing wear and extended take-off distance.*** Install cotter pin. Repeat for other wheel.

WHEEL ASSEMBLY – OPTIONAL HYDRAULIC BRAKE

Refer to **Optional Hydraulic Brake and Wheel Assembly** parts pages.

1. Assemble wheels with tire/tubes, being careful not to pinch the tube while tightening wheel hub bolts. Inflate tundra tires to 9 PSI. ***DANGER: Over inflation may cause tire failure or landing gear axle damage.*** Be sure to include the brake rotor disc in assembly.

2. Assemble each wheel assembly as per the parts drawing. Clean and pack bearings with a good lithium base grease.

   CAUTION: *1. When assembling wheel, be careful **NOT** to pinch tube between rims.*
   2. Double check bolt tightness prior to inflating tire.
   3. Inflate to 9 PSI for hard surface, and 10 to 15 PSI for soft fields.
   PLEASE NOTE: *Low air pressure will extend Take Off Roll dramatically.*

3. Bolt brake assembly and axles to main gear. **NOTE:** *Include the brake caliper mount brackets and reducer bushings.* Torque the 5/16" bolts to 120 in/lb. Torque the 3/8" bolts to 175 in/lb.

4. Jack up one side of the aircraft, so axle is at least 10" off the floor. Slide wheel onto axles. Install nut so there is no endplay, but wheel still spins freely. ***CAUTION: Over tightening wheel nuts will cause excessive wheel bearing wear and extended take-off distance.*** Install cotter pin. Repeat for other wheel.

5. Install brake calipers to mounting brackets. Torque the brake caliper bolts to 80 inch-pounds, and then safety wire. Brake lines will be routed after brake pedal assembly.

INSTALLING TAILBOOM EXTENSION

PLEASE NOTE: *The vertical stabilizer is used to properly set the tailboom extension in place. Please advance to tail assembly. Use the vertical stabilizer without the covering to avoid soiling skin.*

Refer to **Tail Boom Assembly** parts pages.

1. Locate the elevator push pull tube guide on the aft side of the tail boom extension. Drill and cleco, as per **Figure 1-5A**. Do not rivet until after extension is installed.

2. Prepare the 3 aft boom doublers, as shown in **Figure 1-6**. **IMPORTANT:** File and sand smooth cut edges of doublers, to remove stress risers. Drill and rivet a 3/16" nut plate to the inside of the tailboom to the hole approximately 22" from end on bottom. See **Figure 1-7**.

3. Level the top of the fuselage cage. Place a scrap of aluminum tube in the tail boom's aft. Gravity will pull the tube to the exact bottom point. Mark this location. Locate a #30 hole at 5/8" edge distance, then two more in line with the first at 1 ¼" apart. See **Figure 1-7A**.

4. Cut out template from the 11" x 17" sheet provided and cleco in place to the #30 hole on the bottom of the boom tube, location "A". See **Figure 1-7B.**

5. Click punch all locations on template and drill #40 in all places except location "B". Drill "B" locations to #30.

6. Cleco in place the doublers using location "B". See **Figure 1-8**. **NOTE:** Location of flanges on doublers.

7. Drill all holes out to #30, mark doublers 1, 2, 3 to assure exact re-assembly, see **Figure 1-9**. Remove and deburr. Cleco in position, clear of debris and rivet doublers into place. **DO NOT** rivet top aft rivets on the top doublers until tailboom extension is installed or extension will not easily insert into boom.

8. Assemble the two (2) Tail Extension Hole Finders. See **Figure 1-9A**.

9. Out of the three #30 holes located at the bottom end of the boom tube, drill out the aft most hole to ¼", deburr.

10. Place the two (2) hole finders on the tailboom extension and insert the assembly into the tailboom. Bolt with ¼" bolt at the bottom. See **Figure 1-10.**

11. Cleco the horizontal stabilizer attach brackets to the front lower corner of the vertical stabilizer. Slip the unit over the end of the tail boom extension. The vertical fin should rest on the tailboom parallel to the boom with the attach brackets flat on the boom. Adjust the tailboom extension up and down to affect this. Sight from above to check if the tailboom extension is parallel to centerline. **HINT:** Tighten the ¼" bolt to help hold the extension in place. Sight from the rear to check vertical alignment with cage. The fin should be parallel to the cage vertically. Clamp in place by pinching with clamps on each hole finder. Drill through the hole finders with #11 drill bit once you are sure the extension and fin are aligned. Insert bolts to pin the extension in place while drilling the other holes. Drill ¼" holes in the two bottom locations. Remove, deburr all holes and assemble with proper bolts and washers. NOTE: The top tubes of the extension will need shims to fill the gap between the tube and doublers. Take apart the hole finders and use as shims. See **Figure 1-11.**

TAILWHEEL INSTALLATION

Refer to **Tailwheel Assembly & Installation** parts pages.

1. Select the parts depicted in the parts drawing.

2. Bolt the tail spring to the tailwheel assembly, as per parts drawing. Radius the angle on the Tailboom Extension, where the Tail Spring contacts as shown in **Figure 1-11A**. If tailwheel is not vertical, fabricate a shim from .050" aluminum stock to correct, see **Figure 1-12**.

3. The tailwheel is full swivel. This allows pivot turns using brakes. A cam mechanism allows it to engage for steering. If the tailwheel mount leans to one side the full swivel feature will not work to that side. Shim the tailwheel to run vertical.

4. Steering is provided through the two chains and springs. Spring tension should be tight with the springs compressed about half of the full amount. Loose steer springs will cause very soft indefinite steering. The spring is retained to the horn using two of the "S" hooks. Do not squeeze shut the "S" hooks where it attaches to the horn, this will allow full steering movement. Squeeze shut all other "S" hooks. For assembly details on the tailwheel rudder steer horn, see rudder assembly.

5. After the tailwheel is assembled to the aircraft, check it for proper steerage and alignment. The steering springs should be connected with enough tension to move the tailwheel after the rudder has moved 10 degrees side to side.

6. Keep tailwheel greased or difficulty in directional control may result.

KEEL ASSEMBLY 503 / 582

Refer to **Keel Installation** and **Engine Mount Assembly** parts pages.

1. Burnish the keel tube with 230 grit sand paper and Scotch Brite. Wax to retain satin sheen.

2. Drill out the (3) engine mount holes to 5/16” and mount as shown on keel and engine mount assembly parts pages, see **Figure 1-13**. **NOTE:** Drill out the (2) small (SU-118) stainless steel u-brackets to 5/16” to bolt to keel. Deburr inside of keel where stainless steel u-bracket bolts, deburr with sandpaper 220 grit. **HINT:** Jump ahead to engine mount assembly and install mount prior to bolting keel to cage. It’s a little handier!

3. Place the dual and single teleflex retainer on top of keel tube, as per **Figure 1-14**, drill and rivet in place. Be sure retainers are centered and square on keel.

4. Drill the fwd hole in the control stick tee to ¼". Chamfer the control stick tee to allow the bearing flange to seat properly. Assemble the control stick tee as shown in the exploded view in the parts manual. **NOTE:** In some instances it may be necessary to install a washer between the bearings if they are loose inside the bearing flanges. Assemble the control tee to the keel tube at the vertical hole located 10 5/8" from the front of the keel tube. Drill out the hole in the keel tube to ¼". Be sure to include the stand off and washers as shown.

5. Rivet the primer bracket to the bottom of keel using holes provided.

6. Bolt on aileron pulley shackles, as per parts drawing.

KEEL ASSEMBLY 912

Refer to **Keel Installation and 912 Engine Mount Assembly** parts pages.

1. Burnish the keel tube with 230 grit sand paper and Scotch Brite. Wax to retain satin sheen.
2. Wipe out the rear end of the keel tube. Check that the keel reinforcement plates fit inside the keel tube and the holes line up with the holes in the keel. If the plate does not fit, evenly sand material off top and bottom sides of the plate until it fits. Mark the plates left and right.
3. Cleco the reinforcement plates to the outside of the keel using the (3) engine mount holes. See **Figure 1-13A**. Transfer drill #11 into the keel using the reinforcement plates as a guide. Cleco as you drill. At the cage attach points, the keel is pilot drilled on the left side only. **IMPORTANT:** Do **NOT** transfer drill the cage attach points on the right side. This will be done during keel mounting.
4. Transfer drill 5/16" the (3) engine mount holes on plates and keel. Refer to keel and engine mount assembly parts pages. **HINT:** Temporarily bolt or cleco the plates to the outside of the keel and step drill with 1/4" bit. Final size drill 5/16" from both sides. Be sure to drill straight. Use a drill press if available. After drilling, insert a 5/16" bolt straight through plates and keel to check for hole straightness. Take apart and deburr. Use Scotch Brite or fine sandpaper on a stick to deburr inside the keel.
5. Slide the keel reinforcement plates into the keel tube. Check for left and right and cleco securely to the keel wall. As you do so, have bolts running through the (3) engine mount holes to assure proper alignment. Check that the plates are flat against the inside of the keel. Rivet with (4) 3/16" stainless steel rivets per side. See **Figure 1-13A** for locations.
6. Drill out the (2) small (SU-118) stainless steel u-brackets to 5/16" to bolt to keel.
7. Bolt engine mount angles to keel assembly. Refer to **Figure 1-13B**. Don't forget the stainless steel u-brackets (SU-118).
8. Modify aft mount strap per **Figure 1-13C**. Drill (1) hole in aft mount strap (EG-912-AMS) to 3/8". Temporarily bolt to engine mount angle. Align remaining strap hole with mount angle hole. Transfer drill 3/8".
9. Drill (1) hole in fwd mount strap (KPPW0210) to 1/4". Temporarily bolt to engine mount angle. Align remaining strap hole with mount angle hole. Transfer drill 1/4".
10. Place the dual and single teleflex retainer on top of keel tube, as per **Figure 1-14**, drill and rivet in place. Be sure retainers are centered and square on keel.
11. Drill the fwd hole in the control stick tee to 1/4". Chamfer the control stick tee to allow the bearing flange to seat properly. Assemble the control stick tee as shown in the exploded view in the parts manual. **NOTE:** In some instances it may be necessary to install a washer between the bearings if they are loose inside the bearing flanges. Assemble the control tee to the keel tube at the vertical hole located 10 5/8" from the front of the keel tube. Drill out the hole in the keel tube to 1/4". Be sure to include the stand off and washers as shown.
12. Bolt on aileron pulley shackles, as per parts drawing.

CENTER COVER ASSEMBLY

Refer to **Center Cover Installation** parts pages.

1. **Figure 1-15** shows the approximate location of the #30 pre-drilled holes used to locate the center cover LH/RH aft and fwd mount. Cleco in place the aft mounts and transfer drill the additional holes. Remove, deburr and rivet in place.

2. Rivet the reinforcement tangs to the center cover fwd mount as shown in **Figure 1-16.** Cleco the center cover fwd mount to the top of the keel. Using a square, set the center cover fwd mount 90 degrees to the keel tube. Mark and drill hole locations for the reinforcement tangs with the center cover fwd mount perpendicular to the keel. Drill to the specified rivet size. Install the center cover aft mounts using the hardware shown in the parts manual. **NOTE:** If installing a Rotax 912 do **NOT** rivet the 4th hole from the right front. This hole will be used for mounting the choke system. See **912 Engine Installation**. Place the center cover aft wrap in position on the mounts and cleco in place. Locate the aft holes in the keel with the aft edge of the center cover wrap as shown in **Figure 1-16.** Do not drill the fwd three holes in the aft wrap at this point. It is best to drill the center cover fwd wrap **AFTER** the wing has been installed. Install the ¼ turns and receptacles as shown in the parts manual. Install the center cover fwd wrap during final assembly. This will ensure a perfect fit with the wing. Install the (3) ¼ turn screw receptacles to the top flange.

3. Slot the center cover, then cleco onto aft mounts. See **Figure 1-17**. Transfer drill the #30 holes above the slotted hole. See **Figure 1-17**. Remove, deburr and rivet on. **NOTE:** Rivet only if not painting, otherwise paint center cover and then rivet in place.

4. Rivet the (6) nut plates to the **inside** of the mount. Install the rivets from the bottom. See **Figure 1-18**.

5. File, trim edges smooth, and burnish with Scotch Brite, before riveting the center cover bottom in place.

6. For best-fit wing should be attached. However, if fit is not satisfactory, adjust by enlarging holes for lower screws, or filing more clearance into fwd cover when required. Test fit fwd section of center cover by installing a few of the screws to retain the bottom and ¼ turn screw into fwd mount. If fit is satisfactory, remove for painting or if leaving bare, install ¼ turn screws

7. During final installation, glue on rubber strip around under side slot with super glue.

MOUNTING KEEL ASSEMBLY

Refer to **Keel Installation** parts pages.

1. At the cage attach points the keel is pilot drilled on the left side only. See **Figure 1-19**. This is to allow precise alignment of keel to cage. Drill to ¼" on pilot hole side and pin with ¼" bolts. Stand up the assembly, and place a smart level across the top of the keel. **See Figure 1-20**. **CRITICAL:** Take readings, clamp keel in a position parallel to the cage, and drill from other side. Bolt with ¼" bolts on both aft uprights. **NOTE:** Shim the space between "U" brackets with thin or thick washers as required to take up space. Bolt with 5/16" bolt on fwd most upright. Refer to parts catalog, include wing attach brackets and specific bolts called out in the parts drawing. **NOTE:** Leading edge wing brackets need to be drilled and deburred to 5/16". Drill 5/16" through aluminum bushing in fwd cabane. **HINT:** If bushing "spins" when drilling, remove and squeeze on tap if slightly out of round and re-install.

NOSE POD/BELLY PAN ASSEMBLY

Refer to **Nose Pod Assembly** parts pages.

NOTE: Jump ahead to **Rudder Pedal Assembly**, located in the flight controls systems section, then return to #1.

1. Collect all the parts depicted in the parts catalog drawing.

2. Trim and sand nose pod to line molded near edge. Drill #30 holes in all marked locations.

3. Drill three ¼" holes into the nose pod as per **Figure 1-21** for the arch tube and pitot. Drill top center on the marks provided a #30 hole. Lay the arch on a flat surface and measure from each flattened end to locate and mark the top center of the tube. Place the arch tube into the nose pod with the top center of tube lined up on the #30 top hole on the pod. Tape the tube in place with the top centered over the hole and the flattened parts of the tube centered on the ¼" holes. Drill through the top with a #30 bit and cleco. Make sure the arch tube is tight against the pod and drill to mark the ¼" holes into the flattened ends of the tubes. Do not drill through, only drill enough to mark (drilling through will elongate the holes in the fiberglass pod). Remove arch tube and drill through the flattened ends with a ¼" drill. Place the arch tube back into the pod clecoing the top and pinning the bottom ¼" holes with bolts. Drill the remaining #30 hole using the marks molded into the pod. Be sure the arch tube is centered over the holes as you drill. See **Figure 1-21**.

4. Hold nose pod arch and side former tubes up to cage and bolt on to each side of the fwd rudder bar. See **Figure 1-22**.

5. Clip "U" shaped attach bracket over lower cage tube where the side former will contact cage. Clamp attach bracket to tube, with tube touching against cage, then drill through #11 and bolt. See **Figure 1-23**.

6. Rotate the aft support tube until the pre-drilled holes are in front and in line with the side former tubes. Drill out the holes closest to the end to #11 and bolt on (2) trim tab hinges "L" brackets, repeat for the other side. Rotate as required so the "L" brackets align with the side tube formers. Drill and rivet with (2) 3/16 pop rivets in locations shown in **Figure 1-24**. **HINT: Drill and rivet outer locations, remove bolt, push tube down to clear support tube, then drill and rivet second location**. Install bolt once riveted. See **Figure 1-11D**. **NOTE: DO NOT rivet fwd rivet**

location on the left hand side fwd "L" bracket, this will be drilled through #11 to mount the flap lever.

7. Locate "L" brackets as per **Figure 1-32** and rivet in place. Put mid belly pan former in place on the tabs of "L" brackets against the side former tube and drill #11. **NOTE:** It may be required to file top edge of former flat. **See Figure 1-24**.

SHAPING and ASSEMBLY of the BELLY PANS

1. Build a shaping tool as shown in **Figure 1-25**. If no tubing is available, call our Parts Department for either a shaping tool or scrap tubing so you can fabricate a tool. ***NOTE:*** *Tube diameter is* ***NOT*** *critical. Any size from 1 ½" to 2" will work.*

2. Mark the belly pans, as shown in **Figure 1-26**.

3. Using the edge of a table, lay the FWD belly pan with shaping tool as shown in **Figure 1-27**. Using the edge of table, roll the pan at least 90 degrees to 110 degrees to effect a bend. Make repeated bends, as the tool is re-positioned with each bend. Move tool in ¼" increments at the aft end of pan and ½" at front. This action of rolling and moving will shape the pan with a bigger radius in front than the rear. To keep the bend smooth, move in small amounts. If faceting results, position tool on flat spots and roll out. See **Figure 1-27** for an idea on tool movement.

4. After shaping the fwd belly pan, lay on a flat surface and test fit the aft mid belly pan formers. Over bending the pan works best. Drill deburr and rivet the mid former to the pan from the bottom. Only rivet across the bottom not up the curved part of the former. See **Figure 1-28**.

5. Shape the aft belly pan by moving the tool between the marks, roughly 90 degrees to the fwd edge. See **Figure 1-29**.

6. Drill out the (2) aft floorboard supports also, and rivet them to the fwd side of the mid belly pan former. Cleco together the forward pan and mid former. The middle former assembles with flange facing aft. Drill, deburr and rivet the mid former to the pan from the bottom. Only rivet across the bottom and not up the curved part of the former. See **Figure 1-30**.

7. Position the belly pan assembly on the frame by inserting front edge between nose cone and bottom support tube. Cleco the aft former to the pre-drilled hole on the fwd side of the aft support tube. See **Figure 1-31**.

8. Tape the aft belly pan firmly up against the side former tube on **both** sides. See **Figure 1-31**. Make sure belly pan is pushed forward and tight against aft side tubes. Once position is even from side to side and the tabs pre-drilled holes hit close to centerline of side tubes, drill and cleco #30. **HINT:** When drilling tabs hold firm against the tube with a small block of wood or plastic or use small vice grip clamps.

9. Press the aft belly skin firmly against the former from the bottom using a wood block and drill #30 from the top through only the aft skin, holes are pre-drilled in forward pan; at cleco location "A." Only drill on bottom of aft former, See **Figure 1-31**. Once the bottom is drilled, start at "A" **(Fig. 1-31)** and push belly skins tight together from the bottom with a wood block, while drilling from the top. Work each tab all the way to "B" this way. **NOTE:** It will be tricky to get a normal drill into this area, but removing cleco at position "C" will help. Drill thru position "B" by eyeballing approximate center of

tab or measure ¼" in from tab edge to locate hole (or use a 90 degree drill.) Cleco, pull the skin tight against the tabs and drill through at cleco location "B". **NOTE: Use a hole finder or guess the hole location by centering drill over tab and on centerline of side former tube at location "B".**

10. Pull forward belly skin tight against the mid former and clamp or tape. Drill #30 through former tabs on curved part of former and cleco.

11. Tape the top edge of the fwd belly pan on each side and starting at the cleco "B" location. See **Figure 1-31**. Mark off every 2" all the way to the nose cone. Mark the edge distance 3/16" from the edge.

12. Check each side of belly pan. The skin should overlap the side former tube with 3/16 of the tube showing. Drill #30 at a location close to the former and cleco. Drill #30 at the FWD most location. Make sure skin overlaps tube sufficiently to place holes on side of tube. See **Figure 1-33**.

13. After locating, drilling and clecoing the 2 holes on each side, drill and cleco the remaining holes. Be careful to keep the holes lined as shown in **Figure 1-33**.

14. Mark the center of the nose pod bottom support tube and drill through the tube skin and nose pod. **HINT: Hold the drill 90 degrees to tube and pan. Support from bottom with a wood block. IMPORTANT: Push tube fwd to be tight against skin nose pod. Look at pod from side. The correct profile is straight line of the belly. The tube should be within 1/8" of the belly skin. The tube should fit tight against the nose pod.** The flat spot on top of the nose pod should be 35 degrees to top longeron of fuselage. See **Figure 1-34**. Push tube fwd until tight. **HINT: Side former tubes are slotted to allow the belly pan to "float" into position, loosen the ¼" bolts retaining nose pod to allow this effect**. Also place a scrap of wood cut to a length to exert pressure between the nose pod bottom support tube and mid former. This will help hold the bottom support tube in place for drilling. See **Figure 1-34**. The board should push the bottom support tube fwd enough to be flush with the skin. Check the fit of the nose pod bottom support tube. It must be tight against pod.

15. Place a bright light in the nose cone to show the edge of the belly skin. Locate #30 holes every 2" starting from the ¼" bolt on each side. Remember, the location of the holes from the edge of the skin may vary, so make adjustments are required to drill into tube at point of contact with belly skin and pod. Cleco as you go.

16. On each side of the nose pod, locate a #30 as shown in **Figure 1-35**.

17. **OPTIONAL TRIMMING OF NOSE POD**: If you want the aft edge of the nose pod to fit with less gap between the belly skin, mark and trim as shown in **Figure 1-36**. Draw a line from "A" to "B" with a 3/8" edge distance from hole centers. Maintain a 3/8" edge distance from all hole centers all the way around pod. Remove and trim. **HINT: Mark from "A" & "B" then remove to mark trim from other holes.**

18. Make sure all holes in all formers, tubes and pod are drilled #30. Uncleco and unbolt the side former tubes at the aft most point and aft pivot tube to allow the belly pan assembly to swing down enough to drill the rest of the holes in the aft former. Reinstall bolts at aft pivot tube to continue. (Only insert bolts, there is no need to add nuts.) **FINISHING NOTE:** About painting the nose pod and belly pan, on our prototype we did not rivet the pans to the pod or side former tubes, only the aft and mid formers were riveted to the pans. The pod and pan assembly was then removed for painting. The anodized tubes, which are also high traffic areas, do not need painting. As an added finishing touch we painted the inside of the nose pod to match the pan assembly. Leaving the tubes unpainted

18. Make sure all holes in all formers, tubes and pod are drilled #30. Uncleco and unbolt the side former tubes at the aft most point and aft pivot tube to allow the belly pan assembly to swing down enough to drill the rest of the holes in the aft former. Reinstall bolts at aft pivot tube to continue. (Only insert bolts, there is no need to add nuts.) **FINISHING NOTE:** About painting the nose pod and belly pan, on our prototype we did not rivet the pans to the pod or side former tubes, only the aft and mid formers were riveted to the pans. The pod and pan assembly was then removed for painting. The anodized tubes, which are also high traffic areas, do not need painting. As an added finishing touch we painted the inside of the nose pod to match the pan assembly. Leaving the tubes unpainted resulted in a finished look that was not only easier to do, but much more durable. The floorboards were also left raw, very high wear, so it is pointless to paint those. Just rub them down with Scotch Brite and permanently assemble after final installation of the pod and pan assembly.

PAINTING ALUMINUM SURFACES

Aluminum surfaces such as belly pans, center covers, mating strips, etc. should be painted as below. **NOTE:** Always follow the manufacturers recommendations on ventilation and respiratory equipment.

The RANS process is as follows:

1. "Scuff" the surfaces using medium Scotch-Brite to help the primer adhere.
2. Clean surfaces using lacquer thinner.
3. Apply two coats of self etching primer (we use Dupont Variprime) according to the manufacturers recommendations.
4. Apply the paint chosen. It is recommended to use paint from the same manufacturer as the primer you applied, to ensure chemical compatibility. If you are satisfied with the finish, painting can be the last step.
5. Clear coat if even more gloss and protection is desired (we use Dupont 72200S Clear Coat for aluminum surfaces).

FITTING / INSTALLING the FLOORBOARDS

NOTE: As learned earlier, the floorboards will be installed unpainted after the pod and pan assemblies are permanently installed.

1. Trim and position the Floorboard Support Angle on the Nose Pod Bottom Support Tube 11/16" below the Rudder Pedal Pivot Tube. See **Figure 1-37**. **HINT:** Lay the Floorboard on top of the Fwd and Aft Support Angles while positioning to ensure clearance. Drill #30 and cleco the Support Angle to the Bottom Support Tube.

2. Set LH/RH floorboards inside the belly pan centered with approximately 8 1/2" between. See **Figure 1-38**.

3. Drill #30 in locations "A" & "B", see **Figure 1-38**. Drill, deburr and rivet in floorboard, **AFTER** painting belly pod assembly.

503 INSTRUMENT PANEL INSTALLATION

Refer to **Instrument Panel** parts pages.

1. Assemble side panels to the inside on instrument panel using the #6 pan head screws. Line up the panel cover with bent end to the bottom of the panel. Drill and cleco to center of bottom with cover on outside of panel. Set assembly on fuselage centered between the aft set of tabs. See **Figure 1-39**. Drill #30 and cleco to fuselage. Bend panel cover to conform around side panels, drill and cleco, then rivet as per parts drawing. Remove screws and install gauges to instrument panel, refer to engine electrical system. Install rubber grommet and pitot tube to instrument panel cover. Cut segments from ¼" fuel line and install between pitot tube and air speed indicator. Re-install panel with screws.

582 / 912 INSTRUMENT PANEL INSTALLATION

Refer to **Instrument Panel** parts pages.

1. Cleco panel parts together. Transfer drill #30. **NOTE:** Do not drill #30, the holes in the Side Plates for the #6 pan head screws. Cleco as you drill. Deburr and rivet.

2. Drill the fuselage tabs and mount angles to #11. Remove the powder coating from the inside of the left aft tab. Use this tab to ground the engine instruments and ignition switches, refer to engine electrical system. Bolt the panel assembly to the tabs. **IMPORTANT:** Check for proper grounding.

3. Remove screws and install gauges to instrument panel. Drill a 5/8" hole in the Forward Cover inline with the airspeed indicator. Install rubber grommet. Cut segment from ¼" fuel line and install between pitot tube and air speed indicator. Re-install panel with screws.

OPTIONAL AVIONICS INSTRUMENT PANEL INSTALLATION

Refer to **Instrument Panel** parts pages. **NOTE:** The Avionics Panel will work with all engine options.

1. Cleco the Forward and Bottom Covers together. Mark the Mount Angles according to **Figure 1-39A**. Position the Mount Angles flush with the Forward Cover flange. Transfer drill #30 using the Bottom Cover as a guide.

2. Cleco panel parts together. Transfer drill #30. **NOTE:** Do not drill #30, the holes in the Side Plates for the #6 pan head screws. Cleco as you drill. Deburr and rivet.

3. Position panel assembly to allow control stick and brake handle to clear all instruments. Drill the fuselage tabs and mount angles to #11. Remove the powder coating from the inside of the left aft tab. Use this tab to ground the engine instruments and ignition switches, refer to engine electrical system. Bolt the panel assembly to the tabs. **IMPORTANT:** Check for proper grounding.

4. Remove screws and install gauges to instrument panel. Drill a 5/8" hole in the Forward Cover inline with the airspeed indicator. Install rubber grommet. Cut segment from ¼" fuel line and install between pitot tube and air speed indicator. **NOTE:** Drill an exit hole for instrument wiring in the bottom cover. **CAUTION:** Drill to avoid fuselage structure. Re-install panel with screws.

OPTIONAL AFT INSTRUMENT PANEL INSTALLATION

Refer to **Instrument Panel** parts pages.

1. Cleco panel parts together. Transfer drill #30. **NOTE:** Do not drill #30, the holes in the Side Plates for the #6 pan head screws. Cleco as you drill. Deburr and rivet. Transfer drill #11 the top and bottom side holes for the pan-head bolts. Rivet nutplates inside the side plates.

2. Install gauges to instrument panel. Be sure to leave extra wire length to ease installation and maintenance. "T" the pitot line into the existing line inside the front instrument panel. Install the static line and tee to the static port on the ASI.

3. Slip the tube clamps over the fuselage tubes behind the front seat. Slip the cover assembly into the fuselage and place the panel with instruments over the cover. Re-install panel with screws. Bolt the panel to the tube clamps. Be sure the panel bottom clears the fuselage. **NOTE:** The aft panel will be located on the front side of the diagonal tubes.

SEAT and RESTRAINT INSTALLATION

Refer to **Seat and Restraint Installation** parts pages.

1. Place 3/16" bolts through seat pan and install seat attach angles. See parts drawing. The bolts are installed to the inside hole on the angle and seat pan. Rivet the outer holes with the long 3/16" stainless steel rivets. Install cushion and cover. **NOTE:** Two different thickness of cushion foam are provided. Typically the thinner cushion is used on the back seat. Trim and bolt flute tube to seat as shown in **Figure 1-40**. Flute tubes bolt to fuselage bushings. Place seat on fuselage, between any pair of adjustment bushings; install quick pins to secure. Bolt through bushing on frame and flute tubes to secure tilt.

2. Bolt restraint system in place as per parts drawing. *Be sure to buckle up, before every flight!* **CAUTION:** *The rachet on the lap belt is very high leverage, when assisting someone to tighten the rachet, be careful not to over tighten, it may result in injury.*

3. Place black fabric Velcro closures over belts to prevent belt tangle, see **Figure 1-41**.

RUDDER PEDAL and RUDDER CABLE ASSEMBLY

Refer to **Rudder Pedal and Rudder Cable Assembly** parts pages.

1. Slip the 1" pivot tubes into their respective locations. Center tubes on cage. **NOTE:** Sand inside diameters of pivot bushings on frame if tubes **DO NOT** insert easily. **HINT:** Oil inside of bushings for ease of install.

2. Fabricate (6) ½" wide 1-1/8" dia. aluminum bushings. Use a tubing cutter for best results. Slide aluminum bushing on rear pivot, followed by aft rudder pedals, slide on fwd pedals. Pedals should pivot freely, sand the inside of pedals with a ¾" drum sander. **NOTE: NO aluminum bushing** is used on fwd pedals against cage. Check if pivot tubes are centered and drill and rivet bushings to lock pedals and pivot tubes in place. If installing footstep (part of the canopy section), install the 7/8" steel tube doubler, it is powder coated either black or gray. Insert the tube from right hand side: push in 2" beyond end of aft rudder pivot tube. See **Figure 2-1**.

3. Modify Rudder Return Tang per **Figure 2-1A. HINT:** For bend #1, insert a 3/16 bolt and thick washer through the tang, clamp the bolt in a vise, with the tang tight against the vise, and bend down. Install link rods, cables and tangs, as per the parts drawing. Install Rudder Return Springs after Rudder Installation.

4. Bolt pulleys to wire loops on fwd side of landing gear, include rudder cable when installing.

5. Drill out the two plastic cable guides to #11, slip them on the rudder cables and bolt to the inside of boom. See **Figure 2-1B**. Push rudder cables to end of boom, tape to boom to retain. Route cables through the boom extension pulleys and attached to rudder horn, once the rudder is installed.

CONTROL STICK ASSEMBLY

Refer to **Control Stick System Assembly** parts pages.

1. Due to slight variations in the locations of these 3 pivots on the cage, drill out the center attach bushing to 5/16". Drill the fwd and aft pivot out to ¼".

2. On a bench or table, assemble to the control stick torque tube, the 5/16 rod ends in (2) fwd places, press in the bearings. **HINT:** Tap 5/16" fine for easy install. **CAUTION:** If Rod ends turn in hard they can be damaged. Cut (3) bushings 3/8" x .058 x 1 1/8" and install between bearings in control stick torque tube. The bushings serve to support the bearings when the bolt retaining the control stick is tightened. If the bushings are too short and the bolts are tightened, it will put un-due side loads on the bearings. Adjust for this by filing bushing to length, if too long; or shimming with washers, if too short, see **Figure 2-2**. Install stop nuts, see **Figure 2-3**. Do not install control sticks at this time. **HINT:** The bushings are easily lined up with the bearing using a small wire. Install stop bolts and jam nuts. **HINT:** Tap ¼" fine for easy install.

3. Check fit the aileron pulley to the aft end of control stick torque tube (CS-TT). File or sand open holes on pulley until it slides onto end of CS-TT. Drill out push/pull guide mount tab to #11. See **Figure 2-3A**.

5. Insert the outer slide tube into the guide on the CS-TT. It must also slide easily in guide. Use emery cloth if required, on outer slide tube.

6. Apply grease to contacting surfaces of inner & outer slide tube and guide. Install the last and aft most 5/16" rod end.

7. Feed CS-TT assembly into frame from front. By turning and tilting as you go, the CS-TT will fit into cage, be careful of finish, try to do this gently. Stop when CS-TT is against pivots for rod ends, then advance unit fwd 5".

8. Bolt on aileron pulley, then move CS-TT into position on pivots and temporarily pin to pivots with ¼" bolts. Check if CS-TT pivots freely and that slider tube moves fore and aft easily. When bolting tight the aileron pulley slider tubes can bind. Shim with washers to eliminate. **See Figure 2-3A.** Adjust rod ends until it does. **NOTE:** *Fwd rod end should be screwed in all the way, then backed out (2) turns for a good starting point.* **NOTE:** When assembling ¼" bolts to rod ends, drill out the AN970-3 washers to ¼" inner diameter.

9. Once the 3 CS-TT pivot rod ends are adjusted, unbolt and move the CS-TT forward to allow installation of elevator push/pull tube, note how bolts are shimmed. Apply a drop of Loc-tite to each to retain positions.

10. Move the CSS-TT fwd (off the pivots) so the end of outer slide tube is accessible. Drill out "U" bracket to ¼" on hole at bottom of "U". Bolt on "U" bracket as per **Figure 2-4**. Grease "U" bracket contacts outer push-pull tube, adjust castle nut so there is no play, but "U" bracket turns freely, safety with cotter pin.

11. Bolt the elevator push-pull tube to the "U" bracket with the notch up and slide CS-TT into position and bolt rod end to cage pivots. **NOTE:** *Washers may be required to take space between rod ends and cage pivots.* Snug bolts on rod end-cage pivots, checking for free swing motion of the CS-TT. If bolts are too tight it will bind the motion, adjust as required.

12. Install the elevator yoke to aft end of push-pull tube, see **Figure 2-5**.

13. Select the hardware to assemble the fwd and aft 1" elevator push pull tubes. Drill out pilot holes to #30 with end fitting installed flush into tubes. Rivet with 1/8" stainless steel pops, as per parts drawing. Install rod ends with jam nuts.

14. Select hardware for the control sticks and bolt onto the CS-TT. **NOTE:** The aft stick has the double set of tabs to receive the 1" push pull tubes rod ends, place aft stick so the lower set of tabs is facing fwd.

15. Assemble and rivet the 1" push-pull tubes, as per **Figure 2-6**. Adjust to lengths given. This will be a good starting point for the 1" push-pull tubes lengths, adjustments may be required.

16. Position and bolt plastic guide in place on tab of CS-TT. File to fit flat against tube.

17. Bolt in 1" push pull tubes, but do not tighten bolts, adjustment of 1" push pull tubes will come after the elevator is installed.

FLAP LEVER ASSEMBLY

Refer to **Flap Lever Assembly** parts pages.

1. Fabricate the following bushings in the appropriate lengths:

Qty.	Length	Tube Size
1	7/8"	¼" x .028
2	3/8"	3/8" x .058
2	11/16"	¼" x .028

2. Press the plastic caps into each end of the 3/4" flap trip release tube.

3 Screw the rod end onto one end of the 11 ft. teleflex cable. Using the plastic shim, teleflex retainer and 11/16" long bushings, bolt this end of the teleflex to the left inside flap lever side plate as per the parts drawing. Bolt the 7/8" bushing into the side plate's top hole.

4. Bolt the flap lever between the two side plates with the welded tab facing down. Tighten the flap lever pivot bolt so it is snug, but still allows the lever to pivot freely. Slip the spring into the flap lever tube and install the flap trip release tube.

5. Depress and rotate the flap trip release tube until the ¼" hole is lined up with the slot. Install the bolt and 3/8" diameter bushings into the flap lever and trip release tube. The bushings act as rollers and will ride against the flap lever sides. Tighten the bolt to the point the bushings still roll. Apply a light grease to the rollers for the best action. Test operate the lever by pulling up on the lever, then depressing the flap release tube return.

6. Bolt the rod end to the right hand side of the welded tab on the flap lever. The exact adjustment of the rod end on the teleflex will be determined when adjusting the flaps. Remember 6 turns minimum for rod ends.

7. Install the flap lever assembly to left hand side of belly pan tube, by clecoing in position near aft rudder pedal pivot tube, see **Figure 2-7**. **Hint:** Raise flap lever handle for use as an aide in aligning the flap lever assembly 90 degrees to the aircraft.

8. Rotate lever assembly until it is 90 degrees with rudder pedal pivot tube and drill from outside with #11 at rear attach point on lever, see **Figure 2-8**. Remove cleco and bolt. Line up front holes on centerline of belly pan tube, drill and bolt. Be sure to include washers between lever side plates and belly pan tube.

9. Route the teleflex along the belly pan, secure with a clamp. See **Figure 2-8A**. Route up to the slots in the keel. Install the flap fwd dual teleflex retainer. Install the flap lever teleflex into the aft retainer on the keel and secure with safety wire.

10. Install the aft dual teleflex retainer onto the flap teleflex and secure with the **TENSILE** nut. The jam nut is supplied on the teleflex. It is important that this jam nut be in place prior to installing the dual teleflex retainer. After the wings are installed, slip each flap teleflex into the fwd retainer on the keel. Install the flap nuts onto the ends of each teleflex coming from the wings. Slip the slotted end of each flap into the doubler retainer on the end of the flap teleflex. Secure the teleflexes into the retainers with nylon ties or safety wire. See **Figure 2-9**

11. Rig the flaps by adjusting the rod ends and tensile nuts. Both flaps should be even when viewed from the front or aft center. To properly rig the flaps, all three teleflex cables may require adjustment. It may also be required to trim off the ends of the teleflex cables where they attach to the horns. During flight testing, if the aircraft tends to roll to the right or left, flap adjustment may be required. Refer to the rigging section for further instructions. Maintain at least **10 full turns** threaded into all fittings.

503 / 582 THROTTLE LEVER INSTALLATION

Refer to **503/582 Throttle and Trim Lever Installation** parts pages.

1. Select all parts for the throttle system, depicted in the parts manual.

2. Take one of the throttle levers and cut off 5 5/8" from the longer leg, using a tubing cutter. See **Figure 2-10**. This will be the fwd throttle lever. Deburr the ends of both throttle levers.

3. Press the throttle knobs onto the short leg of each lever with the pinning hole aligned as in **Figure 2-10**.

4. Slip a stop collar over fwd throttle and slide it into the pivot bushing on the left hand side of the fuselage. **NOTE:** Remove paint from inside of throttle pivot, pivot bushings if throttle levers do not slide into pivots. Assemble fwd throttle as depicted in **Figure 2-11**. **NOTE:** Throttle cable and link tube arms should fit flush with end of throttle lever and drill so arms are in-line with throttle lever.

5. Slide the aft throttle lever into the bushings near the aft seat bushings. Slip two stop sleeves and a throttle bracket, as shown in **Figure 2-12**. Throttle lever should be placed flush with pivot bushings on right hand side. Hook up link tube to front throttle and aft throttle, with flat side facing inboard to gain maximum clearance of link tube from aft control stick. See **Figure 2-13**. Position aft arm to line-up link tube with center line of aircraft. Drill and bolt with arm in line with lever.

6. Position stop sleeves against pivot bushings and rivet.

7. After engine is installed, adjust friction and throttle stops. **NOTE:** *Be certain throttles have FULL travel and open and close slides in carbs fully.* **NOTE:** *Trim cable housing will clamp to cushioned clamp in a later step, after tail group is installed.*

8. Throttle should move smoothly without excessive effort, oil pivots as required. Avoid getting oil near plastic friction block.

912 THROTTLE LEVER INSTALLATION

Refer to **912Throttle and Trim Lever Installation** parts pages.

1. Select all parts for the throttle system, depicted in the parts manual.

2. Take one of the throttle levers and cut off 5 5/8" from the longer leg, using a tubing cutter. See **Figure 2-10**. This will be the fwd throttle lever. Deburr the ends of both throttle levers.

3. Press the throttle knobs onto the short leg of each lever with the pinning hole aligned as in **Figure 2-10**.

4. Drill 1/4" the lower hole in the 912 Throttle Lever. Fabricate bushing as shown in **Figure 2-11A**. Press into the 1/4" hole of the 912 Throttle Lever and center. **NOTE:** The bushing needs to fit snuggly in the 1/4" hole. Final alignment of the bushing will be done during throttle cable installation.

5. Slip a stop collar over fwd throttle and slide it into the pivot bushing on the left-hand side of the fuselage. **NOTE:** Remove paint from inside of throttle pivot, pivot bushings if throttle levers do not slide into pivots. Assemble fwd throttle as depicted in **Figure 2-11B**. Align the 912 Throttle Lever Arm with the welded arm of the outboard Throttle Bracket and transfer drill #11 and bolt. **NOTE:** Throttle cable and link tube arms on Throttle Brackets fit flush with the end of throttle lever tube. Drill so arms are in-line with throttle lever.

6. Slide the aft throttle lever into the bushings near the aft seat bushings. Slip two stop sleeves and a throttle bracket, as shown in **Figure 2-12**. Throttle lever should be placed flush with pivot bushings on right hand side. Hook up link tube to front throttle and aft throttle, with flat side facing inboard to gain maximum clearance of link tube from aft control stick. See **Figure 2-13**. Position aft arm to line-up link tube with centerline of aircraft. Drill and bolt with arm in line with lever.

7. Position stop sleeves against pivot bushings and rivet.

8. After engine is installed, adjust friction and throttle stops. **NOTE:** *Be certain throttles have FULL travel and open and close carbs fully.* **NOTE:** *Trim cable housing will clamp to cushioned clamp in a later step, after tail group is installed.*

9. Throttle should move smoothly without excessive effort, oil pivots as required. Avoid getting oil near plastic friction block.

ELEVATOR TRIM LEVER and TRIM CABLE HOUSING INSTALLATION

Refer to **Throttle and Trim Lever installation** parts pages.

1. Bolt trim lever to bushing on cage located 4" ahead of fwd throttle. Refer to parts drawing for hardware required and assembly sequence.

2. Slide cable housing into boom from aft end right hand side. Route up to trim lever through cage. **Do Not entangle housing into controls.**

3. The trim cable housing is retained and held in place by the cushioned clamp; installed onto the throttle friction block. Loosen bolt and slip housing through clamp, leaving a little housing ahead of clamp. See **Figure 2-14**.
4. Retain housing with zip ties in cage, clear of controls. When housing exits tailboom, retain to upper right tail extension tube. Route through cushioned clamp and terminate at stop bracket. Make a gentle "S" curve into stop bracket and trim to length. Secure with conduit adjuster assembly.

5. Feed trim wire into housing from tail of plane. **CAUTION:** Be careful untapeing wire, it has a tendency to uncoil with some force. ***Do Not*** *kink wire, feed wire into housing pushing gently.* If wire does not slide into housing easily, check for abrupt bends in housing. Also, if zip ties are too many and too tight, wire may be hard to install into housing.

6. Insert wire into wire stop on trim lever with 1 ½" past stop. Loctite wire stop. Set. Trim lever in a position 90 degrees to top of cage.

7. Set trim lever in a slightly leaning fwd position. This will be approximately the ***Neutral or Take Off position***. Tighten trim lever pivot bolt to hold position of lever.

AILERON CABLE INSTALLATION

Refer to **Aileron Pulley System** parts pages.

1. Assemble and bolt in place the (4) aileron pulleys, as shown in the parts manual. **NOTE:** Place aileron cable into pulleys, as shown. Be sure to safety wire the aileron cable to the notch in the aileron pulley.

2. Attach aileron cables to control stick tee. Tension cables with control stick and tee centered. Tension enough so a full side deflection still has slight tension on cables. Loctite and tighten turn buckle nuts and safety wire. Final rigging will occur with wings attached.

MECHANICAL BRAKE LEVER ASSEMBLY

Refer to **Brake Lever Assembly and Installation** parts pages.

1. Fabricate (2) bushings from the 3/8 x .058 aluminum raw stock 1/4" long.

2. Fabricate (1) wire attach rod, as per **Figure 1-5**.

3. Take the brake lever and drill out the hole shown in **Figure 1-5** to 3/8".

4. Assemble the brake lever by installing wire attach rod with park brake tab in place. Hold in place with masking tape. Attach the brake cable adjustment plate to the lever using the counter sunk screw and Loc-tite. Install adjusting ferrules (brass colored) and nut.

5. Slip lever over fwd control stitch and secure with clamp 6 ¼" down from the top of tube.

6. Route wire and cable housing and lines from lever to brakes direct as possible *with **NO** sharp bends or interference with the rudder cables and control stick.* Make gentle curves, secure with zip ties, as required.

7. Screw adjuster ferrule at each end of cables, all the way in. Secure the wire nuts to the brake lever and bend ends of wire into a tight loop. Adjust at wheel end as tight as possible without using adjuster ferrules. Be sure to Loc-tite all wire nuts. Bend wheel end of wire into a tight loop.

8. Test pull brakes. They should have **little or NO** play in the wires. Adjust as required.

9. **NOTE:** Brakes will set with first use and require adjusting. Use ferrules to adjust.

OPTIONAL HYDRAULIC BRAKE PEDAL ASSEMBLY

Refer to **Optional Hydraulic Brake Pedal Assembly and Installation** parts pages.

1. Install rudder pedals per **Rudder Pedal and Rudder Cable Assembly** directions earlier in this section.

2. Install (6) rivets into the face of each brake pedal. See **Figure 2-15**.

3. Fit brake pedal to rudder pedal per **Figure 2-15**. Use a sanding drum or de-burring tool to enlarge pivot holes as required. ***IMPORTANT:*** *Do **NOT** remove too much material.*

4. Remove inner pan head screw attaching the Aft Belly Pan Former to the pivot tube. Transfer drill 1/4" thru the belly pan former and pivot tube. See **Figure 2-16**. Drill thru both sides, level with top of fuselage cage.

5. Fabricate spacer bushings from raw stock per parts manual. Install 5/8" long spacer bushings and 1/4" eyebolts to fwd side of pivot tubes.

6. Install fittings to Brake Master Cylinders per parts page. ***NOTE:*** *Use Teflon tape or paste thread sealant.*

7. Assemble U-brackets to brake cylinders. Bolt cylinder assemblies to the brake pedals.

8. Mark where the FWD cylinders align with the FWD Rudder Pedal Pivot Tube. Drill 1/4" thru both sides, level with top of fuselage cage. Drill #30 through the fuselage bushings into the FWD Rudder Pedal Pivot Tube and rivet with a Stainless Steel rivet per the parts page.

9. Slide inner stop ring, pedal assembly and outer stop ring over rudder pedals. Bolt brake cylinders to eyebolts. Tighten bolt to allow brake cylinder to pivot on eyebolt. Hold stop rings against brake pedal, transfer drill #30 and rivet. ***IMPORTANT:*** *Brake cylinder must align with eyebolt for free movement.* ***NOTE:*** *Aft brake pedals are mounted as far outboard as possible on rudder pedals. Fwd brake pedals are mounted as far inboard as possible.* Lubricate pivot areas and check for free movement.

10. Route brake lines with **NO** sharp bends or interference with the rudder cables and control stick. See **Figure 2-17**. Make (6) 1/2" stand-offs from blue fuel line and secure brake lines to aft of gear legs with nylon ties. Tighten all fittings.

11. ***IMPORTANT:*** *Use only standard aircraft* ***Mil-H-5606 Red Hydraulic Fluid****. Improper brake fluid will ruin the brake system seals.* ***Never use automotive brake fluid!***

12. The best method to fill and bleed aircraft brakes is from the bottom up. Loosely connect a 1/8" ID clear hose (blue primer line works well) to the brake caliper bleeder screw from your brake fluid source. An oilcan used exclusively for this purpose works well. Pump the oilcan until the hose is full of fluid, with no air bubbles. Tightly secure the hose to the bleeder valve. Open the bleeder a quarter turn. Pump fluid into the system until it fills the brake cylinder reservoir. (The reservoir filler must be open during this process.) Tighten the bleeder valve, remove the hose, and re-seal the reservoir. Check your work by insuring that the reservoir is full and that you have a "hard pedal". If you have a "soft pedal", pump the brakes several times. Many times that will fix the problem. If the problem persists, drain the fluid and repeat the above process.

13. The non-asbestos organic composition brake pads require a thin layer of glazed material at the lining friction surface in order to provide maximum braking performance. This glazed layer is produced by the heat generated during normal braking operations, and is maintained during the life of the lining. Since new brake pads do not have this layer, it must be created by the following process:

    - Heat the pads by performing a full stop from 30 mph. ***CAUTION:*** *Only perform once comfortable with the aircraft.*
    - Allow brakes to cool for 5-10 minutes.
    - Test the brakes at a high static rpm run-up. If the brakes hold, break-in is complete. If they fail to hold, repeat above steps until they do.

503 ENGINE INSTALLATION

Refer to **503 Engine** and **503 Engine Mount** parts pages.

1. Assemble the barry mounts, mount plates and associated hardware to the mount angles; fuel pump installs to ST-16 tangs on right mount angle, as per parts manual. The engine mount plate, that attaches to the engine, has the center holes located offset from the centerline. Bolt these to the engine, as per **Figure 3-1**. Tighten all the bolts and inspect the mount.

2. Place three 7/16" thick washers over each mount hole where the engine studs will insert; use super glue to hold the washers in place. Place the engine onto the mount and secure with washers and nuts.

503 PROPELLER INSTALLATION

Refer to **503 Engine** parts pages.

1. Inspect the prop provided for any nicks, crack or dings. The prop comes from the factory balanced and ready to bolt on, however depending on conditions and how the prop has been stored it may not be in balance at the time of install. To balance the prop it is best to use a two-axis balancer. These are available from several Aircraft Supply stores. Place the prop on the balancer and follow method to correct balance in **Figure 3-2**.

2. Mount the propeller using the ¼" bolts provided. Note the length of the bolts is critical. Use washers to be certain the bolts are not bottomed out on the threads. **DANGER:** If bolts are bottomed out on threads, the prop is not properly torqued, separation from the aircraft during operation may occur and cause injury or death. Torque the bolt to 165 inch pounds in the pattern shown in **Figure 3-2**. Re-torque bolts after 5 hours of flight.

3. Check prop for tracking by turning blade into a vertical position. Measure from the tip of the prop to the frame, spin the prop to the next blade and check measurement. If the measurement is the same the prop is in track. If not, loosen prop bolts and re-torque until prop tracks. **HINT:** Start torquing pattern on the blade that is out of track. See **Figure 3-3**.

IMPORTANT: Consult prop manufacturer's instructions for adjusting pitch.

IMPORTANT!!

Check propellers torque every 50 hours or after large changes in climate. Wood props will shrink and expand with humidity. If you live in a climate with large changes in humidity or fly to a different climate, prop torque may change more often. Failure to maintain proper torque may result in separation of the propeller from the aircraft and may cause injury or death.

503 CARBURETOR and THROTTLE CABLE INSTALLATION

Refer to **503 Engine** and **503 Throttle and Trim Lever Installation** parts pages.

1. Slip the black rubber intake manifolds over the engine intakes. The smaller opening is the carb side of the rubber manifold. Slip on the carburetors and install the clamps. Position the carburetor's vertical to the cylinders. See the engine manufacturer's manual for details.

2. To install the throttle cables splitter unscrew each carb's top plates. 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 and in the same position on both carbs. During re-assembly note the throttle cap is not on center. Position the caps so the cable is directly over its slider position.

3. Refer to the parts manual drawing, for position & where to attach the throttle splitter. Splitter is retained to engine with (2) zip ties, secure and trim ties. Zip ties are used in favor of hose clamps, which can break and damage the propeller and airframe upon exiting.

4. Route the cables to the fwd throttle lever. Double-check to see if everything is curving gently, no sharp turns. Cut off the excess housing. Check closely the housing where you've cut it; a clean cut is a must! The metal coil inside the housing can rub the cable and cause it to break. An unclean cut of throttle cable housing can also result in sticking of the lever due to the added friction. Install the housing to the stop, and push the cable through. Install the fwd end of the cable to the throttle lever horn, securing it with the wire swivel/screw stop and Loc-tite.

5. Check the operation of the throttles, should be smooth and easy, adjust as required.

503 SINGLE CARB ENGINE INSTALLATION

Refer to **503 Engine** parts pages.

1. Put a stack of three (3) 3/8" washers over each mount hole where the engine studs will insert. Use super glue to hold the washers in place. Place the engine in position and install the loc washers and nuts. **PLEASE** get help lifting the engine into position. It is not a good idea to lift the engine alone. Torque the engine mount nuts to 15 ft/lbs. Inspect all the bolts on the engine mount for security.

2. It is necessary to remove the top plate of the carburetor to install the throttle cable. Remove the carb's top plate and the spring just underneath. Remove the white plastic spring clip, which sits just below the spring. Feed the cable through the top plate, spring, and spring clip. Insert the end of the cable into the "keyhole" shaped hole. Make sure not to dislocate the metering needle of the carb. Reinstall the white plastic spring clip, the spring, and the top plate. Notice that the top plate's hole is not in the center of the carb barrel. Orient the top plate to be in line with the cable and reinstall.

3. Attach carburetor to engine as shown. Make sure that the carb is complete seated in the boot and the carb clamps are tight. Attach air filter to carb as shown.

503 EXHAUST ASSEMBLY

Refer to **503/582 Engine** and **503/582 Muffler Mount** parts pages.

1. Install the exhaust manifold as shown. Apply blue Loc-tite to the 10mm shoulder screws which hold the manifold in place.
   503/582 Engines: **IMPORTANT:** Consult operator's manual for instructions on re-torqueing exhaust manifold after break-in. This will prevent leaks and increase engine life.

2. The muffler mount uses (3) or (4) of the top 8mm bolt locations to mount the plates. Look at the parts manual to determine these locations. Unscrew the three existing 8mm bolts that will be replaced by the longer 8mm bolts. Install the FWD and AFT mount plates as shown for your specific engine. Use loc washers and apply a drop of blue Loc-tite to each bolt before insertion.

3. Check the ¾" 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 ¾" holes and assemble the muffler to the mount as shown in **Figure 3-4**. 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.

4. Install the muffler using the springs provided. **Safety wire** springs in place. Apply a bead of silicone to the springs to arrest any high frequency vibrations. See **Figure 3-4**.

503 MANUAL STARTER

Refer to **503 Engine** parts pages.

1. Before or after installing the engine turn starter so the handle/rope exits the left hand side bottom, see **Figure 3-5**.

2. Un-do the handle from the rope and lace rope through the pulley and re-tie the handle to the rope. Bolt the pulley assembly to the diagonal tube on the left hand side of the cage approximately 9" below starter. Place pulley assembly directly below the rope exit point, see **Figure 3-6**.

503 IGNITION SWITCHES

Refer to **503 Engine** parts pages.

1. The ignition switches are located near the control stick in the front seat. Install the guard with the switches to prevent inadvertent power loss, see **Figure 3-7**.

503 ELECTRICAL WIRING

Refer to **503 Engine** parts pages.

1. Install wiring as per schematic in parts manual. Use common methods of routing, protecting and supporting the wire bundle.

   - Route wires away from fuel lines.
   - Retain wires in a bundle with zip ties.
   - Cover wire bundle with an appropriate loom material.
   - Route to avoid entanglement or conflict with controls and other moving parts.
   - Use anti-chafe spiral where needed for protection.
   - General routing runs from engine to instrument panel via the fuselage frame.

582 ENGINE INSTALLATION

Refer to **582 Engine** and **582 Engine Mount** parts pages.

1. Assemble the barry mounts, mount plates and associated hardware to the mount angles; fuel pump installs to ST-16 tangs on right mount angle, as per parts manual.

2. Place three 7/16" thick washers over each mount hole where the engine studs will insert; use super glue to hold the washers in place. Place the engine onto the mount and secure with washers and nuts.

582 PROPELLER INSTALLATION

Refer to **582 Engine** parts pages.

1. Consult prop manufacturer's instructions for installation and adjusting pitch. See **FIGURE 3-3**, for prop tracking.

IMPORTANT!!

Check propellers torque every 50 hours or after large changes in climate. Wood props will shrink and expand with humidity. If you live in a climate with large changes in humidity or fly to a different climate, prop torque may change more often. Failure to maintain proper torque may result in separation of the propeller from the aircraft and may cause injury or death.

582 CARBURETOR and THROTTLE CABLE INSTALLATION

Refer to **503 Engine** and **582 Throttle and Trim Lever Installation** parts pages.

1. Slip the black rubber intake manifolds over the engine intakes. The smaller opening is the carb side of the rubber manifold. Slip on the carburetors and install the clamps. Position the carburetor's vertical to the cylinders. See the engine manufacturer's manual for details.

2. To install the throttle cables splitter unscrew each carb's top plates. 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 and in the same position on both carbs. During re-assembly note the throttle cap is not on center. Position the caps so the cable is directly over its slider position.

3. The throttle splitter will be zip tied to the oil injection tank mount. See **Figure 3-9**.

4. Route the cables to the fwd throttle lever. Double-check to see if everything is curving gently, no sharp turns. Cut off the excess housing. Check closely the housing where you've cut it; a clean cut is a must! The metal coil inside the housing can rub the cable and cause it to break. An unclean cut of throttle cable housing can also result in sticking of the lever due to the added friction. Install the housing to the stop, and push the cable through. Install the fwd end of the cable to the throttle lever horn, securing it with the wire swivel/screw stop and Loc-tite.

5. Check the operation of the throttles, should be smooth and easy, adjust as required.

582 EXHAUST ASSEMBLY

Refer to **582 Engine** and **582 Muffler Mount** parts pages.

1. Install the exhaust manifold as shown. Apply blue Loc-tite to the 10mm shoulder screws, which hold the manifold in place.
   503/582 Engines: **IMPORTANT:** Consult operator's manual for instructions on re-torqueing exhaust manifold after break-in. This will prevent leaks and increase engine life.

2. The muffler mount uses four of the top 8mm bolt locations to mount the plates. Look at the parts manual to determine these locations. Unscrew the four existing 8mm bolts that will be replaced by the 8mm studs, then install the (4) stand offs, use Loc-tite to secure. Install the FWD and AFT mount plates as shown. Use loc washers and apply a drop of blue Loc-tite to each bolt before insertion.

3. Check the ¾" holes in the ends of the mounts for burrs. Remove any burrs around the hole edges to prevent wearing of the rubber muffler barry mounts. Insert the barry mounts into the ¾" holes and assemble the muffler to the mount as shown in **Figure 3-4**. 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.

4. Install the muffler using the springs provided. **Safety wire** springs in place. Apply a bead of silicone to the springs to arrest any high frequency vibrations. See **Figure 3-4**.

582 MANUAL STARTER

Refer to **582 Engine** parts pages.

1. Before or after installing the engine turn starter so the handle/rope exits the left-hand side bottom, see **Figure 3-5**.

2. Un-do the handle from the rope and lace rope through the pulley and re-tie the handle to the rope. Bolt the pulley assembly to the diagonal tube on the left-hand side of the cage approximately 9" below starter. Place pulley assembly directly below the rope exit point, see **Figure 3-6**.

582 IGNITION SWITCHES

Refer to **582 Engine** parts pages.

1. The ignition switches are located near the control stick in the front seat. Install the guard with the switches to prevent inadvertent power loss, see **Figure 3-7**.

582 ELECTRICAL WIRING

Refer to **582 Engine** parts pages.

1. Install wiring as per schematic in parts manual. Use common methods of routing, protecting and supporting the wire bundle. **Figure 03-9A**.

   - Route wires away from fuel lines.
   - Retain wires in a bundle with zip ties.
   - Cover wire bundle with an appropriate loom material.
   - Route to avoid entanglement or conflict with controls and other moving parts.
   - Use anti-chafe spiral where needed for protection.
   - General routing runs from engine to instrument panel via the fuselage frame.

OPTIONAL 582 OIL INJECTION TANK AND MOUNT

Refer to **582 Oil Injection Tank and Mount Assembly** parts pages. The oil injection tank sits above the engine, supported by the oil tank mount.

1. Press ¾" inch isolators into mount sleeves; press 7/16" isolators into ¾" isolators (apply a small amount of dish soap to ease assembly). Isolators should be flush with each other and centered within the sleeves.

2. Locate bosses on sides of magneto housing (aft end of engine). Place mount on engine, when properly oriented, sleeves will cover both 8mm holes of each boss. Drill out 3/16" washers to accommodate 8mm bolts; slip washers over bolts, apply Loc-tite, insert through isolators and tighten.

3. Cut 7/16" black fuel line into two 6" segments, split lengthwise and center on cross members of mount, where tank will contact. Refer to **Figure 03-10**.

4. Locate and drill a ½" hole in the bottom of oil tank as shown in **Figure 03-11**. Carefully deburr the hole and remove all debris from the tank. Take care not to bevel or enlarge while deburring.

5. Insert a rigid wire (an untwisted coat hanger will do) through the ½" hole and out the filler neck. Install an O-ring on the tank withdrawal fitting and slide the fitting onto the wire. Bend the wire sharply near the end to form a hook to retain the fitting; pull the fitting through the tank and into the ½" hole. Slide a rubber washer and ½" thick washer down the wire and onto the fitting; slide the nut-flared tube bulkhead down the wire, apply Loc-tite and thread onto the fitting. Remove the wire. Insert a ¼" Allen wrench into the fitting to hold it while tightening the tube bulkhead. *Do not allow the fitting to rotate while tightening; leaks may occur otherwise.* Apply thread sealant or Loc-tite to the

90-degree withdrawal fitting and install in tank fitting. Again, *do not allow the tank fitting to rotate.* See **Figure 03-11**.

6. Install tank on mount as shown in **Figure 03-12** and secure with clamps and hardware as shown in Parts Manual.

7. Determine oil line routing and cut the 5/16" fuel line to suit. Fit one segment between the tank withdrawal fitting and the oil filter. **IMPORTANT**: The arrow on the filter case shows the necessary direction of flow; orient the filter accordingly. Fit another segment between the filter and the engine's oil injection pump. Secure connections with small hose clamps.

8. Remove the rubber gasket and plastic baffle from the fuel cap. The plastic baffle will "snap" out of the fuel cap; a screw driver works well for the removal. Locate and drill a ¼" hole in the center of the fuel cap as shown in **Figure 03-13**. Install the conduit adjuster assembly in the fuel cap. Apply a small drop of Loc-tite, install the ¼" plain nut and tighten to secure the assembly to the cap. See **Figure 03-13**.

9. With a side cutters or file remove the attach nipples from the plastic baffle. See **Figure 03-13**. Drill a ¼" hole in the center of the plastic baffle and install into the fuel cap over the adjuster assembly stem. Drill a ¼" hole in the center of the rubber gasket and install into the cap. Note the orientation of the rubber gasket. Drill the ¼" large wood washer as shown in **Figure 03-13**. Assemble the bead chain to the bead chain retainer sleeve. Install the bead chain and retainer sleeve into the #30 hole in the large wood washer. Install the washer and bead chain into the fuel cap. Install the ¼" shear nut on the adjuster assembly stem and tighten.

10. Install the bead chain end coupling onto the bead chain. Find the center of the plastic retainer and drill a #30 hole. Using the brass-backing washer, rivet the plastic retainer to the bead chain. Refer to the Parts Manual.

11. Modify the vent tube as shown in **Figure 03-13**. Install the vent tube into the adjuster assembly. Install the fuel cap assembly onto the tank and tighten. Position the vent tube so that the 45-degree angle is pointing forward (into the slipstream) and tighten the assembly cap to secure the vent tube.

12. Check all clamps and fittings, apply anti-chafe where necessary and secure all lines. **IMPORTANT:** Always check the oil tank and mount before **EACH** flight. An empty oil tank can destroy an engine; **ALWAYS** check the oil level before flying.

13. Install the oil injection cable to the injector actuation arm using the hardware shown in the parts manual. At an idle setting the mark on the arm should line up with the mark on the injector body. This should also be idle setting on the carburetors. Adjust the wire swivel stop/screw as required. See **Figure 03-14**.

582 COOLING SYSTEM

Refer to **582 Cooling System** parts pages.

1. Select parts depicted in parts drawing. Assemble the radiator cowl by clecoing the top panel to the side pieces at the pre-drilled holes.

2. Locate and drill holes into the two small angles as per **Figure 03-14A**, and cleco in place.

3. Leading edge of radiator cowl is attached using nut plates. To locate nut plates, place leading edge on radiator cowl so it is flush at front and resting on the small angles on each side and overlaps the first louver by 3/8" to ½". See **Figure 03-14B.**

4. Rivet the two angles to the leading edge.

5. Remove clecos and drill remaining holes out to #11. Remove leading edge and install nut plates as in **Figure 03-14C.** Test fit the leading edge; remove and paint to match skin color if desired.

6. Apply foam seals to radiator sides, see **Figure 03-15**. Assemble radiator to cowl as per parts drawing. Use spacers to hold out sides of radiator, as per **Figure 03-16**. **IMPORTANT:** Radiator bolts to cowl with inlet/outlet aft.

7. Install the trim-loc to the bottom edges of the radiator cowl. Drill FWD mount as per **Figure 03-17**.

582 PREPARING the CENTER COVER for the RADIATOR COWL

Refer to **582 Cooling System** parts pages. At this point the center cover should be assembled to the keel. (Refer to Section 01 - Center Cover Assembly)

1. Cut square rib tube as shown in **Figure 03-18**. **HINT:** Lay tape measure on top for accuracy.

2. Radius the fwd end of ½" square rib tube. On the aft end, drill a #30 hole at 3/8" edge distance on centerline of ½" square tube. Cleco in place. See **Figure 03-18**.

3. Place the fwd radiator cowl mount angle under fwd center cover mount. Tape in place to hold while drilling #30 holes, as per **Figure 03-19**.

4. Cleco the rib, angle and center cover into place. Drill into rib using pre-drilled holes in center cover panel. Cleco, deburr and rivet rib and angle into place.

582 MOUNTING RAD COWL - RADIATOR ASSEMBLY

Refer to **582 Cooling System** parts pages.

1. Drill out rivet (if one is installed) at 2 ½" aft of rivet "A", see **Figure 03-20**. Drill thru #11 for radiator cowl fwd attach bolt.

2. Cleco radiator cowl assembly to the center cover at pre-drilled holes at the rear. **NOTE:** "Z" strip aft radiator seal should be riveted to the ½" tube on rear or radiator.

3. Rivet aft "Z" strip in place. **NOTE:** Sides of radiator cowl should dip slightly below but follow the contour of the center cover.

4. Use Trim Tab Hinge as a Reinforcement Angle. Locate the angle inside the cowling side, 1 1/8" from the front. Transfer drill #11 the cowling and center wrap. Bolt and rivet, refer to FIGURE **3-20**.

582 COOLING SYSTEM - FINAL ASSEMBLY

Refer to **582 Cooling System** parts pages.

1. Assemble filler tee and coolant recovery bottle to the mounting angle as shown in **Figure 03-22** and bolt assembly to the muffler mount with filler tee on left hand side.

2. Assemble reducer couplings to radiator inlets as in **Figure 03-23**.

3. Remove coolant inlet fitting off the top right-hand side of the engine and replace with the provided straight fitting. Attach elbow "C" to fitting. Point it FWD and down ten degrees. Install aluminum coolant tube as per parts drawing between engine and radiator. See **Figure 03-24**.

4. Using the last two segments of the formed hose, "D" and "E", and the C-shaped aluminum tube; assemble as shown in **Figure 03-25**. Also connect small black hose from engine nipple to filler tee. **NOTE**: If engine nipple is FWD, remove and install in AFT hole.

5. Run a short segment of clear 5/16" hose from filler tee overflow to coolant recovery bottle. Run ¼" blue fuel line from recovery bottle down left hand side of oil injection mount and into black cordura hose jacket on right hand side the cage.

6. Double check routing of lines against **Figure 03-26**. Tighten all clamps; make sure all lines, hoses, tubes and stand offs are securely in place. Add a 50/50 mix of distilled water and an antifreeze approved for aluminum block engines. **NOTE**: After radiator is full and screw is replaced, open bleed screw on FWD right hand side of radiator to assure a full FWD fill to top of filler tee.

TEST RUNNING THE COOLING SYSTEM

The cooling system is effected by prop; ambient air temps, gross weight, and localized aerodynamics. To obtain best performance from the cooling system it helps to understand how these variables interact. Please use the following information when setting up for the break-in and first flights to avoid cooling system problems.

COOLANT AND FILLING

Use distilled water and mix equal parts of anti-freeze for alum blocks. Before filling remove the rad cowl leading edge and the venting screw. The venting screw should be seated in silicon caulk, if not apply a high-grade silicon caulk to screw and install. Let cure 24 hours prior to filling system. Fill the system through the filler Tee located at the top of the engine. Close the venting screw on the front and install the leading edge.

AIRFLOW

Because of the location of the rad, test run the engine with at least a 15MPH headwind, or direct a self-standing fan to blow air over the rad.

START-UP and BREAK -IN

Read and follow the engine manufactures recommendations for starting and break in. The break in is usually an hour of static running. This is to prove the integrity of all engine systems, cooling included. During this time check all systems:

1. **Throttle**: check for smooth operation. No slack should be in the cables. The friction should be enough to hold the throttle position, but not be hard to operate. Check the range of motion; be sure you are getting full power. Removing the air cleaner and looking into the carb opening to see if the slider is up all the way at wide- open throttle checks this.

2. **Oil Injection**: If you opted for this system, check all hose connections for kinks and leaks. Make sure oil tank is full and the cap is secure before starting. Typically the oil tank can be topped off every other fuel fill. Monitor the oil level closely and include a level check in your pre-flight.

3. **Cooling System**: Check for leaks and kinks in the lines. Check all hose clamps before starting and after the break-in. It is a good idea to check hose clamps every few hours. If you store the plane outdoors buy an engine canopy cover, it will save the hoses from ultraviolet rays. UV degrades the hoses, tires and the fabric cover of the plane, so a lot of sun will mean more up-keep if no prevention is in force. Indoor storage and clear coating the skins go a long way to preserving your plane and providing many years of service.

4. **Fuel System**: The fuel system has a single shut off valve, be sure this is all the way open prior to starting and flight. Drain the sump to remove sediment and water from the fuel system. When fueling use a water filter or chamois to keep water from entering the system. Use only the recommended fuels avoid fuels with ether based additives and alcohol.

5. **Setting Propeller Pitch**: If the plane is equipped with a ground adjustable propeller, the pitch will need to be set to produce 6200 to 6300 static. Set pitch by running engine and checking RPM. As the break-in progresses the pitch may need adjusted.

If using a wood prop and static RPM is not in the required range, the prop maker will have to re-pitch the prop or exchange it for a better match.

Density altitude plays a big part in adjusting the prop to the engine. Expect to re-adjust if settings are done on a hot day or very cold day. Finding the perfect year round setting may take some time, and a number of test flights.

6. **Test Flying Prop Settings**: Use great care when test flying new or initial prop settings. Flying the first time on a new prop you want to be in the range of RPM to be safe to fly. If the prop has too much pitch the plane will take too long to take off and have little climb. Flying with too much pitch can be dangerous since climb is compromised! Doing your test flights at an airport with plenty of runway will add tremendous safety. Flying with too little pitch is like driving in a low gear. It can overheat the engine and force you to fly dangerously close to the stall speed. Again, having lots of runway can help. The best approach is not to invite the problem and set the prop in the static range required.

7. **Trusting the RPM Gauge**: Don't! Borrow a strobe tach and make sure you know the error in the gauge before you fly. Note the error on the panel so you are always aware of the true RPM you are flying with. Gauges of all types are not to be taken for granted verify the readings on the more critical gauges such as RPM, airspeed, and temp.

8. **Trouble Shooting**: Despite all the effort you may have a hot runrıing engine. In addition to the factors we have discussed, the engine itself can present challenges. If you have a hot running engine trouble shoot from the simple to the complex. Some engines will run hot for the first few hours, and it may require less aggressive climbs or lighter loads for the first 10 to 15 hours.

    a. Check coolant level and signs of leakage.
    b. Check for obstructions in the rad cowl.
    c. Check if the seals on the rad cowl are in place.
    d. Check temp gauges and ranges of operation called out in engine manual.

9. **Maintaining Your Cooling System**: Once the system is up and running it requires only the up keep the engine manual calls out plus the common sense of changing out hoses and keeping the rad clean. Hoses are effected by air born pollution and UV and depending on where you live the frequency will vary. Keep up with your pre-flight and annual inspections to assure your cooling system ready.

912 ENGINE INSTALLATION

Refer to **912 Engine** and **912 Engine Mount** parts pages.

1. Assemble the Barry mounts, mount angles and associated hardware to the mount angles, as per parts manual.

2. Cut the 3/8" aluminum spacer bushing to fit tight between the engine mount angles. Align with 1/4" holes in engine mount plates.

3. Rotate the water pump inlet housing to the 2 o'clock position as viewed from the pump end of the engine.

4. Remove the aft (prop end) cylinder head coolant lines and replace with "S" shaped hoses to clear engine barry mounts.

5. Move the oil withdrawal fitting on the bottom of the engine from the center position to the aft position. This will assure proper oil circulation on start-up. Failure to route the oil lines properly will result in engine failure. Refer to the Rotax Engine Manual.

6. Attach the torsion struts and fwd mount strap to the mount angles. The lower ends of the torsion struts attach to the outside of the welded bushings at the lower ends of the aft and middle diagonal cage tubes. See **FIGURE 3-27**. Once both ends are bolted in place, drill 3/16" and bolt. Place the engine into the mount and secure with 10 MM bolts, loctite and loc-washers.

912 PROPELLER INSTALLATION

Refer to **912 Engine** and **912 Prop** parts pages.

1. Consult prop manufacturer's instructions for installation and adjusting pitch. See **FIGURE 3-3**, for prop tracking.

IMPORTANT!!

Check propeller bolt torque as specified by propeller manufacturer. Failure to maintain proper torque may result in separation of the propeller from the aircraft and may cause injury or death. Wood props will shrink and expand with humidity. Check propellers torque every 50 hours or after large changes in climate. If you live in a climate with large changes in humidity or fly to a different climate, prop torque may change more often.

912 CARBURETOR and THROTTLE CABLE INSTALLATION

Refer to **912 Engine** and **912 Throttle and Trim Lever Installation** parts pages.

1. Make sure the carburetors are completely seated in the rubber boots and carb clamps are tight. The carburetors must be positioned vertical to the cylinders. Attach air filters to carburetors and safety wire. See the engine manufacturer's manual for details.

2. Route the throttle cable and housing, including cable ferrule caps, to the throttle lever. Route the cables to the fwd throttle lever. Double-check to see if everything is curving gently, no sharp turns. Cut off the excess housing. Check closely the housing where you've cut it; a clean cut is a must! The metal coil inside the housing can rub the cable and cause it to break. Unclean cut throttle cable housing can also result in sticking of the lever due to the added friction. Install the housing to the stop, and push the cable through. **HINT:** To keep the trimmed ends of the cables from fraying use a dab of super glue. Install the fwd end of the cable to the throttle lever horn, securing it with the wire swivel/screw stop and Loc-tite.

3. Be sure that the throttle cables actuate the carbs equally and simultaneously. The carb throttle arms must be synchronized. **Notice:** There is a stop for the full throttle position on the carb. **HINT:** Synchronize the throttle arms using the stop and the slot in the throttle arms. If necessary adjust with the throttle adjust ferrule. Check the operation of the throttles. Movement should be smooth and easy. Adjust as required. Set the stops on the forward throttle lever.

4. Locate and install the choke cable hardware as shown in **FIGURE 3-28**. Modify the mixer plate as shown in **Figure 3-29**. Install the cables using the hardware shown in the parts manual. Cable housing and cable will need to be cut to correct length. **HINT:** To keep the trimmed ends of the cables from fraying use a dab of super glue. Apply Loc-tite to secure wire nuts used on throttle and choke cables.

5. Drill a 3/8" hole in the Forward Control Stick Panel near the aft right side. Refer to parts page for detail. Install the Choke Control Cable near the front seat. Install the Beveled Washers to allow the choke knob to point aft toward the pilot seat. Route the cable under the forward seat and up the forward fuselage support to the keel. Use a Cushioned Tube Clamp to retain the cable. See parts page for detail. Route cable to the Choke Cable Stop. Trim the control housing and choke wire to length. Attach and secure the choke wire to the bottom hole in the Choke Pivot Arm with a wire swivel stop.

6. Safety-wire the ends of all cable housings to their respective mounts. This will prevent housings from pushing out of the ferrules.

7. Route the fuel lines as shown in the parts manual. Route from the output of the fuel pump to the brass tee and then to each carburetor. Fasten fuel lines using the hardware shown. Routing of the fuel supply line takes place in the fuel system detail.

912 EXHAUST ASSEMBLY

Refer to **912 Engine** and **912 Muffler Mount** parts pages.

1. Select the parts depicted in the parts manual.

2. Profile and polish inside all lower exhaust pipes, where they attach to the engine. See **Figure 3-29A. CAUTION:** Do **NOT** grind past the inner surface or weld may be compromised.

3. Install the muffler mount angle to the backside of the gear box as shown in the parts manual. The muffler mount angle bolts to the lower set of holes on the accessory side of the gear box. Install the rubber isolators to the muffler. Attach the muffler and rubber isolators to the muffler mount angle using the hardware shown in the parts manual. **NOTE:** Apply loctite to the studs on both ends of the rubber isolators. **IMPORTANT:** T*he muffler canister must be oriented with the exhaust port on the aircraft's right-hand side.* Safety wire the muffler to the gear box using the mounts on the lower side of the muffler.

4. Install the exhaust manifolds as shown in the parts manual. Trim the pipes to length. Refer to **FIGURE 3-29B** and **FIGURE 3-29C**. When installed the muffler canister must rest on the rubber isolators. The isolators should not be stretched or distorted, as early failure will result.

5. Re-route and secure sparkplug wires away from the exhaust pipes.

912 IGNITION SWITCHES

Refer to **912 Instruments and Electrical** parts pages.

1. The ignition (MAG) switches are located near the front seat control stick. Install the guard with the switches to prevent inadvertent power loss, see **Figure 3-7**.

912 ELECTRICAL WIRING

Refer to **912 Instruments and Electrical** parts pages.

1. Install wiring as per schematic in parts manual. Use common methods of routing, protecting and supporting the wire bundle. Refer to **Figure 3-30**.

   - Route wires away from fuel lines.
   - Retain wires in a bundle with zip ties.
   - Cover wire bundle with an appropriate loom material.
   - Route to avoid entanglement or conflict with controls and other moving parts.
   - Use anti-chafe spiral where needed for protection.
   - General routing runs from engine to instrument panel via the fuselage frame.

912 Battery Box Installation

Refer to **912 Battery Box Installation** parts pages.

1. Drill one hole in the support angles and the corresponding hole in the side plate to #30 and rivet the support angles to the side plate. Transfer drill #30 through the second hole of the side plate and support angle and rivet. Refer to the parts drawing.

2. Position the front side of the side plate flush with the mount plate. Transfer drill #30, using the mount plate as a guide, through the three side holes in the mount plate into the side plate. Cleco as you drill. Rivet the side plate to the mount plate through the top two (2) #30 holes only. Slide the battery into the box and pull the opposite (loose) side of the side plate in tight to the battery. Using the mount plate as a guide, transfer drill #30 through the mount plate into the side plate and Cleco. Rivet only the middle hole on the aft end of the battery box.

3. Drill the remaining holes to #11. Position the battery box on the cage using the cushioned clamps and bolt in place. **NOTE:** The aft and fwd bottom cushioned clamps will set the position of the battery box. Position the remaining cushion clamp. Mark the box using the clamp as a guide. Drill the mount hole to #11 and bolt in place.

4. Install the battery, battery bar and cotter pins. Refer to **912 Instruments and Electrical** for wiring.

912 COOLING SYSTEM

Refer to **912 Cooling System** parts pages.

1. Select parts depicted in parts drawing. Assemble the radiator cowl by clecoing the top panel to the side pieces at the pre-drilled holes.

2. Locate and drill holes into the two small angles as per **Figure 3-14A**, and cleco in place.

3. Leading edge of radiator cowl is attached using nut plates. To locate nut plates, place leading edge on radiator cowl so it is flush at front and resting on the small angles on each side and overlaps the first louver by 3/8" to 1/2". See **Figure 3-14B.**

4. Rivet the two angles to the leading edge.

5. Remove clecos and drill remaining holes out to #11. Remove leading edge and install nut plates as in **Figure 3-14C.** Test fit the leading edge; remove and paint to match skin color if desired.

6. Apply foam seals to radiator sides. see **Figure 3-15**. Assemble radiator to cowl as per parts drawing. Use spacers to hold out sides of radiator, as per **Figure 3-16**. **IMPORTANT:** Radiator bolts to cowl with inlet/outlet aft.

7. Install the trim-loc to the bottom edges of the radiator cowl. Drill FWD mount as per **Figure 3-17**.

912 PREPARING the CENTER COVER for the RADIATOR COWL

Refer to **912 Cooling System** parts pages. At this point the center cover should be assembled to the keel. (Refer to Section 01 - Center Cover Assembly)

1. Cut square rib tube as shown in **Figure 3-18**. **HINT:** Lay tape measure on top for accuracy.

2. Radius the fwd end of the 1/2" square rib tube. On the aft end, drill a #30 hole at 3/8" edge distance on centerline of 1/2" square tube. Cleco in place. See **Figure 3-18**.

3. Place the fwd radiator cowl mount angle under fwd center cover mount. Tape in place to hold while drilling #30 holes, as per **Figure 3-19**.

4. Cleco the rib, angle and center cover into place. Drill into rib using pre-drilled holes in center cover panel. Cleco, deburr and rivet rib and angle into place.

912 MOUNTING RADIATOR COWL - RADIATOR ASSEMBLY

Refer to **912 Cooling System** parts pages.

1. Drill out rivet (if one is installed) at 2 ½" aft of rivet "A", see **Figure 3-20**. Drill thru #11 for radiator cowl fwd attach bolt.

2. Cleco radiator cowl assembly to the center cover at pre-drilled holes at the rear. **NOTE:** "Z" strip aft radiator seal should be riveted to the 1/2" tube on rear of radiator.

3. Rivet aft "Z" strip in place. **NOTE:** Sides of radiator cowl should dip slightly below but follow the contour of the center cover.

4. Use Trim Tab Hinge as a Reinforcement Angle. Locate the angle inside the cowling side, 1 1/8" from the front. Transfer drill #11 the cowling and center wrap. Bolt and rivet, refer to FIGURE **3-20**.

912 COOLING SYSTEM - FINAL ASSEMBLY

Refer to **912 Cooling System** parts pages.

1. Mount coolant recovery bottle to the oil tank hose clamps when mounting the oil tank

2. Assemble reducer couplings to radiator inlet and outlet. See **Figure 3-23**.

3. Cut formed hoses as shown in **Figure 3-31**. Assemble segments **"A"** and **"C"** to the reducer couplings. Refer to **Figure 3-23**. **NOTE:** Segment **"C"** runs directly to the filler/expansion tank on top of the engine.

4. Push hose segment **"B"** over the water pump inlet. Connect segments **"A"** and **"B"** with the Aluminum Union

5. Run a short segment of clear 5/16" hose from the filler/expansion tank overflow to the coolant recovery bottle. Run 1/4" blue fuel line from the recovery bottle, down the left hand oil tank mount

and into black cordura hose jacket on right hand side the cage. Secure the overflow line to the cage and exit below the tail boom.

6. Double check routing of lines. Tighten all clamps; make sure all lines, hoses, tubes and stand offs are securely in place. Add a 50/50 mix of distilled water and antifreeze approved for aluminum block engines. ***NOTE****: After radiator is full, open bleed screw on FWD right hand side of radiator to assure a full FWD fill to top of filler/expansion tank and coolant recovery bottle.* ***HINT:*** *Raise the tail to allow fluid to fill the entire radiator.* Check and refill coolant level after running the engine.

912 OIL TANK & OPTIONAL COOLER MOUNT

1. The oil tank mounts forward of the engine, approximately 10 1/2" from the aft end of the keel. The oil tank mounts should be located against the center cover aft wrap, flush with the bottom of the keel. Locate and drill 3/16" holes for the mount angles. Make sure the mount angles are perpendicular to the keel tube. After installation, it may be necessary to tweak the mounts forward in order to obtain clearance between the oil bottle and the engine. ***HINT:*** *Slightly straightening the inboard curved section in a padded vise.*

2. Trim the left oil tank mount as required to clear the water pump inlet fitting by at least 1/4". See **FIGURE 3-32**.

3. Attach the oil tank and cooler assembly to the mounts using the hose clamps shown in the parts manual. Install the fittings as shown in the parts manual. ***IMPORTANT:*** *The pickup fitting is the fitting (OUT) that enters straight into the top of the oil bottle and* ***MUST*** *route to the oil pump just below the engine gearbox.* ***NOTE:*** *If installing the optional oil cooler, route the pickup line to the top of the oil cooler.* The bottom oil cooler line will route to the oil pump. ***CAUTION:*** *There are two types of oil line used. It is important to use the correct line in the correct location to prevent oil pump & engine damage. The Suction Line is very stiff when compared to the Return Line.*

4. The return fitting is the angled fitting (IN) on the oil bottle and **MUST** route to the fitting on the bottom of the engine. ***IMPORTANT:*** *Refer to the Rotax engine manual, it states that the oil withdrawal fitting on the bottom of the engine needs to be moved to the aft position on pusher type aircraft, to assure proper oil circulation on start-up.* ***NOTE:*** *The Banjo Fitting will replace the UNF fitting on the bottom of the engine.* Failure to route the oil lines properly will result in engine failure. ***CAUTION:*** *There are two types of oil line used. It is important to use the correct line in the correct location to prevent oil pump & engine damage.* ***IMPORTANT:*** *When tightening fittings, back up with the proper wrench to prevent damage.*

5. Cut the oil line to the length required and install with hose clamps. ***NOTE:*** *The Suction Line does not require hose clamps when used with the supplied fittings.* ***IMPORTANT:*** *The Return Line requires hose clamps.* Refer to the parts manual and the Rotax engine manuals. ***HINT:*** *To install the fittings to the oil line, place the fitting in a padded vise and push the line onto the fitting.* Double-check all hose clamps. Fill the oil cooler with oil using a syringe or funnel before engine start-up. Apply anti-chafe where necessary and secure all lines.

IMPORTANT!!

Information pertaining to the engine is to be used as a basic guide only. Refer to the ROTAX 912 Operator's manual for more detailed information. Read and follow the engine manufactures recommendations for starting, break-in and operation.

912 ENGINE TEST RUNNING

The cooling system is effected by prop; ambient air temps, gross weight, and localized aerodynamics. To obtain best performance from the cooling system it helps to understand how these variables interact. Please use the following information when setting up for the break-in and first flights to avoid cooling system problems.

COOLANT AND FILLING

Use distilled water and mix equal parts of anti-freeze for aluminum blocks. Before filling remove the radiator cowl leading edge and the venting screw. The venting screw should be seated in silicon caulk, if not apply a high-grade silicon caulk to screw and install. Let cure 24 hours prior to filling system. Fill the system through the filler/expansion tank located on top of the engine. Close the venting screw on the front and install the leading edge.

AIRFLOW

Because of the location of the radiator, test run the engine with at least a 15MPH headwind, or direct a self-standing fan to blow air over the radiator.

START-UP and BREAK -IN

Read and follow the engine manufactures recommendations for starting and break in. This is to prove the integrity of all engine systems, cooling included. During this time check all systems:

1. **Throttle:** check for smooth operation. No slack should be in the cables. The friction should be enough to hold the throttle position, but not be hard to operate. Check the range of motion; be sure you are getting full power. **NOTE:** Pushing forward on the throttle lever opens the carb throttle. Check the throttle arms to be sure they stop against the full-throttle and idle stops and are synchronized.

2. **Cooling System:** Check for leaks and kinks in the lines. Check all hose clamps before starting and after the break-in. It is a good idea to check hose clamps every few hours.

3. **Oil System:** Prior to starting the engine for the first time, install a new oil filter and fill the oil bottle to the full line on the dip stick. Refer to the Rotax manuals for oil specifications. Remove the top spark plugs on all four cylinders. Verify the mag switch positions to **OFF** (mags grounded). Turn the prop through several revolutions by hand. With the spark plugs out and from the pilot's seat, turn the key switch to the start position and crank the engine for several seconds. Check for an oil pressure indication on the gauge. If after several seconds there is no sign of oil pressure, stop cranking the engine. Remove the oil pick up line at the oil bottle. Using a funnel or syringe prime the oil line to the pump. Attach the pick up line to the oil bottle and crank the engine. When an oil pressure indication is achieved, stop cranking. Install the spark plugs and start the engine. Watch the oil pressure gauge as the engine starts. At the moment the engine starts, allow 10 seconds for oil pressure to come up. If there is no pressure indication within 10 seconds, shut the engine off and repeat the previous procedures. The engine will change sound (quieter) as the oil starts pumping. After running the engine for a few minutes, check the oil level and check for any leaks in the system.

4. **Checking Oil:** Prior to oil check, remove the oil filler cap, turn the prop by hand several times to pump oil from the engine into the oil tank. **CAUTION:** Be sure mag switches are **OFF** (mags grounded). When all oil has been pumped from the engine into the oil tank a "gurgling" sound will be heard. The oil level should be between the minimum and maximum marks. Refer to ROTAX 912 Operator's Manual for more detail.

5. **Fuel System:** The fuel system has a single shut off valve, be sure this is all the way open prior to starting and flight. Drain the sump to remove sediment and water from the fuel system. When fueling use a water filter or chamois to keep water from entering the system. Use only the recommended fuels. **CAUTION:** Avoid fuels with ether-based additives and alcohol.

6. **Setting Propeller Pitch:** The pitch of ground adjustable propellers will need to be set to produce 5300 to 5400 static. Set pitch by running engine and checking RPM. 9 to 10 degrees of pitch is a good starting point. **IMPORTANT:** Be sure to tie the aircraft down securely. A loose aircraft at full power is an unfortunate and sometimes expensive way to complete your project. As the engine breaks-in the pitch may need adjusted. Density altitude plays a big part in adjusting the prop to the engine. Expect to re-adjust if settings are done on a hot day or very cold day. Finding the perfect year round setting may take some time, and a number of test flights.

7. **Test Flying Prop Settings:** Use great care when test flying new or initial prop settings. Flying the first time on a new prop, you want to be in the range of RPM to be safe to fly. If the prop has too much pitch the plane will take too long to take off and have little climb. Flying with too much pitch can be dangerous since climb is compromised! Doing your test flights at an airport with plenty of runway will add tremendous safety. Flying with too little pitch is like driving in a low gear. It can overheat the engine and force you to fly dangerously close to the stall speed. Again, having lots of runway can help. The best approach is not to invite the problem and set the prop in the static range required. Ideally, the propeller will be set for 5500 to 5600 at full power in straight and level flight.

8. **Trusting the RPM Gauge:** Don't! Borrow a strobe tach and make sure you know the error in the gauge before you fly. Note the error on the panel so you are always aware of the true RPM you are flying with. Gauges of all types are not to be taken for granted, verify the readings on the more critical gauges such as RPM, airspeed, and temp. Verify RPM gauge dip-switch settings. RPM gauges may be adjusted with the potentiometer accessible through the side of the gauge.

9. **Trouble Shooting:** Despite all the effort you may have a hot running engine. In addition to the factors we have discussed, the engine itself can present challenges. If you have a hot running engine, trouble shoot from the simple to the complex. Some engines will run hot for the first few hours, and it may require less aggressive climbs or lighter loads for the first 10 to 15 hours.

    1. Check coolant level and signs of leakage.
    2. Check for obstructions in the radiator cowl.
    3. Check if the seals on the radiator cowl are in place.
    4. Check temp gauges and ranges of operation called out in engine manual.

10. **Maintaining Your Cooling System:** Once the system is up and running it requires only the up-keep the engine manual calls out, plus the common sense of changing out hoses and keeping the radiator clean. Keep up with your pre-flight and annual inspections to assure your cooling system is ready. If you store the plane outdoors buy an engine/canopy cover, it will save the hoses from ultraviolet rays. Hoses are affected by air born pollution and UV and depending on where you live the frequency will vary. UV degrades the hoses, tires and the fabric cover of the plane, so a lot of sun will mean more up-keep if no prevention is in force. Indoor storage and clear coating the skins go a long way to preserving your plane and providing many years of service.

VERTICAL STABILIZER FRAME ASSEMBLY

PLEASE NOTE: The tailboom 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.

Refer to **Vertical Stabilizer Frame Assembly** parts pages.

1. Fabricate four 6" doublers from 7/8" x .058 raw stock. Mark a line completely around two of the 6" doublers at its mid-point. **DO NOT** use pencil; the graphite in the lead may corrode the aluminum. Insert one of the marked 6" doublers into the vertical stabilizer leading edge. Slide the doubler until the marked line shows in the cable attach point hole (This hole is approximately 35 1/8" from the lower end). Drill #40 and rivet 2 ¼" below the cable attach point hole. Using a #11 bit and the holes as a guide, drill into the doubler from each side at the cable attach point.

2. Install the other marked 6" doubler in the vertical stabilizer trailing edge. Drill #40 and rivet 2 ¼" below the cable attach point hole. Drill doubler out to 3/16" on each side using vertical stabilizer trailing edge as a guide.

3. Install the unmarked 6" doublers flush with each end of the vertical stabilizer spreader tube. Drill and rivet the doublers in place as shown in the parts manual. Note that there is a fwd and aft end to the spreader tube. The fwd end has two #40 holes located approximately 1 9/16" and 3" from the end of the tube.

4. Install the nut plate at the top hinge location of the vertical stabilizer trailing edge.

5. Assemble the vertical fin frame using parts shown in the parts manual. "Fish mouth" the top end of the vertical stabilizer leading edge using the paper template shown in **Figure 4-1** as a reference. The fwd and aft end of the spreader tube will need shaping to allow the holes to align with the corner gussets. Cleco together to check fit. See **Figure 4-2**. Rivet all except one aft lower gusset. This will aid in fitting up the brace tube.

6. **Use the rudder to set the height of the vertical stabilizer. Assemble the rudder as shown in the rudder frame assembly section of the parts manual. Return to this step upon completion of the rudder.** Install the hinge bracket to the trailing edge of the vertical stabilizer. Slip the vertical stabilizer in place over tailboom extension. Bolt the rudder to the vertical stabilizer. **NOTE:** The rudder hinges sit on top of the hinges located on the vertical stabilizer. See **Figure 4-3**. Adjust the vertical stabilizer as required and bolt the lower rudder hinge to the tailboom extension. With the rudder bolted in place and the vertical stabilizer in line with the tailboom, drill through the tailboom extension using the **bottom corner** hole in the trailing edge gusset as a guide. Drill from both sides and cleco. Locate and drill a #30 hole through the trailing edge spar and boom extension on aft centerline 3/8" up from the lower end of the trailing edge spar. Remove from boom once holes are drilled. Refer to the parts manual.

7. With the trailing edge clecoed in place, align the leading edge with the center of the tailboom and drill the tailboom 3/16" using the boom brackets as a guide. **CLECO** after drilling each hole. See **Figure 4-4**. Drill the horizontal stabilizer-adjust bracket as shown in **Figure 4-4**. Also drill the spreader tube to ¼" where required by the horizontal stabilizer-adjust bracket.

8. Fabricate the bushing which goes in between the adjust brackets. The bushing should fit flush with the outside of the adjust brackets. Install the fwd pair of "U" brackets.

9. Drill a remaining pair of "U" brackets to ¼" where they attach to the spreader tube. After the fabric is on, install aft pair of "U" brackets and 1" saddles as shown in the parts manual. **NOTE:** It will be necessary to file the top of the saddle at the point where it contacts the fabric of the vertical stabilizer during final assembly. File as required to prevent chafing or puncturing of the fabric. See **Figure 4-5**.

10. Mark a line extending both directions from the cable attach hole on the leading edge spar. Locate and mark the center of the U-bracket as shown in **Figure 4-6**. Slip the U-bracket onto the leading edge at the cable attach point so that the mark is centered over the hole. Note the orientation of the U-bracket. Make sure the U-bracket is tight against the spar and mark the upper and lower end of the U-bracket where the line on the spar extends. Transfer this mark to the center mark and drill #11. Temporarily bolt the U-bracket to the spar.

11. Fabricate the aluminum brace tube from the raw stock provided. Refer to the parts manual. Remove one clecoed aft gusset. Contour the lower aft end to fit into the corner formed by the spreader tube and the trailing edge spar. Contour the upper end to fit against and match the angle of the leading edge spar and cradle into the bracket. Once fitted, remove the brace tube and slip the ribs over the tube and position vertical fin. If necessary slightly elongate the holes in the ribs for brace and rib alignment. Install the attach angles to the ribs and brace as shown in the parts manual. See **Figure 4-6**.

12. **NOTE:** Straighten the ribs with fluting pliers. Remove the brace tube and slip the ribs over the tube and position on vertical fin. The leading edge and spar are pre-drilled for the rib attach tangs. Install the aluminum brace through the ribs to fit between the U-bracket and the lower aft gussets. Install the spreader tube. If necessary, slightly elongate the holes in the ribs for brace and rib alignment. Install the Attach Angles to the ribs and brace as shown in the parts manual. Refer to **Figure 4-7**.

13. Transfer drill #30 through both sides of the U-bracket into the brace tube and rivet. Locate and drill two #30 holes through the lower aft gussets into the brace tube and rivet as shown in **Figure 4-8**. Locate, drill and place a single rivet through the U-bracket into the leading edge spar. This will keep the U-bracket from shifting during covering. Remove the bolt in the U-bracket. Install all rivets and bolts. Apply anti chafe (masking tape) to the rib flanges prior to covering. Install the upper hinge and hummertang (refer to the tail cable section) after covering and painting. Bend hummer tang to align with cable.

HORIZONTAL STABILIZER FRAME ASSEMBLY

Refer to **Horizontal Stabilizer Frame Assembly** parts pages.

1. Fabricate two (2) 10" doublers and two (2) 6" doublers from 7/8" x .058 raw stock. Mark a line completely around each 6" doubler at its mid-point. Insert a 6" doubler into the horizontal stabilizer leading edge. Slide the doubler until the marked line shows in the cable attach point hole. Locate and drill the 3/32" holes 2 ¼" inboard of the cable attach point required to hold the doublers in place. Install rivets as shown.

2. Install the remaining 10" doublers in the horizontal stabilizer trailing edge. Drill #40 and rivet at a location 3 ¼" inside the cable attach point hole to hold the doubler in place. Drill doubler out to 3/16" on each side at the cable attach point using the vertical stabilizer trailing edge as a guide.

3. Install the nut plates shown on the trailing edge that are shown in the parts manual.

4. Assemble the outer framework for the horizontal stabilizer. Cleco only at this time. "Fish mouth" both ends of the horizontal stabilizer spreader tube and the upper end of the leading edge. The ends should be "fish mouthed" using the templates shown in **Figure 4-9**. As a reference, check fit as you file. **IMPORTANT:** Orientation of the spreader tube is critical. There is a left and right horizontal stabilizer spreader tube. The holes should be oriented so that the stainless steel hinges will sit above the centerline of the spreader tube and the hinge hole with the greatest edge distance should be fwd. See **Figure 4-9**. Make sure to orientate the fwd template properly. Material on the fwd end should be removed from the side that faces the tip. **HINT:** A drum sander attachment for a hand drill works well for forming the desired shape. Drill as required. Assemble using the parts shown in the parts manual.

6. Refer to the vertical stabilizer assembly and follow the same procedure for installing the U-bracket, aluminum brace and ribs. Be sure to rivet the inboard aft gussets and the U-bracket to the brace tube. See **Figure 4-10**.

7. **NOTE:** Straighten the ribs with fluting pliers. Remove the brace tube and slip the ribs over the tube and position on vertical fin. The leading edge and spar are pre-drilled for the rib attach tangs. Install the aluminum brace through the ribs to fit between the U-bracket and the lower aft gussets. Install the spreader tube. If necessary, slightly elongate the holes in the ribs for brace and rib alignment. Install the Attach Angles to the ribs and brace as shown in the parts manual. Refer to **Figure 4-10**.

ELEVATOR ASSEMBLY

The elevator assembly must be put together in conjunction with skinning of the elevator.

Refer to **Elevator Frame Assembly** parts pages.

1. Install the nut plates to the elevator trailing edge and leading edge as shown. Install the buttons to the leading and trailing edges.

2. Assemble elevator frames using the parts depicted in parts manual. "Fish mouth" the top of the trailing edge using the template shown in **Figure 4-11**. The leading edge's inboard/outboard end is determined by the location of the hinge holes. The outboard hinge hole is at approximately 3 ½" and the inboard is at approximately 3". Verify proper orientation by holding against the horizontal stabilizer frames. Control horn and fabric orientation will determine left and right. Assembly will be the same for the elevator frames. Install gussets as shown. Size drill as required by the rivets specified. Both gussets can be riveted to the leading edge's outboard end, but not to the trailing edge. The elevator will have to be **disassembled** to be covered after trial assembly and rigging. Attach control horn to elevator; orienting one for the right and one for the left elevator assembly. On the inboard gussets, **DO NOT** drill the two aft holes on the trailing edge until after covering. See **Figure 4-11**.

3. Cut the internal brace from ½" x .035 to a length of 15 5/8". It should have a slight notch on one end so it will "snap" into position on the button. See **Figure 4-12**. Test fit the internal brace; final installation will be done in the covering section.

4. Assemble the male rod ends to the elevator yoke. Drill the hole in the notched end of the 1 1/4" push-pull tube to 3/16" (the notched end is the front). Slide the push-pull tube into position in tailboom. At the front of the boom (aft seat truss), install the ¼" bolt through the push-pull tube and the 5/8" push-pull tube. Secure with hardware shown. Install the elevator yoke with the angle up as shown in **Figure 4-13**, using the hardware shown.

S-18 RUDDER ASSEMBLY

1. Locate the part shown in the parts manual.

2. Drill the holes at the rudder hinge locations to 3/16". Install the nut plates to the rudder hinge hole locations on the rudder leading edge.

3. Modify the rudder horns as shown in **FIGURE 4-14.**

4. Attach the rudder trailing edge to the rudder leading edge using the hardware shown. Fish mouth the top of the trailing edge using the template shown in **FIGURE 4-15.** Locate and drill #11 the pre-located holes in the leading and trailing edges for the rudder horns. Attach the rudder horns. It may be necessary to file a slight angle on the bottom of the rudder trailing edge. Size drill holes as required for the hardware shown. Refer to **FIGURE 4-15** for the internal rib locations. The holes for the attach angles are pre-located. Install the ribs using the hardware called out in the parts manual.

ELEVATOR TRIM TAB SYSTEM

Refer to **Mechanical Trim System** parts pages.

1. Assemble the trim tab per **Figure 4-16**.

2. Temporarily install hinges to the trim tab, per **Figure 4-16**.

3. With the hinges installed to the trim tab, use the trim tab as a guide to mark the trailing edge of the right elevator. Locate two holes centered on the trailing edge of the elevator as marked. Remove the hinges from the trim tab. Cleco the hinges to the elevator and transfer-drill the remaining holes into the trailing edge. **NOTE:** *Only two holes are required to attach each hinge to the elevator.* See **Figure 4-16**. Trim tab will be final assembled to the elevator after covering.

4. Paint trim tab to match.

S-18 WING ASSEMBLY

LEADING & TRAILING EDGE SPAR ASSEMBLY

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

Refer to **Leading and Trailing Edge Spar Assembly** parts pages.

1. 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.

2. Locate the 3/8" clevis pins, 3/8" drill bit and some scrap metal. Test drill the scrap, insert the 3/8 clevis pin, if it fits tight, it is OK to use, if not adjust accordingly. Once establishing drill fit, drill out the root hole of the leading edge spar to 3/8" to accept the wing attach pin. (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.

3. 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.)

4. 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 ¼" drill, bolt the plate to the spar, then drill the other two holes out to ¼". Remove the strut plate and drill existing ¼" 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, ¼" bolts, strut attach plate and wing channel as shown in the parts drawing.

5. Locate the #11 hole on the leading edge spar's inside (or AFT side), 3 ¾" 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 5-1**. **NOTE:** The outboard compression tube will bolt to this bracket and another S2-SAB rivets to the AFT spar's fwd side in the same location after the tip extension is installed.

TRAILING EDGE SPAR ASSEMBLY

Refer to **Leading and Trailing Edge Spar Assembly** parts pages.

1. Bolt a long wing channel to the #11 hole drilled through the trailing edge spar, 6 ¾" 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.

2. 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.

3. Drill the three holes in a row, starting at approximately 107" from the root, for the aft strut plate out to 3/8". Deburr and install the 3/8" x 2" bushings, ¼" bolts, strut attach plate and S2-SAB as shown in the parts drawing.

4. 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 fwd). 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 using the stainless steel pop rivet shown in the parts manual. Drill a #30 hole on each side of the 3/16" rivet and install the 1/8" stainless steel pop rivets shown in the parts manual. See **Figure 5-1**. **CAUTION:** These rivets must be stainless steel pop rivets. DO NOT use aluminum pop rivets.

5. From the parts drawing determine the location of the inboard most hinge location and rivet a 3/16" nut plate on the fwd side of the spar. **NOTE:** This is the hole closest to the long wing channel at the root end of the trailing edge spar. 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 leading edge spars to verify each location. Also, rivet the nut plate to each trailing edge spar tip extension on the side with the 1 3/8" hole. This nut plate will serve to hold the outboard hinge for the aileron.

UNIVERSAL HINGE ASSEMBLY

Refer to **Universal Hinge Assembly** parts pages.

1. 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.

INTERNAL STRUCTURE

Refer to **Internal Structure** parts pages.

1. Install the four compression tubes using the hardware shown in the parts manual. 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. Bolt the flap compression tubes with the hole for mounting the flap hardware closest to the trailing spar.

2. 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).

3. 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 5-2**. 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 ¼" x .028 x 3/16" bushing and a 3/16" shear nut. Fabricate the bushings from raw stock. See **Figure 5-2**. 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.

4. 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! Locate aileron push pull tube guide on second outboard compression tube, as per **Figure 5-3**. Install the flap teleflex retainer on the W-FCT tube to the inside. See **Figure 5-4**.

5. 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 5-5**.

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

7. Place the aft end of the tip bow on top of the trailing edge spar tip extension. Determine the amount of the tip bow to be removed and file and fit the tip bow's aft end into the trailing edge spar's tip extension. See **Figure 5-5**. Use the 2" tube with the 1 3/8" half hole to mark the tip end. Approximately 1 ½" 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.

8. Establish approximately a 3/8" fwd bow in the trailing edge tip extension. The bow will be straightened by the wing skin. See **Figure 5-6**. 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 leading edge 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.

9. 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 ¼" x .028 x 3/16" bushing and a 3/16" shear nut attach the long wing cable to the gusset. See **Figure 5-6**. 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.

10. The tip wraps are shaped into half round curves. Overlap the tip wrap onto the spar about 3/8". See **Figure 5-7**. 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.

OUTBOARD RIB ASSEMBLY

Refer to **Outboard Rib Assembly** parts pages.

1. Install the rib tips as shown in the parts manual. Dimple as shown in **Figure 5-8.** The one on the top should cup down and the two on the bottom should cup upward.

2. Cleco the outer rib-web plates in place along the outer compression tube. Cleco the web cap in place between the two web plates. The web cap goes at the front of the web plates using the pre-located holes. See **Figure 5-9.**

3. Clamp the outboard rib top tube in position between the two web plates. The centerline of the top tube should be in line with the holes in the web plates. See **Figure 5-8**. Clamp in position. Make sure that the fwd rib tip is in position on the leading edge spar. The aft end of the top tube will over hang the web plates approximately 2 ¼". Drill #30 and rivet in place.

4. Clamp the outboard rib bottom tube in place with the ribs tips touching the leading and trailing edge spars. Again the centerline of the tube should line up with the holes in the web plate. Drill and rivet in place.

5. Install anti-chafe tape to the top and bottom of the rib to protect the wing skin from chafing. Plastic or vinyl tape from any hardware or automotive store will work well as anti-chafe tape. We use 3M Clear Weather Sealing Tape. See **Figure 5-9**.

ROOT RIB TENSIONING SYSTEM

The wing skin is attached and tensioned span-wise using a pre-fabricated root rib. The root rib comes ready to install with the exception of the holes for the 8x½" PHS. Notice that all the pre-located holes are pre-drilled to a #40. Drill these to a #28 and deburr any rough edges. 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.

Refer to **Root Rib Tensioning System** parts pages.

1. Place the root rib in wing with the wing skin flush to the inboard side of the root rib. Prepare the leading edge spar as shown in **Figure 5-10**. Bolt the brackets to the leading edge spar and the inboard side of the universal hinge on the trailing edge spar as shown in **Figure 5-10**. Thread the bolt and washer through the bracket and root rib into the hole provided. **HINT:** Fabricate temporary tensioning bolt as shown in **Figure 5-10A**. Remove the temporary bolts, after the root rib is tight and replace with the required bolt. Install the nut and washer on the inside of the root rib. **NOTE:** Do not tighten the bolts at this point. Line up the wing skin and Velcro so they are properly centered on the trailing edge spar and the entire wing. Install the 8x½" PHS through the wing skin and pre-drilled holes in the root rib. Use an ice pick or a small awl to transfer the pre-drilled holes from the root rib through the wing skin edge webbing. Start installing the 8x½" PHS screws in the center of the root rib, working to the end of the rib. The root rib is curved inboard to assure the rib will be straight when installation is complete. Flip the wing and repeat on the bottom side. When screws are installed, begin to tension bolts. Tighten to 3/8" from the inside edge of the "L" brackets. **CAUTION: Do not over tighten the tensioning bolts. Stop when the skin is tight, if within 3/8" of the bracket.**

FLAP FILLET ASSEMBLY

Refer to **Flap Fillet Assembly** in parts manual.

1. Slip ribs into the outer wrap and cleco in place. Rivet the two internal ribs in place. Drill and rivet the leading edge using 1/8" pop rivets shown in the parts manual.

2. Drill bolt holes used to attach the flap fillet, as per **Figure 5-11,**. Locate and drill #11, top and bottom.

3. Paint to match color of flaps, if desired.

OPTIONAL STROBES

Refer to **Optional Strobes** in options section of the manual.

FUEL SYSTEM INSTALLATION SINGLE and DUAL

Refer to **Fuel System-Single Wing Tank, Fuel Tank Mount-Single Wing Tank, Fuel System-Optional Dual Wing Tank & Fuel Tank Mount-Optional Dual Wing Tank** in parts manual. Please note there are separate parts pages for the 503/582 and 912 fuel system installation. The fuel system is installed most easily after installation of the engine.

1. Install withdrawal fittings, sump drain valve and fuel shut-off valve to mixer block.

2. Run the fuel lines from the wing-mounted fuel tank, along the diagonal tube on the right side of the fuselage, to the mixer block, which may be located near the bottom of the diagonal, immediately aft of the seat. **IMPORTANT:** On dual tanks, locate "Y" as close to the shut off valve as possible. This arrangement places the fuel shut-off valve, as well as the sump drain valve at its base, within reach of the aft pilot and provides the pressure necessary for proper fuel flow. Install the mixer block to the fuselage with the associated hardware and fuel lines, for dual tanks refer to **Figure 6-1**. Install a segment of fuel line from the sump drain valve to the bottom of the fuselage; secure the end of this drain line to the fuselage with a zip tie. See **Figure 6-2**, for single tanks.

3. Route fuel line from shut-off valve, back up fuselage diagonal, to fuel pump; cut fuel line into segments as required to install fuel filter and primer line tee fitting **(503/582 only)**. Secure fuel lines and associated components to fuselage with fabric loom and zip ties. Hot knife an opening in the fabric loom to allow access to the fwd shut off valve.

4. **503/582 ONLY:** Install primer pump to primer bracket on bottom of keel; as per parts drawing. Install primer line between tee fitting and primer pump and between primer pump and carburetor. Install lines between fuel pump and engine, per **Figure 6-3**; refer to engine manufacturer's instructions.

5. **912 ONLY:** Install fuel line from fuel pump to the fuel "T". **HINT:** Secure the "T" to the metal manifold balance tube. Route fuel lines from the fuel "T" to each carburetor. Refer to engine manufacturer's instructions.

Check all lines and components of fuel system for security and proper operation prior to fueling, engine start and flight.

FUEL TANK ASSEMBLY

Refer to **Fuel System-Single Wing Tank & Fuel Tank Mount-Single Wing Tank,** or **Fuel System-Optional Dual Wing Tank & Fuel Tank Mount-Optional Dual Wing Tank** in parts manual.

1. Locate the fuel tank(s). See parts drawings.

2. The fuel tanks are leak tested from the supplier and guaranteed leak proof. You, however, may want to perform a leak test, especially after installing the fuel fittings. If you desire, fill the tank(s) with water and let it sit for approximately 48 hours. Locate three (3) 1/2" diameter holes for the fuel fittings at the locations shown in **Figure 6-4**. ***IMPORTANT:*** *These measurements are very critical for proper clearance of the Tank Withdrawal Fittings.* ***HINT:*** *A UNIBIT step-drill makes a very clean, accurate hole.* All fittings are located on the inboard side of the wing tank (see parts manual for orientation). Debur all holes. ***NOTE:*** *Mark on the tank the position for the 1/4" Tee (lower sight gauge attachment).* Secure the Tee to the Root Compression Tube when installing the tank in the wing. Remove **ALL** shavings and loose debris from the interior of the tank. Use a vacuum to assist in removal.

3. Refer to parts drawing, for proper orientation of parts.

4. Install the fittings by placing a wire in the fitting hole and up through the filler neck, attach a tank withdrawal fitting and an o-ring. Make a loop in the end of the wire to keep the parts from falling off, then pull the fitting to the hole with the threaded portion out of the tank. Remove the wire. Holding the fitting with the threaded portion extended out of the tank, thread on the rubber washer, metal washer and nut with Loctite. ***NOTE:*** *Use a 1/4" allen wrench to hold the tank withdrawal fitting while tightening the nut.* ***HINT:*** *Hold the metal washer with a needle-nose Vise-Grip to prevent rotation while tightening the nut.* Allow Loctite to dry. Apply sealant to the straight or 90-degree fuel line fittings, and screw into the tank withdrawal fitting until snug. ***CAUTION:*** *Do not tighten to the point the tank withdrawal fitting turns in the tank.* Also do not over-tighten fuel line fittings, this may cause the withdrawal fitting to break.

5. Install sight gauge as shown in **Figure 6-7.**

FUEL CAP/VENT ASSEMBLY

Refer to **Fuel Tank Mount-Single Wing Tank & Fuel Tank Mount-Optional Dual Wing Tank** in parts manual.

1. Remove the rubber gasket and plastic baffle from the fuel cap. The plastic baffle will "snap" out of the fuel cap. A screw driver works well for the removal. Locate and drill a ¼" hole in the center of the fuel cap as shown in **Figure 6-5**. Install the conduit adjuster ferrule into the fuel cap. Apply a small drop of Loc-tite and install the ¼" plain nut and tighten to secure the ferrule into the cap. See **Figure 6-5**.

2. With a side cutters or file remove the attach nipples from the plastic baffle. See **Figure 6-5**. Drill a ¼" hole in the center of the plastic baffle and install into the fuel cap over the adjuster ferrule stem. Drill a ¼" hole in the center of the rubber gasket and install into the cap. **Note the orientation of the rubber gasket.** Drill the ¼" large wood washer as shown in **Figure 6-5**. Assemble the bead chain to the bead chain retainer sleeve. Install the bead chain and retainer sleeve into the #30 hole in the large wood washer. Install the washer and bead chain into the fuel cap. Install the ¼" shear nut on the adjuster ferrule stem and tighten.

3. Install the bead chain end coupling onto the bead chain. Find the center of the plastic retainer and drill a #30 hole. Using the brass backing washer, rivet the plastic retainer to the bead chain. Refer to the parts drawing.

4. Modify the vent tube as shown in **Figure 6-5**. Install the vent tube into the adjuster ferrule. Install the fuel cap assembly onto the tank and tighten. Position the vent tube so that the 45 degree angle is pointing fwd (into the slipstream) and tighten the ferrule cap to secure the vent tube.

FUEL TANK MOUNT - SINGLE and DUAL WING TANK

Refer to **Fuel Tank Mount-Single Wing Tank & Fuel Tank Mount-Optional Dual Wing Tank** in parts manual.

1. Make sure that the tank assembly steps shown in the engine section have been completed before installing fuel tank into wing.

2. On the aft side of the leading edge project a centerline mark from the S2-SAB on the inner compression tube to a point approximately 16" outboard. This will locate the centerline for the S2-SAB which holds the outer tank support in place.

3. Place tank on wing frame, leaving 1/8" gap between leading edge spar and tank; also allow 1/8" gap between inner compression tube and tank. Locate S2-SAB on leading edge spar's centerline, leaving 1/8" gap between it and outboard side of tank. **NOTE:** When locating S2-SAB, check that tank withdrawal fittings will clear inner compression tube once tank is in position. If necessary, S2-SAB may be moved slightly outboard, allowing tank to be positioned farther from compression tube; if doing so, ensure that tank remains properly supported. Drill #11 and rivet S2-SAB to spar and install single-ear nut plate to S2-SAB; refer to parts drawing. Bolt fwd end of outer tank support to S2-SAB. With tank in position, pull outer tank support parallel to tank, maintaining 1/8" gap. Trim outer tank support diagonally to accommodate drag brace; take care not to trim tube short. Locate U-bracket to drag brace, transfer-drill #11 through aft end of outer tank support using U-bracket as guide, install nut plate to U-bracket and bolt tank support to U-bracket. Drill two #30 holes through aft side of U-bracket and rivet U-bracket to brace. See **Figure 6-6**.

4. Slot the upper hole in the tank mount brackets as shown in **Figure 6-6**. Bolt the wing tank mount brackets to the fuel tank so that the bolt is in the middle of the slot. Notice that the bent bracket bolts to the aft of the fuel tank on the inboard side. Using the tank mount brackets as a guide, drill the brackets and inner compression tube out to #30. Install the rivets shown in the parts manual. Repeat this for the outer tank support. Once tank installation is complete, apply Loc-tite to the bolts which hold the tank in place.

5. Repeat, if installing the second wing tank.

AILERON PUSH-PULL SYSTEM

Refer to **Aileron Push-Pull Tube System** in parts manual.

1. Drill out the ¾" 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 7-1**. Install the aileron bellcranks as shown in **Figure 7-2**. 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 ¼" through the compression tube, gusset, and doubler. From this ¼" 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.

2. Assemble the push-pull tubes as shown in the parts manual. Slip the push-pull tube end fitting into position and rivet. Use the tube as a drill guide. Size drill as required to install the rivets shown. Install all male rod ends shown. Be sure to install the ¼" plain ("jam") nuts on the inboard end of the 109" push-pull tube and the aft end of the 42 1/8". Install the push-pull tubes to the aileron bellcrank using the hardware shown. Slip the push-pull tube guide in place over the long push-pull tube. **DO NOT attach the guide to the compression tube at this time.** It will be attached during trial assembly and rigging. Tape the push-pull tubes into approximate position.

FLAP FRAME ASSEMBLY

Refer to **Flap Frame Assembly** in parts manual.

1. Thoroughly deburr all flap/aileron ribs to prevent chafing of fabric.

2. Size drill the holes in each rib to #30. Modify the flap/aileron horn attach angle as shown in **Figure 7-3**. Be sure to make one left and one right. **Only make two flap horns. The remaining two horns will be used for the ailerons and should NOT be modified.**

3. Install the three nut plates to the aft side of the flap spar assembly. Notice that the holes located along the spar are not on the centerline. The holes for the ribs are located just behind centerline of the spar for perfect rib alignment. Make sure that before installing nut plates, forward and aft is determined. See **Figure 7-3**.

4. Test fit the end ribs. Notice that the end ribs (#1 & #7) will only locate on one end of the spar. It may be necessary to file a small amount off the end of the spar to align the holes in the rib. **DO NOT** "drift" the holes in order to make the ribs align. Cleco into place.

5. Install the five center ribs. Notice that the flap tapers spanwise; therefore, the ribs must be in sequence according to the parts manual. The ribs should be oriented to "open" toward the small end of the flap. Make sure before riveting that the ribs #2 - #6 face the small tapered end of the flap. Rivet the five ribs in place on the leading edge spar.

6. With the end ribs clecoed in position, check to see if the ribs are "square" to the flap spar assembly using a small framing square. Cleco the 90 tang in position inside the #1 flap/aileron rib. Cleco from the end of the flap. Align the opposite side of the tang with the flap spar assembly. Mark the two holes shown in **Figure 7-4**. Drill the hole which is easily reached with the #1 rib in place. Remove the #1 flap/aileron rib and drill the remaining hole for the rivets specified. Rivet the multi hole tang in place. See **Figure 7-4**.

7. Rivet the two end ribs in place on the flap spar assembly. Insert the trailing edge spar into the ribs. Center the trailing edge spar with the holes in the **end** ribs. Size drill as required and cleco in place. Check for "square" of the end ribs. Place a long straight edge against the trailing edge spar and clamp in place. It is not important for the trailing edge to be "seated" into the mouth of each rib, but it is important for the trailing edge to be straight. Drill and cleco in place.

8. Cleco the multi-hole tang in place along the trailing edge as before. Mark and drill as required for the rivet specified. Rivet the entire assembly together. Drill out the hole in the flap spar assembly for location of the flap/aileron horn attach angle. Temporarily install the flap horns, see **Figure 7-5**. See **Figure 7-6** for horn location and orientation. The horns will be used during Trial Assembly and Rigging; then removed for covering.

9. Remove any sharp edges on ribs or spars with a file. Install plastic tape over all edges and rivets to protect the fabric skins.

AILERON FRAME ASSEMBLY

Refer to **Ailleron Frame Assembly** in parts manual.

1. Thoroughly deburr all flap/aileron ribs to prevent chafing of fabric.

2. Size drill the holes in each rib to #30.

3. Install the three nut plates to the aft side of the aileron spar. Notice that the holes located along the spar are not on the centerline. The holes for the ribs are located just behind centerline of the spar for perfect rib alignment. Make sure that before installing nut plates, forward and aft is determined. See **Figure 7-7**.

4. Test fit the end ribs. Notice that the end ribs (#1 & #7) only locate on the proper end of the spar. It may be necessary to file a small amount off the end of the spar to align the holes in the rib. **DO NOT** "drift" the holes in order to make the ribs align. Cleco in place.

5. Install the five center ribs. Notice that the aileron tapers spanwise; therefore, the ribs must be in sequence according to the parts manual. The ribs should be oriented to "open" toward the small end of the aileron. Make sure before riveting that the ribs #2 - #6 face the small tapered end of the aileron. Rivet the five ribs in place on the leading edge spar.

6. With the end ribs clecoed in position, check to see if the ribs are "square" to the aileron spar assembly using a small framing square. Cleco the 90 tang in position inside the #1 flap/aileron rib. Cleco from the end of the aileron. Align the opposite side of the tang with the aileron spar. Mark the two holes shown in **Figure 7-7**. Drill the hole which is easily reached with the #1 rib in place.

Remove the #1 flap/aileron rib and drill the remaining hole for the rivets specified. Rivet the multi hole tang in place. See **Figure 7-8**.

7. Rivet the two end ribs in place on the aileron spar assembly. Insert the trailing edge spar into the ribs. Center the trailing edge spar with the holes in the **end** ribs. Size drill as required and cleco in place. Check for "square" of the end ribs. Place a long straight edge against the trailing edge spar and clamp in place. It is not important for the trailing edge to be "seated" into the mouth of each rib, but it is important for the trailing edge to be straight. Drill and cleco in place.

8. Cleco the multi-hole tang in place along the trailing edge as before. Mark and drill as required for the rivet specified. Rivet the entire assembly together. Drill out the hole in the flap spar assembly for location of the flap/aileron horn attach angle. Install the horn temporarily to the flap and aileron. Locate the hole for the aileron clip, place it and the bushing on the inside of the trailing edge and transfer drill; see **Figure 7-9**. The horns will be used during Trial Assembly and Rigging; then removed for covering.

9. Remove any sharp edges on ribs or spars with a file. Install plastic tape over all edges and rivets to protect the fabric skins. It is important that the tape be installed to all areas that could cause chafing. **IMPORTANT:** Be sure not to use dark colored tape; it will show through light colored skins. It is best to use clear plastic tape.

INSPECTION of the AIRFOIL LIFT STRUTS

RANS airfoil lift struts are made of extruded aluminum. Extrusions 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.

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. Include strut inspection in your pre-flight check.

LIFT STRUT ASSEMBLY

Refer to **Adjustable Lift Strut** in parts manual.

1. Test fit all strut connectors to wing strut attach plates. If connectors do not slip over strut attach plates, use a flat file to remove material on the inside of fittings. Be careful to file flat and not curve faces on inside of fitting or to gouge out radius at end of slots.

2. Drill and deburr the four (4) AFT lift strut gussets as per **Figure 8-1**. Drill Aft Upper Lift Strut connectors as shown in **Figure 8-1**. **IMPORTANT:** Test drill a scrap metal piece to test fit 5/16" bolt. Bolt fit must be tight, for all 5/16" holes, see **Figure 8-1**. Use of a drill press is recommended when drilling the strut connectors.

3. Take the two (2) fwd struts, locate and drill a 5/16" hole 5/8" from each end. Drill a 1/4" hole for the jury strut from the lower end. See **Figure 8-2.** Use the template shown in **Figure 8-2** to locate and drill from the fwd edge of the strut. Drill from each side. Deburr all holes and the ends of the struts. Assemble the fittings to each end as per the parts drawing. Use the solid rounded aluminum fitting for the main strut attachment. 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 8-2**.

4. Use the small strut template to locate holes in the aft strut, as per **Figure 8-3**. Notch strut as shown. **HINT:** A disc sander works great! Bolt the fittings to each end as per the parts drawing.

5. **IMPORTANT:** Due to dimensional variation in extruded material it may be required to shim the strut fittings. No gap should exist between the fittings and the struts. **CAUTION:** 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. Use the .020 shim material to insure a tight fit. See **Figure 8-4**.

WING/STRUT INSTALLATION

Because of the convenience of the adjustable aft lift strut, the struts can be assembled and set aside until final assembly. However, this means the jury struts can not be completed until then. You may want to install the wings and struts prior to covering, to complete the jury struts. If you choose to do this, please set the wing washout, as it will affect the sizing of the jury struts.

TRIAL INSTALLATION of the WINGS

Some important tools required:

One or two friends
4 saw horses, to lay wings on.
Mallets or small hammers, to tap in pins or bolts
Flat file thinner than 1/4" to file inside of strut attach fittings, if required
Tapered punch from 1/4" to 1/2", 6 to7" long
Small sawhorse, to hold tail up 30" high

1. Set the sawhorses on each side of the fuselage in approximate positions to hold the wings. Place an *UNCOVERED* wing on each pair of sawhorses.

2. Check the root ends of the leading spars, they should be drilled out and de-burred to fit the 3/8" pins. Install flap and ailerons to each wing. Do not install nuts or cotter pins at this time. Hook up the ailerons and flaps to the proper control push pull tubes or teleflex.

3. Set the struts below in position on the floor. **IMPORTANT:** Be sure the rod end is screwed into the end of the strut a minimum of **10 full turns**, loctite applied and the "jam" nut in place.

4. Lift the wing up and insert the spar pins and bolts.

5. Have a helper, on a stepladder if need be, hold the tip at slightly above level. Install the struts. Use of a tapered punch can help line up the strut fittings to the attach plates on the wing spars. Be careful not to force fit any fittings. **CAUTION:** Use mallets lightly! If something is not going together, stop and check alignment, rather than using a bigger hammer! **HINT:** A light oil on the attach plates and fittings will help with assembly. Only pin the bolts into the holes, do not install nuts at this time, and wait until final assembly. **NOTE:** Slight filing of the Fwd Lower Strut Fitting to clear the fuselage attachment may be necessary.

TRIAL RIGGING: WING TWIST and SETTING AILERONS and FLAPS

A wing is twisted slightly so the inboard section flies at a higher angle of attack than the tip. This proves beneficial in preventing tip stalls and maintains roll control through the stall. Adjusting the aft lift struts will set twist in the wing.

1. Install the push pull tubes to the ailerons. All rod ends must be screwed into the fittings at least 6 turns. **HINT:** Screw the long push pull tubes all the way into the rod ends attached to the bellcrank out on the wing, then back off 4 turns. Repeat for short push pull tube at bellcrank end.

2. Route flap teleflex, as per **Figure 8-5**. **NOTE:** The flap teleflex after rigging can be left in place, but will need to be zip tied to the compression tube to allow the covering slide by.

3. Fabricate a rigging level from a straight board and 24" carpenters level. . See **Figure 8-6**. Place the level at the root of the wing. **HINT:** Tape in place the rigging level. Lift tail until it reads level; prop up tail with the sawhorse. Slide saw horse up and down boom tube (place a cloth on the tube to protect finish) until a level reading is achieved.

4. Remove rigging level and place a ¼" thick board under the aft spar, as per **Figure 8-6**. Tape rigging level to the wing underside just outboard of the struts. Adjust the aft lift strut until it reads level. Remove level and tape to the other at the outer strut position, it is not needed set level at root on the other side. Adjust aft lift strut until a level reading is achieved. Set aft lift strut rod ends with Loc-tite to retain setting after dis-assembly.

AILERON and FLAP SETTINGS

1. Neutral position of the ailerons and flaps should be adjusted as shown. Start working from the control stick and move outward. Center the control sticks, then move up to the control tee. Center the control tee; adjust the turnbuckles as required. With the control stick and control tee centered move out to the bellcranks. Center the bellcranks by adjusting the push-pull tubes. The bellcrank is centered when the fwd bolt is centered above the compression tube as shown in **Figure 8-7**. Once the bellcranks are centered adjust the ailerons. Use two straight edges taped in position at the inboard end of the ailerons to set the neutral position as shown in **Figure 8-7**. **WARNING:** The rod end's threads must be at least 6 full turns into the push-pull tube's end fittings. With the ailerons adjusted into position, adjust the flaps to match. Use the fixed flap mount for the ground adjustable type or the rod ends on the in-flight adjustable style. Rod ends on the flap teleflexes must be turned in a minimum of six full turns. With the ailerons set to neutral, locate, drill, and rivet the push-pull tube guides in position on the flap compression tube as shown in the wing frame assembly section of the manual.

2. Adjust the throw of the ailerons at the inboard end until each aileron has a maximum up deflection as shown in **Figure 8-7**. Be sure to take this measurement at the inboard end of the aileron.

3. Once all surfaces are set as described above, lock the "jam" (plain) nuts in position with Loc-tite to save the settings for final assembly. **DANGER:** After setting stops at control stick, check bellcrank, if there is too much stick travel the bellcrank can over-center, adjust to omit over-centering.

4. Set flaps to touch against the board as the ailerons. Preserve setting by using Loc-tite and jam nutting rod ends. **NOTE:** If teleflex cable is too long and prevents obtaining the setting, try trimming off the threaded end of the teleflex at the flap. When trimming keep jam nut threaded on to help re-tap the threads. If not possible to use the jam nuts and get the right setting, use only Loc-tite to retain rod ends.

JURY STRUT ASSEMBLY

IMPORTANT: If installing jury strut fairings, **DO NOT** rivet the jury struts to the gussets during their assembly; cleco only.

Refer to **Jury Strut Assembly System** in parts manual.

1. Make sure that the correct washout is set as described in the lift strut section of the manual before proceeding to jury strut assembly.

2. Cut the three jury struts to lengths shown in **Figure 8-8.** These are **reference** dimensions only. Filing will be necessary to make a perfect fit. Cut two of each length; one set for each wing.

3. Test fit the cross strut between the eye bolts. It should fit snug. Cut/file as required to achieve a tight fit between the eye bolts. Insert the drilled bushing aluminum inserts into each end of the cross strut. Dimple the end of the tubes with a punch to hold in place. 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 8-9.** Cleco the gussets to the tube via the #30 holes using #30 stainless steel pop rivets.

4. Install the gusset shown in the parts manual to the jury strut bracket bolted to the leading edge spar. Install the fwd jury strut in place. Cut/trim as required. It will be necessary to angle cut the top end of the fwd jury strut. Drill #30 using the gusset as a guide and cleco in place. See **Figure 8-9.**

5. Install the diagonal jury strut. Angle cut as required to maintain sufficient edge distance for drilling. Cleco in place. Refer to **Figure 8-9.** Drill the holes shown below into the gussets and tubes. Hole locations in the gussets should be on the centerline of the tube. Deburr all holes and rivet the jury strut assembly in place.

6. Remove wings, ailerons, and flaps for covering.

S-18 GENERAL COVERING NOTES

Before removing skins from their protective packaging it is important to wash all oil and dirt from hands. Wash hands thoroughly before handling any of the Dacron covers. A **new,** inexpensive set of cotton gloves worn by the builder is recommended for handling of the skins, especially if clear coating is desired. Plastic or Vinyl tape from any hardware or automotive store will work well for "Anti-Chafe" tape. We use 3-M Clear Weather Sealing Tape or All-Weather Polyethylene Repair Tape.

TAIL GROUP DACRON COVERS and HARDWARE

COVERING the VERTICAL STABILIZER

Refer to **Tail Group Dacron Covers and Hardware** parts pages.

1. Remove the stabilizer from the tailboom. Remove the stainless steel hinges from the trailing edge of the vertical stabilizer. A pair of padded saw horses works well to support framework while slipping covering into position.

2. Pre-covering Checklist:

   ___ All gussets riveted and rivet heads seated properly.
   ___ Hinge location nut plates installed.
   ___ Tailboom extension attach point nut plate installed.
   ___ Adjust bracket riveted and size drilled as required.
   ___ Internal braces fit snug.
   ___ Aluminum ribs riveted in place.
   ___ Entire surface is clean. Remove part # stickers and marks of any kind.

Make sure to complete the above checklist prior to installing covering.

3. Locate the Dacron cover and hardware shown in the parts manual. Slip the vertical stabilizer Dacron cover into position. Pull the cover as far down onto the vertical stabilizer as possible. Slip the 1/16" wire into each pocket on the bottom edge of the Dacron cover. Using a hot knife, locate holes as shown in **Figure 9-1**.

4. Start by tieing the lacing rope off on either end of the pockets. Lace from side to side tensioning the rope as you go. Make sure Velcro seam stays centered along the trailing edge as you go. **HINT:** Fabricate a small hook out of ¼" steel rod (not supplied) as shown in **Figure 9-2**.

5. With the lacing rope tied at both ends, set the surface on two saw horses. This will allow pulling from the bottom. See **Figure 9-2**. Use the hook to pull on the lacing rope, working from front to back and vice-versa. Pull till skin is tight and free from wrinkles. The lacing wires should at least be beginning to wrap around the bottom of the tube as shown in **Figure 9-2**. It is best if the pockets meet in the middle, but this will not always be the case. Different colors of fabric will have varied stretch ratios. After skin is tight, tie lacing rope at the ends and cut excess off using with a hot knife. Melt open hinge and cable holes. Cut clearance for hinges in Velcro, see **Figure 9-3**.

6. The surface is now ready for clear coating (if desired). Make sure fabric is clean. The surface can be clear coated after attached to the boom or separate by using a stand. Better coverage is likely to be achieved if the surface is painted on a stand. Contact the RANS parts dept. for information on the clear coating video and wing pivot stands.

COVERING the HORIZONTAL STABILIZER

Refer to **Tail Group Dacron Covers and Hardware** parts pages.

1. The horizontal stabilizer should be removed from the airframe. Remove the stainless steel hinges from the trailing edge of the horizontal stabilizer. A pair of padded saw horses works well to support framework while slipping covering into position.

2. Pre-covering Checklist:

    ___ All gussets riveted and rivet heads seated properly.
    ___ Hinge location nut plates installed.
    ___ Internal braces fit snug.
    ___ Aluminum ribs riveted in place.
    ___ Entire surface is clean. Remove part # stickers and marks of any kind.

Make sure to complete the above checklist prior to installing covering.

3. Locate the parts shown in the parts manual. The Velcro edge on the Dacron covers will determine left and right. Make sure these are oriented properly. See **Figure 9-4**.

4. Slip the vertical stabilizer Dacron cover into position. Pull the cover as far down onto the vertical stabilizer as possible. Slip the 1/16" wire into each pocket on the bottom edge of the Dacron cover. Using a hot knife, locate holes as shown in **Figure 9-4**.

5. Start by tieing the lacing rope off on either end of the pockets. Lace from side to side, tensioning the rope as you go. Make sure Velcro seam stays centered along the trailing edge as you go. **HINT:** Fabricate a small hook out of ¼" steel rod (not supplied) as shown in **Figure 9-5**.

6. With the lacing rope tied at both ends, set the surface on two saw horses. See **Figure 9-5**. This will allow pulling from the root. Use the hook to pull on the lacing rope, working from front to back and vice-versa. Pull until skin is tight and free from wrinkles. The lacing wires should at least be beginning to wrap around the bottom of the tube as shown in **Figure 9-5**. It is best if the pockets meet in the middle, but this will not always be the case. Different colors of fabric will have varied stretch ratios. After skin is tight, tie lacing rope at the ends and cut excess off using a hot knife. Melt open hinge and cable holes. Cut clearance for hinges in Velcro, see **Figure 9-3**.

7. The surface is now ready for clear coating (if desired). Make sure fabric is clean. The surface can be clear coated after attached to the boom or separate by using a stand. Better coverage is likely to be achieved if the surface is painted on a stand. Contact the RANS parts dept. for information on the clear coating video and wing pivot stands.

COVERING the ELEVATOR

Refer to **Tail Group Dacron Covers and Hardware** parts pages.

1. Locate the elevator Dacron covers. Remove all hinge brackets from the elevator. Remove the elevator horns. **HINT:** A large clean table works well for covering.

2. Pre-covering checklist:

   ___ Gussets riveted to out board leading edge only
   ___ Hinge location nut plates installed.
   ___ Internal braces fit snug.
   ___ Nut plates installed for elevator horn attachment.
   ___ Entire surface is clean. Remove part # stickers and marks of any kind.

Make sure to complete the above checklist prior to installing covering.

3. Remember that the orientation of the Velcro will determine the right and left elevator skin. Refer back to the illustration shown in the horizontal stabilizer covering. Follow the step by step illustrations for covering of the elevator as shown in **Figure 9-6** & **Figure 9-7** & **Figure 9-8**. The two special tools used in covering the elevators are detailed after the covering illustrations.

COVERING the RUDDER

Refer to **Tail Group Dacron Covers and Hardware** parts pages.

1. Remove the rudder from the vertical stabilizer. Remove all hinges.

2. Pre-covering checklist:

   ___ Gussets riveted and heads seated properly.
   ___ Hinge nut plates installed.
   ___ Rudder horns modified and installed.
   ___ Internal ribs riveted in place.
   ___ Entire surface is clean. Remove part # stickers and marks of any kind.

Make sure to complete the above checklist prior to covering.

3. Locate Dacron cover and hardware shown in the parts manual. Slip the rudder Dacron cover into position. Pull the cover as far down as possible. Slip the 1/16" lacing wires into each pocket and bend the forward end over as shown in **Figure 9-9**. Using a hot knife locate holes as shown in **Figure 9-9** in the lacing wire pocket.

4. Lace the cover in the same manner as the vertical and horizontal stabilizers. Use the hook to pull the cover tight. Make sure the Velcro seam stays centered on the leading edge of the rudder. When satisfied with the fit, tie off and trim the ends of the lacing cord.

5. Trim the rudder lacing cap as shown in **Figure 9-10**. Position the cap on the rudder, covering the lacing cord. Trim the forward end to fit around the rudder horns. Check for a snug, uniform fit against the skin. It may be necessary to re tie or adjust the lacing knot in order to obtain the proper fit. Locate and drill the mounting holes as shown in **Figure 9-10**. Attach the lacing cap using the screws provided. **NOTE:** The lacing cap may be painted to match the rest of the aircraft.

AILERON & FLAP COVERING

Refer to **Aileron/Flap Dacron Covers and Hardware** parts pages.

1. Remove the ailerons and flaps from the wings. Remove all hinge brackets.

2. Pre-covering checklist:

   ___ Hinge location nut plates installed.
   ___ All rivets seated properly.
   ___ Anti-chafe tape placed over all ribs and rivets on leading and trailing edge.
   ___ Nut plates installed on backside of tension rib.
   ___ Holes drilled, but hardware removed for attach angles.
   ___ Entire surface is clean. Remove part # stickers and marks of any kind.

Make sure to complete the above checklist prior to installing covering.

3. Locate aileron/flap tension strip. This strip will need to be formed around the trailing edge and pre-drilled as shown in **Figure 9-11**.

4. Locate Dacron covers. The Dacron covers for the ailerons and flaps are exactly the same except for the orientation of the Velcro gap seal. Since both surfaces are exactly the same the left aileron can be used for a right flap and vise-versa. Be careful when covering the flaps and ailerons. Think about the position of each surface on the aircraft and be sure that the Velcro faces upward.

5. The open end of each surface has a pre-sewn pocket. This needs to be cut open on the bottom side of each surface. Remember the bottom is the side without the Velcro. See **Figure 9-11.** Use a hot knife and cut through outside layer only.

6. Select the surface to cover first, either a flap or aileron. Push the pre-drilled tension strip into the pocket through the bottom slit. Be careful that the tension strips and Velcro are oriented properly. Pull the fabric skin over the end of the surface. Pull the fabric as far into position as possible. Slide the tension into the mouth of the pocket. Use an ice pick to locate the holes in the tension strip. Once holes are located, hot knife them to size and install the rivets shown in the parts manual.

7. Using a good quality screwdriver, begin to tension the fabric by tightening the tension bolts. A power drill with a screwdriver bit can be used to tension the ribs, but be careful not to strip the heads of the screws. **HINT:** Fabricate temporary tensioning bolts as shown in **FIGURE 5-10A**. Remove the temporary bolts after the skin is tight, and replace with the bolts referred to in the parts manual. A small amount of machine oil can be used on the threads of the tension screws to aid in tightening. The fabric should pull all the way down, until the tension rib touches the #1 rib. Due to sewing variances the tension rib may not completely reach the #1 rib. A small flat head screwdriver may be used to assist the fabric and tension strip over the rivet on the #1 rib.

8. Use the template fabricated in the tail group to locate each hinge hole location and cut away the Velcro gap seal.

9. The surfaces should now be ready for clear coating (if desired). It is highly recommended to at least apply a clear coating to seal the fabric. This will ensure top performance. Also, other products may be available to seal the fabric. Check with supply houses for possible alternatives. It is best to clear

coat the flaps and ailerons while attached to the wings. For more information on clear coating contact the RANS parts department for the RANS clear coating video and clear coating supplies.

WING DACRON COVERS and HARDWARE

Refer to **Wing Dacron Covers and Hardware** parts pages.

1. Locate the parts shown in the parts manual. 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. Remove all the hinge brackets until after covering. Use the checklist below to ensure that the wings are ready for covering.

2. Pre-covering Checklist:

   ___ All nut plates installed for hinge brackets.
   ___ All wing fittings, brackets, tubes, and bolts in place and secure.
   ___ Control system installed and checked for proper operation. Push-Pull tube guide installed.
   ___ Flap teleflex routed and secured if installing In-Flight Adjustable Flaps.
   ___ Fuel tank mounted and inspected. Fuel line clamped, routed, and secured.
   ___ All rivet mandrels checked for protrusion. Mandrel should not protrude past rivet head. File if necessary.
   ___ Tip wraps riveted securely in place.
   ___ Tensioning root rib installed properly, with skin attach, holes pilot drilled.
   ___ Entire surface is clean; remove any pencil or marker.
   ___ Plastic tape is installed at all points where fabric could rub. (Bolt heads, joints, tip wraps, etc)

3. Do not attach the flap teleflexes to the retainers or they will protrude and inhibit slipping on the covering. Leave the teleflex cables in the wing secured to the flap compression tube, then pull through the fabric after wing is covered. Use the 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.

4. The short aileron push pull tubes should be removed, leaving the rod end attached to the bellcrank. Leave the jam nut on the rod end for the short push-pull tube. Be sure to bottom the nut and lock the push-pull tube in final assembly. Leave the long push pull tube connected and inside the wing. If you have not already, Loc-tite and tighten the jam nut on the long push pull tube at the bellcrank, see Trial Assembly and Rigging. After the wing is covered and the short push pull tube opening is cut into the wing, Loc-tite the end of the short push pull tube and thread it back into the rod end.

5. Assemble the top and bottom ribs by inserting the tips as shown in **Figure 9-12**. **NOTE:** The top and bottom tip ribs are different than the rest of the ribs. Mark these to keep them from being mis-located. The top and bottom tip ribs also get plastic fittings inserted into the ends. 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. The forward end of each rib has a small black mark. Make sure all ribs are oriented properly. 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 9-12**. This will greatly ease the rib insertion and removal process.

6. Tape over all bolt heads with a good grade of plastic tape. See **Figure 9-12**. This will make it easier to slip on the wing covers.

7. 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. Pull the skin on the frame as far as possible to install it on the root rib. Back out the ¼" bolts that retain the root rib so the skin will reach the rib. **HINT:** Fabricate temporary tensioning bolts. Refer to **Figure 5-10A**. Make sure that the Velcro trailing edge is on the centerline of the trailing edge spar. Attach the Dacron cover to the root rib with the screws provided as shown in **Figure 9-13**. Once the screws are installed the bolts are tightened until the proper tension is achieved. The root rib should be within a ¼" or touching the "L" brackets when the skin is fully tightened.

8. Make a slit for each rib pocket as shown in **Figure 9-13**. 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 9-14**. Cut open the fabric underneath each zipper.

9. 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. 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:** 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 grab a rib and pull it out. Always remove the bottom rib first. 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. Make the template shown below as a guide to remove material for hinge locations. Use a hot knife to remove Velcro. **CAUTION:** Do not cut into the stitching of the trailing edge. See **Figure 9-3**.

10. 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-Kote works great. An electric iron works also, but can leave areas discolored so be careful of the heat setting.

11. It is highly recommended to clear coat the wings. Refer to the clear coating video for specific instructions on our method of clear coating.

For information on clear coating call the RANS parts dept. for information on the RANS clear coating process video.

S-18 JURY STRUT FAIRING INSTALLATION

1. Locate the parts shown in the parts manual.

2. Slip the jury strut fairings in position. Use a Dremel tool or snips and a file to shape the jury strut fairings to fit tightly against the gussets as shown in **Figure 10-1.**

3. Once the jury strut fairings are riveted in place, permanently install the jury struts as shown in **Figure 10-1**.

S-18 CANOPY ASSEMBLY

1. Remove powder coat on keel connect tube 1-1/4" from each end. Bolt Connect tube in place on keel. **NOTE:** #11 hole should be drilled through keel during center cover assembly. If not, drill through pre-drilled hole in bottom mount located ½" aft of the FWD most rivet.

2. Locate, drill and rivet the fairing gusset to the nose pod arch tube as in **Figure 10A-1** to each side.

3. Put windshield side tubes and 90-degree elbow into position. The flattened end goes to the nose cone. Adjust flattened end so center of tube is on center of holes in gusset and tube reaches against the nose pod arch tube. See **Figure 10A-2**.

4. Drill and cleco only one hole in this position and adjust by rotating or sliding the connect tube in and out of the elbow until the angle between the elbows and cage is 6.5 degrees. See **Figure 10A-3**.

5. Once setting has been obtained, mark connect tube at exit of elbow. Then mark, drill and install clecos at 3/8" edge distance into the bottom of each elbow and side tube. This mark will insure that setting is retained. Make sure elbows are inserted equally on each side at the right distance HINT: A clamp helps. See **Figure 10A-4**.

6. Prepare top aft former by locating and attaching gussets, as shown in **Figure 10A-5**. Rub formers with a thin strip of metal to deburr insides of tube before riveting on the 2 nut plates. **HINT:** Slide nut plate into tube close to #11 hole and use a bolt to grab and hold nut plate while riveting.

7. Clamp top former in place and drill and cleco to elbows. Drill both gusset holes into side tubes.

8. Un-cleco side tubes to install nut plates into flattened ends. See **Figure 10A-6**.

9. Clamp the top former in place, drill and rivet with 1/8" stainless steel rivets. See **Figure 10A-7**.

10. Double check if elbows are still at a 6.5 degree angle to the cage. Adjust frame by holding keel connect tube with one hand and pushing up or down on the side tubes with the other.

FITTING THE CANOPY TO THE FRAME

Lexan windshields scratch very easy. To get a longer service life from your windshield and other lexan surfaces, we recommend using a soft terry cloth and a cleaner made for plastic. We use a product called Brillianize. It is available from RANS or any large aircraft supply company. The big no-no is to never dust off a windshield unless you have sprayed on some sort of fluid. Your dry dusting action will readily cut millions of fine scratches into the glazing, dimming its clear optics. **CAUTION:** Do not allow acetone, lacquer thinner, Loctite or fuel to come in to contact with the lexan glazing. These and other solvents will destroy the lexan.

1. Place the canopy on the frame, setting the front edge on top of the nose pod. Take a utility knife and cut away extra protective wrap around the edge of canopy. This will allow a more accurate fitting of the canopy to the frame.

2. Using a high speed cutting disk, trim off and wet sand the top aft corners of the canopy as shown in **Figure 10A-8** with 220 grit paper. Sand till smooth and radius sharp corners.

3. Have (6) quick-clamps handy. Place the front edge of canopy under the edge of the nose pod. Canopy should be touching against the ½" tube arch and show an even amount of edge past each side tube. Clamp on one side and work side to side by releasing clamps and re-positioning canopy until centered with a minimum amount of overhang on each side tube.

4. Once in place the canopy should fit with no gaps against the nose pod arch tube and overlap the top former at least ½". The canopy sides should follow the side tube from ¾" of overlap at the bottom to almost flush at the top. Most likely to get this fit trimming of the front edge may be required, if so mark the amount to be trimmed off by using the nose pod arch as a guide. Un-clamp and trim and sand. Re-clamp in place to check fit. **WARNING: WEAR EYE PROTECTION! HINT:** If the canopy overlaps a ½" or so past the top former then at least a ½" will need to be trimmed off the front. See **Figure 10A-9**. To trim, clamp canopy back about 10" on side tubes.

5. With the canopy clamped in place as best as possible, even overhangs on each side and trimmed to fit tight against the nose pod arch tube. Mark where nose pod edge is on canopy, unclamp and remove protective plastic just in the area that under-laps the nose pod.

6. Final Position and clamp the canopy to the frame. Mark off the canopy screw rivet locations as shown in **Figure. 10A-10**.

7. Drill through canopy and surface of tubes, nose pod and top former with a #30 drill. Cleco every 4th hole. Remove clamps after clecos secure canopy.

8. Extra trimming can be done if desired. Mark edges to the desired edge distance. Trim with canopy off frame. **HINT:** Wait to trim until after drilling out #30 holes to 5/16". See next steps.

9. Using a Uni-bit, drill out all #30 holes to ¼". Take care not to oversize any frame holes past ¼" or the screw rivets will not work. Remove canopy and drill holes in frame to ¼" where clecos were. Drill out (3) top former holes to #11, after canopy is removed.

10. Place canopy on a stand. **HINT:** A 30 gal. plastic trashcan serves well as a stand, and drill all holes out to 5/16" with the uni-bit. **NOTE:** If you let the uni-bit lightly press against the edge it will deburr and chamfer the 5/16" holes edge. This is good and should be done on both edges, just be real careful not to go to far and accidentally drill to next size. **CAUTION:** Support the canopy when drilling to prevent cracking. A section of rubber hose works well. See **Figure 10A-10A**.

11. Install the canopy using screw rivets. Use ¼" thin washer to back up screw rivet on front rim of canopy. **HINT:** Screw rivets can be pushed in then tightened.

HANDHOLD AND VORTEX GENERATORS

1. Locate hand Hold as shown in **Figure 10A-11**. Locate vortex generators also. Be careful when tightening handhold bolts, do not crush side tube. **HINT:** Start with 1/8" bit, drill 90 degrees to side tube. After drilling through in one location, place a 1/8" pin in hole to use as a line up guide for 2nd hole.

UPPER CANOPY INSTALLATION

1. Center and overlap the upper canopy on the top former to the FWD side. Clamp in place. Drill up from the bottom (3) #11 holes already drilled in the top former. **HINT:** Place a wood block on top where drilling through to support. Temporarily bolt with appropriate screws to hold in position, finger tighten only.

2. Quick clamp upper canopy sides to elbows, mark and drill in locations shown **Figure 10A-12**.

3. Counter sink the three holes in the top of upper canopy and install screws. Do not over tighten or cracks in the canopy may result.

FOOTSTEP INSTALLATION

1. Mark and drill the step socket as per **Figure 10A-13**.

2. Deburr and clip into place on right side aft rudder pivot tube. See **Figure 10A-14**. Do not drill bolting holes at this time. First drill a ¾" hole (use a uni-bit, it works best on sheet metal.) Locate this hole at 1-7/16" below the top of the rudder pedal pivot tube and perpendicular to it. See **Figure 10A-15**.

3. Slide step fully into step mount. Rotate step so plate is level with belly pan side tube. Drill #11 through from both sides as shown in **Figure 10A-16** .

4. Drill #11 through step mount from each side into rudder pivot tube. Deburr and bolt.

5. Bolt step to side tube and then drill #11 through step mount and step and install retaining bolt.

6. Place footplate on step; drill through from bottom, counter sink from top. Install screws and grip tape.

S-18 OPTIONAL STROBES

1. Locate the parts shown in the parts manual.

2. Install the strobe box to the left-hand side of the cage as shown on the parts drawing.

3. Cut the 1/2" hole in the trailing edge spar as shown on the parts page. Mark and drill a 1/8" hole on the top and bottom center of the trailing edge spar 3/8" from the end of the spar. Slip the navigation light tip mount into the trailing edge spar and transfer drill. Do **NOT** rivet the tip mount in place at this time. It will be installed after the wing skin is installed.

4. Wire routing can be done within the strobe. Attach the ground to the light internally using the screw shown. Wire routing should be done during final assembly. Wires hanging out the end of the spar will be in the way during covering.

FINAL ASSEMBLY WING INSTALLATION

1. Follow the same procedure used during trial assembly to install the covered wings. Use extra care in handling now that the wings are covered. Install fwd section of center cover. Fit as tight as possible against wing adjustable hole locations as required.

2. Connect aileron push-pull tubes to the control tee on keel. Use the figures at the end of this section to check travel. Once the settings are correct, Loc-tite and jam nut the aileron stop bolts. See **Figure 2-3**.

INSTALLING and RIGGING the VERTICAL and HORIZONTAL STABILIZERS

1. At this point the tail group has been covered and possibly clear coated. Melt open the holes for the cable attach points on the tail group spars.

2. Install the hinges to the Vertical and Horizontal stabilizers. Do not forget to install the hinges to attach the horizontal stabilizers to the vertical fin.

3. Install the vertical fin onto the tail boom. Rivet the trailing edge spar to the extension at the previously drilled hole.

4. Find two supports, cardboard boxes work fine, to hold the tips of the horizontal stabilizers at approximately the assembled height, and bolt the stabs to the vertical fin. **NOTE:** The horizontal stabilizers bolt on with the attach hinges on the topside. Set fwd attach point in appropriate location on adjustable bracket. See **Figure 11-1**.

5. Install cables as per the parts drawing (see Tail Group Cable Assembly). The cables feature a multi-hole tang on each end of the cables. These are used to set and tension the tail. Use washers and various holes in the tangs to arrive at a tail with tight cables and square with the plane. See **Figure 11-1** & **Figure 11-2**.

INSTALLING and RIGGING the ELEVATORS and TRIM TAB INSTALLATION

1. Screw into each end of the elevator yoke a ¼" stop nut and rod end.

2. Bolt on the elevators to the correct side as per the Velcro gap seals, and attach the horns to the yoke.

3. Fabricate two elevator rigging templates from cardboard see **Figure 11-3**. Use the templates to set the elevator travel.

4. When adjusting elevator travel the control sticks will also need adjusted. The 1" push pull tubes connecting the control sticks are to be adjusted to allow the travel range, but not contact the cage structure. **HINT:** The control sticks do not have to be exactly parallel to accomplish the required elevator travel. **Figure 11-3** shows a good starting point for setting the control and push pull sticks. Once the settings are correct, Loc-tite and jam nut the elevator stop bolts. See **Figure 2-3**.

5. Temporarily rivet the hinges to the elevator with one rivet per hinge. Drill out the rivet to remove the hinge prior to covering. Install the trim tab and check for free movement.

6. Locate the hole in the leading edge of the elevator for the clamp as shown. See **Figure 11-4**. Drill hole to ¼" and install rivet nut. Center punch prior to drilling to prevent slipping off mark and damaging fabric covering. Bolt clamp to rivet nut using hardware shown. Refer to the parts drawing.

7. Route the cable out the end of the tailboom to the clamp on the elevator. Refer to the parts drawing.

8. Drill out the cable housing stop bracket to ¼" diameter, to accept cable stop fitting as shown in **Figure 11-5**. **Note:** Insert cable housing and wire into stop. Use safety wire to secure the cable housing to the cable housing stop bracket as shown in **Figure 11-5**.

9. Set trim tab with wire nut on trim tab horn with tab in Neutral with elevator and trim lever leaning slightly fwd 20 degrees. Test movement of system. Tab should be Neutral when lever is at halfway point on travel. Extend the cable housing past the cushioned clamp stop to act as a stop for the trim lever full down position. Adjust as required. Make sure wire nuts are Loc-tited to retain set screws. Trim off excess trim wire leaving at least 1 ½" on both ends.

10. Secure trim cable housing at front exit of boom tube. Do this by zip tying to the left side of the left rudder cable guide. **NOTE:** Be sure zip tie does not interfere with rudder cable.

INSTALLING the FLAP FILLET

1. Glue rubber trim to edges of painted flap fillet.

2. Slip fillet between flaps and center with equal amounts of overlap on each flap, drill trough from #11 holes, top and bottom, into flap rib. See **Figure 11-5A**.

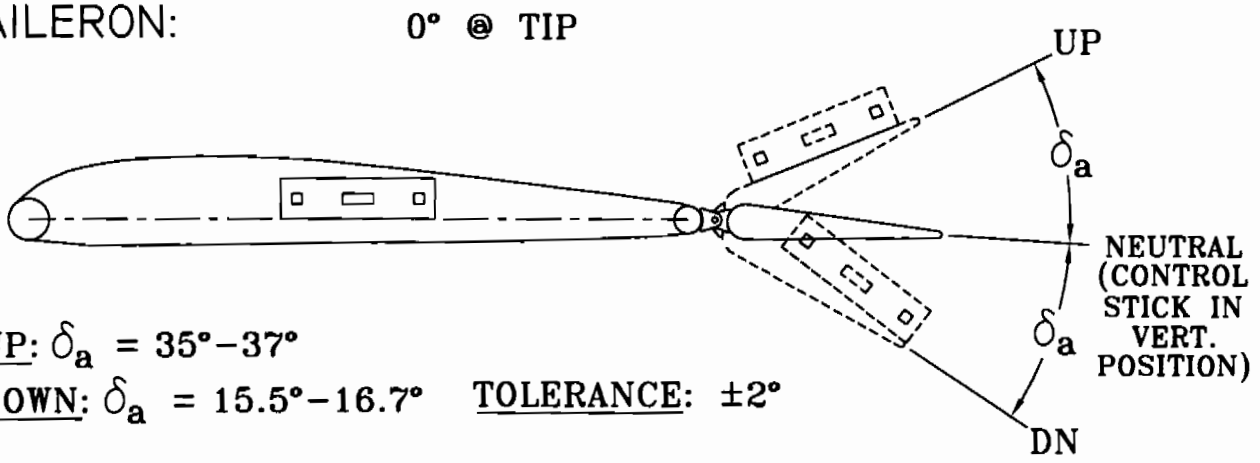
CHECKING RIGGING and SYMMETRY

Use the chart below to verify throws and alignment prior to operation.

With exception of the Engine thrust offset, rudder displacement and landing gear toe-out, all other rigging or symmetries can be measured using a smart level, available at most hardware or industrial supply stores for around $150.00. Another method, is to use a warp drive prop protractor. The following procedures use the smart level.

AILERON:

0° @ TIP

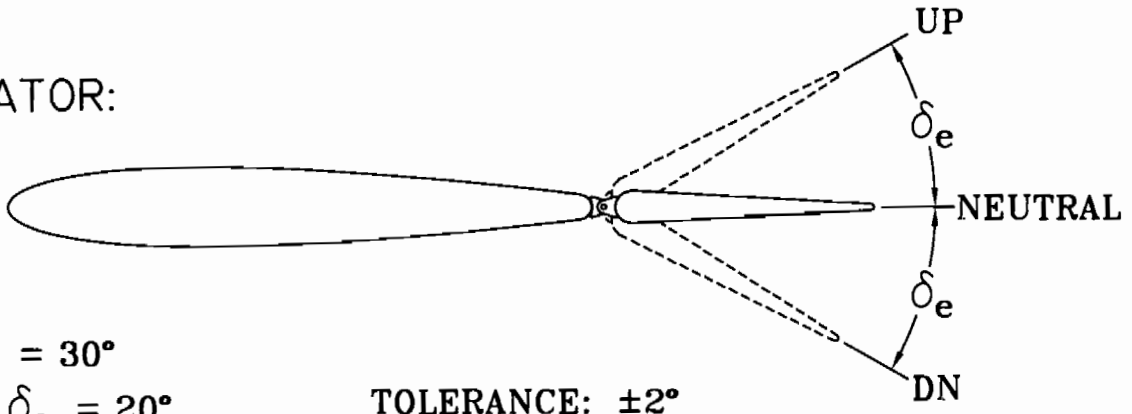


UP: δ_a = 35°–37°

DOWN: δ_a = 15.5°–16.7° **TOLERANCE:** ±2°

PLACE SMART LEVEL ON TIP BOW, MID CHORD AND ZERO.
PLACE ON TOP SURFACE OF AILERON IN BOTH POSITIONS
FULL TRAVEL. FOLLOW THIS PROCEDURE FOR THE ELEVATOR AS WELL.

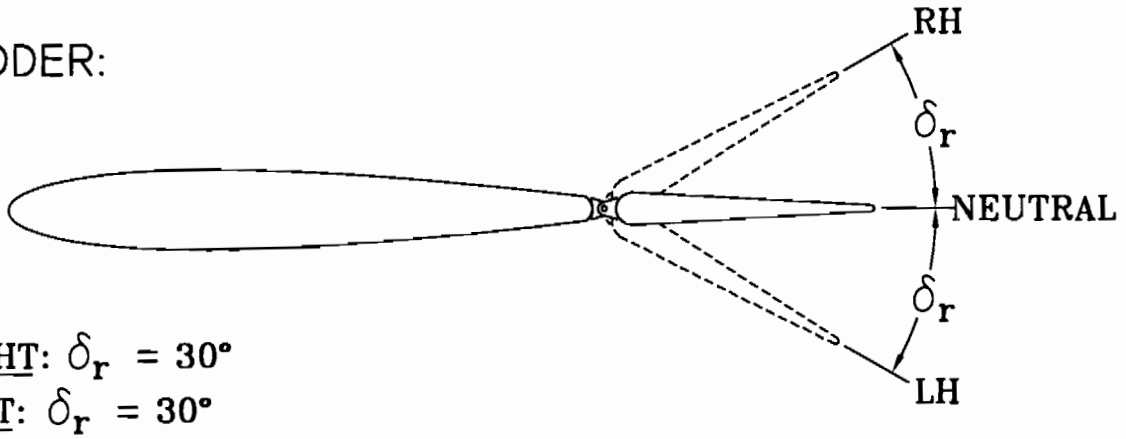
ELEVATOR:



UP: δ_e = 30°

DOWN: δ_e = 20° **TOLERANCE:** ±2°

RUDDER:



RIGHT: δ_r = 30°

LEFT: δ_r = 30°

CHECK FOR CONTACT AGAINST ELEVATOR. ADJUST TO AVOID CONTACT

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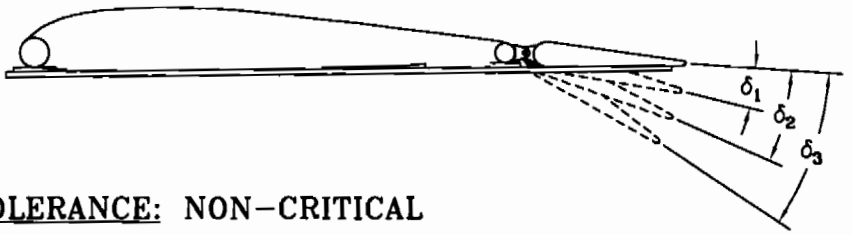
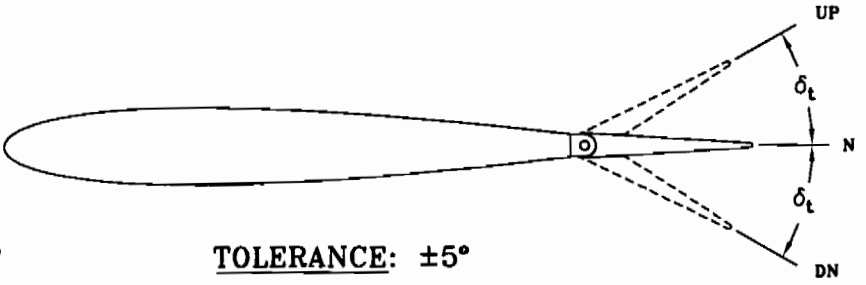
FLAP:



DEFLECTION:
$\delta_1 = 15°$
$\delta_2 = 29°$
$\delta_3 = 44°$

TOLERANCE: NON–CRITICAL

TRIM TAB:



UP: $\delta_t = 35°$
DOWN: $\delta_t = 37°$

TOLERANCE: ±5°

WING WASH-OUT:

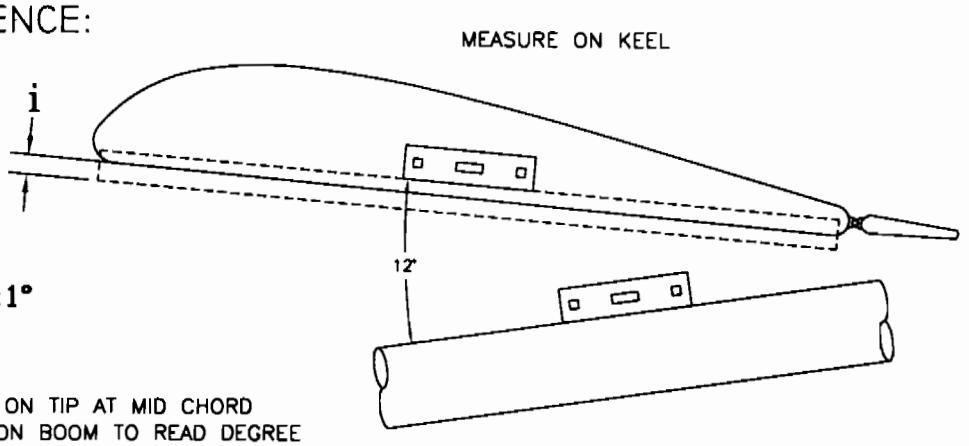
MEASURED AT ROOT

w:= 1.0° TO 1.5°

ZERO AT BOTTOM OF KEEL.
PLACE LEVEL ON TOP
MID WING TIP TUBE.
1° TO 1.5° BEST IF BOTH TIPS
EQUAL. FLIGHT TEST TO VERIFY,
ADJUST AS REQUIRED.

WING INCIDENCE:

i: = 12°

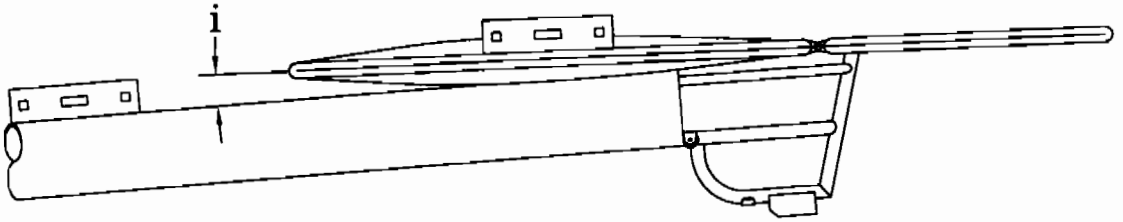


TOLERANCE: ±1°

PLACE SMART LEVEL ON TIP AT MID CHORD AND ZERO. PLACE ON BOOM TO READ DEGREE OF INCIDENCE RELATIVE TO BOOM. FOLLOW THIS PROCEDURE FOR THE TAIL INCIDENCE AS WELL.

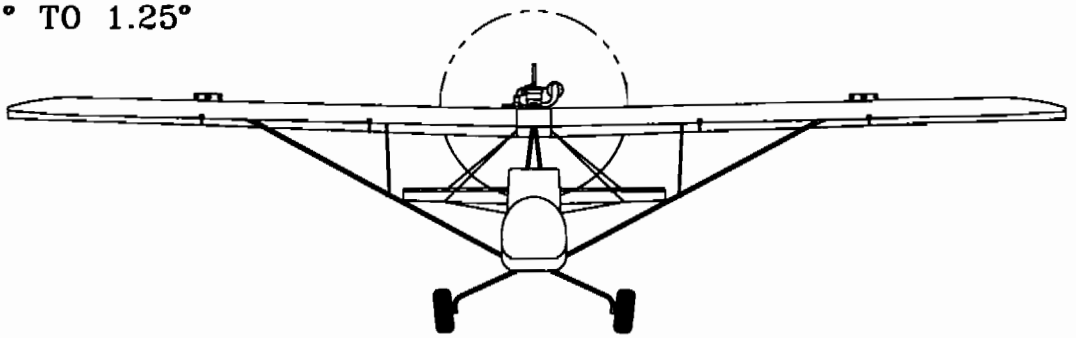
TAIL INCIDENCE:

i: = 4° TO 5°



WING DIHEDRAL:

d: = 1° TO 1.25°



PLACE SMART LEVEL ON CROSS BRACE TUBE DIRECTLY IN FRONT OF SEAT AND ZERO.
PLACE ON WING CENTERED BETWEEN RIBS AT STRUTS.

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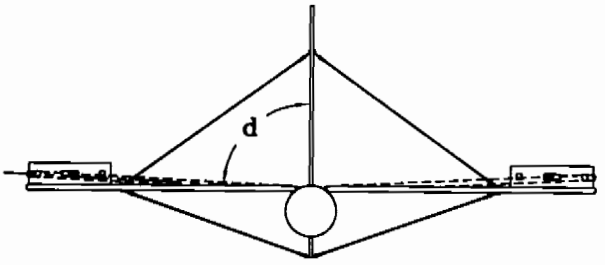
TAIL DIHEDRAL:

d: = 92° TO 89°

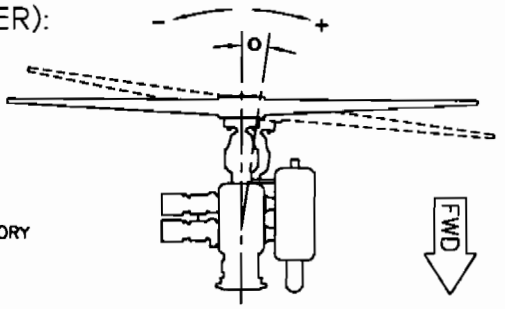
ZERO ON ONE SIDE, THEN PLACE ON THE OTHER SIDE.



ENGINE (PUSHER):

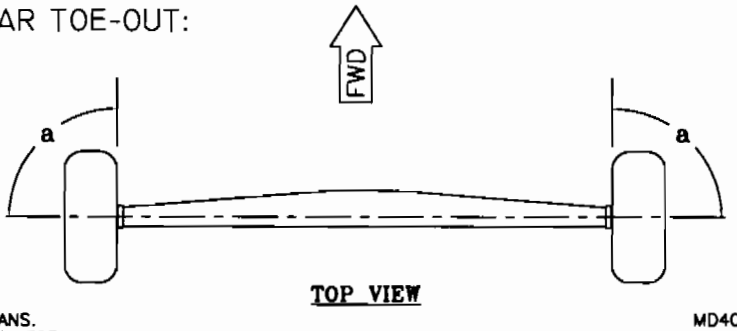
o: = 0°

NO ADJUSTMENT MEANS. PROVIDED. SET BY FACTORY



LANDING GEAR TOE-OUT:

a: = 90°



NO ADJUSTMENT MEANS. PROVIDED. SET BY FACTORY

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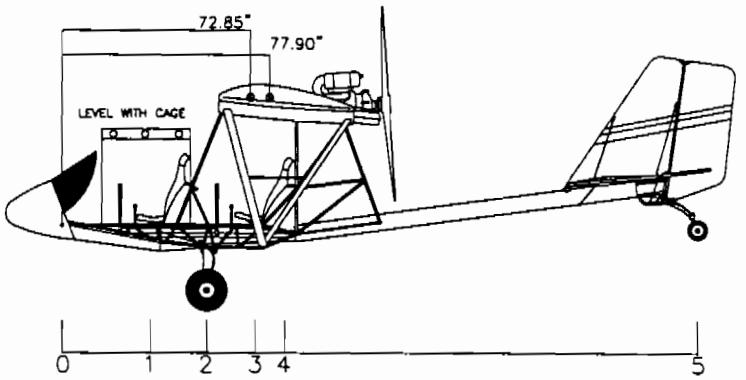
PLACARDS & MARKINGS

Included in your S-18 Stinger kit is a decal sheet and gauge marking decal. These should provide you with just about every label/placard the FAA requires. Apply the decals as per FAA recommendations. Not included in your kit is the data plate. The data plate can be purchased from one of the aircraft supply houses such as Aircraft Spruce & Specialty Company. The data plate can be engraved at a jewelers or trophy shop and if attached to the tailboom doubles as the identifier plate. At least a 3" high "N" number is currently required and can be made by any Decal Shop that computer cuts stick on vinyl. If you have trouble sourcing this service, call us we can have one made at a reasonable cost. Use the sheet of decals, placards & data plate provided to mark items as per See **Figure 11-6** & **11-7** & **11-8** & **11-9**.

WEIGHT & BALANCE - (need 3 working copies)



MD3929

N	
DATE WEIGHED	
ENGINE TYPE	
EMPTY WEIGHT	

RANS S-18 STINGER II
WEIGHT AND BALANCE

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.
DATUM = LEADING EDGE OF WING (FRONT SPAR)
AIRCRAFT IN LEVEL ATTITUDE.

TO PROPERLY DETERMINE THE CENTER OF GRAVITY THE TAIL MUST BE ELEVATED UNTIL THE TOP LONGERON OF THE CAGE IS LEVEL TO SIMULATE LEVEL FLIGHT.

PILOT ARMS IN SAMPLE REFER TO FWD SEAT IN FORWARD AND AFT SEAT IN AFT POSITION

#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT	200	33.25	6650
2	MAIN GEAR LEFT	200	56.5	11300
3	MAIN GEAR RIGHT	195	56.5	11017
4	AFT PILOT	160	72.25	11560
5	WING TANK	54	84.2	4547
6	TAIL	94	239	22466
	TOTAL=	903	TOTAL=	67540

$$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.} \qquad \frac{67540}{903} = 74.79$$

CG = 74.79 " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

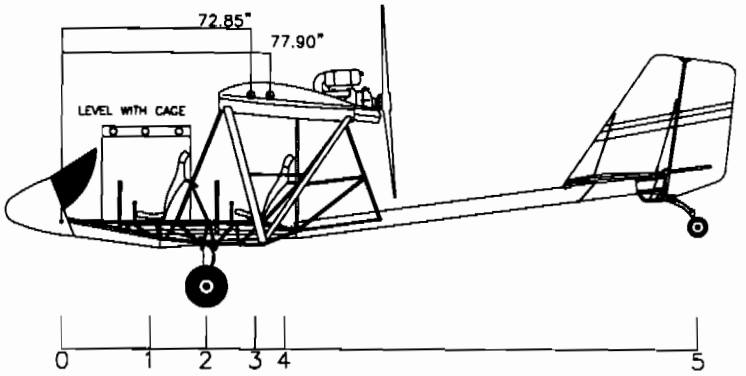
#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT		33.25	
2	MAIN GEAR LEFT		56.5	
3	MAIN GEAR RIGHT		56.5	
4	AFT PILOT		72.25	
5	WING TANK		84.2	
6	TAIL		239	
	TOTAL=		TOTAL=	

$$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.}$$

CG = " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

WEIGHT & BALANCE - (need 3 working copies)



MD3929

N	
DATE WEIGHED	
ENGINE TYPE	
EMPTY WEIGHT	

RANS S-18 STINGER II
WEIGHT AND BALANCE

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.
DATUM = LEADING EDGE OF WING (FRONT SPAR)
AIRCRAFT IN LEVEL ATTITUDE.

TO PROPERLY DETERMINE THE CENTER OF GRAVITY THE TAIL MUST BE ELEVATED UNTIL THE TOP LONGERON OF THE CAGE IS LEVEL TO SIMULATE LEVEL FLIGHT.

PILOT ARMS IN SAMPLE REFER TO FWD SEAT IN FORWARD AND AFT SEAT IN AFT POSITION

#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT	200	33.25	6650
2	MAIN GEAR LEFT	200	56.5	11300
3	MAIN GEAR RIGHT	195	56.5	11017
4	AFT PILOT	160	72.25	11560
5	WING TANK	54	84.2	4547
6	TAIL	94	239	22466
	TOTAL=	903	TOTAL=	67540

$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.}$ $\frac{67540}{903} = 74.79$

CG = 74.79 " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

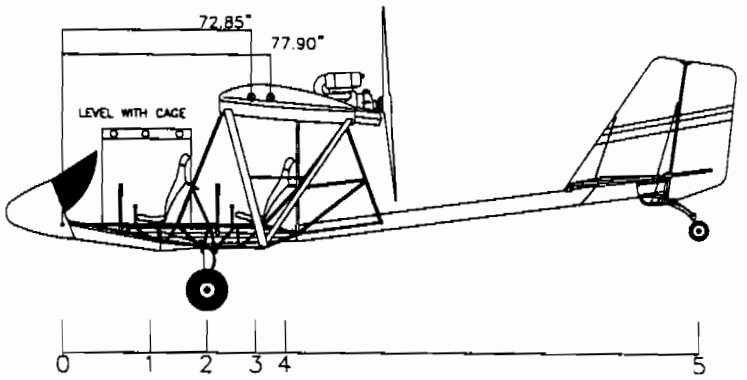
#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT		33.25	
2	MAIN GEAR LEFT		56.5	
3	MAIN GEAR RIGHT		56.5	
4	AFT PILOT		72.25	
5	WING TANK		84.2	
6	TAIL		239	
	TOTAL=		TOTAL=	

$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.}$

CG = " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

WEIGHT & BALANCE - (need 3 working copies)



M03929

N_____	
DATE WEIGHED	
ENGINE TYPE	
EMPTY WEIGHT	

RANS S-18 STINGER II
WEIGHT AND BALANCE

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.
DATUM = LEADING EDGE OF WING (FRONT SPAR)
AIRCRAFT IN LEVEL ATTITUDE.

TO PROPERLY DETERMINE THE CENTER OF GRAVITY THE TAIL MUST BE ELEVATED UNTIL THE TOP LONGERON OF THE CAGE IS LEVEL TO SIMULATE LEVEL FLIGHT.

PILOT ARMS IN SAMPLE REFER TO FWD SEAT IN FORWARD AND AFT SEAT IN AFT POSITION

#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT	200	33.25	6650
2	MAIN GEAR LEFT	200	56.5	11300
3	MAIN GEAR RIGHT	195	56.5	11017
4	AFT PILOT	160	72.25	11560
5	WING TANK	54	84.2	4547
6	TAIL	94	239	22466
	TOTAL=	903	TOTAL=	67540

$$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.} \qquad \frac{67540}{903} = 74.79$$

CG = 74.79 " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

#	ITEM	WEIGHT	ARM	MOMENT
1	FWD PILOT		33.25	
2	MAIN GEAR LEFT		56.5	
3	MAIN GEAR RIGHT		56.5	
4	AFT PILOT		72.25	
5	WING TANK		84.2	
6	TAIL		239	
	TOTAL=		TOTAL=	

$$\frac{\text{TOTAL MOMENTS}}{\text{TOTAL WEIGHT}} = \text{C.G.}$$

CG = " AFT OF DATUM

ACCEPTABLE C.G. 72.85" TO 77.90" FROM DATUM 0.

FINAL INSPECTION

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

APPENDIX 1. SAMPLE CHECKLIST FOR A CONDITION INSPECTION

AC 90-89

AIRCRAFT IDENTIFICATION:

TYPE/SN _____ ENGINE MODEL/SN _____

"N" NUMBER _____ PROPELLER MODEL/SN _____

A/F TOTAL TIME _____ ENGINE TOTAL TIME _____

OWNER _____ PROPELLER TOTAL TIME _____

	BUILDER		INSPECTOR	
GENERAL:	**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 WEIGHT 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 SERVICE				
FRAYED CABLES OR CRACKED/FROZEN PULLEYS				
SKIN PANELS DELAMINATE/VOIDS (COIN TEST)				
POPPED RIVETS/CRACKED/DEFORMED SKIN				

AC 90-89
APPENDIX 1.

APPENDIX 1. - CONTINUED

	BUILDER		INSPECTOR	
FABRIC/RIB STITCHING/TAPE CONDITION				
LUBRICATION				
WING ATTACH POINTS				
FLYING/LANDING WIRES/STRUTS FOR SECURITY				
CORROSION				
FLIGHT CONTROL PLACARDS				
INSPECT FIREWALL FOR DISTORTION AND CRACKS				
INSPECT RUDDER PEDALS AND BRAKES FOR OPERATION AND SECURITY				
INSPECT BEHIND FIREWALL FOR LOOSE WIRES AND CHAFFING LINES				
CHECK CONTROL STICK/YOKE FOR FREEDOM OF MOVEMENT				
CHECK FLAP CONTROL OPERATION				
CHECK CABLE AND PULLEYS FOR ATTACHMENT AND OPERATION				
PERFORM FLOODLIGHT CARBON MONOXIDE TEST				
ENSURE THE COCKPIT INSTRUMENTS ARE PROPERLY MARKED				
INSPECT INSTRUMENTS, LINES, FOR SECURITY CHECK/CLEAN/REPLACE INSTRUMENT FILTER				
INSPECT COCKPIT FRESH AIR VENTS/HEATER VENTS FOR OPERATION AND SECURITY				
INSPECT SEATS, SEAT BELTS/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)				

AC 90-89
APPENDIX 1.

APPENDIX 1. - CONTINUED

	BUILDER		INSPECTOR	
INSPECT IGNITION HARNESS FOR CONDITION AND CONTINUITY				
CHECK IGNITION LEAD CIGARETTES FOR CONDITION/CRACKS				
CLEAN AND GAP SPARK PLUGS				
CHECK MAGNETO TIMING/POINTS/OIL SEAL/DISTRIBUTOR				
INSPECT ENGINE MOUNT/BUSHINGS				
CHECK LANDING LIGHT OPERATION				
CHECK POSITION LIGHTS OPERATION				
CHECK ANTI-COLLISION LIGHT FOR OPERATION				
INSPECT ALL ANTENNA MOUNTS AND WIRING FOR SECURITY				
CHECK ALL GROUNDING WIRES (ENGINE TO AIRFRAME, WING TO AILERON/FLAP, ETC)				
INSPECT RADIOS/LEADS/WIRES FOR ATTACHMENT & SECURITY				
INSPECT CIRCUIT BREAKERS/FUSES/PANEL 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 General Safety Check List

For all types of Aircraft, Ultra lights and Experimental.

Execute this checklist before first flight; thirty minutes 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?	☐	☐
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?	☐	☐

	Yes	No
4. Exhaust Manifold		
Secured and safetied?	☐	☐
All gaskets in good condition?	☐	☐
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?	☐	☐

	Yes	No
3. Control System		
Properly secured and safetied?	☐	☐
Controls stops provided & adjusted?	☐	☐
All fittings of proper thread & size?	☐	☐
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.

EXITS

1. Can aircraft be cleared rapidly in case of emergency?	☐	☐
Are special precautions available during test period, such as jettison able 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 ..... Yes No

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? ☐ ☐

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

1. Fixed Surfaces

Are all interior fastenings secured and/or safetied? ☐ ☐
Is interior properly weatherproofed? ☐ ☐
Have any mice been inside lately? ☐ ☐

2. 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? ☐ ☐

3. 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? ☐ ☐

	Yes	No
4. Attach Fittings		
Are bolts of proper size installed?	☐	☐
Are all bolts secured and safetied?	☐	☐
Have all bolts been examined for wear?	☐	☐
5. 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 bellcranks in good condition?	☐	☐
No interference with fuselage or wing structure throughout full control travel?	☐	☐
6. Fuel Tanks (See Fuselage Section Also)		
Are drains supplied at low point in tank when aircraft is in normal ground position?	☐	☐
Fuel overflow drains clear of aircraft - no tendency for overflow to soak into aircraft structure?	☐	☐
7. 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!

ENGINE TESTING and BREAK – IN

Secure the aircraft in a safe area to test run the engine. Tie a strong rope to the tail boom extension. Secure the other end to a parked vehicle or a secure ground anchor. Fuel the aircraft and drain the sumps. ***SECURE YOUR AIRPLANE BEFORE STARTING THE ENGINE.***

Prior to starting the engine and performing the break-in run, it is necessary to provide adequate air flow through the radiator cooling fan. If it so happens that there is a nice breeze blowing at the time of your run up, simply point the aircraft into the wind allowing the radiator or fan to catch the airflow. Monitor the temps closely, do not overheat or damage to the engine may result.

Follow the engine manufactures starting and break in procedures for your engine. The best position to pull start the aircraft is standing on the left front side facing the engine. Try to pull the rope straight. Pulling to the side wears out the rope. Check the gauges for the proper readings as per the engine manual. If the readings are not right ***STOP THE ENGINE*** and investigate. It may be faulty gauges. If you have problems with starting and testing the engine, please call our technical line or a Rotax engine service center. Do not risk flying on an engine that is not operating within the manufacturers recommendations.

Vibration when the engine is at idle should be low enough that the instruments are steady. If you have a high vibration level take action to rectify. The engines we use are generally smooth in operation, however, some adjusting may be required. The 912 usually needs the carbs balanced right off. Use a mercury balancer to fine tune. Dynamically balancing the prop can significantly reduce vibration levels.

CHECKING STATIC RPM

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

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

Once satisfied with the tachometer, run the engine with the throttle fully open; be certain the tail is tied down and the main gear is chocked. For the two-stroke Rotax 503 and 582, acceptable static RPM is usually about 6000 to 6200; for the four-stroke 912, it's usually 5200 to 5400. (A number of factors influence this, including the number of propeller blades, their length and pitch.) Ideal static RPM would render an *in-flight* RPM just below engine red line with the throttle wide open.

A high static RPM may indicate that the propeller is pitched too finely (the blades take too small a bite of air). This prevents the propeller from performing most efficiently and may allow the engine to over speed in flight. If the blades are adjustable, increase pitch; refer to the manufacturer's instructions. If the blades are fixed, contact the manufacturer, or try repitching, see **Figure 12-1**. Be careful sanding the props flat side, a change in pitch can be effected. Use a sanding block and mark and sand as required.

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

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

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

PRE-FLIGHT INSPECTION AND MAINTENANCE TIPS

1. Start the inspection in the same place every time to develop a pattern. This will lead to a more thorough pre-flight.

2. Check the floorboard and rudder pedals for freedom of movement. Oil the pedals with a light machine oil, if required.

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

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

5. Inspect the starter rope for wear.

6. Look over the cage for dings, bends, cracks or deformation.

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

8. 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, and large retainer washer is intact.

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

10. Check the condition of the prop, look for cracks, nicks and dings. Keep the prop clean and the finish in good condition.

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

12. Check the carbs for security. Check the clamps around the rubber boots. Check the boots for cracks. 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.

13. 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.

14. Check the tail boom for nicks, dings, and dents.

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

16. Check the tail cables for tightness. Look closely at the thimbles for wear. The thimbles can wear through and start cutting into the cables.

17. Check the tire pressure. Inflate to the recommended psi. (9 psi is typical for tundra tires, more pressure for harder ride and shorter take offs, DO NOT exceed 20 psi)

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

19. Inspect cage to boom connections for wear, cracks and tightness.

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

21. Check for general condition and function of all items in the cockpit. Check the trim lever and flap lever. Oil the flap lever rollers with a light machine oil.

S-18 STINGER II OPERATIONS

PRE-FLIGHT

Refer to the pre-flight section above.

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 cable connect points. Avoid lifting at the tips of tail or wing.

Drain the fuel sump. 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 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 ¼ way and pull through. Several pulls 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 for 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. Jockeying the throttle will only accelerate wear on the engine. Be smooth with the throttle and it will respond when you need it! Refer to the engine break-in section of this manual.

TAXIING

Taxiing the S-18 Stinger II is easy and even in a 25 mph wind. The linkage to the steerable tail wheel enhances the ground handling making tight turns a snap. Brakes can be used to tighten a turn by applying after turn is initiated.

If the wing is strong learn to use it to your advantage. Taxiing into the wind with back stick will increase tail wheel 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-18 Stinger II 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.

NOTES on FLYING a HIGH THRUST LINE PUSHER

The S-18 Stinger II 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 noticeable 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. Fly the approach at adequate speeds and you will avoid any problems associated with a high thrust line.

The other side of the pitch 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 aircraft it soon will become second nature to you about these little handling characteristics. 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 aircraft is average in these thrust line related properties. As you will see it is a very easy trait to live with.

TAKING OFF

A normal take off in the S-18 StingerII is performed with 2 notches of flaps. Hold the control stick in neutral, apply full power at around 35 to 45 mph, apply just enough back pressure to rotate the plane to fly off. Slowly raise the flaps and maintain Vx or Vy.

CRUISE FLIGHT

The S-18 StingerII will exhibit a wide range of power settings at which one can cruise. Typically loaded the best cruise should come in around 5500 with an indicated airspeed of 60 to 65 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.

STALLS

The S-18 Stinger II has a very mushy, mellow, undramatic power off stall. The power on stall is even more indefinite. It is highly recommended to take your S-18 Stinger II 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.

SPINS

The S-18 Stinger II has demonstrated the ability to recover from spins; however, due to the unique nature of kit built planes and spins, it is recommended to avoid spins.

NORMAL & STEEP BANKS

The S-18 Stinger'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. It will take very little rudder due to the aircraft's good roll coupling.

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. Roll rate will also slow after 80 mph due to the increase in air pressure on the ailerons.

LANDINGS

The S-18 Stinger II is one of the easiest planes to land, but only if you understand it! What is special about landing over conventional general aviation aircraft is the fact that it is a pusher with low weight and high drag. That means there is a lot less energy the approach and flare. A normal landing is done with no flaps at an approach speed of 50 to 55 mph. The plane is flown 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. Flare as required.

CROSSWINDS

Crosswind landings 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 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. 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.

We can not tell you everything about flying your S-18 Stinger II. You will become more familiar with your S-18 Stinger II as you build time. Each aircraft 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 S-18 Stinger II with the common sense and respect it deserves. Be careful and fly safe and **ALWAYS** do a thorough pre-flight.

APPROVED MANEUVERS

Stalls, all types except Whip Stalls.
Falling Leaf at low power settings (below 4,000 rpm).
Chandelles.
Lazy Eights.
Steep turns up to 60

ALL AEROBATIC MANEUVERS ARE PROHIBITED!

ASI MARKINGS

Apply the appropriate colored arcs on your ASI for the following speeds: See **Figure 12-2**.

White Arc	45 mph to 65 mph (stall to maximum flap extension speed)
Green Arc	65 mph to 80 mph
Yellow Arc	80 mph to 100 mph
Red Line	100 mph

Maximum turbulent air penetration speed is 80 mph.
Maximum flap extension speed is 65 mph.

SPECIAL OPERATIONAL CONSIDERATIONS

POSITION OF IGNITION SWITCH

Up is for on, down is for off.

FLIGHT MANEUVERS THAT INDUCE NEGATIVE LOAD

Flight maneuvers that induce negative load may cause 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 dead stick landing!

CONTROL SYSTEM TRAVEL

Body sizes vary. Please make sure seat adjustment allows full control stick travel. Make adjustments to the seat or sticks as required.

FLIGHT TESTING BY RANDY J. SCHLITTER

Flight testing a brand new aircraft can become quite involved, especially if there are problems with controls, engines or rigging. The approach one should take is to start with a competent pilot, sufficient runway and ideal weather. Flight time in the type of plane you are to test is ideal. This can be obtained at the factory or from a nearby willing owner.

A large amount of common sense should be on hand. The obvious is sometimes lost in the excitement. So keep your cool, to keep your head.

The exact path you take to flight testing can be tailored to your experience and airport. To help you design your approach to flight testing here is a brief synopsis of my approach. Please use this as a suggestion and not the bible.

"The airport we use features 6500 ft. of all weather runway. Off each end is acceptable overruns of another 1000 ft. Plus the fields nearby offer suitable landing sites. The main thing is our airports long runway gives us plenty of room to fast taxi."

"During the fast taxi it is determined if the plane is directionally controllable. Also some feel for pitch and roll can be established. A lot is happening fast, so several runs may be needed to digest the information. I'm looking for anything and everything to AVOID flight. In other words I don't ignore the signs of trouble and think my enthusiasm will fix it. I did that once and it nearly killed me! I want this plane to earn it's place in the sky. Sugar coatings now will only mean more trouble later. After the fast taxi I get out of the plane and look her over, this is mainly to create a space in time to keep relaxed. A test pilot's best friend is his self discipline. Whatever you need to do ritual wise to keep the discipline is fair game."

" The next phase will be crow hops. Here we really start learning about the plane. In fact it is amazing what she'll tell in these brief moments of flight. I can predict stall speed and sometimes stall behavior, just from a crow hop."

" The crow hops grow longer and higher as information confirms the control function. This is where the long runway starts to pay off. From the flights down the runway at above the wing span we learn the full landing nature of the plane, we also by now have a pretty good feel for its control response, and whether or not it is "right". That is where experience in type will help. If this is your first exposure to the plane it will be tough to know if the feel is right, however you should at this point know if it is drastically wrong! If the engine is revving in the redline and you are barely able to climb, something big is wrong. In other words we are developing a sense of performance this new machine may have. That performance should not be far from the expected values, if it is then something may be drastically wrong. To keep me from contradicting myself I write down the numbers I'm getting. Don't try this while flying down the runway, do it at the end of the run. You will be surprised later when you read it back. Your memory at this point is not the most accurate recorder! Also, write down what you actually see and not what you want to see on the gauges. Try to remain objective at this point, after the flight testing is over you will have earned your bragging rights."

" After flying down the runway enough to confirm engine health and that the controls are okay it is time to take another break. This time we inspect everything and do another pre-flight. The next objective is what I call the maiden flight. During this flight we will leave the safety of the runway. It is a critical phase of flight; the runway will be left behind while we climb to a safe height. During this phase of flight keep a landing site in mind. Wear a parachute if your plane is not ballistic equipped, we will be flying high enough to use it. This is not the fly fast low by the waving crowd flight...that comes much much later. Remember baby steps!"

" The maiden flight is designed to learn the main things about the plane: climb performance, moderate cruise speed (later I check out the top end at much higher altitudes), control at moderate cruise, and slow flight. The plane should be climbed to at least 3000 ft. above ground level. Here we in theory have enough height to bail out. The main idea is to advance slowly, getting to know what the new plane can and cannot do."

" As an amateur builder it is your responsibility to establish the performance numbers. However precise the kit may be, it is still possible to have variations in performance. Establish the critical V speeds through actual flight test. Record them in your flight log. The following V speeds are what I feel the most important:

Vr rotation
Vlof lift off speed
Vy best rate of climb
Vx best angle of climb
Vc cruise at 65% power
Vs stall clean
Vso stall speed landing configuration
approach speed should be 1.3 of Vso.

"As the testing continues you may notice slight trim or rigging problems, such as a yaw to the left or right, or the ball sets off to the side in level flight, or it won't maintain level flight. It is best to fine tune the plane until it flies ball centered and level. This is considered perfect rig. In perfect rig you will achieve the optimum cruise speeds, so it is worth the effort. The problem with such fine tuning is that it is easy to get confused as to what effects what. To help with obtaining perfect rigging read 'Post Flight Adjustments'."
RJS RANS, Inc. Test Pilot

POST FLIGHT ADJUSTMENTS

To properly correct a rigging problem the symptom must be correctly analyzed. This is done by establishing the plane in level straight flight, then releasing the controls. The test must be done in calm air. Write down what is happening, that way you make corrections in the right direction. Make adjustments in ½" and 1" turn increments. Isolate the problem, make and correct one axis at a time. If for instance you adjust the wing twist and add a little rudder trim, you may end up chasing the problem rather than solving it!

YAWS LEFT OR RIGHT

This is fairly rare in our planes and is usually caused by engine or rudder offset. The rudder may not be going to a free state due to friction or mis-rigging at the rudder pedals. Adjust the rudder pedals so they are straight with rudder. In some cases it may be necessary to add a slight offset (twist) to the vertical stabilizer. This can be done using the adjustable tangs on the tail cables to offset the leading edge of the vertical stabilizer. Be careful not to affect the position of the horizontal stabilizers when adjusting the vertical fin. Remember if you are holding left rudder the leading edge of the vertical stabilizer will need to move to the right. Stalls should be conducted after rigging adjustment to check for wing drop. If the plane flies straight and level but drops a wing in the stall, check your feet and hands, you must be pushing and little rudder or holding in some aileron!

WING LOW

If the plane flies wing low with very little or no tendency to yaw or roll to the low wing, the wing is washed out to much on the OPPOSITE wing. To correct wash in the OPPOSITE wing. Do so in ½" to 1" turn increments. It is always best to wash in because this means more threads will be holding on the rod end. Once the wings fly level the ball should be centered, in this rig you will achieve the best cruise possible (provided pitch is in trim).

This can also be a low flap on the opposite wing, but then a little roll should be present. Check the flaps for position during flight. Both the ailerons and flaps should be straight and together in level flight. When adjusting the flaps you may run out in travel. In this case it is okay to cut off the end of the teleflex 3/16" and remove the jam nut.

ROLL LEFT OR RIGHT

Roll and yaw can be hard to separate. If the wing rises before the nose yaws then the mis-rigging is in the aileron or the flap. Wing twist can induce roll but it will only lift the wing so far. A true roll tendency will keep right on going until the plane is in a steep bank. It will be the flap that induces the roll, because the ailerons should fly free in the slipstream, unless you are holding the stick again!

To correct, make sure all trailing edge surfaces are flying straight. The flaps and ailerons need to be a seamless surface. Adjust accordingly. See wing low for a tip on gaining more flap inward adjustment.

NOSE UP OR NOSE DOWN

If not able to trim for level flight: Adjuste the leading edge of the horizontal stabilizer up or down. If the plane flies nose down; the leading edge of the horizontal should be moved down one hole position. Likewise nose up flight should be adjusted by moving the horizontal stabilizer position up one hole.

If you have a nose down or nose up problem that the above trim steps can not handle at any cruise speed, then there is a big weight and balance problem. Check your weight and balance sheet, remove that pipe wrench you left in the tail!.

CREATING A PILOT OPERATING HANDBOOK

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

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

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

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

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

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

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

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

MAINTENANCE

ENGINE MAINTENANCE

All engine care and maintenance should be done according to the Rotax manual which comes with your engine.

MUFFLER

The muffler is a part under constant stress while in use and under the attack of time and the element otherwise. 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 and damage the prop.

COVERING

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 pre-flight inspections. During pre-flight 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, hangar, clear coating, or a combination of all these.

Life expectancy of the fabric 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 mentioned 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 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!

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.

ENCLOSED TRAILERS

The distance, terrain, weather and type of trailer will determine how much disassembly is necessary to transport the Stinger. With an enclosed trailer, remove the wings and hang them on the wall of an enclosed trailer. Folding the tail is necessary only if the trailer width proves too narrow.

OPEN TRAILERS

When towing long distances on an open trailer, remove the tail surfaces from the tail boom; highway speeds and gusts can induce damaging loads. Ensure that all components are stowed securely.

If you must tow tail-first with the tail group installed, lock the rudder and elevator surfaces in neutral positions; with the aircraft trailered in this attitude, driving speed should be limited to 35 mph and should not be attempted at all if winds are more than moderate. This method is acceptable for hauling a few miles, but is not suited for long hauls.

CORROSION and WASHING YOUR PLANE

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

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

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

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