

**Quad City Ultralight
Aircraft Corporation**

**Challenger II Aircraft
Construction Manual**

Covering the following models:

Challenger II Standard

Challenger II Clipped Wing Special



PREFACE TO ASSEMBLY

Your Challenger Kit has been supplied to you with most of the major construction completed. Each section of the aircraft has been checked by our quality control process to ensure the section meets our high standards. It is important, however, for you to also examine each component and part of the kit as a double quality control inspection.

There is an old adage that applies very well to the project you are about to undertake:

“ If all else fails... read the instructions !”

This certainly is important in this case. If you have any questions about any phase of assembly of the Challenger, contact the factory.. We are glad to assist in every way. We are as concerned about your completed Challengers Appearance and structural integrity as you are, so please take time to Perform each task carefully and according to instruction. Pre-reading each step before beginning the step will also help in understanding

WARNING:

The parts and hardware in the kit making up the Challenger are of special aircraft grade ! DO NOT attempt to substitute any part or hardware yourself. Contact the factory for assistance when replacement is necessary. Your life may depend on it !

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Section I Inventory

Please conduct a complete and thorough inventory check prior to commencing your build. Contact Quad City Ultralight for any defects or deficiencies to your Section I kit.

<u>CHECK</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
()	1	Instruction Manual (sect. 1,2,3 & 4)
()	1	Challenger retail parts price list
()	1 Qt	Poly-Tak Adhesive
()	1 Qt	M.E.K. (Methyl Ethel Keytone)
()	1	Set of heat shrinkable Dacron socks for Elevators, Stabilizers, Rudder, vertical fin, Dorsal fin.
()	1	EMP-100 Rudder frame
()	1	EMP-200 Vertical fin frame
()	2	EMP-300 Horizontal stabilizer frames.
()	2	EMP-400 Elevator frames
()	20	ST-16L stainless steel hinge brackets.
()	60	AD64ABS 3/16" Aluminum rivets
()	2	EMP-7R & EMP-7L control horns elevator
()	2	EMP-8R & EMP-8L control horns rudder
()	6	AN525-10R20 3/16" Phillips head bolts
()	6	AN365-1032 3/16" Nyloc nuts
()	4	AN960-10 3/16" washers
()	4**	Cotter pins
()	4**	7/8 Rony Brkts (black alum. 'U' Brackets)
()	2**	AN4-15A 1/4" bolts (for Rony Brackets)
()	2**	AN364-428 1/4" Nyloc nuts (thin)
()	4**	AN4-14A bolts (for attaching stabilizers)
()	4**	PW-4 (black plastic washers)

Note: ** These parts are shipped in pre-assembled form.

IMPORTANT NOTE

Make notes on how the hardware is pre-assembled and the sequence of Assembly, so they may be re-installed properly. Refer to fig 10. in this section.

ASSEMBLY INSTRUCTIONS—Introduction

‘Tail Feathers’

CHALLENGER II—SECTION 1- Tail section (Empennage)

We supply a ‘Heat Shrinkable Dacron’ material to cover the tail section. It is lightweight at 1.8oz per sq yard and has a tight weave. Using heavier fabric requires extreme care to avoid distorting airframe members when shrinking, and does not have the fine finish as offered by the lighter material.

The assembly of your Challenger II Kit will be ‘TAIL FIRST’. This will give you the opportunity of getting the feel of working with shrinkable covering material.

OBJECTIVE of SECTION I

Upon Completion of SECTION 1 the tail surfaces (Rudder, Elevators, Horizontal Stabilizers and Vertical Fin) will be finished with most of the tail surface hardware installed.

Tools Required: (not supplied)

Hammer
Good camel hair brushes—1/2” - 1” brush
Razor blades
Scissors (also ‘pinked edged’ scissors if available)
Household clothes iron
3/16” pop rivet gun
Electric drill
3/16” drill bit
Metal file
De-burring tool
Medium grit sandpaper
Suitable filtered breathing mask

Other Materials: (not supplied in kit).

3/4” Masking tape
Paint mixing cups
Paint filter
Paper towels
Sponge brushes 1 1/2” to 2”
Protective gloves (rubber)

Conduct a full and careful inventory check using the list on page 4.

Typical completion time: 8 Hours

How to cover the tail surfaces using 'Heat shrinkable material'

TIPS:

1. Have a large, flat and clean surface on which to build your tail section. A large flat panel on two saw horses works well.
2. It is preferable to 'pre-fit' the elevator and rudder hinges BEFORE covering. It is much easier to drill the rivet holes accurately this way and less likely to damage fabric later. See 'How to install the hinge assembly HNG100' pages 8 & 9.

Covering:

1. Remove sharp edges of gussets and tubes ends with a file
2. Sand perimeter of tubes with 220 'Wet or Dry' abrasive paper.
3. Clean all tubes with MEK (remove all printed lettering from tubes, or this will bleed through the fabric at a later stage).
4. Tape over the rivets and sharp corners with chafe point tape or masking tape. See diagram.
5. Apply two coats of ADHESIVE to outside perimeter of frame and the cross tube also. Try not to go beyond the top and bottom center line of tubes. This helps prevent gluing the fabric too far around the frame. Allow to dry.
6. Slip on sock (SEAMS INSIDE AND STRAIGHT). Use of spring clamps come in handy to hold sock in position.
7. Glue down and seal open end of sock and allow to dry. Have a 2 to 3 inch overlap. Be sure to have overlap on underside of the horizontal stabs and elevators.
8. Tauten fabric with a household iron set to 300 deg. The use of a high temp thermometer is recommended. Attempt to shrink fabric in an EVEN manner from both sides of panel while keeping the seams in place. DO NOT OVER TIGHTEN as this will distort the frame.
9. Dilute the adhesive (in a metallic container) with MEK to 50/50, or until it attains the consistency of melted butter. Observe all breathing and skin protective procedures.
10. Apply the mixture to all the previously glued surfaces (over the fabric). This will re-activate the previously applied two layers of glue and form a bond to the fabric. Allow to dry. Use a good quality 1/2" or 1" brush or a 'Glue master'.
11. Use the iron and set to 350 deg. Tighten the fabric for the final time. Ensure the fabric is ironed evenly. Also, run the iron over the glued edges to remove any wrinkles. Be careful not to hold the iron on any one place for longer than a second or two. It is possible to burn holes in the fabric. A residue will collect on the iron face, this can be removed using MEK (when iron is cold) or an abrasive medium such as 'Green scrubbing pads' when iron is still warm.

Fabric adhesive and 50/50 mix.

TIP:

To 're-activate' previously applied glue, a mixture of Methyl Ethyl Keytone (MEK) and Adhesive is applied to fabric as it is laid over the glued tubing. This dries quickly and provides a very strong bond once cured.

The mixture should have the approximate consistency of melted butter and should not be allowed to dry out, or this mixture will congeal and will become in-effective as a 're-activating agent'. The mixture should be applied to the fabric and tubing in such quantities that it soaks through and turns the fabric to a wet looking grey color.

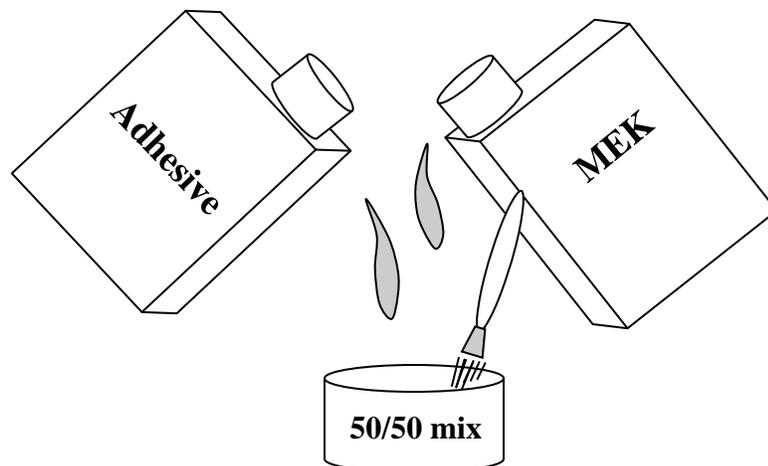
TIP:

Use a clean container (paper paint cups work well) to mix the components in and mark on the outside '50/50 mix'

It is advisable to use a similar container for the 100% adhesive (also mark on outside '100%'). Keep the container covered as much as possible. This will limit the amount of evaporation that naturally takes place.

TIP:

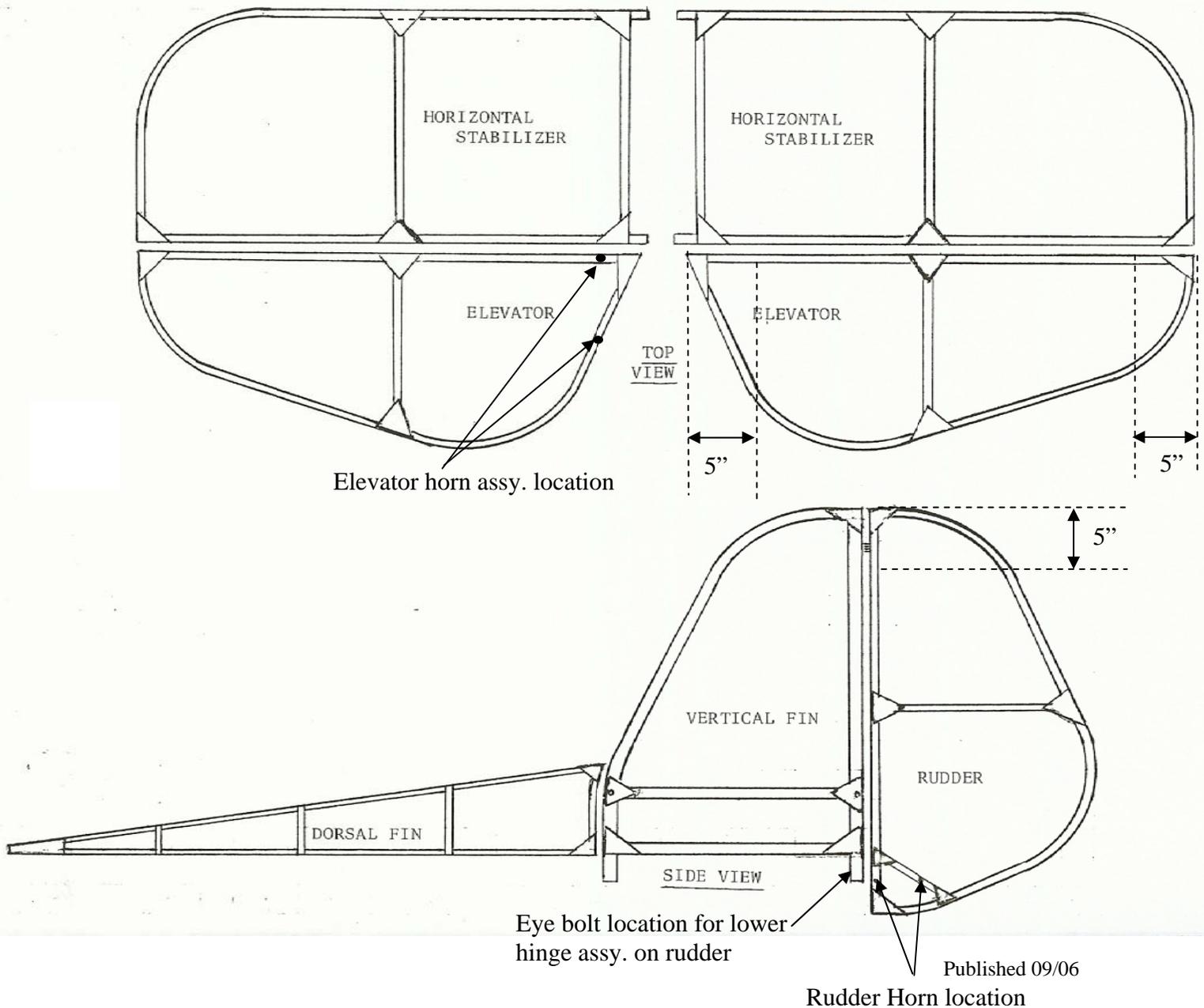
Clean brushes with MEK or Acetone.



Tail Section Schematic

<u>Description</u>	<u>Part number</u>
Rudder	EMP-100
Vertical fin	EMP-200
Horizontal stabilizers	EMP-300
Elevators	EMP-400
Dorsal fin	DF-100
Hinge assembly	HNG-100

Location of HNG-100 hinge assemblies



How to install the hinge assy. HNG100

The components that make up a single hinge assy.

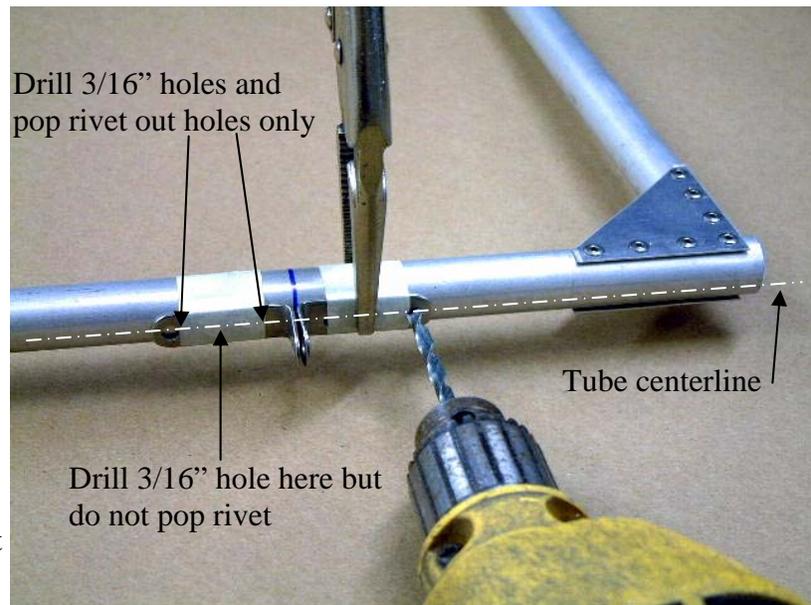
- 4 ST16L Tangs
- 12 AD64ABS 3/16" Rivets
- 1 Dummy bolt
- 1 Dummy nut
- 1 AN363-13 Clevis pin
- 1 LSR (large safety ring)

This picture (right) shows the correct orientation of the ST-16L tangs.



For correct positioning of the hinge refer to Tail Schematic on previous page (page 7.) Be sure to center the ST-16L tang on the center line of the frame tube.

Tape the hinge to the leading edge of elevator. Use tape and clamps (as shown) before drilling 3/16" holes. Pop rivet the two outer holes of the tang and carefully align the second ST-16L tang alongside the first. Proceed to drill the two outer holes as before. Pop rivet the outer holes then drill but DO NOT pop rivet the center



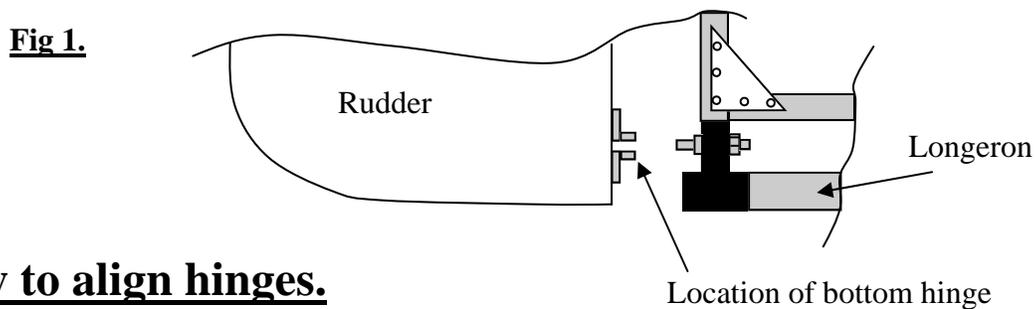
holes. This process is repeated for the second stabilizer and for the top hinge assy. on the rudder. Next, drill out and remove all 3/16" rivets and lay the ST-16L tangs aside until the covering and painting process has been completed..

How to install the hinge assy. HNG-100, Cont:

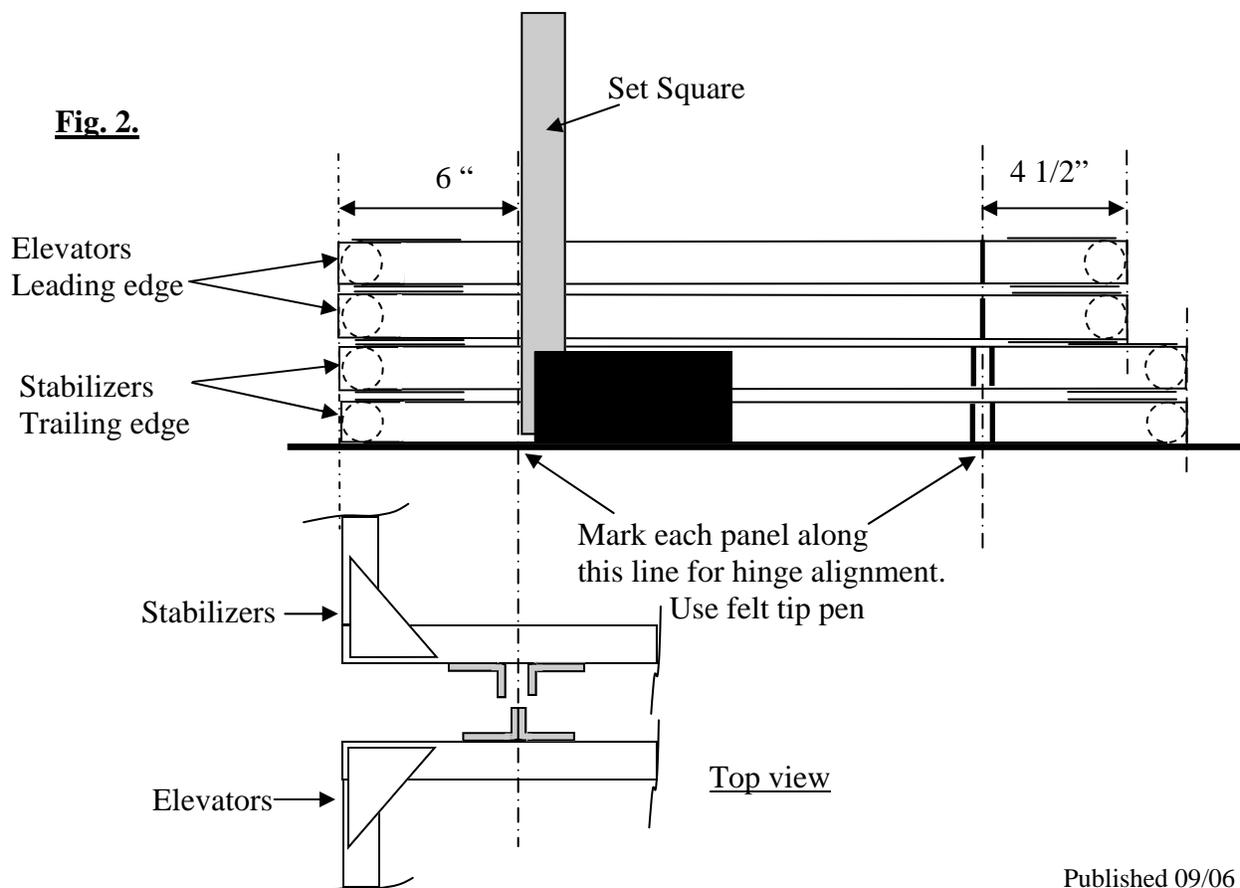
Once the tail section is covered and painted, locate the drilled holes with the use of an X-acto knife and carefully cut the fabric out of these holes. Line up the ST-16L brackets with the holes and rivet in place using 3/16" aluminum long rivets 1/4" grip. Check alignment of the stabilizer, elevator pairs and install clevis pins and safety rings.

Note:

The lower rudder fin hinge assembly will be left to final assembly in Section 3 due to the nature of the method of connection. Ref. Fig 1. below



How to align hinges.



How to cover the tail section framework

Step # 1

- A) Select the rudder frame from kit. If any sharp edges or burrs exist on pre-drilled holes and tube ends, remove them using a suitable metal file. Use a medium grit sandpaper (220) to lightly sand the entire frame. Wipe down the frame using a clean cloth and MEK (also Acetone works well). Remove all sanding and filing residue. This will ensure a good bond for the adhesive.
- B) Apply masking tape to all sharp edges of gussets to prevent fabric envelope from being snagged or torn when slipped on. Do not cover any more aluminum than is necessary since the adhesive will not adhere to masking tape as well as to aluminum. (See Fig 2. below).
- C) Use a soft 1/2" to 1" brush to apply a coat of adhesive to the entire outside perimeter of the tubing and the cross tube. Let this dry for approx 5 to 10 minutes. (See Fig 3. below).

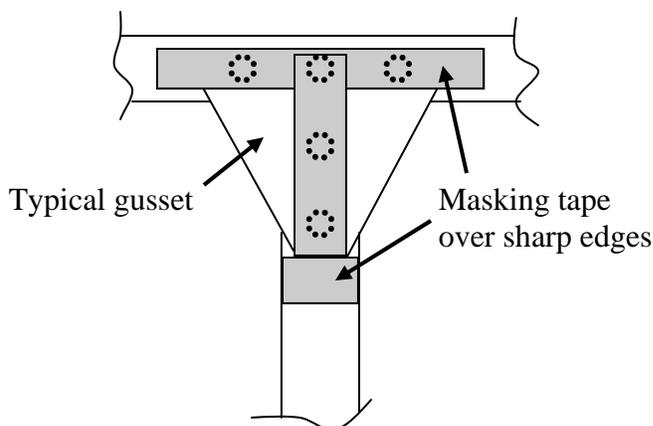


Fig 2.

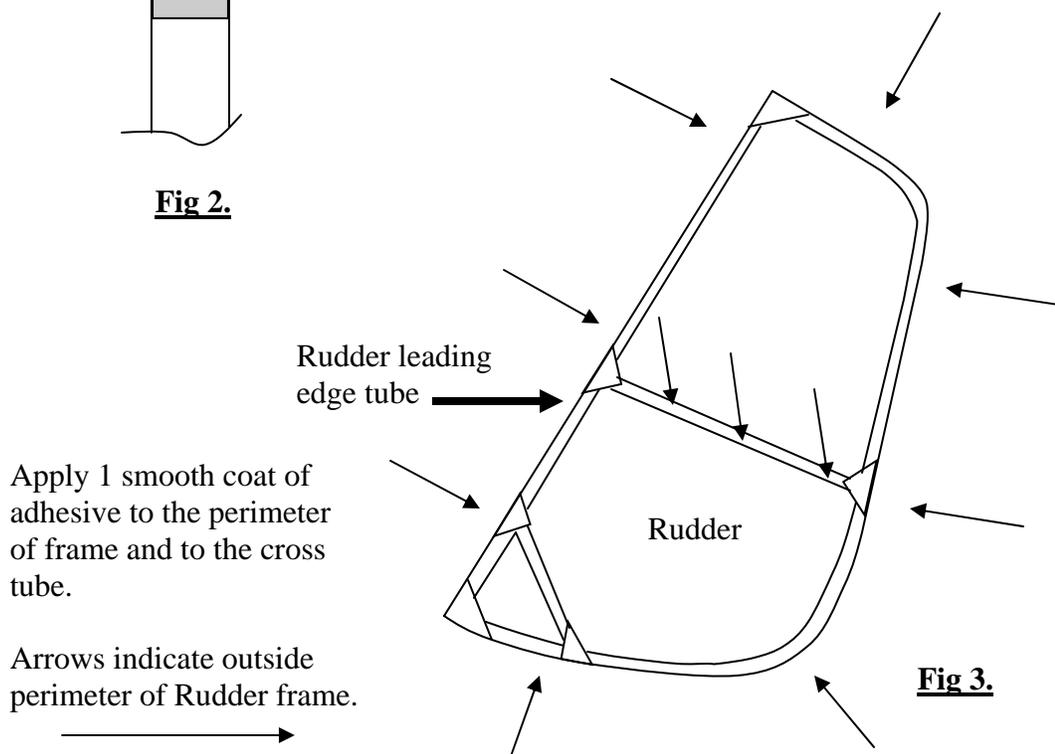
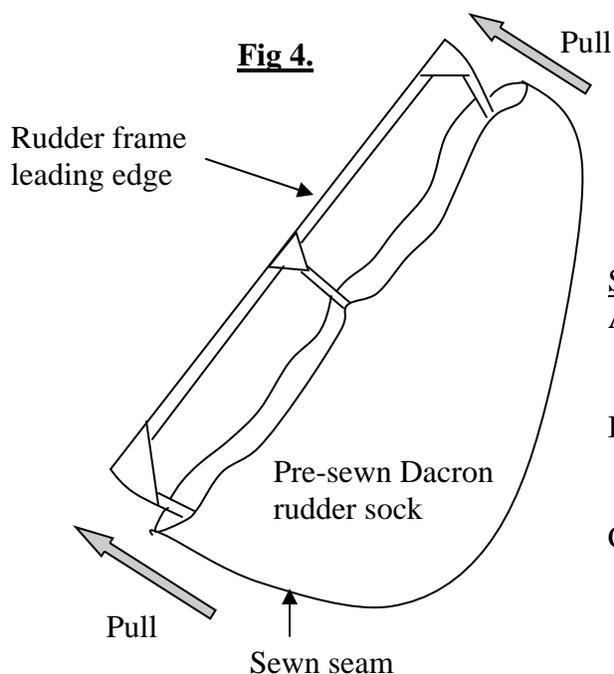


Fig 3.

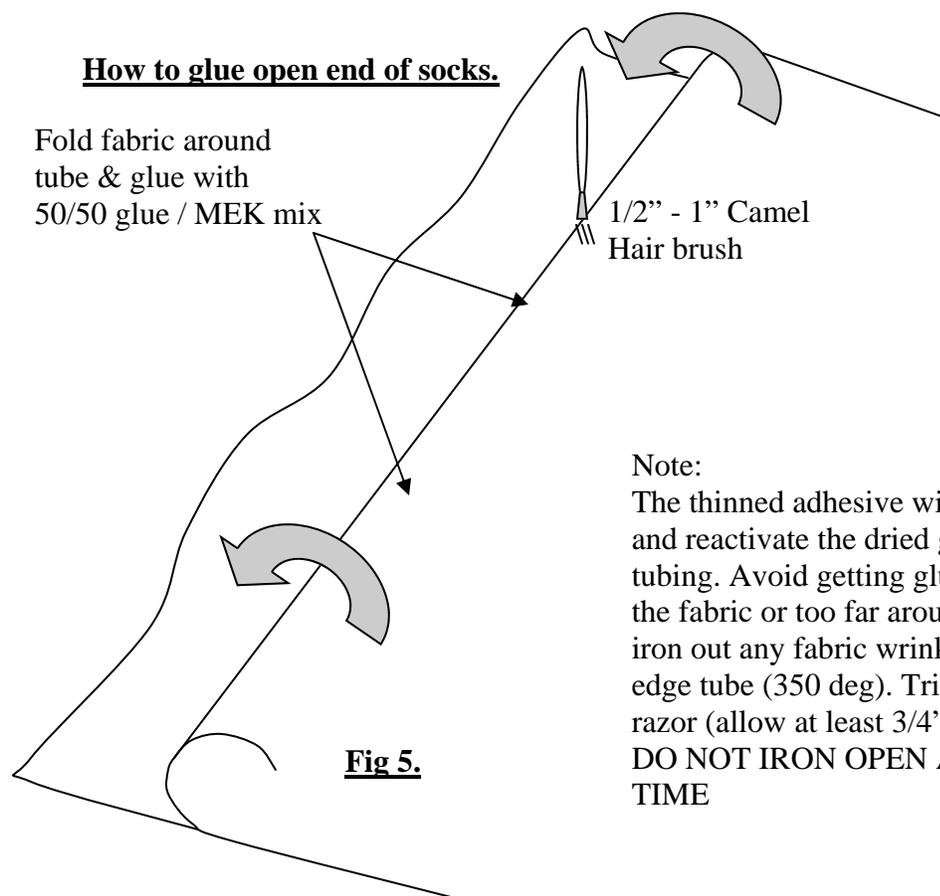
How to cover the tail section framework, cont:



Step #2.

- A. All pre-sewn socks are shipped inside-out. Turn the Rudder sock outside-in before applying to frame.
- B. Slide sock onto frame (Fig.4). Ensure all inside surplus fabric is on one side of the frame for smoother finish.
- C. Pull open end of sock over the leading edge and fold one side over, trim any excess fabric and attach with 50/50mix. See Fig 5.

How to glue open end of socks.

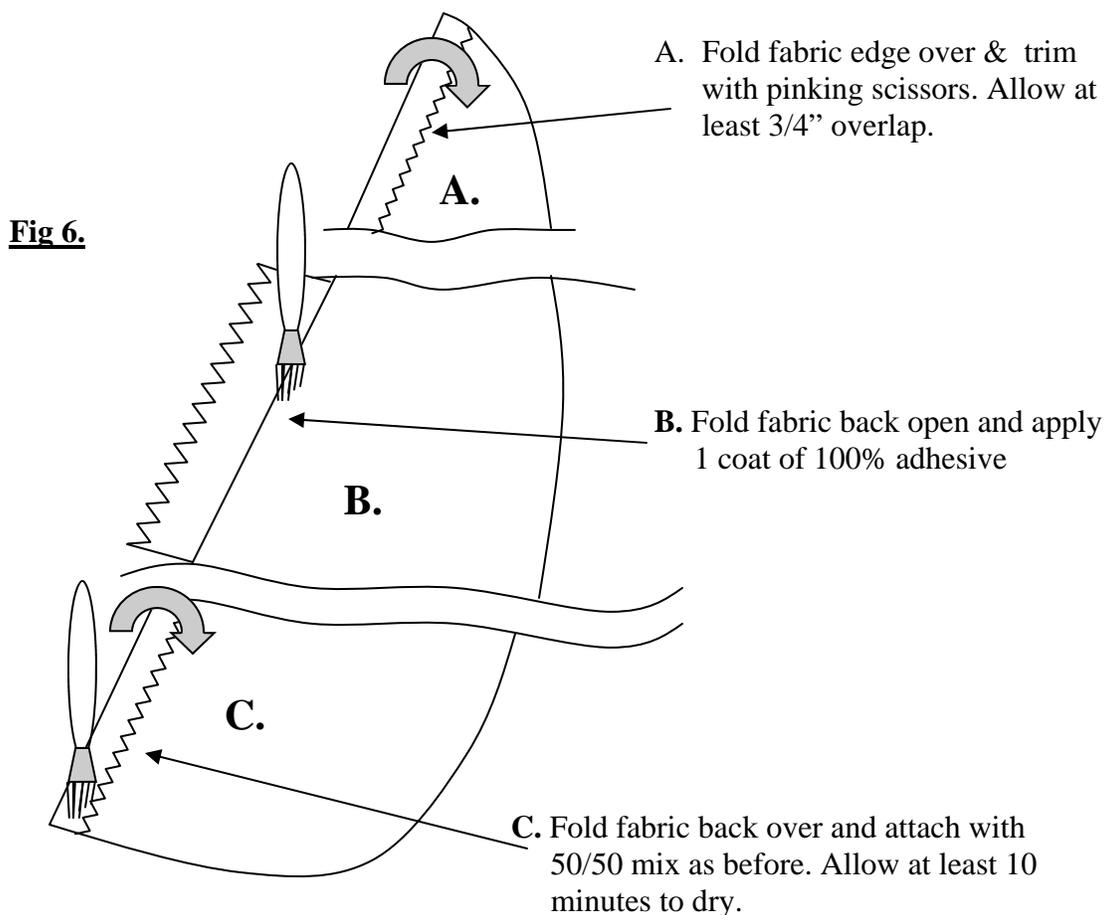


Note:

The thinned adhesive will penetrate the fabric and reactivate the dried glue already on the tubing. Avoid getting glue on any other part of the fabric or too far around the tube. Once dry, iron out any fabric wrinkles on the leading edge tube (350 deg). Trim excess fabric with razor (allow at least 3/4" fabric to contact tube) **DO NOT IRON OPEN AREAS AT THIS TIME**

How to glue open end of socks. Cont.

Step #3



D. Set clothes iron between 300 and 350 deg. to heat shrink fabric sock. Ensure wrinkles on perimeter edge are removed. Shrink fabric until a smooth, wrinkle free covering is achieved. Shrink each side progressively to keep sewn seam centered.. **DO NOT** heat excessively, you may melt a hole in the fabric.

E. After shrinking apply 50/50 mix to the perimeter and cross tube **BUT NOT THE OVER-LAP!** This will reactivate the adhesive that was applied earlier. Quickly wipe off any drips on the open fabric.

Clean up

Step #4.

Use a brush and apply 50/50 adhesive and MEK mix to the perimeter of frame. This will soften any surplus glue that has accumulated during the build process. Wipe off surplus drips or lumps of glue on the frame perimeter and open fabric areas with a lint free cloth while it's still wet. If necessary, use 100% MEK, especially on stubborn and dried glue drips. Be careful not to dilute the adhesive that holds the fabric on the frame. Use the iron to smooth out any lumps or wrinkles that are left.

Tip : Any lumps are easier to fix now than later.

*Tip : Un-even edging can be covered over using the 2" pinked finishing tape. 1.7oz
Cut the to the required length and apply along the seam using a thin coat of poly brush.
Make sure the tape is soaked through and good adhesion is obtained.
To smooth the pinked edge of the finishing tape, use the iron set to 300 Deg and run it along the edge of the tape. Use bias tape if applying around curves.*

Step #5.

Covering the stabilizers, vertical fin and elevators is accomplished in the same manner as the rudder. Follow each previous step, using the same techniques, for the particular frame being covered. Cover all the aforementioned surfaces at this time. Upon completion of this step, covering of the tail surface frames will be complete and ready for painting.

Tip : The Hinge assemblies can be riveted into place once the paint job is complete.

Tip : On two seat Challengers, keep the tail light (not too much paint) to avoid requiring nose ballast.

DF-100 Dorsal Fin.

To expedite shipping, the dorsal fin DF-100 is shipped with the fuselage and is not part of the Section 1 package. Remember to repeat the same process for covering, making sure the sewn seam is centered on the bottom of dorsal fin frame.

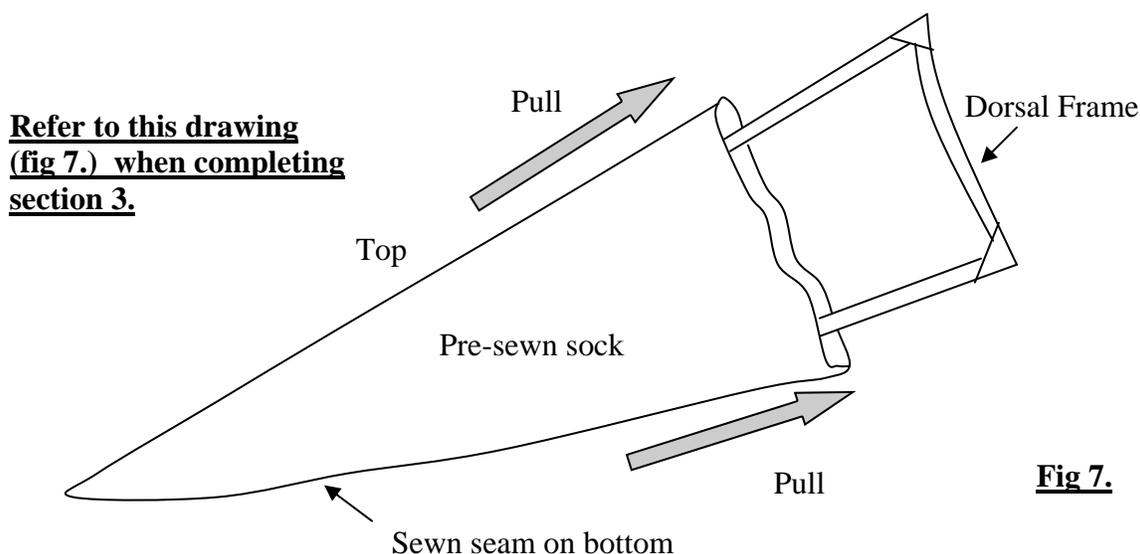


Fig 7.

How to apply fabric sealant, UV protection and paint

Step #6

Fabric Sealant

A good fabric sealant is required to seal the weave.

We have had success with a product called '**POLY BRUSH**'.

POLY BRUSH is available from most reputable aircraft parts suppliers in quarts and gallons. Read instructions on the can before applying.

Apply POLY BRUSH to fabric with the use of sponge brushes or fine paint brushes. One thin coat is carefully and evenly applied. Be careful not to apply too much. This will only soak through and collect in large drips on the inside of the fabric. Be sure to spread out any thick accumulations of Poly Brush as quickly as possible. This will save a lot of work later .

Note, it is recommended to spray a second coat of Poly Brush, thinned by 20% to 50%. Have a proper paint mask when using Poly Brush, and the operation be carried out in a well ventilated area.

UV Protection

Poly Spray is recommended as UV protection for the fabric. This will reduce the harm and damage done to the fabric from the sun's UV rays.

This is a paint that is silver in color. It has very little odor and can be applied with the use of a HVLP spray paint system. It is supplied in Quarts and Gallons and available from most reputable aircraft parts suppliers.

Apply one good coat, being careful not to over spray and accumulate any excess or runs. Once this is dry apply one more thin coat if necessary. The tail section is now ready for your paint job.

Paint

There are various paint systems out there. We have used Poly Fibers - POLY TONE system. Apply paint using any good high volume, low pressure spray paint system.

It is recommended that you apply
2 coats of Poly Brush
2 coats of Poly Spray
2 coats of color. THEN STOP !!

No more should be applied to the aircraft due to weight considerations.

If, however, you wish to complete your aircraft to 'Airshow quality', you can continue your paint job as necessary.

Top View of Stab attach points on vertical fin

Step #8

Install 7/8" U-bracket assemblies in pre-drilled holes in vertical fin. Reinstall hardware in U-brackets as shown in this 'TOP view' drawing.

Set aside until needed in Section III.

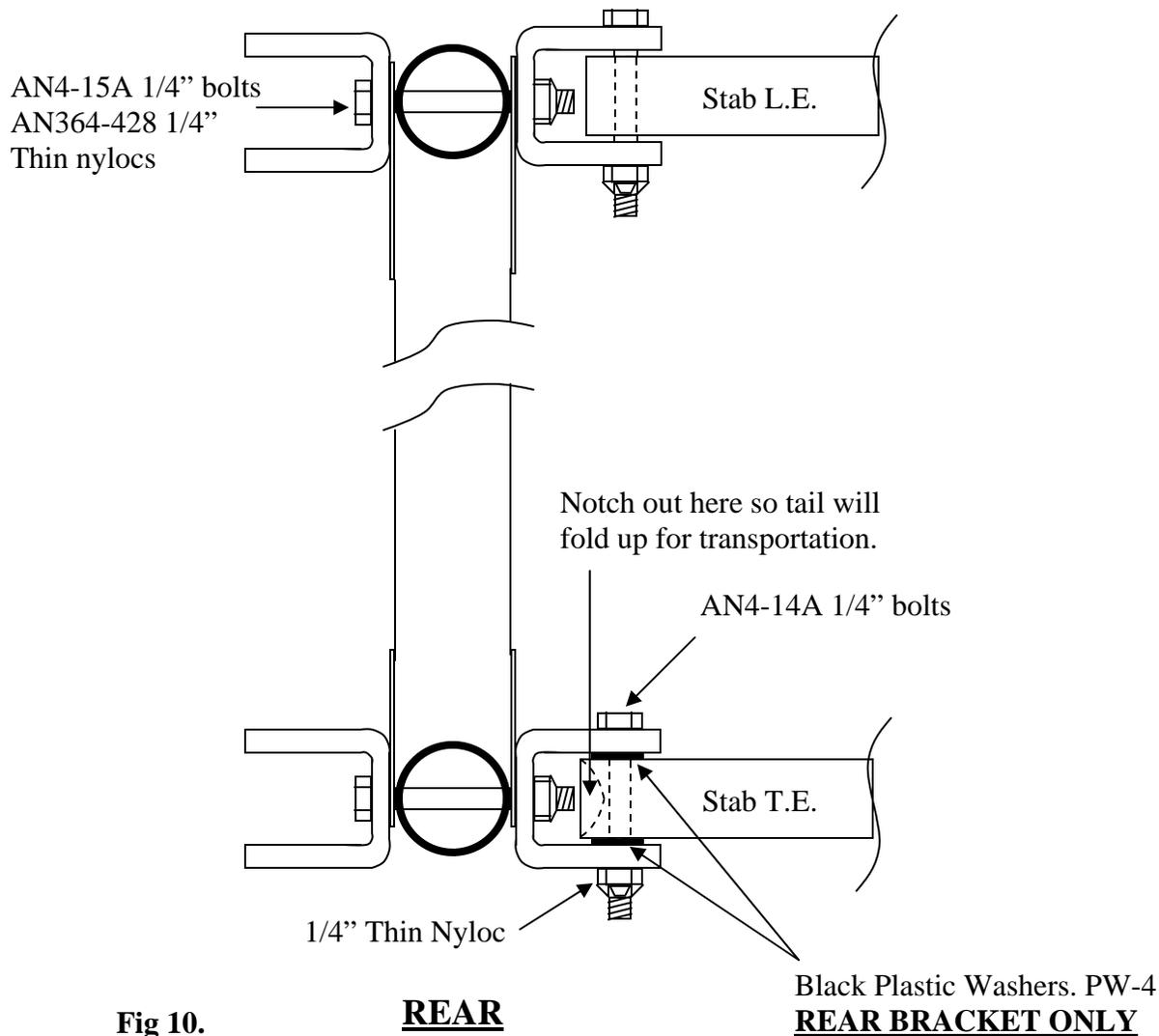


Fig 10.

Your Section I should now be complete and ready to attach to your Section III

... and finally

Inspection:

We did not use inspection covers as most areas are accessible with out them. Drain holes at the back edges of bottom surfaces are a good idea, particularly if aircraft is operated on floats or tied down outside.

Assembly final notes:

It is considered proper procedure to insert all aircraft bolts either with the bolt threads down , pointing outboard or toward tail when possible. This is done in case the nut should somehow be removed, the forces (gravity inertia) will tend to keep the bolt in place. It is wise to observe this procedure in the assembly of any aircraft. Also, when using locknuts, at least one bolt thread should be visible on the outside end of the nut after tightening. Locknuts should be tightened and loosened no more than twice or replaced with a fresh aircraft grade locknut to insure proper locking action.

Bolts that pass through tubes with no solid internal support should be tightened until the tube shows a slight distortion (5%). Where castle nuts are used be certain to lock with a safety pin, cotter pin or safety ring. Bolts that pass through U-brackets should compress the U-bracket no mare than 1/16”

NOTE: In later assembly, check engine owners manual for proper torque values of engine bolts