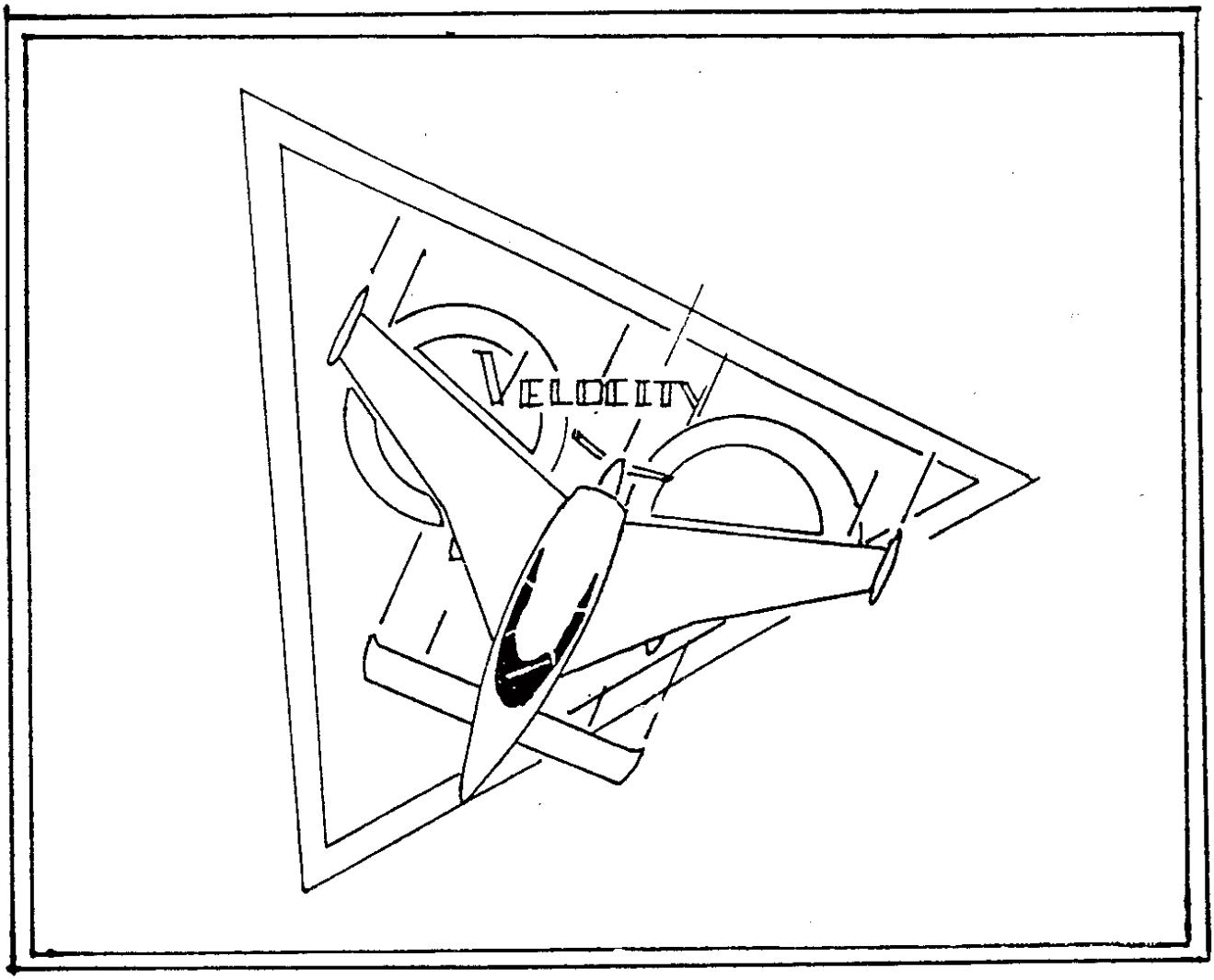
VELOCITY



Section III

CRITICAL DIMENSIONS

This list of dimensions is posted for quick reference by the builder.

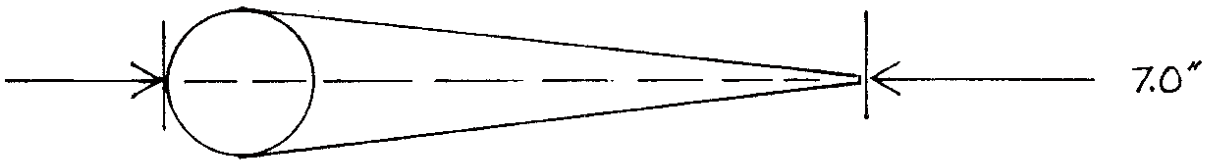
CANARD LENGTH (Prior to installation of canard tips): 154.0"

CANARD CHORD: 11-7/8"

ELEVATOR HINGE POSITIONS (Inches in from canard outboard end)
1) 2-1/2"
2) 20-1/2"
3) 40-1/2"
4) 58-1/2"

ELEVATOR LENGTH (Inboard tube end to Outboard tube end): 76-5/8"

ELEVATOR CHORD (Prior to installation of elevator cuffs): 7.0"



GLASS TO GLASS CONTACTS:
Canard TE: 7/8" Elevator TE: 1/4" to 3/8"

ELEVATOR DEFLECTION:
FULL UP: 23-25 Degrees
FULL DOWN: 26 Degrees MINIMUM

GAP BETWEEN CANARD TE AND ELEVATOR (Cuff installed):
Elevator Neutral position: 0.050"
Elevator Full Down: 0.200"
Elevator Full Up: Not critical, as long as full deflection is achieved.

SUPPLY LIST FOR CANARD CONSTRUCTION

FOAM CORES & SPAR

(1) CANARD SPAR
(2) Canard LE Cores
(2) Canard TE Cores
(2) Canard Tip cores (1 piece in billet, builder splits)
Elevator Cores (3 pieces in billet, builder splits)

FIBERGLASS CLOTH

TRIAX - 13" X 160"
TRIAX - 14-1/2 X 160"
UNIDIRECTIONAL - 16" X 160"
UNIDIRECTIONAL - 22" X 160"
(8) UNIDIRECTIONAL - 64" X 8-1/2"

MACHINED PARTS

(2) Canard Lift Tabs
(8) Elevator Hinges
(8) Elevator Hinge Arms
(1) Elevator Torque Tube
(1) Elevator Torque Arm, Left VETA-L-02
(1) Elevator Torque Arm, Right VETA-R-02
(1) Elevator Counterweight Arm, Left VECA-L-01
(1) Elevator Counterweight Arm, Right VECA-R-01
(1) Elevator Center Hinge Arm Assy VEHP-02
(1) Elevator Counterweight, Left Inboard VECW-LIB-01
(1) Elevator Counterweight, Left Outboard VECW-LOB-01
(1) Elevator Counterweight, Right Inboard VECW-RIB-01
(1) Elevator Counterweight, Right Outboard VECW-ROB-01

ATTACHMENT HARDWARE

(16) BSP-44 RIVETS, 1/8"
(12) AN507-1032R7 SCREWS, COUNTERSUNK
(26) MS21042-3 LOCKNUTS, 10-32
(8) AN525-10R8 SCREWS, 10-32 PANHEAD
(16) AN960-10L THIN WASHERS 3/16"
(6) AN960-10 WASHERS 3/16"
(6) AN4-6A BOLTS, 1/4-28
(1) AN4-12A BOLT 1/4-28
(1) MS21042-4 LOCKNUT, 1/4"
(1) AN960-416L THIN WASHER, 1/4"
(6) AN960-416 WASHER, 1/4"
(8) AN509-10R17 SCREWS, COUNTERSUNK 10-32
(2) AN509-10R28 SCREWS, COUNTERSUNK 10-32

MISCELLANEOUS TOOLS

DRILL BIT FOR 1/4-28 TAP
#30 DRILL BIT
#21 DRILL BIT
3/8 DRILL BIT (POINT GROUND OFF)
3/16 DRILL BIT

1/4-28 TAP
INCLINOMETER (AVAILABLE AT SEARS "CRAFTSMAN UNIVERSAL PROTRACTOR)
(4) 1" X 1" X 2' STRAIGHTEDGES
CARPENTERS SQUARE

PRE-MOLDED GLASS PARTS

CANARD SPAR
ELEVATOR CUFFS (2)

INSTALLATION OF LIFT TABS SKETCH 302-A

The top cap of the canard spar has a slight curve while the bottom cap is flat. The L.E. is thick and the T.E. is lighter.

On the LE spar face, draw both a vertical and a horizontal centerline. Measure 12" outboard to each side of the vertical centerline, and mark these points on the horizontal centerline. At these points, drill and tap into the L.E. spar face for a 1/4-28 bolt (there are aluminum hardpoints built into the spar). Attach each aluminum tab supplied through the center hole with a 1/4"-28 X 3/8" bolt (AN4-6A) and 1/4" washer (AN960-416). Align the aluminum attachment tabs vertically. Drill and tap the other two holes through each tab.

Sand the spar and the 'spar side' of each tab. Apply a mix of GENEMID & MILLED FIBER between the spar and the tab, as well as in each bolt hole. Firmly bolt the tabs into place.

FOAM CORES DIAGRAMS 302B/302C

Sand spar surfaces. Set spar and cores on a long flat surface or clamp the lift tabs to a sawhorse. Fit L.E. foam cores onto the spar, cutting off pointed tips and trimming out clearance for the tabs. Attach the cores with microspheres using masking tape to hold in place. Bond the T.E. cores in the same way using scrap pieces from the billet they came in to protect the T.E. while taping into place. Check the contour with your incidence block, and if any difference in thickness occurs, split it between top and bottom. Check the chord, and compare the dimension to that of the outboard cores before micoing into place.

Make sure cores fit evenly on the spar. Check for alignment and conformity using the canard rigging board on several places along the canard. Use shims between the spar and cores if necessary and pull the tape tighter on the side that leans away from its proper alignment.

It's O.K. for the cores to overlap the spar a little. It is best that the top side conform to the rigging template. A little fill on the spar cap area after the glass lay-ups is better than filling all the core areas to match the spar. The latter runs the risk of changing the basic airfoil. Allow to cure.

Cut two pieces at least 22" (two extra inches would not hurt as this allows you to trim your canard back to proper length and get a neat end)from the canard end section core. Sand the butting ends square with each other and bond the canard extensions with microspheres. Be sure to align them with the spar section of the canard using weights or shims if needed. Use the pre-marked level lines on the tips and the leveling wood template in between. Use nails to hold the cores in place while curing. CHECK REPEATEDLY TO BE SURE THERE IS NO TWIST TO THE CANARD. IT IS RELATIVELY EASY TO FIX PRIOR TO SKINNING THE SURFACE, AND PRACTICALLY IMPOSSIBLE AFTERWARDS. Allow to cure.

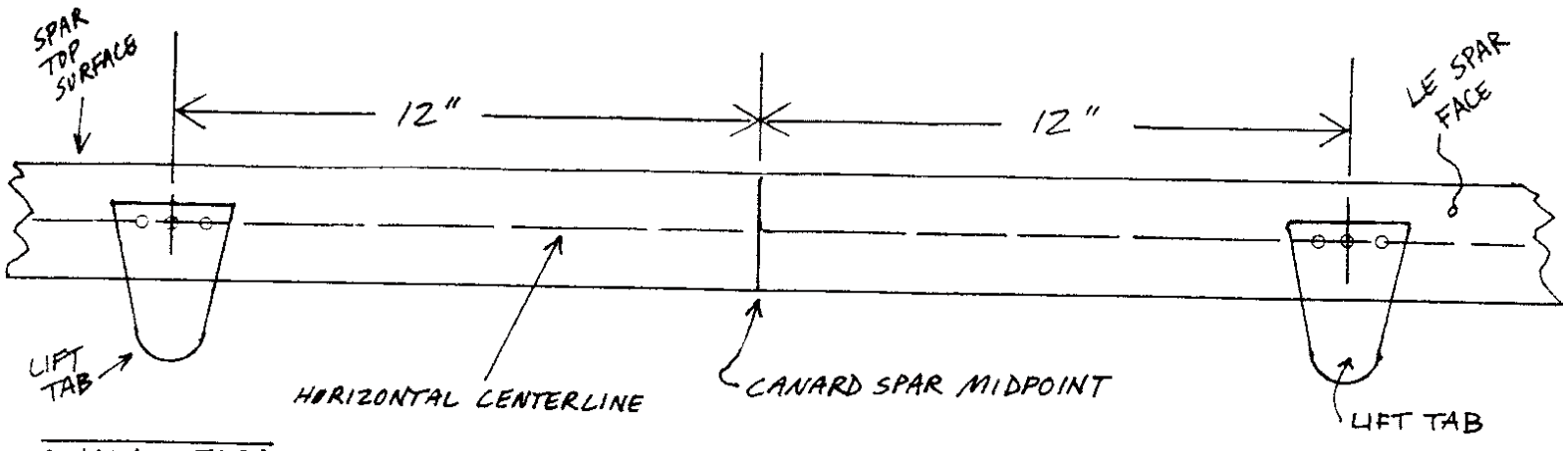
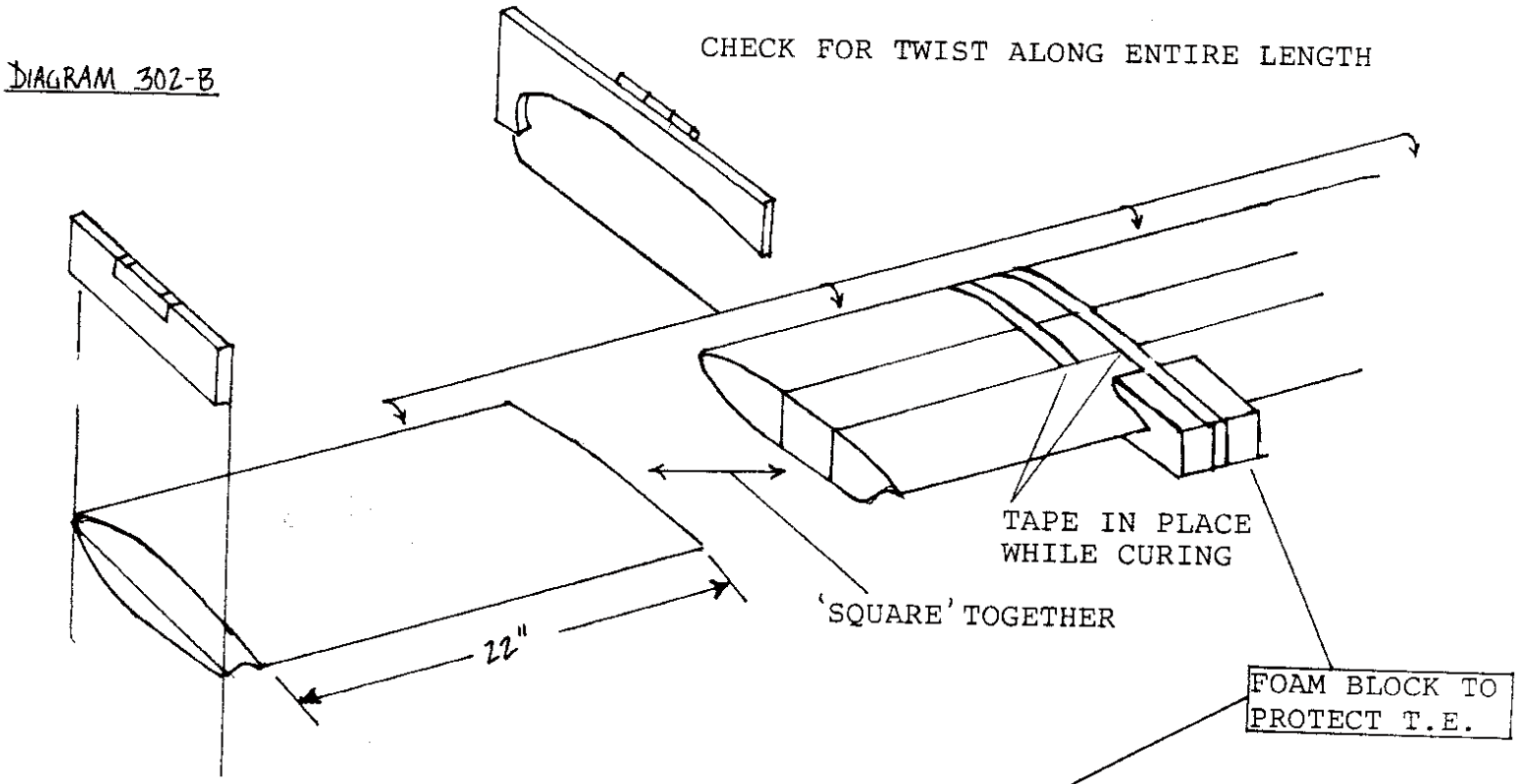


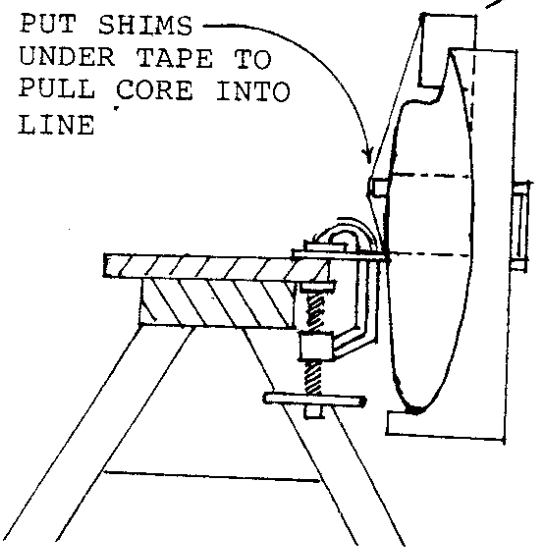
DIAGRAM 302A

DIAGRAM 302-B



ALTERNATIVE:

CLAMP LIFT TABS TO BOARD FASTENED TO SAWHORSE



USE CANARD RIGGING BOARD TO ACHIEVE CONFORMITY OF CORES AND SPAR ALONG FULL LENGTH

DIAGRAM 302-C

PREPARATION FOR SKINNING

Dress down irregularities with 100 grit (light sanding). Use a long sanding block to make the L.E. straight. A 3 foot block would be very advantageous later in the construction. At Velocity, we use up to 5-foot aluminum blocks.

Use 5 minute epoxy to bond one long straightedge to the top surface of the canard, 2" back from the L.E. Invert the canard and carefully sand and fair the canard bottom.

IMPORTANT NOTE AS WE SAID EARLIER, IT IS EXTREMELY IMPORTANT TO REMOVE ANY TWIST FROM THE CANARD PRIOR TO APPLICATION OF ANY OF THE SKINS. FOLLOW THESE STEPS TO MINIMIZE THE CHANCES OF GETTING ANY TWIST IN YOUR CANARD DURING THE FOLLOWING PROCESS:

1) STRAIGHTEDGES MUST BE PARALLEL TO EACH OTHER, AND UNIFORM ALONG THE LENGTH OF THE CANARD. BY THAT, WE MEAN THAT IF THE I-CHANNEL IS 2" FROM THE LE AT ONE POINT, IT SHOULD BE 2" FROM THE LE AT ALL POINTS. THE SAME APPLIES TO THE T.E..

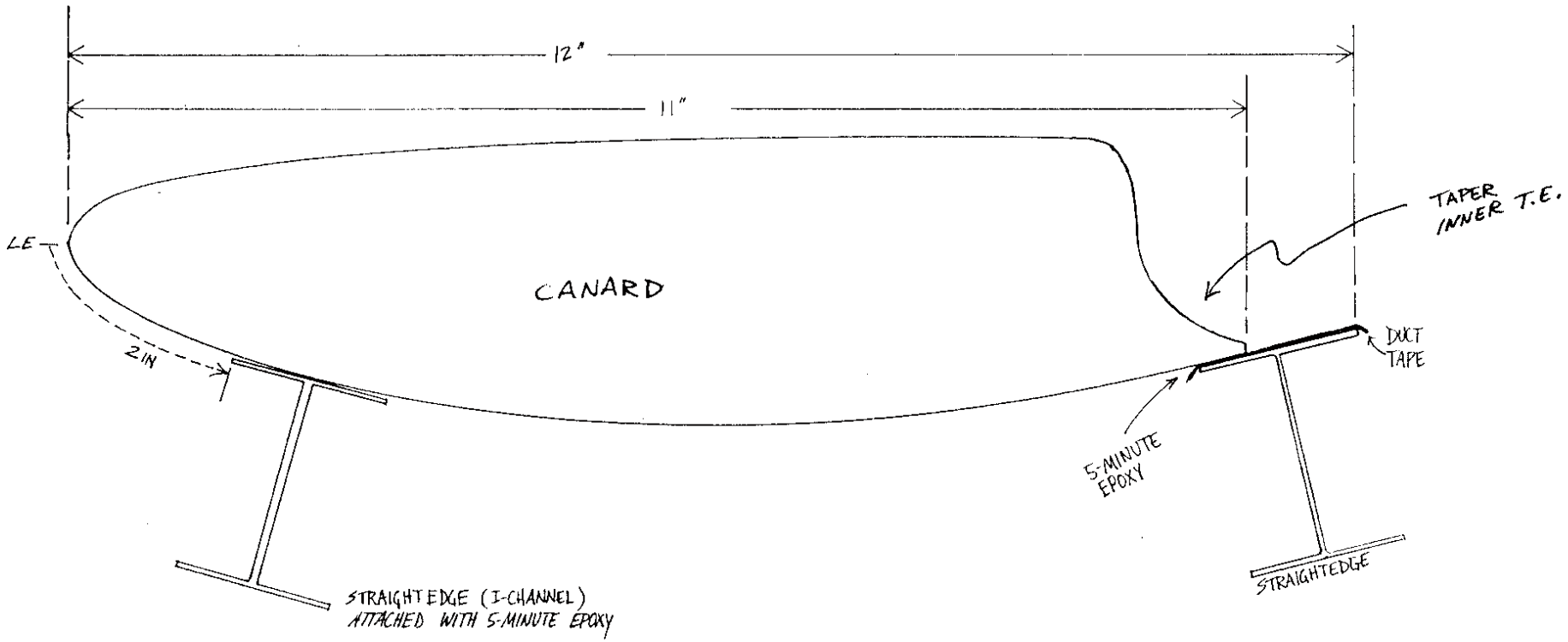
2) I-CHANNELS SHOULD BE LEVEL LENGTHWISE, WITH NO SAG IN THE MIDDLE OR AT THE ENDS. A GOOD SUPPORT POINT FOR THE STRAIGHTEDGES IS 3 TO 3-1/2 FEET IN FROM THE ENDS. BE SURE THAT THE GAP BETWEEN THE STRAIGHTEDGES AND THE CANARD SURFACE IS UNIFORM FOR THE LENGTH OF THE CANARD.

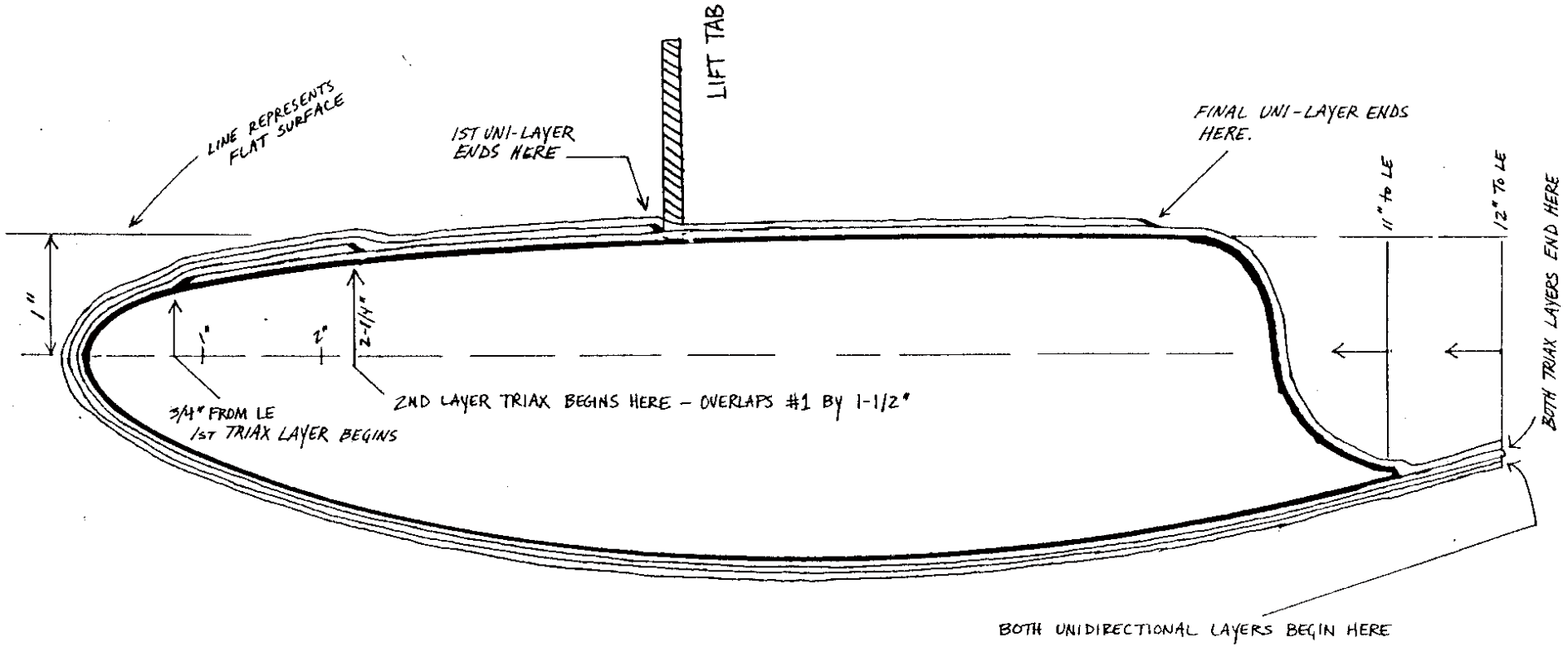
3) SIGHT DOWN THE LE AND TE OF THE CANARD TO DETECT ANY MISALIGNMENT OF THE CORES. YOUR VISION IS SURPRISINGLY SENSITIVE WITH REGARD TO A STRAIGHT LINE.

Put duct tape on the other long straightedge. Place it under, and parallel to, the canard T.E. so that the straightedge aft edge is 12" from the canard L.E.(DIAGRAM 303A). Shim the straightedges against the cores so that their surfaces are parallel to the core surfaces. Bond with the 5 minute epoxy mix in this position clamping and weighting as required.

Trim the T.E. to 11" from the L.E. leaving 1" of the straightedge exposed. Use a 1-1/2 OD tube to sand the concave T.E. core area. Sand the T.E. to a taper.

DIAGRAM 303-A
Rev 11/90

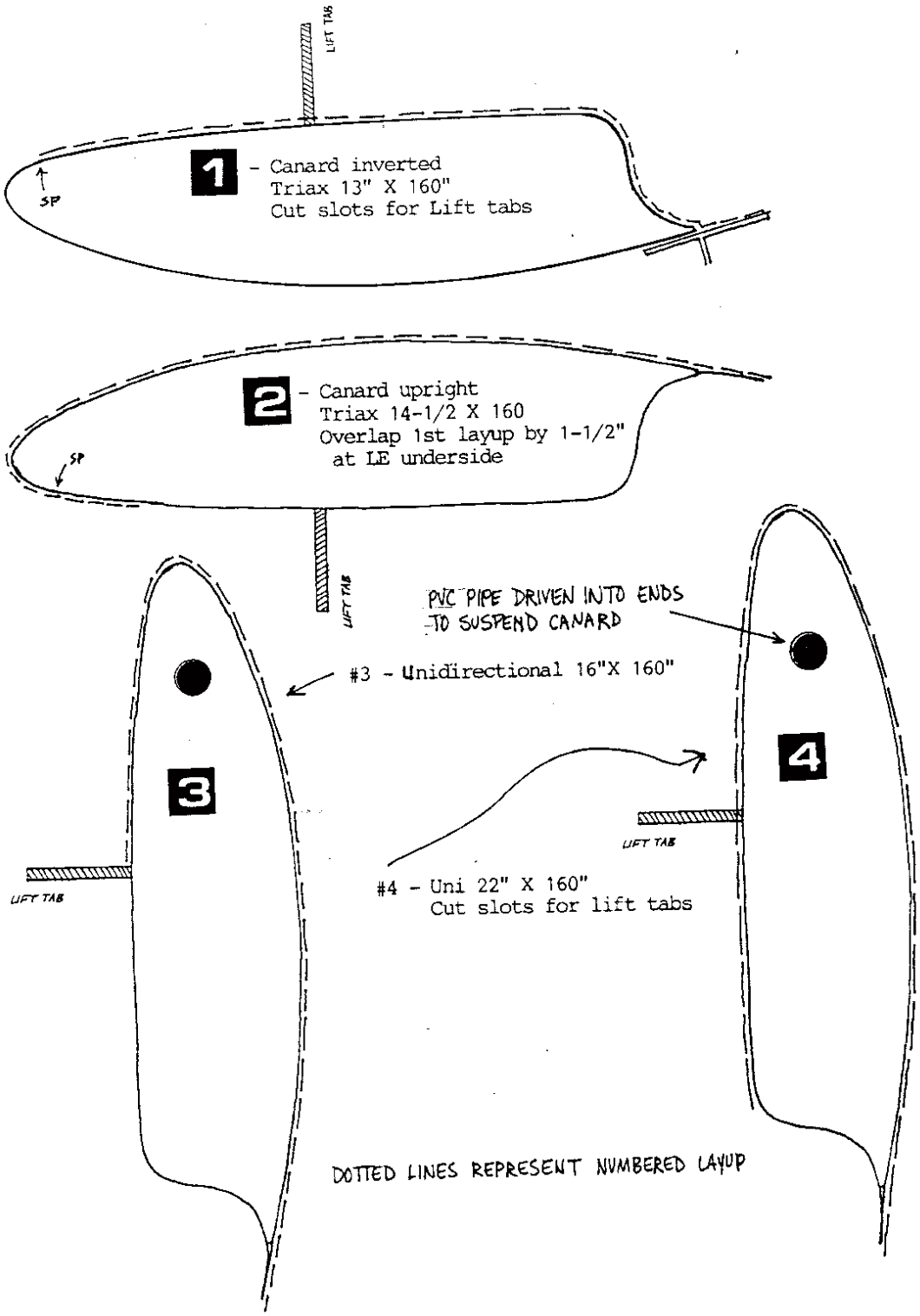




LAYERS EXAGGERATED FOR CLARITY

OVERVIEW OF LAYUP SCHEDULE

LAYER 1 - TRIAX (13" X 160") - SKIN LOWER CANARD SURFACE
LAYER 2 - TRIAX (14-1/2 X 160") - SKIN UPPER CANARD SURFACE
OVERLAP LAYER 1 BY 1-1/2" AT LE
LAYER 3 - UNIDIRECTIONAL (16" X 160")
STARTS AT UPPER TE, GOES AROUND LE, AND STOPS JUST FORWARD OF THE LIFT TABS.
LAYER 4 - UNIDIRECTIONAL (22" X 160")
STARTS AT UPPER TE, GOES AROUND LE, AND STOPS JUST BEFORE ELEVATOR RECESS. CUT SLOTS FOR LIFT TABS.



GLASSING THE CANARD DIAGRAMS 304-A & 304-B

LAYUP #1 Canard is upside down, and supported as shown in DIAGRAM 303-A. Cut a 13" X 160" piece of TRIAX cloth. Sand the spar cap surface. Slurry (SAFETYPOXY & GLASS BUBBLES) the canard bottom cores from a line about 1/4" aft of the L.E., filling core pores and voids, avoiding the spar cap. Large voids should be filled with a dry slurry (just add some bubbles to any leftover slurry).

Recheck for twist with a level across the straightedges at both ends. Using SAFETYPOXY, wet the spar cap and lay-up the TRIAX, selvage edge forward, overlapping the T.E. aluminum slightly. Pull out the longitudinal 'loops' in the cloth. Keep checking for lumps or bubbles that might occur while the layup is curing.

LAYUP #2 File the rough L.E. and sand about 2" aft for the overlapping skin. Sand the spar cap. Trim the T.E. back 1/4". Remove the straightedges. Sand the T.E. skin for bonding.

With canard right side up, bondo a straightedge to the glassed T.E. Bondo or clamp straightedge to table as well. Use the second straightedge to support the L.E. of the canard. Place it back by the lift tabs so that the overlap of the skin is accessible.

Check top surface with template for a smooth conformance. Lightly sand as required. Recheck for twist. Shim as required.

Cut a section of TRIAX 14-1/2" X 160" long. Trial fit the cloth. In proper position, the cloth should overlap LAYER #1 by 1-1/2", and should hang slightly off the canard TE. Remove the cloth from the canard, and wet out the following:

1) top spar cap
2) Overlap area on bottom skin
3) Exposed bottom TE skin

Put the cloth back on the canard, and finish the layup. Recheck your alignment, and let cure.

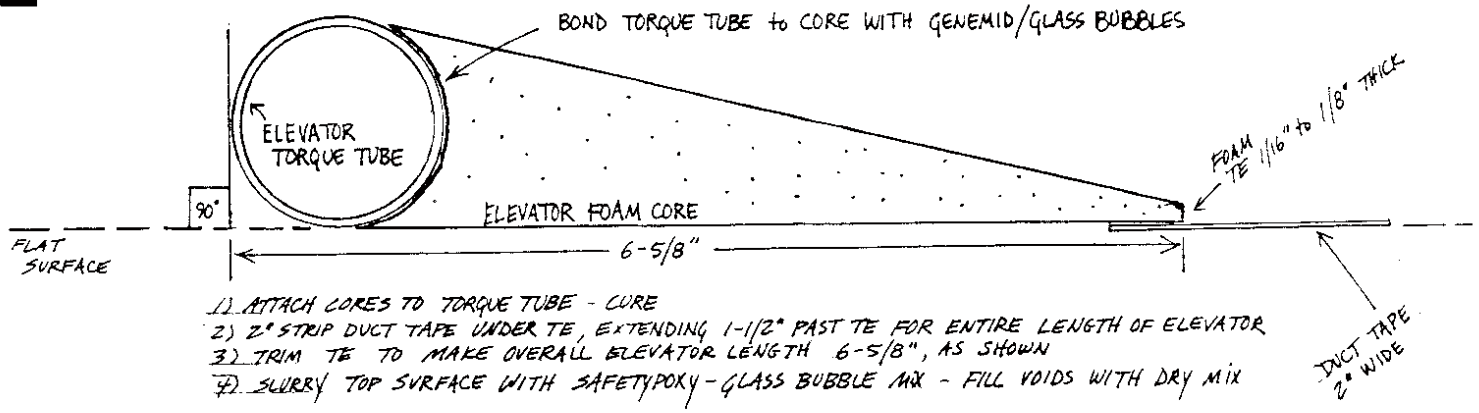
LAYERS #3 & #4

Force pieces of electric conduit into both ends of the canard about 6" and suspend the canard on two saw horses.

Cut 1 layer of UNI 16" X 160" and 1 layer 22" X 160". The first layer goes from the top T.E. around in front of the lift/attach tabs. The second layer is applied from the top T.E. around in front of the elevator recess (Cut slots for the tabs).

Sand the glass for lay-up. Wet with safety-poxy and apply lay-ups. Let cure.

1

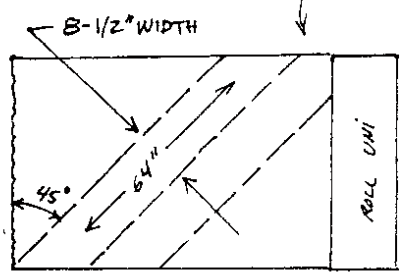


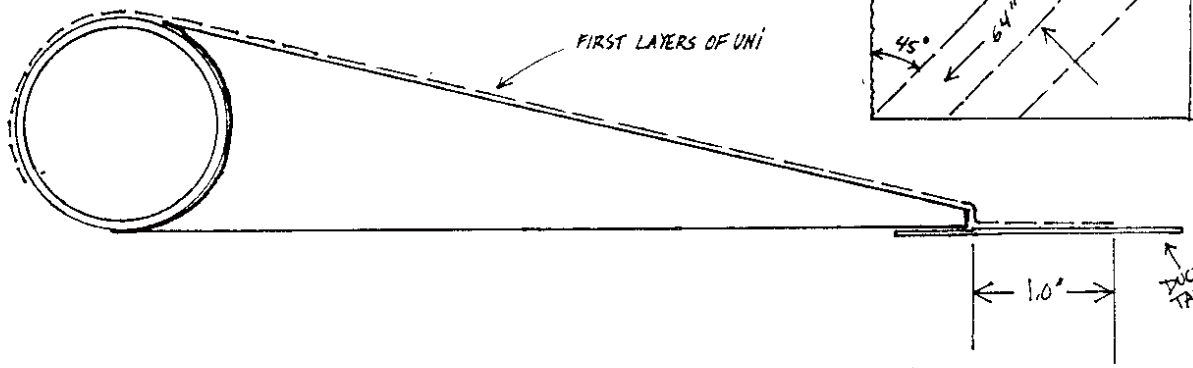
1) ATTACH CORES TO TORQUE TUBE - CURE
2) 2" STRIP DUCT TAPE UNDER TE, EXTENDING 1-1/2" PAST TE FOR ENTIRE LENGTH OF ELEVATOR
3) TRIM TE TO MAKE OVERALL ELEVATOR LENGTH 6-5/8", AS SHOWN
4) SLURRY TOP SURFACE WITH SAFETYPOXY - GLASS BUBBLE MIX - FILL VOIDS WITH DRY MIX

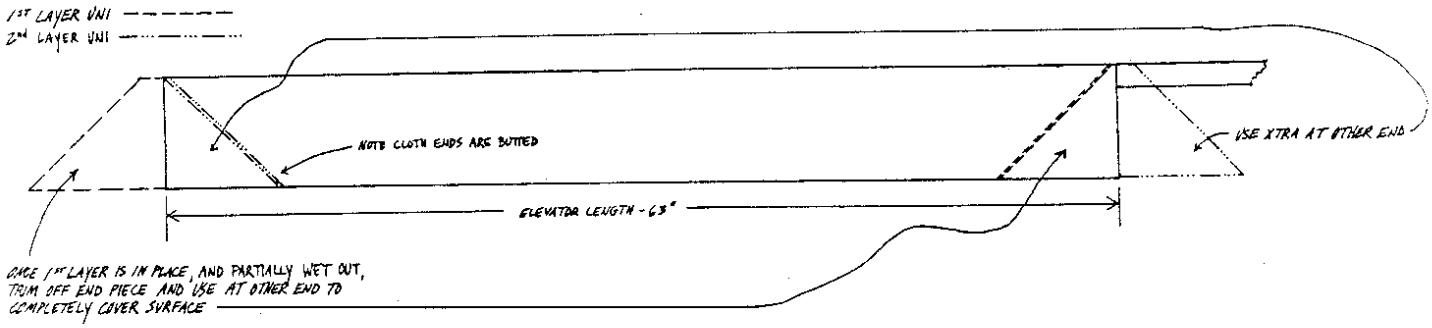
2

GLASSING: CUT (8) 64" X 8-1/2" WIDE STRIPS UNIDIRECTIONAL CLOTH (~~7781~~) ON 45° BIAS

1) TOP SURFACE GETS TWO LAYERS OF UNI
   BUTT ENDS, DON'T OVERLAP — STAGGER BUTT JOINTS
2) LAY-UP WRAPS 3/4 OF THE WAY AROUND LE - EXTENDS APPROX 1.0 INCH PAST T.E.



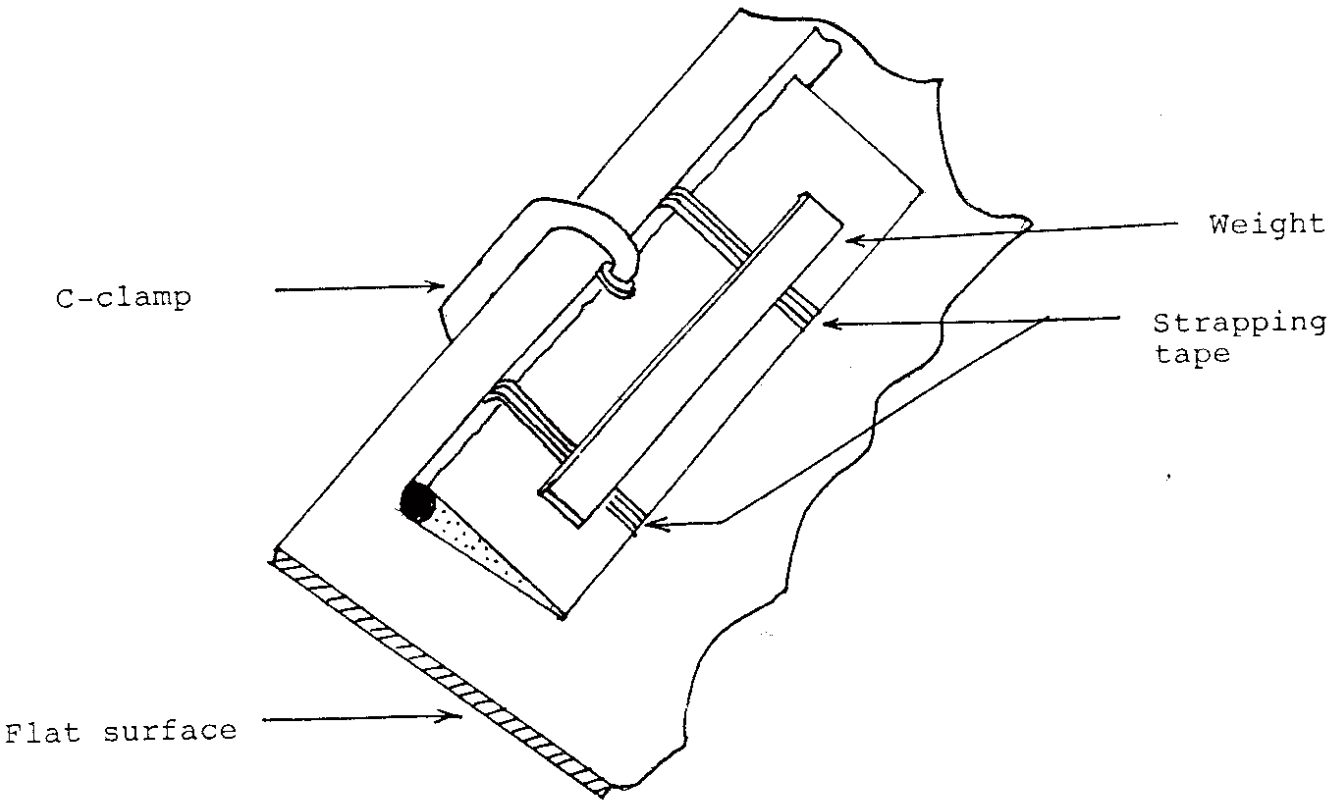




ASSEMBLE CORES

Cut elevator torque tube material in half. There should be at least 79" in each piece. You will trim it accurately later.

Cut and mate the core pieces to make two 63" elevators. Trim off any interfering foam to fit to the torque tubes. Sand the tubes. Bond the cores to the tubes, flush at one end, with GENEMID-GLASS BUBBLE slurry. Hold cores to tubes with tape on a flat surface, weighted, to cure. SEE DIAGRAM BELOW:



Remove 'holding' tape. Bond cores to flat surface, laying T.E. on a 2" strip of duct tape, with dobs of 5 minute epoxy. Trim T.E. straight, 6-5/8" from LE (leaving 1/16" to 1/8" T.E. foam thickness. DIAGRAM 1 PAGE 306 Sand any irregularities, and fill any voids with dry GENEMID MICRO. Weight control is very important in the elevators.

LAYUP PROCEDURE SIDE ONE DIAGRAM PAGE 306

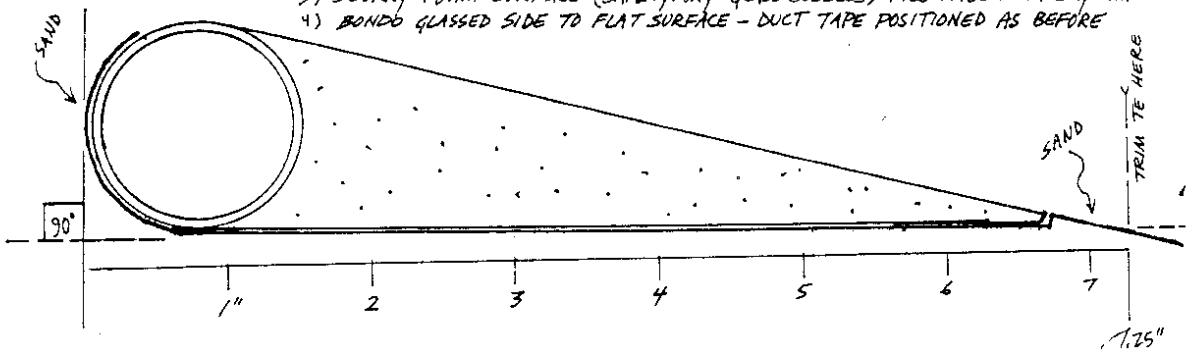
Cut ten pieces of UNI 8-1/2" wide, on a 45 degree bias, to make eight 64" lay-ups (a total of 512"). Don't forget the 8-1/2" width is perpendicular to the cut lines, not along the edge of the cloth roll. Butt, do not overlap, pieces in the same layer. Stagger the butt positions on the second layer. DIAGRAM 2 PAGE 306

Apply SAFETYPOXY-GLASS BUBBLE SLURRY to the core surfaces, avoiding tubes, and wet out two plies of UNI, laying up the bias in opposing directions (fibers at 90 degress). Keep L.E. straight, wrapping around 3/4ths of the tube, as the opposite side lay-up will neatly overlap this lay-up. Overlap the T.E. onto the duct tape 1". Let cure.

1

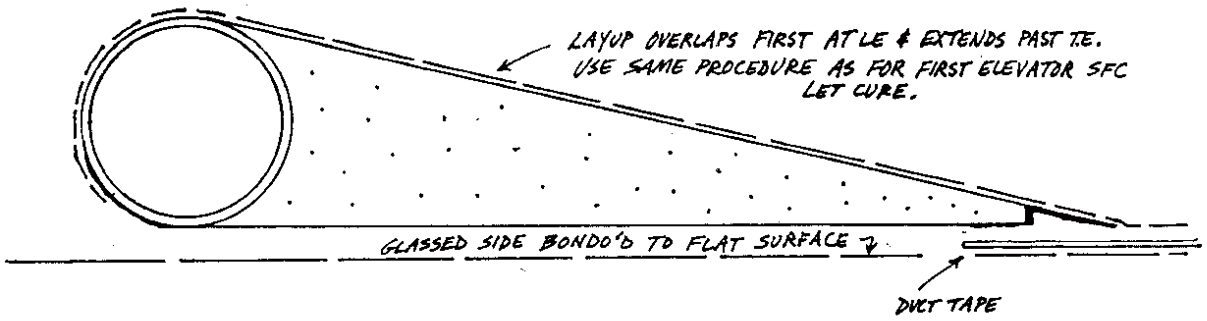
FIRST GLASS APPLICATION HAS CURED - FLIP OVER TO EXPOSE FOAM

1) WITH ELEV. ON FLAT SURFACE AS SHOWN, TRIM T.E. TO 7-1/4" FROM L.E.
2) SAND TUBE LE & TE GLASS FOR NEXT LAYUP
3) SLURRY FOAM SURFACE (SAFETYPOXY - GLASS BUBBLES) FILL VOIDS WITH DRY MIX
4) BONDO GLASSED SIDE TO FLAT SURFACE - DUCT TAPE POSITIONED AS BEFORE

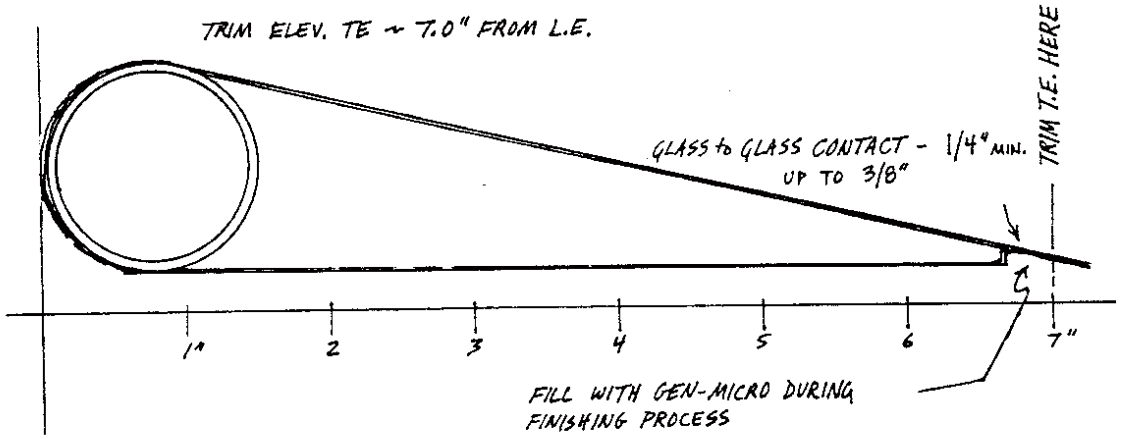


2

APPLICATION OF LOWER ELEVATOR SKIN



3



LAYUP PROCEDURE SIDE TWO DIAGRAM PAGE 308

(#1) Clean up work, sanding the tube and T.E. glass for bonding to next lay-up. Trim T.E. 7-1/4" from L.E.

(#2) Bondo the elevators, glass side down, on a flat surface. Duct tape should be in the same position as for the first layup you did. Prepare surfaces with SAFETYPOXY-GLASS BUBBLES, and fill voids with dry mix. Pre-wet the non-foam contact areas (Glass TE, and Tube LE). Apply lay-ups as before, overlapping at the leading edge of the previous lay-up.

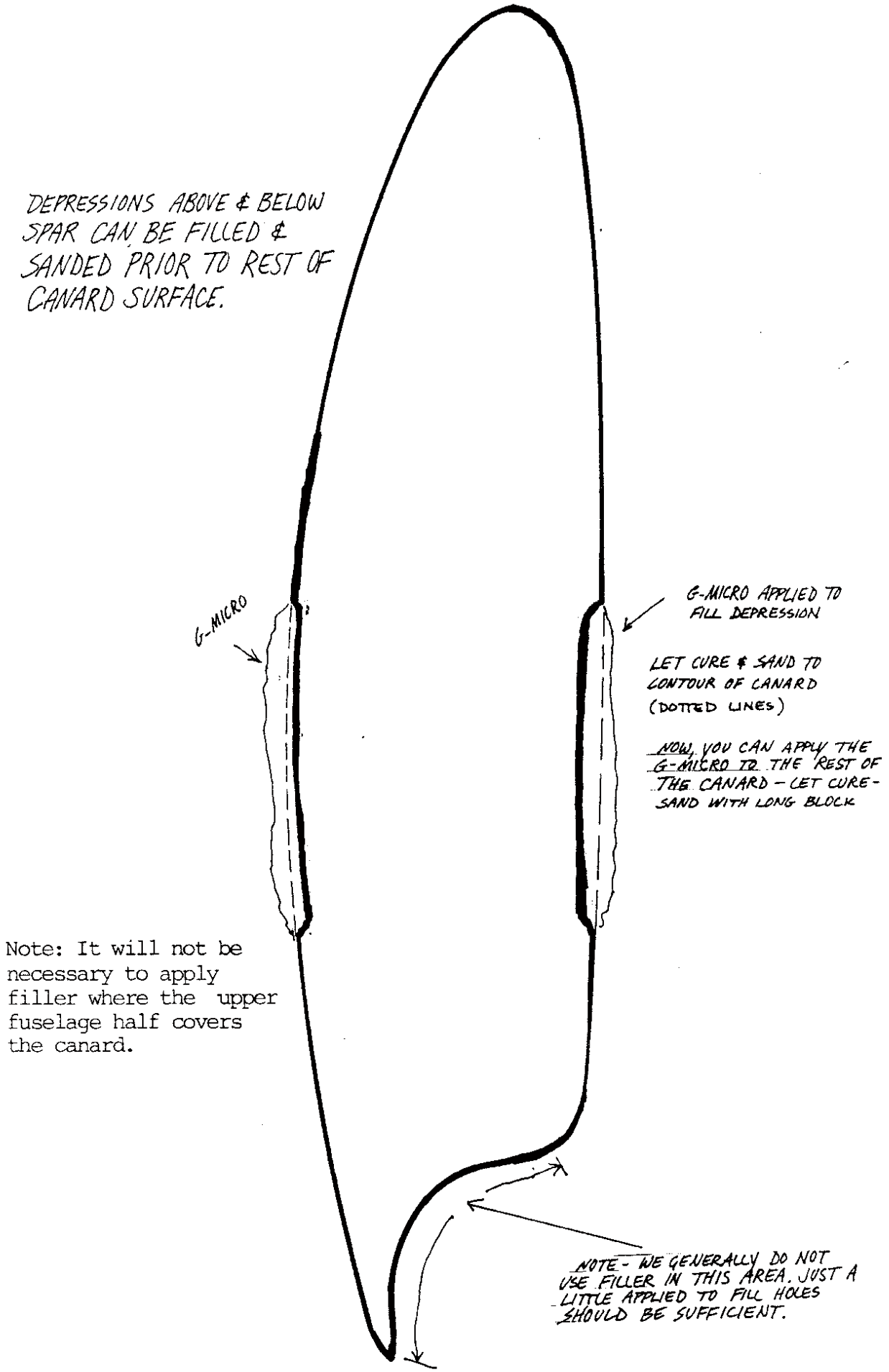
(#3) Let cure and trim the T.E. 7" from the L.E. You want a minumum of 1/4" of glass to glass bond in the T.E. but not more than about 3/8". Too wide a T.E. will require heavy contour filling requiring additional counter balance weight.

FILL & CONTOUR ELEVATOR & CANARD SURFACES

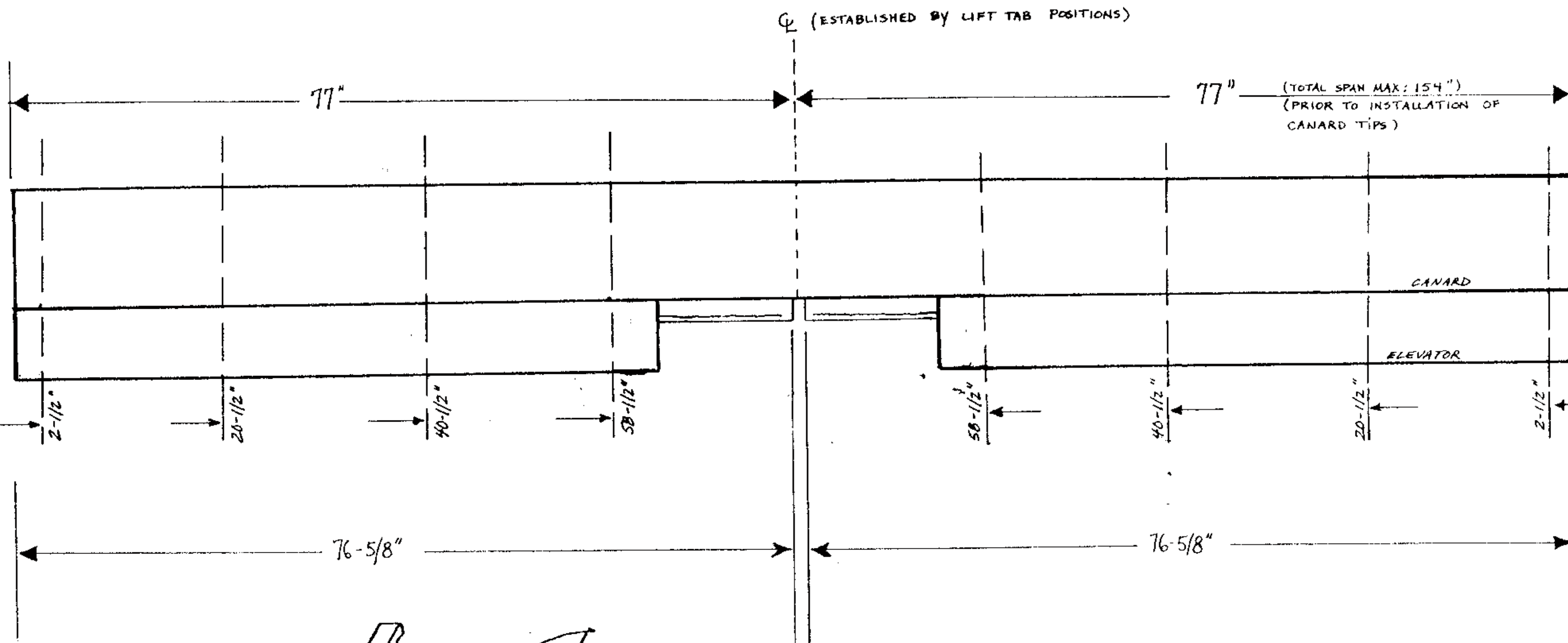
Sand canard and elevators to receive a filler mix of GENEMID-GLASS BUBBLES.

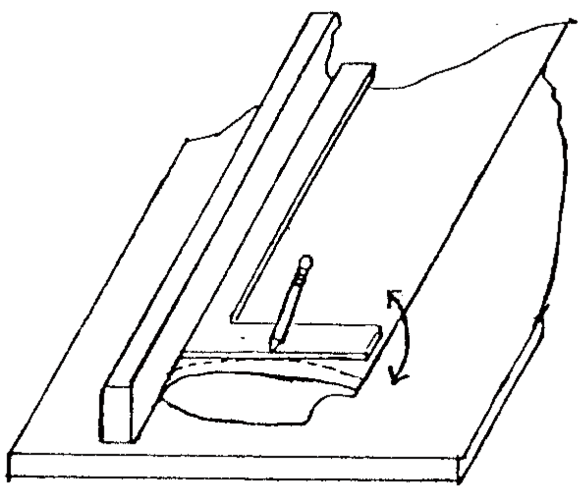
WEAR A MASK TO PREVENT INHALING GLASS BUBBLES. Mix GENEMID-GLASS BUBBLES to a consistency that barely runs out of the bucket. For the rest of the chapter, we'll refer to this mixture as G-MICRO.

Heap on material and trowel with a large blade. Control thickness with the blade-to-surface angle. A steep angle thins the coating and a shallow angle leaves more material. The builder will find it advantageous to fill in the depression left by the spar (both upper and lower surfaces) first, and let it cure (DIAGRAM PAGE 310) . Once cured, sand it down to more closely coincide with the canard curvature, then apply G-MICRO over the entire surface of the canard. Be aware that different mixes of slurry will sand differently, so try to minimize the number of filler applications that you make to any surface. Following cure, use a long sanding block (3'or more) to smooth your contours. We generally start with 36 grit Norton Blue Stripper and end the initial sanding process with 100 grit N.B.Stripper. Patience is a real virtue when it comes to the sanding process.

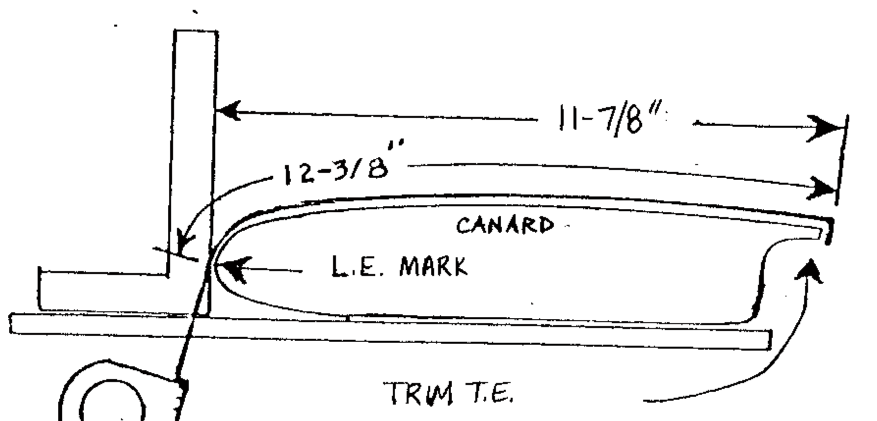

DEPRESSIONS ABOVE & BELOW SPAR CAN BE FILLED & SANDED PRIOR TO REST OF CANARD SURFACE.
G-MICRO
G-MICRO APPLIED TO FILL DEPRESSION
LET CURE & SAND TO CONTOUR OF CANARD (DOTTED LINES)
NOW, YOU CAN APPLY THE G-MICRO TO THE REST OF THE CANARD - LET CURE - SAND WITH LONG BLOCK
Note: It will not be necessary to apply filler where the upper fuselage half covers the canard.
NOTE - WE GENERALLY DO NOT USE FILLER IN THIS AREA. JUST A LITTLE APPLIED TO FILL HOLES SHOULD BE SUFFICIENT.

ELEVATOR-CANARD FIT





SQUARE ENDS TO LENGTH



L.E. MARK SHOULD COINCIDE WITH 1" MARK ON CARPENTER'S SQUARE

ELEVATOR TO CANARD FIT DIAGRAM PAGE 311

Find and mark the center of the canard half way between the installed lift tab centerlines. Measure and mark 77" outboard of this center point and square off the canard ends.

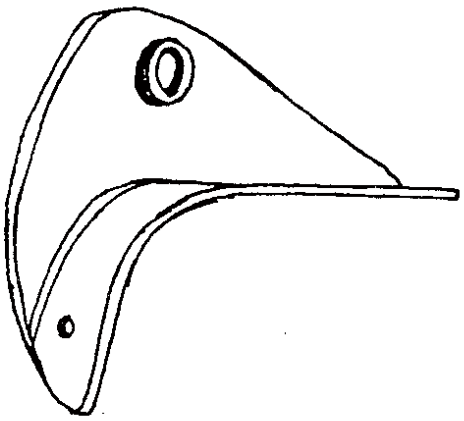
TIP: Lay a 2" X 4" against the leading edge and 'rock' a carpenter's square over the surface while marking.

Square off the elevator outboard ends. Trim the trailing edge of the canard 12-3/8" from the L.E. Mark a L.E. reference mark with the canard bottom on a flat surface and a square. Hook the tape measure on the T.E. and wrap over the canard top to the L.E. for this measurement.

Measure and mark points from the outboard ends, along the bottom surfaces, on canard and elevators as follows: 2-1/2"; 20-1/2"; 40-1/2"; 58-1/2". These marks will serve to position your elevator hinge arms and hinges.

Measure and mark on the elevator torque tube 76-5/8" from the outboard end and cut off the excess. The elevator inboard end will be trimmed when the canard is mated to the fuselage.

Now that you have made your positioning marks for the elevator hinges and hinge arms, it is time to begin the installation. Pull out your (8) elevator hinges (VELH-02) and your (8) hinge arms (VEHA-02).



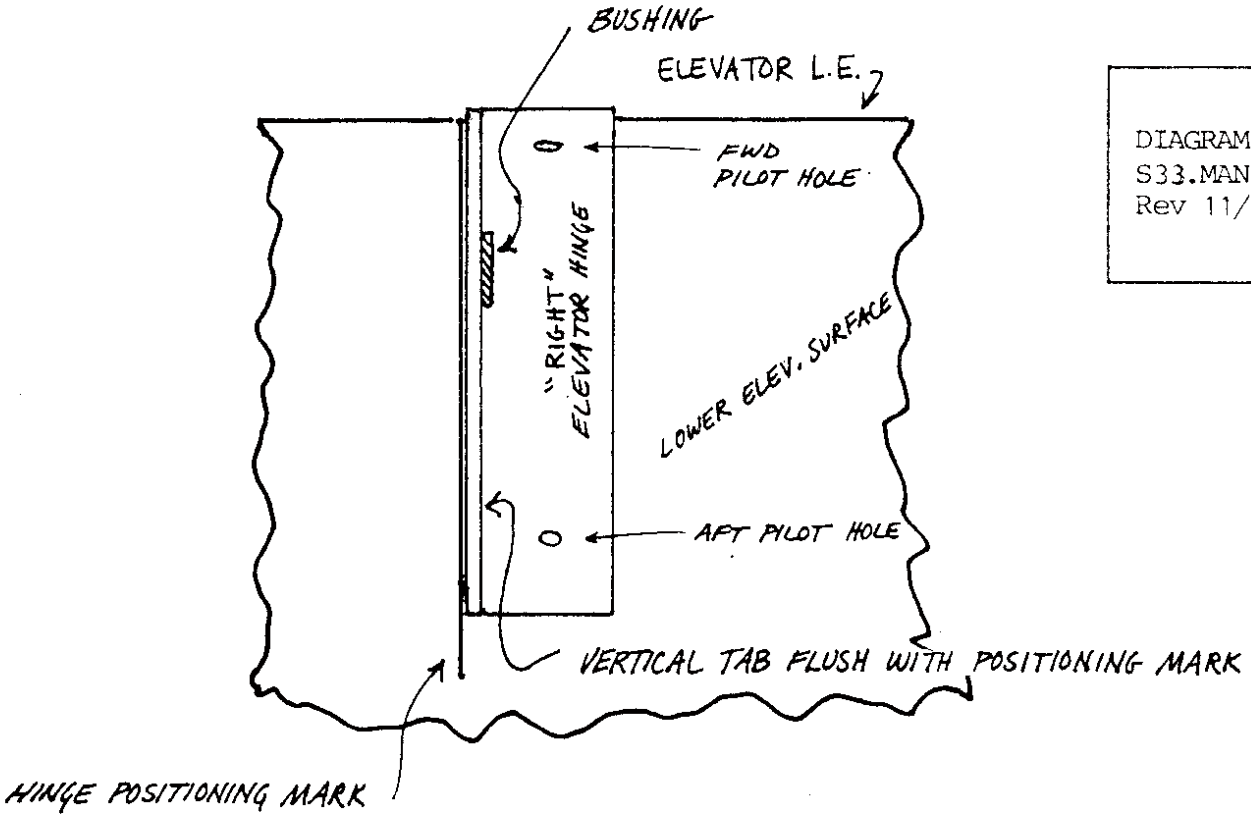
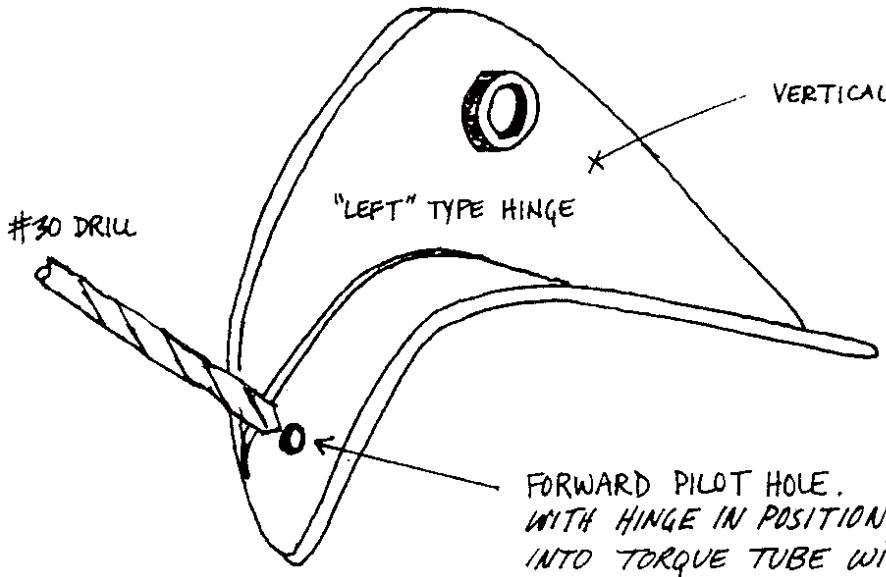
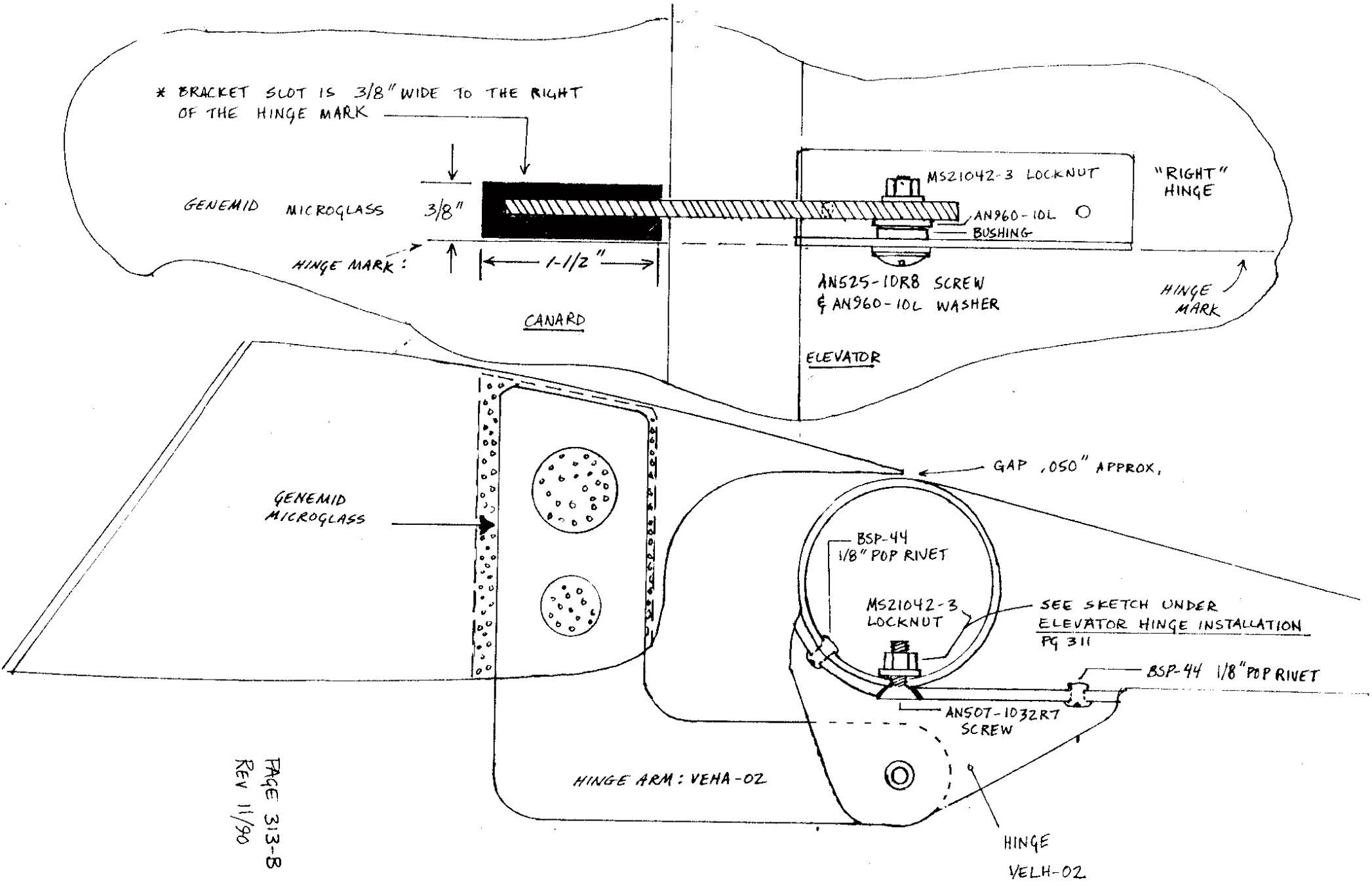


DIAGRAM 313
S33.MAN
Rev 11/90

FITTING ELEVATOR HINGES TO ELEVATOR

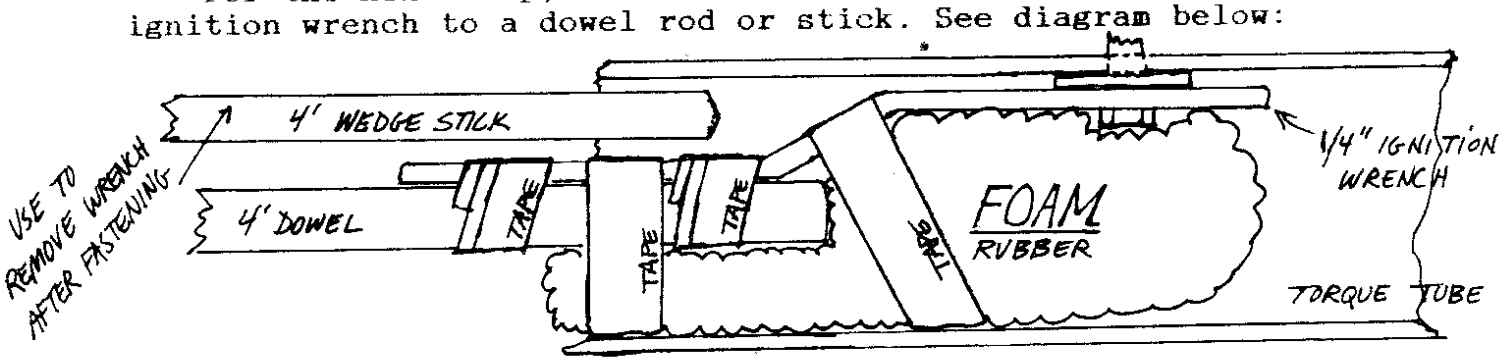



* BRACKET SLOT IS 3/8" WIDE TO THE RIGHT OF THE HINGE MARK
GENEMID MICROGLASS
3/8"
HINGE MARK
1-1/2"
CANARD
MS21042-3 LOCKNUT
AN960-10L
BUSHING
AN525-10R8 SCREW & AN960-10L WASHER
"RIGHT" HINGE
HINGE MARK
ELEVATOR
GAP .050" APPROX.
GENEMID MICROGLASS
BSP-44 1/8" POP RIVET
MS21042-3 LOCKNUT
SEE SKETCH UNDER ELEVATOR HINGE INSTALLATION PG 311
BSP-44 1/8" POP RIVET
AN507-1032R7 SCREW
HINGE ARM: VEHA-02
HINGE VELH-02

ELEVATOR HINGE INSTALLATION DIAGRAMS 313 & 313B

[DIAGRAM PAGE 313] On the bottom surface of your elevators, place your hinges such that the vertical tabs (holding the bushing) are aligned with the positioning marks. The outside surface of the vertical tab should be flush with the marks. The hinges should be self-aligning with respect to each other, but sight down through the bushings to be sure. If a hinge is out of alignment by more than 1/16", shift it to be in line. Though a bit time consuming, you can clamp a strand of fishing line at one end, and run the other through the bushings to really center things up. . When you are pleased with the hinge positions, use a #30 bit to open a hole in the torque tube, using the forward pilot hole in each hinge as a guide. Sand the mating surfaces, both hinge and elevator, bed the hinge in GENEMID-MICROGLASS (Milled Fiber), and pop rivet into place using BSP-44 Pop Rivets (1/8"). Align the hinges fore and aft square with the elevator TE, then drill and pop rivet the aft hole. Carefully clean off the excess Microglass, and let cure. "313B"

For the next step, construct a 4' wrench, by attaching a 1/4" ignition wrench to a dowel rod or stick. See diagram below:



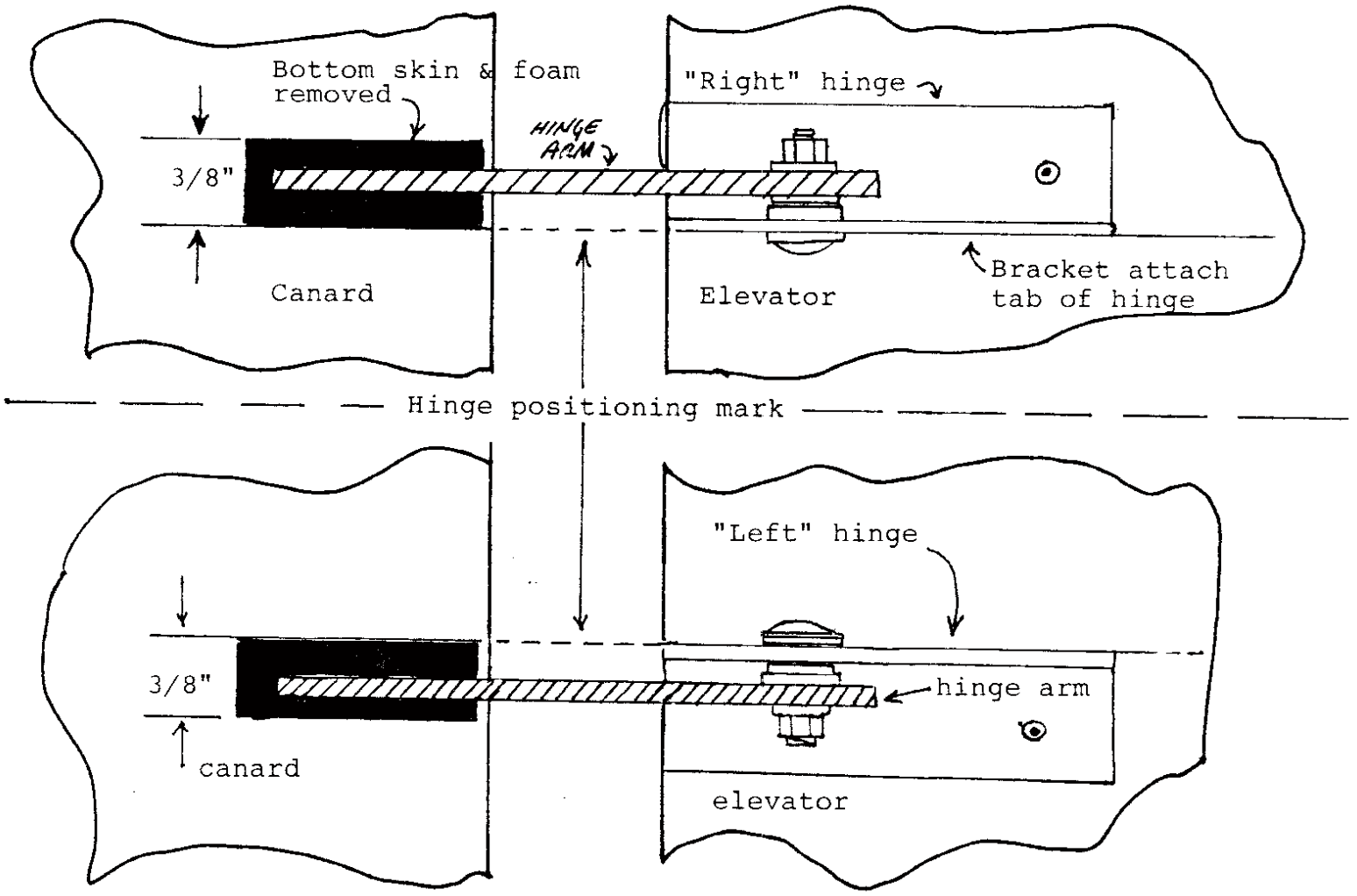
The extended wrench needs to fit inside the elevator torque tube. You will be securing the hinges to the torque tube with AN507-1032R7 screws and MS21042-3 locknuts, and this wrench is used to tighten them down. A bit of foam rubber taped under the wrench will 'squeeze' it up against the tubing. To remove the wrench after fastening the screws, slide another long stick above the wrench 'handle' to pry it away from the nut.

Drill a 3/16" hole in each hinge (countersink 100 deg) as far aft of the forward pop rivet as possible without going into the elevator foam. DIAGRAM PAGE 314 . Use hardware listed in previous paragraph for installation.

HINGE ARM INSTALLATION

Once the Microglass has cured, install the arms to the elevator-mounted hinges. Attach to the side of the hinge where the bushing protrudes. Use a AN525-10R8 bolt, (2) AN960-10L washers, and a MS21042-3 nut for this attachment. Do not overtighten as to interfere with free movement. If a misalignment occurs, you can bend the hinge slightly to make it perpendicular to the elevator. Turn the canard upside down and locate the elevators in the T.E. slot . Line the elevators up

with a section of 1-1/2" I.D. PVC placed over the inboard ends of the torque tubes. In proper position, there should be a space of 3/4" between the ends of the tubes. Rotate the hinge arms to locate the slots to be cut on the canard bottom to accept the hinge arms. Mark these points and remove approximately 3/8" X 1-1/2" of lower skin (DIAGRAM BELOW). Remove the foam below all the way down to the top skin. Expose the top skin, aft skin, and recess the foam a little below the bottom skin. A 3/8" drill bit works nicely to drill out the slot, but be careful not to drill through the top skin. As a precaution,grind the tip off your drill bit so that it won't drill through the top skin.

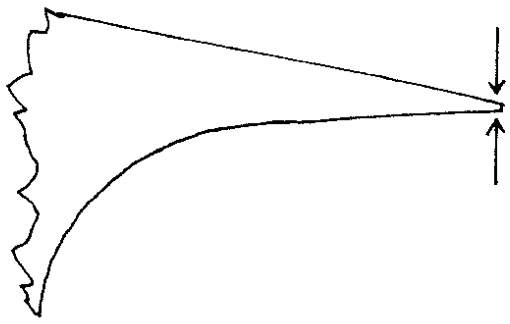


CANARD FINAL PREP FOR ELEVATORS

FIXTURING THE ELEVATOR POSITION

Place the canard upside down, and using a 3' straightedge with 100 grit paper glued to it, straighten the T.E. of the canard from one end to the other. Try to maintain the 11.875" dimension for the chord, but a reduction of this of less than 0.250" is acceptable. If, however, the chord length is lessened any more than that, you will not be able to attain total up elevator. Once you have straightened the T.E., taper the bottom of the T.E. up to the top skin, leaving approximately a .030" T.E. thickness at the tip. The next step is to install the elevators.

CANARD T.E.

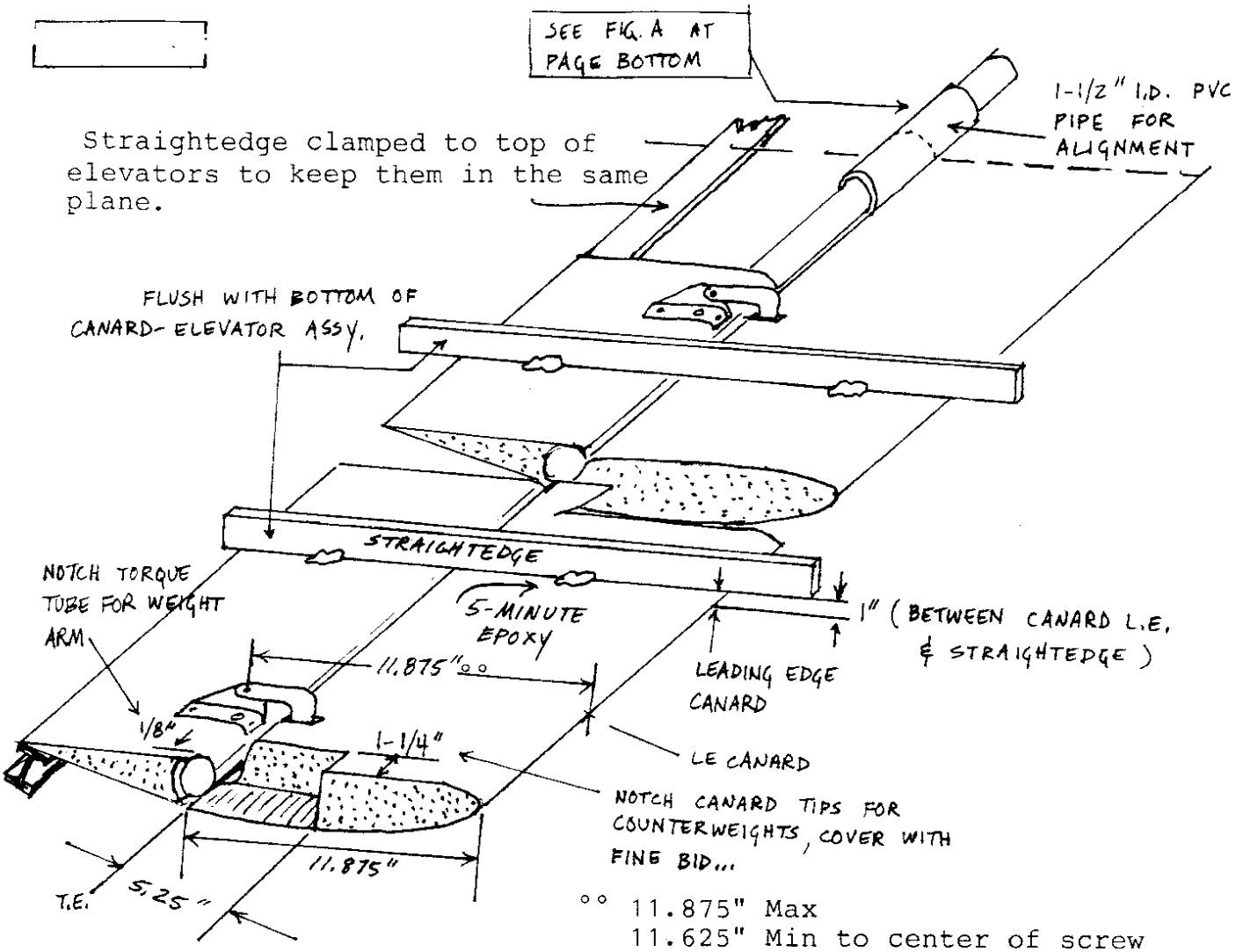


Tip of the canard T.E. should be approximately 0.030" thick

Construct 4 flat straight edges approximately 1" X 1" and 2 feet long. These will be used to hold the elevators to the canard while the epoxy around the hinge arms in the canard cures.

Bond the straightedges to the lower sides of each elevator with a small amount of 5 minute epoxy approximately(1')in from each end of each elevator. Now, lay your canard upside down and set the elevators in their slot. Connect the torque tubes with a piece of 1-1/2" ID thin wall PVC pipe. If the wall of the PVC is too thick, the elevator torque tubes will be more than .050" away from the canard T.E.. This PVC pipe is just for alignment, so anything inside or outside can be substituted. Align the trailing edges of the elevators so that they are in the same plane. The critical things to watch for during this procedure are as follows:

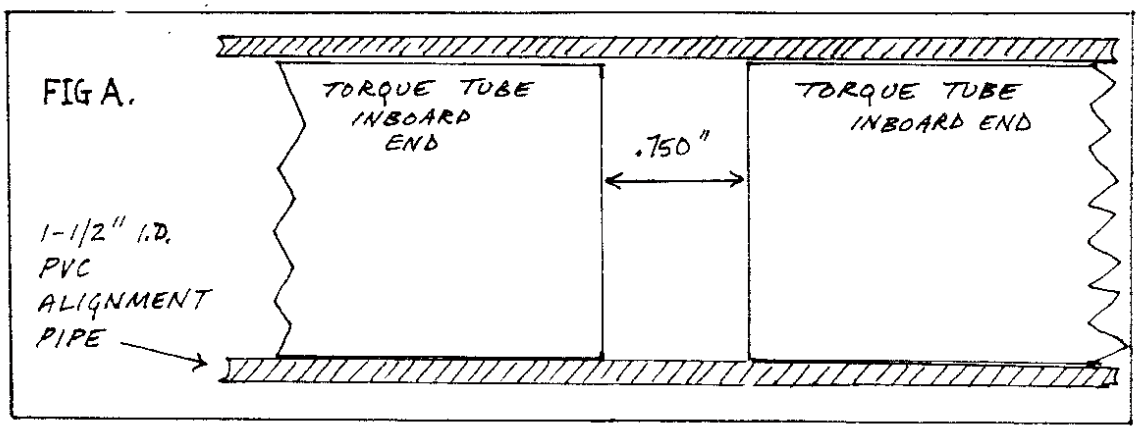
1. Make sure that both of the elevators are in the same plane. Clamp a straightedge to the top of both elevators to hold them in the same plane.
2. The gap between the elevators and the canard T.E. is consistent, and approximately .050".



°° 11.875" Max
11.625" Min to center of screw from Canard T.E.

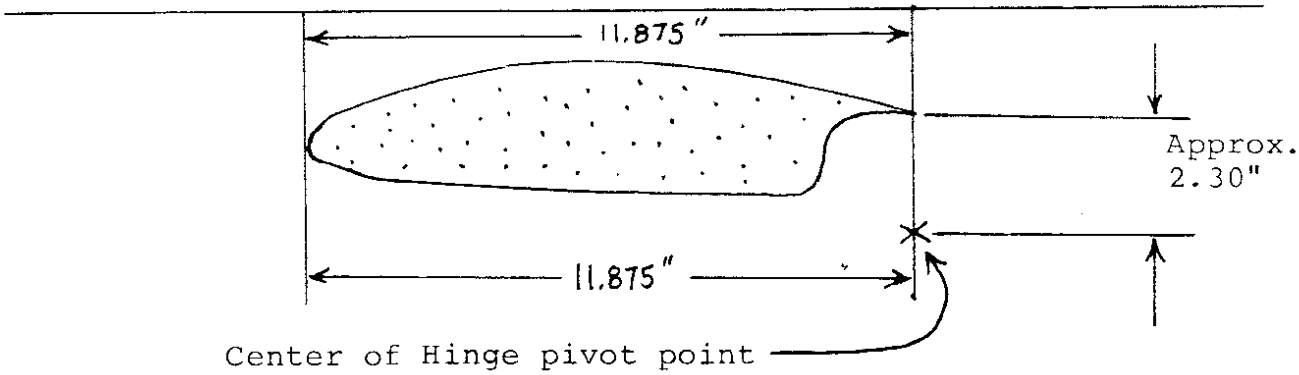
NOTE:

PAY ATTENTION TO THE SLOT BETWEEN THE ELEVATOR TORQUE TUBE & THE CANARD T.E.. IT IS IMPORTANT TO MAINTAIN APPROXIMATELY .050" OF SPACE IN THIS AREA. MIXING STICKS CAN BE USED, BUT CHECK FOR UNIFORMITY. THE RELATIONSHIP OR GAP IN THIS AREA IS NOT ONLY CRITICAL FOR OPERATION, BUT IT IS ALSO COSMETICALLY APPEALING. SHIM UNDER THE FIXTURES BETWEEN THE CANARD AND ELEVATORS IN ORDER TO MAINTAIN A UNIFORM GAP. THE BOTTOM IS NOT AS CRITICAL AS THE TOP.



CANARD FINAL PREP FOR ELEVATORS

3. The dimension from the hinge pivot screw to the LE of the canard should be the same as the dimension from the LE to the TE of the canard. (SEE BELOW)



4. Be sure that the elevator torque tubes are .750 apart at the center. (SEE FIGURE A - PAGE 317A

Your next step is to make about a dozen shims, approximately 0.050" thick (mixing sticks are quite close to this dimension), and install them in the slot between the elevators and the canard TE in order to maintain the .050" gap from one end to the other. If you have trouble maintaining this gap, check where you are supporting your canard, as it may be sagging. If this is the case, support it in such a way that it is perfectly straight (some weights might be in order). You might also try some shimming between the straightedges and the elevators or the canard to achieve a consistent gap. With all this jigged into place, check to make sure that your hinge pivot points are exactly above the TE of the canard (the same distance back as the TE of the canard.) If there is any error, let's hope that the hinge pivot points end up slightly forward, as it is much easier to sand off some of the TE than it is to add on to it. Be aware that sanding on the TE increases the .050" gap, so be careful.

Once you are satisfied with everything, glue the straightedges to the bottom of the canard, thus holding the elevators in position while the hinge arms are installed. Connect the hinge arms to the hinges on the elevators with only screws and washers, no nuts for the moment. Sand the hinge arms and then set them down into the slots in the canard and check for fit. Try to get the top of the hinge arms as close to the top skin as possible. This initial dry run can save you a lot of trouble later on. Once you are satisfied with the fit, fill the cavity with a thin slurry of Genimid microglass. Check to ensure that all hinge arms are in the same plane by sighting down the canard. Shim and adjust accordingly if necessary. Let cure. Remove the screws from the hinges and take off the elevators.

Positioning Torque/Counterweight Arms

Locate the following items:

(1) Elevator Torque Arm, Left	VETA-L-02
(1) Elevator Torque Arm, Right	VETA-R-02
(1) Elev. Counterwgt Arm, Left	VECA-L-01
(1) " " " , Right	VECA-R-01
(1) Elev. Center Hinge Arm Assembly	VEHP-01
(1) Elev. Counterwgt, Left Inboard	VECW-LIB-01
(1) " " , Left Outboard	VECW-LOB-01
(1) " " , Right Inboard	VECW-RIB-01
(1) " " , Right Outboard	VECW-ROB-01

(1)AN4-12A BOLT	(1)MS21042-4 LOCKNUT
(8)AN509-10R17 SCREWS	(10)MS21042-3 LOCKNUTS
(2)AN509-10R28 SCREWS	(4)AN960-416L WASHERS
(4)AN507-1032R7 SCREWS	(6)AN960-10 WASHERS

#21 DRILL
INCLINOMETER
(4) 1" X 1" X 2' STRAIGHTEDGES

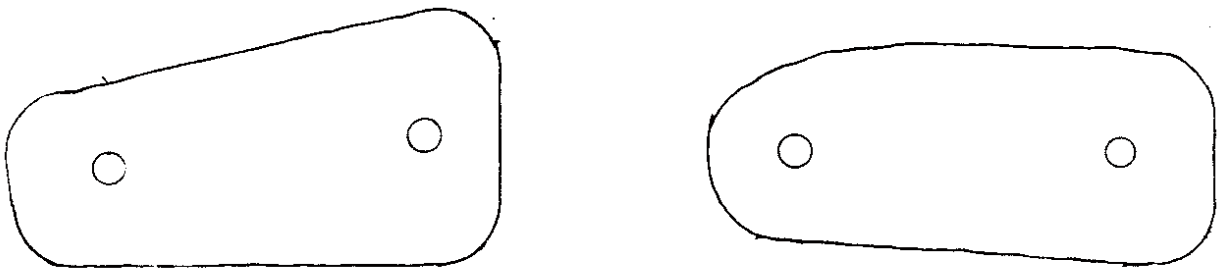
Slip the TORQUE ARMS onto the inboard ends of the torque tubes. Now, attach the CENTER HINGE ARM ASSEMBLY to the torque arms with (1)AN4-12A bolt, (4)AN960-416L Washers, and (1)MS21042-4 locknut. The attach point is the threaded hole in the torque arms (Fig A: previous page). To ensure that the torque arms move together without twist, cut a bushing that will space the torque arms apart the same distance as does the center hinge arm. Attach the bushing at the hole where the push-pull tube will connect to the torque arms later in the manual (Fig B: previous page).

Reinstall the elevators to the canard, one at a time. Swing the CENTER HINGE ARM around to find where you should cut the slot for it on the underside of the canard. It should be just about dead on the canard centerline. Once you have established a position for the hinge arm slot, remove the elevators. Prepare the center hinge arm slot as you did for the other eight hinge arms.

COUNTERWEIGHTS

Inboard Ctrwgts are squared off

Outboard Counterweights are curved



Forward

Fig A

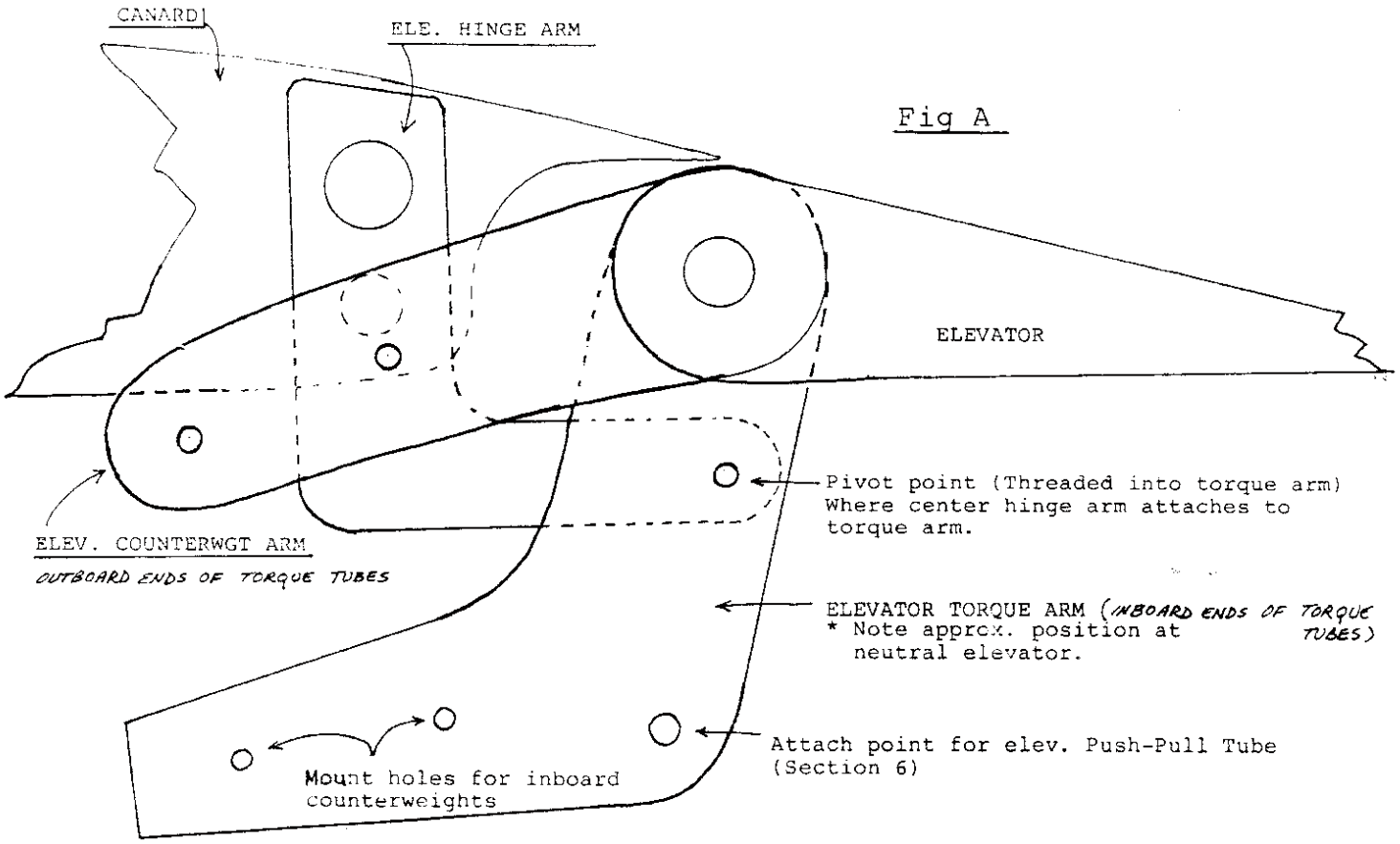
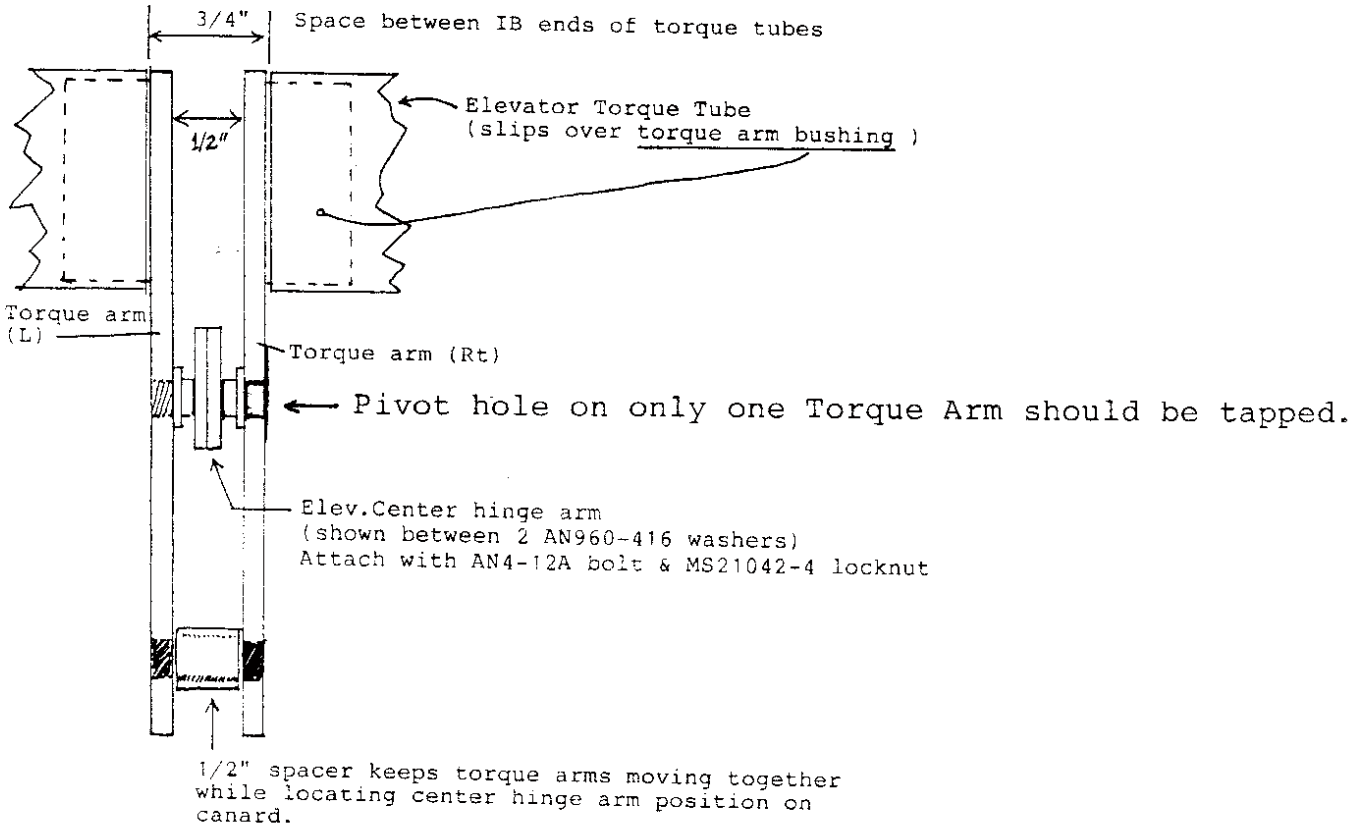
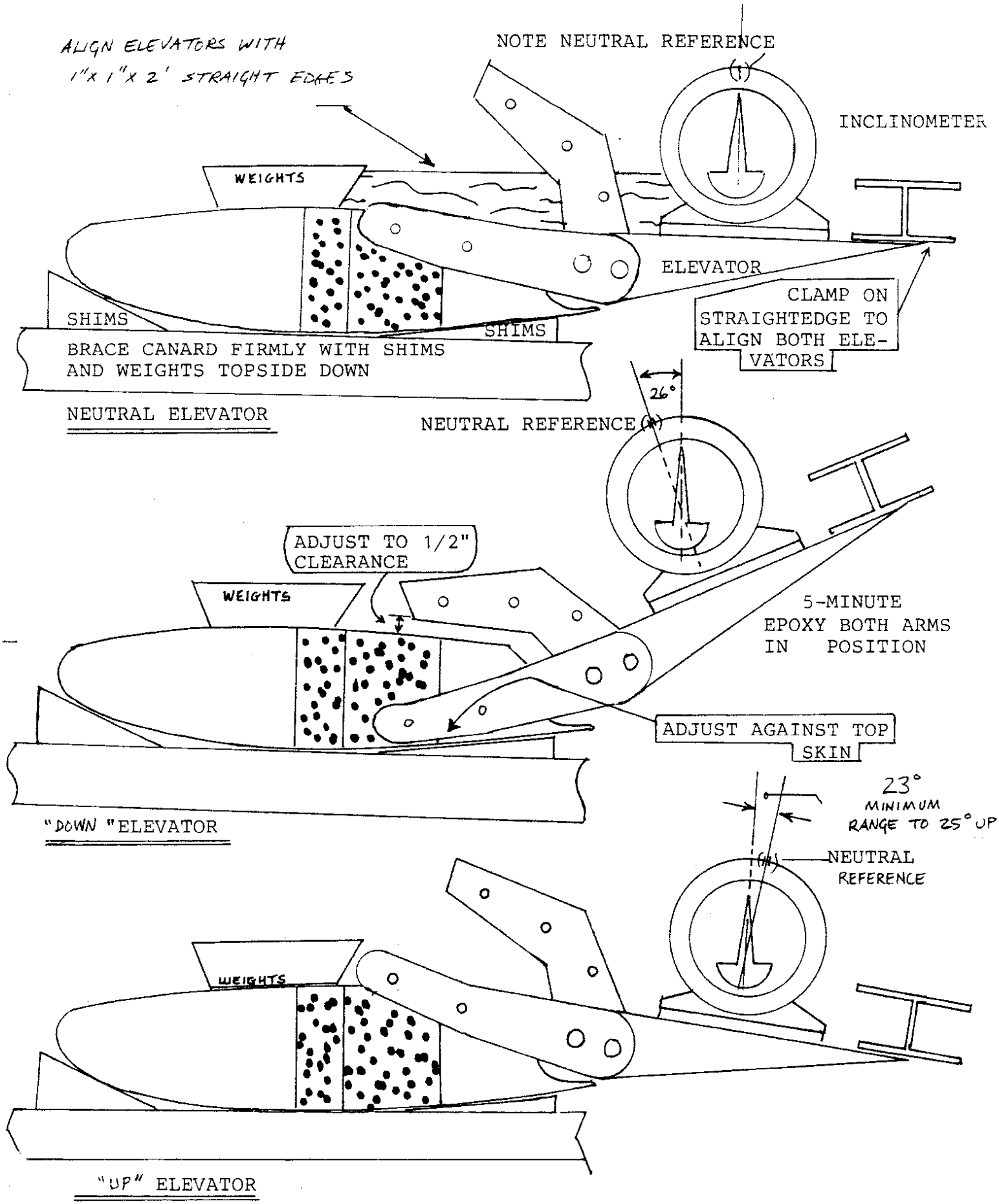

CANARD
ELE. HINGE ARM
ELEVATOR
Pivot point (Threaded into torque arm) Where center hinge arm attaches to torque arm.
ELEV. COUNTERWGT ARM
OUTBOARD ENDS OF TORQUE TUBES
ELEVATOR TORQUE ARM (INBOARD ENDS OF TORQUE TUBES)
* Note approx. position at neutral elevator.
Attach point for elev. Push-Pull Tube (Section 6)
Mount holes for inboard counterweights

Fig B


3/4"
Space between IB ends of torque tubes
1/2"
Elevator Torque Tube (slips over torque arm bushing)
Torque arm (L)
Torque arm (Rt)
Pivot hole on only one Torque Arm should be tapped.
Elev.Center hinge arm (shown between 2 AN960-416 washers) Attach with AN4-12A bolt & MS21042-4 locknut
1/2" spacer keeps torque arms moving together while locating center hinge arm position on canard.


ALIGN ELEVATORS WITH
1"x 1"x 2' STRAIGHT EDGES
NOTE NEUTRAL REFERENCE
INCLINOMETER
WEIGHTS
ELEVATOR
CLAMP ON STRAIGHTEDGE TO ALIGN BOTH ELEVATORS
SHIMS
SHIMS
BRACE CANARD FIRMLY WITH SHIMS AND WEIGHTS TOPSIDE DOWN
NEUTRAL ELEVATOR
26°
NEUTRAL REFERENCE
ADJUST TO 1/2" CLEARANCE
WEIGHTS
5-MINUTE EPOXY BOTH ARMS IN POSITION
ADJUST AGAINST TOP SKIN
"DOWN" ELEVATOR
23° MINIMUM RANGE TO 25° UP
NEUTRAL REFERENCE
WEIGHTS
"UP" ELEVATOR

Notch the outboard ends of the elevator torque tubes approximately 1/8" so that the ELEVATOR COUNTERWEIGHT ARMS lie flush with the side of the elevator core. Like the Torque arms, the counterweight arms bushings should slip right into the torque tube end.

Cut out a notch 1-1/4" in from the canard ends, extending 5-1/4" forward of the TE of the canard. Remove the lower skin and foam, leaving the inner top skin intact. (See diagram at top of 317A) Attach the LEFT OUTBOARD COUNTERWEIGHT to the LEFT COUNTERWEIGHT ARM, and the RIGHT OUTBOARD COUNTERWEIGHT to the RIGHT COUNTERWEIGHT ARM. Each counterweight is attached using (2)AN509-10R17 SCREWS & (2)MS21042-3 locknuts. The counterweights will be attached to the inboard side of the arms. Re-attach the elevators to the canard, with the counterweight arms in place, and check the clearance of the counterweights. When satisfied, remove the elevators, and glass over the exposed foam sides with some fine bid. Let cure.

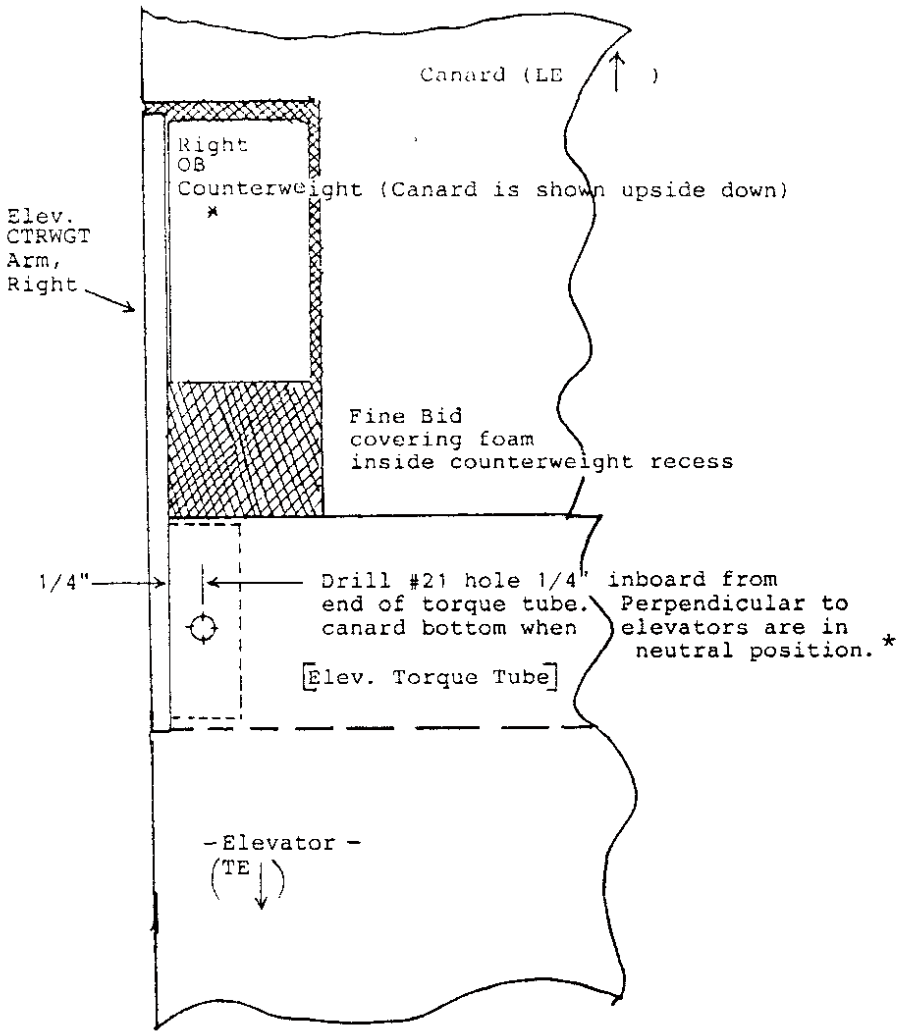
Install the inboard counterweights to the torque arms, using (2) AN509-10R17 screws & (2) MS21042-3 locknuts. The counterweights will attach to the outboard sides of the torque arms. Using weights, secure the canard in position, upside down, so that it will not move. With the torque arms & counterweight arms in place, install the elevators to the canard. Using the straightedges that you employed while making your positioning marks, establish neutral position for the canard/elevator assembly. With an inclinometer (available at Sears), measure your free TE movement. If you don't have an inclinometer, you can equate 1" of TE movement to approx. 10 degrees deflection. See page 319 for diagrams. The minimum acceptable deflection is as follows:

UP ELEVATOR: 23 DEGREES (PREFERABLY UP TO 25 DEGREES)
DOWN ELEVATOR: 26 DEGREES (Approx. 2-1/2" deflection from neutral)

(Remember, the assembly is upside down right now, so don't get the two measurements switched around!)

The COUNTERWEIGHT ARMS (outboard) act as the stop for aft stick movement (down elevator). Now, clamp a straightedge to the TE's of both elevators, ensuring that they are even and moving in unison. Raise the TE of the elevators from neutral to a deflection of 26 degrees (full down elevator). In this position, the counterweight arms should be pressing against the upper skin of the cutout you made earlier. The forward tips of the TORQUE ARMS should be approximately 1/2" away from the lower skin of the canard. The pivot hole of the CENTER HINGE ARM should line up with the other eight hinge pivot points, and the center arm should be sitting down in the slot you cut for it earlier. If you are pleased with how everything looks, secure it all carefully in place.

It would be a good idea at this point to use hot glue to bond the counterweight arms & torque arms in place on the torque tube. Set the elevators to neutral position, then drill a #21 hole (angled perpendicular to the bottom of the canard) through the torque tube, approximately 5/8" into the bushing of the counterweight arm. The hole should be centered about 1/4" from the end of the torque tube. See diagrams A & B, this page.



* Tap to 10-32

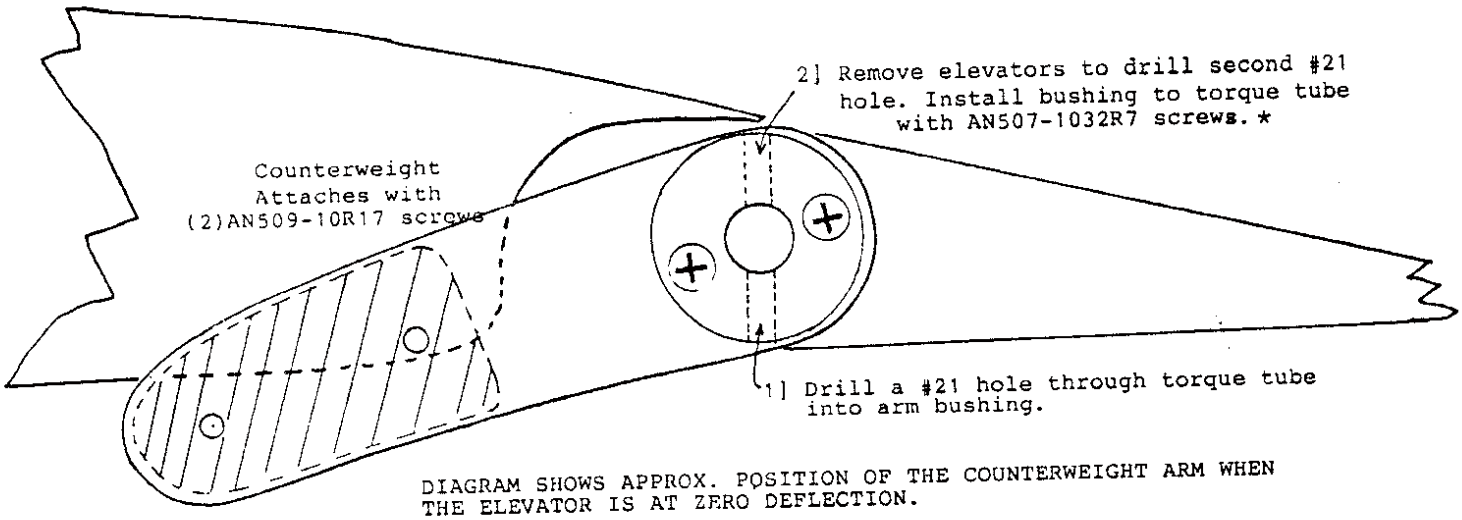
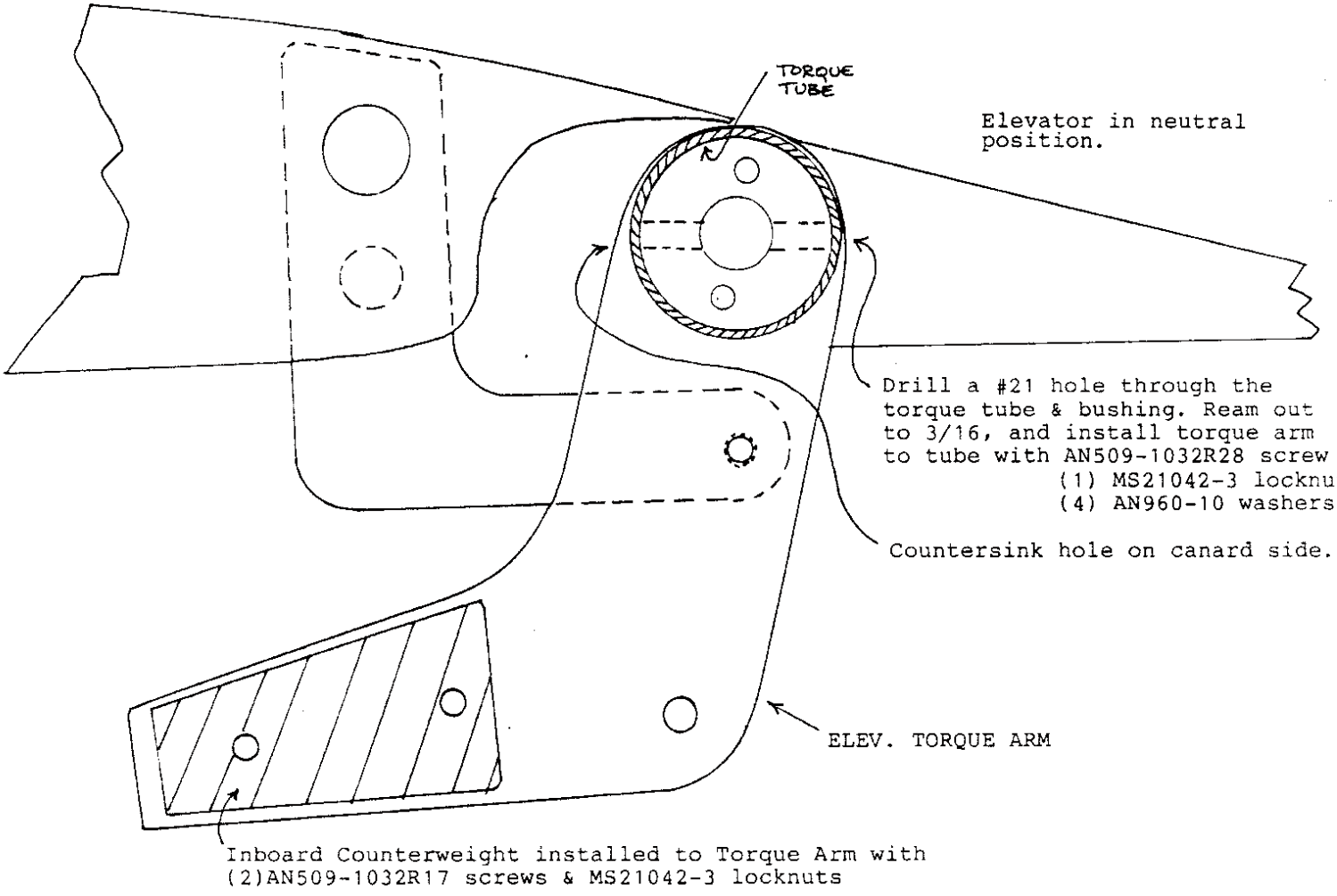


DIAGRAM SHOWS APPROX. POSITION OF THE COUNTERWEIGHT ARM WHEN THE ELEVATOR IS AT ZERO DEFLECTION.

With the elevator still at zero deflection, drill #21 pilot holes 1/4" outboard of the inboard ends of the torque tube to attach the Torque arms in place. This hole needs to be drilled PARALLEL to the bottom of the canard. Drill the hole out to 3/16", and all the way through both sides of the torque tube & torque arm bushing. Countersink the hole on the canard side of the torque tube, and install the torque arm with (1)AN509-1032R28 screw, (1)MS21042-3 locknut, and a couple of AN960-10 washers. See diagram below:



Remove the elevators from the canard, and drill a second #21 hole at the outboard end of the torque tube. This hole should be directly opposite the first that you drilled to attach the counterweight arm. Tap the holes for 10-32, and countersink them to accept (2) AN507-1032R7 screws. Refer to diagrams on page 321 Reassemble the canard & elevators.

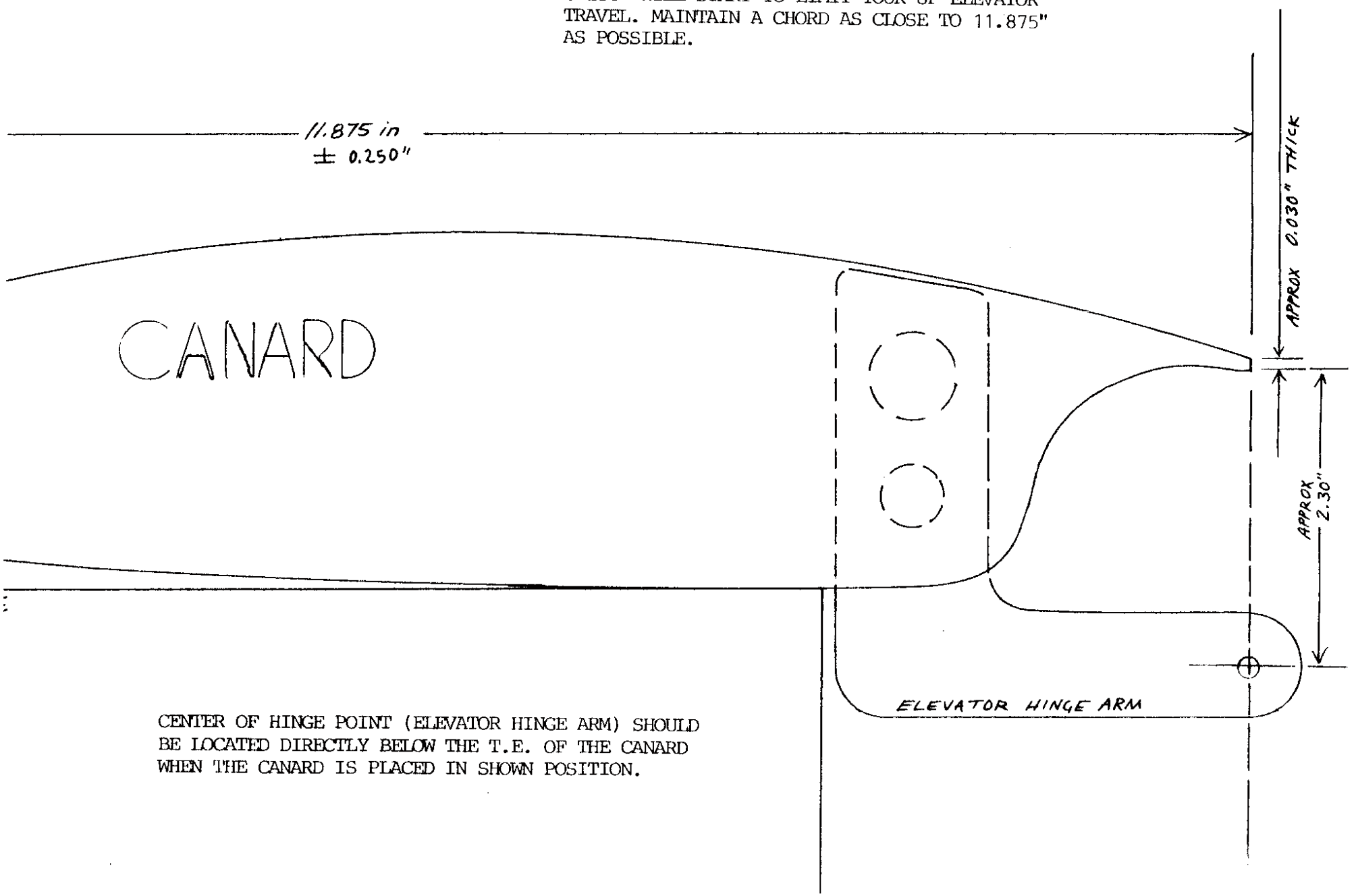
CAUTIONS Check for operating clearance at the final assembly. Interference will occur if the 10R28 (Torque arm attach) screws are put in backwards, with the head on the elevator side. Insufficient countersinking for the 1032R7's will cause interference as well. Check for operating clearance between the torque arms and the top of the rudder pedal assembly. You may file the tips of the torque arms & counterweights provided that you don't remove too much material (See elevator balancing below.)

ELEVATOR BALANCING

Bolt the counterweight arms to each elevator. Suspend each elevator on wires run through the hinge pivot holes. Without paint, the elevators should hang slightly nose down. Ideally, with the final finish applied, the elevators should balance bottom side level. A bit nose down is acceptable.

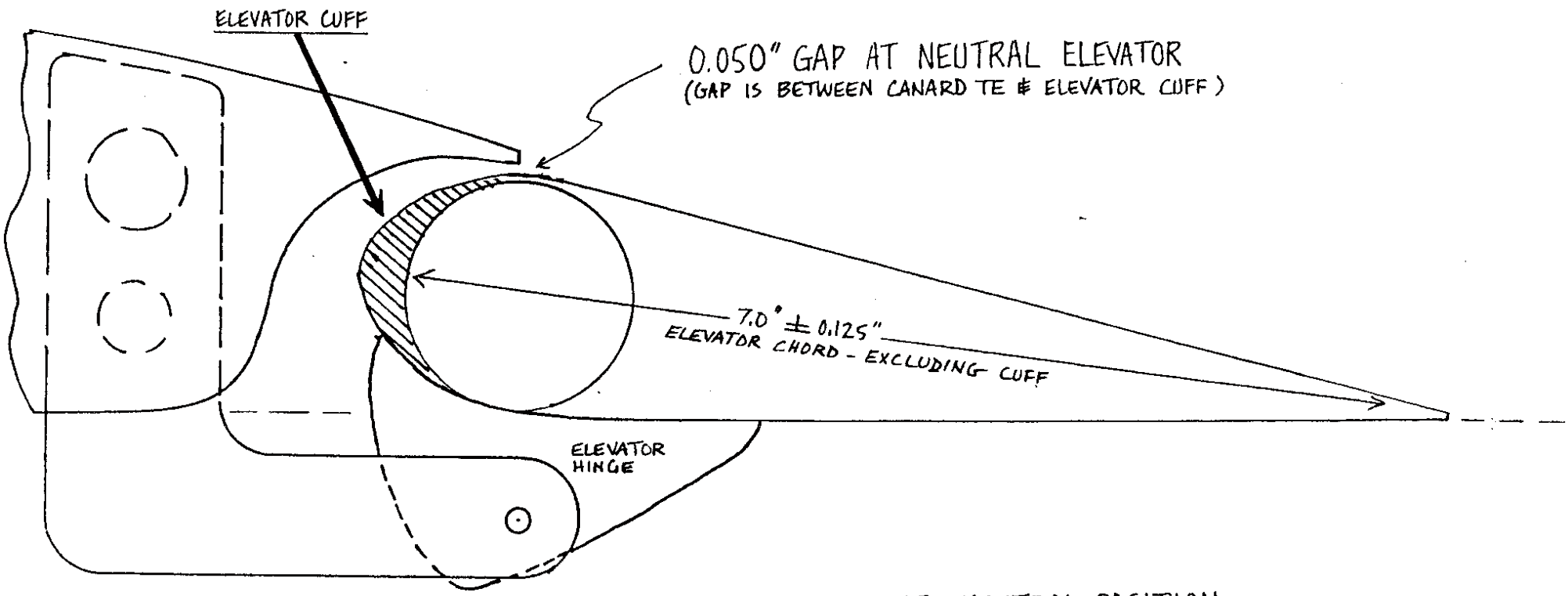
The reason for proper balancing is to prevent flutter. Flutter can occur at high speeds and is aggravated by turbulence. Thus, to achieve the highest safe Vne (Velocity Never Exceed), all control surfaces must conform to the above balancing criteria.

DECREASING THE CHORD OF THE CANARD MORE THAN 0.250" WILL START TO LIMIT YOUR UP ELEVATOR TRAVEL. MAINTAIN A CHORD AS CLOSE TO 11.875" AS POSSIBLE.



CANARD

CENTER OF HINGE POINT (ELEVATOR HINGE ARM) SHOULD BE LOCATED DIRECTLY BELOW THE T.E. OF THE CANARD WHEN THE CANARD IS PLACED IN SHOWN POSITION.



ELEVATOR NEUTRAL POSITION

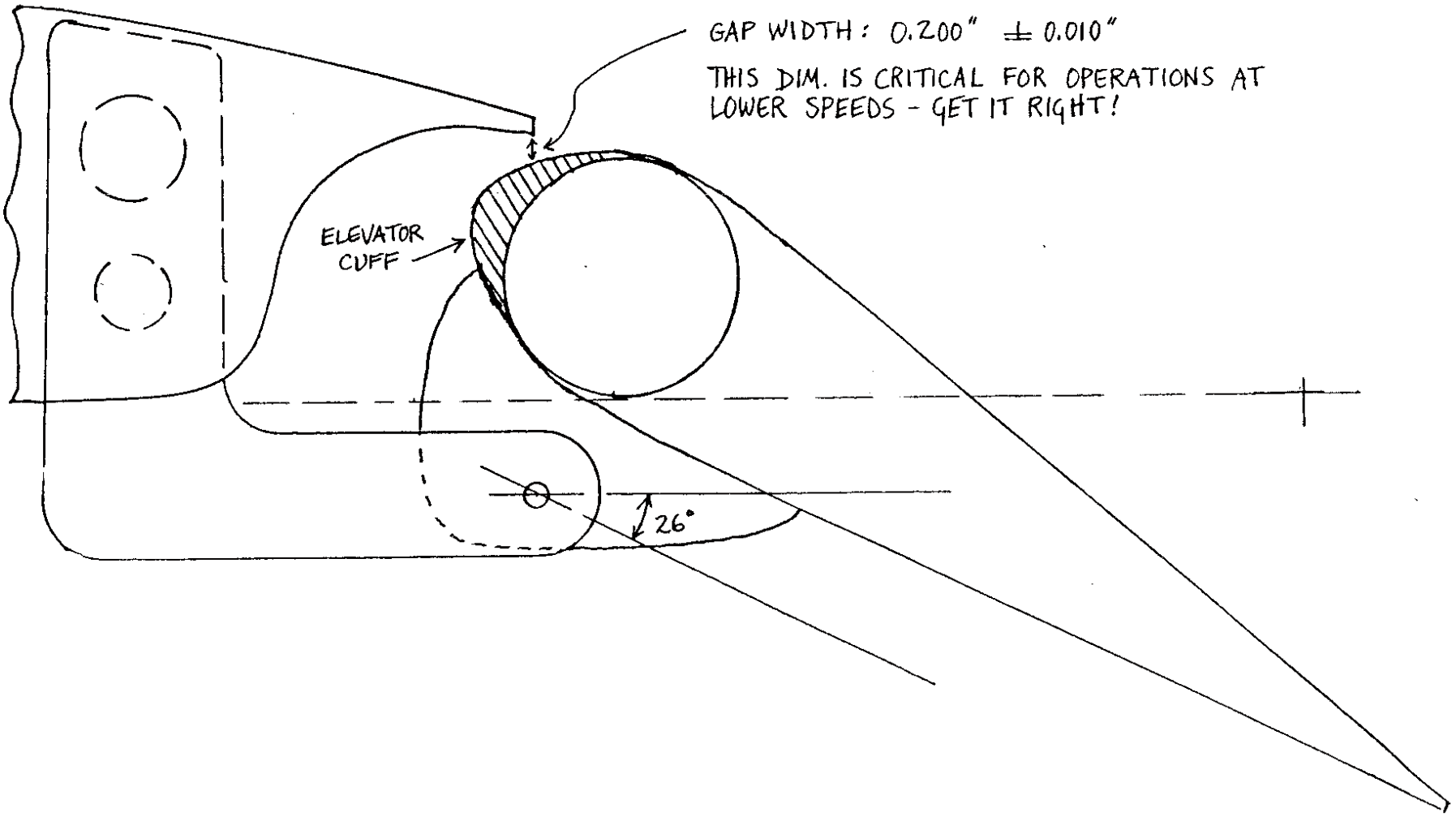
DIAGRAM 325 – SECTION 3
Rev 11/90

THE SIMPLEST WAY TO MEASURE ELEVATOR DEFLECTION IS USING AN INCLINOMETER, SUCH AS THE UNIVERSAL PRO-TRACTOR BY CRAFTSMAN (SEARS). PLACE IT ON THE SURFACE OF THE ELEVATOR, AND READ YOUR DEFLECTION BY TAKING THE DIFFERENCES OF THE ANGLES READ.

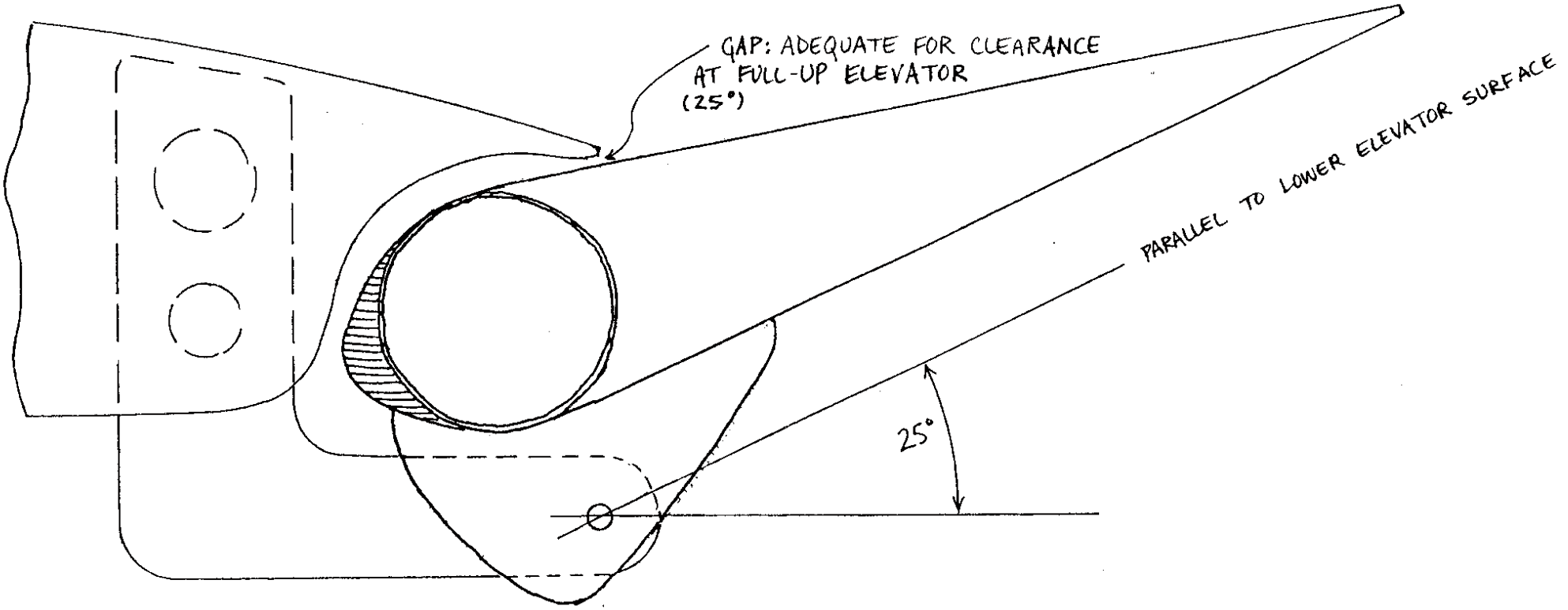
IT IS CRITICAL TO HAVE AT LEAST 26° DOWN DEFLECTION.

ELEVATOR DEFLECTION: 26° DOWN

DIAGRAM 326 - SECTION 3
Rev 11/90

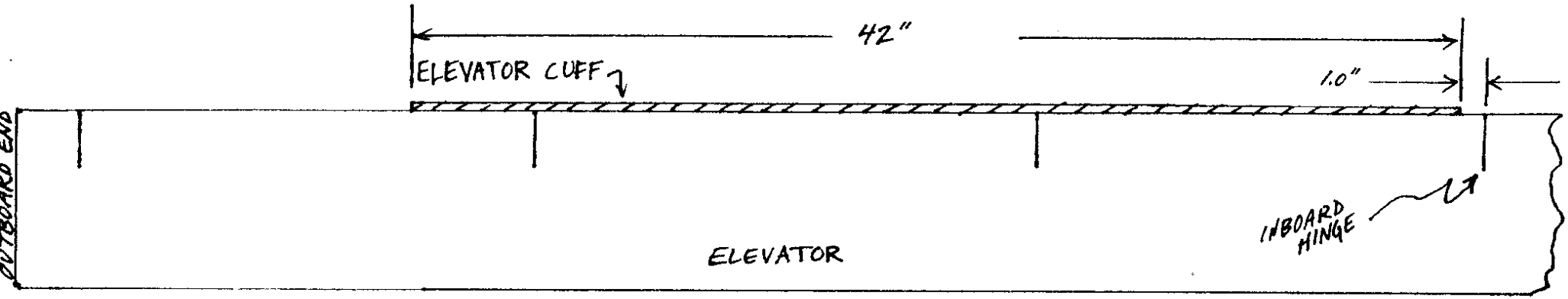


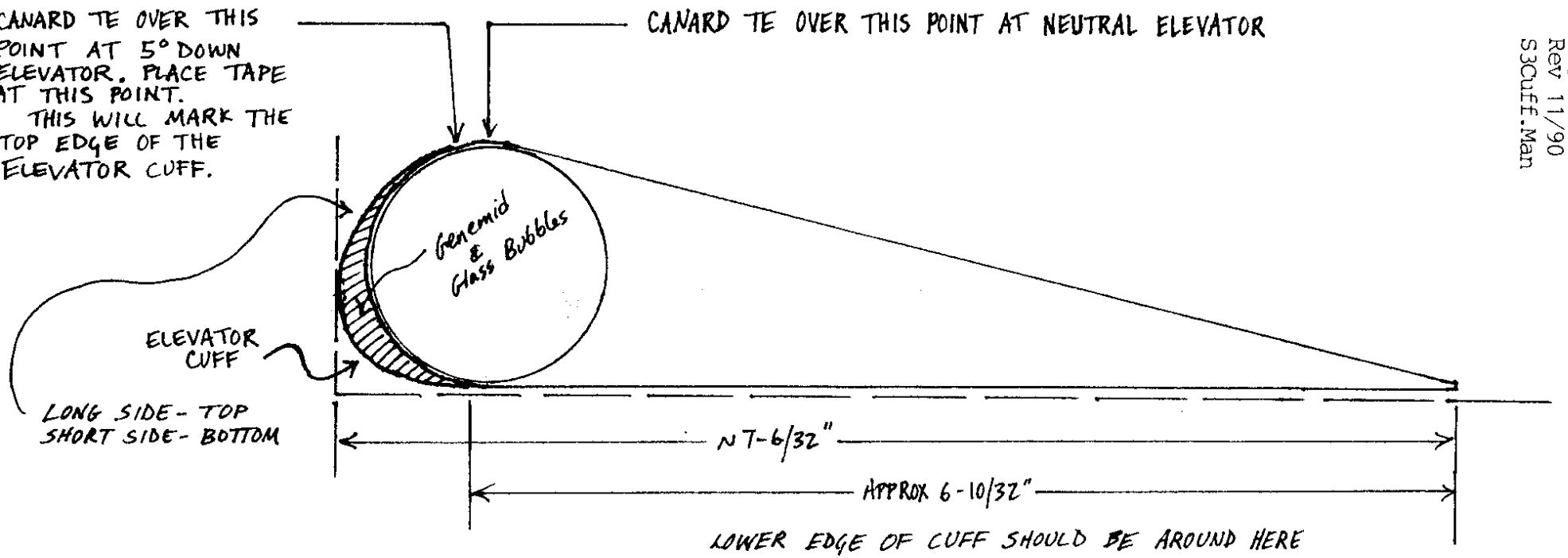
ELEVATOR DEFLECTION: 25° UP



YOU SHOULD GET 23° - 25° Up ELEVATOR TRAVEL. THE GAP SIZE IS NOT CRITICAL FOR UP ELEVATOR AS LONG AS CLEARS TO 23°-25°.

DIAGRAM 327 - Section 3
Rev 11/90


42"
ELEVATOR CUFF
1.0"
OUTBOARD END
INBOARD HINGE
ELEVATOR


CANARD TE OVER THIS POINT AT 5° DOWN ELEVATOR. PLACE TAPE AT THIS POINT. THIS WILL MARK THE TOP EDGE OF THE ELEVATOR CUFF.
CANARD TE OVER THIS POINT AT NEUTRAL ELEVATOR
Genemid & Glass Bubbles
ELEVATOR CUFF
LONG SIDE - TOP
SHORT SIDE - BOTTOM
≈ 7-6/32"
APPROX 6-10/32"
LOWER EDGE OF CUFF SHOULD BE AROUND HERE

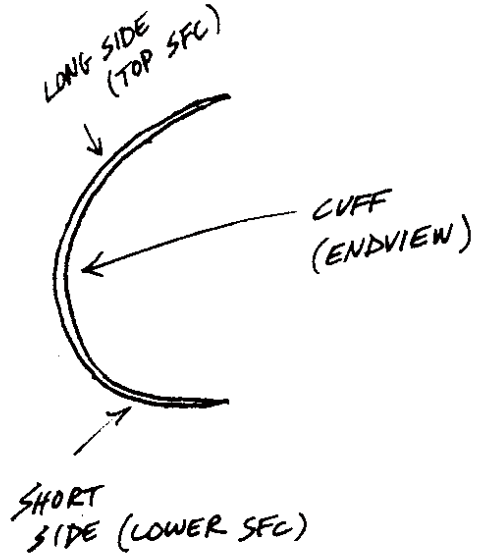
THE 4 DIAGRAMS PRECEDING THIS PORTION OF SECTION 3 CAN BE REFERENCED THROUGHOUT THE CHAPTER.

The idea behind the installation of the cuff to the LE of the elevators is that we wish to control the size of the gap between the elevators and the canard TE. If the gap is held to approximately 0.200" at full down elevator (26 deg), the porpoising normally experienced in canard aircraft at stall will be greatly reduced, making landings at slower speeds possible.

To begin, you must have your elevators mounted to the canard. Bring the elevators down 5 degrees from neutral. With a pencil, mark a line along the top edge of your elevators, just beneath the canard TE. The mark should run the full length of the elevators. Remove the elevators from the canard and apply strips of duct tape just aft of the lines you drew. Use the mark as the forward edge guide for the tape. DIAGRAM PAGE 328

The forward edge of the tape (your line) marks where the top edge of the cuff starts. The bottom edge of the cuff will end somewhere under the torque tube.

The cuffs should be cut to 42" each. They will extend from 1" outboard of the inboard hinge to about 15-1/2" from the OB end of the elevator (DIAGRAM PAGE 328). Looking at the cuffs from the ends, you will notice that one surface is longer than the other. The long surface will be the TOP LE of the cuff. SEE BELOW:



ELEVATOR CUFF INSTALLATION

TRIAL FIT OF CUFFS

SEE DIAGRAMS 324-327

Place the cuff into position at the elevator LE, and mark where you'll have to notch the cuff to fit around the hinges. Notch the cuff at this time.

Affix the cuff in place on the elevator with tape, aligning the top cuff edge with the edge of the duct tape that you applied to the top surface of the elevator. Reattach the elevator, and see how the cuff fits as you deflect the elevator through its cycle. Does it clear everywhere? Is the gap what it should be (0.050" at neutral elevator, 0.200" at 26 degree down elevator)? Will the cuff allow full up deflection, at least 23 degrees? Trimming on the upper and lower cuff edges will most likely be necessary. Use masking tape as a guide, and make your trim lines as straight as possible. When you are close to being satisfied with the fit, taper the inside edges to conform a bit more closely to the elevator LE.

When you are satisfied with the fit, and your ability to stabilize the position of the cuff, you are ready to attach it permanently.

INSTALLATION

Remove the elevators from the canard. Sand the elevator LE and the inner surface of the cuff. Fill the cuff with G-MICRO and attach to the elevator with masking tape, or whatever works best for you. Be careful not to deform the cuff during cure.

POST-CURE

Taper the edges of the cuff into the elevator, and fill any creases or gaps with dry G-MICRO. Reinstall the elevators to the canard, and check for interference or binding during elevator deflection. Once proper operation is achieved, sand and prime your work.