G-200 CONSTRUCTION MANUAL
VERSION 1.6

SUPPLEMENT

Please make the following changes to version 1.6 of the G-200 construction manual:

P. 35 The bearings should press in with only light resistance. If the fit is too tight, the bearing will not operate smoothly.

P. 43 Step B Instead of making the plates out of fiberglass, builders may use .032 aluminum. This aluminum is not supplied with the kit.

P. 44 Step C Drill #19 hole, not #19 inch hole.

P. 46 Step D The template is missing from this version of the manual.

P. 54 Step B Builders may want to use tan tape instead of clear tape, the tan tape is much more visible and is less likely left in place after the trial fitting and build-up process is completed.

P. 57 Note The G-200 flies well without any spades installed. If the spades are used, they should be no wider than 12 inches at the trailing edge. Measure forward 6 inches from the trailing edge and cut the front of the spade off at this point. The leading edge of the spade should end up approximately 5 inches wide. AkroTech does not recommend using any different spade configuration.

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P. 67 Step A This should read "Find and position..." Please note that the pad is not necessary if wingtip lights are not being used. If lights are installed, they tend to interfere with the pitot tube. The pad is used to allow the builder to mount the pitot tube far enough away from the tip rib so that the light base will clear the tube.

P. 68 The pitot tube sleeve is plastic, PN is 10-103.

P. 79 Step C There are more than six backing plates.

P. 89 Step F Do not trim the trailing edges of the wing skins 4.25 inches aft of the pivot point of the hinges. This will leave the skins too short! Trim the skins to the flange of the rear spar, this will be very close to the correct amount. Leave a little extra at first, as it is much easier to trim material away than it is to add material back!

P. 96 Step B	Run a line of tape ALONG the perimeter of the wet area of the tank. Although Hysol will bond to the tank sealer, a superior bond will be made if there is no sealer between the Hysol and the carbon. Be sure that there is either Hsyol or sealer covering every part of the tank area.
P. 112 Step A	Dimension of 1/8 inch in this step should be 1/16.
P. 114 Step C	Dimension of 1/8 inch should be 1/16.
P. 116	The rudder must be removed in order to install and remove the elevators.
Step B	This should read "Trim the inboard edges of the elevator panels close to their final trim line..." The dimension is 40 7/8 inches or longer.
Step D	Dimension should be 1/16 instead of 1/8.
P. 119 Step K	The areas that the backing plates contact have a layer of fiberglass installed at the factory. But the builder should still paint the backing plates to give them added protection from corrosion.
P. 138 Step B	To mark the center of the rudder post, find and mark the center at the top of the post. Then install the tailwheel spring and run a line from the center of the tailwheel spring to the top of the rudder post. This will result in a more accurate center line.
P. 140	Install the LSS-4 bearings in the rudder hinges before permanently mounting the hinges. Mount the hinges so that the open side of the bearings face in opposite directions.
P. 142	When positioning the rudder hinges, be sure the rudder counter-balance will clear the fin.
P. 150	The second line should read "...corresponding section of the STABILIZER with..."
P. 151 Note	None of the kits have had the core material removed, so core will be exposed and need to be sealed.
P. 152	The top fuselage has been pre-aligned and drilled at the factory.

P. 152	Step D and E are being rewritten. Please consult AkroTech before proceeding with these steps.
P. 155 Step B	The fin cap rib should be installed before this step is completed.
P. 157 Step B	The spacer should be 1/8 inch, not 18/ inch.
Note	Disregard note. Center the tip rib on the rudder post. It will appear to be too wide, but will work out just fine.
P. 158	Lead shot has been outlawed in some areas and can be difficult to find. Steel shot can be used instead.
P. 162	Third paragraph should read "...at 65 degrees F (but preferably 12 hours at 85 to 110 degrees F)...
P. 165	Disregard note, follow steps B and C.
P. 172	Service Bulletin #4 affects this area. The service bulletin will be issued in January of 1997.
P. 176 Step A	The G-200 shoulder harness brackets are molded individually.
P. 177 Step A	Drill the hole at the juncture of the rudder post and fuselage, at the edge of the fiberglass.
P. 186	Check the alignment of the stab and wing before installing the fin skin. The more parts that are installed, the more rigid the structure becomes.
P. 200	The gear bolt spacing depends on the width of the flat of the landing gear. The bolts should be close enough together so that the gear blocks do not contact the bend radius of the gear. Position the blocks 1/8 to 1/4 inch from the start of the bend radius. The distance between the bolt holes should be between 17 and 18 inches.
P. 202	The bottom of the gear may need to be relieved slightly in order for the brake caliper to clear.
P. 203	It is easier to install the seat before the top is bonded into place.
P. 204	All the strips are intersected by the spar plates.
P. 206	It is easier to install the access panel in the seat before the seat is installed in the fuselage.

P. 216	One NACA duct will be provided in the kit. The eyeball vent is not included, as each builder seems to have a different preference.
P. 218	This bulkhead is installed at the factory.
P. 220	"Belcrank" should be "Bellcrank".
P. 224	This section is being rewritten. There is no joggle on the G-200 wing skins. Be careful not to drill into the wing spars!
P. 227 Step J	The first line should read "...fairings should just barely clear..."
P.230 Step C	There are no phenolic blocks in the bulkhead. After drilling holes for the panel, relieve and seal the exposed core material. Install the nutplates by mounting them to small flat pads of cured fiberglass lay-ups (4-ply), then bonding the lay-up in position on the back of the bulkhead.

AkroTech Aviation G-200

Fast Build Manual
For the G-200 Aerobatic Aircraft

Part # MAN1.6

Draft version 1.6

December, 1996

PLEASE NOTE:

This manual is presented in preliminary draft form for the convenience of builders of pre-production and early production kits of the G-200. As the final assembly details of the G-200 kit evolve, it is anticipated that some of the procedures and instructions included in this manual will later be superseded by more current information. Please use this manual with this caution in mind.

Should the users of this draft version have any thoughts or suggestions concerning this manual, we at AkroTech Aviation would welcome them. Please do not hesitate to let us know how this manual might be improved.

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General Information Section

It is important to read and understand this section of this manual before attempting to assemble the G-200. The General Information Section contains techniques and procedures that you will perform a number of times during the construction of your G-200. Become familiar with these procedures before you are required to perform them.

When your fuselage kit is delivered, remove all protective wrapping and check for damaged or missing parts. Place the fuselage on two sawhorses for inspection. Place the fuselage upside down on the sawhorses when finished for best stability. Check your materials against the Fuselage Inventory list found below. **NEVER** attempt to substitute store-purchased supplies or modify the parts supplied with your kit unless you have contacted AkroTech and have been specifically advised to do so.

Caring for G-200 Components:

Carbon fiber is blessed with an extremely favorable strength to weight ratio, however it does require a few special measures during handling, moving, and storing. These measures are intended to keep you from damaging the carbon fiber parts -- and to keep them from damaging you.

First, be aware of the damage that carbon fiber can do to you: USE CARE WHEN HANDLING ALL CARBON FIBER PIECES. As they come out of the molds, carbon fiber pieces can have razor sharp edges. If handled carelessly, unfinished pieces can produce deep cuts in the hands. We strongly suggest that you **wear gloves when handling** all unfinished pieces. This is particularly true of the thinner pieces such as wing skins.

Second, be aware of the damage you can do to carbon fiber components: A carbon fiber component's strength depends on the integrity of its individual fibers. The resin serves merely to hold the carbon fibers in the desired form. The fiber itself provides the strength. If the carbon fibers themselves are scratched, dented, or even sanded incorrectly, some of those individual fibers will be broken. Broken strands of carbon fiber weaken the structure. This can be avoided by using a few simple precautions:

- Do not drop anything on the carbon fiber pieces. They are quite sensitive to impact.
- Do not drop carbon fiber pieces.
- Do not attempt to move large or unwieldy pieces by yourself.
- Find a secure place to store the pieces until you are ready to work on them.
- Protect them from damage in their storage place.

If any components must be stored on edge, protect them by putting pre-slit foam "C" shaped pipe insulation over the edges where they contact the floor of your shop.

Health Hazards:

A discussion of the bonding process is incomplete without strong mention of the health hazards composite materials pose. The resins used in the G-200, while relatively benign compared with the adhesives in use only a few years ago, are still strong chemicals which can have a significant negative impact on your health. Read, understand, and follow all manufacturer's precautions.

Acetone, used to clean spills and mating surfaces just before bonding, is a solvent which can freely penetrate unprotected skin.

The microballoons and structural filler used to thicken the laminating resin (and in a few cases the structural adhesive) is so light that particles can easily become airborne during mixing and may be inhaled. Other airborne particulate hazards include any dust created by sanding. All these sources pose a danger to your lungs. Wear an effective respirator!

The effects of these chemicals and materials are cumulative: the more exposure you incur, the greater the chance that you will suffer a reaction. The unfortunate stories of aircraft builders having to abandon projects due to chemical allergies are too common. Equally unfortunate is the fact that many of those allergic reactions could have been avoided.

Ordinary household rubber gloves will not protect you from adhesive resins and hardeners. Always wear latex gloves on your hands when working with these chemicals.

Paper filter masks are only partially effective against structural filler, microballoons and sanding dust. Always wear paint spray/insecticide respirators featuring replaceable filters.

Significant additional protection may be gained by aggressively ventilating the construction area and by constructing a simple power vented hood from cardboard or Styrofoam for the mixing station. The belt sander is another site where a lot of dust is produced. A shop vac type attachment on the sander will minimize the introduction of dust into the air and help keep your shop, as well as your lungs, clean. Location of the vacuum canister outside of the shop will eliminate the inevitable dust cloud which rises when you clean or empty the vac.

Tools:

If you do not already own them, you will need to invest in some quality tools before you can begin work on your G-200.. Do not attempt to build your aircraft using those cheap screwdrivers and rusty, bent pliers that have been sitting in your kitchen drawer since you bought them at that garage sale back in '64. Compared with the cost of the aircraft, the cost of quality tools is minimal, so buy the best you can get. Most of the required tools can be purchased at your local hardware store. Any tools you cannot find locally can be purchased through one of the mail order companies listed below.

The following list has been broken down into two categories - tools that are required and tools that are not absolutely necessary but will expedite the construction process considerably. Read through this list and check it against your current tool inventory.

Required Tools

Hand held 3/8 inch electric drill
Drill bits (both number and fraction sizes)
100 deg. Counter sink
Jig saw
Jig saw blades (fine tooth, metal cutting)
Files
Sandpaper (60, 80, 100, and 150 grit)
Hack saw with fine tooth blades
Dremel tool with an assortment of attachments (a very useful tool)
Sanding block 6" and 12"
Felt tip markers with fine tip
25 ft tape measure
6" precision steel rule
Fabric shears or scissors
4 ft level
Torpedo level
Water level

String level
Nylon twine (50 ft)
Carpenters square
Framing square
Carpenter's chalk line
Spring clamps (all sizes)
C-clamps (all sizes)
Quick grip clamps (extremely useful; buy four of the smaller size)
Automatic center punch
Scribe
X - acto knife
Plastic or rubber faced mallet
Vise -bench mounted, heavy duty
Pliers (diagonal cutters / channel locks)
Socket set (1/4" drive U.S.)
Combination wrench set
Screw driver set (straight slot and phillips #1, #2, #3)
Clecos (1/8 inch, about 50 needed - see Aircraft Spruce catalog)
Cleco pliers (see Aircraft Spruce catalog)
Rivet squeezer (for squeezing the solid an type rivets-see aircraft spruce catalog)
Blind rivet puller
Torque wrench / in. Lb.
Digital gram scale (for measuring out the resin)
Hot glue gun
Automotive wax
Clear packaging tape (2" width)
Masking tape
37 degree tube flaring tool (for fuel tubing, see Aircraft Spruce catalog)
Tube bending tool (for fuel tubing, see Aircraft Spruce catalog)
Small electric heater
Paint brushes (disposable with natural bristles)
Plastic film (polyethylene "drop cloth" material will work)

Optional Tools:

Drill press
Band saw
Bench grinder
Rotary files and carbide burrs (1/4" shank)
Makita hand held 1 inch belt sander (expensive, but worth it)
Micro stop countersink
Air compressor
Assorted air tools (die grinder with cutting discs and sanding drum accessories)

Consumable Items:

Latex Gloves
Disposable Dust Masks
Epoxy Mixing Cups (NOT WAXED)
Mixing Sticks / Tongue Depressors
Acetone
Clean Shop Towels (Disposable from Paint Store)
Automotive Body Filler (Bondo)

Tool and Consumable Vendor List:

Aircraft Spruce & Specialty
P.O. Box 424
Fullerton, CA 92632
1-800-824-1930 or (714) 870-7551
Fax (714) 871-

Avery Enterprises, Inc.
2290 W. Hicks Rd., Hanger 54
Ft. Worth, TX. 76179
817-439-8400
Fax (817) 439-8402

Brown Aviation Tool Supply
3411 S.W. 29th St.
Oklahoma City, OK 73119
1-800-587-3883
Fax (405) 681-7250

Cleaveland Aircraft Tool and Material
1804 First Street
Boone, IA 50036-4417
515-432-6794
Fax (515) 432-7804

Mixing & Thickening Epoxy Resins

Before using any epoxy product for the first time, you should thoroughly and completely read the manufacturer's instructions and product safety information. This information can be found in the back of this manual.

Both the structural adhesive and the laminating resin in your kit include two components (resin and hardener) that must be mixed carefully if the full mechanical properties of the resin are to be realized. Always follow the manufacturers instructions when mixing resin. **Never** vary the mix ratio unless specifically instructed to do so.

To accurately proportion the resin and hardener for the epoxies utilized in your kit, you will need an accurate scale. You may either purchase a digital scale (accurate to the gram over 1000 grams) or build a simple wooden scale. The digital scale has the advantage of being accurate even for batches as small as 50 grams (smaller batches than this should not be attempted) but can lead to mix ratio errors if careful calculations are not employed. The wooden scale has the advantage of almost eliminating mix ratio calculation errors but the disadvantage of not being accurate for batches of less than 100 grams.

Laminating resin and structural adhesive are mixed in paper cups. The mixing cups and sticks supplied in your kit may not be sufficient to complete your G-200. If you find you need more, ensure that the cups and sticks you use are not wax lined. Plastic coated bathroom cups in the 3 oz. and 12 oz. sizes, available in many grocery stores, work very well. Tongue depressors, available in most drug stores, work well as mixing sticks.

Spillage is a fact of life. Unless cleaned up immediately, spills will tend to travel around your shop on rags, gloves, and tools, ending up where they are not appreciated. Use acetone to clean up. Clean-up can be eased by covering flat surfaces of your mixing area with Saran wrap or clear plastic drop cloth material (polyethylene).

If instructions call for thickening the adhesive with filler do the following:

- Thoroughly mix the resin and hardener before adding any filler.
- Identify the correct filler to be used.

- Put on your respirator before opening the filler containers and keep it on all the while that you are mixing.
- Stir slowly when you first add filler to the previously mixed adhesive. Otherwise you can generate significant amounts of airborne filler.
- Never mix more than 8 oz of resin and hardener at a time. If you have a large adhesive job to do, try to mix several smaller batches of adhesive rather than one large one. This will postpone the onset of an exothermic reaction in the adhesive and increase pot life.

NOTE:
There are two fillers supplied with your kit - microballoons and structural filler. These two filler materials look somewhat similar and are easily confused. Structural adhesive is always thickened with structural filler and never with microballoons. **It is very important that you do not accidentally substitute microballoons for the structural filler when thickening your structural adhesive**. To do so could seriously compromise the structural integrity of your aircraft. Also

The thickness or consistency of an adhesive is determined by how much filler is added to a resin/hardener mixture of the proper ratio. In many places in this manual, a specific consistency is denoted in terms of the food it most closely resembles:

"Syrup" Consistency:

"Syrup" consistency results from of a thorough mixture of resin and hardener in the proper ratio, without the addition of any other filler. It will be a slow-running liquid.

"Catsup" Consistency:

"Catsup" is the consistency made by a thorough mixture of resin and hardener in the proper ratio, slightly thickened by the addition of a small amount of filler. It will slowly run down a vertical surface in loose globs.

"Mayonnaise" Consistency:

"Mayonnaise" is the consistency that results when a thorough mixture of resin and hardener, in the proper ratio, is thickened by the addition of an approximately equal volume of filler. It will cling to a vertical surface, but peaks will fall over.

Peanut Butter" Consistency:

"Peanut Butter" consistency results when a thorough mixture of resin and hardener, again in the proper ratio, is extensively thickened by the addition of the maximum amount of filler. It will cling easily to a vertical surface, and it will form peaks that will not fall over.

Bonding Procedures:

Most of the premolded composite components included in your G-200 kits are assembled using a two part structural adhesive. Because the structural integrity of your aircraft is dependent on such bonds, it is imperative that you perform them carefully.

A good bond begins with an accurate dry fitting of the parts. It is almost impossible to separate the carbon fiber parts after they are bonded; know before you begin to mix the adhesive that the parts fit exactly as they should.

Determine how the parts will be held together while the adhesive cures and make those tools accessible. In many cases the bonding flanges of premolded parts can be drilled and tools called Clecos inserted into these holes both properly position the parts and provide the necessary clamping pressure. Parts may also be held in place with clamps, hot glue, five-minute epoxy, jigs, or duct tape. Small parts may not require clamping pressure, while large bonding operations, such as the wing or stabilizer skins, will require weights to hold the mating surfaces together. The manual will alert you if you need a particular kind or number of weights or clamps.

The bond areas of parts to be mated are prepared using a three step process. First clean all bond areas with a clean rag dipped in acetone. Then thoroughly roughen the surfaces using 80 grit sandpaper with medium pressure. Lastly you must clean the bond areas once more with acetone to remove any traces of carbon dust, oil, or grease. After cleaning with acetone, do not touch the surface again with your hands. The surfaces are now ready for bonding.

Thoroughly mix the adhesive according to the manufacturer's instructions. If instructions in the procedure call for a thickening filler, thoroughly mix the adhesive **before** adding the filler. Again, put on your respirator before opening the filler containers and keep it on while you are mixing. Be sure not to confuse the two filler materials. Only structural filler should be used when thickening the structural adhesive for bonding. **Never** use microballoons.

Apply a thin layer of the mixed structural adhesive to the bonding zones of both mating surfaces. Join the two mating surfaces, making sure their positions are correct, and secure the parts in position. After securing, re-measure to ensure the part is accurately located.

Remove any excess adhesive which has squeezed out from between the mating surfaces with paper towels. Excessive adhesive is only dead weight and does not contribute to the strength of the bond.

Wet Lay-ups:

The term "wet lay-up" is used to describe the process of saturating fiberglass cloth with mixed epoxy laminating resin. Most wet lay-ups used in the G-200 are relatively small and involve placing epoxy-wetted fiberglass strips at the juncture of parts which must be joined. A wet lay-up may be used to bond two parts together, or to create a flange which will be used later to bond the two parts together. The procedure for both is the same, with the exception that during flange creation, a barrier such as 3M packing tape is placed between the two parts so that the lay-up bonds to one part, but is prevented from bonding to, and may be separated from, the other after cure.

The procedure outlined below is typical of the wet lay-ups you will perform when building your G-200.

1. Dry fit the parts to be mated.

2. Locate and mark the part and bond zone positions.

3. Thoroughly scuff the mating surfaces with 80 grit sandpaper

4. Clean the mating surfaces with acetone.

5. Cut fiberglass cloth strips as necessary for the lay-up. Be sure to cut these strips on the bias (fibers running at 45 degrees to the edge, also known as BID). Also, you should cut these strips slightly oversize so they can be trimmed down later.

6. Using your epoxy scale, measure out the proper amounts of resin and hardener.

7. Mix the laminating resin and hardener thoroughly using a tongue depressor. Observe all appropriate cautions and procedures mentioned in the earlier section entitled Mixing & Thickening Epoxy Resin. Remember **never** to thicken epoxy laminating resin used to wet out fiberglass. Now is the time to put on latex gloves and turn on the fan at your mixing station.

8. Wet out the strips of fiberglass one at a time on a piece of clear plastic sheet. Use a brush to spread the resin out on the fiberglass. Don't try to force the resin into the cloth. Instead, give the resin a little time to soak into the fiberglass. Keep adding layers of fiberglass cloth and wetting them out until you have the required number of layers built up.

9. Use a plastic squeegee to remove any excess resin from the lay-up. The cloth should now be fully saturated and appear to be translucent. Inspect the lay-up carefully for the presence of small white flecks. These flecks indicate a dry lay-up.

10. Place a second layer of clear plastic sheet on top of the saturated fiberglass strips. You should now have a sandwich consisting of one layer of plastic, the saturated strips of fiberglass, and a second layer of clear plastic.

11. Using scissors, trim the fiberglass strips down to their final size. The plastic sheet will prevent the fiberglass from distorting while you cut it, allowing you to accurately size the strips.

12. Using a paint brush, paint the bond zones, of both the pieces you are joining.

13. Remove one layer of plastic from the fiberglass and carefully lay the fiberglass into the junction of the two parts to be joined. Work the strip into the joint with your fingers. then remove the outer layer of plastic. Use a light stabbing motion with the brush to smooth out the fiberglass and remove any air bubbles.

14. Carefully inspect the lay-up once more for the presence of air bubbles or dry areas. Use the brush to work out the air bubbles and add resin as necessary to eliminate any dry areas.

Wet Lay-Up Tips:

Remember, the ideal amount of epoxy is only the amount needed to completely wet out the cloth, and no more. You will find that if you are somewhat generous with the amount of epoxy in the first and second layers, and saturate the subsequent cloth layer by bringing the epoxy up through the weave by stippling (gentle vertical stabbing with the brush), that fewer air bubbles will be trapped. Do not overdo this trick, however, for if epoxy in the first two layers gels before you have finished applying the last layer, the epoxy will not flow up through and wet out the cloth, and you will pay a weight penalty. On the last layer add only the epoxy needed to wet out the cloth. Excess epoxy adds weight without increasing strength.

Work in small sections. When the cloth seems difficult to wet out, your epoxy batch is probably gelling. Throw it away and mix a new batch. Gelling epoxy will not properly wet out and will not form a secure bond. Often, just before the laminating resin begins to gel, and particularly in larger batches, you may notice the mixing cup begins to get warm, a process termed "kicking-off". A warm mixing cup means the working life of the adhesive is nearly over.

Properly wet out cloth will have a consistent, translucent, satin look without any light colored areas or air bubbles. Shiny areas indicate an excessive amount of epoxy. Use a squeegee to remove excess epoxy.

Fillets:

Some wet lay-up instructions may ask that you lay in a filet between two parts before setting down the cloth layers. Fillet material usually consists of a mixture of epoxy and microballoons of "Peanut Butter" consistency which is spread into the corner created between the two parts using a mixing stick or your gloved finger. The fillet extends for the length of the intersection and should be about a 1/4" radius.

Preparing Carbon Fiber Pieces for the Attachment of Fittings:

There will be many occasions in the building of your G-200 in which you will have to prepare carbon fiber components in order to attach fittings. While carbon fiber is not particularly difficult to work with, it demands different construction techniques than metal or wood.

Particular attention must be paid when attaching metal fittings to carbon fiber parts. Anyplace carbon fiber contacts metal, there is a potential corrosion problem. The solution to this problem involves both the use of fiberglass to separate metal fittings from the carbon fiber and the use of stainless steel bolts to attach these fittings. In a few areas, stainless steel bushings are used to isolate bolts from the carbon.

Any and every time you have **exposed core material** that is between the inner and outer layers of carbon fiber it **must be sealed**. If it is not sealed, any exposed core material will provide a path through which the core might absorb rain water, atmospheric moisture, or fuel. Should this happen, it might eventually diminish the integrity of the structure. There will be several instances when it will be necessary to expose core structure in order to attach fittings and install systems.

NOTE:
Early G-200 kits utilized stainless steel bushings extensively as a means of separating bolts from carbon fiber parts. Recently, the G-200 carbon fiber parts have been modified to allow for the installation of most metal fittings without the need to seal core material and install bushings. Such changes have been incorporated in an attempt to completely eliminate this relatively time consuming task. Currently, the factory installs phenolic block and a layer of fiberglass at most locations where a fitting is installed. In addition, standard bolts have been replaced with stainless steel bolts. Such special preparations were not incorporated into some of the early kits. For these kits, stainless steel bushings and a layer of fiberglass must be installed by the builder everywhere a metal fitting is attached.

The following steps are required for installing metal fittings. Note that some of the steps have been marked with an asterisk. If your kit has factory installed phenolic and fiberglass at fitting locations, you may disregard these steps.

1. Place A Layer Of Fiberglass Over The Carbon Fiber Part *

Lightly sand the area of the carbon fiber part where the fitting will be installed. Prepare a small batch of fiberglass resin and laminate a single layer of fiberglass on both sides of the carbon fiber part at the fitting area.

2. Clamp The Fitting To The Carbon Fiber Part And Drill The Holes

Precisely position and clamp the fitting to the carbon fiber part using C-clamps. Orient these clamps so that they are positioned diagonally across the face of the fitting. Most likely, these clamps will obscure one or more holes in the fitting. If this happens, drill the accessible holes first, then place two more clamps over the drilled holes and remove the clamps obscuring the undrilled holes. Now drill the remaining holes. *Note: be sure the fitting does not move while you are exchanging clamps. To prevent this from happening, you may wish to use bolts to secure the fitting after the first two holes are drilled.*

3. Remove The Fitting From The Part

Remove any clamps from the fitting and separate it from the carbon fiber part

4. Drill Out The Holes To The Size Of The Bushings *

Use the existing holes as pilot holes to bore new larger holes for the stainless steel bushings. Drill a bushing hole that is the exact outer diameter of the bushing that you will use.

5. Remove The Core Material From The Area Surrounding The Holes *

Gently but thoroughly remove the core material at least 1/4 inch back from the hole's edge. **Do not cut, gouge, or damage the surrounding carbon fiber in the process.** In the case of a smaller diameter hole, this may require a little persistence. However, if you use small scraping tools (such as an X-acto blade) and a gentle hand, you will succeed. If you are careful, you may use a Dremel tool with a small round cutting bit to remove the core material.

6. Seal The Core Material With Structural Adhesive And Install The Bushings *

NOTE:
There are some places in the G-200 structure where a phenolic reinforcing block has been substituted for core material. These are typically areas that are subject to high, localized loads. An example of this is the rear wing spar in the area where the aileron hinges attach. **It is not necessary to seal the material between the inner and outer layers of carbon fiber where a phenolic block has been substituted for core material.**

Clean the bonding area with acetone. You may want to apply a piece of 3M clear tape to the exterior side of the hole in which the bushing will be inserted. This will keep the bushing from being pushed out of the hole and will help minimize adhesive clean up on the taped side.

Make a fairly thick mixture of structural adhesive and micro balloons. The mixture should be thick enough so that it is not runny and will not sag. Make sure that you thoroughly fill the area and do not leave any voids where the core remains exposed.

Fill the exposed core recess with the structural adhesive mixture. Apply some structural adhesive to the outside of the bushing. Slip the bushing into the bushing hole for which it was cut and fit. Using a Q-tip, remove any excess structural adhesive from the interior bore of the bushing. Allow the structural adhesive to cure.

Your final finish hole will be protected by a bushing and any previously exposed core material will be surrounded by at least 1/4" of structural adhesive. This will completely isolate the core material from the outside environment and the bolts or fittings that pass through the carbon fiber will be protected from the effects of both corrosion and abrasion.

Cut the bushing material to length. When you insert it in the hole, the bushing must be flush with both the front and back surfaces of the hole. Bushings can be cut to approximate length with a hack saw or a band saw, and then fine fit using a hand file, however a small grinding wheel will greatly accelerate the process. This will require custom fitting and in order to end up with a flush fit, it may be that both end surfaces of the cylindrical bushing are not precisely parallel. You may also find that the bushings required for a single fitting must be of slightly different lengths in order for them all to be flush with the surfaces on both ends of their respective holes. Once you are certain that you have achieved a flush fit for each bushing in question, they are ready to be bonded into the carbon fiber structure.

HINT:
If you are sealing exposed core material that results from the drilling of a small hole, such as for a bolt, or where a piece of tubing passes through a structural member, place a piece of clear 3M tape over one side of the hole, firmly press it into place, then fill the exposed core recess with the structural adhesive mixture from the other side. This will allow you to work the structural adhesive mixture into every corner of the recess without it flowing out through the hole on the other side. Place the tape on whichever side of the hole you would like to maintain a neat appearance. For instance, if you are sealing exposed core in a hole that penetrates your wing skins, place the tape on the exterior surface. That will minimize the amount of clean up and surface preparation necessary in that area prior to painting.

8. Install The Backing Plate With Structural Adhesive And Waxed Bolts.

Prepare the backing plate and the mating carbon fiber part for bonding by sanding both surfaces with 100 grit sandpaper. Dip a clean rag in acetone and clean both bond areas thoroughly. Prepare structural adhesive and mix in enough structural filler to achieve "catsup" consistency. Coat both surfaces with the mixture. Leave 1/8 inch surrounding each bolt hole free of structural adhesive. This will minimize the tendency for the structural adhesive to ooze into the bolt holes when clamped down. Coat the shaft of the fitting bolts with automotive wax. (Note: *always be extra careful to keep wax away from any bond areas*) Install the waxed bolts through the fitting and the carbon fiber part and into the backing plate. Tighten the bolts down and remove all excess structural adhesive from around the backing plate.

Since the backing plate is bonded in place using adhesive, it is inevitable that some adhesive will get squished out from behind the plate during the bonding process., Some of this migrating adhesive will unavoidably find its way into the screw holes in the nut plates. Normally, you could deal with this overflow by simply re-tapping the hole. However, the threads of nut plates hold bolts captive because their female threads are deliberately deformed. **Never tap the threads of a nut plate.** If you tap a nut plate you will remove that deliberate deformity and the nut plate will no longer hold the bolts captive. For that reason, it is necessary to wax the threads of one bolt for every nut plate in the backing plate you are bonding into place. When you screw the waxed bolts into the nut plates, these waxed bolts will keep unwanted structural adhesive from fouling the threads and/or adhering to the bolts themselves. Thus, after curing, the bolts can be removed, leaving the bolt holes and nut plate threads free of unwanted structural adhesive. Also, a layer of clear tape placed over the face of the fitting will prevent any structural adhesive that may be forced through the bolt holes from bonding the fitting in place.

9. Install The Retaining Screw In The Backing Plate

Drill an 11/64 inch hole through the approximate center of the backing plate and through the carbon fiber part. Countersink this hole on the side where the fitting will be attached (side opposite of the backing plate) with a 100 degree countersink. Install an 8-32 stainless steel screw in this hole. Locate the appropriate nut for this screw and install it on the back of the screw.

10. Permanently Install The Fitting With Stainless Steel Bolts

Use stainless steel bolts to permanently install the fitting. (You may use standard bolts if your kit uses bushings)

Backing Plates:

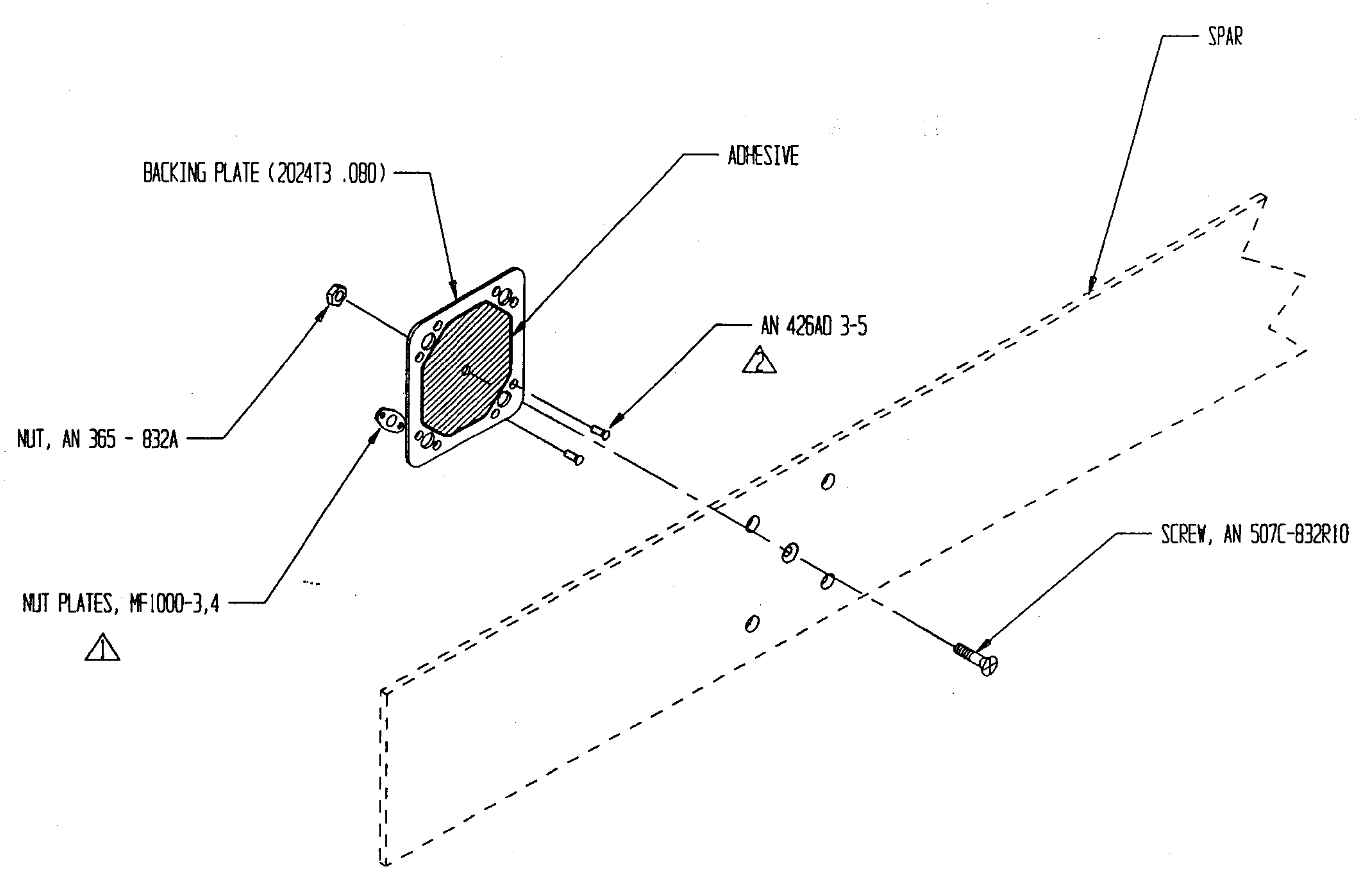
NOTE:
Some early kits were shipped with the backing plates pre-made. AkroTech now no longer furnishes these parts pre-made. Instead, the builder must fabricate these plates from the .080 aluminum sheet supplied with the kit. The following instructions assume you do not have the pre-made backing plates.

Backing plates are used throughout the G-200 wherever high load fittings are attached to composite structural members. A significant portion of your building time will be spent preparing and attaching backing plates. They serve to transfer high localized loads to the composite members of the airframe. They do this by mechanically sandwiching the composite structural member between the high load fitting and its backing plate.

It is important to note that **backing plates are always bonded in place** with structural adhesive, whereas the fittings the backing plates are meant to support are not. The backing plates must be made captive since most of them are in areas that will be virtually inaccessible after the builder closes the wing, tail surfaces, or fuselage sections. This allows for the later removal, servicing or replacement of the primary fittings, while still utilizing the backing plates originally installed by the builder.

Even though every backing plate is bonded in place with structural adhesive, AkroTech suggests that a retaining screw also be used to secure the backing plate to the structure. The reason for this is simple. Though highly unlikely, should the structural adhesive bond holding the backing plate fail for some reason, the backing plate will drop away from its proper position. Should this happen, that backing plate will rattle around uselessly inside the permanently sealed wing or tail. The retaining screw is a simple backup that will prevent this. Below are the steps you will need to follow to bond and rivet backing plates in your G-200.

1. Cut Out The Backing Plate



NOTES:

1 - NUT PLATES VARY DUE TO BOLT SIZE
2 - RIVETS VARY DUE TO NUT PLATES
3 - SHAPE OF BACKING PLATE AND NUMBER OF NUT PLATES VARY DUE TO SHAPE OF BRACKET

GENERAL BACKING PLATE DETAIL FOR AILERON HINGES, RUDDER HINGES, ELEVATOR HINGES, AND SPADES

DRAWING NO. G004B	TASK NO.	STEP NO.	AkroTech	
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Find the .080 aluminum backing plate material included in your kit. Position the base of the hinge or fitting on this backing plate material. Trace the outline of the fitting using a fine felt tip pen. Carefully cut out the backing plate just outside of this line using a hand-held jigsaw or bandsaw. Smooth any rough edges on the backing plate with a file or belt sander.

2. Drill The Bolt Holes In The Backing Plate Using The Fitting As A Template

Clamp the appropriate fitting to the backing plate using two C-clamps. Drill holes into the backing plate using the holes in the fitting as a drill guide. Remove the fitting from the backing plate.

3. Install Nutplates In The Backing Plate

Refer to the section labeled "Installing Nutplates" in this manual to install the nutplates in the backing plate.

Installing Nutplates:

Nutplates are installed wherever there will be limited access to the rear side of a component where a fitting or panel is attached. In most cases, nutplates will be installed on backing plates which will be permanently bonded inside a sealed wing or tail structure.

Two different types of nutplates are included in your kit: fixed nutplates and floating nutplates. Floating nutplates have a threaded section that "floats" on a fixed base to allow for the inevitable slight misalignment of the bolts used to attach fittings. Fixed nutplates have a threaded section that is solidly attached to the base. Fixed nutplates are used on removable panels (such as inspection plates) and as drill guides for the floating nutplates. Floating nutplates are used anyplace a fitting is attached through a phenolic block. All backing plates for the wing and empennage hinge fittings use floating nutplates.

The installation of nutplates is a relatively straightforward operation. The following steps outline the process necessary for installing a nutplate on a typical backing plate. A similar procedure is used when installing nutplates for an inspection plate or removable panel with the exception that the floating nutplate is not used for these installations.

NOTE: Some early versions of the G-200 came with pre-made backing plates. If your kit includes these backing plates you may disregard steps 1-4 below.

1. Drill Bolt Holes In The Backing Plate

If you have not already done so, clamp the appropriate fitting to the backing plate and use this fitting as a drill guide to drill the bolt holes into the backing plate.

2. Use A Short Bolt To Clamp A Fixed Nutplate In The Bolt Hole

Find a bolt of the appropriate diameter and just long enough to pass through the backing plate and about halfway through the nutplate. If you cannot find a bolt short enough, try placing several washers under the head of a slightly longer bolt. Save this bolt as you will reuse it many times in the construction of your G-200. Using this bolt, clamp a fixed nutplate of the appropriate size to the backing plate so that is tight and will not rotate. Make sure to orient the nutplate correctly as marked on the backing plate template.

3. Drill The Holes In The Backing Plate For The Retaining Rivets

Use a 3/32 inch bit to drill a hole through the backing plate using one rivet hole in the nutplate as a drill guide. Now place a rivet in that hole to prevent the nutplate from rotating and drill the remaining nutplate rivet hole through the backing plate. Remove the bolt and fixed nutplate from the backing plate.

4. Countersink The Rivet Holes

Use a 100 degree countersink to countersink the holes on one side of the backing plate. Countersink these holes just enough to allow the AN426 AD3 rivets to sit flush with the surface of the backing plate.

5. Mount The Nutplate

Locate the proper floating nutplate and mount it to the backing plate using two AN426 AD3 rivets. Drive these rivets using a rivet squeezer.

Setting Bearings Into Control Surface Hinge Brackets:

All of the control surfaces of the G-200 employ sealed, self-aligning bearings. These bearings are designed to be press fit into machined receiver holes in the aluminum hinge brackets supplied with your G-200 kit. These are durable bearings, though some care must be exercised in their installation. Follow these procedures:

The bearings may be press fit using either an arbor press or a common bench vise. In either event care must be used. Note that each bearing consists of an outer collar within which a swiveling inner bearing floats. It is imperative that when you press these bearings into place, you **only apply force to the outer collar and never to the inner swiveling portion of the bearing**. The inner swiveling portion of this type of bearing is not designed to tolerate the lateral forces associated with press-fitting.

1. Make Up A Bearing Driving Die.

In order to properly seat the bearings yourself, you can construct a driving die out of a short (2" or less) length of appropriately sized pipe. Cut both ends of the pipe square and parallel.

2. Press Fit The Bearings Into Their Hinge Brackets.

The bearings can be press-fit by placing the hinge against one jaw of an open bench vice with the bearing receiver hole facing away from the jaw. Then put the bearing into place at the mouth of its receiver hole. Place one end of the driving die on center over the outer collar of the bearing, and then slowly and carefully tighten the vice until the driving die has pushed the bearing all the way into its fully seated position.

3. Hone The Bearing Bore Of The Bracket If Necessary.

In the event you can not set the bearing without the use of excessive force, you may need to purchase a brake cylinder honing tool from your local auto parts store. **In no event should you attempt to grind down or file any part of the bearing itself.** Instead, carefully increase the inside diameter of the receiver hole by honing a small amount of metal from the walls of the hole. Remember that the hinge brackets are aluminum, not steel. A little honing will go a long way. After removing any metal shavings that might contaminate the bearing, try fitting the bearing again. It should be a firm (not excessively tight) press fit. Hone out the hole until the bearing drives in with moderate resistance.

4. Stake The Bearings In Place

AkroTech suggests that the builder also employ a technique called *staking* to further anchor the bearings into the aluminum hinge brackets. Bearings are staked in place only after they are fully seated in their aluminum hinge brackets. Using a pointed center punch, make three separate punches in the aluminum of the hinge bracket, equally spaced around the circumference of the bearing, each one being 1/16" from the bearing. Do not punch the bearing itself. Be sure to stake the bearing on both sides of the hinge bracket. These punches minutely deform the metal of the hinge bracket, making it that much harder for the bearing to inadvertently depart from its hinge bracket.

Getting Started

Setting up your work space

The G-200 can be built in a minimal space with a minimal number of tools. However, before you start construction, you must look at the space that is available to you and make a few decisions concerning how your particular space is best utilized. You will need to construct a 4 ft by 12 ft work table to serve as a platform for the various jigs required to properly align your G-200 airframe components. You will also need a separate work table on which you will construct some of the smaller assemblies and to act as a repository for the various tools which would otherwise end up scattered all over your shop floor. And you will also need a place to store your G-200 components until you actually need them. If your shop space is limited, it is recommended that you keep most of your components in the shipping crate until they are required. This shipping crate can be left outside if you place a tarp over it to protect it from the weather.

However you arrange your shop space, bear in mind that you will want to allow about 2' of walking space around all sides of your main construction table.

Building Your Construction Table

Brief Task Description:

In order to accurately and efficiently assemble your G-200, you will need to construct a sturdy, rigid work table. This work table will need to be a minimum of 4 ft wide by 10 ft long but we suggest a size of 4 ft by 12 ft as this size will make it easier to perform certain jigging tasks with the wings. The materials needed to build this table can be found at your local lumber store.

Tools & Materials Required:

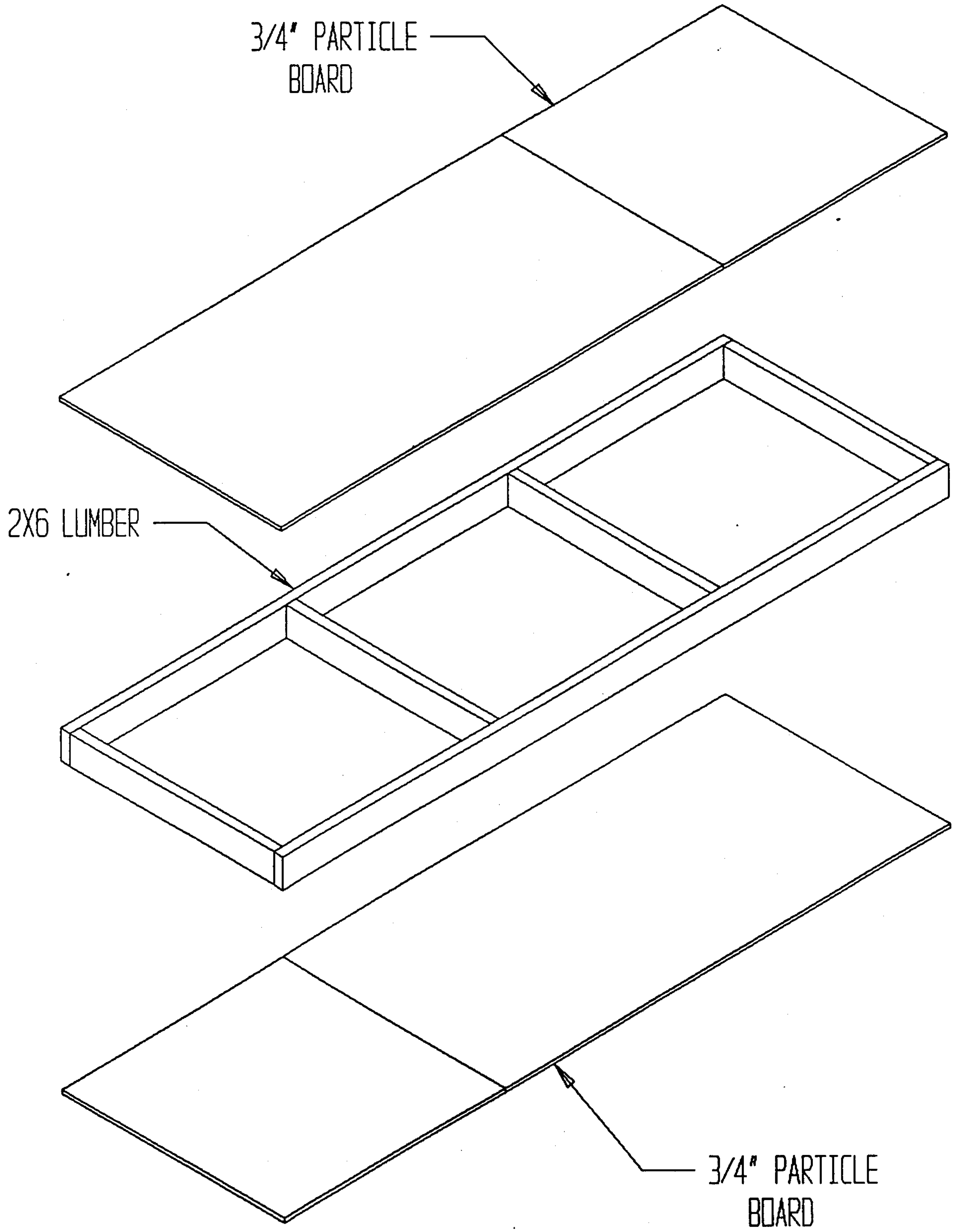
2	Straight kiln dried 2" x 6" x 12' construction grade lumber
2	Straight kiln dried 2 x 6 x 8 construction grade lumber
2 sheets	3/4" by 4' by 12' particle board for work surface
200	2" drywall screws.
20	3" drywall screws
2	Sturdy sawhorses
1	#2 Phillips bit
1	Electric drill
1	48 inch level

Follow steps A through E to build your G-200 construction table

Step A Cut Your Lumber To Size

Using a circular saw, cut one of the 4 ft x 8 ft pieces of particle board in half. (Note that most lumber stores will cut your 4 x 8 sheet in half for a small fee if you do not own a circular saw). Cut the two 2 x 6 x 8 lumber into four pieces, each 45 inches in length. Make sure that the edges of these members are square and that they are all exactly 45 inches in length .These will become the cross members that will span the width of the table.

Step B Assemble The Table's Frame



CONSTRUCTION TABLE DETAIL

DRAWING NO. G002A	TASK NO.	STEP NO.	AkroTech
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Lay out the 2 in x 6 in x 12 ft lumber on your shop floor with the 2 in x 6 in x 45 in cross members. Use your drill and a #2 phillips bit to assemble the cross members to the longerons with four 3 inch drywall screws securing each member. When assembling this frame, check to make sure the top surface of the cross members and the top surface of the longerons are even with each other.

Step B Mount The Top Table Surface To The Frame

Place the 4 x 8 x 3/4 particle board on the frame and adjust the frame until the edges of the frame are even with the edges of the particle board. Attach the particle board to the frame with the 2 inch drywall screws every eight inches. Now place the 4 x 4 x 3/4 inch piece of particle board in place on the frame and screw it in place with drywall screws.

Step C Level The Table Surface

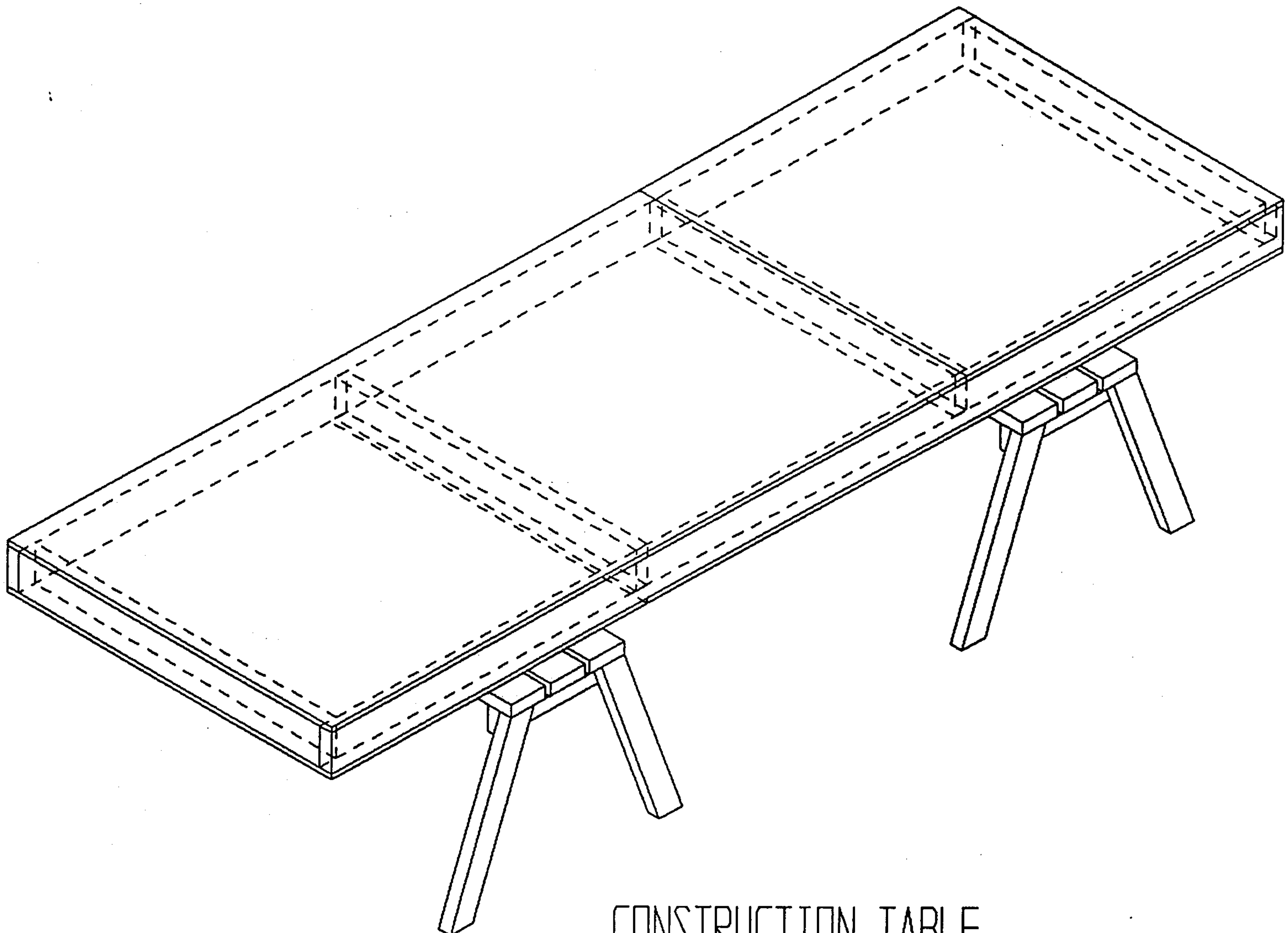
Since the jigs and cradles used to build your flying surfaces will be aligned independently of the work surface they are mounted to, is not essential that your construction table be perfectly straight or level. Despite this fact, it is preferable to keep your table surface relatively flat since this surface will often be used as a reference when constructing smaller parts and assemblies.

Turn the entire table frame and top surface over. Now align the assembly so that it is roughly straight and untwisted. Place a level across the longerons of the table frame at one end and check for level. If the table is not level, place shims between the floor and the table until it is. Continue to move the level down the length of the longerons using shims as necessary to get the assembly level.

Step D Mount The Bottom Surface To The Table

Without disturbing the alignment of the table, mount the remaining particle board sheets to the table's frame just as you did earlier for the top surface. This will form a rigid box structure which will retain its alignment even after being bumped or moved.

Step E Mount The Table At A Comfortable Height



CONSTRUCTION TABLE

DRAWING NO. G001A	TASK NO.	STEP NO.	AkroTech	
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Place the table on two sturdy sawhorses so it is at a comfortable working height. If you want a more permanent structure, mount four legs (using 2 x 6 lumber) to the table. Locate these legs about two feet in from the ends of the table.

Step F Check The Stability Of The Construction Table

Although your work surface does not need to be perfectly straight or level, it is essential that it is stable. To check for stability, place a level across the width of the table at one end and try rocking the table back and forth with your hand. Repeat this procedure with the level placed along the length of the table. The table's alignment should not be easily upset.

CRITICAL: Check the accuracy of your level. This is very simple. Place blocks or shims under each end of the level until it reads **dead level**. Now, keeping the same surface of the level facing down, lift it off the blocks and spin it end for end 180 degrees and put the same surface of the level back down on the blocks. Be sure you are looking at the same bubble in the same glass tube. Does it still read **dead level**? If so that one bubble tube **and only that one** is accurate. Use a felt tipped marker and put a "check" mark on the level next to that one bubble tube. If not, use your felt tipped marker and put an "X" over that particular bubble tube so that you will know not to use it. Do the same thing for every other bubble tube on the level, and be sure not to use those that you have X'ed out. If, in the course of building you G-200, you drop or bang the level, take a few minutes and check all the tubes again to be sure it has not been knocked out of alignment. In the end, your airplane will only be as accurate as your level.

Wing Construction Tasks

TASK W-1 Install Inspection Plates In The Aileron & Wing

Brief Task Description:

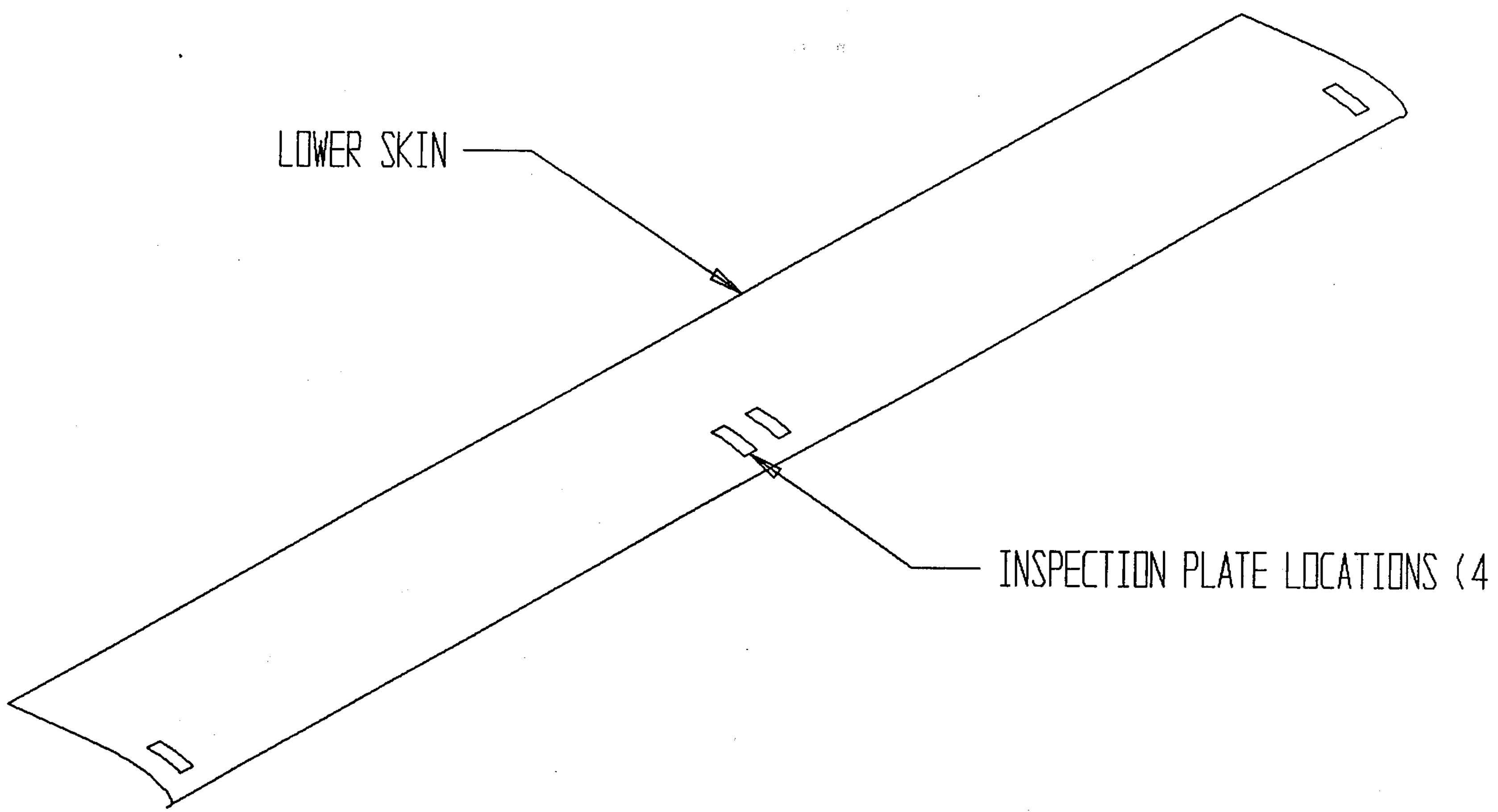
In order to inspect and maintain the aircraft in the course of normal usage, it will be necessary to provide inspection plates to access the aileron belcrank, the pitot system, and the aileron hinge components that would otherwise be inaccessible within a closed wing or aileron. First you will cut out the holes in the premolded inspection plate flanges in the wing and aileron skin. Then you will make the inspection plates themselves by laying up fiberglass near the inspection plate flange. Lastly, you will install the necessary nutplates in the inspection plate flanges.

Step A Cut Holes In The Inspection Plate Flanges

In this step you will cut holes in the premolded recesses in the wing and aileron. These holes will be cut somewhat smaller than the recesses themselves, leaving a recessed flange to accept the inspection plate. To do this, cut two strips of posterboard, one 1/2 inch wide and the other 1/4 inch wide. Place these strips up against the inside edges of the recesses and use a felt tip marker or scribe to mark off the edges of the holes. Give the corners of the holes a generous radius. Cut out the holes using a jigsaw with a narrow, fine-toothed metal-cutting blade and smooth the edges of the holes with sandpaper .

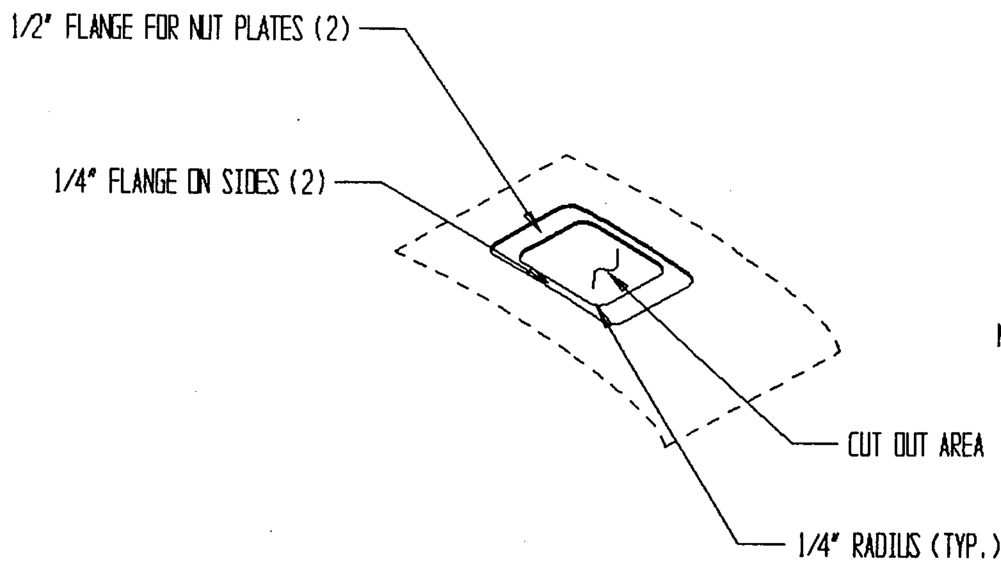
Step B Make the Inspection Plates

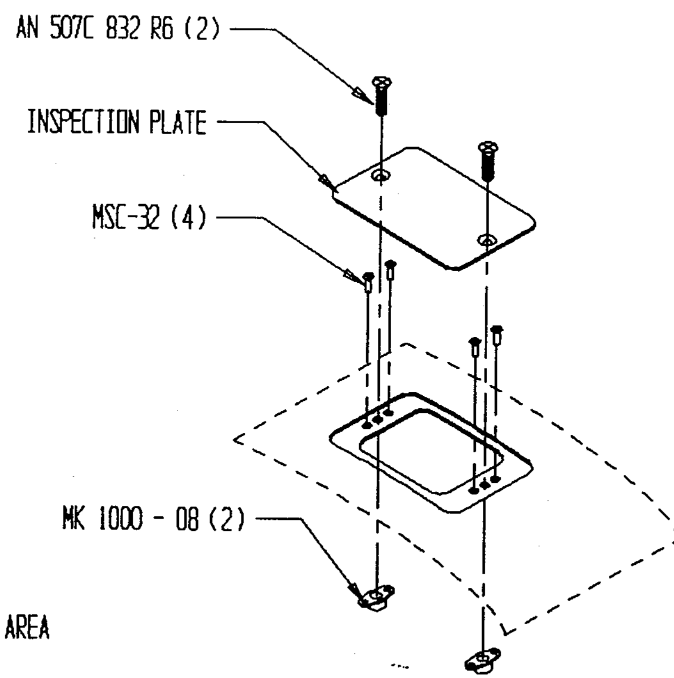
In this step you will make the inspection plates that fit into the premolded recesses in the wing and aileron. To begin, place clear tape on the aileron and the wing beside each premolded recess. Try to choose an area that closely matches the contour of the inspection plate recess. The clear tape should be about an inch larger all around than the size of the inspection plate. Prepare some epoxy laminating resin (refer to the section entitled "Wet Lay-ups" in this manual) and lay up five plies of fiberglass a little larger than each respective inspection plate recess on the clear taped areas. Note: fiber orientation is not critical for the inspection plates but you may find it easier to have the fibers running at 45 degrees to the edge. Let these lay-ups cure completely, then mark each one with its position and remove them from the wing and aileron skins.



AILERON INSPECTION PLATE LOCATIONS

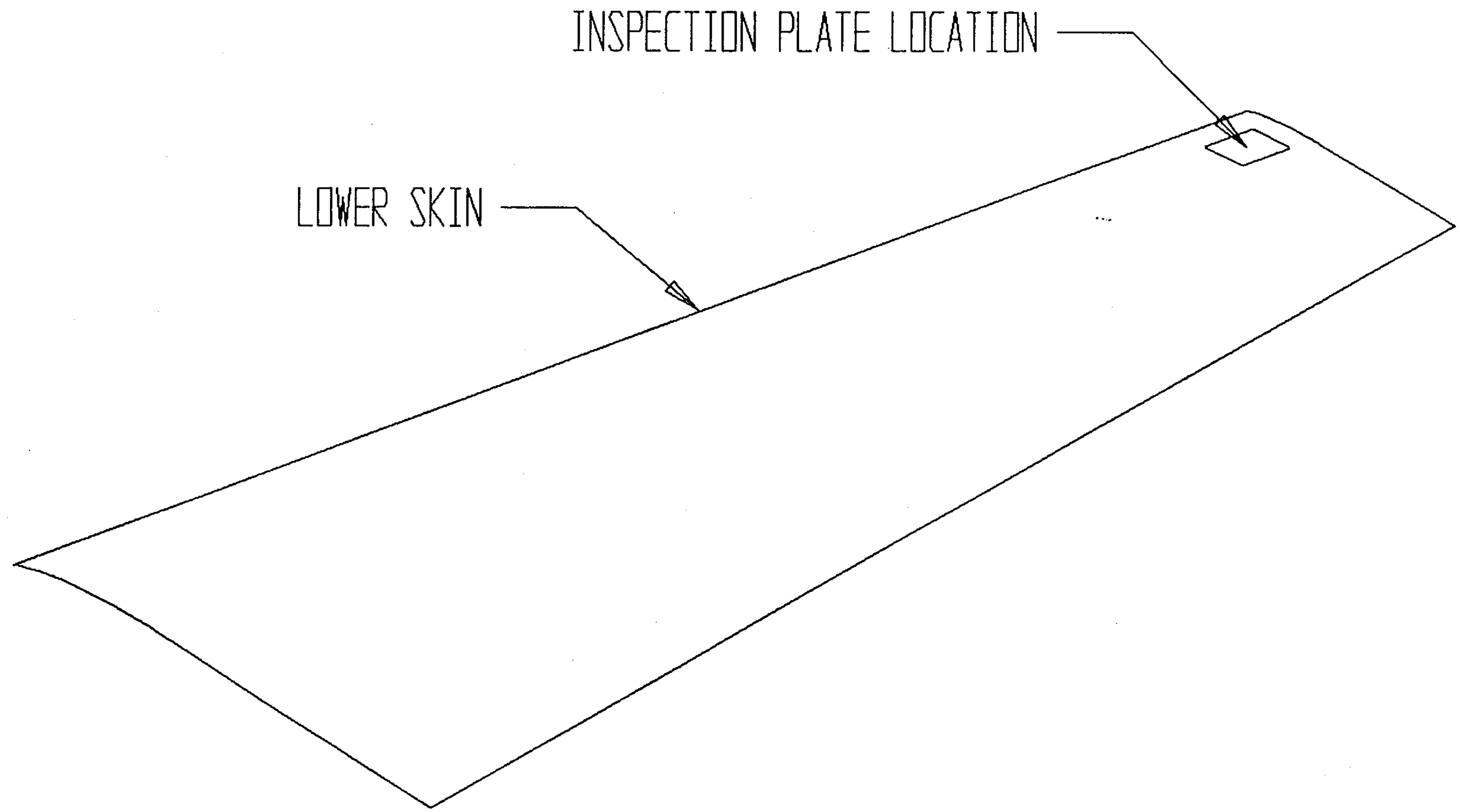
DRAWING NO. 2001A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING	REVISION	PAGE





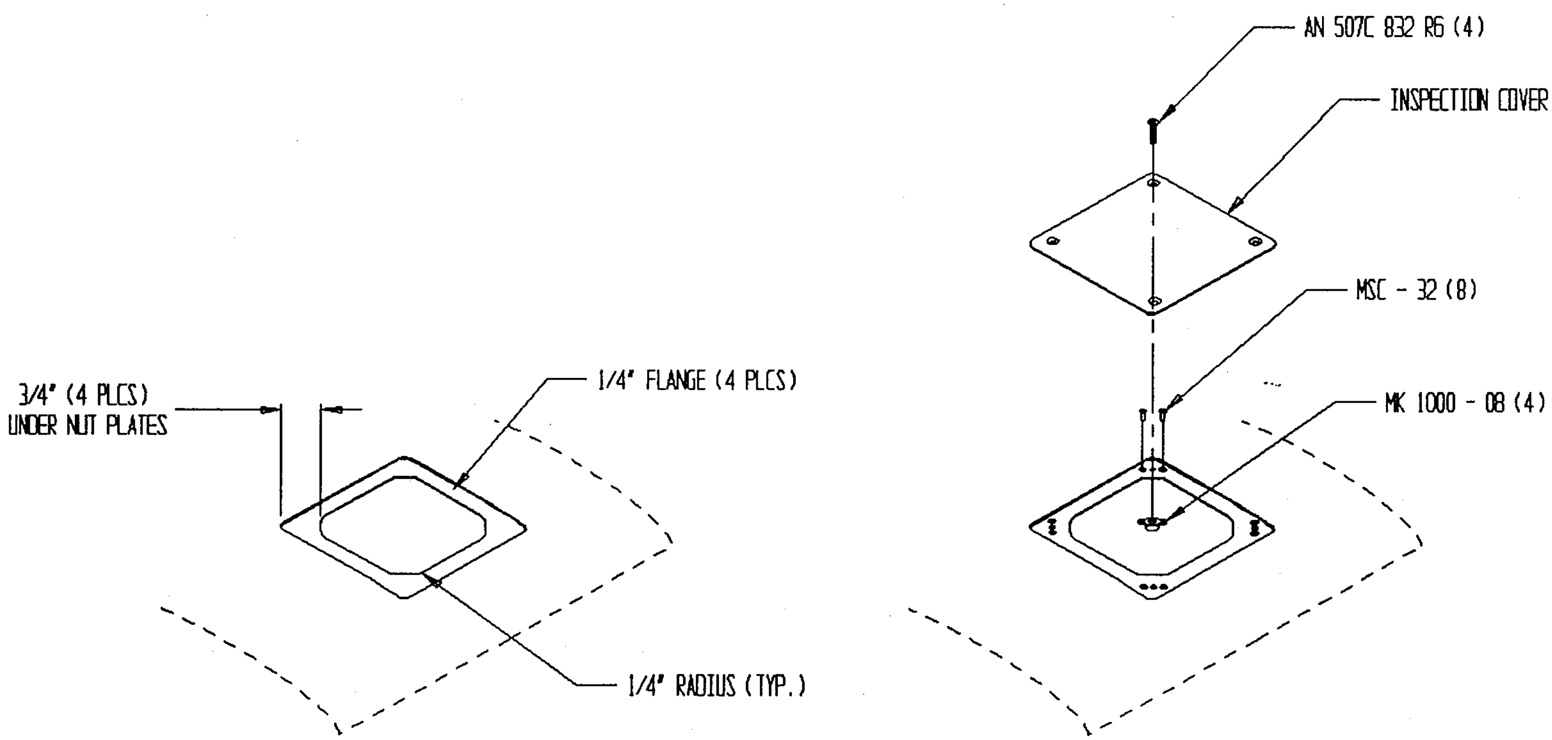
AILERON INSPECTION PLATE DETAIL

DRAWING NO. 2002A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING		REVISION / PAGE



WING INSPECTION PLATE LOCATION

DRAWING NO. 20011A		TASK NO.	STEP NO.	AkroTech	
MODEL G - 200		SECTION WING		REVISION	PAGE



WING INSPECTION PLATE DETAIL

DRAWING NO. 20012A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING		REVISION / PAGE

Cut out each inspection plate using the appropriate inspection plate recess as a guide. Cut out the inspection plates a little oversize then use a belt sander or sanding block get them to fit into the recesses.

Step C Locate And Drill Holes For The Inspection Plate Screws

Mark the screw hole locations on each inspection plate. Use a center punch to place a small dimple at the center of each hole. Tape each inspection plate into its appropriate recess in either the wing or aileron being careful not to cover the dimples just made in the inspection plates with the tape. Now drill the no. 19 inch holes through the inspection plates and the inspection plate flanges (recesses) in the wing and ailerons. Remove the inspection plates from the wing and aileron.

Step D Install Nutplates In The Inspection Plate Flanges

Refer to the section entitled "Installing Nutplates" in the general information section of this manual to install the 8-32 nutplates in the inspection plate flanges. Note that in this application, floating nutplates are not needed.

Step F Countersink The Holes In The Inspection Plates

Use a 100 degree countersink to countersink the holes in the inspection plates so the 8-32 screws will sit flush.

TASK W-2 Install Backing Plates In The Ailerons

Brief Task Description:

In this task you will make and install the backing plates for both the left and right aileron. These backing plates will receive the bolts that secure the spade brackets to the ailerons. You may wish to review the section entitled "Backing Plates" in the General Information Section of this manual at this time.

Note that you will need to cut slots in the aileron skins to clear the wing mounted aileron hinges first. This must be done prior to drilling the aileron spars for the spade bracket mounting bolts since the skin would otherwise obstruct the drill bit.

Step A Cut Slots For The Aileron Hinges In The Aileron Skins

Remove the peel ply from the bottom aileron skin, if you have not done so already. Cut the three slots for the aileron hinges in the top and bottom aileron skins. Use the rib positions as a reference for centering the slots in the top skin. Be extra careful not to cut into the ribs when cutting the top skin. Each slot should be .5 inches wide and about 3 inches deep (the depth of the slots will be increased later once the ailerons are rigged to the fuselage). Now carefully position the bottom skin over the top skin and mark the positions of the slots on the bottom skin. Proceed to cut the slots in the bottom skin. You may wish to cut the slots slightly undersize at first and, after bonding the bottom skin in place, file the slots out to their full width. Finish the corners of the slots with a generous radius. You can accomplish this by cutting each slot short, then finishing each slot with a round file or Dremel tool.

Step B Cut Out The Backing Plates

Use a fine tip felt pen to trace an outline of the base of the spade bracket on the supplied .080 aluminum backing plate material. Cut out the backing plates from the aluminum sheet using a jigsaw or a bandsaw. Smooth the edges of the backing plates using a file or belt sander.

Step C Drill Holes In The Backing Plates

Clamp the aluminum backing plates to the spade brackets. Using a 3/16 inch drill bit, drill out the backing plates using the spade bracket as a drill guide. This will assure alignment of the holes.

Step D Install Nutplates In The Backing Plates

Refer to the General Information Section of this manual to install the two 10-32 floating nutplates in each backing plate. Be sure to orient the nutplates diagonally as shown on the template.

Step E Bed The Spade Brackets With Structural Adhesive

It is imperative that the hinge bolt holes in the spade bracket and the hinge bolt holes in the ribs match up perfectly. The following procedure will assure that these holes will remain in perfect alignment after the spade bracket is affixed to the aileron spar via the two 3/16 inch mounting bolts.

Trial fit the spade brackets on each aileron using the 1/4 inch hinge bolt. There should be a little clearance (about .010 inch) between the spade bracket and the aileron spar. This space will need to be filled with structural adhesive. Remove the spade brackets from the ailerons and place some clear tape over the side of each spade bracket which faces the aileron spar. Prepare the web of both aileron spars for bonding by sanding with 80 grit sandpaper and cleaning with acetone. Now mix a small batch of structural adhesive and add enough structural filler to achieve "mayonnaise" consistency. Apply the adhesive to the forward face of each aileron spar then reinstall the spade bracket with the 1/4 inch hinge bolt. Remove any excess adhesive using a clean cloth then adjust each spade bracket until it is parallel to the spar web. Hold the spade bracket in this position using a C-clamp.

Step F Drill Holes In The Aileron Spars

Once the structural adhesive has cured, use a long 3/16 inch drill bit to drill through the aileron spars using the holes in the spade brackets as a drill guide. Try to keep the drill perpendicular to the spar web while drilling. If these holes are not drilled perpendicular to the web, they may not match up with the holes in the backing plates. Now trial fit the backing plates using the 3/16 inch bolts. After you are satisfied the backing plates fit as they should, remove them from the aileron spars (leave the spade brackets in place for now).

Step G Bond The Backing To The Spars

Prepare the aft surface of the spars and the backing plates for bonding. Mix a small batch of structural adhesive and add enough filler to achieve "mayo" consistency. Coat each backing plate and spar web with the adhesive. Wax the 3/16 inch mounting bolts and re-install them through the spade bracket and into the backing plates. Tighten the bolts down and remove any excess adhesive. Allow to cure completely before proceeding.

Step H Install The Stainless Steel Retaining Screw

Remove the spade brackets from the aileron spars. Drill a no.19 inch hole through the aileron spars directly between the two 3/16 inch mounting holes for the spade bracket. Countersink this hole on the forward side of the spar using a 100 degree countersink. Insert the 8-32 stainless steel retaining screw through the spar and backing plate. Install and tighten the nut on the retaining screw.

TASK W-3 Build The Aileron Construction Jig

Brief Task Description:

Until this point, you have been working on the ailerons without placing them in a jig. You may have noticed that they are not completely rigid. That is, the ailerons can be flexed to a certain degree. Rest assured that the ailerons will be several orders of magnitude stiffer once the they have been closed by bonding the lower skins into place. In order for the ailerons to be absolutely free of twist once closed, they must be secured into a true, twist-free jig as its lower skin is bonded into place. In this task you will make that jig.

The same jig is used for both the left and right aileron. The left aileron will be built first and then the position of the root and tip formers will be switched on the jig to build the right aileron.

> NOTE:
> The 1 inch square steel tubing used to support the trailing edge and spar in the aileron jig can usually be found at a local steel supplier. If you have trouble locating this tubing, please call us at AkroTech for assistance.

Step A Cut Out The Aileron Jig Formers

Remove the aileron jig former templates from this manual and use spray adhesive to mount them to 1/2 inch particle board or plywood. Cut out the aileron jig formers using a jigsaw. Stay just to the outside of the line when cutting, then use a belt sander or sanding block to bring the surface down to the line.

Step B Mark The Former Locations On The Construction Table

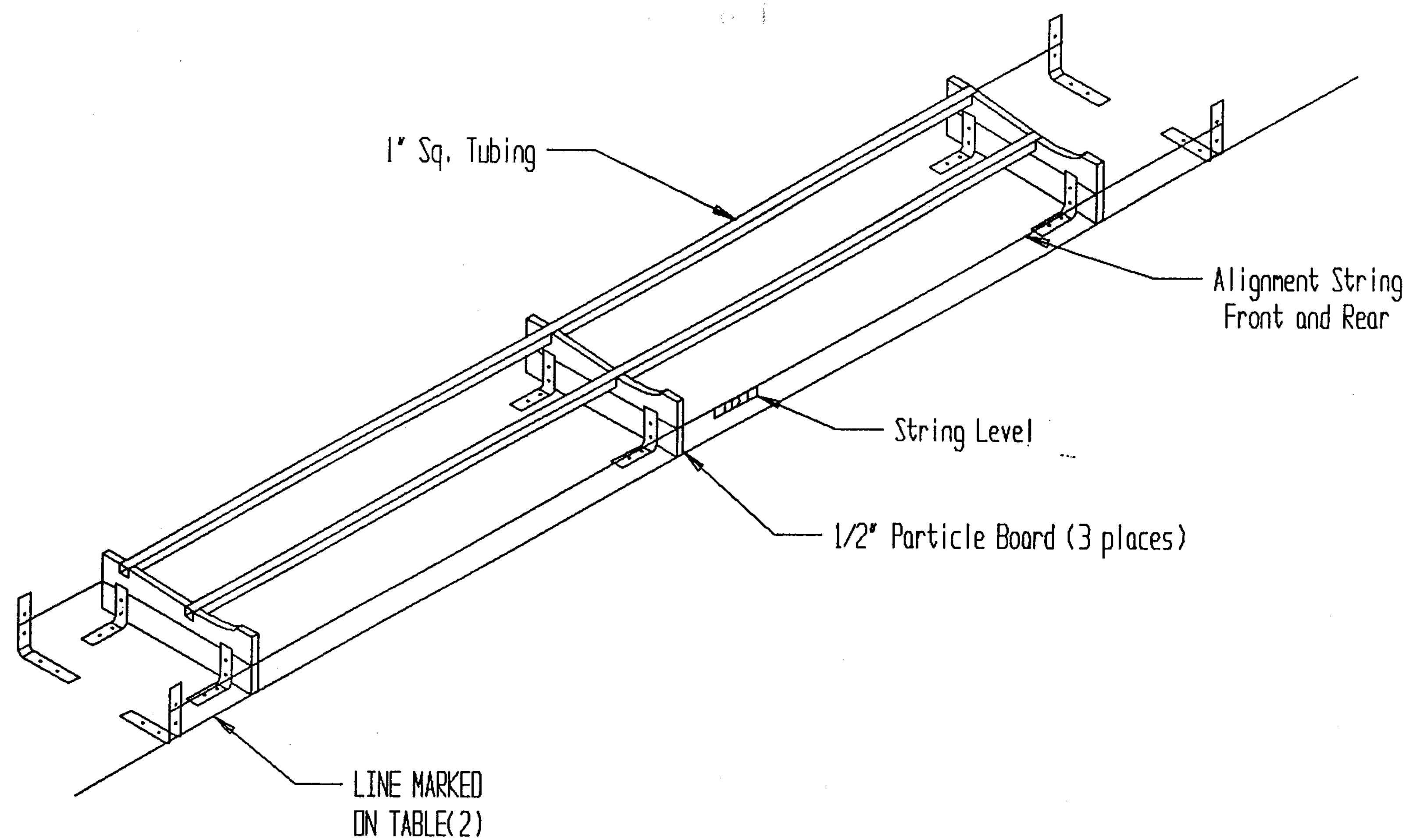
Using a carpenter's chalk line, snap a line parallel to and about 6" in from the edge of your work table. The line should run the entire length of your work table. Draw a line perpendicular to the line just drawn at a location about 6 inches in from the left end of the table using a framing square. This line will reference the position of the root rib former for the left aileron jig. Draw two more lines perpendicular to the chalk line 51 inches and 102 inches from the root rib mark. These lines locate the center and tip rib formers respectively.

Step C Mount The Angle Brackets To The Table

Now it is time to position the steel angle brackets that will support the aileron formers.. Clamp four, 4 inch steel angle brackets to either side of each former (do not screw them to the formers yet). The brackets should be positioned as indicated on the former templates. Place the formers in position on the table (with the angle brackets clamped to them) so that the left edge of each former is aligned with its appropriate mark on the table and so that the trailing edge of each former is aligned with the chalk line near the edge of the table. Screw the angle brackets to the work surface (but not into the formers yet) so that they will support each former in the proper position on the table. After screwing the angle brackets to the table surface, remove the clamps. Each former should now be snug between its brackets, but still able to slide so that it can be adjusted later.

Step D Cut And Fit The Spar And Trailing Edge Support Tubes

Now you will need to cut the two, 1 inch square tubes for supporting the spar and the trailing edge of the aileron while the top skin is bonded in place. These support tubes fit into the notches cut into the formers. Note that the notches are a little deeper than they need to be. This will allow the tubes to be shimmed up to align accurately with the surface of the formers. Cut each tube just long enough to span the length of the jig. Trial fit the support tubes in the formers then remove both the tubes and the formers and set them aside.



AILERON JIG

DRAWING NO. 2005A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING	REVISION	PAGE

TASK W-4 Align The Aileron Construction Jig

Brief Task Description:

Having made the components for the aileron jig, and having roughly laid out their location on your work table, in this task you will assemble and precisely align the aileron construction jig. Accuracy is essential here. Your aileron will only be as good as the jig in which you build it.

The first step is to build a simple alignment tool that will allow you to exactly position the formers. It will consist of two pairs of sturdy steel angle brackets with two lengths of monofilament line stretched tight between them. These brackets will be positioned just ahead and just behind the front and rear edges of the formers. That way, the formers can be dropped carefully into place between the monofilament lines (with about 1/16 inch to spare at either end). The ultimate goal is to adjust the alignment tool so that the two monofilament lines are dead level and parallel to each other. Those two lines will then be used as references to which the aileron formers themselves will be aligned.

Step A Mount The Alignment Tool To The Table

This step involves positioning and mounting four 6" heavy duty steel angle brackets on your construction table and stretching some monofilament line between these brackets to act as a reference for aligning the aileron formers.

Locate one pair of angle brackets exactly on the chalk line snapped on the construction table earlier. Locate another pair of angle brackets parallel to, and 16 1/8 inches from, the first pair of brackets. Make sure the faces of each pair of opposing brackets are exactly 16 1/8 inches apart. These brackets need to positioned carefully, so take your time. Once you have them properly located, screw them down to your work surface.

Stretch monofilament line between the 6 inch angle brackets so that you have two parallel lines running the length of the aileron work area. These lines need to be adjustable vertically (so that you can fine tune their position on the angle brackets) and they must be very tight. You can mount the line by forming a loop in one end, placing that loop over one bracket, then forming a loop at the opposite end so that the line is about 1/2 inch too short when unstretched. You can then stretch the line over the supports and it will be tight. Regardless of the method used to mount the monofilament line, make sure it is tight and does not sag in the middle. Remember: this is the line you will use to align your aileron - if it sags, so will your aileron

Step B Level The Monofilament Line

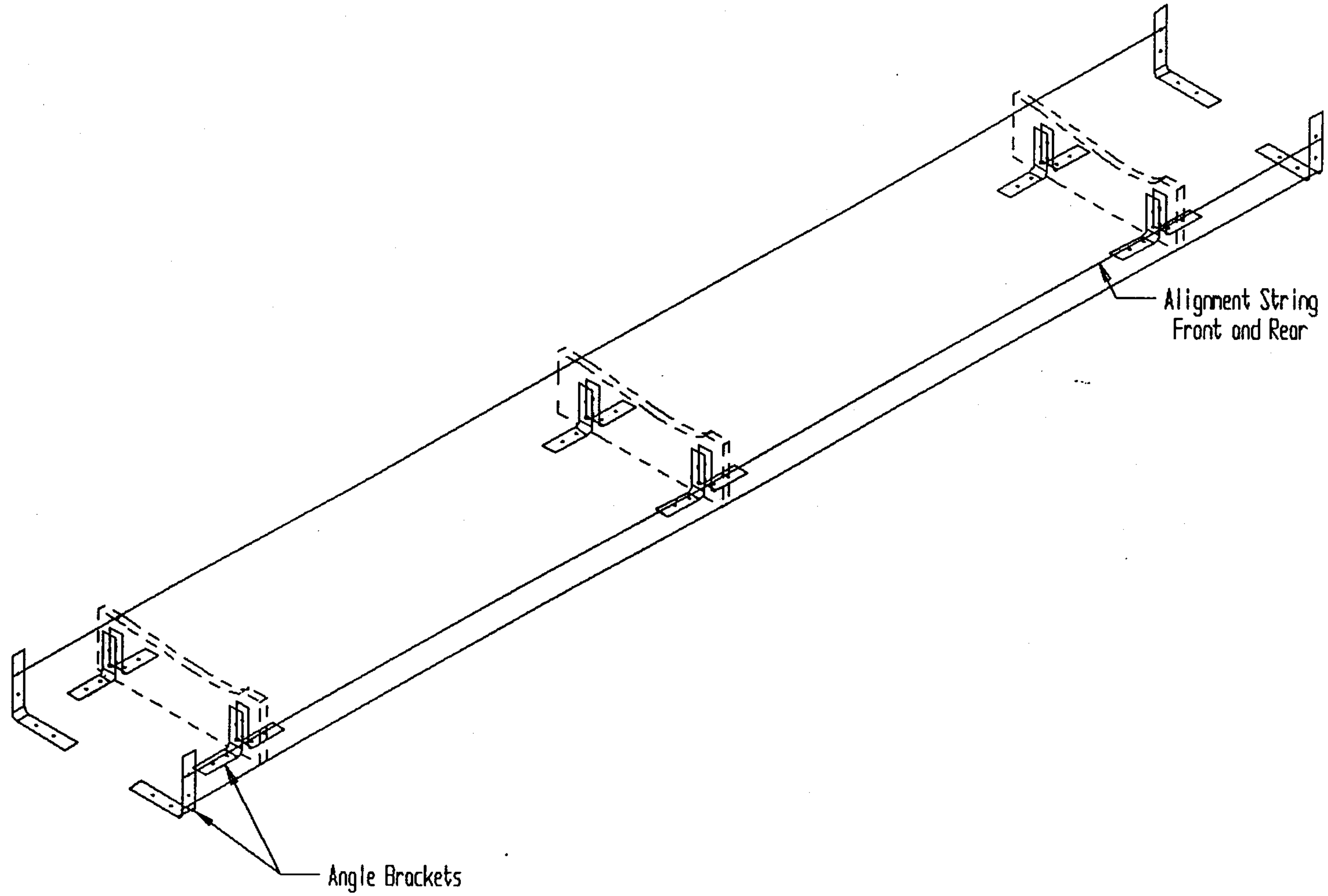
In this step you will adjust the monofilament lines so that they are exactly level. Adjust the lines to their starting position three inches above the table surface. Now place a string level (available at most hardware stores) on the center of one line and adjust the line by sliding it up and down the angle brackets until the string level reads level.. Repeat this procedure for the other line. It is perfectly acceptable to raise the monofilament reference lines a little above the arbitrary 3 inch starting height if necessary. It is only critical that the alignment requirements be met. It does not matter if that occurs at 3 1/8" above the surface of the work table, or at some other height. If you find that you have to move the string a lot to get it level then your table is probably not very level. You may wish to level your table before proceeding.

Remove the string level and double check the alignment of the monofilament lines using an accurate 6' level or a water level. Now is the time to be accurate. The level monofilament lines are the fixed reference points from which the entire aileron will be assembled. Once you are certain the monofilament lines are level, use some tape to secure the lines to the angle brackets so they cannot slide out of place.

Step C Place The Aileron Formers Into Position

Carefully drop the aileron formers back into place. Do not disturb or bump the monofilament reference lines in the process. They should have 1/16" to spare on either end. As you did with the alignment tool, clamp the aileron formers lightly into place between their brackets so that you can move them by small amounts with firm taps from the butt of a screwdriver or small hammer -- but tight enough so that they will not move when you do not want them to.

Step D Align The Aileron Jig Formers



ALIGNING AILERON FORMERS

DRAWING NO. 2003A	TASK NO.	STEP NO.	AkroTech
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There are two alignment conditions that must be met:

1. The reference line printed on each former must be in exactly the same plane as both the monofilament lines.
2. Each former must be centered between the monofilament lines.

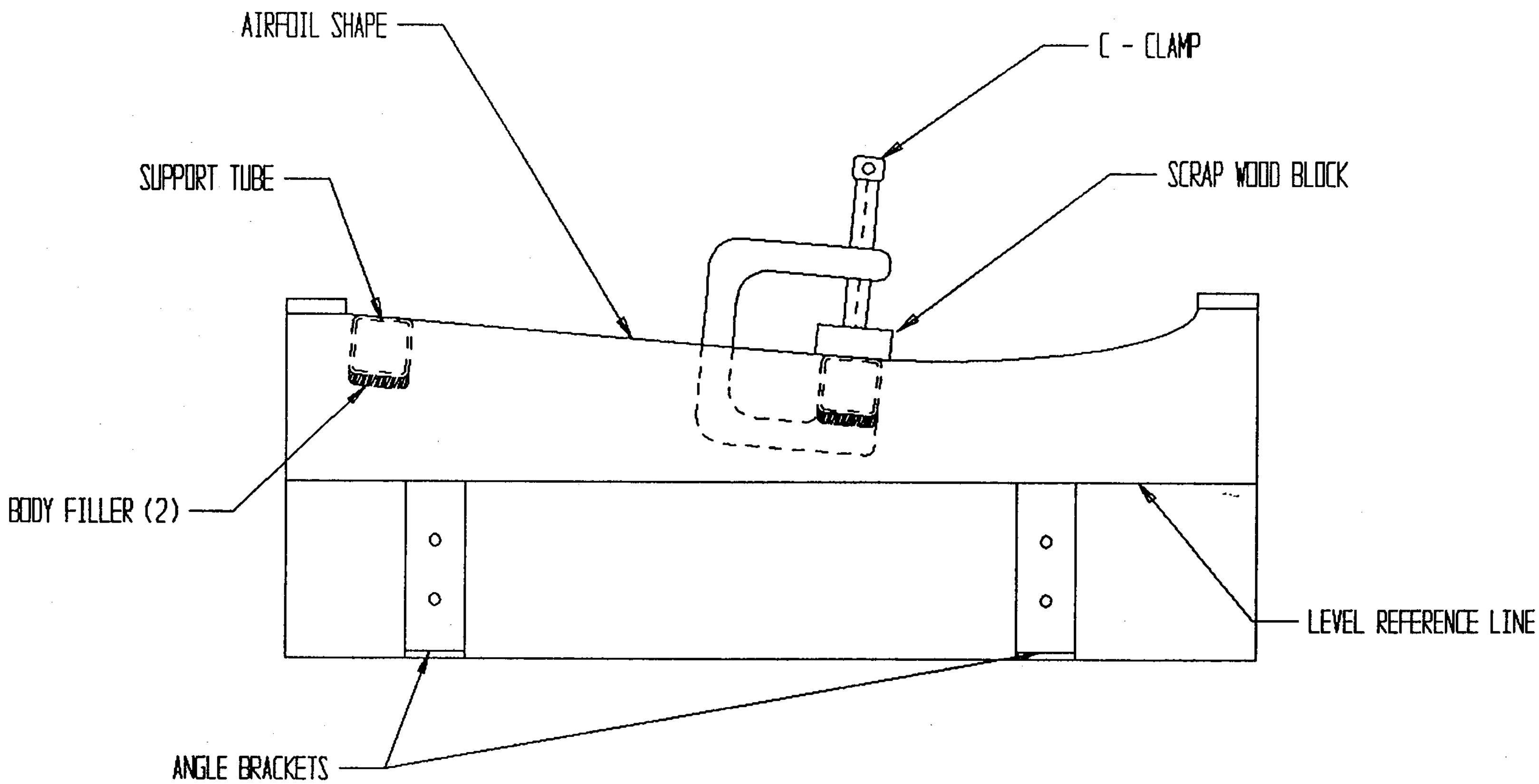
Raise or lower each aileron former to bring the reference lines printed on the former templates exactly level with an imaginary plane defined by the two monofilament lines. You can check this with a level, or by simply sighting down the reference lines and adjusting each former until it is aligned with both monofilament lines. Then check that each former is exactly centered between the monofilament lines (if the 6 inch angle brackets were positioned correctly, there should be 1/16 inch between the former and the monofilament line on each side). Alternate between these two adjustments. Once you have the formers precisely positioned, clamp each former in place between the brackets screwed to the work table.

Step E Mount The Formers To The Brackets

Once you are sure the formers are correctly positioned, carefully fasten all aileron formers into their support brackets. Take care not to knock the formers out of alignment as you secure them. Use appropriately sized screws and drill pilot holes.

Step F Mount The Trailing Edge and Spar Support Tubes To The Formers

Place some clear tape over the support tubes where they fit into the notches in the formers. This clear tape will prevent the body filler from adhering to the tubes so that you can remove them later to make the right aileron jig. Cut out six pieces of particle board about 1 1/4 inches wide by 3 inches long from some scrap. Clamp these blocks to the two support tubes where they intersect the formers. These blocks should just barely extend over the sides of the tubes. Now prepare a small batch of body filler and put a blob in each notch where the tubes are to rest. Push the tubes into the notches (with the wood blocks clamped to them) and squeeze out the excess body filler. The tube should now rest on the wood blocks which span the notches in the formers. This will perfectly align the top surface of the support tubes with the top surface of the formers. When the body filler has cured, remove the wood blocks from the tubes.



MOUNTING SUPPORT TUBES IN FORMERS

DRAWING NO. 2004A	TASK NO.	STEP NO.	AkroTech
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Check the formers and support tubes to be sure that nothing protrudes above its surface. A protrusion may prevent the aileron from properly seating in the jig and might also scratch the carbon fiber skin. Place a layer of clear 3M tape on all the surfaces of the aileron jig that will come in contact with the aileron skin. This will prevent the adhesive that seeps from carbon fiber from permanently bonding the aileron into the jig.

Step G Recheck The Alignment Of The Jig

Meticulously recheck the alignment of the entire jig. Be certain that the completed jig is true. It is possible that an unnoticed error crept in. If you find an error, no matter how small, correct it now. It will be easier to correct an error now rather than in the flight test phase.

TASK W-5 Build Up The Bond Area On The Ribs And Spars

Brief Task Description:

In this task you prepare the aileron for closing by building up the bond areas on the wing ribs and spars. This insures that there will be no low spots on the spars or ribs when it comes time to bond the lower aileron skin in place. The goal is to add a layer of structural adhesive to any low areas on the aileron ribs and spars that will allow the final bond layer of structural adhesive to be thin and uniform.

Remember that you are building the aileron upside down. This means that anytime we refer to the upper skin we mean the one with the ribs and spars bonded in (and not the one that is actually on top during assembly). And anytime we refer to the lower skin we mean the one without the ribs and spars.

Step A Place The Left Aileron In The Jig

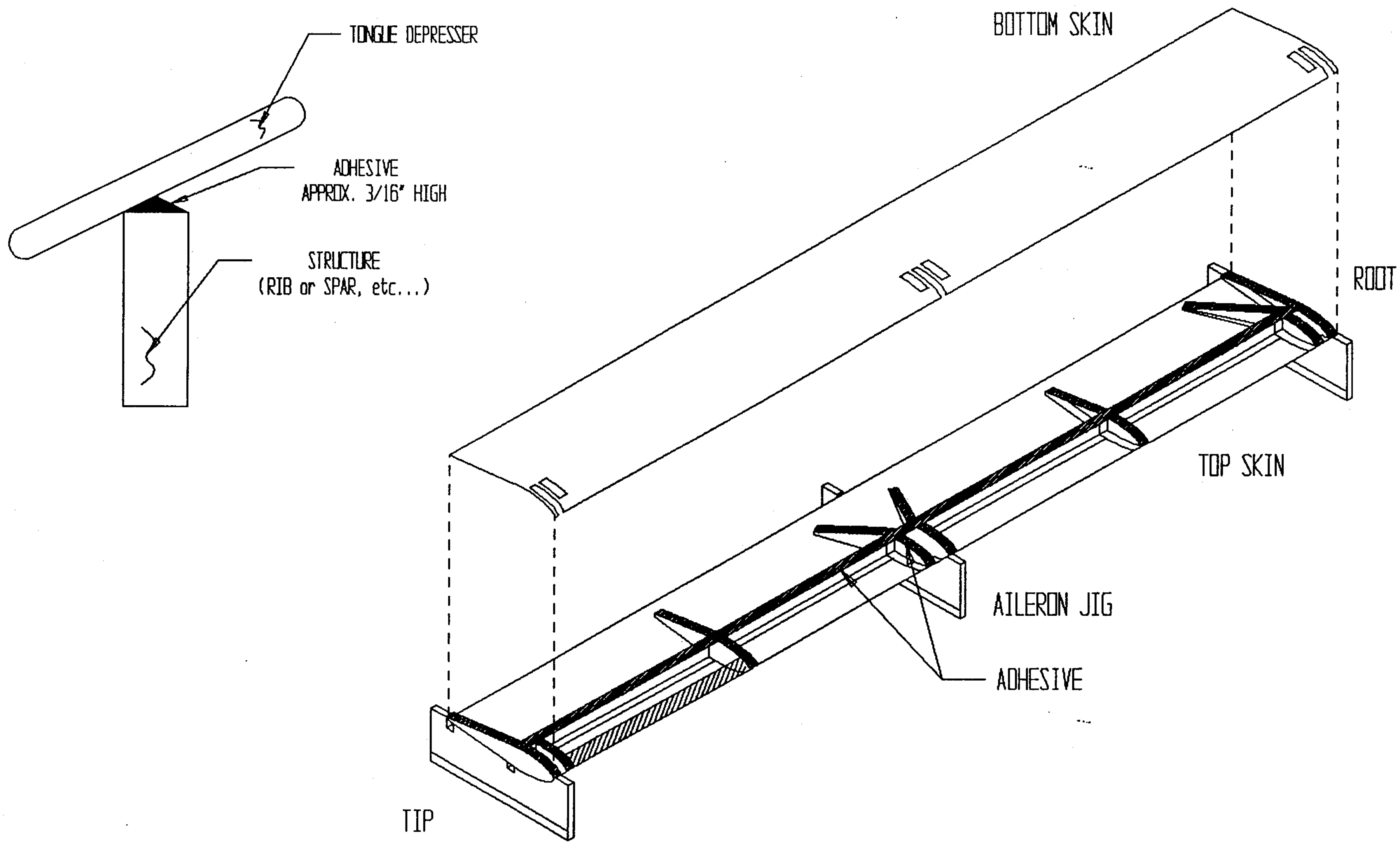
Place the aileron assembly in the jig. Use spring clamps to secure the aileron trailing edge to the steel support tube that you built into the aileron construction jig. Place sand bags in the aileron to be sure that it is fully seated in the aileron jig.

Check that the jig former contours match those of the aileron skins. The aileron construction jig formers should contact the aileron skin along their entire length. If not, double check that the aileron is in proper side-to-side alignment in the jig.

Step B Mark The Bond Areas On The Skin

Lay the lower aileron skin (which is now on top) in its proper place on the aileron assembly. Locate the bond areas on the lower skin. Cover all the bond areas on the inner face of the lower aileron skin with a layer of clear 3M tape.

The reason you are doing this is that you will be applying structural adhesive to the aileron spars and ribs, then placing the lower aileron skin on that adhesive. The idea is to exactly impart the shape of the inner face of the lower aileron skin onto the adhesive that you have applied to the spars and ribs, but without yet permanently bonding the lower



BUILD UP BOND SURFACES ON RIBS AND SPAR

DRAWING NO. 2009A	TASK NO.	STEP NO.	AkroTech
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aileron skin in place. The layer of tape covering the bond zones insures that you will be able to remove the lower skin after the structural adhesive hardens.

This is a good time to dry fit the lower skin to be certain that it mates properly with the spar and ribs. It is also a very good idea for you and an assistant to practice putting the upper aileron skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower aileron skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step C Prepare The Aileron

Carefully place the upper aileron skin into exact position on the spar, ribs and lower skin assembly. Use tape to secure the lower skin to the upper skin at the leading edge. Place 10 lb. sand bags every foot along the spar.

Drill holes for Cleco fasteners every 4" along the center of the leading edge joggle and through the skin along the root and tip rib flanges. These Clecos will hold the skin in position while you are building up the bond area and while finally bonding the skin in place.

Now remove the lower skin from the assembly. Prepare the bond zones of the aileron spars and ribs for bonding. (See the General Information section of the manual.) Be sure that all are properly scuffed and cleaned with acetone immediately prior to the bonding operation.

Step D Mix And Apply Adhesive

Prepare a batch of structural adhesive and thicken it to "mayonnaise" by mixing in a volume of structural filler that is approximately equivalent to the volume of adhesive (See the section entitled "Mixing and Thickening Adhesives" in this manual).. Put a generous but not excessive layer of this mixture on the ribs and spars This layer should evenly cover the entire bond area of the ribs and spars.

Remember that you are trying to accomplish two things. First, you must force the skin firmly and completely onto all the bond areas. Second, you must press a perfect

impression of the inner surface of the upper skin into the fairly thick mixture of structural adhesive that is on the ribs and spars.
The goal is to build up the thinnest possible layer of structural adhesive that will still provide a bond area that has no gaps or low spots. Inadequate pressure over the bond areas will allow too thick a layer of structural adhesive to build up, however, you do not want to use so much pressure that you begin to locally deform the upper skin.

Step E Place The Aileron Skin In Position

Carefully and slowly place the upper elevator skin into exact position on the spar, ribs and lower skin assembly. Try to lower the skin directly onto the ribs and spars without smearing the adhesive. Install the Clecos in the holes drilled into the leading edge and the root and tip ribs earlier. Position the 10 lb. sand bags every foot along the spar. Place an aluminum angle over the trailing edge of the aileron and use spring clamps to sandwich the trailing edge between this aluminum angle and the rear spar support tube. Allow the structural adhesive to cure undisturbed overnight.

Step F Remove The Aileron Skin

After adequate cure time, remove the upper skin. This should be a fairly simple process involving little more than some gentle tugging -- unless you have not done an adequate job of masking off the bond areas of the upper skin.

Inspect the hardened structural adhesive on the bond areas of the aileron and spars. Ideally all the taped surface came into full contact with the adhesive. Look closely at the adhesive surface that were supposed to contact the taped and waxed sections of the aileron skin. The areas that contacted properly should appear smooth and glossy. Those areas that did not contact the taped and waxed sections will have a slightly rougher, more irregular surface appearance.

Should you find such rough or irregular areas, it means that there are still some low spots in the bond area. If these low areas fall more than 1/16 inch below the surrounding areas, they will need to be built up until they too are of the proper height. If so you will need to repeat Steps D, E and F of this task again.

TASK W-6 Balance The Left Aileron

Brief task description:

In this task you will be installing the counterbalance weight in the left aileron. This counterbalance weight consists of a mixture of lead shot and structural adhesive which is poured into a sectioned off area in the outboard panel of the aileron. This counterbalance weight is necessary to prevent a rather destructive aerodynamic phenomenon called "flutter". Do not attempt to fly your aircraft without properly balanced control surfaces.

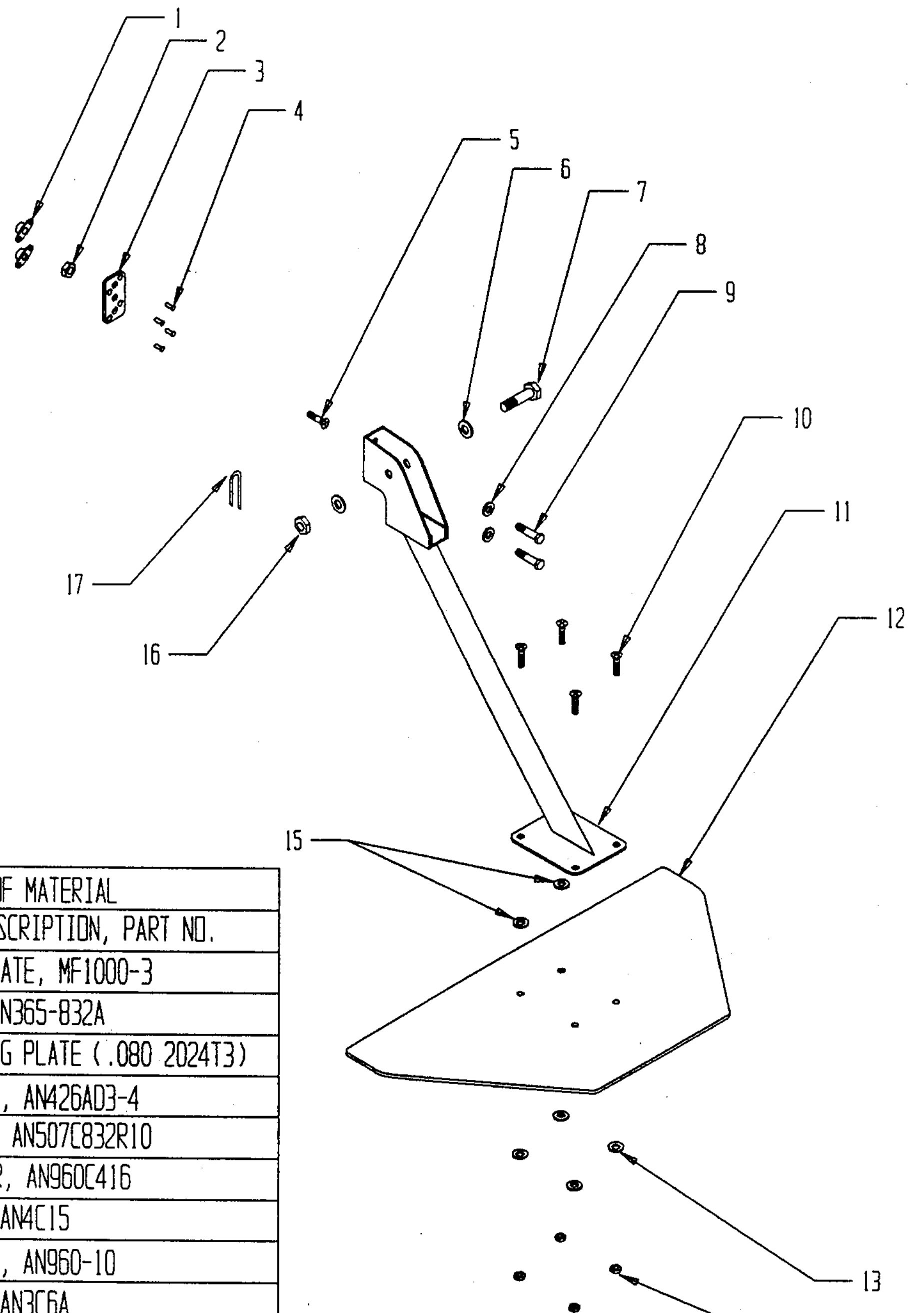
Step A Make The Knife Edge Supports

Cut two 4 inch pieces of 1.5 x 1.5 angle aluminum. Mount them to your construction table so that they are parallel and roughly 1/2 inch further apart than the span of the aileron. Place two long 1/4 inch bolts into the hinge bolt holes in both the root and tip ribs of the aileron. Place the aileron on the two aluminum angle supports mounted to your work table. The bolts protruding from either end of the aileron should now rest on the edges of the aluminum angle supports. The aileron should now be free to pivot on the two "knife edge" supports with very little friction.

Step B Install Cardboard Dam In Aileron

Find a piece of corrugated cardboard about 1 inch wide by 24 inches long. Completely cover this strip with clear tape. Install this strip in the outboard section of the aileron parallel to and 1 inch back from the aileron's leading edge. Use clear tape on the aft side of the strip to hold it in position. Make sure this "dam" is sealed along the entire bottom edge and also where this strip meets the two ribs.

> NOTE:
> On some early kits the supplied spade was too large. If you have an early kit please contact us at AkroTech and we will advise you on how to modify these spades so that they will provide the proper control response. DO NOT ATTEMPT TO FLY YOUR AIRCRAFT UNLESS YOU HAVE THE PROPER SPADES INSTALLED.



BILL OF MATERIAL		
ITEM	QTY	DESCRIPTION, PART NO.
1	2	NUT PLATE, MF1000-3
2	1	NUT, AN365-832A
3	1	BACKING PLATE (.080 2024T3)
4	4	RIVETS, AN426AD3-4
5	1	SCREW, AN507C832R10
6	2	WASHER, AN960C416
7	1	BOLT, AN4C15
8	2	WASHER, AN960-10
9	2	BOLT, AN3C6A
10	4	SCREW, AN525-10R8
11	1	SPADE BRACKET, 10-003
12	1	SPADE, 10-015
13	4	WASHER, AN960-10
14	4	NUTS, AN365-1032A
15	AS NEEDED	WASHER, AN960-10L
16	1	NUT, AN310-4
17	1	COTTER PIN, MS24665-132

SPADE ASSEMBLY

DRAWING NO. 2006C	TASK NO.	STEP NO.	AkroTech
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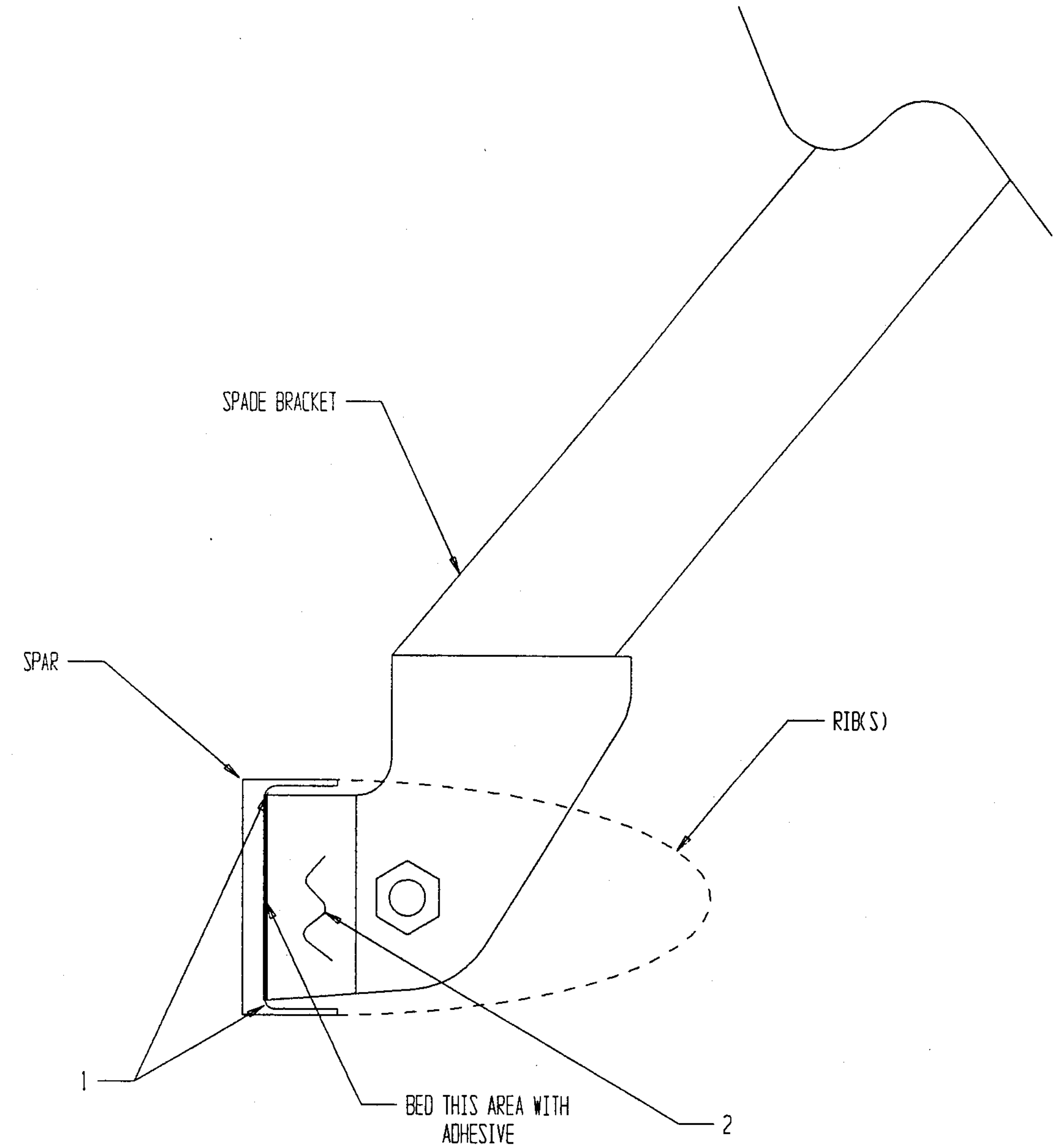


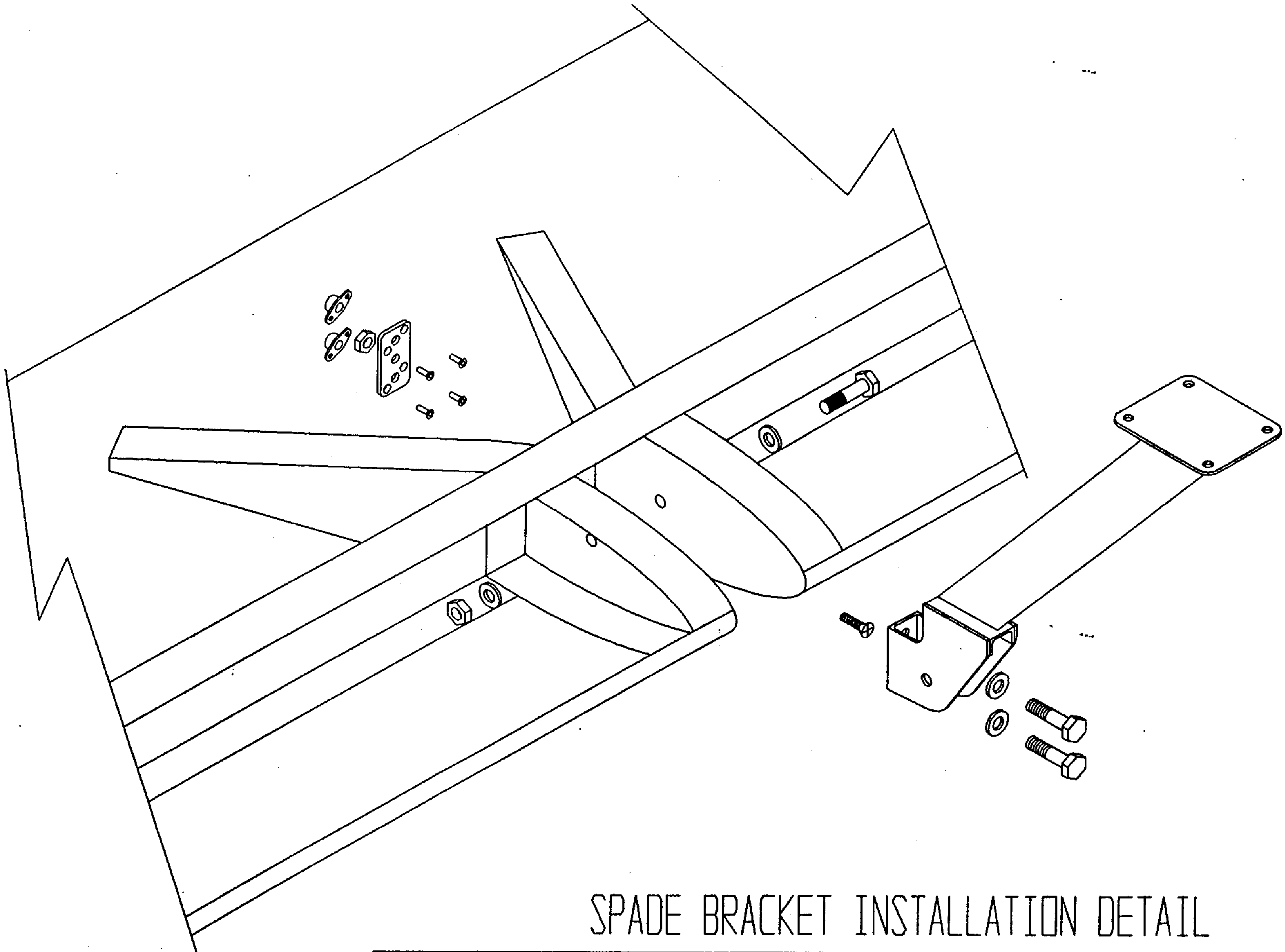
NOTES:

1 - CHECK THIS AREA FOR CLEARANCE BETWEEN THE SPADE BRACKET AND THE SPAR RADII. GRIND SPADE BRACKET FOR CLEARANCE TO REDUCE HIGH STRESS CONCENTRATIONS

2 - CLEAR TAPE SPADE BRACKET MOUNTING FACE AND SIDE WHEN BEDDING THIS AREA

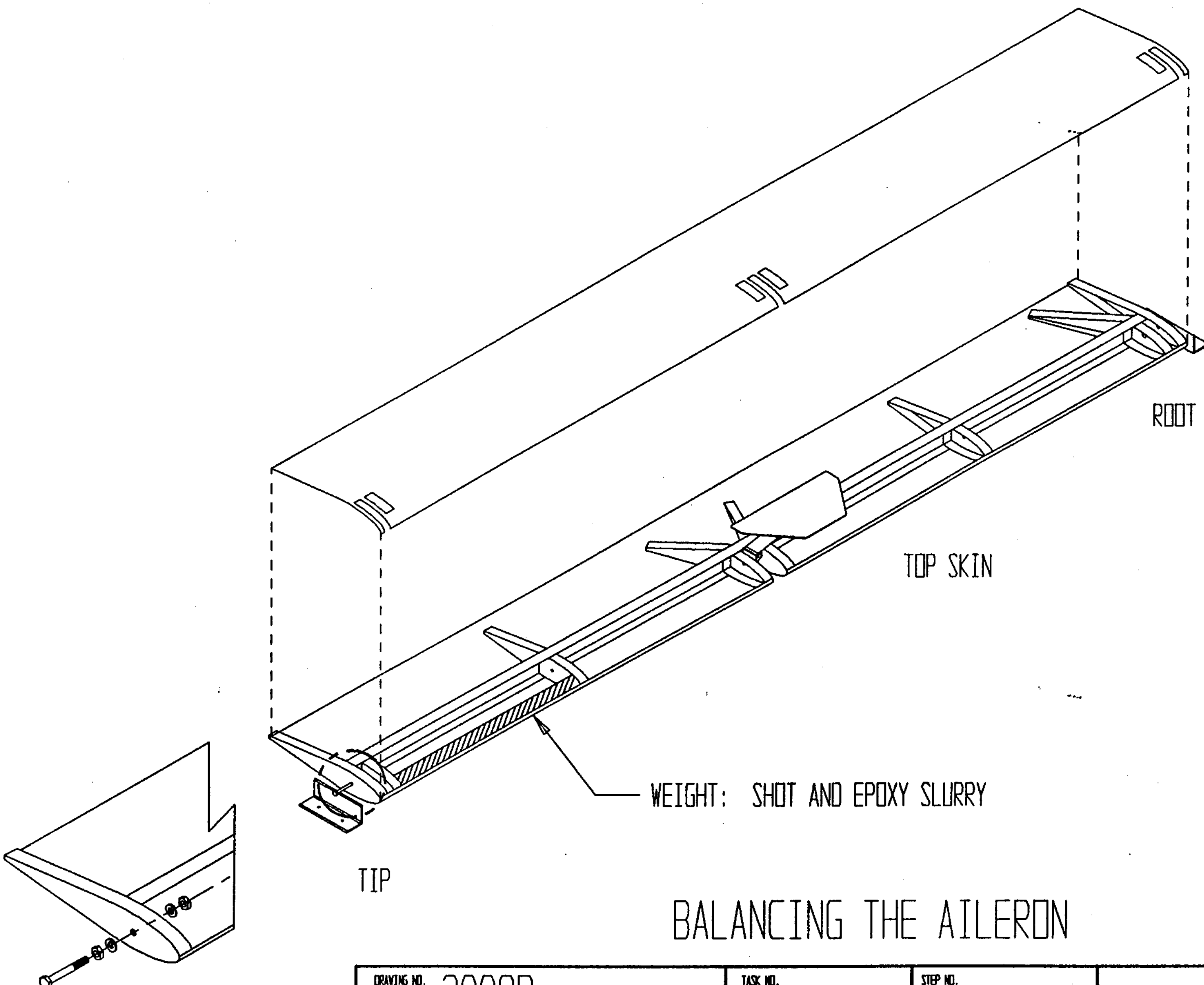
SPADE BRACKET ADHESIVE AREA

DRAWING NO. 20020B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING	REVISION	PAGE



SPADE BRACKET INSTALLATION DETAIL

DRAWING NO. 2007B	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION WING		REVISION	PAGE



BALANCING THE AILERON

DRAWING NO. 2008B	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION WING		REVISION	PAGE

Step C Mount The Spade Arm And Spade To Aileron

Mount the spade to the spade arm using the supplied hardware. Mount this assembly to the aileron using two 3/16 inch bolts.

Step D Balance The Aileron

With the aileron free to pivot on the knife edge supports, pour some lead shot into the sectioned off area of the aileron until the aileron balances. Now place the lower skin on the aileron. Lift up the leading edge and continue to add lead shot to the aileron until it balances with the lower skin in place. Carefully remove the lead shot from the aileron. This is the amount of counterbalance weight needed to balance the aileron.

Step E Prepare The Lead Shot / Adhesive Mixture

Place the aileron back in the aileron jig so that it is level. Prepare a four ounce batch of structural adhesive and mix in the lead shot removed from the aileron in Step D. Carefully pour this mixture into the sectioned off area of your aileron. Note that the adhesive will add a little weight to the aileron, making it nose heavy (overbalanced). Allow the adhesive to cure completely.

TASK W-7 Close The Left Aileron

Brief Task Description:

This task involves closing the aileron by bonding the lower aileron skin into place on the (already partially completed) aileron assembly. The aileron gains an enormous amount of structural strength and rigidity thorough the process of bonding on the lower aileron skin. If not done carefully, the result will be a twisted aileron, and an aircraft with undesirable flying characteristics. Take your time. Do not build in twist or error.

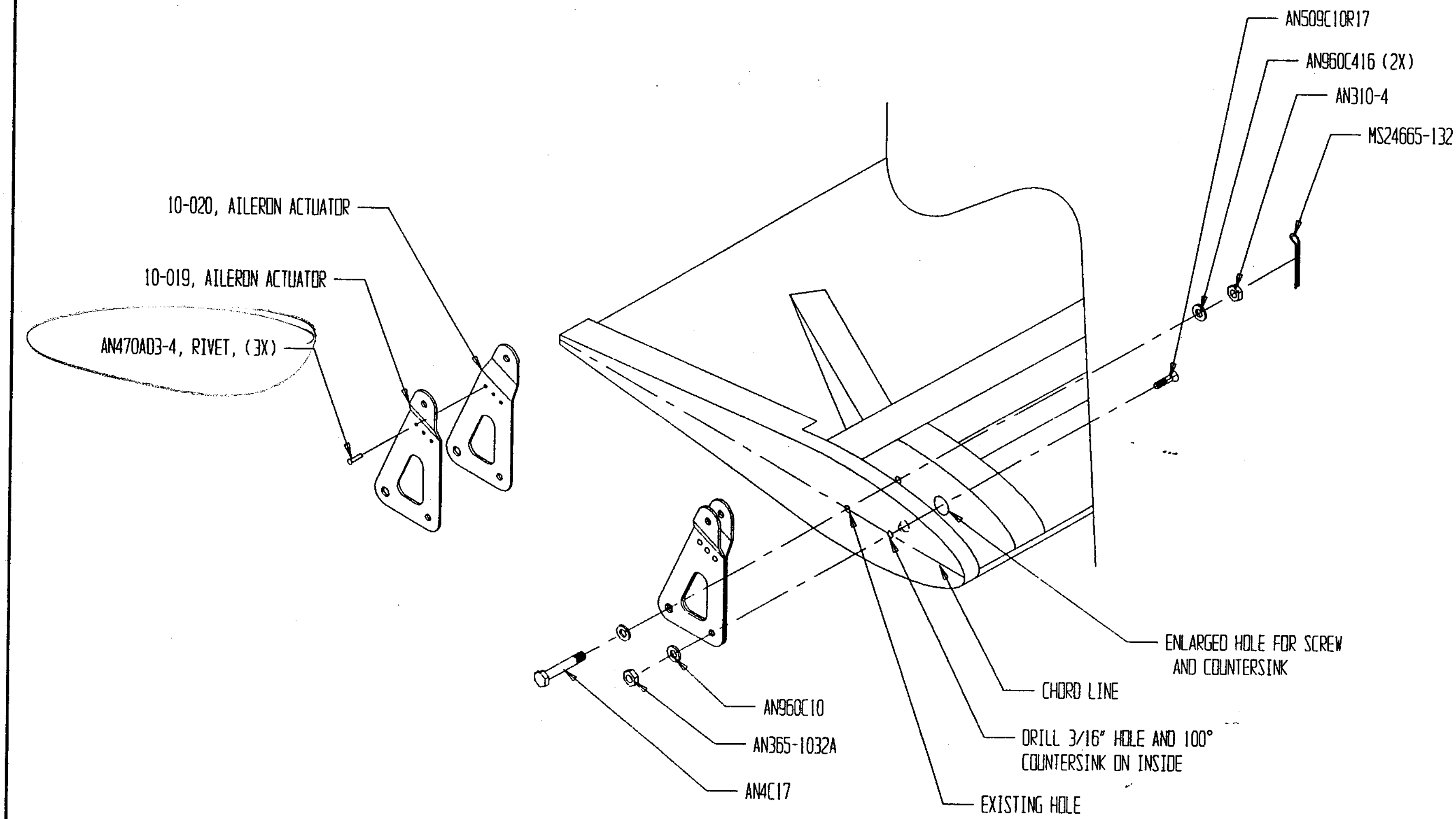
Note that you will first close the left aileron, then you will modify the aileron jig to accept the right aileron. The right aileron will then be placed in the jig and its lower skin bonded in place.

Step A Drill And Countersink Hole For The Aileron Actuator

Before you can close your aileron, you will need to drill and countersink a hole in the root rib for mounting the aileron actuator.

Carefully draw the chordline on the root rib of the aileron. Do this by measuring across the thickness of the rib and marking the center of these measurements at several locations along the length of the rib. Now draw a line through these marks. Use a 1/4 inch bolt to mount the aileron actuator to the aileron root rib through the pre-drilled hinge bolt hole. Adjust the position of the aileron actuator until the second mounting hole is centered on the chord line marked on the rib. Clamp the actuator to the rib then use a 1/4 inch drill to drill through both the root rib and the rib just beside the root rib on the aileron. Enlarge the hole in the second rib until it is just large enough to fit the head of the ~~1/4-28~~ 3/16 countersunk screw through it. Use a 100 degree countersink to countersink the hole on the inside face of the root rib. Trial fit the countersunk screw to be sure it sits flush with the inside face of the root rib.

Step B Drill Pressure Equalization Holes In The Ribs



AILERON ACTUATOR DETAIL

DRAWING NO. 20023C	TASK NO.	STEP NO.	AkroTech
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Drill a 3/32 inch hole in the center of each aileron leading and trailing edge rib (except the tip ribs). These holes will allow air to escape from the compartments in the aileron.

Step C Place The Left Aileron In The Aileron Jig

As you work, remember that the aileron is built upside down, with the spar and ribs factory-bonded into the upper skin. Place the aileron assembly in the jig. Use spring clamps to secure the aileron training edge to the steel trailing edge support tube that you built into the aileron construction jig. Place sand bags in the aileron to be sure that it is fully seated in the aileron jig. This may take quite a bit of force.

Check that the rib former contours match those of the aileron skins. The formers should contact the aileron skin along their entire length. If not, double check that you have the correct aileron, and that the tip end of the aileron is placed in the tip end of the jig.

Step D Dry Fit The Aileron Skin On The Aileron

Dry fit the bottom skin to be certain that it mates properly with the spar and ribs. It is a very good idea for you and an assistant to practice putting the lower aileron skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower aileron skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step E Prepare The Aileron For Bonding

Be sure to completely mask off all exposed fittings on the aileron. It will be very difficult to remove any excess adhesive that bonds to hinge assemblies, etc. Good masking will prevent this. Also, remember to use clear 3M tape to mask. Adhesive will soak through standard household masking tape.

Next, prepare all bond zones of the skin, spar, and ribs for bonding. Review the Section entitled “Bonding Procedures” in the General Information Section of this manual. Be sure that all are properly scuffed and cleaned with acetone immediately prior to bonding. Do not to touch the bond areas after cleaning. Any contamination, including oil from your skin, will compromise the structural integrity of your aircraft. Always be extra careful when bonding.

CRITICAL DOUBLE CHECK:
We can not over-emphasize the importance of the alignment of the three aileron jig formers. It is still possible to build in twist unless this entire task is approached with great care. With the aileron held in place in the jig, recheck everything. Are the aileron's leading and trailing edges **precisely** matched up with the leading and trailing edge marks on the formers? Are those marks all still in **exactly** the same plane? Is that plane still perfectly level? Recheck **everything** before proceeding. This is you last chance to correct any error.

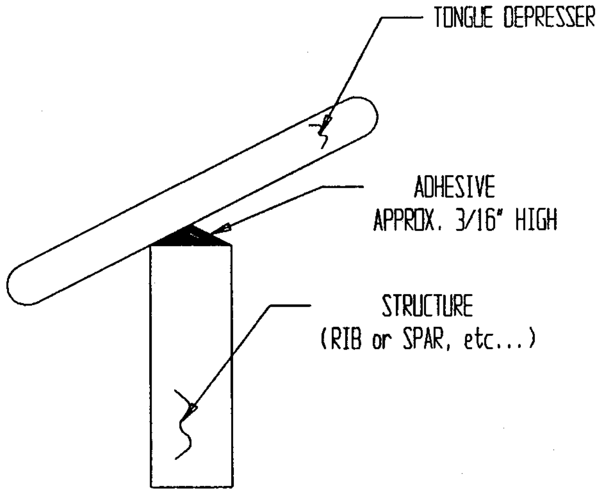
Step F Prepare And Apply Adhesive To The Aileron

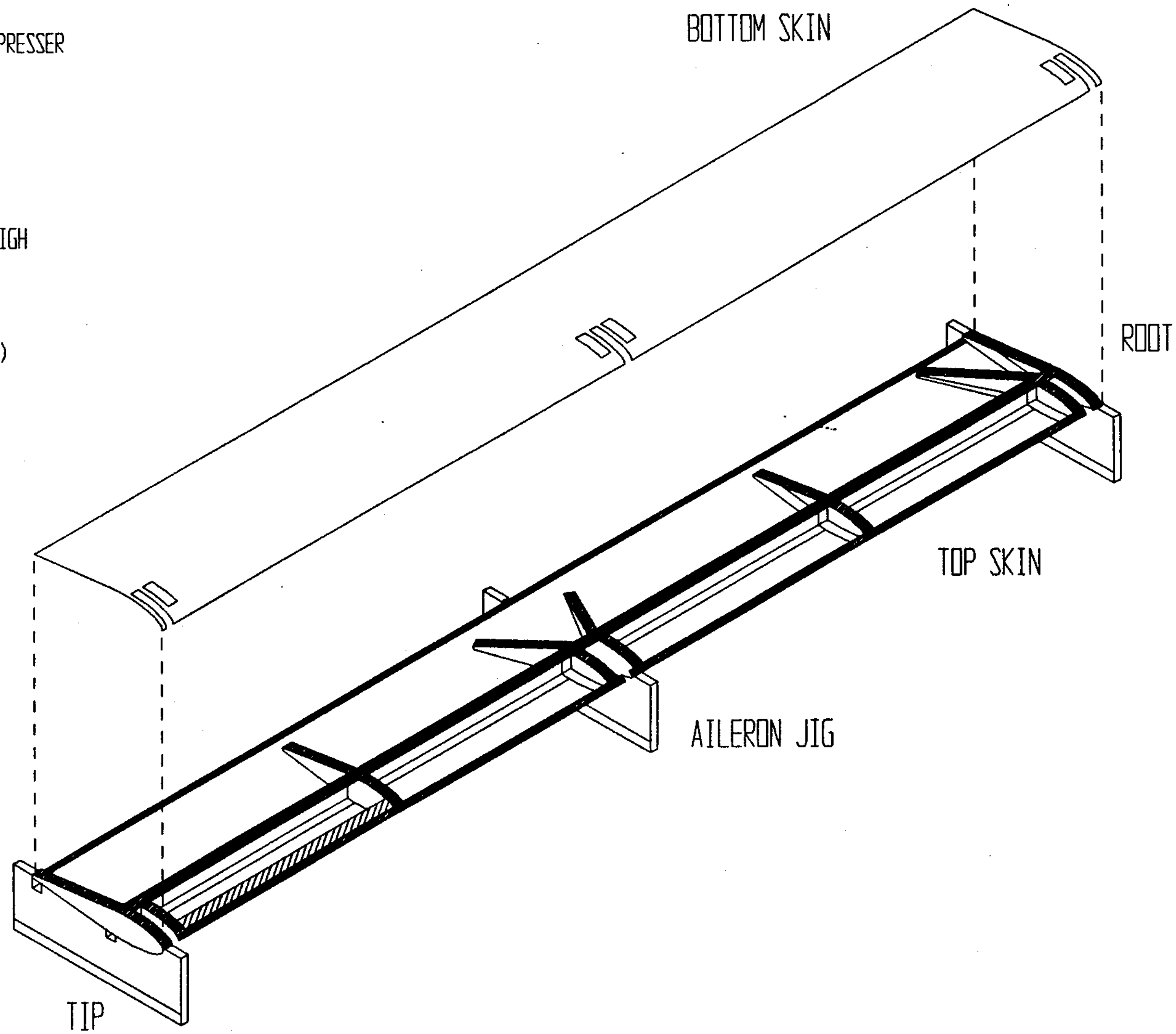
Before you start the bonding process, you should be very sure that you have everything ready. Once you start the applying the adhesives, you can not stop. All the tools and materials you need must be close at hand. Here are the things that you will want to have standing by before you start to mix adhesive:

- Latex gloves for mixing and applying adhesive.
- A roll of paper towels for clean up.
- Adequate solvent for clean up.
- A 10' long aluminum "L" section. One wide face of this piece should be protected with clear 3M tape where it will contact the carbon fiber of the aileron skin.
- About 20 spring clamps.
- Clecos
- eight, 10 lb. sand or lead shot bags

NOTE:
Bonding the aileron skin in place requires a helper and the knowledge that you will have the time to complete the following steps in uninterrupted succession:
1. 2 hours to complete the application and clean up of the adhesive.
2. 8 to 12 hours at 65_ to 110_ F for the initial cure.

Measure out and mix three, four ounce batches of structural adhesive (you may wish to refer to the section entitled "Mixing and Thickening Epoxy Adhesives" in the General Information Section of this manual at this time). Measure and mix according to



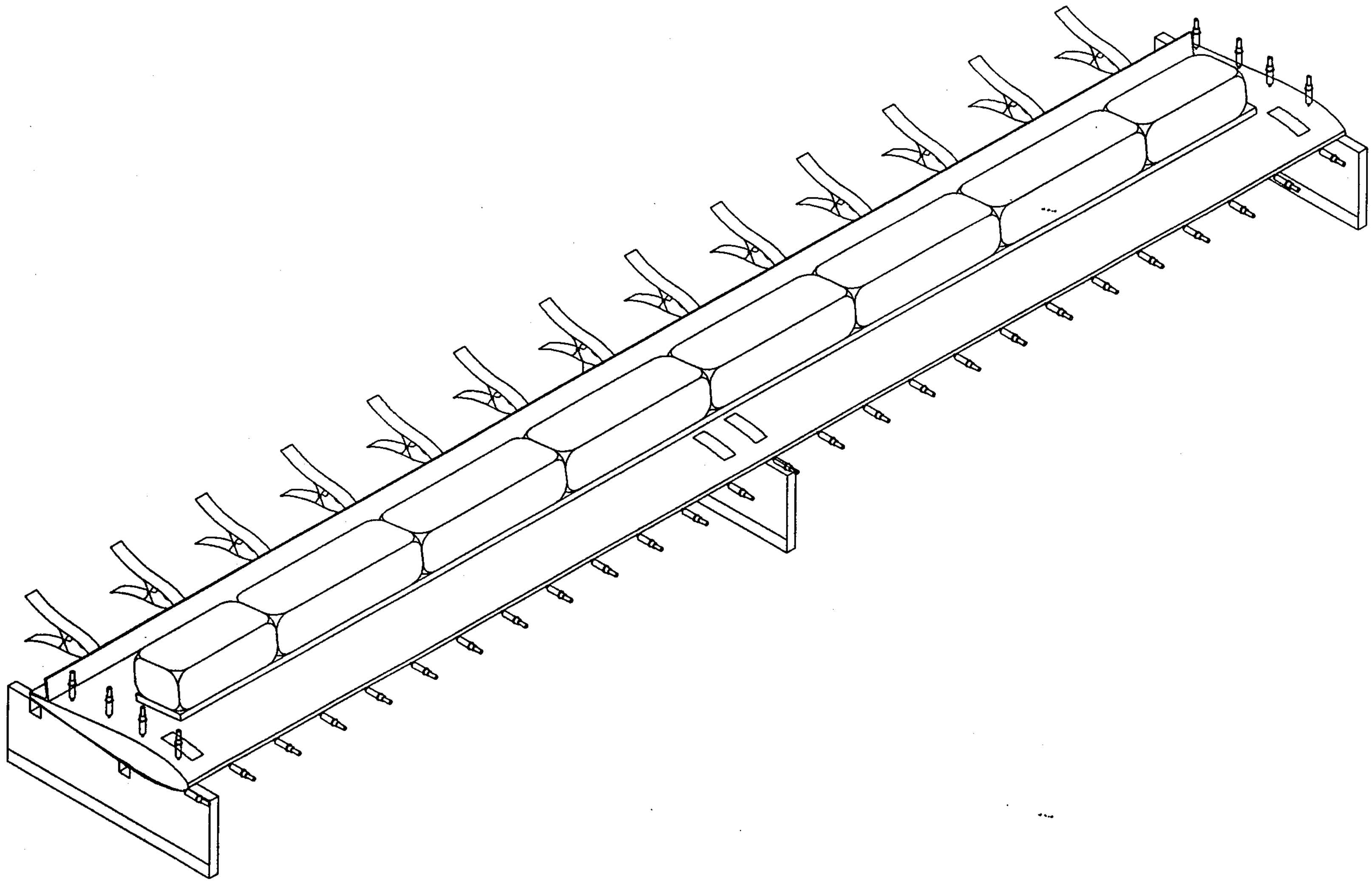


NOTES:

1 - SHADED AREA, ADHESIVE

AILERON CLOSURE

DRAWING NO. 20094B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION WING	REVISION	PAGE



DRAWING NO. 20019B	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION WING		REVISION	PAGE

manufacturer's instructions. Stir slowly at first, then continue to stir for at least two minutes after your mixture assumes a uniform viscosity. After thoroughly mixing the adhesive, add enough structural filler to achieve "mayonnaise" consistency. This will prevent the mixture from flowing out of the joints during cure. Leave one cup of adhesive unthickened (5 oz) for application to the bond areas on the lower skin.

You may find it helpful to place a few sand bags in the aileron, away from the bond areas, before you apply the adhesive. The weight of the sand bags will serve to hold the aileron in place as you apply the adhesive.

Apply a thin but even layer of the thickened adhesive mixture to **all the bond zones** of the upper skin / spar / rib assembly:

- Aileron leading edge.
- Aileron ribs.
- Aileron spar.
- Aileron trailing edge.

When applying the adhesive, try to form it into a triangular shape on the tops of the ribs and spars. This will help prevent voids in the bonded areas.

Now find the areas on the lower skin which mate to the ribs and spars of the upper skin assembly. Use a small brush with stiff bristles to paint the unthickened adhesive on all of these areas. Be sure to coat **all** areas that will come into contact with a rib or spar surface.

VERY IMPORTANT: Be very certain to remove all sand bags and tools (or any other foreign matter that you do not wish to become a permanent part of the aircraft) from inside the aileron now.

Step G Bond The Lower Aileron Skin In Place

Using a helper, carefully, slowly, and precisely, position the lower aileron skin into place over the bond area. Get it dead right the this time! Put the skin down as close to it's final position as you can. The less you have to move it to get proper alignment, the less adhesive you will smear, and the better bond you will make.

Align the lower aileron skin with the top aileron assembly. Be sure that the leading edge of the lower aileron skin is fully seated into its joggle recess along its entire length.

Next, start to secure the aileron into the construction jig. In general, you want to move from the leading edge to the trailing edge. The effect will be to gently pull the lower aileron skin aft, thereby seating it into the leading edge joggle, bonding it to the aileron spar and finally into the trailing edge.

Install Clecos into the holes drilled earlier in the leading edge. When inserting these Clecos, start from the center of the aileron and move outward.. Place 10 lb. sandbags every foot along the spar. Place your aluminum "L" section over the lower skin trailing edge and clamp it every foot using spring clamps. Your clamps should sandwich the freshly bonded trailing edge of the wing between the steel support tube and the aluminum "L" section.

Wipe off any excess structural adhesive that has squeezed out along bond lines. Excess adhesive adds weight but not strength.

Step H Remove Aileron From Jig After Complete Cure

Only after the bond in the ailerons has completed an initial cure of at least 24 hours at 65_F, should you loosen your clamps and remove the aileron from the aileron construction jig. Do not rush to remove the aileron from the construction jig. Allow full and complete cure time.

CRITICAL: **You must allow each bonded aileron to cure undisturbed in the construction jig for a minimum of 24 hours at 65_ F** -- however it is preferable to allow a minimum of 12 hours cure time at 85_ to 110_F. A small electric heater placed under the work table (but away from any combustibles) can help you achieve higher temperature readings in the vicinity of your aileron construction jig. **Do not loosen any clamps or move any sandbags during this period.**

Step I Trim The Aileron Skin

Use a Dremel tool or jig saw to trim the trim the aileron skin where it protrudes from the root and tip aileron ribs. Be careful not to damage the ribs while trimming.

TASK W-8 Close The Right Aileron

Brief Task Description:

In this task you will modify the aileron jig to accommodate the right aileron. Then you will use this jig to close the right aileron. Note that the procedure used to close the right aileron is identical to that previously used to close the left aileron.

Step A Remove The Support Tubes From The Aileron Jig

Remove the support tubes from the jig formers being careful not to damage the formers themselves. The clear tape placed on the tubes earlier should have prevented the body filler from adhering to the tubes. If you cannot pull the tubes out by hand, tap the tubes with a hammer to knock them out of the notches.

Step B Switch The Positions Of The Root And Tip Formers

Remove the root and tip formers (BL 30 and BL 132) from your construction table. Leave the steel angle brackets attached to your work surface. Switch the positions of the root and tip formers on your work table. Trial fit the support tubes in place in the former notches. Note that the tubes will now protrude slightly above the surface of the formers. You will need to grind some of the body filler out of the notches to get the tubes to sit all the way into them. Now remove the tubes from the jig and set them aside.

Step C Align The Aileron Jig

Repeat the alignment procedure you performed in task W-4 to align the aileron construction jig. Double check to be sure your two alignment strings are tight and level. Once the formers are properly aligned, replace the support tubes using body filler as you did previously.

Step D Build Bond Area On Ribs And Spars

Refer to task W-5 to build up a level bond area on the ribs and spars of the right aileron. Remember to properly prepare all bond areas before applying the adhesive.

Step E Balance The Right Aileron

Balance the right aileron following the procedure outlined previously for the left aileron.

Step F Close The Right Aileron

Mount the lower skin on the right aileron using the procedure for the left aileron.

TASK W-9 Install The Pitot System

Brief Task Description:

The hardware and plumbing for the pitot/static system must be installed in the wing prior to permanently closing the wing. The pitot system is mounted at the wing tip, with the ram air and static air lines running inside the leading edge toward the fuselage.

NOTE:	At this point you must complete all the pitot system operations that require work inside an open wing. Once the wing is closed, it will not be possible to perform these operations.

Step A Cut And Fit The Premolded Pitot Tube Mounting Pad To The Spar

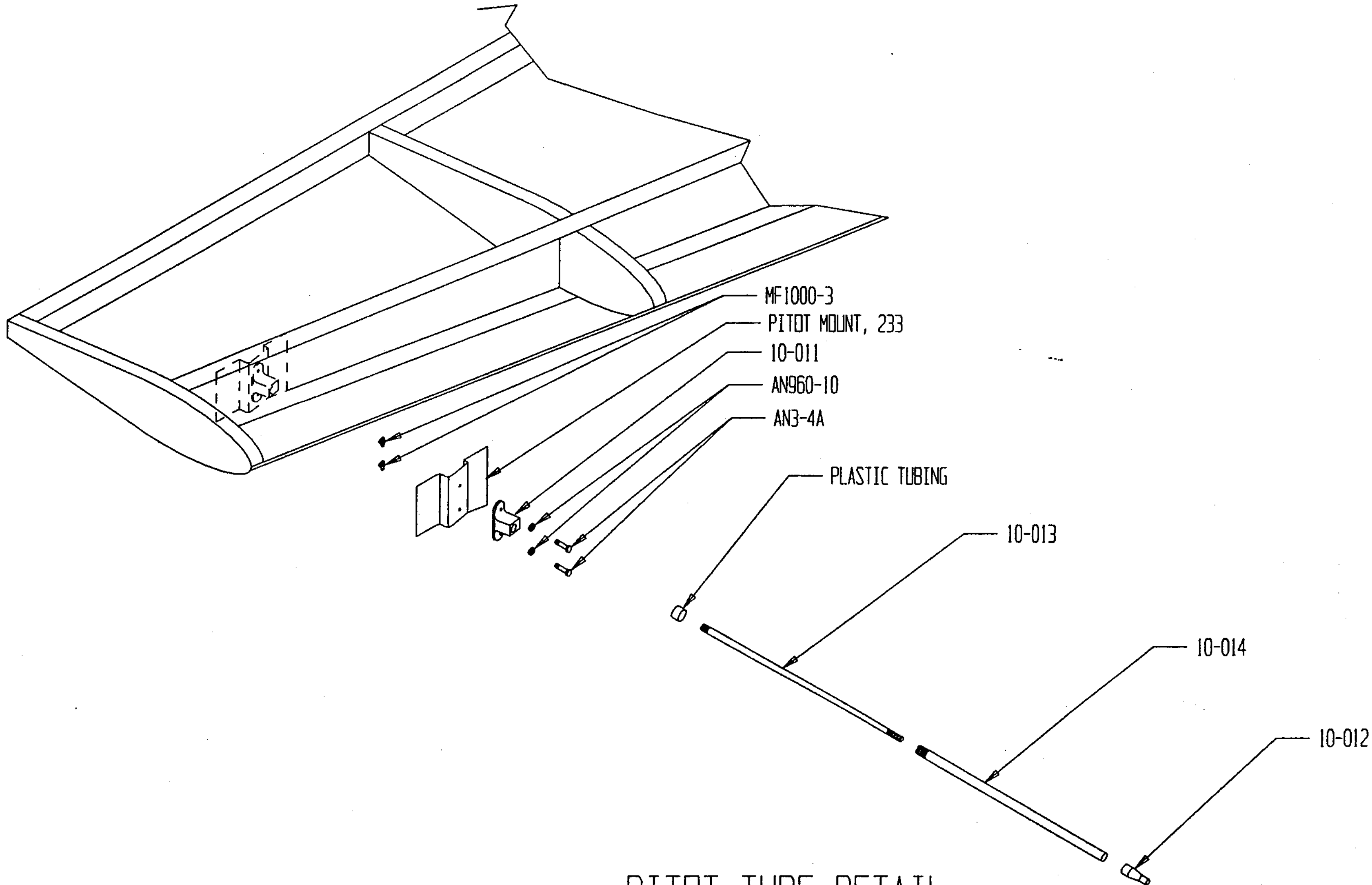
Find the Position the pitot tube mounting pad as supplied with your kit. This mounting pad is supplied long and must be trimmed to the proper length. Use a jigsaw to trim this pad down so that it will fit on the front face of the left main wing spar, 3.5 inches inboard of the tip rib. This pad should be cut a little undersize so that it clears the top and bottom spar caps by about 1/8 inch (this will allow you to precisely position the pitot tube later).

Step B Install Nutplates In The Pitot Tube Mounting Pad

Center the aluminum pitot tube fitting on pitot tube mounting pad. Use two C-clamps to clamp the fitting to the mounting pad. Using the fitting as a drill guide, drill two 3/16 inch holes through the mounting pad. Refer to the section entitled "Installing Nutplates" in the General information section of this manual to install the two 10-32 nutplates on the rear face of the mounting pad.

Step C Cut Hole In The Leading Edge Of The Wing

mark the position on the leading edge 3 1/2 inches from the outside face of the tip rib where the pitot tube will extend. Drill a 1/4" pilot hole centered vertically, in the leading edge. Now drill out this hole to 5/8 inch using a hole saw to accept the pitot tube



PITOT TUBE DETAIL

DRAWING NO. 20015B	TASK NO.	STEP NO.	AkroTech
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assembly. Note that this hole is about 1/8 inch larger than the pitot tube. This is to allow for the insertion of a stainless steel sleeve which will isolate the aluminum pitot tube from the carbon fiber.

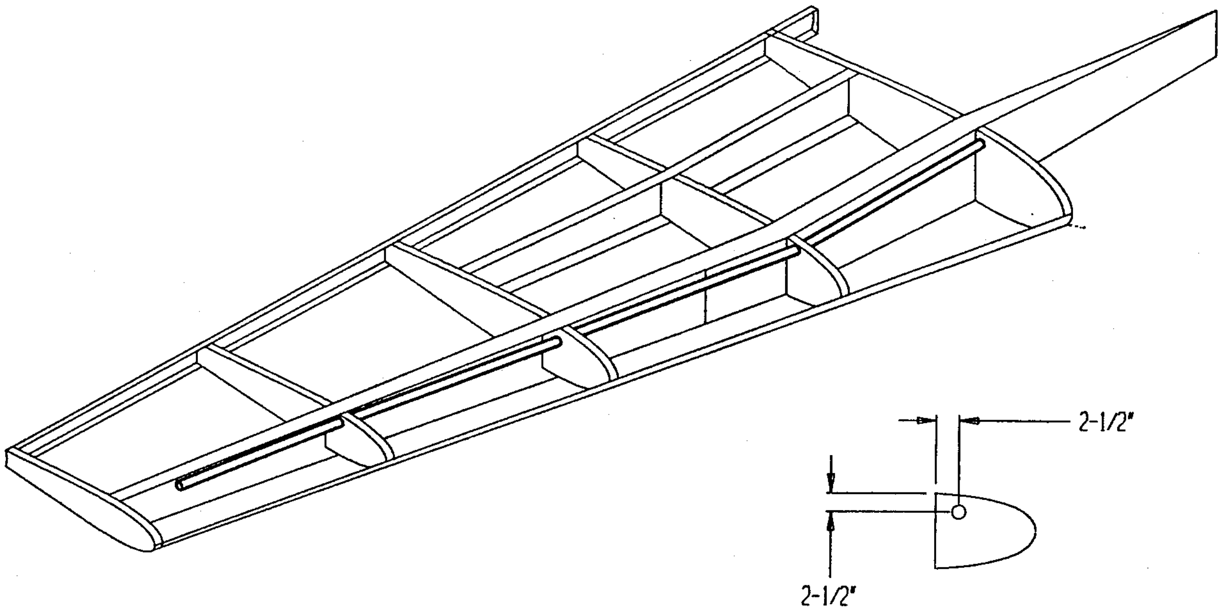
Step D Install The Pitot Tube Mounting Pad And Plastic Sleeve

Prepare the front face of the main spar and the pitot tube mounting pad for bonding. Also prepare the exterior surface of the supplied 5/8 inch x 1 inch plastic steel sleeve for bonding to the inside of the leading edge skin. Assemble the pitot tube fitting to the pitot tube mounting pad using the supplied AN3C6A bolts. Place some clear tape over the pitot tube and slide it into the hole in the leading edge of the wing. Now assemble the pitot tube to the pitot tube fitting and mounting pad. Note: install only the outer aluminum tube; the inner steel tube and aluminum tip do not need to be installed for this operation. Slide the plastic sleeve over the pitot tube and position it near the hole in the leading edge. Trial fit the mounting pad on the spar face and check to make sure the pitot tube can be slid in and out of the hole in the leading edge without binding. Adjust the position of the mounting pad until the pitot tube clears the hole. Mix a small batch of structural adhesive (about 4 ounces) and add enough structural filler to achieve "mayonnaise" consistency. Coat both the spar, mounting pad and plastic sleeve with the structural adhesive mixture. Position the mounting pad on the spar face and clamp it into position using a C-clamp. Slide the plastic sleeve onto the pitot tube and through the hole in the leading edge. Adjust its position so that about 1/16 inch is left protruding through the leading edge skin and bond it in place by packing the area between the sleeve and the interior wing skin with the adhesive mixture. Clean up all excess adhesive with a clean rag. After the adhesive has cured, remove the pitot tube to protect it from damage. It does not have to be reinstalled until your aircraft is ready to fly.

Step E Install The PVC Conduit For The Pitot / Electrical System

Drill the holes for the 1 inch PCV conduit through the leading edge ribs in the wing for the pitot lines and electrical lines Using a 1 inch holesaw.

Slide the 1 inch PVC conduit into the holes drilled in the leading edge ribs. If the fit of the PVC conduit is too tight, remove the conduit and enlarge the holes with sandpaper. Mix a small batch of structural adhesive and smear some around each rib-conduit junction to seal the core material and lock the conduit in place. Once the adhesive has



TYPICAL HOLE LOCATION

NOTES:
1 - CONDUIT, 3/4" PVC WATER PIPE (THIN WALL)

CONDUIT DETAIL FOR PITOT/STATIC, AND STROBE LINES

DRAWING NO. 20022B	TASK NO.	STEP NO.	AkroTech
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cured, round off the sharp interior edges of the conduit on both ends to prevent chafing of the wires and pitot lines.

Step F Install The Pitot Lines

Find the 1/4 inch Nylo-Seal tubing supplied in your kit. Cut 2 pitot lines that are long enough to run from the pitot tube to the wing root, from the pitot base to the wing root rib, allowing 12" to spare. Attach the 268P-04X02 fittings to the ends of the lines that will be connected to the pitot tube fitting. Attach the line fittings to the pitot tube fitting. Cut both the ram air and static lines approximately 2" on the inboard (fuselage) side of the root rib. Install the 262-N04 unions to the inboard end of the pitot lines. Label the static line at the wing root with a felt tip marker so that you can identify it later.

NOTE:
You will not be able to access these lines once you have closed the wing. Now is the time to be sure that this system is installed correctly. Are the lines run correctly? Have you labeled which wing root fitting is the pitot source and which is the static source?

TASK W-10 Build The Wing Construction Jig

DECISION POINT:
If you wish to incorporate optional fuel tanks into the wings of your G-200, this would be a good point at which to perform tasks OPT-1 and OPT-2. Though they can be performed at any point up to the closing of the wing, doing those tasks while you are doing other similar work within the wing structure makes sense.

Brief Task Description:

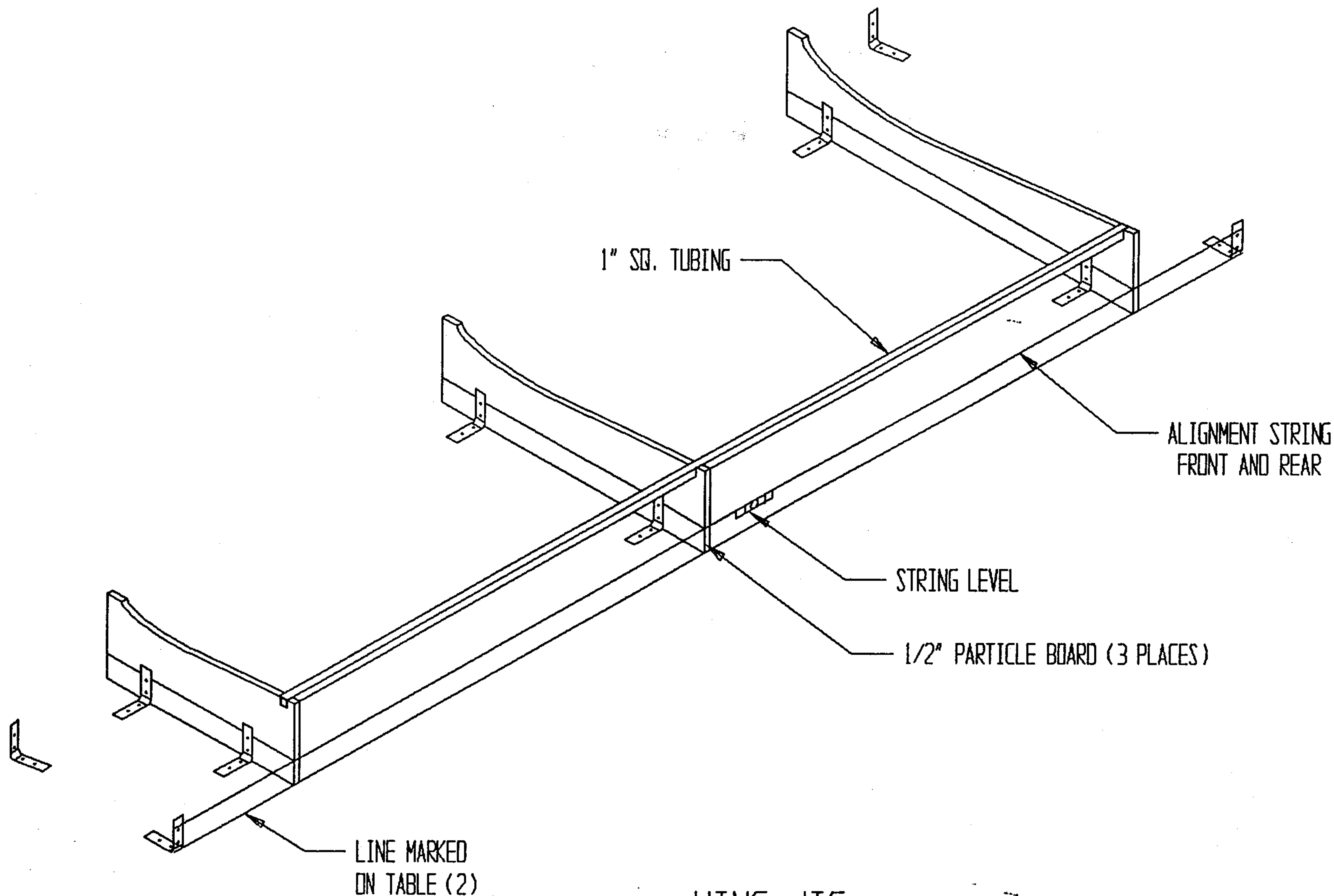
Even though it is not part of the airplane, the wing jig is one of the most important parts of your G-200. From it the wing will receive its final shape. The final shape of the wing will have everything to do with the eventual flying qualities of your aircraft. In order for the wing to be absolutely free of twist once closed, it must be secured into a true, twist-free jig as its lower skin is bonded into place. In this task you will make that jig.

The same jig is used for both the left and right wing. The left wing is built first, then the position of the root and tip formers will be switched on the jig to build the right wing . This task will be virtually identical to the task in which you built the aileron jig. Accuracy in building the aileron jig was critical. Accuracy in building the wing jig is, if anything, even more critical. Take all the time you need. Get it right now. You wont be able to fix it later.

Step A Cut Out The Wing Jig Formers

Remove the templates for the wing jig formers from this manual and use spray adhesive to mount them to 1/2 inch particle board or plywood. Cut out the wing jig cradles using a jigsaw. Stay just to the outside of the line when cutting, then use a belt sander or sanding block to bring the surface down to the line.

Step B Mark The Former Locations On The Construction Table



WING JIG

DRAWING NO. 20014A	TASK NO.	STEP NO.	AkroTech	
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Remove the aileron jig from the construction table. Draw a line perpendicular to the chalk line used for the aileron jig and about 10 inches from the end of the table. This line will reference the position of the root rib former for the left wing jig. Draw two more lines perpendicular to the chalk line 57 inches and 114 inches from the root rib mark. These lines locate the center and tip rib formers respectively.

Step C Mount The Angle Brackets To The Table

Now it is time to position the steel angle brackets that will support the wing formers.. Clamp four, 4 inch steel angle brackets to either side of each former (do not screw them to the formers yet). The brackets should be positioned as indicated on the former templates. Place the formers in position on the table (with the angle brackets clamped to them) so that the left edge of each former is aligned with its appropriate mark on the table and so that the trailing edge of each former is aligned with the chalk line near the edge of the table. Screw the angle brackets to the work surface (but not into the formers yet) so that they will support each former in the proper position on the table. After screwing the angle brackets to the table surface, remove the clamps. Each former should now be snug between its brackets, but still able to slide so that it can be adjusted later.

Step D Cut And Fit The Trailing Edge Support Tube

Now you will need to cut the, 1 inch square tubes for supporting the spar and the trailing edge of the wing while the top skin is bonded in place. This support tube fits into the notches cut into the formers. Note that the notches are a little deeper than they need to be. This will allow the tube to be shimmed up to align accurately with the surface of the formers. Cut the tube just long enough to span the length of the jig. Place some clear tape over the tube where it intersects the notches. Trial fit the support tube in the formers, then remove the tube and set it aside.

TASK W-11 Align The Wing Construction Jig

Brief Task Description:

Having made the components for the wing jig, and having roughly laid out their location on your work table, in this task you will assemble and precisely align the wing construction jig. This procedure is almost identical to that used to align the aileron jig. Accuracy is essential here. Your wing will only be as good as the jig in which you build it.

The first step is to build a simple alignment tool that will allow you to exactly position the formers. It will consist of two pairs of sturdy steel angle brackets with two lengths of monofilament line stretched tight between them. These brackets will be positioned just ahead and just behind the front and rear edges of the formers. That way, the formers can be positioned between the monofilament lines (with about 1/16 inch to spare at either end). The ultimate goal is to adjust the alignment tool so that the two monofilament lines are dead level . Those two lines will then be used as references to which the wing formers themselves will be aligned.

Step A Mount The Alignment Tool To The Construction Table

This step involves positioning and mounting four 6" heavy duty steel angle brackets on your construction table and stretching some monofilament line between these brackets to act as a reference for aligning the wing formers.

Locate one pair of angle brackets exactly on the chalk line snapped on the construction table earlier. These brackets will support the monofilament line for aligning the trailing edge of the wing jig. Mount these two brackets to the table using screws. Stretch some monofilament line between these two brackets, then adjust the formers until their trailing edge just clears this line by 1/16 inch. Now locate another pair of angle brackets on the opposite side of the root and tip formers to support the monofilament line for aligning the leading edge of the wing jig. Carefully position these brackets so that a line stretched between them will clear the leading edge of the formers by 1/16 inch. These brackets need to positioned carefully, so take your time. Once you have them properly located, screw them down to your work surface.

Be certain the monofilament lines stretched between the angle brackets are taught and adjustable. You can accomplish this by forming a loop in one end of the line, placing that loop over one bracket, then forming a loop at the opposite end so that the line is about 1/2 inch too short when unstretched. You can then stretch the line over the supports to get it taught.

Step B Level The Monofilament Line

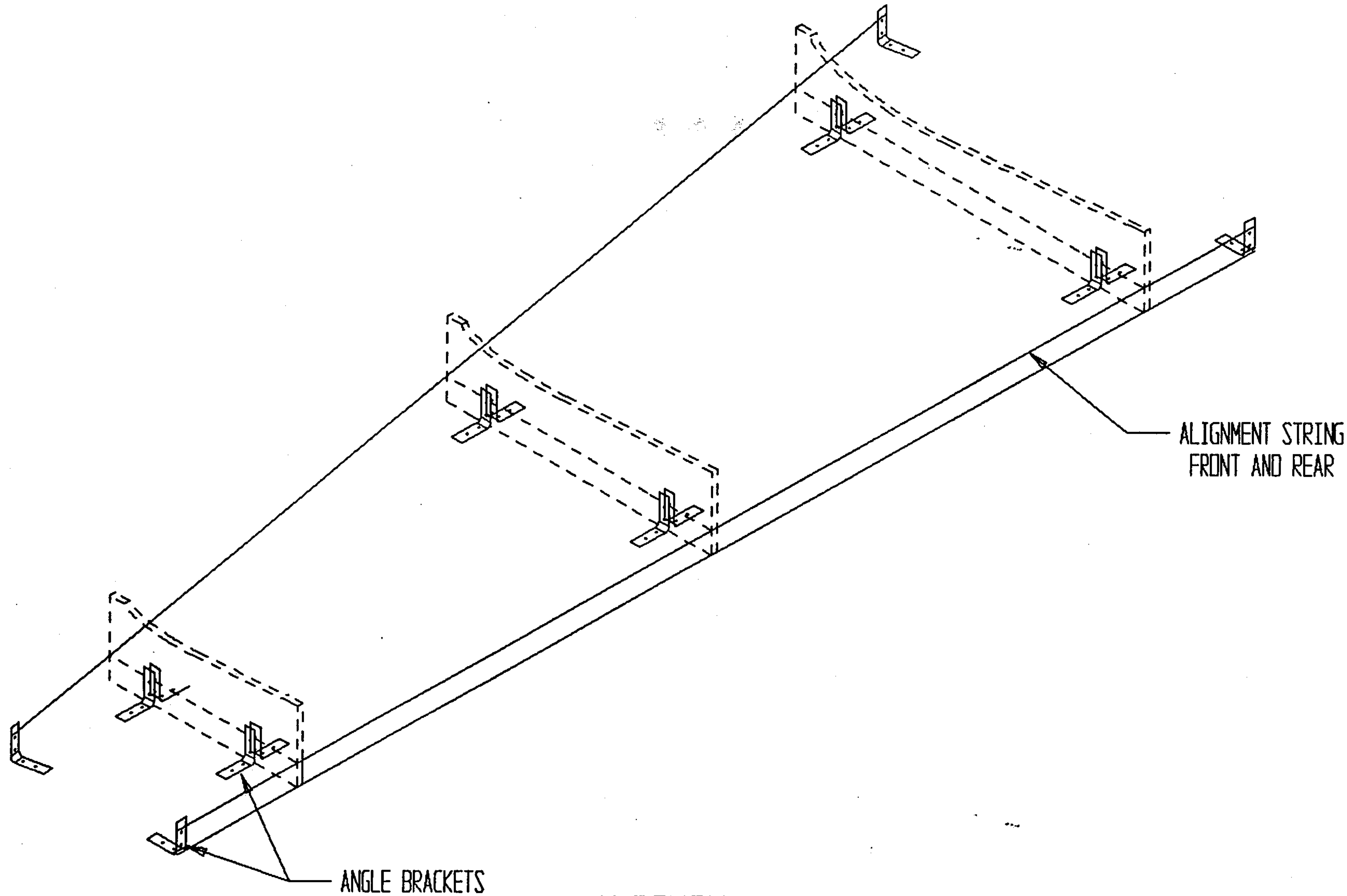
In this step you will adjust the monofilament lines so that they are exactly level. Adjust the lines to their starting position three inches above the table surface. Now place a string level (available at most hardware stores) on the center of one line and adjust the line by sliding it up and down the angle brackets until the string level reads level.. Repeat this procedure for the other line. It is perfectly acceptable to raise the monofilament reference lines a little above the arbitrary 3 inch starting height if necessary. It is only critical that the alignment requirements be met. It does not matter if that occurs at 3 1/8" above the surface of the work table, or at some other height. If you find that you have to move the string a lot to get it level then your table is probably not very level. You may wish to level your table before proceeding.

Remove the string level and double check the alignment of the monofilament lines using an accurate 6' level or a water level. Now is the time to be accurate. The level monofilament lines are the fixed reference points from which the entire wing will be assembled. Once you are certain the monofilament lines are level, use some tape to secure the lines to the angle brackets so they cannot slide out of place.

Step D Align The Wing Jig Formers

There are two alignment conditions that must be met. As before, go sequentially through the below list of alignment conditions. You will need to go through the list several times. With each run through the list, your adjustments will be progressively smaller.

1. Vertical alignment is assured by being certain the reference line printed on each former is in exactly the same plane as both the monofilament lines.
2. Horizontal alignment is assured by being certain each former is centered between the monofilament lines.



ALIGNING WING FORMERS

DRAWING NO. 20013A	TASK NO.	STEP NO.	AkroTech
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Raise or lower each wing former to bring the reference lines printed on the former templates exactly level with an imaginary plane defined by the two monofilament lines. You can check this with a level, or by simply sighting down the reference lines and adjusting each former until it is aligned with both monofilament lines. Then check that each former is exactly centered between the monofilament lines (if the 6 inch angle brackets were positioned correctly, there should be about 1/16 inch between the former and the monofilament line on each side). Alternate between these two adjustments. This will take time. Do not rush. Accuracy comes from an equal measure of patience and persistence.

Shim up each former as needed, then clamp each former in place between the brackets screwed to the work table.

Step E Mount The Formers To The Brackets

Once you are sure the formers are correctly positioned, carefully fasten all wing formers into their support brackets. Take care not to knock the formers out of alignment as you secure them. Use appropriately sized screws and drill pilot holes.

Step F Mount The Trailing Edge Support Tube To The Formers

Clamp three pieces of particle board 1 1/4 inches wide by 3 inches long and clamp these to the support tube where it intersects the formers. Now prepare a small batch of body filler and put a blob in each notch where the tube is to rest. Push the tube into the notches (with the wood blocks clamped to them) and squeeze out the excess body filler. The tube should now rest on the wood blocks which span the notches in the formers. This will perfectly align the top surface of the support tube with the top surface of the formers. When the body filler has cured, remove the wood blocks from the tube.

Check the formers and support tubes to be sure that nothing protrudes above its surface. A protrusion may prevent the wing from properly seating in the jig and might also scratch the carbon fiber skin. Place a layer of clear 3M tape on all the surfaces of the wing jig that will come in contact with the wing skin. This will prevent the adhesive that seeps from carbon fiber from permanently bonding the wing into the jig.

Step G Recheck The Alignment Of The Jig

Meticulously recheck the alignment of the entire jig. Be certain that the completed jig is true. It is possible that an unnoticed error crept in. If you find an error, no matter how small, correct it now. It will be easier to correct an error now rather than in the flight test phase.

TASK W-12 Mount The Aileron Hinges On The Wing

Brief Task Description:

In this operation you will mount the aileron hinges onto the rear spar of the main wing. As with the last task, this is a critical operation. Again, take time to check and recheck before you drill. Your accuracy here will have very tangible results. A properly aligned control system will feel just right, however even a slight error here can result in controls that simply are not as smooth and light as they otherwise could be.

CRITICAL ALIGNMENTS: There are three critical alignments to be maintained in this task. First, the horizontal centerline of each aileron hinge bracket **must** be mounted exactly even with the horizontal centerline of the rear spar. Second, each hinge **must** be placed at precisely the same butt line location as the receiving slots in the aileron. Third, each hinge bracket **must** be mounted plumb, that is to say with its hinge arm perfectly vertical. A little extra care and attention to accuracy in this step could save you a great deal of totally avoidable added work and aggravation later.

Step A Install The Bearings In The Aileron Hinges

First, press the aileron hinge bearings into the hinge brackets. Refer to the section entitled "Setting Bearings Into Control Surface Hinges" in the General Information Section of this manual to install these bearings.

Step B Place The Left Wing In The Wing Jig

Like the aileron, the wing is built upside down, with the spars and ribs factory-bonded into the upper skin. Place the wing assembly in the jig. Use spring clamps to secure the wing trailing edge to the aluminum trailing edge support that you built into the wing construction jig. Place sand bags in the wing to be sure that it is fully seated in the wing jig.

Check that the rib former contours match those of the wing skins. The formers should contact the wing skin along their entire length. If not, double check that the wing is correctly oriented in the jig.

Step C Mark Centerlines On The Rear Spar And Hinges

Bisect the height of the rear spar at several locations to find its centerline. Mark this centerline on the aft face of the rear spar along its entire span.

Find the six aluminum aileron hinges supplied with your kit. Note that you have four hinges with a rectangular base and two with a triangular base. The hinges with the rectangular bases are the root and center aileron hinges while the hinges with the triangular bases are the tip aileron hinges.

Use a pencil and a straight edge to mark a horizontal line exactly through the center of the base of each hinge (A pencil works fine on the aluminum fittings.).. Make small pencil "tick marks" on the thin edge of the hinge bases where it can be easily seen when the hinges are clamped to the wing spar. These tick marks will help you align the centerlines on the hinges with the centerlines on the rear spar.

Step D Assemble The Hinges To The Aileron

Assemble the aileron hinges to the aileron using the supplied hardware.. Be sure to use washers on either side of the hinge to properly center them in the hinge slots. If you find it difficult to hold the washers in position while inserting the bolt, use a small amount of super glue to hold the washer to the inner race of the hinge bearing. Be careful not to get any glue into the bearing itself.. Install nuts on the bolts to hold them in place, but do not tighten them.

Step E Fit The Aileron Up To The Wing

Hold the aileron (with the hinges mounted on it) to the wing and move it inboard or outboard until the tip rib on the aileron is even with the tip rib of the wing. Using the marks made earlier on the hinges, align each hinge with the centerline of the rear spar and clamp it securely in position. When clamping the hinges to the spar, make sure the base of the hinges are resting flat against the rear face of the spar. If they are not, the hinges will not properly align. After all three hinges are securely clamped to the rear spar, disassemble the aileron from the hinges by removing the hinge bolts.

Step F Drill The Hinge Mounting Holes In The Rear Spar

Before drilling the rear spar, be absolutely sure the hinges are perfectly positioned. Once these holes are drilled, it will not be possible to adjust the hinge positions. Check to make sure the wing is firmly seated in the jig. then sight down the center of the bearing holes to make sure they are aligned. Finally, double check each hinge to be certain it is properly aligned with the centerline on the spar.

Drill through each hole in each hinge using a 1/4 inch drill. To prevent the hinges from shifting while drilling the holes, you may want to place bolts in each hole immediately after it is drilled. Remove the hinges from the rear spar when finished.

TASK W-13 Make And Install The Aileron Hinge Backing Plates

Brief Task Description:

In this task you will make and install the aileron hinge backing plates for the left wing. Though only the backing plates for the left wing will be installed in this task, it is suggested that you prepare the backing plates for the right wing simultaneously. You can save time by performing similar operations together. You may wish to review the section entitled "Backing plates" in the General Information Section of this manual.

Step A Cut Out The Aileron Hinge Backing Plates

Use a fine tip felt pen to trace an outline of the base of each aileron hinge on the supplied .080 backing plate material. Use a jigsaw or a bandsaw to cut out the six backing plates from this sheet. Smooth the edges of the backing plates with a file or belt sander.

Step B Drill Holes In The Backing Plates

Clamp each of the backing plates to its respective hinge. Use the hinge holes as a drill guide to drill the 1/4 inch holes in the backing plates.

Step C Install Nutplates In The Backing Plates

Refer to the General information section of this manual to install the 1/4-28 floating nutplates in each of the six backing plates.

Step D Bond The Backing Plates On The Rear Spar

Prepare the backing plates and the forward face of the rear spar for bonding. Wax all of the aileron hinge mounting bolts. Mix a batch of structural adhesive and apply enough filler to achieve "catsup" consistency. Apply the adhesive to all bond areas on the rear spar and the backing plates. Try to keep away from the holes on the backing plates and the rear spar when applying the adhesive. Press all three backing plates into position on the rear spar. Install the waxed bolts though the hinges and into the backing plates. tighten the bolts down and remove any excess adhesive with a clean rag. Leave the hinges mounted to the rear spar but cover them with clear tape to protect them from adhesive.

Step E Enlarge The Aileron Hinge Slots

Fit the ailerons to the wing and enlarge the hinge slots as required. Allow for 22 degrees of aileron travel in both the up (+) and down (-) direction.

TASK W-14 Build Up The Bond Area On The Ribs And Spars

Brief Task Description:

In this task you prepare the wing for closing by building up the bond areas on the wing ribs and spars. This insures that there will be no low spots on the spars or ribs when it comes time to bond the lower wing skin in place. The goal is to add a layer of structural adhesive to any low areas on the wing ribs and spars that will allow the final bond layer of structural adhesive to be thin and uniform.

Remember that you are building the wing upside down. This means that anytime we refer to the upper skin we mean the one with the ribs and spars bonded in (and not the one that is actually on top during assembly). And anytime we refer to the lower skin we mean the one without the ribs and spars.

Step B Mark The Bond Areas On The Skin

Lay the lower wing skin (which is now on top) in its proper place on the wing assembly. Locate the bond areas on the lower skin. Cover all the bond areas on the inner face of the lower wing skin with a layer of clear 3M tape.

The reason you are doing this is that you will be applying structural adhesive to the wing spars and ribs, then placing the lower wing skin on that adhesive. The idea is to exactly impart the shape of the inner face of the lower wing skin onto the adhesive that you have applied to the spars and ribs, but without yet permanently bonding the lower wing skin in place. The layer of tape covering the bond zones will allow you to remove the lower skin after the structural adhesive hardens.

This is a good time to dry fit the lower skin to be certain that it mates properly with the spar and ribs. It is also a very good idea for you and an assistant to practice putting the upper wing skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower wing skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step C Prepare The Wing

Carefully place the upper wing skin into exact position on the spar, ribs and lower skin assembly. Use tape to secure the lower skin to the upper skin at the leading edge. Place 10 lb. sandbags over the wing spar every foot and two 10 lb. bags over each rib.

Drill holes for Cleco fasteners every 2" along the center of the leading edge joggle and through the skin along the root and tip rib flanges. These Clecos will hold the skin in position while you are building up the bond area and while finally bonding the skin in place.

Now remove the lower skin from the assembly. Prepare the bond zones of the wing spars and ribs for bonding. (See the General Information section of the manual.) Be sure that all are properly scuffed and cleaned with acetone immediately prior to the bonding operation.

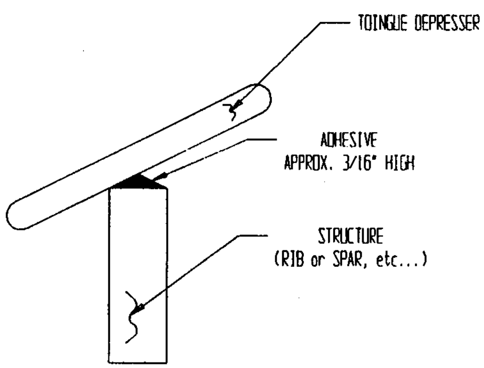
Step D Mix And Apply Adhesive

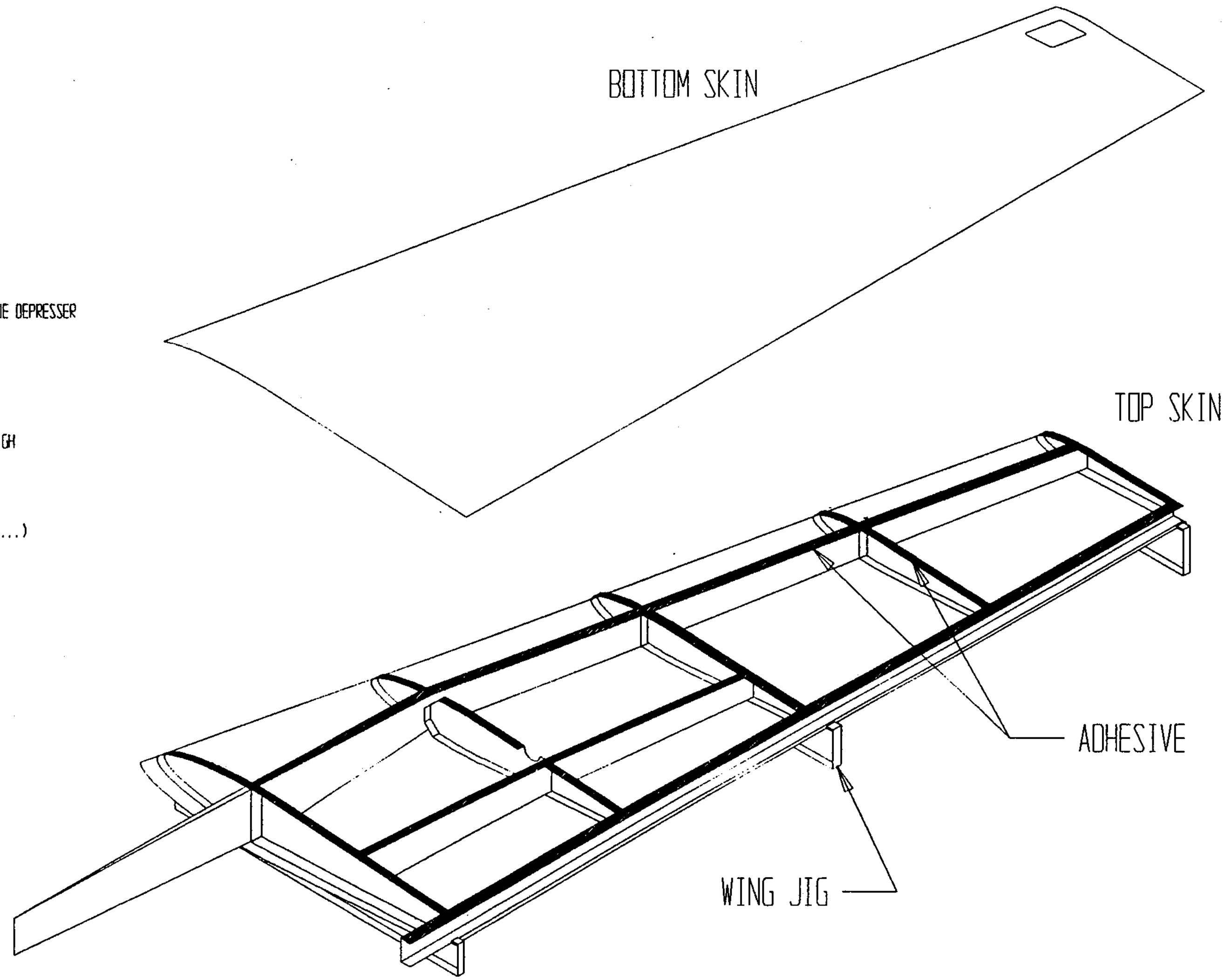
Prepare three, eight ounce batches of structural adhesive and thicken them to "mayonnaise" consistency. Put a generous but not excessive layer of structural adhesive on the ribs and spars. This layer should evenly cover the entire bond area of the ribs and spars.

Remember that you are trying to accomplish two things. First, you must force the skin firmly and completely onto all the bond areas. Second, you must press a perfect impression of the inner surface of the upper skin into the fairly thick mixture of structural adhesive that is on the ribs and spars. **The goal is to build up the thinnest possible layer of structural adhesive that will still provide a bond area that has no gaps or low spots.** Inadequate pressure over the bond areas will allow too thick a layer of structural adhesive to build up, however, you do not want to use so much pressure that you begin to locally deform the upper skin.

Step E Place The Wing Skin In Position

Carefully and slowly place the upper elevator skin into exact position on the spar, ribs and lower skin assembly. Try to lower the skin directly onto the ribs and spars without





BUILD UP BOND SURFACES ON RIBS AND SPARS

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smearing the adhesive. Install the Clecos in the holes drilled into the leading edge and the root and tip ribs earlier. place eight, 10 lb. sand bags or similar weight over the spar and two to three 10 lb sand bags over each rib. Place an aluminum angle over the trailing edge of the wing and use spring clamps to sandwich the trailing edge between this aluminum angle and the rear spar support tube. Allow the structural adhesive to cure undisturbed overnight.

Step F Remove The Wing Skin

After adequate cure time, remove the upper skin. This should be a fairly simple process involving little more than some gentle tugging -- unless you have not done an adequate job of masking off the bond areas of the upper skin.

Inspect the hardened structural adhesive on the bond areas of the wing and spars. Ideally all the taped surface came into full contact with the adhesive. Look closely at the adhesive surface that were supposed to contact the taped and waxed sections of the wing skin. The areas that contacted properly should appear smooth and glossy. Those areas that did not contact the taped and waxed sections will have a slightly rougher, more irregular surface appearance.

Should you find such rough or irregular areas, it means that there are still some low spots in the bond area. If these low areas fall more than 1/16 inch below the surrounding areas, they will need to be built up until they too are of the proper height.

Start by thoroughly sanding the bond surfaces of the adhesive you just applied. If the low spots are prevalent over much of the bond area, you may want to apply another full layer of structural adhesive. If there are only a few localized low spots, it may be adequate to merely apply structural adhesive in the vicinity of the low spots. In any event, remember to place the upper skin exactly in position, and fully weight it in place.

Step G Drill Pressure Equalization Holes In The Wing Ribs

Drill a 3/32 inch hole through the aft rear corner of each wing rib (both leading and trailing edge ribs). These holes will allow air to escape from the panels when flying at high altitude. They will also act as drain holes for condensed moisture.

TASK W-15 Close The Left Wing

Brief Task Description:

This task first involves setting the wing into the wing jig, checking the jig for accuracy again, and then dry fitting the lower wing skin. Accuracy here will certainly serve to make the bonding operation smooth and accurate. You will finish this task by bonding the lower wing skin into place on the factory-completed wing assembly. As with the aileron, the wing gains an enormous amount of structural strength and rigidity thorough the process of bonding in the lower skin. However, accurate and careful you were in closing your ailerons, if anything, you should be even more so in this task. An aircraft is only as good as its wings. Take your time. Do not build in twist or error.

Also, though many of the steps you will perform in this task are identical to those you performed in closing the ailerons, there are some important differences. Take time to read and comprehend each step before you start the closing sequence.

Step A Dry Fit The Wing Skin

Dry fit the bottom skin one more time to be certain that it mates properly with the spar and ribs. Does the lower wing skin cover all the bond areas on the ribs and spars? Does the leading edge of the lower wing skin mate with the joggle in the leading edge of the upper wing skin correctly? It is possible that the lower wing skin might slightly overhang the bond areas. Any such overhangs will be trimmed later.

It is a very good idea for you to find the **two assistants** you plan to use and practice putting the lower wing skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower wing skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step B Prepare The Wing For Bonding

Be sure to completely mask off all exposed fittings on the wing. (If you are building your G-200 with wing tanks, **do not mask off the fuel vent fittings inside the tanks**. Once the skin is bonded into place, you will be unable to remove the masking, thus rendering the vent inoperable!) It will be very difficult to remove any excess adhesive that bonds to hinge assemblies, etc. Good masking will prevent this. Also, remember to use clear 3M tape to mask. Adhesive will soak through standard household masking tape.

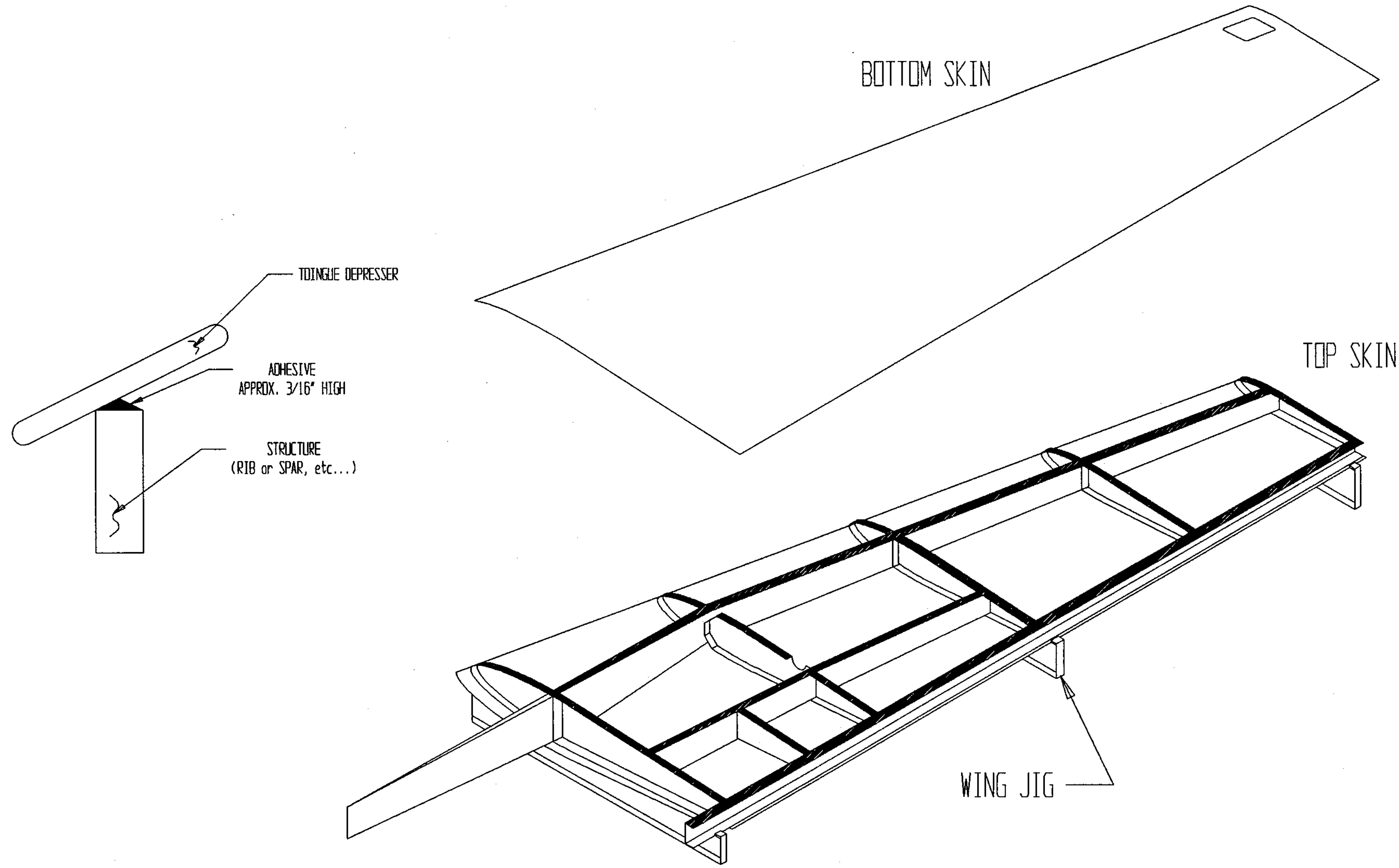
Next, prepare all bond zones of the skin, spar, and ribs for bonding. (See the General Information section of the manual.) Be sure that all are properly sanded and cleaned with acetone immediately prior to bonding. The structural integrity of your aircraft depends heavily on proper bond surface preparation. Please re-read the section on "Bonding Procedures" in the general Information section of this manual.

> CRITICAL NOTE:
> The importance of proper surface preparation for bonding cannot be overemphasized. Make absolutely certain that all surfaces have been properly cleaned with acetone, sanded with 80 grit sandpaper, then cleaned once more with acetone. The surface should appear completely dull with no shiny areas anywhere.

Recheck the alignment of the jig formers. With the wing held in place in the jig, recheck everything. Are the wing's leading and trailing edges **precisely** matched up with the leading and trailing edge marks on the formers? Are those marks all still in **exactly** the same plane? Is that plane still **perfectly** level? Recheck **everything** before proceeding. This is you last chance to correct any error in the jig.

Step C Prepare And Apply Adhesive To The Wing

Before you start the bonding process, you should be very sure that you have everything ready. As with the ailerons, once you start applying the adhesive, you can not stop. Though you now have the benefit of the experience from closing the ailerons, closing the wings is a larger task. You will only have about forty five minutes to work with the adhesive before it starts to cure. Therefor you will need at least two assistants to help mix and apply adhesive to the ribs and spars. It is also be helpful to measure out the adhesive components ahead of time and place them in separate cups on your work table. This way, once you start the bonding process, you do not have to waste time measuring out adhesive.



APPLY ADHESIVE TO LEADING EDGE JOGGLE AND SHADED AREA FOR CLOSURE

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All the tools and materials you need must be close at hand and ready to use. Here are the things that you will want to have standing by before you start to mix adhesive:

- Latex gloves for mixing and applying adhesive.
- Tongue depressors for applying and cleaning up adhesive.
- A roll of paper towels for clean up.
- Adequate solvent for clean up.
- A 10' long aluminum "L" section. One wide face of this piece should be protected with clear 3M tape where it will contact the carbon fiber of the wing skin.
- About 20 spring clamps.
- Twenty four 10 lb. sand bags or lead shot bags to provide clamping pressure for the lower skin during cure.
- At least two trained, eager assistants

READ THIS BEFORE PROCEEDING:
Bonding the lower wing skin in place requires at least two helpers and the knowledge that you will have the time to complete the following steps in uninterrupted succession:

1. 4 hours to complete the application and clean up of the adhesive.
2. 24 hours at 65 to 85 F degrees F for the initial cure

Measure out and mix four, eight ounce batches of structural adhesive (you may wish to refer to the section entitled "Mixing and Thickening Epoxy Adhesives" in the General Information Section of this manual at this time). Measure and mix according to manufacturer's instructions. Stir slowly at first, then continue to stir for at least two minutes after your mixture assumes a uniform viscosity. After thoroughly mixing the adhesive, add enough structural filler to achieve "mayonnaise" consistency. This will prevent the mixture from flowing out of the joints during cure. Leave one cup unthickened (8 oz).

You may find it helpful to place a few sand bags in the wing, away from the bond areas, before you apply the adhesive. The weight of the sand bags will serve to hold the wing in place as you apply the adhesive.

Apply a thin but even layer of the thickened adhesive mixture to **all the bond zones** of the upper skin / spar / rib assembly:

- Wing leading edge.
- Wing ribs.
- Wing spar.
- Wing rear spar.

When applying the adhesive, try to form it into a triangular shape on the tops of the ribs and spars. This will help prevent voids in the bonded areas.

Now find the areas on the lower skin which mate to the ribs and spars of the upper skin assembly. Use a small brush with stiff bristles to paint the unthickened adhesive on all of these areas. Be sure to coat **all** areas that will come into contact with a rib or spar surface.

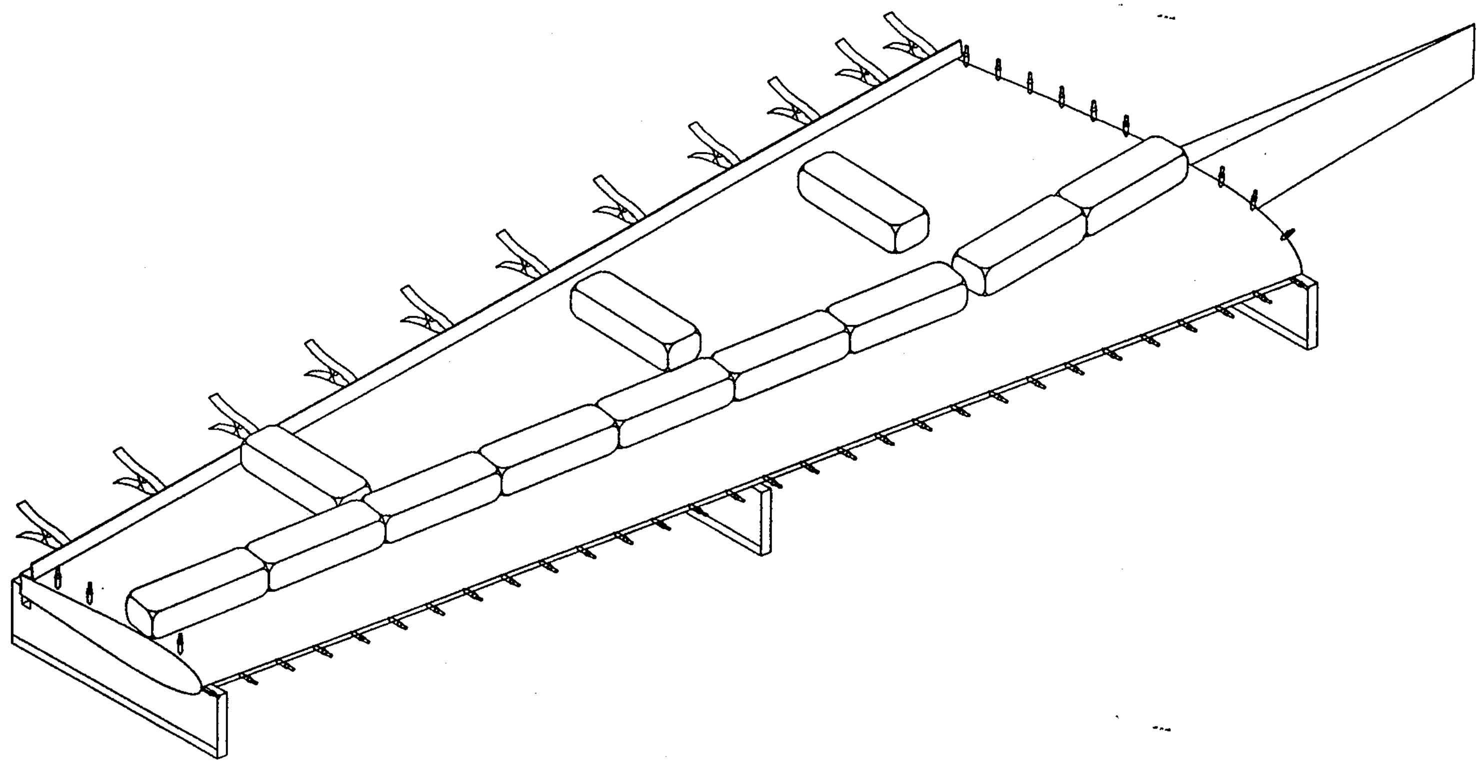
VERY IMPORTANT: Be very certain to remove all sand bags and tools (or any other foreign matter that you do not wish to become a permanent part of the aircraft) from inside the wing now.

Using a helper, carefully, slowly, and precisely, position the lower wing skin into place over the bond area. Get it dead right the this time! Put the skin down as close to it's final position as you can.. Be sure that the leading edge of the lower wing skin is fully seated into its joggle recess along its entire length The less you have to move it to get proper alignment, the less adhesive you will smear, and the better bond you will make.

Step D Bond The Lower Wing Skin In Place

Next, start to secure the wing into the construction jig. In general, you want to move from the leading edge to the trailing edge. The effect will be to gently pull the lower wing skin aft, thereby seating it into the leading edge joggle, bonding it to the wing spar and finally into the trailing edge.

Install Clecos into the holes drilled earlier in the leading edge. When inserting these Clecos, start from the center of the aileron and move outward.. Place 10 lb. sandbags every foot along the spar. Place two or three, 10 lb. sand bags over every rib. Clamp the freshly bonded trailing edge of the wing between a steel support tube situated under the top of the rear spar and an aluminum "L" section placed over the trailing edge of the skin.



WING CLOSURE

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Wipe off any excess structural adhesive that has squeezed out along bond lines. Excess adhesive adds weight but not strength.. This will also help minimize sanding, filling, and fairing when you finish your aircraft.

CRITICAL: **You must allow each bonded wing to cure undisturbed in the construction jig for a minimum of 24 hours at 65_ F** -- however it is preferable to allow a minimum of 12 hours cure time at 85_ to 110_F. A small electric heater placed under the work table (but away from any combustibles) can help you achieve higher temperature readings in the vicinity of your wing construction jig. **Do not loosen any clamps or move any sandbags during this period.**

Step E Remove Wing Form The Jig After Complete Cure

Only after the bond in the wing has completed an initial cure of at least 24 hours at 65_F, should you loosen your clamps and Clecos and remove the aileron from the aileron construction jig. Do not rush to remove the aileron from the construction jig. Allow full and complete cure time.

Step F Trim The Trailing Edge Of The Wing

Place a marks on the outside of the wing skin near the trailing edge that are exactly 4.25 inches from the center of each hinge. Do this on both the top and bottom of the wing. These marks represent the trim line for the trailing edge. Use a carpenters snap line or a long straight edge to draw a line through these marks. Trim the trailing edge just outside of this line using a jigsaw with a fine toothed blade. Use a belt sander or a sanding block to trim the trailing edge down to the line.

TASK W-16 Close The Right Wing

Brief Task Description:

In this task you will modify the wing jig to accommodate the right wing. Then you will use this jig to close the right wing. Note that the procedure used to close the right wing is identical to that previously used to close the left wing.

Step A Remove The Support Tube From The Wing Jig

Remove the support tube from the jig formers being careful not to damage the formers themselves. The clear tape placed on the tube earlier should have prevented the body filler from adhering to the tube. If you cannot pull the tube out by hand, tap the tube lightly with a hammer to knock it out of the notches.

Step B Switch The Positions Of The Root And Tip Formers

Remove the root and tip formers from your construction table. Leave the steel angle brackets attached to your work surface. Switch the positions of the root and tip formers on your work table. Trial fit the support tube in place in the former notches. Note that the tube will now protrude slightly above the surface of the formers. You will need to grind some of the body filler out of the notches to get the support tube to sit all the way into them. Now remove the tube from the jig and set it aside.

Step C Align The Wing Jig

Reposition the two steel angle brackets which support the leading edge alignment string. Repeat the alignment procedure you performed in task W-11 to align the wing construction jig.. Double check to be sure your two alignment strings are tight and level. Once the formers are properly aligned, replace the support tubes using body filler as you did previously.

Step D Build Bond Area On Ribs And Spars

Refer to task W-14 to build up a level bond area on the ribs and spars of the right wing. Remember to properly prepare all bond areas before applying the adhesive.

Step E Close The Right Wing

Mount the lower skin on the right wing using the procedure outlined in task W-16 for the left wing.

TASK W-17 Safely Store The Completed Wings & Ailerons

Brief Task Description:

Remember the 1st Law of Hangar Rash:

> "The likelihood of accidental damage to any experimental aircraft component varies directly with the product of its cost of replacement and the number of hours of work already expended on it."

Step A Find A Safe Place For Your Wings And Ailerons

Find a safe place to store your completed wings and ailerons. A very safe place. If they are where they might get bumped, cover them with moving blankets. Never allow things to fall on them. If you must store them on end, use generous amounts of foam padding to protect them where they contact the floor. Put eyes into the wall and tie your components in place if they are at any risk of falling over. Explain the concept of tribal banishment to your family members. Casually introduce the phrase "...pound of flesh..." into your dinner table conversation.

OPTIONAL TASKS

Wing Tanks:

If the builder decides that he or she might want to use the wing to carry fuel, tasks OPT-1, OPT-2 and OPT-3 must be completed while the wing is open. These operations will be impossible to perform after the wing is closed.

IMPORTANT OPERATIONAL NOTE:

Due to their design, it is possible to unport the G-200 wing fuel tanks at moderate or high angles of attack. Such angles of attack are routinely achieved by the G-200 during normal takeoff and climb out. Unporting can result in fuel starvation and engine failure. For that reason AkroTech states that **wing fuel tanks should be used only for level flight**. For other flight conditions such as takeoff, climb out, maneuvering, descent, and landing the pilot should select the primary fuel tank installed in the G-200 fuselage.

Required Placard Language:

DO NOT USE WING FUEL TANKS FOR TAKEOFF, LANDING, OR MANEUVERING. FUEL FLOW TO ENGINE MAY BE INTERRUPTED.

TASK OPT-1 Install The Fuel Level Sensor In The Left Wing

Step A Cut A Hole In The Root Rib For The Fuel Sensor

Find the aluminum backing plate supplied with your fuel level sensor. Place this backing plate in its appropriate position on the root rib of the left wing and trace its outline using a felt tip pen. Drill 1/4 inch holes in the corners of this outline then use a jigsaw to cut out the hole. Smooth the edges of the hole using the drum sander attachment on your Dremel tool.

Step B Laminate Fiberglass Over The Hole

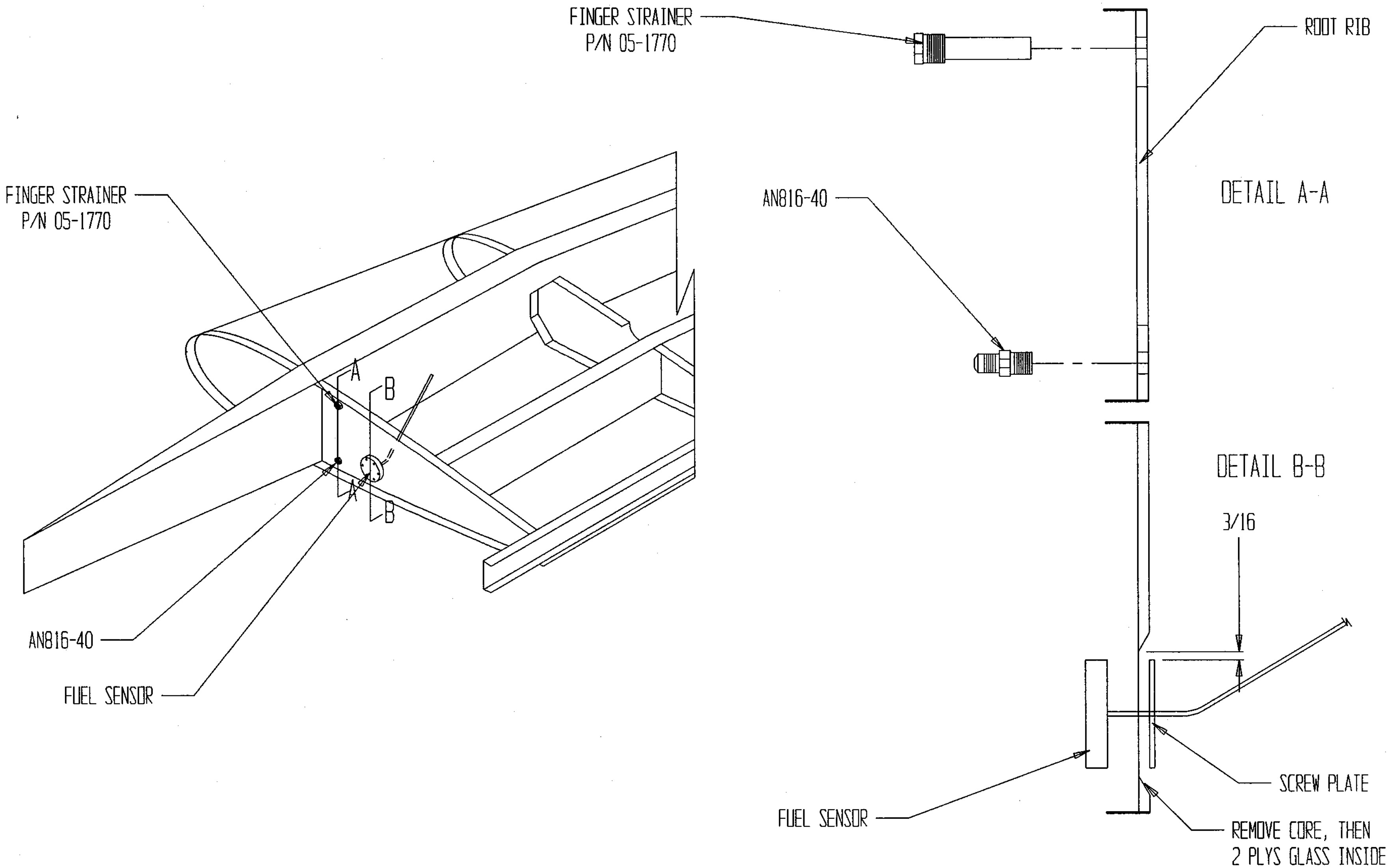
Find a flat piece of wood that will cover the hole and place some clear tape over one side of the wood. Clamp the wood over the hole on the outside of the root rib (with the clear tape up against the rib).

Cut out three squares of fiberglass about 1.5 inches larger than the holes on all sides. Prepare a small batch of laminating resin and pour about a third of the resin into a separate cup. Use the larger batch of resin to wet out the three plies of glass onto a piece of plastic on your work bench. Mix microballoons in with the remaining resin until it assumes the consistency of peanut butter. Use this mixture to fill the core material surrounding the cutout in the rib and to create a generous radius between the rib and the clear-taped surface of the wood block. Now install the wet fiberglass over the hole on the inside of the rib. Allow this lay-up to cure completely.

Remove the wood block from the rib. Prepare the fiberglass surface on the outside of the rib for bonding. Also prepare the surface of the rib surrounding the hole for bonding. Mix up some more laminating resin and laminate three more plies of glass over hole on the outside of the rib. This lay-up should also extend at least 1 inch onto the surface of the ribs surrounding the hole. Allow the lay-up to cure completely.

Step C Drill Holes For The Fuel Level Sensor In The Root Rib

Center the backing plate for the fuel level sensor on the fiberglass lay-up. Trace the outline of the holes on the fiberglass. Remove the backing plate and drill slightly



FUEL LEVEL SENSOR AND TANK FITTING INSTALLATION

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oversized holes for the probe and the mounting screws through the fiberglass using the marks as a guide. Trial fit the sensor on the root rib using the supplied mounting screws.

Step D Install The Backing Plate For The Fuel Level Sensor

Prepare one side of the fuel level sensor backing plate and the inside surface of the fiberglass lay-up for bonding. Wax the mounting screws for the fuel level sensor. Prepare a small batch of structural adhesive and thicken it to "mayo" consistency. Apply the adhesive to the backing plate. Try to stay away from the holes on the backing plate when applying the adhesive. Press the backing plate into position on the inside of the root rib. Insert the fuel sensor probe through the backing plate (make sure the gasket is on the base of the sensor) and mount it using the waxed mounting screws. Remove any excess adhesive then allow to cure.

Step E Bend The Fuel Level Probe

You will need to bend the fuel level probe so that it dips immediately down to the bottom of the tank and then gradually up to the top of the tank (don't forget the wing is upside down in the jig!). Refer to the manufacturer's instructions (included in the back of this manual) to do this.

TASK OPT-2 Seal And Prepare The Interior Of The Wing Tanks

Brief Task Description:

If you do wish to use your wings to carry fuel, it is essential that all fuel contact surfaces be sealed. The carbon fiber material in your G-200 is not susceptible to chemical attack by gasoline, however, it is porous to some liquids, including gasoline. Therefore, it is necessary to carefully and thoroughly seal all carbon fiber surfaces that will come in contact with fuel. If this is not done, fuel will weep out of the wing tanks or into the core material.

The sealant specified for use in the wing tanks of the AkroTech G-200 is:

Jeffco 9700 FCR resin
Jeffco 9700 FCR hardener

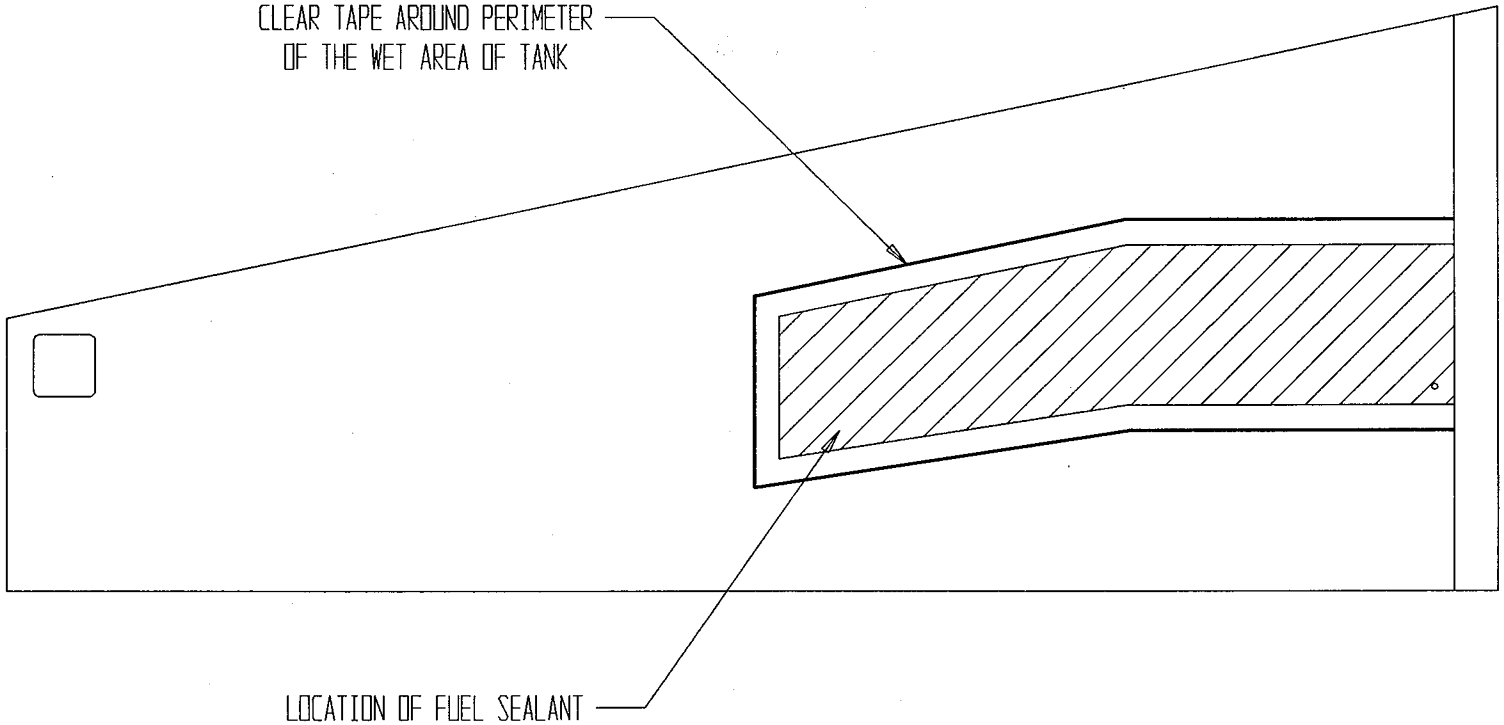
Step A Mark Off The Tank Area On The Wing Skin

Start the sealing process with a clean tank area. Rub carpenter's chalk liberally onto the spars and ribs that cross through the wet area of the tank. Place the lower wing skin in exact position atop the wing/rib/spar assembly. Remove the skin, note the location of the areas where the chalk transferred into the lower wing skin.

Use a soapstone pencil to mark the outside perimeter of the area where the skin makes contact with the chalked bond areas. This will provide an accurate picture of the area of the lower wing skin that will be in fuel contact and thus in need of sealing. If the first attempt at the chalk transfer technique is only partially successful, try again. Try spraying the ribs and spars very lightly with water from a sprits bottle after you have rubbed chalk on them. This may help more chalk to transfer. It may require several attempts to complete. Remember to thoroughly **clean all the chalk** from the bond areas after you are done. Several good scrubbings with a damp sponge will normally do the job.

Step B Clean The Tank Area

On the lower wing skin, run a line of clear 3M tape 1" outside the perimeter of the wet area of the tank. The area inside the tape is what will be sealed in the next operation.



INSIDE VIEW OF BOTTOM WING SKIN

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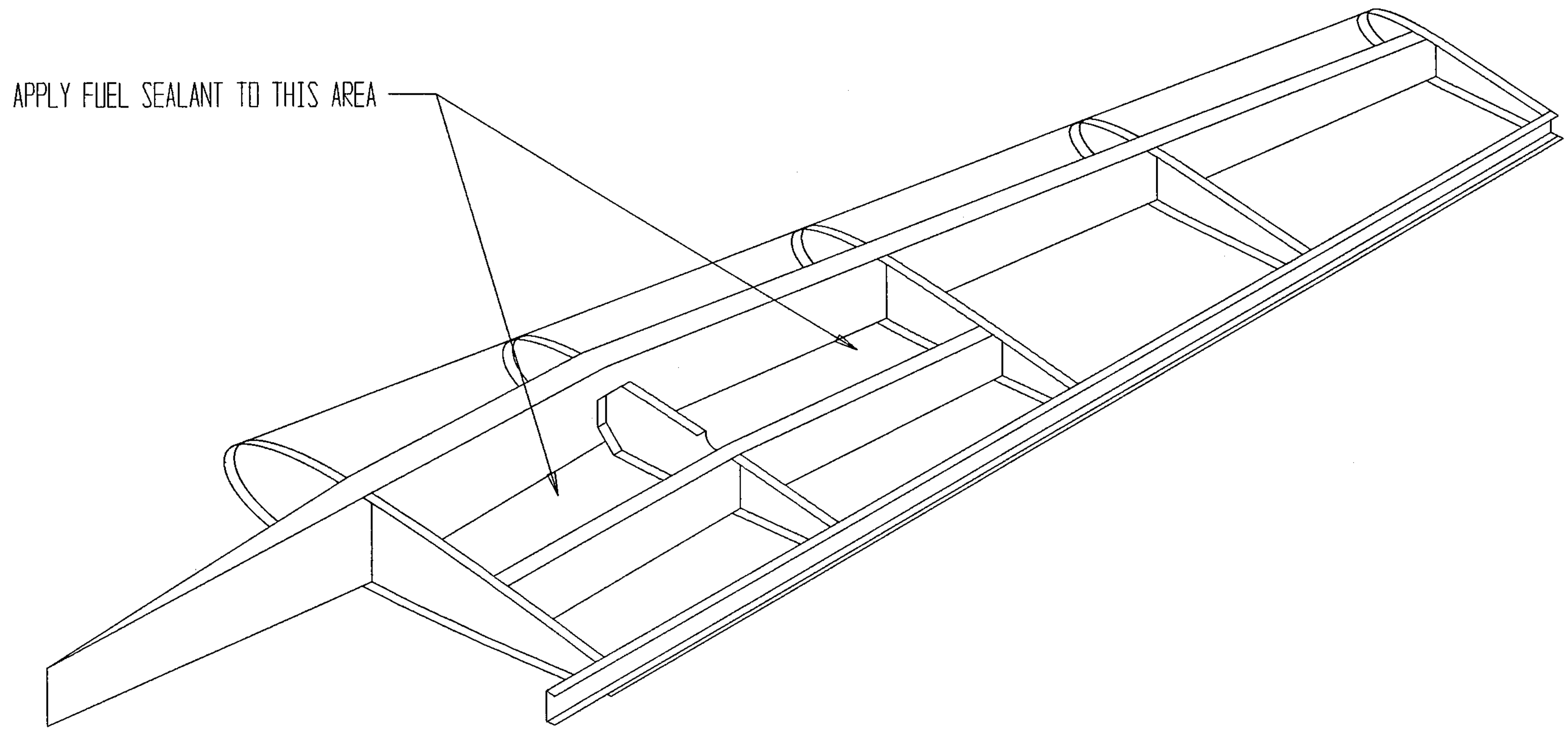

WING TANK LOCATION

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Using acetone, thoroughly clean all the surfaces of the wing skins, ribs, and spars to be sealed. This will help provide a good bond between the sealing compound and the carbon fiber surface to which it is applied. Protect the threads of the fitting holes with clay or silicone and the surface of the sensor probe with tape.

Step C Apply Sealer To The Tank Area

Mix sealer per manufacturer's instructions. Thoroughly and completely coat all the fuel contact surfaces of the tank area. This includes not only the inside of the wing skins but the spars and ribs as well. If fuel can touch it, it must be sealed.. Do not coat the bond areas of the ribs, spar, and lower wing skin with sealer..

Do not forget to seal the fuel contact areas on the lower wing skin. These deserve special attention. After all, the upper surfaces of the tank will be in fuel contact some of the time, however the lower surface of the tank will be in fuel contact all the time. Remember that any area that does not get thoroughly sealed will be the likely source of a fuel weep-through problem.

Before the first complete coat of sealing epoxy has fully cured, we recommend that a second complete coat be applied. This second coat will go on wet-on-wet. The second coat may add a small amount of extra weight, but it will provide extra confidence. If you do not wish to apply a complete second coat of sealing epoxy, you may wish to apply a partial second coat to only the fuel contact surfaces of the lower half of the tank. Allow to cure.

After the interior surfaces of the wing tanks have cured, turn the wing over. Mix up enough sealer to carefully seal the exposed edges of the carbon fiber that you sanded away from the edges of the exterior of the fuel tank filler neck. Allow to cure.

Step D Remove The Skin From The Fuel Cap Flange

Lay the wing panel, upper skin down, on your work table. Locate the gas cap fitting ring that is factory-bonded into each upper wing skin. Drill a 3/4" hole through the wing skin in the center of the fitting. Carefully enlarge the hole with an 1/2" cylindrical abrasive bit or drum sanding attachment. Work cautiously.

When you start to get close to the fitting, switch to sand paper, and remove the remaining material by hand sanding. The goal is to remove all the carbon fiber material from the inside of the gas cap fitting without damaging the aluminum fitting itself. (Any damage to this fitting may result in a gas cap that will not seal properly.)

TASK OPT-3 Install Fittings In The Wing Tanks

Step A Install Fittings Into The Phenolic Inserts

Find the locations where the fuel supply lines, the fuel vents, and the fuel drain will attach to the wing.

1. **The fuel intake finger strainer** is installed in the lower pre-drilled and tapped hole (now on the top) through the root rib in what will be the low point of the tank in level flight.
2. **The fuel tank vent fitting** is installed in the upper pre-drilled and tapped hole (now on the bottom) in the root rib. This will be the high point of the tank in level flight.
3. **The fuel drain** must be placed at the low point of the tank when the aircraft is at rest on the tarmac in a 3 point attitude. Therefore, the fitting is installed in the lower wing skin at the extreme aft, inboard corner of the tank. (Note that the lower wing skin is the one that **does not** have the ribs and spars bonded in place.) Locate the pre-installed phenolic block in the lower wing skin and drill and tap a hole for the fuel drain fitting. (See illustration.)

Apply a small amount of structural adhesive to the threads of these fittings when mounting them in their tapped holes. This will assure a tight seal.

Remember that you are building the wing upside down. Therefore, as the wing appears when you work on it, the fittings may seem to be incorrectly placed. Make certain that the fittings are in correct position.

Empennage Construction Tasks

TASK E-1 Build The Stabilizer / Elevator Jig

Brief Task Description:

Like the wings and ailerons, you may have noticed that the stabilizer and elevator, as you received them, are not completely rigid. That is, they can be flexed and twisted to a certain degree. Having already completed and closed the wings and ailerons, you can expect that the stabilizer and elevator will also gain several orders of magnitude of stiffness once they have been closed by bonding their upper skins into place. In order for the stabilizer and elevator to be absolutely free of twist once closed, they too must be secured into a true, twist-free jig as their upper skins are bonded into place. In this task you will make that jig.

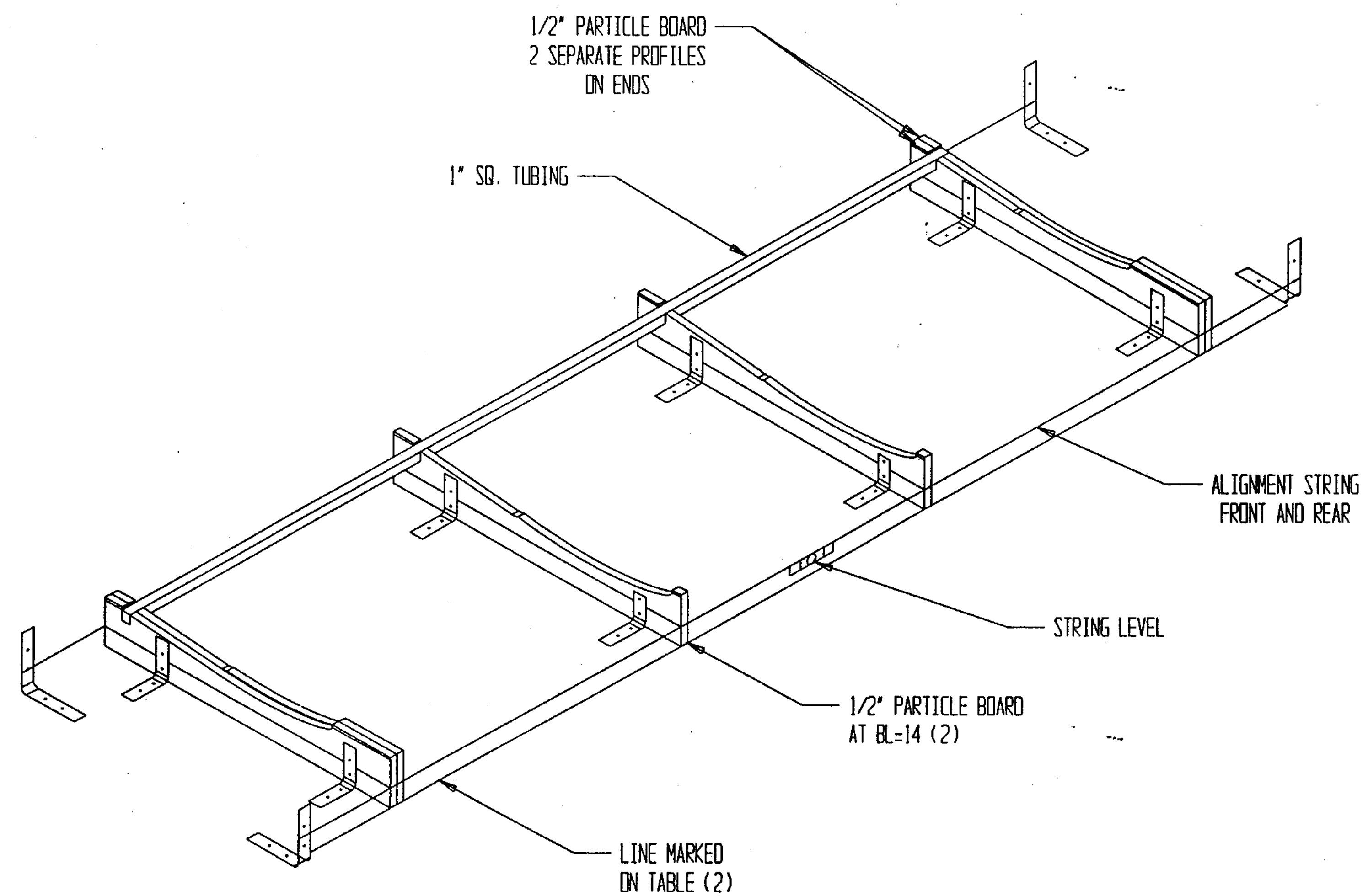
We outline a procedure that allows you to use a single jig for the assembly of both the stabilizer and the elevator. This will save you time and effort since only one jig will need to be built, aligned, and affixed to the work surface.

Step A Cut Out The Stabilizer / Elevator Jig Formers

Remove the Stabilizer / Elevator jig former templates from this manual and use spray adhesive to mount them to 1/2 inch particle board or plywood. Cut out the Stabilizer / Elevator jig formers using a jigsaw. Stay just to the outside of the line when cutting, then use a belt sander or sanding block to bring the former surface down to the line.

The outboard jig formers will need to be secured together with small drywall screws. These two formers support both the tip of the stab and the inboard side of the elevator counterbalance arm. Make sure the chordlines of these two formers are aligned before screwing the them together.

Just as you did for the aileron and wing jigs, make a cutout near the trailing edge of the elevator in each stabilizer / elevator construction jig former for a 1 inch square steel support tube. You can use the same tubing that was used for the wing jig. This tube will be used to support the trailing edge of the elevator along its entire length.



ELEVATOR AND HORIZONTAL STABILIZER FORMERS

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Step B Mark The Former Locations On The Construction Table

Lay the stabilizer on your work table so that its trailing edge rests exactly over the previously marked chalk line. Taking time to work accurately, put tick marks on the chalk line at the location of the vertical web (not the rib flanges) of the inboard ribs (BL 12 ribs) , and at the outboard side of the stabilizer tip rib (BL 41.375 ribs).

Use a carpenter's square and lay out lines, perpendicular to the chalk line, and extending away from the edge of the work table, at each of the tick marks. These will be the reference lines on which you will set up your stabilizer / elevator construction jig formers.

Step C Mount The Angle Brackets To The Table

Now position the steel angle brackets that will support the stabilizer / elevator formers.. Clamp four, 4 inch steel angle brackets to either side of each former (do not screw them to the formers yet). The brackets should be positioned as indicated on the former templates. Place the formers in position on the table (with the angle brackets clamped to them) so that the inboard edge of each former is aligned with its appropriate mark on the table and so that the trailing edge of each former is aligned with the chalk line near the edge of the table. Screw the angle brackets to the work surface (but not into the formers yet) so that they will support each former in the proper position on the table. After screwing the angle brackets to the table surface, remove the clamps. Each former should now be snug between its brackets, but still able to slide so that it can be adjusted later.

TASK E-2 Align The Stabilizer / Elevator Jig

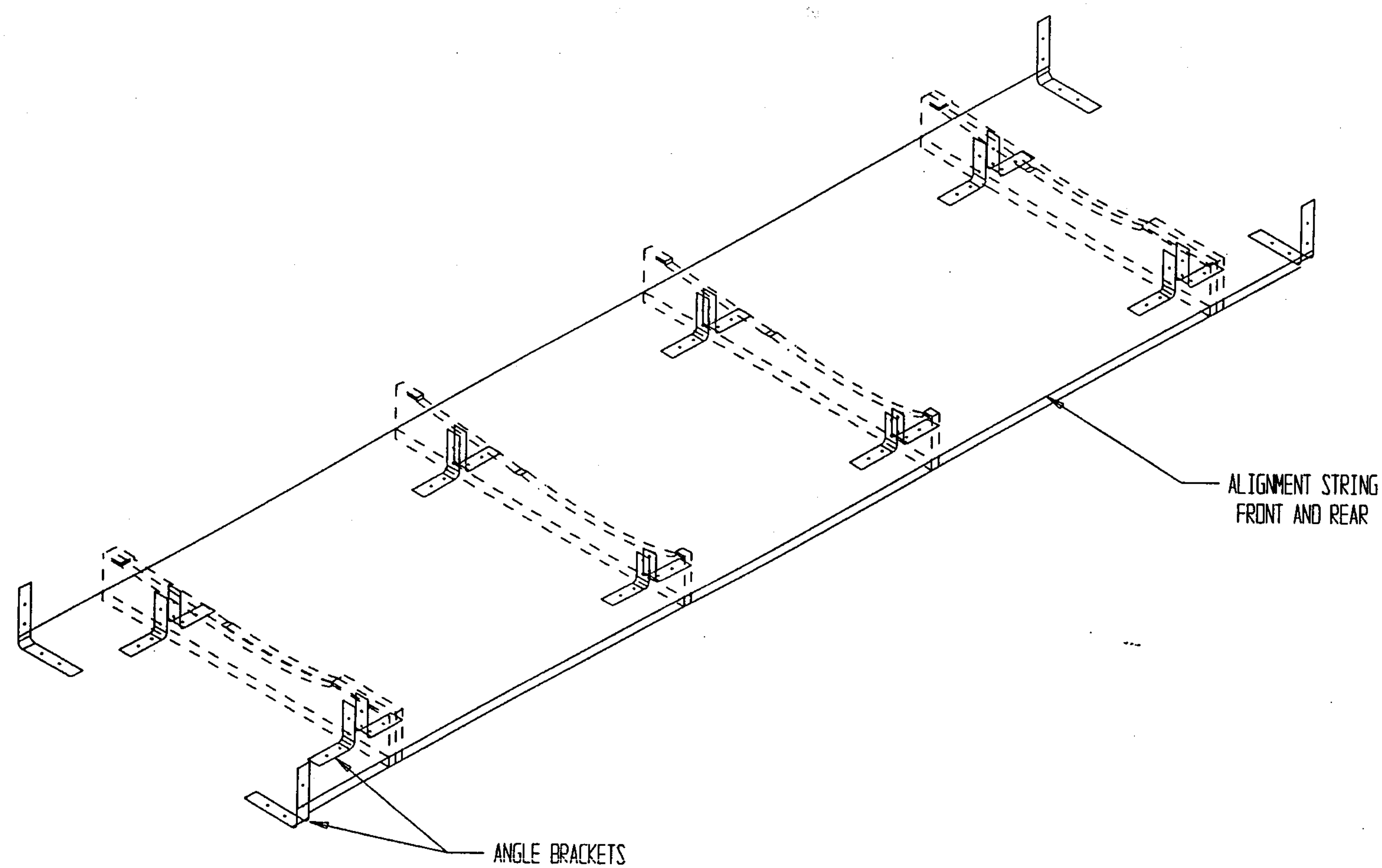
Brief Task Description:

Having made the components for the stabilizer / elevator jig, and having roughly laid out their location on your work table, in this task you will assemble and precisely align the stabilizer / elevator construction jig.. Just as was the case with the wing and aileron assemblies, accuracy is essential here. Your stabilizer and elevator will only be as good as the jig in which you build it.

Step A Align The Stabilizer Jig

The alignment procedures you used for the wing and aileron jigs are identical to those that you will use for the stabilizer / elevator construction jig. That being the case, we refer you back to the section of the wing manual that details the wing jig alignment procedure.

CRITICAL: Just as was the case with the wings and the ailerons; accuracy matters here. Warped and twisted empennage or control surfaces will result in an aircraft that is less than it otherwise would have been. Take the time to get it right. An extra few minutes invested in accurate work now will provide rewards in each of the thousands of hours you will spend flying your G-200.



ALIGNING ELEVATOR AND HORIZONTAL STABILIZER FORMERS

DRAWING NO. 20028A	TASK NO.	STEP NO.	AkroTech	
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TASK E-3 Trim The Stabilizer And Elevator Skins

Step A Trim The Counterbalance Skins From The Stabilizer

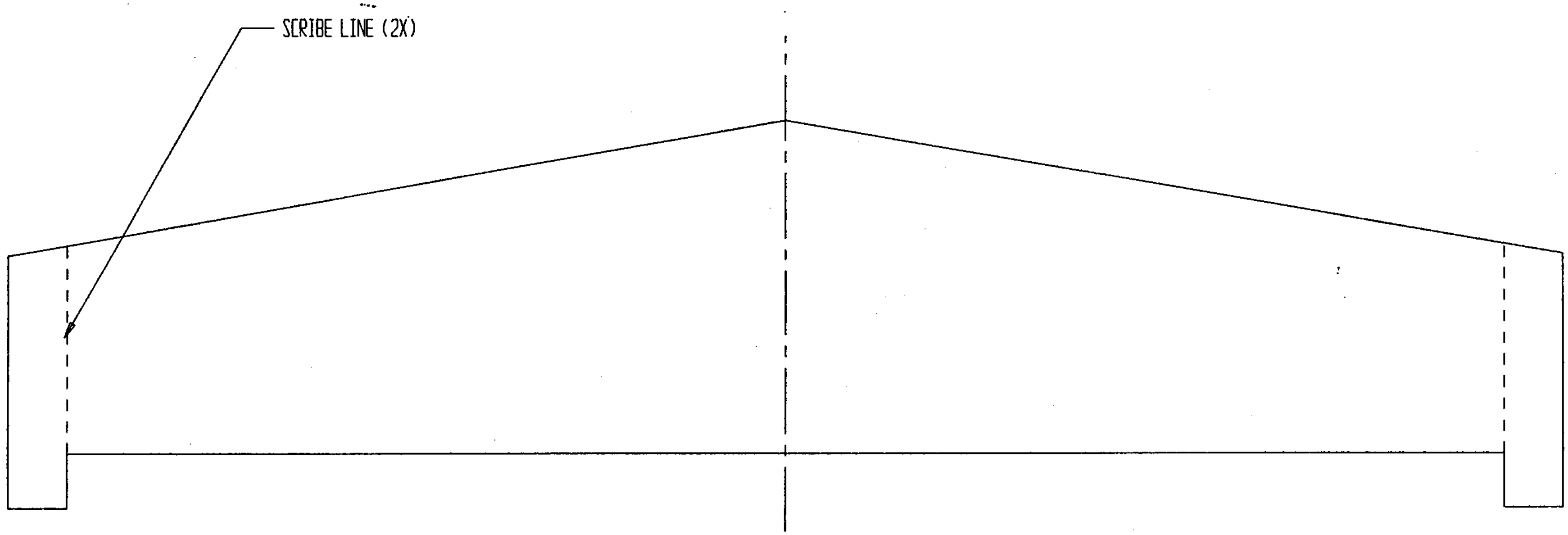
Note that the close out skins for the elevator counterbalance arms are actually molded as part of the stabilizer skin. Trim these pieces from the stabilizer skins by cutting along the molded scribe line. Cut carefully along this line as you will be using the material on both sides of the cut. Set the counterbalance arm skins someplace where they won't be lost; they will be used later when the elevator is closed.

Step B Trim The Leading Edge Of The Lower Stabilizer Skin

The leading edge of the lower stabilizer skin (the skin without the ribs and spars) will need to trimmed so that it will fit inside the joggle in the upper skin assembly. Use a cut off wheel or a jigsaw to trim the lower skin along the molded recess at the leading edge. After trimming, trial fit the skin over the upper skin assembly to check for proper fit. Carefully sand the skin as necessary to achieve a tight fit at the leading edge.

Step C Trim The Elevator Skins

Now you will need to trim leading edge of the lower elevator skin (the skin without the ribs and spar) at the counterbalance arm locations. Place the lower elevator skin on the upper elevator assembly and mark the locations of the inside edge of the counterbalance arm on the skin. Cut the leading edge of the lower skin back until it is even with the forward edge of the flange on the elevator spar.



TRIM ELEVATOR COUNTER BALANCE ARM SKINS FROM STABILIZER

DRAWING NO. 200119A	TASK NO.	STEP NO.	AkroTech	
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TASK E-4 Insert Bearings In The Elevator Hinges

Brief Task Description:

The elevator hinge receiver brackets, like the aileron hinge receiver brackets, require the builder to install bearings. This is a simple process, but certain precautions are necessary. First, the hinge receiver brackets must be honed out to a diameter appropriate to the bearing. The bearings should install with an easy press fit into their respective hinge receiver brackets. Too tight a fit will cause the bearing to bind and be less readily self-aligning than it should be. Second, dress or de-burr the hole for the bearing so that the bearing will drive in squarely. Third, the bearings should be *staked* in place. This will serve to insure that they remain captive in their hinge receiver brackets.

Step A Install Bearings Into The Elevator Hinges

Be certain that you have correctly identified the elevator hinges. Seat the self-aligning bearings into the hinges. This will be done in exactly the same manner as it was done for the aileron hinges. For instruction on this process, we refer you to the notes on the subject in the General Information Section.

TASK E-5 Mount The Elevator Hinges On The Stabilizer Spar

Brief Task Description:

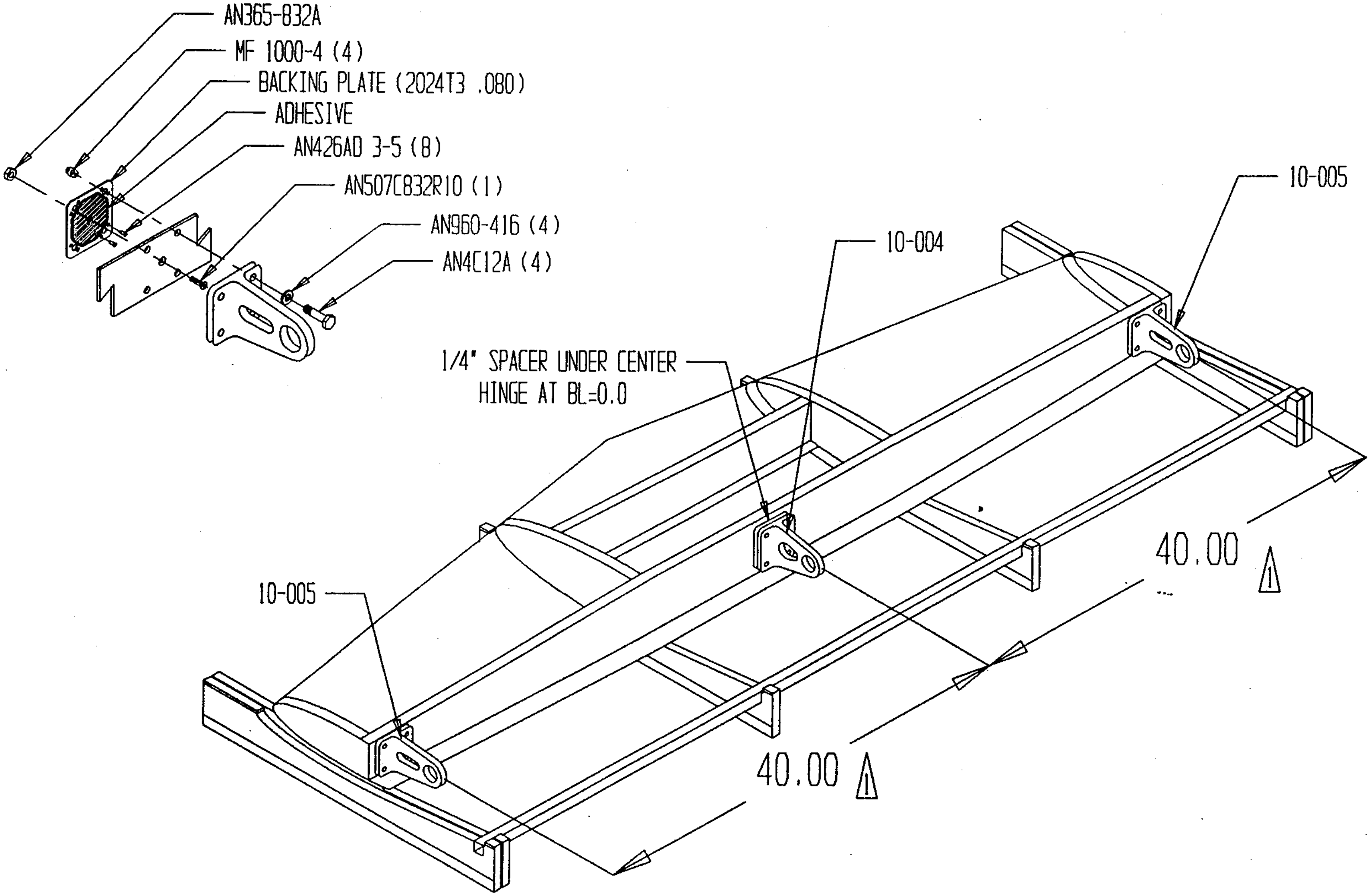
In this operation you will mount the elevator hinges onto the rear spar of the stabilizer. This is a critical task. Take time to check and recheck before you drill. Your accuracy here will have very tangible results. A properly aligned control system will feel just right, however even a slight error here can result in controls that simply are not as smooth and light as they otherwise could be.

NOTE:
There are three critical alignments to be maintained in this task. First, the horizontal centerline of each elevator hinge must be mounted exactly even with the horizontal centerline of the stabilizer spar. Second, each hinges must be placed at precisely the butt line measurement listed in the manual. In this task you will perform operations to precisely position the mid and outboard elevator hinges. Third, each hinge bracket **must** be mounted plumb, that is to say with its bracket arm perfectly vertical. A little extra care and attention to accuracy in this step could save you a great deal of totally avoidable added work and aggravation later.

Step A Mark Centerlines On The Hinges And Spar

Now you must position the elevator hinges at BL 40.0 To do this, it is necessary to find the vertical and horizontal center of those fittings as well. This is not complicated, but accuracy is essential here too.

First, place the stabilizer into the stabilizer jig. The stabilizer should be evenly supported by all the construction jig formers. It should be evenly seated in the jig. If the stabilizer is not resting squarely in the construction jig, gently but firmly force it into place by the use of weights and clamps. Remember, the jig is your "truth" reference. The stabilizer should be made to fit the jig, not the other way around.



NOTES:

1 - MEASURED FROM HINGE CENTER LINE(S)

ELEVATOR HINGE PLACEMENT

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Snap a horizontal chalk line along the exact centerline of the rear face of the stabilizer spar. Find BL 00 and both the right and left hand BL 40.0 (See reminder immediately below.) At those points, draw a crisp line that is perfectly perpendicular to the chalk line. These intersecting lines mark the position of the mid and outboard elevator hinges.

REMINDER:
BL 40.0 is 40.0 inches outboard from the exact centerline of the aircraft.

Find the BL 00 and BL 40.0 fittings. The BL 00 fitting is 1/4" shorter than the BL 40.0 fitting. (More simply, the two BL 40.0 fittings are identical, while the BL 00 differs from the other two.) Note that there are four holes drilled through the flat mounting surface of each hinge fitting.

Use a pencil and a straight edge to mark a line that exactly bisects the hole pattern mounting surfaces of those hinges. (A common pencil works fine on the aluminum fittings.) Using a straight edge, extend both ends of both lines around to the edge of each hinge. Make a small pencil "tick mark" on the thin edge of the mounting flange where it can be easily seen when the hinge is clamped to the stabilizer spar. These tick marks will help you align the centerlines of the fittings with those of the spar. The horizontal pair of tick marks will line up with the chalk line at the horizontal centerline of the stabilizer spar. The vertical pair will line up with the vertical lines that mark BL 00 and BL 40.0.

Step B Align The Elevator Hinges On The Stab Spar

Clamp only the two BL 40.0 hinges in place for the moment, using clamping pads where necessary. (Remember to make certain that the hinges themselves are vertically oriented.)

Run a length of monofilament fishing line through the bearing hole in the stabilizer tip hinge fitting, then through the bearing hole of the BL 00 hinge (even though you have not yet clamped it into position), and finally through the bearing hole of the hinge bolted into place on the other end of the stabilizer. Leave the monofilament line slack for the moment.

Obtain a piece of 1/4" thick material to act as a spacer in place of the rudder spar that will later cross over the rear side of the stabilizer spar at BL 00. You will need to transfer the tick marks you made on the stabilizer spar at BL 00 to the spacer. Next, clamp the BL 00 hinge fitting in position matching the tick marks you made on the fitting with the marks you made on the spar.

Now tighten the monofilament line so that it is quite snug. Make sure the line passes through the dead center of the bearing holes in the hinges at BL 00 and BL 40.0. This will place the monofilament line exactly level with, and parallel to, the horizontal centerline of the stabilizer spar, and exactly on the extended cord line of the stabilizer.

The monofilament line should pass exactly through the center of each bearing hole in each hinge. If it does, it indicates that all your elevator bearings will be in alignment. This is what you seek. However, should you find that the monofilament reference line does not intersect the exact center of the bearing hole in the hinge at BL 00, you will need to adjust that fitting until it does. It is more important that all three elevator hinge bearings are in perfect alignment than it is that the BL 00 elevator hinge be mounted on the precise horizontal centerline of the stabilizer spar.

If the monofilament reference line indicates that it is necessary, adjust the position of the BL 00 elevator hinge up or down until it is perfectly aligned with the elevator fittings at the stabilizer tip. Be certain that you keep the BL 00 elevator hinge exactly on BL 00, and perfectly plumb. If you find the hinge needs to be spaced further than ¼ inch from the surface of the spar to get it to line up with the outboard hinges, make and additional spacer from a piece of scrap aluminum. Clamp the hinge securely in place when you are confident it is in position.

Finally, do any of the bearing holes appear to be too far forward or too far aft? If so, please contact AkroTech before proceeding.

Step C Drill The Mounting Holes For The Hinges

Drill through the stab spar with a 1/4" drill using the mounting holes in each hinge as a template. Make sure the hinges do not move while you are drilling these holes. When finished, remove the hinges from the stab spar.

TASK E-6 Make And Install The Elevator Hinge Backing Plates

Brief Task Description:

In this task you will make and install the elevator hinge backing plates that mount to the stabilizer spar. You may wish to review the section entitled “Backing plates” in the General Information Section of this manual.

Step A Cut Out The Elevator Hinge Backing Plates

Trace the outline of the base of each elevator hinge on the supplied .080 aluminum backing plate material. Use a jigsaw or a bandsaw to cut out the three backing plates from this sheet. Smooth the edges of the backing plates with a file or belt sander.

Step B Drill Holes In The Backing Plates

Clamp each of the backing plates to its respective hinge. Use the hinge holes as a drill guide to drill the 1/4 inch holes in the backing plates.

Step C Install Nutplates In The Backing Plates

Refer to the General information section of this manual to install the 1/4-28 floating nutplates in each of the three backing plates.

Step D Bond The Backing Plates On The Stabilizer Spar

Prepare the backing plates and the forward face of the stab spar for bonding. Wax all of the elevator hinge mounting bolts. Mix a batch of structural adhesive and add enough filler to achieve “mayo” consistency. Apply the adhesive to all bond areas on the stab spar and the backing plates. Try to keep away from the holes on the backing plates and the spar when applying the adhesive. Press all three backing plates into position on the rear spar. Install the waxed bolts though the hinges and into the backing plates. Tighten the bolts down and remove any excess adhesive with a clean rag.

Step E Install The Stainless Steel Retaining Screws In The Backing Plates

After the adhesive has cured completely, remove the hinges from the stab spar. Use a no. 19 drill bit to drill a holes through the approximate center of each backing plate. Countersink these holes on the aft spar face using a 100 degree countersink. Install the supplied stainless steel screws through the spar and backing plates then secure these screws with the appropriate nuts.

TASK E-7 Cut The Elevator Hinge Slots

Brief Task Description:

In this task, slots will be cut in the leading edge of the elevator to clear the stab mounted elevator hinges.

Step A Mark The Position Of The Hinges On The Elevator

Mount the two outboard elevator hinges on the stabilizer using the supplied ¼ inch hardware. Hold the elevator up to the trailing edge of the stabilizer it will be mated to. Position the elevator so its inboard/ outboard alignment is correct. The outboard surface of the stab's tip rib should be spaced 1/8 inch from the inboard rib on the elevator's counterbalance arm. You can accomplish this by inserting 1/8 inch spacers between these ribs. When this is done, the elevator should be properly centered on the stabilizer.

Mark the location where the two outboard elevator hinges intersect the leading edge of the elevator skin. Since the aluminum hinges are 5/16" wide at the point at which they contact the elevator's leading edge, that is how far apart the marks should be on your elevator skins.

Step B Cut The Elevator Hinge Slots

Now cut a 3/8" slot that is centered on the marks you just made. To do that, cut a slot that is 1/32" wider than the marks you made. The slot should extend deep enough to allow the hinge to make contact with the elevator spar, with a little to spare. Cut the slot deep enough so that you can move the elevator up and down slightly. (This slot will be expanded and finished in a later step.)

TASK E-8 Locate The Hinge Receiver Brackets On The Elevator Spar

Brief Task Description:

In this operation you will use the hinges that you have just mounted on the stabilizer as a pattern to help you precisely locate and attach the mating hinge receiver brackets on the elevator.. You will then drill the mounting holes for these brackets into the elevator spar.

Step A Assemble The Hinge Receiver Brackets To The Elevator Hinges

Temporarily bolt the two outboard elevator hinge receiver brackets to the stab mounted hinges. Be sure to place washers on either side of the hinge bearings to properly center the hinges in the receiver bracket.

Step B Trim The Stabilizer Skin

Secure the stabilizer in the stabilizer/elevator jig using weights. Note that the trailing edge of the stabilizer skin has been left slightly long so that it can be trimmed for a custom fit. Install the elevator in the jig and press it up against the trailing edge skin on the stab. Approximate how much you will need to trim from the trailing edge of the stab to allow the hinge receiver brackets to reach the elevator spar. Remove the stabilizer from the jig and carefully trim the correct amount from the trailing edge.

NOTE: Be aware that you will be trimming the stab skin very close to its final dimension in this step. And since it is always much easier to cut material away than it is to put it back on, you should proceed with caution. To guard against trimming off too much, you may wish to trim the skin in incremental steps, each time placing the stab and elevator back in the jig to check the progress. Also, using a long sanding block after each trimming operation will help to keep the trailing edge straight.

Step C Position The Hinge Receiver Brackets On The Elevator Spar

Position the elevator up against the hinge receiver brackets (which are now assembled to the stab mounted elevator hinges).Place 1/8 inch spacers between the counterbalance arms on the elevator and the tip ribs of the stab to properly center the elevator. Adjust the receiver brackets so that they lie flat against the forward face of the elevator spar and are approximately centered. Use fine tipped felt pen to place a mark along either side of each hinge receiver bracket on the elevator spar. Remove the elevator from the jig and disassemble the receiver brackets from the hinges.

Step D Clamp The Hinge Receiver Brackets To The Elevator Spar

With the elevator out of the jig, carefully position the hinge receiver brackets between the marks made earlier on the elevator spar. Adjust each bracket vertically on the elevator spar until it is centered between the upper and lower spar caps. Adjust each bracket in rotation until it is level (a small level placed across the top of the hinge will work well). Use small C-clamps to clamp the brackets to the elevator spar once they are properly positioned.

Step E Drill Mounting Holes For The Hinge Receiver Brackets

With the hinge receiver brackets securely clamped to the elevator drill 1/4 inch holes through the elevator spar using the mounting holes in the brackets as a drill guide.

TASK E-9 Make And Install The Hinge Receiver Bracket Backing Plates

Step A Cut Out The Hinge Receiver Bracket Backing Plates

Trace the outline of the base of each hinge receiver on the supplied .080 aluminum backing plate material. Use a jigsaw or a bandsaw to cut out the two backing plates from this sheet. Smooth the edges of the backing plates with a file or belt sander.

Step B Drill Holes In The Backing Plates

Clamp each of the backing plates to its respective bracket. Use the bracket holes as a drill guide to drill the 1/4 inch holes in the backing plates.

Step C Install Nutplates In The Backing Plates

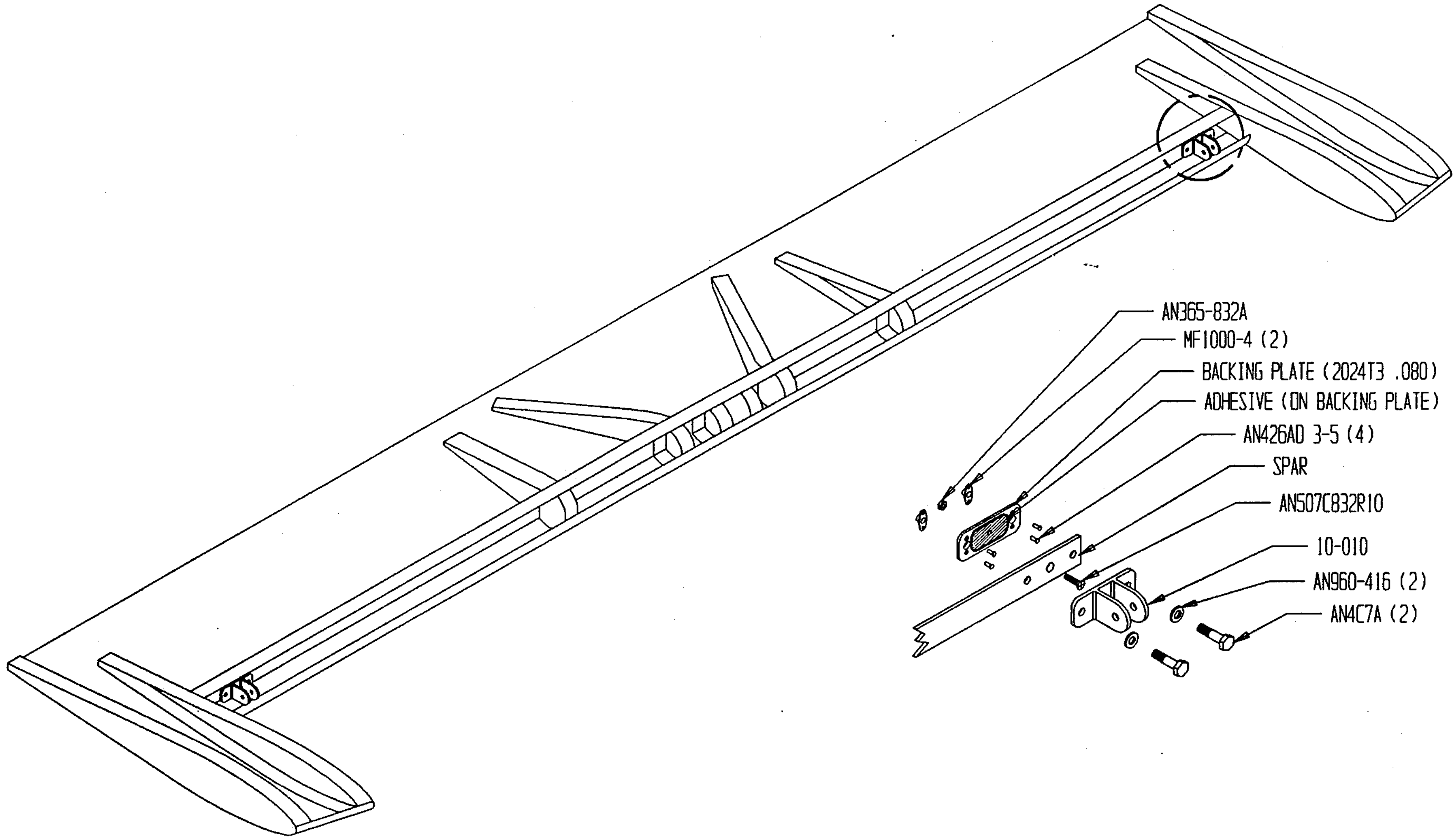
Refer to the General Information Section of this manual to install the 1/4-28 floating nutplates in each backing plate.

Step D Bond The Backing Plates On The Stabilizer Spar

Prepare the backing plates and the aft face of the elevator spar for bonding. Wax the receiver bracket mounting bolts. Mix a batch of structural adhesive and apply enough filler to achieve "mayo" consistency. Apply the adhesive to all bond areas on the elevator spar and the backing plates. Try to keep away from the holes on the backing plates and the spar when applying the adhesive. Press the backing plates into position on the elevator spar. Install the waxed bolts though the hinges and into the backing plates. Tighten the bolts down and remove any excess adhesive with a clean rag.

Step E Install The Stainless Steel Retaining Screws In The Backing Plates

After the adhesive has cured completely, remove the brackets from the elevator spar. Use a no. 19 drill bit to drill a holes through the approximate center of each backing plate. Countersink these holes on the aft spar face using a 100 degree countersink. Install the supplied stainless steel screws through the spar and backing plates then secure these screws with the appropriate nuts.



ELEVATOR HINGE RECIEVER BRACKET DETAIL

DRAWING NO. 20032B	TASK NO.	STEP NO.	AkroTech
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TASK E-10 Separate The Elevator And Install The Elevator Actuator

Brief Task Description:

In this task you will cut the elevator into separate left and right panels. This allows for installation and removal of the elevator without removing the rudder. After cutting the elevator in half, you will install the actuator and root ribs in the elevator panels.

Step A Cut The Elevator In Half

Find and mark the approximate centerline of the elevator. Draw a line perpendicular to the trailing edge through this mark. Cut the elevator in half using either a table saw or a hand held jigsaw with a long blade. You do not have to be very accurate with this cut since you will be trimming the elevator further in the next step.

Step B Trim The Inboard Edge Of The Elevator Panels

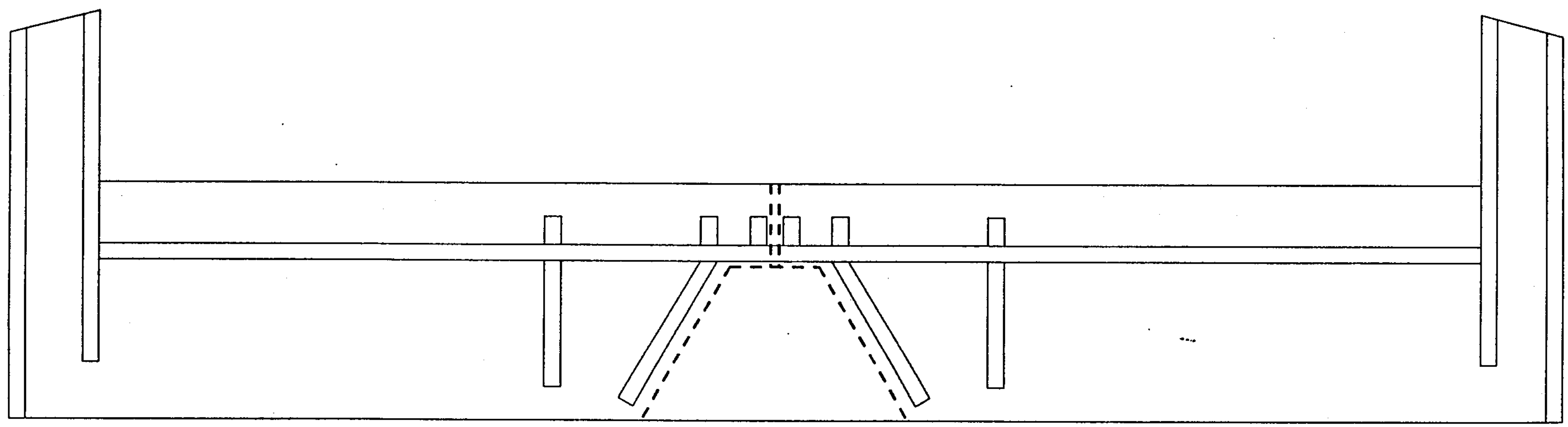
Trim inboard edge of the elevator panels to close to their final trim line using a jig saw or bandsaw. This trim line should be parallel to each counterbalance arm and exactly ??? inches from the inboard edge of the counterbalance arm.. Cut just inboard of this trim line, then use a belt sander to trim the skin and spar down to its final size. Once the elevator is trimmed, use the belt sander to round the edge of the spar to match the inside radius on the actuator arms.

Step C Mount The Elevator Hinges On The Stabilizer

Mount the elevator hinges on the stabilizer once again using the appropriate spacers and hardware.

Step D Install The Stab And Elevator In The Stab / Elevator Jig

Install the stabilizer in the stab / elevator jig and secure it with sand bags. Insert the two elevator panels in the jig and align them so that the inboard edge of the counterbalance arms are spaced 1/8 inch from the outside surface of the stabilizer tip ribs. This will



ELEVATOR CUT-OUT DETAIL FOR RUDDER

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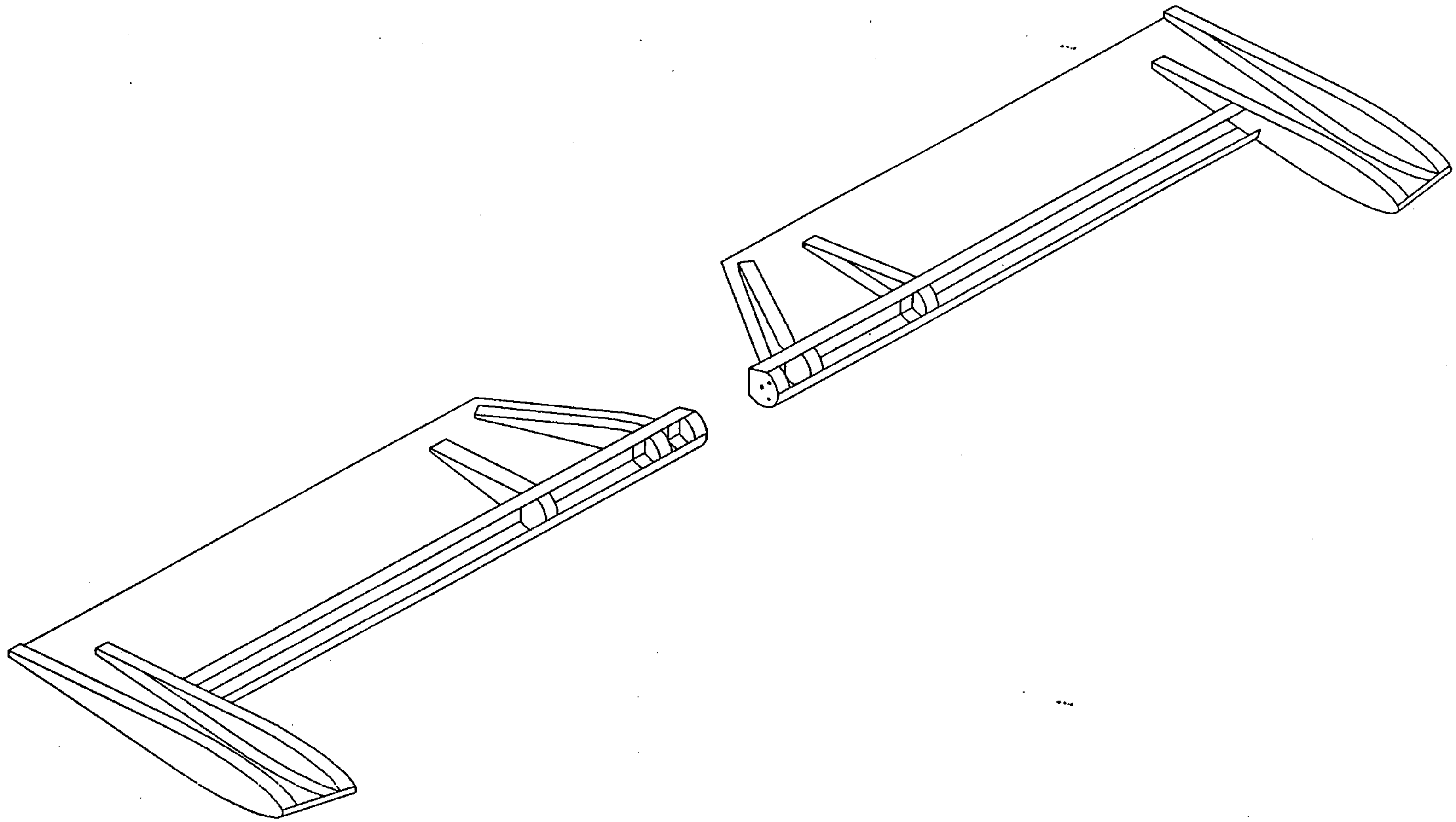


DRAWING NO. 20030B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION EMPENNAGE		REVISION / PAGE

position the elevator in its proper location relative to the stab. Weight the elevator panels down to secure them in the jig

Step E Drill The Hinge Pin Hole In The Elevator Root Ribs

Insert the elevator actuator backing plate without the pin into one of the mushroom shaped root ribs. Orient the backing plate so that its flange lies flat against the flat side of the root rib. Now properly center the backing plate and clamp it in position. Drill a 1/4 inch hole through the rib using the hinge pin hole in the backing plate as a drill guide. Remove the backing plate and repeat this procedure for the opposite root rib.

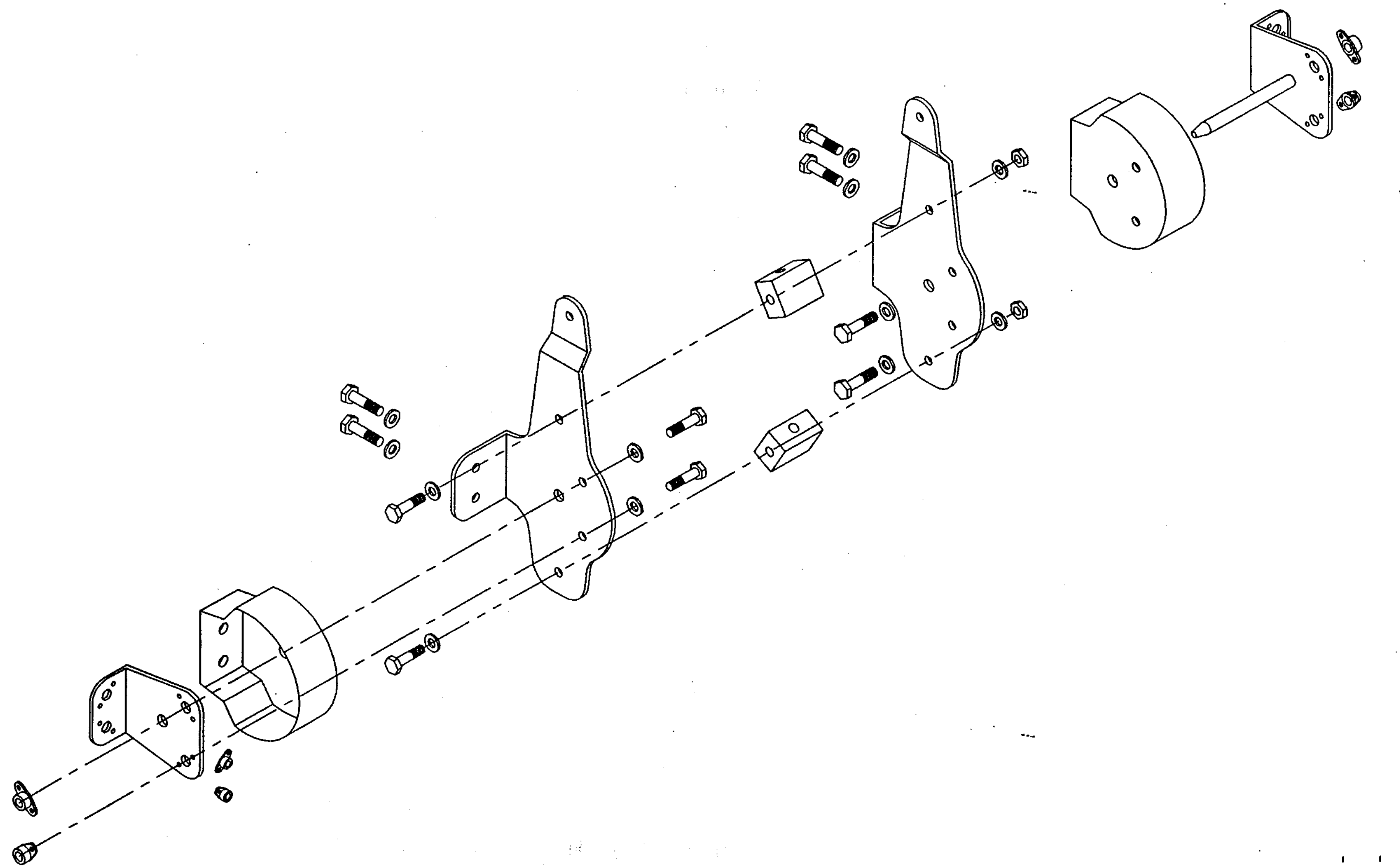
Step F Assemble Actuator Arms, Backing Plates, And Root Ribs To The Elevator

Now assemble the backing plates, actuator arms and ribs to the elevator panels. Assemble the left and right actuator arms together using the supplied 3/16 inch bolts. These bolts pass through the blocks that are welded to one of the arms. Install the left and right root ribs in the elevator panels. Hold the actuator arms in position over the center hinge (with the arms pointing up) while installing the backing plate with the pin. Thread the pin through the right rib (left when looking down on the jig), the right actuator arm, the center hinge, the left actuator arm and the left rib. Install the other backing plate over the pin where it protrudes through the left rib.. Clamp the actuator arms and backing plates to the root ribs. Center this assembly on the center elevator hinge and check the fit of the ribs.

NOTE: You may find it difficult to line up the hinge pin holes in the actuator arms with the hinge pin holes in the backing plates. If this is the case, you may cut off the aft flange of the root ribs (the flat section of the rib flange). This will allow the backing plate and root rib to move further aft thus helping to align the holes.

Step G Bond The Ribs To The Elevator Panels

Disassemble the actuator arms, backing plates, and ribs from the elevator panels. Prepare the flange on the ribs and the inside surface of the elevator skin for bonding. Place some clear tape over the outboard surface of the actuator arms.. Mix some structural adhesive



DRAWING NO. 20031A	TASK NO.	STEP NO.	AkroTech
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and thicken to "mayo" consistency using structural filler. Apply this mixture to the rib flange and the inside of the elevator skin. Carefully pull on the elevator skin while inserting each rib into position. Press the ribs firmly into place and remove any excess adhesive with a clean rag. Now carefully reassemble the actuator arms and the backing plates to the ribs as you did in step C. Try not to move the ribs too much while doing this. Clamp the ribs to the actuator arms and align the actuator arms so that they are centered on the center hinge. Double check the arms to make sure they are plumb (straight up and down) then lightly clamp the ribs to the elevator panels to secure the assembly. Allow the adhesive to cure completely.

Step H Drill Holes Through The Actuator And Into The Elevator Spar

Before disassembling the actuator arms from the elevator, use a 3/16 inch drill and drill into the aft side of the elevator spar using the holes in the actuator arms as a drill guide. Drill only about half way through the spar. These holes will be finished later after the backing plates have been removed.

Step I Finish Drilling The Mounting Holes For The Actuator Arms

Disassemble the actuator arms from the elevator panels and remove the elevators from the jig. Separate the left and right actuator arms from each other. Finish drilling the 3/16 inch holes through the elevator spar. Temporarily assemble the right actuator arm to the right elevator panel by installing a 1/4 inch bolt through the hinge pin hole. Do the same for the left actuator arm and elevator panel. Now install the two 3/16 inch bolts through each actuator arm flange and elevator spar. These bolts do not need to be secured with nuts, just wrap some tape over their heads to retain them. Now drill the 3/16 inch holes through the face of the ribs using the holes in the actuator arms as a drill guide. While drilling these holes do your best to keep the drill bit perpendicular to the face of the actuator.

Step J Install Nutplates In The Actuator Backing Plates

Refer to the section entitled "Installing Nutplates" in the General Information Section of this manual to install four 10-32 floating nutplates in each elevator actuator backing plate.

Step K Paint The Actuator Backing Plates paint the two actuator backing plates with a good quality enamel or epoxy based paint. This will isolate the steel from the carbon and help prevent corrosion.

Step L Install The Backing Plates In The Elevator

Dry fit the actuator and actuator backing plates in both the right and left elevator panels. Check to be sure the two panels can be properly aligned in the jig with the hinge pin engaged. Prepare the backing plates and the inside surface of the two elevator root ribs for bonding. Wax the four 3/16 inch actuator attach bolts and a single 1/4 inch bolt. Mix a small batch of structural adhesive and thicken it to "mayo" consistency. Spread the adhesive on each backing plate. Try to stay away from the holes and the pin on the backing plates when applying the adhesive. Carefully place the backing plates in position on the inside of each root rib. Insert the waxed bolts through each actuator and into the backing plates. For the backing plate without the pin, insert the waxed 1/4 inch bolt through the hinge pin hole to keep the backing plate properly aligned. Tighten all bolts and remove the excess adhesive using a clean rag. Allow the adhesive to cure undisturbed.

Step M Install Retaining Screws In The Backing Plates

Remove all bolts from the backing plates. Drill no. 19 holes through the root ribs and into the backing plates. Center these holes between the two forward mounting bolts. Countersink these holes in the root rib and install 8-32 stainless screws. Secure the screws with the appropriate nyloc nuts.

TASK E-11 Build Up The Bond Area On The Stabilizer Spar & Ribs

Brief Task Description:

In this task you prepare the stabilizer for closing by building up the bond areas on the stabilizer ribs and spars. This process is identical to that used earlier on the wing and ailerons. The goal is to add a layer of structural adhesive to any low areas on the stabilizer ribs and spars that will allow the final bond layer of structural adhesive to be thin and uniform.

Step A Place The Stabilizer In The Jig

As you work, remember that the stabilizer, like the ailerons and wing, is built with the spar and ribs factory-bonded into the upper skin. And since the stabilizer is built upside down, the upper skin is actually on the bottom and the lower skin is actually on top.

Place the stabilizer assembly in the jig.. Place sand bags in the stabilizer to be sure that it is fully seated in the stabilizer jig .Check that the jig former contours match those of the stabilizer skins. The stabilizer / elevator construction jig formers should contact the stabilizer skin along their entire length. If not, double check that the stabilizer is in properly located in the jig.

Step B Mark The Bond Areas On The Lower Skin

Using either the wet sponge or chalk method, lay the lower stabilizer skin in its proper place on the upper stabilizer assembly. Locate the bond areas on the lower skin. Cover all the bond areas on the inner face of the top stabilizer skin with a layer of clear 3M tape.

This is a good time to dry fit the lower skin to be certain that it mates properly with the spar and ribs of the upper skin. It is also a very good idea for you and an assistant to practice putting the lower stabilizer skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower stabilizer skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step C Prepare The Stabilizer

Remove all removable fittings. Next prepare the bond zones of the stabilizer spars and ribs for bonding. (See the General Information section of the manual.) Be sure that all are properly sanded and cleaned with acetone immediately prior to the bonding operation.

Carefully place the lower stabilizer skin into exact position on the spar, ribs and lower skin assembly. Generously weight the skin in place by placing small sand bags directly over the bond areas of the spars and ribs.

Drill holes for Cleco fasteners every 4" along the center of the leading edge joggle and through the skin and the rib flanges. These Clecos will hold the skin in exact position while you are building up the bond area and while finally bonding the skin in place.

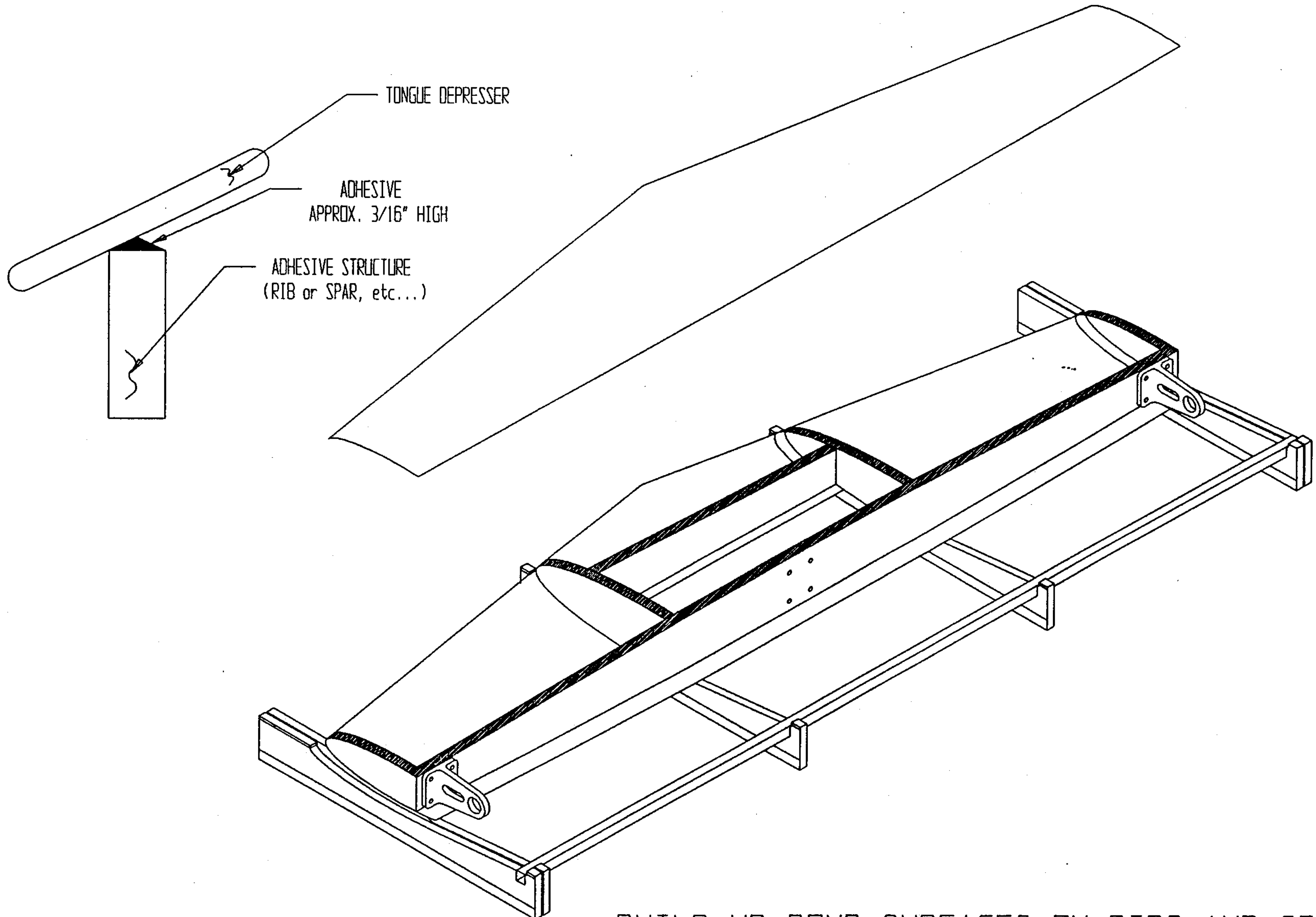
Step D Mix And Apply Adhesive

Put a generous but not excessive layer of structural adhesive that you have thickened to "mayo" consistency on the ribs and spars. This layer should evenly cover the entire bond area of the ribs and spars.

Remember that you are trying to accomplish two things. First, you must force the skin firmly and completely onto all the bond areas. Second, you must press a perfect impression of the inner surface of the lower skin into the fairly thick mixture of structural adhesive that is on the ribs and spars. **The goal is to build up the thinnest possible layer of structural adhesive that will still provide a bond area that has no gaps or low spots.** Inadequate pressure over the bond areas will allow too thick a layer of structural adhesive to build up, however, you do not want to use so much pressure that you begin to locally deform the lower skin.

Step E Place The Stabilizer Skin In Position

Carefully and slowly place the lower elevator skin into exact position on the spar and ribs of the upper assembly. Insert Clecos into the holes drilled in the leading edge flange. Weight the skin down by placing sand bags directly over the bond areas of the spars and ribs. Allow the structural adhesive to cure completely.



BUILD UP·BOND SURFACES ON RIBS AND SPAR

DRAWING NO. 20033A	TASK NO.	STEP NO.	AkroTech
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Step F Remove The Stabilizer Skin

After adequate cure time, remove the lower skin. This should be a fairly simple process involving little more than some gentle tugging -- unless you have not done an adequate job of masking off the bond areas of the lower skin.

Inspect the hardened structural adhesive on the bond areas of the stabilizer and spars. Ideally all the taped surface came into full contact with the adhesive. Look closely at the adhesive surface that were supposed to contact the taped sections of the stabilizer skin. The areas that contacted properly should appear smooth and glossy. Those areas that did not contact the taped sections will have a slightly rougher, more irregular surface appearance.

Should you find such rough or irregular areas, it means that there are still some low spots in the bond area. If these low spots cover more than twenty percent of the total bond area, they will need to be built up to the proper height by repeating steps A through F.
Start by sanding the bond surfaces of the adhesive you just applied. If the low spots are prevalent over much of the bond area, you may want to apply another full layer of structural adhesive. If there are only a few localized low spots, it may be adequate to merely apply structural adhesive in the vicinity of the low spots. In any event, remember to place the lower skin exactly in position, and fully weight it in place.

Step G Drill Pressure Equalization Holes In The Stabilizer

Drill a 3/32 inch hole through each of the two inboard ribs in the stabilizer. Drill another small hole in the bottom center of the forward stab spar. Leave one of the cleco holes in the leading edge of the stabilizer open. These holes will allow air to escape from the enclosed sections of the stab when flying at high altitude.

TASK E-12 Build Up The Bond Area on The Elevator Spars & Ribs

Brief Task Description:

In this task you prepare the elevator for closing by building up the bond areas on the elevator ribs and spars. As with the stabilizer, this insures that there will be no low spots on the spars or ribs that might result in gaps in the structural adhesive. Here too, the goal is to add a layer of structural adhesive to any low areas on the elevator ribs and spars that will allow the final bond layer of structural adhesive to be thin and uniform.

Step A Place The Elevator Panels In The Jig

Place the right and left elevator panels in the jig. Use spring clamps to secure the trailing edge of each panel to the steel trailing edge support that you built into the elevator construction jig. Place small sand bags in each panel to be sure that it is fully seated in the elevator jig.

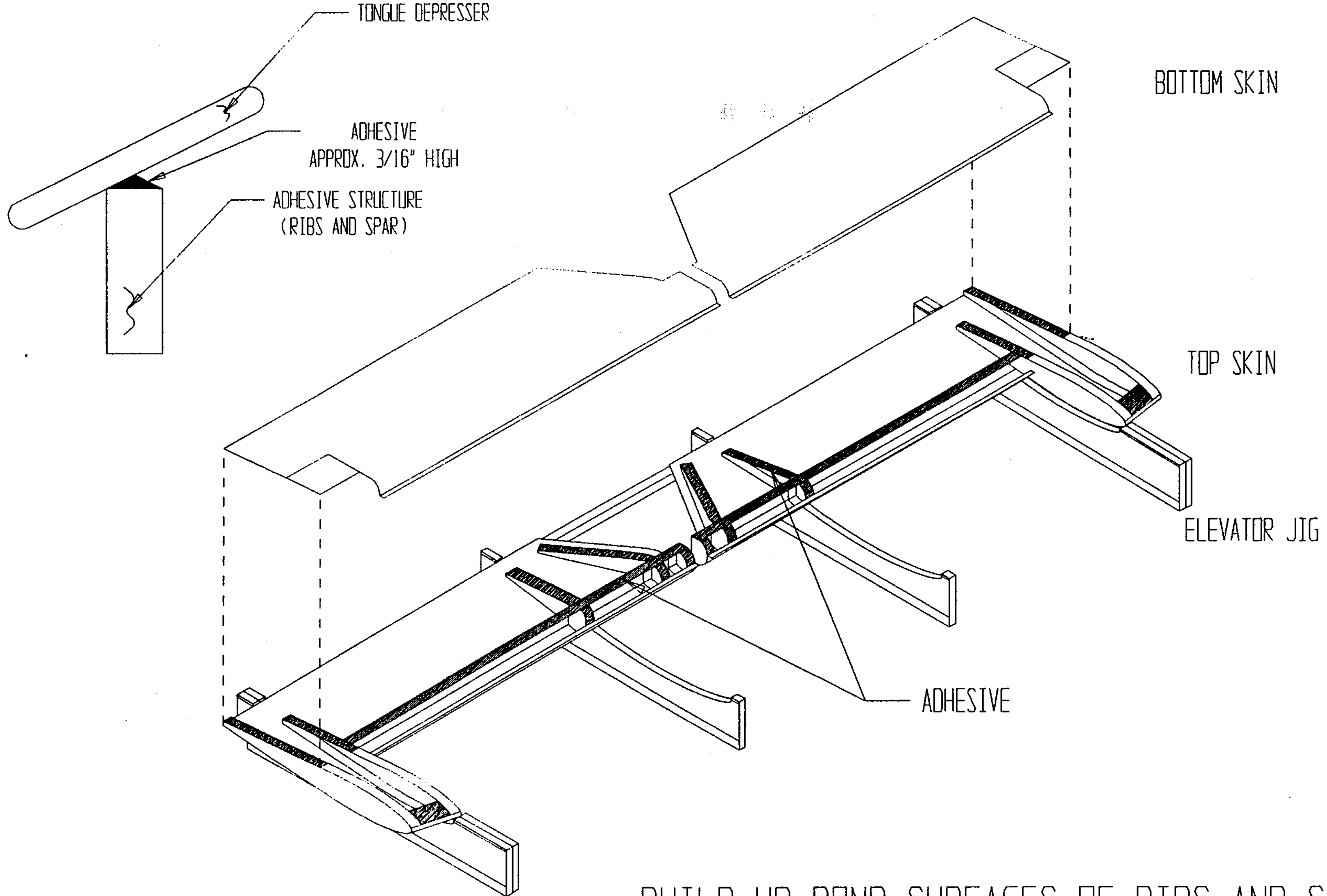
Check that the construction jig former contours match those of the elevator skins. The jig formers should contact the elevator skin along their entire length. If not, double check that the elevator is properly positioned in the jig.

Step B Mark The Bond Areas On The Lower Skin

Using either the wet sponge or chalk method, lay the lower elevator skins in its proper place on the elevator assembly. Locate the bond areas on the lower skins. Cover all the bond areas on the inner face of the lower elevator skins with a layer of clear 3M tape.

This is a good time to dry fit the lower skin to be certain that it mates properly with the spar and ribs. It is also a very good idea for you and an assistant to practice putting the lower elevator skin precisely in place as if there were adhesive on the ribs and spars a few times. A few dry runs will help you place the lower elevator skin with perfect precision the one time that it really counts -- that is, when it is covered with adhesive.

Step C Prepare the Elevator



BUILD UP BOND SURFACES OF RIBS AND SPAR

DRAWING NO. 20036B	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION EMPENNAGE		REVISION	PAGE

Remove all removable fittings. Next prepare the bond zones of the elevator spars and ribs for bonding. (See the General Information section of the manual.) Be sure that all are properly sanded and cleaned with acetone immediately prior to the bonding operation.

Carefully place the lower elevator skin into exact position on the spar and ribs of the upper skin assembly. Weight the lower skin in place by placing sand bags directly over the bond areas of the spars and ribs.

Drill holes for Cleco fasteners every 4" along the center of the leading edge flange and through the skin and the rib flanges. These Clecos will hold the skin in exact position while you are building up the bond area and while finally bonding the skin in place. Remove the lower skin when done.

Step D Mix And Apply the Adhesive

Put a generous but not excessive layer of structural adhesive that you have thickened to "mayo" consistency on the ribs and spars. This layer should evenly cover the entire bond area of the ribs and spars.

As before, the goal is to build up the thinnest possible layer of structural adhesive that will still provide a bond area that has no gaps or low spots. Inadequate weight over the bond areas on the lower skin will allow too thick a layer of structural adhesive to build up, however, you do not want to use so much weight that you begin to locally deform the lower skin.

Step E Place The Elevator Skins In Position

Carefully and slowly place each lower elevator skin into exact position on the spar, ribs and upper skin assembly. Install Clecos in the previously drilled holes in the leading edge. Generously weight the skin in place. Place sand bags directly over the bond areas of the spars and ribs. Allow the structural adhesive to cure undisturbed.

Step F Remove The Elevator Skin

After adequate cure time, remove the lower skin. This should be a fairly simple process involving little more than some gentle tugging -- unless you have not done an adequate job of masking off the bond areas of the lower skin.

Inspect the layer of structural adhesive for low spots. These will need to be built up until they too are of the proper height. Start by sanding the bond surfaces of the adhesive you just applied. If the low spots are prevalent over much of the bond area, you may want to apply another full layer of structural adhesive. If there are only a few localized low spots, it may be adequate to merely apply structural adhesive in the vicinity of the low spots. In any event, remember to place the lower skin exactly in position, and fully weight it in place.

TASK E-13 Close The Stabilizer

Brief Task Description:

This task involves closing the stabilizer by bonding the lower stabilizer skin into place on the stabilizer assembly. The stabilizer gains an enormous amount of structural strength and rigidity thorough the process of bonding in the lower skin. This operation completes the structure of the stabilizer. If not done carefully, the result can be a twisted stabilizer. Take your time. Work accurately. Do not build in twist or error.

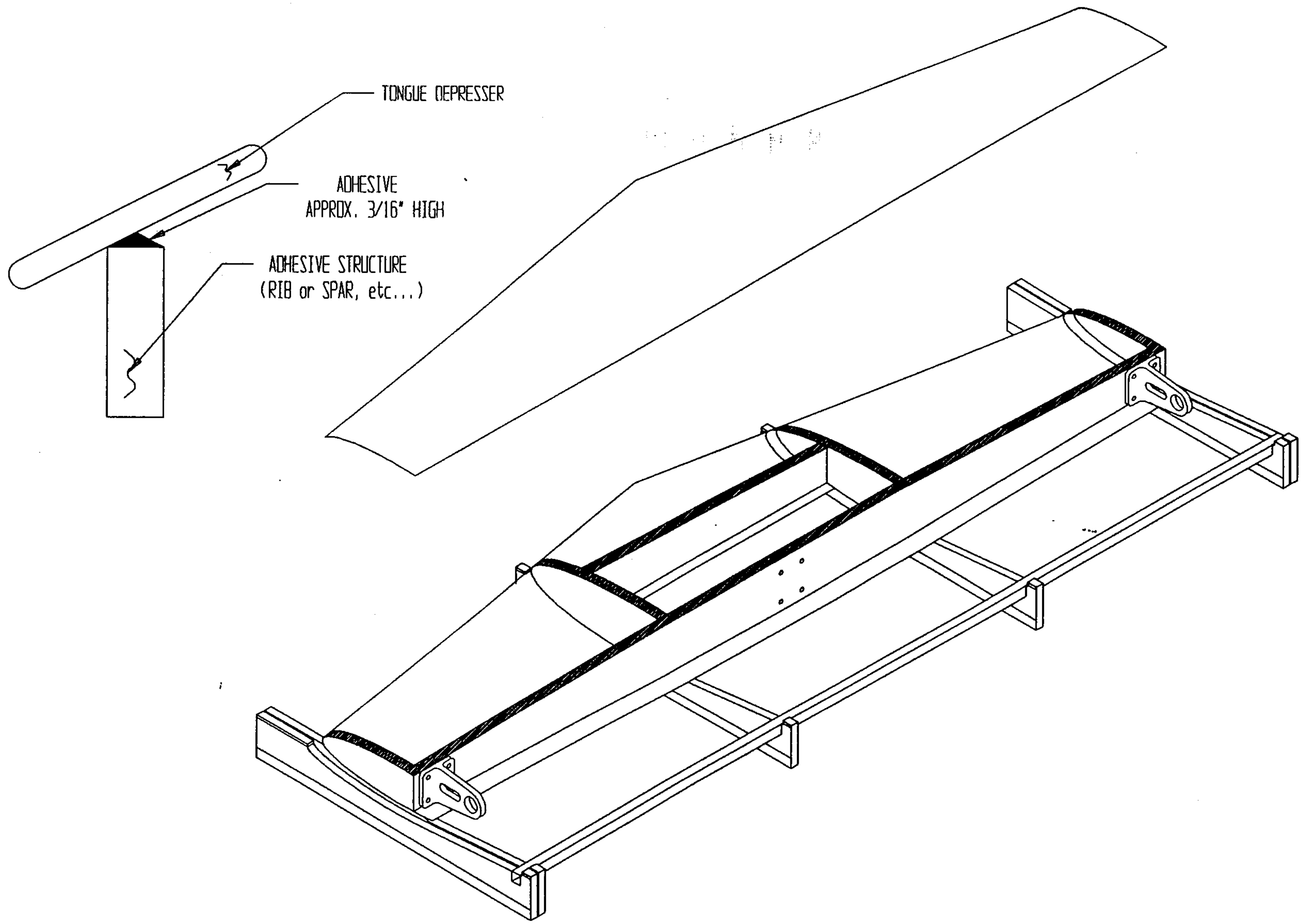
CRITICAL DOUBLE CHECK: We can not over-emphasize the importance of the alignment of the stabilizer construction jig formers. It is still possible to build in twist unless this entire task is approached with great care. With the stabilizer held in place in the jig, recheck everything. Are the stabilizer's leading and trailing edges **precisely** matched up with the leading and trailing edge marks on the stabilizer / elevator construction jig formers? Are those marks all still in **exactly** the same plane? Is that plane still perfectly level? Recheck **everything** before proceeding. This is you last chance to correct any error.

Step A Prepare The Stabilizer For Bonding

Be sure to completely mask off all exposed fittings on the stabilizer. It will be impossible to remove any excess adhesive that bonds to internal fittings during the closing process. Good masking will prevent this. Mask in such a way that your masking will prevent adhesive from clogging nut plates etc., but not in such a way that the masking interferes with any of the bond zones. Also, remember to use clear 3M tape to mask. Adhesive will soak through standard household masking tape.

Before you start the bonding process, you should be very sure that you have everything ready. Once you start the applying the adhesives, you can not stop. All the tools and materials you need must be close at hand. Here are the things that you will want to have standing by before you start to mix adhesive:

- Latex gloves for mixing and applying adhesive.



APPLY ADHESIVE TO LEADING EDGE JOGGLE AND SHADED AREA FOR CLOSURE

DRAWING NO. 200100A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION EMPENNAGE	REVISION	PAGE

- Tongue depressors for applying and cleaning up adhesive.
- A roll of paper towels for clean up.
- Adequate solvent for clean up.
- Cleco fasteners and a Cleco tool.
- Small sand or lead shot bags to hold stabilizer in place in the construction jig and for providing clamping pressure while the adhesive cures..

Prepare all bond zones of the skin, spar, and ribs for bonding. (See the General Information section of the manual.) Be sure that all bond areas are properly sanded and cleaned with acetone immediately prior to bonding. Once these areas have been prepared, do not touch them with your bare hands. Remember: the structural integrity of your aircraft is dependent on proper surface preparation prior to bonding.

Step B Mix And Apply The Adhesive

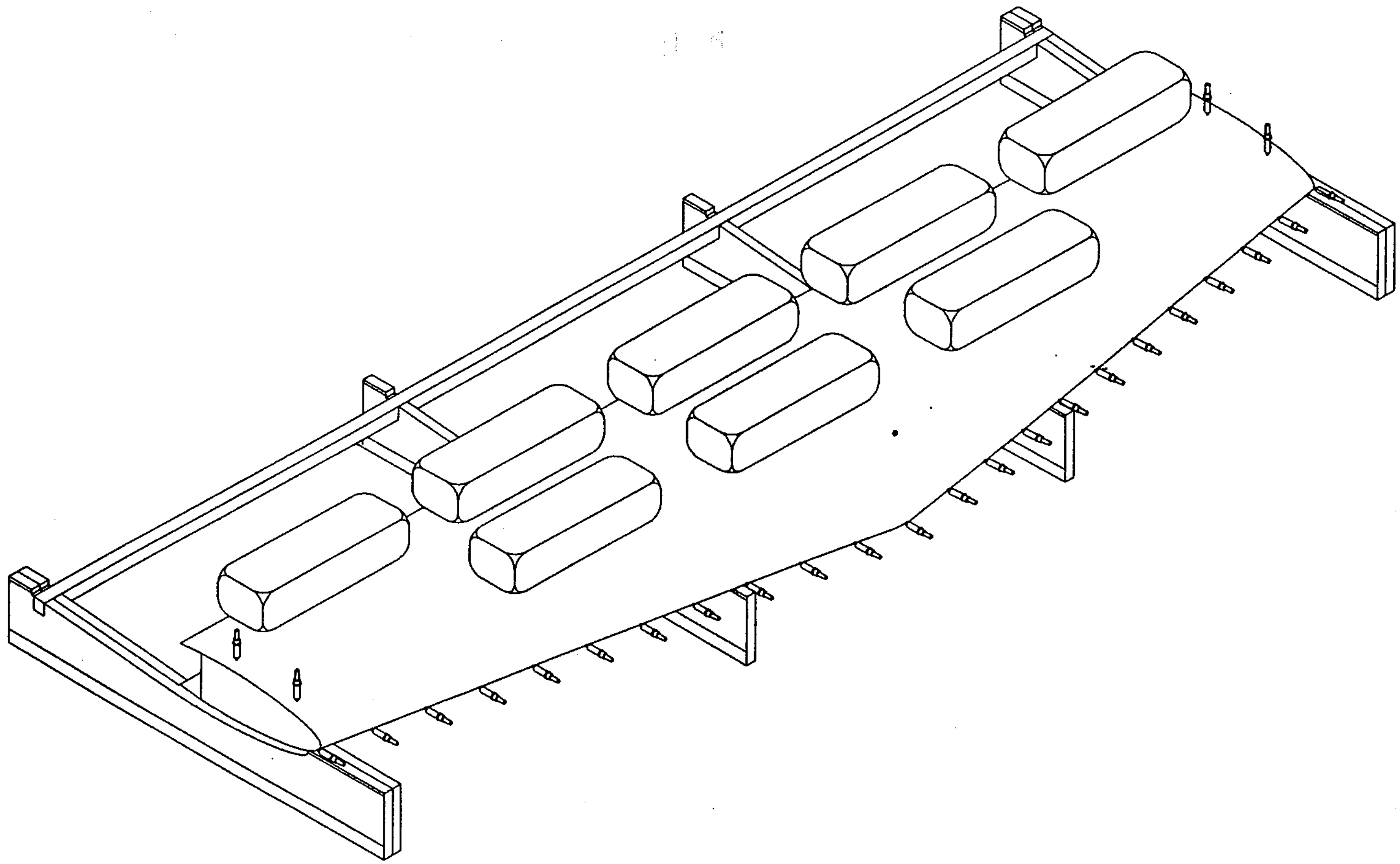
Prepare a batch of structural adhesive. Thicken the adhesive to "mayo" consistency and apply an even layer to **all the bond zones** of the spar and rib assembly of the stabilizer:

- stabilizer leading edge.
- stabilizer ribs.
- stabilizer spar.
- stabilizer trailing edge.

Carefully lower the skin **exactly** into position and press down lightly. Then, lift the lower skin back off the lower skin / spar / rib assembly. Some adhesive will have adhered to the inner face of the lower stabilizer skin where it contacted the ribs and spars. Those smear marks will show you exactly where the bond area is on the lower stabilizer skin. Using those smear marks as a guide, apply a layer of structural adhesive to all the bond areas of the inner stabilizer skin. The net result will be that you will have applied a thin, even **layer of adhesive to both sides of every bond zone**.

NOTE:
Be very certain to **remove all sand bags and tools** (or any other foreign matter that you do not wish to become a permanent part of the aircraft) from inside the stabilizer now.

Step C Bond The Skin In Place



HORIZONTAL STABILIZER CLOSURE

DRAWING NO. 20034B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION EMPENNAGE	REVISION	PAGE

Using a helper, carefully, slowly, and precisely, position the lower stabilizer skin into place over the bond area. Get it dead right this time! Put the skin down as close to it's final position as you can. The less you have to move it to get proper alignment, the less adhesive you will smear, and the better bond you will make.

Align the lower stabilizer skin with the top stabilizer assembly. Be sure that the leading edge of the lower stabilizer skin is fully seated into its joggle recess along its entire length.. Next, start to secure the stabilizer into the construction jig. In general, you want to move from the leading edge to the trailing edge. The effect will be to gently pull the lower stabilizer skin aft, thereby seating it into the leading edge joggle, bonding it to the stabilizer spar and finally into the trailing edge.

Secure the leading edge with Clecos then place 10 pound sand bags over the ribs and every foot along the spar.

Wipe off any excess structural adhesive that has squeezed out along bond lines. Excess adhesive adds weight but not strength.

NOTE:
You must allow the bonded stabilizer to cure undisturbed in the construction jig for a minimum of 24 hours at 65_ F or higher-- however it is preferable to allow a minimum of 12 hours cure time at 85_ to 110_F. A small electric heater placed under the work table (but away from any combustibles) can help you achieve higher temperature readings in the vicinity of your stabilizer construction jig. **Do not loosen any clamps or move any sandbags or Clecos during this period.**

Only after the bond in the stabilizer has completed it initial cure should you loosen your clamps and remove the stabilizer from the stabilizer construction jig. Do not rush to remove the stabilizer from the construction jig. Allow full and complete cure time.

TASK E-14 Install The Elevator Trim Tab

Brief Task Description:

The G-200 uses a ground adjustable tab mounted to the elevator to trim the aircraft for level flight in cruise. This tab is constructed out of sheet aluminum and is installed on the trailing edge of the left elevator panel. Follow Steps A through C to install this tab.

Step A Cut Out The Trim Tab

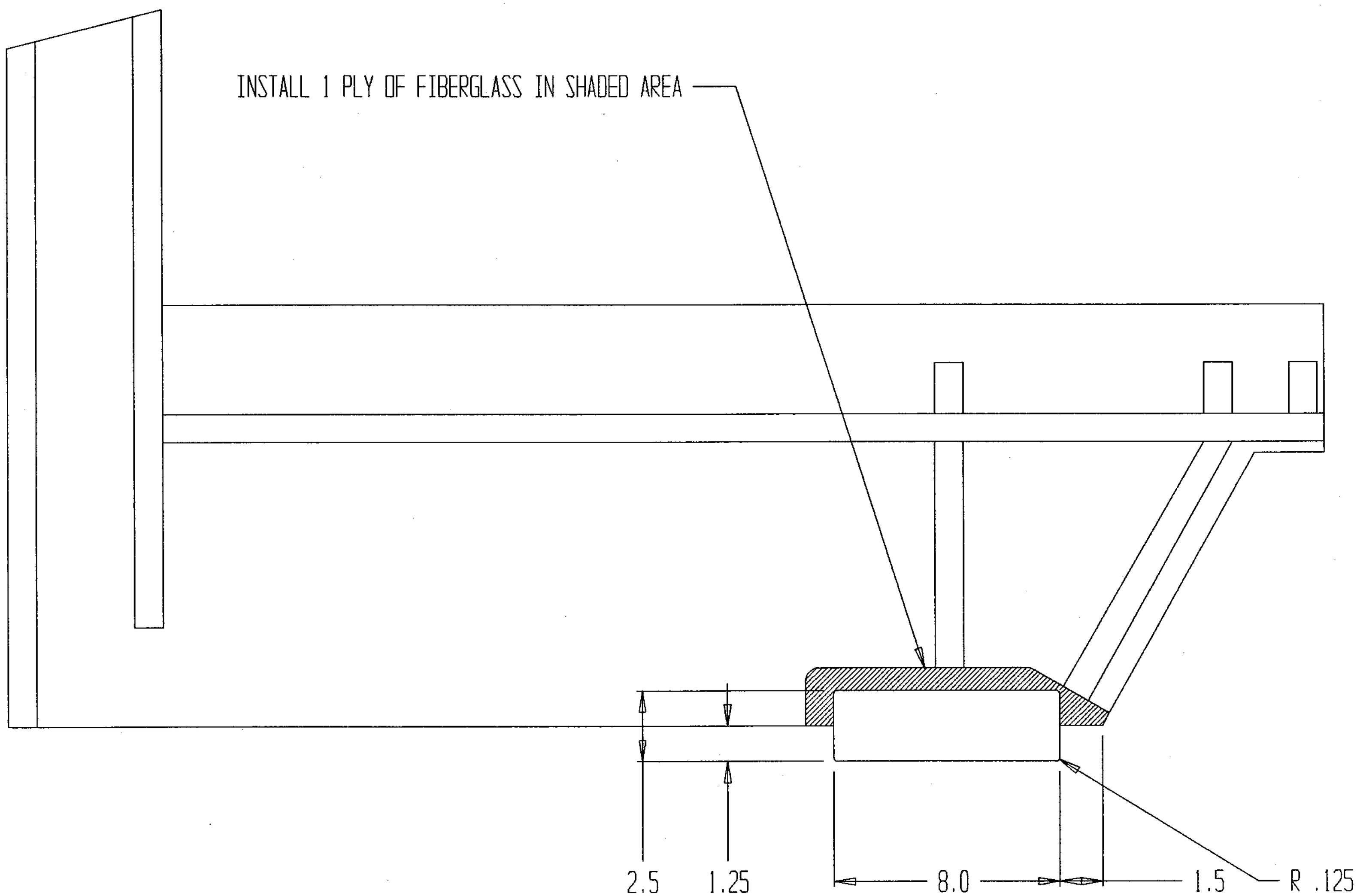
Cut out the trim tab from the supplied .040 aluminum sheet using a jigsaw or a bandsaw.

Step B Make A Cut Out In The Elevator For The Trim Tab

Grind a small notch into the interior skin of the elevator to accept the trim tab. This notch should be about .020 inches deeper than the thickness of the tab.

Step C Install The Tab

Prepare both sides of the aluminum tab where it will be bonded to the elevator skin. Sand the tab thoroughly and clean with acetone. Prepare the mating area on the elevator for bonding in a similar fashion.. Cut out two fiberglass rectangles a little larger than the size of the tab. Mix up a small batch of laminating resin and wet out one of the fiberglass rectangles over the tab area on the elevator. Paint one side of the tab with resin and press it down into the fiberglass on the elevator. Wet out the other rectangle of fiberglass over the tab where it mates with the elevator skin. The tab should now be completely isolated from the carbon fiber skin. Allow the lay-up to cure completely



ELEVATOR TRIM TAB

DRAWING NO. 200121A	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION EMPENNAGE		REVISION	PAGE

TASK E-15 Balance The Elevator

Brief Task Description:

In this task you will be installing the counterbalance weight in the elevator panels. This counterbalance weight consists of a mixture of lead shot and structural adhesive which is poured into a sectioned off area in the counterbalance arm of the elevator. This counterbalance weight is necessary to prevent a rather destructive aerodynamic phenomenon called “flutter”. Do not attempt to fly your aircraft without properly balanced control surfaces.

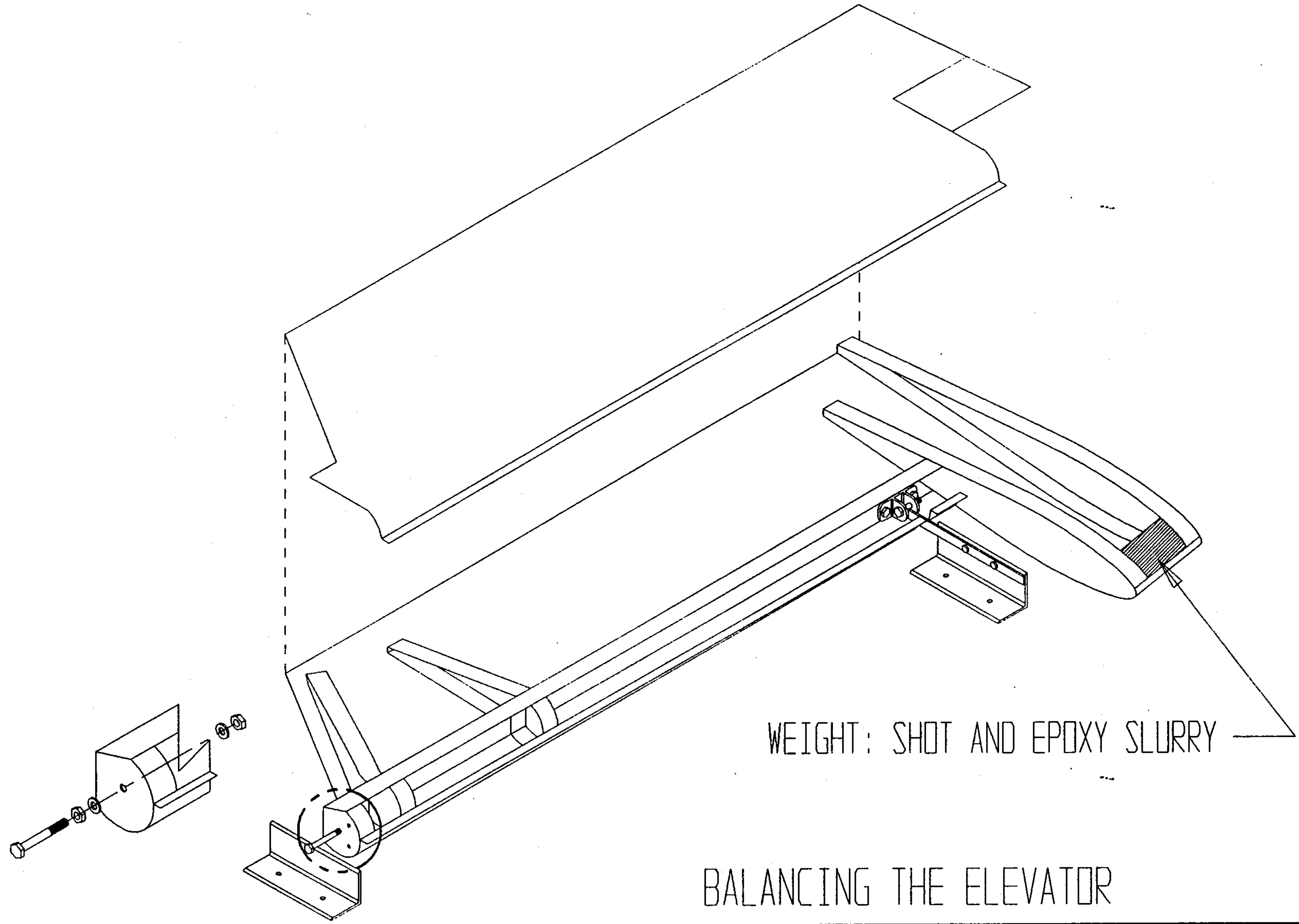
Step A Make The Knife Edge Supports

Cut two 4 inch pieces of 1.5 x 1.5 angle aluminum. Mount them to your construction table so that they are parallel and roughly 40.0 inches apart. One support should be offset about 2 inches from the other. Find a piece of steel or aluminum about 1/8 inch thick by 1 inch by 3 inches long. Attach this piece to one of the angle aluminum supports so that it overhangs the center of the opposite support. Place a 1/4 inch bolt through the hinge receiver fitting on both elevator panels. Insert another bolt into the hinge pin hole of the root rib of the left panel. Secure these bolts with washers and nuts.. Place the left elevator panel on the two supports mounted to your work table.. The elevator should now be free to pivot on the two “knife edge” supports with very little friction.

Step B Install Cardboard Dam In The Elevator

Find a piece of corrugated cardboard about 1 inch wide by 24 inches long. Completely cover this strip with clear tape. Install this strip in the forward section of the counterbalance arm of the left elevator panel so that it sits about 2 inches back from the leading edge of the elevator arm. Use clear tape on the aft side of the strip to hold it in position. Make sure this “dam” is sealed along the entire bottom edge and also where this strip meets the two ribs.

Step C Balance The Elevator Panels



BALANCING THE ELEVATOR

DRAWING NO. 20035B	TASK NO.	STEP NO.	AkroTech	
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With the aileron free to pivot on the knife edge supports, place the lower skin on the elevator. Pour some lead shot into the sectioned off area of the elevator counterbalance arm until the it balances. Carefully remove the lead shot from the elevator.. This is the amount of counterbalance weight needed to balance the left elevator panel. Place this lead shot in a cup and label it so you do not confuse it with the lead shot for the right panel later. Repeat this procedure for the right elevator panel.

Step D Prepare The Lead Shot / Adhesive Mixture

Set each elevator panel down on your work bench and jig the trailing edge up so that the elevator panels are level. Prepare a four ounce batch of structural adhesive (do not thicken the adhesive with filler). Mix half of the adhesive with the lead shot removed from the right elevator panel and mix the other half with the shot removed from the left panel. Carefully pour each mixture into the appropriate section of the left and right elevator panels. Note that the adhesive will add a little extra weight to the elevator, making it nose heavy (overbalanced). This overbalanced condition will be corrected later when primer and paint is added to the elevator. Allow the adhesive to cure completely then remove the cardboard dam.

TASK E-16 Close The Elevator

Brief Task Description:

This task involves closing the elevator by bonding the lower right and left elevator skins in place on the elevator assembly. You will also bond the counterbalance arm skins on the elevator. This operation is almost identical to that just used to close the stabilizer.

Step A Mount The Elevator Panels In The Jig

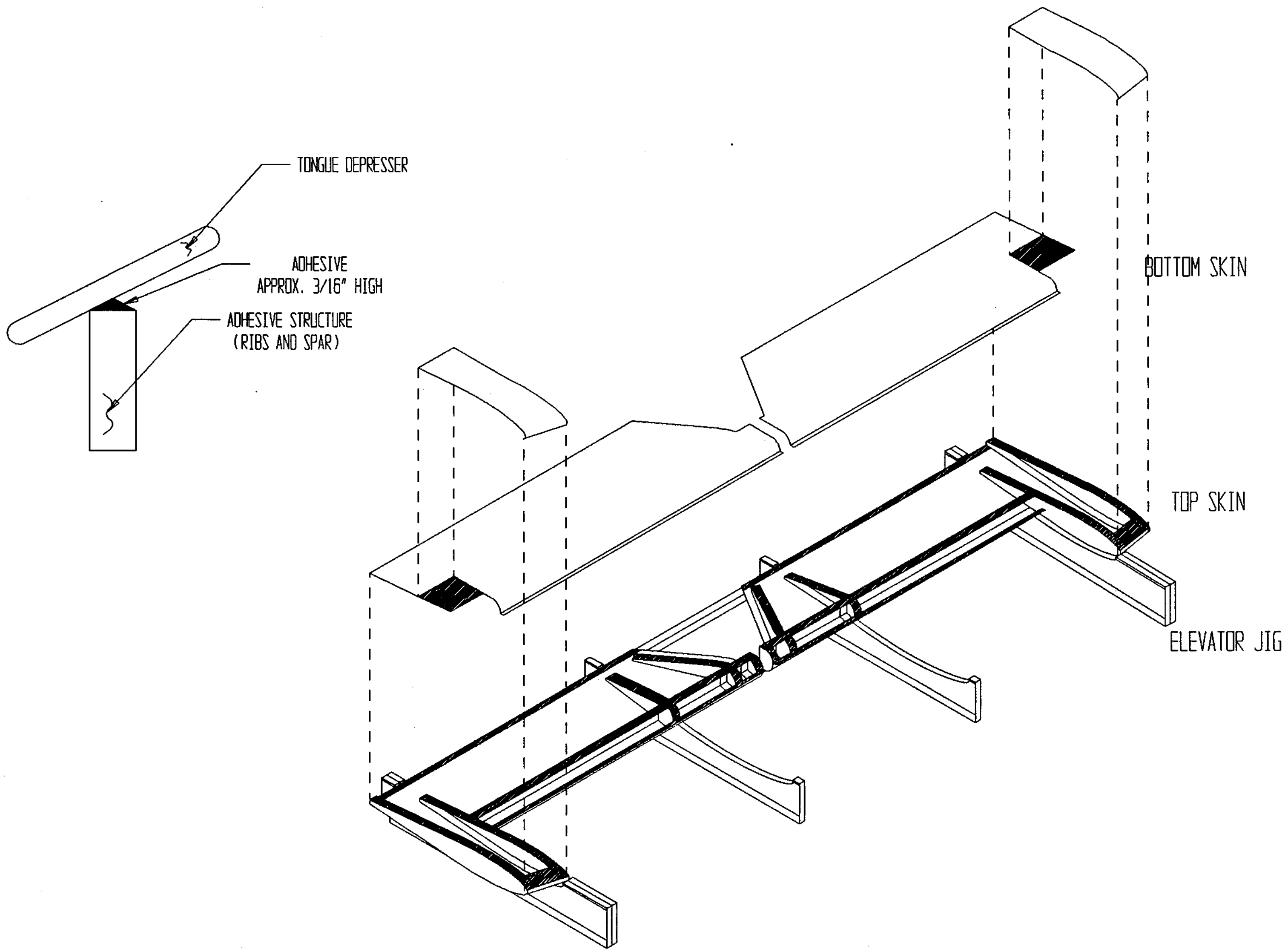
Mount the right and left elevator panels in the stabilizer/elevator jig. Check to make sure the chordlines on the tip and the root of each panel is level. Once you are certain the panels are properly aligned, you may use body filler to secure the panels to the jig so that they will not move .

Step B Prepare The Elevator For Bonding

Be sure to completely mask off all exposed fittings on the elevator. It will be impossible to remove any excess adhesive that bonds to internal fittings during the closing process. Good masking will prevent this. Mask in such a way that your masking will prevent adhesive from clogging nut plates etc., but not in such a way that the masking interferes with any of the bond zones. Also, remember to use clear 3M tape to mask. Adhesive will soak through standard household masking tape.

Before you start the bonding process, you should be very sure that you have everything ready. Once you start the applying the adhesives, you can not stop. All the tools and materials you need must be close at hand. Here are the things that you will want to have standing by before you start to mix adhesive:

- Latex gloves for mixing and applying adhesive.
- Tongue depressors for applying and cleaning up adhesive.
- A roll of paper towels for clean up.
- Adequate solvent for clean up.
- An aluminum "L" section extrusion for clamping the trailing edge. One wide face of this piece should be protected with clear 3M tape where it will contact the carbon fiber of the elevator skin.



APPLY ADHESIVE TO SHADED AREA FOR CLOSURE

DRAWING NO. 20099B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION EMPENNAGE		REVISION / PAGE

- About 20 spring clamps.
- Cleco fasteners and a Cleco tool.
- Small sand or lead shot bags to hold elevator in place in the construction jig and for providing clamping pressure while the adhesive cures..

Prepare all bond zones of the skin, counterbalance arm skins, spar, and ribs of both elevator panels for bonding (See the General Information section of the manual.). Be sure that all bond areas are properly sanded and cleaned with acetone immediately prior to bonding. Once these areas have been prepared, do not touch them with your bare hands. Remember: the structural integrity of your aircraft is dependent on proper surface preparation prior to bonding.

Step C Mix And Apply The Adhesive

Prepare a batch of structural adhesive. Thicken the adhesive to "mayo" consistency and apply an even layer to **all the bond zones** of the spar and rib assembly of the right and left elevator panels:

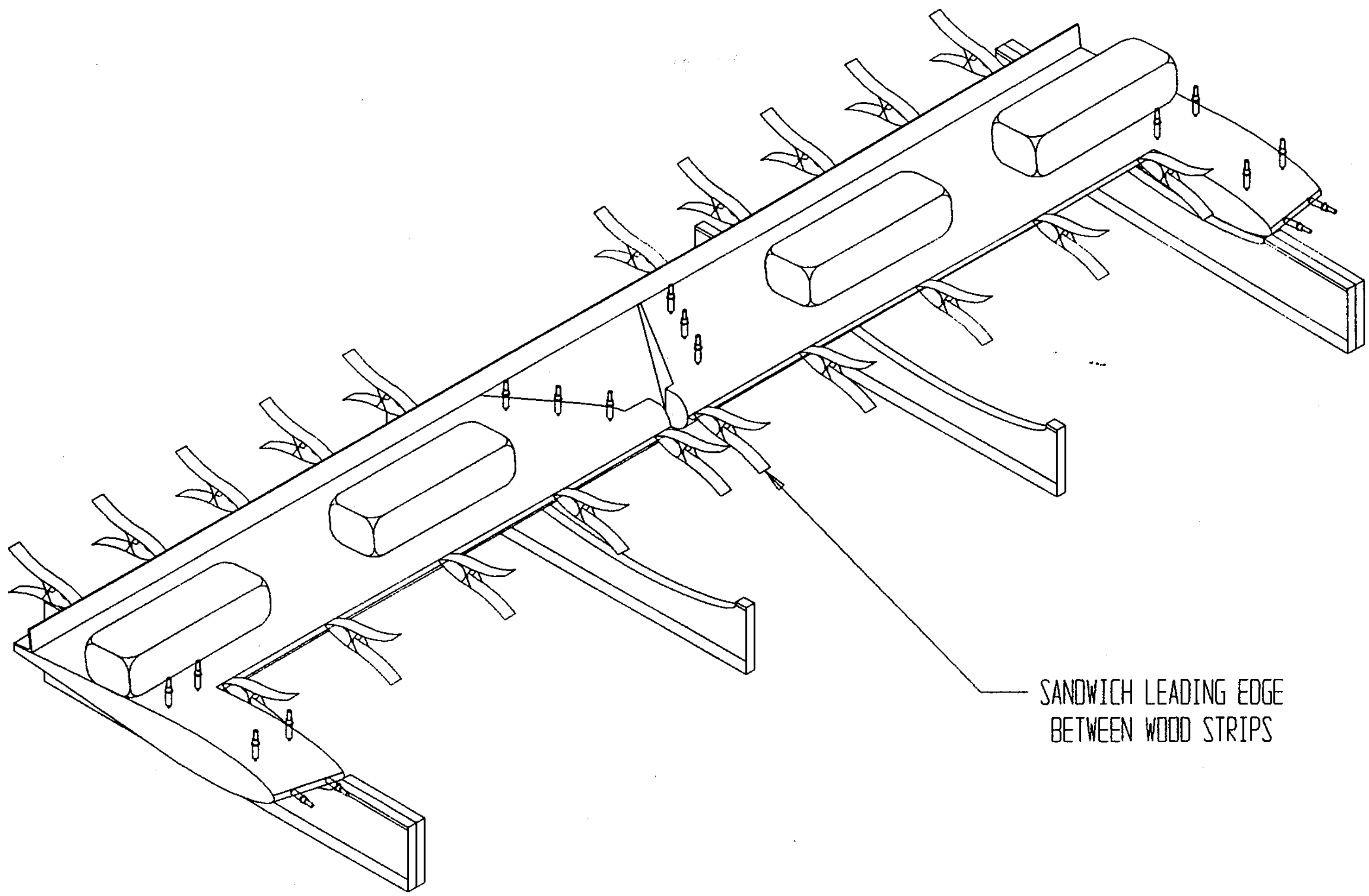
- elevator leading edge.
- elevator ribs.
- elevator spar.
- elevator trailing edge.

Shape the adhesive on all surfaces into a triangular wedge. This will reduce the chance of trapping air in the adhesive when the close out skin is pressed upon it.

NOTE:
Be very certain to **remove all sand bags and tools** (or any other foreign matter that you do not wish to become a permanent part of the aircraft) from inside the elevator now.

Step D Bond The Lower Skins In Place

Using a helper, carefully, slowly, and precisely, position the lower left elevator skin in place over the bond area. Put the skin down as close to it's final position as you can. The



ELEVATOR CLOSURE

DRAWING NO. 20037B	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION EMPENNAGE		REVISION / PAGE

less you have to move it to get proper alignment, the less adhesive you will smear, and the better bond you will make. Now align the lower elevator skin with the upper elevator assembly. Next, start to secure the lower elevator skin to the top skin. In general, you want to move from the leading edge to the trailing edge. The effect will be to gently pull the lower elevator skin aft, thereby seating it into the leading edge joggle, bonding it to the elevator spar and finally into the trailing edge.

Secure the leading edge flanges with spring clamps then place 10 pound sand bags over the ribs and every foot along the spar. Place your aluminum "L" section over the trailing edge and clamp every six inches (the trailing edge should be sandwiched between the aluminum Wipe off any excess structural adhesive that squeezed out along bond lines. Excess adhesive adds weight but not strength. Finally, mount the counterbalance arm skin on the elevator. Place a small sandbag over the skin and remove any excess adhesive.

Now repeat the above procedure for the right elevator skin

Step E Bond The Counterbalance Arm Skins In Place

Press the two counterbalance arm skins in place on the elevator. Secure the leading edge of the skins with two clecos and place a small weight over aft edge of the skin to provide clamping pressure.

Only after the bond in the elevator has completed an initial cure of at least 24 hours at 65_F (but preferably 12 hours at 85_ to 110_ F) should you loosen your clamps and remove the elevator from the elevator construction jig. Do not rush to remove the elevator from the construction jig. Allow full and complete cure time.

TASK E-17 Finish The Elevator Hinge Cut Outs

Step A Mount The Cut Out Templates To The Elevator

Remove the elevator hinge cut out templates from the back of this manual. Position these templates on the leading edge of the elevator skin using the hinge slot cut earlier as a reference. Use spray adhesive to mount the template to the elevator skin.

Step B Cut The Access Holes

Use a jigsaw to cut out the access holes along the line on the template. Cut the holes a little under-size then finish them with a small rotary grinding tool.

Fuselage Construction Tasks

TASK F-1 Construct the Fuselage Mounting Stand

Brief Task Description:

The fuselage assembly is to be the central assembly point for all remaining and previously constructed components and requires few structural changes from its shipping form. The first task is to make a stable mounting stand on which to mount the fuselage. The fuselage stand is constructed utilizing two saw horses and a rear cradle cut from sheet plywood or particle board. This stand will be used for the remainder of the project. Follow the instructions in steps A and B to assemble the mounting stand.

Step A Adjust Saw Horse Height

Cut down the legs of two saw horses so that the top rail is approximately 28 inches from the floor. This will allow you to raise the fuselage to a comfortable height for installation of the various systems. If you are especially short or tall you may adjust this dimension accordingly.

Step B Make The Rear Fuselage Cradle

Remove the rear fuselage cradle template from this manual and bond it to a piece of 5/8 inch plywood or particle board. Cut out the cradle which supports the rear of the fuselage from a piece of 5/8 inch plywood (or particle board). Attach the cradle to one saw horse with clamps so that it is approximately level and so that the bottom of the cradle is about 4 inches from the top of the sawhorse.

TASK F-2 Mount And Level The Fuselage.

Brief Task Description:

The lower fuselage will need to be mounted so that it is level in the stand constructed in Task F-1. This alignment procedure will require the use of three levels. Follow the instructions in Steps A - C to mount and level the fuselage

Step A Place Lower Fuselage Into The Cradles

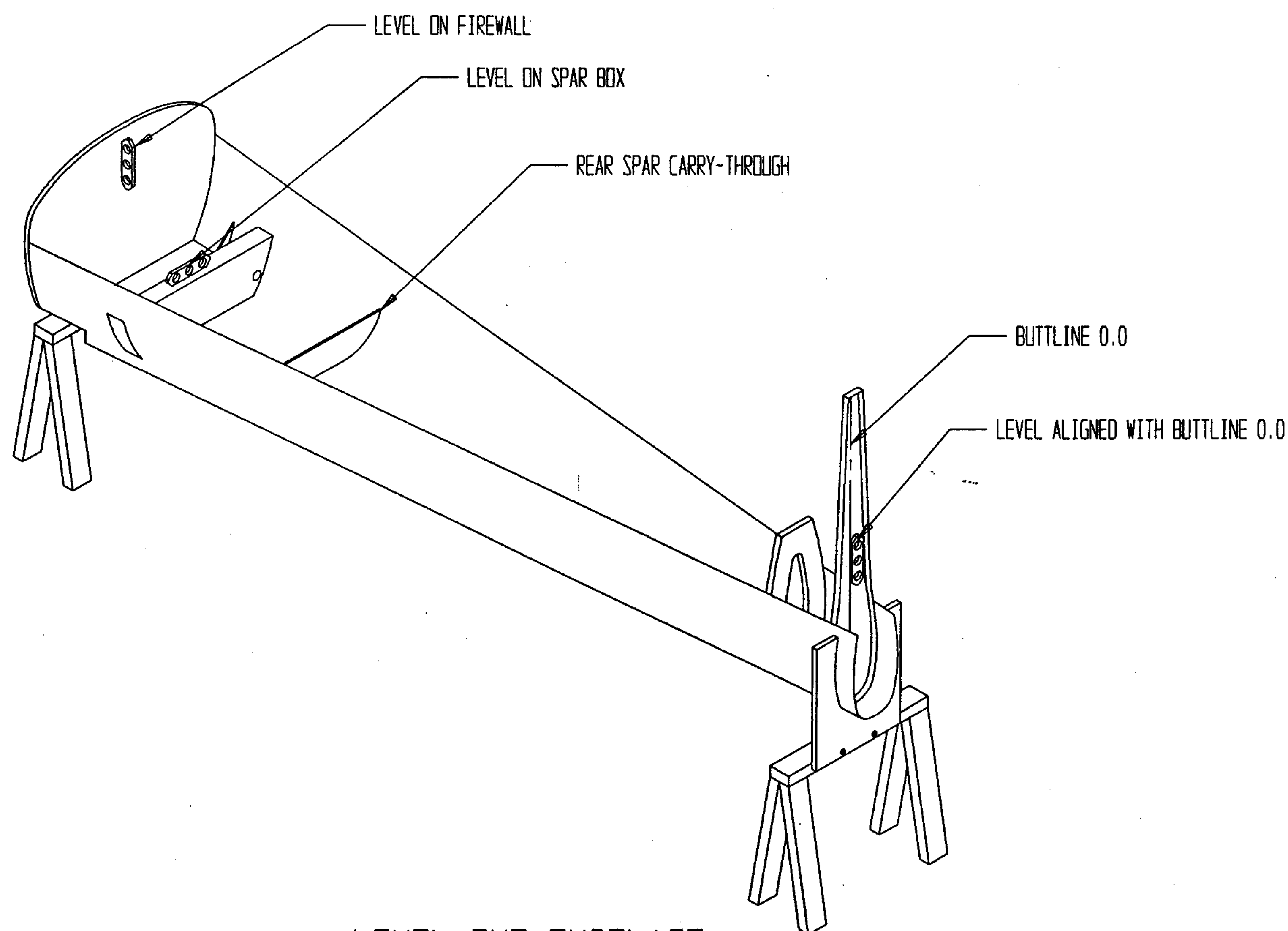
Separate the front sawhorse and the rear cradle so they are roughly ten feet apart and roughly parallel then place the lower fuselage onto the two supports. Now move the rear cradle forward until it is snug against the fuselage. (The rear cradle should intersect the fuselage close to the rudder post).

Step B Draw Buttline 00 On The Rudder Post

Place a piece of 2 inch wide masking tape vertically along the approximate center of the rear face of the rudder post. Draw a line bisecting the rear face of the rudder post on this tape. Do this by measuring across the width of the rudder post and marking a midpoint at several locations along the length of the rudder post. Draw a line through these points. This line represents buttline 00 and will be used to align the fuselage.

Step C Level The Fuselage

Place one level horizontally across the top of the spar box. Make sure this level is resting flat on the surface of the spar box. Clamp a second level oriented vertically to the aft face of the firewall. Clamp a third level to the aft face of the rudder post so that one edge is lined up with buttline 00. These three levels will be used to align the fuselage. Loosen the clamps holding the rear cradle to the sawhorse and adjust the cradle until the bubbles in both the rudder post level and the firewall level are reading plumb. Now adjust the sawhorse under the landing gear step until the level on the spar box reads level by placing shims under the legs of the sawhorse. Continue to adjust the fuselage until all three levels are reading correctly. Test the stability of the fuselage assembly by trying to rock the



LEVEL THE FUSELAGE

DRAWING NO. 20041A	TASK NO.	STEP NO.	AkroTech
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fuselage back and forth on the sawhorses. The fuselage alignment should not be easily upset.

TASK F-3 Install The Rudder Hinges

Brief Task Description:

In this task, you will align and mount the rudder hinges to the rudder post.

Step A Mark The Hinge Locations On The Rudder Post.

Find the location of WL 00 and WL 31.00 on the rudder post and mark these using a felt tip pen. Remember that waterline 00 is aligned with the top edge of the lower fuselage.

Step B Mark Centerlines On The Rudder Hinges

Measure across the width and height of each hinge. Mark lines that bisect these dimensions on the hinge bases. Place small "tick" marks on the edges of the hinges at the location of these center lines.

Step C Clamp The Hinges To The Rudder Post

Place each hinge on the rudder post and carefully align the tick marks on the edges of the hinges with the lines on the rudder post. Clamp each hinge in place using two C-clamps.

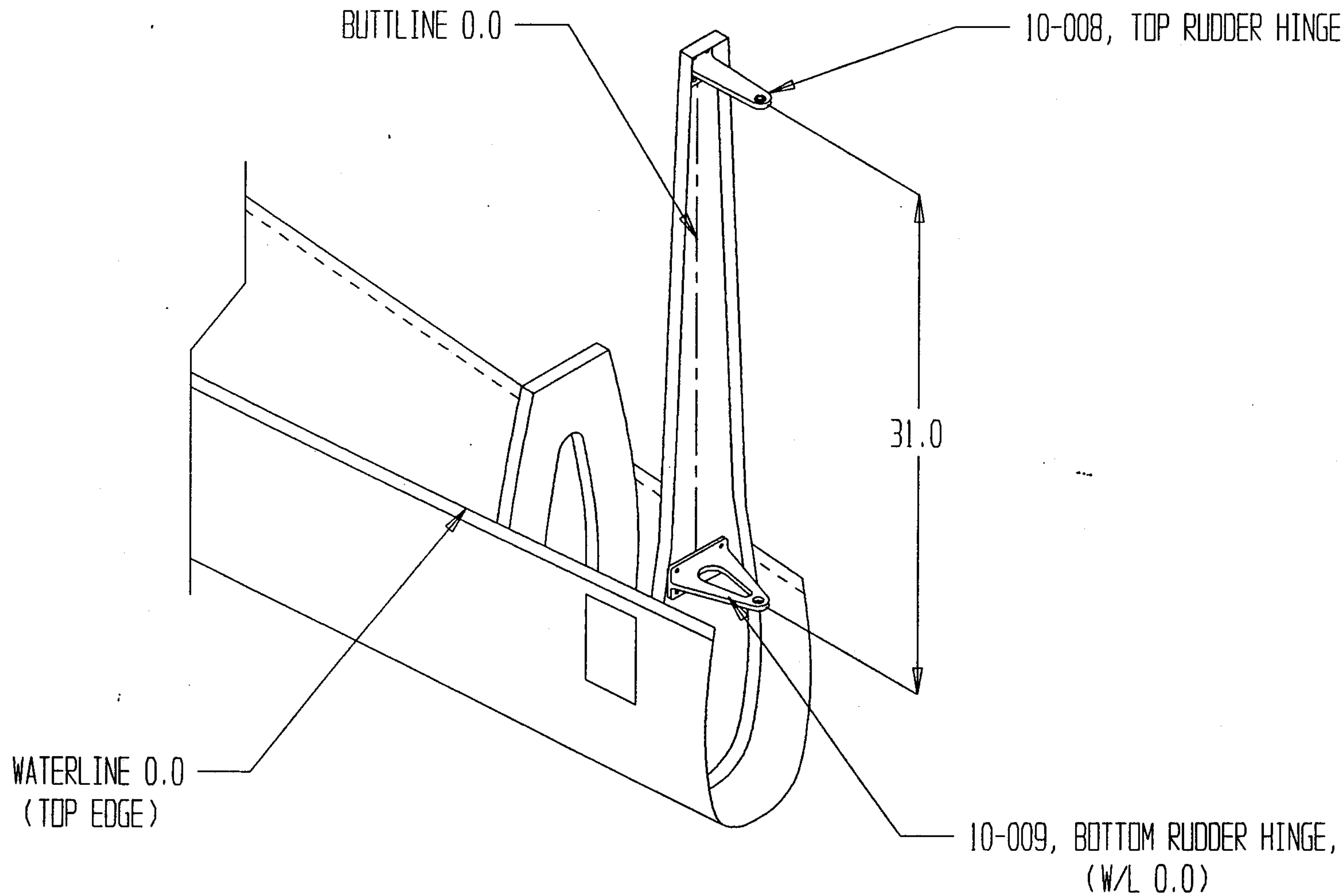
Step D Fine Tune The Position Of The Rudder Hinges

Check to make sure each hinge is level and properly centered on the rudder post. If you find the hinges are not level, carefully unclamp them and rotate them until they are (make sure the fuselage is properly leveled before moving the hinges).

Step E Drill Holes Through The Rudder Post

Using the hinges as a drill guide, drill the eight 1/4 inch mounting holes into the rudder post. Remove the hinges from the rudder post when done.

Step F Make The Rudder Hinge Backing Plates



INSTALL THE RUDDER HINGES

DRAWING NO. 20098A	TASK NO.	STEP NO.	AkroTech
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Find the .080 aluminum supplied with your kit. Use the base of each hinge as a pattern to make each backing plate. Cut out the two rudder hinge backing plates using a jigsaw or a bandsaw. Smooth the edges of these plates using a file or a belt sander.. Clamp each plate to its matching hinge and drill holes through each backing plate using the hinge as a template. Refer to the General Information Section of this manual to install the four nutplates in each backing plate.

Step G Bond The Backing Plates To The Rudder Post

Prepare the upper and lower rudder hinge backing plates for bonding to the rudder post as described in the General Information section of this manual. Wax the threads of the bolts for the upper and lower hinges. Mix and apply structural adhesive to both the backing plate and the forward face of the rudder post. Press the upper backing plate in place and install upper hinge using the waxed bolts. Tighten these bolts down so that the backing plate is pulled tight against the face of the rudder post. Clean up all excess structural adhesive. Do the same for the lower backing plate and hinge. Disassemble the hinge from the rudder post

Step H Install The Stainless Steel Retaining Screw In The Backing Plates

Drill a hole through the approximate center of each backing plate. Use a 100 degree countersink to countersink these two holes on the rudder post. Install the supplied stainless steel screw and secure with a locking nut.

TASK F-4 Install The Hinge Receiver Fittings On The Rudder Spar

Brief Task Description:

In this task you must accurately position and mount the rudder hinge receiver fittings to the rudder spar. The rudder post mounted hinges are used as a reference to position these fittings on the rudder. This assures that the rudder is properly aligned relative to the fuselage. Note that the upper fitting is a simple hinge receiver fitting identical to those used on the elevator while the lower fitting is a combination hinge receiver fitting and rudder horn. As with all other control surfaces, hinge placement is critical.

Step A Mark The Position Of The Hinges On The Rudder Spar And Skin

Secure a piece of 1/8 inch thick material to the bottom of the rudder with some tape. This will act as a shim to correctly space the bottom of the rudder off the bottom fuselage skin. Hold the rudder up to the rudder post at an angle (while resting it on the shim) and mark the locations of the rudder hinges on the rudder skin and rudder spar. You may have to trim the bottom fuselage skin to get the rudder to slide all the way up against the rudder hinges.

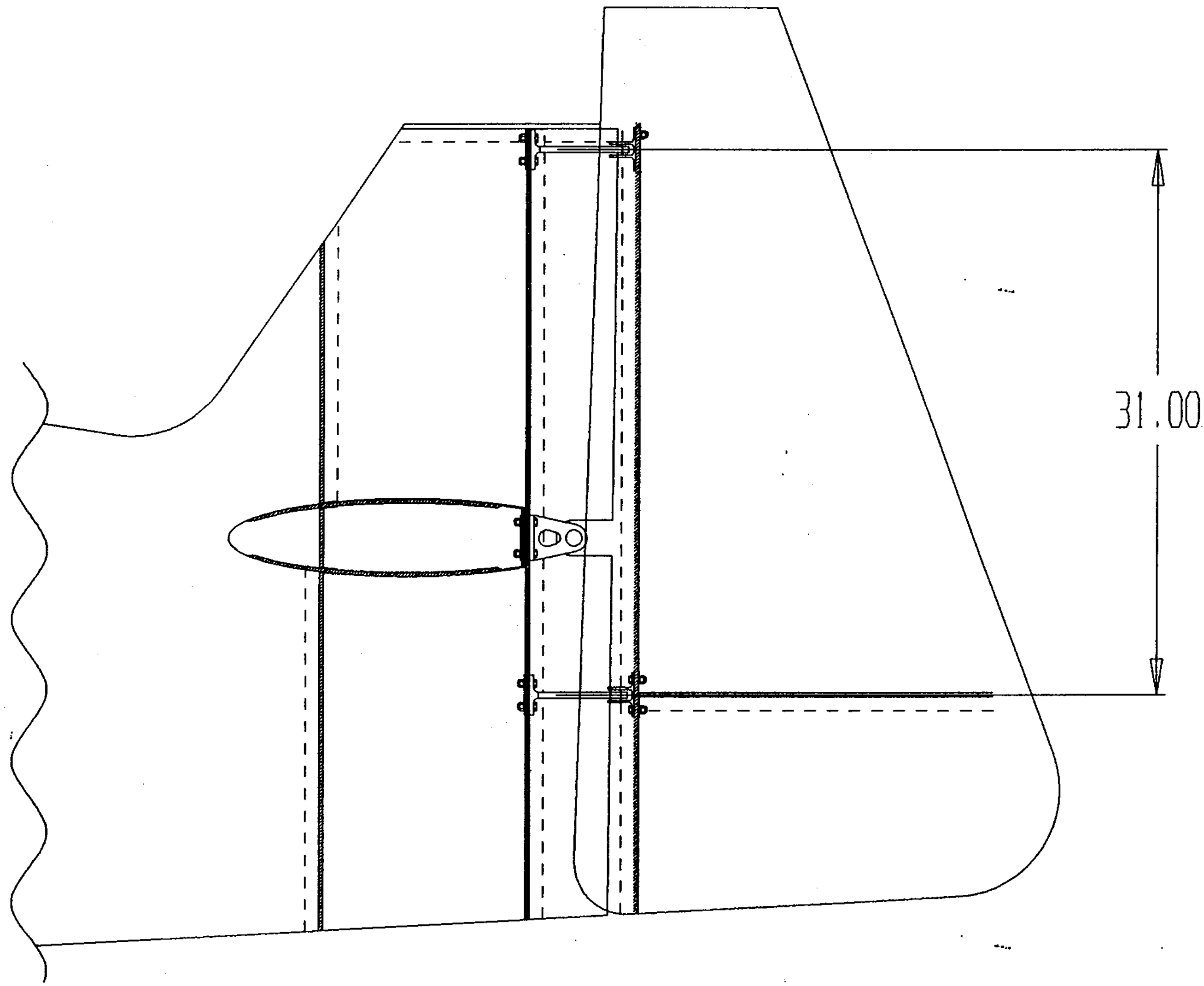
Step B Cut Slots In The Rudder Skin To Clear The Hinges

Use the marks made on the rudder skin in Step A to cut slots in the rudder skin to clear the hinges. Extend these slots back far enough towards the rudder spar to allow the rudder to slide straight onto the rudder post mounted hinges.

Step C Mark Centerlines On The Rudder Spar For The Fittings

Find buttline 00 on the rudder spar by measuring across the width of the spar at several locations and marking the midpoint of these measurements on the spar. Use the marks made in step A to find the horizontal centerlines (waterline 00 and waterline 31.0) for the fittings on the rudder spar.

Step D Mark Centerlines On The Fittings



DRAWING NO. 20056B	TASK NO.	STEP NO.	AkroTech
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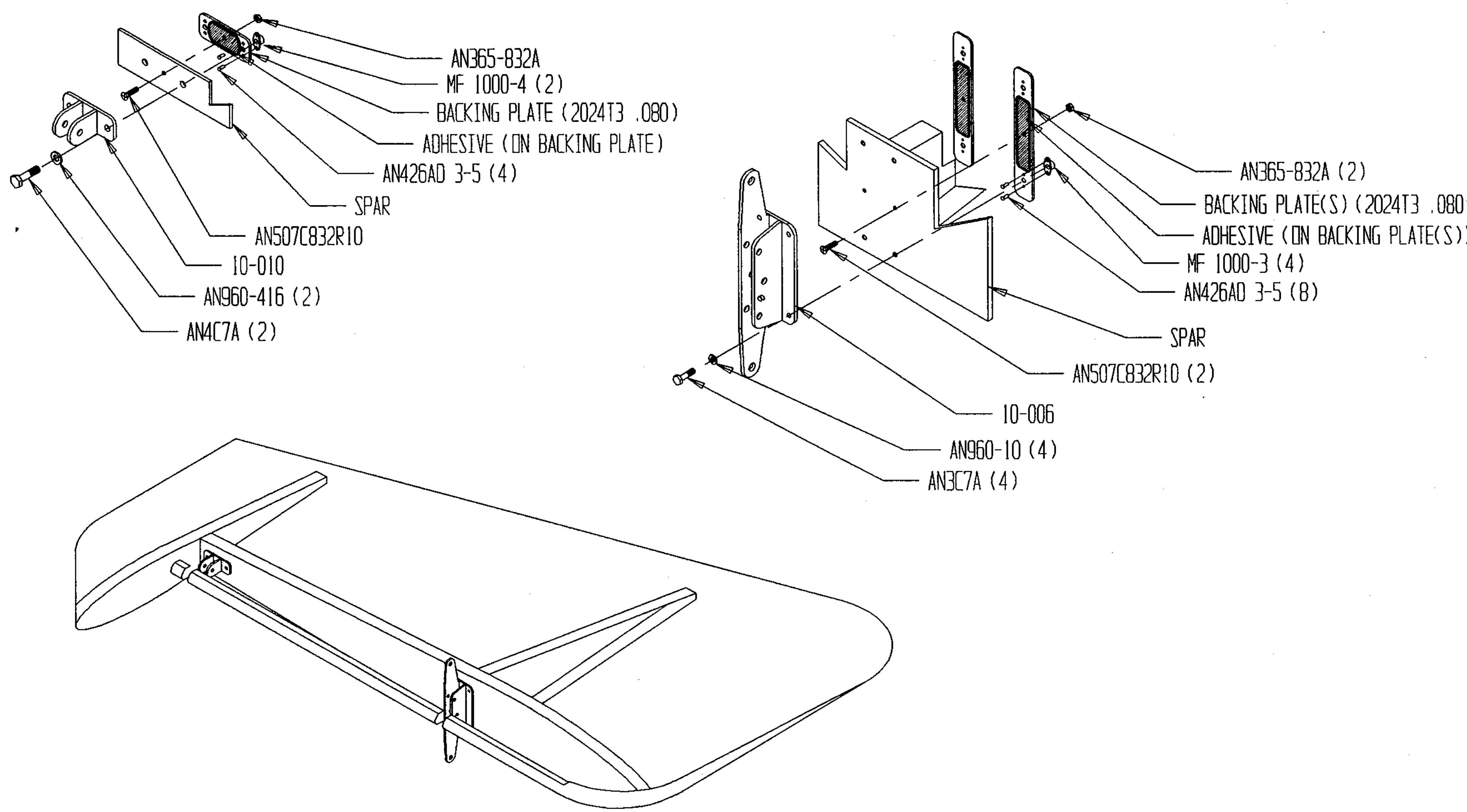

RUDDER HORN AND RECIEVER BRACKET INSTALLATION

DRAWING NO. 20039A	TASK NO.	STEP NO.	AkroTech
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Measure across the width and height of the base of each hinge fitting. Mark the midpoint of these measurements on the base. Carry these lines out to the edges of the fittings and place tick marks on the edges of the fittings. These marks will be used to position the fittings on the rudder spar.

Step E Cut A Slot In The Rudder Skin To Clear The Rudder Horn Arm

Now you will need to cut a slot in the rudder skin to clear the arm of the rudder horn. Double check that your rudder hinge placement puts the rudder horn exactly where you plan to cut the slot. This slot should be positioned just above the slot cut earlier for the rudder hinge but should extend further back towards the spar.

NOTE:
All slots that are cut in the skin should be rounded to a "U" shape at their ends. Slots that terminate in a square or a vee will act as "stress risers" and may eventually result in stress cracks.

Step F Clamp The Hinge Receiver fittings To The Rudder Spar

position the hinge receiver fittings on the using the reference lines. Clamp the fittings to the rudder spar using C-clamps. Now double check that the fittings are correctly positioned by holding the rudder up to the rudder post (with the 1/8 inch spacer between the rudder and the bottom fuselage skin). The rudder hinges should be centered in the fittings. If they are not, adjust them until they are.

NOTE:
Before you drill any holes, go back and double check all your measurements and positions. Are the hinge receiver fittings in the precise horizontal center of the rudder spar? Are the fittings cocked to one side or the other? Is everything clamped securely enough so that it will not shift as you work? Be certain of these factors before you drill the first hole.

Step G Drill The Holes For The Hinge Receiver Fittings

Once you are certain that the hinge fittings are securely held in the correct position, drill the two 1/4 inch holes through the upper fitting and rudder spar.. Now use the lower fitting as a drill guide to drill the four 3/16 inch holes through the rudder spar. Remove both fittings from the rudder when done.

Step H Make The Backing Plates For The Hinge Receiver Fittings

Next you must make the two backing plates for the hinge receiver fittings. You may wish to review the section entitled "Backing Plates" in the General Information Section of this manual at this time. These backing plates are installed on the rear face of the rudder spar and are made from the supplied .080 inch thick aluminum plate. Position the base of each fitting on the .080 aluminum sheet. Use a fine tip felt pen to trace the outline of the base on the aluminum. Cut out the backing plates from the aluminum using a jigsaw or bandsaw. Use a file to smooth any rough edges on the backing plates. Refer to the section entitled "Installing Nutplates" to install the four nutplates in the lower fitting backing plate and the two nutplates in the upper fitting backing plate.

Step I Bond The Backing Plates To The Rudder Spar

Prepare the backing plates and the rudder spar for bonding as instructed in the General Information Section of this manual. Wax the four stainless steel bolts that hold the lower hinge receiver fitting (rudder horn) in place. Wax the two bolts that hold the upper hinge receiver fitting in place. Prepare a small batch of structural adhesive and mix in enough structural filler to achieve "mayo" consistency. Coat the appropriate positions on the rear face of the rudder spar and the backing plates with the structural adhesive. Try to stay about 1/8 inch away from the holes when applying the adhesive. Now place the backing plates into position on the spar and insert the waxed bolts though the fittings and the rudder spar and into the nutplates. Tighten the bolts down and clean up all excess Adhesive. Allow the structural adhesive cure completely.

Step J Install The Stainless Steel Retaining Screws In The Backing Plates

After the structural adhesive has completely cured, remove the fittings from the rudder spar. Using the marks made earlier to locate the hinge receiver fittings, drill holes through both the rudder spar and the center of each backing plate (at WL 00 and WL 31.0). Use a 100 degree countersink to countersink these holes on the front face of the rudder spar for the 8-32 stainless steel screws. Install the stainless steel screws through the rudder spar and the backing plates and secure with nyloc nuts.

TASK F-5 Install The Rear Inspection Plates

Brief Task Description:

The rear inspection plates will allow access to the internal components in the tail of the aircraft. Installation of inspection plates is covered in greater detail in the General Information Section of this manual. You may wish to review that section at this time. These inspection plates are similar to the ones installed earlier in the aileron. There is a slight difference here in that these inspection plates are made of polycarbonate sheet instead of aluminum to allow for inspection of the tail without removing the inspection plate. Follow steps A-D to install the rear inspection plates.

Step A Cut Out The Inspection Plates

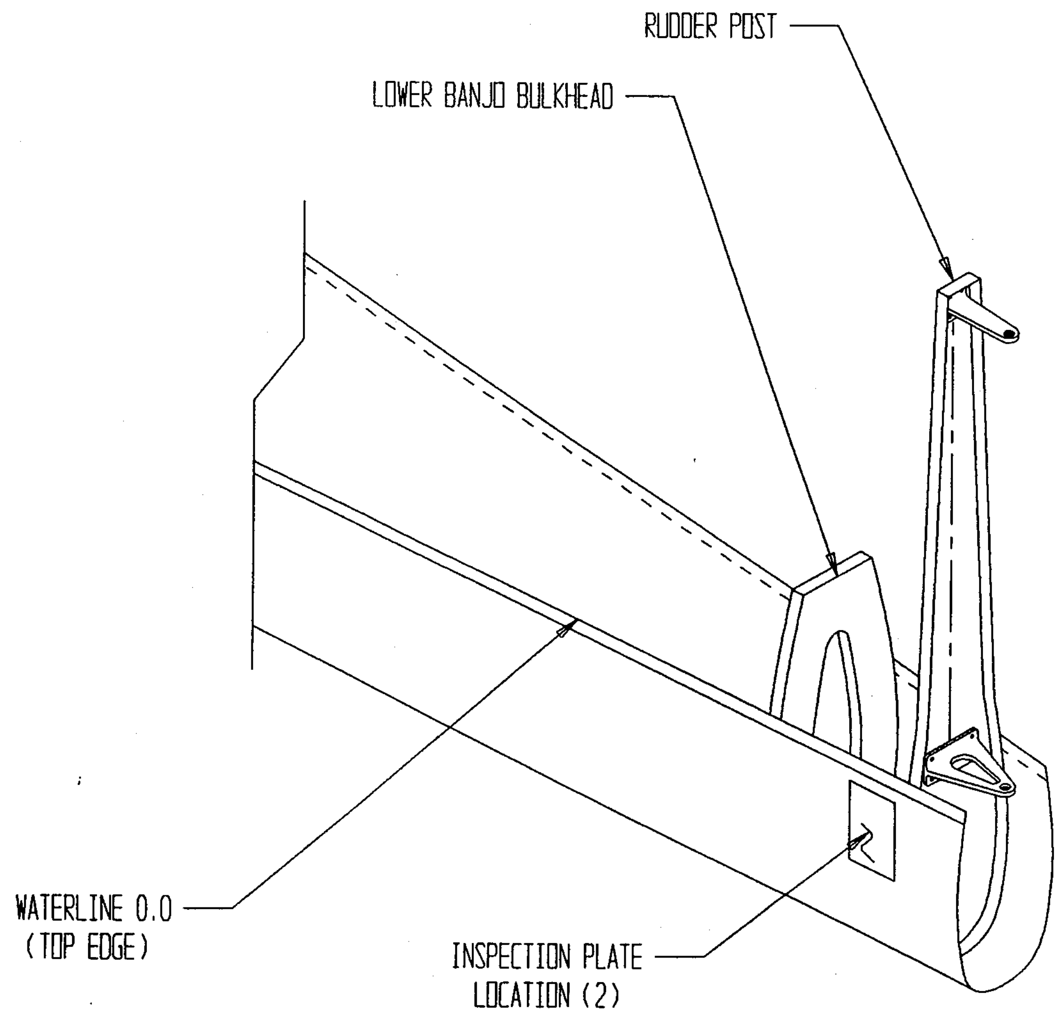
Remove the rear inspection plate templates from this manual and use spray adhesive to bond these to the supplied polycarbonate sheet (Note: do not remove the paper backing on the polycarbonate). Cut out the inspection plates along the solid line using a jig saw or band saw with a metal cutting blade. Leave the paper template in place for now.

Step B Cut Out The Flanges For The Inspection Plates

Remove the rear inspection plate flange templates from this manual and use spray adhesive to bond them into the premolded recessed flanges on the fuselage. Make sure the templates are centered in the flange recesses. Use a jig saw to cut out the center of the flanges along the solid line on the template.

Step C Drill Holes In The Inspection Plate And Flange

Find the center of each of the four holes on one inspection plate and use a center punch to prepare the four holes for drilling. Use two inch wide tape to secure the inspection plate in the pre-molded flange. Use plenty of tape to secure it well enough so that it will not move while drilling the holes. (Note: Because the plate is flat and the fuselage is contoured, the inspection plate may not sit perfectly flat in the recessed flange). Hold the top of the plate flat against the fuselage and use a 1/8 inch drill bit to drill out the two top



INSTALL REAR INSPECTION PLATES

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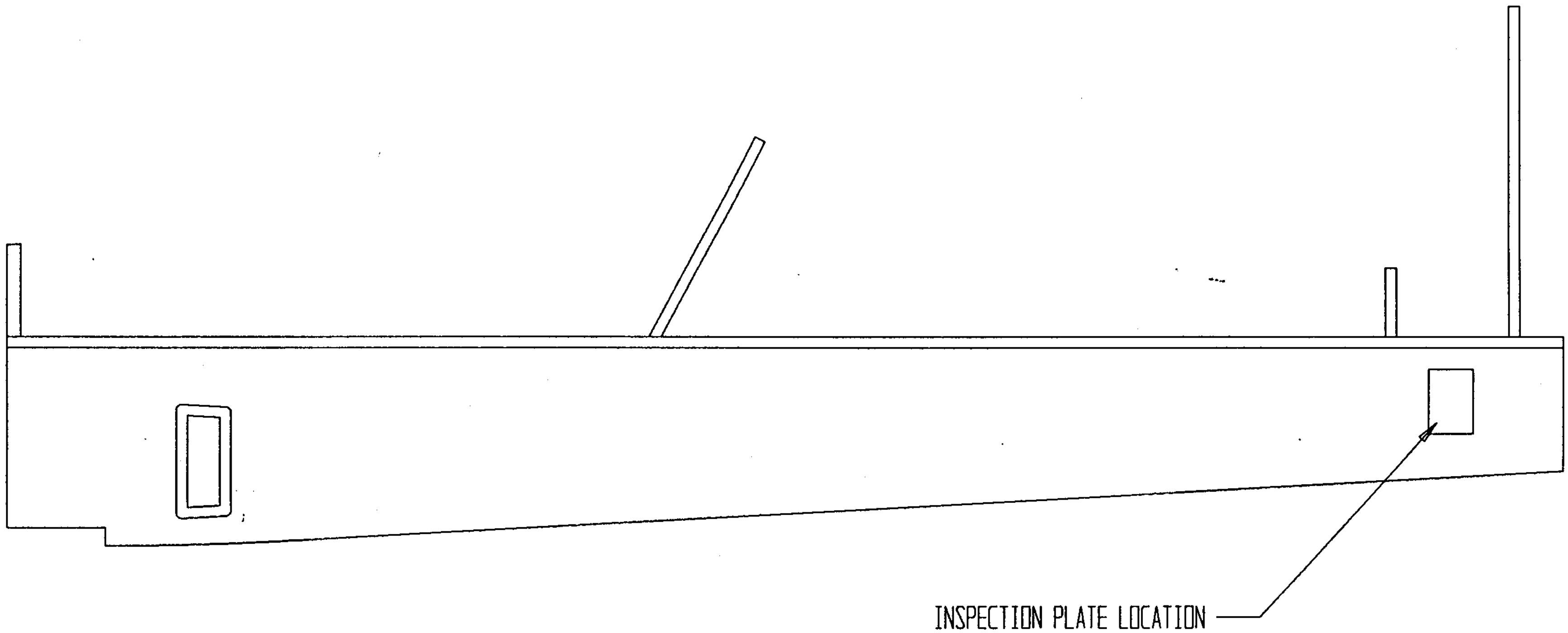

REAR INSPECTION PLATE

DRAWING NO. 20055A	TASK NO.	STEP NO.	AkroTech	
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holes. Install Clecos in these two holes to hold the plate in place. Now hold the bottom of the plate flat against the fuselage and drill the two bottom holes. Remove the plate from the flange. Drill out the holes in both the flange and the inspection plate with a 11/64 inch bit to fit the inspection plate screws. Now countersink the holes in the inspection plate so that the screws will sit flush when installed. Repeat this process for the other inspection plate.

Step D Install Nutplates For The Inspection Plate

Refer to the general information section of this manual to install the four nutplates into the premolded recessed flanges on both sides of the fuselage.

TASK F-6 Mount And Align The Stabilizer

Step A Locate And Drill Holes For The Rudder Post Stabilizer Hinge

Locate and mark waterline 9.00 on the rear face of the rudder post. Center the rudder post stabilizer hinge on waterline 9.00 and buttline 00. Clamp this hinge in place on the rudder post. Double check for proper alignment by placing a level on one side of the hinge. Make sure the hinge side is exactly plumb (vertical). Using the hinge fitting as a template, drill 1/4 inch holes through the rudder post. Remove the hinge from the rudder post. Drill out the holes just drilled in the rudder post using a 9/32 inch bit (This will oversize them and allow for later stabilizer alignment).

Step B Cut A Notch In The Stab

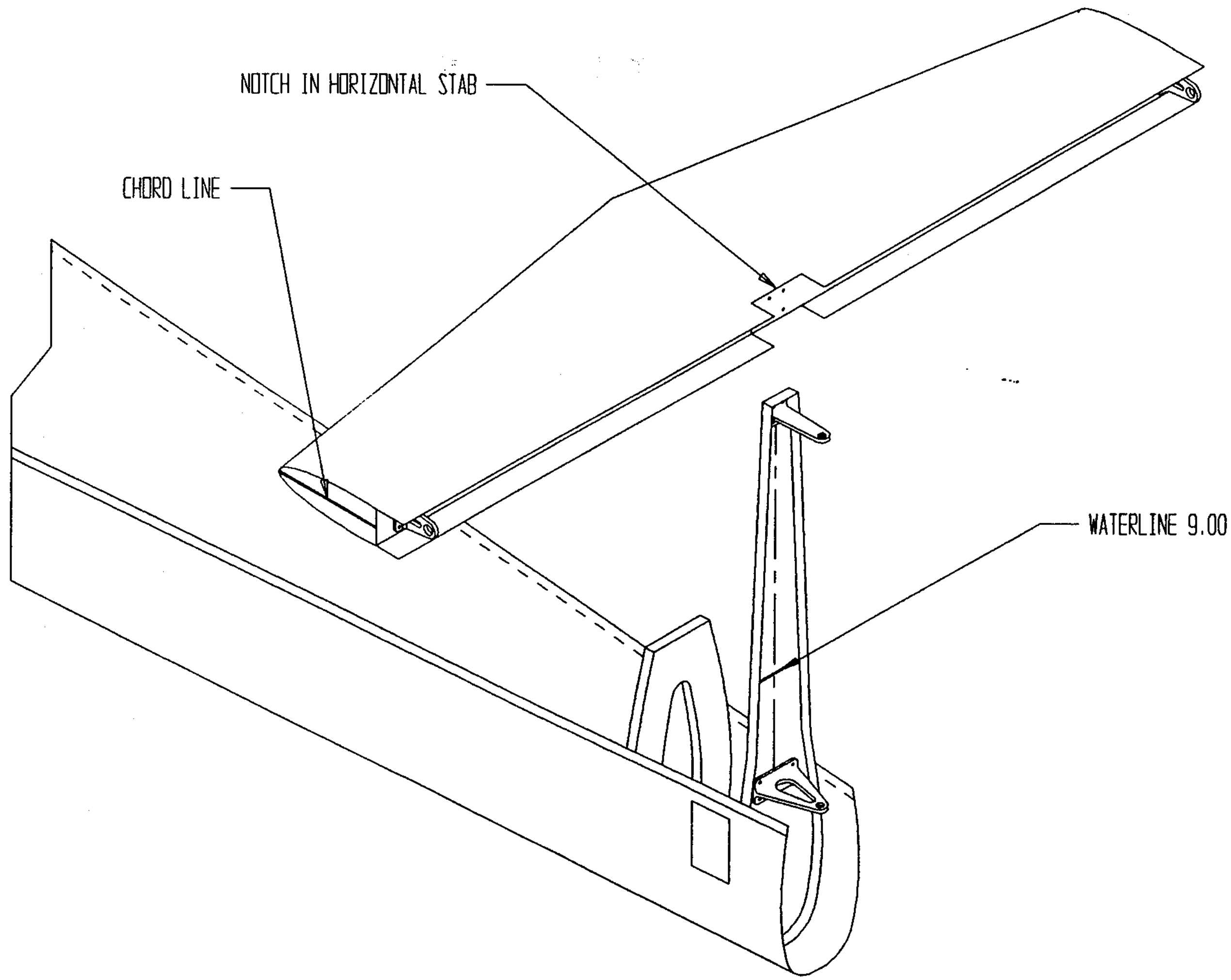
Cut out the notch in the trailing edge of the stabilizer with a hand held jigsaw. . This notch is necessary to allow the rear face of the stab spar to sit up flush against forward face of the rudder post. While cutting the notch be extra careful not to cut into the shear web of the stab spar! Use a Dremel tool or the equivalent to carefully grind down the notch close to the stabilizer spar shear web. Finish the notch by hand using sandpaper.

Step C Draw A Chord Line On The Tip Rib Of The Stab

To properly align the stab in pitch, you will need to draw a line bisecting the tip rib of the stab. To do this place some masking tape over the tip rib of the stab. Use a ruler with a fine scale to mark the midpoint of the thickness of the rib at several locations. Draw a line through these points on the masking tape.

Step D Trial Fit The Stabilizer To The Fuselage

Slide the stabilizer into place around the rudder post . Insert bolts through the rudder post into the stabilizer and tighten them down just enough to allow the stabilizer to move relative to the rudder post with a little friction. Now check to see if the stabilizer can be aligned properly with the bolts slightly loose. Check for proper pitch alignment by placing a level on the line marked on the tip rib in step C. Measure from the right outboard edge of the stabilizer to the right top edge of the rudder post and the left



MOUNT AND ALIGN THE HORIZONTAL STAB

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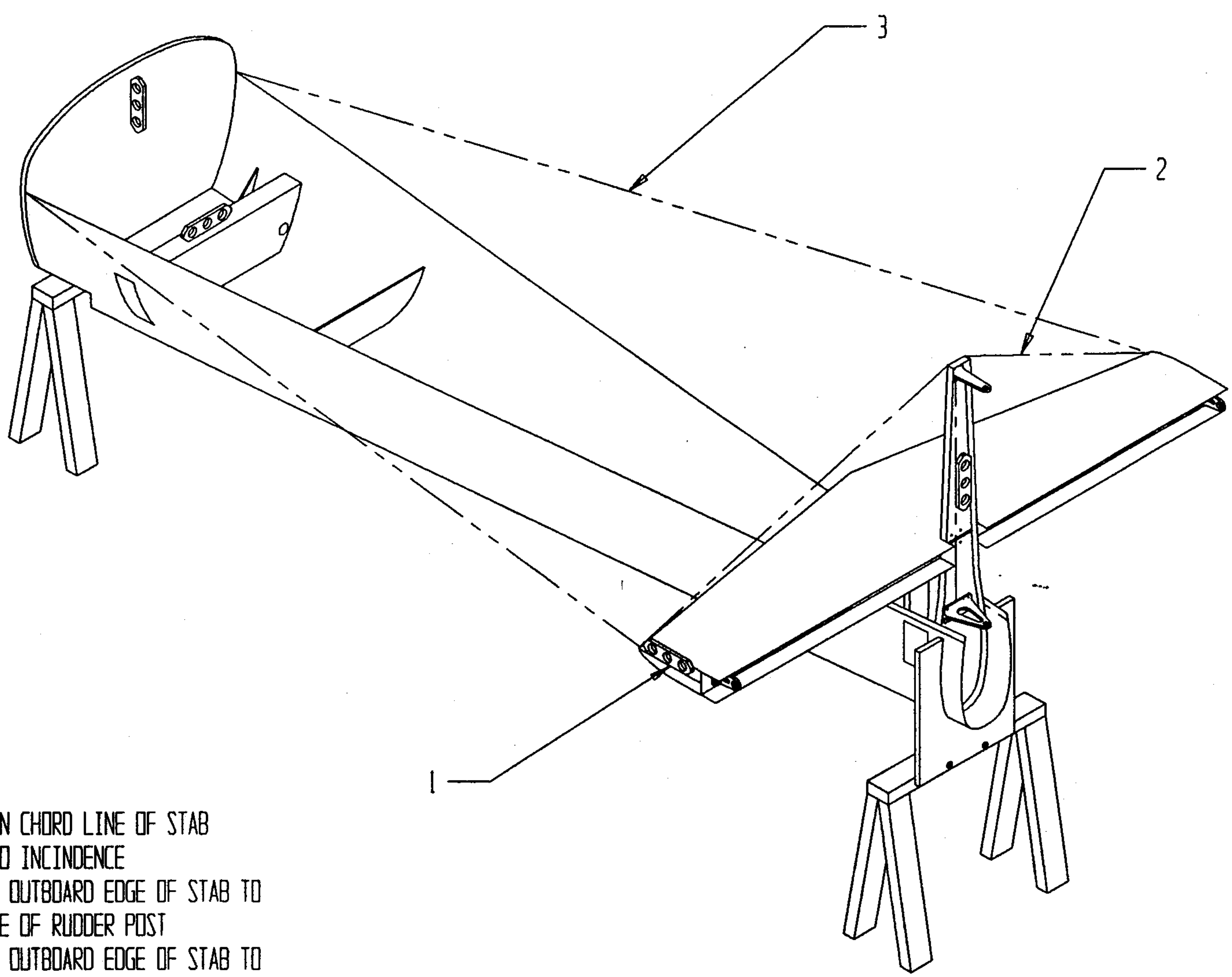

NOTES:

1 - LEVEL ON CHORD LINE OF STAB
FOR ZERO INCINDENCE

2 - MEASURE OUTBOARD EDGE OF STAB TO
TOP EDGE OF RUDDER POST

3 - MEASURE OUTBOARD EDGE OF STAB TO
TOP EDGE OF FUSELAGE AT FIREWALL

DRAWING NO. 20044A	TASK NO.	STEP NO.	AkroTech
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outboard edge of the stabilizer to the left top edge of the rudder post, these measurements must be equal, for roll alignment. Check for proper yaw alignment by measuring from the right side of the forward face of the firewall at buttline 00 (buttline 00 is coincident with the top edge of the lower fuse) to the right tip of the stab. Do the same for the opposite side of the stab. These two measurements must be equal.

NOTE:
Do not use measurements off of the floor for the purpose of leveling the stabilizer. Concrete floors may have high and low spots that will give you an inaccurate measurement. Also, be sure the fuselage is properly aligned prior to checking stabilizer alignment.

Step E Shim Gaps With Structural Adhesive

Once you have the stabilizer properly aligned, Check to see if you have any gaps exceeding 1/16 inch between the stabilizer and the lower banjo and/or the stabilizer and the rear face of the rudder post. If a shim is required in any location, it can be made by first placing clear tape on the stabilizer where it intersects the banjo and rudder post, applying a layer of structural adhesive mixed to "mayo" consistency to the area with the gap, and finally positioning the stabilizer on the banjo and rudder post so that it is once again properly aligned. Make sure all excess structural adhesive is removed from the gap. After the structural adhesive has cured, remove the stabilizer and the clear tape.

NOTE:
On early kits the lower banjo bulkhead is about 1/4 inch too short. If you have a short banjo bulkhead, you will have a gap of about 1/4 inch between the bottom of the stab and the top of the lower banjo when the stab is properly positioned at waterline 9.0 and leveled. It is acceptable to use the method described above to fill this gap.

Step F Permanently Install The Stabilizer

To permanently install the stabilizer, prepare all mating surfaces for bonding according to the procedures outlined in the General Information Section. Coat the top edge of the lower banjo and the corresponding section of the stabilizer with structural adhesive. Coat the forward face of the rudder post and the corresponding section of the elevator with structural adhesive. Install the rudder post elevator hinge with waxed bolts but do not tighten them yet. Position a 5 lb weight over the lower banjo to provide clamping pressure. Check the stabilizer for correct alignment just as you did in Step D. *This is a critical step. If the stabilizer is not properly aligned, the flying qualities of the aircraft will be compromised.* When you are sure the stabilizer is correctly aligned, tighten the rudder post stabilizer hinge bolts. Clean up any excess structural adhesive with a rag and leave the stabilizer undisturbed until the structural adhesive has cured.

NOTE:
The stabilizer will require 24 hours of undisturbed curing at 65 degrees or higher. If your shop temperature is below 60 degrees, cover the stabilizer with a tent of clear plastic and place a small electric heater inside the tent. Also, be aware that some pets (such as cats) love to sleep on the warm surface of a heated stabilizer. Take the proper precautions to make sure this doesn't happen.

TASK F-7 Install The Right Fin Skin And Upper Banjo Bulkhead

Brief Task Description:

In this task you will mount the right fin skin, install your antenna/e in the vertical fin, and install the upper banjo bulkhead. Even though you will not be bonding the top fuselage in this operation, you will need to mount it so you can properly align the forward edge of the fin skin.

Step A Cut Out Stabilizer Opening In Right Fin Skin

Follow the premolded scribe line to cut out the stabilizer opening in the fin. use a hand held jig saw with a fine-toothed, metal cutting blade. Carefully fit the right fin skin around the stabilizer and trim if necessary.

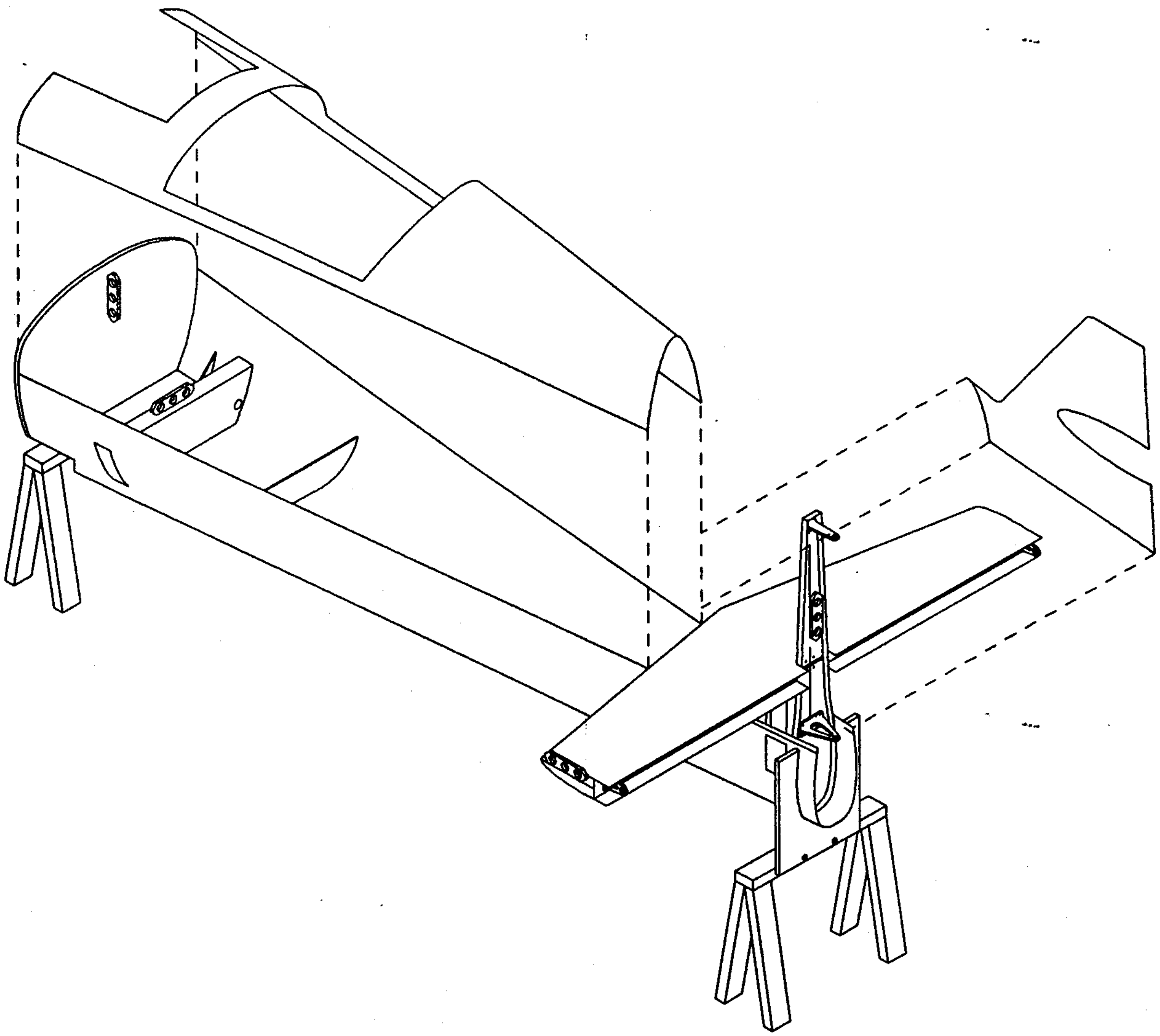
> NOTE:
> Early kits do not have the core material removed from the area where the stab cutout is made on the fin skins . If the core material has not been removed from this area on your fin skin, you will need to seal the core material exposed in step A using a mixture of laminating resin and microballoons. Refer to the section entitled "Mixing and Thickening Epoxy Resins" in the general information section of this manual.

Step B Remove The Counterbalance Arm Skins From The Fin Skins

The skins for the counterbalance arms of the rudder are molded as part of the fin skins. Thus you will need to cut off these pieces so they can be bonded to the rudder. Use a jigsaw or cut off wheel to trim the counterbalance arm skins from the fin skins along the premolded scribe line.

Step C Temporarily Mount The Upper Fuselage On The Lower Fuselage

Check the alignment of the lower fuse once more to be certain it is not twisted. Place levels on the spar box and along the centerline of the stabilizer and check for level. Once



INSTALLATION OF RIGHT FIN SKIN

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you are certain the lower fuse is properly aligned, mount the top fuselage on the lower fuselage. Align the bottom edge of the top fuselage with the pre molded joggle in the lower fuselage. Clamp the top fuselage in position with spring clamps and drill about ten equally spaced holes for clecos through the upper and lower fuselage where they overlap. Remove the top fuselage when done.

Step D Temporarily Mount The Right Fin Skin

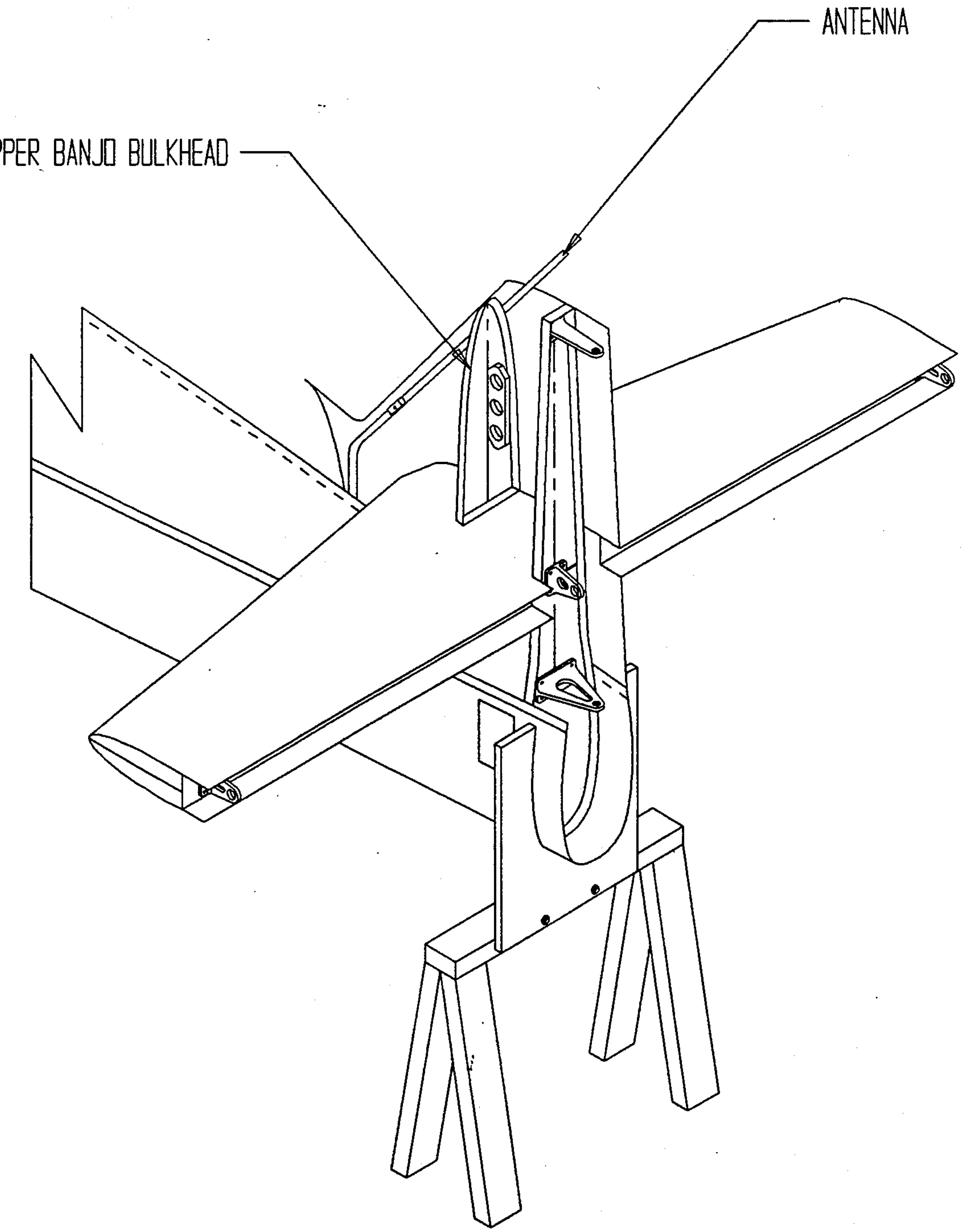
Slide the right fin skin over the stabilizer. Mount the top fuselage over the bottom fuselage once more and secure it with clecos. The upper fuse will provide a reference for the forward edge of the fin skin thus ensuring proper alignment of the fin skin. Clamp the fin skin to the top fuselage and to the bottom of the rudder post.

Mount the rudder once more to the rudder post hinges (you may have to trim the fin skin to get it to fit) .Now flex the top of the rudder post until the leading edge of the counterbalance arm on the rudder matches up with the leading edge of the fin skin. With these two leading edges matched up, clamp the top of the fin skin to the rudder post. Drill and Cleco the fin to the recessed edge along the top of the lower fuselage, to the rudder post flange, and to the top fuselage every four inches. Drill two holes for Clecos through the upper banjo flange and into the inside layer of the fin skin. Remove the top fuselage, fin skin and rudder when done.

Step E Permanently Mount The Right Fin Skin

Prepare the inboard surface of the right fin skin for bonding where it intersects the upper and lower banjo, rudder post, and lower fuselage. Place some clear tape over the area on the top fuselage that mates with the joggle on the fin skin (you will not be bonding the fin skin to the top fuselage at this time). Mix structural adhesive and add enough structural filler to achieve "mayo" consistency. Coat all mating surfaces with the adhesive. Use Clecos to mount the right fin skin to the lower fuselage, rudder post. and lower banjo. Now mount the top fuselage to the lower fuselage with clecos. Secure the fin skin to the top fuselage along the forward joggle with clecos. Remove all excess structural adhesive using a clean rag.

Step F Mount The Necessary Antennae On The Right Fin Skin



INSTALLATION OF UPPER BANJO BULKHEAD

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Prior to installing the upper banjo bulkhead, you may wish to install any necessary antennae. This is especially true of the flat type of antennae since these are easily mounted directly to the fin skin (this will be difficult to accomplish once the upper banjo bulkhead is in place).

Because there are a number of different antenna options for composite aircraft, we cannot provide specific installation instructions. However, we do offer the following guidelines for installation:

- Mount the antenna securely using fiberglass (a loose antenna will not be easy to secure later)
- Try to get the full length of the antenna within the fiberglass area of the fin (The carbon is conductive and will block radio signals).
- Secure the cable for the antenna with fiberglass at several locations along the length of the fuselage.

If you use the flat type of antenna you can run it just inside the leading edge of the fin and fold it over so that it runs under the fin tip rib. This will allow you to fit it inside the fin without it overlapping the bottom fuselage..

If you have any further questions concerning antenna installation please feel free to call us at AkroTech for assistance.

Step G Install The Upper Banjo Bulkhead

Position the upper banjo bulkhead on top of the stabilizer. Align the upper banjo so that its face is plumb (vertical) and its flange lays flat against the right fin skin. With the upper banjo held in position, drill two holes for Clecos through the lower flange and into the top layer of the stabilizer skin. Install Clecos in these holes. Now drill two more holes through the left flange and into the inside layer of the right fin skin (it is not necessary to drill all the way through the fin skin).

Prepare the upper banjo for bonding to the stabilizer. Mix structural adhesive and coat the bottom and side of the upper banjo and the corresponding area of the stabilizer and fin skin with adhesive. Place the upper banjo into position and install clecos into the cleco holes. Allow the adhesive to cure completely.

TASK F-8 Mount The Counterbalance Rib And Skin On The Rudder

Step A Trim The Leading Edge Of The Rudder For The Counterbalance Arm

Use your Dremel tool to cut away the leading edge skin of the rudder where the counterbalance arm will be mounted. Cut away only the forward 1.5 inches of skin at the location of the molded recess at the top of the rudder. Do not cut along the recess line itself.

Step B Install The Counterbalance Rib In The Rudder

Place the right rudder skin (the skin with the rib installed) in the rudder jig. Weight it down slightly so that the skin contacts the jig all around. Prepare the flange on the counterbalance rib and the mating area on the rudder skin for bonding. Mix up some structural adhesive and thicken with stuctural filler to "mayo" consistency. Apply the adhesive to the counterbalance rib and press it into position on the rudder skin. Adjust the rib as necessary to get the face of the rib plumb (straight up and down) then secure it with tape in that position. Allow the adhesive to cure completely.

Step C Bond The Right Counterbalance Skin To The Rudder

Remove the rudder assembly from the jig. Prepare the entire recess on the rudder skin and the flange on the counterbalance rib for bonding. Also, prepare the mating areas on the counterbalance arm skins for bonding. Mix up a small batch of structural adhesive and thicken with structural filler to "mayo" consistency. Apply the adhesive to all bond areas. Press the counterbalance arm skin in position and secure with light clamping pressure. Allow the adhesive to cure completely.

NOTE:
Only the right side counterbalance arm skin will be bonded in this task. The left side skin will be bonded later when the rudder is closed.

TASK F-9 Build And Install The Rudder Trim Tab

Brief Task Description:

In this task you will fabricate and install a simple ground-adjustable rudder trim tab. It will be made of sheet aluminum and manually bent to the desired angle of deflection.

Step A Cut Out The Aluminum Trim Tab

Find the .040 Aluminum trim tab material supplied with your kit. Mark out a rectangle 5.25" long by 2.5" wide. Cut out this piece using a jigsaw or bandsaw.

Step B Cut The Recess Into The Rudder Skins

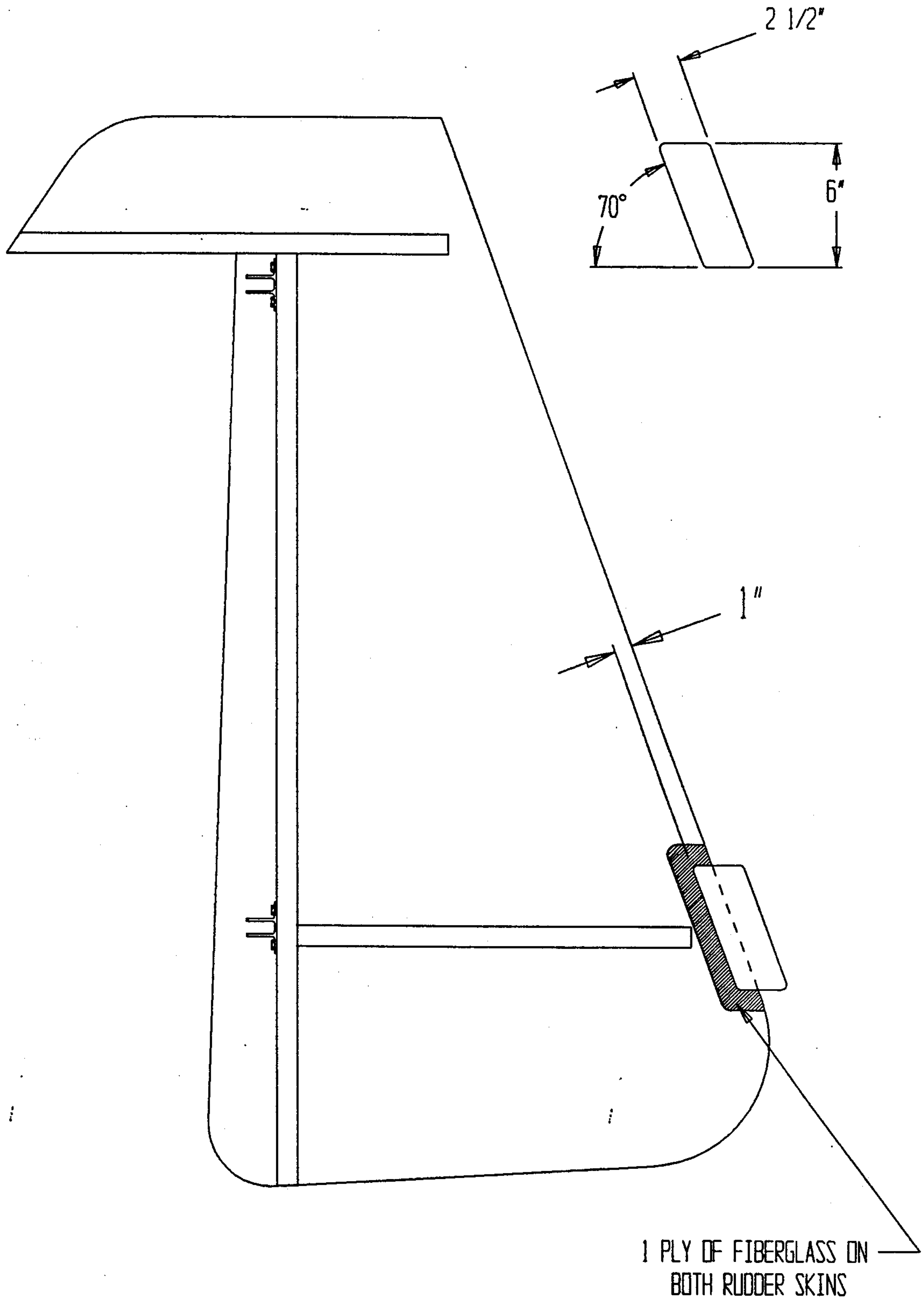
Cut a recess in the trailing edge of the rudder to allow room for the trim tab to pass through while still allowing the two ruder halves to mate. This recess should be deep enough to allow for both the thickness of the trim tab and the fiberglass lay-up necessary to separate the aluminum from the carbon.

Step C Lay Up Fiberglass In The Trim Tab Recess

Refer to the section entitled "Wet Lay-ups" in the General Information Section of this manual to lay up a single ply of fiberglass in the trim tab area on both rudder skins. This ply of fiberglass should cover the entire area where the aluminum trim tab would otherwise contact the carbon fiber of the rudder skin. Its purpose is to isolate the aluminum from the corrosive effects of the carbon fiber.

Step D Bond The Trim Tab To The Rudder

Prepare both the right rudder skin and the part of the trim tab that will be bonded into the rudder for bonding. Bond the tab in place with structural adhesive, so that 1.25" is exposed beyond the trailing edge.



RUDDER TRIM TAB LOCATION

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TASK F-10 Install The Fin Tip Rib

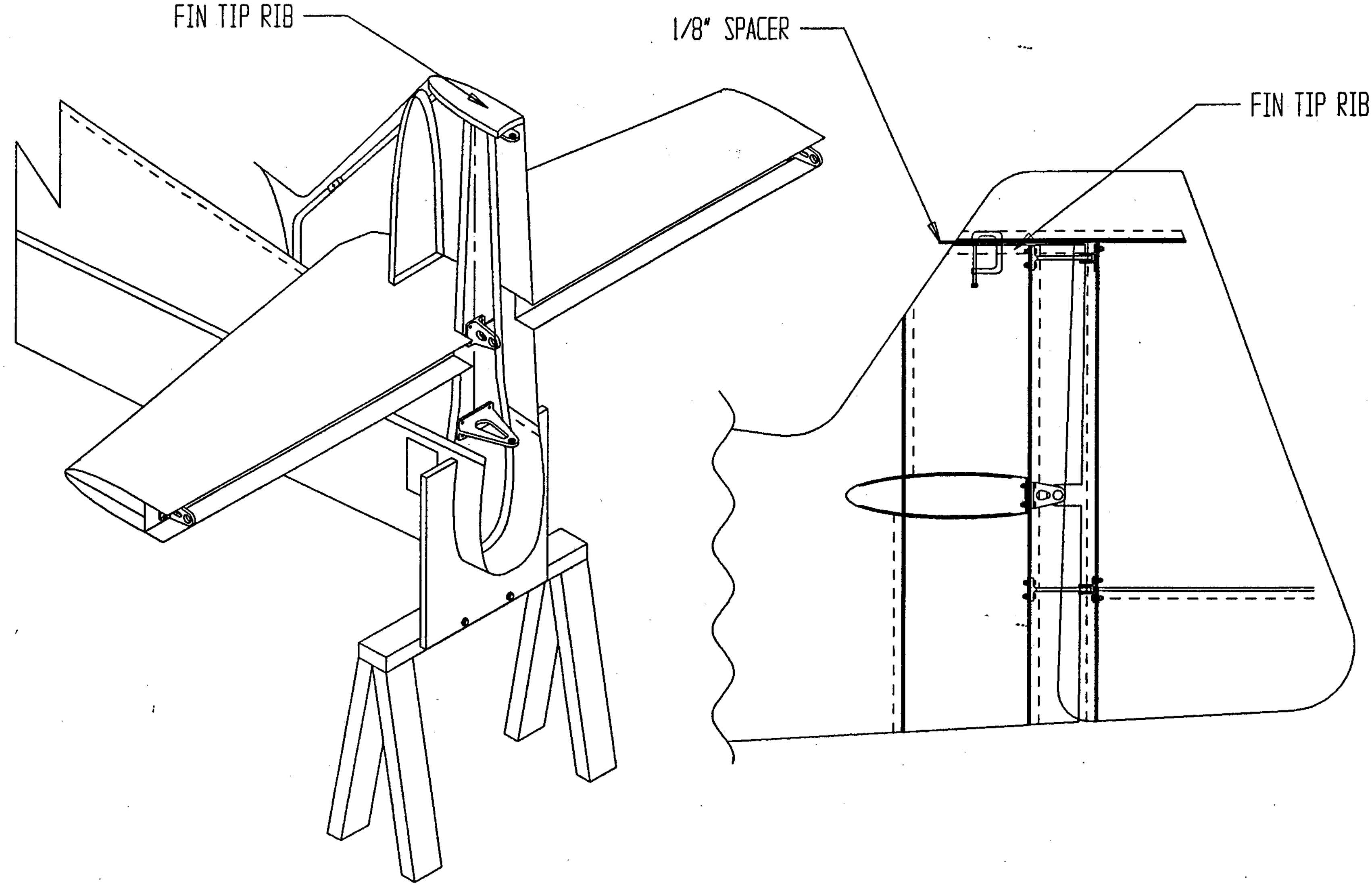
Step A Position The Fin Tip Rib

Mount the rudder to the rudder post hinges once more. Find some material that is 1/8 inch thick to act as a spacer. Locate the fin tip rib that is supplied with your kit. Position the rib on top of the rudder post so that its flange points downward and its tip even with the leading edge of the fin skin. Clamp the rib to the counterbalance rib of the rudder with the 1/8 inch spacer in between.. Drill and Cleco the rib to the right fin skin and the rudder post.

Step B Install The Fin Tip Rib

Remove the fin tip rib from the fuselage. Prepare all mating surfaces for bonding. Prepare structural adhesive and thicken it with structural filler. Bond the fin tip rib to both the right fin skin and the rudder post. Install Clecos into the previously drilled holes and clamp the rib to the counterbalance arm of the rudder with the 18/ inch spacer as you did in Step A.

NOTE:
Some of the early kits were shipped with a fin tip rib that is too wide. If you received this oversized rib, please call us at AkroTech and we will send you the correct rib.



INSTALLATION OF UPPER FIN RIB

DRAWING NO. 20063A	TASK NO.	STEP NO.	AkroTech
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TASK F-11 Install The Counterbalance Weight In The Rudder

Brief Task Description:

In this task you will add counterbalance weight to the rudder. Unlike the aileron and the elevator, the rudder is not balanced 100% (i.e. the weight added to the counterbalance arm will not balance the rudder). Instead, the rudder will be balanced to 50% using a predetermined amount of lead shot.

Step A Measure Out The Lead Shot

The G-200 rudder will need approximately 1290 grams of lead shot in the nose of the counterbalance rib. Measure out the lead shot with your epoxy scale and set it aside.

Step B Prepare The Rudder

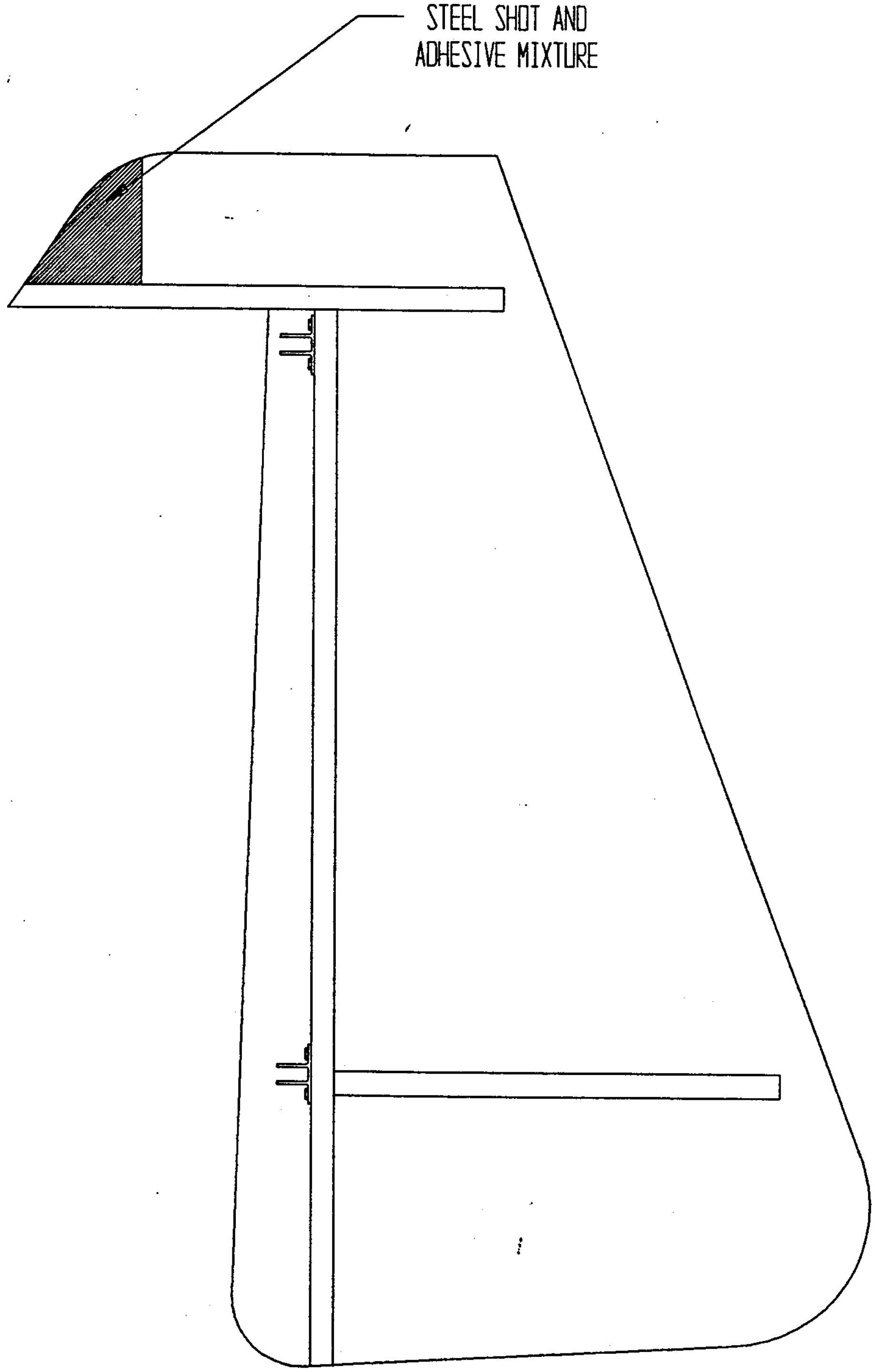
Prepare the area inside the tip of the counterbalance arm for bonding .

Step C Prepare The Lead Shot / Adhesive Mixture

Prepare a three oz batch of structural adhesive and mix in enough structural filler to achieve to mayo consistency. Add the lead shot to the adhesive and mix thoroughly until all of the lead shot pellets are coated.

Step D Pack The Lead Shot / Adhesive Mixture Into The Rudder

Jig on your work table so it is resting slightly nose down. Pack the lead shot mixture into the tip of the counterbalance arm. Try to keep the mixture as close to the tip of the arm as possible. Allow the adhesive to cure undisturbed.



STEEL SHOT LOCATION

DRAWING NO. 20059A	TASK NO.	STEP NO.	AkroTech	
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TASK F-12 Build The Rudder Jig

Brief Task Description:

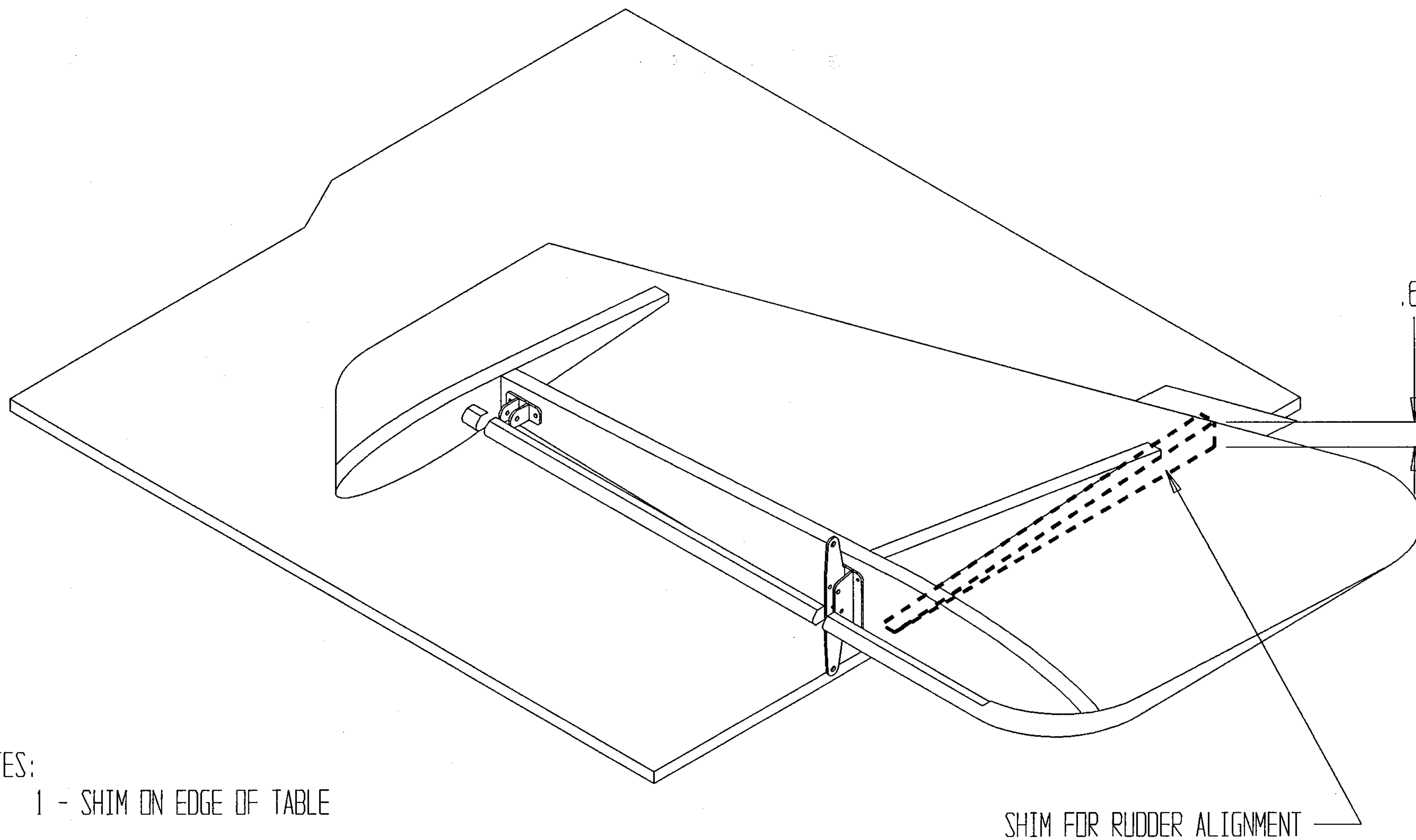
The rudder jig is quite simple compared to the jigs made previously. A flat work table and simple wood shim is all that is required to properly align the rudder. Follow the instructions in steps A and B to build this simple jig.

Step A Check To See If Your Work Table Is Flat

Verify that your work table is flat by sliding a four foot level along the table over an area about the size of your rudder. First place the level across the width of your table and slide it along the table's length then place the level along the table's length and slide it along the table's width. If you find the table is not level, shim the legs of the table until it is. If you find the table is not flat, you can twist it until it is by using shims.

Step B Make A Shim To Support The Waterline 00 Rib

You will now need to make a wood shim to support the waterline 00 rib at the correct angle. Cut out this ribs from some ½ inch or thicker wood (see illustrations) and mount it to the table with hot glue so that its face is flush with the end of the table. This will allow the bottom of the rudder to overhang the table (necessary because the bottom of the rudder flares outward).



NOTES:

1 - SHIM ON EDGE OF TABLE

RUDDER JIG

DRAWING NO. 200120B	TASK NO. - -	STEP NO. - -	AkroTech
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TASK F-13 Close The Rudder

Brief Task Description:

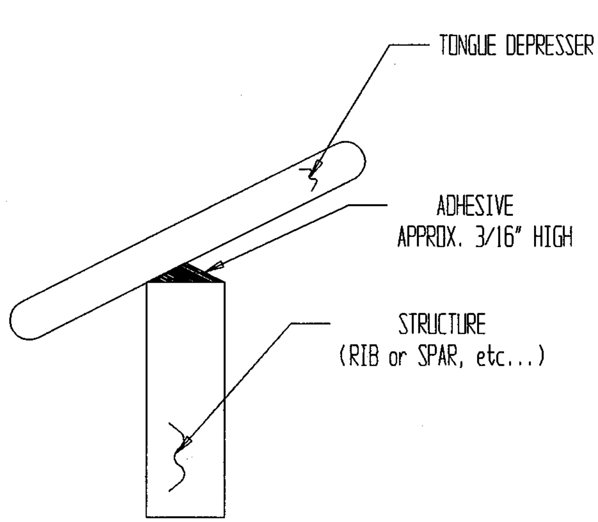
This task involves closing the rudder by bonding the left rudder skin and left counterbalance arm skin into place on the rudder assembly. Unlike the other flying surfaces, the rudder does not require that the bond surfaces be built up prior closing. This operation is performed with the rudder mounted in the simple jig built earlier to keep it properly aligned.

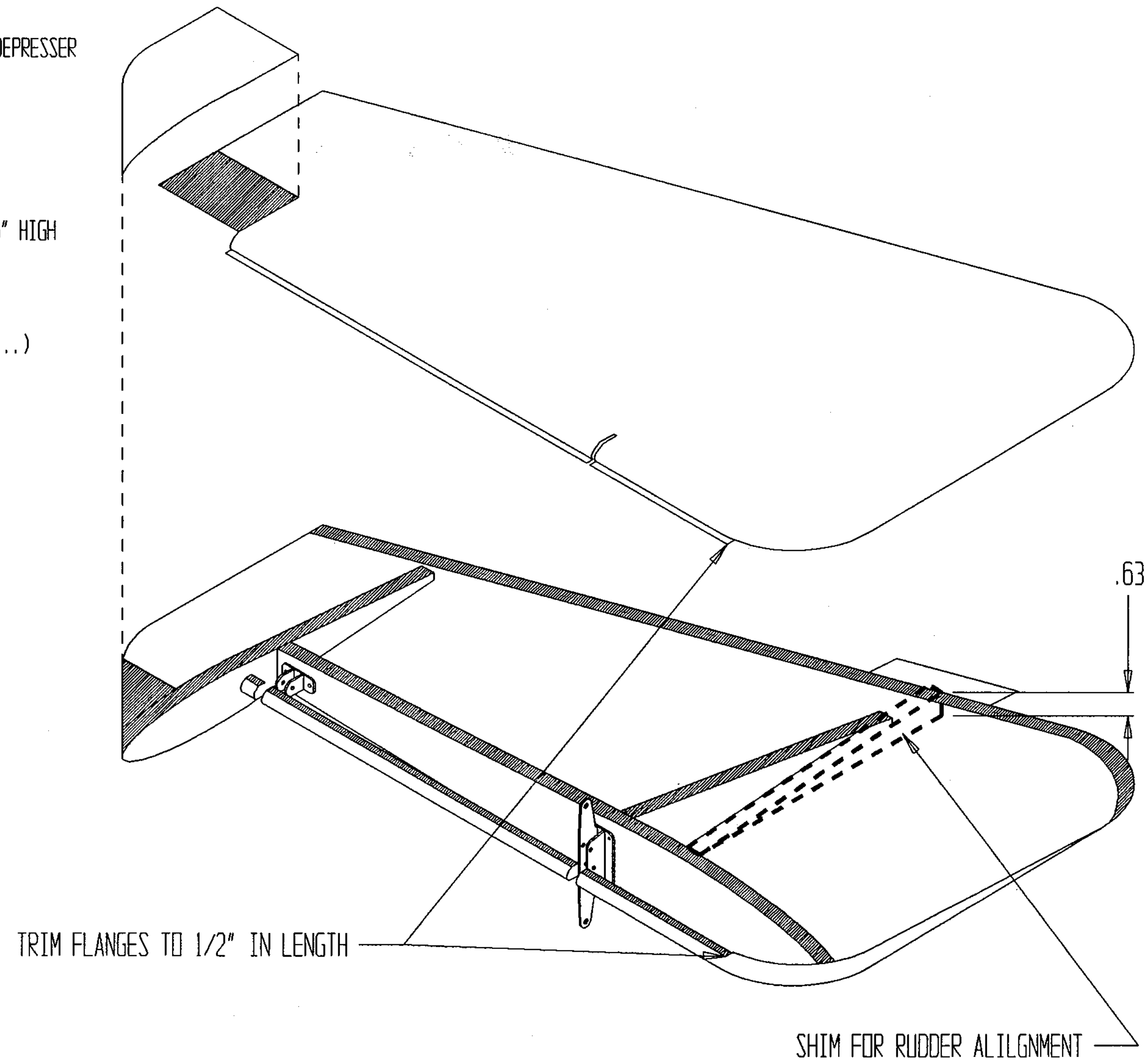
Step A Prepare The Rudder For Bonding

Remove the hinge fittings from the rudder to prevent any excess adhesive from contaminating these parts. Install the rudder in its jig and place just enough weight on the skin to get it to conform to the jig. Double check to make certain the rudder is correctly situated in the jig. The rudder spar and top rib should sit flat on the table and the waterline 00 rib should sit flat against the tapered wood shim. Remember that the jig is your reference thus you must always adjust the part to match the jig and never the reverse.

As with the elevator and stabilizer, you should be very sure that you have everything ready prior to mixing the structural adhesive . Once you start the applying the adhesives, you can not stop. All the tools and materials you need must be close at hand. Here are the things that you will want to have standing by before you start to mix adhesive:

- Latex gloves for mixing and applying adhesive.
- Tongue depressors for applying and cleaning up adhesive.
- A roll of paper towels for clean up.
- Adequate solvent for clean up.
- An aluminum "L" section extrusion for clamping the trailing edge of the rudder. One wide face of this piece should be protected with clear 3M tape where it will contact the carbon fiber of the rudder skin.
- A couple of flat pieces of wood covered with clear tape for clamping the leading edge flanges.
- About 16 spring clamps.





NOTES:
1 - SHADED AREA, ADHESIVE
2 - SHIM ON EDGE OF TABLE

RUDDER CLOSURE

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- Cleco fasteners and a Cleco tool.
- Small sand or lead shot bags to hold rudder in place on your work table and for providing clamping pressure while the adhesive cures..

Prepare all bond zones of the skin, counterbalance arm skin, spar, and ribs for bonding (See the General Information section of the manual.). Be sure that all bond areas are properly sanded and cleaned with acetone immediately prior to bonding. Once these areas have been prepared, do not touch them with your bare hands. Remember: the structural integrity of your aircraft is dependent on proper surface preparation prior to bonding.

Step C Mix And Apply The Adhesive

Prepare a batch of structural adhesive. Thicken the adhesive to "mayo" consistency with structural filler and apply an even layer to **all the bond zones** of the spar and rib assembly of the rudder:

- rudder leading edge flange.
- rudder ribs.
- rudder spar.
- rudder trailing edge.

NOTE:
Be very certain to **remove all sand bags and tools** (or any other foreign matter that you do not wish to become a permanent part of the aircraft) from inside the rudder now.

Step D Bond The Skin In Place

Using a helper, carefully, slowly, and precisely, position the upper rudder skin into place over the bond area. Put the skin down as close to it's final position as you can. The less you have to move it to get proper alignment, the less adhesive you will smear, and the better bond you will make.

Secure the leading edge with the clear taped wood blocks and spring clamps then place 10 pound sand bags over the ribs and every foot along the spar. Place your aluminum "L" section over the upper skin trailing edge and clamp every six inches with spring clamps.

Now mount the counterbalance arm skin on the rudder assembly. Press the skin down into position, then place a small sandbag over the skin to clamp it to the counterbalance arm rib and rudder skin. Place some plastic sheet between the sandbag and the skin to prevent the sandbag from becoming permanently bonded to the rudder.

Wipe off any excess structural adhesive that has squeezed out along bond lines. Excess adhesive adds weight but not strength.

Only after the bond in the rudder has completed an initial cure of at least 24 hours at 65_F (but preferably 12 hours at 85_ to 110_ F) should you loosen your clamps and remove the rudder from the rudder jig. Do not rush to remove the rudder from the jig. Allow full and complete cure time.

TASK F-14 Fiberglass The Rudder

Brief Task Description:

In this task you will bond the free edges of the left and right rudder skins together at the top and bottom using fiberglass strips. These strips are prepared on plastic sheet using a method similar to that outlined in the General Information Section of this manual. After installing these strips on the rudder you will finish the cut outs in the rudder to clear the rudder hinge fittings and the elevator.

Step A Prepare The Fiberglass Strips

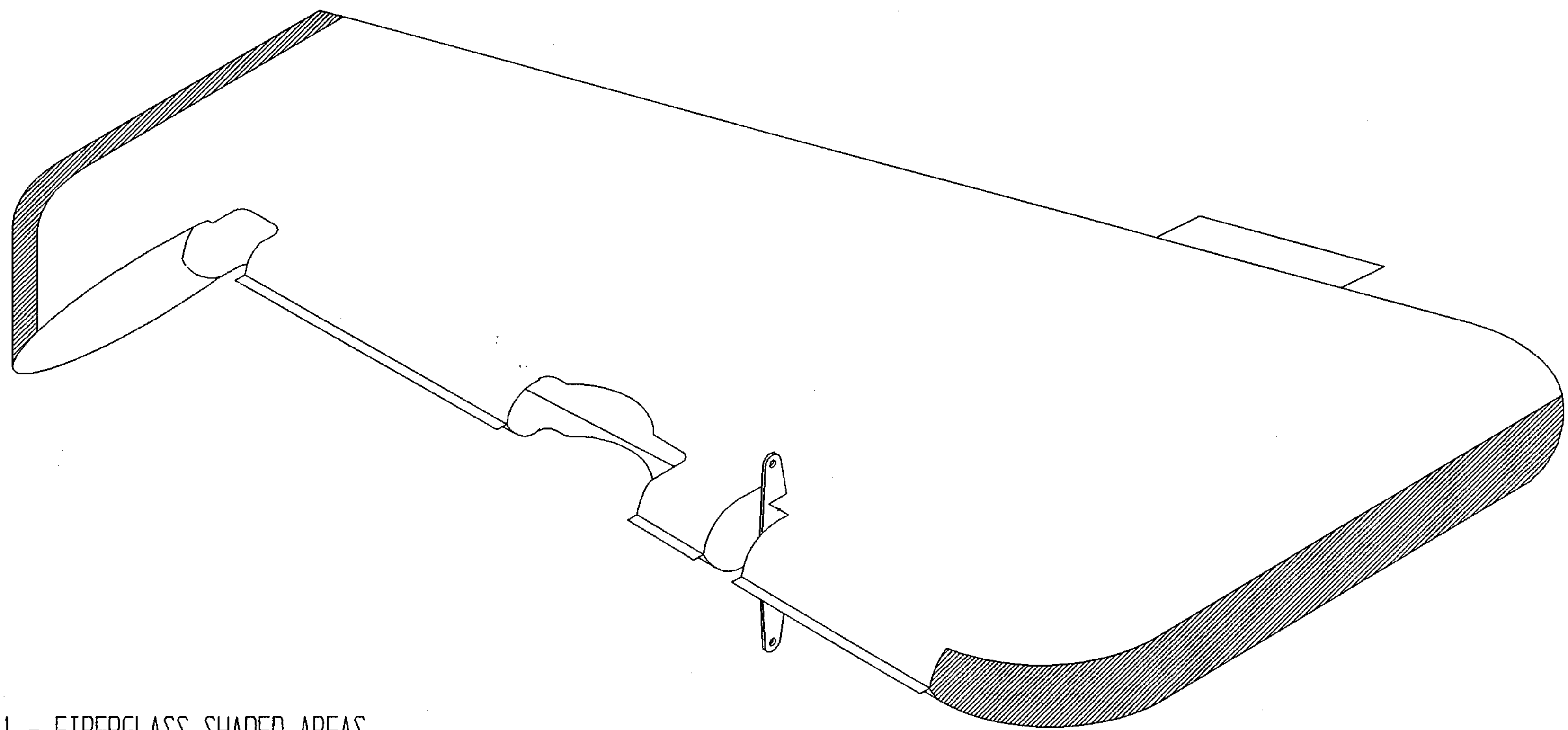
Cut two strips of fiberglass on the bias about 3 inches wide and long enough fit inside the premolded recess along the top of the rudder. Cut another two strips of fiberglass also three inches wide and long enough to fit inside the recessed area on the bottom of the rudder.

Step B Install The Fiberglass Strips

Prepare the recessed areas on the rudder for bonding. Mix up some laminating resin and wet out the fiberglass strips on some plastic sheet (thick drop cloth material will work) on your work table. After removing all excess resin, place another piece of plastic on top of the wet strips of fiberglass. Trace out the final dimensions of the strips (2 inches wide) on the plastic using a ruler and a felt tip pen. Cut out the strips with scissors along the outline. Remove one layer of plastic from the strips. Install the strips inside the recessed areas on the rudder,. removing the outside layer of plastic as you go. Inspect the lay-up for trapped air then allow it to cure completely

Step C Make A Cut Out To Clear The Elevator And Elevator Actuator

Remove the template from this manual for the elevator cut out. Use the slot cut earlier in the rudder skin as a guide to position this template on the leading edge of the rudder. Cut through the skin just inside the line on the template using your Dremel tool with the cut off wheel attachment. Finish the cut out using a small drum sander or grinding tool.



NOTES:

1 - FIBERGLASS SHADED AREAS

FIBERGLASS THE RUDDER

DRAWING NO. 200102B	TASK NO.	STEP NO.	AkroTech	
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Step D Make A Cut Outs To Clear The Upper And Lower Rudder Hinge Fittings

Remove the templates from this manual for the rudder hinge cut outs. Position these templates on the rudder using the previously cut slots as a guide. Use spray adhesive to mount these template to the rudder skin then cut just inside the line as you did in step C for the elevator cut out.

Step E Mount The Rudder To The Rudder Post And Check For Proper Clearance

If it is not already installed, mount the elevator to the stabilizer . Re-install the hinge fittings on the rudder spar. Temporarily mount the rudder to the rudder post using the supplied hardware. Modify the rudder cut outs as necessary until you can achieve +/- 30 degrees deflection of both the elevator and rudder.

TASK F-15 Cut Holes For The Rear Spar Plates

Brief Task Description:

The rear spars of the wings are connected to the rear spar carry-through structure with four aluminum plates. These rear spar plates pass through holes in the fuselage at either side of the rear spar carry-through. In this task you will cut these holes and reinforce the edges of these holes with a fiberglass lay-up.

Step A Cut Holes For Rear Spar Plates

Use spray adhesive to mount rear spar cut-out template to the inside of the fuselage so that it fits over the right side of the rear spar carry-through. Use a 1/4 inch drill to drill holes through the fuselage side as indicated on the template. Repeat this procedure for the left side of the fuselage using the other template. Now use a jigsaw with a fine tooth blade to connect the 1/4 inch holes (cutting from the outside of the fuselage). Trim these cut outs to their final size using a Dremel tool with a small grinding attachment.

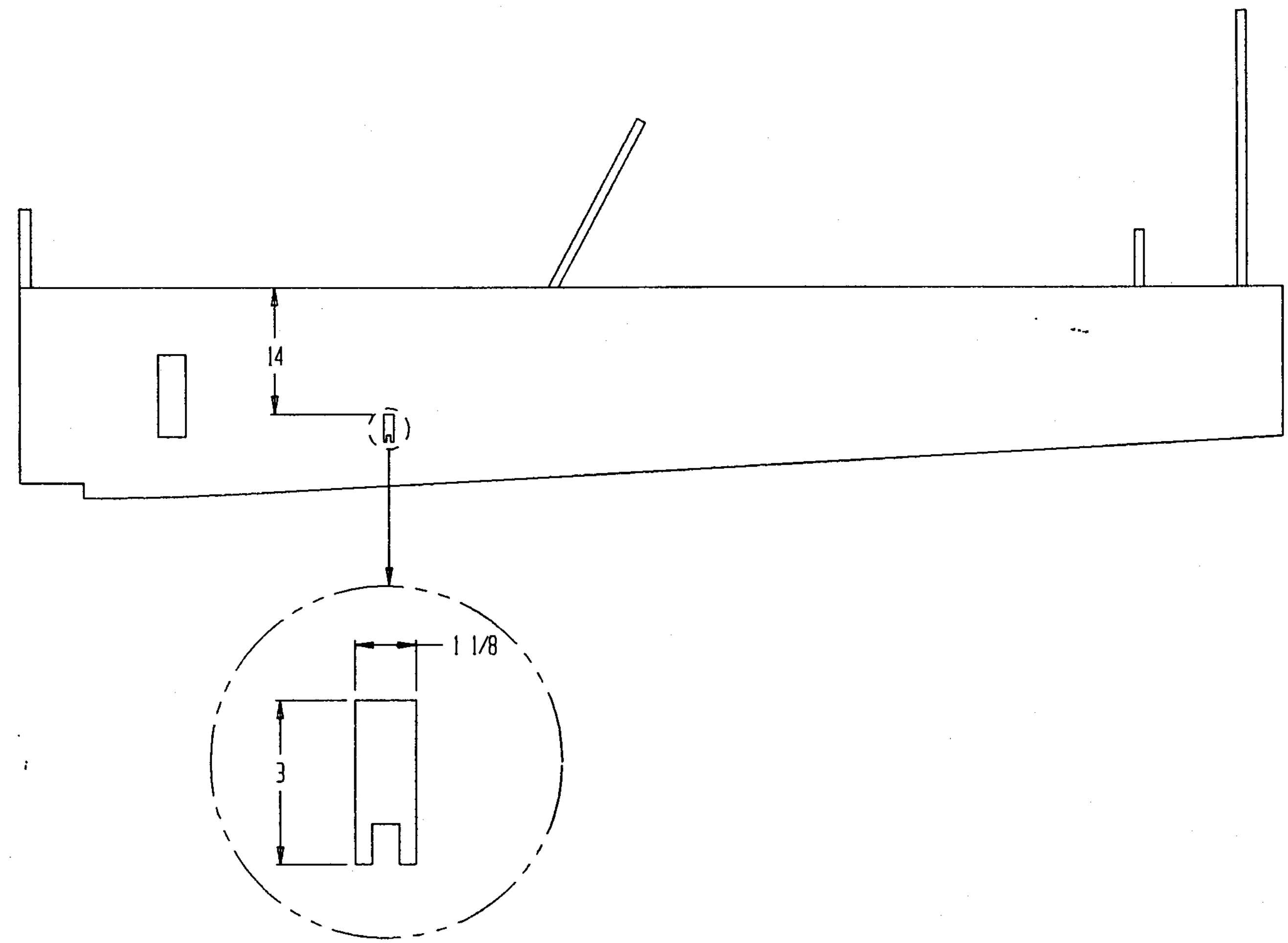
> NOTE:
> Early versions of the G-200 do not have the core material removed at the location of the spar plate cutout. If your kit does not have the core material removed from this area you will need reinforce the edges of the hole with structural filler. Follow steps B and C to accomplish this.

Step B Remove The Core Material From The Edges Of The Hole

Use your Dremel tool to remove the core material to a depth of about ¼ inch around the entire perimeter of the hole.

Step C Reinforce The Edges Of The Hole With Structural Adhesive

Mix up a small batch of structural adhesive and add enough structural filler until it assumes the consistency of peanut butter. Use a tongue depressor to force this mixture



NOTES:

1 - THESE ARE INITIAL CUT-OUT DIMENSIONS

POSITION OF CUT-OUT FOR REAR SPAR PLATES

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into the area where the core material was removed. Allow the adhesive to cure then sand smooth.

TASK F-16 Install The Spar Box Bushings

Step A Trial Fit The Spar Box Bushings In The Spar Box

Trial fit the bushings in the spar box. The flange on the aft spar box bushings may have to be trimmed to get it to clear the side of the fuse. Use a grinding wheel or belt sander to trim this flange as necessary. The bushings should be slightly loose in the spar box holes to allow for adjustment of the wing panels relative to the fuse. If you find that your bushings are a tight fit, grind out the holes slightly with a round file or similar tool until they are about 1/32 inch oversize.

Step B Jig The Wings Panels To The Fuselage

Place some clear tape over the spar bushings on the outside surface of the spars (the side that faces the spar box). Use a sharp knife to trim the tape away from the holes in the bushings so the spar bolts can pass through.. Slide the wing panels into the fuselage. Support the each wing panel near its center with a sawhorse. Roughly align the spars and install the spar bolts through the spar box bushings and the spars..

Step C Align The Wing Panels In Roll

Stretch a line through the hinges of one wing panel and pull it tight. Center this string in the bearing holes. Use a string level or water level to check this line. Adjust the wing panels by placing shims under one tip or the other to get the string level.

Step D Align The Wing Panels In Pitch

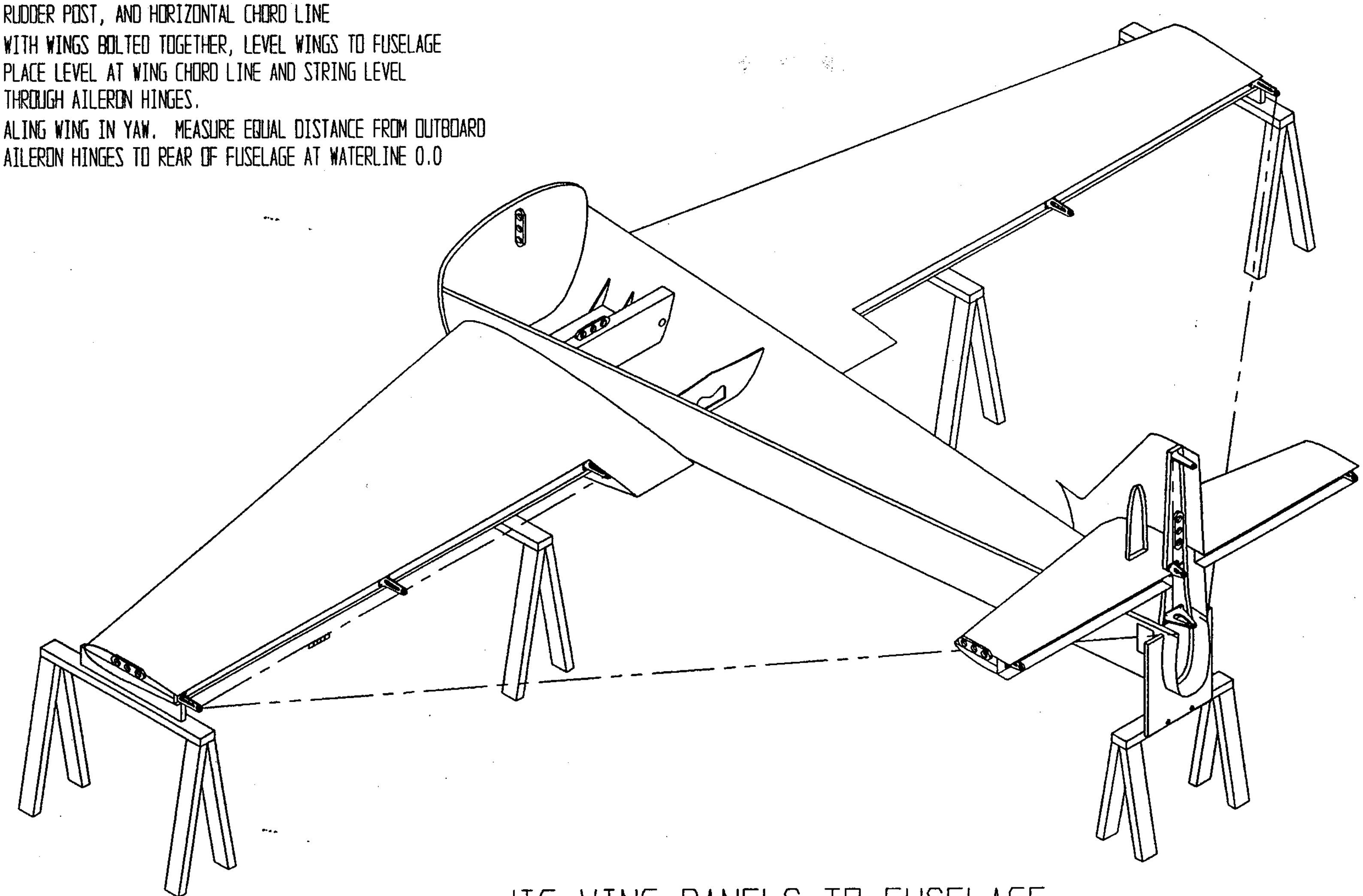
Check the chord line marked earlier on the tip rib of one wing panel to make sure it is level (double check the fuse to make sure it is level too). If the wing is not level in pitch, adjust it until it is.

Step E Align The Wing Panels In Yaw

Measure from the trailing edge of the tip rib on each wing panel to the rear of the fuselage at water line 00. These two measurements should be equal. If they are not, adjust the wings in yaw until they are.

NOTES:

1 - LEVEL FUSELAGE - PLACE LEVEL AT FIREWALL, SPAR BOX, RUDDER POST, AND HORIZONTAL CHORD LINE
2 - WITH WINGS BOLTED TOGETHER, LEVEL WINGS TO FUSELAGE PLACE LEVEL AT WING CHORD LINE AND STRING LEVEL THROUGH AILERON HINGES.
3 - ALING WING IN YAW. MEASURE EQUAL DISTANCE FROM OUTBOARD AILERON HINGES TO REAR OF FUSELAGE AT WATERLINE 0.0



JIG WING PANELS TO FUSELAGE

DRAWING NO. 20250D	TASK NO.	STEP NO.	AkroTech	
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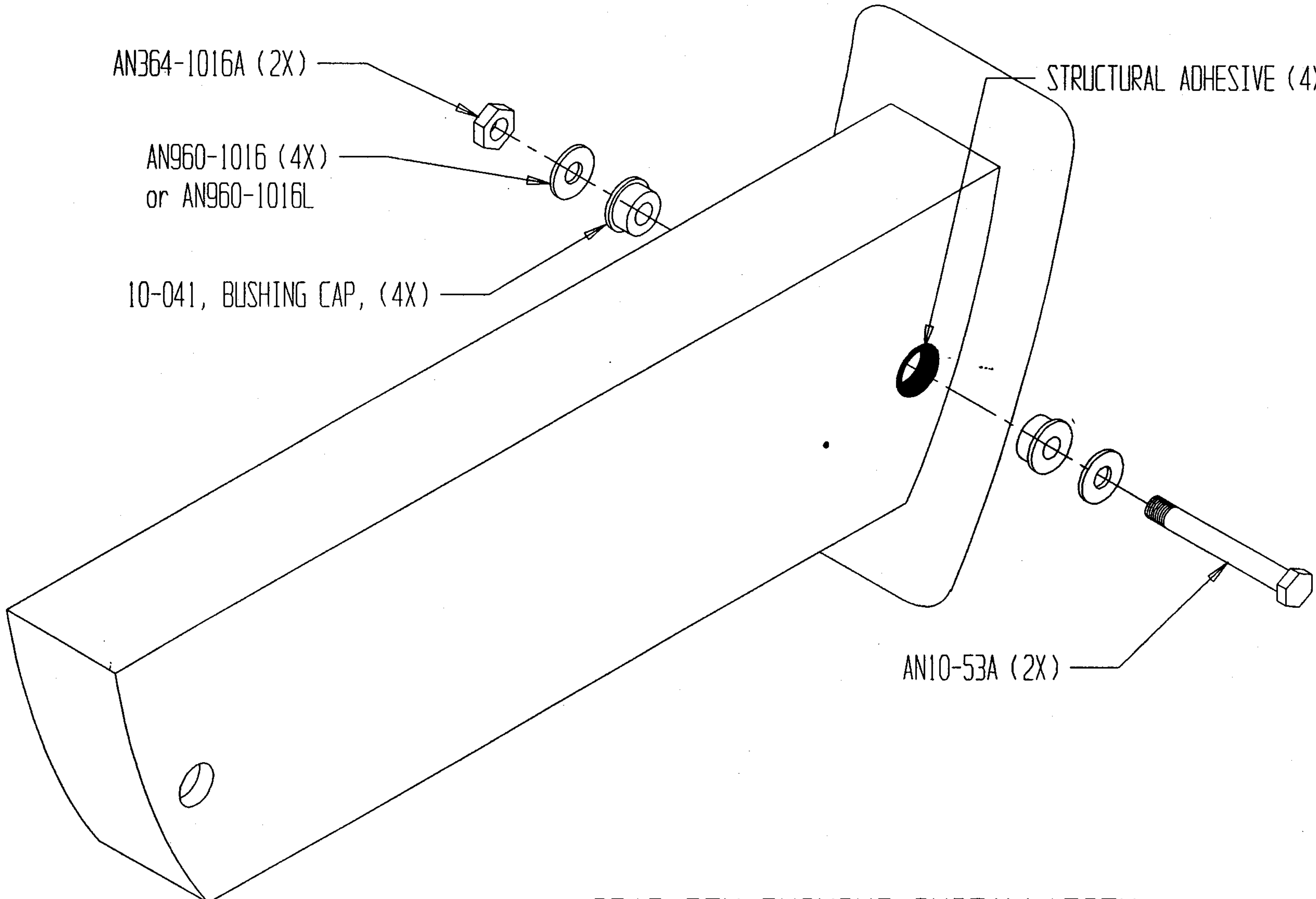

SPAR BOX BUSHING INSTALLATION

DRAWING NO. 20052B	TASK NO.	STEP NO.	AkroTech
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Step F Recheck All Three Alignments

Go back and recheck each of the three alignments. It is very easy to upset one alignment condition while adjusting the wings to match another alignment condition. Continue to adjust the wing panels until all three alignments are correct.

Step G Install The Spar Box Bushings With Structural Adhesive

Once you are certain the wing panels are properly aligned, remove the spar bolts and spar box bushings. Prepare the bushings and the holes in the spar box for bonding. Mix a small batch of structural adhesive and thicken it to "mayo" consistency with structural filler. Spread the adhesive mixture on both the bushings and the inside of the holes of the spar box. Twist the bushings as you insert them to prevent too much of the adhesive from being pushed out of the hole. Be careful not to get too much structural adhesive between the spar and the spar box or you may end up bonding the spars in permanently! Now wax the spar bolts and insert them through the spar box bushings and spars. Install appropriate castle nuts. Tighten the nuts <u>hand tight</u> and clean up all excess structural adhesive. Leave the setup undisturbed until the structural adhesive has completely cured.

TASK F-17 Install The Rear Spar Plates

NOTE:
Early versions of the G-200 had the rear spar carry-through structure bonded in at the factory. More recently, AkroTech decided to have the builder install this structure to simplify certain alignment tasks. If your aircraft does not have the rear spar carry-through factory mounted in the fuselage, please contact us for specific instructions.

Step A Drill Holes Through The Rear Spar Carry-Through

With the wings properly aligned relative to the fuselage, position a rear spar plate on the forward face of the right side of the rear spar and slide it into position against the rear spar fitting. Insert the 7/16 inch bolt through both the rear spar plate and the rear spar fitting. Tighten this bolt just enough to allow the spar plate to rotate with a little friction (Again, be careful not to upset the alignment of the wings). Position the rear spar plate so that it is approximately 1/8 inch from the fuse along the curved section of the spar plate. Clamp the spar plate in position and drill the 1/4 inch rear spar plate mounting holes through the rear spar using the spar plate as a drill guide. Remove the clamp and the bolt holding the right spar plate in position Repeat this procedure for the left side of the rear spar carry-through.

Step B Drill Out The Rear Spar Carry-Through For The 3/8 Inch Bushings.

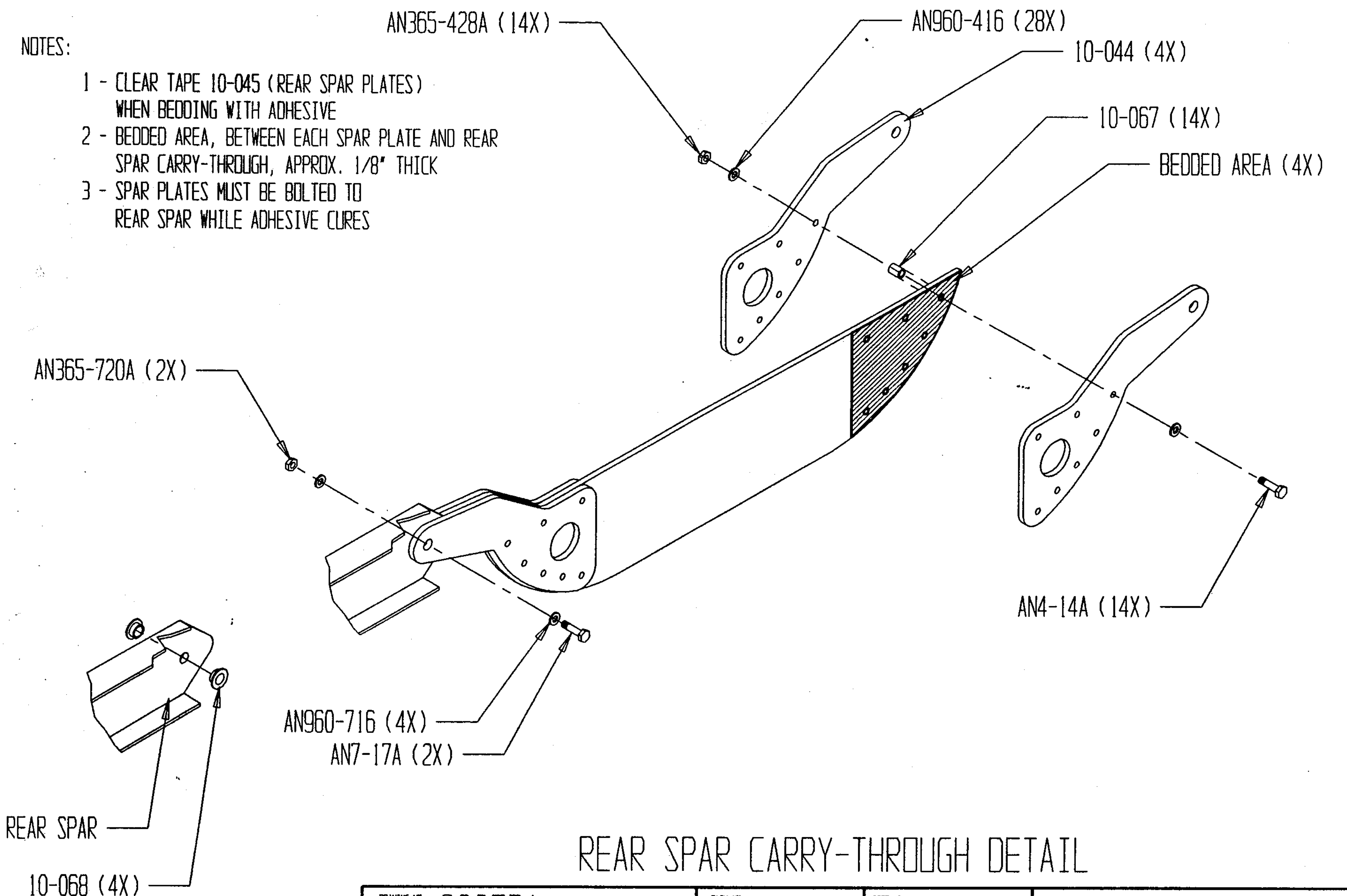
Drill out the 1/4 inch holes just drilled in the rear spar carry thorough to accommodate the 3/8 inch bushings. Try to keep the drill bit perpendicular to the surface of the rear spar while drilling these holes.

Step C Bed The Rear Spar Plates With Structural Adhesive

Prepare the surface of both the right and left side of the rear spar carry-through for bonding where the rear spar plates mate to it. Tape the rear spar plates with clear tape to act as a mold release. Remove the tape from the holes to allow a 1/4 inch bolt to pass through. Prepare the stainless steel bushings for each of the holes drilled in the rear spar carry-through. Clear away the core material for each hole as dictated in the General Information Section. Wax the seven 1/4 inch bolts that attach the rear spar plates to the

NOTES:

1 - CLEAR TAPE 10-045 (REAR SPAR PLATES) WHEN BEDDING WITH ADHESIVE
2 - BEDDED AREA, BETWEEN EACH SPAR PLATE AND REAR SPAR CARRY-THROUGH, APPROX. 1/8" THICK
3 - SPAR PLATES MUST BE BOLTED TO REAR SPAR WHILE ADHESIVE CURES



REAR SPAR CARRY-THROUGH DETAIL

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rear spar carry through. Prepare a batch of structural adhesive and add just enough structural filler so that it will not run or sag. Seal the core surrounding each hole and coat each bushing with the structural adhesive mixture. Install the bushings. Liberally coat the mating surfaces with the structural adhesive mixture and assemble the spar plates to the rear spar carry through with the waxed bolts. Insert and tighten the 7/16 inch bolt through both spar plates and the rear spar fitting. Install the appropriate nuts on the 1/4 inch bolts and tighten **Hand Tight**. **Do not** tighten these bolts with a wrench. Remove any excess structural adhesive. The object here is to create a pad with the structural adhesive which will allow the rear spar plates to sit flat on the rear spar carry-through.

TASK F-18 Cut And Install The Firewall Shield

Step A Cut And Fit The Aluminum Firewall Shield

Find the .020 aluminum sheet supplied in your kit. Have a helper hold the aluminum sheet up to the firewall and use a felt tip pen to draw an outline of the firewall on the aluminum. Remove the sheet and use tin snips to cut the firewall along the outline. The firewall shield should now be a little oversize. Use a belt sander to carefully grind the firewall shield down until it fits into the flange surrounding the firewall with about 1/16 inch clearance.

Step B Paint The Firewall And The Firewall Shield

Coat both the front face of the firewall and the aft face of the firewall shield with a good quality enamel or epoxy based paint. This paint will provide a corrosion barrier between the carbon firewall and the firewall shield.

Step C Bond The Aluminum Firewall Shield To The Firewall

Run a small bead of high temperature silicone around the perimeter of the firewall. Press the firewall shield on the firewall. Try to squeeze out most of the silicone allowing the firewall shield to sit flat against the firewall.

Step D Drill Holes For Engine Mount Bolts

Use a 3/8 inch drill to drill through the firewall shield using the holes in the engine mount fittings as a drill guide.

TASK F-19 Install The Fuel Tank Mounting Brackets

Brief Task Description:

In this task you will prepare and bond the four fuel tank support brackets to the rear face of the firewall. Also, you will prepare the spar box and aft tank tabs to accept the aft tank attach bolts.

Step A Cut Out The Support Brackets

Find the supplied premolded hat section fiberglass stock. Use a jigsaw or a bandsaw to cut the hat section stock into four pieces as shown in the illustration. Note that the top two brackets will need to be cut off at an angle to match the contour of the firewall. Cut this angle into these two brackets after the they have been cut to length.

Step B Install Nutplates In The Support Brackets

Refer to the general information section of this manual to install the four 10-32 fixed nutplates in the support brackets. Locate them on the support brackets as shown in the illustrations.

Step C Bolt The Support Brackets To the Tank

Find the four tank mounting bolts supplied with your kit. Mount the four support brackets to the tank. Do not tighten the bolts down all the way. The mounting tabs should be left a little loose. Mark each support bracket with its location on the tank so that you will not confuse them later.

Step D Dry Fit The Tank To The Firewall

Push the tank into position on the firewall. With the support brackets mounted to the tabs, the tank should fit fairly snug between the firewall and the spar box. Place some scrap wood under the tank to prop it up to the correct height. Precisely position the tank on the firewall. Now Orient the support brackets so they are vertical and clamp the two top tabs in position. Drill two Cleco holes through the outboard flange of each bottom support bracket and into the firewall. Do not drill these holes all the way through the firewall. They should be just deep enough to hold a Cleco. Use a felt tip marker to mark the outline of each support bracket on the firewall. Now remove the tank from the firewall and remove the lower brackets from the tank.

Step E Prepare The Support Brackets For Bonding

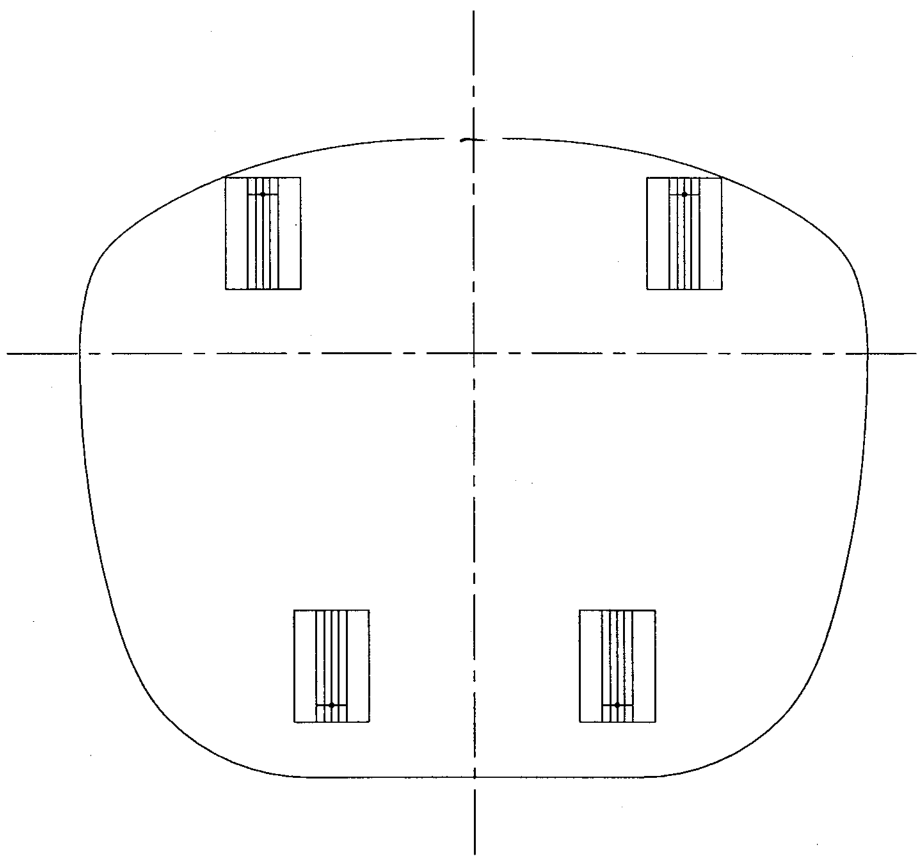
Prepare the four support brackets for bonding to the firewall. Make sure the flange of each bracket has been thoroughly sanded and cleaned with acetone. Prepare the firewall for bonding using the marks made earlier as a reference.

Step F Bond The Tank Support Brackets To The Firewall

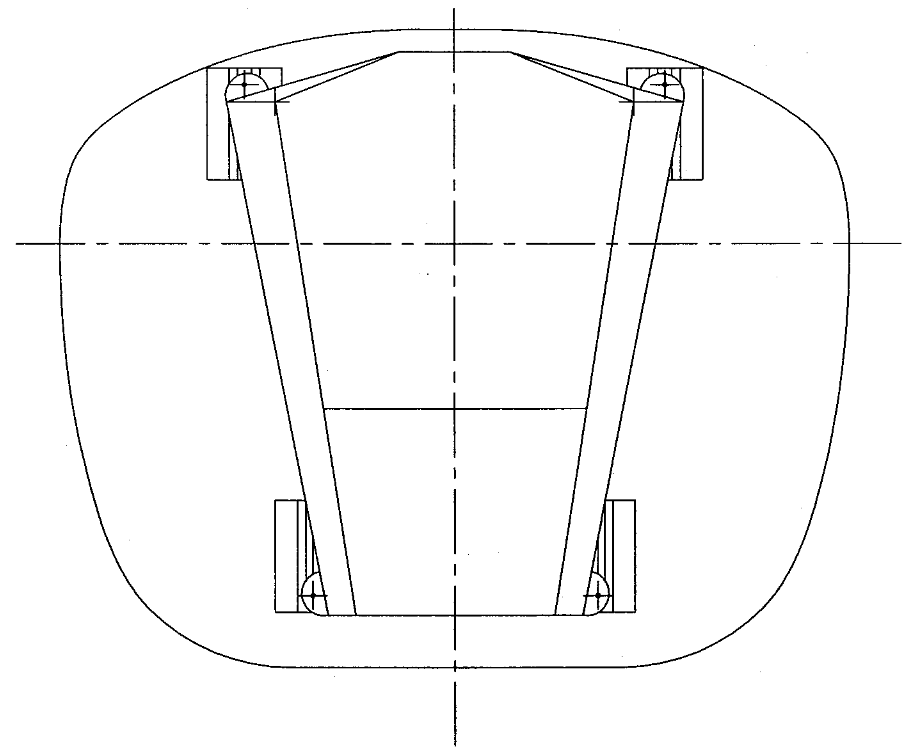
Mix a small batch of structural adhesive and add enough structural filler to achieve "mayonnaise" consistency. Coat the bond areas of both the firewall and the brackets with the mixture. Now place the two bottom brackets in position and place Clecos in the holes drilled into them earlier. These Clecos will hold the brackets in position while the tank is being set in place against them. Now carefully lower the tank (with the two top brackets bolted to it) into position against the firewall. Try not to let the brackets touch the firewall until they are close to their final position. Once the tank is roughly located, push the two top brackets up against the firewall and have a helper hold the tank in position while you place bolts through the bottom tabs on the tank and into the bottom support brackets. Do not tighten these bolts down all the way. Now use the marks made on the firewall to position the top of the tank accurately. Once the tank is in its final position, clamp the two top tabs in place against the firewall. Use a clean rag to remove any excess adhesive.

Step G Drill Through The Spar Box For The Rear Tank Attach Bolts

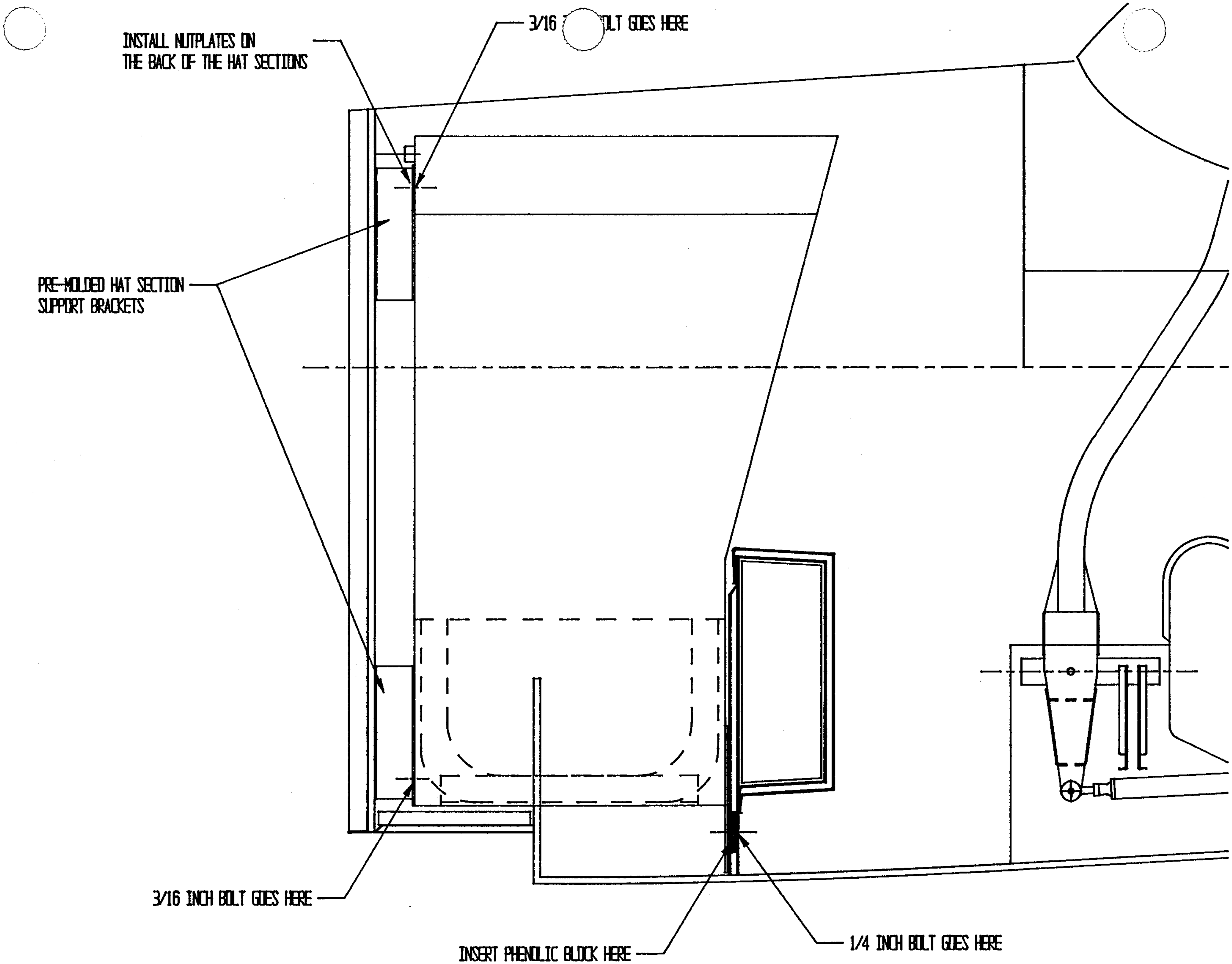
After the adhesive has cured completely, use a felt tip marker to trace the outline of the lower rear tabs on the forward face of the spar box. Now un-bolt the tank from the firewall mounted brackets, and remove it from the fuselage. Measure down from the top of the spar box 10 inches and draw a line parallel to the top of the spar box. This line should intersect the two tab outlines marked on the spar box. Mark a point in the center of each tab outline where the horizontal line intersects it. This will be the location for the two rear tank attach bolts. Drill a 1/8 inch hole through these two points back through the



SUPPORT BRACKETS ON FIREWALL



TANK MOUNTED TO SUPPORT BRACKETS


INSTALL NUTPLATES ON
THE BACK OF THE HAT SECTIONS
3/16 BOLT GOES HERE
PRE-MOLDED HAT SECTION
SUPPORT BRACKETS
3/16 INCH BOLT GOES HERE
INSERT PHENOLIC BLOCK HERE
1/4 INCH BOLT GOES HERE

bottom web of the spar box. These holes should come out about .5 inches below the bottom of the spar box.

Step H Install Phenolic In The Spar Box

On the forward face of the spar box, mark out a square measuring 1.5 inches by 1.5 inches surrounding each drilled hole. Use a Dremel tool to cut away the face sheet of the spar box in this area. Remove the core material in this region being careful not to damage the rear carbon face sheet. Cut out two phenolic blocks 1/4 x 1.5 x 1.5. Sand these blocks thoroughly with 80 grit sandpaper. Sand the area surrounding the holes in the spar box. Make sure the blocks sit flush in the prepared holes and do not protrude above the surface. Prepare a small batch of epoxy laminating resin and pour half into a separate cup. Mix in enough microballoons in one cup until it has the consistency of peanut butter. paint a layer of pure resin on the phenolic blocks and the mating face inside the holes cut into the spar box. Insert the phenolic blocks and use the microballoon mixture to fill in any gaps around the perimeter of the blocks. Laminate two layers of fiberglass over each of the blocks, extending one inch past the edge of the blocks on all sides. Check the lay-up for air bubbles or dry areas. Remove any resin that may have squeezed out through the hole on the rear face of the spar box (You will use this hole to drill back through the spar box in the next step)

Step I Drill Holes For The Aft Tank Mounting Bolts

Place the tank back into the fuselage and install the four bolts into the firewall mounted brackets. Use the holes on the rear face of the spar box as a reference to drill 1/8 inch pilot holes through the spar box and the aft tank tabs. Enlarge these holes using a 1/4 inch drill bit then remove the tank from the fuselage.

Step J Install Nutplates In The Aft Tank Tabs

Refer to the General Information Section to install 1/4 -28 floating nutplates in each of the aft tank tabs.

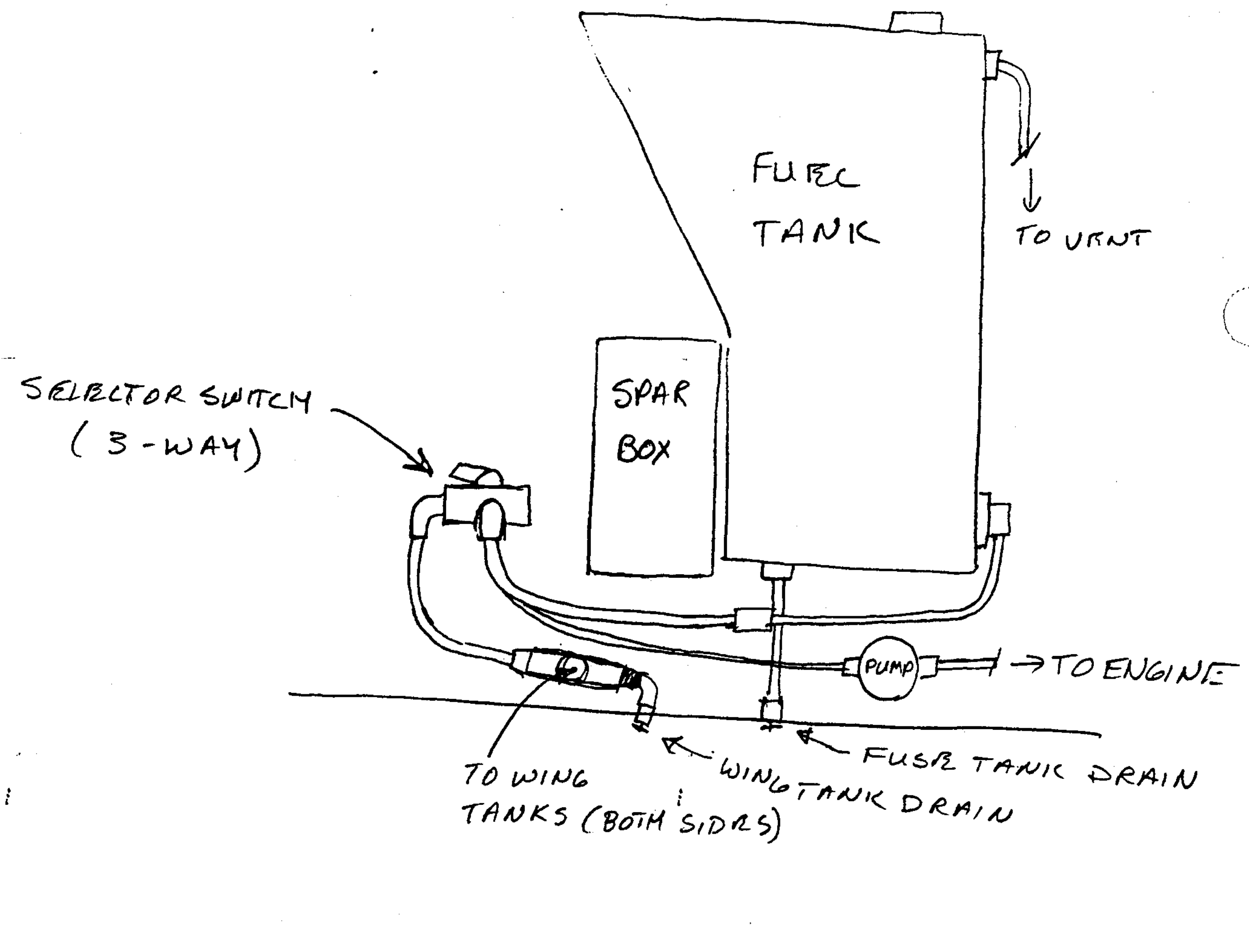
TASK F-20 Install The Fuel Tank Fittings

Step A Install The Fuel Level Sensor In The Fuel Tank

Find the fuel level sensor included in your kit. Follow the manufacturer's instructions (see the appendix of this manual) to install the fuel level sensor in the tank. Note that the backing plate for the fuel level sensor has already been installed in the tank. Thus you need only install the sensor with the supplied screws and gasket.

Step B Install The Flop Tube, Fuel Drain And Vent Fittings

Apply some thread lubricant (Fuel Lube) to the threads of the flop tube fitting, the flop tube, and the drain and vent fittings. Assemble the flop tube to the flop tube fitting. Install the flop tube fitting (with the flop tube on it) into the large threaded fitting on the lower forward side of the tank.. Now install the vent and drain fittings into the appropriate threaded fittings on the tank.


FUEL TANK
TO VENT
SPAR BOX
SELECTOR SWITCH (3-WAY)
PUMP
TO ENGINE
FUSE TANK DRAIN
WING TANK DRAIN
TO WING TANKS (BOTH SIDES)

TASK F-21 Install The Shoulder Harness Brackets

Step A Cut Out The Premolded Shoulder Harness Brackets

Find the premolded shoulder harness brackets included with your kit. Each bracket consists of top and bottom pieces which are molded separately. Thus the top left and right brackets are molded as a single piece and the bottom left and right brackets are molded as a single piece. Trim these pieces along the pre-molded scribe line using a jigsaw or a bandsaw. Use a sanding block or a belt sander to smooth the edges of the bracket pieces after cutting.

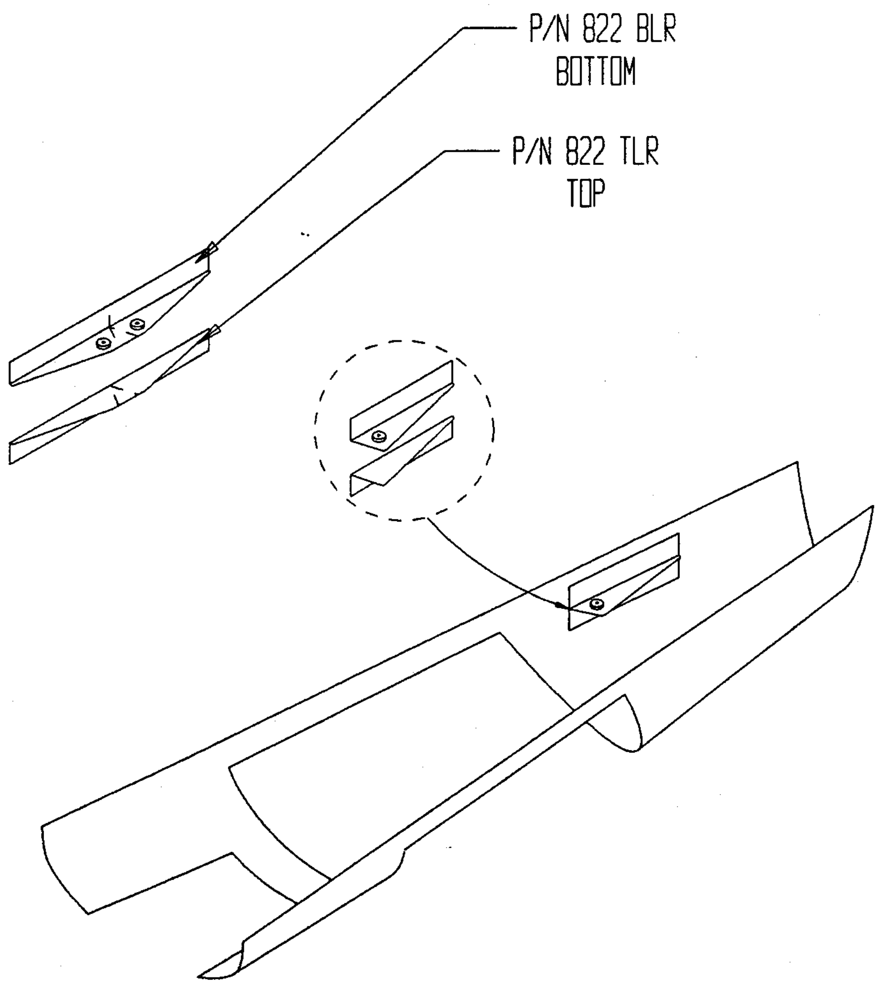
Step B Install The Shoulder Harness Brackets

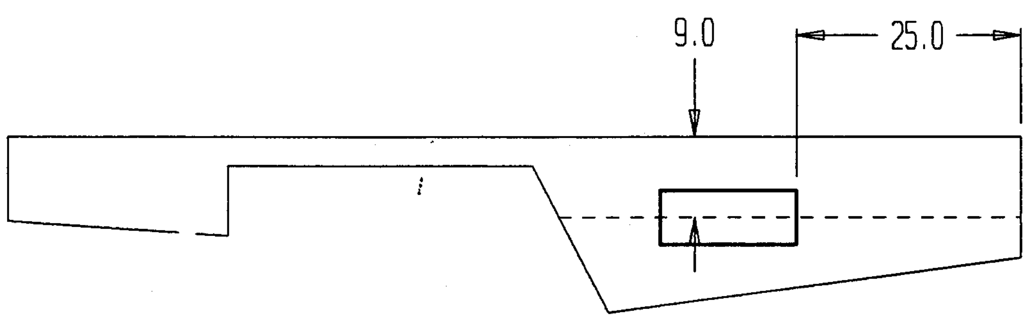
Clamp the top and bottom pieces of each bracket together using spring clamps. Position each bracket at its proper location on the inside surface of the top fuselage. Drill four cleco holes through the base of each bracket and into the inside layer of the top fuselage skin. Prepare the inside of the fuse at the location of the brackets for bonding. Remove the spring clamps from the top and bottom bracket pieces and prepare their surfaces for bonding.

Prepare a mixture of structural adhesive and thicken it to "mayo" consistency with structural filler. Apply the adhesive to the mating surfaces of the top and bottom pieces of the shoulder harness brackets. Clamp the top and bottom pieces together with spring clamps and remove the excess resin from the edges with a clean rag. Now coat both the surface of the fuse and the flanges on the brackets with the remaining adhesive mixture. Install the brackets with clecos and remove the excess resin. Allow the adhesive to cure completely.

Step C Drill Holes In The Brackets

Find the center of each pre-installed phenolic block in the shoulder harness brackets. Use an automatic center punch to mark the center of these blocks. Drill a small (1/8 inch) pilot hole through the phenolic blocks. Enlarge these holes with a 1/4 inch drill bit.





INSTALL THE SHOULDER HARNESS BRACKETS

DRAWING NO. 20085A	TASK NO.	STEP NO.	AkroTech
MODEL G - 200	SECTION FUSELAGE	REVISION	PAGE

TASK F-22 Install The Tailwheel and Tailwheel Lock System

Step A Install The Tailwheel

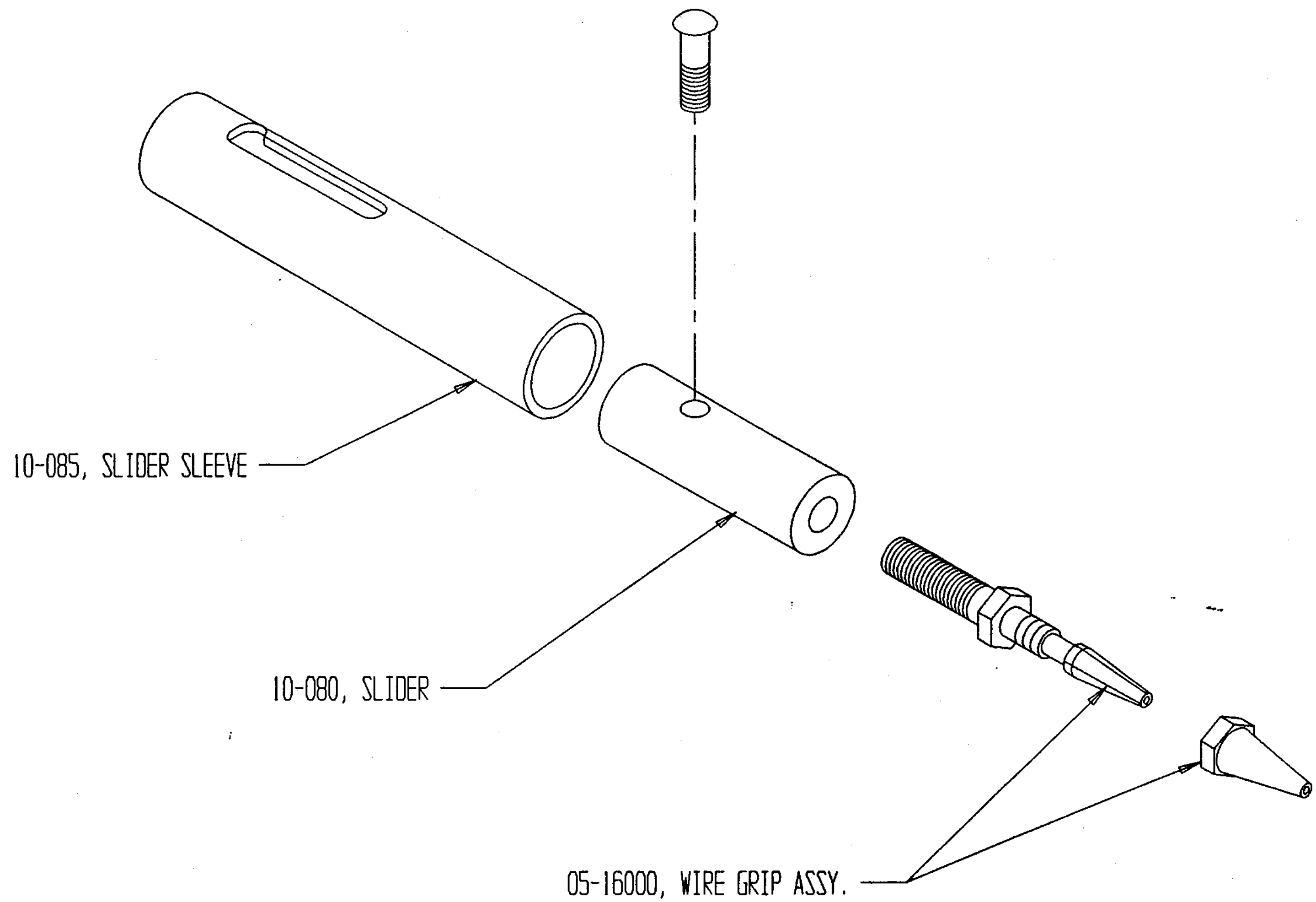
Insert the supplied tail wheel assembly into the tail wheel mounting bracket located at the rear of the fuselage. Install the supplied 5/16 inch bolt into the tailwheel mounting bracket and through the tailwheel. Secure the bolt in place with the supplied nut. Drill a 1/4 inch hole for the tailwheel lock release cable beside the point at which the tailwheel spring exits the fuselage ??????. Angle this hole so that it is parallel to the tailwheel spring. Using structural adhesive, install a 2 inch ??? section of nylon tube for the cable to travel through. Trim this tube flush with the outside surface of the fuselage.

Step B Install The Sliding Pin Housing On The Inside Of Fuse

Find the supplied tailwheel lock components. Remove the tubular housing for the sliding pin. Prepare this housing for bonding by sanding with 80 grit sandpaper and cleaning with acetone. Also prepare the inside of the fuse for bonding at the location of the tailwheel lock handle. Use hot glue to tack the housing in position inside the fuse. Cut three strips of fiberglass on the bias (fibers running 45 degrees to the edges). Make these strips large enough to cover the housing and extend at least one inch onto the fuse on either side of the housing. Mix some laminating resin and laminate the fiberglass strips over the housing.

Step C Install The Tailwheel Lock Cable Housing

Drill a small hole in the fuse on the left side of the tailwheel spring where it enters the fuselage. Elongate this hole a little so the cable can enter at an angle. Drill another hole near the bottom of the lower banjo bulkhead for the cable. Drill a third hole through the rear seat bulkhead at the same height as the lock handle. Feed the cable housing through these holes. Sand the housing where it passes through the bulkheads and at three locations along the length of the tail. Adjust the cable housing until it penetrates the seat back bulkhead by one inch. Mix some laminating resin and add microballoons until it assumes the consistency of peanut butter. Use this mixture to bond the cable housing into each bulkhead and to the fuse at three locations along the tail. Use the supplied clamp to clamp the cable housing to the tailwheel spring near the tailwheel.



TAILWHEEL LOCK COMPONENTS

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Step D Install The Tailwheel Lock Cable And Cut It To Size

Form a loop in one end of the tailwheel lock cable by wrapping it twice around a .25 inch rod. Pass the straight end of the cable through the housing and into the cockpit area. Secure the loop on the cable to the locking arm on the tailwheel with the supplied bolt.

Mock up the tailwheel lock components to find the right cable length.. The threaded hole on the side of the sliding pin should be near the aft end of the slot in the housing when the cable is mounted to the sliding pin via the cable attach fitting. Once you are certain of the proper cable length, cut the cable using cable cutters or the cut off wheel on your Dremel tool.

Step E Install The Sliding Pin And Handle On The Cable

Mount the cable fitting on the free end of the cable. Screw the sliding pin onto the cable fitting. Insert the sliding pin into the tubular pin housing. Screw the supplied screw through the slot in the pin housing and into the threaded hole in the side of the sliding pin.

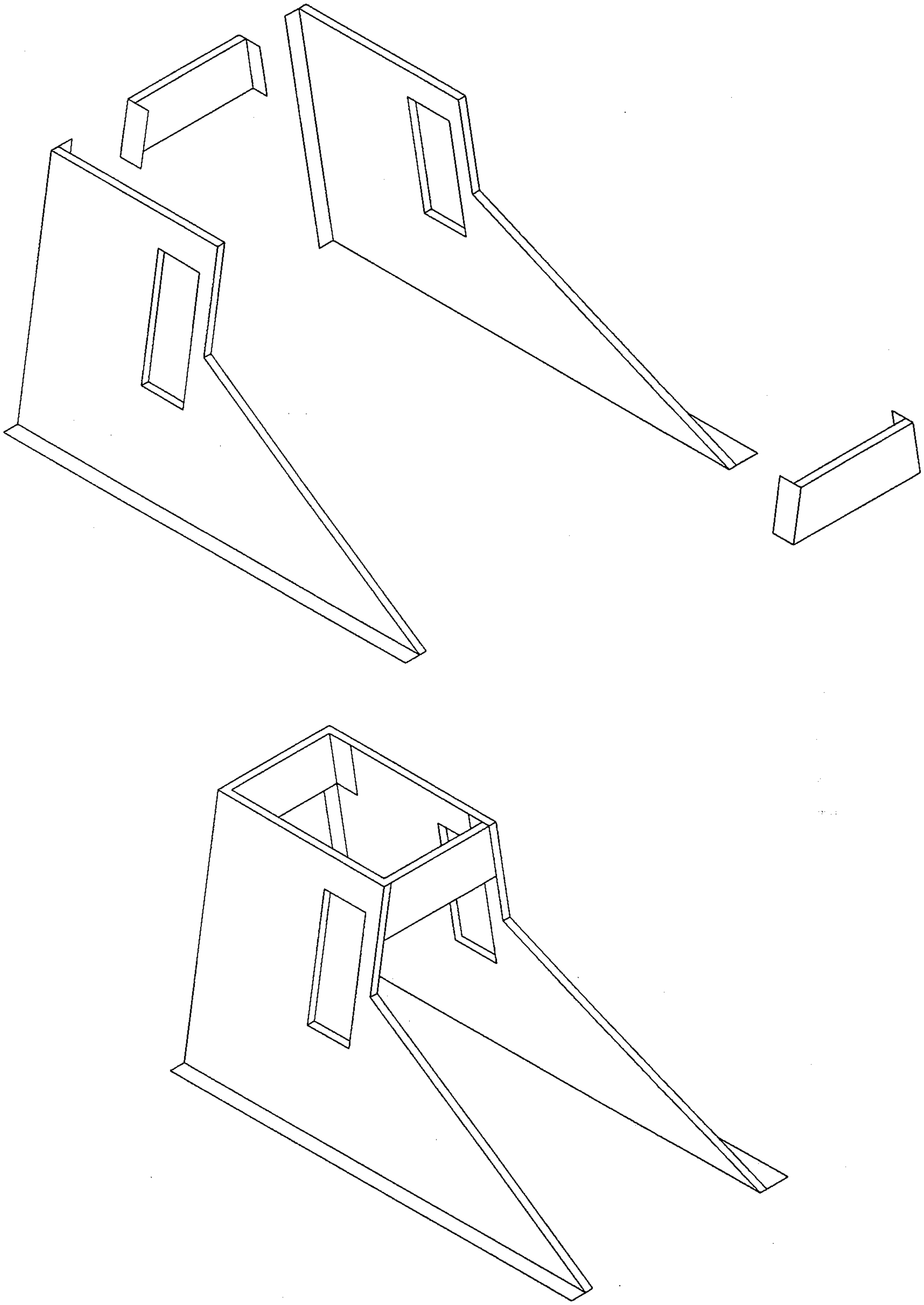
TASK F-23 Assemble And Install The Control Stick Box

Step A Assemble Control Stick Box

Locate the four pieces that comprise the control stick box. Prepare the flanges on the front and rear pieces for bonding. Also prepare the mating area on the side pieces for bonding. Prepare some structural adhesive and thicken it to "mayo" consistency. Spread the adhesive on the four pieces and assemble the them using spring clamps. Now lay the box on your table and check to make sure the bottom flanges sit flat. Also check to see if the front and rear pieces are parallel with one another and that they are even with the top of the box. Adjust the pieces as necessary to get them aligned then allow the adhesive to cure undisturbed.

Step B Install The Control Stick Box In The Fuselage

Draw a reference line down the center of the bottom of the fuse. Trial fit the control box inside the fuselage. Center the box on the longitudinal reference line at the proper fuselage station (fore aft location) and check to make sure the bottom flanges lay flat against the bottom of the fuselage. Drill three cleco holes through each flange and into the inside skin of the fuselage. Prepare the lower flanges on the control box and the mating area on the fuselage for bonding. Mix up some structural adhesive and thicken it to "mayo" consistency with structural filler. Spread this mixture on the control box flanges and carefully lower it into position on the fuselage bottom. Install clecos into the cleco holes and allow to cure.



CONTROL BOX ASSEMBLY

DRAWING NO. 200122A	TASK NO.	STEP NO.	AkroTech
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TASK F-24 Assemble And Install The Stick Pivot Assembly

Step A Install Bearings In The Stick Pivot Block

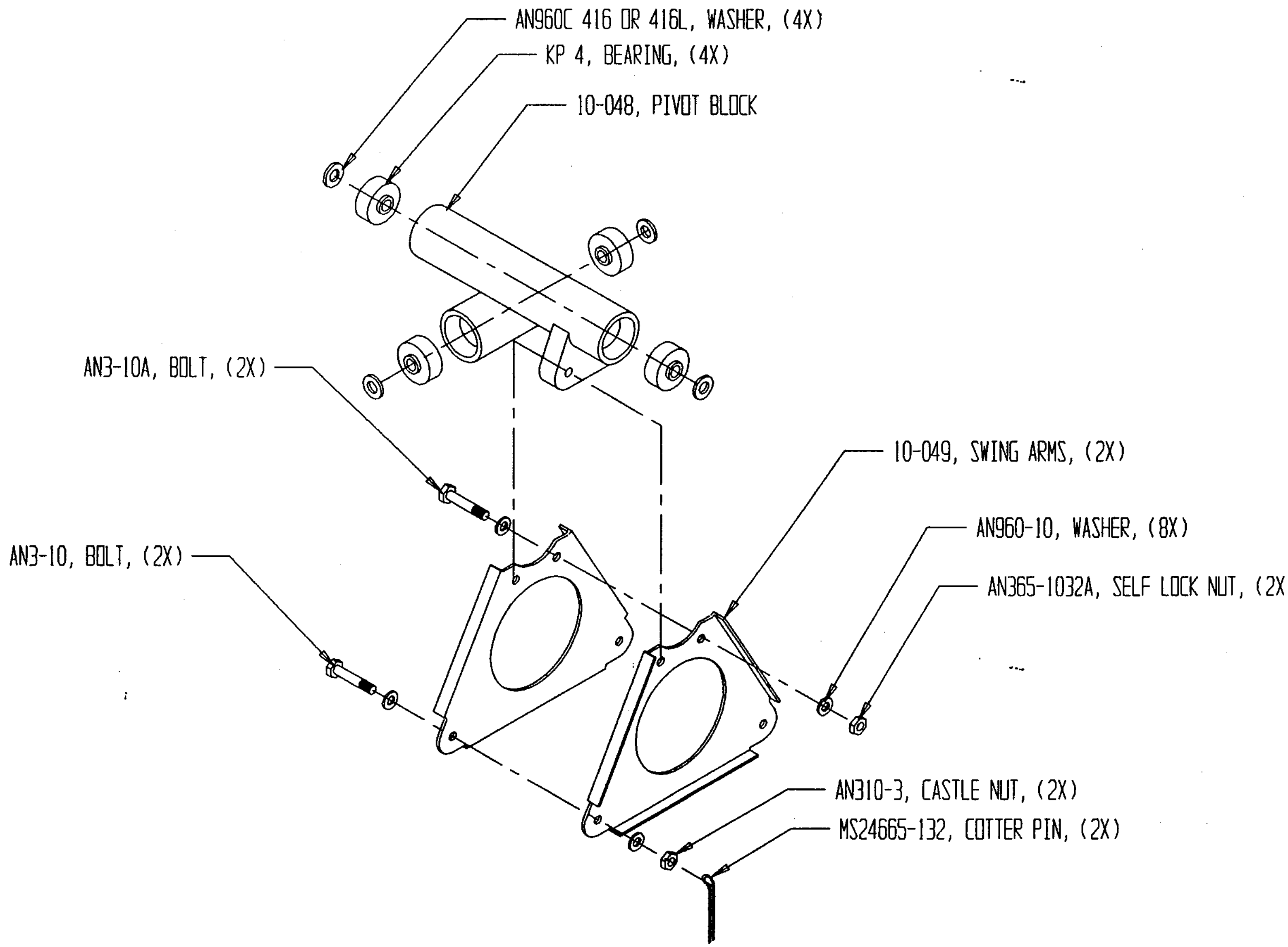
Find the pivot block bearings supplied with your kit. Install these into the stick pivot block using Locktite. These bearings install with a very light press fit and thus they can be assembled by hand. If you find they are a little tight, use a vice and the proper size socket to press the outer race into the pivot block. Never apply pressure to the inner race!!!

Step B Assemble The Swing Arms To The Stick Pivot Block

Locate the swing arms that mount to the pivot block. Mount the swing arms to the stick pivot block using the appropriate hardware.

Step C Install The Pivot Block In The Control Box

Install the stick pivot block in the control box using the supplied ¼ inch bolt. Be sure to place a thick washer on each end of the pivot block to properly center the assembly in the control box. Do not install the nut on the bolt yet as you will be removing the assembly several times before it is permanently installed.



DRAWING NO. 20072A	TASK NO.	STEP NO.	AkroTech
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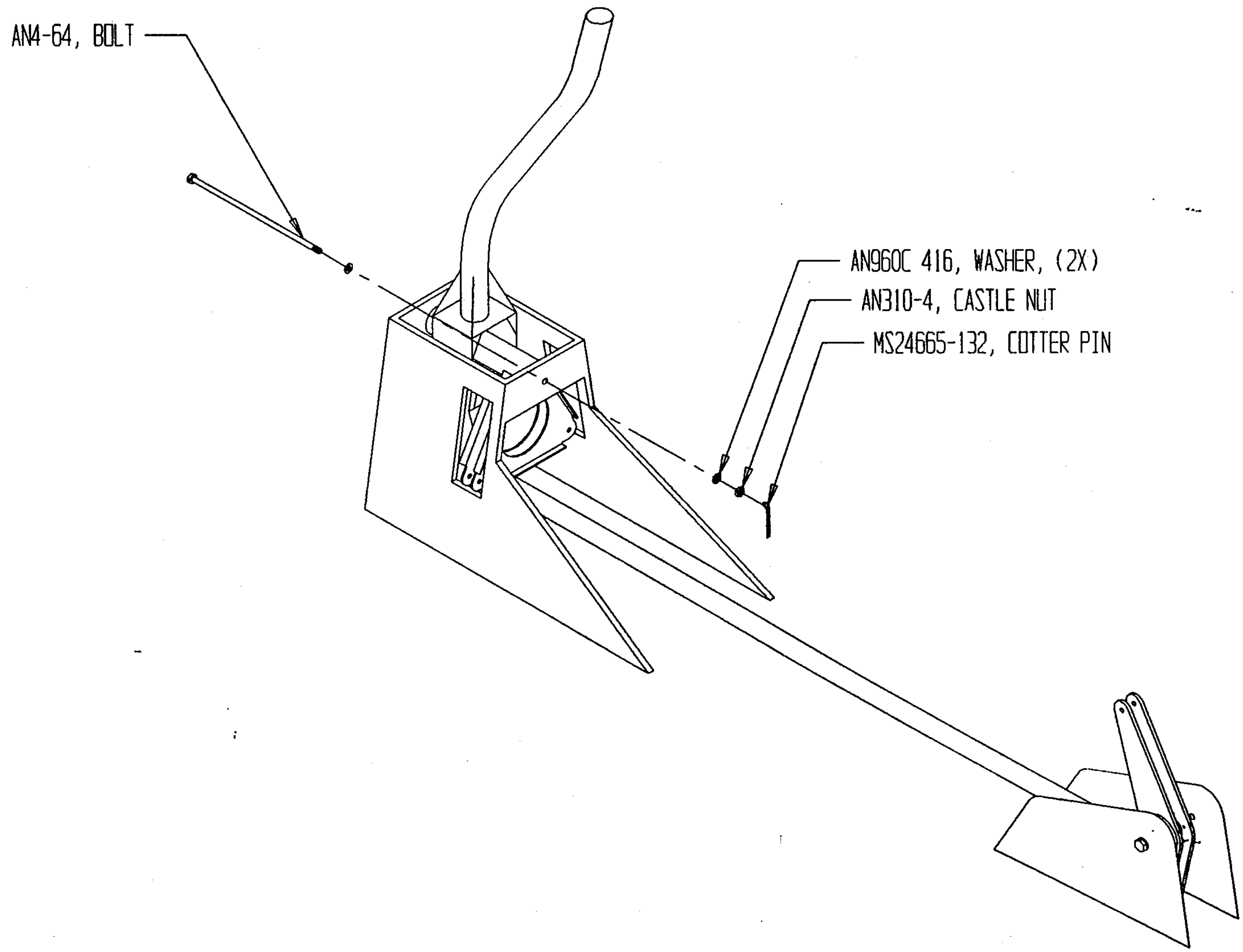


DRAWING NO. 20074A	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION FUSELAGE		REVISION	PAGE

TASK F-25 Assemble And Install The Aileron Stop Brackets

Step A Trim The Aileron Stop Brackets

Find the premolded fiberglass aileron stop brackets supplied with your kit. Trim these brackets to the dimensions shown in the illustrations using a Dremel tool or a bandsaw.

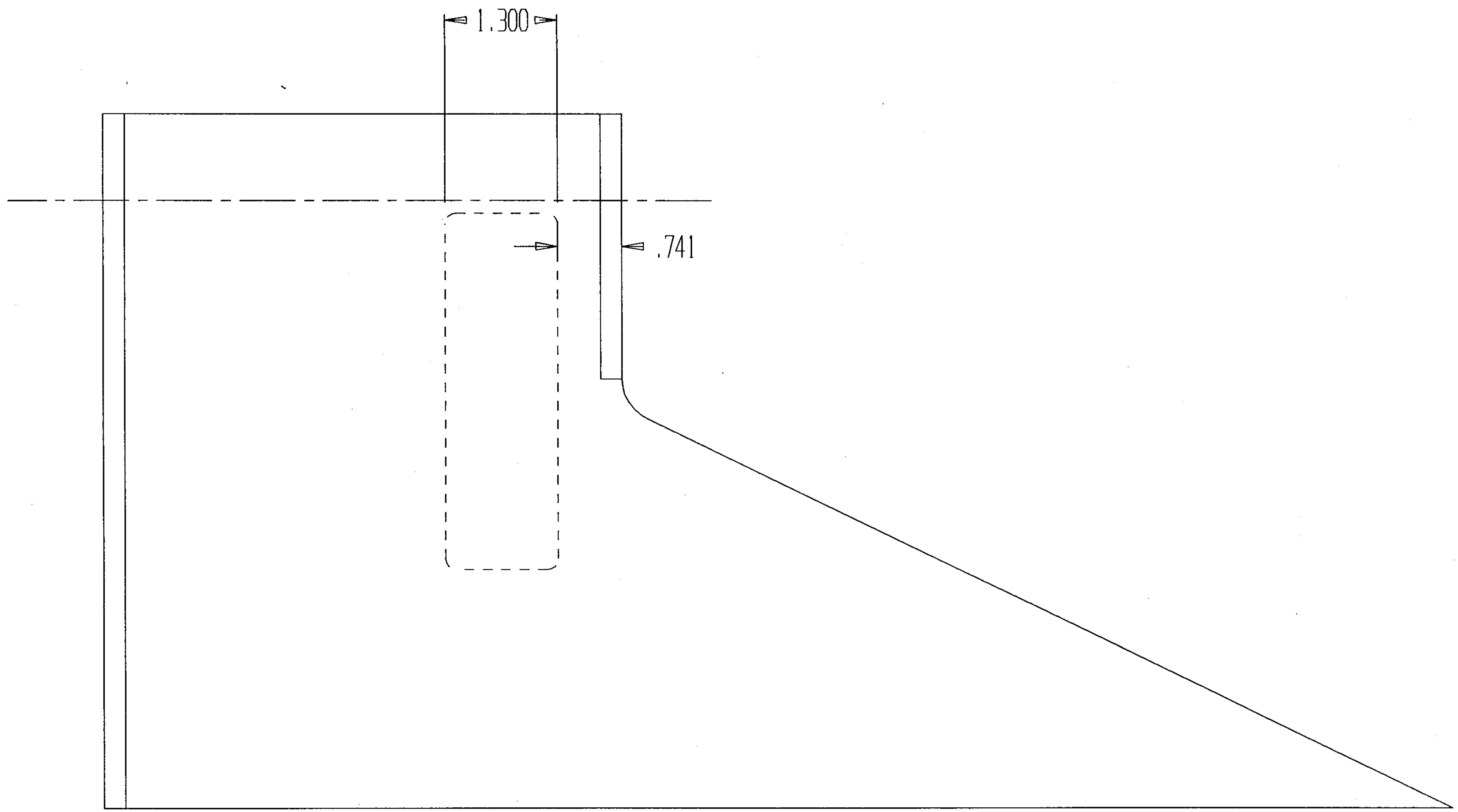
Step B Install The Aluminum Aileron Stop Blocks In The Brackets

Locate the aluminum aileron stop blocks. Round the edges of the aluminum blocks where they will intersect the inside corners of the fiberglass brackets to allow the blocks to sit flat on the inside surface of the brackets. Position the blocks in the brackets and mark the position of the holes on the brackets. Drill a 3/8 inch hole in the brackets at the marked hole locations. Now prepare the blocks and the mating surface of the fiberglass aileron stop brackets for bonding. Mix a small batch of structural adhesive and thicken it to "mayo" consistency with structural filler. Apply the adhesive mixture to the inside of the brackets and the prepared face of the aluminum blocks. Be careful not to get any adhesive in the tapped hole in the blocks. Assemble the blocks to the brackets and secure with clamps. Remove any excess adhesive using a clean rag. If you did accidentally get some adhesive into the threaded holes, thread a bolt into the blocks to "chase out" the adhesive.

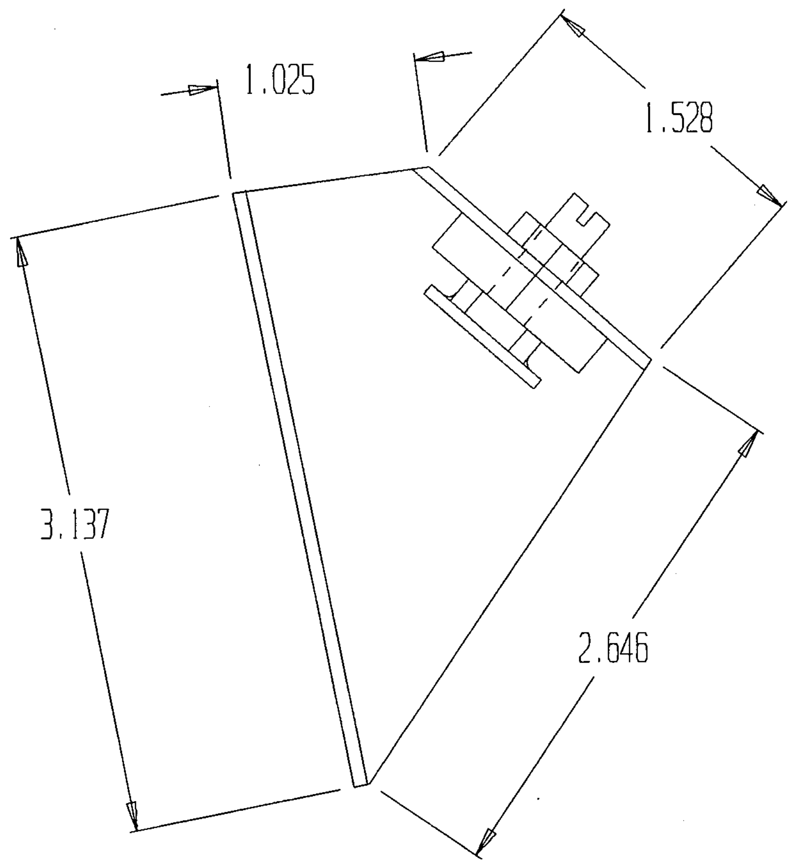
Step C Trial Fit The Aileron Stop Brackets

Find some material which is about .040 inches thick. Cut out two spacers from this material which are slightly larger than the outline of the swing arms. Use some clear tape to secure these spacers to the outside of the swing arms. These spacers will allow you to perfectly center the aileron stop brackets on the swing arms.

While holding the swing arm on the pivot block assembly to one side, feed one of the brackets into position. Now rotate the pivot block assembly until the swing arms fully engage the bracket. With the spacers mounted to either side of the swing arms, they should fit fairly tight inside the bracket. Secure the pivot block in this position while drilling four cleco holes through the outside of the control box and into the flanges of the bracket. Install clecos into each hole as it is drilled. Repeat this procedure for the other aileron stop bracket.



ROUND CORNERS OF CUTOUT
REMOVE CORE MATERIAL AROUND HOLE AND FILL WITH STRUCTURAL FILLER



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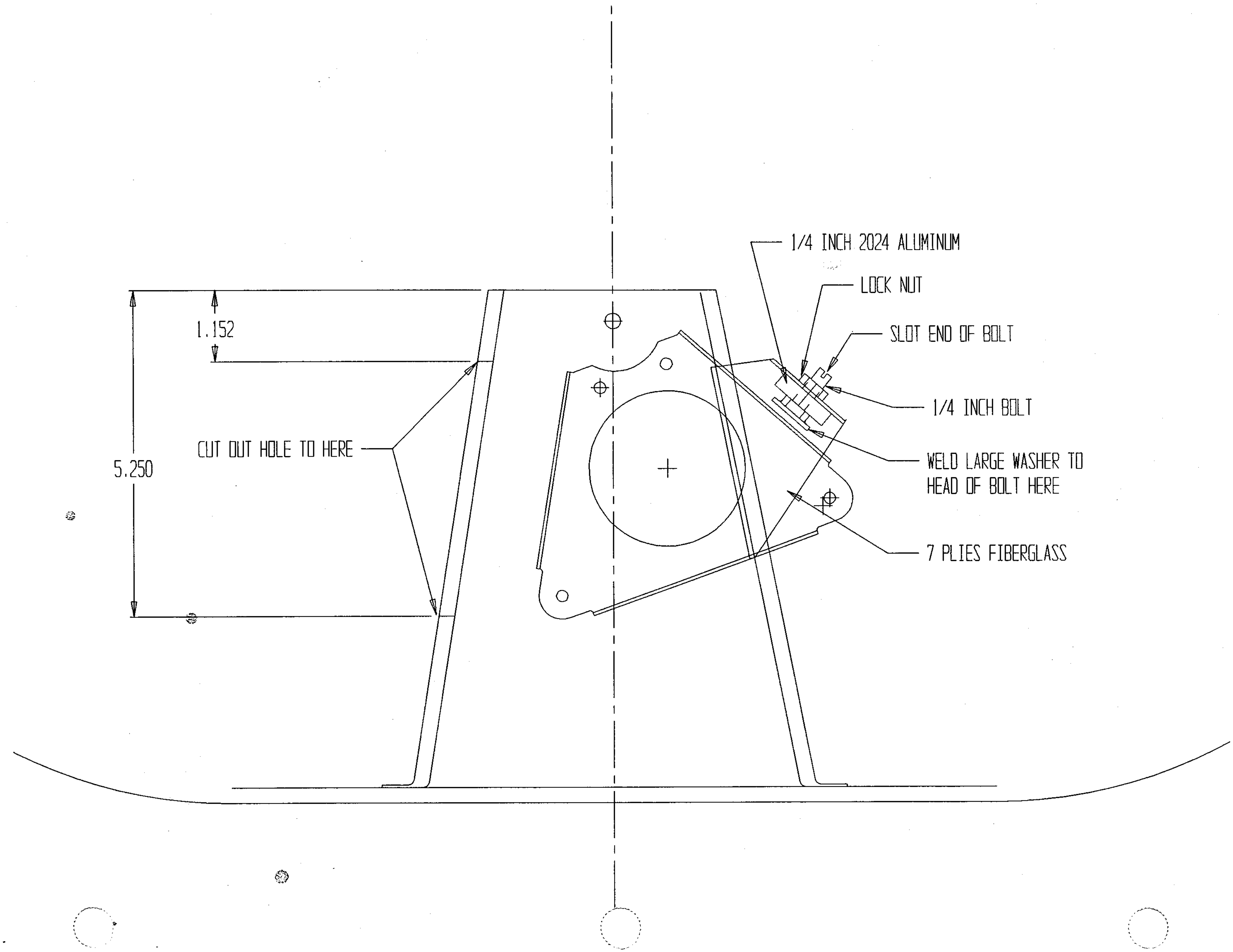


1/4 INCH 2024 ALUMINUM
LOCK NUT
SLOT END OF BOLT
1/4 INCH BOLT
WELD LARGE WASHER TO
HEAD OF BOLT HERE
7 PLIES FIBERGLASS
CUT OUT HOLE TO HERE
1.152
5.250

Step D	Mount The Aileron Stop Brackets To The Control Stick Box

Remove the pivot block assembly from the control box. Prepare the flanges on the brackets and the mating area on the inside of the control stick box for bonding. Mix a small batch of structural adhesive and thicken with structural filler. Apply the adhesive to the flanges on the brackets and install them with clecos. Clean up all excess adhesive with a clean rag.

Step E	Check For Proper Clearance

Before the adhesive cures, remove the spacers from the swing arms and reinstall the pivot block assembly in the control stick box. Swing the pivot block from side to side and check to make sure the swing arms clear the inside surface of the brackets.

TASK F-26 Assemble And Install The Elevator Control System

Step A Install The Control Stick And Stick Pivot Block In The Control Box

Disassemble the swing arms from the pivot block. Find the control stick supplied with your kit. Assemble the control stick to the pivot block using the proper hardware. Install this assembly into the control box using the long 1/4 inch bolt. Secure the bolt with a castle nut and cotter pin.

> NOTE:
> If you are planning on painting the interior of your G-200, do not secure any of the bolts for the control system with cotter pins. You will most likely want to remove the control system components before you paint.

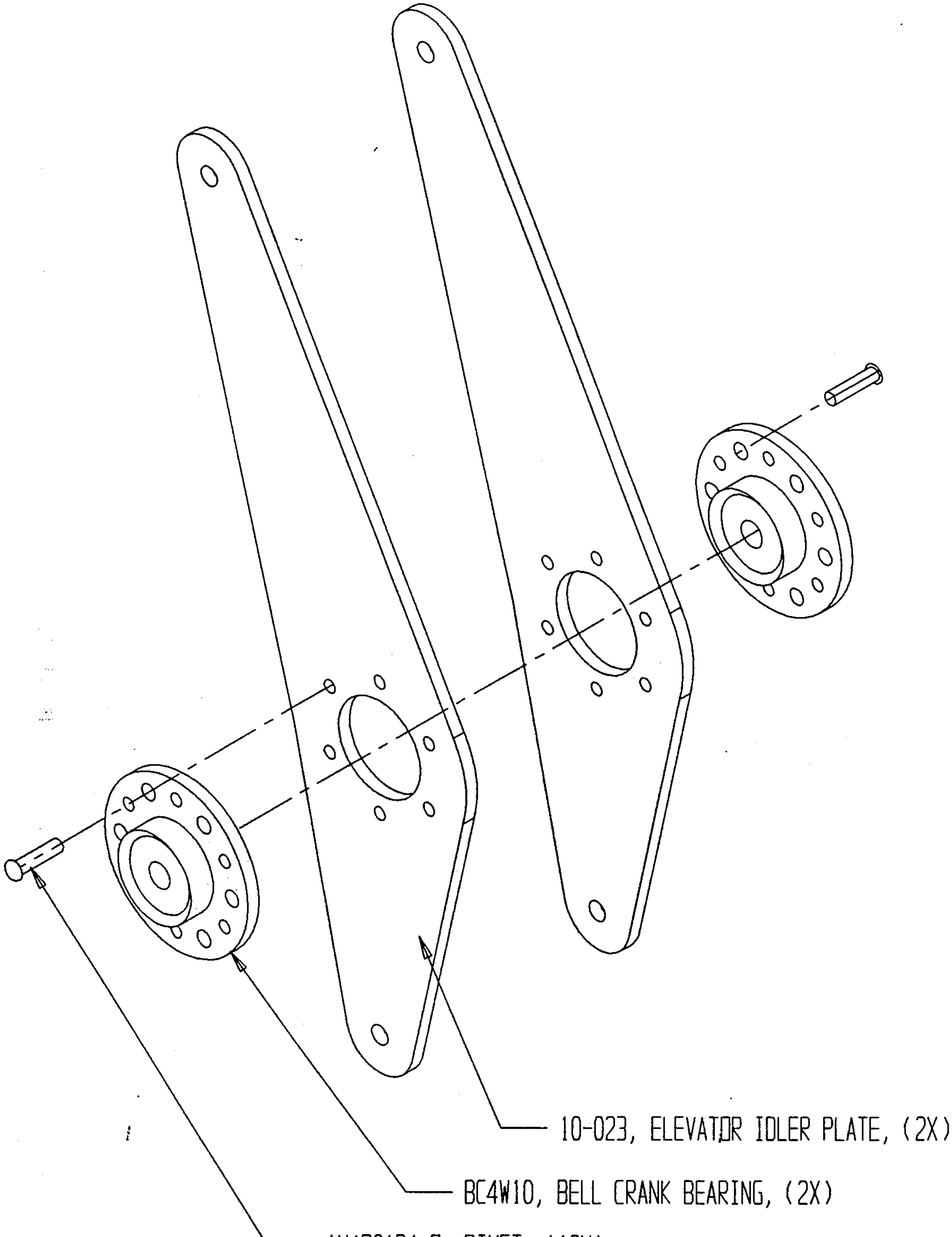
Now reassemble the swing arms to the pivot block. Note that you will need to swing the assembly to one side or the other to gain access to the bolt holes. Install the bolts from the rear then use two nut-drivers to install the nyloc nuts on these bolts. Hold one nut-driver on the head of the bolt on the aft side of the swing arms. Then insert the nyloc nut into the other nut driver and install it on the front side of the swing arms. If the nut falls out of the nut-driver, place some tape over the corner of the nut to hold it in place until you get the threads started.

Step B Assemble The Bearings To The Elevator Idler Arm Plates

Locate the elevator idler arm plates and belcrank bearings. Insert the belcrank bearings into each elevator idler arm plate. Use six rivets to secure each of the two idler arms to the belcrank bearings. Note that the bearing does not go on the same side of each plate. Be sure you have the bearing on the proper side of each plate before driving any rivets.

Step C Install The Elevator Idler Arm

Drill holes in idler arm brackets for the elevator idler arm. Install the elevator idler arm plates using the appropriate bolt, washers and spacers. Secure the bolt using the proper castle nut and cotter pin.



ELEVATOR IDLER ARM DETAIL

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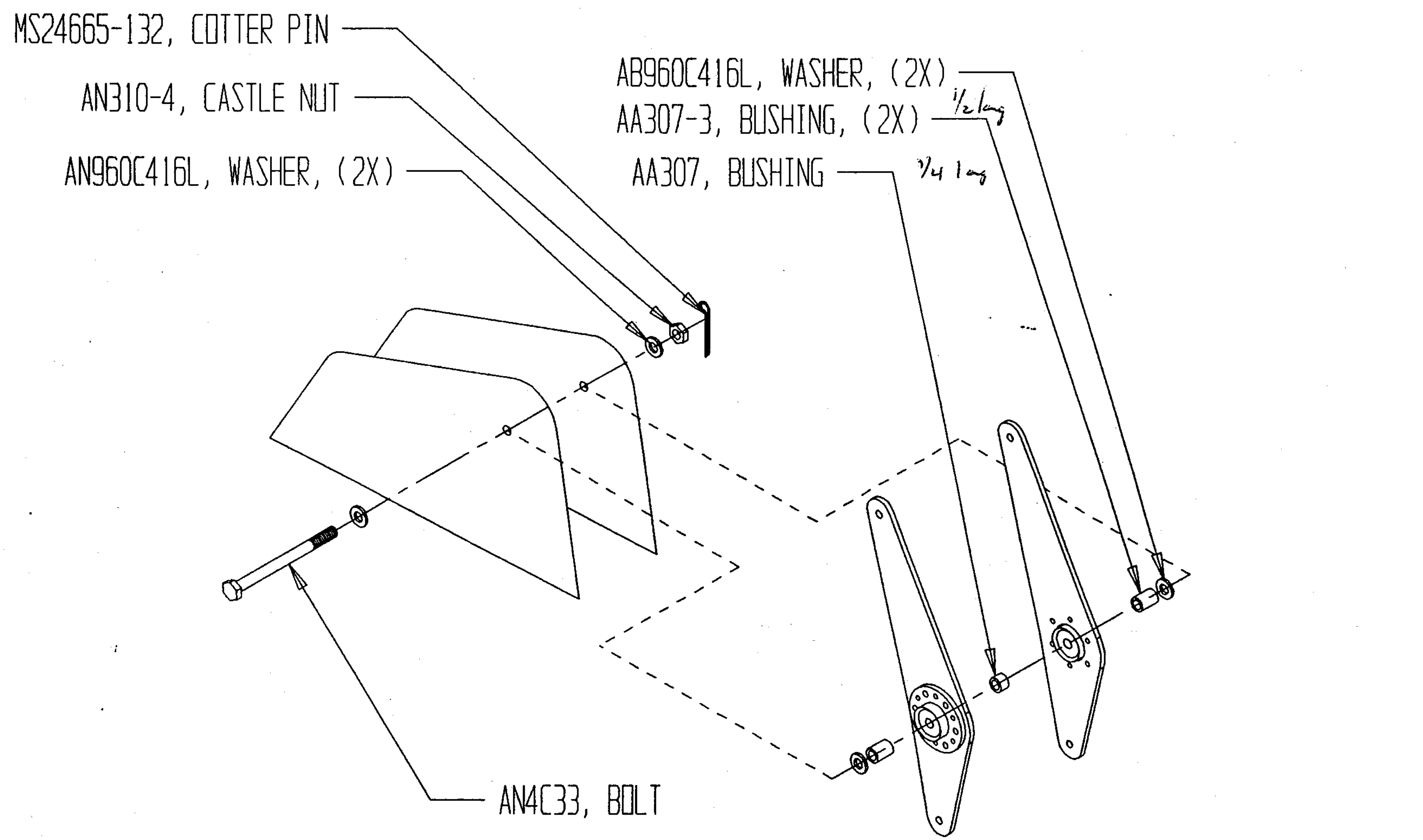

ELEVATOR IDLER ARM INSTALLATION

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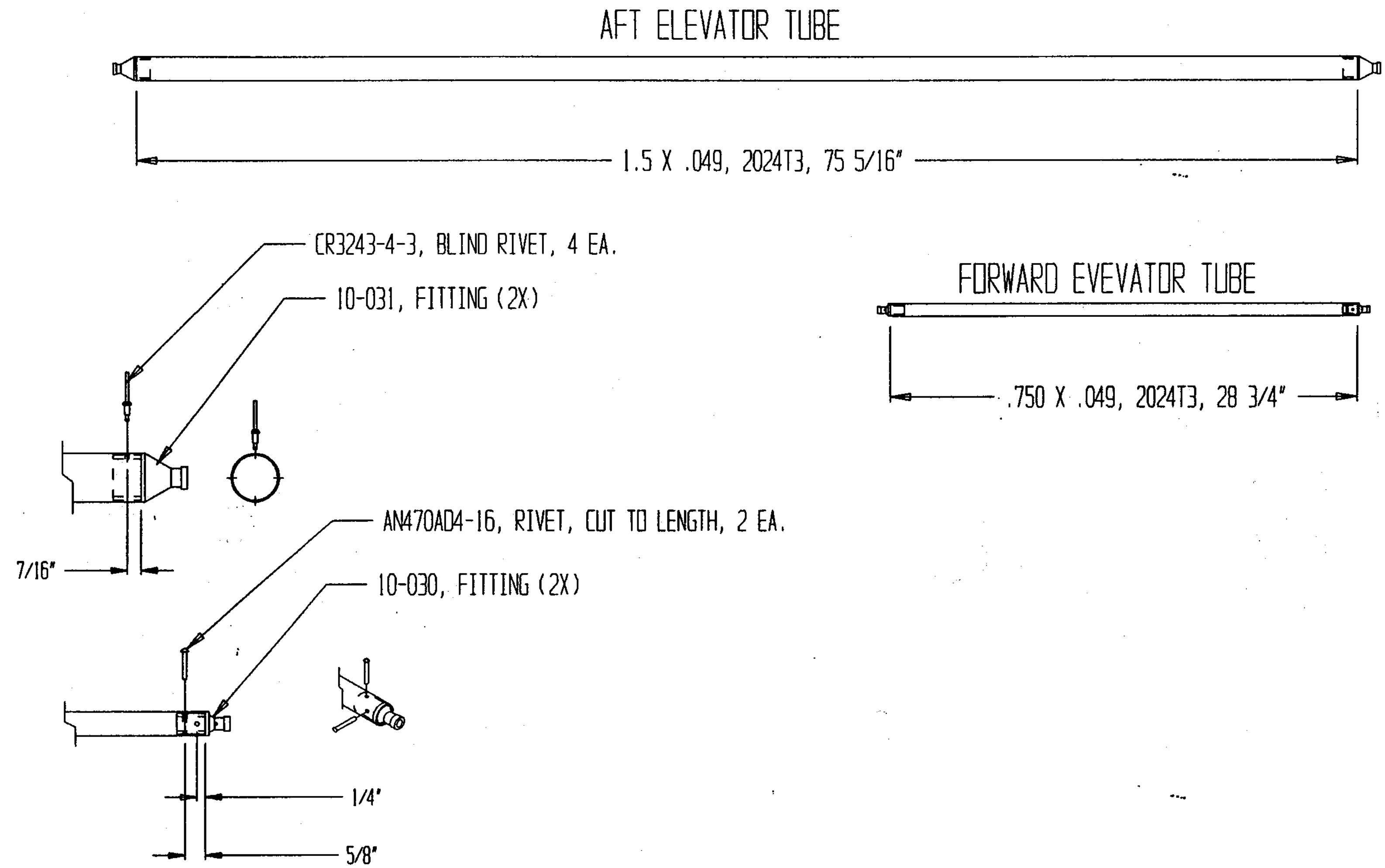
MODEL G - 200	SECTION FUSELAGE		REVISION	PAGE



ASSEMBLE ELEVATOR CONTROL TUBES

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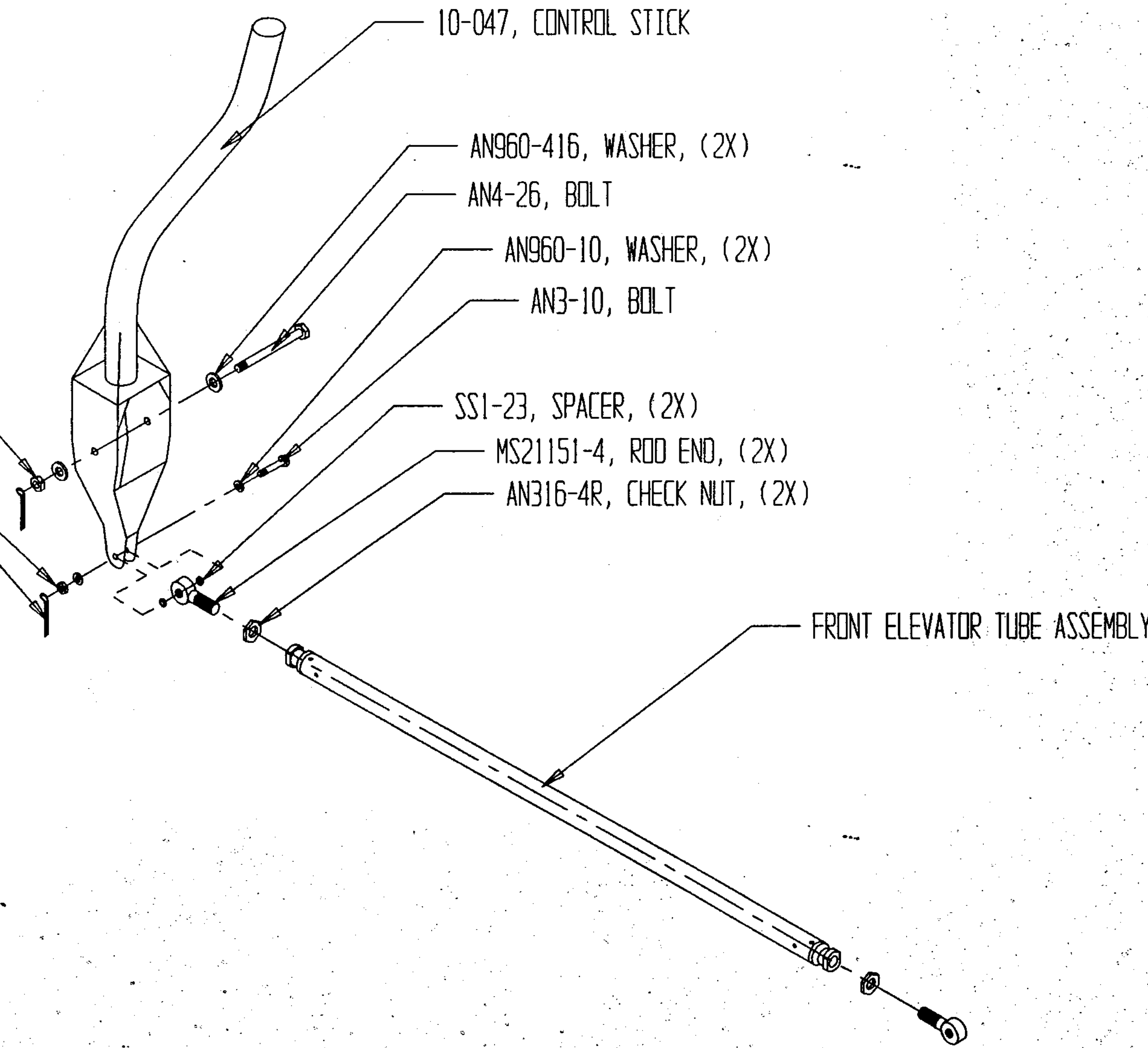

DRAWING NO. 20073A	TASK NO.	STEP NO.	AkroTech
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Step C Assemble The Elevator Control Tubes

Find the tubing for the forward and aft elevator control tubes. Cut these tubes to the lengths shown in the illustrations. Install the machined aluminum tube end fittings using rivets. Secure the proper rod end bearings for the elevator control tubes. Screw a lock washer onto each rod end bearing and install them into the tube end fittings. The rod end bearings should be initially installed so that about 75% of the threads are buried inside the fittings. This will allow the bearings to be adjusted in either direction as needed to fine tune the length of the tubes.

Step D Cut A Hole In The Rear Spar Carry-Through To Clear The Elevator Tube

You will need to cut a hole in the rear spar carry-through to allow the forward elevator tube to pass through. Find the rear spar carry-through cut out template in the back of this manual and use spray adhesive to mount it to the forward face of the rear spar carry-through. Now drill holes in the four corners of the cut-out. Use your Dremel tool with the cut-off wheel attachment to cut between the drilled holes. Finish the edges of the cut-out with sandpaper.

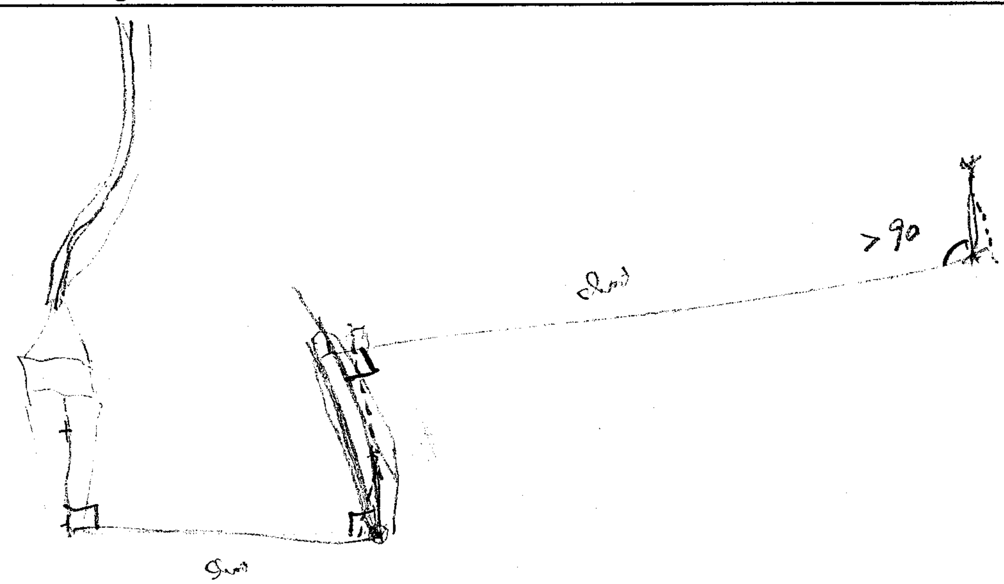
Step E Cut Out The Seat Back Bulkhead To Clear The Elevator Tube

Now you will cut out the seat back bulkhead between the elevator idler arm brackets to clear the elevator control tube. Mock up the elevator control tube and remove only enough of the bulkhead to clear the tube.. Remove the exposed core material from the cut edges of the bulkhead and the rear spar carry-through. Fill these areas with a mixture of laminating resin and structural filler thickened to “peanut butter” consistency.

Step F Install The Elevator Control Tubes

Assemble the forward elevator control tube to the stick and idler arm using the supplied hardware. Adjust the rod end bearings on this tube until its length is the same as the distance between the pivot point for the control stick and the pivot point for the idler arm. Now adjust the system to its neutral position. The neutral position is found by adjusting the stick until a line drawn through the elevator tube attach point and the pivot point is perpendicular to the aircraft’s waterline. Note that in this position the idler arm’s forward control tube attach point and pivot point should be similarly oriented. Use masking tape to secure the stick in this position. Tape the counterbalance arm on the elevator to the leading edge of the stabilizer to hold it in its neutral position as well. Now adjust the rod end bearings on the aft elevator control tube until it is the proper length to fit between the elevator actuator and the idler arm. Assemble the aft elevator control tube to the idler arm and the elevator actuator using the supplied hardware.

NOTE:
The elevator control system is one of the most critical systems in an aircraft. Therefor you should double check each control tube to make sure it has been installed correctly. Check each bolt to make sure that it is the proper length. Inspect each nut to be certain it has been properly secured with a cotter pin (this is very important!). Also, check to make sure that the rod end bearings in the forward control tube do not bind with extreme left or right movement of the control stick. You can check this by holding the control stick all the way to one side while trying to rotate the forward elevator control tube with your hand. You should be able to rotate the tube back and forth a small amount. If you cannot, check the rod end bearings to be certain their faces are in the same plane.



TASK F-27 Mount The Left Fin Skin

Brief Task Description:

In this task you will mount the left fin skin. Even though you will not be bonding the top fuselage in this operation, you will need to mount it so you can properly align the forward edge of the fin skin.. This procedure is very similar to that used previously to mount the right fin skin.

Step A Cut-Out The Opening For The Stabilizer In The Fin Skin

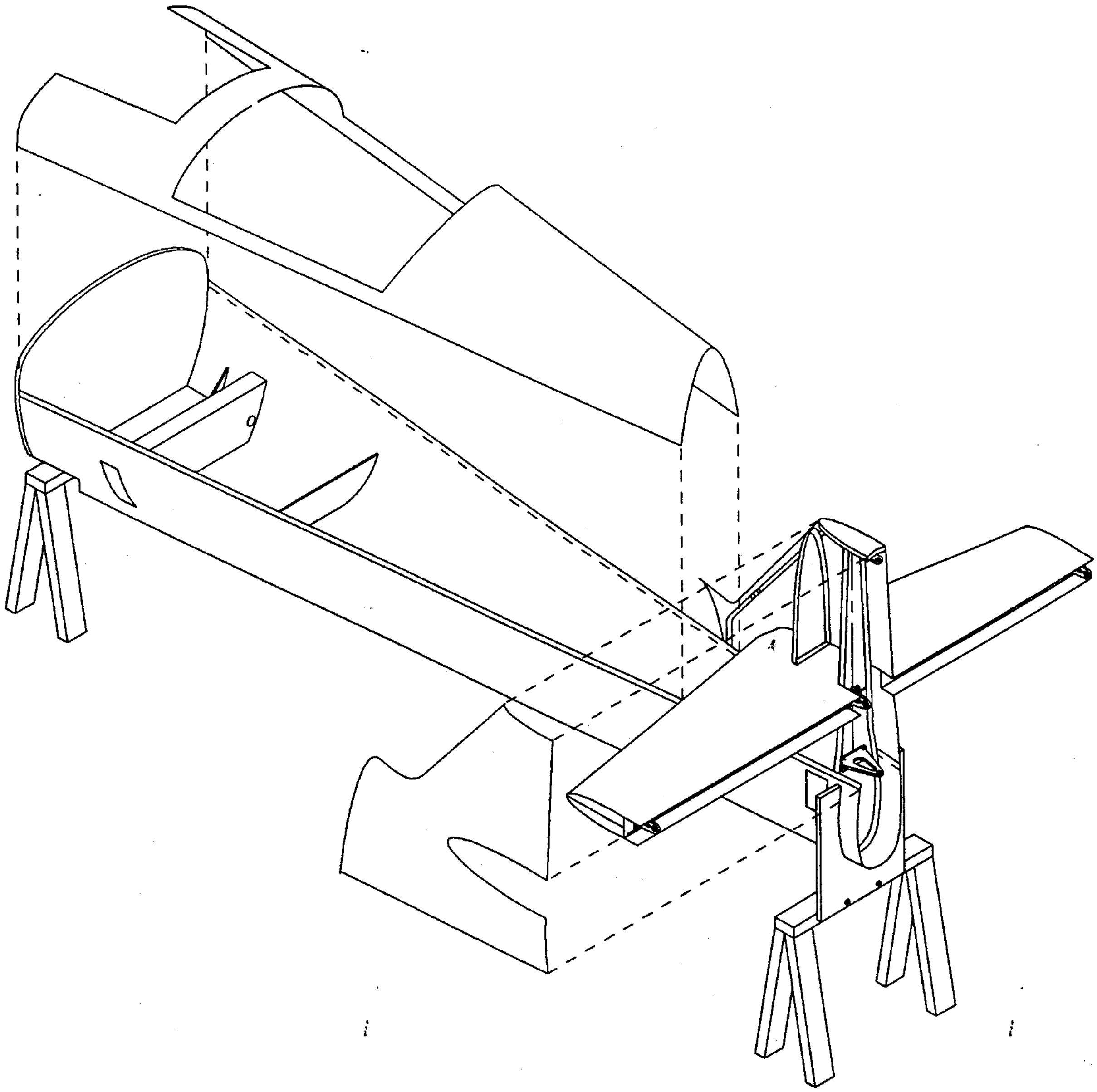
Use a jigsaw or bandsaw to cut out the opening in the fin skin for the horizontal stabilizer. Follow the molded in scribe line on the outside of the part. You may wish to high-light this scribe line with a felt tip marker before cutting.

Step B Trial Fit The Left Fin Skin

Trial fit the left fin skin over the stab and check for proper fit. Temporarily mount the top fuselage with clecos. Trim the cut-out as needed to properly align the fin skin. Once the fin skin is properly aligned, clamp the skin to the rudder post in several places using spring clamps. Use masking tape to hold the leading edge of the left fin skin in proper alignment with the right fin skin. With the fin skin properly aligned, drill holes for clecos about every four inches through the fin and into the flanges of the top fuse, bottom fuse, fin tip rib and rudder post. Remove the top fuselage and apply some clear tape to the top surface of the joggle that mates with the fin skin.

Step C Install The Left Fin Skin

Prepare the bond areas on the fin skin for bonding. Also prepare all mating surfaces on the rudder post, the bottom fuse, and the upper banjo bulkhead. Mix a batch of structural adhesive and thicken with structural filler to achieve "mayonnaise" consistency. Apply the adhesive to all bond areas on the bottom fuse and fin skin. Do not apply adhesive to the joggle that mates with the top fuselage as this will be bonded later. Carefully slide the fin skin over the stab and onto the fuse. Install clecos in the cleco holes. Wrap tape around the leading edge to hold the skin against the upper banjo. Mount the top fuselage



MOUNT THE LEFT FIN SKIN

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once more and insert clecos through the fin skin and into the top fuselage flange. Clean up any excess adhesive using a clean rag and allow the adhesive to cure completely.

Step D Fiberglass The Fin Leading Edge

Prepare the leading edge joggle on the fin skin for the fiberglass reinforcement by sanding thoroughly with 80 grit sandpaper and cleaning with acetone. Cut three strips of fiberglass cloth on the bias about three inches wide and long enough to span the length of the joggle. Prepare a mixture of laminating resin and lay-up the three plies of glass cloth onto some plastic sheet on your work table. Place another layer of plastic on top of this and trace out the final width of the strip on the plastic sheet using a ruler and pen. Cut out the strip using scissors. Remove one side of the plastic from the strip. Remove the remaining plastic sheet as you lay the fiberglass into the leading edge joggle.

TASK F-28 Install The Canopy Hinge Reinforcements

Step A Remove The Cockpit Rail At The Hinge Locations

Set the top fuselage on your work table upside down. Use a Dremel or similar tool to remove the inside of the cockpit rail at the location of the hinges. Be careful not to damage the outer skin while cutting. Use a drum or belt sander to sand the cut edges of the rail down to the outside skin. Chamfer the fore and aft edges of the rail at about 45 degrees. Prepare the entire surface surrounding the cut -out for bonding.

> NOTE:
> A primary structural member passes through the area where you will be removing core material for the canopy hinge reinforcements. This structural member is a multi-layer unidirectional laminate that resides just below the exterior skin. Be extremely careful not to cut or grind into this underlying structural laminate when removing the core material from the canopy rail.

Step B Mount A Temporary Lay-Up Surface To The Cockpit Rail

Now you need to make up a temporary surface on which you will lay up the fiberglass hinge support flange.

Secure two flat pieces of wood or metal a little wider than the cockpit rail and little longer than the hinge cut-out. Place some clear tape over these blocks.. Mount the blocks flush on the cockpit rail over the hinge cut outs using hot glue.

Step C Lay-Up The Hinge Reinforcements

Prepare twelve fiberglass strips about ten inches long by four inches wide. Mix up some laminating resin and wet six fiberglass strips out on the inside of the top fuselage at each hinge location. The strips should extend onto both the fuselage and the temporary lay-up surfaces. Remove all excess resin from the lay-up and inspect carefully for trapped air. Allow to cure undisturbed.

Step D Drill Out The Support Flanges For The Hinges

Mark the interior side of each hinge for the mounting screws and use a center punch to mark each hole. Place the hinges into position on the support flanges. Place a straight edge along the exterior side of the hinges and adjust them until the hinge pins line up. Move the hinges outboard until hinge line falls outside of the edge of the fuse (otherwise the canopy will bind). Drill mounting holes through the hinges and the support flange. Countersink these holes with a 100 degree countersink and mount the hinges to the support flanges with the supplied hardware.

TASK F-29 Install The Crankcase Breather Tube

Step A Prepare the PVC pipe for installation

The breather tube consists of four lengths of PVC tubing connected by two 45 degree fittings and one 90 degree fitting. Cut the PVC to the required lengths but do not install any fittings yet.

Step B Prepare The Fuselage For The Tube

Use a 1 inch hole saw to drill holes for the PVC tube in the firewall, rear seat bulkhead and tail of the fuse. You may have to grind these holes out slightly as the tubing is slightly larger than 1 inch in diameter. Sand a 3 inch wide strip down the length of the cockpit area along the centerline of the location of the breather tube. Clean this area with acetone after sanding to propare it for bonding.

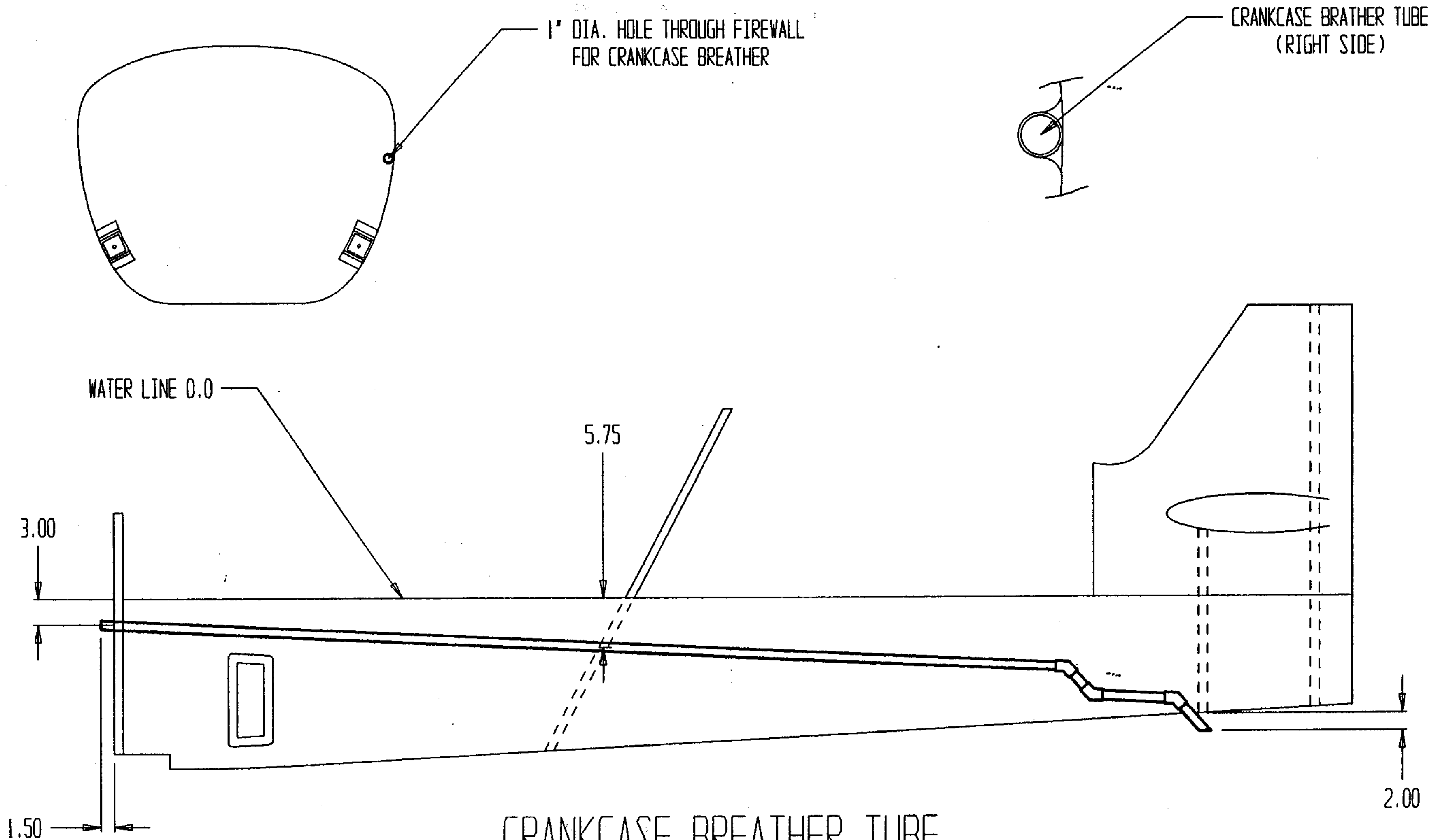
Step C Install The Forward Tube

Sand the entire outside surface of the forward PVC tube with 80 grit sandpaper. Slide this tube through the hole in the firewall, through the cockpit area and through the hole in the rear seat bulkhead. When fully inserted, the forward end of the tube should protrude about 1.5 inches ahead of the forward face of the firewall. Seal the area around the tube where it passes through the firewall with high temperature silicone sealant. Tack the tube to the inside surface of the cockpit at several locations using hot glue or five minute epoxy.

Prepare a 6 oz batch of laminating resin and add microballoons until the mixture assumes the consistency of peanut butter. Use a tongue depressor to create a fillet between the tube and the side of the fuselage. Give this fillet a fairly generous radius.

Cut some strips of fiberglass cloth on the bias about 5 inches wide and long enough to span the entire length of the cockpit area. Mix another 6 oz batch of laminating resin and laminate the fiberglass strips over the tube and onto the inside of the cockpit. Remove any excess resin then allow the lay-up to cure undisturbed.

Step D Install The Remainder Of The PVC Tubes



CRANKCASE BREATHER TUBE

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Assemble the remainder of the PVC tubes using the 45 degree PVC fittings and PVC adhesive. Be certain this assembly is long enough to reach from the hole drilled earlier through the bottom of the fuselage to the forward tube with a little left over. Slip this assembly into the tail of the aircraft and drop the aft-most tube into the elongated hole in the tail of the airplane. Now glue the forward end of this assembly to the forward fiberglassed tube.

Mix up some structural adhesive and thicken it to "peanut butter" consistency with structural filler. Use this mixture to secure the aft tube assembly to the bottom of the fuselage and to fill in the area surrounding the tube where it exits the fuse.

TASK F-30 Install The Rudder Cable Fairleads

Step A Install The Aft Cable Fairleads

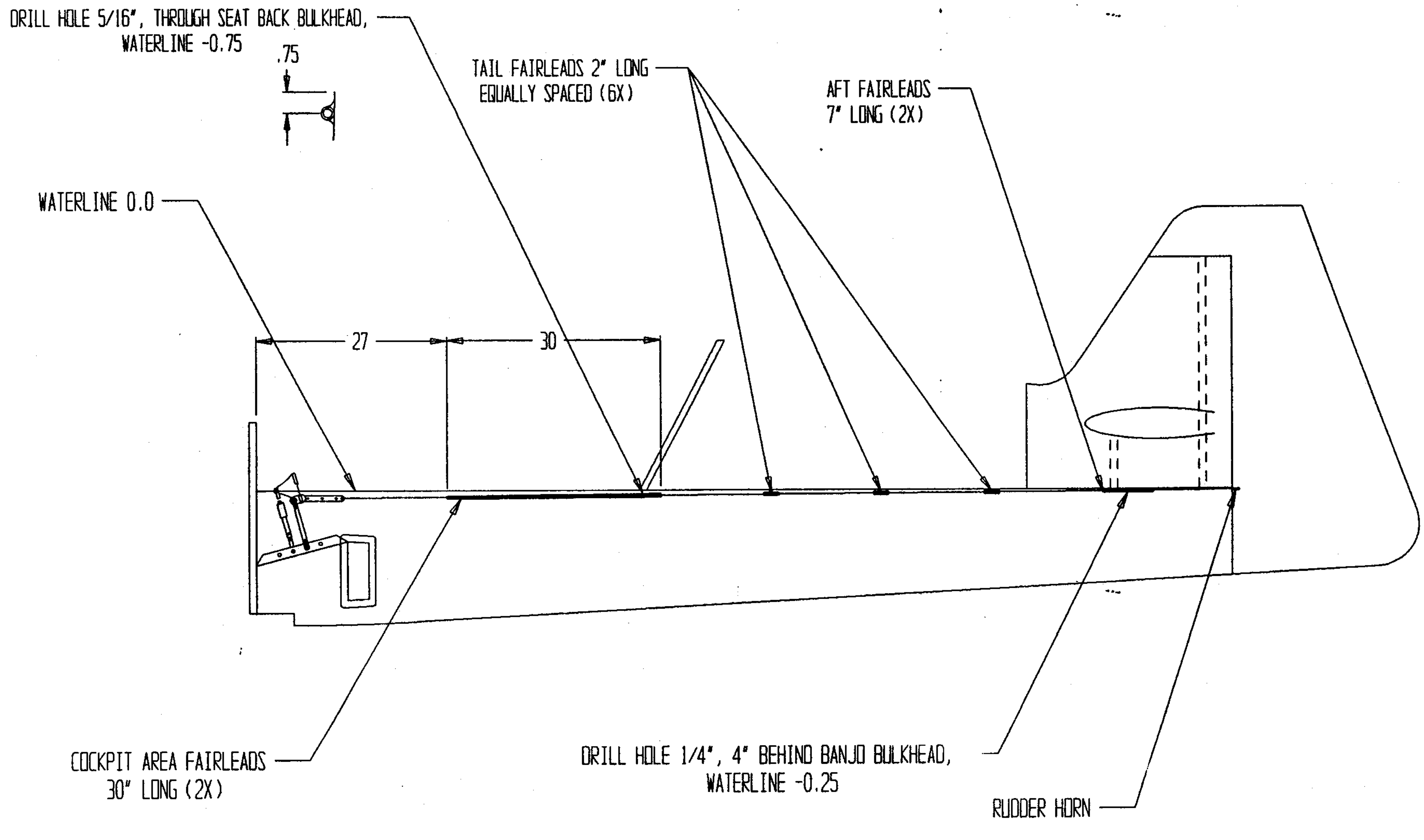
Drill 1/4 inch holes on either side of the fuse for the rudder cable just forward of the rudder post. These holes should be located 4 inches aft of the lower banjo bulkhead and at exactly the same waterline as the arm on the rudder horn (which is 1/4 inch below waterline 00). Elongate these holes for and aft using a Dremel tool with a small grinding bit. Now drill another two 1/4 inch holes through the lower banjo bulkhead at exactly the same waterline. Locate these holes as close to the inside skin of the fuse as possible. . Find the 1/4 inch nylon tubing supplied with your kit. Cut off two pieces about 7 inches long. Thoroughly sand the tubing with 80 grit sandpaper. Install these tubes through the elongated holes in the side of the fuse and into the holes in the lower banjo bulkhead. Tack the tubing in place with hot glue.

Step B Install Fairleads In The Cockpit Area

Cut another two pieces of tubing about 28 inches long to shield the cable where it passes through the cockpit area. Sand the tubing with 80 grit sandpaper. Use a 5/16 inch drill bit to drill holes through the seat bulkhead .75 inches below waterline 00 for the fairleads. Locate these holes as close as possible to the sides of the fuselage..Slip one end of each of the fairleads through these holes so they protrude about 2 inches behind the bulkhead. Now tack the tubing in place with hot glue every 3 inches so that it is parallel to, and .75 inches below, waterline 00.

Step C Lay-Up Fiberglass Over The Fairleads

Prepare one 4 oz portion of laminating resin and hardener. After thoroughly mixing the resin and hardener, add enough microballoons to create a mixture with the consistency of peanut butter. Use this mixture to create a generous fillet between the forward fairlead tubing and the side of the fuselage. Also, use the micro mixture to fair in the aft tube where it exits the fuselage at the tail and where it passes through the lower banjo bulkhead.



INSTALL THE RUDDER CABLE FAIRLEADS

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Prepare some fiberglass strips about 2 inches wide and long enough to span each forward fairlead. Cut the strips so that the fibers run at 45 degrees to the edge of the strips. Mix a 6 oz batch of laminating resin and laminate the fiberglass strips over the fairleads and onto the sides of the fuselage. Allow to cure completely.

Step D Install Fairleads In The Tail

Cut off six, 2 inch pieces of tubing. Sand these pieces throroughly with 80 grit sandpaper. Now Install the rudder cables through the aft fairleads. Thread three of the short fairleads onto each cable then thread the remaining cable through the forward fairleads.. Each cable should now have three of the 2 inch fairleads floating free between the front and rear fairleads. Pull the cable tight then use hot glue to tack each of the short fairleads to the inside of the fuse. These tubes should end up being very close to the top edge of the lower fuse (waterline 00). Try to space these tubes equally so they will give adequate support to the cable. Prepare the area immediately surrounding each fairlead for bonding. Mix up some structural adhesive and thicken it to "peanut butter" consistency with structural filler. Use this mixture to bond the 2 inch tubes permanently to the sides of the fuse. Try to build the adhesive up as much as you can on top of and around the tubes without getting any on the cables. If you do accidentally get some adhesive on the cables, be sure to remove it immediately. Allow the adhesive to cure then remove the cables.

TASK F-31 Install The Rudder Pedal Trays

Brief Task Description:

Each rudder pedal tray is supported by three premolded fiberglass flanges. One premolded flange is mounted to the forward face of the spar box and supports the aft end of the tray. The other two flanges are mounted to the firewall and support the forward end of the tray. Two screws secure the aft end of the tray to the spar box mounted flange. while the forward end of the tray is trapped by the two firewall mounted flanges. Note that there are only two angles of premolded stock supplied with your kit. One angle is used for both the spar box flange and the upper firewall flange. The other angled stock is used for the lower firewall flange.

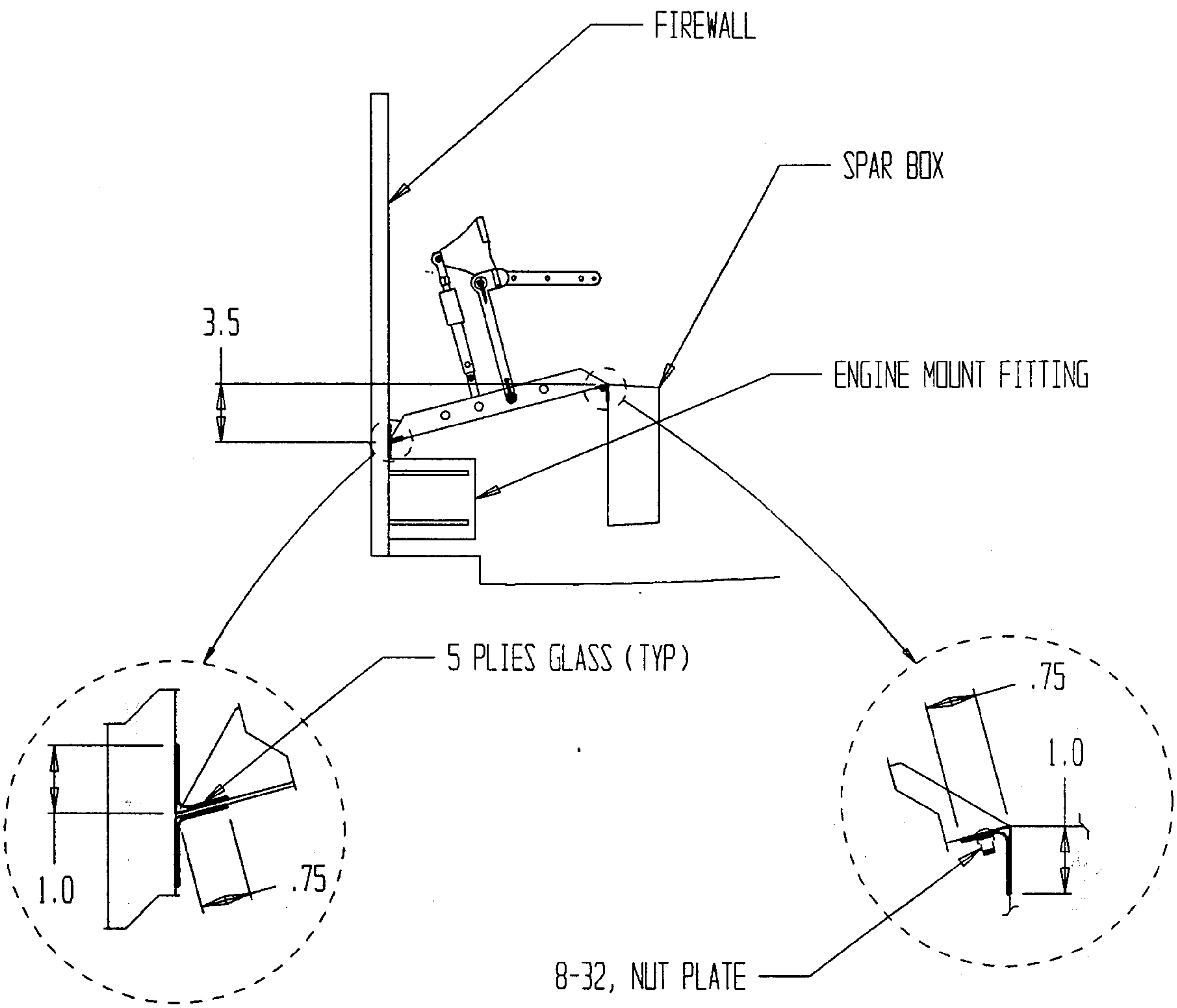
Step A Cut The Flanges From The Premolded Stock

Cut the premolded stock into sections that are just long enough to span the inside width of the rudder pedal tray (see illustration). You should have four pieces with an acute angle and two pieces with an obtuse angle.

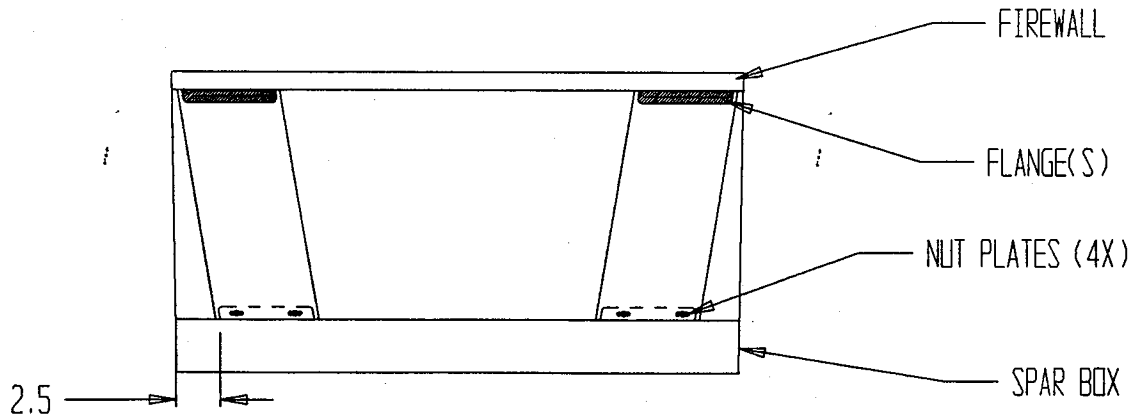
Step B Trial Fit The Rudder Pedal Trays

Place some clear tape over both ends of each rudder pedal tray. Clamp the six flanges to the rudder pedal trays using C-clamps. You will have to use blocks to clamp the forward flanges to the tray as there is not enough room to fit two C-clamps over the flanges themselves (see illustration). Trial fit the rudder pedal trays to the firewall and spar box. The trays should just barely overlap the spar box and the forward flanges should fit flat against the firewall. Once you are satisfied that the trays are positioned correctly, drill two 1/8 inch holes through each upper, firewall mounted flanges and into the firewall (do not go all the way through the firewall). These holes will be used for clecos which will hold the forward flanges in the proper position while the structural adhesive cures. Remove the trays from the fuselage but leave the flanges clamped to the trays.

Step C Bond The Flanges To The Firewall And Spar Box



SIDE VIEW



TOP VIEW

DRAWING NO. 20077A	TASK NO.	STEP NO.	AkroTech
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Prepare the flanges, the firewall, and the spar box for bonding as instructed in the General Information Section of this manual. All bond areas should be thoroughly sanded with 80 grit sandpaper and cleaned with acetone. Prepare a small batch of structural adhesive and add enough filler to achieve "mayonnaise" consistency. Coat all bond areas with the adhesive. Carefully re-install the trays with the fiberglass flanges clamped to them. Install clecos through the holes drilled into the upper firewall mounted flanges and into the firewall. Clean up all excess structural adhesive with a clean rag and allow to cure completely.

Step D Install Nutplates In The Aft Flanges

Using the holes in the trays as a drill guide, drill two no. 19 holes through each of the spar box flanges. Now remove the rudder pedal trays and install two 8-32 nutplates in each spar box flange. You may wish to refer to the section entitled "Installing Nutplates" in the General Information Section of this manual.

TASK F-32 Assemble And Install The Rudder Pedal System

Step A Assemble The Locking Pins And Pedals To The Pedal Hanger

Find the locking pins, bushings, washers and screws supplied with your kit. Assemble these parts to the rudder pedal hanger as shown in the illustrations. Be certain to use Locktite when installing the screws which retain the bushings. Now assemble the rudder pedal to the pedal hanger using the pedal pivot pin.

Step B Assemble The Brake Cylinder To The Brake Cylinder Hanger

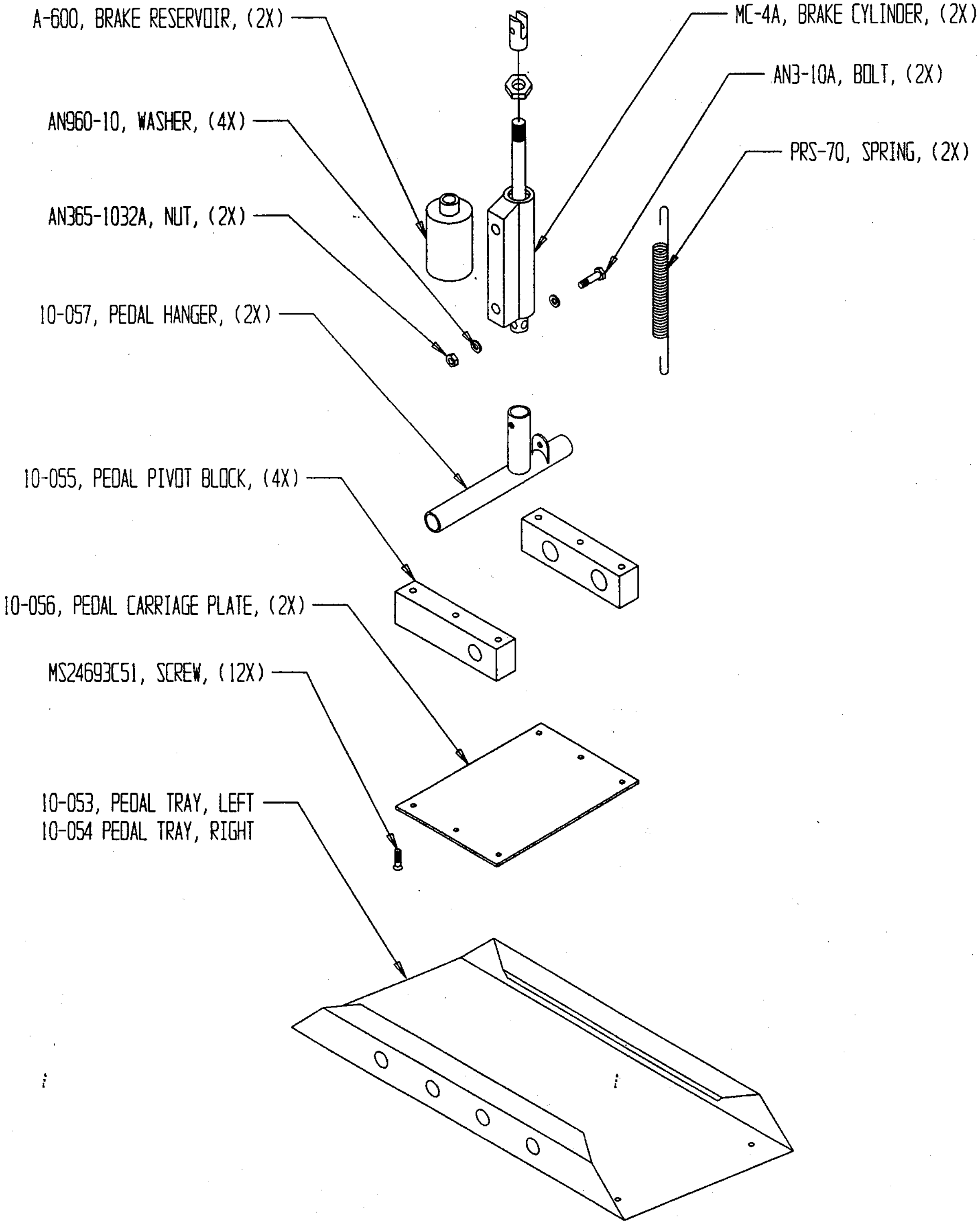
Find the brake cylinder hanger and brake cylinder supplied with your kit and assemble these components using the appropriate hardware (See illustrations).

Step C Assemble The Pedal Components

Locate the nylon rudder pedal blocks and assemble these to the brake cylinder hanger assembly and pedal hanger assembly. Remove the rudder pedal tray from the fuselage and slide the pedal assembly into it. Check to make sure the locking pins fully engage the holes at each of the four adjustment positions. If the pins tend to catch on the edges of the holes, ream out the holes until the pins engage easily.

Step D Install The Rudder Cables

Re-install the rudder pedal trays in the fuselage. Slide the rudder pedals into the rudder pedal trays. Adjust the pedals so that they are in their most forward position. The back of the pedals should now be hitting the firewall. Place a 3/8 inch spacer behind each pedal where it touches the firewall. Secure this spacer to the firewall with tape. Now install the cable attach tangs over the pedal pivot pins on each pedal (this pin should engage the last hole on the tang). Slide the cables through the fairleads. Secure the fork end of the cable to the rudder horn using the supplied bolts. Secure the rudder itself in its neutral position by placing some tape over the tip of the counterbalance arm and onto the top of the fin. Adjust the supplied turnbuckles so that they are in their neutral adjustment position (75% of the threads of each end fitting should be buried inside the barrel). Insert the cable thimbles into the eye end of the turnbuckle then mount the fork end of the turnbuckle to the rudder cable tangs using the appropriate hardware. Slip a nicopress fitting onto each



RUDDER PEDAL SYSTEM COMPONENTS

DRAWING NO. 20079A	TASK NO.	STEP NO.	AkroTech
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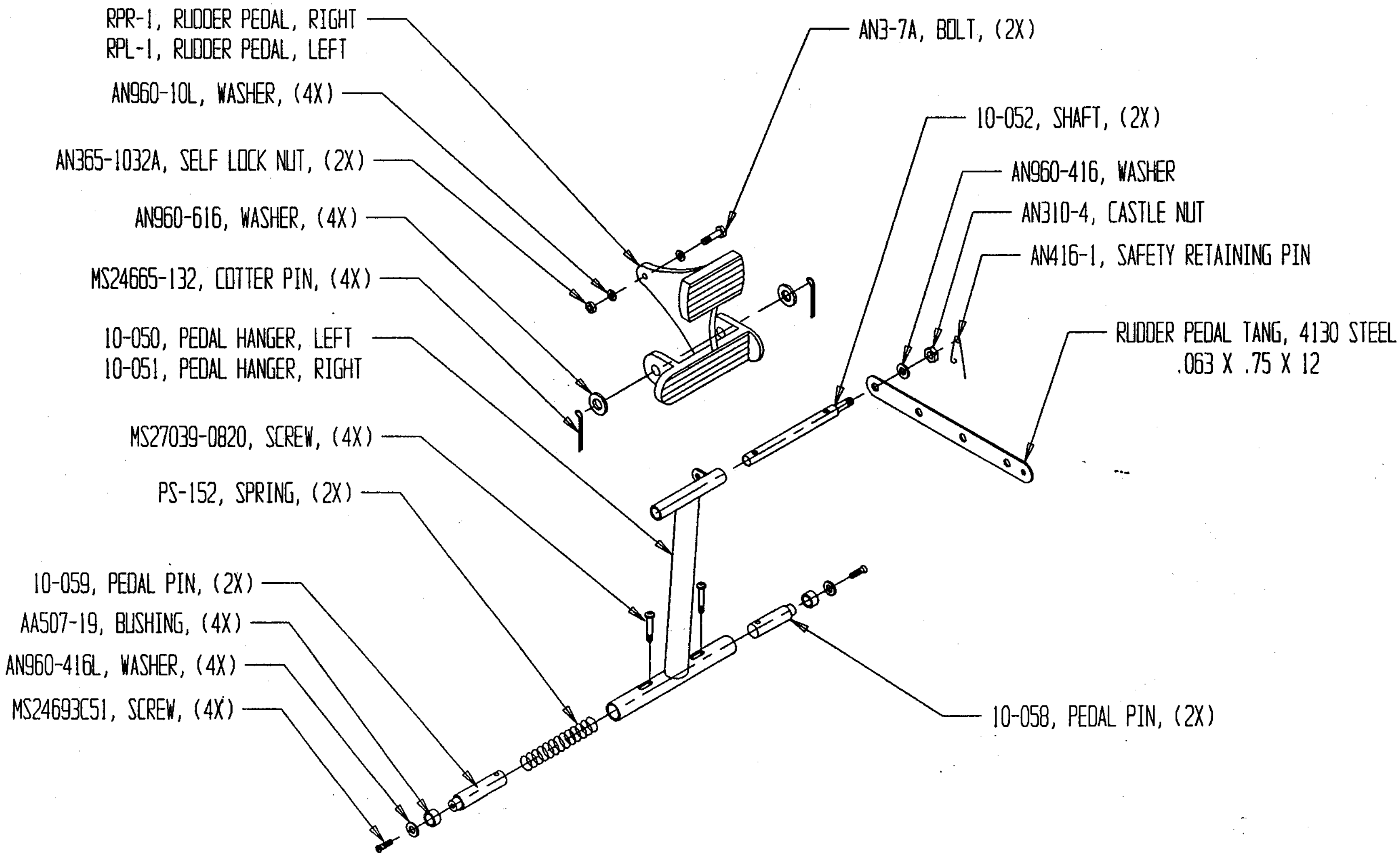

RUDDER PEDAL SYSTEM COMPONENTS

DRAWING NO. 20080A	TASK NO.	STEP NO.	AkroTech
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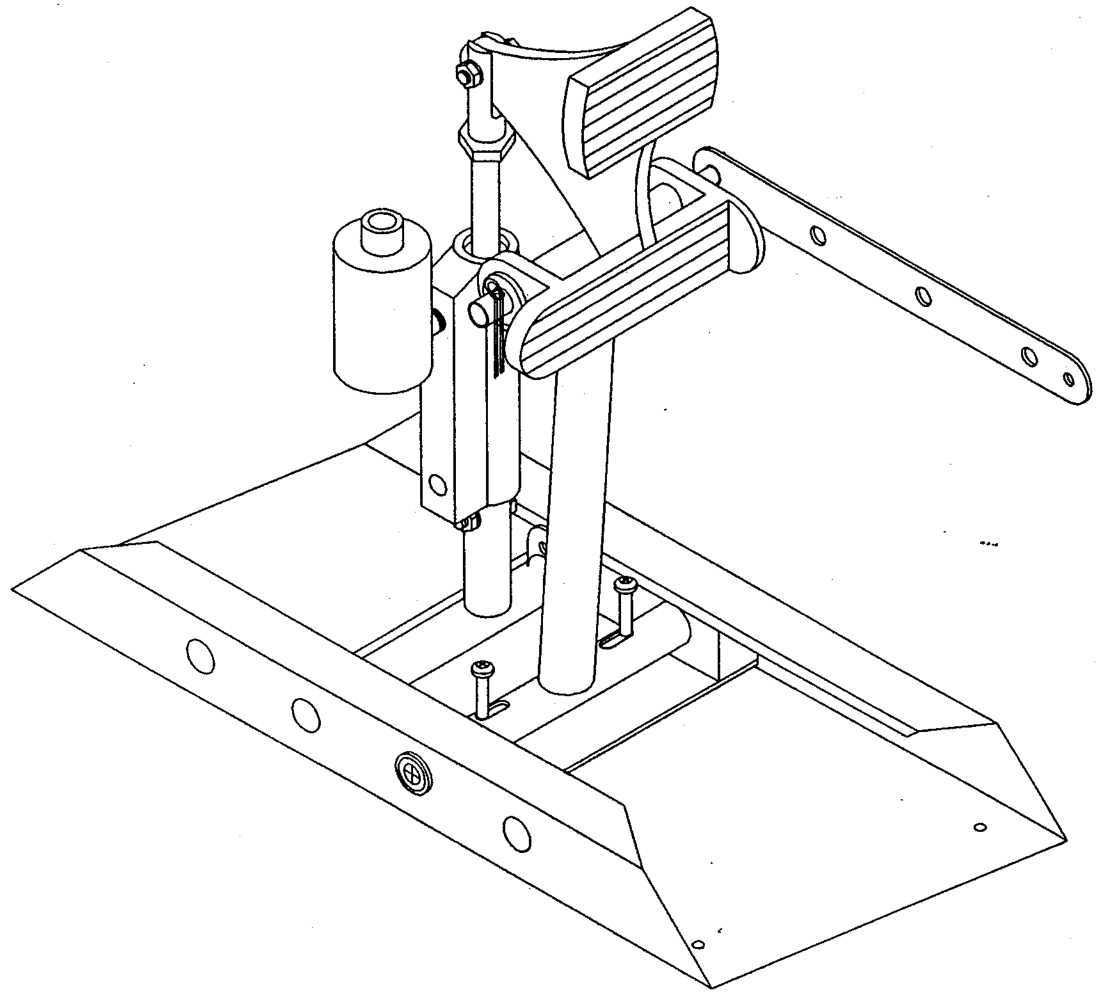

DRAWING NO. 20081A	TASK NO.	STEP NO.	AkroTech	
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cable. Loop the free end of each cable around a cable thimble and pass it back through the nicopress fittings.

Step E Swage The Cables

Use your cable swaging tool to compress the nicopress fittings just enough to apply some friction to the cable. Do not compress it all the way yet! Remove the slack in the cables by pulling on the free end while holding the pedals against the spacers on the firewall (have a helper hold the pedals while you pull on the cable). The partially compressed nicopress fittings should keep the cable from slipping back through the nicopress fitting. With the cables tight and the pedals against the spacers, finish compressing(swaging) the nicopress fittings. When finished, cut off the excess cable using a cut-off wheel on your Dremel tool. Cut the cable about an inch from the fitting and wrap some masking tape around the cable before cutting to keep it from fraying.

TASK F-33 Mount The Top Fuselage

Step A Level The Horizontal Stabilizer

Place a level on the spar box to make sure the fuselage is level. If the fuse is not level, adjust the fuse by placing shims under the legs of the sawhorse supporting the forward fuselage. Now check the stabilizer by placing a level along the centerline of the stabilizer spar. If the stab is not level, adjust the cradle supporting the rear of the fuselage until it is. If you adjust the stab, go back and check the spar box once more to be certain it is still level. Now check the entire setup for stability - the alignment should not be easily upset.

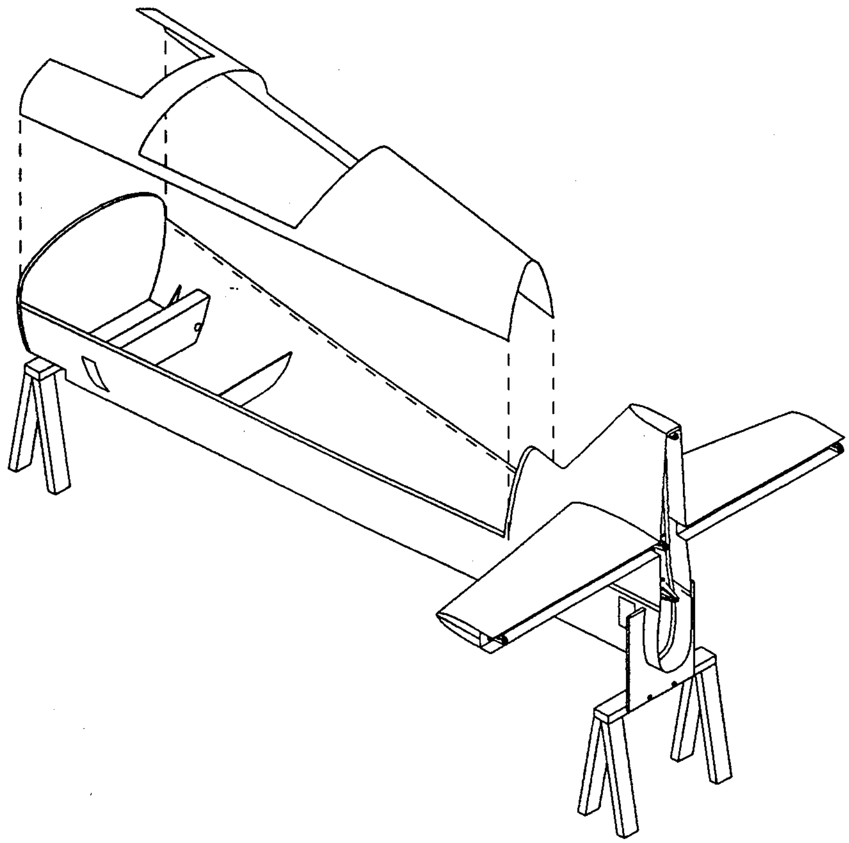
Step B Prepare The Top Fuselage

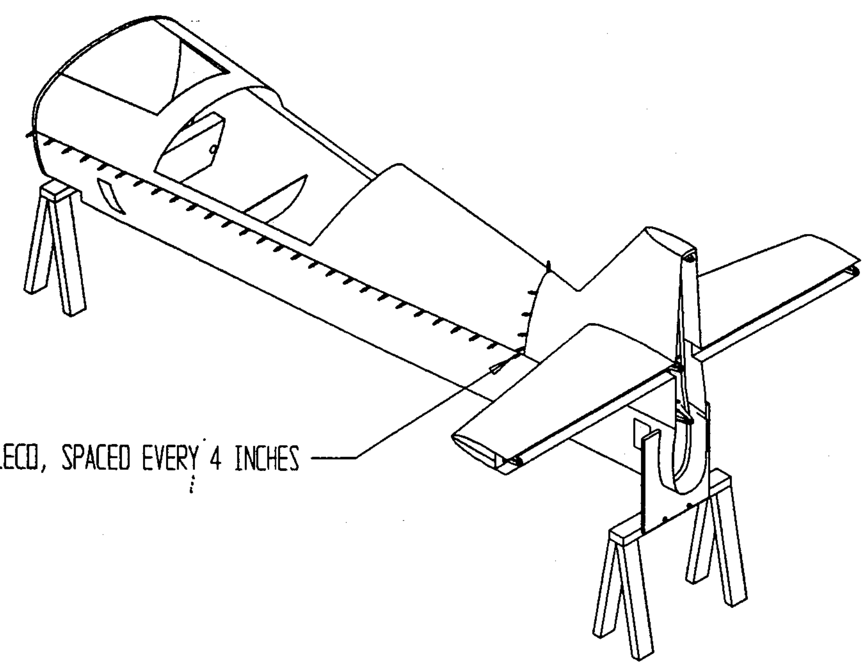
Mount the top fuselage on the lower fuselage. Check the alignment of the cleco holes drilled earlier. These cleco holes may or may not line up with the stab leveled. If they line up correctly, install clecos in these holes.. Drill more cleco holes every four inches through the flanges of the top and bottom fuselage and into the fin skin flanges. Remove the top fuselage when done. Mark any holes that do not line up correctly so that you can identify them later.

> NOTE:
> Once the top fuselage is bonded on, you will no longer be able to adjust the stabilizer alignment in roll. Be absolutely certain that your stab is properly aligned before proceeding.

Step C Mount The Top Fuselage

Prepare the flanges of the top and bottom fuselage, forward flange on the fin skin, firewall flange, and the flange on the rear seat bulkhead for bonding. Prepare a mixture of structural adhesive and add enough structural filler to achieve "mayonnaise" consistency. Recruit at least two people to help you mix and apply the adhesive to all bond surfaces. Now, with one person on either side of the fuselage, spread the top fuselage slightly and lower it very carefully onto the bottom fuselage. Try not to smear the adhesive. Have your two helpers hold the fuselage in position while you proceed to install clecos in the cleco





MOUNT THE TOP FUSELAGE

DRAWING NO. 20089A	TASK NO.	STEP NO.	AkroTech
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holes. Use spring clamps to secure the top fuselage to the firewall flange. Remove all excess adhesive with a clean rag and allow to cure completely.

TASK F-34 Install The Main Landing Gear

Step A Turn The Fuselage Over

Find a friend to help you turn the fuselage over. Rest the top of the fin on a thick pad and the forward section of the fuse on a sawhorse. Check the setup for stability by rocking the fuse back and forth by hand.

Step B Locate The Center Of The Landing Gear Step

Find the center of the landing gear step by placing a framing square on the step so that it hangs down over the side of the fuse. Mark a line on the step 15 inches inboard from the side of the fuse. Now flip the square over and place another mark 15 inches inboard from the opposite side of the fuse. Find the center between these two marks. This is the center of the landing gear step.

Step C Align The Gear On The Landing Gear Step

Place the landing gear on the landing gear step. Align the gear so that the hole in the center of the gear is lined up with the centerline on the gear step. Place the landing gear saddle blocks over the gear and adjust the gear fore or aft until the saddle blocks are centered inside the gear step. Using the small pre-drilled hole in the center of the gear as a pilot, drill a 1/4 inch hole though the gear and into the landing gear step (be careful not to disturb the gear alignment). Place a 1/4 inch bolt in the hole but do not secure it with a nut yet. Now measure from the tip of each gear leg to the center of the fuse at the rudder post. These two measurements should be equal. If they are not equal, adjust the gear by rotating it until they are.

Step D Drill Holes Though The Landing Gear Step

Locate the gear saddle blocks in their correct buttline position on the gear. Hold each block firmly in place while using a 5/16 inch drill to drill through the holes in the saddle blocks and into the landing gear step.

Step E Install The Bolts And Backing Plates

Reach under the fuselage and install the backing plates and bolts through the step and the gear saddles. Install nuts on the bolts and tighten.

Step F Bed The Backing Plates With Structural Adhesive

Wrap some cardboard around the end of the landing gear legs to protect them. Turn the fuselage over and rest it on the gear at the front and a sawhorse at the rear. Remove one of the backing plates on the gear and prepare the top mating surface of the landing gear step for bonding. Place some clear tape on the backing plate so that one side is completely protected. Use an X-acto knife to trim the tape from the bolt holes. Wax the bolts and reassemble the backing plate to the landing gear step with the waxed bolts. Now repeat this procedure for the other backing plate but do not reassemble the plate to the gear step.

Prepare a batch of structural adhesive and thicken it to "mayo" consistency with structural filler. Spread some of this mixture on the backing plate which is loose. Try to stay away from the bolt holes when applying the adhesive. Carefully assemble this backing plate to the landing gear step using the waxed bolts. Now remove the opposite backing plate (which has been previously prepared) from the step and spread some adhesive on it. Assemble this backing plate to the step with the waxed bolts. Tighten all bolts and remove any excess resin with a clean rag.

Step G Drill Holes In The Landing Gear For The Axles

Turn the fuselage over once more so that it is upside down. Carefully align the axles on the tips of the gear legs and clamp them in place. Use the holes in the axles as a drill guide to drill the 1/4 inch mounting holes though the landing gear. Note that you will need to use a long drill bit to drill these holes. Long drill bits can be found at most hardware stores. Remove the axles when done.

NOTE:
The G-200 landing gear installation will require several additional reinforcements. Please refer to service bulletin #4 for a detailed explanation of these reinforcements and how they should be installed. If you did not receive this service bulletin, please contact AkroTech immediately.

TASK F-35 Assemble The Wheels And Brakes

Step A Mount The Axles And Related Components To The Gear Legs

Find the wheel pant mounting plates, brake caliper brackets and axle mounting hardware supplied with your kit. Assemble these components to the landing gear using the supplied mounting bolts. Note that the brake caliper plates can be mounted in a variety of positions. Be certain that you have this plate oriented correctly.

Step B Assemble The Tires And Tubes To The Wheel Hubs

Find the supplied tubes and tires. Fill the tubes with just enough air to hold their shape. Sprinkle some talcum powder over the tubes and insert them into the tires. Insert the valve stem of the tube into the valve stem hole in the wheel hub. Assemble the other half of the wheel hub to the tube/tire/hub assembly being careful not to pinch the tube in the process. Hold the brake rotor against the hub assembly (on the side opposite of the valve stem) and install the three bolts through both the brake rotor and the hub assembly. Install and tighten the three nyloc nuts and washers on the bolts.

Step C Mount The Wheels On The Axles

Mount the completed wheel assemblies on the axles using the appropriate washers on either side. Install the retaining nuts and cotter pins on the axles.

Step D Assemble The Brake Calipers To The Brake Caliper Brackets

Find the brake calipers included with your kit. Note that the caliper arms separate so that you can install it over the brake rotor with out removing the wheel. Separate the caliper arms by removing the two bolts which hold them together. Slide the pins on the brake calipers into the holes in the brake caliper brackets. Replace the caliper arm on the caliper assembly.

TASK F-36 Install The Seat

Brief Task Description:

The G-200 seat consists of a curved carbon fiber panel which must be trimmed to fit inside the fuselage. After trimming, A fiberglass flange is then built on the rear spar carry-through. The seat is then bonded to this flange and fiberglassed around its entire perimeter to secure it to the sides of the fuselage.

Step A Trim The Seat

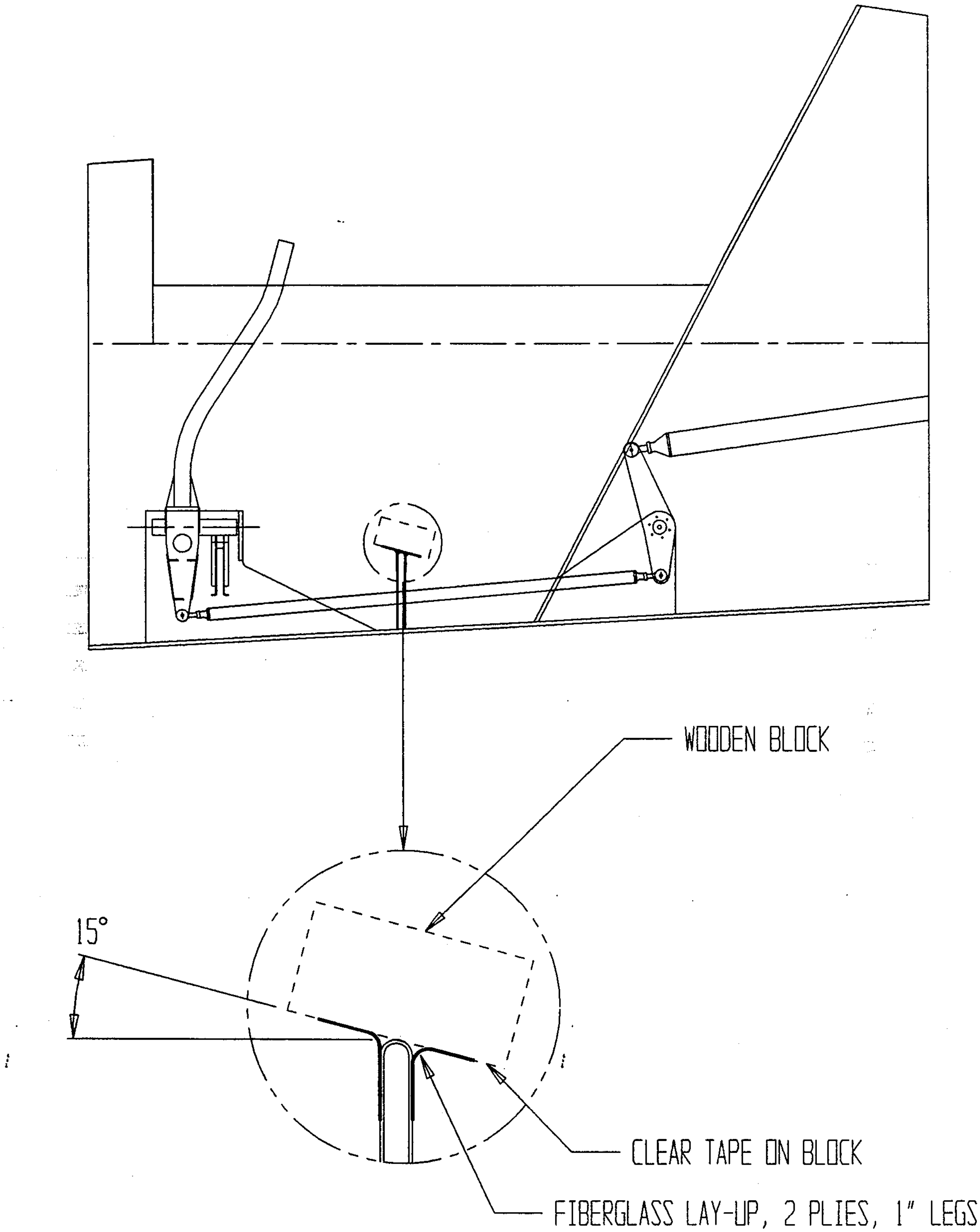
Find the template for the seat. Note that the seat template is printed half size as it will not fit on the paper full size. Draw a line down the center of the seat for aligning the template. Cut out the template and place it on the seat so the centerline of the template lines up with the centerline on the seat. Trace the outline of the template on the seat. Now flip the template over and trace the outline of the template once more on the opposite side of the seat. Use a jigsaw to cut out the seat along the trim line. Temporarily install the seat in the fuselage to check for proper fit. With the bottom of the seat resting on the rear spar carry through and the back of the seat resting against the aft bulkhead, the sides of the seat should fit tight against the inside of the fuselage. Continue to trim the seat as necessary to achieve a good fit.

Step B Build A Flange On The Rear Spar Carry Through

Prepare the top one inch of the fore and aft faces of the rear spar carry through for bonding. Thoroughly sand the surface and clean with acetone.

Find a piece of scrap wood long enough to span between the rear spar plates and about 3 inches wide. Place some clear tape over one side of the scrap wood to act as a mold release. Center the wood over the rear spar carry through (with the clear tape facing down) and use hot glue to tack it to the rear spar plates.

Cut some eight fiberglass strips on the bias 2.5 inches wide and long enough to span the distance between the rear spar plates. Prepare some laminating resin and laminate four strips into the forward junction of the rear spar carry through and the clear taped wood block. The fiberglass should extend onto both surfaces equally. Now laminate the



LAY-UP FIBERGLASS FLANGES OR REAR SPAR CARRY THROUGH

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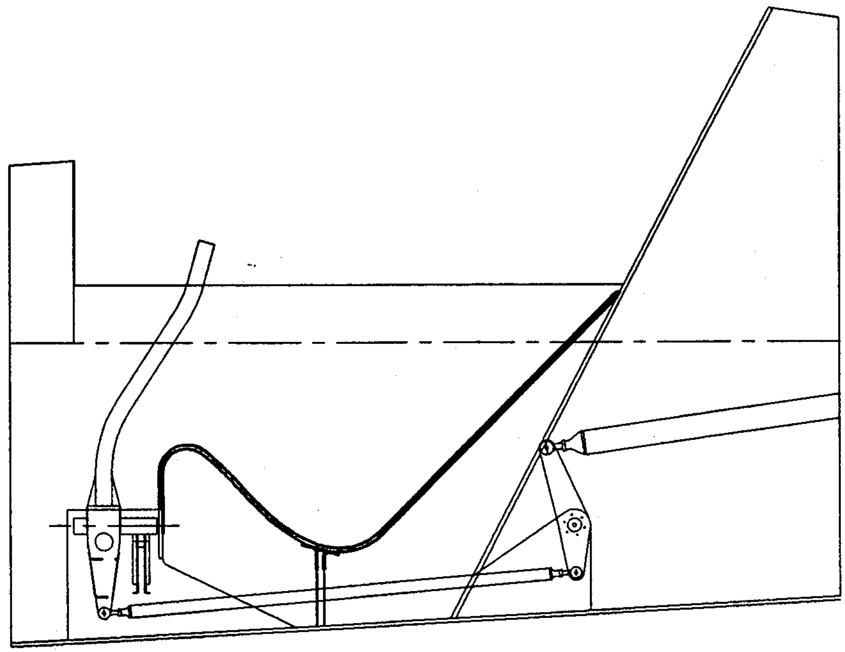
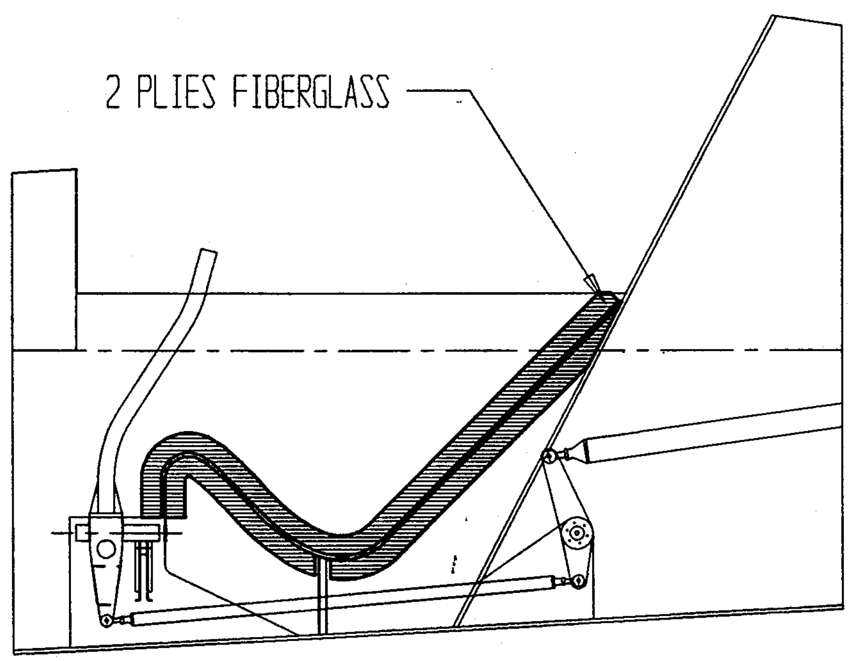


BOND SEAT TO CONTROL BOX AND FIBERGLASS FLANGES



SECURE SEAT TO FUSELAGE SIDES WITH FIBERGLASS

SEAT INSTALLATION

DRAWING NO. 200114A	TASK NO.	STEP NO.	AkroTech
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remaining four plies onto the aft junction. Allow the lay-up to cure then remove the wood block from the top of the rear spar carry through. You should now have two fiberglass flanges bonded to the rear spar carry through; one facing forward and one facing aft.

Step C Prepare All Bond Areas On The Seat And Fuselage For Bonding

Place the seat in position in the fuselage. Trace the outline of the seat onto the inside of the fuse using a felt tip pen. Also, reach under the seat and trace the outline of the fiberglass flanges on the seat. Remove the seat and prepare the inside of the fuse for bonding along the seat outline.. Prepare the outboard edges of the seat where it intersects the fuselage sides in a similar manner. Also prepare the fiberglass flanges on the rear spar carry through and the mating area on the bottom of the seat for bonding. Finally, prepare the forward flange of the seat and the mating area on the control box for bonding.

Step D Bond The Seat To The Rear Spar Carry-Through And Control Box

Mix a batch of structural adhesive and thicken it to "mayo" consistency with structural filler. Apply the adhesive mixture to the top of the fiberglass flanges on the rear spar carry through and the forward flange on the seat where it bonds to the aft face of the control box. Carefully lower the seat into position against both the control box and the fiberglass flanges on the rear spar carry through. Place some weight on the seat to hold it firmly against the fiberglass flanges and use spring clamps to secure the seat to the control box. Remove any excess adhesive with a clean rag then allow the adhesive to cure completely.

Step E Fiberglass The Seat To The Fuselage Sides

Prepare eight strips of fiberglass 3.0 inches wide and long enough to extend the entire length of the junction between the seat and the side of the fuselage. Four of these strips will be used to join the top of the seat to the fuselage sides and the remaining four strips will be used to join the bottom of the seat to the fuselage sides. Cut the four strips which will go on the bottom of the seat where they intersect the rear spar plates.

Prepare some laminating resin and pour about half of the mixed resin into a separate cup. Thicken one cup of mixed laminating resin with microballoons until it assumes "peanut butter" consistency. Use this mixture create a smooth radius in the junction between the seat and the side of the fuse. Now use the unthickened resin to laminate the fiberglass strips two plies at a time on some plastic sheet on your work table. When done, you should have six, two ply strips on your work table - two strips for the top of the seat and four for the bottom. Trim the strips using scissors so that the edges are straight. Carefully press the strips into their appropriate position in the fuse - seat junction, removing the plastic sheet from the fiberglass as you go.

TASK F-37 Install The Access Panel In The Seat

Step A Make And Install The Fiberglass Flange For The Access Panel

Mark the outline for the access panel on the top surface of the seat. Place some clear tape on the seat extending at least 2 inches over the outline for the access panel. Cut out sixteen strips of fiberglass about 2 inches wide by 12 inches long. Cut these strips on the bias (fibers run at 45 degrees to the edges of the strips). Mix some laminating resin and wet out the strips on the clear taped seat surface. Center four strips over each line marked on the seat. Overlap the strips where they meet at the corners of the access panel outline. Allow the lay-up to cure completely.

After the fiber glass flange has cured, mark the outline of the access panel on it then remove it from the seat. Trace a line on the flange .75 inches <u>outside</u> of the access panel line. Trace another line .5 inches <u>inside</u> of the access panel line. Give the corners of the flange a generous radius. Trim the flange along these lines.

Step B Install The Access Panel Flange On The Seat Back

Cut out the access panel from the back of the seat using a hand held jigsaw. Smooth the edges of the panel cut out with a sanding block. Prepare the access panel flange and the mating area surrounding the panel cut-out in the seat for bonding. Mix some structural adhesive and add enough filler to achieve "mayo" consistency. Apply this mixture to the fiberglass flange and bond it to the rear surface of the seat. to the rear surface of the seat.

Step C Fill The Edges Of The Access Panel

Remove the core material from the entire perimeter of the access panel to a depth of .25 inch. At the mounting screw locations remove the core material to a depth of about .75 inches. Mix up some laminating resin and add microballoons until it assumes the consistency of peanut butter. Use this mixture to fill in the area where the core material was removed. Allow the filler to cure then sand the edges of the access panel smooth.

Step D Fill The Edges Of The Access Panel Cut-Out In The Seat

Remove the core material to a depth of about 1/4 inch surrounding around the perimeter on the access panel cut out in the seat. Place duct tape around the perimeter of the access panel so it is smooth on the back side and edges of the access panel. Mix another small batch of "micro" (laminating resin and microballoons). Use this mixture to fill the area where the core material was removed from the seat. Allow some excess filler to remain in the area surrounding the cut out for the access panel. Now press the access panel (with the duct tape on it) into the cut out and against the flange, squeezing out the excess filler. Fill the slot between the edges of the access panel and the cut out completely with filler. Allow the filler to cure then gently pop the access panel from the seat. The tape should have prevented the panel from adhering to the cut out flange leaving a perfect gap the same thickness as the tape.

Step E Install Nutplates In The Access Panel Flange

With the access panel taped in place on the seat, use a no. 19 drill bit to drill the eight mounting holes for the access panel through the access panel and the panel flange. Countersink the holes in the access panel for the 8-32 flat head screws. Install the 8-32 fixed nutplates in the access panel flange.

TASK F-38 Install The Cockpit Side Consoles

Brief Task Description:

The cockpit side consoles provide a convenient mounting location for the engine and propeller controls, tailwheel lock handle, hand-held radio, and whatever other miscellaneous items you find do not fit on your instrument panel. The side consoles are shipped as two premolded sheets with a 90 degree bend. You will first have to trim these premolded panels to fit your seat and fuselage. Then you will install tabs in the fuselage for mounting the consoles. Lastly you will install whatever instrumentation, handles, etc. you want installed in or on the consoles.

> NOTE:
> It should be noted that the side panels are not structural members and thus do not have to be installed. If you are a larger person you may wish to leave them out to increase cockpit space.

Step A Trim The Side Panels

Fine the template in the back of this manual for the cockpit side consoles. Cut out this template and trace its outline on the two premolded side console panels. Trim the side consoles along the traced outline using a hand held jigsaw. Temporarily install the side panels in the fuselage and check for proper fit. The seat may have flexed during installation, necessitating further trimming of the side consoles to get them to fit correctly.

It is a good idea at this point to actually sit in the cockpit to check fit of the side consoles. While doing this you should also consider the type of engine and propeller controls you will be using and where they will be placed. Be certain to use your chute when checking for proper fit as this will change your position noticeably. If you don't have a chute, a 2 inch spacer placed behind the back will work fine. Continue to trim the side consoles as necessary to get a comfortable fit.

Step B Make Mounting Tabs For The Consoles

Find some scrap pieces of wood about two feet long and join them so that they form a 90 degree angle. Place some clear tape into the junction of the two pieces of wood so that it extends about three inches from the joint onto both surfaces. Cut out six plies of glass 18 inches long by 4 inches wide on the bias. Mix some laminating resin and laminate the six plies into the clear taped junction of the clear taped wood. Allow the lay-up to cure then remove it from the wood. Cut the cured fiberglass angle into twelve pieces, each 1.25 inches long. These tabs will be used to mount the consoles to the fuselage and seat.

Step B Install The Mounting Tabs For The Side Consoles

Prepare the outside surface of the mounting tabs for bonding. Use a small dab of hot glue to mount each of the twelve tabs to the consoles at the appropriate locations. Orient each tab so that one surface of the tab will sit flat against the mating surface in the fuselage. Once all the tabs have been tacked in place, trial fit the consoles in the fuselage once more. Remove any tabs that do not fit correctly and reinstall them with hot glue. Mark the location of the tabs on the outside of the consoles so that you can drill the mounting holes later. Prepare the area on the inside of the fuse and the seat at the tab locations for bonding. Mix up enough structural adhesive to bond the tabs in place. Thicken the adhesive with structural filler then apply the adhesive to each tab on both consoles. Carefully press each console into position against the seat top and fuselage side. Allow the adhesive to cure undisturbed.

Step C Install Nutplates In The Mounting Tabs

Use the marks made earlier as a reference to drill no 19 mounting holes through both the consoles and the tabs. After all holes have been drilled, gently pry the consoles loose from the tabs. If you did not use too much hot glue, the consoles should release relatively easily. Remove any remaining hot glue residue with a putty knife. Refer to the General Information Section of this manual to install the 8-32 fixed nutplates in the tabs using the drilled holes as a reference.

Step D Fill The Holes And Edges Of The Consoles With Filler

Drill out each of the mounting holes <u>on the outside skin only</u> to 5/16 inch. Remove the core material to about a 3/16 inch from the center of each hole using your Dremel tool with a small grinding bit. Place some tape over the no 19 holes on the inside skin surface.

Now remove the core material to a depth of about .25 inch along the entire perimeter of the consoles.

Mix some laminating resin and thicken with microballoons until it assumes the consistency of peanut butter. Using a tongue depressor, force this mixture into all areas where the core material was removed. The tape placed over the holes on the inside skin of the consoles should allow you to pack filler into the holes without it exiting the other side. Allow the "micro" to cure completely.

Step E Re-Drill And Countersink The Mounting Holes

Remove the tape covering the mounting holes on the inside skin of the consoles. Re-drill the mounting holes with a 11/64 inch drill bit using the no. 19 holes as a pilot. Countersink these holes on the outside of the consoles for the 8-32 flat head stainless mounting screws.

TASK F-39 Install The Canopy Frame Side Reinforcements

Step A Trim The Canopy Frame

Use the cut off wheel attachment on your Dremel tool to trim the canopy frame close to the scribe line. Make the first cut about 1/8 inch outside of the scribe line then trial fit the frame on the fuse. Continue to trim the frame down until a fairly close fit between the canopy frame and the fuselage is realized.

Step B Make Hinge Spacers And Secure Them To The Top Fuselage

Locate some scrap material the same thickness as the canopy frame hinge when folded over. Cut this material into two pieces each having the same dimensions as the canopy hinges. Position these spacers on the top fuselage canopy rails so that they are 4.5 inches from the forward and aft edges of the canopy frame opening. Use some clear tape to secure the spacers to the canopy rail. Place more clear tape over the entire top fuselage canopy rail on both sides to act as a mold release.

Step C Mount The Canopy Frame To The Fuselage

Cut two notches in the canopy frame to clear the hinges at the location of the fuselage mounted spacers. Prepare the lower two inches of the inside surface of the canopy frame for bonding. Mount the canopy frame to the fuselage and position it so that it sits flush with the fuselage skin around its entire perimeter. To facilitate this, you can install scrap wood spacers in the fore and aft joggles in the top fuselage. Mount these spacers with hot glue so they can be removed later.

Step D Install The Fiberglass Side Reinforcements

Cut ten strips of fiber glass 3 inches wide and long enough to extend the full length of the canopy frame and . Cut another ten strips of fiberglass 3 inches wide and 10 inches long to reinforce the canopy hinge areas. Cut all of the strips on the bias (fibers running at 45 degrees to the edge). Mix up some laminating resin and laminate two fiberglass pads each five plies thick from the long strips. Laminate two more fiberglass pads from the short strips of fiberglass each five plies thick. Trim the edges of all of the strips with scissors so that they are straight. Paint some resin into the junction of the canopy frame and the top fuselage canopy rail on both sides of the fuse. Install the long fiberglass pads into this junction. Inspect the laminate carefully for trapped air then install the short pads over the two hinge spacers on the right side of the fuselage. Allow the laminates to cure completely then remove the canopy frame from the fuselage.

TASK F-40 Install The Canopy Latch

Brief Task Description:

The G-200 uses the same latch as does the Glasair. The directions for assembling and installing the latch can be found in the back of this manual. Please refer to these directions for installing the latch in your canopy frame.

TASK F-41 Install The Canopy Glass In The Canopy Frame

Step A Construct The External Canopy Support Frame

Trace the outline of the of the front and rear edges of the canopy frame on some .5 inch particle board or plywood. Cut out these formers out and set them aside. Mount the canopy frame on the fuselage and check for proper fit. It should fit flush around the entire perimeter of the canopy. Flex the canopy frame to fit the fuselage where necessary. Set the wooden formers on the fore and aft edges of the canopy frame and use automotive body filler to bond them to the frame. Cut out two more pieces of wood approximately eight inches wide and long enough to span the distance between the formers. Use Bondo to bond these longerons to both the canopy frame and the formers. Check to make certain the entire support frame is dimensionally stable and will not flex out of alignment once it is removed from the fuselage.

Step B Install The Canopy Glass

NOTE:
The canopy comes with a special protective coating. Remove only enough of this coating to bond the canopy to the canopy frame. The remainder of this coating should be left on until the aircraft is ready to fly.

Remove the canopy frame (with wooden support structure attached) from the fuselage and place it upside down on your work table. Place the canopy glass into the canopy frame and mark the glass where it intersects the frame with a felt tip marker. Trim the canopy glass back to about one inch from this mark using a cut off wheel or a jigsaw with a very fine metal cutting blade. Remove the protective coating on both sides of the glass extending from the edge to the mark on the glass. Sand this area thoroughly with 80 grit sandpaper on both sides of the glass. Sand the area surrounding the opening on the inside of the canopy frame with 80 grit sandpaper. Clean all surfaces with acetone. Prepare a mixture of structural adhesive and mix in enough structural filler to achieve "mayo" consistency. . Coat all mating surfaces with a thick layer of the adhesive. Place the canopy glass into the canopy frame and force out all any excess Hysol. You should still have a large gap at the front junction of the canopy frame and the canopy glass. Add some microballoons to the remaining structural adhesive mixture until it assumes the consistency of peanut butter and fill the gap with this mixture.

Step C Fiberglass The Canopy Glass In Place

Sand the area filled by the adhesive mixture until it is smooth. Sand the area surrounding the this area on the canopy frame. Clean all bond areas with acetone. Prepare four fiberglass strips long enough to extend from the rear corner of the canopy glass around to the front centerline of the canopy glass. Make these strips a little wider than what is necessary to extend onto the canopy glass one inch, over the fill area, and onto the canopy frame one inch.. Prepare two 48 inch fiberglass strips to fit along the rear junction of the canopy frame and the glass. Lay these fiberglass strips onto a plastic sheet and wet them out in pairs with laminating resin. You should now have a total of three strips on your work table, each two plies thick. Cover these strips with another layer of plastic. Cut out each strip from this plastic sandwich with scissors so that the edges are straight. Remove the plastic from one side of each fiberglass strip and lay it into its appropriate position. When laying the strips into position, make sure the edge that overlaps the canopy glass is straight. Once each strip is properly positioned, carefully remove the remaining plastic sheet. Remove all air bubbles with a brush and allow the lay-up to cure completely.

Step D- Install The Rear Internal Canopy Frame Bulkhead.

Prepare the premolded canopy frame bulkhead for bonding. Mix some structural adhesive with enough structural filler to achieve "mayonnaise" consistency. Coat the bond areas with the adhesive and install the bulkhead so that the edge of its flange is lined up with the rear edge of the canopy frame. Do not use clamps to secure the bulkhead to the canopy frame as the clamping pressure could distort the frame. Allow the adhesive to cure completely then remove the wood external support frame from the canopy frame. Clean off the excess bondo with a putty knife.

TASK F-42 Install The Cabin Air Vent And Drill Drain Holes

Brief Task Description:

In this task you install the premolded ducts and eyeball air vents in the side of the fuselage. These vents are invaluable for keeping temperatures tolerable inside the cockpit during the summer months. Also you will drill holes in the bottom of the fuse to allow any water that may leak inside to escape.

NOTE: The position of these ducts has been carefully selected so as not to interfere with certain internal structural lay-ups in the fuselage. If you choose to move them to a different location, please contact us at AkroTech first.

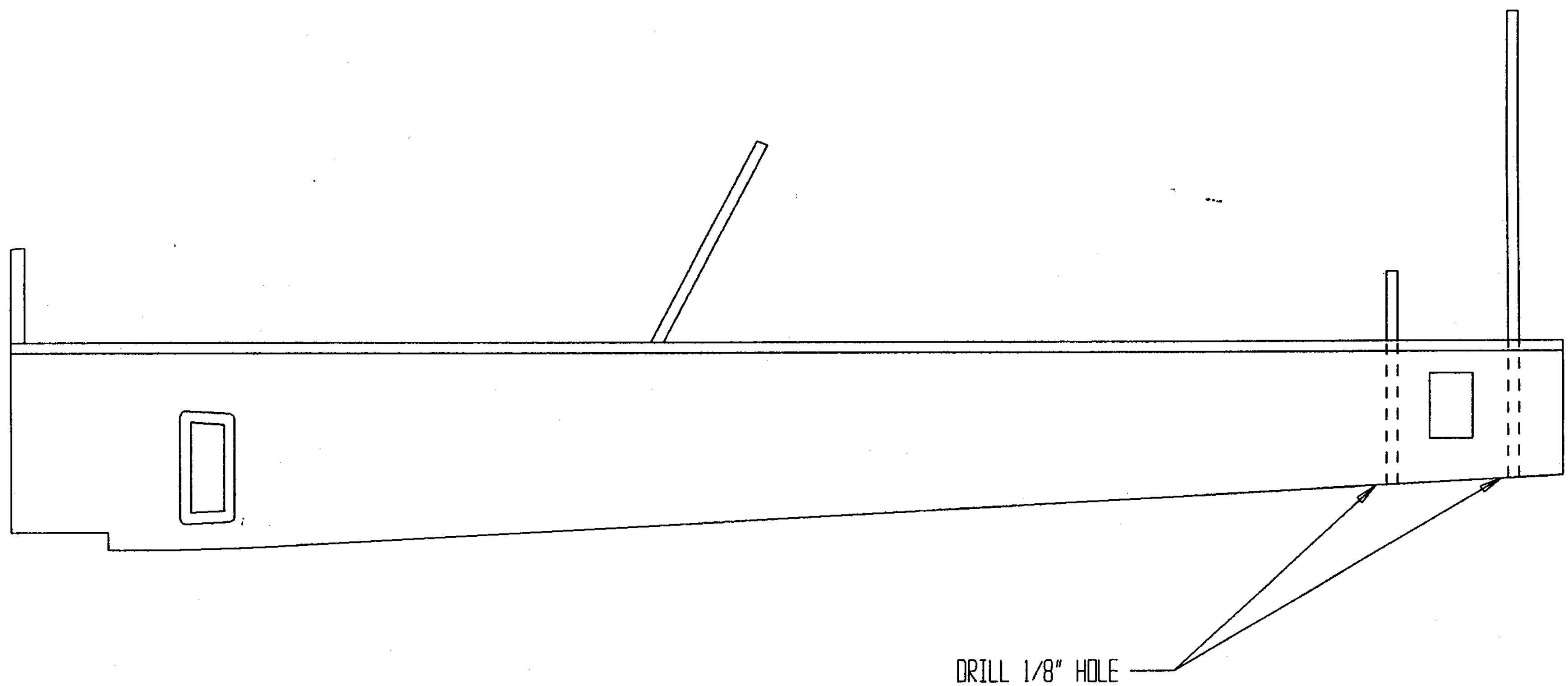
Step A Make A Cutout In Canopy Frame For The NACA Vent

Remove the NACA duct template from this manual and use spray adhesive to bond it to the canopy frame at the appropriate location. Use a 1/4 inch drill bit to drill holes in the sharp corners of the duct as indicated on the template. Use a hand held jigsaw to cut out each duct, connecting the holes drilled earlier. Finish the edges and corners of the duct cut-outs using a file. Remove the template when done and use acetone to clean up any remaining adhesive residue.

Step B Install Nutplates In The Premolded NACA Duct

Use the holes in the supplied eyeball vent as a template to drill four holes in each premolded duct for the 8-32 eyeball vent mounting screws. Install four 8-32 corner nutplates in the duct (refer to the General Information Section of this manual for instructions).

Step C Install The NACA Duct



DRAIN HOLE LOCATIONS

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Prepare the flanges of the duct and the inside of the canopy frame for bonding. Position each duct in its appropriate location on the inside of the canopy frame and drill four holes for clecos through the flange of each duct and into the canopy frame. Mix a small batch of structural adhesive and thicken to mayonnaise consistency using structural filler. Coat the flanges of the ducts and the canopy frame with the mixture. Now mount the premolded ducts with clecos and remove all excess resin with a clean rag.

Step D Drill Drain Holes In The Fuselage

Drill 1/8 inch drain holes through the bottom of the lower banjo bulkhead and the rudder post. Expand these holes out to ¼ inch on the inside skin of the fuselage only. Place some tape over the holes on the outside skin. Remove the core material from the area surrounding the holes (work from the inside of the fuse).. Mix some laminating resin and thicken with microballoons. Use this mixture to fill the area where the core material was removed. Allow the filler to cure then remove the tape and re-drill the 1/8 inch holes.

TASK F-43 Install The Instrument Panel Bulkhead

Step A Install The Fuel Tank In The Fuselage

Install the fuel tank in the fuselage. Secure it to the pre-molded recess using the supplied 8-32 screws.

Step B Trial Fit The Panel Bulkhead

Trial fit the instrument panel bulkhead in position under the fuselage top. Drill five equally spaced cleco holes through the flange on the bulkhead and into the inside skin on the fuselage top. Remove the bulkhead when done.

Step C Prepare The Panel Bulkhead And The Fuselage For Bonding

Prepare the area just under the aft edge of the top fuselage and the entire flange on the instrument panel bulkhead for bonding. thoroughly sand these areas with 80 grit sand paper and clean with acetone.

Step D Install The Bulkhead

Prepare a small batch of structural adhesive and mix in structural filler to thicken it to “mayo” consistency. Spread this mixture on both the bulkhead flange and the bond area on the fuselage. Press the bulkhead into position and install clecos into the cleco holes. Remove any excess adhesive and allow to cure.

TASK F-44 Install The Rear Spar Carry-Through Reinforcements

Step A Trim The Reinforcements

Find the four pre-molded fiberglass rear spar carry-through reinforcements supplied with your kit. Use a jigsaw or bandsaw to trim these reinforcements to the dimensions shown in the illustrations. Smooth the edges of the reinforcements with sandpaper.

Step B Drill Holes In The Reinforcements

Hold each of the two forward reinforcements in position against the front side of the forward rear spar plate then drill two cleco holes through each reinforcement flange and into the side of the fuselage. Install clecos in the cleco holes then clamp the face of the reinforcements to the forward rear spar plate. Now use a 7/16 inch drill to drill through the forward reinforcements using the holes in the rear spar plates as a drill guide. Mark the reinforcements so that you can identify them later. Remove the forward reinforcements when done. Repeat this procedure for the aft reinforcements.

> NOTE:
> Each of the four reinforcements is shaped to fit in one position only. Be certain the correct reinforcement is in the correct position before drilling any holes

Step C Bond The Reinforcements To The Fuselage

Prepare the flanges on the reinforcements and the mating area on the fuselage for bonding. Mix up a small batch of structural adhesive and thicken it to "mayo" consistency using structural filler. Apply this mixture to the reinforcement flanges and the sides of the fuselage. Press each flange in position on the fuselage and install clecos into the previously drilled cleco holes. Install the rear spar bolts through the reinforcements and the rear spar plates. Place washers and nuts on these bolts and tighten them <u>hand tight</u>. Remove any excess resin with a clean rag.

TASK F-45 Install The Aileron Belcrank Brackets And Belcranks

Step A Cut Slots In The Fuselage To Clear The Belcranks And Control Tubes

Find the templates for the aileron belcrank cut-out in the back of this manual. Use spray adhesive to mount this template to the side of the fuselage at the appropriate location. Drill 1/4 inch holes into the corners of the cut-out then use a jigsaw to cut between the holes. Finish the cut-out using a small grinding tool (the drum sander attachment on the Dremel tool will work well for this). Remove the template when done and clean the surface with acetone.

Step B Reinforce The Edges Of The Slots

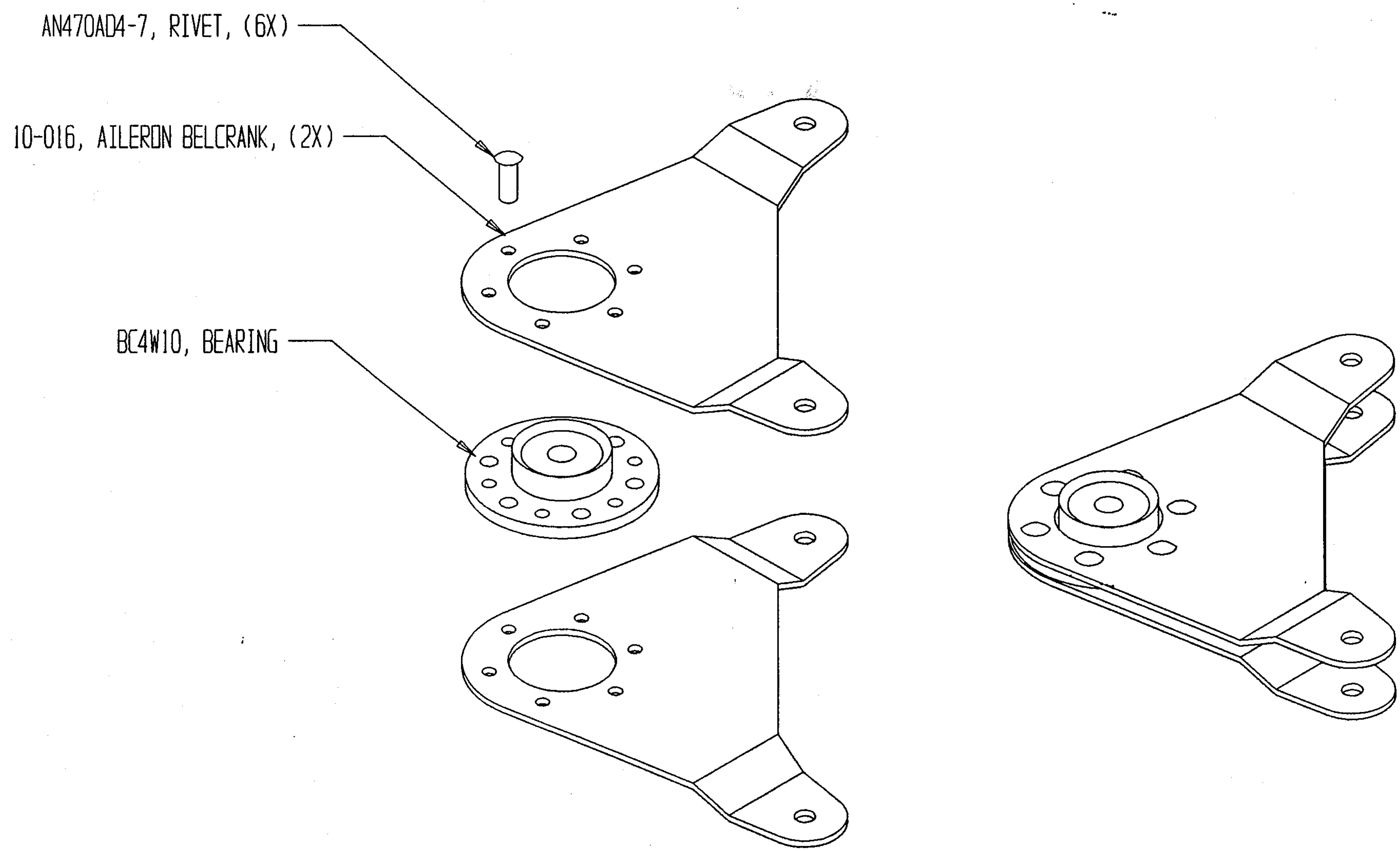
Remove the core material to a depth of about 1/4 inch from around the edges of the slots cut in step A. You can use a Dremel tool with a small grinding bit to accomplish this. Try to remove all of the core material from the internal surfaces of the skin. Now mix up some structural adhesive and thicken it to "peanut butter" consistency with structural filler. Use this mixture to fill in the area where the core material was removed.

Step C Trial Fit The Belcrank Brackets

Find the four triangular-shaped carbon fiber belcrank brackets supplied with your kit. Note that there are two upper brackets and two lower brackets. Align one of the lower brackets with the bottom edge of the slot cut in the left side of the fuselage. Drill two cleco holes through the flange on the bracket and into the fuselage. Install clecos in these holes to hold the bracket in place. Repeat this procedure for the right bracket. Trial fit the upper brackets by placing a 3/4 inch spacer (a small 3/4 inch thick piece of wood will work). on top of the lower brackets, then rest the upper brackets on this spacer. Press each upper bracket against the side of the fuselage and check to make sure the edge of the bracket matches up with the top edge of the slot. Also check to make sure the flanges of both brackets will sit relatively flat against the fuselage.

Step D Bond The Brackets To The Fuselage

Prepare the flanges on the brackets and the mating area on the fuselage for bonding. Mix up a small batch of structural adhesive and thicken it to "mayo" consistency with



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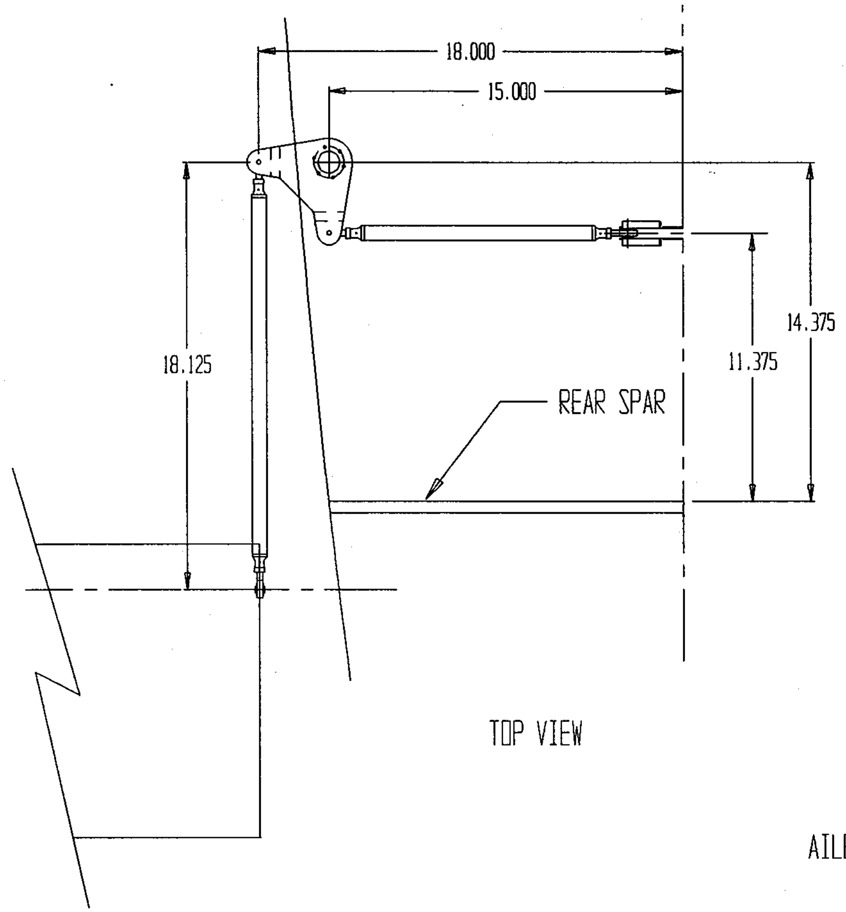
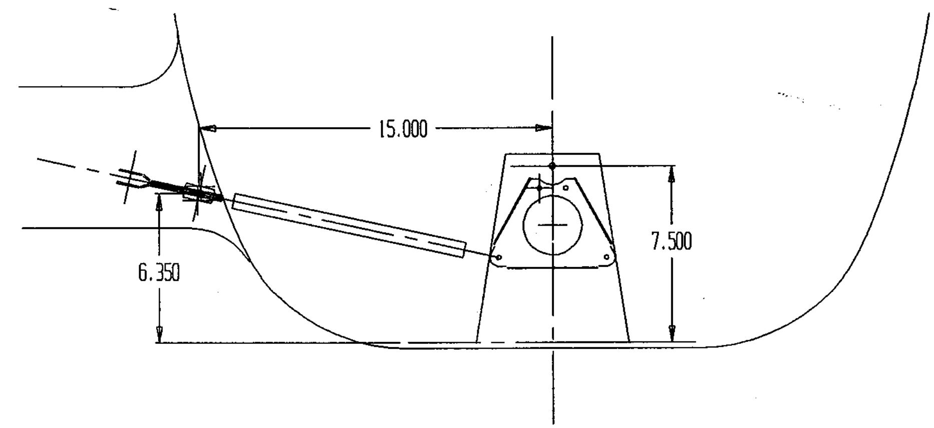


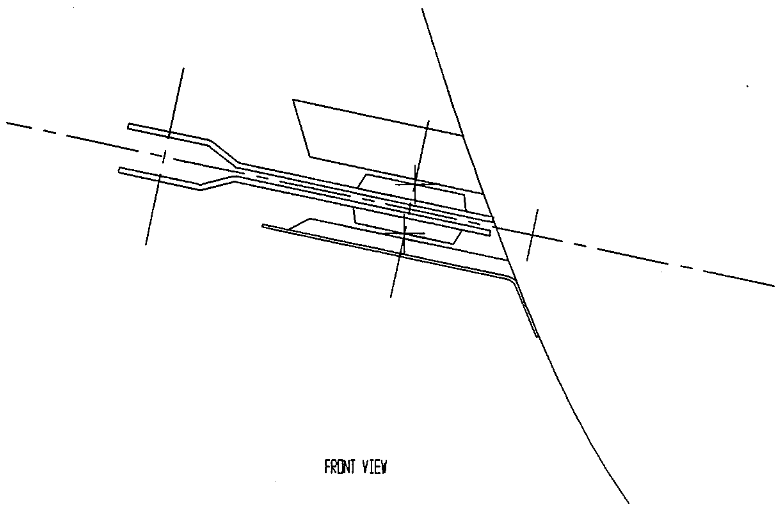
TOP VIEW



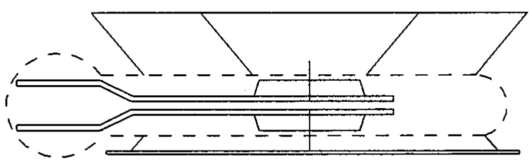
FRONT VIEW

AILERON BELCRANK POSITION

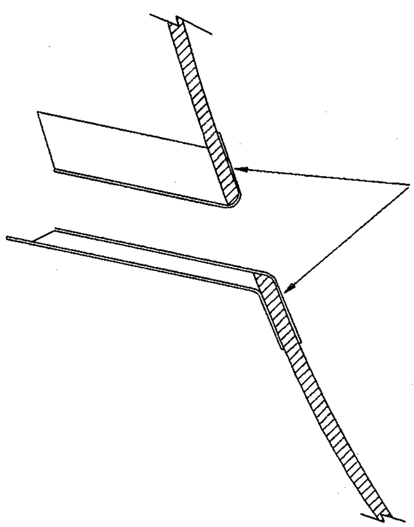
BELCRANK BRACKET DETAIL



FRONT VIEW



SIDE VIEW



structural filler. Coat the flanges of the lower brackets with this adhesive and press them in place on the fuselage. Install clecos in the holes drilled previously to hold the lower brackets in position. Now place the 3/4 inch spacers on top of the lower brackets. Spread adhesive on the flanges of the upper brackets. Place the upper brackets on top of the spacer block and slide them against the fuselage. With the top brackets tight against the fuse, clamp them to the lower brackets (with the spacer block in between). Now wrap some masking tape around the clamp and stretch the tape up and over the canopy rail to prevent the upper bracket from pulling away from the fuse. Allow the adhesive to cure undisturbed.

Step E Lay Up The Internal Fiberglass Reinforcement

In this step you will reinforce the inside corners of the brackets with fiberglass. Cut 12 fiberglass rectangles large enough to cover the inside surface of each bracket and extend through the cut-out and onto the inside fuselage skin at least 1.5 inches. Cut the fiberglass so the fibers run at 45 degrees to the edge. Prepare the inside surface of each bracket for bonding. Also prepare the inside fuselage skin for bonding 1.5 inches above and below the cut-out. Round the inside edge of the cut-out to allow the fiberglass to wrap smoothly around this corner. Now prepare some laminating resin and wet out the twelve fiberglass rectangles, three layers at a time, on some plastic sheet on your work bench. Place another layer of plastic over the four fiberglass pads. Cut out the pads with scissors to clean up the edges. Now remove one layer of plastic from the pads and place them in position on the inside surfaces of the brackets. The fiberglass should extend through the slot and onto the inside skin about 1.5 inches. Remove the final layer of plastic from each pad after it is properly positioned. Check the lay-up for any air or excess resin then let them cure completely.

Step F Drill Belcrank Mounting Holes In The Belcrank Brackets

Mark the belcrank mounting hole location on the bottom of the lower blearing brackets. Retrieve one of the blocks used earlier to properly space the belcrank brackets. Use a drill press to drill a 1/4 inch hole through this block that is exactly perpendicular to the face of the block. Now position this block on the bottom surface of the lower left belcrank bracket so the hole in the block is aligned with the hole mark on the bracket. Clamp the block to the bracket then use a 1/4 inch drill to drill through both brackets using the hole in the block as a drill guide. Now repeat this process to drill the hole in the right belcrank brackets.

Step G Assemble The Aileron Belcranks

Locate the belcrank arms and belcrank bearings supplied with your kit. Assemble the belcrank arms to the belcrank bearings using the appropriate rivets (see illlustration).

Step H Install The Aileron Belcranks

Mount the belcranks to the belcrank brackets using the supplied ¼ inch bolts, washers and castle nuts. Be certain to secure the nuts with cotters pins.

TASK F-46 Mount the Cowling

Step A Mount The Engine Mount To The Firewall

Install the engine mount on the firewall using the four stainless engine mount bolts. Secure these bolts with the supplied heat resistant nyloc nuts.

Step B Mount The Engine To The Engine Mount

Install the engine on the engine mount using the requisite Dynafocal mount pads.

Step C Make A Wood Spinner Ring To Center The Cowling

Make a temporary spinner ring for positioning the cowling using a piece of scrap wood. Use the flat area on the front of the cowling as a reference for sizing the ring. Lay out this ring on the wood using a compass and mark the center so you can easily locate it later. Lay out the position of the bolt holes for the prop on the ring. Cut all the requisite holes in the ring using the marks as a reference. Mount the ring to the prop flange on your engine using the prop bolts and washers.

Step D Temporarily Install The Top And Bottom Cowlings

Use the wood spinner ring made in step C as a reference to fit the top and bottom cowlings over the engine. Trim the edges of the cowlings as necessary to get them to to fit properly. Note that the amount of clearance you will need between the back of the spinner ring (which is also the forward face of the prop flange) and the forward surface of the cowling will depend on the spinner you will be using. Use a piece of scrap wood to space the cowling off the back of the wood ring the appropriate amount. When you have both top and bottom cowlings properly trimmed, secure them together and to the flange in the fuselage with clecos.

TASK F-47 Install The Wing Fairings

Brief Task Description:

In this task you will install the fiberglass fairings which act to smooth the airflow at the wing-fuselage junction. The forward section of these fairings attach to the wing while the aft section attaches to the fuselage. This is done to eliminate any gaps near the leading edge of the wing-fuse junction where it might interfere with air flow.

The forward wing fairings on the G-200 overlap the bottom cowling. This would effectively prevent the removal of the bottom cowling with the wings on. To remedy this situation, a portion of the bottom cowling will need to be separated and attached to the wing fairing..

Step A Trace The Outline Of The Wing Skins On The Supplied Flat Stock

Locate the premolded 1/8 inch foam core fiberglass flat stock supplied with your kit. This material will be used to make ribs to support the outboard edge of the wing fairings. Trim the flat stock to the proper dimensions to fit between the main spar and the rear spar on the wing with about a 1/4 inch gap on either side. Slip the flat stock in between the main and aft spars of the wing and trace the outline of the wing skin on one side of the flat stock. Repeat this procedure for the other wing root rib.

Step B Mount The Wings To The Fuselage

Mount the wings to the fuselage using the appropriate bolts.

Step C Partially Split The Fairings Along The Fore-Aft Split Lines

Find the pre-molded fiberglass fairings included with your kit. Locate each fairing in its appropriate position at the wing-fuse junction. Place a mark on each fairing at the aft edge of the spar box. Extend this line so that it runs the full width of each fairing. This will be the split line for the fairing. Forward of this line, the fairings will be attached to the wing and aft of this line the fairings will be attached to the fuselage. Now remove the fairings from the aircraft. Use a Dremel tool with the cut-off wheel attachment to split each fairing along the mark between the scribe lines. Do not cut all the way across the fairings, just cut between the scribe lines. This way the fore and aft portion of the fairings will still be attached by the excess material outside of the scribe lines.

Step D Fiberglass The Joggle For The Fore-Aft Split Line

Set each fairing on your work table so the inside of each fairing is facing up. Try to support each fairing so it is not warped or twisted at the split line cut in step B. Place some clear tape on the forward side of the split line on each fairing. Insert tape through the split and wrap it onto the opposite side of the fairing to completely protect the forward edge. Now thoroughly sand the area just aft of the split line on each fairing. This will allow the forth-coming fiberglass lay-up to adhere to the aft portion of the fairings but not the forward section of the fairings.

Cut out twelve fiberglass squares on the bias about 3 inches on a side. Prepare some laminating resin and laminate 3 plies of glass over each of the four split lines. Try to center the fiberglass squares on the split lines. Allow the lay-ups to cure completely.

Step E Trim The Fairings Along The Scribe Lines

Use a Dremel tool to trim the fairings just outside of the pre-molded scribe lines. Carefully sand the edges of the fairings down to the scribe lines using a belt sander. The for and aft sections of each fairing should now be separable. Remove the tape applied to the forward section of the fairings and sand the forward edge of the fiberglass lay-up.

Step F Place Tape Over The Inboard Edge Of The Forward Fairings

Cut off some strips of duct tape about 5 inches long. Wrap these strips around the inboard edge of the forward fairings from the aft split line forward to the firewall (do not place any tape on the fairings where they project ahead of the firewall). Apply the tape so that it is smooth on the inside surface where of the fairings where they butt up against the fuselage (it's OK to have wrinkles on the outside surface of the fairings). Cover the entire edge that will contact the fuselage, overlapping the tape strips as you go. This tape will prevent the microballoon/resin mixture that you will use to fair in the edge of the forward fairing from sticking to the fairing itself.

Step G Prepare The Fairings For Installation

Set the aft fairings in position inside the fuselage-wing junction. Check the fairings for proper fit. They should fit tight inside the premolded joggle on the wing skins and against the fuselage. Use masking tape to secure the fairings inside the pre-molded joggle on the wing.. Press the aft fairings (both upper and lower) up against the fuselage while drilling cleco holes every four inches through the fairings and into the outside skin of the fuselage. Use a felt tip pen to mark the outline of the rear fairings on the fuselage side for reference later. Now place the forward fairings in position. Drill and cleco the forward fairings to both the wing and fuselage. Trace their outline on each side of the fuselage as you did the aft fairings. Remove all of the fairings when done.

Prepare the fairings for bonding. On the aft fairings, sand the edge that butts up against the fuselage. On the forward fairings, sand the edge that butts up against the wing and the cowling. Prepare the joggle where the forward fairings overlap for bonding. Also prepare all mating bond surfaces on the wing and fuselage in a similar manner.

Step H Install The Aft Bottom And Forward Fairings

Mix up enough structural adhesive to attach the aft bottom and forward fairings. (the aft top fairings will be installed later). Thicken the adhesive to "mayo" consistency with structural filler. Apply the adhesive mixture to the edge of the aft bottom fairings which mate to the fuselage. Carefully position each fairing on the fuselage. Tape the fairings into the premolded recess in the wing and install the clecos into the previously drilled cleco holes to hold the fairings against the fuselage.. Now apply adhesive to the edge of the forward fairings which mate to the wing and the cowling (be certain you do not bond the forward fairings to the fuselage) . Also apply adhesive to the joggle on the forward fairings where they mate at the leading edge. Carefully press these fairings into position and secure with clecos. Remove any excess adhesive with a clean rag.

Step I Make And Install The Fairing Support Ribs

Cut out the support ribs from the flat stock along the line drawn in Step A. Trial fit these ribs in position between the forward and aft spars. The ribs should be parallel to the root wing rib and sit about 1/8 inch inboard from the edge of the wing skin. The bottom of these ribs should fit flush against the inside surface of the bottom fairings and the fore and aft edges of the ribs should clear the spar surfaces by about 1/4 inch. Once you are confident the rib fits correctly, prepare it for bonding by removing the core material to a depth of 1/8 inch along the bottom of the rib. Prepare the mating area of the wing fairing for bonding. Mix up some structural adhesive (you may use left over adhesive from Step G) and bond the rib to the lower wing fairing. Use tape to hold the rib in position while the adhesive cures.

Step J Install The Aft Upper Fairings

Trial fit the upper aft fairings in position. Check to make sure the fairings just barley clear the top of the support rib when it is pressed into position against the fuselage and wing. Sand the ribs as necessary to get a custom fit. Once you are confident the fairings fit correctly, prepare the top of the ribs, the mating area on the inside of the fairings, the entire upper edge of the fairings, and the fuselage for bonding. Mix up some structural adhesive and thicken it with structural filler. Apply the adhesive to the top of the support ribs and the edges of the fairings which will mate to the fuselage. Press the fairings into position and install clecos in the previously drilled cleco holes. Use tape to secure the fairings inside the premolded joggle in the wing. Clean up any excess adhesive and allow to cure.

Step K Fill The Edges Of The Fairings

Lightly sand the areas where the fairings attach to the wing and fuselage. Now mix up about 6 ounces of laminating resin and add microballoons until it assumes the consistency of peanut butter. Use this mixture to fill in the entire edge of the fairings where they mate to the fuselage, wing and cowling (plastic squeegees work well for applying the mixture). Generously fairing in the edges over a distance of about three or four inches.

Allow the filler to cure then smooth it out with a rubber sanding block and 60 grit sandpaper. If you find low spots, repeat the above procedure until they are filled to your satisfaction.

Step L Cut the cowling

Now you will need to cut the bottom cowling to separate it from the forward fairings. Refer to the illustrations to make this cut.

Step M Remove The Wings From The Fuselage

Remove the wings from the fuselage. The duct tape placed on the forward fairings should have prevented the filler from adhering to the forward fairings. If you find they do stick a little, some gentle prying should release them..

Step N Cut Holes In The Support Ribs To Clear The Aileron Control Tubes

Trace the outline of the cutout for the aileron control tubes on the outside of both support ribs. Use a jigsaw to cut out these holes along the line. Smooth the edges of the holes with sandpaper.

TASK F-48 Install The Aileron Control Tubes

Step A Assemble The Control Tubes

Locate the 5/8 aluminum tubing supplied with you kit. Cut this tubing to the dimensions shown in the illustrations. Find the tube end fittings for the 5/8 inch tubes. Install these into the end of the tubes using rivets.

Step B Install The Inboard Control Tubes

Mount the inboard control tubes to the swing arms on the stick pivot using the appropriate hardware. Mount the opposite end of the control stick to the belcranks. Secure all bolts with cotter pins.

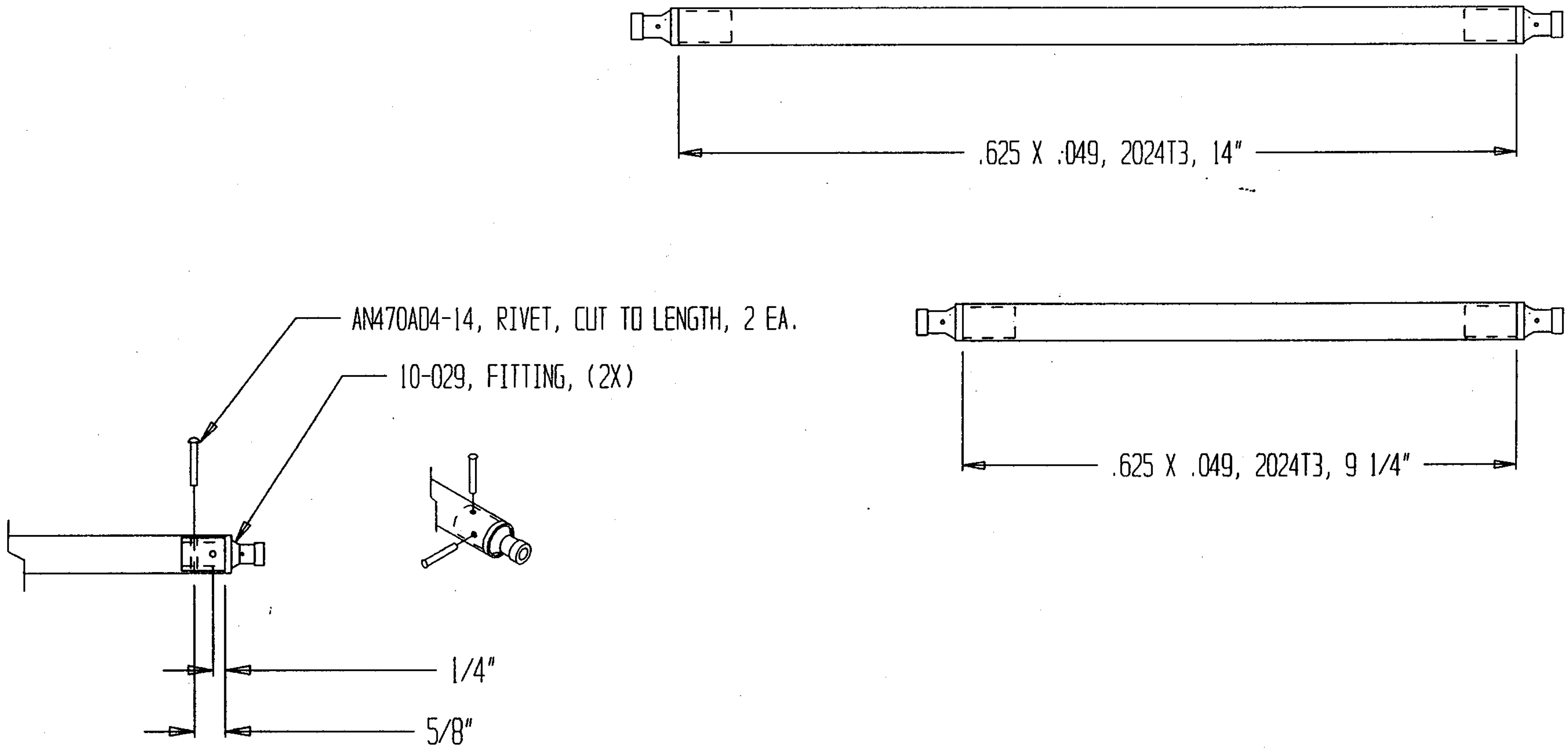
Step C Cut A Slot For The Outboard Control Tubes

Grind a notch into both the wing fairing and the inboard edge of the wing to clear the outboard aileron control tube (see illustration).

Step D Install The Outboard Control Tubes

Mount the outboard aileron control tubes to the aileron belcranks using the appropriate hardware.

> NOTE:
> The aileron belcrank can be easily damaged if vertical loads are placed on the free end of the outboard control tube. To prevent this from happening, secure the free end of the control tube to the wing fairing with tape until it is ready to be attached to the aileron control horn.



ASSEMBLE AILERON CONTROL TUBES

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TASK F-49 Assemble And Install The Instrument Panel

Step A Decide On Your Panel Lay-Out

Decide where you want your instruments to go on the panel. Generally you will want to place your air speed over to left side where you can see it well on final approach. Remember that the top of the instrument panel will overlap the instrument panel bulkhead by about 3/4 inch. Make sure the housings for the instruments will not interfere with this bulkhead when installed.

Step B Cut Holes In Your Panel For The Instruments

Once you have your panel lay-out completed, use a center punch to center punch all of the mounting holes. Drill out these holes using the appropriately sized drill bit (usually no. 19). Drill a 1/4 inch hole in the middle of each instrument hole and use a jig saw with a narrow blade to cut close to the hole outline. Finish the hole with a round file or sandpaper.

Step C Drill Holes For Mounting Your Panel To The Panel Bulkhead

Note that phenolic blocks have been pre-installed in the instrument panel bulkhead at five locations. Position mounting holes in the instrument panel so they will intersect the center of these pre-installed phenolic blocks. After drilling the holes in the panel, clamp the panel to the bulkhead and drill through the bulkhead using the holes in the panel as a drill guide (this will assure proper alignment). Now countersink the holes on the forward side of the panel with a 100 degree countersink.

Step D Install Nutplates In The Panel Bulkhead

Refer to the section entitled “Installing Nutplates” in the General Information Section of this manual to install five fixed nutplates to the forward side of the panel bulkhead. These nutplates should end up centered on the pre-installed phenolic blocks.

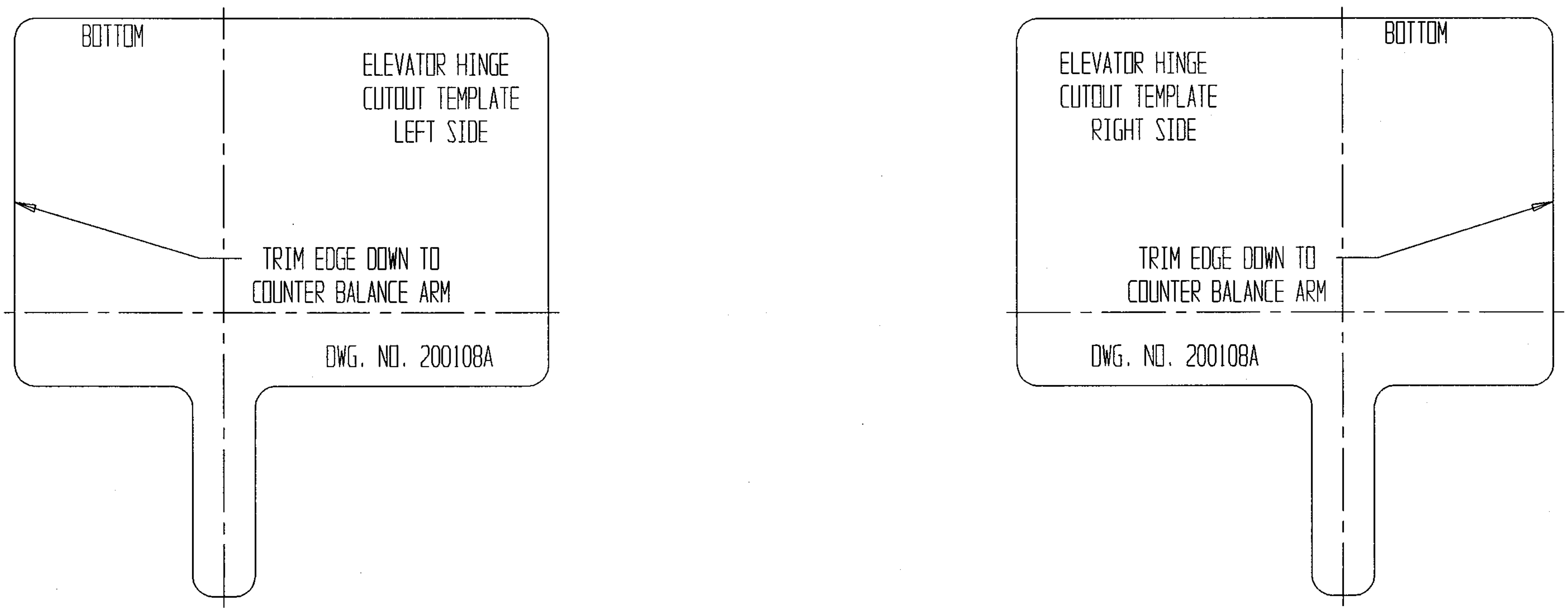
Step E Paint The Instrument Panel

Use a good quality epoxy or enamel based paint to paint the panel. Allow the panel to dry completely.

Step F Mount Instruments To The Panel And Mount The Panel

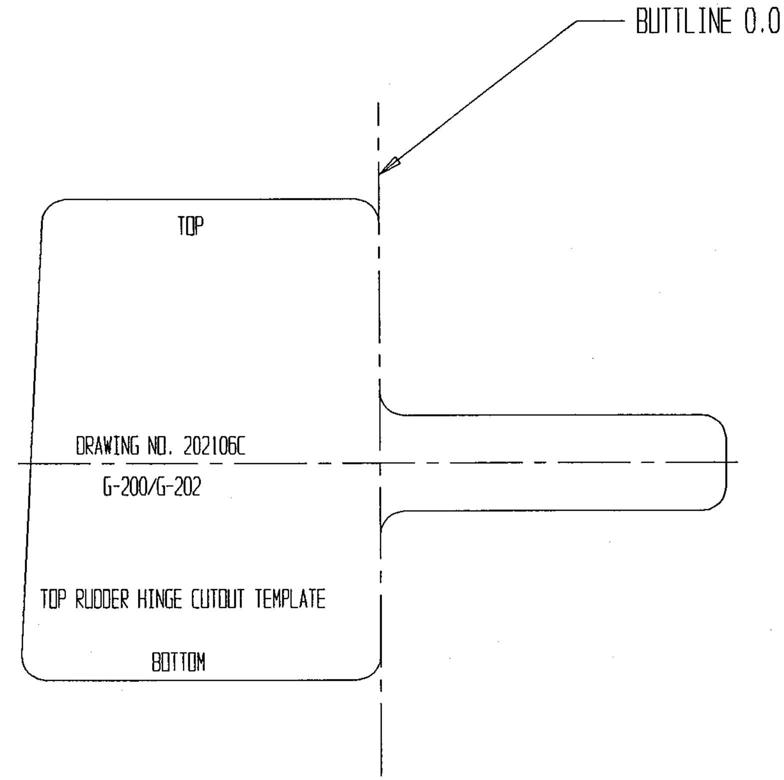
Mount each instrument to the panel using the appropriate mounting screws (usually #8). Install the appropriate pitot and/or static line fittings to the back of the instruments. Mount the panel to the panel bulkhead using the supplied #8 screws.

Templates



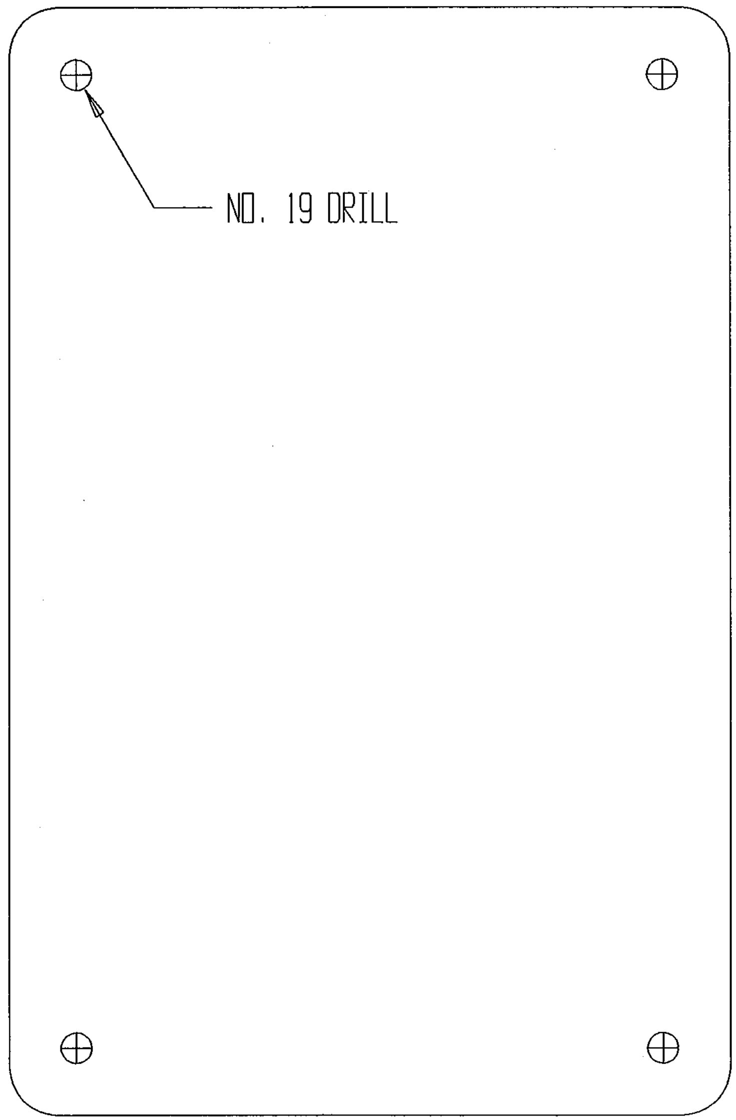
ELEVATOR HINGE CUTOUT TEMPLATES

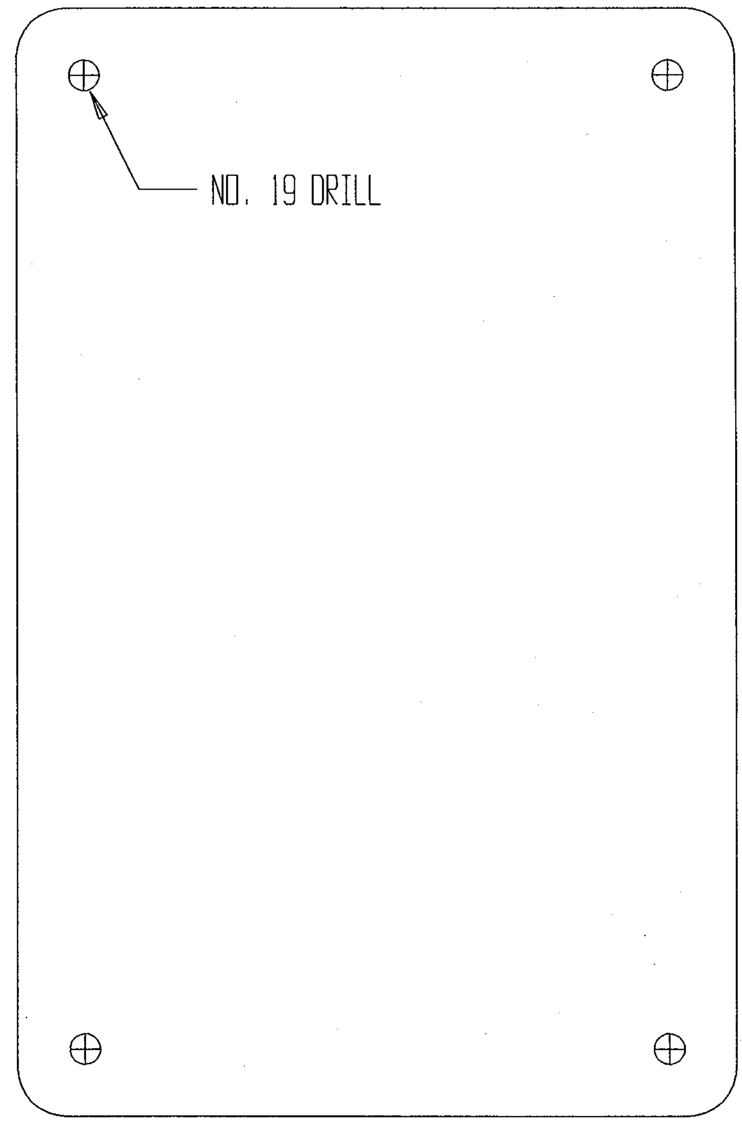
DRAWING NO. 200108A	TASK NO.	STEP NO.	AkroTech	
MODEL G - 200	SECTION EMPENNAGE		REVISION	PAGE



TOP RUDDER HINGE CUTOUT TEMPLATE

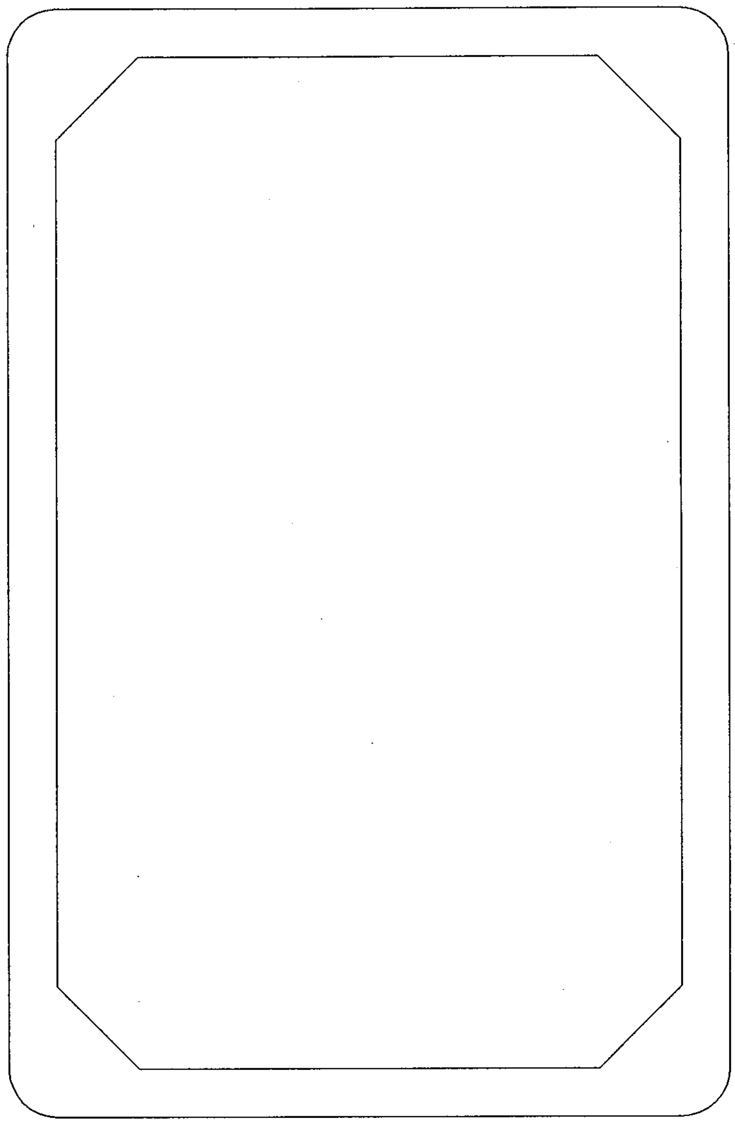
DRAWING NO. 202106C	TASK NO.	STEP NO.	AkroTech
MODEL G - 200/202	SECTION EMPENNAGE	REVISION	PAGE

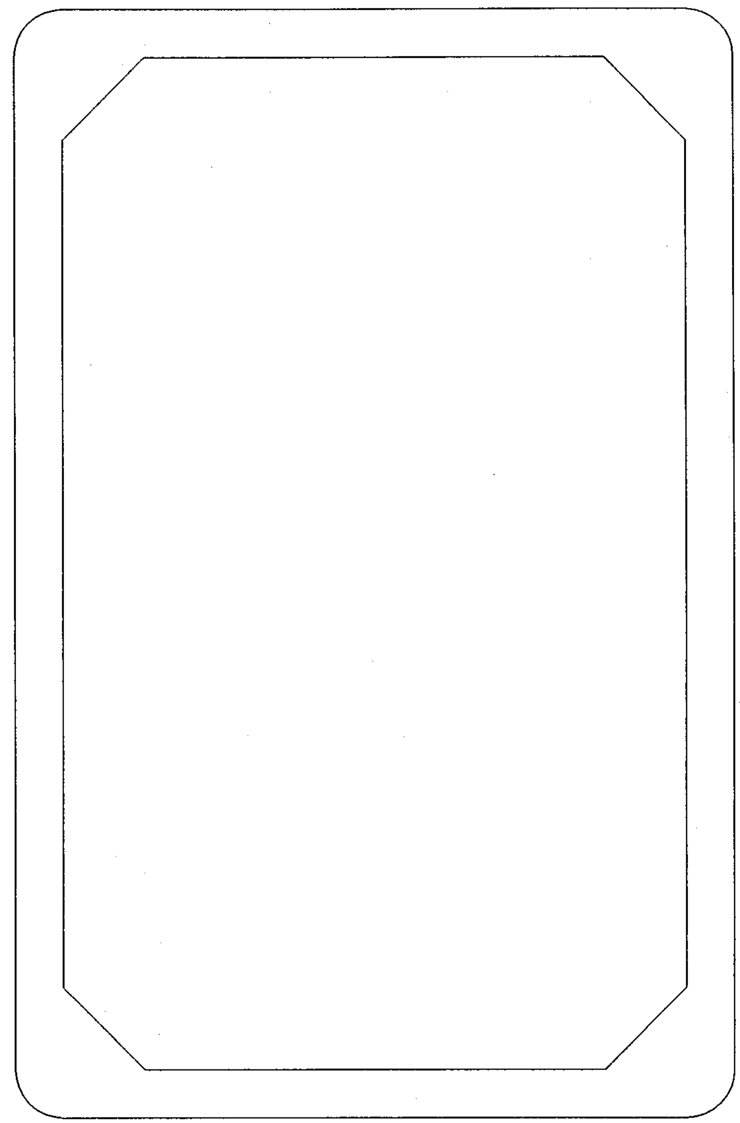




REAR INSPECTION PLATE TEMPLATES

1. USE SPRAY ADHESIVE TO SECURE TEMPLATE TO SUPPLIED POLYCARBONATE SHEET
2. CUT OUT INSPECTION PLATES ALONG SOLID LINE



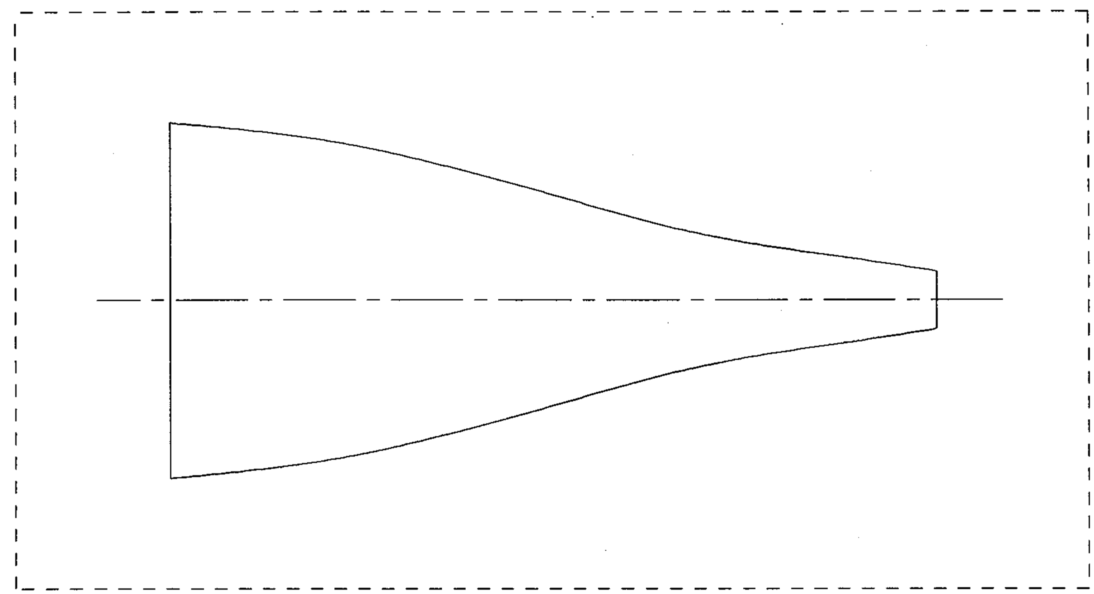


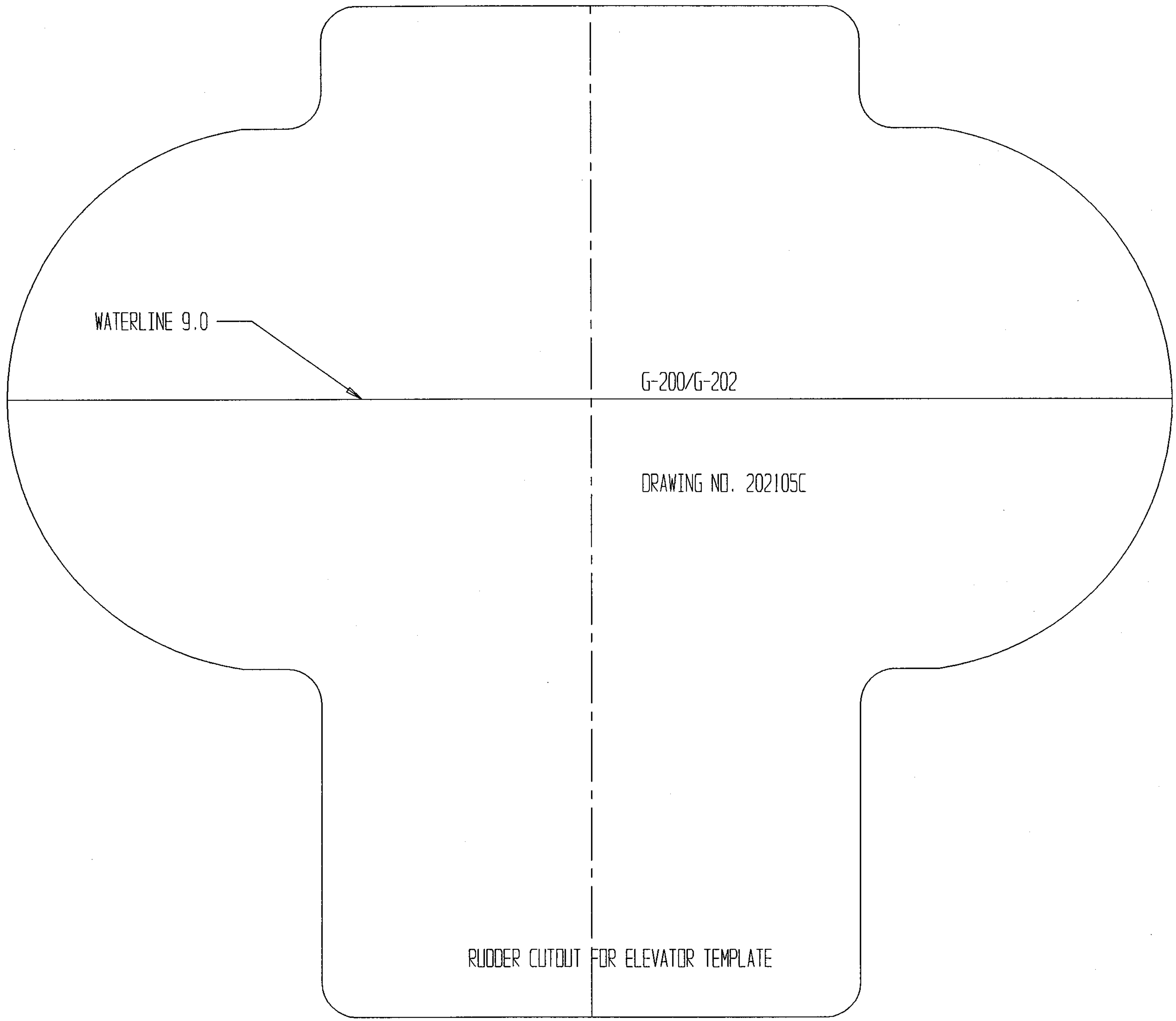
REAR INSPECTION PLATE FLANGE TEMPLATES

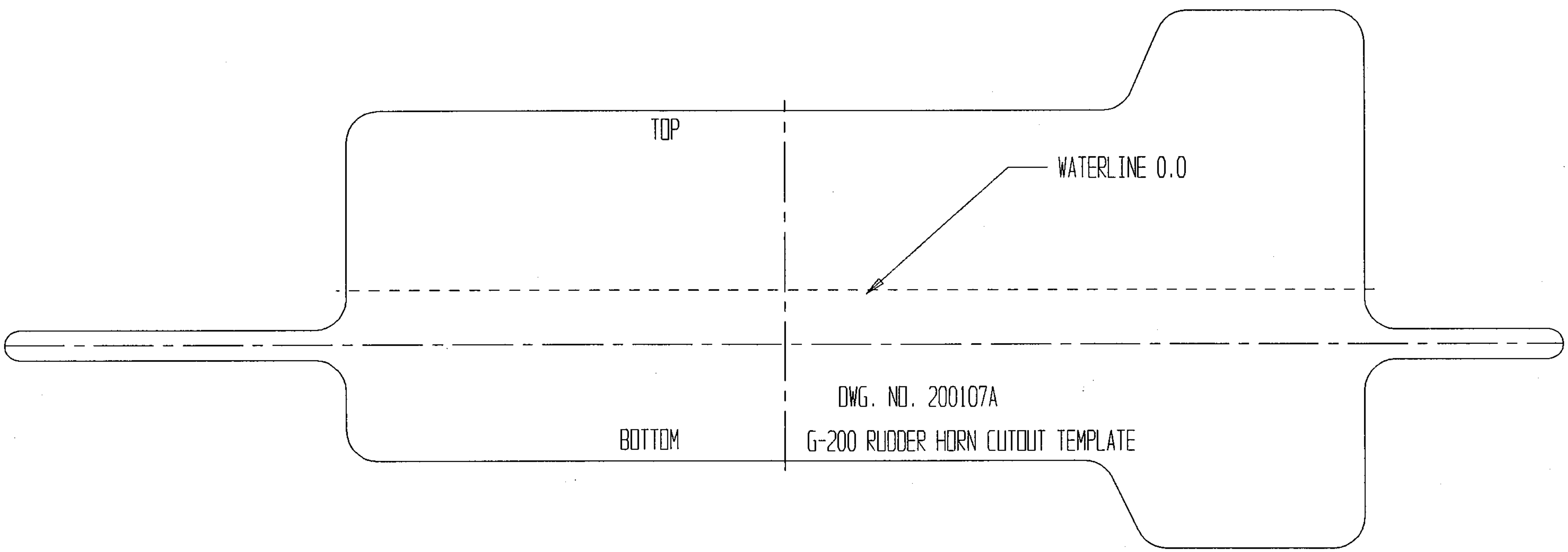
1. CUT OUT TEMPLATES ALONG EXTERIOR LINE
2. MOUNT TEMPLATES IN PRE-MOLDED RECESS USING SPRAY ADHESIVE
3. CUT ALONG INTERIOR LINE USING A JIGSAW

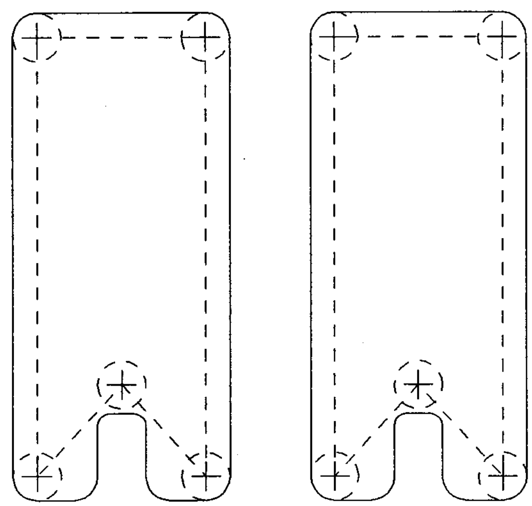
NACA DUCT CUT-OUT TEMPLATE

1. CUT OUT TEMPLATE ALONG DOTTED LINE
2. MOUNT TEMPLATE TO FUSE USING SPRAY ADHESIVE
3. CUT OUT NACA DUCT ALONG SOLID LINE



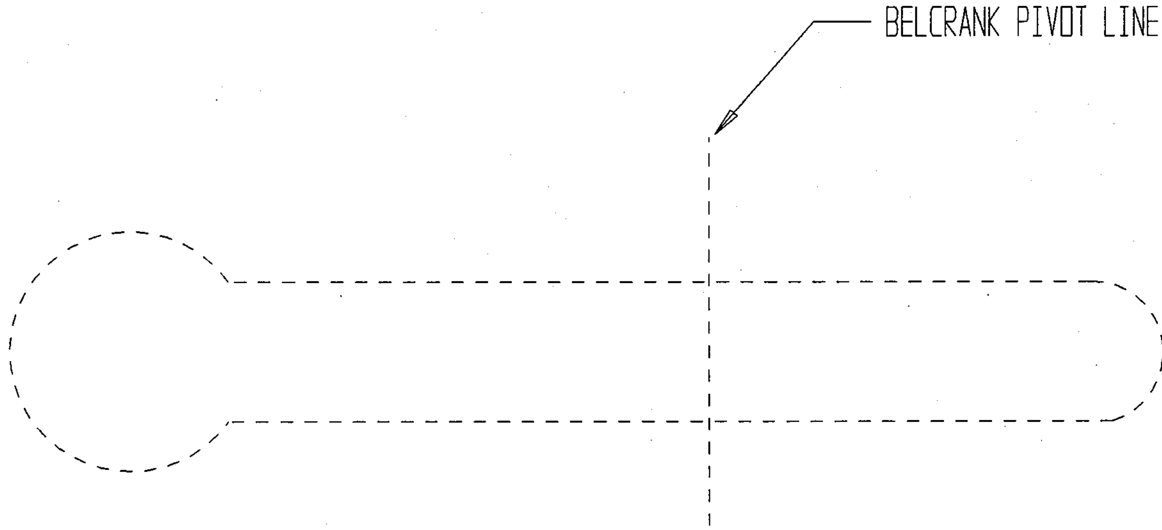

WATERLINE 9.0
G-200/G-202
DRAWING NO. 202105C
RUDDER CUTOUT FOR ELEVATOR TEMPLATE


TOP
WATERLINE 0.0
BOTTOM
DWG. NO. 200107A
G-200 RUDDER HORN CUTOUT TEMPLATE

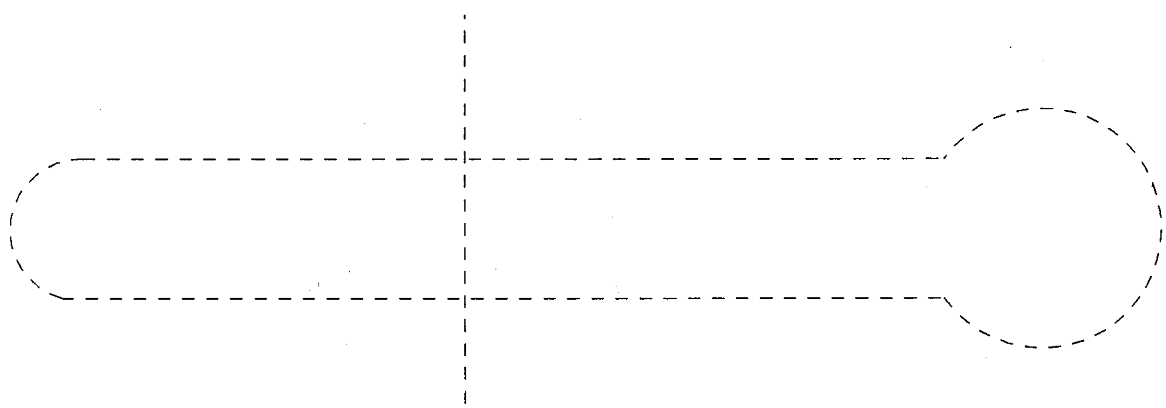


1. CUT OUT TEMPLATES ALONG SOLID LINE
2. USE SPRAY GLUE TO MOUNT TEMPLATES OVER REAR SPAR CARRY-THROUGH
3. DRILL HOLES THROUGH FUSE AT SPECIFIED LOCATIONS
4. CUT BETWEEN HOLES (DASHED LINES) FROM OUTSIDE OF FUSE USING A JIGSAW
5. USE A SMALL GRINDING TOOL TO OPEN HOLE OUT TO FULL SIZE

REAR SPAR PLATE CUT-OUT TEMPLATES



RIGHT SIDE TEMPLATE

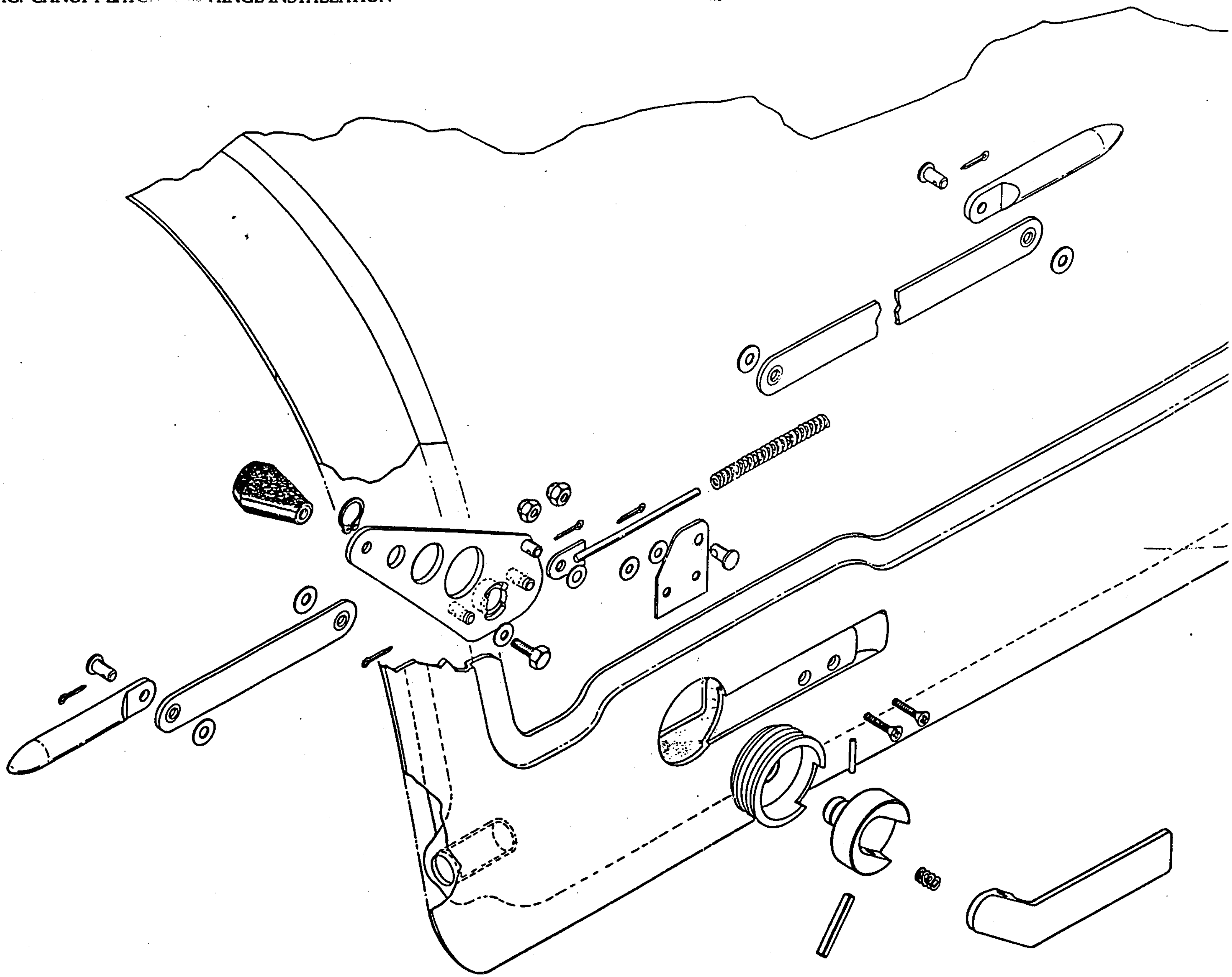


LEFT SIDE TEMPLATE

BELCRANK CUT-OUT TEMPLATES

Canopy Latch Instructions

AG. CANOPY LATCH AND HINGE INSTALLATION



The canopy latch system allows the canopy to be opened either from inside or from outside the aircraft. The canopy locking pins are actuated by arms connected to the interior handle, which moves independently of the exterior handle through a large enough range to permit the interior handle to either latch or unlatch the canopy without moving the exterior handle. When the exterior handle is moved beyond the range of independent motion, it engages the interior handle to either latch or unlatch the canopy. The interior handle travels to a spring-assisted overcenter position to firmly secure the locking pins when the canopy is closed.

These instructions describe the assembly of the left hand canopy latch only. The right hand latch system is a "mirror image" of the left hand system and the same instructions can be used.

NOTE: Assemble the left and right canopy latch systems simultaneously since some procedures require that parts from one side be used as locating tools for the opposite side.

NOTE: Whenever working on the canopy frames, take care to adequately protect the plexiglass in the frame from chafing, scratches, and fiberglass dust. We recommend applying several coats of Sign-Strip, which is a liquid material that can be brushed or sprayed on and that dries to a thick protective film. Sign-Strip is available from the Glasair Options Catalog.

CAUTION: Do not leave Sign-Strip on the plexiglass for longer than 6 months. The Sign-Strip is easier to remove if applied in a thick coat. We recommend using high pressure air to help remove particularly tenacious layers of Sign-Strip.

STEP AG-1 ASSEMBLING THE EXTERNAL CANOPY LATCH HANDLE

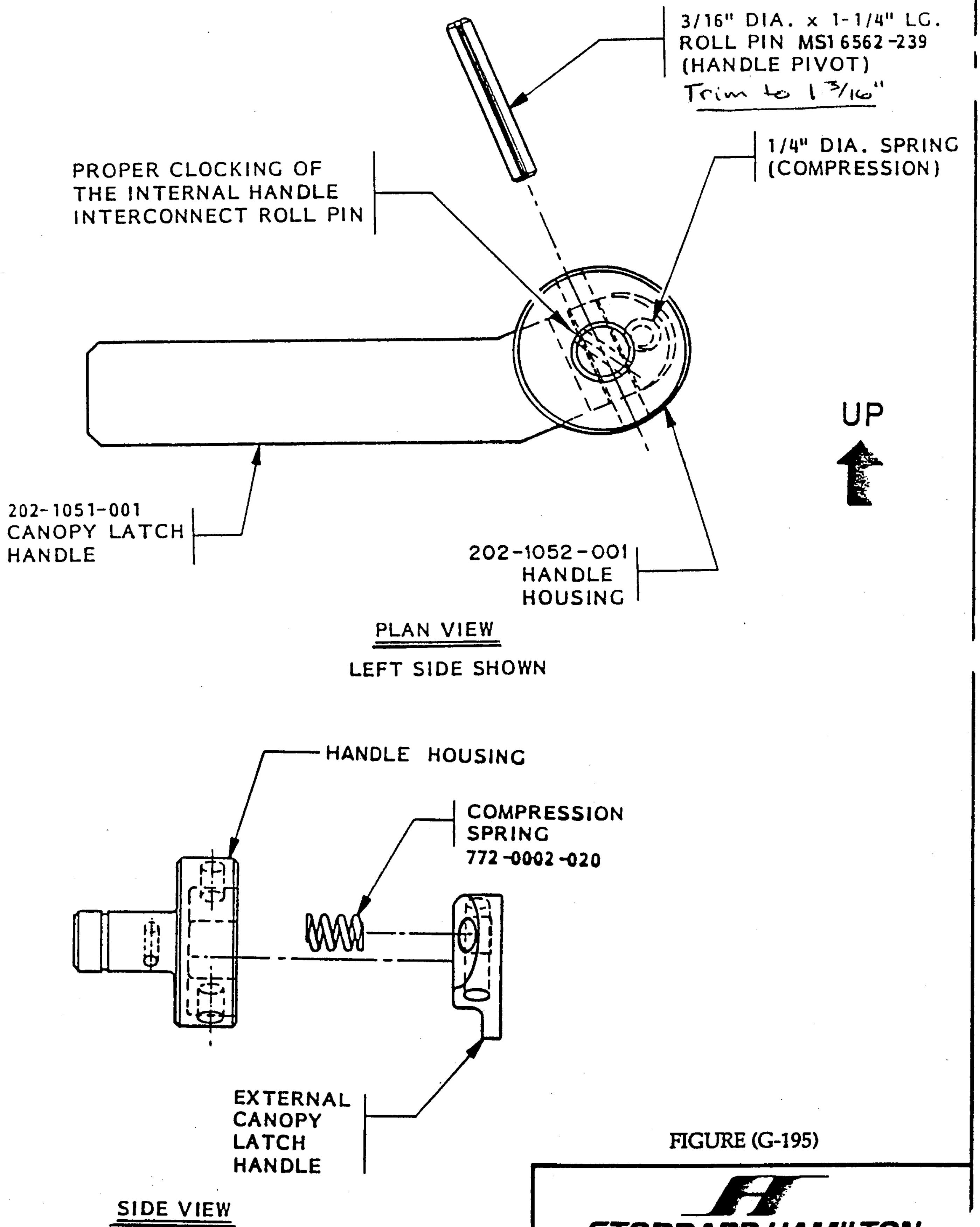


FIGURE (G-195)

Place the left external canopy latch handle (202-1051-001) on a flat work surface with the spring retaining hole facing up. Place the short, 1/4" diameter spring (772-0002-020) into the retaining hole in the latch handle. When the external latch handle is installed in the recessed latch opening in the canopy frame, this spring holds the handle flush with the outside surface of the canopy frame.

Place the left handle housing (202-1052-001) in place over the latch handle, as shown in FIGURE (G-195).

<u>NOTE</u>: Verify that the correct handle housing is being installed on each external latch by confirming the correct clocking (angular relationship) of the internal latch interconnect roll pin hole with the handle pivot roll pin hole, as shown in FIGURE (G-195).

Install the 3/16" dia. x 1-1/4" long handle pivot roll pin, as shown. Trim to 1 3/16"

<u>NOTE</u>: The handle pivot roll pin hole through the external handle is slightly larger than the 3/16" x 1-1/4" roll pin so that the handle can pivot on the roll pin.

The assembled external latch and handle housing will be used to position the cutout for the pivot housing on the outside of the canopy frame.

STEP AG-2 PIVOT HOUSING BUSHING INSTALLATION

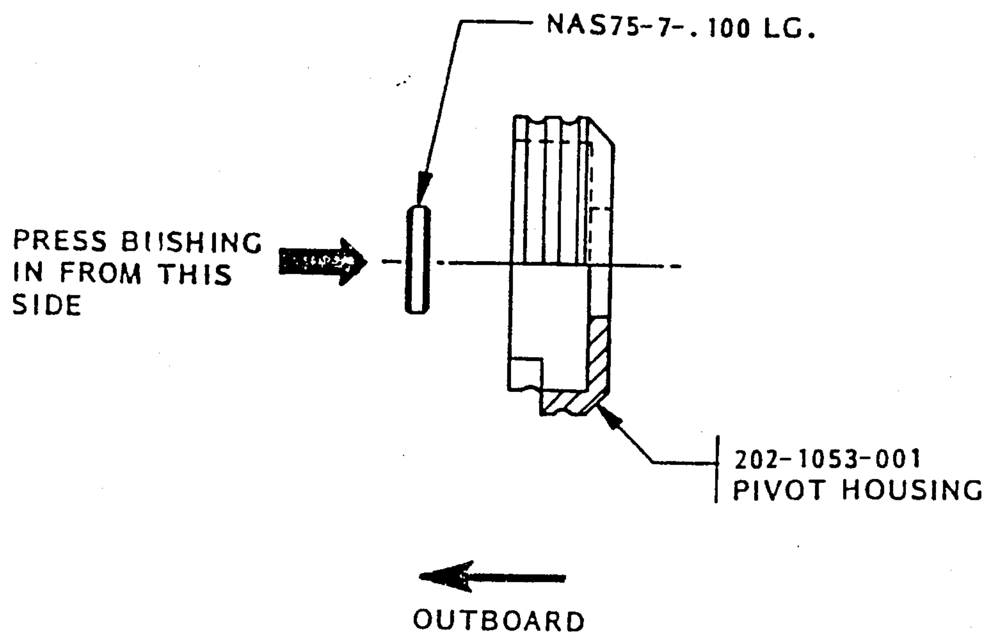


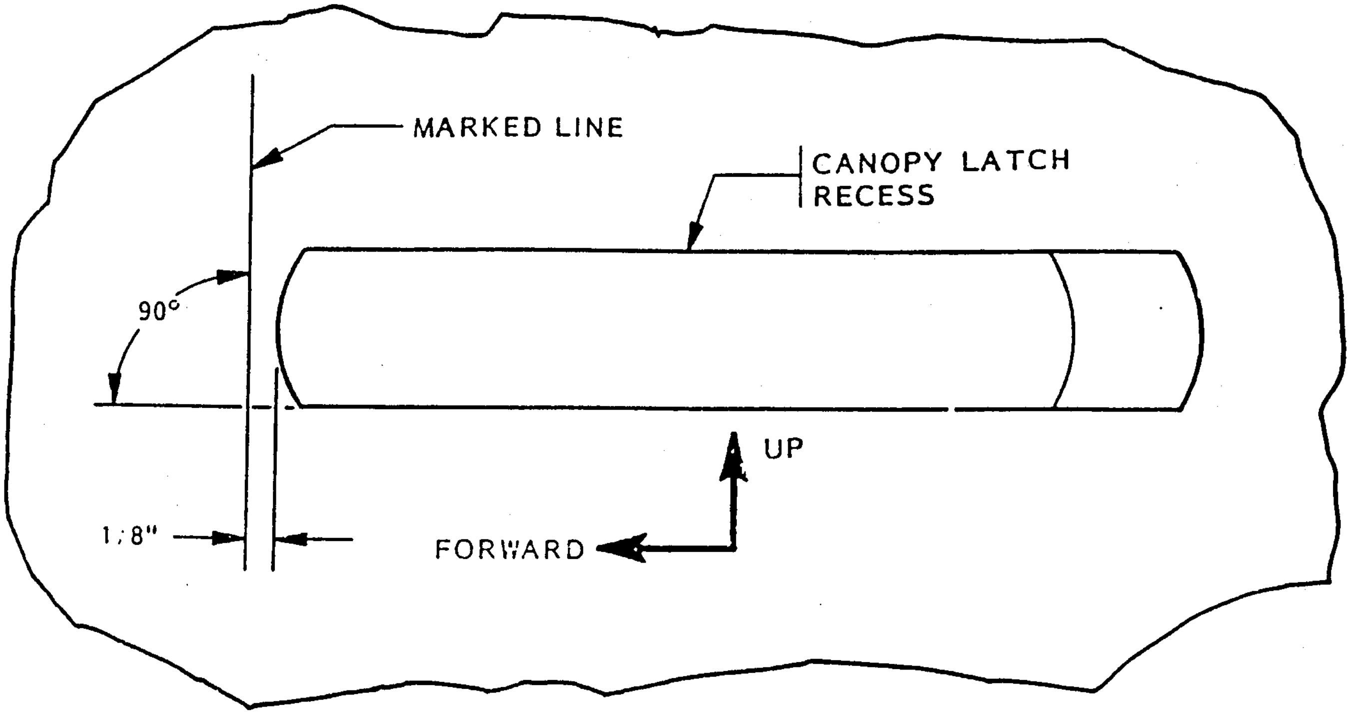
FIGURE (G-196)

An NAS75-7-.100 bushing must be installed in the (202-1053-001) pivot housing, as shown in FIGURE (G-196). Place the inboard face of the pivot housing on a flat surface and carefully press the bushing into place in the pivot housing, as shown.

NOTE: To lock the bushing in place, apply a small amount of Loctite to its outside diameter before pressing it into the pivot housing.

Install the pivot housing on the assembled handle housing.

STEP AG-3 MARKING THE PIVOT HOUSING CUTOUT ONTO THE CANOPY FRAME



OUTSIDE CANOPY LATCH RECESS

FIGURE (G-197)

Measure forward 1/8" from the most forward point of the canopy latch recess in the canopy frame, as shown in FIGURE (G-197). Use a small square and a felt pen to mark a short vertical line at this 1/8" forward point, as shown.

CAUTION: Lay out this line as accurately as possible since it will be used as a reference to locate the internal latch components.

The assembled right hand latch and pivot housing will be used as a tool to mark the left hand pivot housing clearance cutout on the outside of the left hand canopy frame, and vice versa.

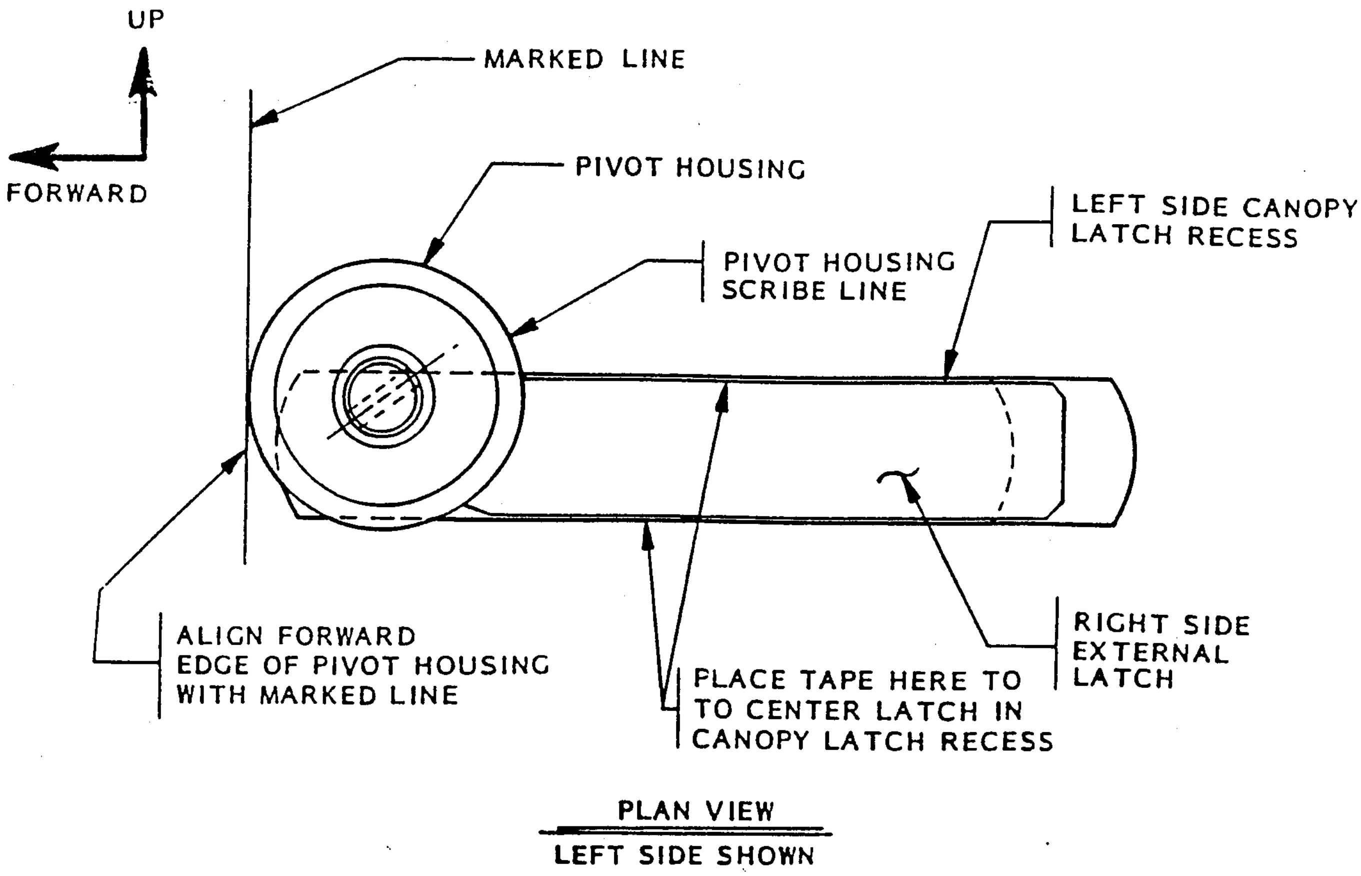


FIGURE (G-198)

Place the right hand latch and pivot housing into the left hand canopy frame latch recess, as shown in FIGURE (G-198). Move the right hand latch and pivot housing in the left canopy frame latch recess until the most forward edge of the right pivot housing aligns with the 1/8" line marked previously, as shown in FIGURE (G-198). Place strips of masking tape along the upper and lower edges of the right hand latch handle to center the latch securely in the canopy latch recess. Scribe a line around the outside circumference of the pivot housing onto the outside canopy frame, as shown.

Remove the right hand latch and pivot housing parts.

Carefully locate the center of the pivot housing circle scribed on the canopy frame. Drill a 1/8" dia. hole straight through both the outside and inside laminates of the canopy frame at this center point. Be careful to drill perpendicular to the outside surface of the canopy frame.

Cut the pivot housing clearance hole through the outside laminates of the canopy frame with a 1-1/2" hole saw, using the 1/8" diameter hole for the hole saw pilot hole. Alternatively, drill a series of small holes inside the pivot housing mark, and then use a file to enlarge and smooth the opening out to the scribe line.

CAUTION: Cut the pivot housing clearance hole in the outside laminates of the canopy frame only.

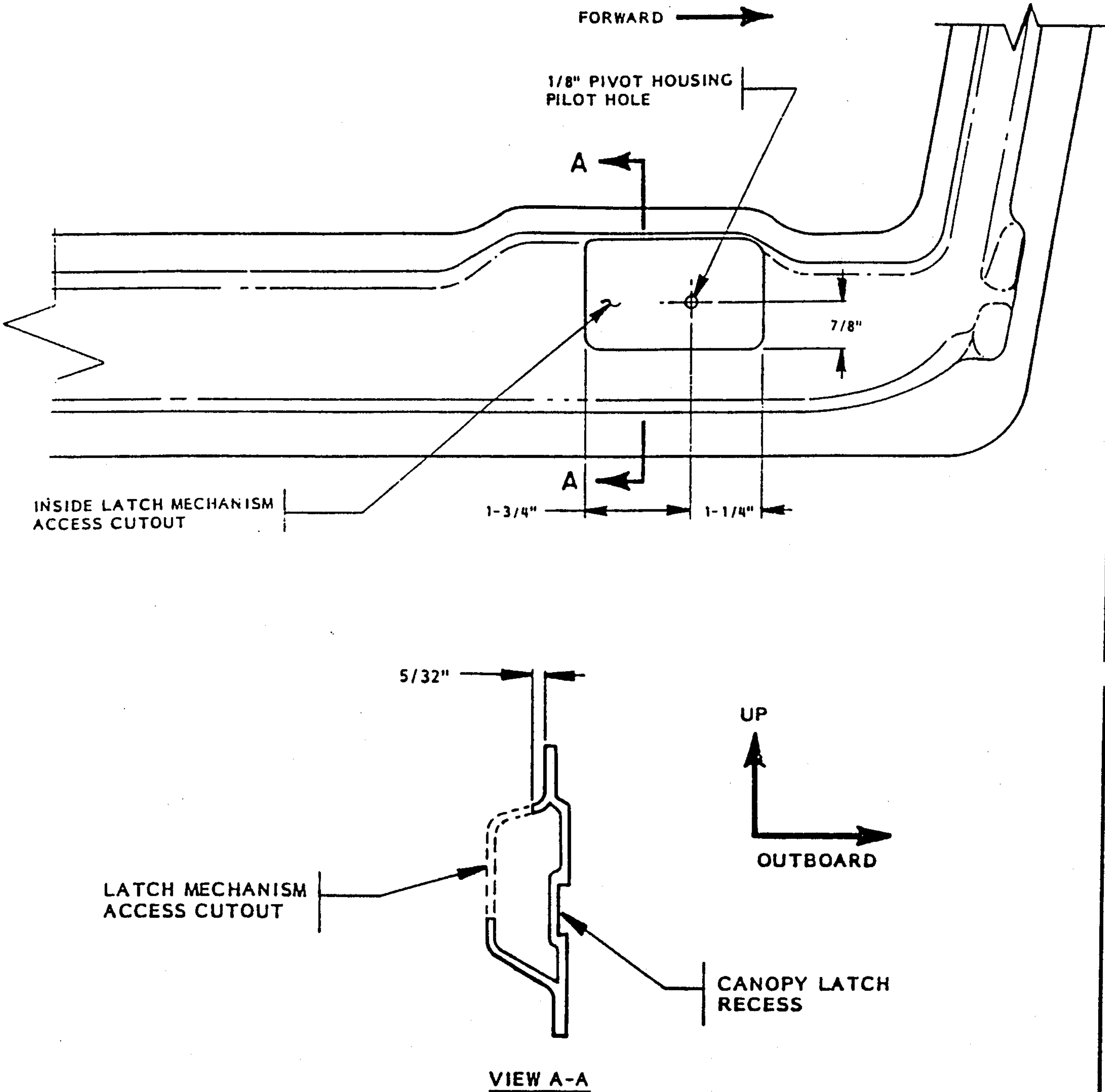

FORWARD
1/8" PIVOT HOUSING
PILOT HOLE
A
7/8"
A
INSIDE LATCH MECHANISM
ACCESS CUTOUT
1-3/4"
1-1/4"
5/32"
UP
OUTBOARD
LATCH MECHANISM
ACCESS CUTOUT
CANOPY LATCH
RECESS
VIEW A-A

FIGURE (G-199)

The location of the inside canopy frame latch mechanism access cutout is referenced from the 1/8" dia. pivot housing pilot hole drilled earlier through the inside canopy frame laminates. Use the dimensions provided in FIGURE (G-199) to mark the outline of the latch mechanism cutout. Take care to leave a 5/32" width of material along the upper edge of the cutout, as shown in FIGURE (G-199), View A-A.

Use a very small keyhole saw or a series of holes drilled along the inside of the marked line to cut the latch mechanism access opening. Cut inside the marked line first, and then use a file and sandpaper to smooth the edges of the access cutout.

STEP AG-5 INSTALLING THE PIVOT HOUSING IN THE CANOPY FRAME

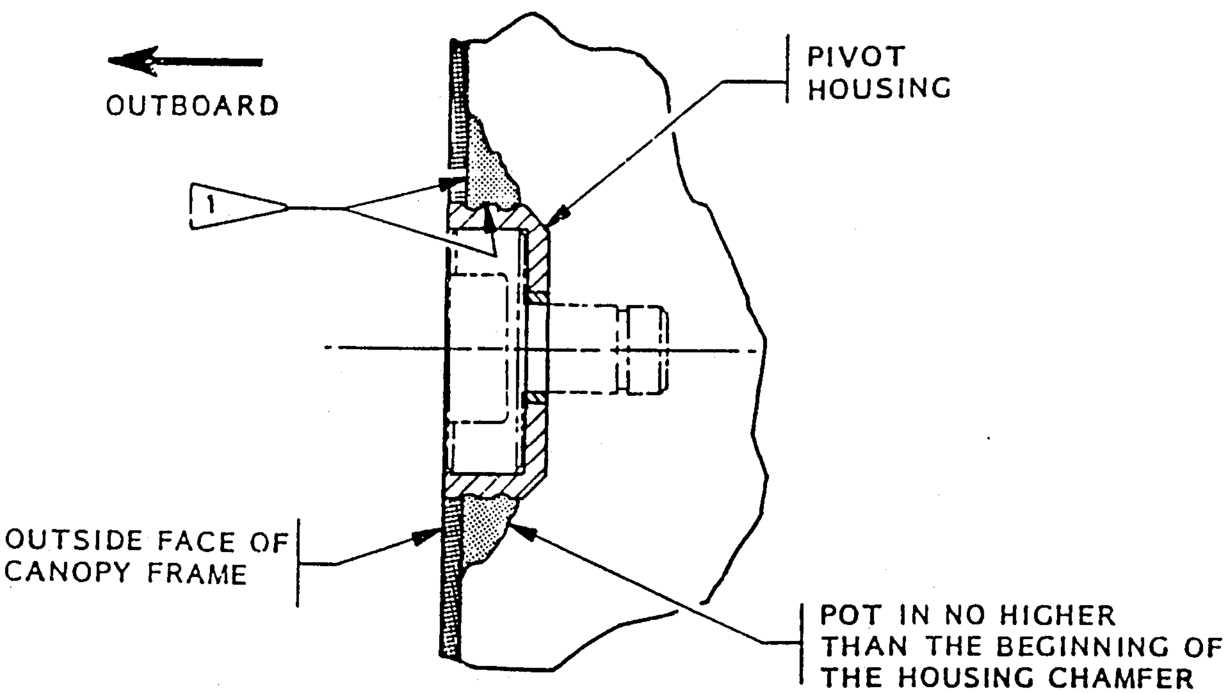


FIGURE (G-200)

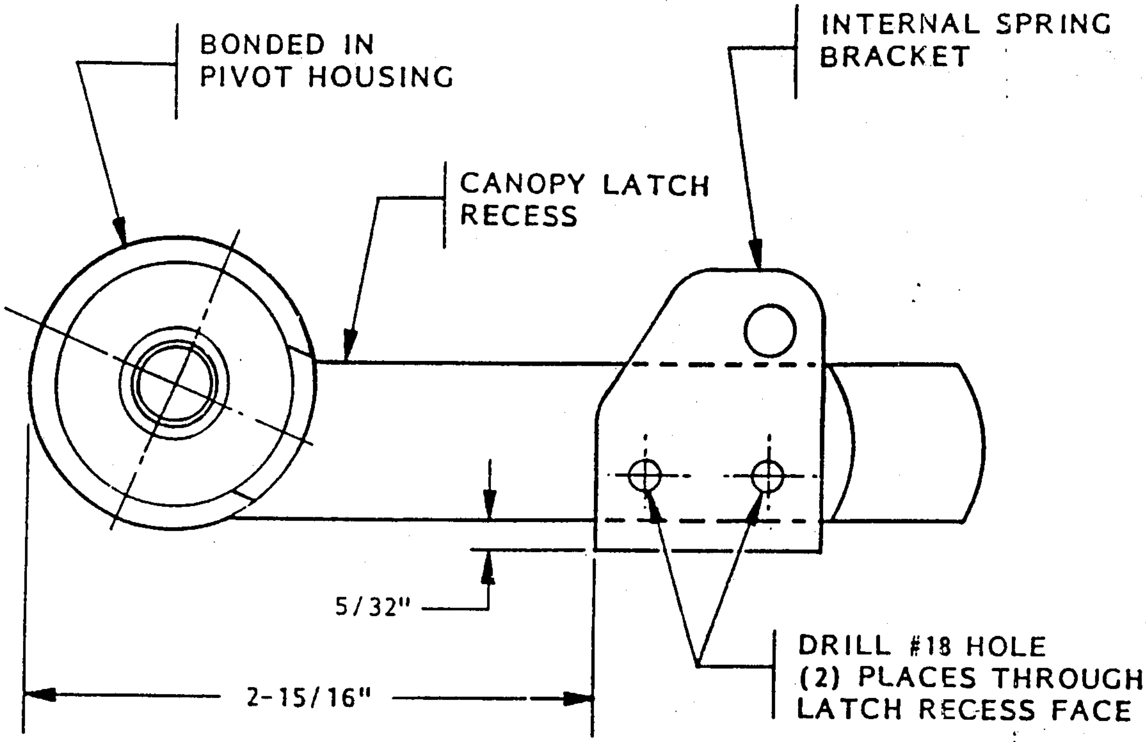
Use 80 grit sandpaper to roughen the inside surface of the canopy frame and the outside surface of the pivot housing, as indicated by Flag #1, FIGURE (G-200), to prepare for bonding. Also, use a hacksaw or a file to score the pivot housing perpendicular to the existing circumferential grooves.

Place the left hand latch and pivot housing assembly into its proper position in the left canopy frame. Use strips of masking tape along the upper and lower edges of the latch to center the latch in the latch recess, as shown in FIGURE (G-198). Mix a thick batch of Cabosil/mill-fiber/resin mixture and bond the outside perimeter of the pivot housing to the inside surface of the canopy frame laminates, as shown in FIGURE (G-200). Let cure.

NOTE: Keep the potting mixture below the chamfer on the pivot housing, as shown in FIGURE (G-200), to provide clearance for the internal latch mechanism.

NOTE: Hot glue tongue depressors (or similar small, flat pieces of wood or metal) to the outboard surface of the canopy frame over the latch and pivot housing to ensure that these components will be flush with the outside of the canopy frame when the pivot housing bonding is completed.

STEP AG-6 POSITIONING THE INTERNAL SPRING BRACKET



PLAN VIEW
OUTSIDE OF CANOPY FRAME

FIGURE (G-201)

Remove the latch housing and latch from the pivot housing in the canopy frame.

Position the internal spring bracket over the latch recess on the outside of the canopy frame, using the dimensions provided in FIGURE (G-201). Use the existing #18 mounting holes in the internal spring bracket as guides to drill (2) matching #18 mounting holes through the outside canopy frame laminates in the canopy latch recess. Remove the internal spring bracket.

STEP AG-8 LOCKING PIN INSTALLATION

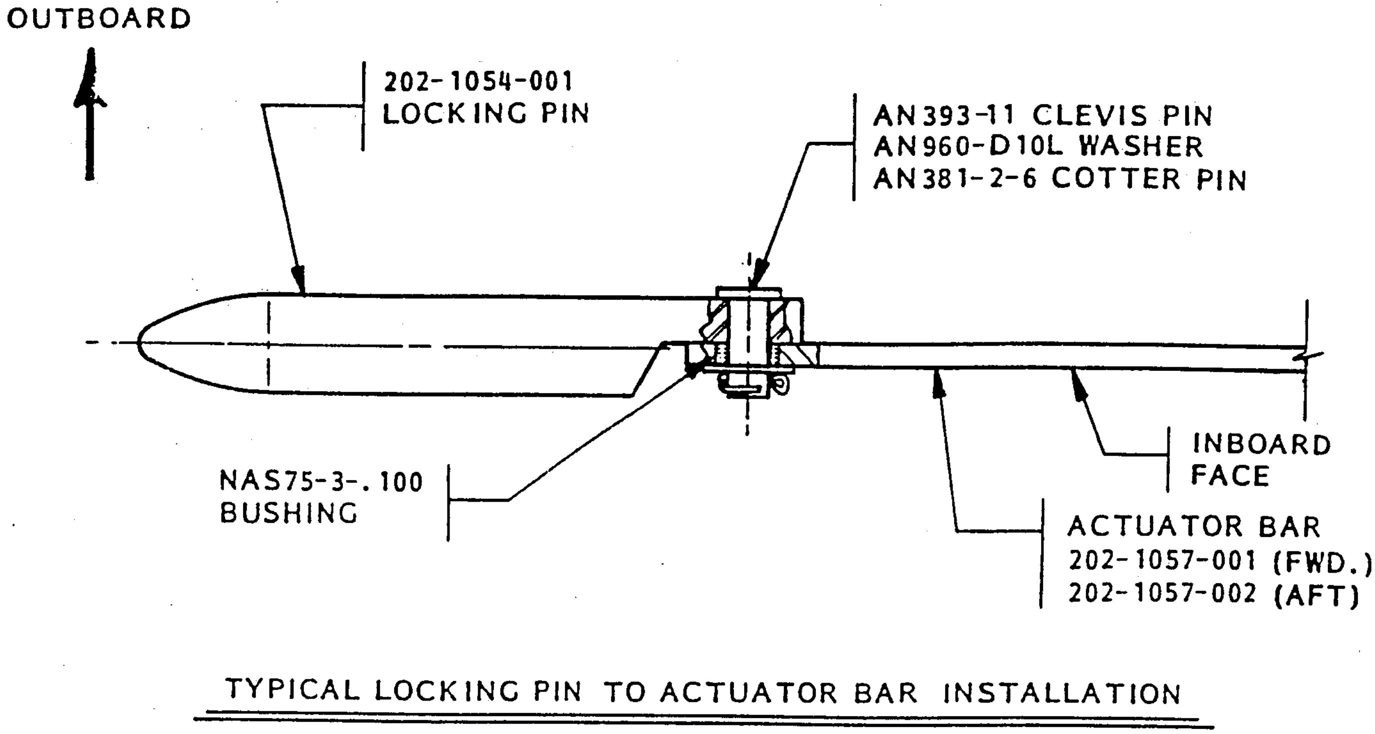


FIGURE (G-203)

Steel sleeves were installed between the inside and outside halves of the canopy frame when the halves were fabricated. The canopy locking pins travel within the sleeves. Small holes have been pre-drilled through the canopy frame to show the approximate locations of the centers of the canopy sleeves within the canopy frame. Use a "Unibit" or round file to carefully enlarge the existing holes to match the inside diameter of the internal sleeves.

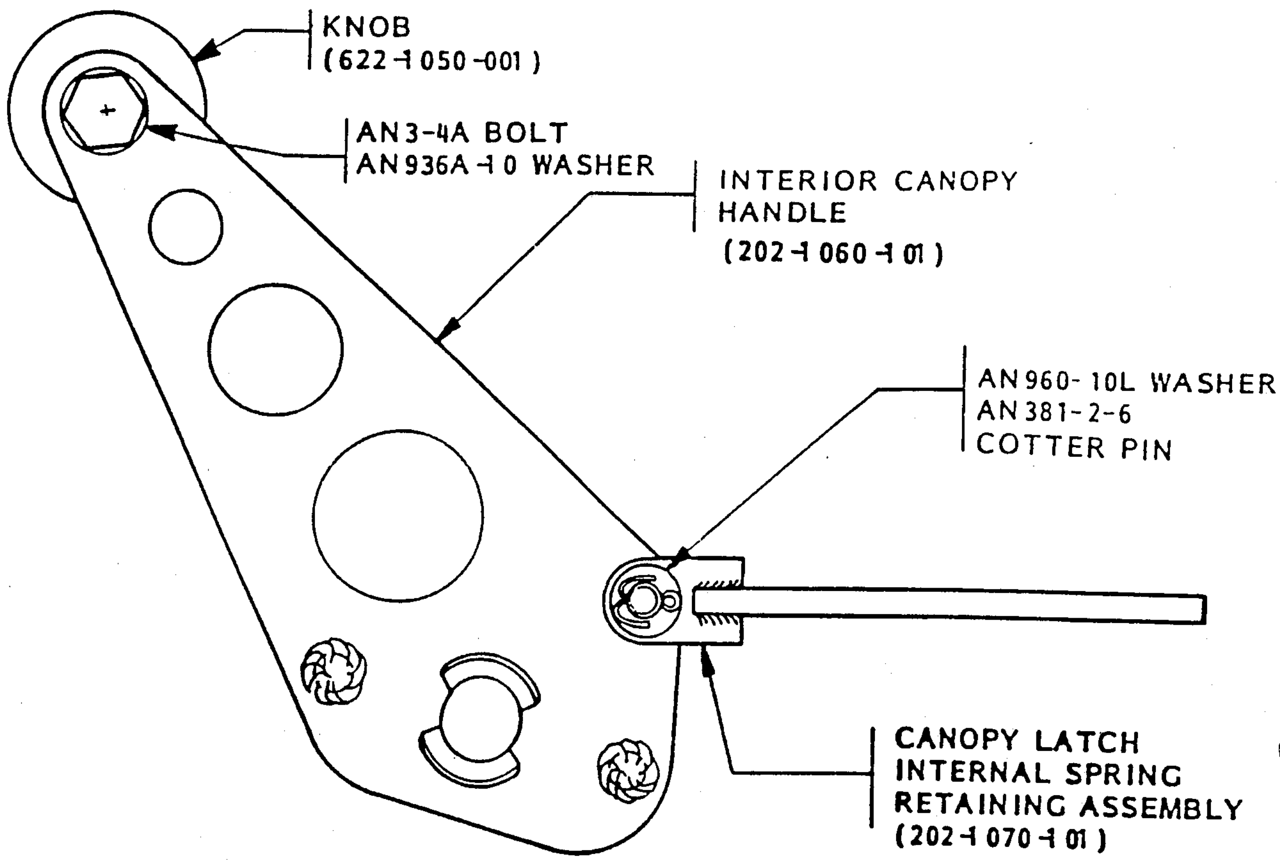
Install a NAS75-3-.100 bushing into each end of the forward and aft actuator bars (forward: 202-1057-001, aft: 202-1057-002), as shown in FIGURE (G-203). Use a small amount of Loctite on the outside edge of each bushing to securely lock it in place.

Assemble a (202-1054-001) locking pin onto one end of each of the forward and aft actuator bars using an AN393-11 clevis pin, AN960-D10L washer, and AN381-2-6 cotter pin, as shown in FIGURE (G-203).

Use a felt marking pen to mark the inboard faces of the actuator bars (shown in FIGURE [G-203]) on the ends of the bars opposite the installed locking pins. These marks will enable the actuator bars to be oriented properly when they are fastened to the interior latch handle.

Install the aft (202-1057-002) actuator bar with its attached locking pin into the canopy frame. Make sure the inboard face of the actuator bar is oriented inboard.

STEP AG-9 INTERNAL CANOPY LATCH HANDLE INSTALLATION



VIEW OF OUTBOARD FACE

L/H INTERIOR CANOPY HANDLE

FIGURE (G-204)

The internal canopy latch handle has (3) posts welded into it. The (2) posts on the inboard face are for attaching the actuator bars to the handle and the single post on the outboard face is used to attach the overcenter spring retainer arm.

Install the actuator knob (622-1050-001) on the inboard side of the internal canopy latch handle, as shown in FIGURE (G-204), using an AN3-4A bolt and AN936A-10 locking washer.

NOTE: Lightly grease the (3) posts and the inside of the collar on the internal canopy latch handle prior to assembling components to it.

Assemble the canopy latch internal spring retainer (202-1070-101) to the single post on the outboard side of the internal latch handle. Secure the retainer with an AN960-10L washer and an AN381-2-6 cotter pin, as shown in FIGURE (G-204).

Shorten the overcenter spring (772-0005-005) from its present length of 3" to a new length of 2-1/4". Slide the spring over the internal latch retainer shaft.

<u>STEP AG-10</u> INSTALLING THE INTERNAL LATCH SPRING RETAINER ASSEMBLY

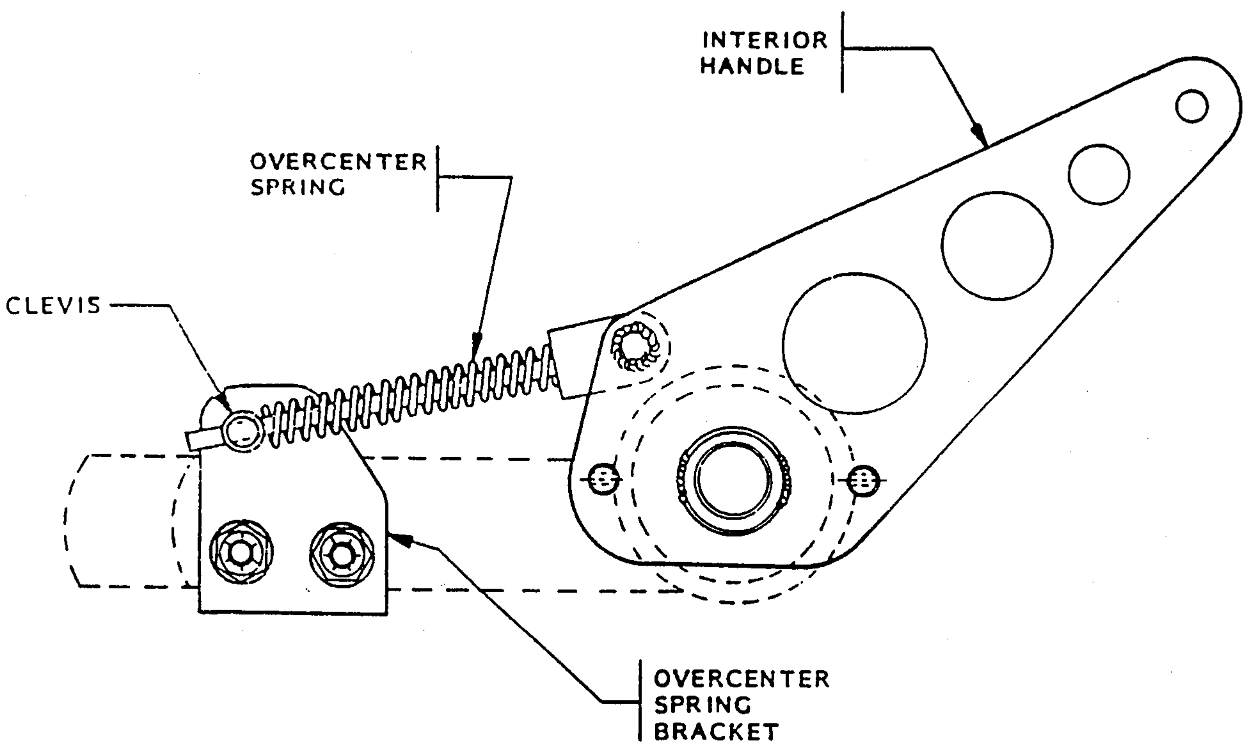


FIGURE (G-205)

Temporarily remove the exterior latch handle assembly to provide room for installing the interior latch handle.

Carefully move the interior latch handle into position while guiding the shaft of the latch spring retainer assembly through the hole in the clevis pin installed in the overcenter spring bracket, as shown in FIGURE (G-205). When the interior latch is centered over the pivot hole in the pivot housing, reinsert the exterior latch handle and housing through the pivot hole and through the collar on the interior latch handle.

Move the interior latch handle fore and aft to check for binding and proper overcenter spring action.

Carefully pull the internal latch handle inboard on the pivot post far enough to insert the (450-0420-004) 3/32" x .625" stainless steel pin into the hole in the pivot shaft. As soon as the pin is in place move the interior latch handle back into place over the pin. Secure the interior latch handle to the pivot shaft with a (450-5101-043) snap ring. Orient and install the snap ring as shown in FIGURE (G-206).

NOTE: The (450-5101-043) snap ring is bowed to apply a slight pressure against the interior latch handle as well as locking it onto the pivot shaft.

STEP AG-11 ATTACHING THE ACTUATOR BARS TO THE INTERNAL LATCH HANDLE

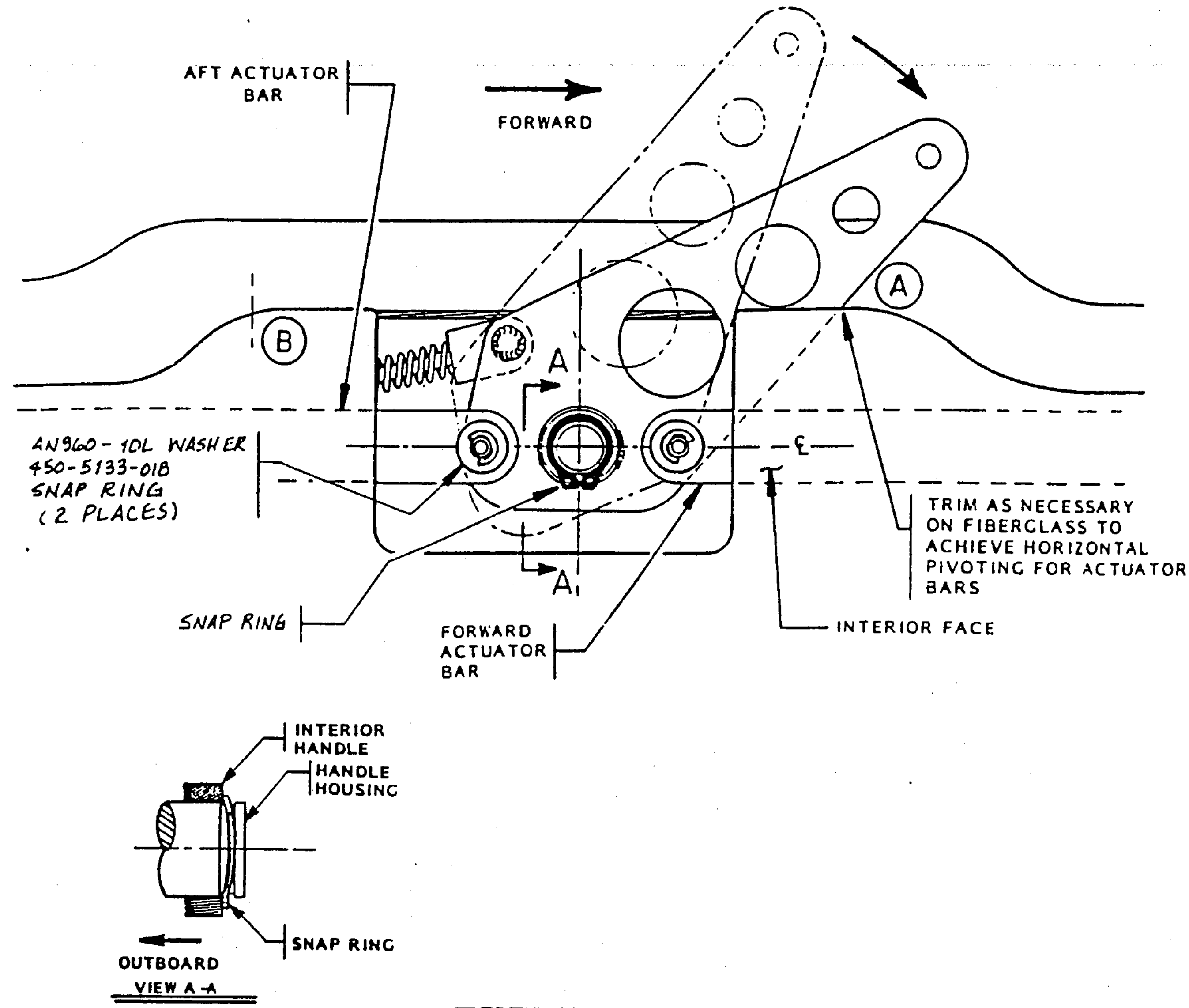


FIGURE (G-206)

Slip the aft actuator bar onto the aft peg on the inside face of the interior latch handle and secure the bar to the peg with an AN960-10L washer and a (450-5133-018) E-type snap ring, as shown in FIGURE (G-206).

NOTE: Instead of being grooved for snap rings, the actuator arm pegs on early latch handles were drilled for cotter pins. For these latches, assemble the actuator bar to the peg using an AN960-10L washer and an AN381-2-6 cotter pin.

NOTE: When installing the actuator bars onto the pegs of the interior latch handle, make sure that the inboard sides of the bars (marked with a felt pen earlier) are oriented toward the inboard side of the canopy frame.

Install and secure the forward actuator linkage assembly using the same procedures and hardware as for the aft linkage assembly.

STEP AG-12 SETTING THE TRAVEL STOPS FOR THE INTERNAL LATCH HANDLE

The forward and aft edges of the interior latch mechanism access cutout provide the travel stops for the interior latch handle. Use the narrow edge of a flat file to file notches in the edges of the access cutout to increase the travel range of the interior latch handle, as described in the following paragraphs.

File a notch of sufficient depth at Point A, shown in FIGURE (G-206), to allow the interior latch handle to move to the point where the centerlines of the actuator bars are aligned with the centers of the actuator bar attach pegs and the handle pivot post, as shown.

File a notch for the aft interior latch handle stop at Point B, shown in FIGURE (G-206). To determine the depth of the notch, move the exterior handle upward until the stainless steel locking pin seats firmly and the interior and exterior latch handles react simultaneously to the aft motion of the interior handle. With the exterior handle held lightly against the aft motion of the interior handle, file the aft stop notch to a depth at which the aft movement of the interior handle causes the exterior handle to move down sufficiently to just seat in the canopy latch recess.

NOTE: If filing the aft stop to the point where the exterior handle just seats in the canopy latch recess does not provide enough rotation to retract the locking pins into the canopy frame, double check that the correct handle housing has been installed on each exterior latch handle. Refer to Step AG-1.

CAUTION: Do not file the interior latch handle stop notches deeper than necessary as this could result in damage to the internal interconnect of the interior and exterior latches. If the aft stop notch is too deep, it could also allow the exterior handle to rotate past the handle recess, resulting in excessive wear on the airplane's exterior finish.

STEP AG-20 CANOPY LOCKING PIN INSERT INSTALLATION

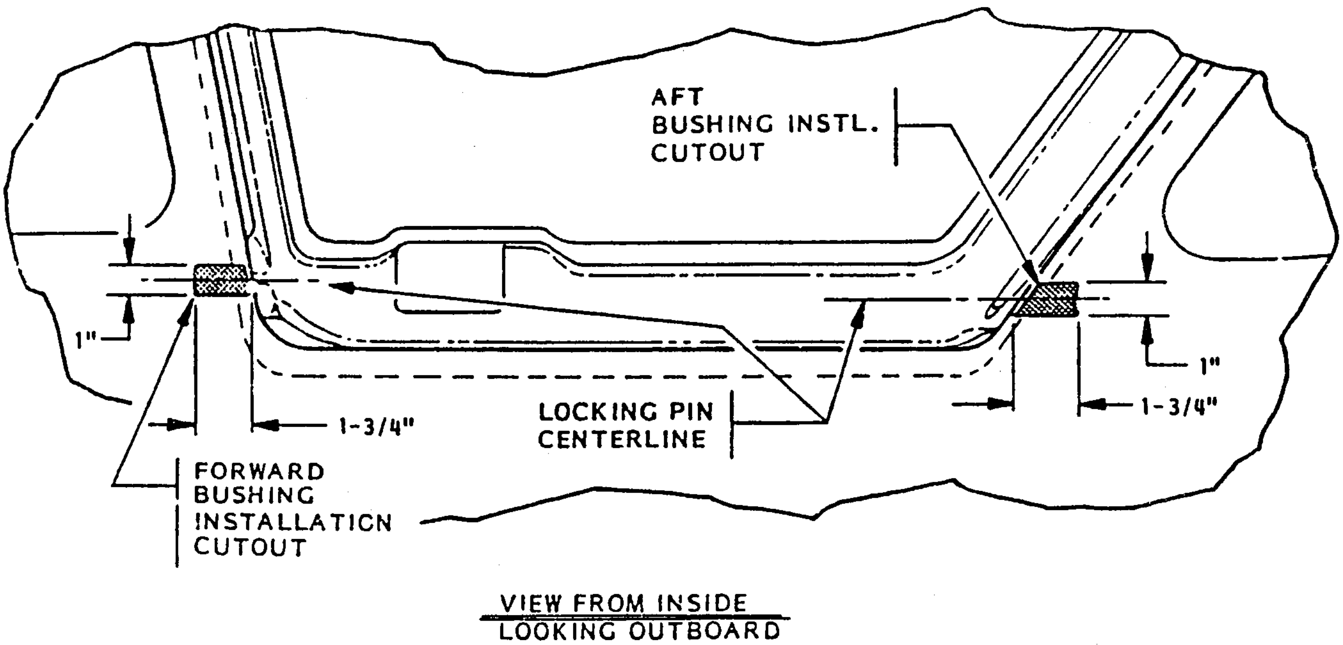


FIGURE (G-217)

The locking pins in the forward and aft ends of the canopy frame pass through the holes in the fuselage canopy frame and fit into inserts installed in the sides of the fuselage. To install the inserts for the canopy locking pins, the locking pin holes in the fuselage canopy frame must be drilled, and access cutouts must be made in the fuselage side for installing the locking pin inserts.

To determine the locations of the locking pin clearance holes in the fuselage canopy frame, place carbon paper on the sides of the canopy frame in the general area of the locking pin clearance holes. Close the canopy completely and carefully move the canopy latch toward the locked position (locking pins extended). The locking pins will press the carbon paper against the sides of the fuselage canopy frame, marking the centers of the locking pin clearance holes.

Open the canopy and use a #20 drill to pilot drill locking pin clearance holes in the fuselage frame. Enlarge the pilot holes in small increments to adjust their exact locations, as required, until 1/2" diameter holes have been drilled in the fuselage frame. Each locking pin clearance hole must be positioned such that the latch mechanism can fully extend the locking pins, and, when the locking pins are extended, the canopy frame outside surface is flush with the outside surface of the fuselage.

Relieve the interior fuselage laminates to form the locking pin insert installation cutouts, as shown in FIGURE (G-217). Remove the foam core in the installation cutouts also.

Install the forward (202-1058-003) and aft (202-1058-001) locking pin inserts using similar techniques and materials as used in Step AG-17 for the hinge pin inserts. Fill the remaining voids in the installation cutouts with scrap foam and cover with (2) bidirectional laminates, as described in Step AG-17.

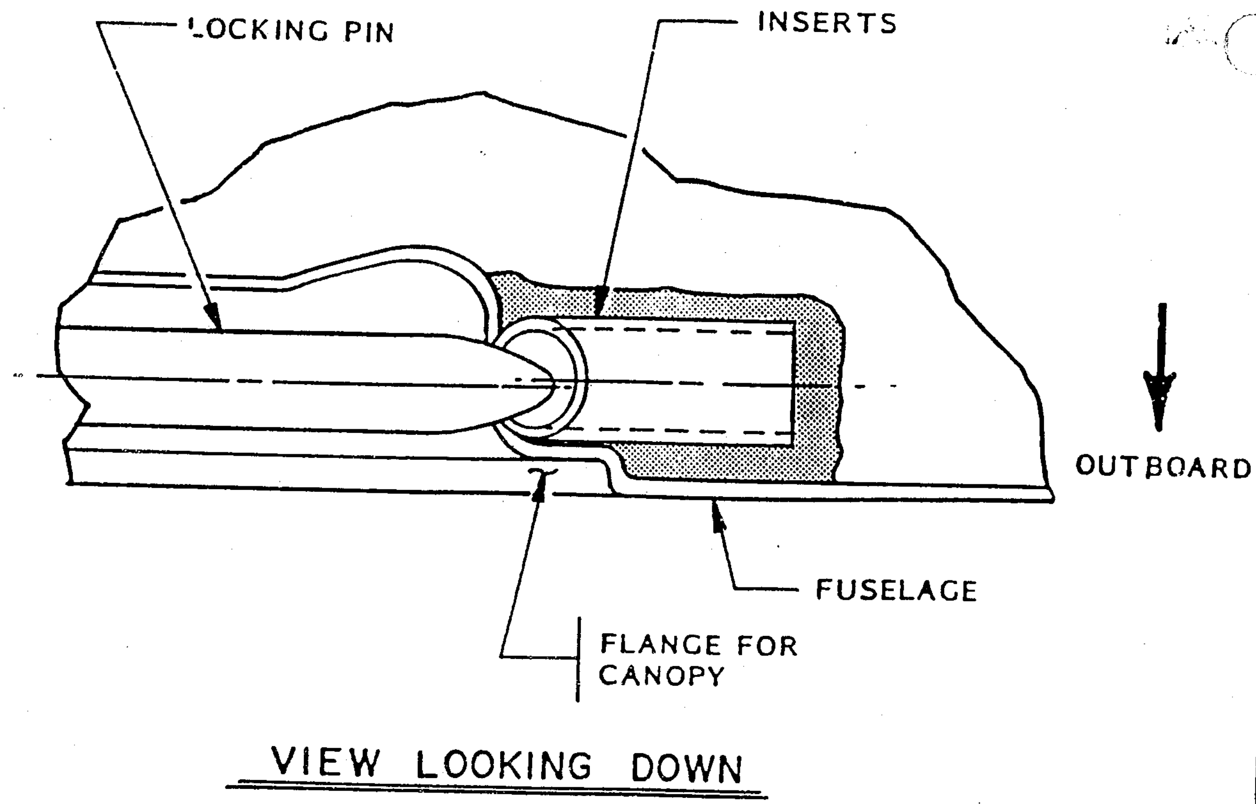


FIGURE (G-218)

NOTE: When installing the locking pin inserts, do not remove any of the fuselage laminates on the inside of the canopy recess (other than the bushing installation holes previously drilled), as shown in FIGURE (G-218).

INSTRUCTIONS

CAT # 395-5S 12 Inch 395-5S-1 24 Inch
395-5SB 12 Inch (bendable) 395-5S-1B (24 Inch bendable)

GENERAL INFORMATION

The fuel sender works by supplying a minute amount of precise power to the outer aluminum tube of the probe. The amount of this power is induced into a second conductor inside the tube (and insulated from it) depends upon the resistance values of the mediums seperating the two conductors. A microprocessor in the head of the probe measures the induced potential, amplifies it and sends it to the gauge. As the amount of fuel in the probe decreases from burnoff, the amount of air increases, thus continuously changing the amount of power being induced.

The electronics are epoxy-potted to isolate them from weather, fuel spills,etc. The system will work properly with nearly any hydrocarbon based compound, ranging from kerosene to diesel oil.

Because the electronics are designed to measure hydrocarbons, the gauge will read FULL if the probe touches water, providing another way to determine if the fuel tank has been contaminated. The probe will also read FULL if it touches metal. Therefore when planning installation, care must be taken to isolate the probe from any possible contact with metal.

Turbulance induced fuel (slosh) has little effect on the system because the fuel being measured is inside the probe and the fuel cannot move fast enough to effect the gauge.

The probe length is determined by the depth of the tank and the owners decision as to the amount of fuel to be kept in reserve. Probes are supplied in increments of one foot , so it is necessary to know whether the tank is 12" or 24" deep. The user trims back the probe to the depth determined, using a tubing cutter. Then calibrates the probe, by adjusting the EMPTY and FULL trim pots in the probe head, following the intstructions.

NOTE: The minimum a 12" probe can be cut back is 4 1/2" measured from the plastic boss the probe tube is mounted in. A 24" probe can be cut back to 12 1/2".

The standard probe head is 1" high including the studs.

The probe is dead accurate, reading linearly. However most fuel tanks are not linear (the sides are not parallel with the probe. As a result most gauges will be off at some point in the needle travel. Depending on the shape of the tank, some reading may be off to some degree. The amount of which can be carded adjacent to the gauge or on the gauge glass.

If a probe location requires the probe to be bent, a benable probe must be used, as standard probes must not be bent. The bendable area of the probe is marked by a blue line on the tube approximately 3" from the plastic boss. (Bend the tube only in this area. Do not bend the area between the blue mark and the open end of the probe this must remain straight). The blue mark represents the full level of the probe.

The standard system is a single probe reading to a single gauge, or two probes reading to a single gauge through a left/right switch. However if you have multiple tanks, dual, triple and quad instruments are available.

Do not use rectifier/regulator to operate system, you must use a battery, Or 329-LPA to operate off of lighting coil. The gauge will go to full for 1/2 second when power is first applied.

SENSOR PREPARATION

Measure the depth of your tank, from the outside top to the bottom.

Using a tubing cutter, cut the outside tube approximately 1/4" shorter than the measured depth. Remove the outer tube and cut the inside tube, using a pair of wire cutters (do not let the inside tube touch the ouside tube). Use the insulators from the piece that was cut off and slide onto the inside tube to prevent the two tubes from touching. The meter will peg full if the two touch.

When using a bendable probe, the tube does not have to run straight up and down. It may be more practical to have it run diagonally.

!!! CAUTION !!!

disconect battery before making any electrical connections

The probe is a 12 VDC unit. Use a 680 ohm 2 watt resistor for 28 VDC. in series with the red lead of the probe.

Do not use battery charger for calibration or operation.

We recommend that you use a tube or tank of fuel the same depth as you fuel tank for calibration, as this procedure requires you to remove the probe from the tank several times.

Be sure the unit is dry before you attempt to calibrate. Residual fuel left inside the probe will give erroneous readings and affect the calibration. If your unit has been immersed in fuel, let it dry before you calibrate. The empty and full adjustment screws are located on top of the unit. A small slotted screwdriver is required to make the adjustments.

Turn both the empty and full adjustments full cw (clockwise) position. Make the wiring connections as shown in the illustration.

Slowly turn the empty screw ccw (counter clockwise) until the needle on the gauge goes to the empty mark. The needle should be on or just below the empty mark. Now turn the screw cw to make sure the needle starts to move upscale immediately, then turn ccw until the needle returns to the empty mark. This is the empty reference mark. Repeat this step until you are sure the empty reference is obtained.

Put probe completely into fuel. Turn the full screw ccw until the needle indicates the fuel level in your container. For best results the probe should be completely immersed in the fuel. If you accidently adjust below your actual tank level, turn the full screw to the full cw position, then ccw to indicate tank level.

Remove the probe from the fuel, the needle should go to the empty mark or just above. Shake the probe a few times to remove the residue fuel. The needle should now rest on the empty mark.

INSTALATION

Place the gasket on the sender unit. Align the holes and apply a sealer such as permatex on the gasket. Put a small amount of sealant in the mounting holes and insert the mounting screws.

Place the sending unit in the tank. Note the holes are not symmetrical, rotate until the holes line up, then tighten down the mounting screws.

Connect a wire from the sender terminal (yellow) on the sender to the sender terminal on the gauge. (see gauge instructions) Connect a wire from the neg terminal (black) to a ground buss. Connect a wire from the pos terminal (red) to a pos buss. (master switch) 12VDC.

This completes the installation. Put a generous amount of sealant over the wire terminals and the adjustment screws.

Connect the battery and turn on the main switch, the meter will go above the empty mark then to the correct fuel level.

PROBLEM ?

Symptom: Meter pointer stays above full mark when the main switch is turned on.

1) full tank of fuel.
2) water in fuel tank.
3) meter not grounded properly.
4) sender wire is touching neg. terminal or wiring.
5) center rod is touching the outside tube.
6) sender not calibrated.

Symptom: Meter pionter stays at empty

1) no power to sender.
2) no power to gauge.
3) sender not connected to gauge.

Symptom: Meter fluctuates

1) wire connections loose.
2) wire connections corroded.

LOCATIONS

See the illustration below for six possible locations for fuel probe in various difficult tank locations.

(1) This is an installation of a bendable probe from the wing tip end of a wet wing or wing tank. This will work, but the probe may be very long up to 96", causing extra intallation steps. Probes over 24" are 1/2" OD for strength, but an eight foot probe will require additional support inside the tank.

(2) This is a bottom mount system, required at times when the only opening or space available is at the bottom of the tank. No problem with installation, except obvious care must be taken to seal the opening and bolt holes.

(3) This is a 90 deg. bendable probe installation in a wet wing. The problem here is that the probe will not be reading the total depth of the tank. It can, however, be calibrated to read accurately once the fuel level reaches the readable portion of the probe.

(4) This is a standpipe installation. A good solution to the mounting problems posed by wet wings. It requires the builder to create a standpipe in which to mount the probe. The standpipe can be made of any non metallic material such as abs, pvc or fiberglass. It should be longer than the height of the fuel and mounted in any convenient location. The top of the stand pipe should be equivalent to the height of the fuel in a full tank and the bottom an inch below the bottom of the tank. The diameter of the standpipe should be a minimum of 1/2" ID and be topped by a 3" D. flange on which to mount the probe. Plumb the standpipe to the fuel line (a tee will work) and vent the top of the standpipe back to the tank, directly outside through a fuselage vent or to a fuselage vent system.

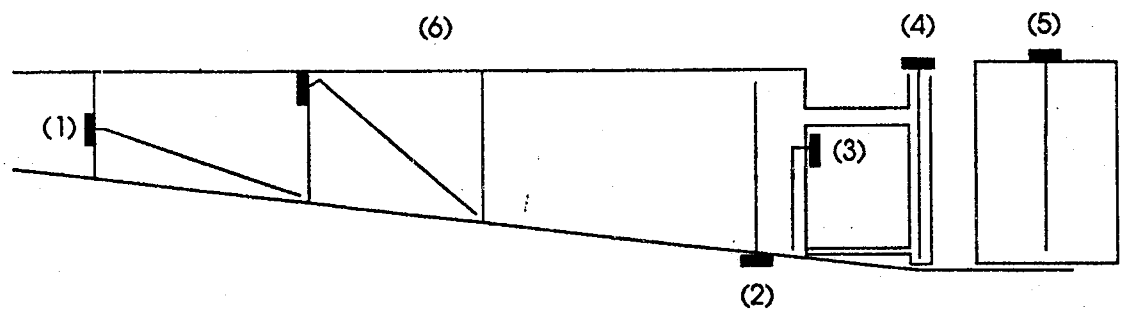
If the machine has a header tank whose top is lower than the wing fuel level at full, a standpipe can be extended from the top of the tank in which to mount the probe.

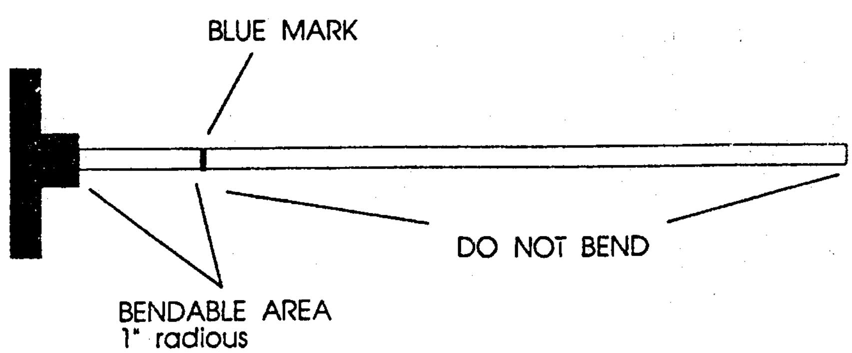
(5) This is an example of a probe installed in a header tank which is as high as the fuel level in the wings at full.

NOTE: These instructions are to be used with Westach probes, that are used with Westach 240 ohm single or multiple gauges.

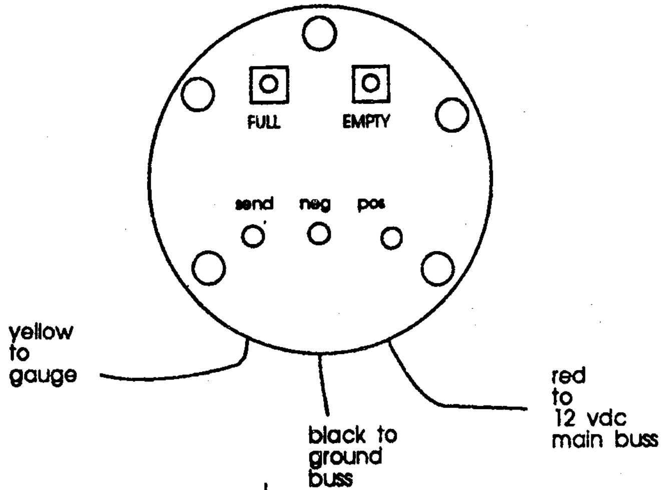
Probes to be installed from the bottom up may be calibrated in the right side up position.

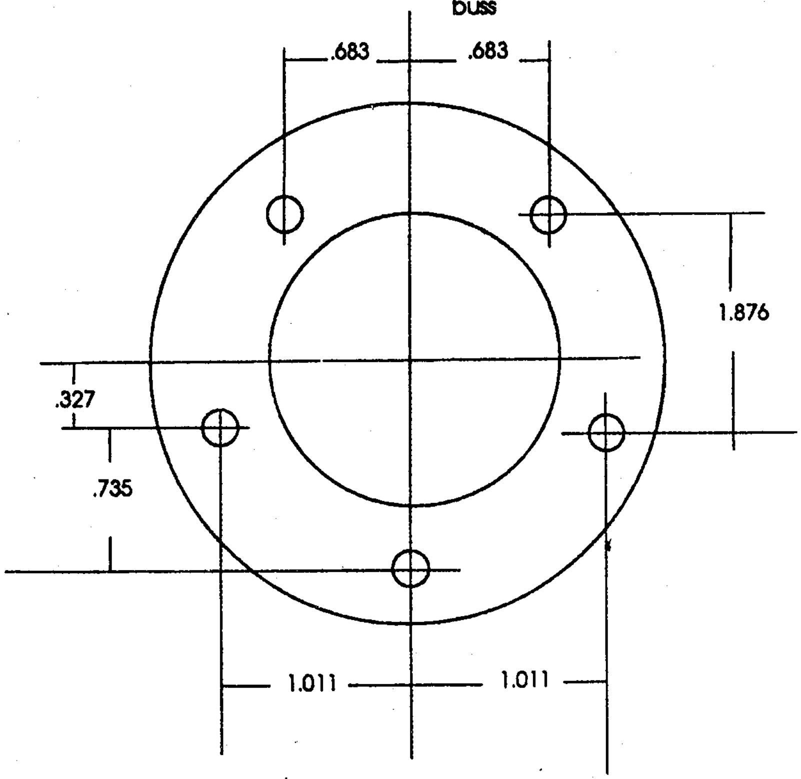
Note; When using the bendable probe as in #1 and #3 you may wish to slightly bend the probe up then down diag. This will allow you read more fuel. See fig. #6





ILLUSTRATION





WARRANTY

WESTACH INSTRUMENTS are made with the highest quality material and workmanship. With reasonable care, instruments will give long and satisfactory service. WESTACH INSTRUMENTS are guaranteed against defective material and workmanship for 1 year of service or 18 months from the manufacturing date.

WARRANTY REPAIR , No charge will be made for labor and material consumed in affecting repairs in units which are covered by our warranty. Package carefully including description of malfunction and type of engine unit is used on. Include your correct return address and phone number. Our obligation is limited to correct and return instruments prepaid and covers no liability for damage from shipment, improper installation, excessive vibration, rough handling or if opened, tampered with or modified b customer. WESTBERG MFG. INC. WILL NOT REIMBURSE CUSTOMER FOR COST(S) INCURRED IN REMOVING AND/OR REINSTALLING REPLACEMENT PARTS. The manufacturer reserves the right to make changes at any time in the design and price of its equipment without notice. (For quick returns UPS-next day, send $20. or 2nd day, send $10.)

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