

CHAPTER 6: CENTER STUB WINGS

REVISIONS

From time to time, revisions to this assembly manual may be deemed necessary. When such revisions are made, you should immediately replace all outdated pages with the revised pages. Discard the out dated pages. Note that on the lower right corner of each page is a "revision date". Initial printings will have the number "0" printed and the printing date. All subsequent revisions will have the revision number followed by the date of that revision. When such revisions are made, a "table of revisions" page will also be issued. This page (or pages) should be inserted in front of the opening page (this page) of each affected chapter. A new "table of revisions" page will accompany any revision made to a chapter.

ARROWS

Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that particular assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows. That old cartoon of the guy agonizing over the plans for his canoe, built one end up, one end down, should not happen in real life. Especially to you.

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Chapter 6
CENTER STUB WINGS

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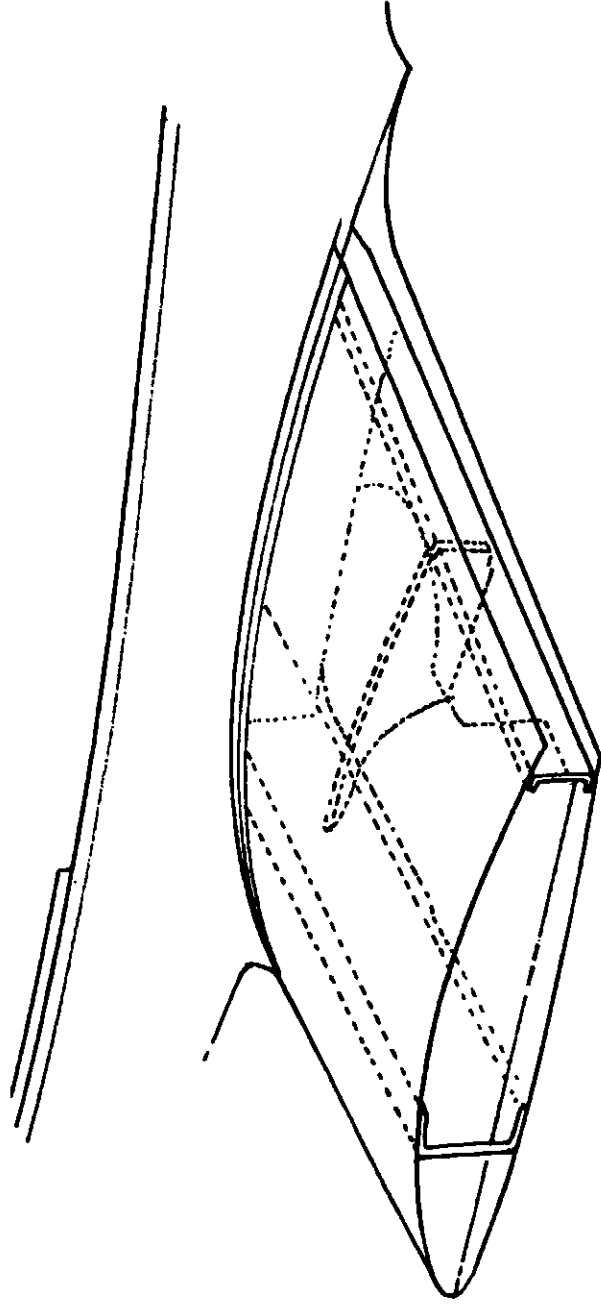
1. INTRODUCTION

The inbound wing sections (stub wings) extend from fslg fillet to the BL 50 position. The partial rib will be installed per figure 6-1. It can be installed at a later time if preferred. The stub wing skin should be installed permanently only after the outbd wing skin alignments have been checked. It is not necessary to have the outbd wing skins to perform this check. The stub wing skins can however be temporarily clecoed into position, thus if slight changes are required, they can be easily accommodated.

The final fit and attach will require the fslg to be inverted and levelled.

Stub wing

Figure 6-1



For purposes of section continuity, the stub wing section will end with the permanent bonding in position of the upper stub wing skin. It is recommended that the flap linkage be installed into the stub wing prior to the permanent bond. The installation can be accomplished later but it is a bit easier with the stub wing skin removed. See Chapter 10 section "E" page 10-24, titled "Flap bellcrank assembly into fslg and stub wing".

2. DRAWING LIST

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3. **EQUIPMENT REQUIRED**

A. **Parts**

- 1/2" foam
- pop rivets (about 3 doz.)
- 2 carriage bolts or similar (approx. 3/8" dia. x 1 3/4")



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B. Tools

- BL 50 rib template
- BL 50 wing jig (fabricate out of 5/8" particle board or similar)
- Water level
- Cleco tool & clecos



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C. Materials & supplies

- epoxy
- flox
- BID cloth
- structural adhesive



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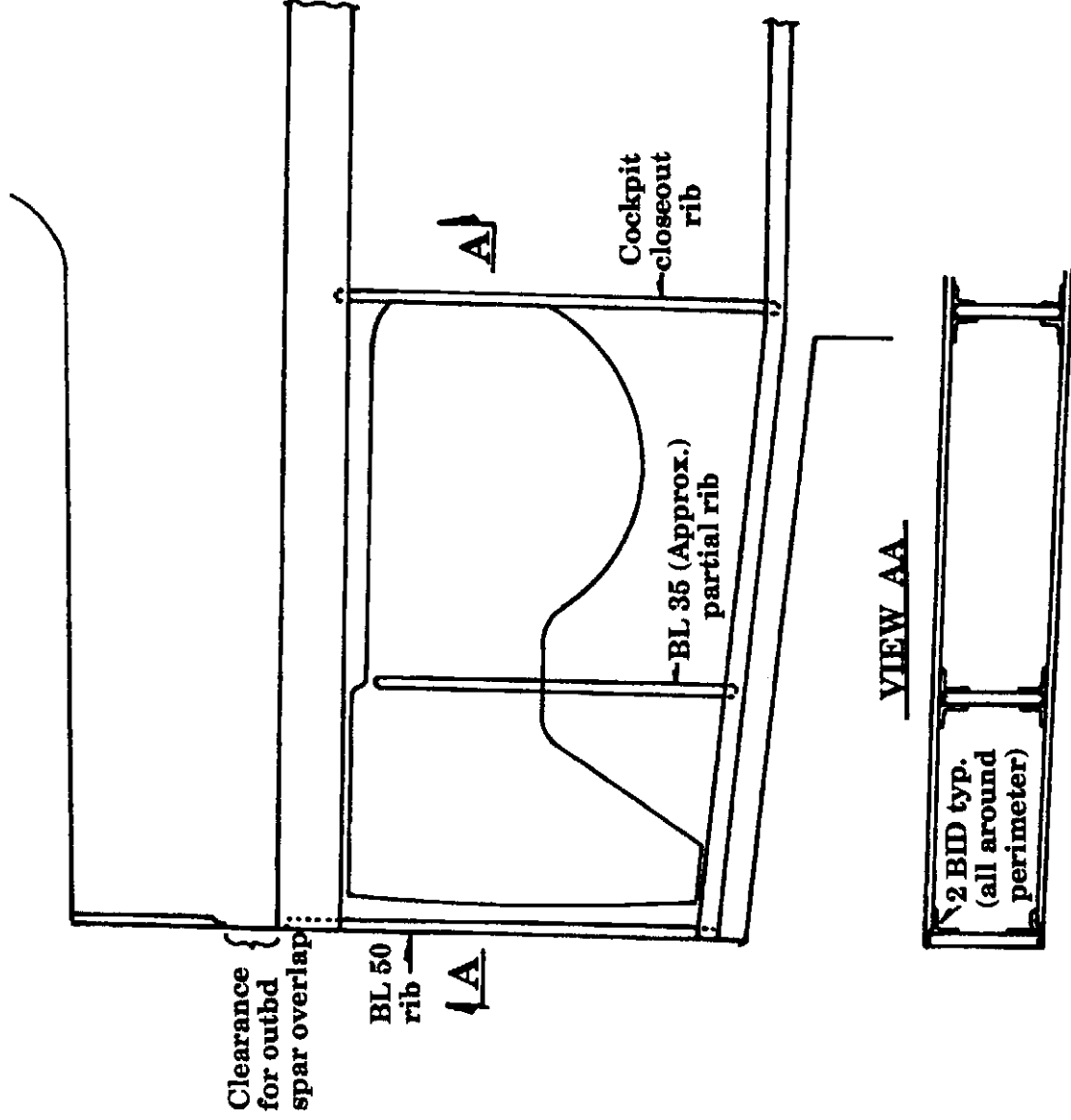
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4. PROCEDURE

- A. Installing partial ribs**
1. With the fslg upright, fit and install the partial ribs per figure 6-2, see blueprint "C". This rib requires 2 BID per side oriented 0° - 90°. Use micro to bond into position and attach with 2 BID all around. It is advisable to leave the upper contoured section a little tall so that a good fit can be established against the upper stub wing skin. Spanwise location of this partial rib is not critical, the nearest inch is acceptable. This rib can also be installed after the stub wing skin is attached, it makes no difference.

Fitting partial ribs

Figure 6-2

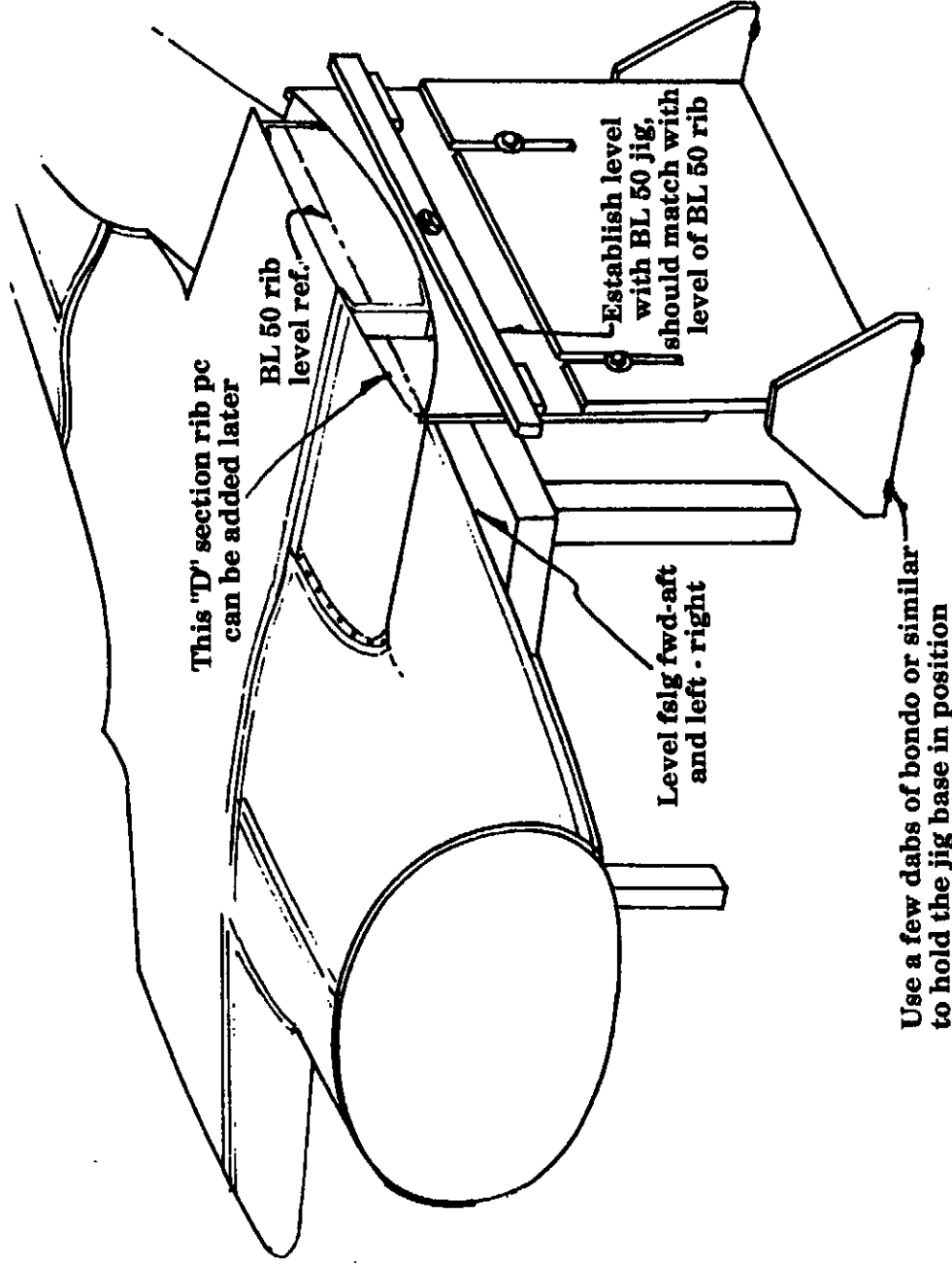


NOTE: It is important to check the fit of the gear doors during the installation of this partial rib. Often that lower portion of the belly pan stub wing which juts fwd in the middle will flex downward or upward. The partial rib will lock its position so check that it is correct by using the gear doors themselves as a fit checking tool.

2. With the BL 50 ribs already fitted and installed, theory would have it that all you would need to do is simply see that the stub wing skins fit snugly to these ribs. In theory, that's true but it is quite easy for a builder to be slightly off in either contour or incidence alignment of these ribs. So, the best method of accurately establishing the upper stub wing skin position is to use a wing contour jig.
3. Trim the stub wing skins so as to have no more than a 1" joggle where they will attach to the fslg fillets. Do not trim anything from the outbd end at this time.
4. Level the fslg in the inverted position.
5. Make a BL 50 upper surface wing jig per figure 6-4. You'll need two of them. If you can possibly make both outbd wings at the same time, then you will also need two similar type jigs for the wing tips. If space requires that you do only one outbd wing at a time, then you'll only need one tip jig.

Levelling BL 50 rib

Figure 6-3



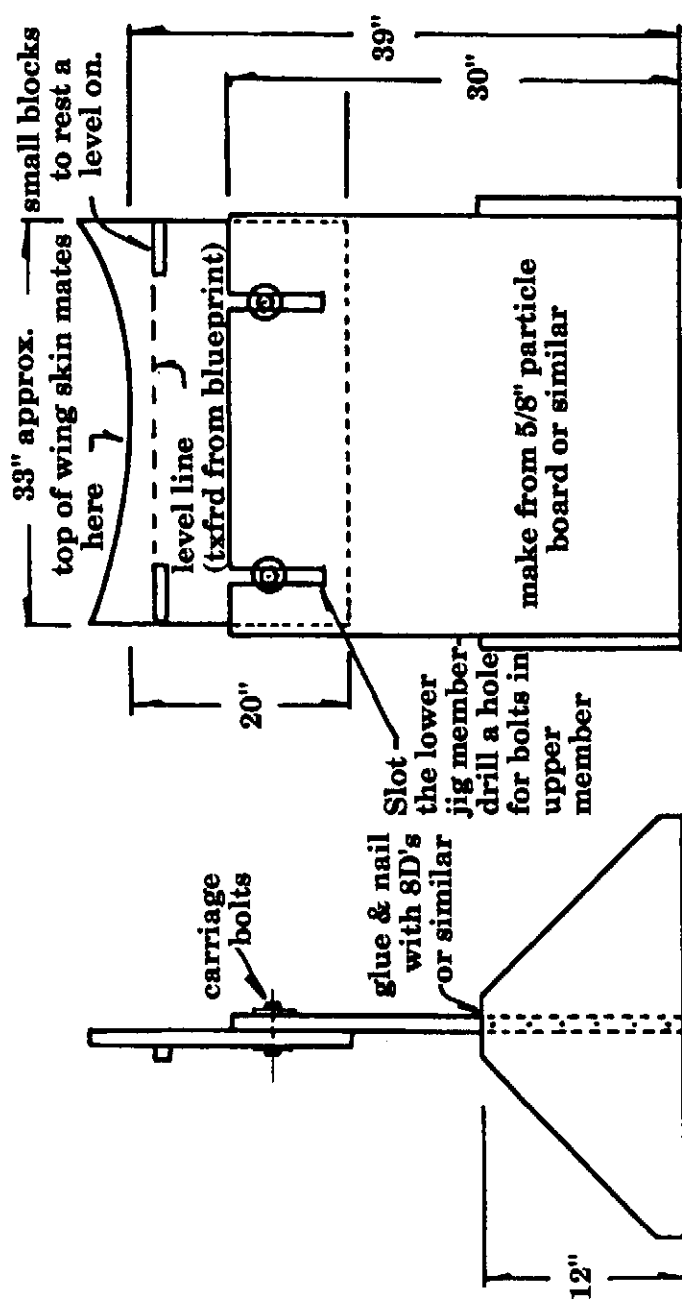
6. You have already fitted the outbd spars and wing tip patterns once when you were checking and establishing the proper fit for the bellypan. It is best to once again attach these outbd wing spars to accurately establish the best alignment of the inbd wing stub skins. If you have the full Lancair kit (vs. just the "A" kit), it will be best to assemble the outbd wings in conjunction with the stub wing skins. This is not, however, necessary.
7. Bolt up the outbd wing spars with a temporary wing tip rib attachment. You could also, at this point, use the wing tip jig instead of the tip rib itself. For the wing tip alignment, use the same 8" dimension from aft face of the outbd spar web to L.E.

8. Position the stub wing skin onto the fslg by first pressing it firmly into the L.E. joggle on the fslg fillet section where the two will interlock. Set one cleco there.

NOTE: Do not drill any cleco holes directly over any spar cap areas. Drilling holes through spar caps will destroy their structural integrity and could result in structural failure. Clearly mark these areas off.

Wing tip jig

Figure 6-4



NOTE: These vertical dim's are correct for use with a 30" high bench (onto which the fslg would be placed inverted on longerons).

Cut 4.5" off bottom dims when building the wing tip jig (it will also be a little narrower)

9. Now, the stub wing skin can be adjusted off this cleco. Run a string line from inbd wing fillet to outbd wing tip. Swing the stub wing skin until it properly aligns with the string line at BL 50. This will determine the best possible L.E. alignment of your wing sections and generate a straight wing L.E. Mark the position and/or drill for the remaining clecoes along the fslg/stub wing interlock joggle. **DO NOT DRILL THROUGH FOR CLECOES OVER ANY OF THE SPAR CAPS!!**

The dimension at BL 50 from the spar web to L.E. is typically $9 \frac{3}{4} \pm 1/8$ ". However, the above described method is basically fool proof.

10. Next, position and slide up the BL 50 wing jig. It should make a smooth contact along the surface of the wing. With the fslg level rechecked, check the level reference on the BL 50 jig, they should match up. If they do not, perhaps the BL 50 rib, positioned earlier, was not properly positioned. The jig is your best alignment source.

11. Next, check the trailing edge alignments from inbd upper wing skin to outbd wing tip. A straight line should be established. Since the inbd T.E. fillet is established and the wing tip is established, the only alignment corrections possible are at the BL 50 T.E.

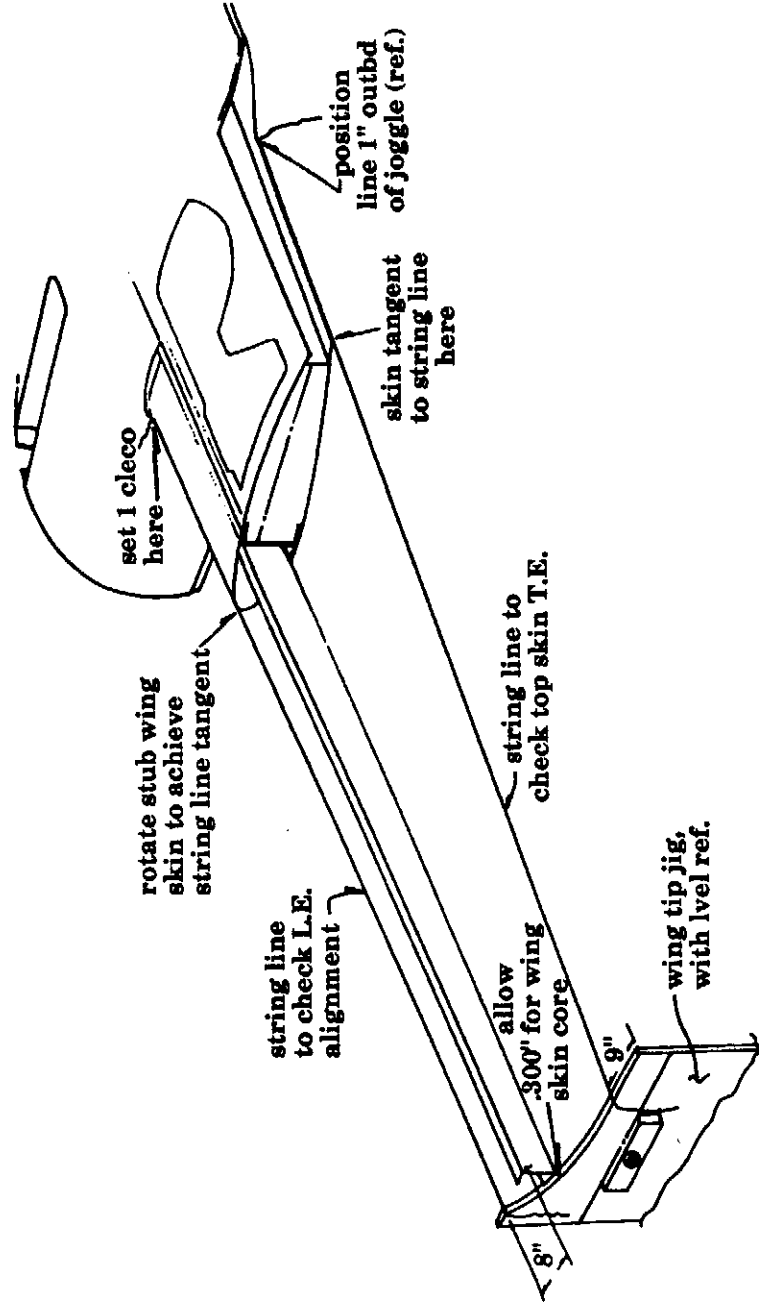
It is best to use a long straight edge clamped from inbd fillet to wing tip, particularly when attaching the outbd upper wing skins. When only attaching the inbd stub wing skins, a short straight edge aligned to the string line is O.K.

NOTE: When checking with the string line, the inbd end of the string line should be held tightly against the surface of the wing and slightly outbd of the fslg joggle since that joggle is on a section of the stub wing which is still rolling down to meet the wing contour. Hold it outbd by approximately 1" - 2".

While the stub wing skin is in position, mark the BL 50 trim line. A nice straight line is primarily what you want to establish. When the stub wing skin is removed, trim to that line before attaching permanently.

BL 50 string line

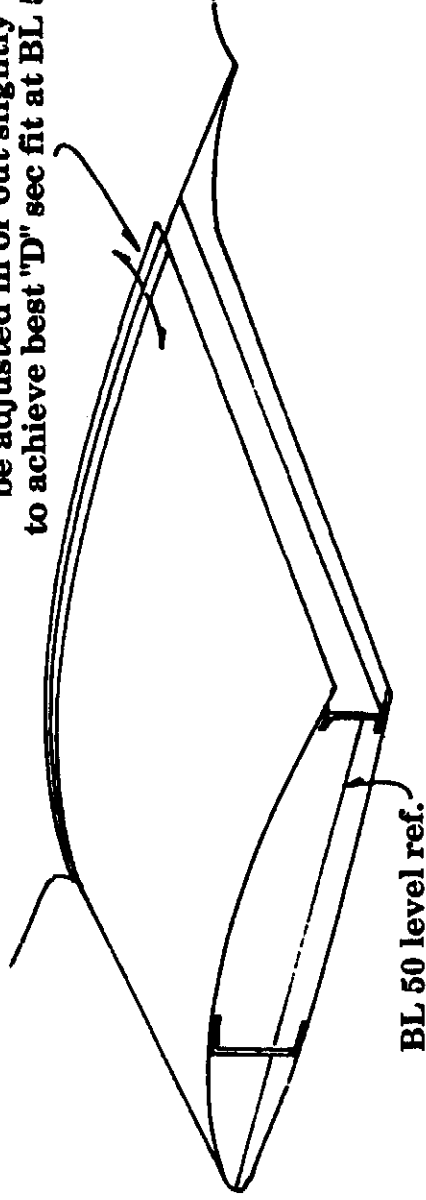
Figure 6-5



BL 50 level reference

Figure 6-6

approx 2" double joggle can be adjusted in or out slightly to achieve best "D" sec fit at BL 50



12. With all of the above position checks made, you're ready to bond the stub wing skins into permanent position. Prep the surfaces as usual (36-50 grit sanding with a good cleaning etc.) and spread a coat of structural adhesive onto the fslg fillet joggles - spread a coat onto both surfaces.
13. Often, a filler is required between the skin and the aft ctr spar cap - use micro for this filler. A filler is also often required between the fwd spar cap and wing skin, use flox for this filler. Use micro along the BL 50 rib/skin joint line. For the main spar filler, use plenty of flox so that you get a good squeeze out when clamping into position. Scrape off all excess. Also, place plastic tape over the outbd spar caps and along the ctr main spar web on the fwd face so if adhesive squeezes out in the "D" section, it won't get permanently stuck to anything.
14. Slip the skins into position and set with temporary pop rivets along the fslg joggle. Use light clamping pressure along the main spar bond lines. Use a straight edge to hold the T.E. in proper alignment and straight. Slide the BL 50 wing jig up into position and recheck for level alignment. Allow to cure.
15. After cure, add the BID tapes. These are typically 2 BID along all surface junctures except at the upper main spar cap line, use 3 BID there.

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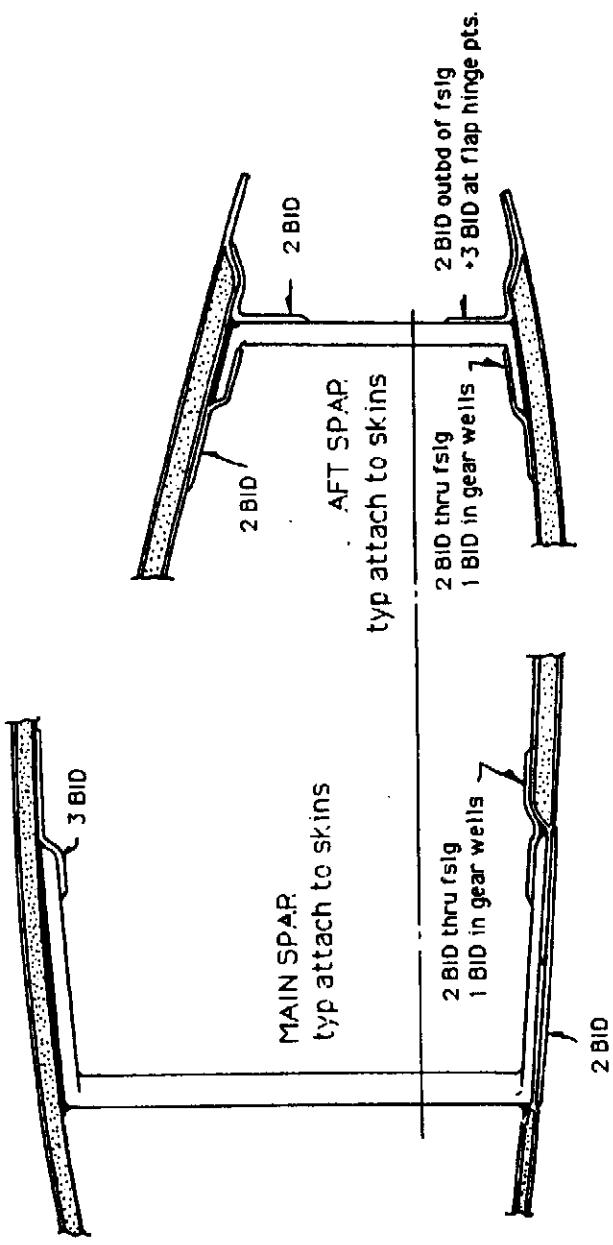
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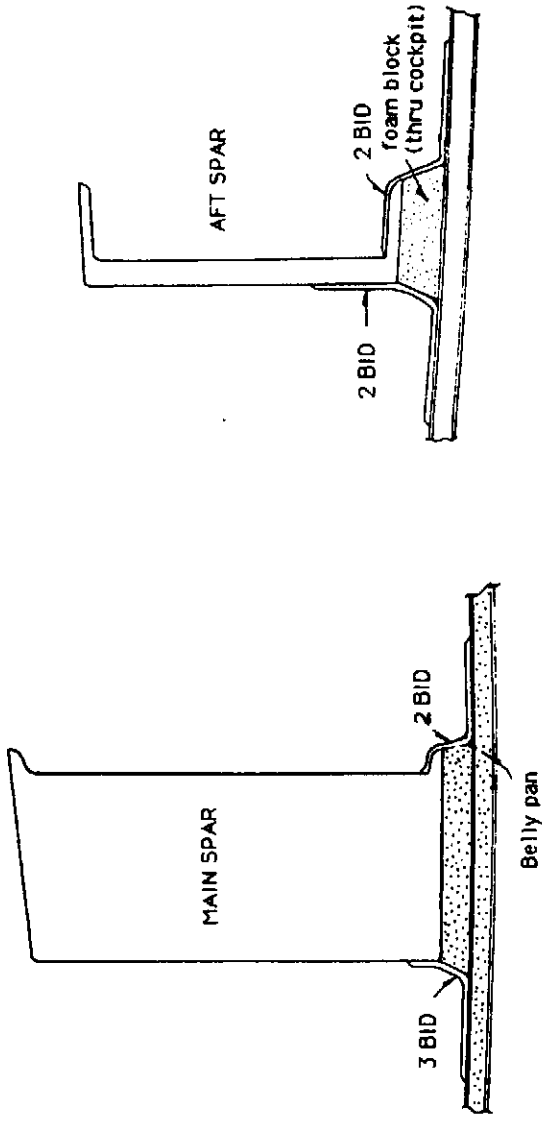
Wing Skin/Spar and Spar Fslg Attachment

Figure 6-6b

TYPICAL SPAR TO WING SKID ATTACHMENT

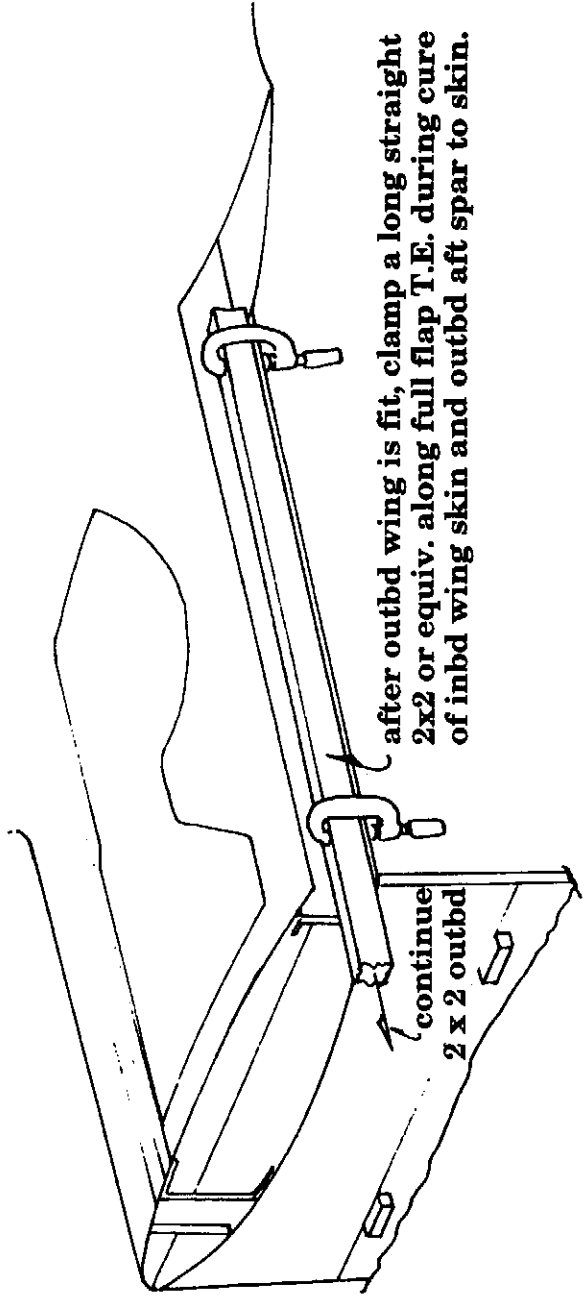


TYPICAL SPAR/FSLG BOTTOM PAD ATTACH



Clamping straight edge to trailing edge

Figure 6-7

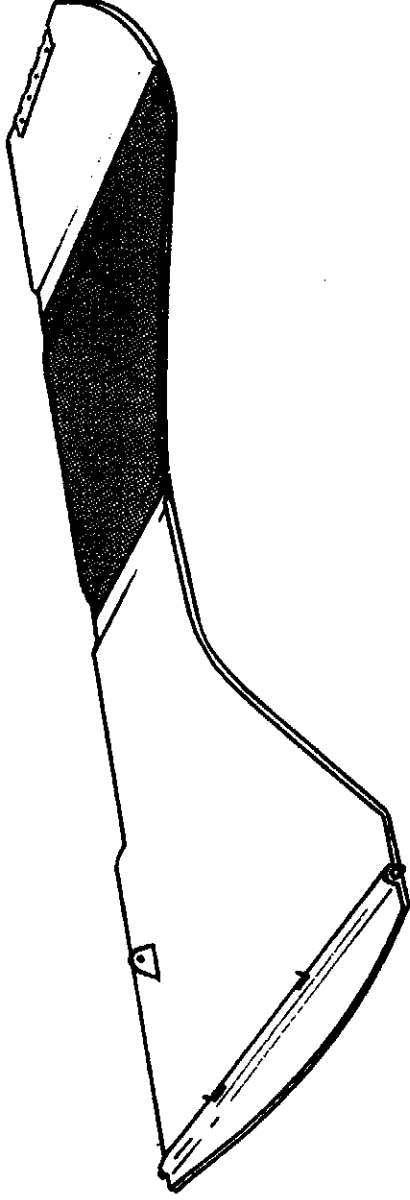


B. Main gear middle doors

With the fslg still in the inverted position, it is advantageous to complete the landing gear door installations.

Main gear middle doors

Figure 6-8



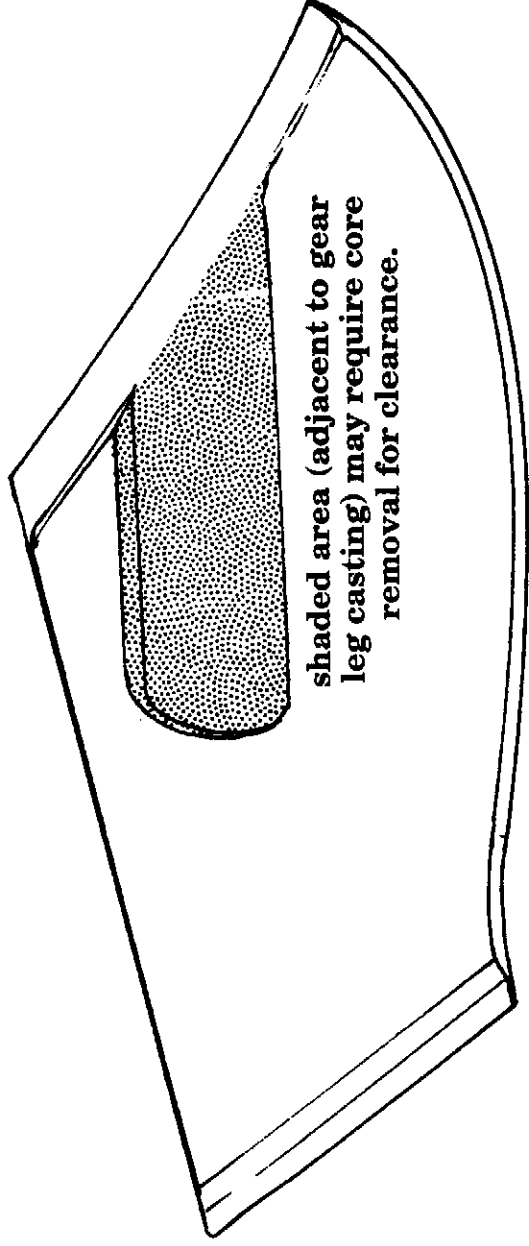
NOTE: it is best to not fit the middle gear door until you have established the desired main gear length which can vary somewhat by choice. See page 5-9, figure 5-3. Any variation in the length of the compression assembly will swing the gear leg and thus affect the gear door orientation on it.

1. With the main gear itself all installed, place it in the retract position and fit the middle door in its proper position (mating to the lower wing skin).
If there is any interference with the landing gear leg preventing a flush fit of the door, mark the interference area for adjustment.

The gear is quite close to the inner skin at this middle door location and sometimes requires the removal of the 1/4" core material in order to achieve a truly flush fit of the door to the lower wing skin. If this is the case, cut the inner skin in the proper area along the gear leg and scrape out all the core material. Add small 1 BID pieces to seal off the core and proceed with the installation.

Removing core material for adequate clearance

Figure 6-9

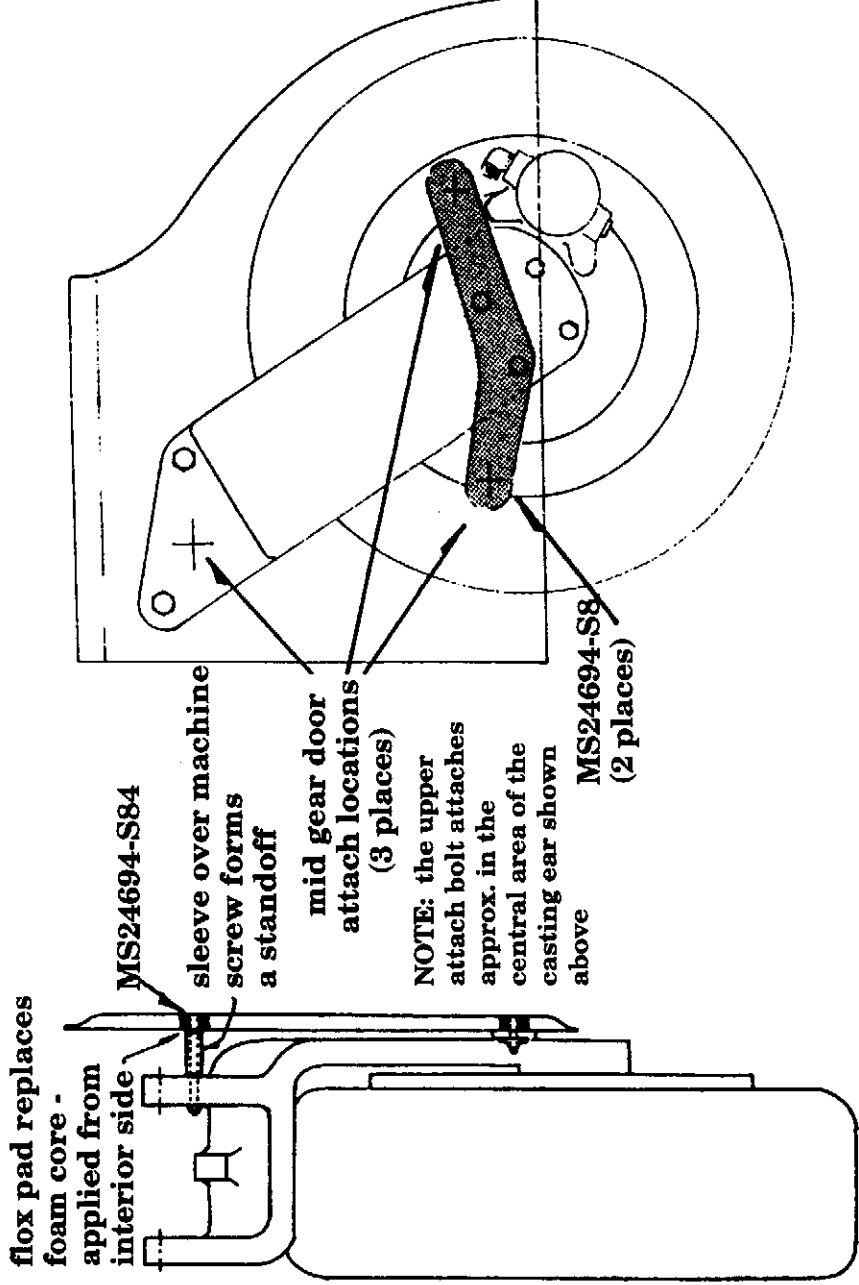


shaded area (adjacent to gear leg casting) may require core removal for clearance.

2. From some .090 aluminum, form an attachment bracket similar to that in figure 6-11. This will attach through the upper two landing gear axle bolt locations and extend outward to attach to what will be the lower portion of the middle gear door (if viewed while in the gear down position).
3. Attach this above bracket using the two axle bolts.

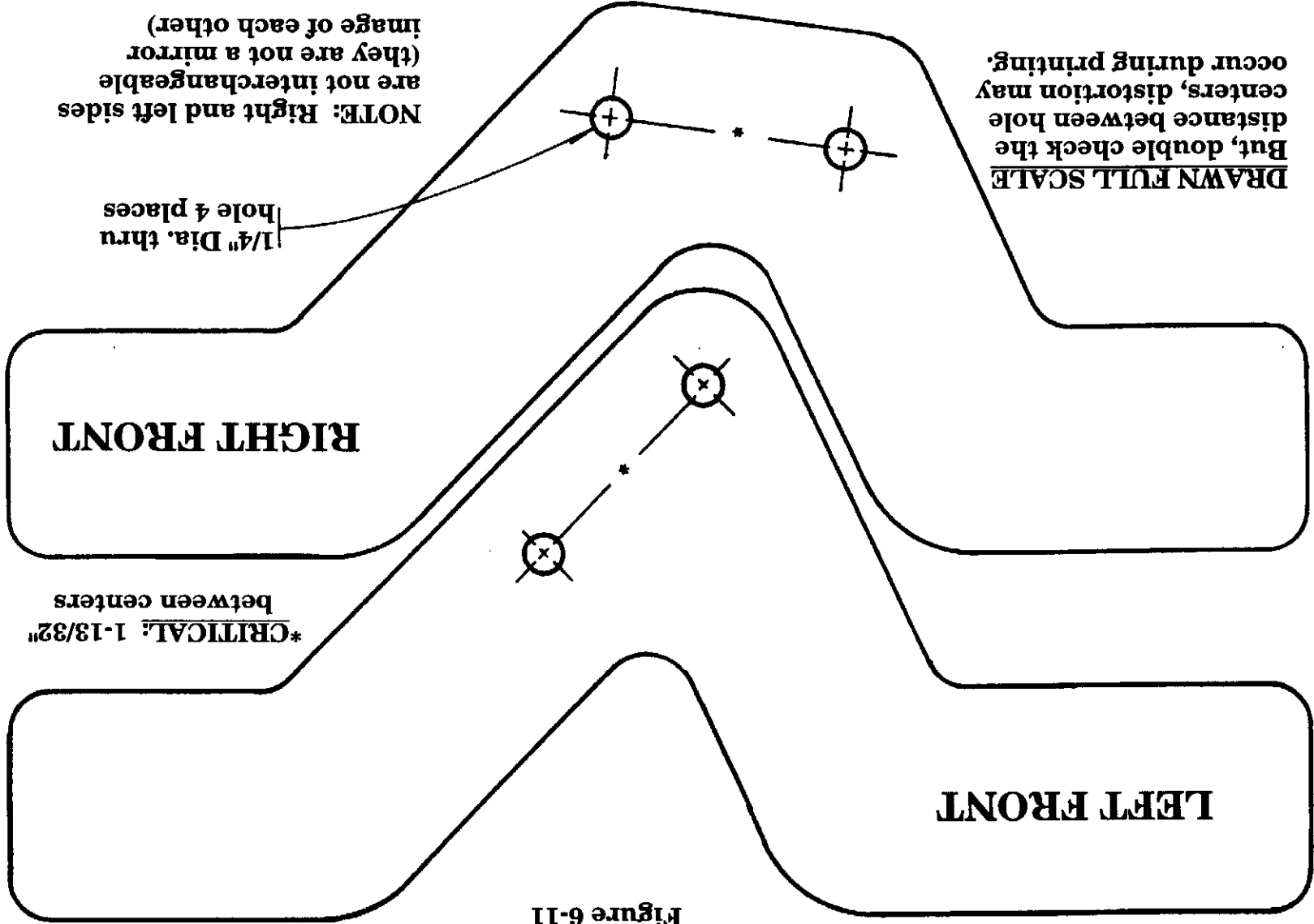
Middle gear door

Figure 6-10



MIDDLE GEAR DOOR - MOUNT BRACKET

Figure 6-11



***CRITICAL: 1-13/32"**
between centers


RIGHT FRONT

LEFT FRONT

NOTE: Right and left sides are not interchangeable (they are not a mirror image of each other)

1/4" Dia. thru hole & places

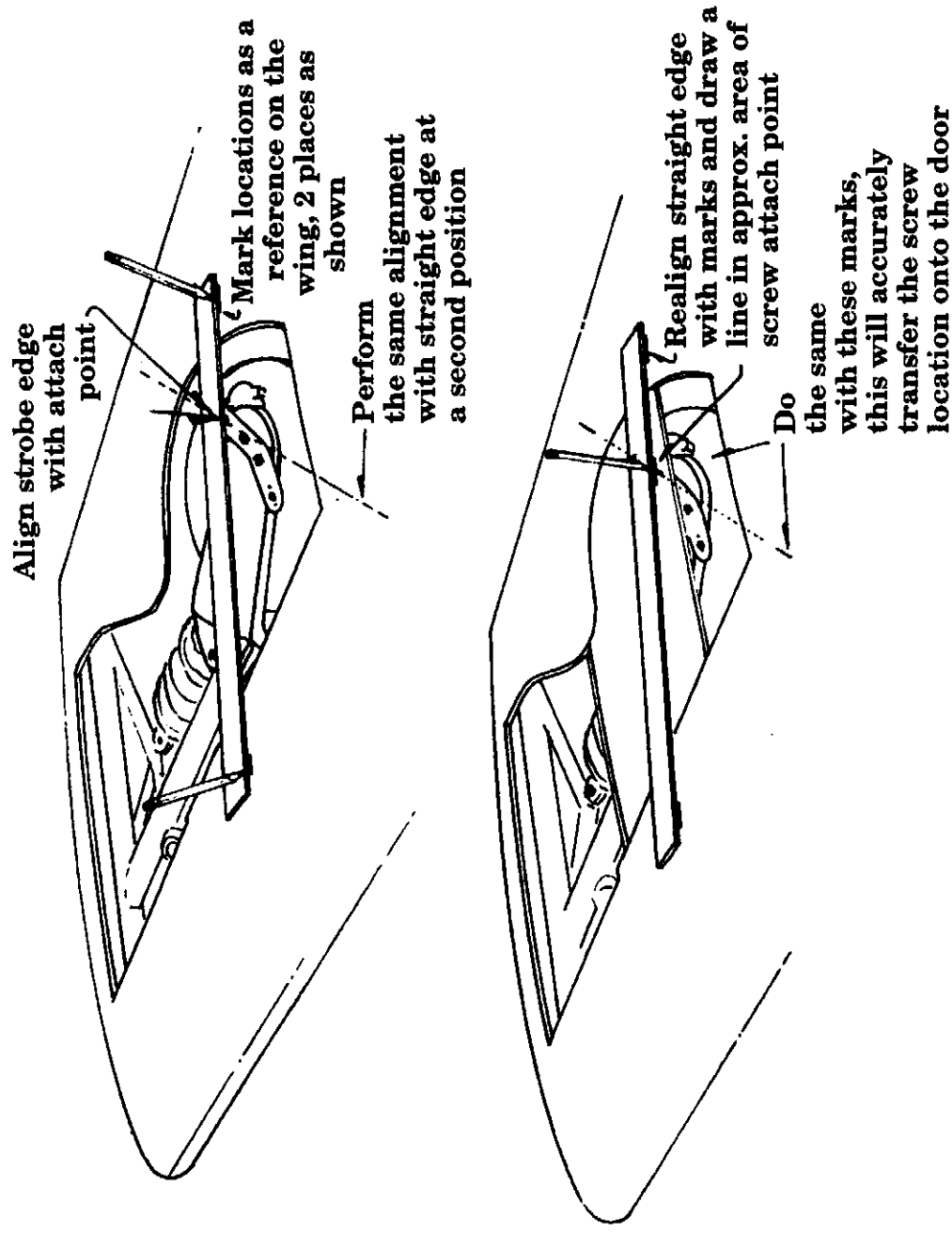
DRAWN FULL SCALE
But, double check the distance between hole centers, distortion may occur during printing.

- 
4. With the gear in the retract position, fit the bracket such that there is a small gap at each end between it and the inside of the gear door itself. This may require some slight bending.
 5. Sight from the edge to align the attachment hole location and mark this location on the gear door. Refer to step 9, below, for a good method of locating these holes properly.
 6. Using a #19 drill bit, drill through the gear door and through the .090 aluminum bracket. Drill one hole at each end.
 7. Remove the gear door and attach a nutplate (8-32 size or K1000-08) with two rivets each to the under side of the .090 aluminum bracket.
 8. With the door still removed, locate the attach point of the upper bolt per figure 6-10 on the gear leg casting.
 9. By laying a straight edge over the gear well and sighting directly down to align with the upper attach point marked on the casting, place a pencil mark on the outer wing skin thus allowing you to relocate the straight edge later. Doing this in two directions will then allow you to establish the same upper attach point on the gear door skin once it is positioned back over the gear (this is similar to finding your navigational position on a flight map by establishing two bearing lines and marking where they intersect one another). This method can be used to locate the other two attachment holes on the lower end with excellent results. Refer to figure 6-12.



Aligning attach point and gear door

Figure 6-12



10. Drill through the gear door using a #12 bit and continue drilling through the casting.
11. This attach bolt used on the upper attachment will need to be staked off, establishing the proper position for the middle door. Use a small length of either the 3/8" x .085 steel tubing or the 3/8" x .058 aluminum tubing. You'll only need about 1.75" or less. See figure 6-10.

12. With all the attachment holes drilled into the middle gear door, grind out the foam core material just around the hole area (approx. 3/4" dia. around hole will be enough). Add (very wet) flox to fill this area. After cure, redrill the hole using the same #19 drill. Note that the flox should be added from the inside skin surface of the door, **NOT FROM THE OUTSIDE SURFACE**. The three door attachment holes will all need to be counter sunk (100° typical).
13. Mount the gear door and check for fit.
14. Install the outbd gear door push rod and adjust until it pulls the door down snugly. **DO NOT SET THIS TOO TIGHT JUST YET SINCE THE HYDRAULICS WILL TEND TO PULL THE GEAR (AND THUS THE DOOR) UP EVEN TIGHTER.**



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C. Nose gear door

The nose gear door is a simple piece of composite (1/4" core + 2 BID per side). It will measure approximately 7" x 27 3/4". Additional BID will be added for stiffening.

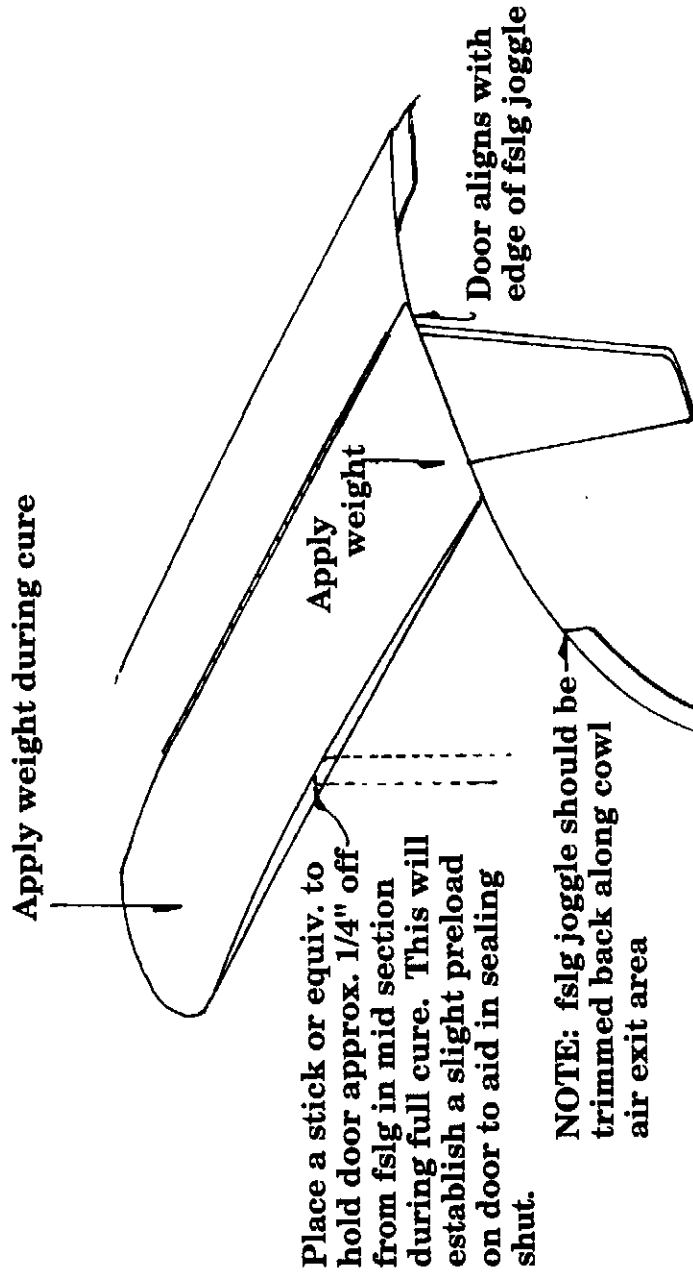
1. From a piece of 1/4" foam cut to the proper shape and lay up 2 BID on what will become the exterior surface.
2. After cure, scarf back the interior edges by 1" and the area where the control horn will attach. See figure 6-14. Add 2 BID over this area with one additional BID along the edges. Add 2 BID over the control horn area bringing this areas ply schedule up to 4 BID on the inside. Once the hinge is fitted, additional BID will be required under the control horn area to bring it flush with the hinge surface (about 3 BID is required).
3. It is best to establish a slight curve into the door such that the aft end contacts the fslg first and thereby generating a preload into the door seal at the aft end. This curvature can be easily established with a high temperature post cure after assembly.
4. A piece of extruded aluminum hinge approx. 20-1/2" long will be fitted into the gear door. This will require reversing the hinge pieces and notching into the gear door, see figure 6-14. Mount to the door with MS24694-S5 machine screws and K1000-08 anchor nuts. Often, due to the tight clearances between wheel and gear door during retract, the ends of the machine screws will require filing down to within one thread of the anchor nut edge. This is only required along the areas where the wheel itself passes.
5. Make and install the control horn per figure 6-14, 6-15, 6-16 and 6-17. Note that a BID patch will be required under the control horn to bring the door surface flush to the hinge half so that the control horn has a smooth flat surface on which to attach. Mount the control horn using two MS24694-S5 machine screws. One will also mount through the hinge.
6. Drill #30 holes (every 1-1/2") for the structural pop rivets that will hold the door onto the fslg. Position the door onto the fslg and instant glue it into position temporarily; check for a good alignment to the fslg. When satisfied, open the door and drill through for the pop rivets. The door may now be attached.
7. To fair the door into the fslg, use micro around the door. Wrap plastic tape around the edges of the door to form a release.
8. To help achieve a good tight seal of the door, the previously described preload is desired. This can easily be established with a heat gun.

9. Using suitable weights, hold the door tight against the fslg at the aft end and fwd end.
10. Next slip about three or four stir sticks between the door and the fslg around the middle point.
11. From the inner side, run a heat gun back and forth along the edges of the door (not by the hinge section though) until it is too hot to hold your hand on. Maintain this temperature for about 5 minutes and allow to cool. This will place a warp into the door which will facilitate a tight seal at the aft end.

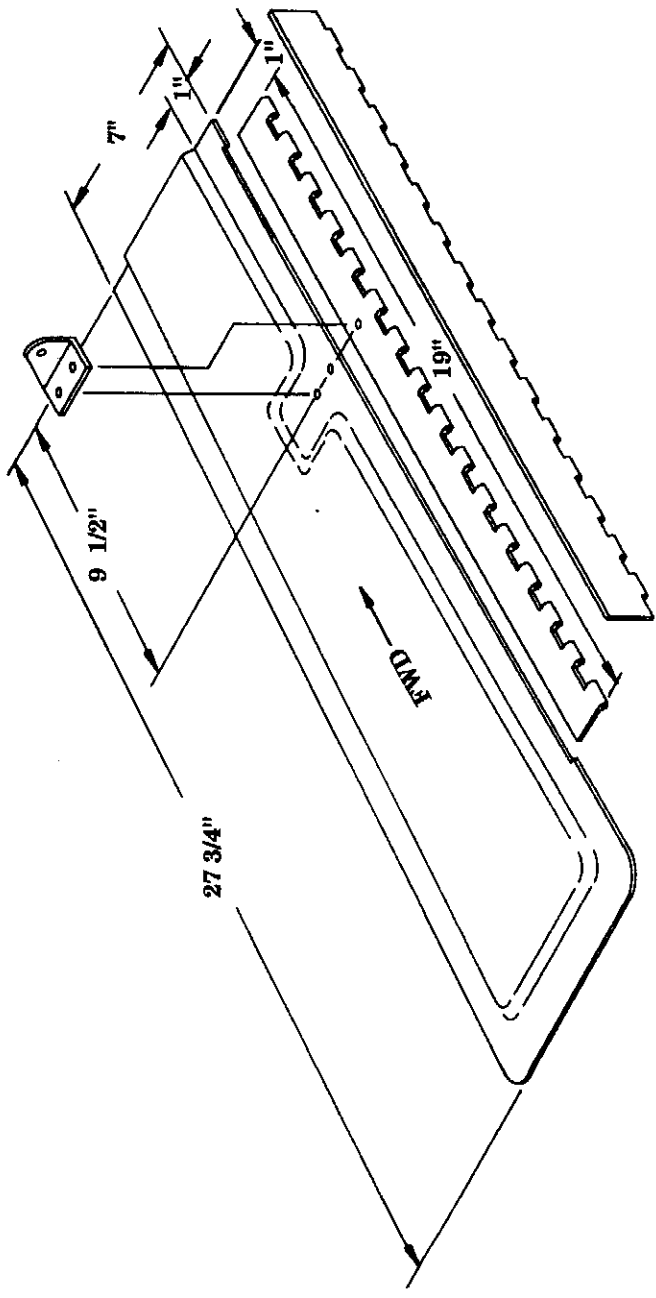
NOTE: it is possible to place too much of a warp into the door. To check, see if a 15 lb. weight will push the door shut when placed 5" out from the doors hinge line and perpendicular to the control horn attach position. If it will, then all is good, if it won't then a little preload should be taken out of the door with a similar heat application.

Applying weight to establish preload

Figure 6-13

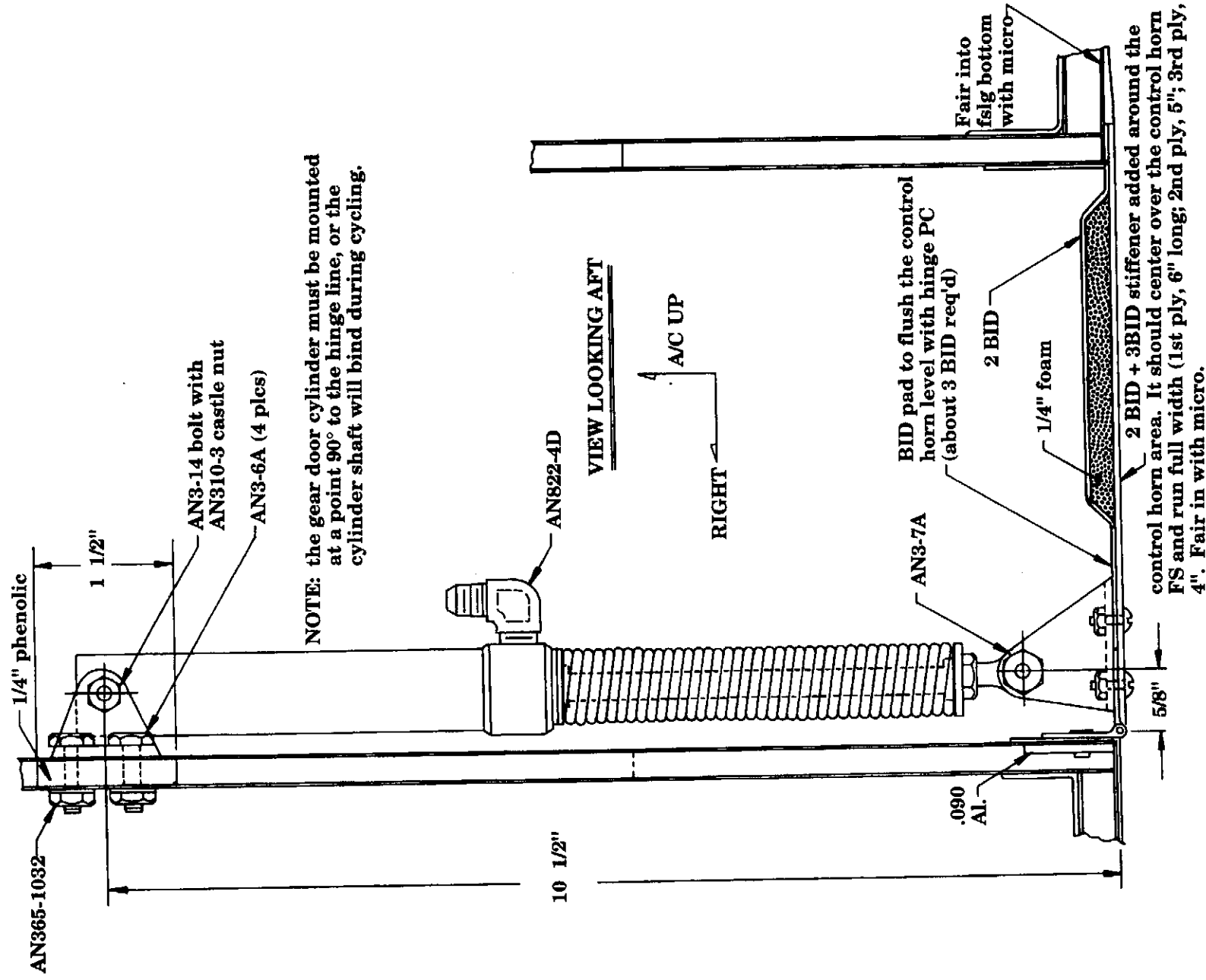


Location of hinge on gear door
 Figure 6-14



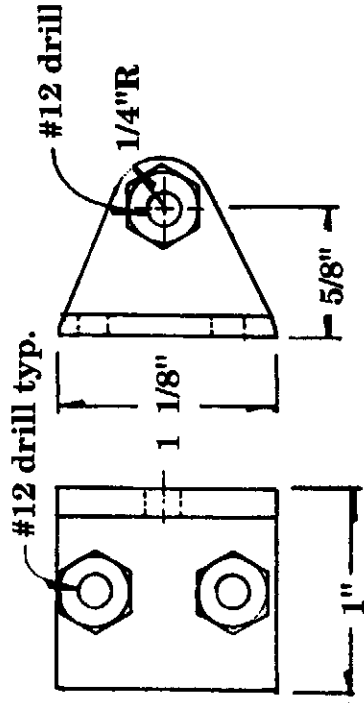
Nose gear door cylinder installation

Figure 6-15



Nose gear door cylinder attach bracket

Figure 6-16



Nose gear door control horn

Figure 6-17

