

# CHAPTER 11 REVISION LIST

The following list of revisions will allow you to update the Lancair ES construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shown and "R" to remove the pages.

Page(s) affected	Current Rev. #	Action	Description
11-1	0	None	
11-2	3	R&R	Changed title for figure 11-1.
11-2.1	6	Add	
11-3 thru 11-15	0	None	
11-16 thru 11-47	6	R&R	Changed rivet part numbers.
11-48	0	None	
11-49 thru 11-59	0	None	



11-i

Chapter 11      6/4-1-99  
FUEL SYSTEM

# CHAPTER 11: FUEL SYSTEM FIREWALL - AFT

## 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 When such revisions are made, you should immediately replace all outdated pages with the revised pages.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.

## CONTENTS

1. INTRODUCTION
2. DRAWING LIST
3. SPECIAL PARTS, TOOLS & SUPPLIES LIST
  - A. PARTS
  - B. TOOLS
  - C. MATERIALS & SUPPLIES
4. PROCEDURE
  - A. FORWARD DECK ALIGNMENT
  - B. MOTOR MOUNT INSTALLATION
  - C. FIREWALL FLANGE
  - D. HEADER TANK POSITIONING / FWD DECK BRACING
  - E. FUEL PICK UP PORT
  - F. SUMP DRAIN INSTALLATION
  - G. OPTIONAL FUEL GAUGE INSTALLATION IN HEADER TANK
  - H. FUEL TRANSFER PORTS
  - I. VENT LINE
  - J. FLOAT SWITCH (OPTIONAL)
  - K. TANK BAFFLES
  - L. ATTACHING HEADER TANK TO FWD DECK
  - M. PRIMARY FUEL SUPPLY LINE TO FIREWALL / ENGINE
  - N. WING TANK CONNECTIONS
  - O. PERMANENT FORWARD DECK INSTALLATION
  - P. REMOVABLE FORWARD DECK INSTALLATION, HINGED
  - Q. REMOVABLE FORWARD DECK INSTALLATION, SCREW MOUNTED

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11-1

Chapter 11

REV.

0 / 11-1-91

FUEL SYSTEM

## 1. INTRODUCTION

There are many types of fuel systems that are acceptable to the Lancair (or any other type of low wing aircraft). The system described here is one which emphasizes installation simplicity. The fuel system is comprised of a 15-1/2 gallon tank in each wing that transfers fuel via one electric fuel pump for each wing tank (thus two transfer pumps will be installed, one under each seat), to the 11 gallon central header tank. From the header tank sump the fuel passes through a Main Shut-off Valve and through the firewall to the gascolator, an electric boost pump, the mechanical engine driven pump, finally to the carburetor/injector system. See figure 11-1 for an over view.

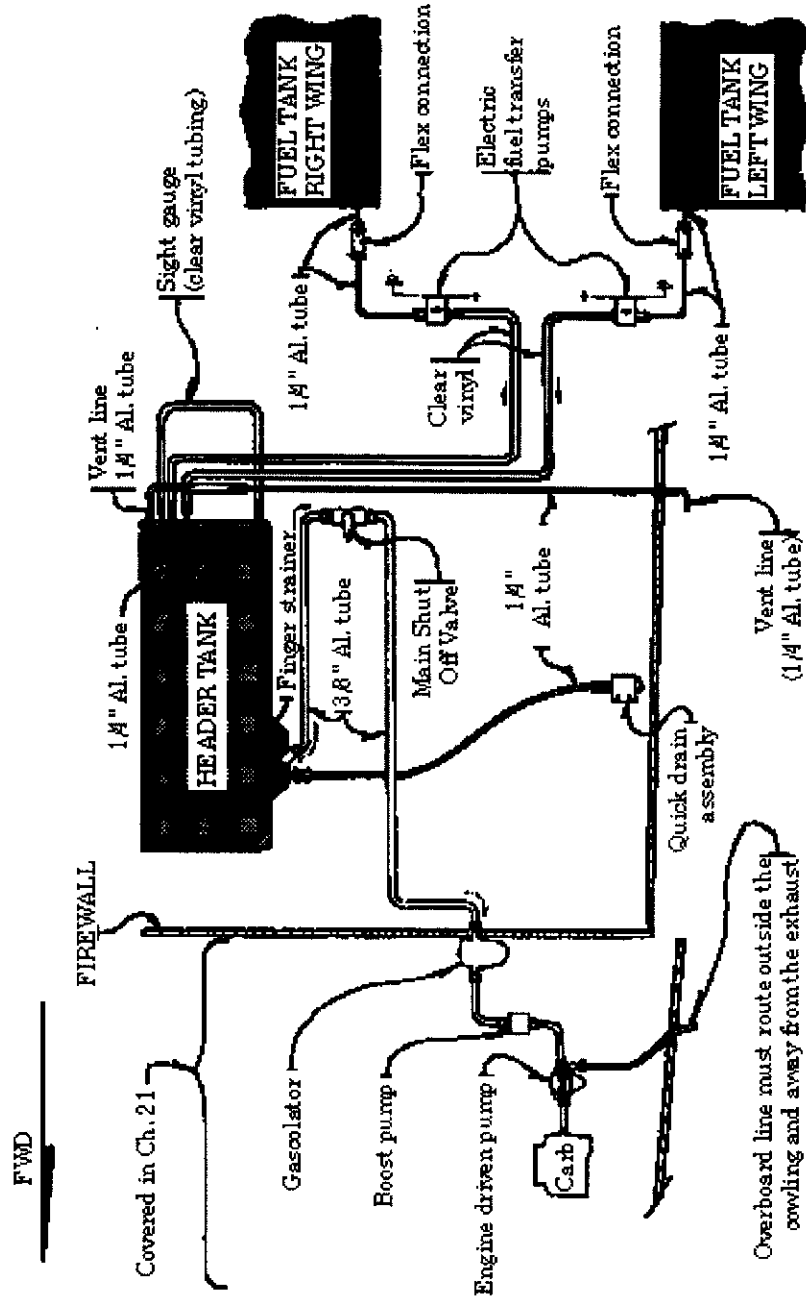
15 1/2  
11  
15 1/2  
4 1/2 988

The fuel system fwd of the firewall is covered in chapter 21, "Firewall Forward".

READ THIS CHAPTER IN ITS ENTIRETY, BEFORE PROCEEDING WITH THE CONSTRUCTION.

### Fuel system schematic with Header Tank

Figure 11-1



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11-2

Chapter 11

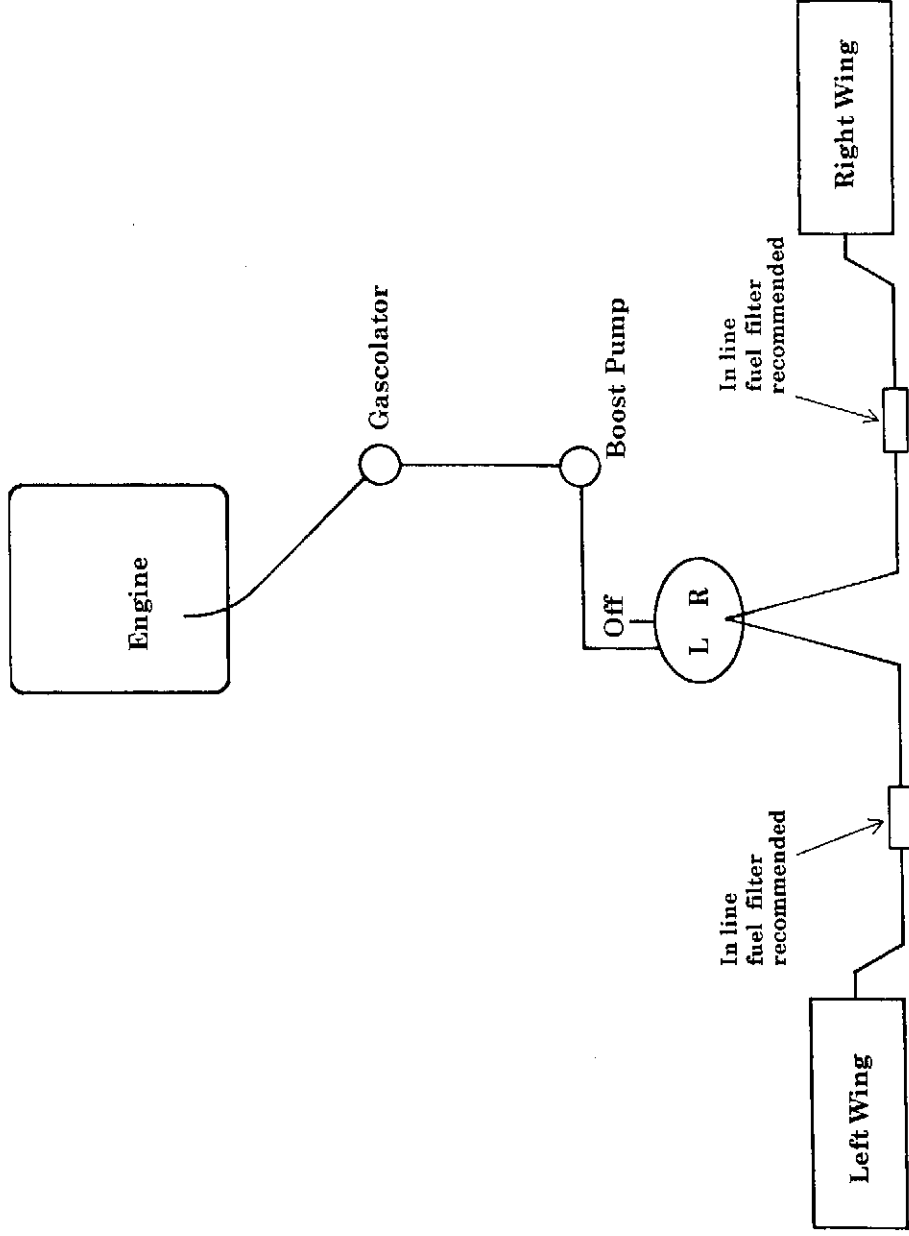
REV.

3 / 10-15-97

FUEL SYSTEM

# FUEL SYSTEM SCHEMATIC WITHOUT HEADER TANK

Figure 11-1a



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11-2.1

Chapter 11 REV. 6/04-01-99  
FUEL SYSTEM

## 2. DRAWING LIST

Drawing	Page	Title
11-1	11-2	Fuel system schematic
11-2	11-9	Motor mount installation
11-3	11-10	Temporary fitting of cowling
11-4	11-12	Firewall flange
11-5	11-13	Fwd deck bracing
11-6	11-15	Header tank preparation
11-7	11-16	Header tank
11-8	11-17	Header tank fuel sump
11-9	11-19	Sump-Quick drain fittings
11-10	11-20	Sump-Quick drain mount block
11-11	11-24	Header tank "port" tube installation
11-12	11-26	Instrument panel - sight gauge installation
11-13	11-29	Vent line
11-14	11-33	Header tank baffles
11-15	11-34	Header tank to fwd deck installation
11-16	11-35	Primary fuel supply
11-17	11-36	Main shut-off valve mount bracket
11-18	11-38	Mount plate - fuel transfer pump
11-19	11-39	Fuel transfer pumps - installation
11-20	11-40	Fuel line routing - stub wing area
11-21	11-41	Grommet installation
11-22	11-43	Visual fuel transfer indicator
11-23	11-44	Restraints for visual fuel transfer indicator
11-24	11-48	Forward deck installation, hinge mount system
11-25	11-49	Fslg joggle preparation
11-26	11-50	Fslg joggle preparation
11-27	11-52	Hinge preparation
11-28	11-53	Upper hinge section to fwd deck installation
11-29	11-55	Safety wire mount tab
11-30	11-57	Forward deck installation, screw mount system

### 3. EQUIPMENT REQUIRED - SPECIAL PARTS, TOOLS & SUPPLIES

#### A. Parts

- Fwd deck
- 4) AN723A bolt
- 4) AN365-720 nut
- 3/8" 5052-0 aluminum tubing (primary fuel lines)
- FU-3 threaded aluminum plate
- Finger strainer
- AN822-6D insert
- Sump-Quick drain fittings (optional - see page 11-19 for list & details)
- Small hose clamps
- Fuel shut-off valve
- 2) Fuel transfer pump
- Hinges (optional - see page 11-45 for details)



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11-4

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM

**B. Tools**

- Cleco pliers
- Clecoes
- Ruler or tape measure
- Dremel™ type rotary grinder
- drill motor
- drill bits: 7/16"  
1/4"
- Level, 4' (or shorter, with a 4' straight edge)
- 7/16" transfer punch (not mandatory, but nicer)
- Assorted wrenches for installing engine mount
- Pencil
- RED pencil
- Sabre saw
- Some small weight bags - 5 to 10 lbs., 3 or 4.
- Rivet squeezers

**LANCAIR® 320FB**

11-5

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM

**C. Materials & supplies**

- epoxy
- flox
- BID cloth
- micro
- release tape
- sandpaper, assorted grit
- some 3/8" plywood or similar for bracing (see page 11-13)
- Bondo or equiv.
- grease (for release agent on some bolt threads later, most any kind will do)
- MC or acetone for cleaning
- cardboard for making templates
- fuel tank sealer (optional)

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11-6

Chapter 11    REV.    0 / 11-1-91  
FUEL SYSTEM



#### 4. PROCEDURE

The header tank will be attached to the forward deck which forms the top of this tank. There are three primary methods of installing this fwd deck. One is to permanently attach it using the standard overlap joggles, this is the easiest method. The other two methods make the fwd deck always removable. This will require more initial work but the rewards can be significant, particularly if you will have a fairly full instrument panel.

You will always have access to the back of the panel when the dust cover is removed. For many instrument panel layouts, this provides sufficient rear panel access for later installations, service checks, etc. If your panel becomes complex, then often the radio stack alone will quite literally fill all the available space and a removable fwd deck can be a great blessing.

All the methods will be covered at the end of this chapter. If you are permanently bonding the deck on, it must be installed **last**, the fwd deck should be only clecoed in place until all the wiring is finished and all the engine installations are completed.

Due to removability, either of the non-permanent methods may be done at the end of this chapter, or at any time thereafter. However, it is recommended that the installation of the fwd deck be postponed until the firewall fwd installations are complete. This way the cowling is adjusted and permanently aligned around the completed engine/exhaust/baffling/etc. Then a better alignment of the fwd deck/cowl can be made.

If you wish, you may follow steps 1 through 9 of chapter 20 to complete the firewall fwd installation, before finishing this chapter.

**NOTE: If you are considering installation of the "forward hinge" version of the canopy actuation system, you should now review Chapter 17, since it will affect the header tank installation.**

*Forward Deck Hinge Install - Page 11-47*

#### A. Forward deck alignment

The fwd deck must be aligned at the same time as the cowl / engine for absolute best results. The canopy frame can not be installed until the fwd deck is located and temporarily held in position with clecoes or equivalent.

1. Select the fwd deck and locate it onto the double joggle along the fslg. This resultant joggle should measure 2.0" - 2.25" high when the deck is positioned. The fwd, L.E. joggle will form the lip for the cowling attach. This joggle should be in close alignment with the lower fslg cowling joggle. The fwd deck should rest on the top of the firewall bulkhead with 1-1/2" lip fwd of the fire wall.

**LANCAIR® 320FB**

11-7

Chapter 11

REV. 0 / 11-1-91

FUEL SYSTEM

2. Press down on the top fwd edge of the fwd deck, directly above the firewall. Be sure that the fwd deck has a good fit at the firewall, and cleco only the two front corners (in front of the firewall), from the inside of the fslg so as not to interfere with the cowl during temporary alignment.

**NOTE:** This firewall position of the fwd deck will not change but the aft vertical alignment of the fwd deck on the fslg could be adjusted up or down as required to achieve the best alignment of cowling to deck. To effectively "sight" this alignment, you will need to temporarily hang the engine on the engine mount. This is necessary to locate the exact position of the spinner. The spinner is, of course, what the cowling must align to at the fwd end.

**NOTE:** The engine is designed to mount with no upward or downward angle relative to the fslg level line. Thus the thrust line is parallel to the level line in the vertical plane of reference.



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11-8

Chapter 11

REV. 0 / 11-1-91

FUEL SYSTEM

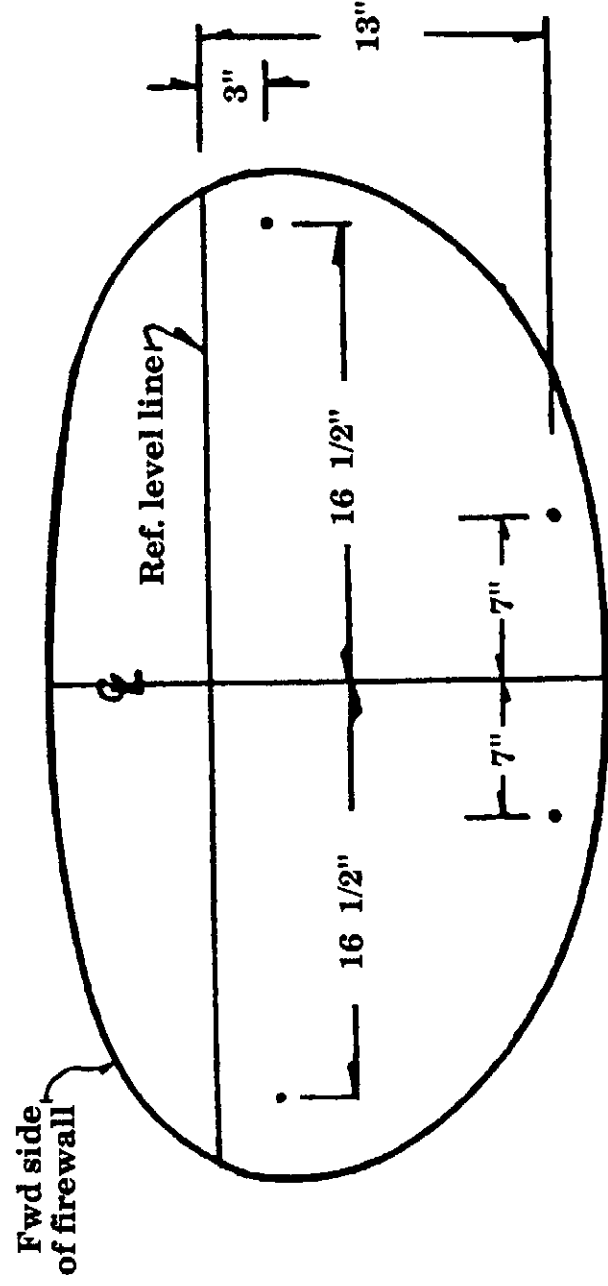
## B. Motor mount installation

Although the installation of the motor and mount is "temporary" at this point, the mounting holes are permanent. So take care in locating and drilling these holes.

1. Be sure the fslg is level, check the level of the top left and right hole marks (ignore the center one for now). If they are not level with each other, cover the old line with tape so as not to get confused. Be sure to leave the hole mark exposed, use a level as a straight edge and pivot on the lower of the two hole marks. Move the opposite end up or down to establish level and mark a new level line across the firewall, see figure 11-2.
2. Using a 7/16" bit, drill through the firewall at the original pivot mark, and bolt the motor mount to the firewall using one AN-723A/AN365-720 bolt/nut, loose enough to swing it up or down. Now align the center, of the opposite side of the motor mount hole, with the level line. Holding the motor mount firmly in place, use a 7/16" dia. transfer punch or use the motor mount as a drill guide and drill through the firewall (the nylock nuts must be on the aft side of the firewall).
3. Bolt through this hole in the same manner as the first. Tighten both bolts. Now the remaining mount holes can be drilled and bolted in the same manner.
4. Mount the motor to the motor mount using the pads that are appropriate to your motor. Install the 4" extension to the engine crankshaft flange, and the 12" spinner back plate to the flange extension.

### Motor mount installation

Figure 11-2



5. The upper cowl will need to be trimmed in the area behind the spinner back plate **ONLY. DO NOT TRIM ANYWHERE ELSE.** Do not trim all of the vertical face away, leave a flange of about 1" all around, see figure 11-3.

6. With the engine in place and the fwd deck still in place, set the upper cowl in place and align and clamp to spinner plate. The aft edge of the cowl will lay on top of the fwd deck and overlap the joggle, **DO NOT TRIM THE COWL AT THIS TIME.** This is just to provide a visual guide for the cowl / fwd deck angle.

### Temporary fitting of the cowling

Figure 11-3



**NOTE: Do not trim anywhere except behind the spinner plate.**

7. With the front of the cowling located, a smooth transition should be made from cowl across to the fwd deck. This can be aided by making slight up or down adjustments of the fwd deck at the aft end of it (do not trim the cowling to fit just yet since the firewall installation will affect the final fit). All you are interested in at this time is establishing a smooth, flowing transition from top cowl, to the fwd deck. When that transition looks smooth, lock the fwd deck into position with four clecoes. Place one at each aft corner (as far aft as possible to avoid interference with the installation procedure). **CIRCLE THESE SACRED ALIGNMENT HOLES WITH A RED PENCIL. YOU'LL BE NEEDING THEM LATER, AND YOU WON'T WANT THEM CONFUSED WITH ALL THE OTHER HOLES YOU'RE GOING TO BE DRILLING.....**

**NOTE:** If you are unable to attach the engine temporarily to make this fit check, i.e. you don't have your engine yet, etc., the next best method is to simply make the joggle height (as measured at the aft end of the fslg / fwd deck joggle line) the same height as that same joggle measures at its fwd end (adjacent the firewall position). This dimension should fall within the above mentioned 2.0" - 2.25" joggle height.

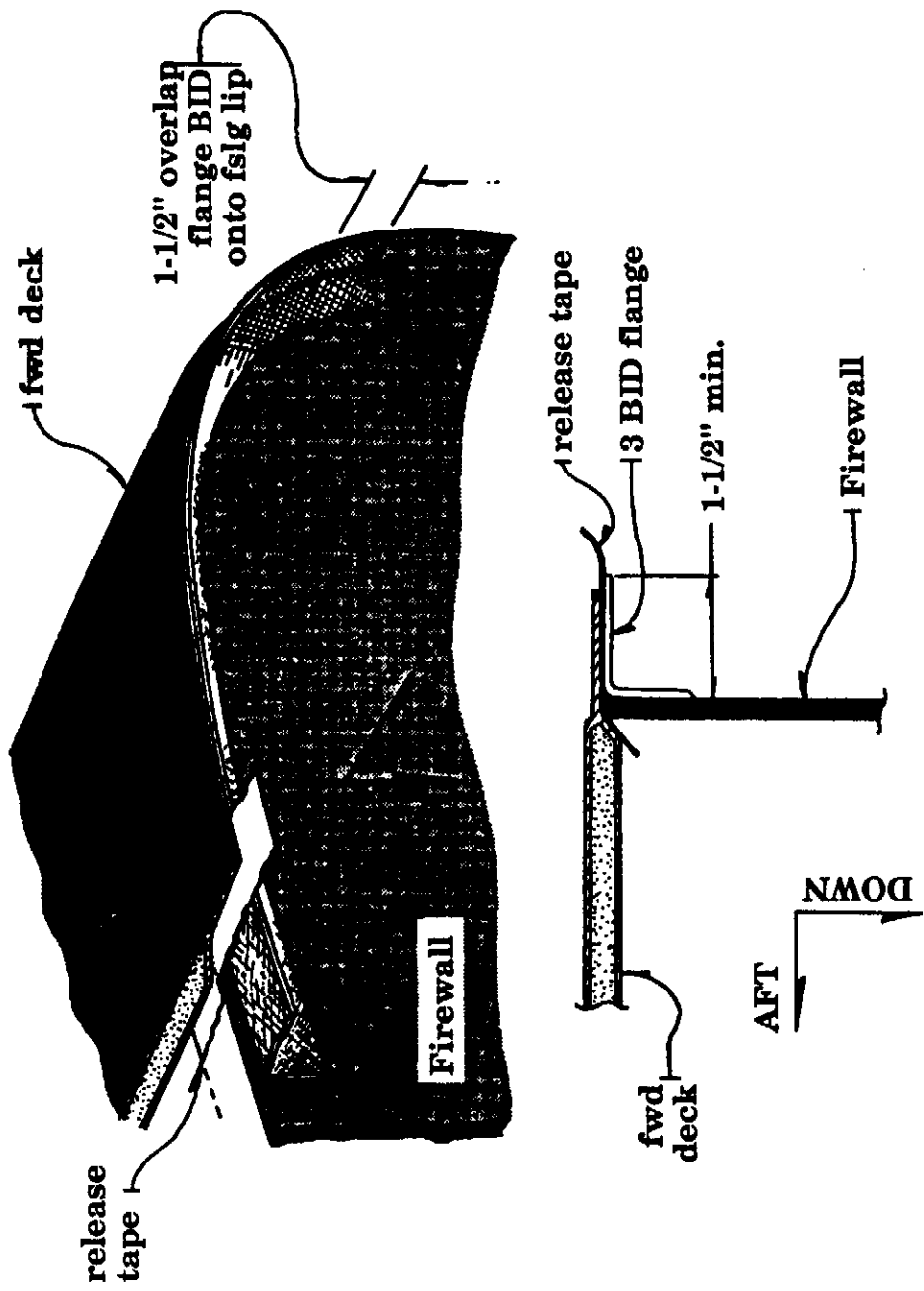
### C. Firewall flange

A 3 BID flange must be added that will provide a means to attach the fwd lip of the deck where it contacts the top of the firewall bulkhead. This flange should be made such that it is permanently attached to the firewall bulkhead and "released" off from the fwd deck, see figure 11-4. This must be done before the firewall insulation (fiberfrax and stainless steel) can be installed. This 3 BID flange should extend far enough fwd for the three layers of fiberfrax insulation and the stainless steel, while still allowing sufficient room for the nut plates on the inside of the flange. We recommend a minimum of 1-1/2" firewall forward (less than 1" is inadequate) see figure 11-4. The fwd deck and cowl will be attached to this lip at a later time. *See 5-39*

1. Apply release tape to the fwd deck, on the inside of the joggle that overlaps the firewall. Cleco the fwd deck in place.
2. Make a micro/epoxy fillet along the fwd deck overhang.
3. Apply a 3 BID (3" wide) layup as shown in figure 11-4. Be sure to overlap the fslg seam (where the fwd deck meets the fslg) by 1-1/2". Allow to cure.
4. Sand/trim the fwd edge as necessary. Be sure to leave a minimum 1-1/2" of flange as measured from the fwd face of the firewall.

**NOTE:** Firewall fwd may be completed at any time from herein. If you wish, you may proceed to chapter 21 to complete the firewall fwd installation, before finishing this chapter.

**Firewall flange**  
Figure 11-4

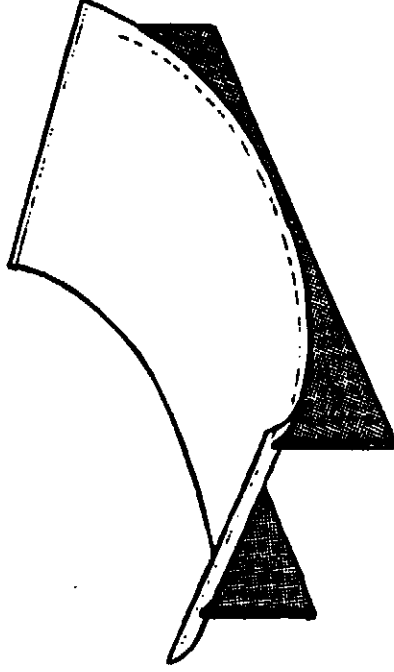


#### D. Header tank positioning / fwd deck bracing

1. With the fwd deck in position on the fslg, reach up from inside the cockpit and mark a pencil line to indicate where the aft face of the firewall bulkhead meets the upper inside of the fwd deck. This line will be helpful in locating the attach point of the header tank.
2. Next, you will fit the header tank onto position on the inside of the fwd deck. Note that the fwd deck is flexible and therefore could possibly be flexed too far open. This would then ruin its good fit onto the fslg. It is therefore recommended that a very simple jig or retainer brace be placed over the fwd and aft ends of the fwd deck. This brace can be made of 3/8" plywood or similar. Place the piece of plywood against the deck and trace off the decks top contour. Use a sabre saw to cut the shape out, it does not have to be very accurate. If you make the top side of the two plywood braces level, then the deck will sit very nicely on the wood braces when it is inverted.

#### FWD DECK BRACING

Figure 11-5



3. With the fwd deck clecoed into position on the fslg, scuff up the surfaces of the fwd deck and attach these temporary braces using a thick bead of Bondo or equivalent. Let that harden for about an hour and then lift off the deck with the braces attached. Now, you know that the deck will be held in perfect position while the header tank is bonded into position which then locks in that contour.
4. Lift off the fwd deck, with braces, and place it inverted on your workbench, see figure 11-5.

5. Fit the header tank into the deck. Note the pencil mark along the fwd edge - this is the back of your firewall. The tank should be kept AFT of this line by about 1/2". This will allow for some insulation on the back of the firewall. Some sanding on the flange of the header tank may be required to achieve its best fit into the fwd deck contour. When the fit looks good, mark a pencil line all around the edge. This will provide a visual reference of where to sand and prep the inside of the fwd deck prior to bonding the tank.
6. Fit check: The header tank has the central sump area which must fit into the recess of the nose wheel tunnel. Left to right orientation is not of much concern, but you'll need to check the fwd to aft fit. You can simply place the tank in its approximate location and lay the fwd deck (with braces attached) back into position. Cleco it down to the joggles. Now reach in and raise the tank to align with the pencil mark on the inside of the deck which locates its position. Have someone look from both sides to verify that the sump is not touching the nose wheel tunnel at any point. Adjust if necessary and clearly remark the reference pencil line.
7. Remove the fwd deck and place it once again inverted on a work bench.

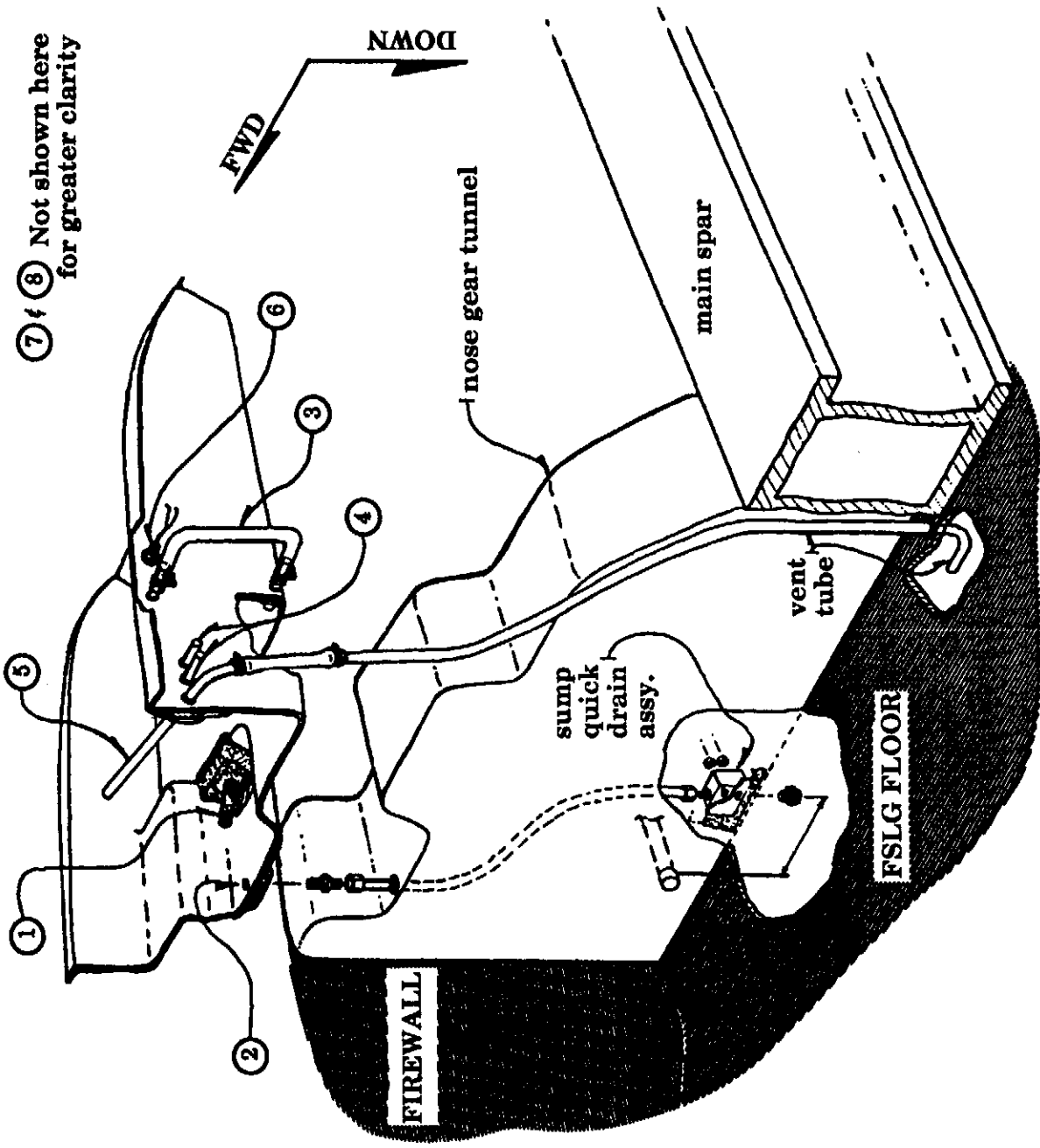


## HEADER TANK PREPARATION

Figure 11-6

The header tank will first require several installations prior to attaching it to the fwd deck. They are:

- 1.) Fuel pick up port..... (for finger strainer insertion - 3/8NPT)
- 2.) Sump drain port..... ( 1/8 NPT) (optional)
- 3.) Fuel gauge provisions..... (either sight gauge or conventional float gauge)
- 4.) Fuel ports for transfer lines... (from the wing tanks - 1/4" aluminum lines)
- 5.) Vent line..... (1/4" aluminum lines)
- 6.) Float switch..... (in header tank)(optional)
- 7.) Baffles..... (in header tank)
- 8.) Fuel cap..... (on fwd deck)

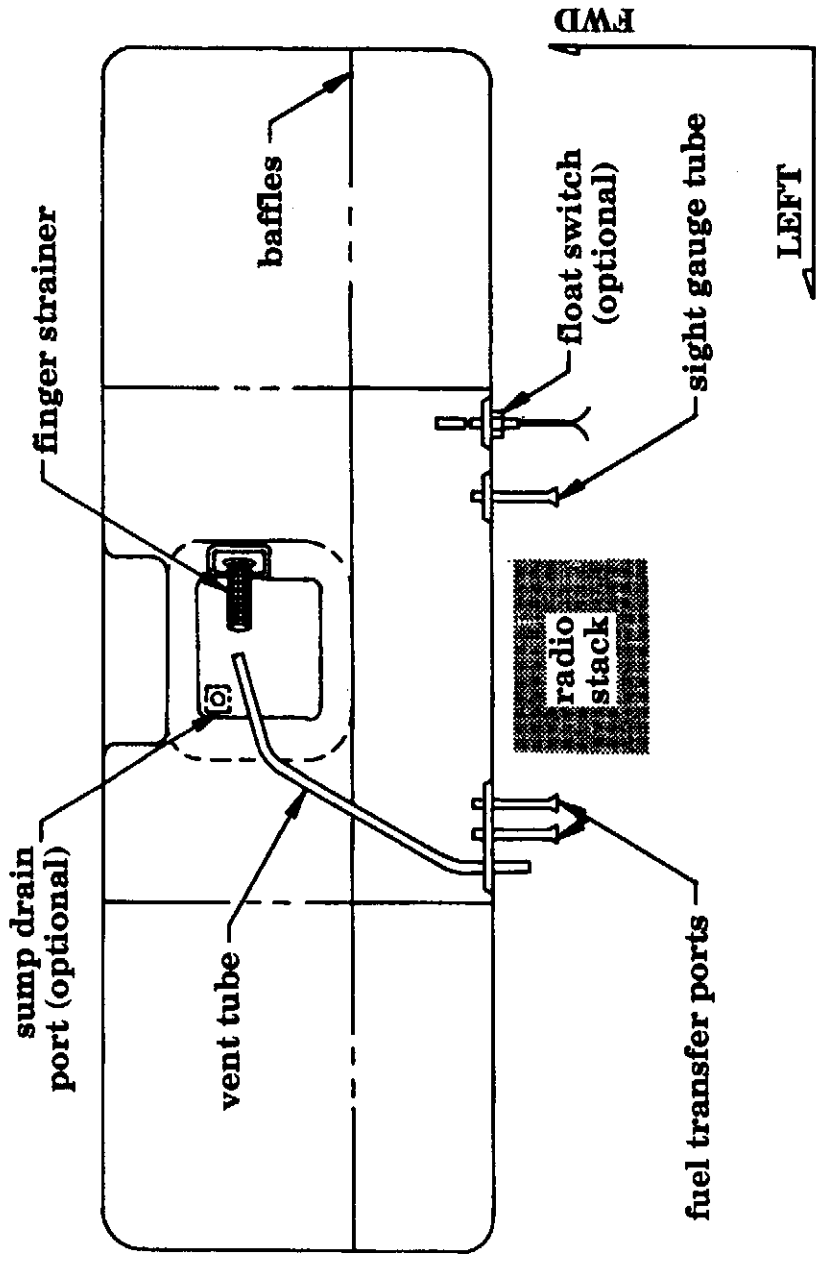


⑦ & ⑧ Not shown here  
for greater clarity

# HEADER TANK

(TOP VIEW)

Figure 11-7



### E. Fuel pick up port

This is the primary fuel line which goes to the engine. All such lines must be 3/8" diameter, either aluminum (5052-0) or flexible line (for connections from stationary objects to the engine, which is non-stationary).

1. Into the right side of the sump (passenger side), the FU-3 threaded aluminum plate will be bonded into position. This 1/4" thick block has the 3/8 NPT (pipe threaded) hole in it.

**NOTE:** Note the direction of taper in this threaded hole. The wider side of the taper **MUST** be facing the outside of the tank.

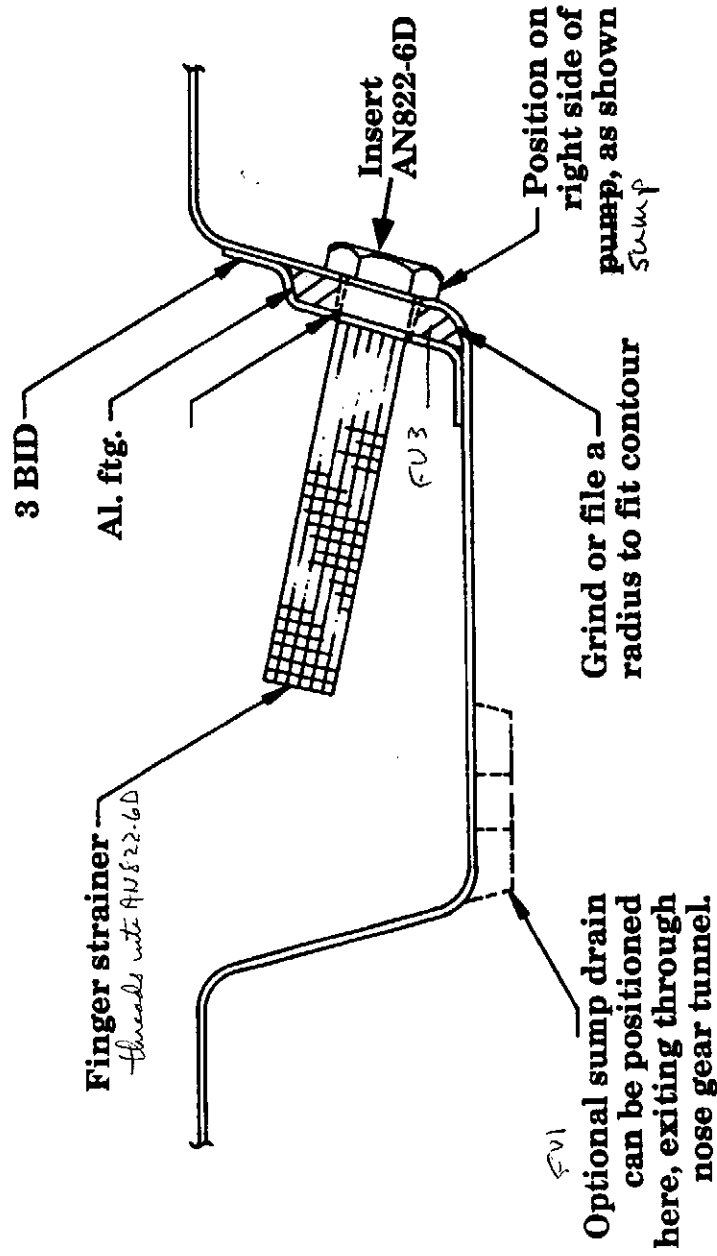
2. The best method of installing this fitting is from the inside. Rough up the sump wall and fit the block into place. It is best to file a bevel on the sides of the block so that it fits well to the sump wall and provides for a smooth transition from the plate to the sump. This smooth transition is needed for a good attach of the 3 BID that will be applied over the top.

**NOTE:** This fitting block will naturally position the hole up slightly from the very bottom of the sump. This is correct. The hole for the finger strainer should **NOT** be at the bottom of the sump. See figure 11-8.

### Header tank fuel sump

(Viewed from aft looking fwd)

Figure 11-8



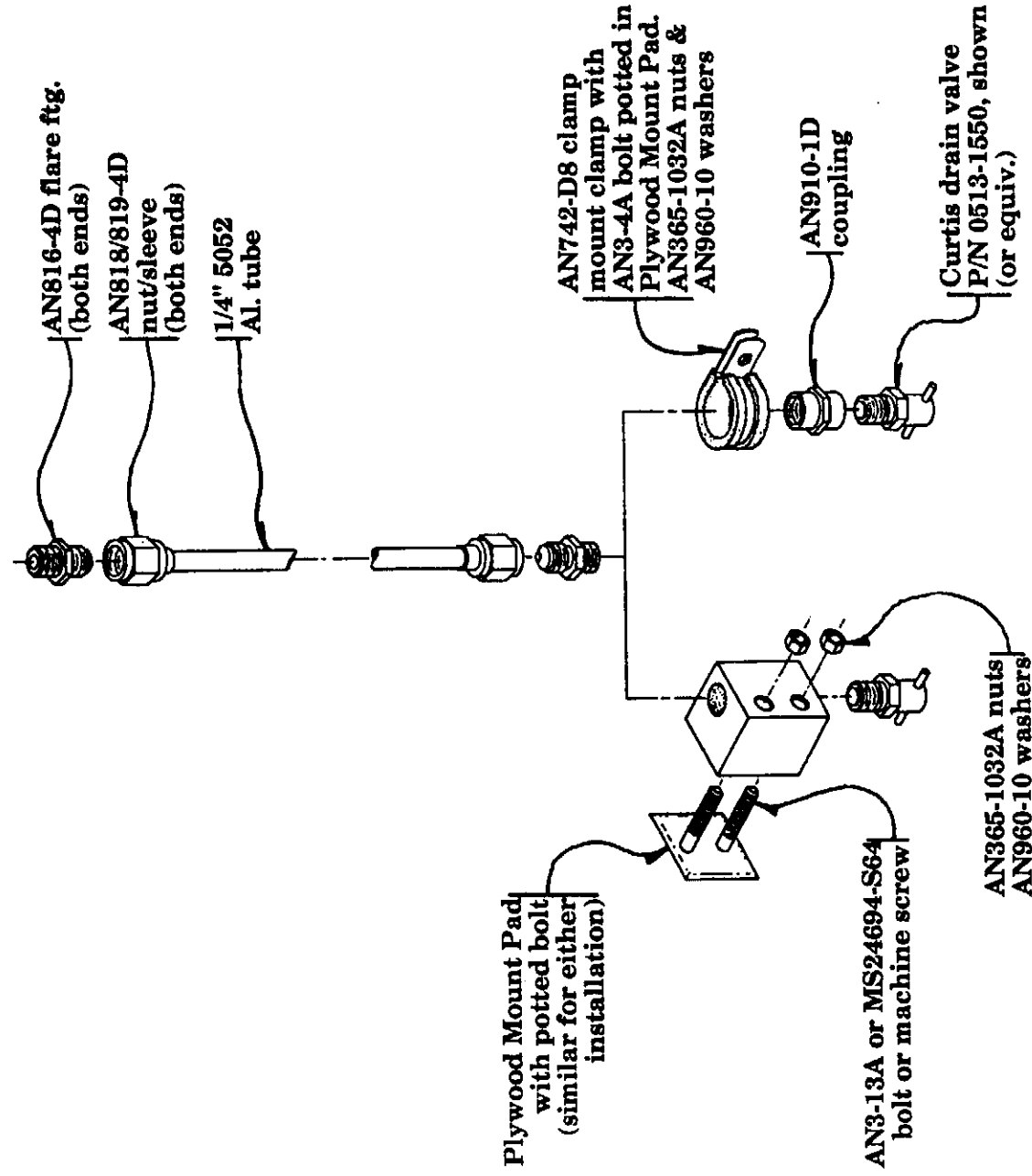
3. Locate and cut in the through hole in the sump for the finger strainer that will thread into the fitting block. When the fit is good, put a slight amount of grease around the threads of the finger strainer as a "release". Be careful NOT to gob a lot of grease onto it, just enough to provide a thin film to serve as a release in case any epoxy gets onto it during the next step.
4. Rough up the face of the aluminum plate that attaches against the side of the sump. Use 80 grit. Clean with acetone and *immediately* bond into position with epoxy/flox. Insert the lightly greased finger strainer through the hole to assure proper alignment and allow to cure. Apply weights against the fitting block during cure, about 5 lbs. is sufficient weight.
5. After the above cures, add a 3 BID tape over the top of the fitting block. Make sure that there are no air pockets or voids around the fitting block. Use epoxy/flox as a filler if necessary. The 3 BID can be positioned over the through hole (finger strainer is now removed along with any traces of grease) in one piece. The cut out for the hole can be made with a sharp Xacto blade after it reaches the "green" stage during cure. Be sure that these 3 BID are smooth and thus have no crevices or burrs which could snag contaminants. After cure, sand lightly to assure a smooth surface along the tank interior.

## F. Sump drain installation

This is an optional installation which provides an additional means of draining the sump. The header tank line to the engine should always pass through a gascolator, mounted on the firewall, but an additional sump drain can be installed if desired. This line can be routed directly down through the nose gear tunnel and be accessed from inside the fwd end of the nose gear tunnel from below. Items for this optional installation are not included in standard Lancair kits. If you do choose to install this additional sump drain, fittings can be quickly shipped from either Aircraft Spruce and Specialty or Wicks Aircraft Supply.

## Sump - Quick Drain Fittings

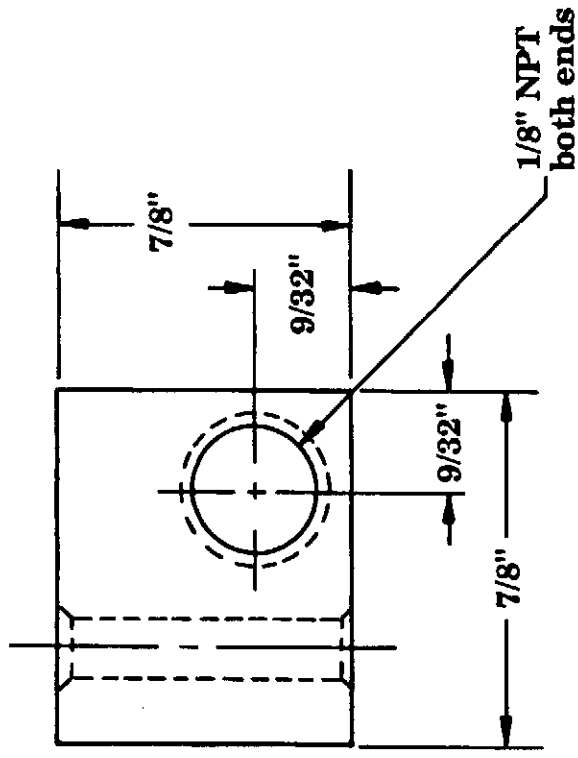
Figure 11-9



If so desired, you may fabricate a block to install the sump drain. The following drawing can be followed:

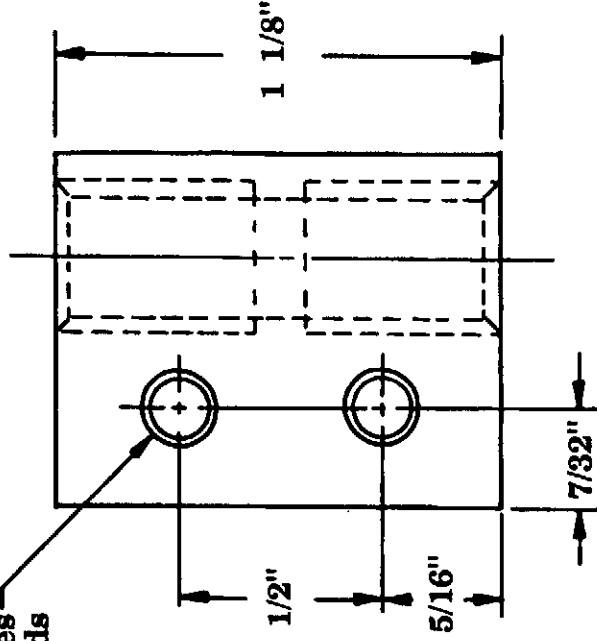
### Sump - Quick Drain Mount Block

Figure 11-10



SHOWN TO SCALE  
Material: Aluminum

3/16" thru hole  
2 places  
chamfer both ends



1. The sump drain fitting block can be brass or 1/4" phenolic. Threads can be cut into the phenolic block, make it the same size (1/8 NPT) as the brass type. Your Lancair 320 kit does supply three 1/8 NPT fitting blocks made of brass. One can be used for this purpose (the other two are for the wing tank drain sumps. Phenolic can also be substituted here for a weight reduction if desired).

**WARNING:** If you use a phenolic plate, take care in cutting the pipe threads and do not over tighten the fitting into the block. This could break the threads and cause the fitting to work loose.

2. This header tank sump drain fitting block should be bonded to the **OUTSIDE** of the sump bottom. The block should also be positioned to the far left (pilot side) of the sump area. This allows you to attach a 1/4" aluminum drain line such that it fits down through the tunnel close against the left side. (In contrast, if the line were to exit straight out the center of the sump bottom, it would be running into and through the center of the tunnel which would be undesirable.) Grind off the gel coating on the tank exterior where the fitting block will attach and include an area 1" around the block where BID will attach.

**WARNING:** You can not attach BID tapes to the gel coated surface. They will not bond and would likely fail at some point in time. Be sure that all gel coat material is removed where you are applying BID tapes to the exterior of this header tank.

3. Attach the sump drain fitting block in a manner similar to that used for the previous fitting block. Add 3 BID over the fitting block in a similar manner as well.
4. A flare fitting can now be screwed into this sump drain location (AN816-4D). Next, reposition the fwd deck/header tank onto the aircraft. Locate the sump drain fitting position relative to the nose gear tunnel. Place a mark, directly under the fitting, on the nose gear tunnel to reference this sump drain location.
5. Now remove the fwd deck / header tank and note the reference mark. An aluminum line will be attached which then punches straight down through the nose gear tunnel, near the left side. See figure 11-6.
6. Position the through hole such that there is a remaining flange area over which the grommet can fit. The standard elastic grommet (AN931-4-12) will require 1/8" all around the 3/4" hole. Punch a 3/4" dia. hole through the tunnel and install the elastic grommet.

**LANCAIR® 320FB**

11-21

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM

7. Attach a length of 1/4" aluminum line. The line should have an AN818 / 819-4D nut connected to the top end of the tubing. The tubing must then extend down to the base of the nose wheel well, with extra length for routing aft of the over center pivot.
8. With the 1/4" aluminum line attached, guide it down through the 3/4" hole and position the fwd deck / header tank back on the plane.
9. Locate a point at the base of the nose gear tunnel, approx. 3" aft of the over center pivot, where the line will terminate and the quick drain assembly will be installed. There are two methods of making this assembly, see figure 11-9.
10. Install a typical mounting pad (see figure 11-18) with 2 BID for the quick drain assembly about 3" aft of the over center pivot, and about 1" above the nearest surface of the nose gear door. Bend the aluminum tubing inside the nose gear tunnel, making a smooth flowing line from the through hole in the top to the quick drain assembly mounted at the bottom. Mark the line for a position to cut. Install the flare with an AN818 & 819 nut and sleeve.

**WARNING:** When making a sump drain check, you must drain an amount of fuel equal to the amount in the full line BEFORE any fuel specimen sample can represent what is up in the sump area itself. Thus you should fill the line with fuel and measure the amount it will hold. Then when making field samples, you'll know how much to drain before an accurate sump reading can be made each time. Generally about 1 oz. is sufficient.

**NOTE:** The header tank sump can easily be inspected "visually" with a flashlight since the sump is directly below the fuel cap. This visual inspection is recommended.

**NOTE:** When installing the pipe threaded fittings such as finger strainers, etc., use a standard pipe thread sealing compound. This is preferred over the teflon tape types since the tape can shear off and get into the lines.

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Chapter 11      REV.      0 / 11-1-91

11-22

FUEL SYSTEM



## G. Optional fuel gauge installation in header tank

There are two approaches to reading the fuel quantity in the header tank. One method is very simple and uses a "sight gauge". This is merely a clear vinyl tube (material is supplied in kits) which makes a loop from the bottom of the tank to the top of the tank. The line will thus attach at the bottom of the tank, run fwd to face of instrument panel, up the panel and back to the top of the tank. Thus you'll always see what you've got - WYSIWYG (What You See Is What You Got).

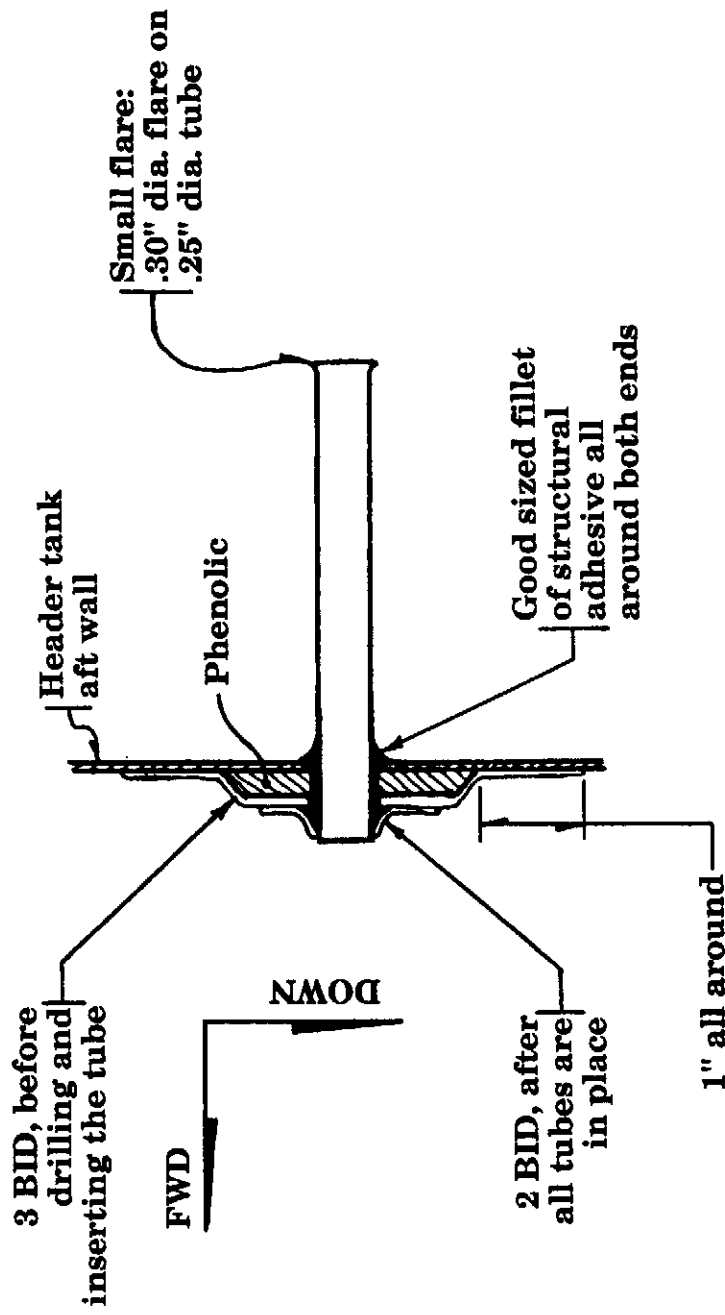
Many builders prefer to install a sender in the tank with an instrument gauge on the panel. The feeling is that it is more sophisticated in appearance. It's a matter of personal preference. Both methods will be discussed.

1. **Sight gauge**  
Refer to figure 11-6 for an overview.
  - a. Decide on which side of the radio stack you want the gauge to be located. Locate a point 4" left or right of tank centerline along the aft lower corner of the tank. Make a 1" x 1" x 1/4" phenolic block with tapered edges and bond it into the inside corner of the tank. Apply a 3 BID layout over it contacting 1" all around.
  - b. Locate a position directly above the bottom phenolic block and bond a similar sized phenolic block onto the inside of the tank 1" below the top. Lay a similar 3 BID patch over it too.
  - c. Next drill a 1/4" hole through the center of each phenolic block. Drill through the entire tank wall.
  - d. Make a short tube (about 3" long) out of 1/4" aluminum. Place a small flare on one end only. This flare should be about half the size of a standard type flare which would be used with a flare fitting. The purpose is to create a slight bulge over which a flexible tube can be sealed. The tube measures .250" in diameter, the flare should measure about .300".
  - e. Use a small amount of structural adhesive to bond the tube length into the phenolic. Insert the tube such that it extends 1/2" into the tank interior. Generate a good sized fillet of adhesive around the tube on both inside and outside.
  - f. It is advisable to add a 3 BID tape around the tube for added bonding strength. These tapes are best laid up one at a time from small strips of bi-directional cloth scraps. You need only apply these to the tube around the inside of the tank. See figure 11-11. The sight tube will be slid over these two tubes.

## Header Tank "PORT" (tube) Installation

Cross section view

Figure 11-11



- g. On the face of your instrument panel, locate the position where you want the sight gauge to be installed, see figure 11-6. Drill a 3/8" hole at the base of the panel and another at the top of the panel. The 3/8" O.D. sight tube will run up the panel through these holes. Use a piece of sand paper around a small piece of tubing or similar to sand a radius in the holes such that it helps the tube make the turn up the panel face.

**NOTE:** We generally position the tube against the right side of the radio stack area, since the left side tends, after time, to become packed tight with flight instruments.

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11-24

Chapter 11

REV.

0 / 11-1-91

FUEL SYSTEM

- h. To make a nice looking housing for this gauge, place a piece of 3/8" aluminum tubing (waxed) in position and fill the area around it with epoxy/micro. A piece of wood (waxed) can be temporarily placed to form a "dam" to hold the micro in position until it cures. At that time, remove the dam and the tube and punch through at the top and bottom for the entrance and exit of the sight gauge tube. With a little light sanding, this will make a very nice looking, custom installation for the sight gauge. If your instrument panel is dark colored, place a clean white stripe (about 1/8" wide) in the depression where the sight tube will locate. A white vinyl tape works well. That will make reading the fuel level easy. An alternate method is to carve a scrap piece of foam to the desired shape, then fiberglass in place. Refer to figure 11-12.

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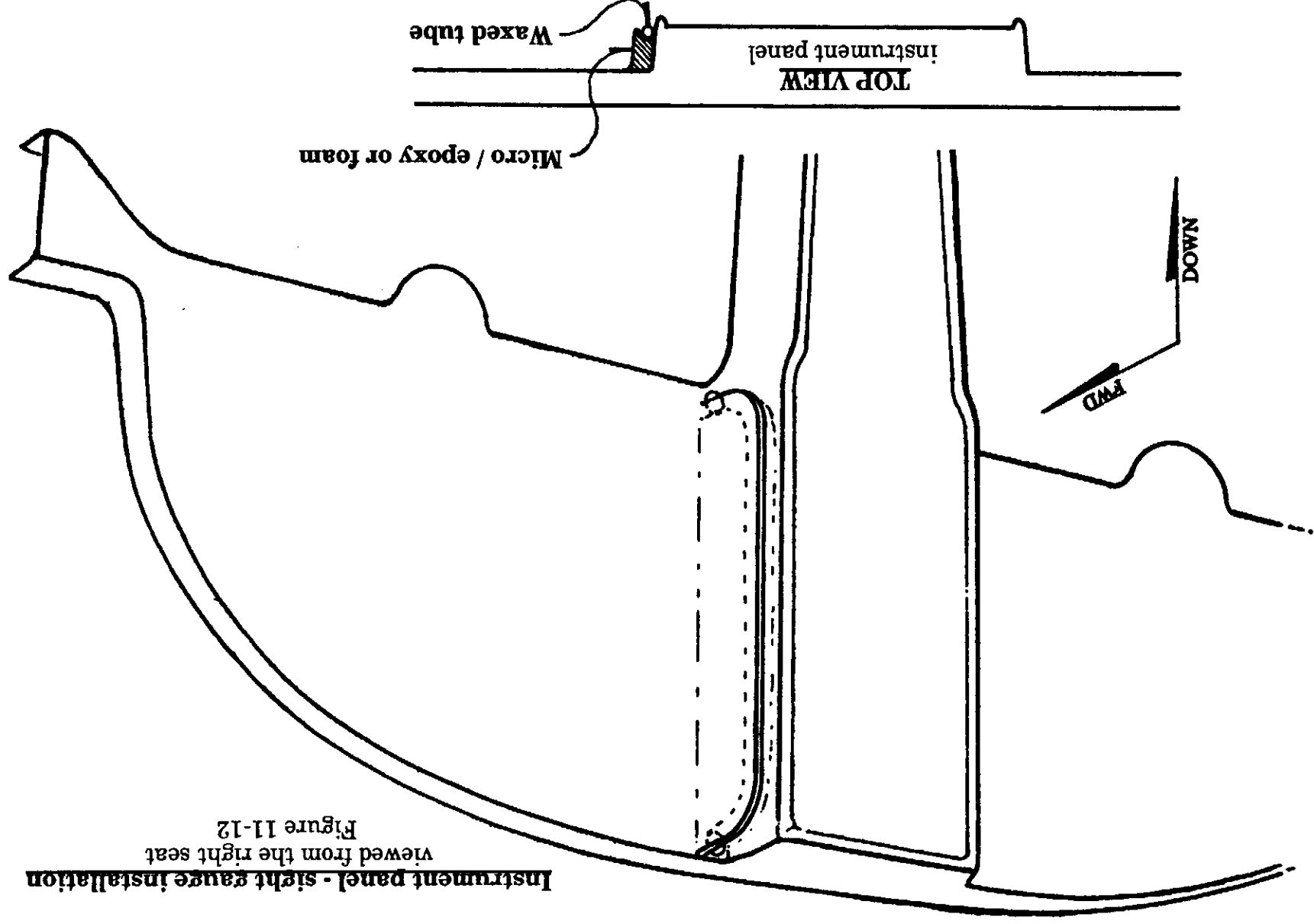
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11-25

Chapter 11    REV.    0 / 11-1-91  
FUEL SYSTEM



**Instrument panel - sight gauge installation**  
viewed from the right seat  
Figure 11-12



2. Remote fuel sender (optional)

Any of the remote type of fuel senders can be installed into the header tank. They will generally install from either the bottom or the side, along the top. Obviously, a top mounted sender would not work.

a. Whichever sender type you choose, it should generally be mounted near to the center of the tank so that the reading will remain the most steady in banks. This also allows for the full height of the tank to be measured.

b. There are several gauges available, most have what is a standard 5 bolt mounting pattern on them. They will require a through hole so that the sender can be mounted from the outside and a gasket placed on the outside of the tank will seal it.

c. The mounting collar is usually a piece of 1/8" aluminum with 5 threaded holes in it for AN3 bolts. This plate can be bonded to the inside of the tank just like the method used for attaching the brass fitting blocks. Apply 3 BID over the plate and during the "green" stage of the BID cure, trim away for the through holes and the bolt holes.

**LANCAIR® 320FB**

11-27

Chapter 11

REV. 0 / 11-1-91

FUEL SYSTEM

## H. Fuel transfer ports

The standard fuel management system has the wing tanks transferring fuel to the header tank. This is via an electric fuel transfer pump, one for each wing. Since the engine is not directly operating from the wing tanks, a 1/4" line can be used for transferring.

1. Make a phenolic block 1/4" x 1" x 4". Taper the edges on about a 60° angle.
2. Locate a position on the left inner side of the header tank rear vertical face. This position should be such that the block is at least 1/2" below the top. It should also be left of center such that it clears all radio trays, etc. This means it's inbd edge must be at least 3-3/4" left of center to provide a little clearance room.
3. Attach the phenolic block to the inside in the standard manner and apply 3 BID over it.
4. From the inside: mark the phenolic block for 3, 1/4" holes. Evenly spaced, 1" apart. Drill these holes from the inside.
5. Make two short (3") pieces of tube (1/4" aluminum 5052-0) and put a slight flare on them.
6. Bond them into the two inbd holes in the phenolic such that they extend 1/2" into the inside of the tank. Rough up the tubing a little and use structural adhesive. Leave a good sized fillet around the tubes at each side of the tank wall.
7. Add 3 BID strips around the tube ends on the inner side where the tubes protrude. The third hole is for the vent tube. It is recommended that you wait until you have installed this vent tube before adding these 3 BID tapes so that you can run these tapes around all three tubes at the same time. See figure 11-11.

## I. Vent line

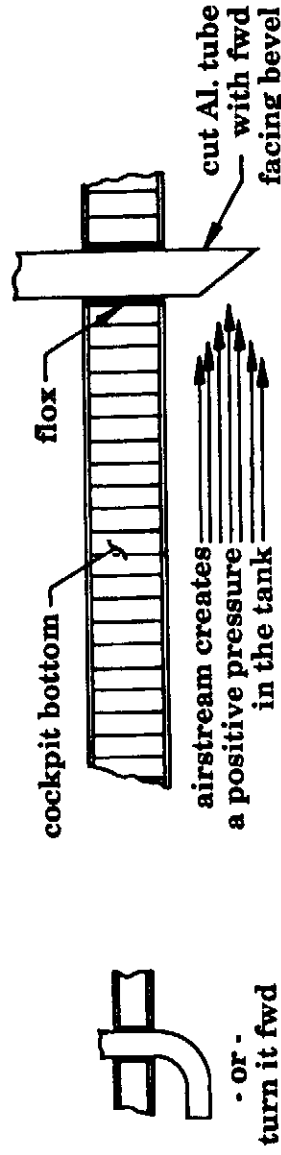
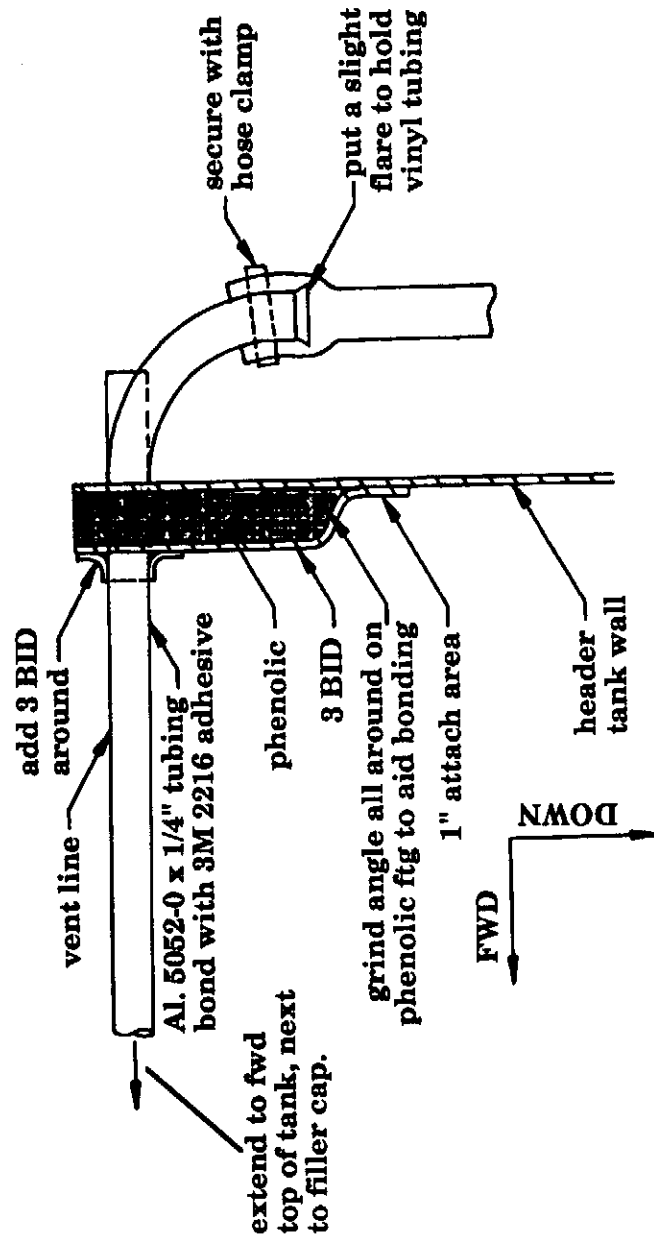
The header tank must be vented to atmosphere to prevent an air lock as fuel is drained out to the engine. A vent line will be installed which effectively goes from the fwd top center of the tank and exits out the bottom of the fslg. Refer to figures 11-6 and 11-7.

1. Using a length of 1/4" 5052-0 aluminum line, fit it to transition across from the third remaining hole in the phenolic block, across to the fwd center of the tank, at the top. It should end about six (6") inches aft of the tank fwd face. That will place it actually near the fwd-aft center of the tank which will be close to the filler port.

The tube should extend aft, through the phenolic block and make a downward turn as it exits the tank. There a small flare will be placed to accept a hose connection. See figures 11-6 and 11-13. (p 11-15, 11-16)

### Vent line

Cross section view  
Figure 11-13



2. With this length of tubing cut, fitted and flared slightly, insert it through the phenolic block. Use structural adhesive to bond into the block. Just leave the length of line loose in the tank area for now, it will be secured later.
3. Now add the 3 BID around this vent tube and both filler tubes on the inside of the tank at the phenolic block locations.
4. Once the tank and fwd deck are in position, the vent line will connect via a hose connection and extend down to the base of the fslg. The location of the tank vent out of the fslg is not too critical. Consider the placement of the vent line exiting the fslg relative to leg room, etc. Also be sure that it does not exit so close to the nose gear tunnel that it actually falls under the overlap lip of the nose gear door onto the fslg bottom.  
Generally, If you drill the 1/4" hole close to the fwd face of the main spar and in a line just outbd of the nose gear tunnel, the location will be good. See figure 11-6. (P 11-15)
5. Use a length of 1/4" aluminum line that extends 1/2" out the bottom of the fslg. This line can extend up to a point within 3-4" of the vent line that exits the header tank. Place a slight flare on this end of the line and cut the outbd end of the line on a 45° angle INTO the airstream. See figure 11-13. (P 11-29)
6. Use a short length of hose to make the vent line connection with small hose clamps to secure at both ends.



## J. Float switch (optional)

To prevent the possibility of forgetting to turn off the fuel transfer pump and thus pumping overboard, a float switch connected to a warning light can be installed. Aircraft Spruce and Specialty carries a switch which works well for this application. P152,157

**NOTE:** Some of the switches that we have received did not have sufficient buoyancy in gasoline's low density to activate the switch. We cut the end off the float switch, epoxied 2 wine corks end to end (3" to 4" total length), sanded the cork to fit the inside diameter of the float cylinder, then covered the cork with epoxy and epoxied it into the float cylinder.

1. The float switch can be installed near the top of the aft wall of the tank with a threaded phenolic block that is bonded and 3 BID taped into position. Again, it is best to install this away from the center radio stack area.
2. Be sure to test the float switch out (in gasoline) so you'll know exactly where it activates. The switch should be set up to close the contact points when the float is raised by the rising fuel in the tank. Thus, as the tank is filled, the light will let you know it and remind you to turn the filler pumps off.
3. If you wire the float switch light through a DPDT (double pole, double throw) fuel transfer pump switch, then when you turn the switch off, the warning light will also go off. Otherwise you'll have to wait until the tank drains down some before the float drops and the light goes off.

## K. Tank baffles

The header tank should have sloshing baffles installed. These baffles prevent fuel from moving too fast in the tank which could upset balance and trim. As always, make cardboard patterns first, refer to figure 11-7 for positioning.

P11-16 also Fig 11-14, P11-35

1. A simple method of making the baffles themselves is to lay up 2 BID on a flat surface that has a plastic tape release on it. Allow to cure.
2. Trim this material to form the baffles as shown in figure 11-14 (as always, make cardboard patterns first, we can't stress it enough). Use a straight edge along the top of the tank to check pattern fit.
3. Use 1 BID tapes to hold the baffles in position in the tank.

**WARNING:** The cutouts in these baffles is very important. You must be careful to not isolate any "pockets" where fuel would be trapped and contaminants could gather. An area that could gather contaminants could cause a sudden release of the contaminants which could in turn travel over and cause a total and instant blockage of the pickup port thus causing the engine to quit. **BE VERY CAREFUL ABOUT THIS.** Also, for the same reasons, the inside of the tank should be smoothed where tapes have been applied.

4. Where the vent line crosses the baffles, make a notch and place a 1 BID tape to secure the vent line in position. The inbd end of the vent line will simply be bent such that it remains approximately 1/4" below the top surface of the tank. This can be established with the use of a straight edge along the top of the tank and checking for proper clearances. Adjust the tube as necessary by making slight bends in it.

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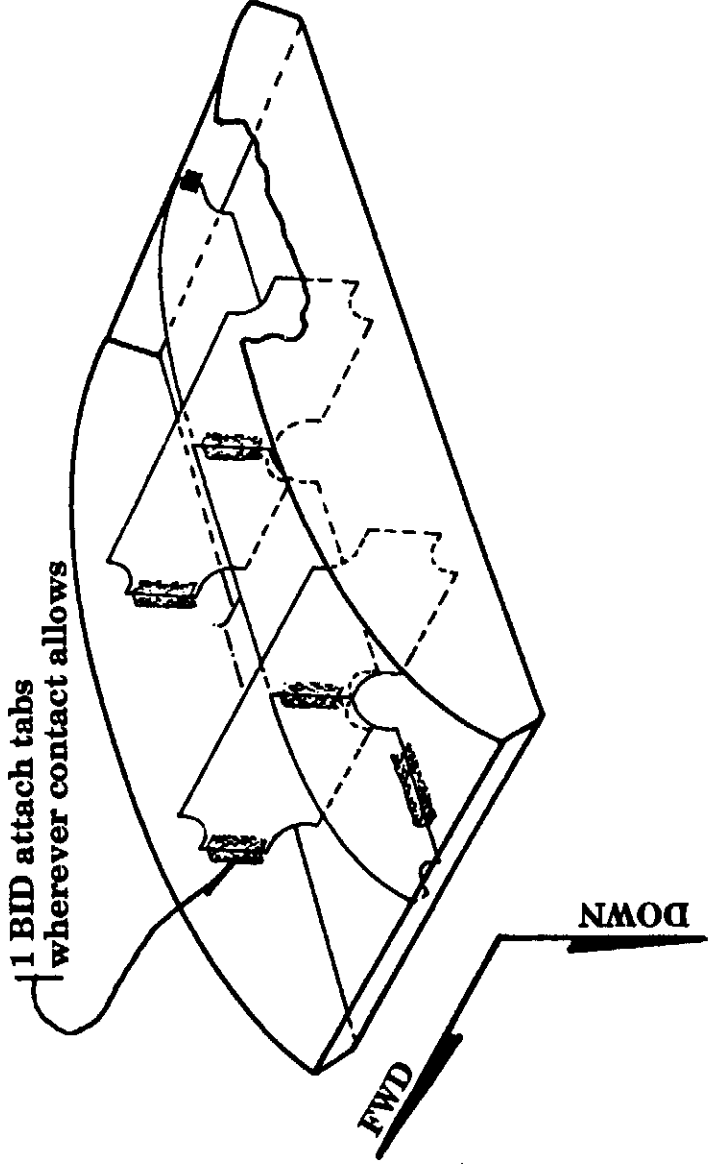
11-32

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM

# Header tank baffles

Figure 11-14



## L. Attaching header tank to fwd deck

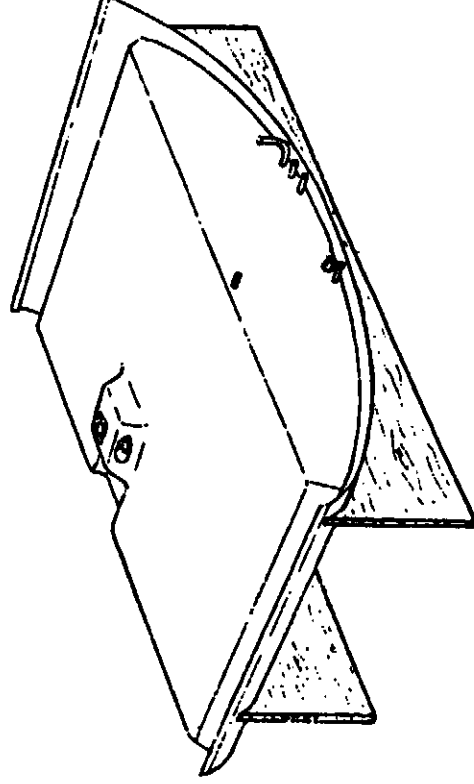
With all of the inside fuel tank fittings installed, the tank is ready to be permanently bonded to the upper fwd deck. The upper inside of the deck must first be prepared.

1. Lightly sand the entire area of the tank plus an area 3-4" outside of that area.
2. If you are using the PRC 1422 sealer, it should be applied to the fwd deck in a manner similar to that used to apply it to the wing tanks. A primer is also recommended. The primer sealer must be applied only to the areas which will be inside the tank itself (not to the areas where the tank will be bonded into position). The other alternative is to apply two thick coats of resin over the surfaces.
3. With the fwd deck still in its cradle (inverted on a flat surface), apply epoxy/flox around the perimeter where the tank lip mates and install the fuel tank, see figure 11-15. Use weights to hold it down against the fwd deck. If the lip on the tank does not fit tightly against the fwd deck, simply fill the voids with epoxy/flox. Try to position the epoxy/flox such that most of the squeeze out will be on the outside of the tank. You don't want the stuff dropping down into the tank interior.
4. After cure, sand smooth, clean and apply a 3 BID tape all around the perimeter. This tape should be 2-1/2" to 3" wide. Contact 1-1/2" to 2" onto the fwd deck interior surface. Be sure that there are no voids or air bubbles which could generate a leak later.
5. This will complete the header tank assembly. The two plywood cradles can be knocked off now. There will be some Bondo residue remaining, just sand that off.

### Header Tank to Fwd Deck Installation

(inverted)

Figure 11-15



**M. Primary fuel supply line to firewall / engine**

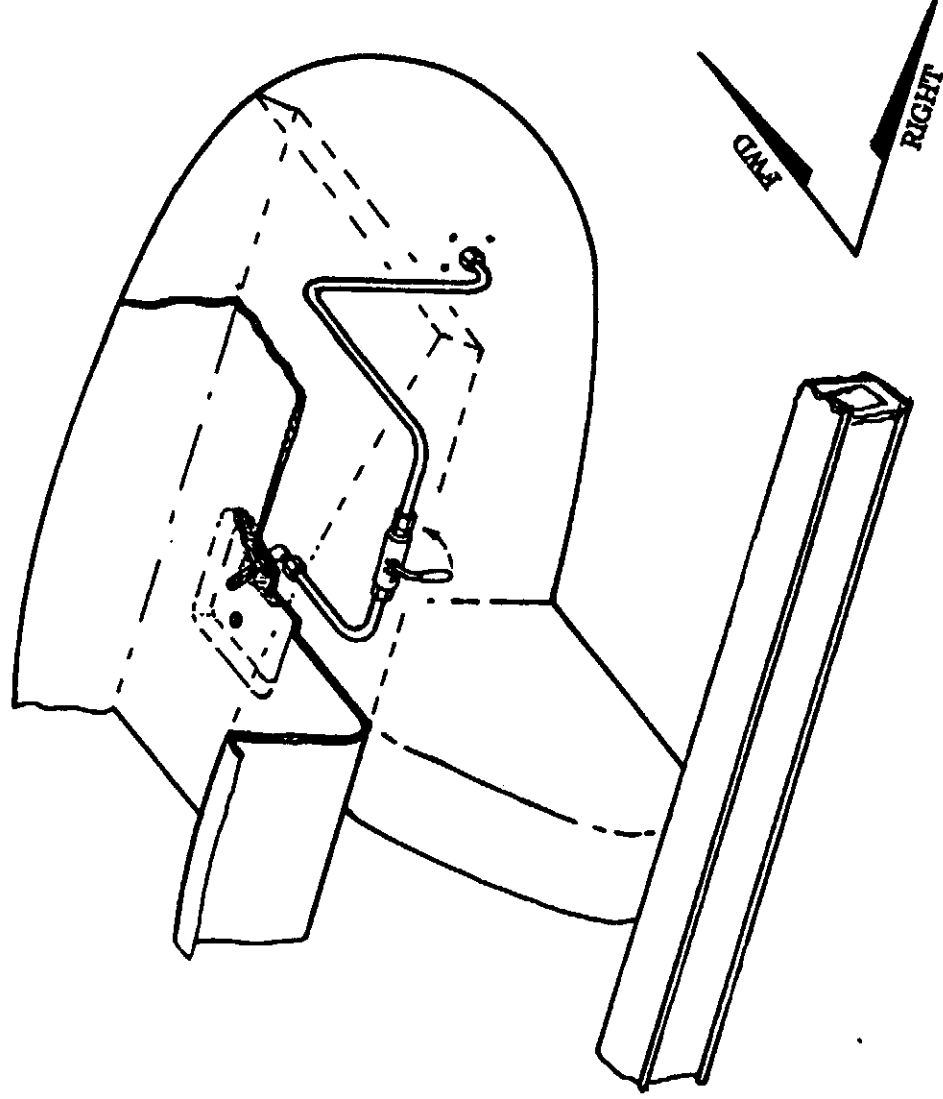
The fuel supply to the engine will originate from the Main Fuel Pickup Port located on the right side of the header tank sump. The 3/8 NPT fitting block has already been installed into position for this use.

The fuel line (3/8" 5052-0 aluminum tubing) is routed from this fitting, aft, making a "U" shape under the header tank where it passes through a Main Shut-Off Valve and then fwd to the firewall and down to the point where it passes through to the engine, see figure 11-16. The purpose is to locate the Main Shut-Off Valve where you can reach it from the pilots seat (the fuel system fwd of the firewall is covered in chapter 21). Place pipe thread sealer around the threads on all fittings.

**Primary fuel supply**

(cut away view)

Figure 11-16

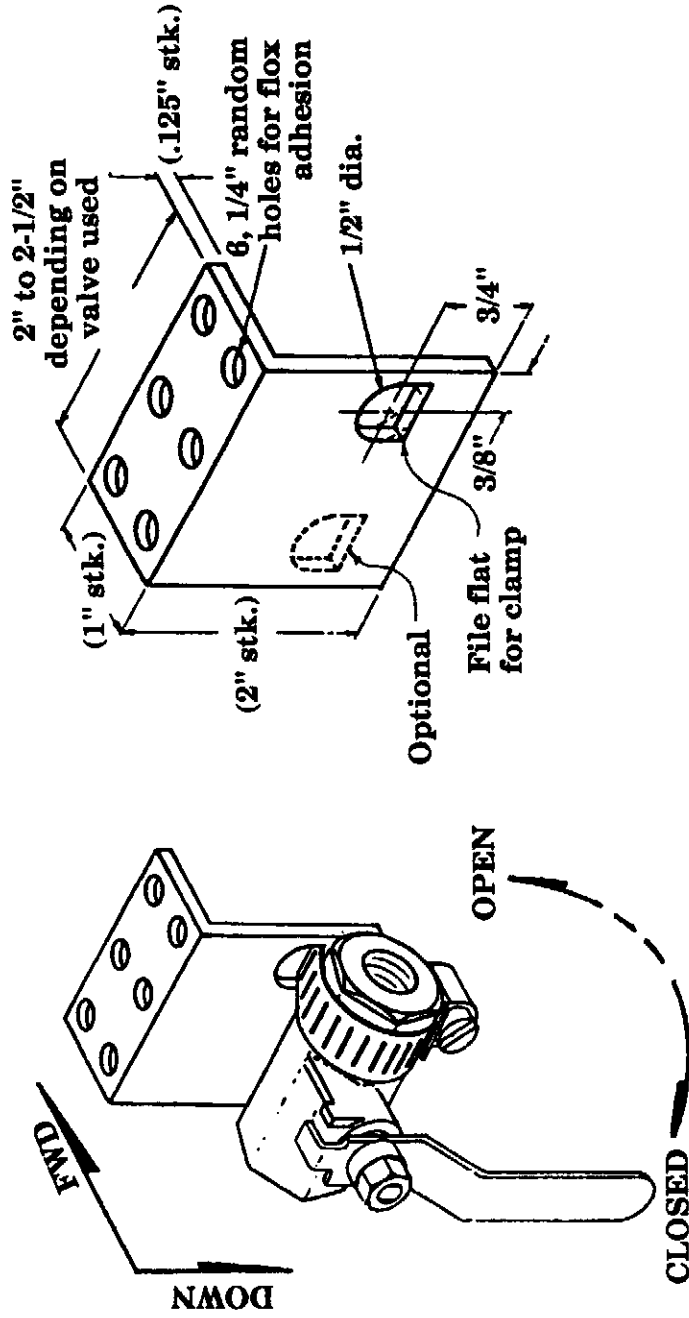


1. Remove the fwd deck/header tank from the fslg.

2. Per figure 11-17, use aluminum angle stock (1" x 2" x .125" thick) to make the mount bracket for the Main Shut-Off Valve attachment onto the base of the header tank.

### Main Shut-Off Valve Mount Bracket


Figure 11-17



3. To locate the attachment area (for the mounting bracket) on the bottom of the header tank: measure approx. 7" outbd from the center line along the aft edge, start at this point and mark a rectangle that extends 6" outbd x 4" fwd. Sand the gel-coat off around this area. Be very careful to only sand the gel-coat, do not sand into the tank "glass" itself.

4. Clean and rough sand the base of the "L" bracket (top & bottom) where it is attached to the header tank. Immediately flox the base (pushing it through the holes) and press it in place with the back of the "L" bracket near the aft edge of the header tank. Smooth the flox to form fillets around the edges.

5. Apply 4 BID over the base of the "L" bracket while the flox is still wet. The BID shall extend 1-1/2" all around. Allow to cure completely.


- 
6. Clamp the Main Shut-Off Valve to the "L" bracket with the handle in the "CLOSED" position, then work the valve handle to be sure there is no interference. Also tend to any sharp corners that may need filing.
  7. Insert the finger strainer into the fuel tank fitting block.
  8. Next install the AN822-6D elbow into the finger strainer.
  9. Install 2 AN816-6D (nipples) in the Main Shut-Off Valve, one each side.
  10. Install AN818-6D and AN819-6D (coupling nut & sleeve) to the fuel line ends as you route the aluminum tubing as shown in figure 11-16.
  11. Fit the aluminum line to the tank such that it runs down the vertical face of the firewall. At this point you will need to refer to chapter 21 for the "Firewall Fwd" to complete the fuel system installation fwd of the firewall.

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11-37

Chapter 11      REV.      0 / 11-1-91  
FUEL SYSTEM



## N.

### Wing tank connections

The fuel from the outboard wing tanks will be transferred to the central header tank via one electric fuel transfer pump for each wing tank, thus two transfer pumps will be installed. These transfer pumps are generally installed under the seats. They are standard with all Lancair 320 kits.

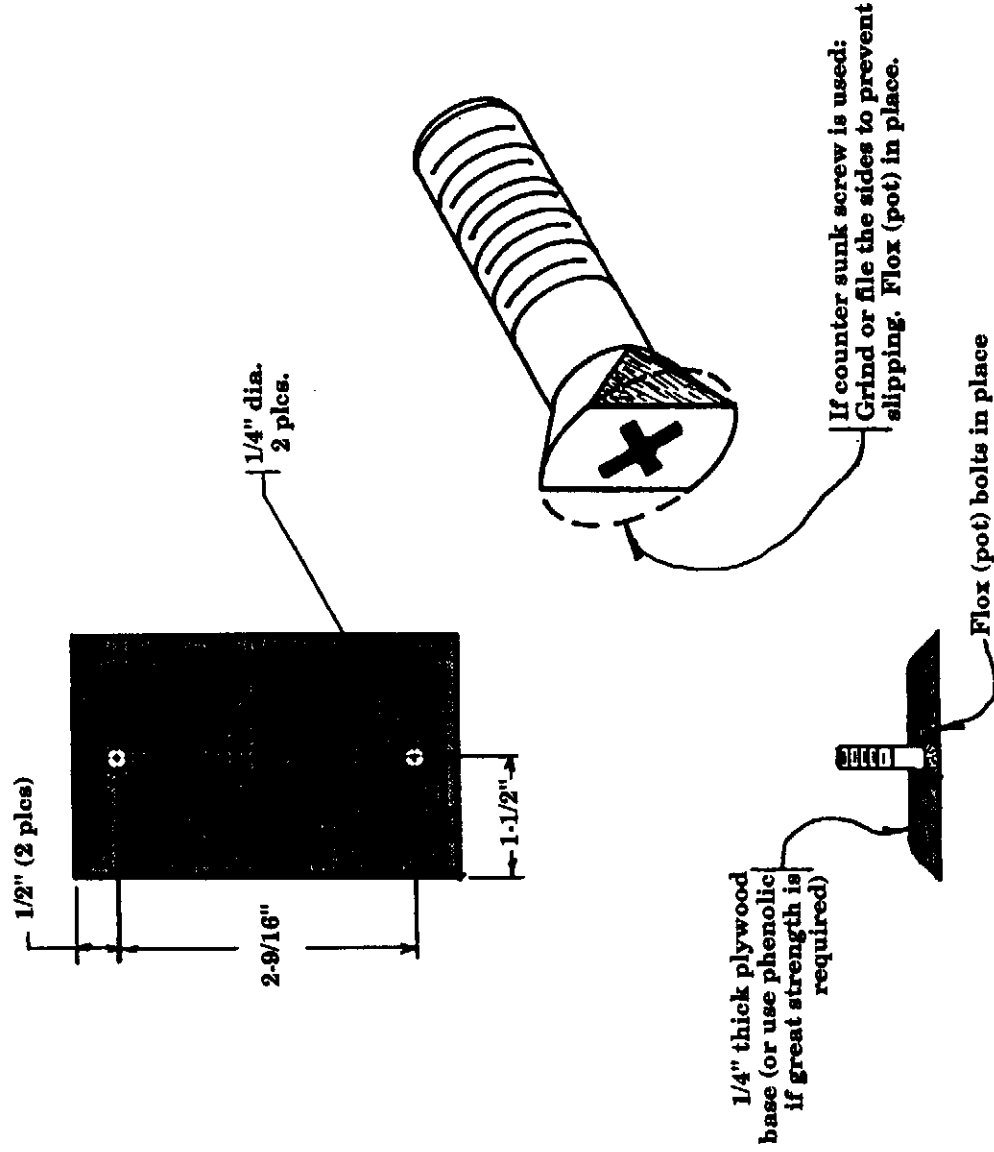
1. First, make two 1/4" thick plywood base plates that anchor the transfer pumps down to the floor, see figure 11-18. Each plate will require two AN3-5A bolts or MS24694-S52 screws. Pot (bond) the two AN3 bolts into the plywood from the bottom side using epoxy/flox and allow to cure.

**NOTE:** Many builders have reported excellent installations of the transfer pumps into the aft portion of the stub wings.

### Mount Plate - Fuel Transfer Pump

(typical mount plate for composite surfaces)

Figure 11-18



**LANCAIR® 320FB**

11-38

Chapter 11

REV.

0 / 11-1-91

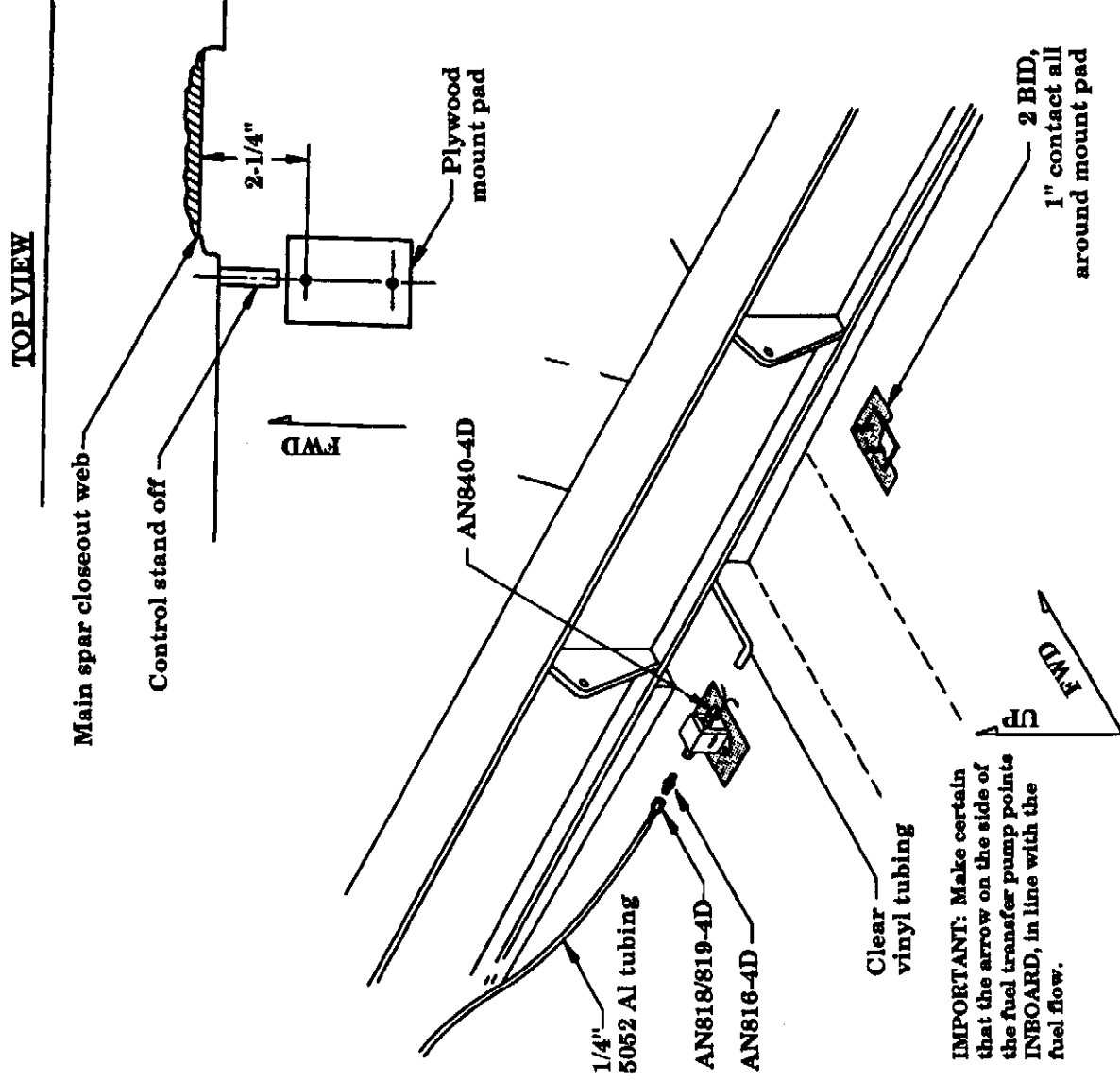
FUEL SYSTEM



2. Using epoxy/flox again, pot the plywood plates down onto the floor in proper position and apply 2 BID over the top (wrap the bolt threads with plastic tape to protect them). Contact 1" onto the bottom pan, all around the plate. See figure 11-19.
3. Install the right and left fuel transfer pumps on the mount pads with elastic stop nuts (AN365-1032). Be sure that the flow direction of each pump is inboard (the arrow on the side should point to the center of the airplane).

### Fuel Transfer Pumps - Installation

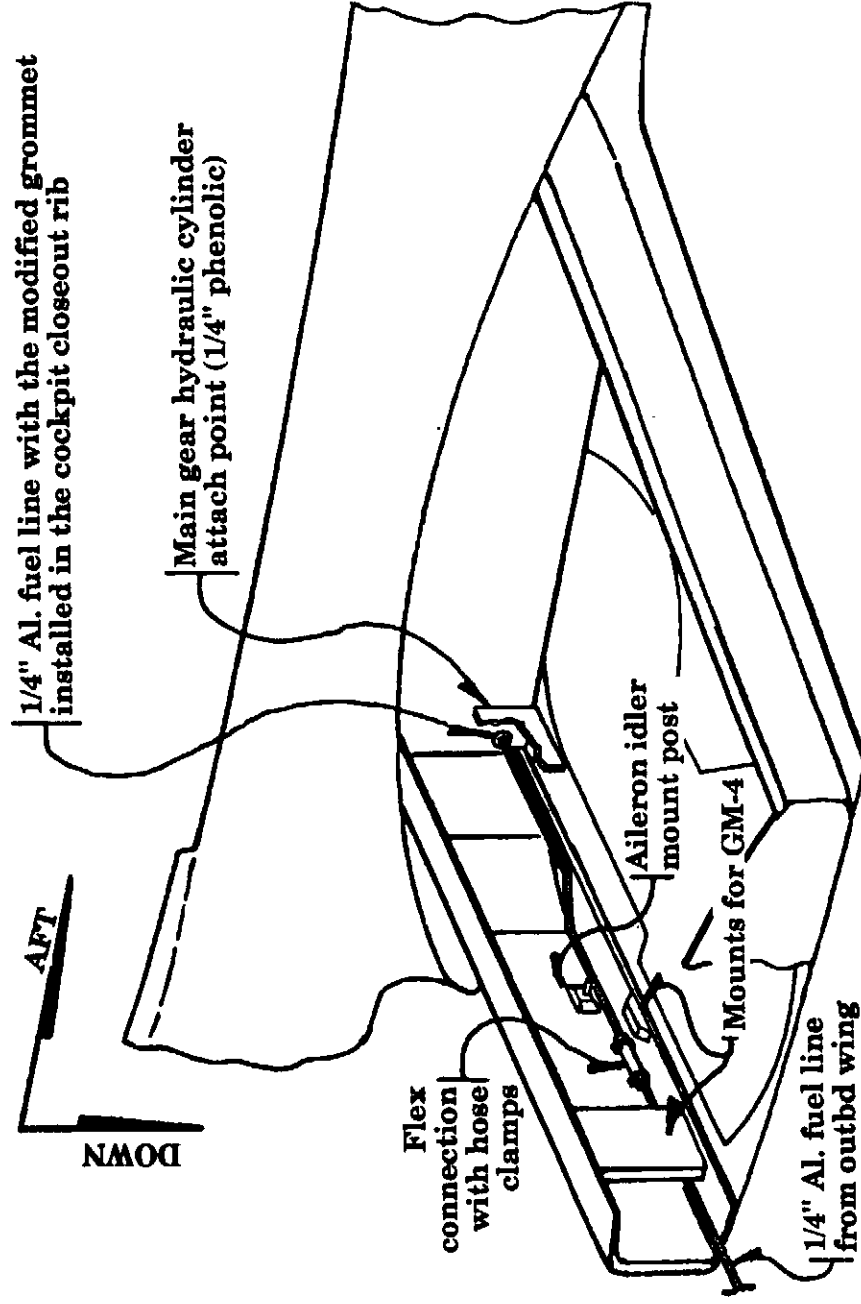
Figure 11-19



4. With the outboard wings completed, the aluminum line will route through BL 50 rib, behind the primary phenolic support brace for the main gear GM-4, and terminate 3" outboard of the secondary attach point for GM-4. This will place the flextube connection between GM-4 and the vertical spar face. From this point the fuel line must now be continued.
5. Here a 6" long piece of flexible tubing will serve as a connector between the two aluminum lines. The aluminum line should have a very slight flare on both ends to facilitate a tight seal, do not put a full flare though since it will not allow the flex hose coupling to slip over it. Tighten hose clamps on each end. See figure 11-20.
6. Next route the aluminum line from a point 2-3" from the end (in the stub wing area) through the cockpit closeout rib and to the "in" side of the electric fuel pump, see figure 11-20.

### Fuel Line Routing - Stub Wing Area

Figure 11-20

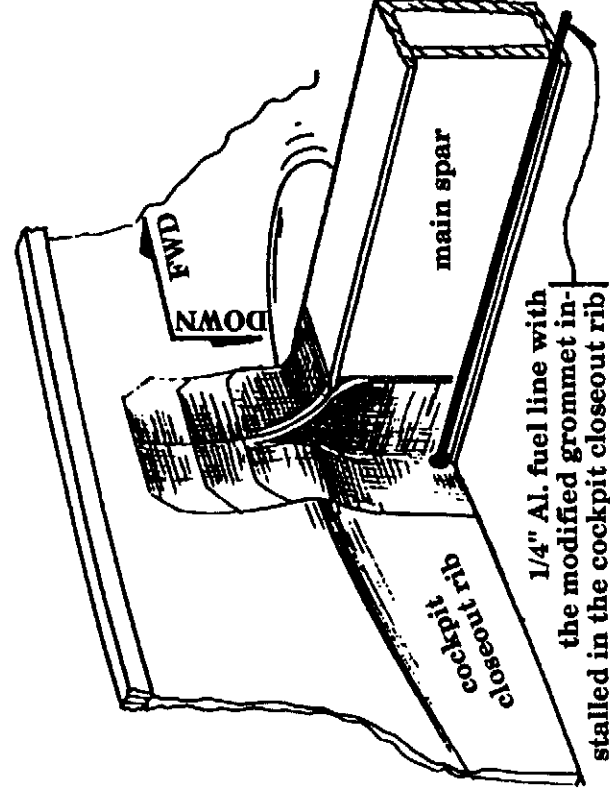


7. Where the line passes through the cockpit closeout rib, a rubber grommet or equiv. should be positioned to prevent any chance of chafing against the fiberglass of the rib. Most grommets are not designed to accommodate a thick bulkhead thus the following procedure can be used. See figure 11-21.
8. Trim off the flange from one side of the grommet (AN931-4-7) leaving the center portion with a flange on one side. This center portion will be 7/16" dia. Make two for each line.

### Grommet Installation

Thick bulkhead modification

Figure 11-21



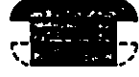
Trim off one flange with Xacto knife, toe nail clippers, or small scissors



AN931-4-7  
(2 req'd per side)



Silicone adhesive



**LANCAIR® 320FB**

11-41

Chapter 11

REV. 0 / 11-1-91

FUEL SYSTEM

9. Drill a 7/16" hole through the bulkhead and use silicone to bond one grommet into the hole from each side. Allow this to cure about one hour. Next the 1/4" aluminum line can be slid through the grommets which will then provide an insulation from the fiberglass side walls. A little silicone on the tube where it passes through the grommet will assure a weather tight seal.

10. Check to make sure that the fuel line is not subject to any chafing, and is well clear of the gear well opening so that the gear and tire can not rub against it during cycling. The line can be secured down the airframe along its path by means of a simple clamp (MS21919-DG4). Secure the clamps to the composite surface with the same effective method used to mount the fuel pumps (pot a bolt into a piece of plywood, then floc and 2 BID it to the surface). These type of clamps have a rubber cushion around their perimeter to prevent any possibility of chafing.

11. Recheck the side of the fuel pump for a flow direction arrow, making sure that the line coming in from the wing tank is routed to the INLET side of the pump. Also be sure that your routing of the line stays clear of the hydraulic actuator.

12. Cut and flare the aluminum line (remembering, of course, to put the AN818-4D and 819-4D nut and sleeve on the line first), with a flare fitting, AN816-4D, in the fuel pump.

**NOTE:** Next, the line from the fuel transfer pump to the header tank must be installed. Many builders prefer to route this section of line using clear vinyl tubing and routing it such that the lines can be visually observed during flight to verify that fuel is indeed moving through the lines when the pumps are turned on. Also to verify when the tank runs empty so that the pump can be turned off. To accomplish this, the instrument panel must be installed so that an area along its console base can be used to expose a short portion of the clear line for visual observation.

13. If the line installation is to accommodate the above consideration, the instrument panel must be installed (see instrument panel installation, chapter 16). After that installation, insert the AN840-4D nipple fitting into the "OUT" side of the fuel transfer pump.

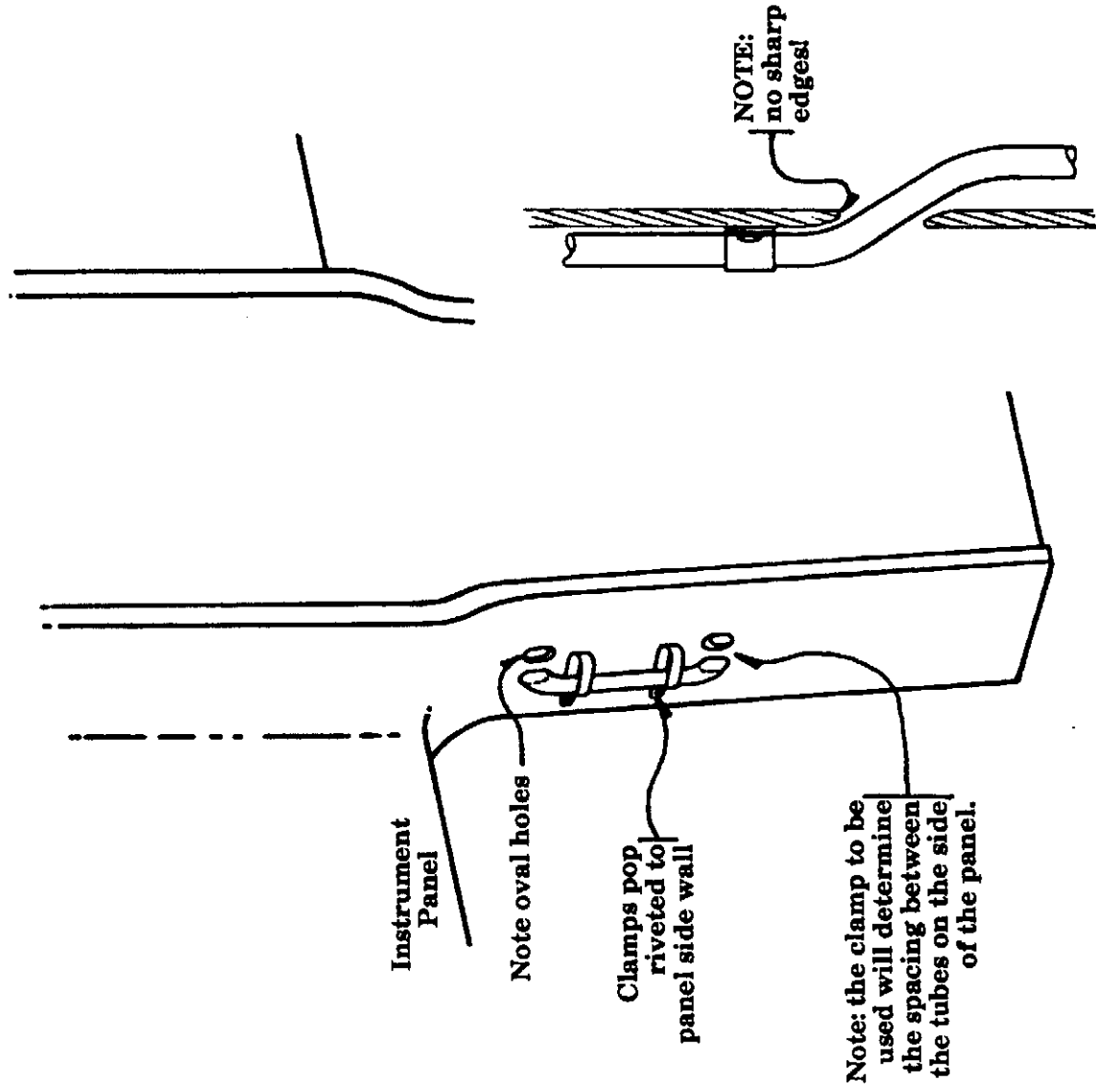
14. Locate a position on the side of the instrument panel/console base for the two fuel lines to allow observation, see figure 11-22. Cut the through holes in the panel and sand/file a smooth radius for the exit and insertion of the clear vinyl lines. **USE EXTREME CARE** to make sure that there are no sharp edges that could cut into the fuel lines. With a scrap piece of line, check the fit through the holes. Adjust as necessary. When the hole is properly fitted, it will take on an oblong appearance.

15. Route the fuel lines through this cutout, out through the sidewall, up the face approximately 3-4" and back through the panel sidewall. From there the line will extend upward to the fuel transfer ports on the header tank. This should not be installed until the panel is essentially installed, wired and completed.
16. Secure the line carefully so that there is no chance of any chafing. The line should also have a little bit of "slack" in it so as to not get stretched or receive a pull should the panel flex or shake with engine operation or passenger entry/exit, etc.

### Visual fuel transfer indicator

(clear vinyl tubing)

Figure 11-22



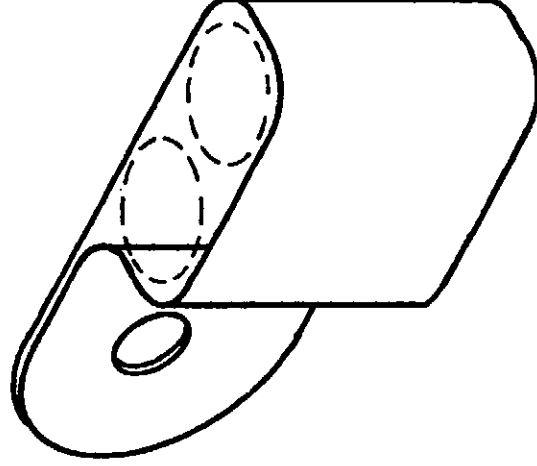
17. Note that the line will tend to bow out from the surface of the panel sidewall. This must be restrained and the line must be secured against the side of the panel sidewall. A small scrap of soft aluminum or equiv. can be cut and sized to nicely secure the line against the sidewall, see figure 11-23. Two small pieces like this will work well and provide a good looking installation as well. They can be pop-riveted to the panel sidewall after the panel is painted.

**NOTE:** It is acceptable to make a trial fit of these lines but do not permanently install them just yet. All the cockpit installation should be completed before these lines are permanently installed.

### Restraints for Visual Fuel Transfer Indicator

(Clear vinyl tubing)

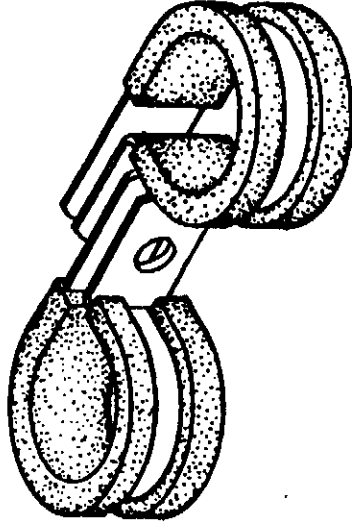
Figure 11-23



Custom made aluminum  
clamp (2 required)

**NOTE:** The clamp to be used will determine the spacing between the tubes on the side of the panel.

Two MS21919-DG6  
clamps (min. 4 req'd)



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11-44

Chapter 11

REV.

0 / 11-1-91

FUEL SYSTEM

## Forward deck installation

The fwd deck is now ready for installation. BUT, unless you are using on of the removable fwd deck methods, **THIS SHOULD BE DONE LAST**. After all systems and mechanicals are installed and double checked (just prior to final sanding and paint preparation). The permanent installation will be described here for future reference. **IF YOU DON'T WAIT, YOU'LL BE SORRY!!**

If you are installing either of the removable systems, they can be installed at any time from now on. A removable forward deck provides valuable access to service the instruments and mechanicals located in this area.

### OPTIONS:

1. **The PERMANENT** installation is the simplest and provides a seamless finish, but lacks the advantage of access. The bonding is identical to joining the fslg halves. P 11-45

2. **The HINGE MOUNT, REMOVABLE** method is used on the Company's red 320. Basically, it works by attaching the top of the hinge to the fwd deck and the bottom of the hinge to the fslg. The pin is cut long for a grab handle and is pulled out for removal of the fwd deck, then pushed back in when the deck is reattached. Externally it has a clean horizontal fit line showing no hardware (show quality finish), but it is the most complicated to install and can be difficult to reinstall if the hinge pin does not slide in and out with moderate resistance. P 11-47

3. **The SCREW MOUNT, REMOVABLE** method works just like the cowl, it is very straight forward to install and is very easy to remove/reinstall, but has flush screw heads showing along the exterior fit line (just like the cowling). P 11-57

### O. The PERMANENT forward deck installation

The forward deck will attach in the same manner as joining the fslg halves.

1. Drill and cleco as you go, starting at the top center of the fire wall lip, work down to one corner, then from the top down to the other corner. Then work horizontally, from the firewall, aft. Locate the rivet holes, 2" apart, so that the same holes can be used for the upper cowl mounting.
2. Remove all clecoes and sand/clean the surfaces for adhesive. Apply structural adhesive to both the fwd deck and the fslg/firewall, where contact is made. Cleco the fwd deck to the fslg, using only the alignment holes at the corners.
3. Pop rivet the fwd deck/fslg following the same pattern as when installing the clecoes.
4. After adhesive has set, drill out all rivets and micro/epoxy all rivet holes and micro/epoxy fill along the horizontal fslg seam.

**LANCAIR® 320FB**

11-45

Chapter 11

REV.

0 / 11-1-91

FUEL SYSTEM

5. Sand the horizontal fslg joggles on both sides and apply 2 BID to the inside and out, (left and right). DO NOT APPLY BID TO THE JOGGLE WHERE THE COWL OR CANOPY FITS.



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11-46

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM





**P. Forward deck installation hinge mount system**

It is imperative to the proper operation of this mount system that the surface to which the hinge is to be mounted is smooth and consistent in its contour (the more straight it is the better it works), otherwise the hinge pin will bind when being inserted.

**NOTE:** Two electric drills will save a lot of time and frustration for this procedure, one for the 1/8" or 3/16" and one for the countersink. At times, each hole must be drilled, countersunk and riveted, before going on to the next hole. Use of a "micro stop, piloted, countersink" is highly recommended (this item is available from many aircraft parts suppliers).

1. Sand the old BID area inside of the joggle area above the longeron, where the fwd deck will attach (inside the fslg) with a block sander for a flat finish.
2. Apply 4 BID from the aft end of the joggle to the butt end of the old BIDs covering the fire wall brace, fire wall and vertical joggle, see figure 11-25.

**NOTE:** If the old BIDs are not straight after sanding, 2 additional BIDs may be necessary, covering the full length.

3. Before allowing the BID lay up to cure, cover two pieces of angle aluminum (1" x 2" works well) with wax or release tape and clamp it in place. Be sure that the angle piece used for the inside is taped so that there are no tape overlaps or bumps. One on the inside and one on the outside as shown in figure 11-26. Start at the fire wall and work aft, clamping as you go. The clamps on the old BID should be tight, while pressure on the remaining portion will need to be varied to achieve a visually consistent thickness. Allow this to cure completely before removing the clamps.

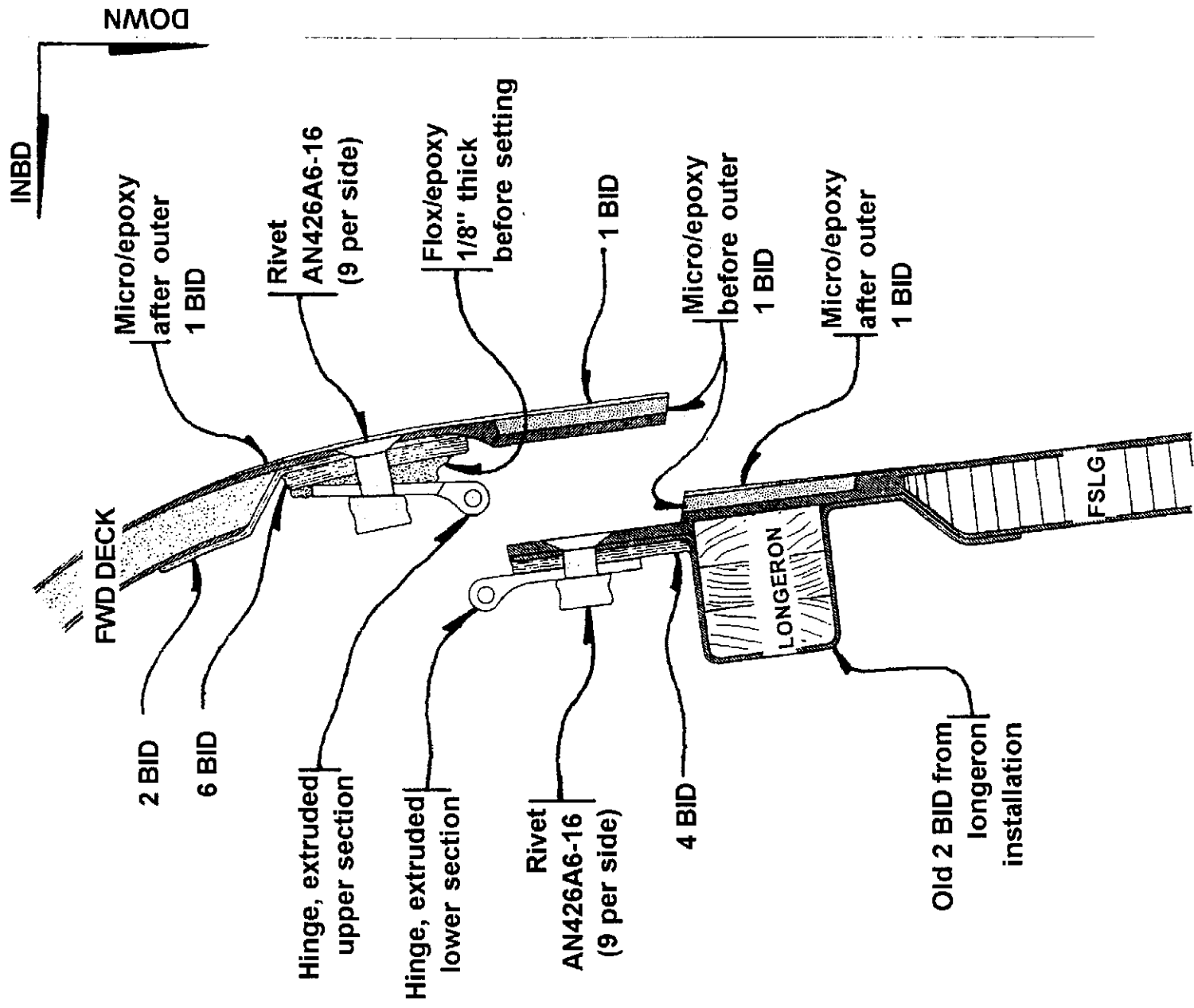
4. Sand to a flat, smooth contour.

5. The hinges must be prepared for installation. Refer to figure 11-27 for cutting, fitting marking and drilling instructions (as always, make a cardboard pattern first and check the fit). It is important to mark each hinge section on the inside; "upper left", "lower left", "upper right", "lower right" as is appropriate. This will eliminate confusion after the hinges are disassembled for installation.

**IMPORTANT:** The pin must be longer than the hinge, the extra length of the pin will be used to form the handle at the aft end (3-1/2" recommended). But do not bend the pin until installation is complete.

# Forward deck installation, hinge mount system

Cross sectional view  
Figure 11-24



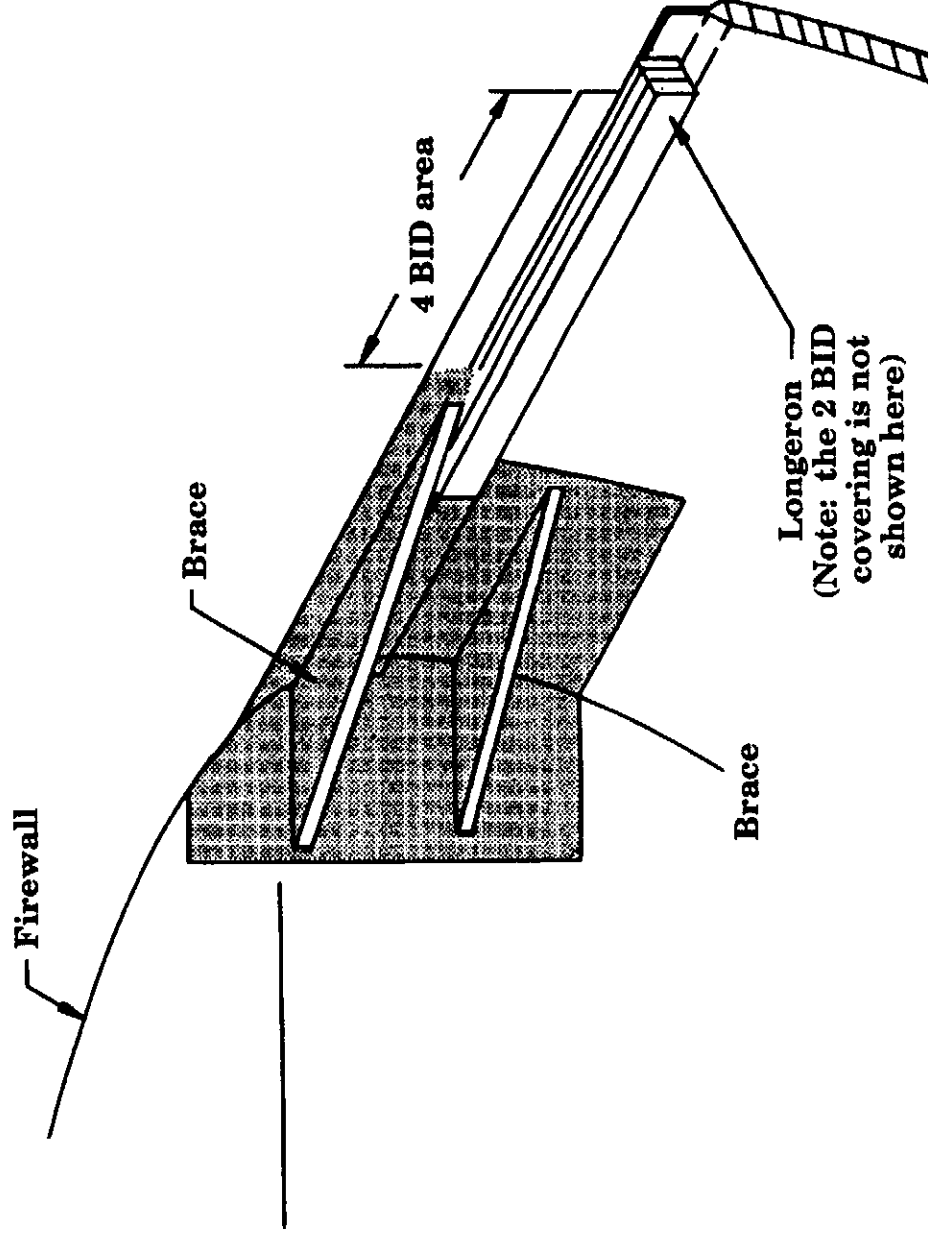
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11-48

Chapter 11 REV. 6/04-01-99  
FUEL SYSTEM

## FSLG joggle preparation

Figure 11-25



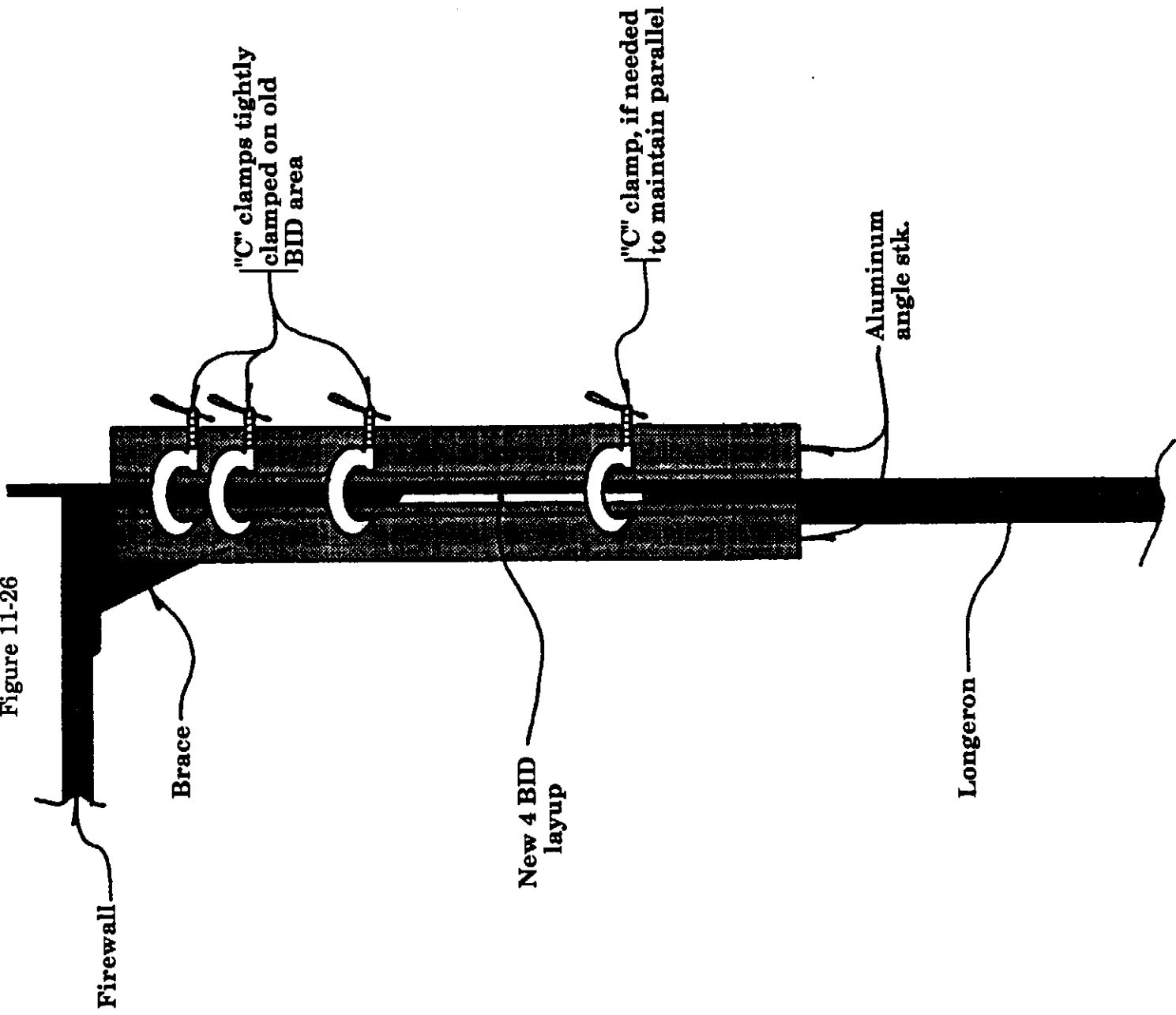
6. Disassemble the upper and lower sections of the hinge, set the upper section aside. Position the lower hinge section with the flat side against the BID (curve facing inboard). Trim the edge to fit around the brace with the hinge line just above the fslg joggle, see figure 11-28. File or sand all edges and corners smooth and free of burrs. Clamp in place with 4 clamps per side.

**NOTE:** If the alignment holes are covered by the hinge: drill through the original cleco holes and the hinge to re-establish fwd deck alignment. Remember not to rivet the alignment holes until after the upper hinge section is riveted to fwd deck, the fwd deck should be marked in the same manner (otherwise you will have to start all over again to align the fwd deck to the cowl/engine). Cleco the hinge through these holes and remove the clamps. If the alignment holes are out of the way and do not align with the hinge, they may still need to be drilled out due to the BID lay-ups.

# FSLG JOGGLE PREPARATION

Clamping 4 BID lay-up

Figure 11-26



7. Starting at the fire wall, work aft. DRILL, COUNTER SINK, AND RIVET EACH HOLE BEFORE PROCEEDING TO THE NEXT. Drill 3/16" dia. hole from inside the fslg. Remove the clamps as you come to them. Counter sink from the outside of the fslg. Insert the rivet (MS2042646-16) from outside, and trim it so that it extends 1-1/2 times the dia. (9/32") beyond the hinge. (A1142646-16?)

**NOTE: DO NOT COUNTERSINK OR RIVET ANY OF THOSE SACRED ALIGNMENT HOLES YOU'VE GOT CIRCLED IN RED!**

8. Install right and left lower hinge sections, before proceeding to the upper sections.
9. Taper the fwd end of the hinge pin with a file and sand it smooth to a slightly rounded point so that it will insert more easily. The pin will be used to ream the hinge, later. Apply oil to the pin now, in preparation for that process.
10. Assemble upper hinge to lower with the modified pin inserted from the aft end of the hinge. Flop upper hinge section inward for fitting of the fwd deck.
11. Cleco the completed fwd deck / header tank in place using those sacred original alignment holes that you circled in red.
12. At this point a recheck of the fwd deck/cowl alignment would be in order if you have any doubt about your original alignment. This would involve repeating the steps from page 11-7 through 11-10.
13. Hold the upper hinge section against the inside of the fwd deck and mark out the outline of the hinge (right and left).
14. Remove the fwd deck and place inverted on your work bench. Use a straight edge along the hinge line and continue the line all the way fwd and aft. Mark the ends as well so that the marks can be seen from the outside. Turn the fwd deck over and transfer the hinge line to the outside of the fwd deck, right and left sides (this marks the top of the upper hinge section).
15. Now back to the inside. The core material will have to be removed if it is within 1" of the hinge line so that the hinge will rivet to flat, solid, BID lay ups. Mark a BID area line 1" up from the hinge line, straight across. Grind away any core material or other surface irregularities within this area and sand to a smooth flat finish. Grind/sand the core material at an angle along the edge of this area for a smooth BID lay up transition, see figure 11-24. (p 11-48)
16. Apply 2 BID to the hinge BID area, overlapping any exposed foam core by 1", then apply an additional 6 BID to just the flat area under the hinge, see figure 11-24.
17. Cleco the fwd deck in place, using the alignment holes.

**LANCAIR 320FB**

11-51

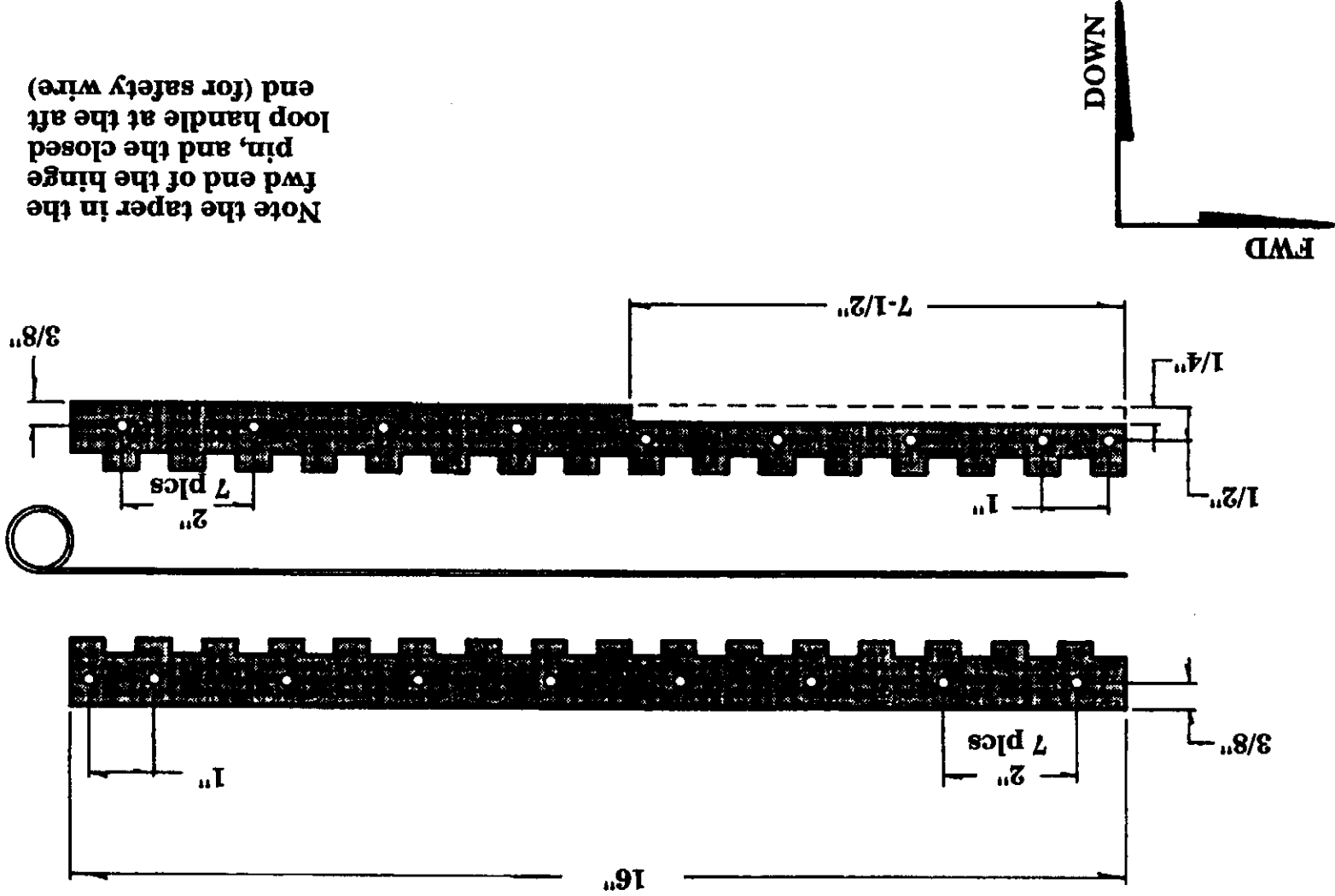
Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM

# HINGE PREPARATION

Mirror image - right and left sides  
(two complete hinge sets required)

Figure 11-27



Note the taper in the fwd end of the hinge pin, and the closed loop handle at the aft end (for safety wire)

18. Now the upper hinge section will be attached to the fwd deck. **BE SURE TO CHECK YOUR LABELLING AND MATCH THE PROPER PARTS.** Use the "top of the hinge line" as a reference. Clamp the hinge in place at the aft end. Drill and cleco, 3/16" below the top edge of the hinge, start next to the clamp. Then drill/cleco in the middle, then the fwd end of each hinge, right and left.

19. Reach inside and re-mark the outline of the upper hinge section (right and left).

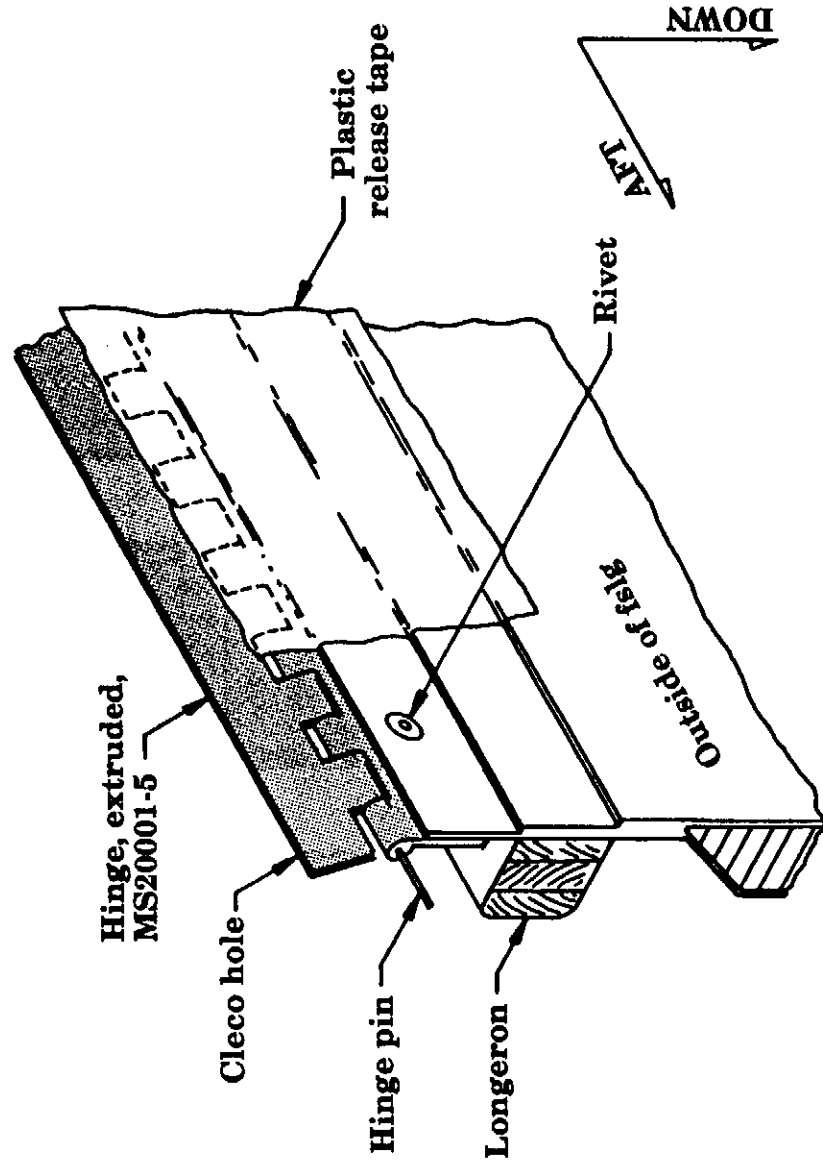
**NOTE:** The purpose of this method is to place the cleco holes at the top edge of the upper hinge section; (A) This will keep the holes out of the way of riveting. (B) And more importantly, this seats the upper hinge section against the fwd deck with a minimum of pressure, while maintaining alignment with the lower hinge section.

20. Remove all clecoes and remove the fwd deck leaving the upper hinge section attached to the fslg.

21. Apply release tape to the outside of the hinge joint and joggle area, as shown in figure 11-28. Sand and acetone or MC clean for bonding.

### Upper hinge section - to fwd deck installation

Figure 11-28



22. Apply "dry" epoxy/flox, 1/4" thick to the inside of the fwd deck with in the hinge outline (if the epoxy/flox is too "wet" it may crush when riveting). Mount the fwd deck to the fslg with clecoes in the red circled alignment holes. Press the upper hinge section against the fwd deck and cleco in place with waxed clecoes. Allow to cure completely.
23. Attach an electric screwdriver or similar rotary tool to the exposed, aft end of the stainless steel hinge pin, to ream smooth any possible bind points in the aluminum hinge. Slide the hinge pin in and out a few inches while it is rotating, continue until the non-rotating pin slides in and out with only slight to moderate pressure (it may be necessary to repeat this procedure several times, after the installation is completed).
24. Remove the hinge pin.
25. Now comes the test of straightness of your installation. Reinsert the hinge pin, a second set of hands might be necessary at this point... Moderate pressure may be required, but be very careful not to bend it (if the pin is bent it must be discarded, and a new one made). Banging on the fwd deck, while continuing to push, helps when the pin binds.

**NOTE:** Some of the existing installations required an amazing amount of reaming, banging, pushing and cursing to get the pin inserted. But the owners still feel that it is worth it, considering how infrequently the fwd deck will be removed after the plane is completed (if this is the case for you, those alignment holes and clecoes are the recommended temporary attachment).

**NOTE:** At this point, if the installation is hopelessly misaligned, it is time to try something else. Remove the hinge pin, leaving the fwd deck attached by the clecoes. Check the fwd deck alignment, if the hinges are impairing a good fit, at least the lower hinge section will have to be removed. Drill out the rivets and pry the hinge off. If your mistakes are evident to you, and you feel that they are correctable, then you may wish to start over.. If you still wish to have a removable fwd deck, the screw mount method is very straight forward, and the existing holes in the lower hinge section might be usable. If the holes must be filled, do so with epoxy/flox and avoid them completely. If all else fails, there is always the permanent installation which hides all goofs.

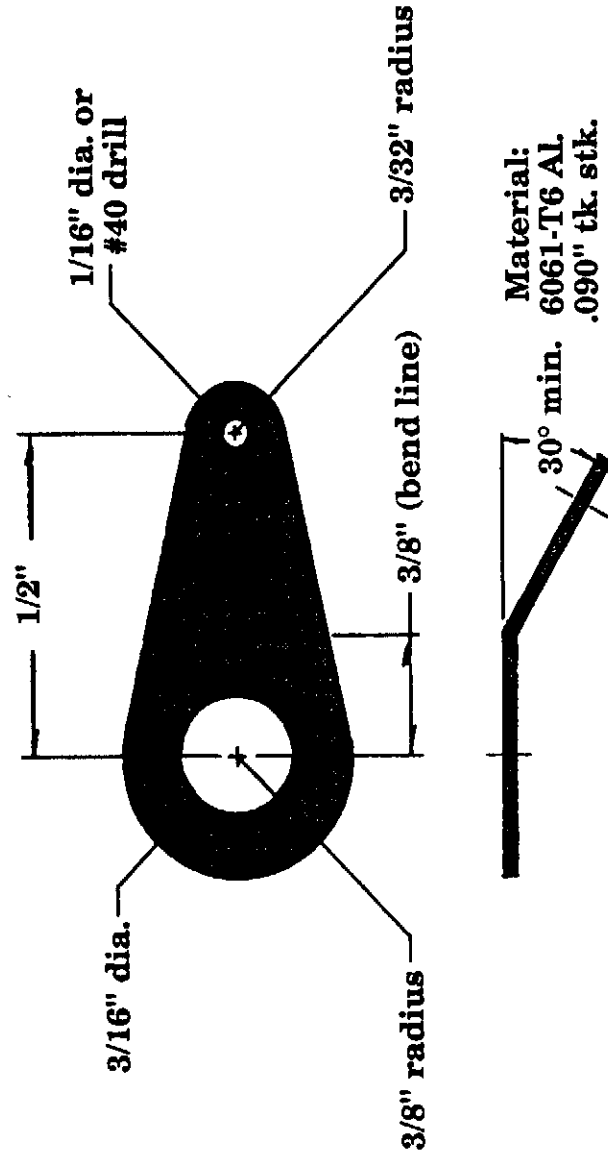
26. Remove all clecoes. Pull the pin from the hinge. Remove the fwd deck, with the upper hinge section attached, and place it on the workbench.
27. Lay out and center punch the hole locations on the hinge. Mark in red, the aft most hole location, for a safety wire tab (This is a reminder, do not rivet this hole; yet).



28. Now the upper hinge section will be riveted to the fwd deck in the same manner as the lower hinge section. Starting at the firewall, work aft **ONE RIVET AT A TIME**. Align the drill, perpendicular to the outside of the fwd deck (not the angled surface of the hinge), this will position the countersink heads as flush as possible. Drill  $3/16''$  dia. holes, countersink the rivet holes, from outside the fslg. Insert the rivet (MS2042646-16,  $3/16'' \times 1''$ ) and trim it so that it extends  $1-1/2$  times the dia. ( $9/32''$ ) beyond the highest point of the hinge. **ONE HOLE AT A TIME - DO NOT DRILL THE NEXT HOLE UNTIL THE PRECEDING HOLE HAS BEEN RIVETED**. Drill and countersink the aft most hole, but do not rivet it yet.

**Safety wire mount tab  
(2 required)**

Figure 11-29



29. Insert the final, aft most rivet in the fwd deck through the upper hinge section. Slide the finished tab over the rivet with the wire hole pointed aft and bent inbd. Trim the rivet to  $9/32''$  extension and compress (left and right).
30. The hinge pin must now be modified. There should be at least  $3''$  excess pin length when the hinge is assembled to form the handle. Assemble the hinge and mark the pin to show where the hinge starts.
31. Use a vise with aluminum or brass jaw covers to protect the pin. Clamp the pin in the vise with the hinge start mark  $1/4''$  from the vise. Use needle nose pliers to roll the excess pin in a tight circle. Be sure that a safety wire will not be able to come loose from the handle. Welding it is the safest way.

32. Reinstall the fwd deck, with the modified pin.
33. Epoxy/micro fill the entire upper and lower joggle area. Use a utility knife to separate the FWD DECK FILL from the FSLG FILL (run the knife along the bottom edge of the fwd deck joggle). Cure and sand smooth, repeat as necessary.
34. The rivet heads should be covered with 1 BID, to prevent the rivets from showing through the paint due to heat expansion. This BID should be 2" wide, starting at the bottom edge of the fwd deck, see figure 11-24. (71-15)
35. Again epoxy/micro fill the lower fslg joggle and over the 1 BID on the fwd deck. Sand to a smooth fit, see figure 11-24.

**The hinge mount installation is complete.**

**JANCAIR® 320FB**

11-56

Chapter 11    REV.    0 / 11-1-91  
FUEL SYSTEM

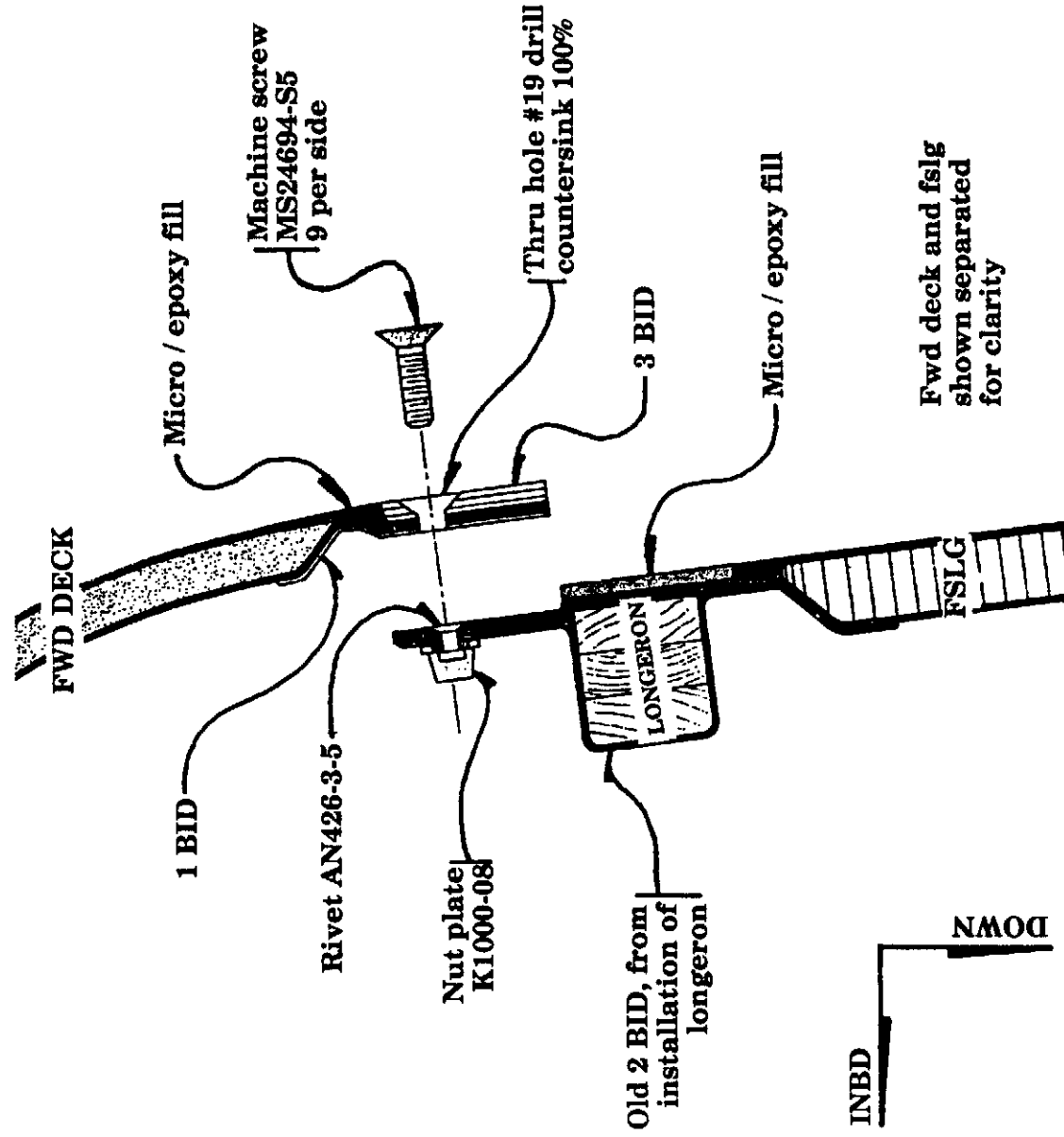
**Q.**

**Fwd deck installation - screw mount system (Optional)**

Due to the firewall brace on the longeron, the nut plates will need to be placed near the top of the fslg joggle. Use of a "micro stop, piloted, countersink" is highly recommended for this installation (this item is available from many aircraft parts suppliers). A total of 4 BID must be added to the fwd deck joggle where the countersunk screw heads hold it to the FSLG. **DO NOT APPLY BID TO THE FWD COWL/FIREWALL JOGGLE OR TO THE AFT CANOPY JOGGLE.** This installation will be started with the fwd deck placed on the workbench, inverted. All directional references apply to the "normal", installed, position.

**Fwd deck installation - screw mounted system  
cross sectional view**

Figure 11-30



Fwd deck and fslg  
shown separated  
for clarity

1. Prep the fwd deck joggle area, inside and out (sand - 24 grit & clean). Right and left sides.
2. Apply 1 BID (2" wide x 17" long) to the inside of the fwd deck joggle. Allow about 1/4" to overhang the bottom edge of the joggle. Trim this flush when the BID is green (right and left sides).
3. Apply 3 BID (2" wide x 17-1/2" long) to the outside of the fwd deck joggle. Butt the BID against the top of the joggle step, and allow any excess to overhang the bottom edge of the joggle. Trim this flush when the BID is green (right and left sides). Allow all BIDs to cure while working on the receiving joggle on the fslg.
4. Lightly sand the top edge of the fslg joggle straight and parallel to the lower edge of the joggle, this will be your reference plane.
5. Now establish the screw centers. Mark a horizontal line 5/16" below the top of the fslg joggle, all the way fwd and aft, and onto the ends of the joggle (be sure that the end marks will be visible with the fwd deck mounted).
6. Mark a vertical line 3/4" aft of the interior face of the firewall, then mark at 2" intervals to a total of 9 vertical marks (spanning 16" total). Run these lines down past the joggle, onto the fslg (so they can be seen with the fwd deck mounted).
7. Cleco the fwd deck in place and transfer the horizontal and vertical lines to the outside of the fwd deck.
8. This establishes the center for the nut plates. Drill these holes with a #9 drill bit.
9. Countersink the holes in the fwd deck (100°).

**NOTE:** The installation of the nut plates along the cowl joggle will be covered during the "COWL INSTALLATION".

10. Remove the fwd deck and set aside.
11. To insure alignment while drilling; (A) use a "nutplate drill guide", they cost about \$30.00, or (B) use the following steps.
12. Use a spacer that will not get in the way of riveting, such as a 1/4" length of 1'4" dia. tubing, with the end that will go against the fslg sanded/filed flat and dull. Insert from the outside, the MS24694-S5 screws through the spacer, fslg joggle, and the K1000-08 nut plate. Carefully tighten all of the nut plates snug, against the inside of the fslg joggle (too much pressure and the tubing will cut through the fslg). Align all the nut plate rivet holes horizontally.

**NOTE:** One side of each nut plate must be securely riveted before drilling the other side. Drill and rivet all right sides, then all the left sides.

13. Use the nut plate as a drill guide. Drill from the inside with a #40 bit.
14. Countersink the rivet holes, from outside the fslg joggle, for AN426-3-5 rivets (120°).
15. Rivet from the outside of the fslg joggle. Set (squish) each rivet to 5/32" (1-1/2 times the dia.).
16. Remove the screws and spacers. Mount the fwd deck and screw in place. Tinnerman washers may be used, loose or bonded to the fwd deck and painted.
17. Micro/epoxy fill the lower fslg joggle (if Tinnerman washers are bonded in, fill fwd deck to flush with the top of the washers). Sand to a smooth contour.

**THE SCREW MOUNT INSTALLATION IS COMPLETE.**

**THIS CONCLUDES CHAPTER 11.**

**THE FUEL SYSTEM FWD OF THE FIREWALL IS COVERED IN CHAPTER 21.**

**LANCAIR® 320FB**

11-59

Chapter 11 REV. 0 / 11-1-91

FUEL SYSTEM