

# CHAPTER 27

## REVISION LIST

### (Pressurized Version)



The following list of revisions will allow you to update the Lancair IV 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
27-1 thru 27-10	0	None	
27-11	PC5	R&R	Revised Figure 27:B:3
27-12	PC4	R&R	Revised Figure 27:B:4
27-28	PC8	R&R	Fig.27:E:3 & Steps E5,E6 Revised
27-30	PC16	R&R	Revised Figure 27:F:1



# CHAPTER 27

## FUEL SYSTEM

### 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 When such revisions are made, you should immediately replace all outdated pages with the revised pages.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 assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows.

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**LANCAIR® IV**

27-1

Chapter 27

REV. 0 / 2-2-94

Fuel System

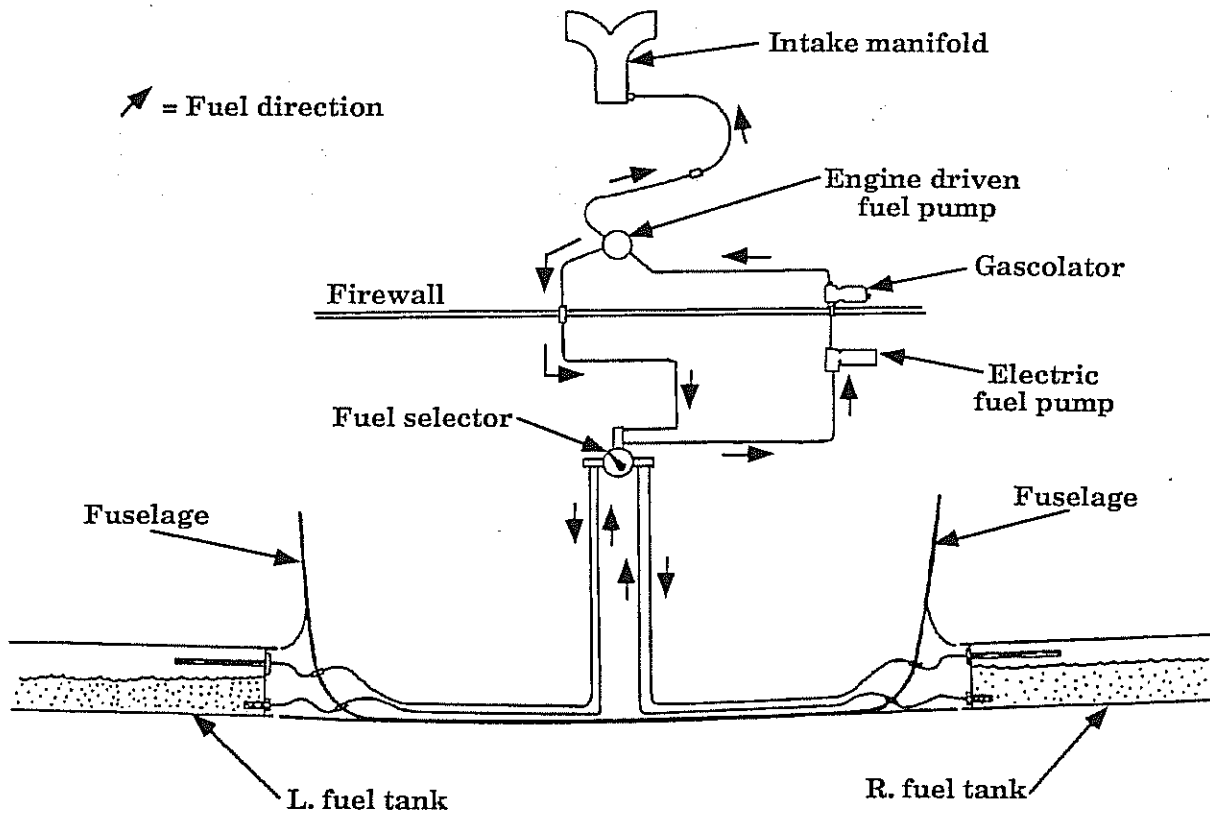
# 1. INTRODUCTION

The fuel system of the Lancair IV is can be thought of as segmented. First the fuel runs through flexible lines from the wing tanks to the fuselage shell. Then the fuel is routed through aluminum tubes forward to the fuel selector, which is mounted between the pilot and copilot on the floor. Fuel from the selcted tank then moves to the electric fuel pump mounted aft of the firewall. From the electric pump, the fuel is pushed into the gascolator, where any water will settle to the bottom and not reach the engine. The engine driven fuel pump draws fuel out of the gascolator, decides how much the engine needs, and supplies only that amount to the intake manifold. Using the fuel injected Continental, the engine will return unused fuel to the wing tanks through smaller tubes.

The fuel system described is for the Continental TSIO-550, which is the only engine tested on the Lancair IV at this time. Other engines may require modifications to this chapter, but the basic concept of fuel supply and return are essentially the same.

## Fuel system schematic

Figure 27:i:1



**2. PARTS (\* = optional parts for fuel pump and gascolator)**

- 12 MS24693-S26 screw
- 12 MS21069-06 nutplate
- 24 AN426A3-5 rivet
- 3 AN924-4D nut
- 2 AN924-6D nut
- 2 AN960-916 washer
- 2 AN960-716 washer
- 2 AN833-6D
- 3 AN833-4D
- 2 AN822-6-6D
- 2 ft. RS3001 braided hose
- 4 RS1002 hose end fitting
- 2 ft. RS3000 braided hose
- 4 RS1001 hose end fitting
- 2 AN823-4D
- 1 pc. 1/4" x 3 1/2" x 3 1/2" phenolic
- 3 MS24694-S100 screw
- 3 AN365-428A locknut
- 1 Fuel selector valve
- 1 C5515-8 fitting, 90°
- 3 AN816-4D
- 2 AN816-6-6D
- 1 AN913-3D plug
- 1 AN913-1D plug
- 18 ft. 1/4" D. x .035" wall, 5052-0 Al. tube (three, 6' sections)
- 12 ft. 3/8" D. x .035" wall, 5052-0 Al. tube (two, 6' sections)
- 4 ft. 1/2" D. x .035" wall, 5052-0 Al. tube
- 4 AN818-6D
- 4 AN819-6D
- 6 AN818-4D
- 6 AN819-4D
- 2 AN818-8D
- 2 AN819-8D
- \*1 Electric fuel pump
- \*1 Gascolator
- \*2 C5315x8x6 fitting
- \*1 3200x6 adapter
- \*1 AN816-8D
- \*1 ft. RS3002 braided hose
- \*2 RS1003 hose end fitting



### 3. CONSTRUCTION PROCEDURE

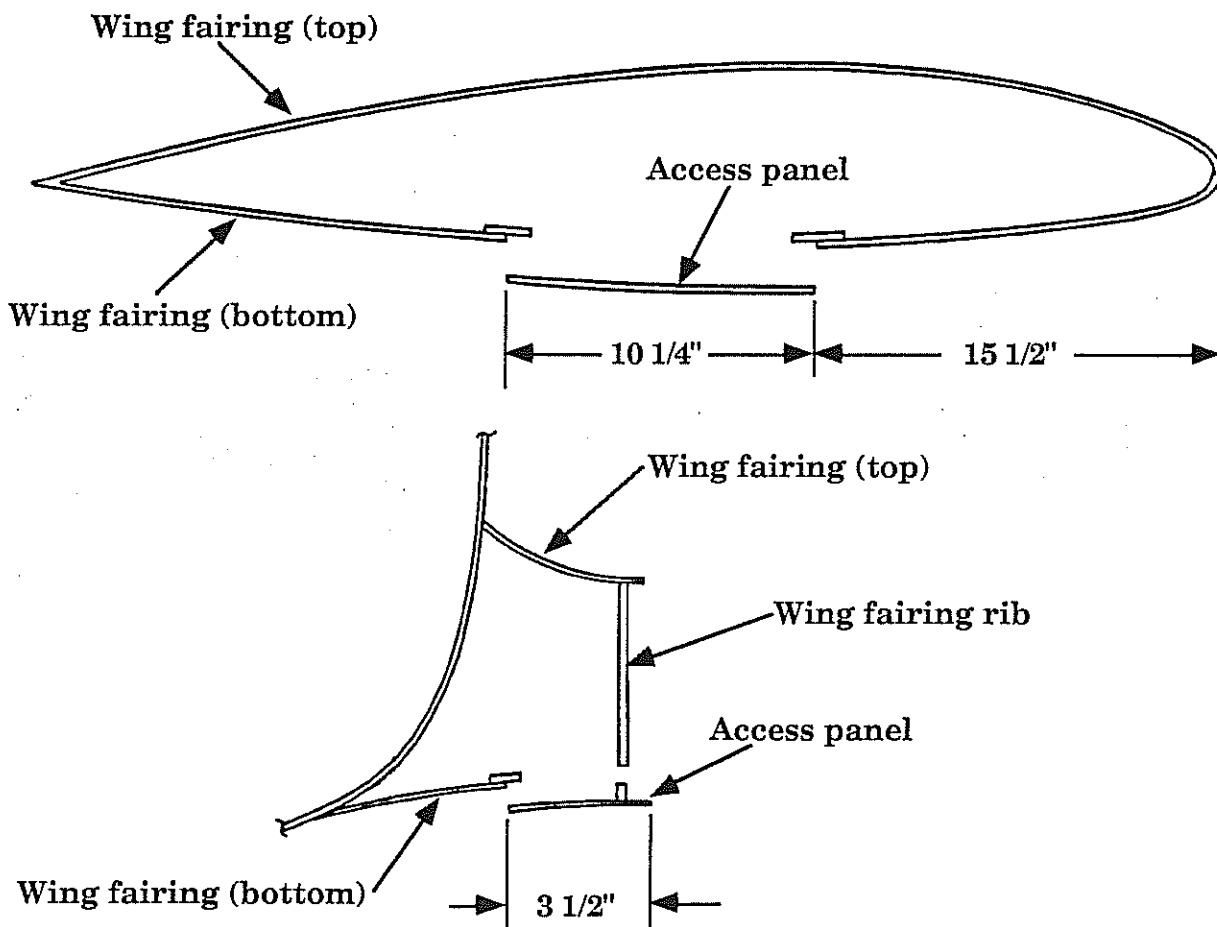
#### A. WING FAIRING ACCESS PANEL

In able to make the wing to fuselage lines, an access panel must be cut into each wing fairing. These access panels are also necessary for wing installation and future maintenance.

- A1. Mark the access panel location on the bottom of each wing fairing. See Figure 27:A:1 for dimensions.

#### Access panel location

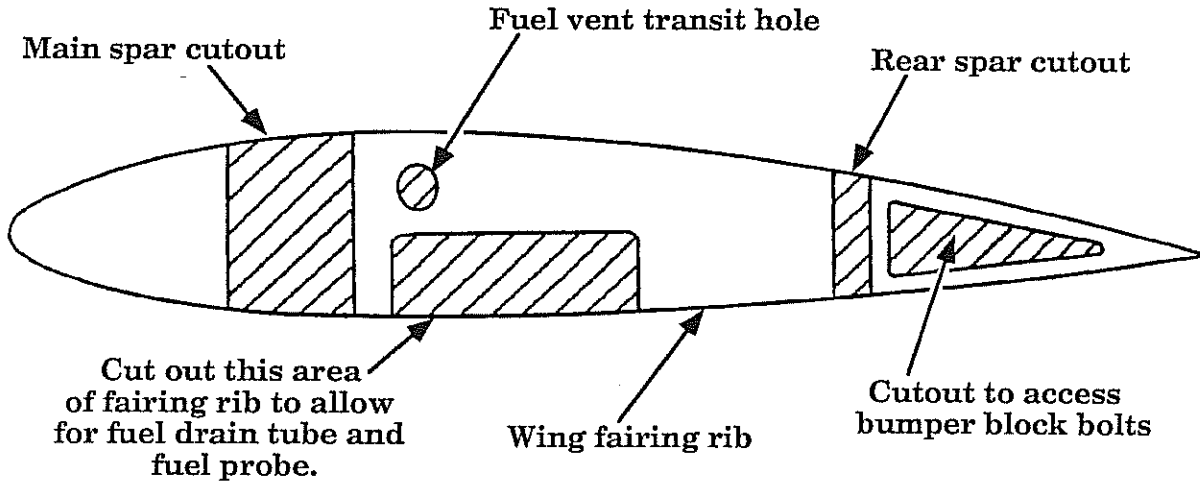
Figure 27:A:1



- A2. The wing fairing access panels also include part of the wing fairing ribs. Figure 27:A:2 shows the areas of the ribs that should be removed and cut.

### Wing fairing rib cutouts

Figure 27:A:2

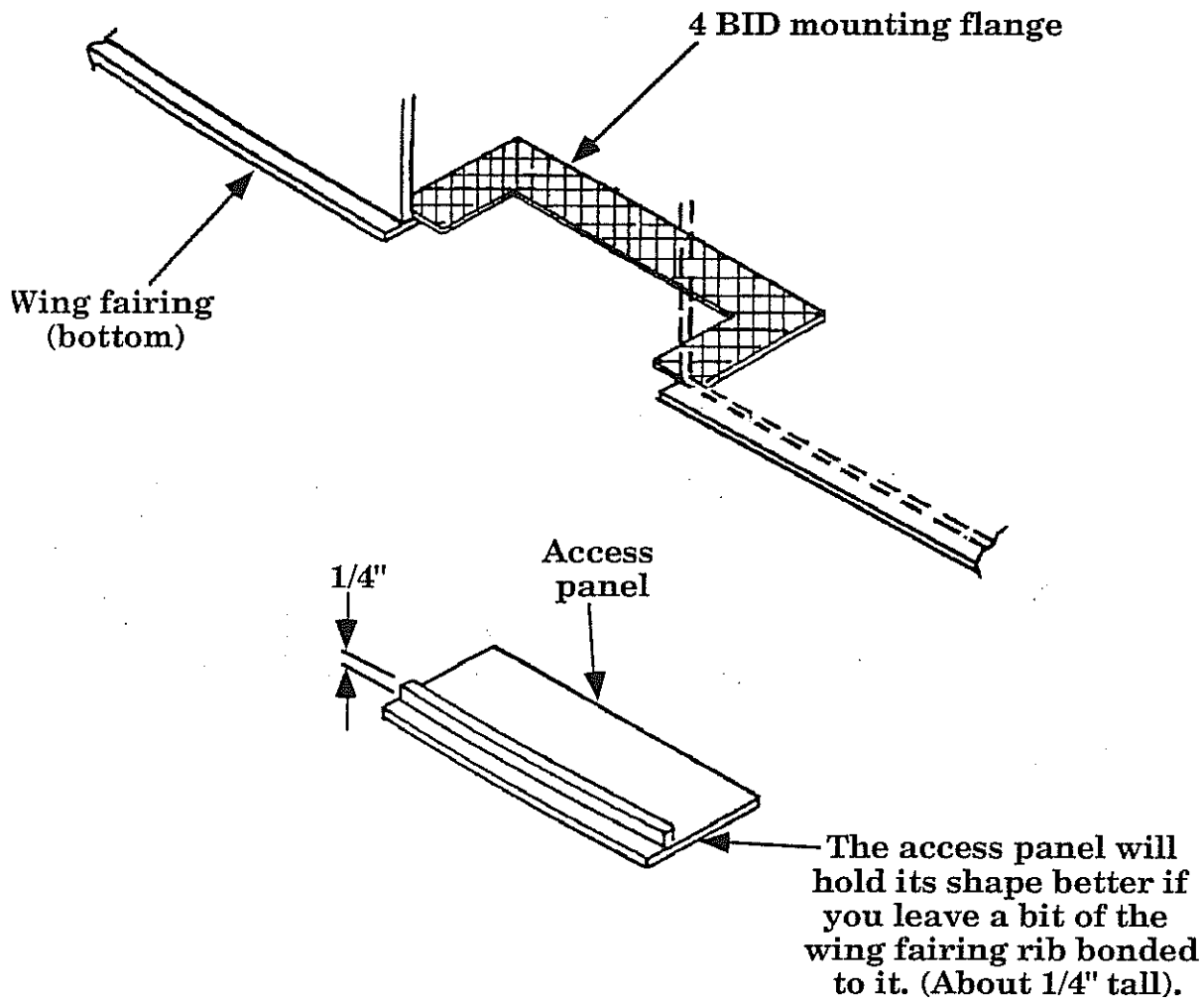


- A3. Cut out the access panels from the wing fairings.

- A4. Form a 4 BID mounting flange above the access panels. Do this by applying release tape to the panels, then tacking them in place with instant glue and tongue depressors, and finally laying up the 4 BID flange on the inner surface of the wing fairing.

### Access panel flanges

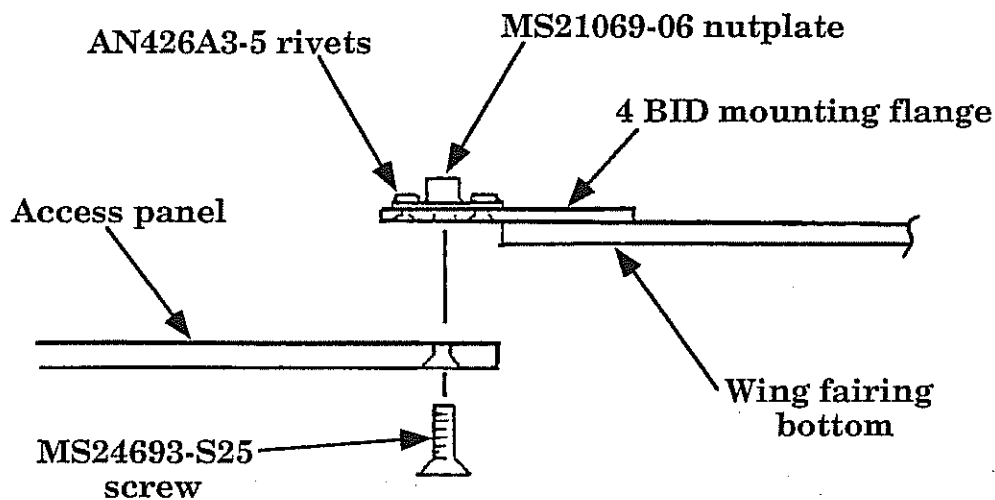
Figure 27:A:3



- A5. When the 4 BID flanges have cured, remove the access panels. Trim the flanges to 5/16" width.
- A6. Secure the access panels to the wing fairings with MS24693-S26 screws and MS21069-06 nutplates. Use AN426A3-5 rivets to secure the nutplates to the flanges.

### Securing access panel

Figure 27:A:4



- A7. You will probably want to clean up the edges around the access panels by doing a micro release. This can be done anytime.





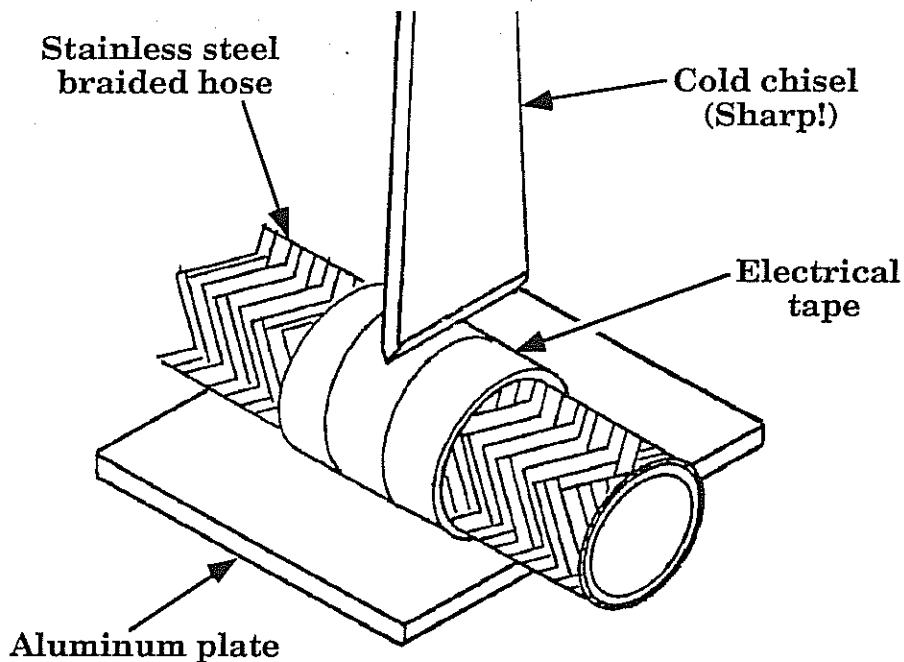
## B. WING TO FUSELAGE FUEL LINES

Stainless steel braided fuel hoses are used to connect the fuel tanks in the wing to the fuselage. Bulkhead fittings are mounted through the fuselage. For wing installation and removal, you will have to remove the wing fairing access panels, then disconnect the flexible hoses from the bulkhead fittings (hopefully *AFTER* draining the fuel!).

- B1. Before we get into the specific of the fuel system, we'll explain how to install fittings onto the ends of stainless steel braided hose. First, the length of the hose is determined by measuring from the very tips of the flared ends of the fittings. Try to measure along a smooth arc between the fittings to avoid kinking the hose from overbending. Subtract about 1/2" from the measurement to find the actual hose length. In case you haven't guessed, there are no absolute rules in hose measurement, just do your best to avoid kinking.
- B2. To cut the braided hose, tightly wrap electrical tape a few times around the hose, centered on the cut line. The best way to actually cut the hose depends on who you talk to. We've had good luck using a large, sharp cold chisel. We place the hose on a thick piece of aluminum and with one good "whack" with a hammer, the cold chisel produces a clean cut. A band saw also works decent, and a hack saw will suffice in a pinch.

### Cutting braided steel hose

Figure 27:B:1:a

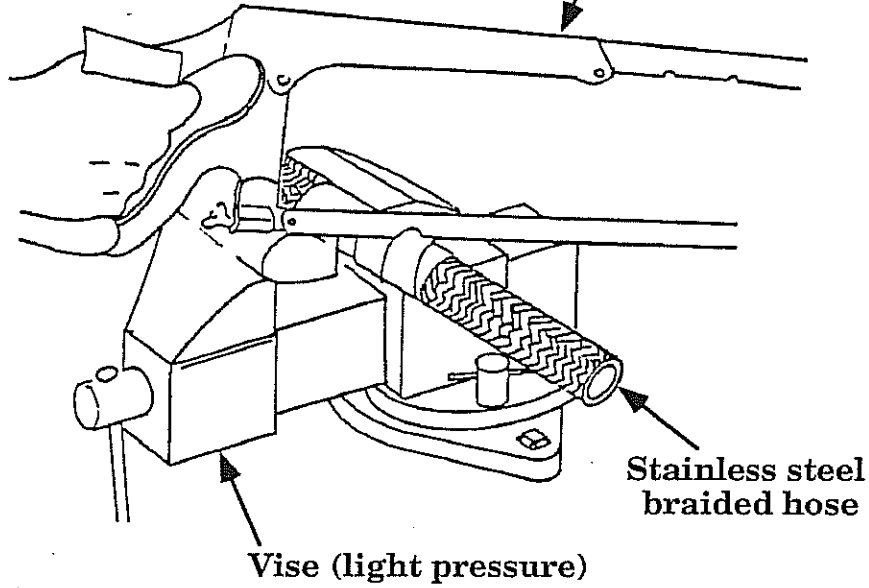


# Cutting braided steel hose

Figure 27:B:1:b

Note: Electrical tape is wrapped tightly around hose to prevent fraying.

Hack Saw (or band saw) with fine tooth blade.



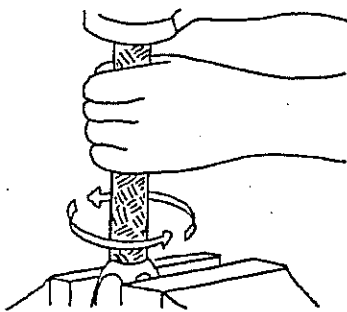
B3. Most fuel and hydraulic hose end fittings are installed similarly. Eastman hose fittings are shown in Chapter 1, with some helpful tips and things to avoid. Russell fittings are usually used on the braided steel hoses, such as those in this chapter. The procedure for installing Russell fittings is as follows.

1. Unscrew the red socket of the hose end fitting from the nipple.
2. Hold the socket in a vise and thread the hose into it counter clockwise. The hose will stop at the bottoming step of the socket.
3. Hold the nipple in a vise. Apply oil sparingly to the threads of the nipple and the socket.
4. Start threading the socket and hose onto the nipple by hand to ensure proper alignment. Finish tightening the socket with a wrench until it reaches the nipple hex or when there is no more than 1/16" gap between the nipple and socket.

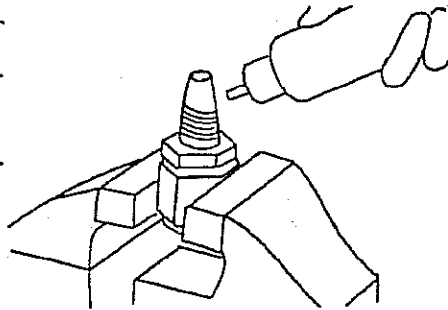
### Installing hose end fittings

Figure 27:B:2

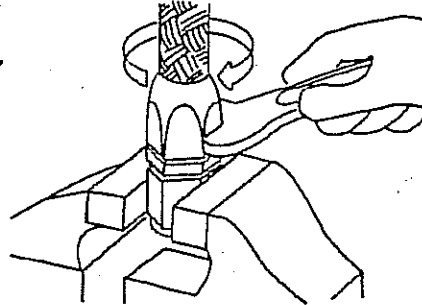
Twist the hose onto the socket counter-clockwise until the hose bottoms out.



Clamp the nipple into a vise and, apply oil sparingly to the nipple threads.



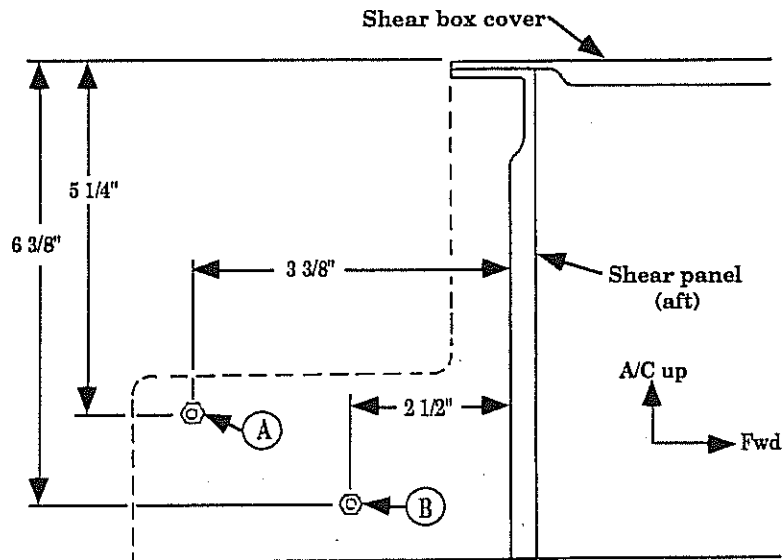
Thread the hose and socket over the nipple until there is no more than 1/16" gap between the socket and nipple.



- B4. Now back to the actual fuel system. There are coreless areas in the inside corners of the bottom fuselage shell, just behind the aft shear panel. In each of these coreless areas, you will mount two bulkhead fittings, one for the fuel to the engine, and one for fuel returning from the engine. Drill holes for the bulkhead fittings as shown in Figure 27:B:3. Use a 7/16" drill for the AN833-4D fitting and a 9/16" drill for the AN833-6D fitting.

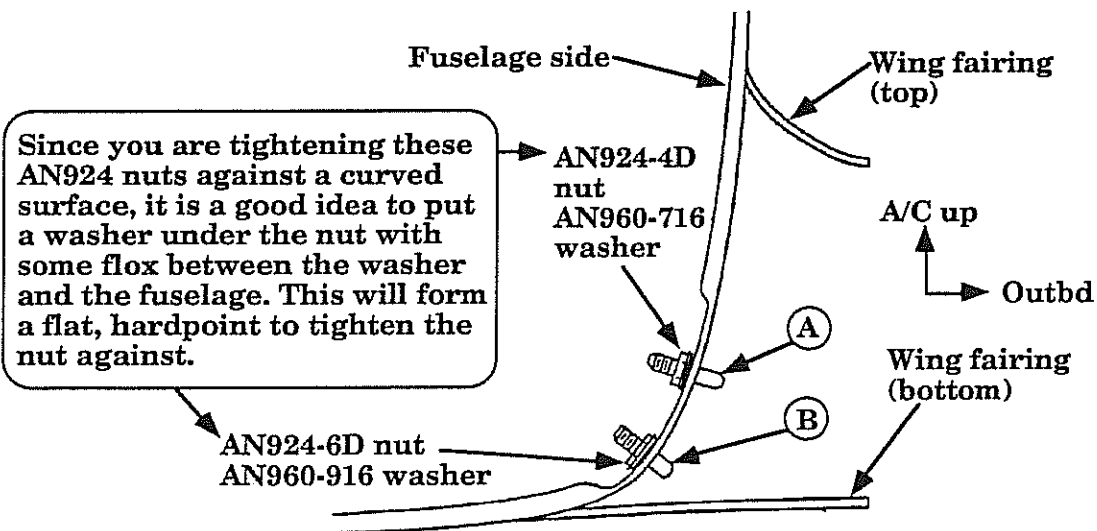
### Bulkhead fitting locations

Figure 27:B:3



(A) = Fuel return bulkhead fitting (AN833-4D)

(B) = Fuel supply bulkhead fitting (AN833-6D)

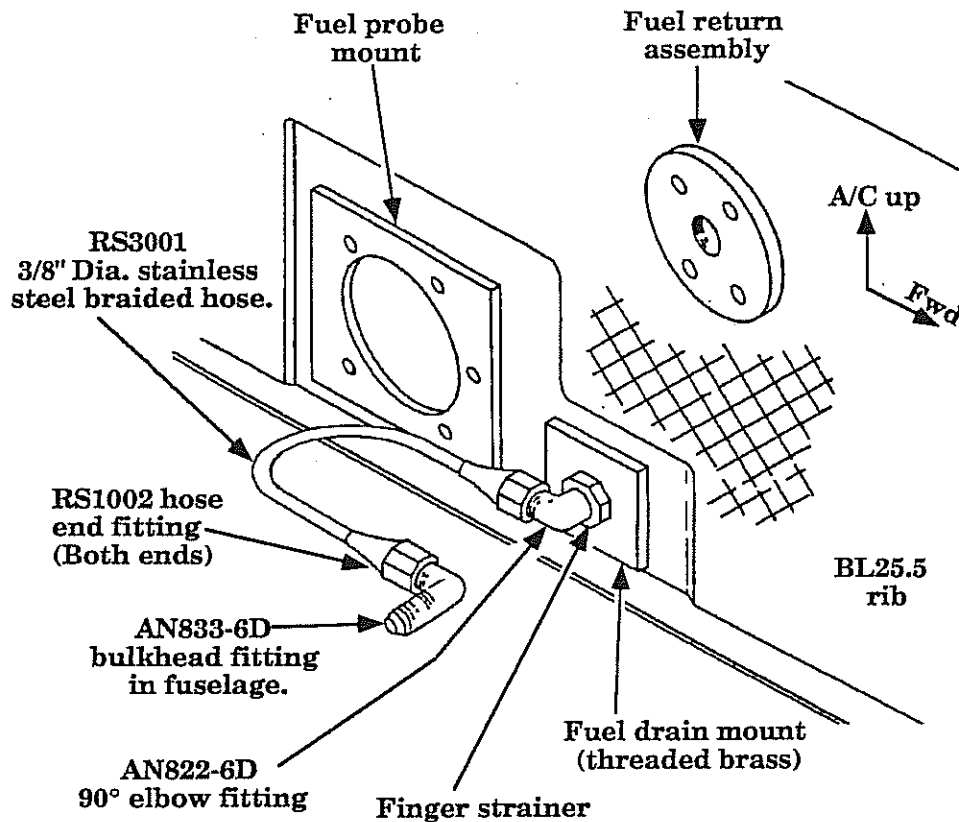


Since you are tightening these AN924 nuts against a curved surface, it is a good idea to put a washer under the nut with some floc between the washer and the fuselage. This will form a flat, hardpoint to tighten the nut against.

- B5. In each coreless area, install one AN833-4D fitting and one AN833-6D fitting. The -4D fitting is for the fuel return and the -6D fitting is for the fuel supply. Use AN924-4D and -6D nuts to secure the bulkhead fittings.
- B6. If you haven't yet installed the finger strainers into the brass drain fittings in the BL25.5 ribs, do so now. You should apply a coating of teflon impregnated pipe compound to the threads of the finger strainer before screwing it into the brass fitting. This pipe sealing compound is available from most hardware stores. Apply the compound only to the MALE pipe threads and wipe any excess away from the first couple threads to avoid pushing the compound into the system.
- B7. Into the finger strainers, thread AN822-6D elbow fittings. Again, apply teflon pipe sealing compound to the threads of the fittings. The elbow fitting should point aft and slightly up when tight.
- B8. Connect the AN822-6D elbow fittings in the wing to the AN833-6D fittings you installed in the fuselage in Step B5. Use RS3001 braided steel hose and RS1002 hose end fittings, installing the fittings as described earlier in this section. DO NOT use pipe sealing compound on flared threads!

### Wing/fuselage fuel supply line

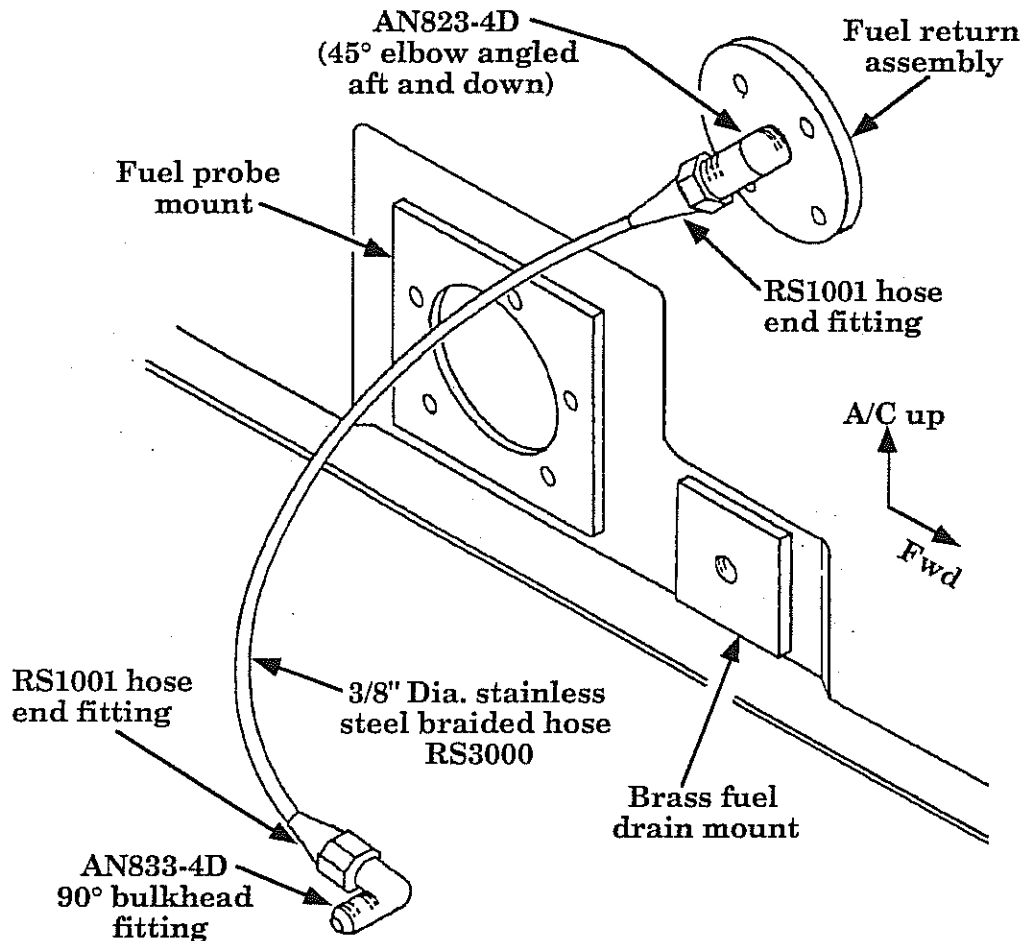
Figure 27:B:4



- B9. Thread an AN823-4D elbow fitting (45°) into the fuel return assembly of each wing. The fitting should point aft and down when tight. Use teflon pipe sealing compound on the fitting's threads.
- B10. Connect the AN823-4D elbow fittings to the AN833-4D fittings you installed in the fuselage in Step B5. Use RS3000 hose and RS1001 hose end fittings.

### Wing/fuselage fuel return line

Figure 27:B:5



- B11. This completes the fuel fittings and hoses between the wing and fuselage. The braided stainless steel hose are very resistant to kinking, but double check anyway. As for installation and removal of the hoses when the wing is mounted to the fuselage, it is a very tight squeeze, so you may want to put the hoses you just made aside until the wing is installed for the last time.

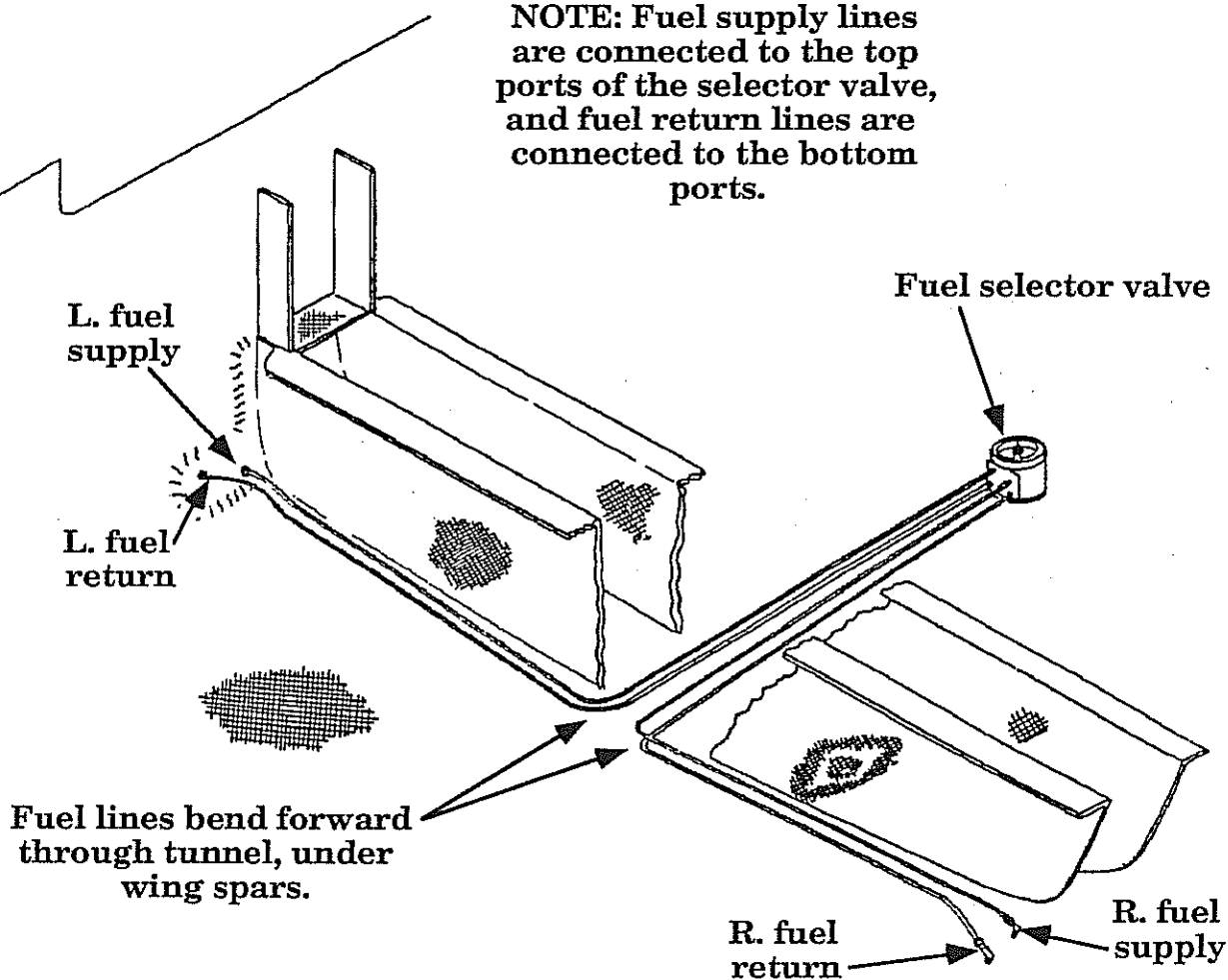
## C. FUEL SELECTOR

The fuel selector is mounted to the floor of the cabin, between the pilot and copilot. Lancair has specifically designed the selector valve for smooth operation and easy installation. The bottom plate of this fuel selector is attached with a Permatex sealant at the factory. The bottom plate is structurally secured in place when the fuel selector is mounted to the studs.

### Fuel selector valve and connecting lines

Figure 27:C:1

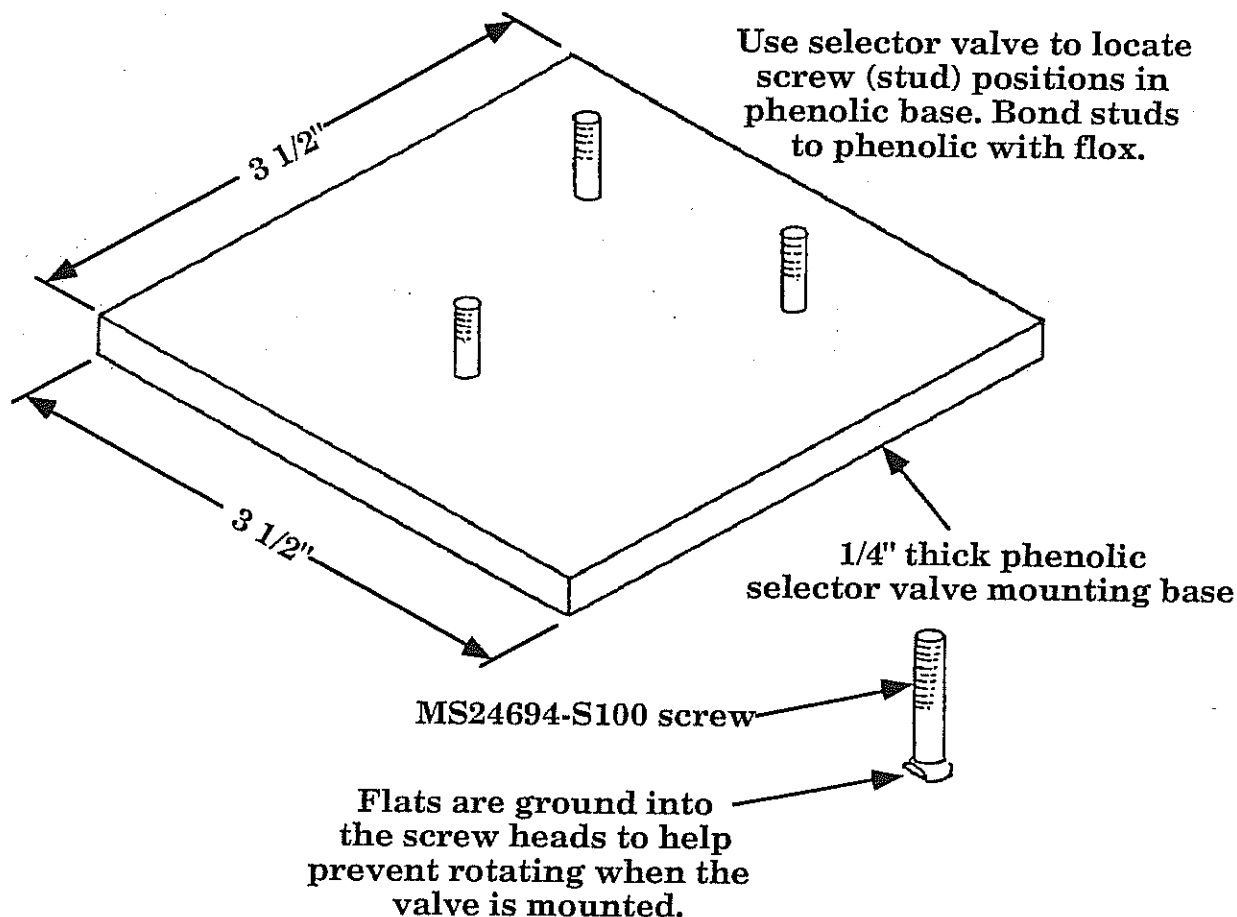
**NOTE: Fuel supply lines are connected to the top ports of the selector valve, and fuel return lines are connected to the bottom ports.**



- C1. Cut a piece of 1/4" thick phenolic, 3 1/2" x 3 1/2". This will be the mounting base for the fuel selector.
- C2. Mark the selector valve mounting hole locations onto the phenolic base. At these locations, drill 1/4" diameter holes through the phenolic. Countersink these holes to accept MS24694-S100 screws.
- C3. Take three MS24694-S100 screws and grind flat sections on their heads. This will prevent them from rotating when used as studs.
- C4. Use epoxy/flox to bond the MS24694-S100 screws you have modified into the phenolic mounting base. Make sure the threads of the screws are not fouled with flox.

### Selector valve mounting base

Figure 27:C:2

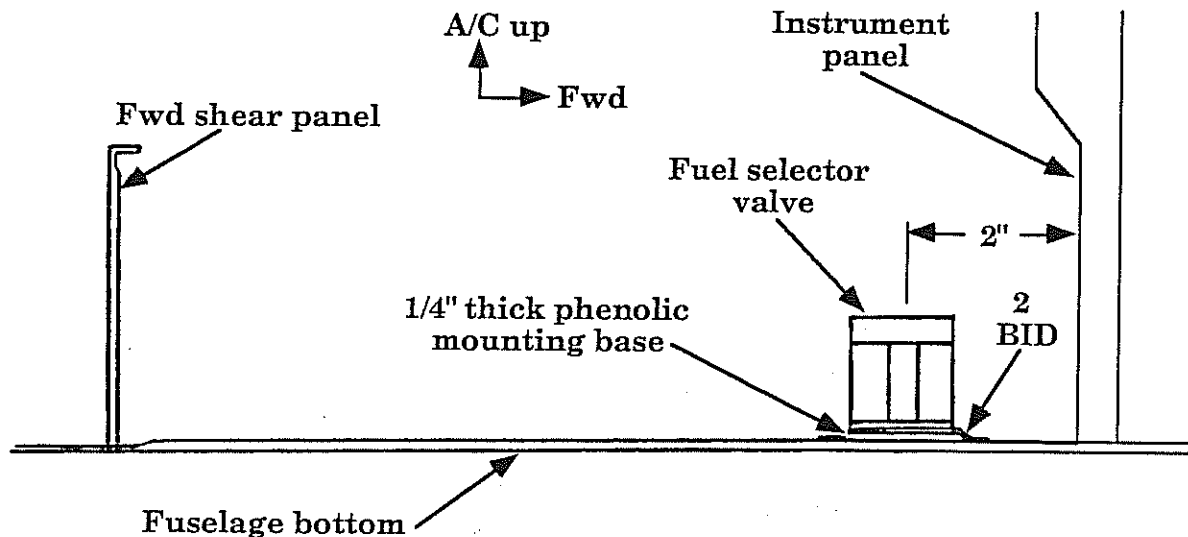




- C5. Locate the fuel selector valve and mounting base so the center of the handle is 2" aft of the instrument panel and on the fuselage centerline.
- C6. Sand the bottom of the phenolic mounting base and bond it to the fuselage with epoxy/flox. Reinforce this bond with 2 BID, overlapping onto the fuselage 1" around the phenolic. The BID will have cut to be fit over the mounting studs. Remember to sand and clean the fuselage where you are bonding and glassing.

### Locating and mounting selector valve

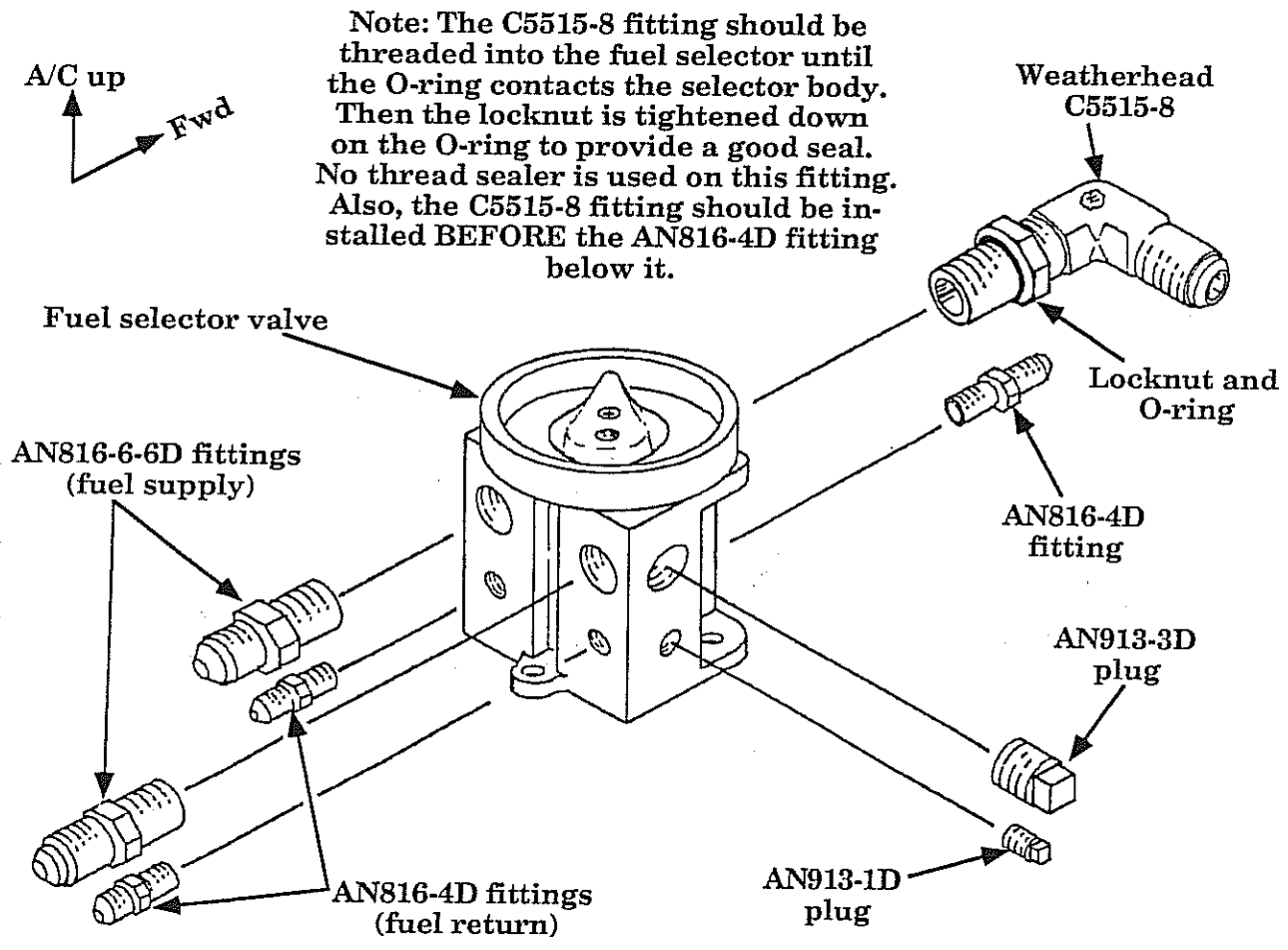
Figure 27:C:3



- C7. Secure the selector valve to the phenolic mounting base with AN365-428A locknuts.

- C8. Install the proper fittings to the selector valve, as shown in Figure 27:C:4. The fuel supply fitting on the  fwd  side of the selector has an O-ring and does not require any pipe sealing compound on its threads. All other fittings in the selector should have sealing compound applied to their threads as discussed earlier in this chapter.

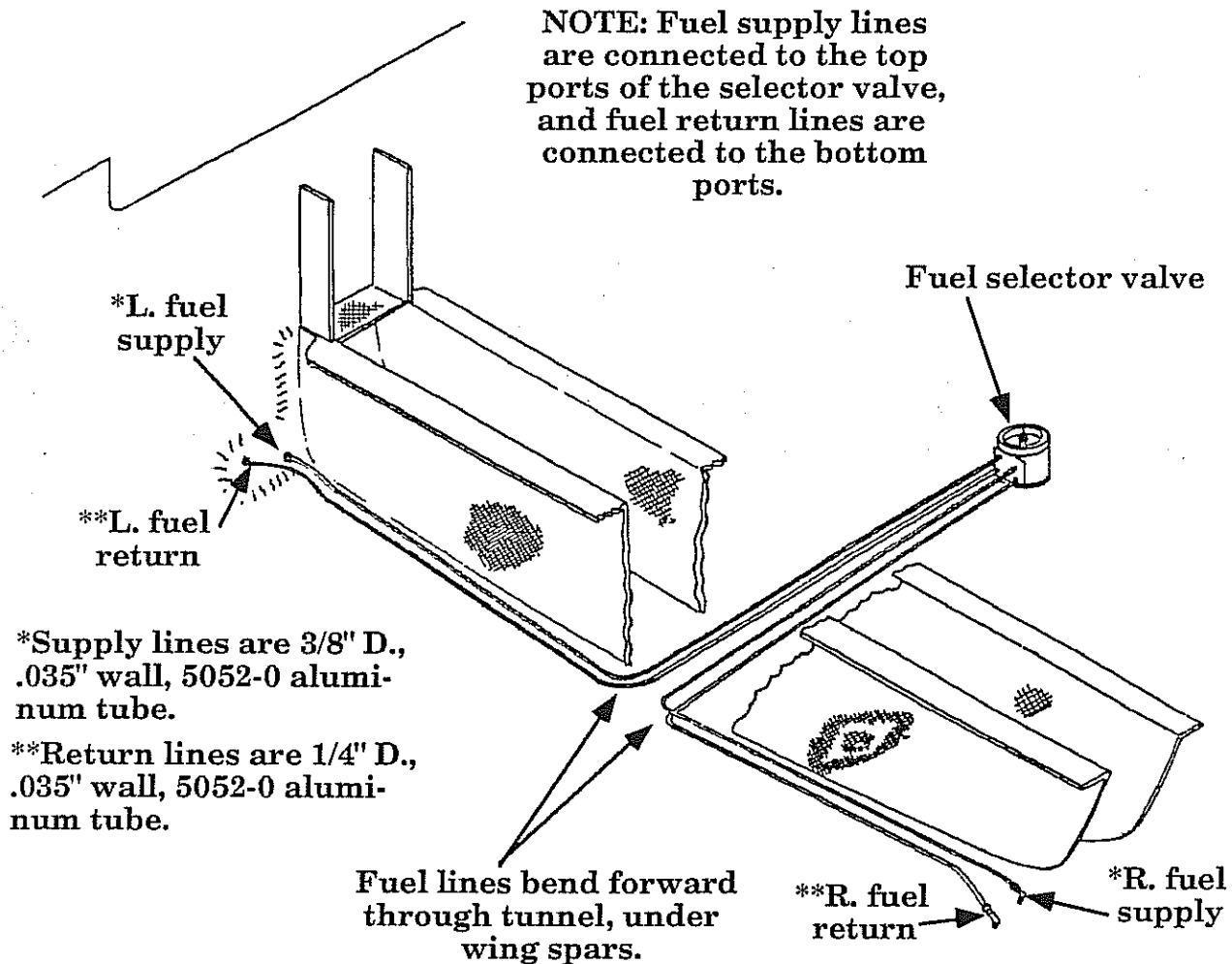
**Selector valve fittings**  
Figure 27:C:4



- C9. Use 3/8" diameter, .035" wall, 5052-0 aluminum tubing to connect the fuel supply bulkhead fitting to the fuel selector. It will take some careful bending to get the tubes to the proper shape, just take your time. Both the fuel supply and fuel return tubes should run close to the aft shear panel, then turn forward through the tunnel under the shear panels. At both ends of the 3/8" tubes, slip on AN818-6D nuts and AN819-6D sleeves, then flare the tube ends with a flaring tool.
- C10. Use 1/4" diameter, 5052-0 aluminum tubing to connect the fuel return bulkhead fitting to the fuel selector. At both ends of the 1/4" tubes, slip on AN818-4D nuts and AN819-4D sleeves, then flare the tube ends with a flaring tool.

### Fuel lines to the selector

Figure 27:C:5

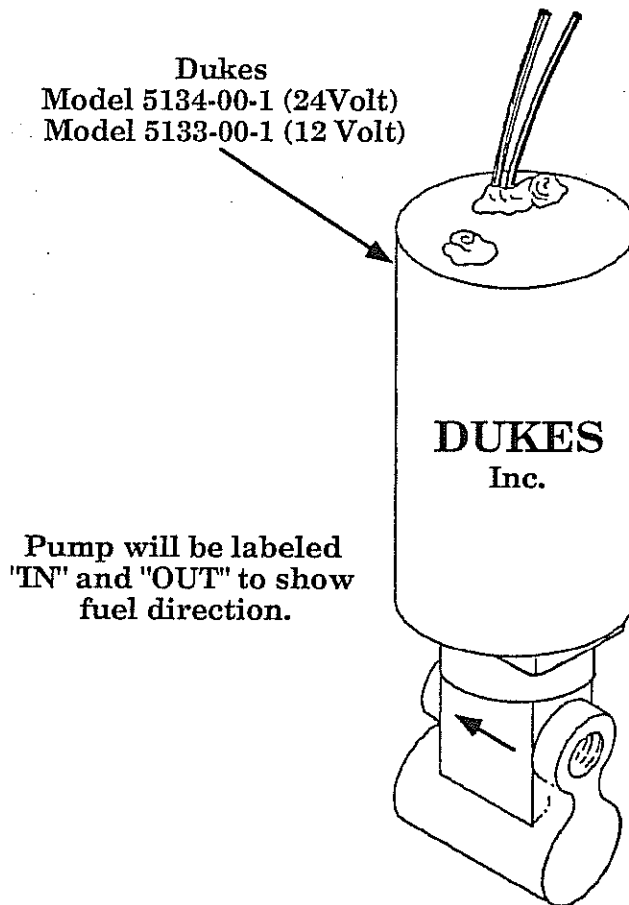


## D. FUEL PUMP INSTALLATION

From this point on, your fuel system can vary to accommodate your particular engine. However, we will continue to concentrate on a fuel system tailored to the Continental TSIO-550 engine. The electric fuel pump in this installation is located behind the firewall, saving valuable firewall space and protecting the pump from heat.

The Dukes, model 5133-00-1 (5134-00-1 for 24 volt), two stage electric fuel pump is the recommended brand. This pump has a high boost for priming the engine and a low boost for maintaining consistent pressure to the engine driven pump. At high altitudes (12,000 ft.+), the electric fuel pump is run on low boost constantly to pull the fuel from the wing tanks forward to the engine. An engine "surging" can result from laboring the engine at altitude without the low boost position.

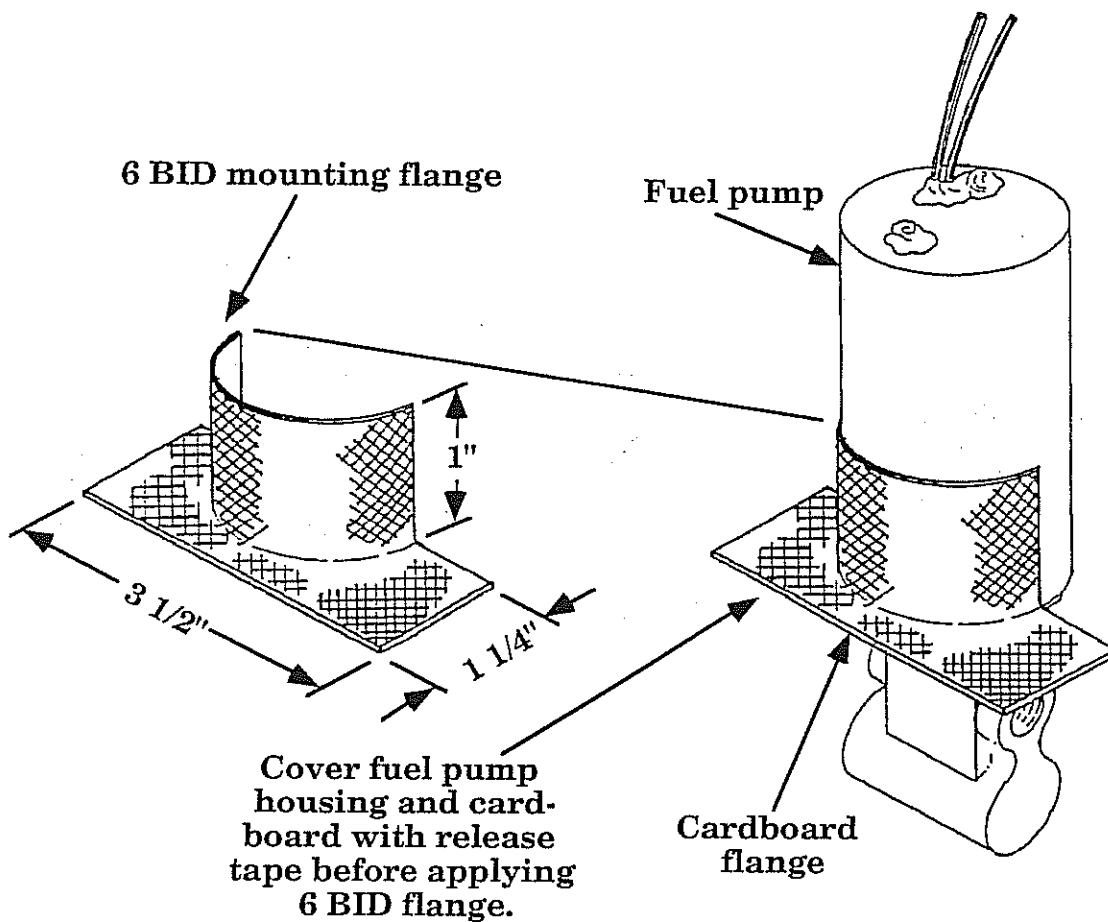
**Dukes, two stage, electric fuel pump**  
Figure 27:D:1



- D1. Apply release tape to the fuel pump in preparation for making a custom fiberglass mounting bracket. Cut a piece of cardboard to act as a flange mold for the bracket. Secure the cardboard (covered with release tape) to the fuel pump casing with a few drops of instant glue as shown in Figure 27:D:2.
- D2. Apply 6 BID to the fuel pump casing and cardboard flange to form a mounting bracket. When the BID has cured, remove the bracket from the pump and trim as shown in Figure 27:D:2.

### Fuel pump mounting bracket

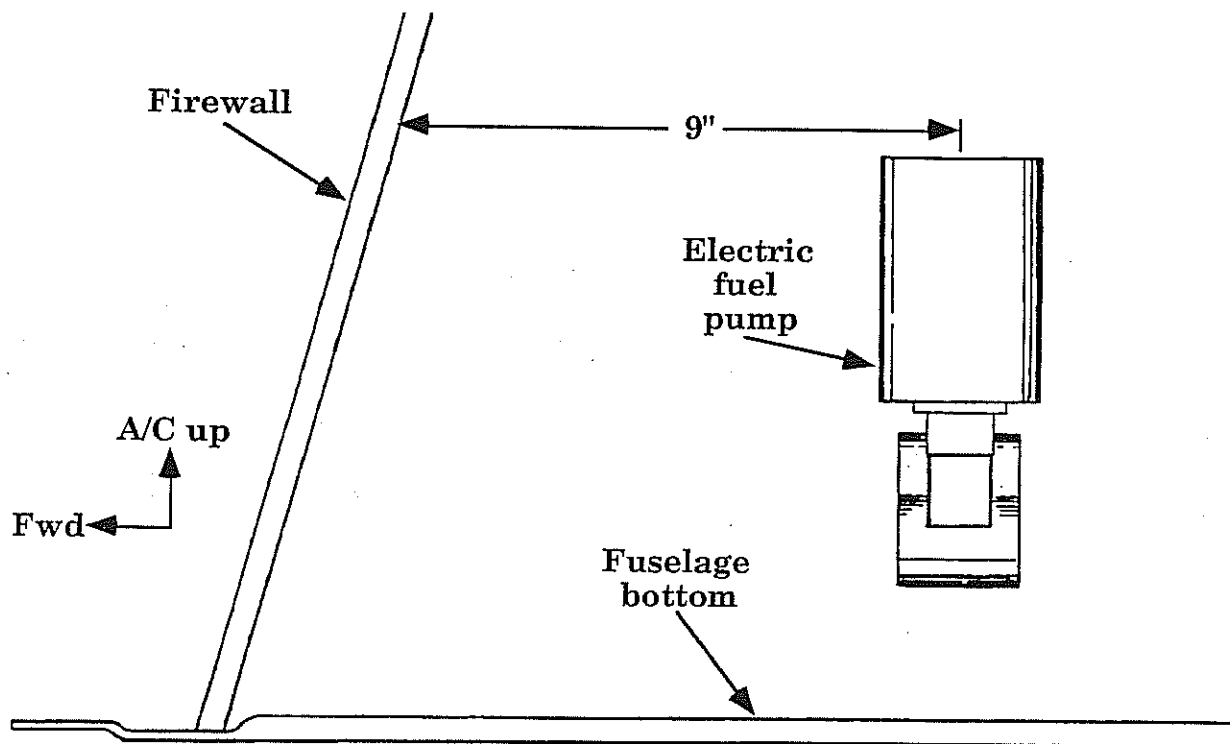
Figure 27:D:2



- D3. Position the fuel pump and mounting bracket on the right fuselage side, behind the firewall as shown in Figure 27:D:3. Trim the bracket so the fuel pump is as close as possible to the fuselage side, but the fittings are still accessible. You don't want the pump too far inbd because it might interfere with the rudder pedals. Secure the bracket to the fuselage with a thick epoxy/flox mixture along the bottom edge. While the flox is drying, you can hold the bracket (without the pump) to the fuselage with some instant glue.
- D4. When the flox has cured, reinforce the bracket/fuselage joint with 3 BID.

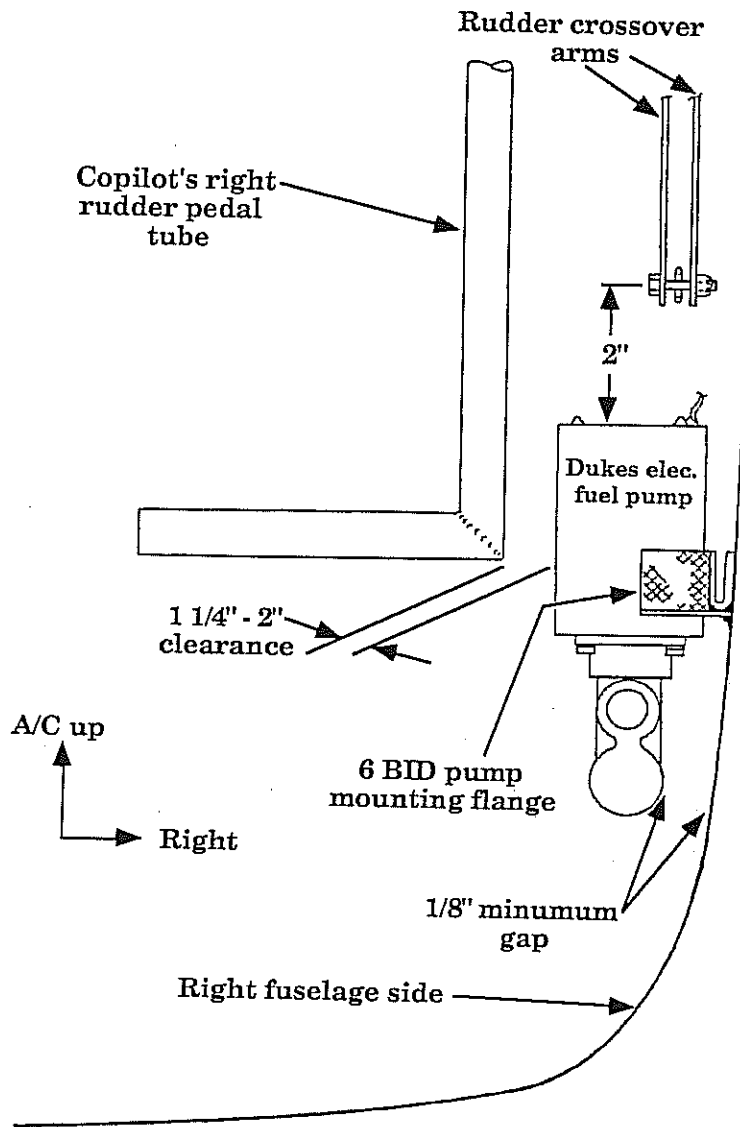
### Locating fuel pump bracket to fuselage

Figure 27:D:3:a



# Securing fuel pump bracket to fuselage

Figure 27:D:3:b

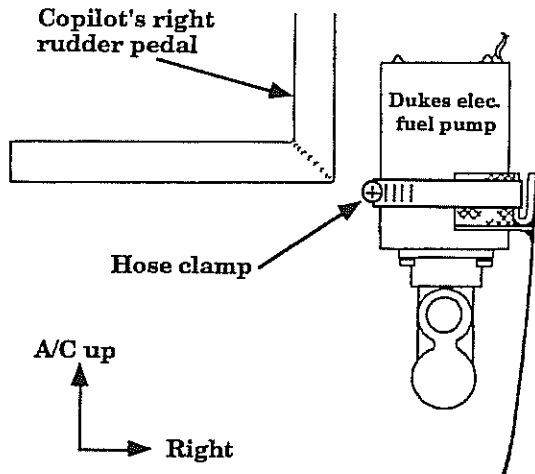


- D5. Thread a C5315x8x6 fitting into each end of the fuel pump. Coat the threads of the fittings with teflon impregnated pipe compound for sealing.

- D6. Secure the fuel pump to the mounting bracket with a hose clamp.

### Fuel pump secured to fuselage

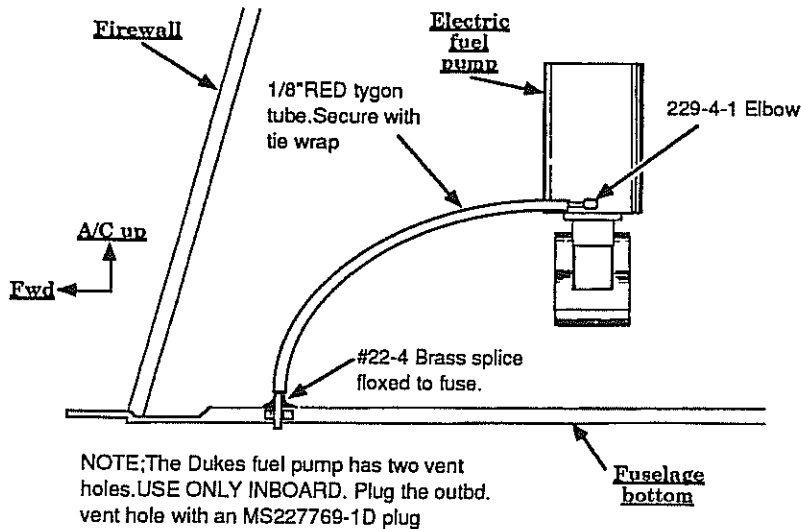
Figure 27:D:4



- D7. Thread an 229-4-1 hose elbow fitting into the *inbd* vent hole of the fuel pump. Cap off the outbd vent hole with an MS227769-1D plug. To vent the pump outside the cabin, use epoxy/flox to pot a #22-4 Brass splice through the bottom fuselage shell, located just outbd of the right exhaust tunnel. Connect the #22-4 splice to the elbow 229-4-1 fitting with 1/8" dia. red Tygon plastic tubing. Secure the tubing at each end with a tie wrap. Exact length and position of the plastic tube is not critical, it's just a safety vent.

### Fuel pump safety vent

Figure 27:D:5



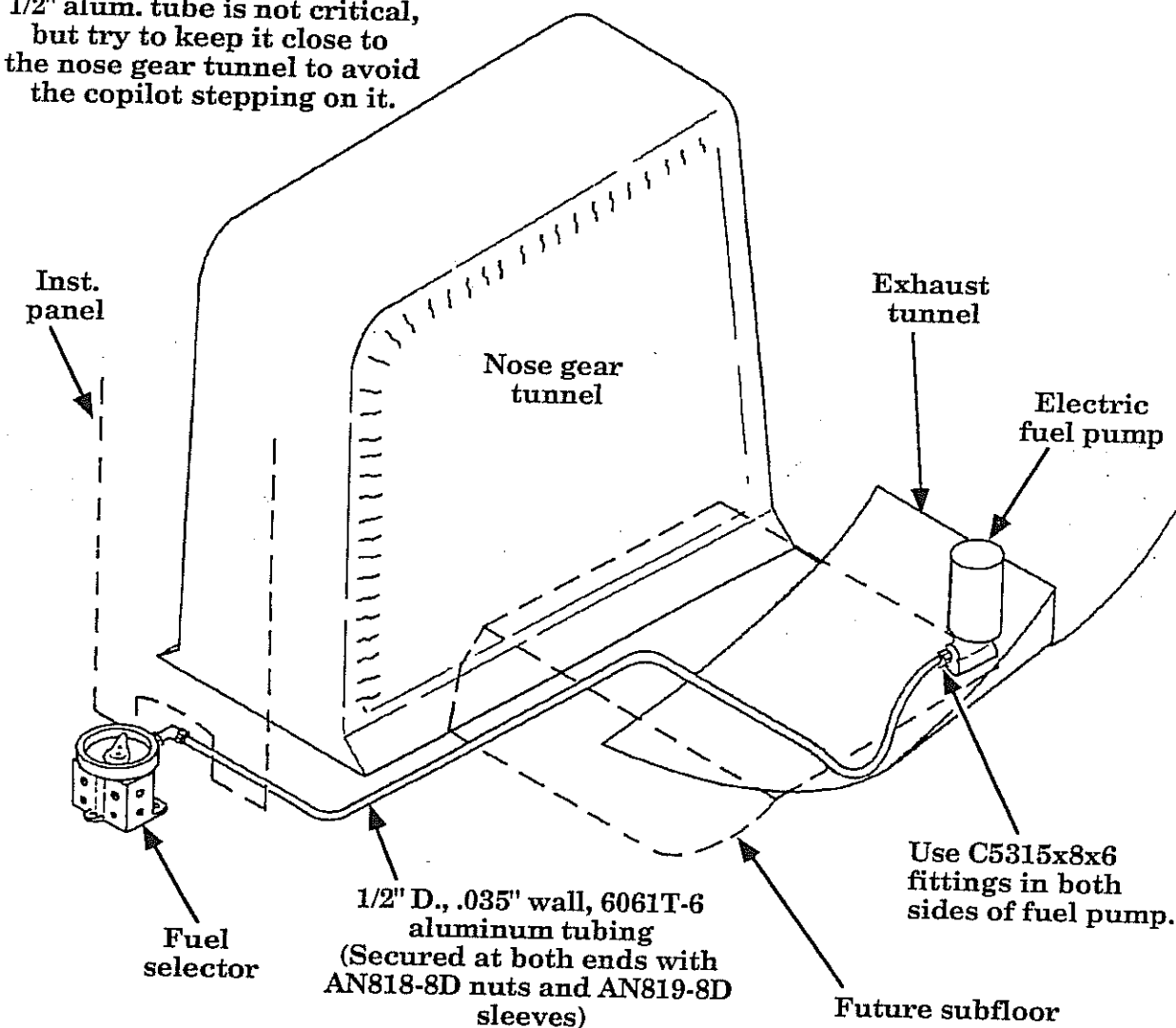


- D8. Use 1/2" dia., .035" wall, 6061-T6 aluminum tubing to connect the fuel selector to the electric fuel pump. Bend the tubing to follow the general route shown in Figure 27:D:6. Use AN818-8D nuts and AN819-8D sleeves at each flared end of the 1/2" tube. C5315x8x6 fittings are used in both fwd and aft ends of the fuel pump. No, the copilot will not be stepping on this tube because there will be a sub-floor under the rudder pedals.

### Fuel selector to fuel pump tube

Figure 27:D:6

Note: Exact routing of the 1/2" alum. tube is not critical, but try to keep it close to the nose gear tunnel to avoid the copilot stepping on it.

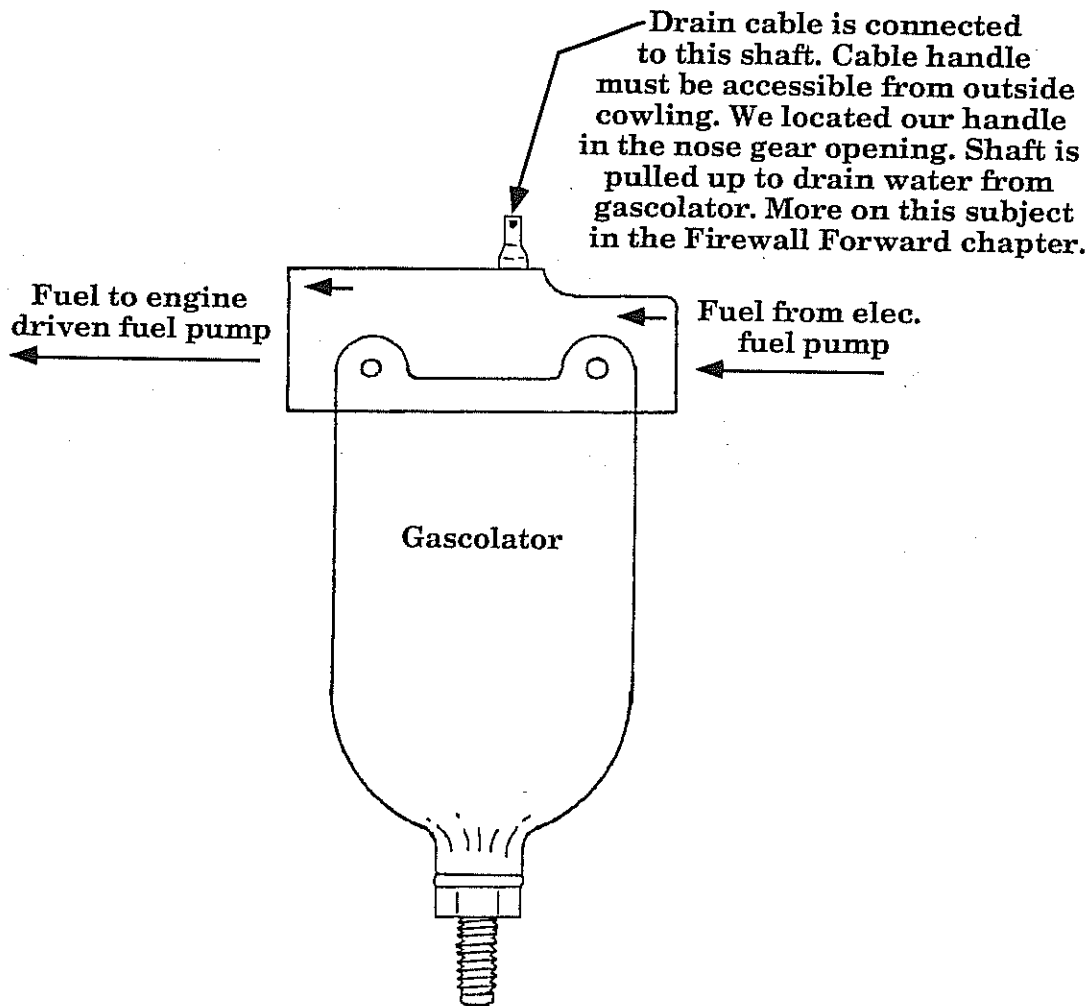


## E. GASCOLATOR INSTALLATION

The gascolator is the last chance for water to be separated from the fuel before entering the engine. If you are using the two stage electric fuel pump necessary for the Continental TSIO-550, your gascolator must be capable of handling the high boost pressures of that pump. Unfortunately, newly manufactured gascolators in this category are not readily available from parts houses. We recommend you call aircraft salvage yards and buy a gascolator from a Cessna. These gascolators were widely manufactured and are easy to find. The Cessna part number on our gascolator is #0756005-1.

### Gascolator

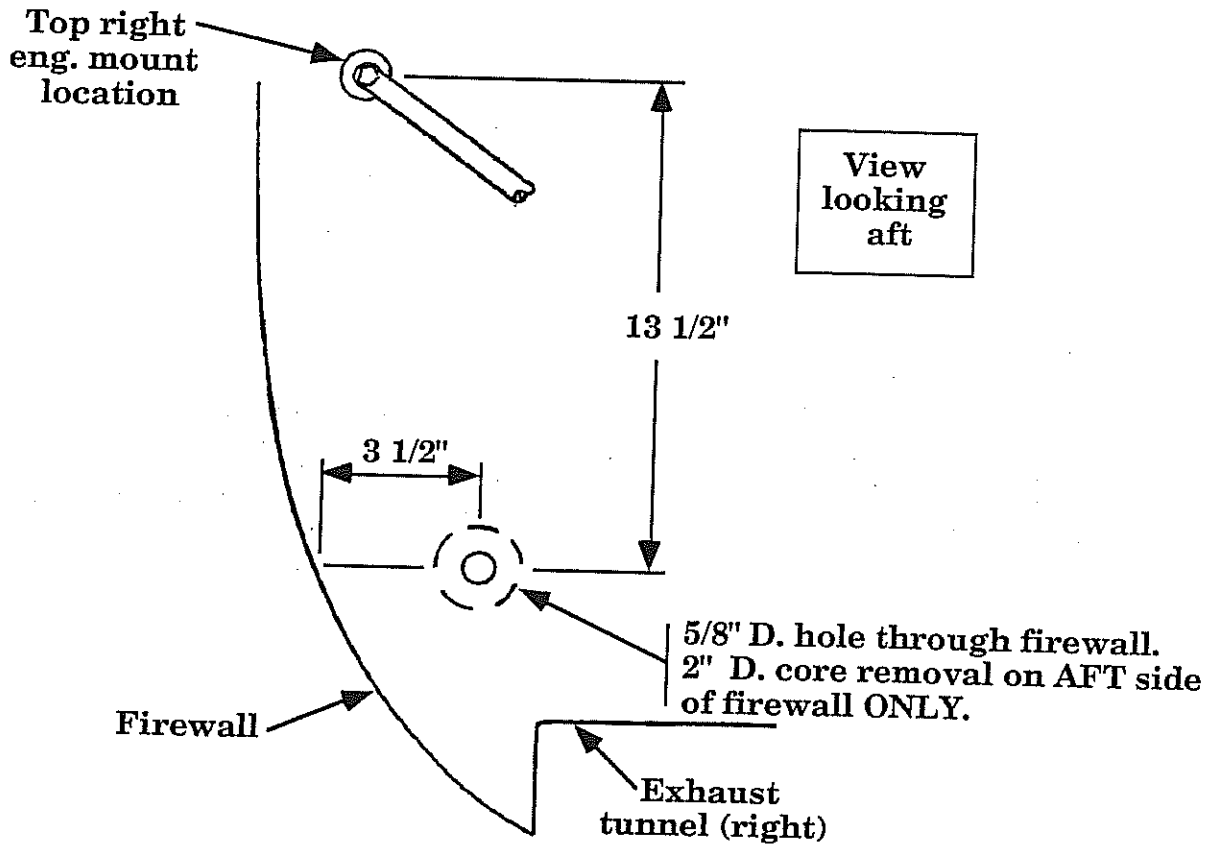
Figure 27:E:1



- E1. Cut out a 2" diameter section of the firewall's aft laminate and core at the location shown in Figure 27:E:2.
- E2. Sand and clean the circular cutout area and the surrounding laminate in preparation for BID.
- E3. Form a radius around the exposed core of the circular cutout with a thick epoxy/micro mixture. Reinforce the cutout area with 4 BID, overlapping onto the original aft laminate 1" around the cutout perimeter.

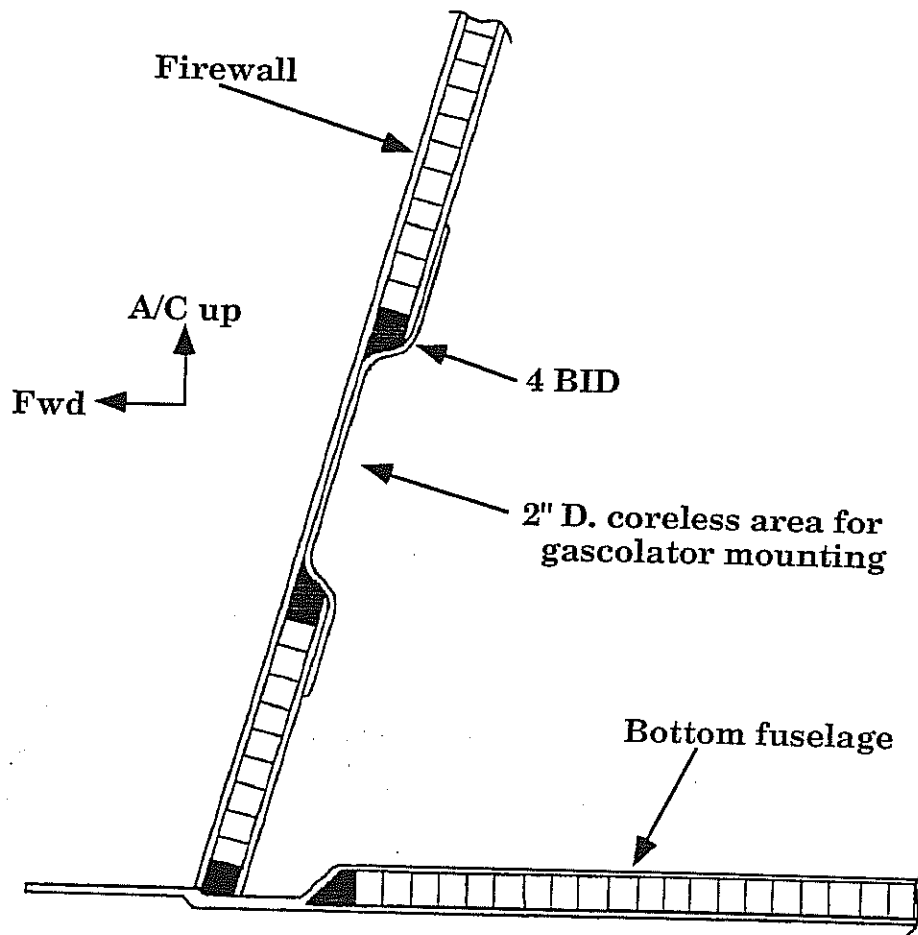
**Gascolator mounting area**

Figure 27:E:2:a



# Gascolator mounting area

Figure 27:E:2:b

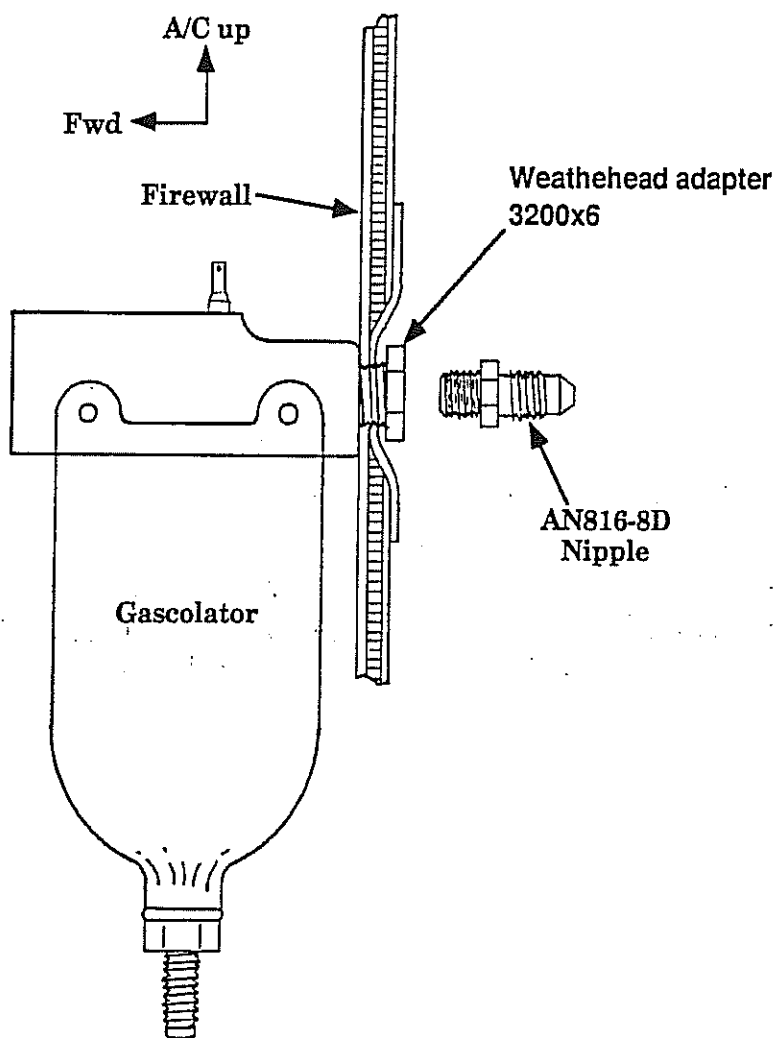


- E4. Drill a 7/8" diameter hole through the firewall, centered on the coreless area you just made.

- E5. To mount the gascolator to the firewall, hold it against the firewall's fwd face and thread a 3200x6 adapter fitting into it from aft of the firewall. The firewall will be sandwiched between the gascolator and the fitting.

### Mounting gascolator to firewall

Figure 27:E:3

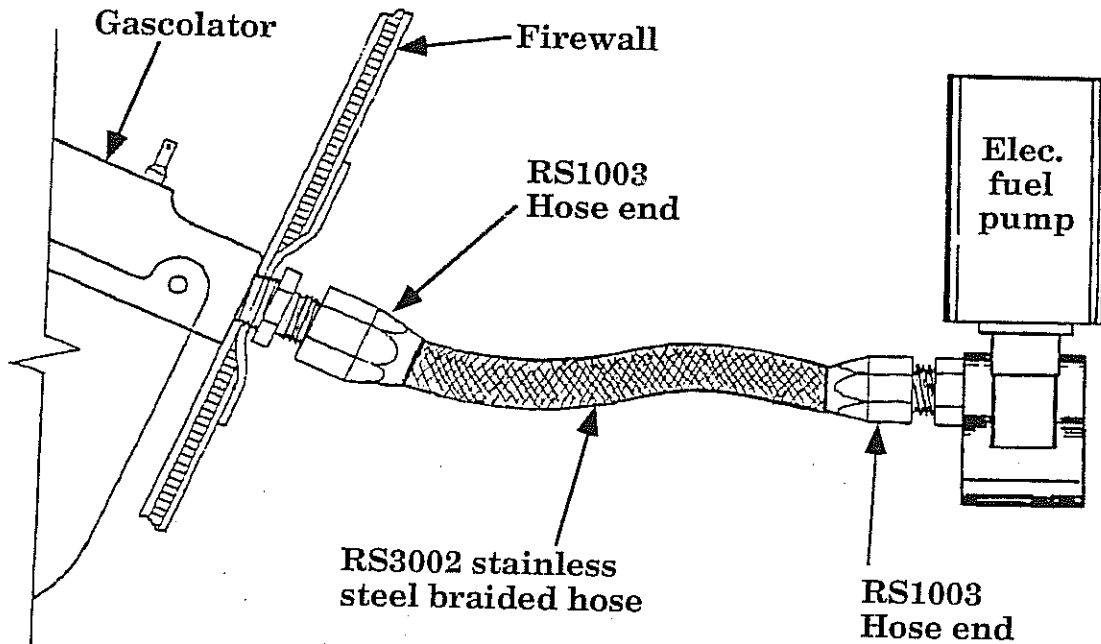


- E6. Thread an AN816-8D fitting into the 3200x6 adapter fitting. Use some teflon impregnated pipe sealing compound to seal this joint. Now you are ready to connect the gascolator to the fuel pump.

- E7. Fuel flows from the fuel pump to the gascolator through flexible, stainless steel braided hose. This is the same RS3001 hose you used in the wing fairing areas. Make up a hose with RS1002 hose end fittings that when installed, has a slight bend. This will allow some flexing in the system without damaging the hose. Do not use sealing compound on these flared fittings.

### Connecting fuel pump to gascolator

Figure 27:E:4

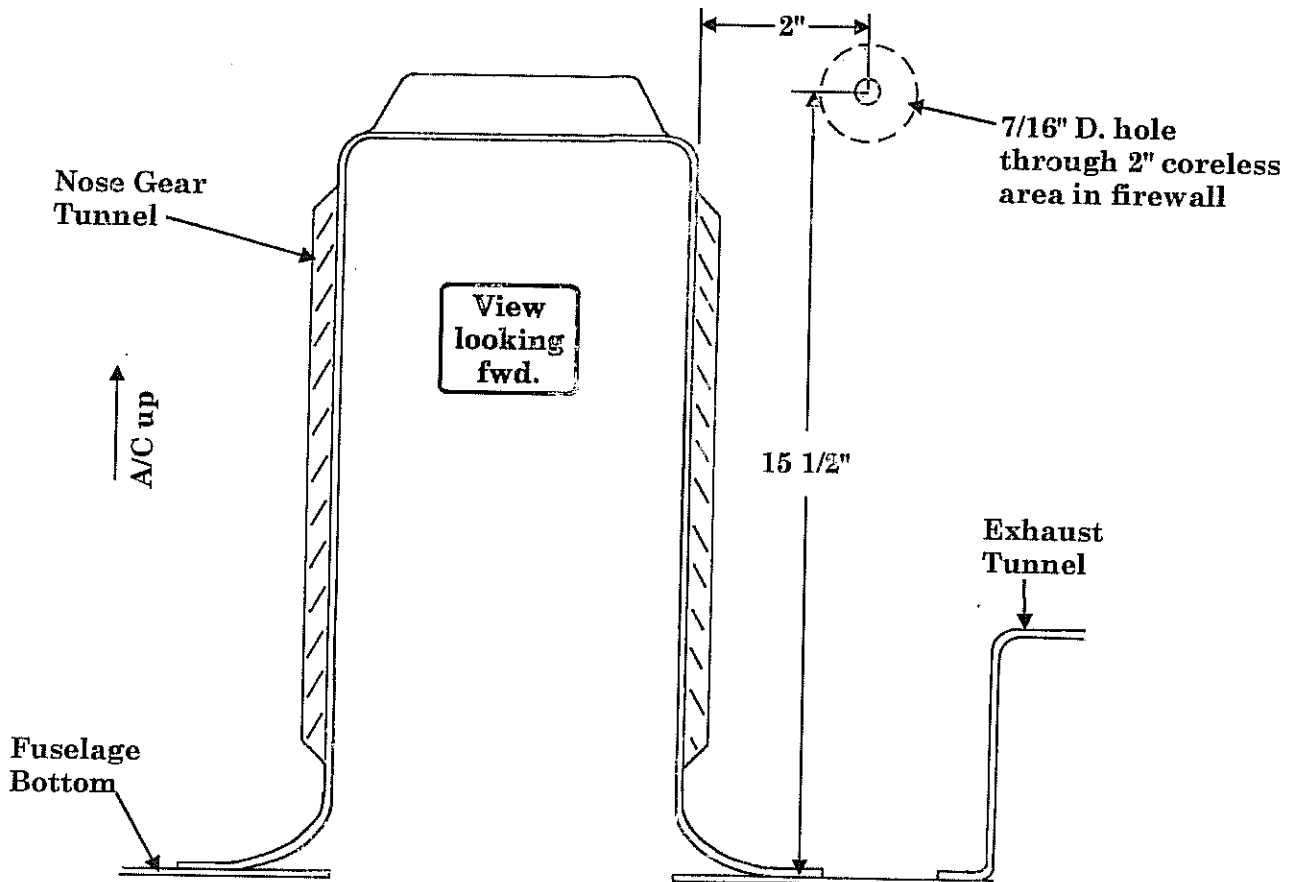


## F. FUEL RETURN LINE TO FIREWALL

From the firewall to the fuel selector valve, unused fuel flows back toward the wing tanks through a 1/4" diameter aluminum tube. This tube is connected to the lower, fwd fitting of the selector valve and a bulkhead fitting on the firewall.

### Fuel return line (Firewall to selector)

Figure 27:F:1

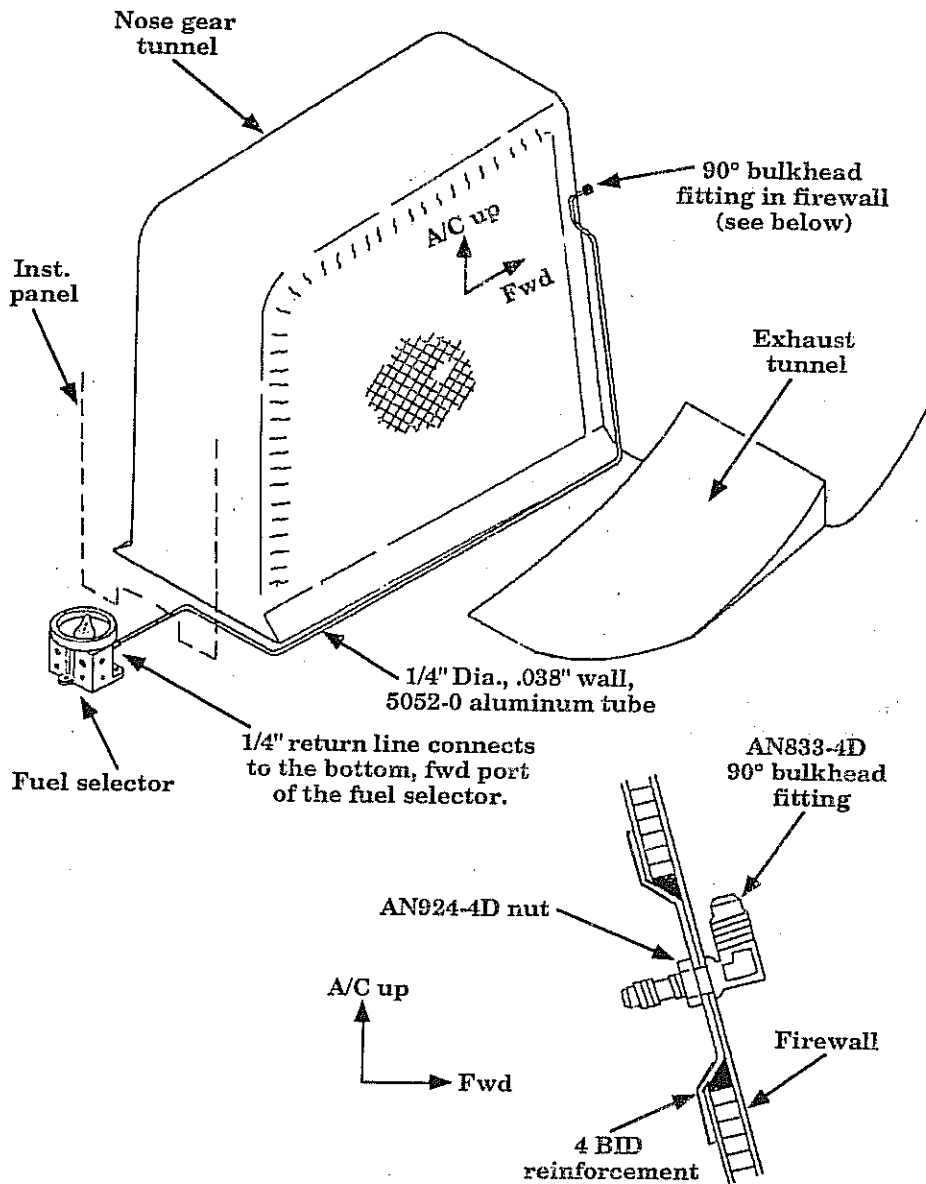


- F1. Cut out a 2" diameter section of the firewall's aft laminate and core. The location of this cutout is shown in Figure 27:F:1.

- F2. Sand and clean the circular cutout area and the surrounding laminate in preparation for BID.
- F3. Apply a 4 BID patch to the circular cutout area, overlapping onto the original aft laminate 1" all around. Use a thick epoxy/micro mixture to radius the exposed core areas underneath the BID.

### Bulkhead fitting in firewall & tube routing

Figure 27:F:2







- F4. When the 4 BID has cured, drill a 7/16" diameter hole in the center of the coreless circle to accomodate an AN833-4D bulkhead fitting. Secure the fitting to the firewall with an AN924-4D nut.
- F5. Bend a 1/4" D., .035" wall, 5052-0 aluminum tube to connect the AN833-4D bulkhead fitting with the lower fwd AN816-4D fitting in the selector valve. From the selector valve, route the tube fwd past the instrument panel, around the nose gear tunnel, along the lower right corner of the tunnel, then up close to the firewall to the bulkhead fitting. Refer to Figure 27:F:2 to get an idea of the general routing of this tube. Flare each end of the tube and use AN818-4D nuts and AN819-4D sleeves to connect the tube to the selector valve and the bulkhead fitting.



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Chapter 27

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Fuel System

