

# CHAPTER 26

## REVISION LIST

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
26-1 thru 26-2	0	None	
26-3	C5	R&R	Updated schematic & parts list
26-4	C14	R&R	Edited parts list.
26-5 thru 26-12	0	None	
26-13	C8	R&R	Fig.26:B:1 Revised
26-14	0	None	
26-15	C13	R&R	Changed BL 171 to BL 172
26-16 thru 26-18	0	None	
26-19	C4	R&R	Revised Step D2
26-20	C14	R&R	Revised Figure 26:D:2
26-21	0	None	
26-22	C14	R&R	Revised Figure 26:E:1
26-23	C8	R&R	Step E1, Loctite added
26-24	0	None	
26-25 thru 26-27	0	None	
26-28	C8	R&R	Revised Figure 26:F:1
26-29 thru 26-30	C4	R&R	Revised Steps F1, F4, F5 Revised Figures 26:F:1 & 2a
26-31	C14	R&R	Edited part number in Figure 26:F:3.
26-32	0	None	
26-33	C11	R&R	Changed part no. in Fig. 26:F:5.
26-34	C4	R&R	Revised Steps F11 Revised Figures 26:F: 7
26-35	0	None	
26-36	C11	R&R	Revised Figure 26:F:11
26-37	C8	R&R	Fig.26:F:12 Revised
26-38	C4	R&R	Revised
26-39	C13	R&R	Changed BL 171 to 172
26-40	C6	R&R	Revised Step G4
26-41	C8	R&R	Revised Figure 26:G:4





# CHAPTER 26

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Page(s) affected	Current Rev.#	Action	Description
26-42	C17	R&R	Edited text in Step G9.
26-43	C17	R&R	Modified text in Fig. 26:G:7.
26-44	C17	R&R	Edited text in Step G11.
26-45 thru 26-46	C5	R&R	Revised Step G14 Revised Figure 26:G:11
26-47	0	None	
26-48	C8	R&R	Revised
26-49 thru 26-51	C5	R&R	Revised Fig's: 26:G:13, 14, 15, 16
26-52	0	None	
26-53 thru 26-54	C5	R&R	Revised format Revised Figure 26:G:19, Step G22
26-55	C5	Add	New page



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Chapter 26

REV. C17/1-25-99

Hydraulic System







2244 Airport Way, Redmond, Oregon 97756 Phone 541 923-2233 Fax 541 923-2255

## SERVICE BULLETIN

**SB042-0298**

Subject: Lancair IV and Lancair ES Fuel Vent Lines

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Status: Mandatory Inspection and Replacement (if necessary)

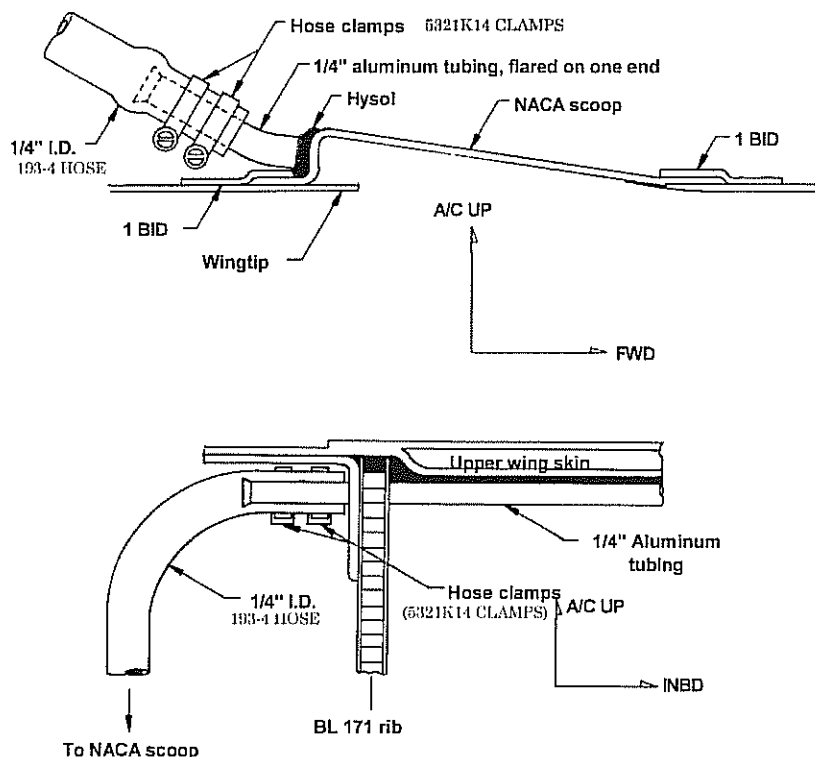
### Background:

We have noted a degradation over time of the hose that connects the NACA scoop to the aluminum vent line of the fuel tank. After several years of use, the hose apparently is affected by the fumes from the fuel tank and it tends to become "rubbery". A collapse or complete blockage of this hose could cause engine failure.

Visually inspect the vent line. If there are any signs of damage or if in doubt, replace the hose with 193-4 hose available through Lancair. Use 5321K14 clamps to secure hose.

### Fuel Vent Line Connection to NACA scoop

Fig. 1





# CHAPTER 26

## HYDRAULIC 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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  - C. MANIFOLD / ACCUMULATOR
  - D. EMERGENCY HAND PUMP
  - E. CONTROL QUADRANT
  - F. FITTINGS
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Chapter 26

REV.

0 / 2-5-94

Hydraulic System



## 1. INTRODUCTION

The landing gear and flap system of the Lancair IV are both actuated by hydraulics. The theory of hydraulics is very simple. An electric pump pressurizes the hydraulic fluid in the system. The pressurized fluid pushes the piston of a hydraulic cylinder one way or the other. The action of the piston will raise or lower the gear or flaps.

With the Lancair IV, the hydraulic fluid is pressurized using an electric driven pump. This unit is referred to as the "power pack" because it comprises the electric motor, the small gear pump and the fluid reservoir into essentially one unit. The pump runs in one direction only, pressurizes the line and an accumulator which is added to assist the gear and flaps. When one operates the gear or flaps, one is simply routing the high pressure fluid in the selected direction. The gear handle and flap handle (on the instrument panel) are actually rotating valves which in turn, route the fluid. A pressure switch is used to maintain system pressure (approximately 1100 psi) at all times when the master switch is turned on.

There is an electrically operated solenoid pin which locks the gear handle into the down lock position. This switch must be electrically activated to allow the gear handle to be moved out of the down locked position. We use an airspeed sensor switch to activate this solenoid pin, thus the solenoid pin will not retract and allow gear "up" until you reach approximately 65 kts of airspeed. While this is intended to be a safety device to prohibit accidental gear "up" while on the ground, one should always be VERY careful with that gear handle since any mechanical device (valve, solenoid switch, etc.) can stick or otherwise fail to operate properly. So, the best advice is to always assume that if one lifts on the gear handle, it will indeed move - as will the gear!

As a gear down back up, we have a hand operated pump. In the event of electrical failure or a line leak, etc., the emergency system can take over. Briefly, to use this system, place the gear handle in the down position. This will automatically allow the nose gear to drop down and lock due to the high pressure gas strut on the assembly. The main gear will fall to a vertical position which is not fully down. At that time, simply pump the hand pump to move the main gear into the full down position which then automatically sets the internal down-lock pins in the main gear cylinders. The hand pump pressure will slowly bleed off due to a controlled bleed down feature in the hand pump. This feature is used in conjunction with periodic, in flight systems checks by allowing the standard gear system to be re-energized and the gear then run back up into the fully retracted position.

The flaps can actually be operated one or two cycles on the ground without any electrical power, provided the hydraulic system is fully charged. The accumulator has enough capacity to perform this task without being recharged. This, by the way, creates a simple means of "bleeding the system pressure down" if so desired - simply run the flaps up and down until they stop moving, the pressure in the system is then reduced to only a small residual level.



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Chapter 26

REV.

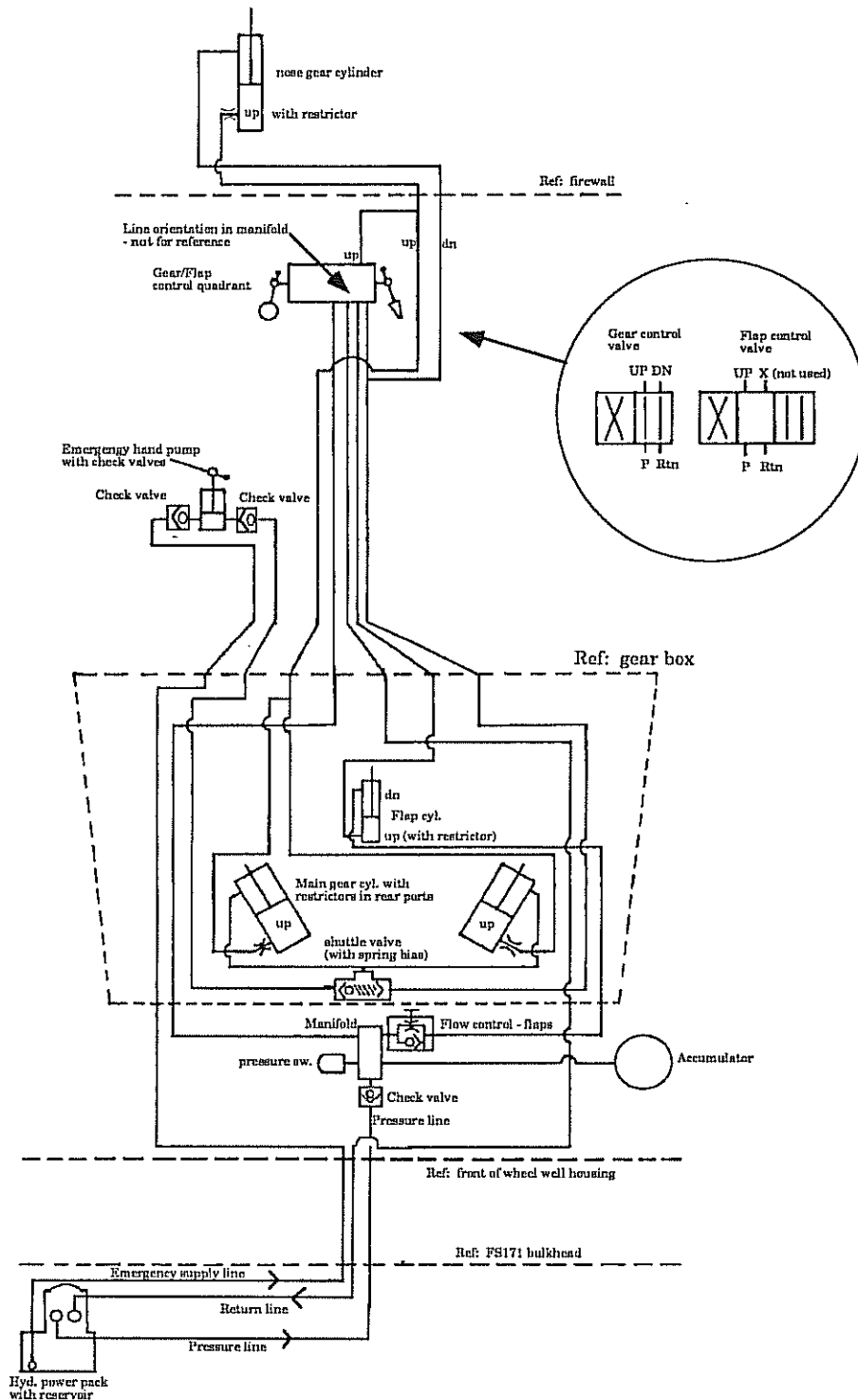
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Hydraulic System



# Lancair IV hydraulic system

Figure 25:A:0





## 2. SPECIAL PARTS, TOOLS, & SUPPLIES LIST

### A. PARTS

- 1 Power pack with enlarged reservoir #488, 638082-12V, (638083-24V)
- 1 Control quadrant assembly (gear and flaps)
- 1 Manifold (high pressure) #476
- 1 Accumulator #ACC-30
- 1 Emergency hand pump assembly #490
- 1 Check valve - hand pump (low seat press.) supply line #B-6C-1/3
- 1 Check valve - hand pump emergency down line #CMM10B1 (or B-2C2-1/3)
- 1 Shuttle valve (gear down), #LSV1-2P-N
- 1. Shuttle valve spring, Century #10877
- 1 Pressureswitch, #~~0169420041016~~ **PS1100**
- 1 Flow control valve (flaps), #FMF10B Deltrol
- 1 Gear down high temp. flex line (firewall forward) #570
- 1 Gear up high temp flex line (firewall forward) #571
- 36 ft. Line (1/4" dia. aluminum) rigid
- 12 ft. Line (3/8" dia. aluminum) rigid
- 12 ft. Line (flexible), #HR303
- 2 3/8-16 bolts (pump attach)
- 2 AN3-7A bolts (reservoir attach)
- 4 AN365-1032 lock nuts
- 4 AN960-10 washers
- 6 AN970-3 area washers
- 2 10-24 x 3/8" cap screws (shuttle valve bracket attach)
- 2 MS24694-S70 machine screws (pressure manifold attach plate)
- 2 MS35206-263 (10-24) cap screws (control quadrant attach brkt to control manifold)
- 4 MS35207-262 cap screws (control quad to tunnel)
- 4 K1000-3 anchor nuts
- 8 AN426A-3-5 rivets for anchor nuts
- 1pc 1/4" phenolic 1" x 5" (manifold attach) & hand pump bumper block
- 12 Flex line ftgs.
- 2 AN804-4D bulkhead Tee, bulkhead on run
- 4 AN816-4D straight
- 2 AN816-4-4D straight
- 1 AN816-6-2D straight (em. supply line, at reservoir with 1/8 pipe reservoir thread size)
- 44 AN818-4D nut
- 12 AN818-6D nut
- 44 AN819-4D sleeve
- 12 AN819-6D sleeve
- 1 AN822-4D elbow
- 4 HK822-4D (elbow with restrictor)
- 1 AN822-6-2D
- 2 AN823-4D 45°
- 1 AN824-4D flair Tee
- 4 AN832-4D bulkhead straight
- 3 AN832-6D bulkhead straight
- 5 AN837-4D bulkhead 45°
- 1 AN837-6D bulkhead 45°
- 3 AN913-1D pipe plug
- 1 AN913-4D pipe plug (reservoir)
- 1 AN914-1D 90° (out of hand pump)
- 18 AN924-4D nut
- 4 AN924-6D nut
- 1 C5255x4 straight (at hand pump)
- 1 6801-04-08 90° O-ring to 37° flair
- 1 C5605x4x4x4 Tee with pipe on side (to shuttle valve)
- 2 C5315x4 (to hydraulic power pack)





**B. TOOLS**

- Tube cutter
- Tube bender (optional)
- Flaring tool (37° JIC)
- Deburring tool





### 3. CONSTRUCTION PROCEDURE

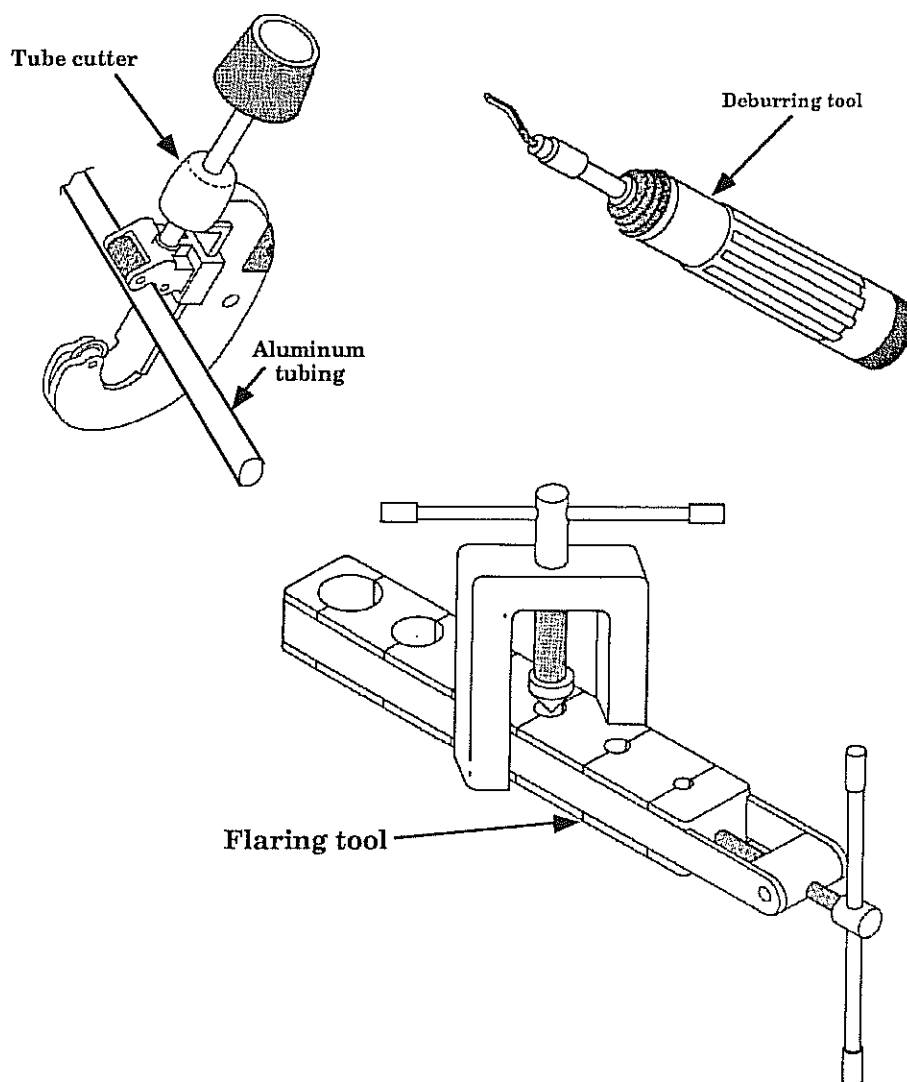
#### A. GENERAL HYDRAULIC HINTS

Installing the hydraulic system is much easier if you have a few specialized tools. A flaring tool and a deburring tool are required for this chapter, and a tubing bender is very handy.

In this section, we will not begin assembling the hydraulic system but will explain how to flare the end of an aluminum tube, how to deburr tubes, and how to install fittings. These are all basic skills necessary for hydraulics.

#### Tools for hydraulics

Figure 25:A:1



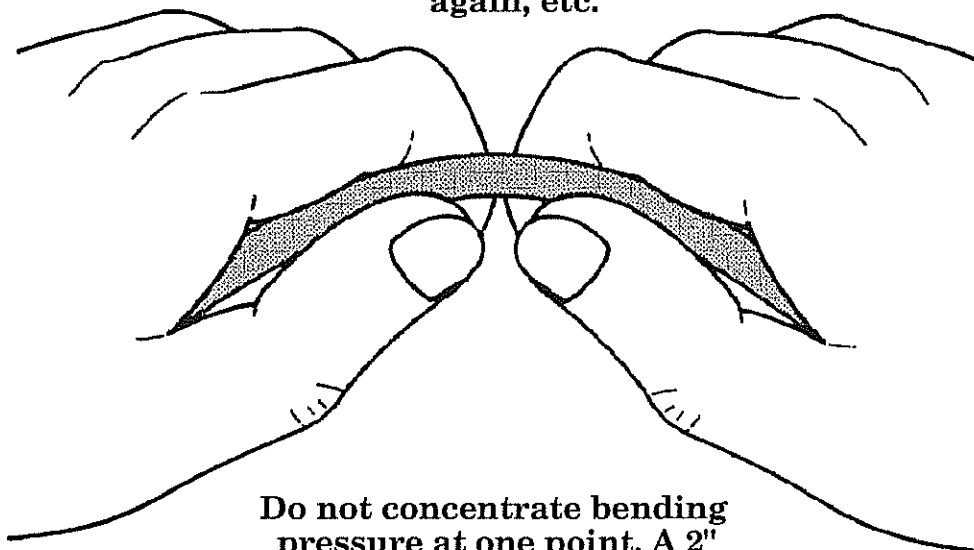


- A1. Fitting a hydraulic line into the fuselage will require cutting and bending. Use a tape measure to get a rough idea of the proper length for the aluminum tubing. Cut the tubing to this length (plus a few inches for good luck).
- A2. Carefully bend the tubing (usually 2024, 1/4" aluminum tubing) to the proper shape. Avoid tight radius bends as this tends to flatten the tubing, possibly reducing the flow capacity. A tubing bender, available through the large aircraft parts retailers, is a good tool to make the tighter bends. Large bends, such as those needed to follow the fuselage shape, can be done by hand (carefully!).

### **Bending aluminum tubing**

Figure 25:A:2

**With your thumbs close,  
bend a little then slide the  
tube fwd 1/8" and bend again,  
then slide fwd 1/8" and bend  
again, etc.**



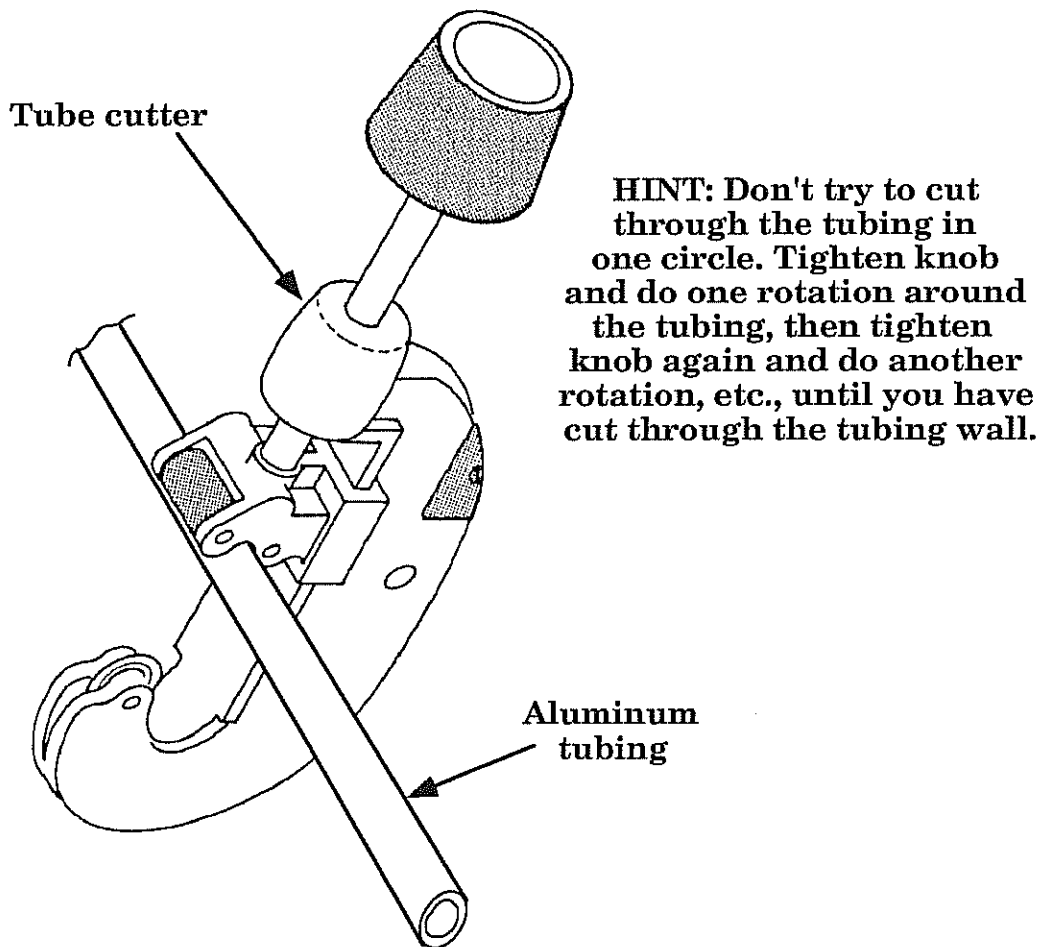
**Do not concentrate bending  
pressure at one point. A 2"  
radius is the smallest bend  
that should be attempted  
by hand.**



- A3. When the tube is bent to the proper shape, cut it to the exact length you need. These final cuts should be done with a tubing cutter, again available through the aircraft parts retailers. This tool makes clean cuts and helps reduce the possibility of jagged ridges on the tube end. Jagged ends can cause cracking when the tube is flared.

### Using the tubing cutter

Figure 25:A:3

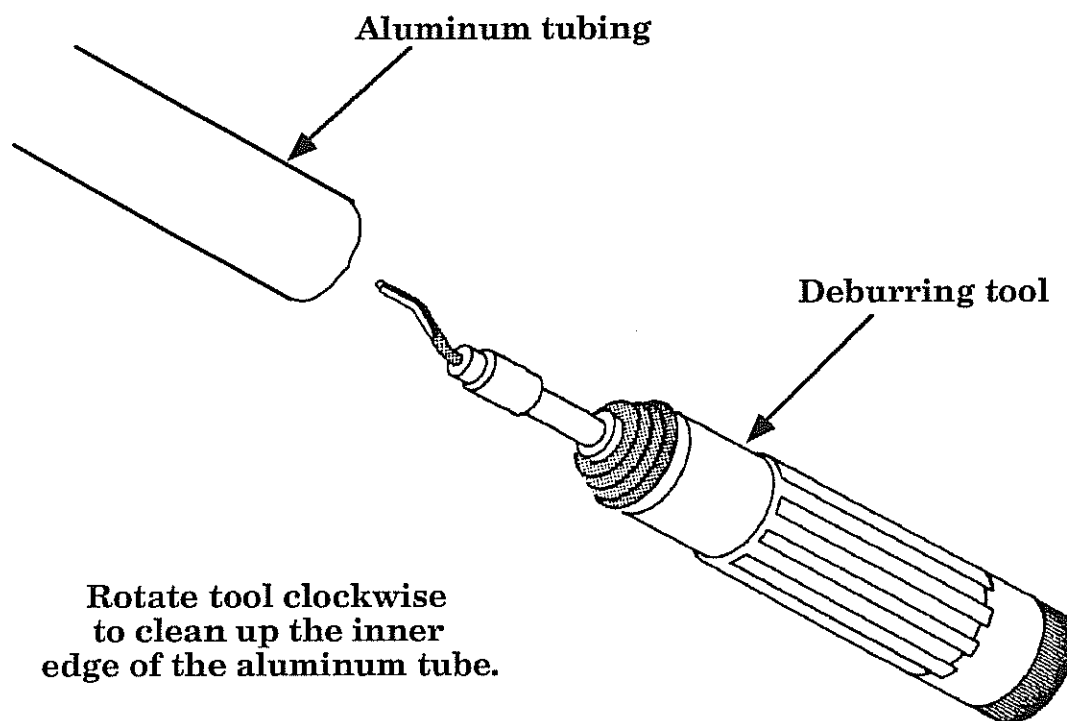




- A4. Use a fine file to smooth the end of the tube. Also use a deburring tool to clean up the inner edges of the tube. Perfectly sharp edges do not flare as well as edges that have been deburred and radiused slightly.

### Deburring tube end

Figure 25:A:4



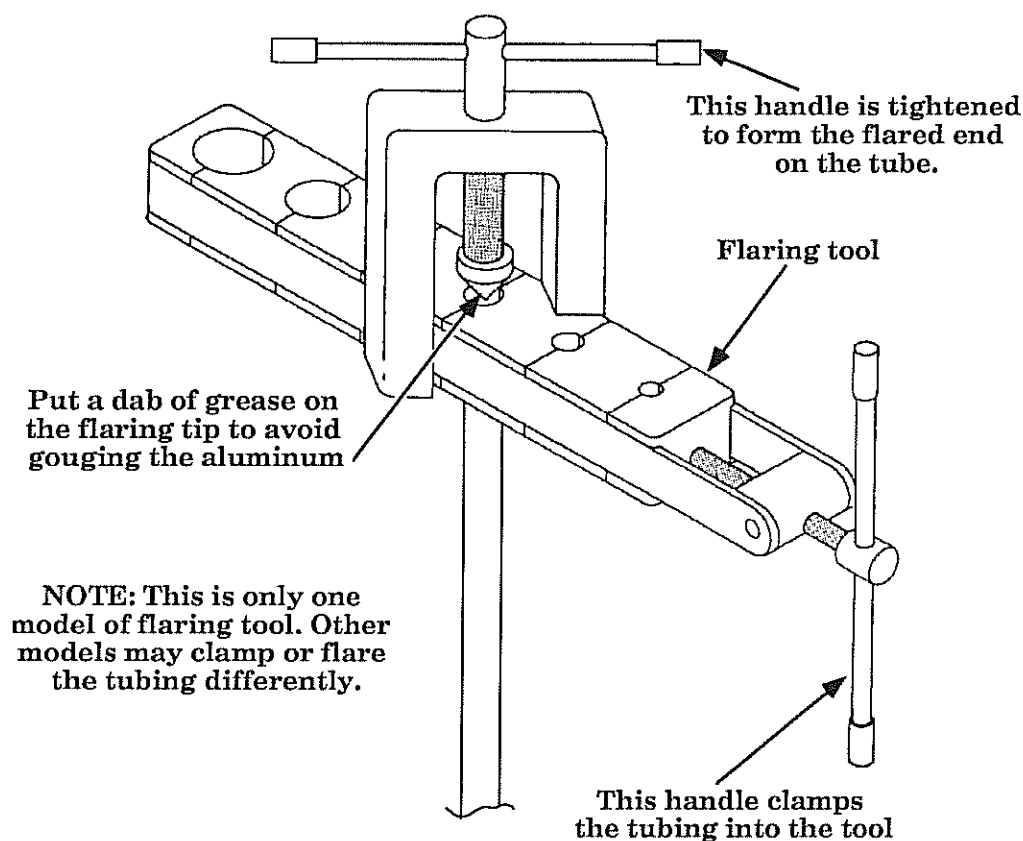
- A5. Before you flare the end of a tube, be sure to slide your fittings onto the tube. This is a classic mistake for builders, forgetting to slide the AN nut and sleeve onto the tube before flaring.



- A6. Different flaring tools use different method of holding the tube, but they all generally have a clamping fixture to securely hold the tube in place. Be sure the clamping fixture is set to the proper size tube to avoid crimping the aluminum.
- A7. Put a dab of grease onto the tapered flaring head. We find this reduces the gouging in the flared tube surface.
- A8. Now screw the flaring tool down onto the tube end until the end is flared. It is better to screw a half turn, then back off, then screw another half turn, etc., until the flare is done. This tends to reduce cracking in the flare.

### Flaring a tube end

Figure 25:A:5



- A9. Remove the flaring tool from the tube. Check the inside surface of the tube where it has been flared. Check for cracking or severe gouging. If the tube looks good, it is ready to be installed on the hydraulic cylinder, pump, etc..



A10. Flexible hydraulic lines cannot be flared and require an end fitting (like the Imperial Eastman BU03-04NJ). These fittings are easy to install as shown in Figure 26:A:6. Here's a few tips we've found handy.

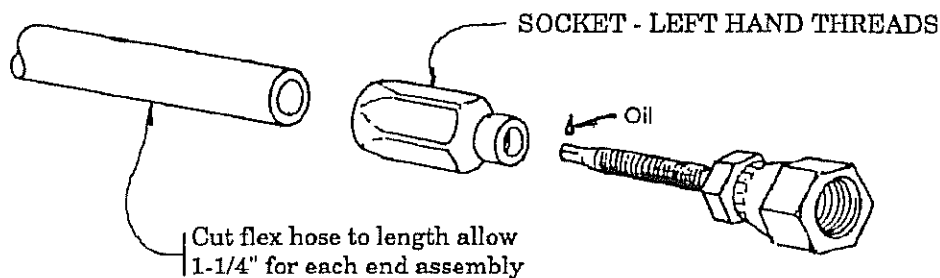
\*When holding the hose in the vise, it is good to clamp it between two pieces of wood that have a half round shape cut into them. This will protect the hose from the metal jaws of the vise.

\*Push a smooth nail of the appropriate diameter into the end of the hose before threading on the socket (Step 1). The nail will prevent the hose from being shrunk by the socket, and ease the threading of the nipple (Step 3). Be sure to remove the nail.

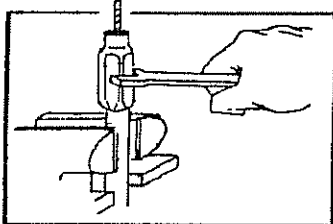
\*After threading the nipple onto the hose, check that you did not cut into the hose side with the nipple. This can create a flapper door effect, blocking flow in one or both directions. Check by looking into the hose (if it is short) or blowing through it both ways. If there is a flap, you should be able to hear it when blowing.

### Installing end fittings on flex hose

Figure 25:A:6

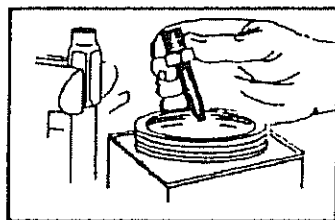


#### Step 1



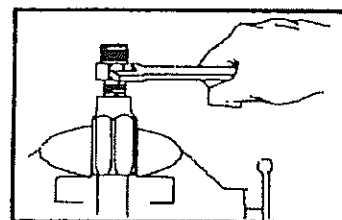
Place hose in vise with center mandril inserted. Thread socket counterclockwise onto hose until hose bottoms, back off 1/2 turn.

#### Step 2



Oil nipple threads and inside of hose with Hoze-Oil or heavy oil. Caution: Do not oil hose cover.

#### Step 3

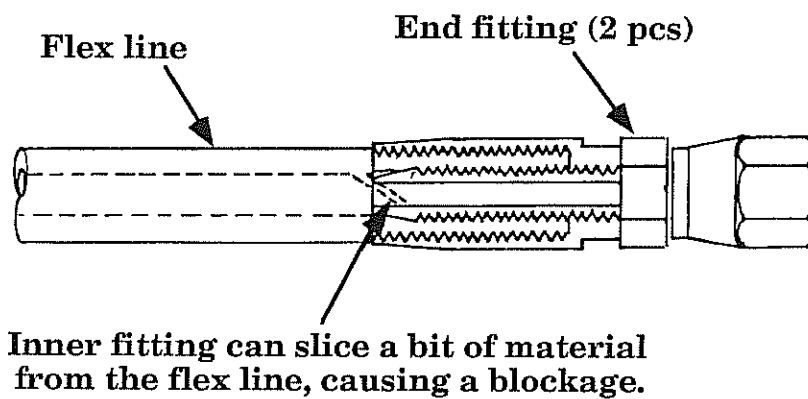
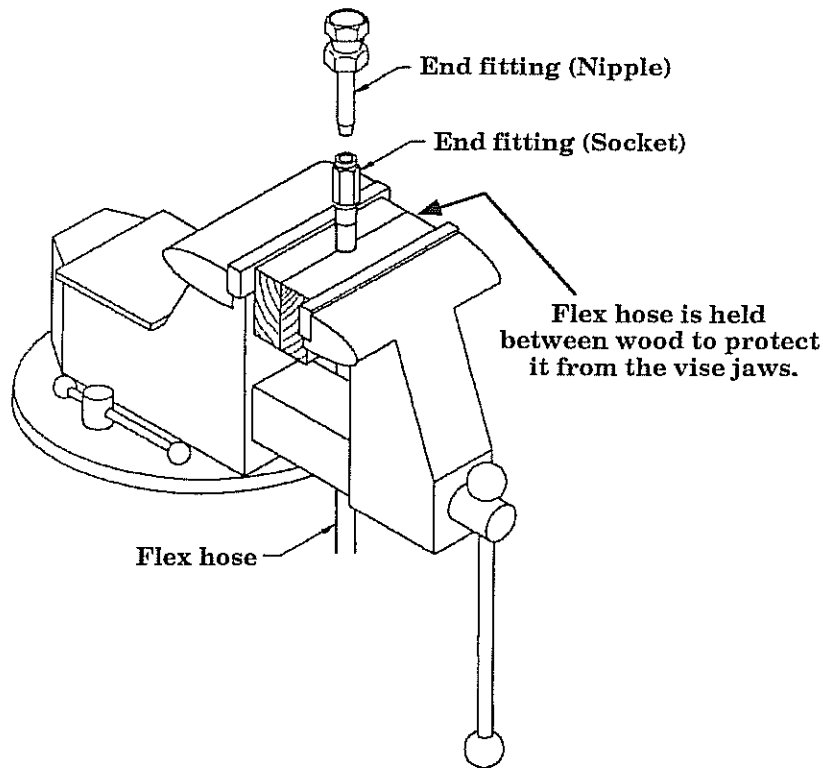


Thread nipple clockwise into socket until nipple hex shoulders against socket.



## More flex tubing hints

Figure 25:A:7



Those are the basic guidelines for assembling hydraulic tubing. Now we can begin assembling the system in the airplane. Be sure to keep all hoses clean and *never* kink a hose, either aluminum or flexible.

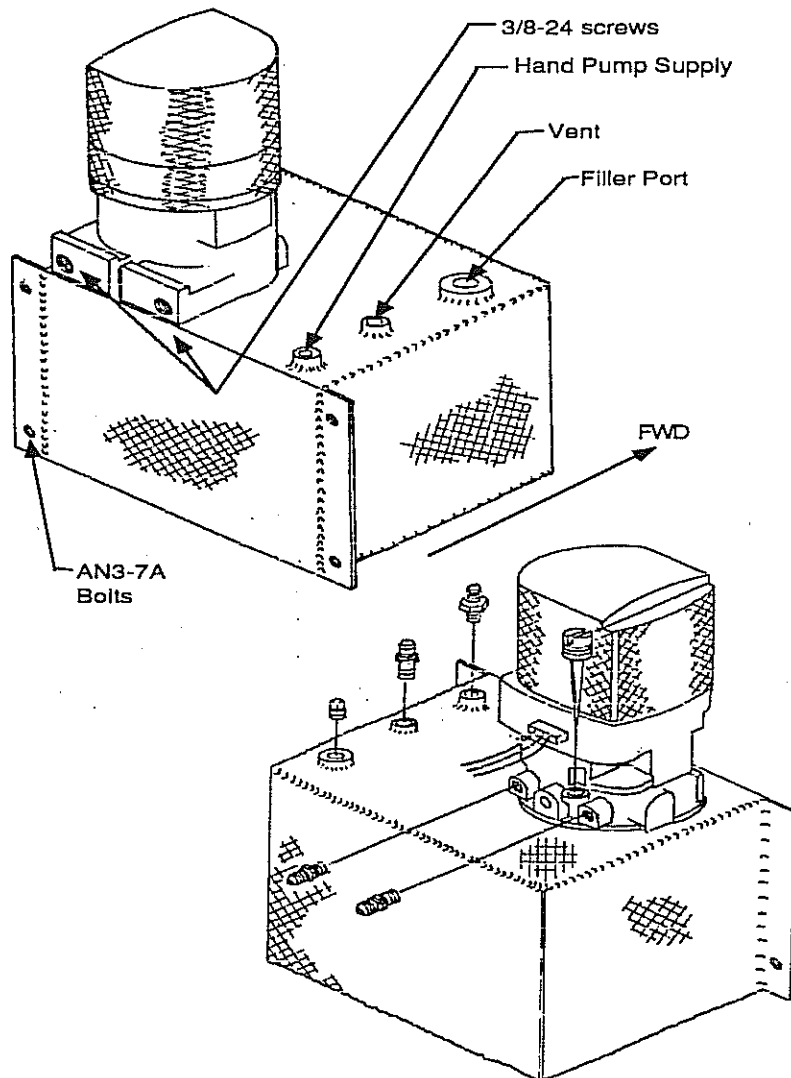


## B. POWER PACK

The power pack bolts onto the aft side of the FS-171 bulkhead, on the left side.

### Power pack

figure 26:B:1





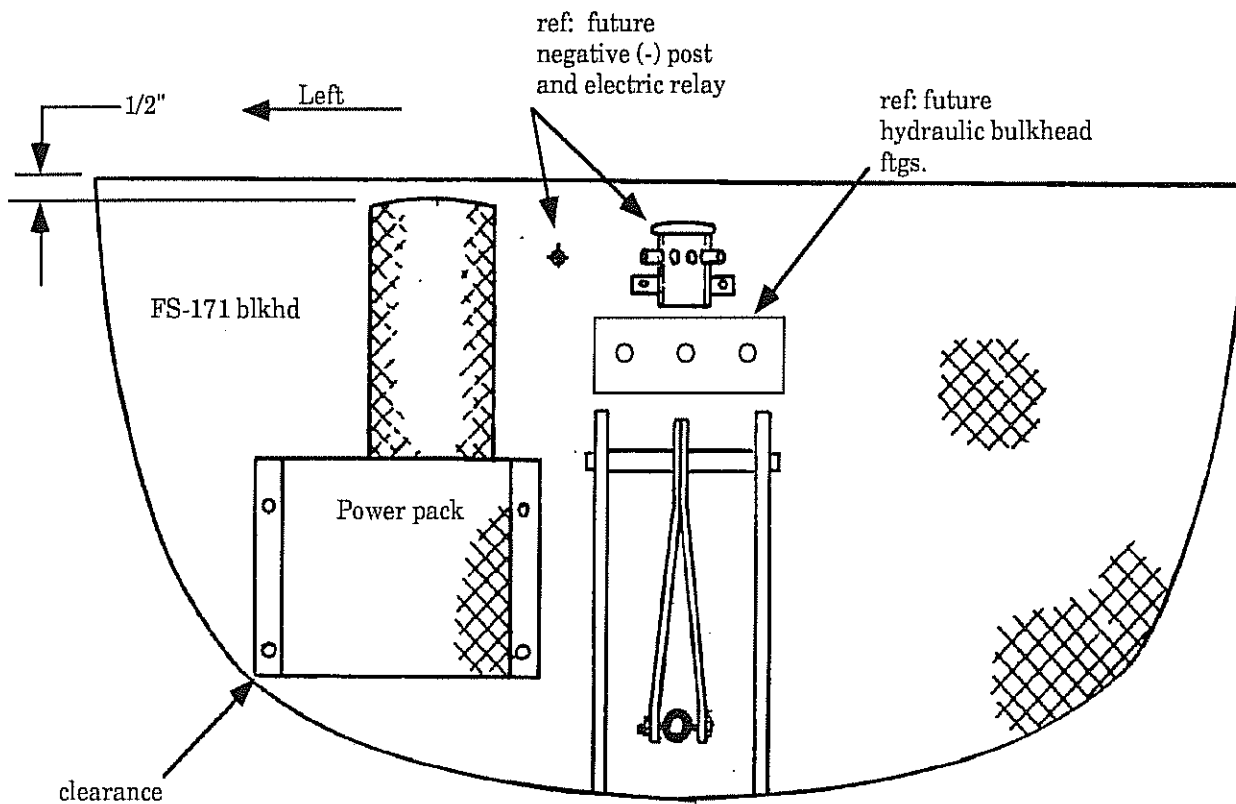
- B1. Locate power pack position. The power pack has 2 bolts for attachment, the reservoir also has two smaller attach bolts on side flanges.

Position the power pack such that it clears the fslg and also adequately clears the elevator push rod / idler arm assemblies. The top of the power pack should remain at least 1/2" below the top of the 171 bulkhead so that you'll have room to fit a baggage closeout shelf across.

With a couple of reference marks, you can adequately estimate where these bolts will align on the bulkhead.

### Power pack location

figure 26:B:2

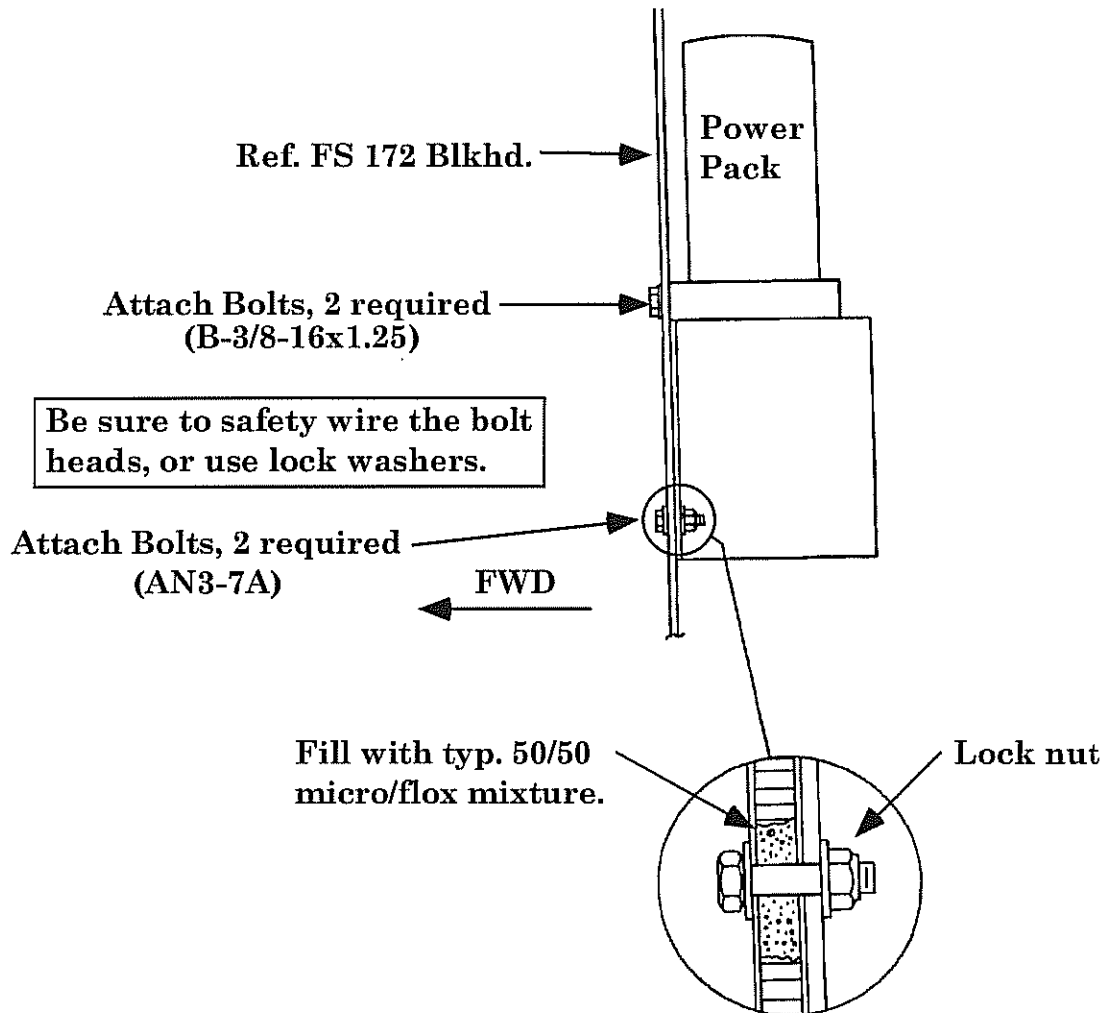


- B2. Drill for the power pack attach bolts. Use a 3/8" drill bit and punch through the bulkhead.
- B3. Reposition powerpack and drill for the reservoir support bolts. Slip the two powerpack bolts temporarily into position through the bulkhead and into the powerpack. Then mark and drill for the two 3/16" reservoir attach bolts.



## Power Pack Attachment

Figure 26.B:3



- B4. Flox the bolt holes. Dig out the core around the six bolt holes in the bulkhead and fill with epoxy/flox. Allow to cure then redrill for the bolt holes.
- B5. Permanently attach the powerpack. Use the two 3/8-16 bolts and two AN3-7A bolts with lock nuts. Run all bolts through from the fwd face of the FS172 bulkhead. Use AN365-1032 lock nuts at the two reservoir bolt locations.



## C. MANIFOLD / ACCUMULATOR

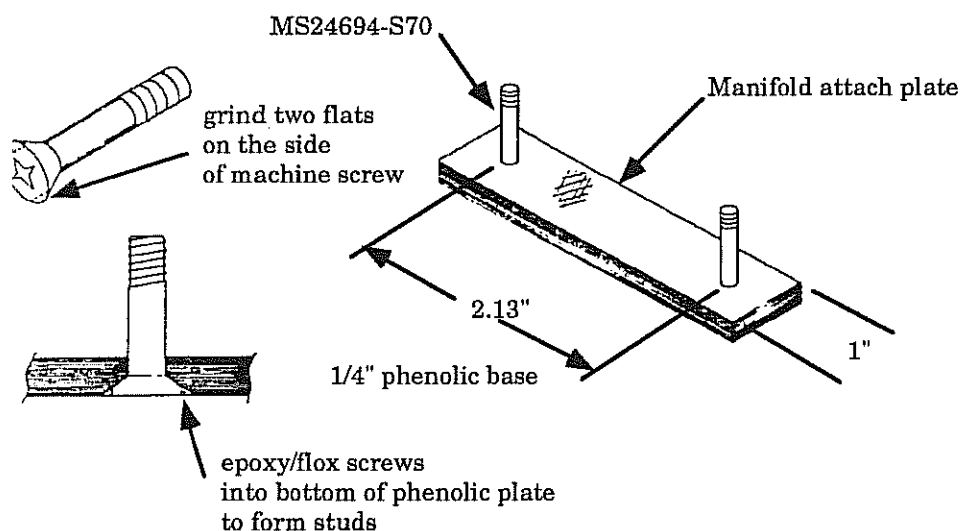
The manifold is simply a block that allows for several high pressure lines and fittings to be easily connected together. The manifold locates behind the gear box, its exact position is not particularly critical.

The accumulator helps to increase gear operating speeds as well as provide a buffer for flap actuation as well as any minor leak downs that might occur without requiring the pump to cycle on each time. The accumulator will also mount behind the gear box along the right outbd side of the right gear leg door cut out. It should be located as close to the bottom of the flsg as possible but you must be sure to allow clearance room for the fitting which exits from the bottom of the accumulator.

- C1. Make a mounting block for the manifold. Use a piece of 1/4" phenolic and embed two MS24694-S70 machine screws. First grind a couple of flats on the sides of the screws so that when embedded in flox, they will lock and resist spinning. See fig. 25:C:1

**Manifold base mount**

Figure 26:C:1

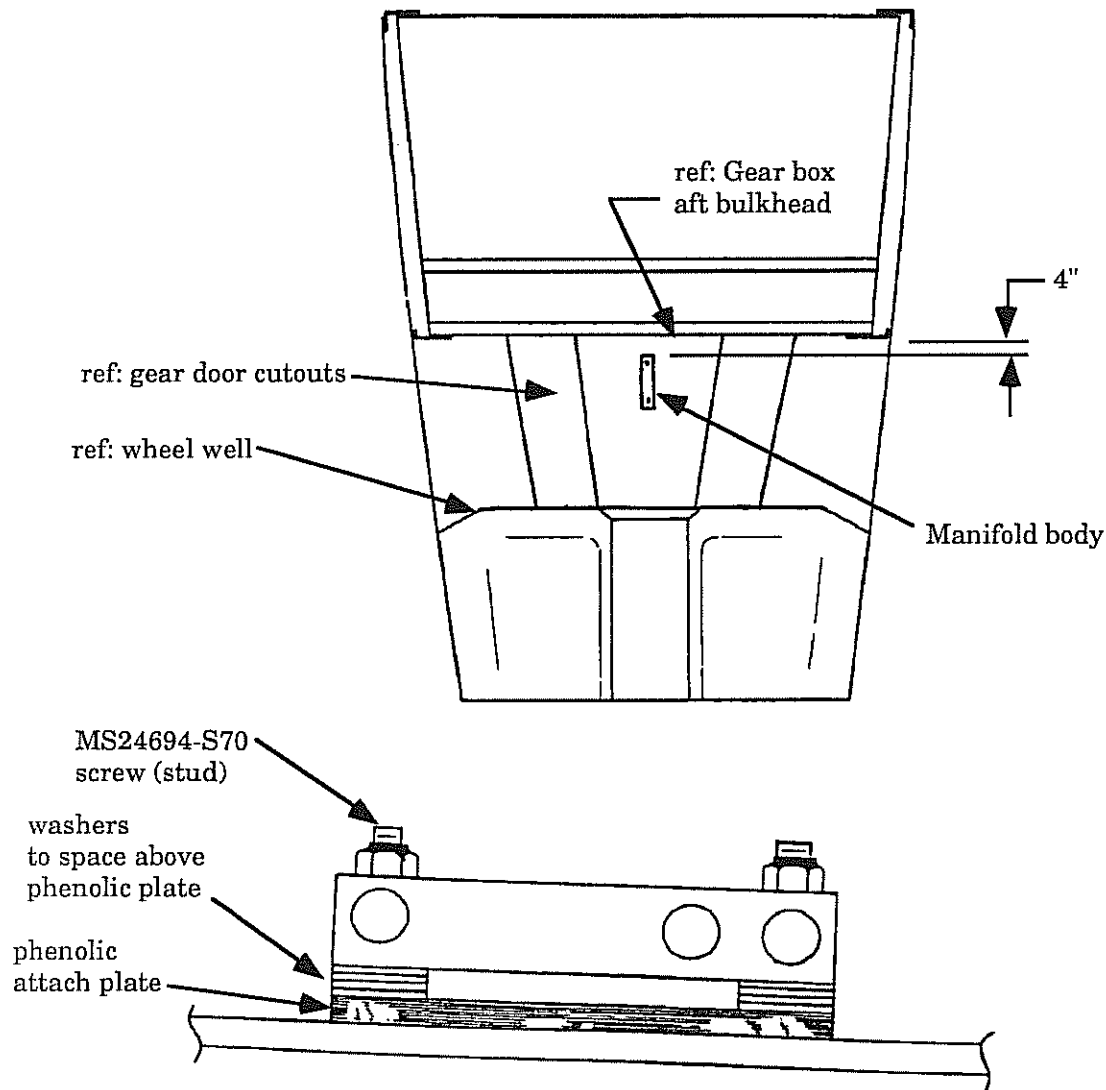


- C2. Locate the position for the manifold. See fig. 25:C:2. First clean and prep the flsg and phenolic pad. With the mounting pad positioned on the manifold and an epoxy/flox mixture applied to its bottom, position the manifold onto the flsg bottom, apply a little weight and allow to cure. Note that the "studs" are longer than what would appear to be necessary, that is because the manifold will be supported above the phenolic mounting block slightly for future fitting clearances.



## Manifold position

Figure 26:C:2

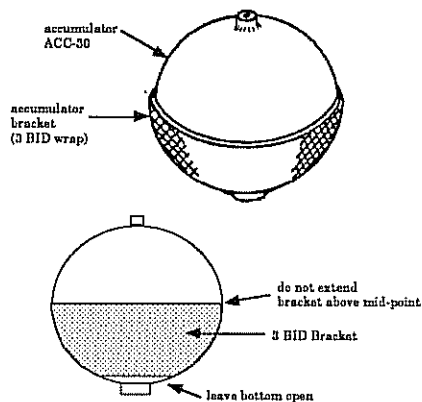


- C3. Make a fiberglass bracket to attach the accumulator. This is a simple matter of covering the accumulator with plastic "release" tape and laying up 3 BID around the bottom half of it. It is not necessary to cover the bottom area completely since a clearance hole is required (about a 2" - 2.5" diameter) for the 90° fitting which will attach to the bottom of the accumulator. Allow the BID to cure, then remove and clean it up along with cutting the hole in the bottom. See fig. 25:C:3



## Accumulator bracket

figure 25:C:3

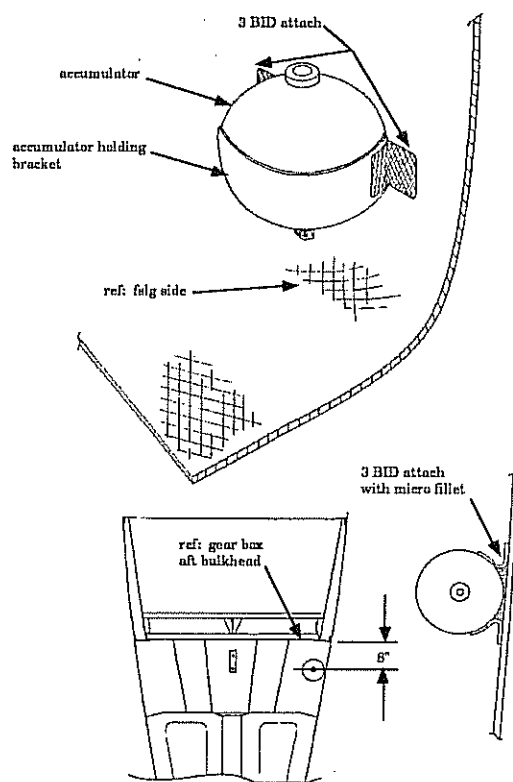


- C4. Attach the accumulator / bracket. Place the accumulator with bracket into position on the lower right side of the fuselage in a near level orientation. Allow 1.25" below the bottom fitting port for the fitting itself.

Glass the 3 BID "cup like" bracket into position with 3 BID attaching onto the fuselage side. See fig. 26:C:3

## Accumulator bracket attach

figure 26:C:4





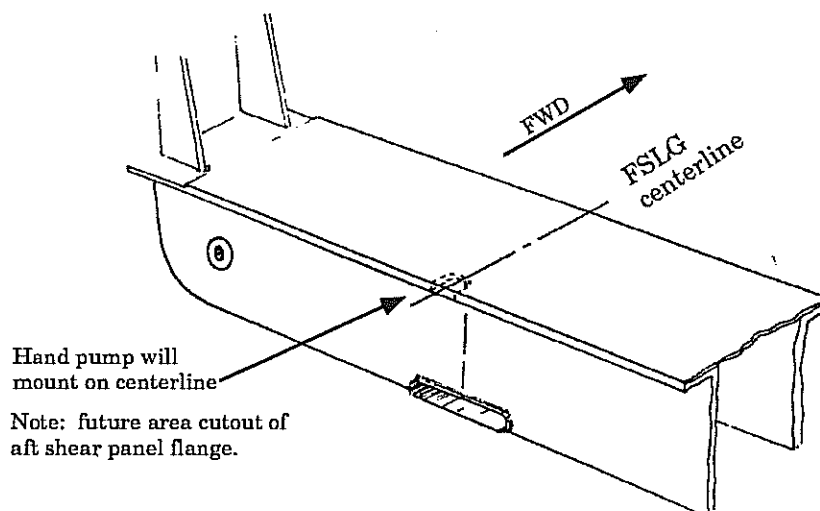
## D. HAND PUMP

The hand pump is only used in an emergency situation when the standard gear down system is inoperative. The procedure is very simple. To use, simply place the gear handle in the down position and pump away. The nose gear will simply free fall down, the pump is only required to extend the main gear the final half of their travel range from retracted to down and locked.

- D1. Locate the position for the hand pump on the main spar carry through. It centers and installs on that aft edge and is "nested" slightly forward into the top flange of the aft shear panel. See fig. 26:D:1

### Hand pump location

figure 26:D:1



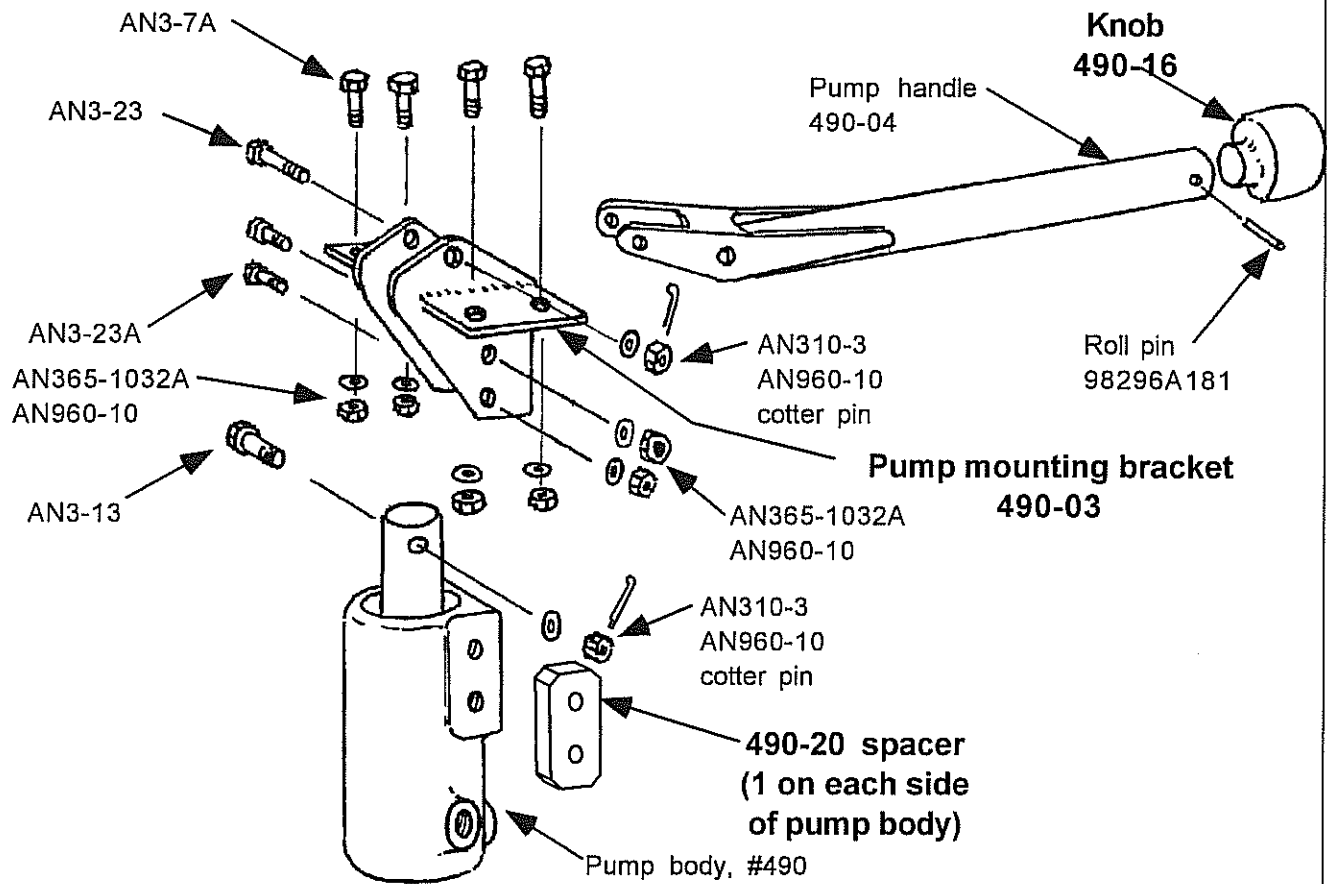
- D2. Assemble the hand pump per fig. 26:D:2. This is a simple assembly and doing so now may prove helpful in positioning and drilling for the attach bolts. Note that a check valve is used in the hand pump line at the reservoir.

Essentially, the left (#7) line, is the pump inlet. The right (#6) line is the outlet which feeds to the main gear shuttle valve.



## Hand pump assembly

figure 26:D:2

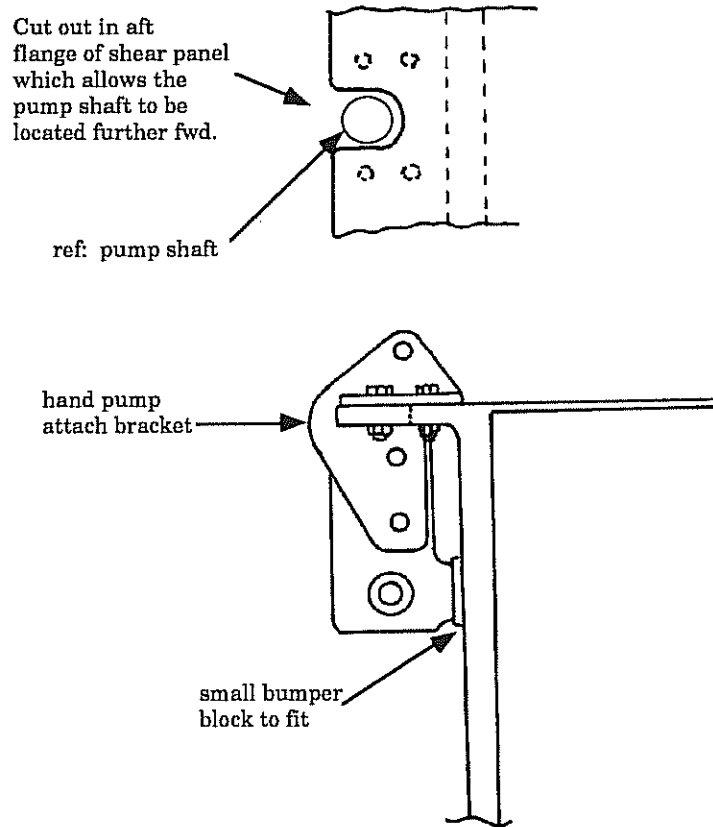


- D3. Attach the hand pump assembly into position. The attach bolts are AN3-7A with two per side. Use the assembly as a drill guide. The pump is "nested" into the lip of the spar shear panel, this moves the assembly forward for a better fit in the cabin. See fig. 26:D:3



## Hand pump attach

figure 26:D:3



- D4. Make and install a phenolic bumper block for the lower pump body. This will simply provide a solid brace for the pump body when under operation.

With the bolt holes drilled for the upper attachment, position the pump assembly and check the thickness required for the phenolic bumper block. Simply sand a piece (approx. 1" x 1") to fit and bond in position with epoxy. See fig. 26:D:3.

- D5. Bolt the hand pump into position. Place tape or plugs over the ports so dirt won't get into the body. (Note: for ease of assembly, you may wish to install the hydraulic fittings into the pump body first. See Section "F" - Fittings").



## E. CONTROL QUADRANT

The control quadrant includes:

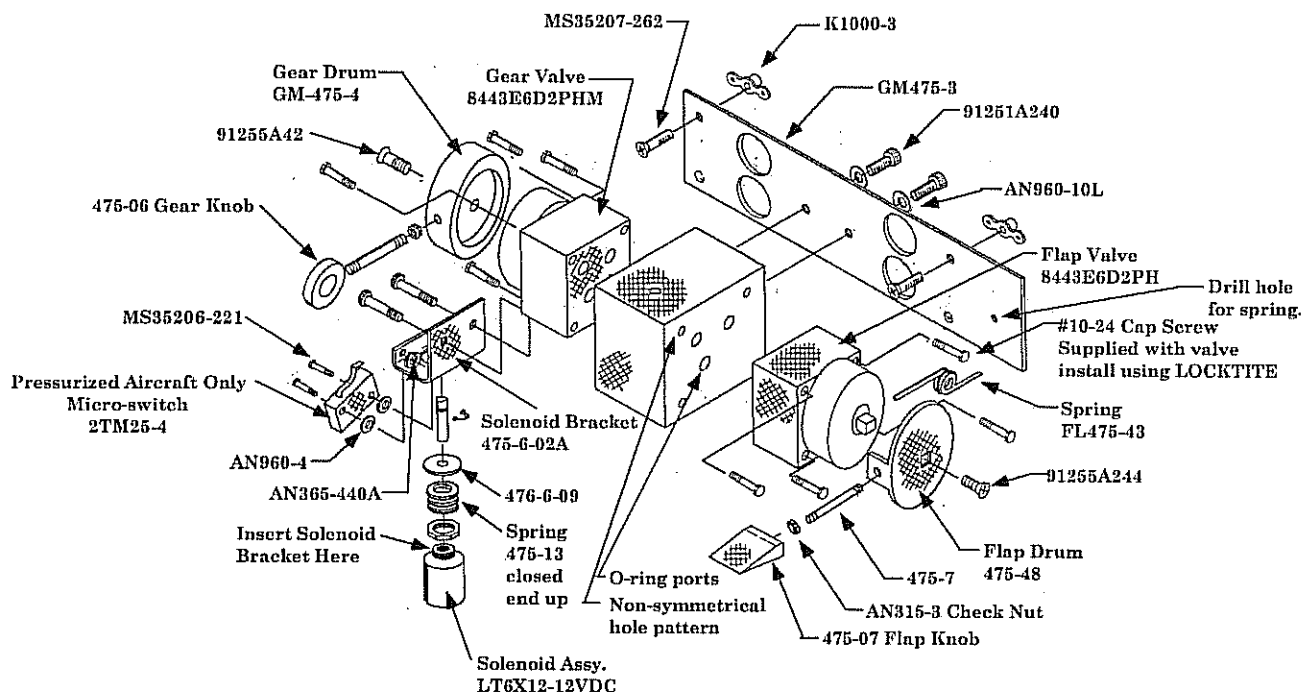
- a.) The central valve body
- b.) The gear valve and handle assembly
- c.) The flap valve and handle assembly

This quadrant installs just behind the nose gear tunnel and must be aligned with the instrument panel since a removeable instrument panel section below the throttle quadrant area is designed to cover this gear/flap control quadrant. The gear and flap actuation handles will emerge through the instrument panel cover plate which is attached to the lower instrument panel section, so alignment is very important.

The central valve body will attach the whole assembly by means of a flat plate screwed to the fwd face of it. This flat plate then attaches to a fiberglass BID layup you'll be putting on the back of the nose gear tunnel.

### Control Quadrant Assembly

Fig. 26:E:1



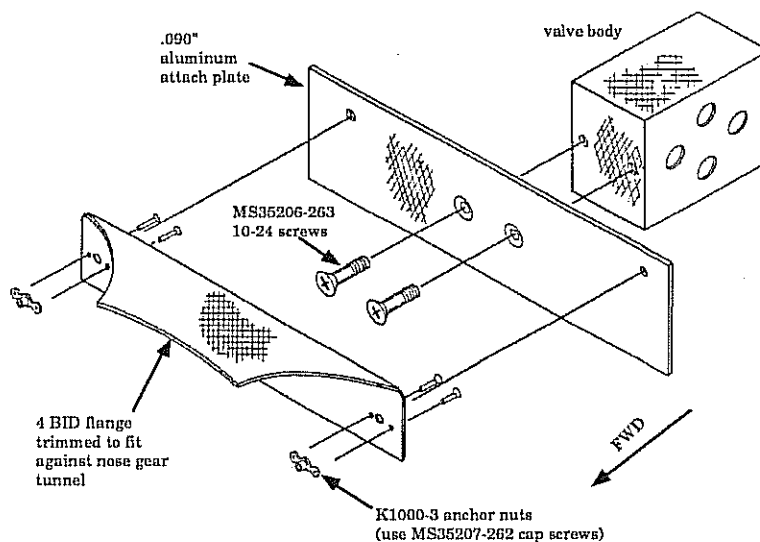


- E1. Assemble the control quadrant. To orientate the central valve body, note the two attachment screw holes, they are on the fwd, vertical face of the valve body. Bolt the landing gear valve onto the left side using the four supplied bolts. Bolt the flap valve on the right side in a similar manner. Be sure the mating surfaces are clean and that the O-rings are in position around each of the four ports on each side. Also note that the four bolt pattern is not symmetrical, so you'll only have one possible way to assemble it onto the central valve body. Use LOCKTITE
- E2. Attach the gear handle drum. This drum is simply set with one 10-24 screw in the top of the drum. Position the drum such that when the drum is rotated into a gear down position, the threaded hole on the drum side, is aligned 45°s (down and aft). This will leave another depression in the side of the drum which faces straight down. (This hole is to accept the electric solenoid pin which locks the gear down handle position.
- E3. Attach the gear down lock bracket. This is the aluminum bracket which positions the electric solenoid pin (plus a micro switch for pressurized models only). This bracket is attached with two screws, per fig. 26:E:1.
- E4. Attach the gear electric solenoid pin. Per fig. 26:E:1, screw and set the solenoid body into the attach bracket. Slip the compression spring over the check nut. Assemble the pin with the area washer and circular clip. This assembly will index into the gear drum hole (the hole facing straight down when the gear handle is down) and prevent the gear handle from moving out of that gear down position. The pin is electrically retracted from the drum hole (using an airspeed sensing micro switch) thus allowing the gear handle to be moved to the "retract" position.
- E5. Attach the flap handle drum & spring. This is similar to the gear drum except it adds a coil spring to position the flap handle in the middle, "off" position. The flap handle has a detent in the flaps "up" position and will rotate freely between the center off position and the down position. Rotate the valve stem to learn where the detents are, then position it in the middle "off" position.  
Drop the spring over the stem with one "tang" of the spring extending fwd. It will lock into the valve body attach plate, through a small hole on the right side of the plate.  
The other "tang" of the spring is captured by the base of the flap handle drum. This will actuate the "center off" feature of the handle.
- E6. (Pressurized models only:) Attach the micro switch onto the gear solenoid attach bracket. See fig. 26:E:1. This will be used in conjunction with the automatic cabin pressurization dump system.
- E7. Screw the central valve body attach plate onto the valve body itself.  
Use two 10-24 screws. See fig. 26:E:2



## Central valve body

fig. 26:E:2



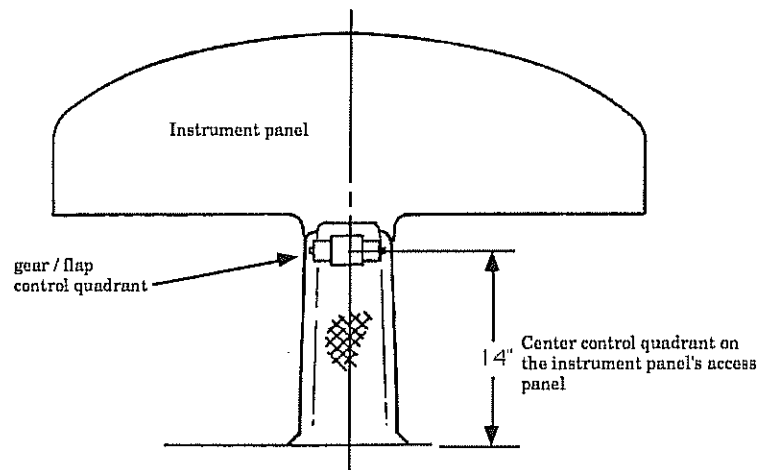
- E8. Locate the mounting position for the control quadrant. This location is on fslg centerline and, just aft of the nose gear tunnel. See fig. 26:E:3. Make some reference marks on the nose gear tunnel so you can quickly get back to the correct position.

**NOTE:** It is very important that this quadrant assembly align with the appropriate panel on the instrument panel. The quadrant must be as close as possible to the back face of the instrument panel and be centered both left/right as well as vertically. If this alignment is off, then the gear and flap levers will not fit through the panel face properly.



## Central valve body position

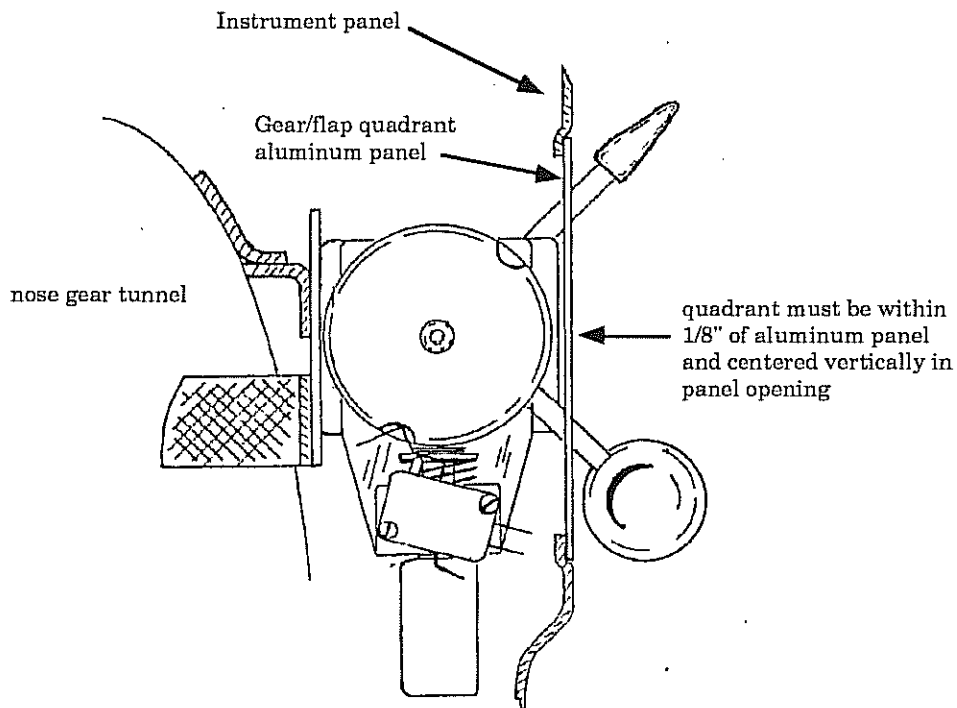
figure 26:E:3



- E9. Make up some fiberglass angle stock. This will be used for attachment of the valve body on the top and on the bottom sides. Simply release tape a piece of wood (2"x4") or equivalent to attain a 90° angle. Lay up 4 BID over this such that you have at least 3-1/2" on one leg and 1" on the other. You'll need about 18" of it but it's always good to have a little of this laying around so make some extra.

## Central valve body side view

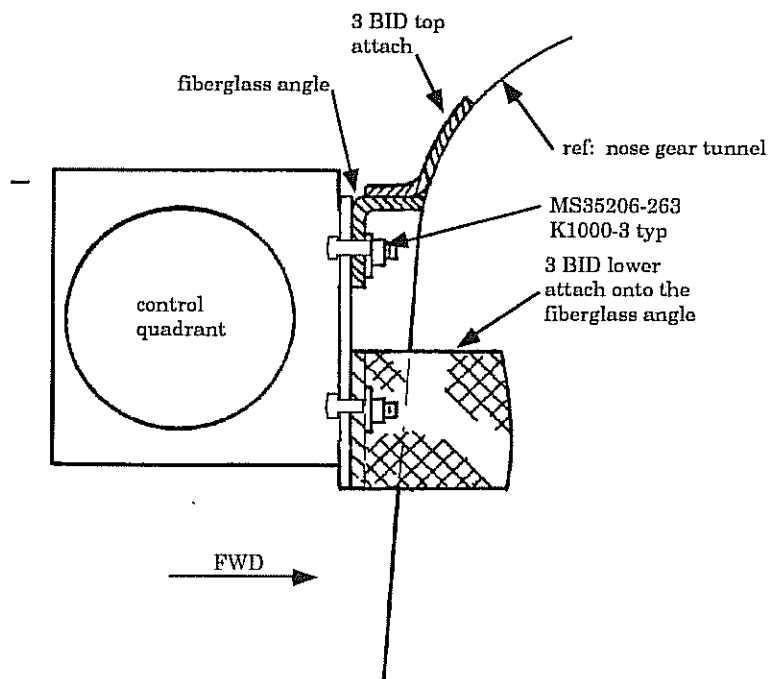
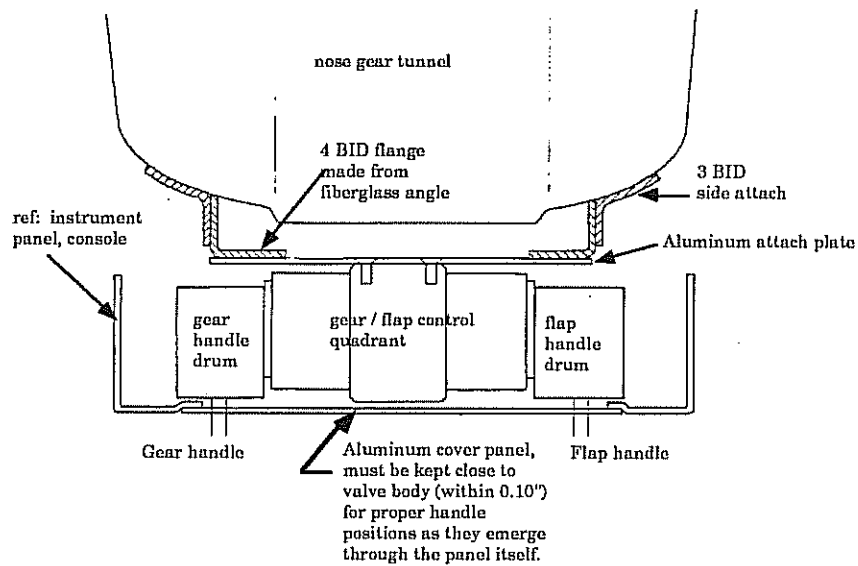
figure 26:E:3b





# Central valve body attach/ top view/ side view

Figure 26:E:4

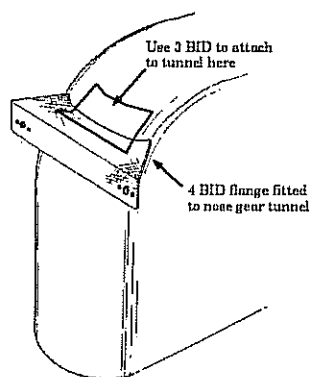




- E10. Trim the fiberglass angle stock to fit between valve body (top) and nose gear tunnel. Hold the valve body in position and mark a piece of the fiberglass angle stock to fit between the attach plate and the nose gear tunnel. This piece will then be glassed onto the tunnel and the valve attach plate will screw onto it. When it fits well, mark and drill for the two K-1000-3 anchor nuts. (It's easier to install them now.)
- E11. When the top angle piece is fitted, glass it in place. With the angle piece screwed to the fwd face of the attach plate, use a dab of quick set glue to hold it in temporary position on the nose gear tunnel and apply 3 BID over it to secure it to the tunnel.  
Support the bottom of the valve body so it remains true vertical during this cure.
- E12. Trim and fit the two side fiberglass angle pieces between valve body attach plate and nose gear tunnel. The top piece will pretty much hold the valve body in position while you attach the side pieces. In a similar manner, mark, drill and attach the anchor nuts. Screw the pieces into position on the valve attach plate then set the 3 BID to attach the fiberglass angles onto the sides of the nose gear tunnel.
- E13. Temporarily attach the central valve body. You can now attach the valve body however it is necessary to swing it aft when tightening up the fwd most lower hydraulic fitting so there is no point in permanently attaching this quadrant until the lines are connected.  
You may install the complete control quadrant at this time as well. Do not permanently attach the gear or flap handles at this time. They'll just get in the way and the ends must be installed after the cover plate is installed on the instrument panel anyway.  
(Note: When you do finally install the gear and flap handle shafts, be sure to set the check nut to hold the shafts into the drums which are attached to the valves. The handle ends are then screwed onto the shafts after the instrument panel cover panel is positioned. Use a dab of thread lock to secure them on their shafts.)

### Valve body upper tunnel attach

Figure 26:E:5





## F. HYDRAULIC FITTINGS

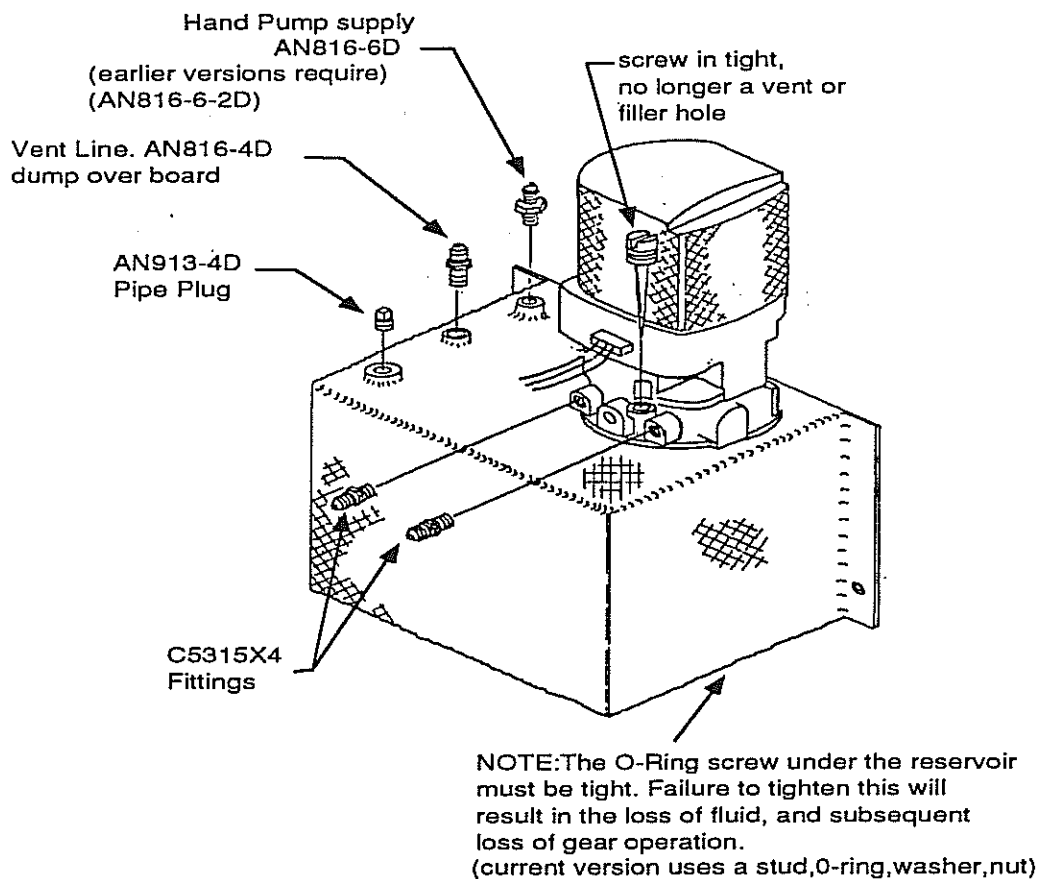
- Bulkhead ftgs: Used to transition through a bulkhead. For our typical -4 fitting (ftg), use a 7/16" drill bit and for the -6 use a 9/16" bit.
- Sealing pipe threads: To remind you again, seal all pipe threads carefully. We do not recommend use of the teflon type sealing "tape". A plumber's pipe thread sealer compound is preferred. Be very careful to NOT get any of the pipe sealer compound on the first thread of the fitting. By keeping the sealer off that first thread, you are assured that none will get deposited in front of the ftg. as it is screwed into its housing. Loose sealer in the system can cause problems.

We'll start by installing all the fittings first, working from the aft area fwd, although that doesn't make much difference.

- F1. Install power pack ftgs: Attach the fittings to the power pack per fig. 26:F:1.

### Power pack ftgs.

figure 26:F:1

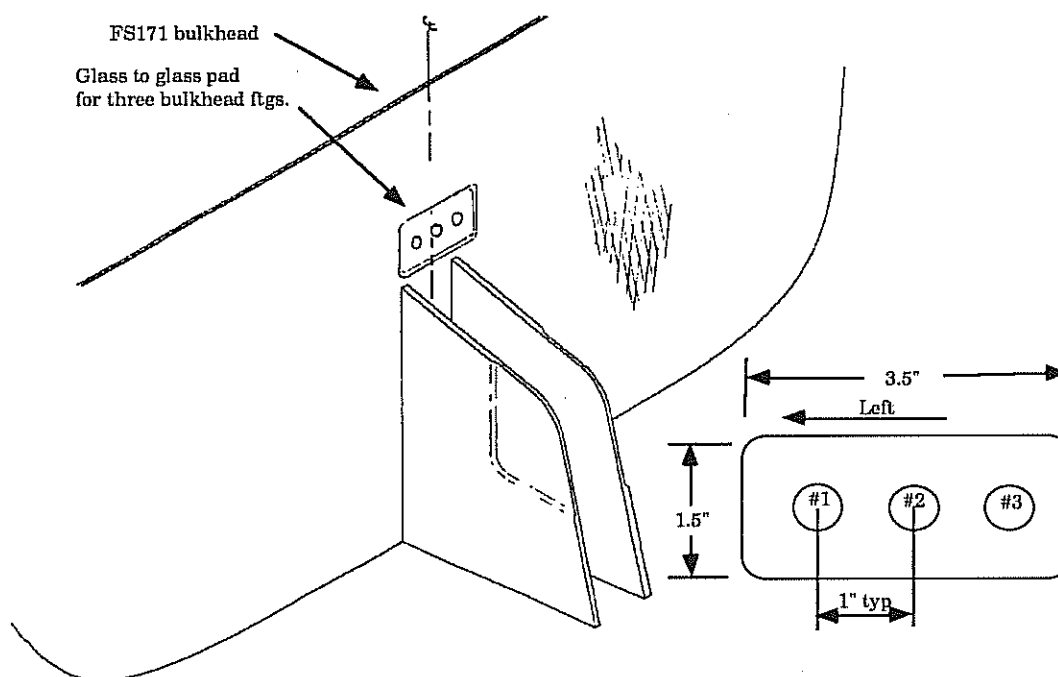




- F2. Mark location for the three FS 171 bulkhead ftgs. The glass to glass pad will be just right of centerline (by about 3/4") and just above the idler arm bulkheads, for best fit. With the location marked, make a "glass to glass" section measuring approximately 1.5" x 3.5". Cut the aft plies away, remove the core and add 3 BID over to create this pad.

**FS171 bulkhead ftgs. pad**

figure 26:F.2



- F3. Install bulkhead ftgs. for power pack forward routing. Three lines for the power pack will be routed forward. These lines will route forward using bulkhead ftgs. on the FS-171 bulkhead and further fwd through the wheel well. These lines are:

- 1.) Emergency hand pump supply
- 2.) Return
- 3.) Pressure

- F4. Install the three FS171 bulkhead ftgs.

Use: 2- AN832-4D ftgs.

1- AN832-6D ftg. (for the emergency hand pump supply)

Run the AN832 ftgs. through from the fwd side with the AN924 check nut on the aft face.



F5. Install the three wheel well bulkhead ftgs.

Use: 2- AN832-4D bulkhead ftgs.

2- AN924-4D check nuts.

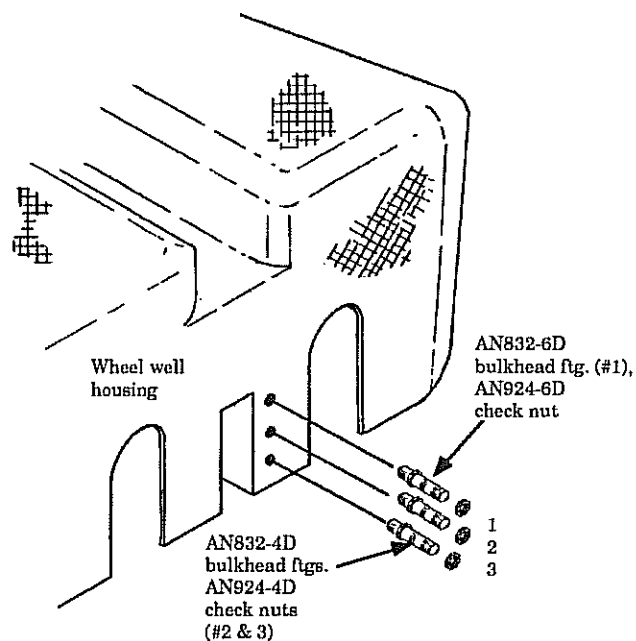
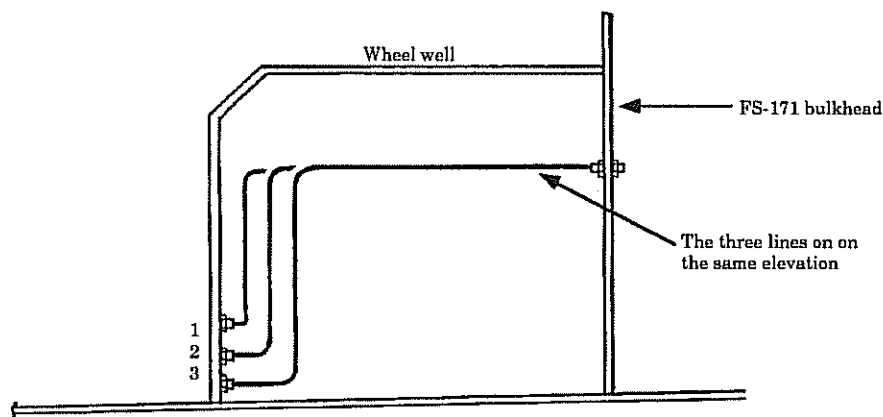
1- AN832-6D bulkhead ftg (emergency hand pump supply)

1- AN924-6D check nut

Run the AN832 ftgs. through fwd, from inside the wheel well with the AN924 check nuts on the fwd face of the wheel well.

**Wheel well bulkhead ftgs.**

Figure 26:F:2a





F6. Install all ftgs. into manifold body.

Use: 2 - AN816-4D ftgs. (straight)

1 - AN823-4D ftg. (45°)

1 - AN913-1D plug (available for pressure gauge during testing if desired)

1 Check valve (CMM10B1)

1 Flow control valve (flaps) (FMF10B)

1 - AN823-4D 45° ftg.

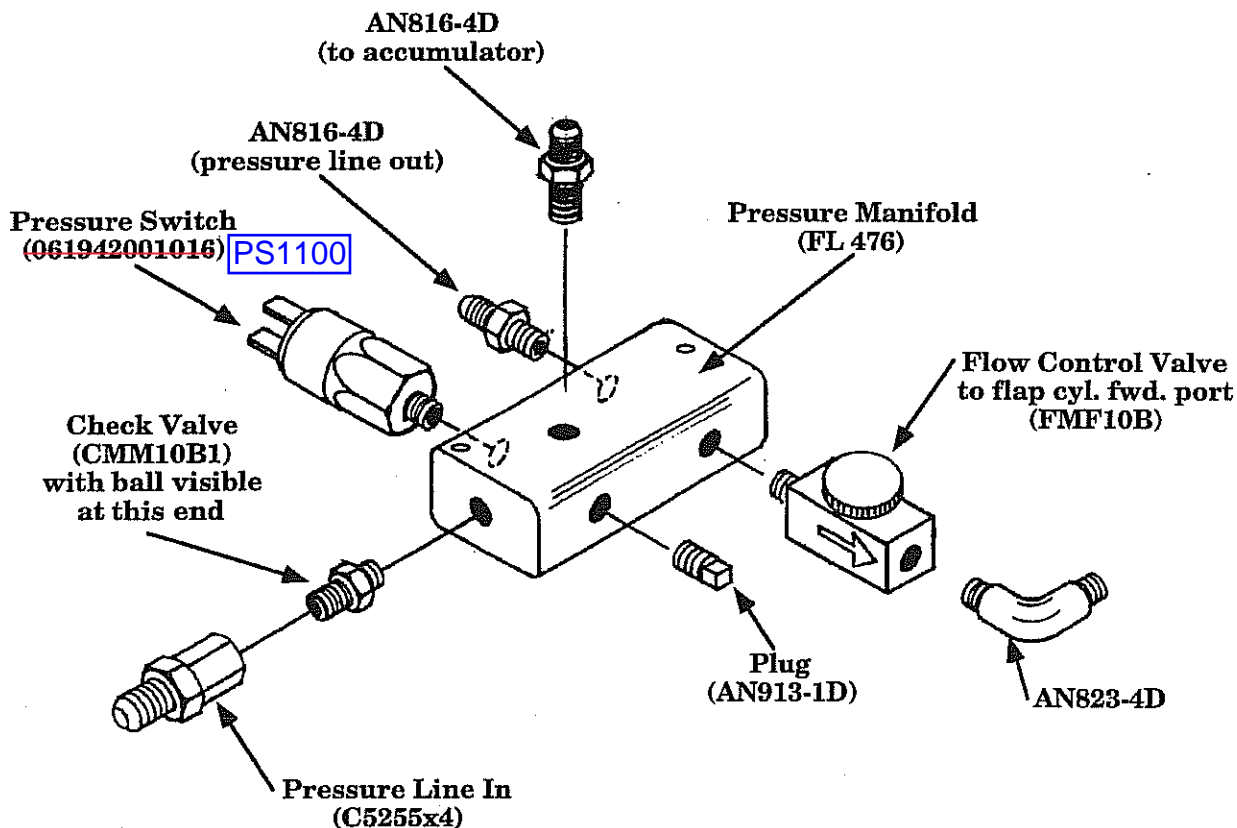
1 C5255x4 Adaptor ftg.

1 Pressure switch

Note: The flow control valve should be installed first due to its size when rotating. The Check Valve **MUST** be installed so that it flows into the manifold and "checks" in the opposite direction. This means that the end with the ball (it's visible in the end of the check valve ftg.) must be facing aft or sticking out of the manifold when the check valve is screwed into the manifold.

**Manifold ftgs.**

figure 26:F:3





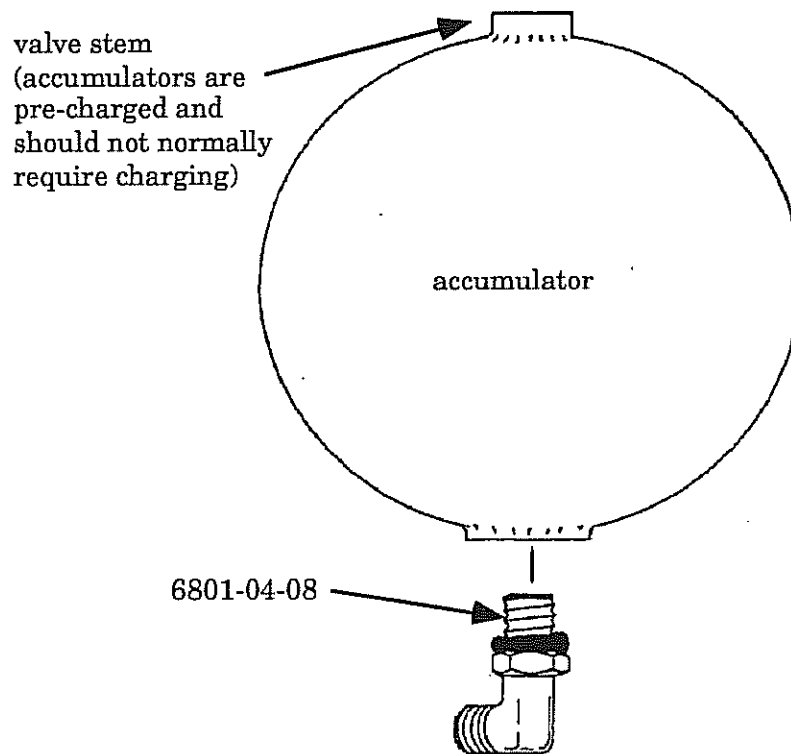
When all ftgs. are installed, cover them temporarily with tape or a cap to keep dirt out.

F7. Bolt the manifold into permanent position. Use the two "studs" to secure the manifold installing approximately 3 washers between manifold and base plate to hold the manifold up off the floor for ftg. clearance. Use AN365-1032 lock nuts.

F8. Install the 90° O-ring type ftg. in the base of the accumulator. See fig. 26:F:4.  
Use: 1- 6801-04-08 (90° 3/4-16 to 1/4" flair tube ftg.)

### Accumulator ftg.

Figure 26:F:4





- F9. Install the shuttle valve. The shuttle valve is held in position using a "U" shaped bracket. The ftgs. "on the run of this shuttle valve Tee, serve to lock the valve in place. Locate the bracket at the rear center of the gear box, onto the thick 1/4" bracket that serves as the center seat belt attach plate.

Drill and tap two 1/4-20 holes in this plate for attachment. See figure 26:F:6.

- F10. Install shuttle valve ftgs. See fig. 26:F:5.

Use: 1- C5605x4x4x4 ftg. Tee

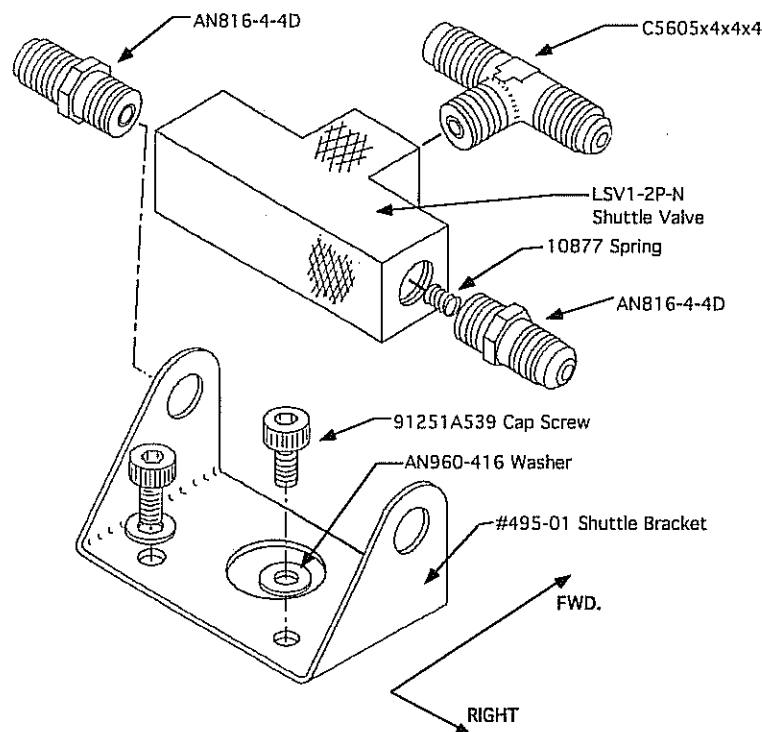
2- AN816-4-4D ftg. (on the run, right side - spring goes in first)

1- shuttle spring (10877 century)

NOTE: Since the attach bracket secures over the two end ftgs. on the shuttle valve, you should first install the bracket to the gear box aft bulkhead before finally installing the 816-4-4D ftgs.

### Shuttle Valve ftg.

Figure 26:F:5



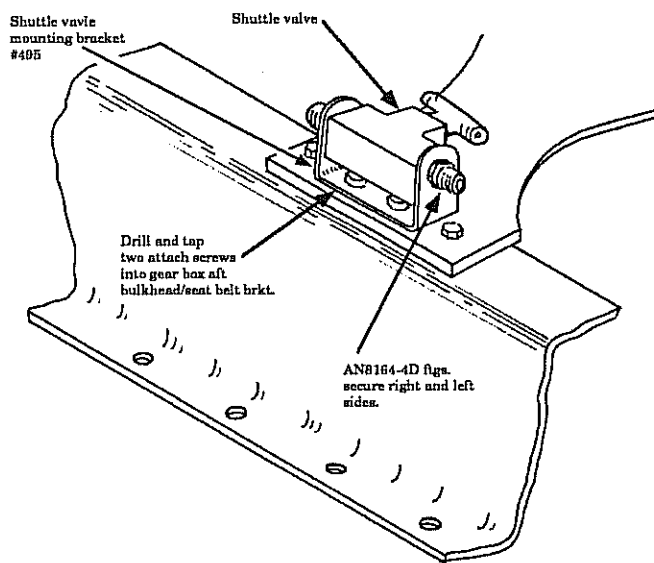
Note: The spring in the shuttle valve is critical. It must be inserted into the RIGHT HAND side before the AN816-4-4D ftg. is installed. For future reference, place a representative mark on the shuttle valve to indicate which side the spring is on. The spring must be on the side which connects the normal main gear down line. The purpose of the spring is for routine test operations of the hand pump. When operating the hand pump, the supply line to the two main gear will fill with oil. In order to relieve this oil, the hand pump check valves have been fitted with



a controlled leak down. The spring assures that the ball in the shuttle valve will indeed move back to the "normal" side of the shuttle valve once the emergency side line pressure has been relieved. Thus, whichever side the spring is inserted from must be used as the normal supply line side and conversely, the side that the shuttle valve ball is on (driven over by the internal spring) must serve as the emergency supply line side.

### Shuttle valve installation

Figure 26:F:6



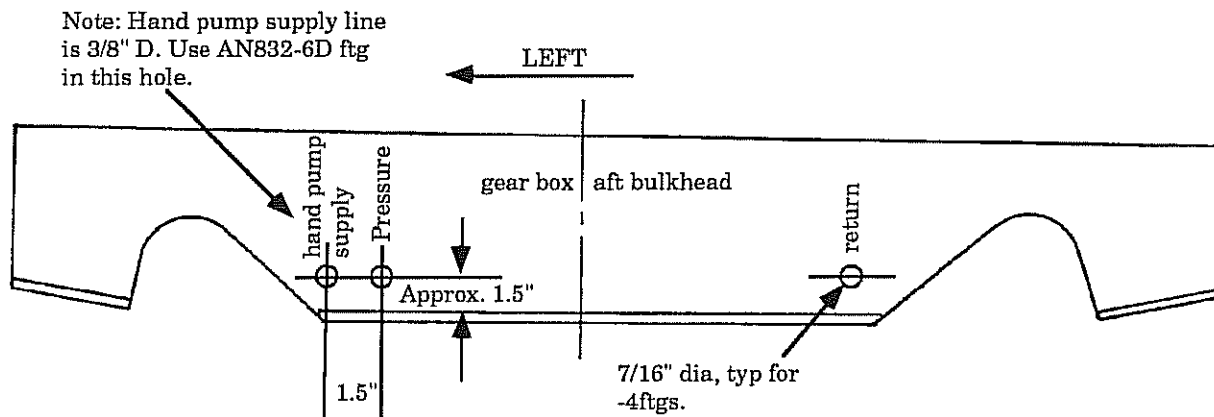
F11. Install the three gear box, aft bulkhead flgs. See fig. 26:F:7

Use: 2 - AN832-4D

1 - AN832-6D (emergency hand pump supply)

**Gear box aft bulkhead flgs.**

Figure 26:F:7



**LANCAIR® IV**

26-34

Chapter 26

REV.

C4 / 3-9-94

Hydraulic System



F12. Install main gear cylinder ftgs. See fig. 26:F:8.

Use: 2- HK822-4D ftgs. (back of cylinder) These ftgs have a restrictor function

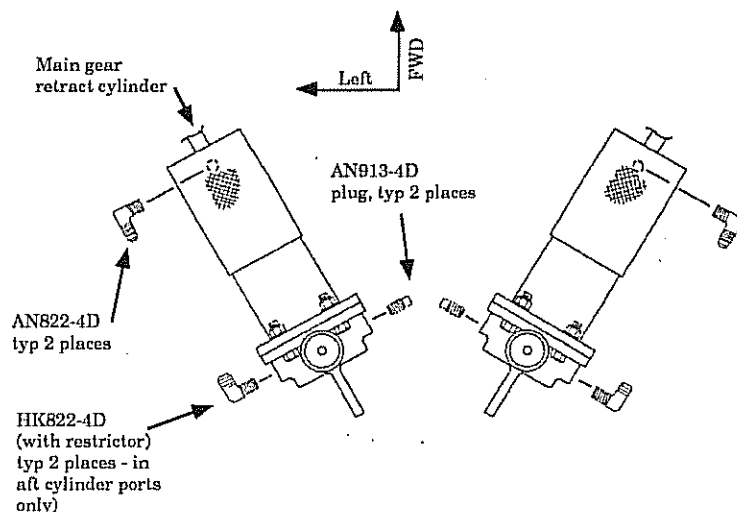
2- AN822-4D ftgs. (front of cylinder)

2- AN913-1D plugs (plug the inbd aft ports of each cylinder)

- Set the fwd 90° ftgs. such that they point aft and about 45°'s downward.
- Set the outbd aft 90° ftgs. such that they point slightly down and fwd.

### Main gear cylinder ftgs.

Figure 26:F:8



F13. Install the flap cylinder ftgs. See fig. 26:F:9.

Use: 1- AN822-4D ftg. (fwd. port, nearest shaft)

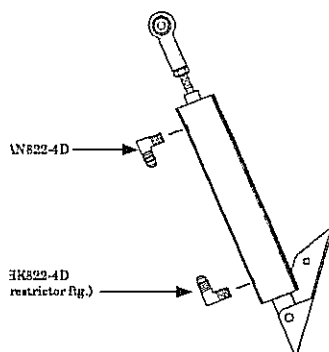
1- HK822-4D ftg. (restrictor type, aft port)

The fwd ftg. points on an approx. 45° line, (aft and down).

The aft ftg. points on an approx. 45° line, (fwd and down).

### Flap cylinder ftgs.

Figure 26:F:9





F14. Install the fwd gear box bulkhead ftgs. See fig.26:F:10 for locations.

Use 5 - AN837-4D bulkhd 45° ftgs.

1- AN804-4D bulkhd Tee ftg. (gear up line)

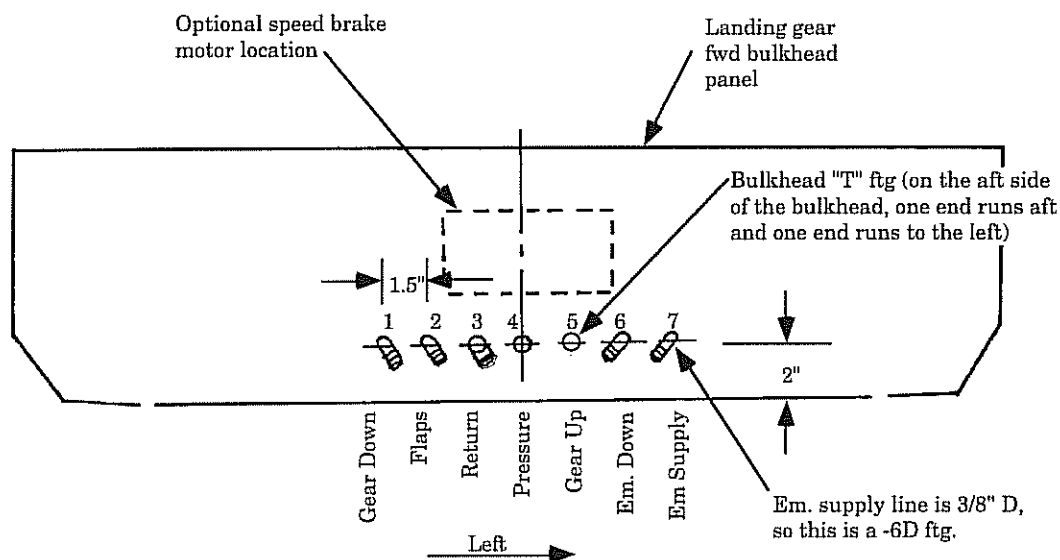
1 - AN837-6D Bulkhead 45° ftg (emergency supply line

The seven ftgs. are roughly centered along a line 2" up from the bottom of the gear box fwd bulkhd. An optional speed brake motor location is just above these ftgs.

The ftgs. install from the fwd face with the check nuts on the aft side (except for the single bulkhead Tee ftg. which must install from the aft side).

### Fwd gear box bulkhead ftgs.

Figure 26:F:10



F15. Install the hand pump ftgs. See fig.26:F:11

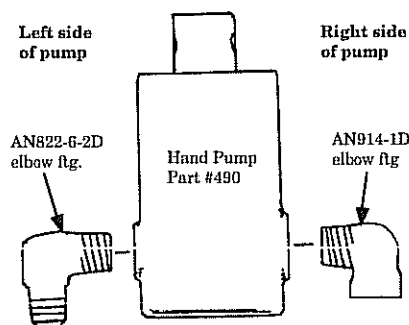
Use: 1- AN914-1D ftg

1- AN822-6-2D ftg (left side for supply)

They should be aligned to point straight down.

### Hand pump ftgs.

Figure 26:F:11





F16. Install the control quadrant ftgs. See fig. 26:F:12.

Use: 1- AN822-4D (90° ftg., on top, single port.)

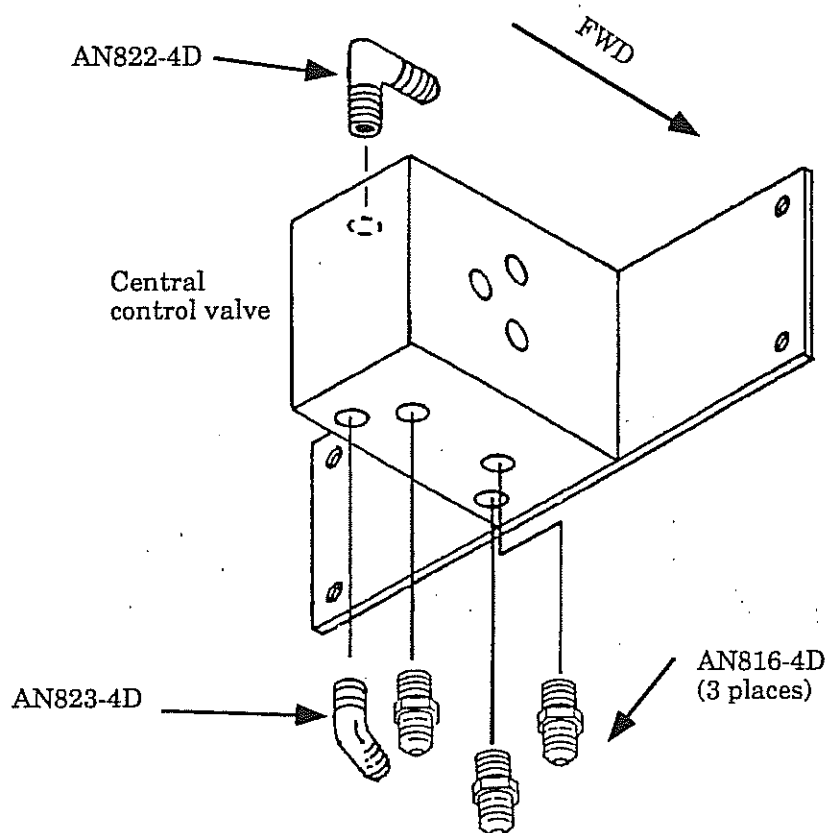
1- AN23-4D (45° ftg., on lower, aft port.)

3- AN814-4D (straight ftgs., on remaining lower three fwd ports.)

Aim the 45° lower ftg. such that it points slightly fwd and right when the manifold is in position. This lower ftg. must be installed first.

**Control quadrant ftgs.**

Figure 26:F:12

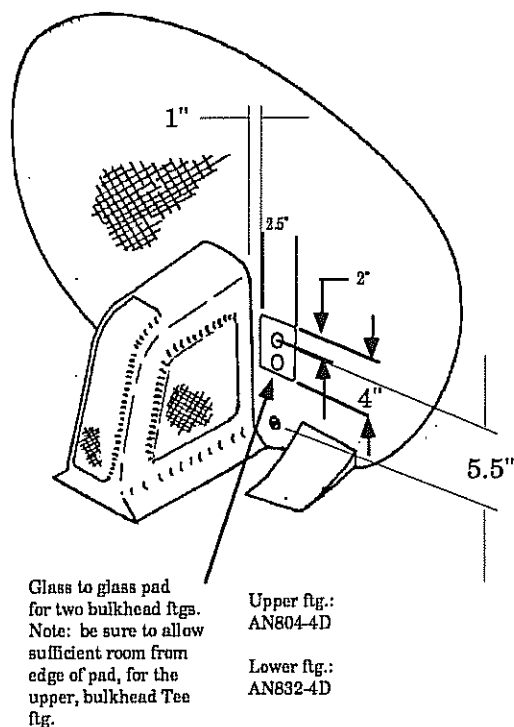


F17. Install the firewall bulkhead ftg. pad. This is a "glass to glass" pad required for the bulkhead ftgs. Cut the aft firewall plies away, remove the core material and add 4 BID over the area extending at least 1.5" onto the existing firewall surfaces all around the cut out area. See fig.26:F:13 for location.



## Firewall hydraulic bulkhead pad & ftgs.

Figure 26:F:13



### F18. Install the firewall bulkhead ftgs. See fig. 26:F:13

Use: 1- AN804-4D bulkhead Tee (top ftg. hole, Tee facing up and slightly left)  
1- AN832-4D bulkhead straight (lower hole)

### F19. Install the nose gear cylinder ftgs. See fig. 26:F:14

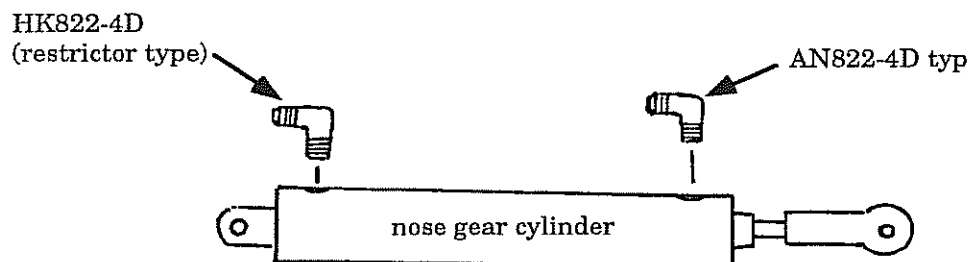
Use: 1- AN822-4D ftg. facing aft on the cylinder.  
1- HK822-4D ftg. restrictor type, facing aft on the cylinder.

These are high temperature lines and supplied pre-built. The high temperature lines are used since turbo temperatures are quite high and the lines run relatively close to the turbos.

Note: A rear port restrictor is being recommended and supplied which serves to slow the nose gear extension speed.

### Nose gear cylinder ftgs.

Figure 26:F:14





## G. HYDRAULIC LINES

There are two types of lines:

flexible: #HR303 which attaches to any moving part.

rigid: 1/4" or 3/8" diameter, .035" wall, 5052-0 aluminum line.

- G1. Install the three lines from the power pack to bulkhd FS172. All three lines are rigid.

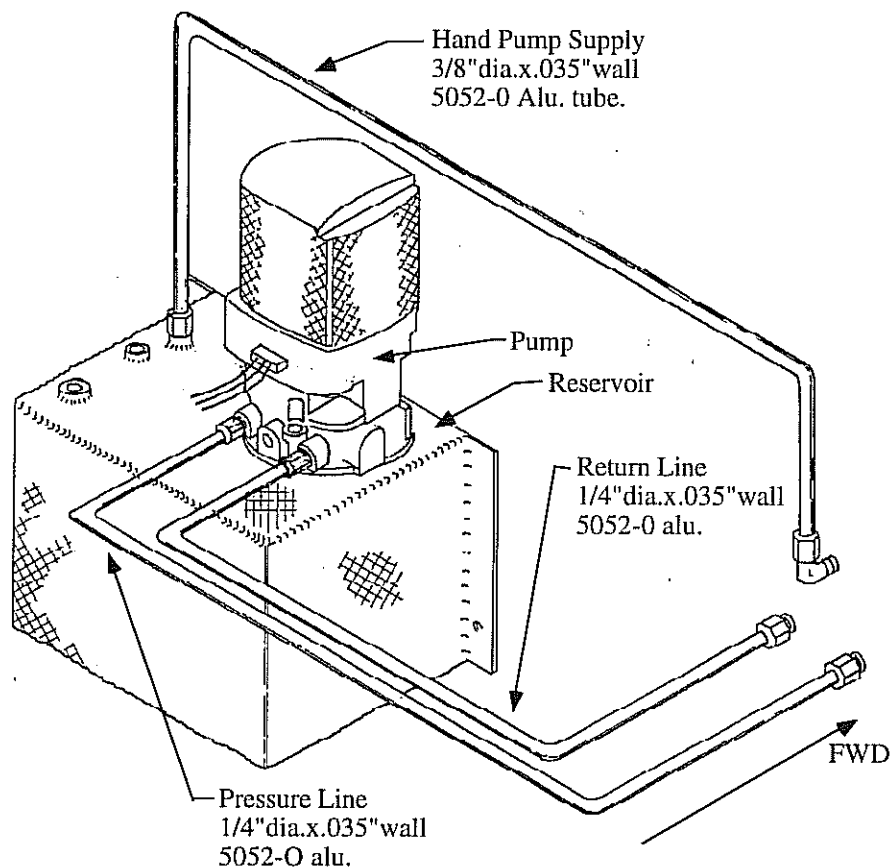
Line 1: Emergency supply to hand pump (3/8" diameter aluminum)

Line 2: Return to reservoir (1/4" diameter aluminum)

Line 3: High pressure line out (1/4" diameter aluminum)

### Power pack - FS172 lines

Figure 26:G:1

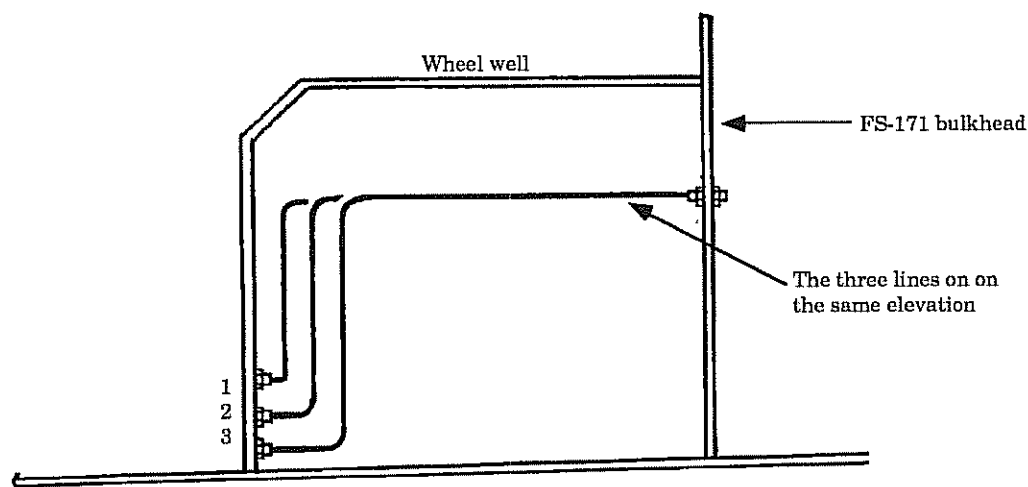


- G2. Install the three lines from FS172 to the wheel well fwd face. See fig. 26:G:2. Keep them close to centerline as they pass forward inside the wheel well to maintain adequate tire clearances.



## Wheel well lines

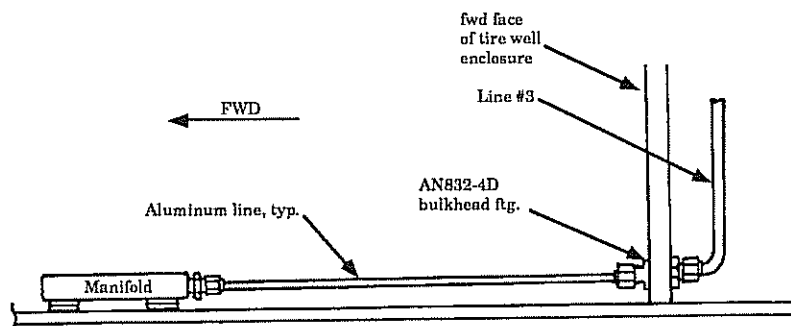
Figure 26:G:2



- G3. Install the three lines from the wheel well - forward.  
 Connect line 3 (bottom line on wheel well, 1/4" D alum.) to the manifold aft port.  
 Connect line 2 (middle line, 1/4" D alum.) to the right side bulkhead ftg. on the gear box aft bulkhead.  
 Connect line 1 (top line, 3/8" D. Alum.) to the outbd bulkhead ftg. on the left side of the gear box aft bulkhead.

### Wheel well to manifold, high pressure line

Figure 26:G:3

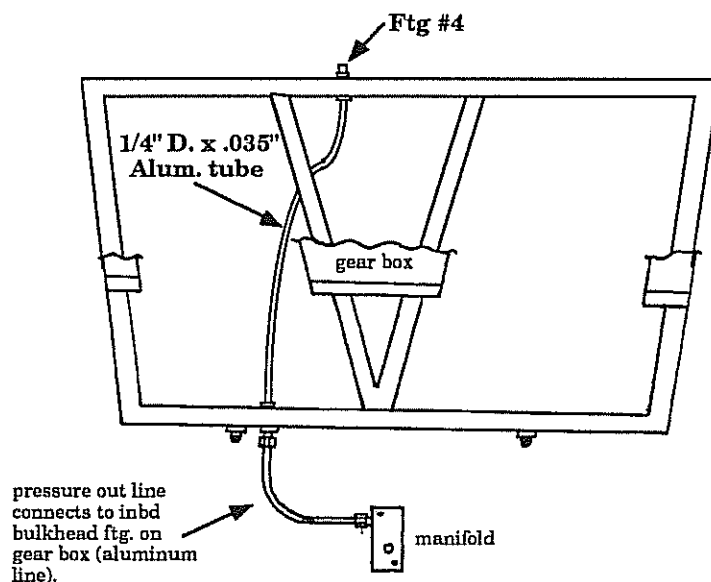


- G4. Install the manifold, high pressure "out" line. This 1/4" D., .035" wall aluminum line connects the fwd left port on the manifold to the inbd left bulkhead ftg. on the back of the gear box. Fabricate another 1/4" D., .035" wall aluminum line that continues the high pressure line fwd through the gear box. This line will connect to the #4 fitting on the fwd gear box bulkhead. See Figure 26:G:4.



## Manifold to aft gear box lines

Figure 26:G:4



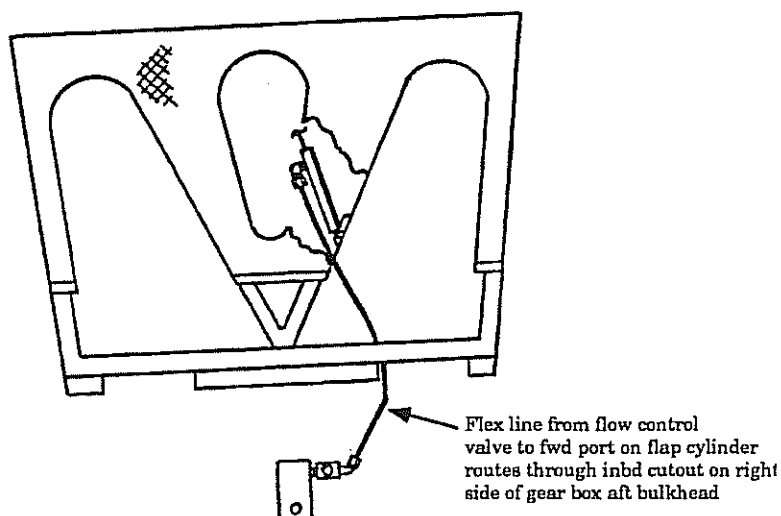
### G5. Install the flap cylinder (up) line.

Flex line: 27.5" long

This line connects from the fwd, right ftg. on the manifold (which already has the flow control device on it) to the fwd side of the flap cylinder. Routing is around the right side of the gear's aft panel, under the main gear cylinder and fwd to the flap cylinder (fwd port). See fig. 26:G:5.

### Manifold to flap - cylinder line

Figure 26:G:5

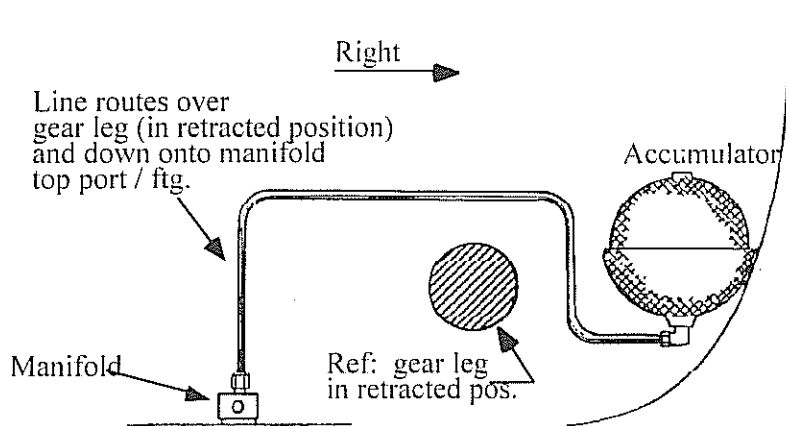




- G6. Install the accumulator line to the manifold. This line connects from the accumulator bottom to the single port facing up on the manifold. The line routes up and over the area the gear leg will occupy when in the retract position. See fig. 26:G:6.

### Manifold to accumulator line

Figure 26:G:6



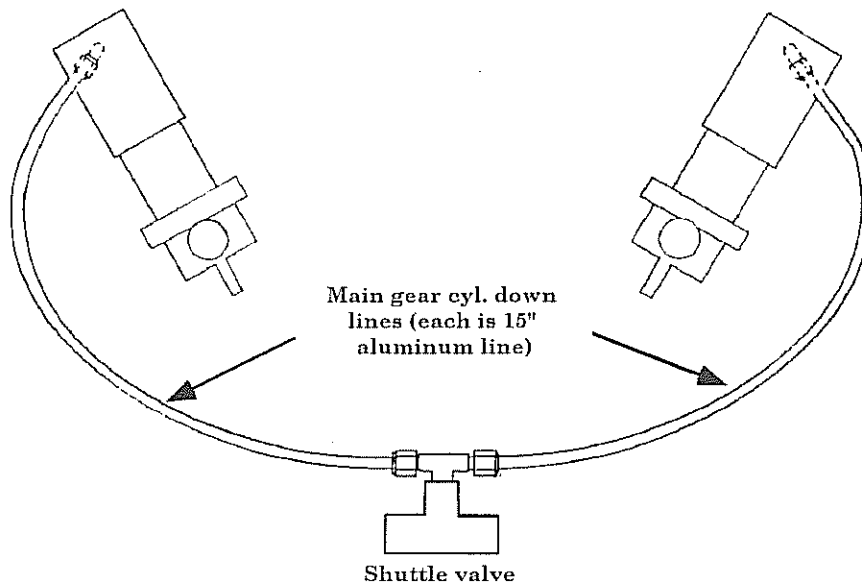
- G7. Install the pressure switch into the manifold. The pressure switch screws into the right rear port on the manifold.
- G8. Install the manifold plug.  
Use: 1- AN913-1D ftg. This is simply an available accessory port which could be used to check system pressure, etc.
- G9. Install the main gear cylinder down lines.  
Aluminum lines: 15" long (two required)  
These are flex lines and route from the shuttle valve Tee ftg. to the cylinder (fwd) ports. See fig. 26:G:7.





## Main gear cylinder down lines

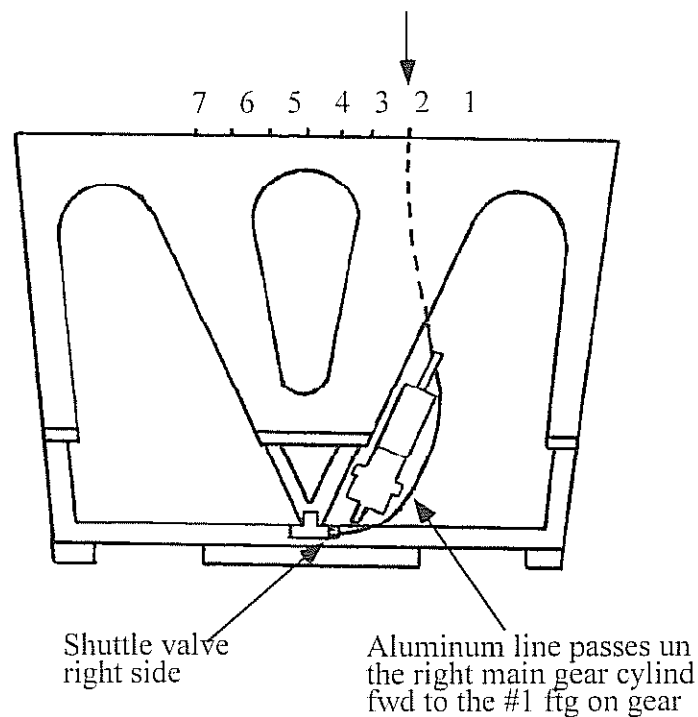
Figure 26:G:7



- G10. Install the (normal) gear down line from the shuttle valve. This aluminum line routes from the right side of the shuttle valve, fwd to the #1 fitting on the gear box fwd bulkhead.

## Gear down (normal) shuttle valve line

Figure 26:G:8.1







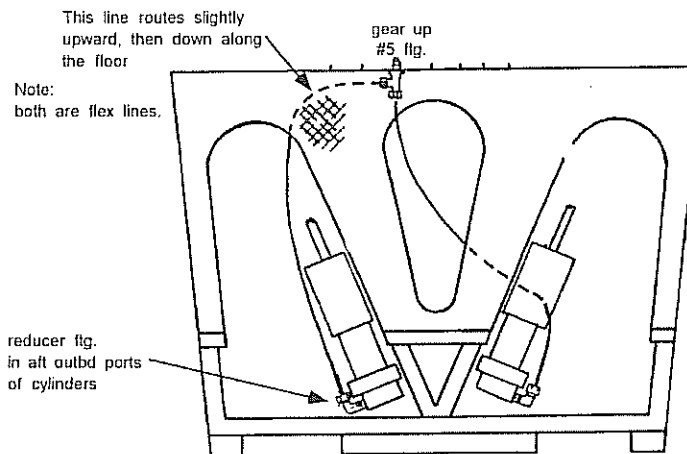
G11. Install the gear up lines.

Aluminum lines:    Approx. 31.25" right retract cylinder to straight on the run Tee located on the gear box #5 ftg.  
                              Approx. 39.5" left retract cylinder to 90° on the run Tee located on the gear box #5 ftg.

These lines connect from the bulkhead Tee ftg. on the gear box fwd panel to the aft port ftgs. on the main gear retract cylinders.

**Gear up lines**

Figure 26:G:8.2



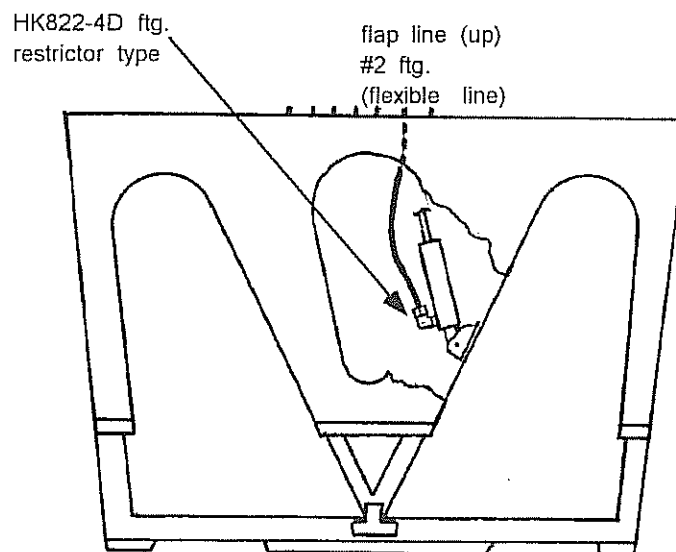
G12. Install the flap up line.

Flex line:    13.5" long

This line connects from the gear box #2 ftg. to the aft ftg. on the flap cylinder.

**Flap up line**

Figure 26:G:8.3

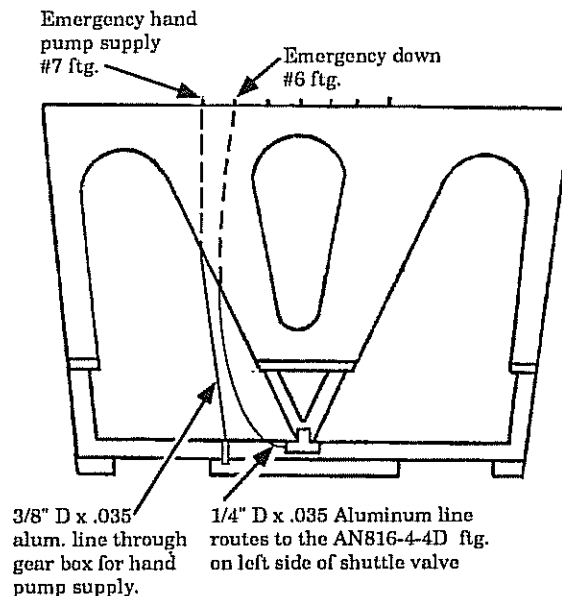




- G13. Install the emergency gear down shuttle valve line. This 1/4" D. x .035" wall, aluminum line routes from the left side of the shuttle valve, fwd to the #6 line on the gear box fwd bulkhead. This line is only used in an emergency situation or during routine backup tests.

**Gear down emergency shuttle valve line**

Figure 26:G:9



**ROUTING HYD. LINES FWD FROM GEAR BOX:**

There are seven lines routing fwd from the gear box. Two will route to the hand pump and the remaining five route fwd, under the spar shear panels, to the control quadrant and firewall.

- |                           |                                       |
|---------------------------|---------------------------------------|
| 1.) Gear down (normal)    | to quadrant bottom and on to firewall |
| 2.) Flaps                 | to quadrant bottom                    |
| 3.) Return                | to quadrant bottom                    |
| 4.) Pressure              | to quadrant bottom                    |
| 5.) Gear up               | to firewall & back to quadrant top    |
| 6.) Gear down (emergency) | to hand pump, right side              |
| 7.) Hand pump supply      | to hand pump, left side               |

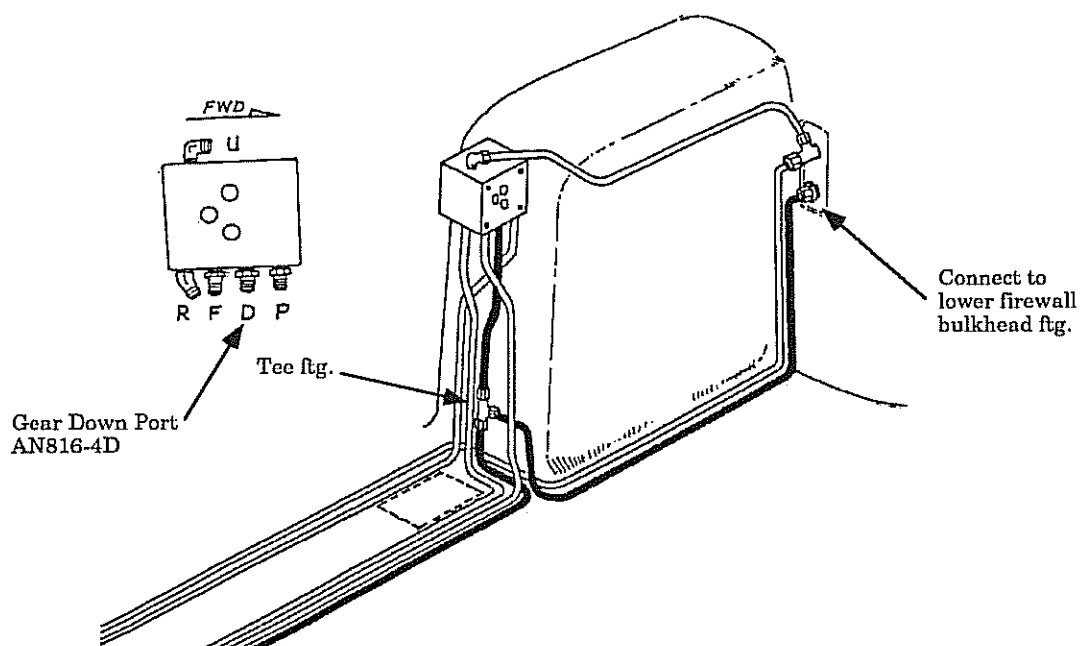
- G14. Install the gear down line first. This line routes from the #1 gear box ftg. to the bottom #2 port on the control quadrant valve body (second ftg. from front).

At the base of the nose gear tunnel, a Tee ftg. must be installed which allows for a line to continue fwd to the lower firewall bulkhead ftg. (for the nose gear). These lines should be kept close to the nose gear tunnel and the line fwd should stay low to the floor so that the sub floor can easily fit over it. The large 1/2" fuel line will pass just aft of the lines that route up to the quadrant, thus the importance of keeping the quadrant lines well forward as you fit them in position.



# Gear down line - gear box to quadrant

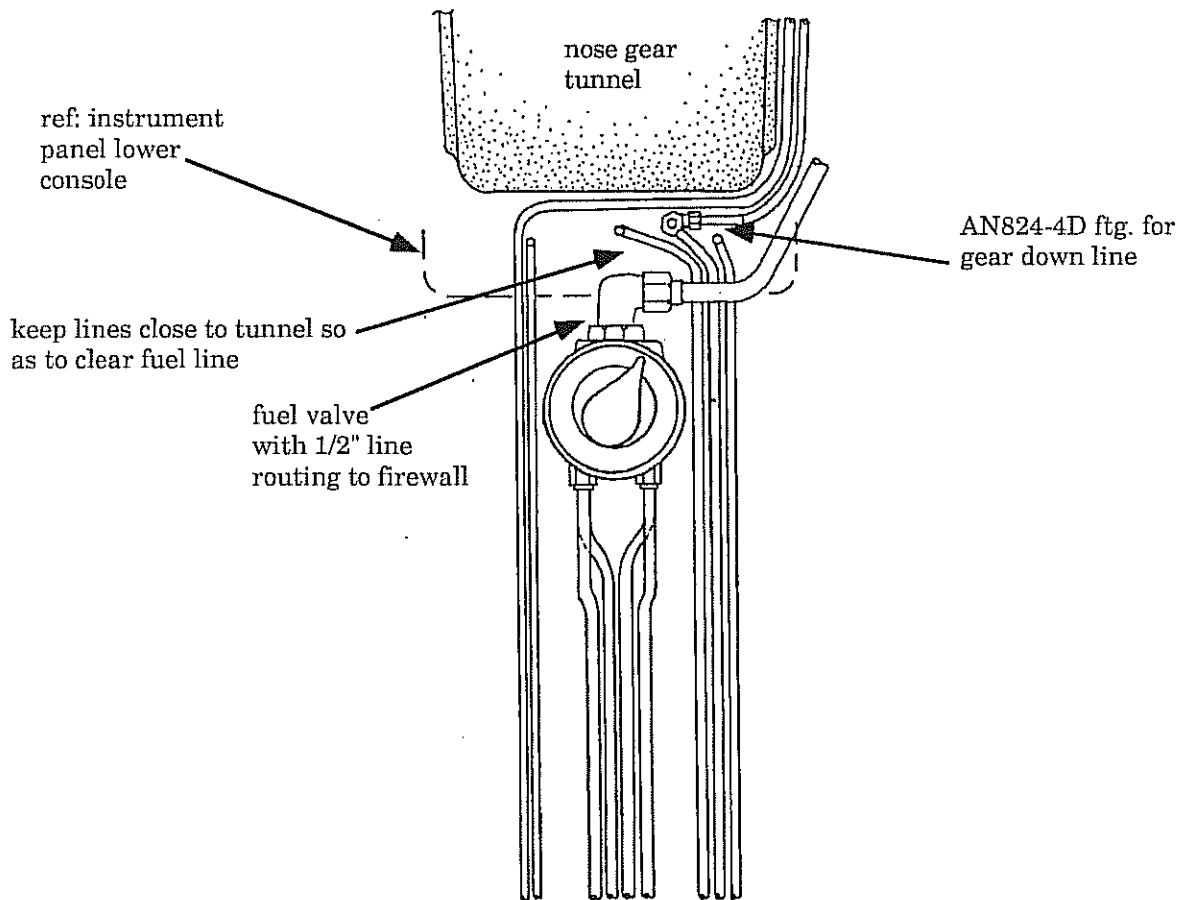
Figure 26:G:11





## Fwd hydraulic lines with fuel valve reference

Figure 26:G:12

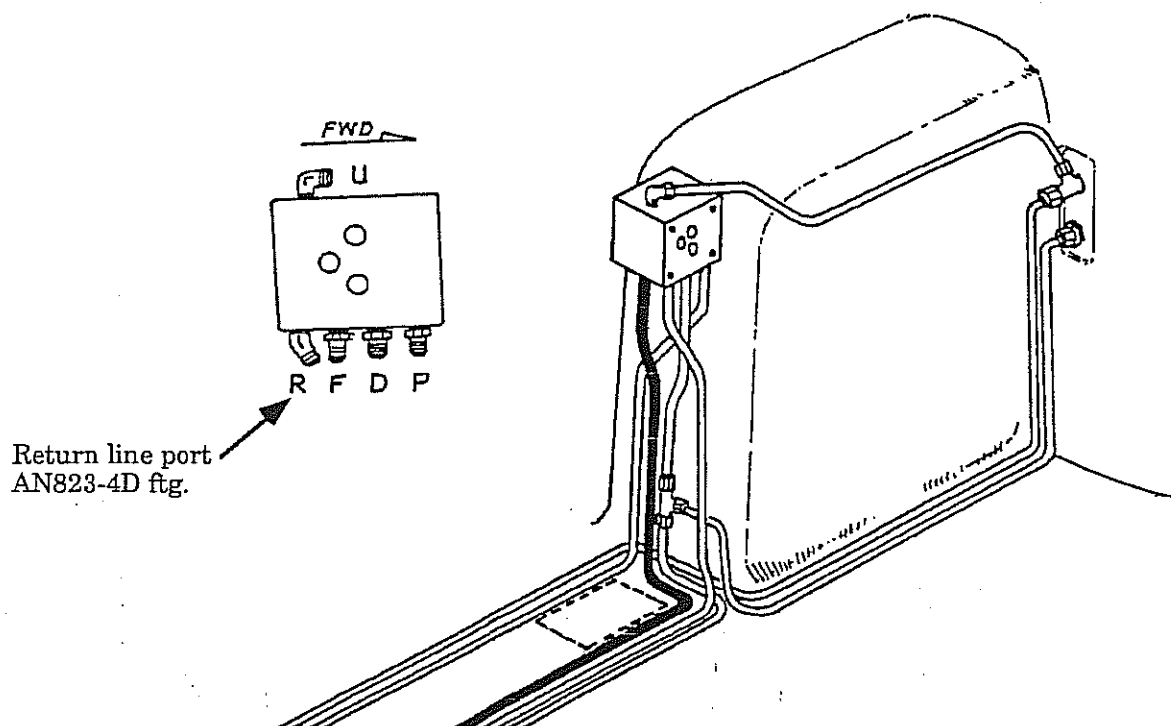




G15.. Install the return line. See fig. 26:G:13. This line routes fwd from the #3 ftg on the gear box to the most aftport on the bottom of the control quadrant. Once again, keep this line close to the nose gear tunnel as it bends left and up so as to provide clearance for the fuel valve.

**Return line - gear box to quadrant**

Figure 26:G:13

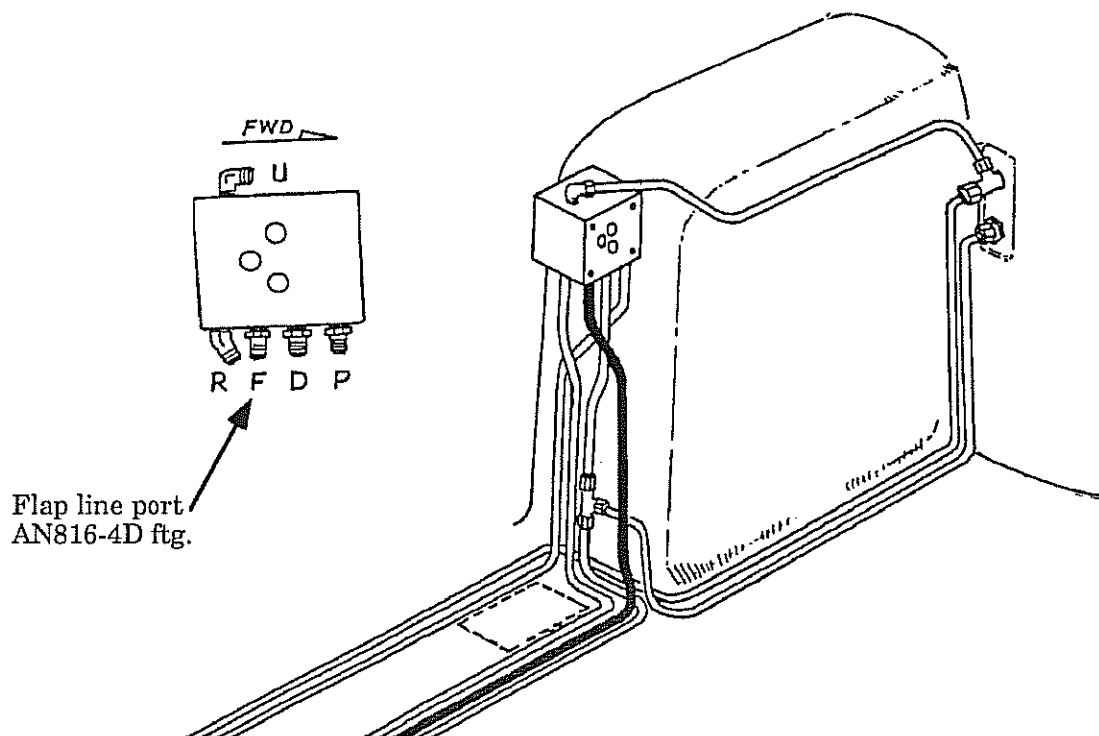




G16. Install the flap line. See fig. 26:G:14. This line routes fwd from the #2 ftg. on the gear box to the third most aft port on the bottom of the control quadrant.

**Flap line - gear box to quadrant**

Figure 26:G:14

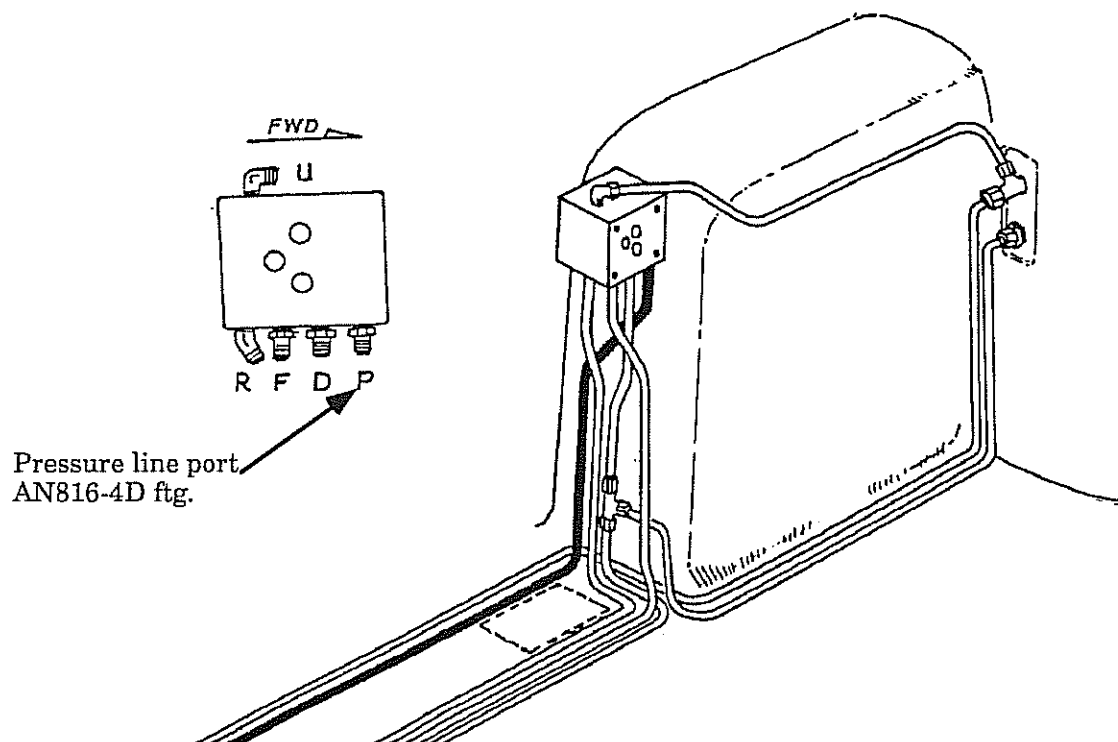




- G17. Install the pressure line. This line routes fwd from the #4 ftg. on the gear box to the most fwd port on the control quadrant.

**Pressure line - gear box to quadrant**

Figure 26:G:15



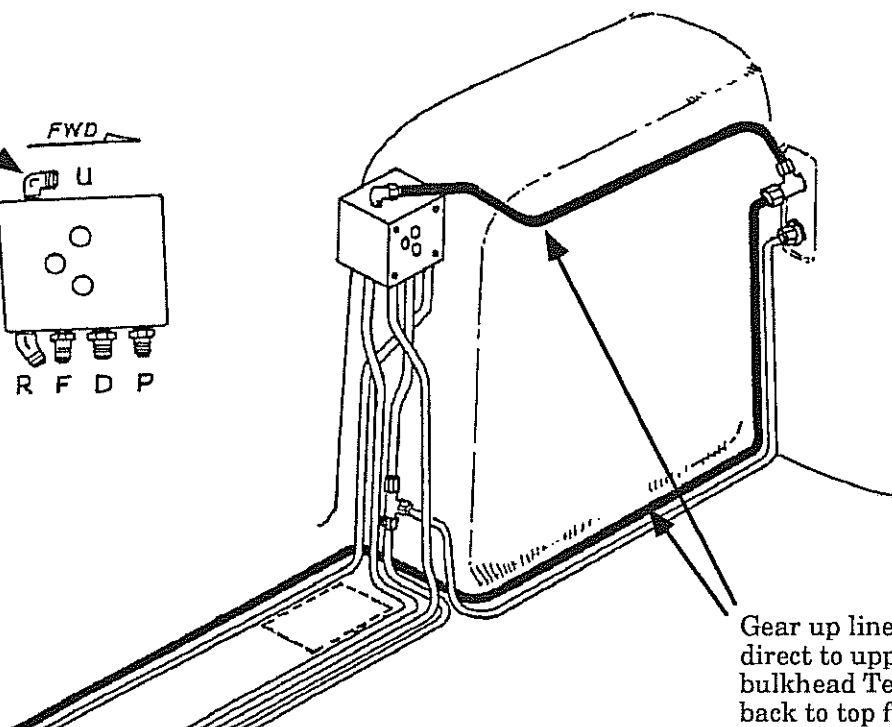
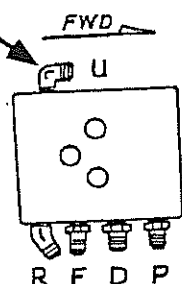


- G18. Install the gear up line. See fig. 26:G:16. This line routes fwd from the #5 ftg. on the gear box to the firewall top ftg. (attaching to the Tee portion which is "on the run".) A second line is connected to the firewall ftg. which routes along the side of the nose gear tunnel and connects to the top ftg. on the control quadrant.

**Gear up line - gear box to firewall / quadrant**

Figure 26:G:16

Gear up line port  
AN822-4D ftg.



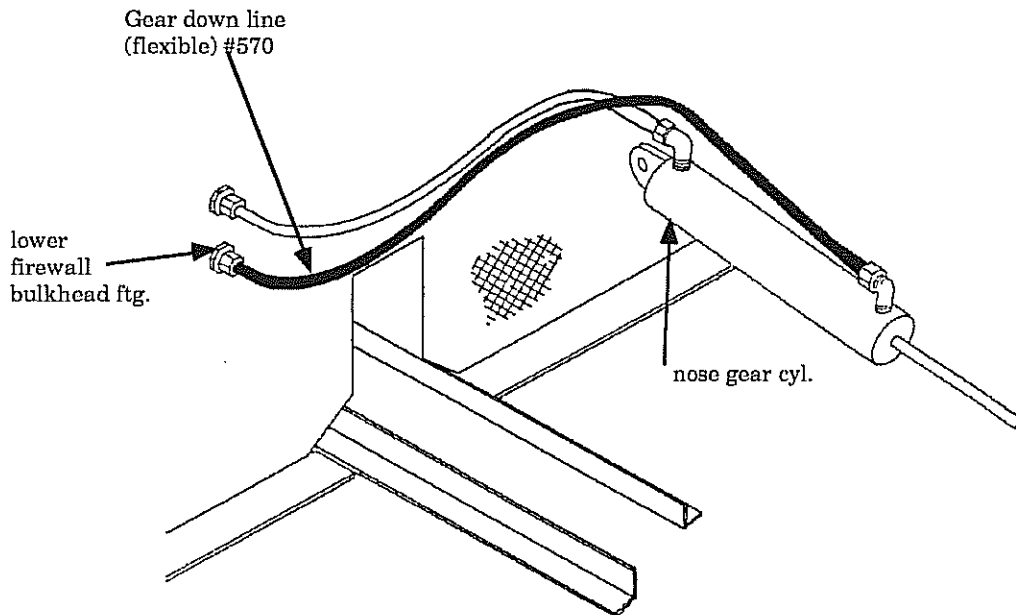
Gear up line runs  
direct to upper firewall  
bulkhead Tee ftg. and  
back to top ftg. on  
manifold.



- G19. Install the gear down firewall fwd line. See fig. 26:G:17. This line connects from the lower firewall ftg. to the fwd. ftg. on the nose gear retract cylinder. This must be a high temperature flex line.

**Gear down - firewall fwd line**

Figure 26:G:17



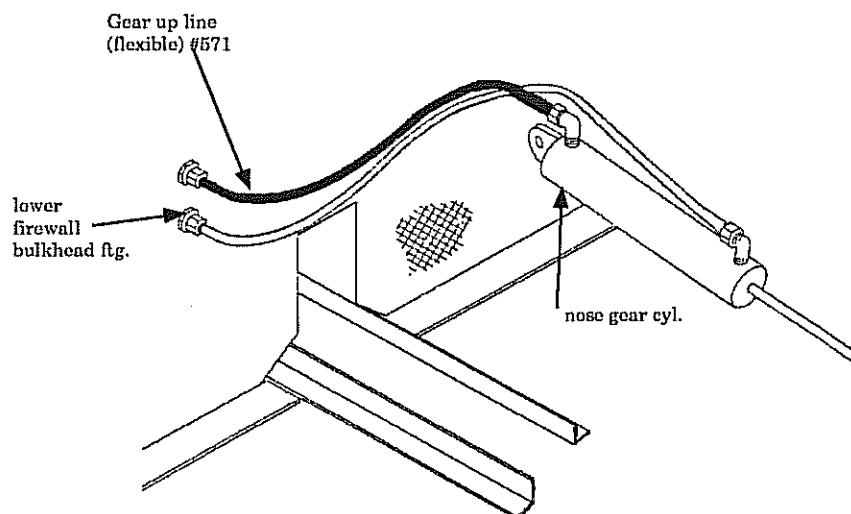


G20. Install the gear up, firewall fwd line. This line connects the upper firewall ftg. to the aft port on the nose gear retract cylinder. This line must be a high temperature flex line.

Note: We have recommended and supplied a restrictor ftg. for the aft (nose gear up) port.

### Gear up - firewall fwd line

Figure 26:G:18



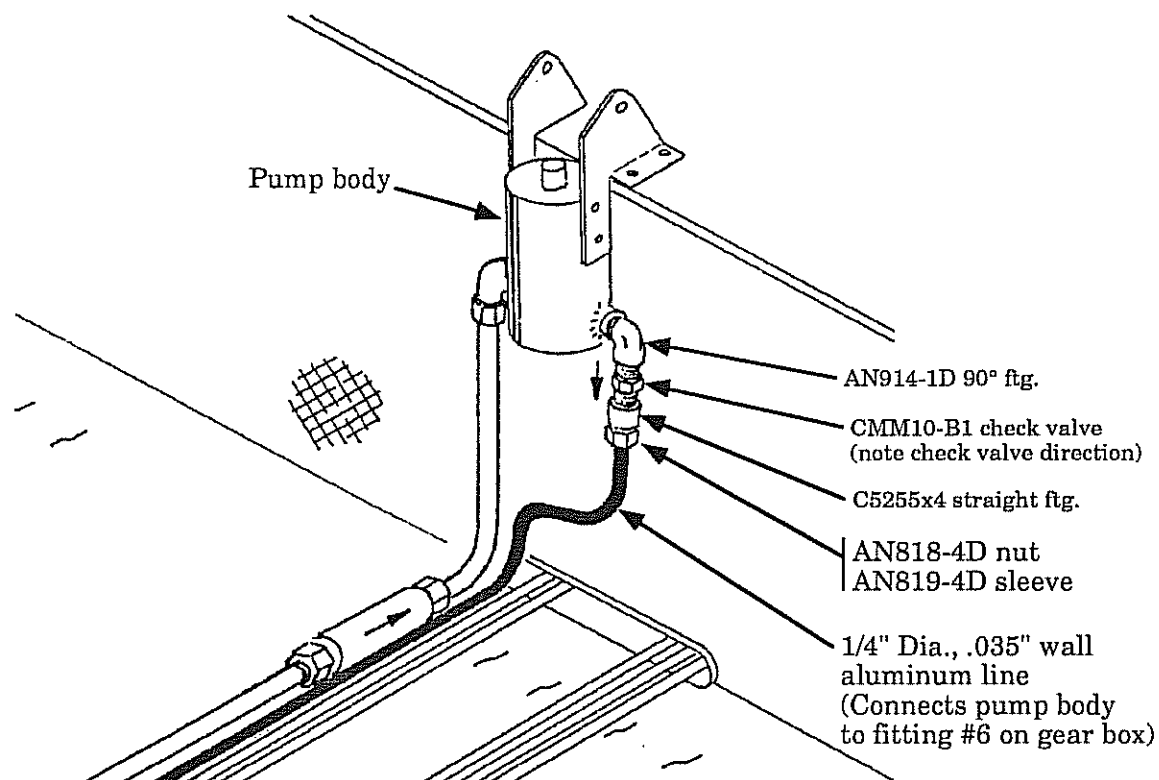


G21. Install the hand pump, emergency down line. See fig. 26:G:19. This line connects from the #6 ftg. on the gear box to the right side ftg. on the hand pump.

This is 1/4" aluminum line. Install the check valve and the C5255x4 fitting to the AN914-1D fitting before figuring the length of the aluminum line.

**Hand pump, emergency down line - gear box to pump**

Figure 26:G:19

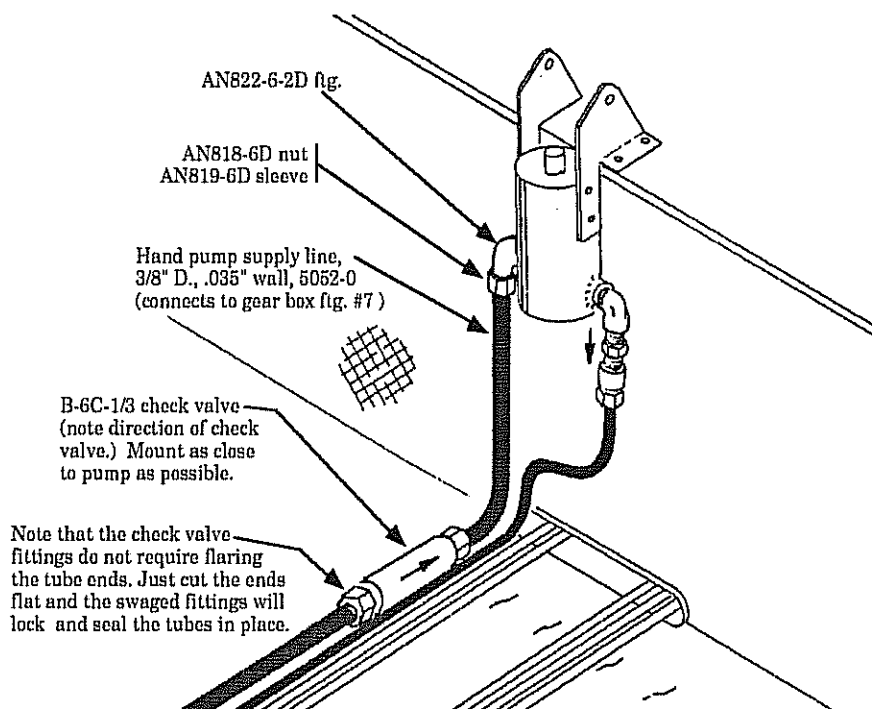




- G22. Install the hand pump supply line. See figure 26:G:20. This 3/8" D., .035" wall al. line connects the #7 ftg. on the gear box to the left side of the hand pump. Install the large check valve on the floor, as close as possible to the shear panel.

### Hand pump supply line - gear box to pump

Figure 26:G:20



This completes the hydraulic line connections . . . whew!

### FILLING THE SYSTEM:

Use: 5606 standard aircraft hydraulic fluid (red in color)

Oildyne recommends that the cylinders be individually drained to bleed out air. That becomes quite messy unless you're well experienced in such matters. In practice though, the system will eventually self bleed the air out. What is very important however, is to never run the pump dry, this will quickly damage the pump gears and housing. Note that it is recommended that the hand pump line be bled by pumping from the reservoir with the line disconnected at the shuttle valve - simply pump into a can until the hand pump lines are charged up.

Fill the reservoir with oil and run the pump in bursts of not more than 30 seconds at a time. Wait a minute or two between bursts to allow the motor to cool down. This is a safe and conservative approach to motor maintenance. It will take some time to fill the entire hydraulic system since the accumulator and all the cylinders must be filled. Note that the dip stick in the pump housing is not used as a fluid level gauge since we have a much enlarged reservoir. The reservoir should be monitored closely as you begin charging up the system as it can not be allowed to run so low that the pump gulps air. Keeping it at least half full at all times is safe. When fully charged up (in the gear down position and flaps up position), then refill the reservoir to a point about 1" down from the top.

**LANCAIR® IV**

26-55

Chapter 26

REV.

C5/4-19-94

Hydraulic System



