SECTION IX

FUEL SYSTEM

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SECTION IX

FUEL SYSTEM

9-1. INTRODUCTION. The fuel system components covered in this section consist of the fuel cells, selector valves, control cables, filter screens and electric fuel pumps. Instructions are given for remedying difficulties which may arise in the normal operation of the fuel system. The instructions are organized so the mechanic can refer to: Removal, Repair, Installation and Adjustment of each part of the system.

Maintenance for the carburation and fuel injection system may be found under Power Plant, Sections VIII, VIIIA or VIIIB.

9-2. DESCRIPTION. The fuel system is contained in two independent units that allow each engine to have its own fuel supply. The systems are connected only by a crossfeed valve that will allow fuel to be drawn from one set of fuel cells to the engine on the opposite side, in the event of an emergency.

The fuel cells are of the bladder type and are installed in cavities within the wings, with each inboard cell having a capacity of 35 or 36 U.S. gallons. The outboard cells hold 35 or 36 U.S. gallons each. (Refer to the Pilot's Information Manual for the exact amount of fuel available for the particular airplane being serviced.) Aircraft with serial numbers 27-7654001 and up may have additional optional wing tip fuel cells which are interconnected to the outboard main cells, thus increasing the capacity of each outboard cell to 55 U.S. gallons. On airplanes including wing tip fuel cells an optional sight gauge is installed on the main outboard fuel cell of each wing. A check of the fuel quantity can be performed on the ground during the preflight check of the airplane.

Fuel is taken from each cell through a finger screen located in the cell outlet fitting and then onto the shutoff selector valve. From the selector valve, fuel is drawn in a series configuration through the fuel filter, electric fuel pump and onto the engine driven pump.

Drains are provided for each fuel cell, filter bowl and crossfeed line. The cell drains and filter screen drains are accessible through an access door on the bottom inboard part of each nacelle. The crossfeed drain is located in the fuel control box between the two front seats and is operated by a knob on the front of the box.

The fuel valves are operated by control handles located on the fuel control box between the two front seats. The fuel gauges will indicate the quantity of fuel in each cell that fuel is being drawn from. On aircraft which incorporate wing tip fuel cells, the quantity of fuel is combined with the main outboard fuel cells to give a combined total indication.

Figures 9-1 through 9-7 give a pictorial diagram of the various fuel systems for specific serial numbered aircraft.

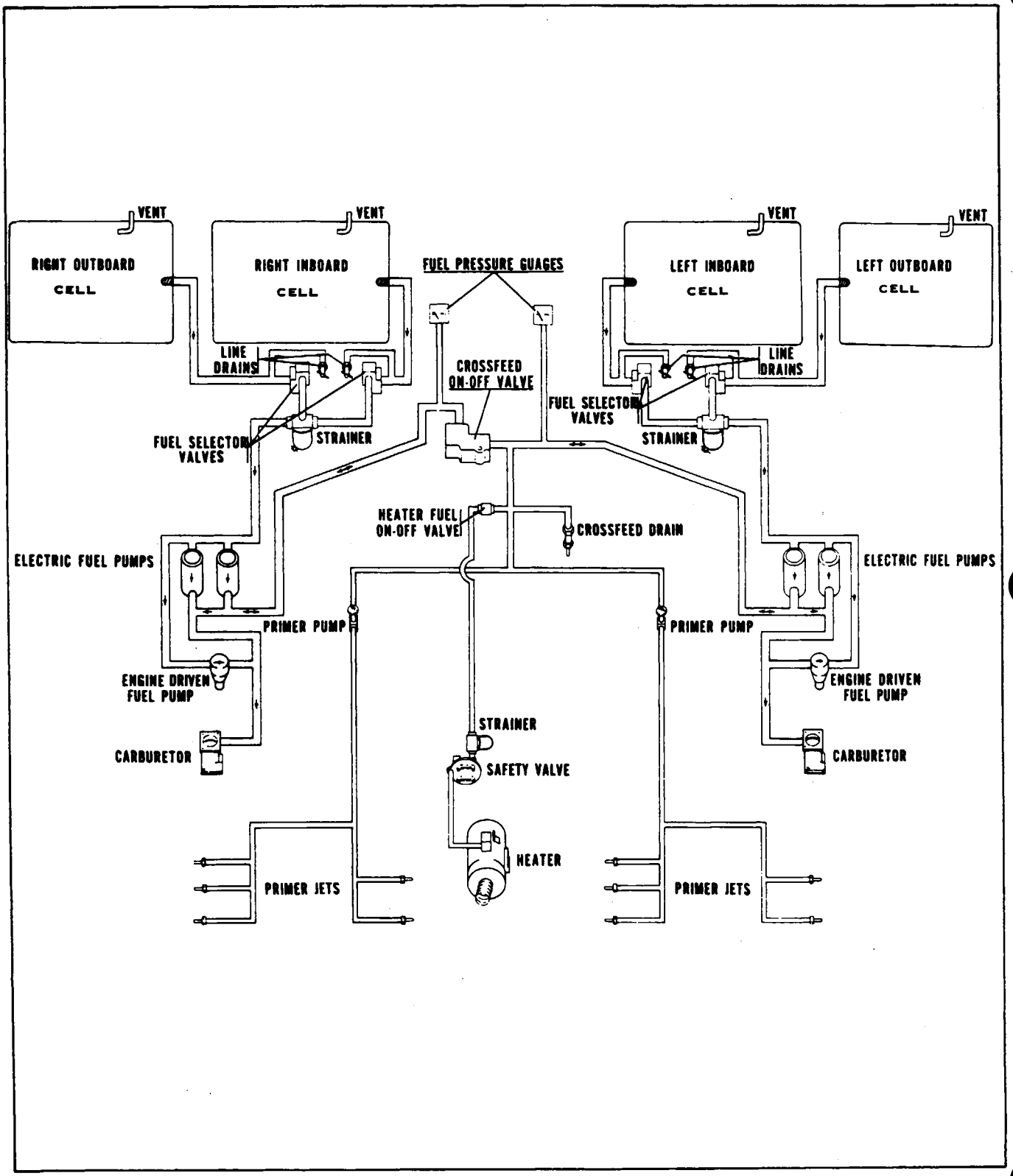

Figure 9-1. Fuel System Diagram (2 valves)
PA-23-250; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2222 incl.

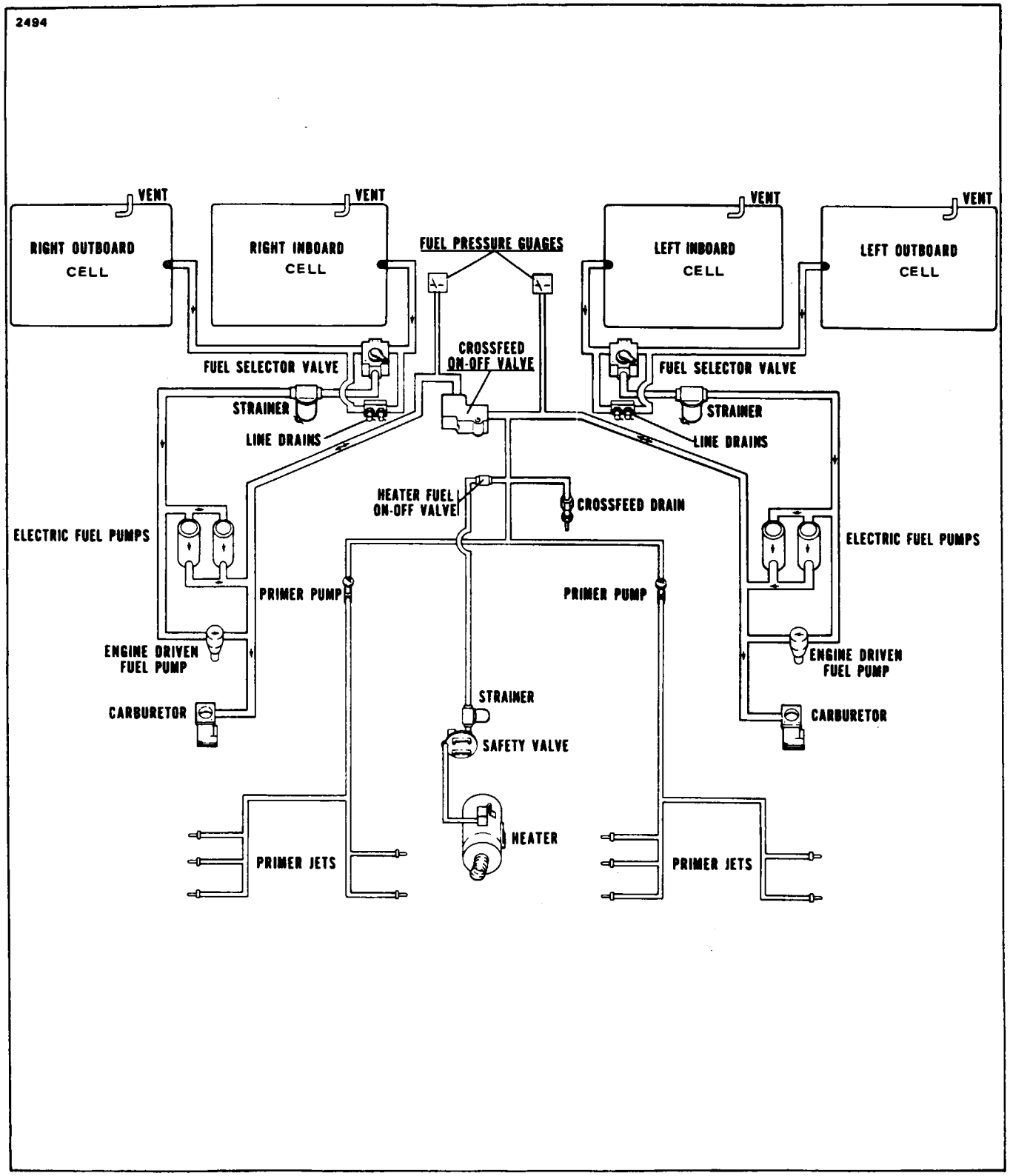

Figure 9-2. Fuel System Diagram
PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2223 to 27-2504 incl.

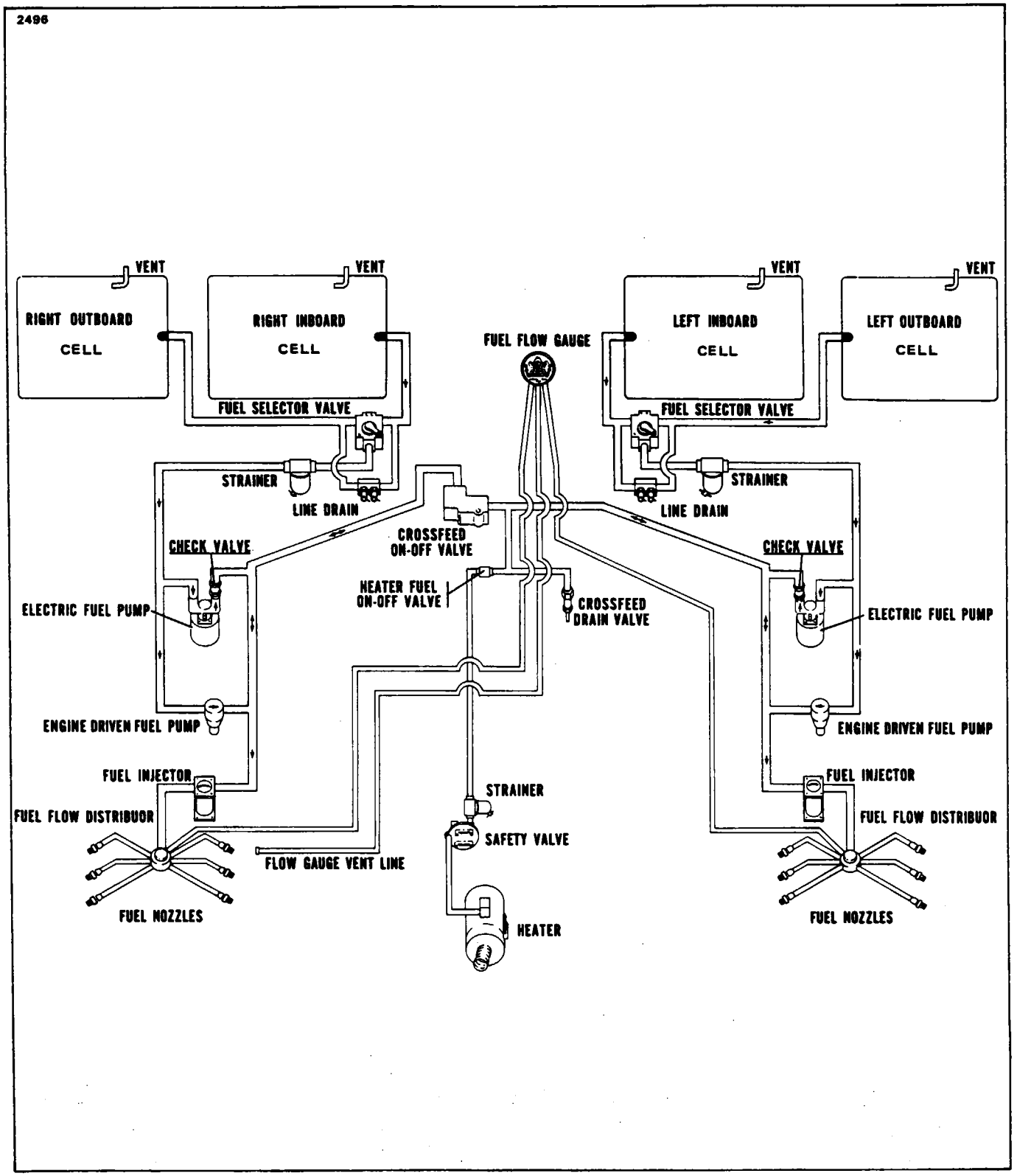

Figure 9-3. Fuel System Diagram
PA-23-250 (six place), Serial Nos. 27-2322 to 27-2504 incl.

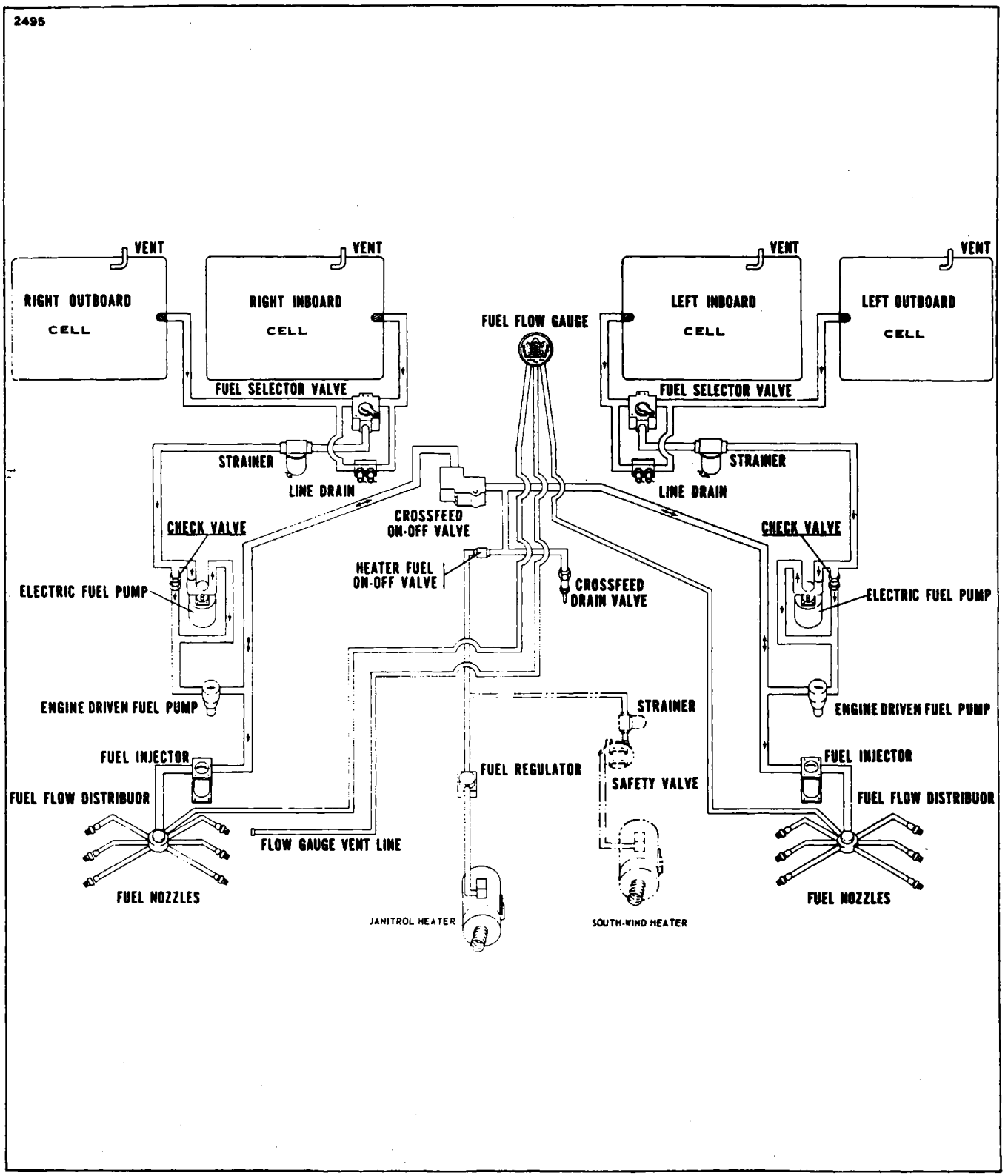

Figure 9-4. Fuel System Diagram, PA-23-250 (six place), Serial Nos. 27-2505 to 27-3836; 27-3838 to 27-3943 incl. (Except 27-2582, 27-2686, 27-3135 and 27-3941)

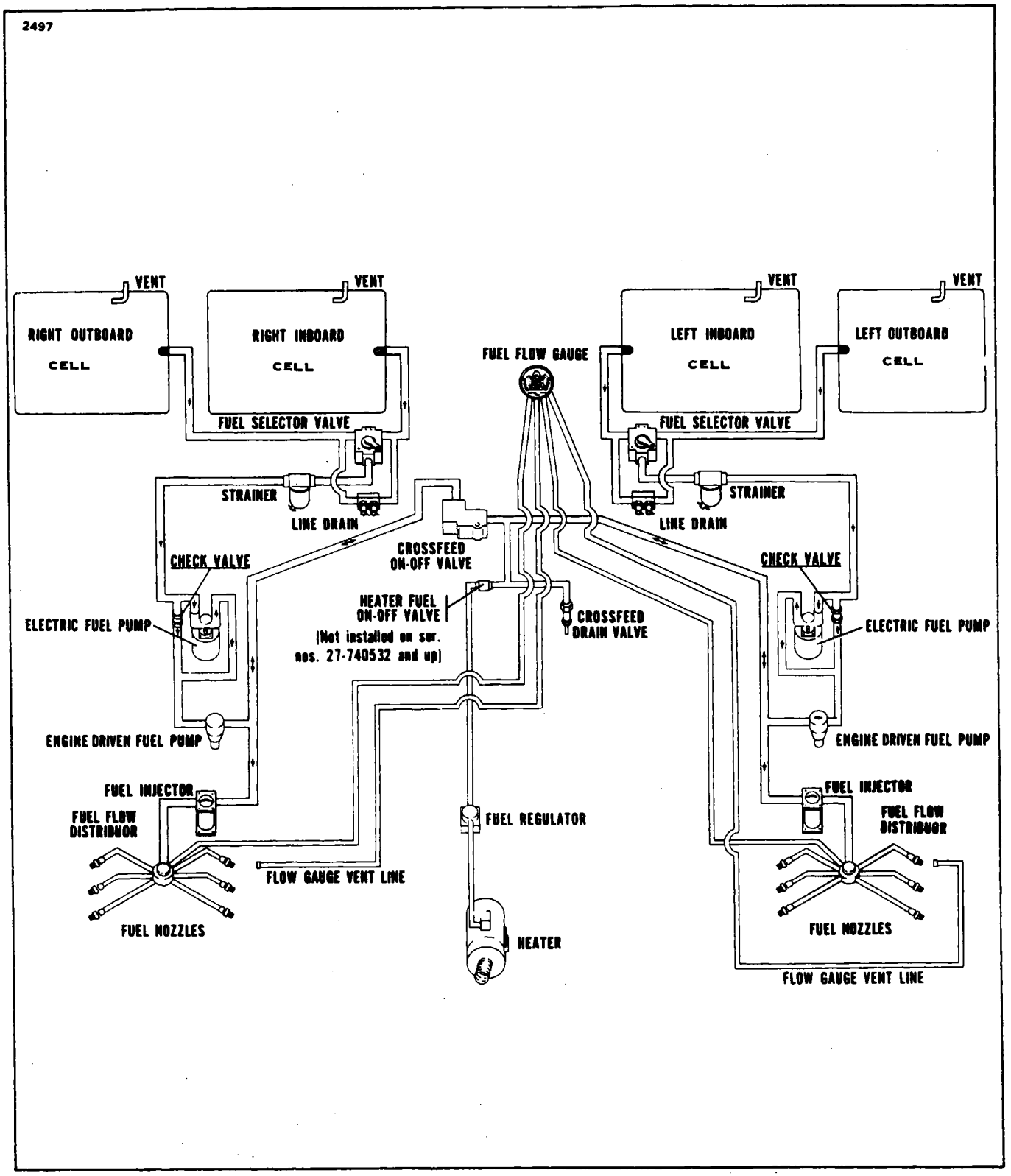

Figure 9-5. Fuel System Diagram, PA-23-250 (six place),
Serial Nos. 27-3937 and 27-3944 to 27-7554172 incl.
(Except 27-4520)

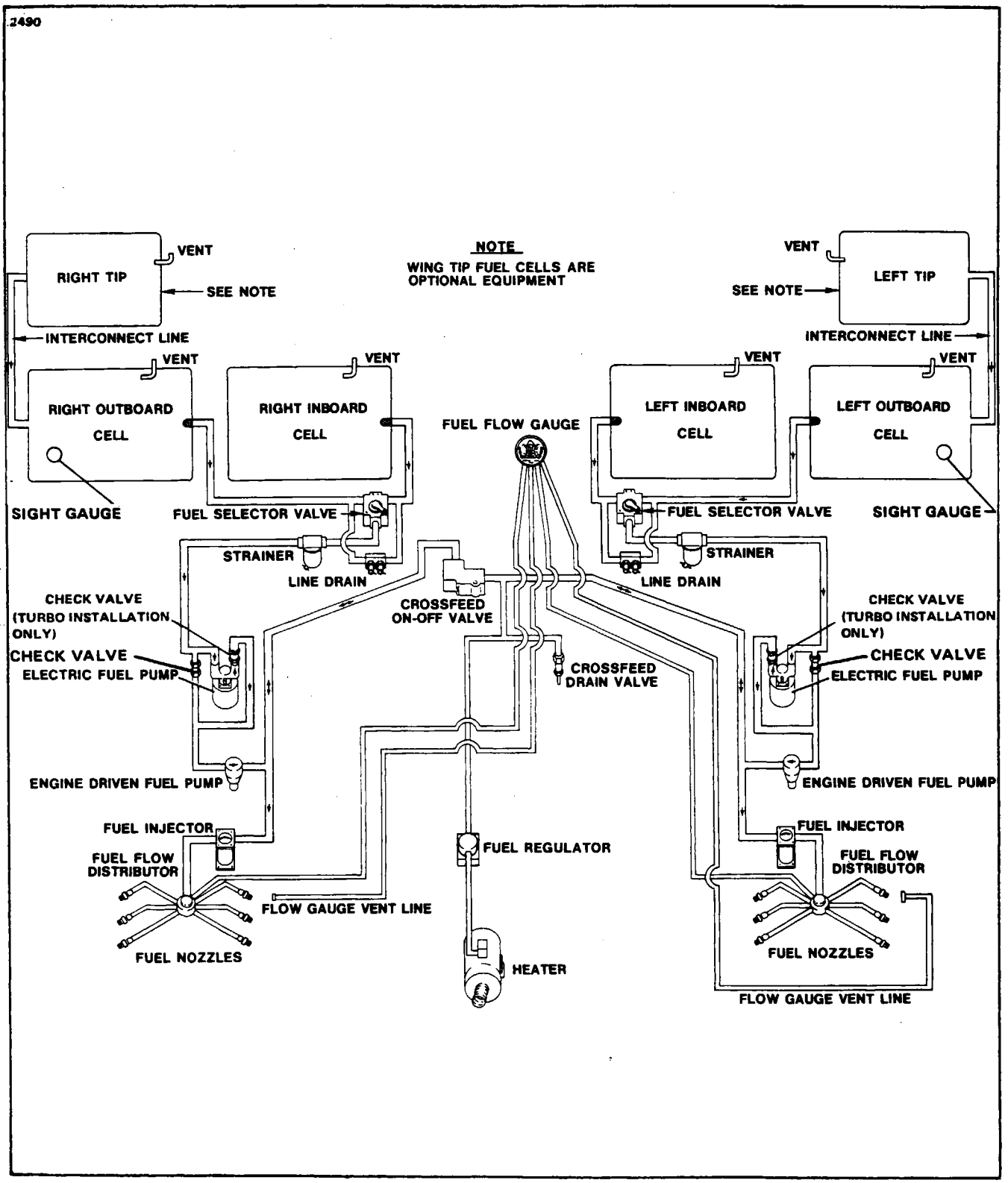

Figure 9-6. Fuel System Diagram, PA-23-250 (six place), Serial Nos. 27-7654001 and up with Optional Wing Tip Fuel Cells

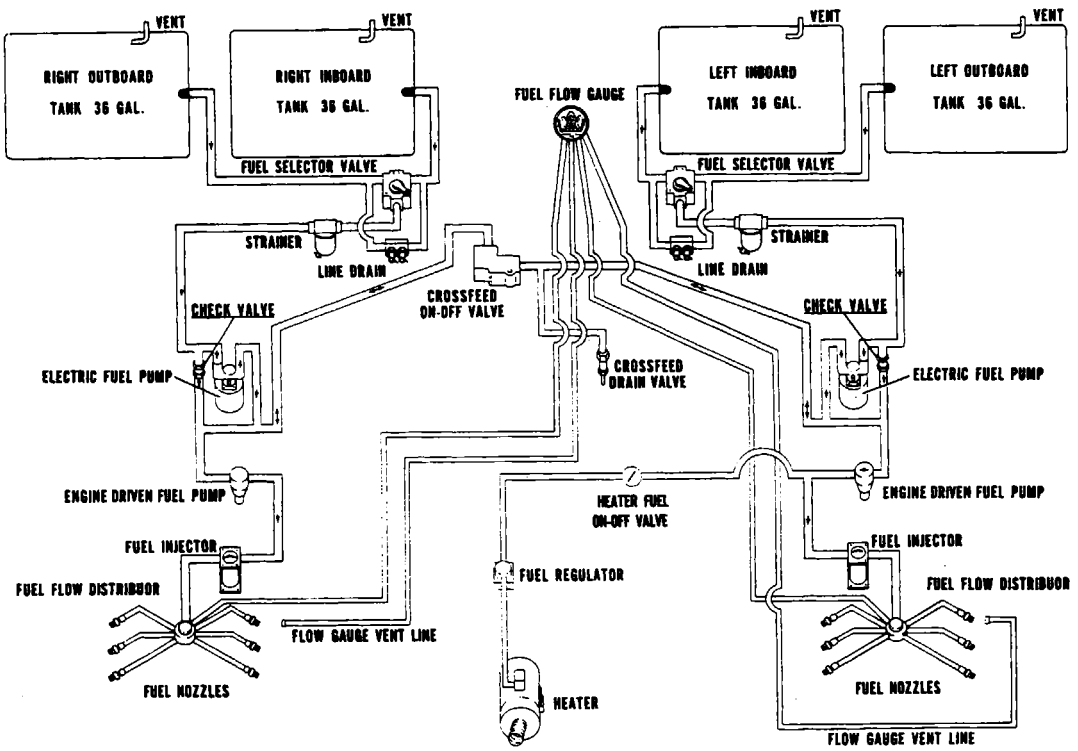

Figure 9-7. Fuel System Diagram, PA-23-250 (six place), Serial Nos. 27-2582, 27-2686, 27-3135, 27-3941 and 27-4520

9-3. TROUBLESHOOTING. Troubles peculiar to the fuel system are listed in Table IX-I at the back of this section, along with their probable causes and suggested remedies. When troubleshooting, check from the fuel supply to the items affected. If no trouble is found by this method, the trouble probably exists inside individual pieces of equipment; they may then be removed from the airplane and overhauled, or identical units or units tested and known to be good, installed in their place. Troubleshooting the fuel quantity indicator may also be found in Section X, Instruments. The complete electrical system diagram for the system may be found in Section XI, Electrical System.

9-4. FUEL CELLS.

9-5. REMOVAL OF FUEL CELLS. (Refer to Figure 9-9.)

a. Drain the fuel cell to be removed. (Refer to Draining Fuel System, Section II.) Should time permit, and if the cell is to be reused, it is suggested that the cell be flushed, sprayed or rubbed with a light engine oil. Then do not remove the cell until 24 hours have elapsed after the oil has been applied. This will keep the cell pliable until ready to reinstall.

b. Remove the access plate from the underside of the wing at the inboard end of the fuel cell being removed.

NOTE

On aircraft with serial nos. 27-7654001 and up with tip fuel cells, refer to Paragraph 9-6 for removal instructions.

c. Loosen the clamp on the outlet neck.

d. Remove the oval access plate on top of the wing.

e. Disconnect the fuel sender unit wires from the unit inside the access opening.

f. Remove the sender unit plate by removing mounting bolts, lockwashers and gaskets.

g. Remove the filler cap and the mounting bolts around the filler neck plate or optional sight gauge and mounting bolts around plate.

h. Insert an arm between the fuel cell and the top of the wing; work outward from the opening releasing the cell support bayonet clips. The clips fit into brackets in the cell compartment and can be released by exerting pressure downward.

i. Reach under the fuel cell and release the button type fasteners by pushing them in an outward direction toward the corner of the cell unseating them from their mounting brackets.

j. Place tape or equal protective covering around the oval access hole in the top of the wing to prevent damage to the cell when removing it.

k. Fold the cell neatly within the wing and remove it gently through the oval opening.

9-6. REMOVAL OF WING TIP FUEL CELL. (Refer to Figure 9-8.)

NOTE

Airplanes equipped with pneumatic deicers. (Refer to Section XIV for removal instructions.)

a. Place the crossfeed valve in the OFF position and drain the fuel from the outboard and tip fuel cells to be removed. (Refer to Draining Fuel System, Section II.)

b. Remove the wing tip fairing attachment screws; disconnect the navigation light electrical connector, and remove the fairing.

c. Remove the fuel sender access plate on the wing tip; disconnect the sender unit electrical leads; remove the sender unit screws, and carefully withdraw the sender unit with the gaskets from the cell. Note the position of the installed unit to facilitate installation.

d. Disconnect the fuel vent line; remove the oval access plate and the outer and inner rings from the outboard tip rib.

e. Reach into the outboard fuel cell and remove the clamp on the large diameter internal nipple; remove the access plates on the bottom and top skins.

f. Remove the wing tip hinge pin at the centerline of the main spar by removing the screw securing the end of the pin to the bottom of the wing tip, grasping it with pliers, and pulling it out.

g. Remove the wing tip attachment screws and carefully pull the tip away from the wing far enough to gain access to the external nipples of the tip fuel cell, crossover tubes and electrical connector.

h. Loosen the clamps on the three external nipples of the tip fuel cell and the clamp securing the ground lead to the large diameter interconnect tube. Unplug the electrical connector.

i. Remove the tip by separating the tip cell nipples from the crossover tubes and disconnecting the ground leads on the tip rib.

j. Remove the filler cap assembly from the wing tip and the bolts attaching the fuel cell to the filler neck plate assembly.

k. Untie the nylon cords; collapse the fuel cell and neatly fold the cell within the tip. Tape the edges of the oval access opening; tape or tie the cell and remove it through the opening in the tip rib.

9-7. CLEANING, INSPECTION AND REPAIR OF FUEL CELLS.

a. Fuel cells may be cleaned by the following procedure:

1. New Cells: It should not be necessary to clean new cells upon removing them from their containers, if they are installed in the fuel cell cavities promptly. If for any reason the cells are not installed immediately and they become dirty, they should be cleaned with soap and warm water to remove foreign material prior to installation in a clean cavity.

2. Used Cells: Prior to removal, the cells are to be drained of fuel, purged with fresh air and swabbed out to remove all traces of fuel. Following removal, the cells are to be cleaned inside and out with soap and warm water.

WARNING

Use a vapor-proof light for inspection.

b. Fuel cells may be inspected by the following procedure:

1. New Cells: Inspect the cell surface inside and outside for cuts, abraded (scuffed) areas and accessory damage. Also, inspect the fitting seals for nicks, scratches and foreign material.

2. Used Cells: Cells removed from the fuel cell cavity for inspection and repair or cells being returned to service from storage, should be inspected as outlined below:

(a) Remove fuel cells from wing cavity in accordance with Paragraph 9-5.

(b) Check for leakage in accordance with test procedure in Paragraph 9-15.

(1) If leaks appear, repair per Paragraph 9-14, clean per Paragraph 9-7, and reinstall per Paragraph 9-11 or replace with new cells.

(2) If no leakage appears, clean and reinstall cell per Paragraph 9-7 and 9-11.

(c) Check condition of fuel cap assemblies especially the rubber expandable seal portion. Caps showing indications of deterioration or hardening (of seal) should be replaced. On models with Serial Nos. 27-1 to 27-7654000 inclusive, the caps have holes which act as vents for the fuel system. In addition the fuel cells have drain tubes that are attached to the filler neck plate assembly just below the filler cap and gasket. With later models, Serial Nos. 27-7654001 and up, the caps do not have vents. The venting tube is attached lower down in the filler neck assembly, underneath a retainer and gasket. (See Figures 9-9 and 9-10.)

WARNING

Only use the correct type of cap for the airplane in question.

(d) Inspect the fuel cell filler cover plate gasket for evidence of aging, hardening or deterioration; replace gasket if any of these conditions are noted:

(1) Check fit of cover plate in relation to wing surface when closed; cover plate should fit flush with wing surface.

(e) Check fuel lines and fittings for integrity.

(1) Fuel lines showing evidence of damage or possible splitting and loose or damaged fittings should be replaced.

3. Baffled Fuel Cells: After each 500 hours of operation, conduct the following inspection:

(a) Defuel the aircraft.
(b) Remove the inboard and outboard cell access plates on the wings and fuel cells.
(c) Check the tension and knots of the support cells.
(d) Inspect the interior of the cells for security of the baffle and free operation of the flapper valve. Inspect both sides of the baffle.
(e) Inspect the exterior of the cells to insure the Velcro tape has not parted from the cell surface or linear surface.
(f) Install all access plates on fuel cells and wings; fill cells and check for leaks.

c. Due to the length of the fuel cell repair procedures, this information will be found in paragraph 9-14.

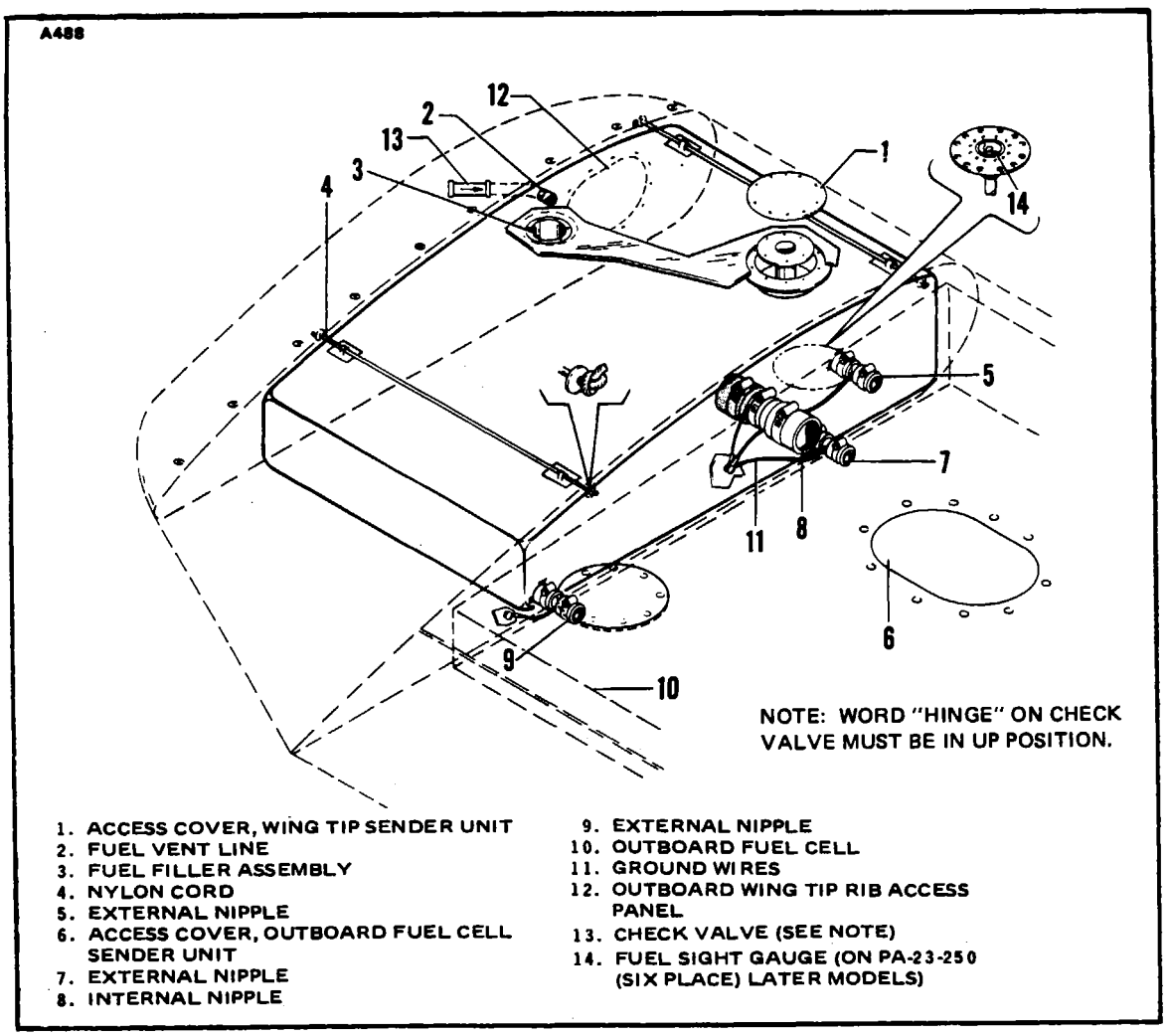

Figure 9-8. Wing Tip Fuel Cell Installation

9-8. FUEL CELL COMPARTMENT.

a. Thoroughly clear the cell compartment of all fittings, trimmings, loose washers, bolts or nuts.

b. Round off all sharp edges of the fuel cell compartment.

c. Inspect the fuel cell compartment just prior to fuel cell installation.

d. Tape over all sharp edges and all rough rivets with moleskin tape which may be obtained locally.

9-9. RESEALING INBOARD FUEL CELL WING CAVITY AREA.

a. Remove inboard fuel cells from the left and right wings in accordance with Paragraph 9-5.

b. Remove tape from fuel cell liner cutout area where the fuel cell's outlet nipple fits.

c. To facilitate flow-thru of sloshing compound along bottom rib flange at Station 80.31 and bottom skin stringer to rib attachment areas (see detail), proceed as follows:

1. Insert a 1/8 inch welding rod (pointed on end) into fuel cell liner cutout (fuel cell outlet area), routing rod behind inboard fuel cell liner and along bottom rib outside flange using a push-pull motion which will "drill" hole through existing sealant. This procedure shall apply to all four stringer to rib attachment points. Remove rod from wing cavity.

d. Insert two 1/16 inch welding rods into fuel cell liner cutout, one toward front spar and one toward rear spar, routing rods behind inboard fuel cell liner and along bottom inside radius of rib flange. (See detail.) Leave rods in this position. They will be removed later.

e. Cover hole in rib through which the fuel cell's outlet nipple fits, and cover all drain holes in bottom of wing skin between Stations 80.31 and 127.25 with masking tape.

f. Level aircraft longitudinally.

g. Reseal the fuel cell cavity area of one wing at a time, using a sloshing compound that meets MIL-S-4383B specifications. Two sources of this sloshing compound are:

1. Products Research & Chemical Corporation - Gloucester City, New Jersey (Part No. 1005-L)

2. Coast Pro-Seal Company - Compton, California (Part No. 444R)

(a) Pour two quarts of the sloshing compound into the two inboard fuel cell mounting bracket holes in the liner and the liner cutout area of the left wing, so that the compound will flow under the fuel cell liner and be distributed fore and aft along the rib to skin junction.

(b) Place jack under jack pad of right wing and raise until left wing is level on underside. This action will distribute the sloshing compound laterally along the rear and front spar skin junctions. Let the aircraft sit in this position for ten (10) minutes and then remove jack.

(c) Perform Steps (a) and (b) on the right wing.

h. Open drain holes in bottom of wing skins to allow excess sloshing compound to drain out. Return aircraft to normal ground attitude and let drain for one (1) hour.

i. Allow the sloshing compound to dry for twenty-four (24) hours and then remove the two 1/16 inch welding rods from both wings.

j. Retape liner cutout area at inboard end of fuel cell cavities. Also clean out drain holes on bottom wing skins of any buildup of sloshing compound.

k. Reinstall inboard fuel cells in accordance with Paragraph 9-11.

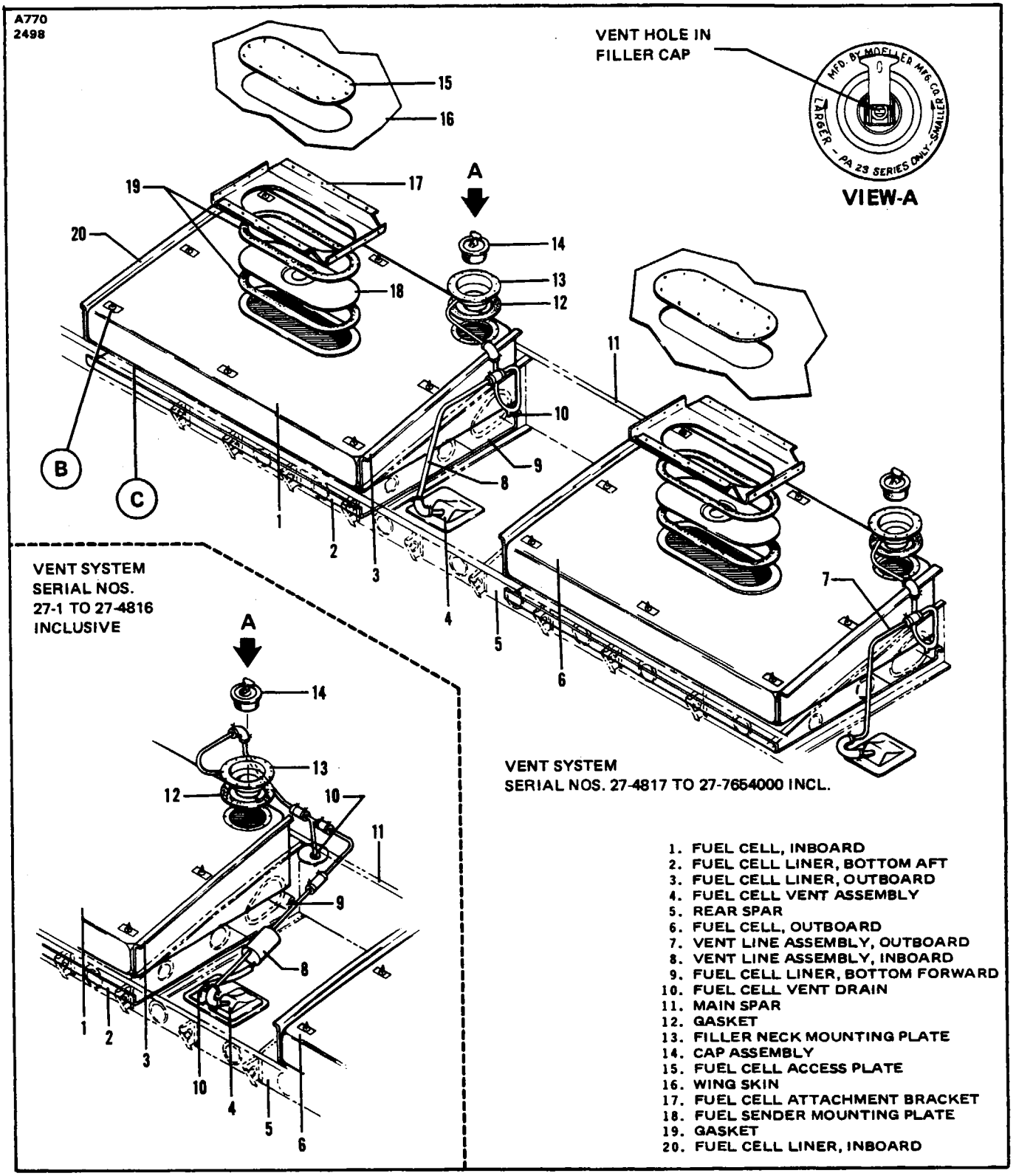

Figure 9-9. Fuel Cell Installation and Vent System
(Serial Nos. 27-1 to 27-7654000 inclusive)

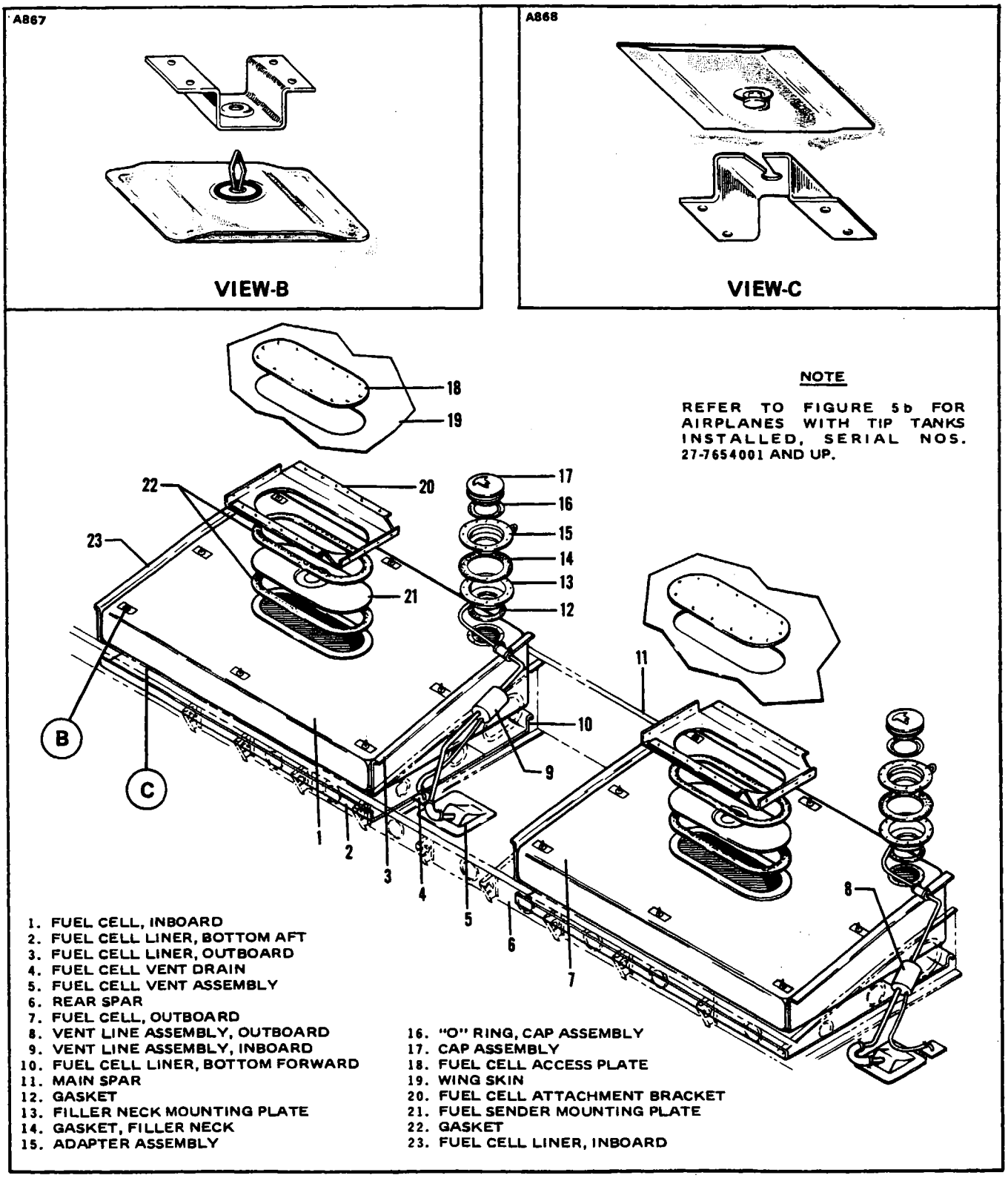

Figure 9-10. Fuel Cell Installation and Vent System
(Serial Nos. 27-7654001 and up)

9-10. MOLDED NIPPLE FITTINGS. The molded nipple fitting is a lightweight fitting developed for ease in installation in certain locations in the airplane. In order to get the best service from this type fitting, it is necessary to exercise certain precautions at the fime of installation. The specific precautions other than the general care in handling are as follows:

a. Insert the flow tube into the fitting until the end is flush with the inside edge of the nipple.

b. The hose clamp must be clear of the end of the fitting by one-quarter inch where possible.

c. Locate the hose clamp on the fabric reinforced area of the nipple.

d. Tighten hose clamp snug. Do this once. Do not re-tighten unless hose clamp is loosened completely and allowed to set for 15 minutes before retightening.

e. Do not use sealing paste or gasket compound.

f. Apply a thin film of Simonize Wax to metal flow tubes to facilitate installation and removal.

9-11. INSTALLATION OF FUEL CELL. (Refer to Figure 9-9.)

a. To allow hook-up of all cell fasteners, note location of each fastener bracket. Do not use sharp tools such as files and screwdrivers for installation purposes.

b. Fold the cell and insert it through the oval opening in the top of the wing.

NOTE

On aircraft with Serial Nos. 27-7654001 and up with tip fuel cells installed, refer to Paragraph 9-12 for installation instructions.

CAUTION

Use care when inserting the fuel cell so as not to cut or damage the cell.

c. Unfold the cell within the wing and position the outlet neck through its hole inside the wing.

d. Fasten the button type fasteners located on the bottom of the cell and then the bayonet type clips on the top, to their respective brackets. Draw each button fastener inward toward the center of the cell cavity to engage it into its bracket. Early cells have locating tabs at each fastener, located inside the cell; later cells do not have these tabs, though installation is similar. Grip the tab or the cell area around the fastener and insert the fastener into its bracket.

e. Reach inside the fuel cell and position the filler opening to the filler neck plate and gaskets. Secure with attaching bolts and washers. If optional sight gauge is installed secure with same procedure.

f. Replace the two oval gaskets and sender unit mounting plate on oval opening to cell. Insert locating pins (P/N 18551-00) to align the gaskets and plate with the twenty four holes in the cell. Pull the pins through the bolt holes in the wing opening and safety temporarily.

Place lock washers under the bolt heads. Turn the 24 bolts in by hand and tighten to 25 inch-pounds with a torque wrench and special torque wrench adapter (P/N 18642-00).

g. Connect the sender unit wires.
h. Tighten the clamp on the cell outlet neck.
i. Check the fuel sender unit as described in Paragraph 9-14.
j. Check for fuel leaks at all fittings.
k. Install access plates.

9-12. INSTALLATION OF WING TIP FUEL CELL. (Refer to Figure 9-8.)

a. Inspect the tip cell cavity for sharp edges.
b. Place tape over the edges of the oval access opening in the tip rib to prevent damage to the fuel cell.

CAUTION

Do not use sharp tools such as files or screwdrivers for installation purposes.

c. Roll the cell into the shape and size that can be inserted through the oval access opening in the tip outboard rib.
d. Insert and unroll the cell establishing the correct relationship of the cell to the tip compartment.
e. Feed the nylon cord through the cell hangers and the tip ribs; draw the cords tight and tie each end as shown in Figure 9-7.)
f. Install the fuel filler neck assembly and secure to fuel cell with screws. The gasket should be positioned between the filler neck plate assembly and the fuel cell outer ring. Torque cap bolts to 25 inch-pounds.
g. Wipe the inside of the cell clean of all dirt and foreign material with a clean, lint free tank cloth, and inspect for cleanliness.
h. Hold the wing tip in position next to the wing and insert the crossover tubes. Install the clamps on the external tip cell nipples. Ascertain that each crossover tube is grounded. Connect electrical wiring.

NOTE

Position clamps on the external nipples with the screw heads positioned so they will be accessible through the access holes in the skins.

i. Secure wing tip to the wing with the attachment screws and insert wing tip hinge pin. Secure the end of the pin.
j. Reach into the outboard fuel cell and install the clamp on the large internal nipple.
k. Install the outboard fuel sender unit; torque cap bolts to 25 inch-pounds. Connect electrical leads and install the oval access plate.
l. Install the tip sender unit; torque cap bolts to 25 inch-pounds. Install access plate.
m. Connect the fuel cell vent line. Ascertain that word "Hinge" on vent check valve is in the up position when installing fuel cell vent line.

n. Install the oval access cover in the tip rib with a gasket on each side of the rib and torque cap bolts to 25 inch-pounds.
o. Place enough fuel in the cells to check for any leakage around the crossover tubes.
p. Install the access plates on the upper and lower skins.
q. Connect the navigation light wires and install the wing tip fairing.
r. Install deicer boots, if equipped, per instructions in Section XIV.

9-13. HANDLING AND STORAGE OF FUEL CELLS. When synthetic rubber fuel cells are placed in service, the gasoline has a tendency to extract the plasticizer from the inner liner of the fuel cell. This extraction of plasticizer is not detrimental as long as gasoline remains in the fuel cell, inasmuch as the gasoline will act as a suitable plasticizer. When the gasoline is drained from the fuel cell, the plasticizing effect of the gasoline is lost and the inner liner of the fuel cell begins to dry out and subsequent cracking will occur. This cracking may penetrate through the walls of the cell after the cell has been refueled. To prevent this failure from affecting serviceable fuel cells which previously contained gasoline and are now to be stored for more than 10 days in the airplane or in storage, a thin coat of engine oil should be applied to the inner liner of the cells. If it becomes necessary to return cells to the contractor, they should be repacked as nearly similar to the original factory pack as possible.

a. Do not drag or handle the fuel cells any more than necessary by their molded nipple fittings, cell openings or attachment fittings.
b. Store cells at room temperature with no more than normal humidity.
c. Do not allow the cells to remain any longer than necessary under strong light.
d. When storing the cells, store in such a manner that their shipping containers are placed level and will not crush the cells. When necessary to stack more than one high, see that the containers are placed squarely on each other so as to preclude any danger of slipping and the sharp edge of one container perforating another.

9-14. REPAIR OF FUEL CELL.

CAUTION

No repairs are to be made on the radius of a cell or in the fitting area of a cell. Cells with such damage are to be returned to the factory for repairs. No damaged areas such as cuts and tears larger than one inch are to be repaired in the field. Return cells to: U.S. Rubber Co.,Fuel Cell Dept., Mishawaka, Indiana.

NOTE

To determine if the fuel cell is repairable, reach through the fuel cell access plate and take a section of cell between thumb and forefinger. Wipe the ridge created by this action with Methylethylketone. If fine cracks are evident, the fuel cell is not repairable.

NOTE

For the following procedure use Piper Fuel Cell Repair Kit, P/N 754 321.

a. Outside of Cell:

1. Use a piece of synthetic rubber coated fabric (U.S. Rubber 5200 outside repair material) large enough to cover damage at least two inches from cut in any direction. Buff this material lightly and thoroughly with garnet paper and wash with Methylethylketone (U.S. Rubber Co. 3339 solution) to remove buffing dust.

2. Cement buffed side to patch with two coats of U.S. Rubber Co. 3230 cement or Minnesota Mining Co. EC-678. Allow each coat to dry 10 to 15 minutes.

3. Buff cell area to be patched lightly and thoroughly with garnet paper and wash with 3339 solution to remove buffing dust.

4. Cement buffed area with two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement. Allow each coat to dry 10 to 15 minutes.

5. Freshen cemented area of patch and cemented area of cell with 3339 solution.

6. While still tacky, apply edge of patch to edge of cemented area on the cell. With a roller or blunt instrument, roll or press the patch to the cemented area and roll or press it down a half-inch to an inch across at a time so as not to trap air between patch and cell. Lay 50 pound shot bag over patch which is protected by a piece of Holland Cloth to prevent sticking. Weight should not be removed for six hours.

7. Seal coat edge of patch one-half inch with one coat of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement and allow the cement to dry thoroughly.

b. Inside of Cell:

1. After the damaged area has been patched on the outside of the cell and the repair allowed to stand a minimum of six hours, the cell is then ready to have the patch applied on the inside of the cell.

2. Lightly and thoroughly buff a piece of cured U.S. Rubber 5200/5187 nylon sandwich material large enough to cover damage at least two inches from cut in any direction. Wash buffing dust off patch with Methylethylketone solution (U.S. Rubber 3339).

3. Cement buffed side of patch with two coats of black rubber cement, U.S. Rubber 3230 or Minnesota Mining Co. EC-678 and allow each coat to dry 10 to 15 minutes.

4. Buff cell area to be patched lightly and thoroughly with fine sandpaper ("0") and then wash off buffing dust with Methylethylketone solution (U.S. Rubber 3339).

5. Coat buffed area with two coats of black rubber cement, U.S. Rubber 3230 or Minnesota Mining Co. EC-678, and allow each coat to dry 10 to 15 minutes.

6. Freshen cemented area of patch and cemented area of cell with Methylethylketone solution (U.S. Rubber 3339).

7. While still tacky, apply edge of patch to edge of cemented area, centering patch over cut in cell. With a roller or blunt instrument, roll or press the patch to the cemented area on the cell. Hold part of patch off the cemented area and roll or press it down a half-inch to an inch across at a time so as not to trap air between patch and cell. Apply 50 pound shot bag to repaired area and do not disturb for six hours.

8. Seal coat patch and one-half inch from edge of patch with two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement. Allow the first coat to dry one hour or more. Wipe patch and cemented area lightly with No. 10 oil, so that when the cell is in its original position, the patch area will not stick to other areas of the cell.

c. Scuffed Fabric:

1. Buff area surrounding scuffed fabric.
2. Wash buffing dust from area with 3339 solution.
3. Apply two coats of U.S. Rubber 3230 or Minnesota Mining Co. EC-678 cement to the buffed area, allowing 10 minutes drying time between coats.

9-15. TESTING FUEL CELLS. When cells are removed from the airplane for suspected leakage, the following method for locating leaks may be used. This method may also be employed after local repairs have been made to check both the efficiency of the repair and presence of other leaks not originally found.

a. Materials Needed:

1. Commercial or household ammonia (28-29% concentration).
2. Indicator solution - contents per gallon as follows:
   (a) 1/2 gallon of distilled water.
   (b) 1/2 gallon of denatured alcohol.
   (c) 15 grams of phenolphthalein crystals or powder.

NOTE

New phenolphthalein-ammonia solution must be prepared each shift and clean or new cloths shall be used each shift.

3. Approximately three yards of balloon cloth or airplane cloth.

b. Procedure:

1. Pour ammonia on an absorbent cloth at the rate of 3cc per cubic foot of cell capacity with a minimum of 10cc. Place saturated cloth inside cell.
2. Close all openings and apply positive test air pressure of 1/4 to 1/2 psi.

CAUTION

Extreme caution must be maintained to prevent cover plates from damaging or cutting the cell during installation, phenol test, deflation and removal.

NOTE

Unsupported tests must be conducted on a level, dirt free surface having no sharp projections or anything which could damage the inflated cell. An unsupported bladder cell can be inflated only to a pressure of 1/4 to 1/2 psi. Any pressure in excess of this will cause damage or rupture of the cell.

3. Soak cloth in phenolphthalein indicator solution.
4. Wring out cloth and spread evenly and smoothly over area of cell being checked.
5. Check all surfaces of cell. Leaks will be indicated by the appearance of pink spots on the cloth.

9-16. FUEL QUANTITY INDICATING SYSTEM.

NOTE

On the latest models of the PA-23-250 (six place), there are fuel gauges installed on the wing tips, left and right. (See Paragraph 9-18 for installation and removal procedures.)

9-17. CHECKING FUEL QUANTITY INDICATING SYSTEM.

a. General checking of the system.

1. Completely drain the fuel cells that relate to the gauge that is to be checked. (Refer to Draining Fuel Cells, Section II.)
2. Level the airplane longitudinally and laterally. (Refer to Leveling, Section II.)
3. Ascertain that the crossfeed valve is closed.
4. Connect a 14-28-volt power supply to the airplane electrical system and observe the fuel quantity gauge. It should read empty with the respective fuel selector lever at both the inboard and outboard ON positions.
5. Add fuel to each cell in the amount of 9.0 U.S. gallons to the outboard cell and 9.0 gallons to the inboard cell, to bring each cell to one-quarter its full capacity.
6. Again move the selector lever to both ON positions and observe the gauge. At either position the quantity pointer should align with any part of the one-quarter index of the gauge.
7. Continue to add fuel in increments of 9.0 and 9.0 U.S. gallons to the outboard and inboard cells respectively for each quarter capacity of the cells. At each quarter increment, until full, check that the quantity pointer aligns with any part of the index, with the selector lever at either ON position.
8. Should the gauge and the amount of fuel in the cell not correspond, the procedure in step "b" through "d" may be necessary to isolate the trouble in the system.

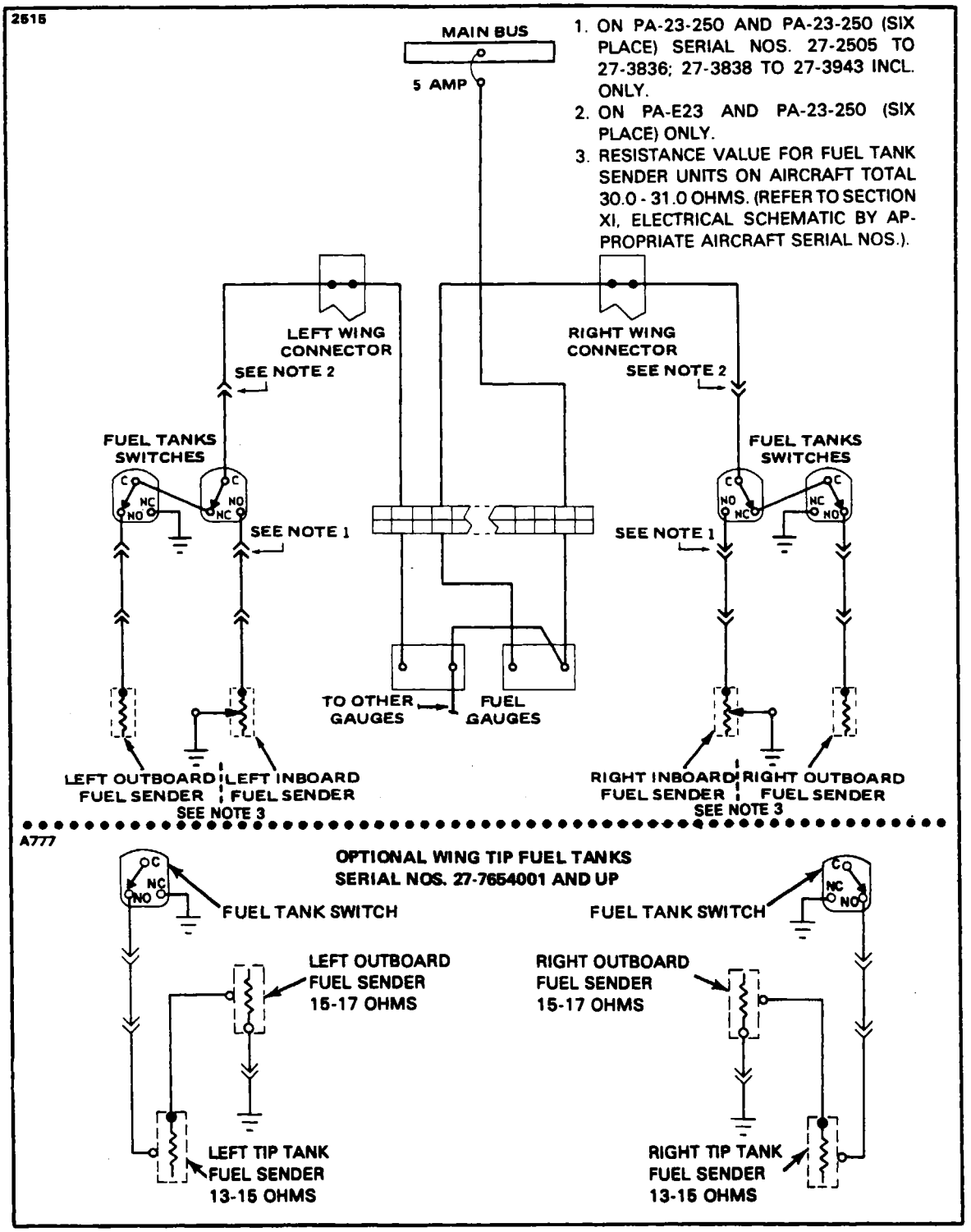

Figure 9-11. Fuel Indicating System Wiring Schematic

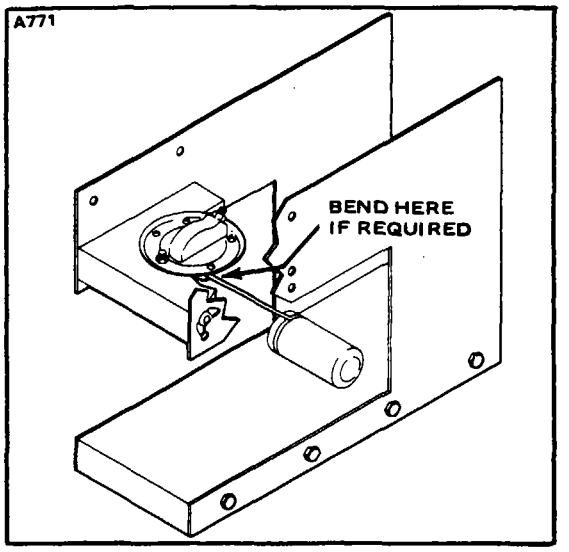

Figure 9-12. Checking Fuel Quantity Sender

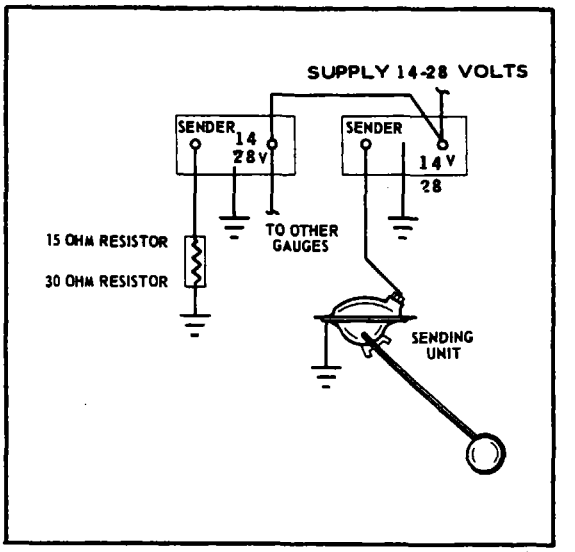

Figure 9-13. Checking Fuel Gauges Schematic

b. Sender Check:

1. Remove the fuel sender to be checked. (Refer to Paragraph 9-19.)

2. Secure the sender in the appropriate position on the fabricated jig as shown in Figure 9-12. (The jig may be fabricated from dimensions given in Figure 9-26.)

3. With the float arm against the bottom stop, the float should be just touching the base of the jig. If the float arm is not touching the base of the jig or the bottom stop, adjust the float by bending the arm at a position shown in Figure 9-12.

4. After the sender has been adjusted, check for the proper amount of resistance by the following procedure:

(a) Connect an ohmmeter to the sender unit.

(b) Position the float arm against its bottom stop and ascertain the ohmmeter indicates 0.00 ohms resistance.

(c) Slowly move the float arm from the bottom stop to the top stop while watching the ohmmeter indicator. The ohmmeter needle should steadily move up, without fluctuation, as the float arm is moved.

(d) **With the float arm against its top stop, the ohmmeter should indicate the following:**

(1) Without tip tank—inboard and outboard 30.0 to 31.0 ohms.

(2) With tip tank—inboard 30.0 to 31.0 ohms; outboard 15.0 to 17.0 ohms; tip tank 13.0 to 15.0 ohms.

If incorrect resistance or fluctuation is found, the sender should be replaced.

c. Wiring Check: (Refer to Figure 9-13.)

1. Check all ground connections throughout the indicating system for corrosion or loose connections that may cause excessive resistance in the circuit.

2. Check all splices and terminal connections for corrosion and security.

3. Check wiring between connections for excessive resistance due to frayed or broken strands.

d. Gauge check:
   1. Sender Method:
      (a) Position and secure a calibrated sender to the fabricated checking jig.

CAUTION

Make certain the sender restrictor is connected to the proper side of the gauge.

      (b) Connect the sender directly to the gauge being checked using No. 16 or larger wire. (Refer to Figure 9-13.)
      (c) Connect a 14-28 volt power supply to the electrical system of the airplane.
      (d) Operate the power supply and move the sender float arm through its travel. Ascertain that the empty and full positions of the sender and the gauge correspond. If not, the gauge should be replaced.
   2. Resistor Method:
      (a) Connect a 15 ohm resistor to the sender unit of the gauge being checked. (Refer to Figure 9-13.)
      (b) Connect a 14-28 volt power supply to the electrical system of the airplane.
      (c) Operate the power supply and ascertain the gauge indicates one-half full.
      (d) Repeat the procedure using a 30 ohm resistor which should cause the gauge to indicate full.
      (e) If the gauge does not indicate properly, it should be replaced.

9-18. REMOVAL AND INSTALLATION OF WING TIP FUEL SIGHT GAUGE. (On latest models of PA-23-250 (six place) only.)
   a. Remove gauge by removing inner circle of screws which fasten gauge to gasket and plate.
   b. Withdraw first the gauge, then the arm and float.
   c. To install gauge, place the arm and float in wing then secure gauge to gaskets and plates with screws.

9-19. REMOVAL OF FUEL SENDER.
   a. Remove the screws attaching the oval access plate to the top of the wing and remove the plate.
   b. Disconnect the two electrical leads from the sender.
   c. Remove the screws and washers attaching the sender to the mounting plate and remove the sender.
   d. On aircraft with tip tanks installed (serial nos. 27-7654001 and up), an additional sender unit is mounted in the tip tank. Remove the tip tank sender unit as follows:
      1. Remove the screws attaching the round sender unit cover to the top of the wing tip.
      2. Disconnect the electrical leads to the sender unit.
      3. Remove the screws attaching the sender unit to the fuel cell mounting plate and carefully withdraw the sender with the gasket from the fuel cell.

9-20. INSTALLATION OF FUEL SENDER.

a. Position the fuel sender to its mounting plate inside the wing. The sender should be installed with the float arm forward.

b. Secure the sender with machine screws and washer.

c. Connect the electrical leads. Connect the lead coming through the wing to the terminal post of the fuel sender. Connect the sender ground strap to one of the mounting plate attaching bolts.

d. Install the oval access plate to the top of the wing.

e. On aircraft with tip tanks installed (serial nos. 27-7654001 and up), install the tip sender unit as follows:

1. Install the gasket on the sender unit and insert the sender unit into the fuel cell with the float arm and float facing outboard.

2. Secure the sender unit with machine screws and washers; connect the ground lead to one of the sender unit mounting screws, and torque all screws evenly to 25 inch-pounds.

3. Connect the positive lead to the sender unit terminal and install access cover.

9-21. FUEL SELECTOR VALVES. (PA-23-250; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2222 incl.)

9-22. REMOVAL OF FUEL SELECTOR VALVE. (Refer to Figure 9-15.)

a. Remove the aft bottom section of the nacelle by removing attaching screws.

b. Drain the appropriate fuel cell or cells for the selector valve or valves to be removed. (Refer to Draining Fuel System, Section II.) Close the crossfeed line.

c. Remove the fuel selector for the outboard fuel cell by the following procedure:

1. Disconnect the operating rod and control cable from the valve arm removing the cotter pin and pin.

2. Disconnect the fuel lines from the valve fittings.

3. Remove the valve assembly by removing the two machine screws and self-locking nuts, installed through the valve assembly.

d. Remove the fuel selector for the inboard fuel cell by the following procedure:

1. Disconnect the operating rod from the valve arm if not previously disconnected at the opposite end.

2. Disconnect the fuel lines from the selector valve and fuel strainer fittings.

3. Remove the valve and strainer assembly by removing the two machine screws and self-locking nuts installed through the valve.

4. Separate the selector valve and fuel strainer.

9-23. DISASSEMBLY OF FUEL SELECTOR VALVE. (Refer to Figure 9-14.)

a. Remove the end fitting (1) and "O" ring (2) by unscrewing it from the valve body (5).

b. Disconnect the control arm from the valve stem by removing the speed nut, washers and rivet.

c. Examine the exposed portion of the piston (6) for damage before removing it.

d. Remove the piston (6) by pushing it through the end fitting (1) end of the body assembly.

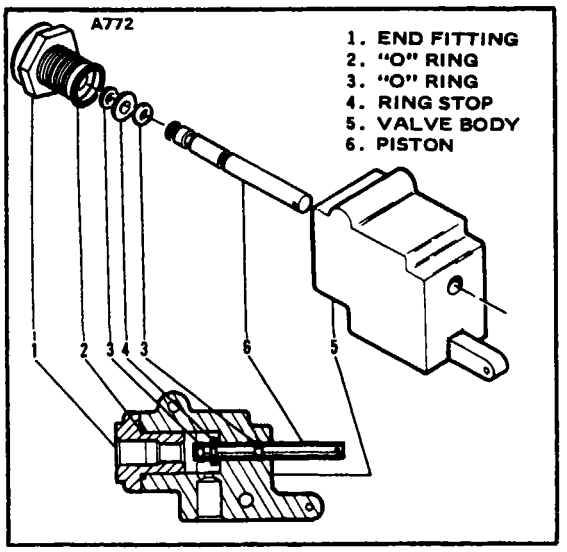

Figure 9-14. Fuel Selector Valve

9-24. CLEANING, INSPECTION AND REPAIR OF FUEL SELECTOR VALVE.

a. Clean the valve components in a suitable dry type cleaning solvent.

b. Inspect the valve for the following:

1. Check that the friction surfaces of the valve body and stem are free of nicks, dents and burrs.

2. Check that the stop on the piston is secure and undamaged.

3. Check that the threaded surfaces of the body and end fitting are not stripped or cross-threaded.

c. Repair to the valve is limited to reconditioning of parts, such as smoothing out minor nicks and scratches and the replacement of "O" ring packings.

9-25. ASSEMBLY OF FUEL SELECTOR VALVE. (Refer to Figure 9-14.)

a. Install new "O" rings (3) to the piston assembly (6).

b. Lubricate "O" rings (3) with lubricating oil (MIL-L-6082) and install the piston (6) to the body assembly (5).

c. Install the end fitting (1) with a new "O" ring (2) to the body assembly (5).

d. Connect the control arm to the piston using washers, rivet and a speed nut.

9-26. LEAK TEST OF FUEL SELECTOR VALVE.

a. Connect the inlet port of the valve to a 50 psi air source.

b. Close valve, apply pressure to 50 psi and submerge in kerosene or a similar petroleum base fluid for two minutes.

c. There should be no evidence of leakage through the valve port around the seat.

d. Disconnect air source and wipe fluid from exterior of valve.

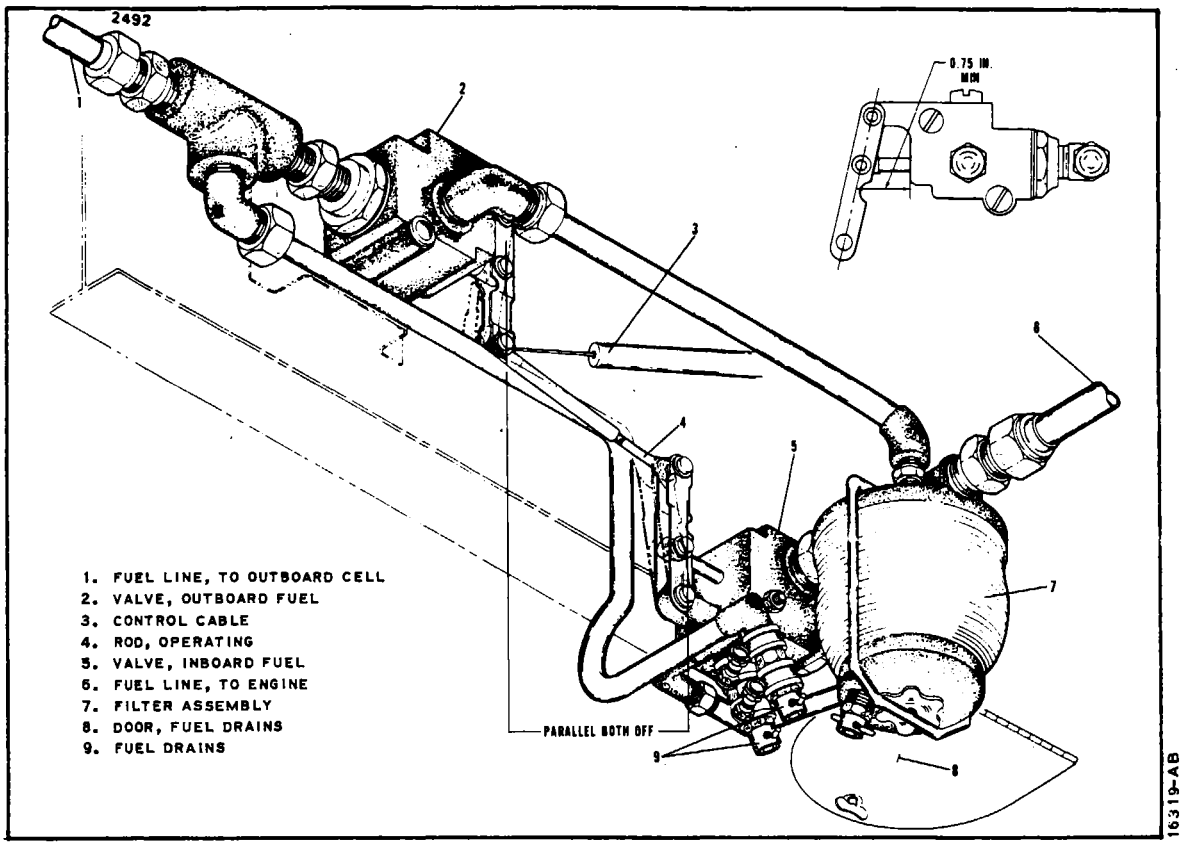

Figure 9-15. Fuel Selector Valve Installation
PA-23-250; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

9-27. INSTALLATION OF FUEL SELECTOR VALVE. (Refer to Figure 9-15.)

a. Install the selector valve for the inboard fuel cell by the following procedures:

1. Assemble all fuel line fittings, if previously removed, and fuel strainer to the selector valve.

2. Position the valve and strainer to the mounting bracket inside the aft bottom section of the appropriate nacelle. Install the two machine screws and self-locking nuts securing the units in place.

3. Connect the fuel lines to the valve and strainer fittings.

4. Connect the operating rod to the valve arm, if previously disconnected, and check for proper adjustment. (Refer to Paragraph 9-28.)

b. Install the selector valve for the outboard fuel cell by the following procedure:

1. Assemble all fuel line fittings, if previously removed, to the selector valve.

2. Position the valve to the mounting bracket inside the aft bottom of the appropriate nacelle. Install the two machine screws and self-locking nut, securing the valve in place.

3. Connect the fuel lines to the valve fittings.

4. Connect the operating rod and control cable to the valve arm and check for proper adjustment. (Refer to Paragraph 9-28.)

c. Fill the fuel cell or cells and allow fuel to flow through the valves. Check for leaks.

d. Install the aft bottom section of the nacelle.

9-28. ADJUSTMENTS FOR FUEL SHUT-OFF VALVE CONTROLS. (Refer to Figure 9-15.)

a. With fuel valve controls disconnected at switch actuating arm (under front floorboard) place valve control levers (in cockpit) in "OFF" position.

b. Adjust the position of the valve arms on the inboard tank valve and the outboard tank valve so that they are parallel to each other.

c. Move each valve to the "ON" position and measure distance between valve face and valve arm attachment pin centerline. A 3/4 inch minimum dimension is required here to obtain adequate fuel flow.

NOTE

If this distance is less than 3/4 inch, adjust the connector rod until 3/4 inch is obtained.

d. Reposition valve arms as described in step "B" (both OFF) and secure control cables at switch actuating arm with switch actuating arm in neutral position between switches.

e. Move inboard valve control lever (in cockpit) to "ON" position and check position of valve arm on outboard tank valve. The arm stop bushing must contact the valve face. Move outboard valve control lever to "ON" position and check. The inboard tank valve stop bushing must contact the valve face.

9-29. FUEL SELECTOR VALVE. (Three-way valve.) (PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2223 to 27-7305126 incl.)

9-30. REMOVAL OF FUEL SELECTOR VALVE. (Refer to Figure 9-17.)

a. Remove the aft bottom section of the nacelle by removing attaching screws.

b. Drain the appropriate fuel cells. (Refer to Draining Fuel System, Section II.)

c. Disconnect the control cable from the control arm by removing the cotter pin and loosening the nut. Draw the wire from the stud.

d. Disconnect the fuel line from the fuel selector valve and strainer fittings.

e. Remove the selector valve and strainer by removing the four machine screws and self-locking nuts installed through the valve assembly.

f. Separate the valve and strainer.

9-31. DISASSEMBLY OF FUEL SELECTOR VALVE. (Refer to Figure 9-16.)

a. Remove the four screws (10) and washers (11) that attach the cap assembly (12) to the valve body (15).

b. Pull the cap assembly straight from the valve body.

c. Push the spool (19) from the valve body.

d. To disassemble the cap assembly (12), remove the roll pin (13) that secures the gear (14) on its shaft (7) by driving the pin with a 1/16 straight drift punch.

e. Remove the gear and spacer (1) from the shaft. Note position of gear in relation to handle.

f. Remove the four screws (9) that secure the packing and seal cover (2). Remove the cover.

g. Remove old packings and seal.

h. If fitting (17) is removed, replace "O" ring packing (18).

9-32. CLEANING, INSPECTION AND REPAIR OF FUEL SELECTOR VALVE.

a. Clean the valve components in a dry cleaning solvent.

b. Inspect the valve for the following:

1. Check that the friction surfaces of the valve are free from nicks, dents and burrs.

2. Check that the teeth of the gear and spool are not damaged.

3. Check that the threaded surfaces are not stripped or cross-threaded.

4. Check that the selector detent mechanism is operating properly.

c. Repair to the valve is limited to reconditioning of parts, such as smoothing out minor nicks and scratches, and the replacing of "O" ring packings and seal.

NOTE

Fittings (17) in valve are special. DO NOT use AN fittings.

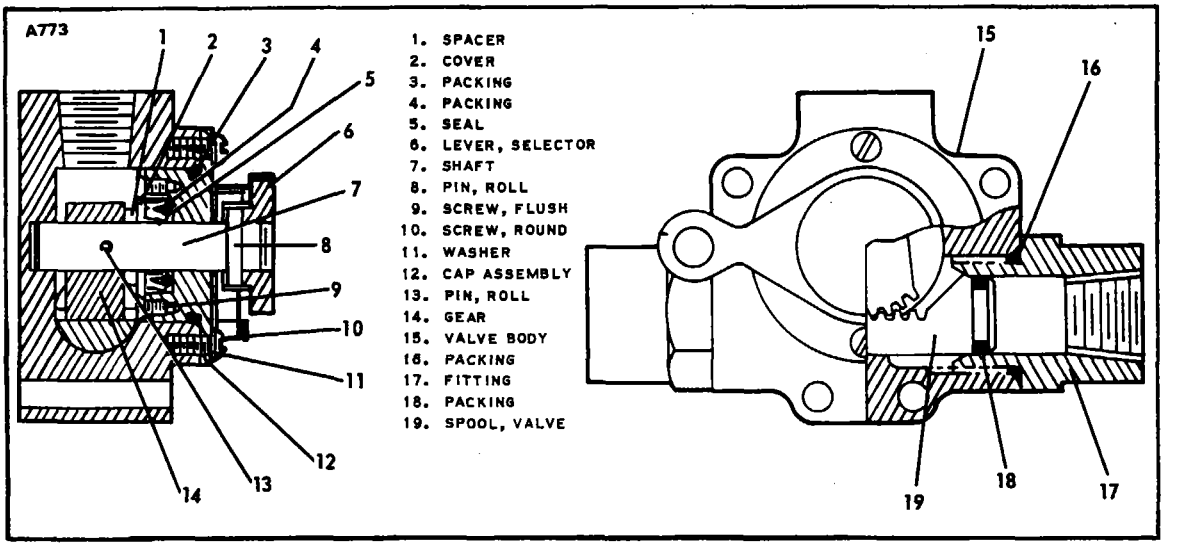

Figure 9-16. Fuel Selector Valve (Scott)

9-33. ASSEMBLY OF FUEL VALVE. (Refer to Figure 9-16.)

a. If either fitting (17) was removed, install the packing (18) and assemble the fitting on the valve body (15). Torque to 20 foot-pounds.

b. Apply a thin coat of Krytox Lubricant (No. 240 AB) to the packings (18), to sprocket of lever (6), and to bore of fittings (17).

c. Insert and center the spool in the valve body.

d. Apply a thin coat of Krytox Lubricant (No. 240 AB) to the seal (5) and packing (4), and install in the cap assembly (12).

e. Ascertain that the shaft (7) is in place and install cover (2). Secure with screws (9).

f. Slide the spacer (1) and gear (14) on the shaft, with the pin holes aligned so that the gear teeth are 90 degrees to the selector lever (6). Secure the gear with roll pin (13). The position of the gear in relation to the selector handle for the valve of the left wing is shown in Figure 9-16; the gear for the right wing is positioned opposite.

g. Install the packing (3) on the cap assembly.

h. Place the selector handle in neutral in relation to the cap and install the cap assembly in the valve body. Secure the cap assembly with screws (10) and washers (11).

i. Check valve operation.

9-34. LEAK TEST OF SELECTOR VALVE.

a. Connect the inlet port of the valve assembly to a 24 psi source.

b. Plug the right-hand port and close the left-hand port by placing the control lever to the right.

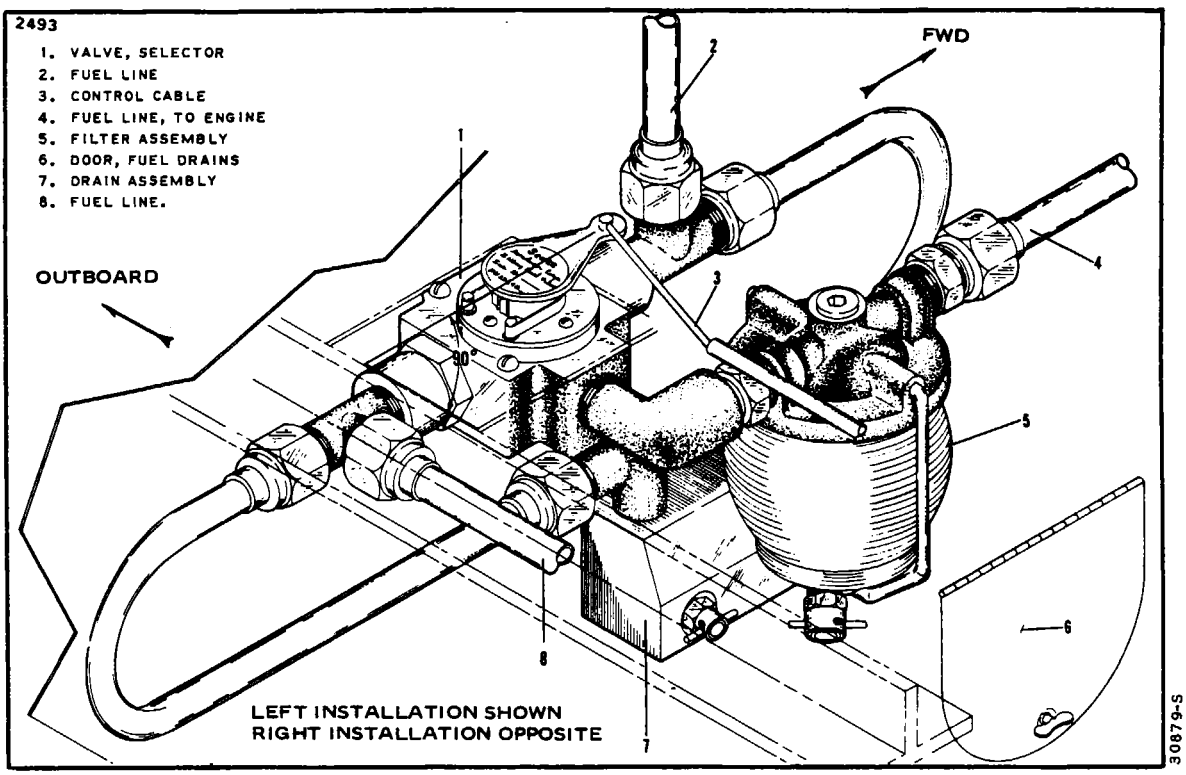

Figure 9-17. Fuel Selector Valve Installation (Scott)
PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2223 to 27-7305126 incl.

c. Apply pressure to 24 psi. There shall be no evidence of leakage either through the port or around the fitting and lever when submerged in kerosene or a similar petroleum-base fluid for 30 seconds.

d. Depressurize, remove the plug from the right hand port, place on left hand port and close right hand port by placing the lever to left.

e. Repeat step c.

f. Disconnect and wipe fluid from exterior.

9-35. INSTALLATION OF FUEL SELECTOR VALVE.

a. Assemble the line fittings, if previously removed, and the strainers to the selector valve.

b. Position the valve and strainer inside the aft bottom section of the appropriate nacelle. Install the machine screws and self-locking nuts, securing the units in place.

c. Connect the fuel lines to the valve and strainer fittings.

d. Connect the cable wire to the valve arm and check for proper adjustment.

(Refer to Paragraph 9-36.)

e. Fill fuel cells allowing fuel to flow through the valve. Check for leaks.

f. Install the aft bottom section of the nacelle.

9-36. ADJUSTMENT AND LUBRICATION OF FUEL SELECTOR VALVE. (Refer to Figure 9-17.)

a. Place the fuel control levers on the fuel control panel box, located between the front seats, in the OFF position. Ascertain that the control cable is connected at the control panel box and clamp at the spar.

b. Place the fuel valve in an OFF position. The fuel valve arm should be at a 90° angle to the spar and can be felt when moved into the OFF position.

c. Clamp the control cable to the spar in the fuselage and at the engine nacelle.

d. Connect and secure the control cable to the shutoff valve.

1. Lubrication: It will be required that the fuel valve selector mechanism be lubricated with ESSO Beacon 325 grease at the following points:

(a) Detent sprocket on the Scott fuel selector valve.

(b) At the attachment of the control cable to the valve.

(c) Inner member of the control cable.

(d) Attachment of control cable to the lever in the cockpit.

NOTE

A check should be made that there is no friction in the system with the control disconnected at the valve.

9-37. FUEL SELECTOR VALVE. (Three Way Valve.) PA-23-235 and PA-23-250 (six place) (Dukes P/N 3564-00-1, -2.)

9-38. REMOVAL OF FUEL SELECTOR VALVE. (Refer to Figure 9-19.)

a. Remove the aft bottom section of the nacelle by removing attaching screws.

b. Drain the appropriate fuel cells. (Refer to Draining Fuel System, Section II.)

NOTE

On Serial Nos. 27-7954057 and up, remove (noting the order of) two flexible push-pull control cable assemblies (with rod end bearings) from the control arm of the fuel selector valve and proceed with Step d following. Otherwise, (Serial Nos. 27-7954056 and earlier) proceed with Step c following.

c. Disconnect the control cable from the control arm by removing the cotter pin and loosening the nut. Draw the wire from the stud.

d. Disconnect the fuel lines from the fuel selector valve and strainer fittings.

e. Remove the selector valve and strainer by removing the mounting hardware.

f. Separate the valve and strainer.

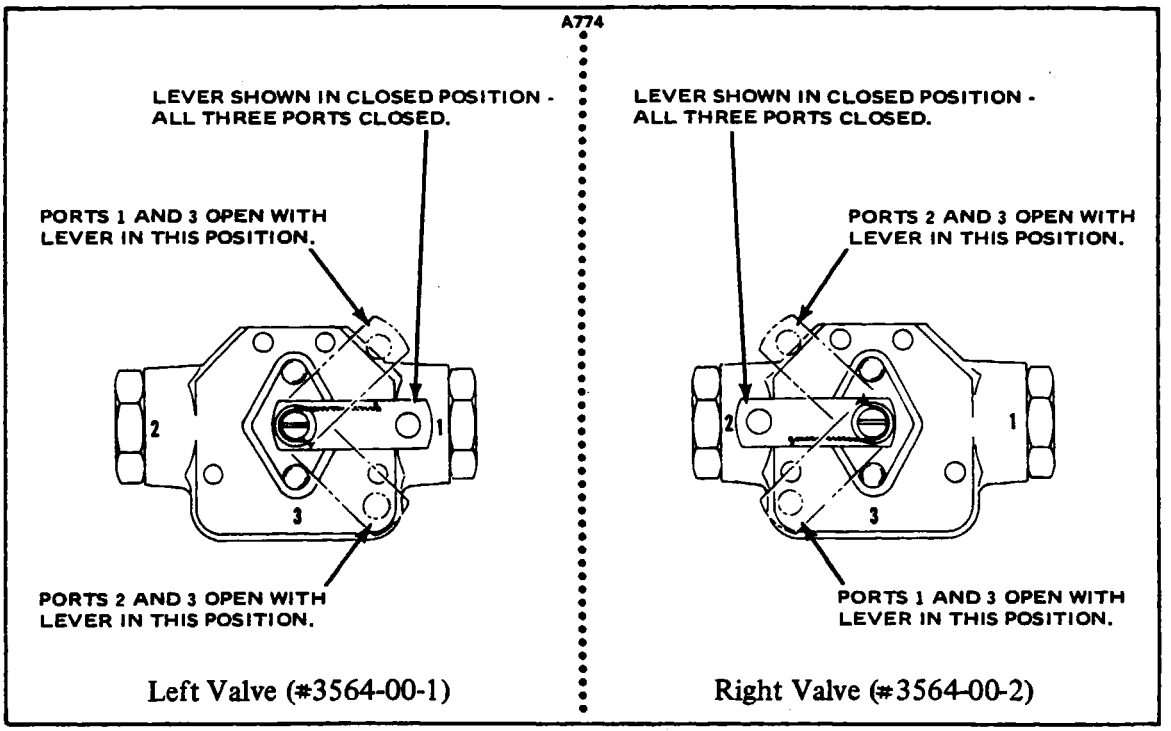

Figure 9-18. Fuel Selector Valve Port Positions

9-39. INSPECTION AND LEAK TEST OF FUEL SELECTOR VALVE. (Refer to Figure 9-18.)

a. Inspect fuel selector valve for proper function. The following function inspection is accomplished with the valve removed from the airplane. (See step b, noted below for function inspection of valve while installed in airplane.)

1. With the selector in the "OFF" position, observe that all three ports are closed.

2. Move the selector lever to either side against the stop. Insert a pipe cleaner or equivalent through the open inlet port. The cleaner should pass through the ball and out port number 3.

3. Move the selector lever to the opposite stop position; use a pipe cleaner to observe that the center and opposite (from step 2) port are open. All lever and port positions must agree with Figure 9-18.

4. If the valve assembly fails any of these steps, remove lever safety wire, screw and washer. Reposition selector lever until all port and lever positions correspond with above inspection as noted in Figure 9-18.

b. Inspect fuel selector valves while installed in the airplane per the following:

1. Ascertain that fuel tanks are full.
2. Turn left and right fuel selector valves and crossfeed valve to off position.
3. At the right and/or left engine compartment(s), gain access to the main fuel feed line at the engine firewall by removing the inboard engine cowl side panels.
4. Disconnect the fuel line from the fitting at the firewall and cap the fuel line to prevent fuel spillage.
5. Place flexible hose over the firewall fitting and place the opposite end of the hose into a five gallon container.

NOTE

Use caution to prevent fuel spillage.

6. Select the "Inboard - Main Tank" position and turn on Emergency Fuel Pump. Observe flow of fuel into container; flow should be full line capacity, indicating proper selector valve function (i.e., no restriction to flow). Allow approximately five gallons to flow into container.
7. Check tank to insure that fuel has been drawn from the selected (inboard) tank.
8. Select "Outboard" tank and repeat step numbers five and six.
9. If no restriction to fuel flow is observed in either tank position, reconnect fuel lines and repeat steps two through seven (above) on opposite engine.
10. Should there be any indication of restricted fuel flow during the above procedure, remove valve from the airplane and conduct function inspection per step a. noted above.

c. Leak test the fuel selector valve using the steps noted below. The valve must first be removed from the airplane. If the following tests indicate a defect, refer to Parts Catalog for replacement valve or components.

NOTE

The leak tests should be conducted with the valve submerged in test fluid of kerosene or similar petroleum-base fluid. The valve should remain submerged when changing lever position.

1. **Shaft and cover leak test.**
   (a) **Plug 1 and 2 ports and position the lever halfway between off position and either stop (neither open or closed). Apply 30 psi air pressure to port 3. There should be no indication of air leakage around the shaft or the cover.**
2. **Internal leak test.**
   (a) **Position the lever in the closed position. Apply 13 psi air pressure to port 1.**
   (b) **Move the lever to the open position for port 2 and back to the closed position.**
   (c) **There should be no air leakage from port 2 or port 3 during the above open-close cycle.**
   (d) **Repeat steps (a) through (c) with 2 psi air pressure. This provides a test of valve packing at a lower psi.**

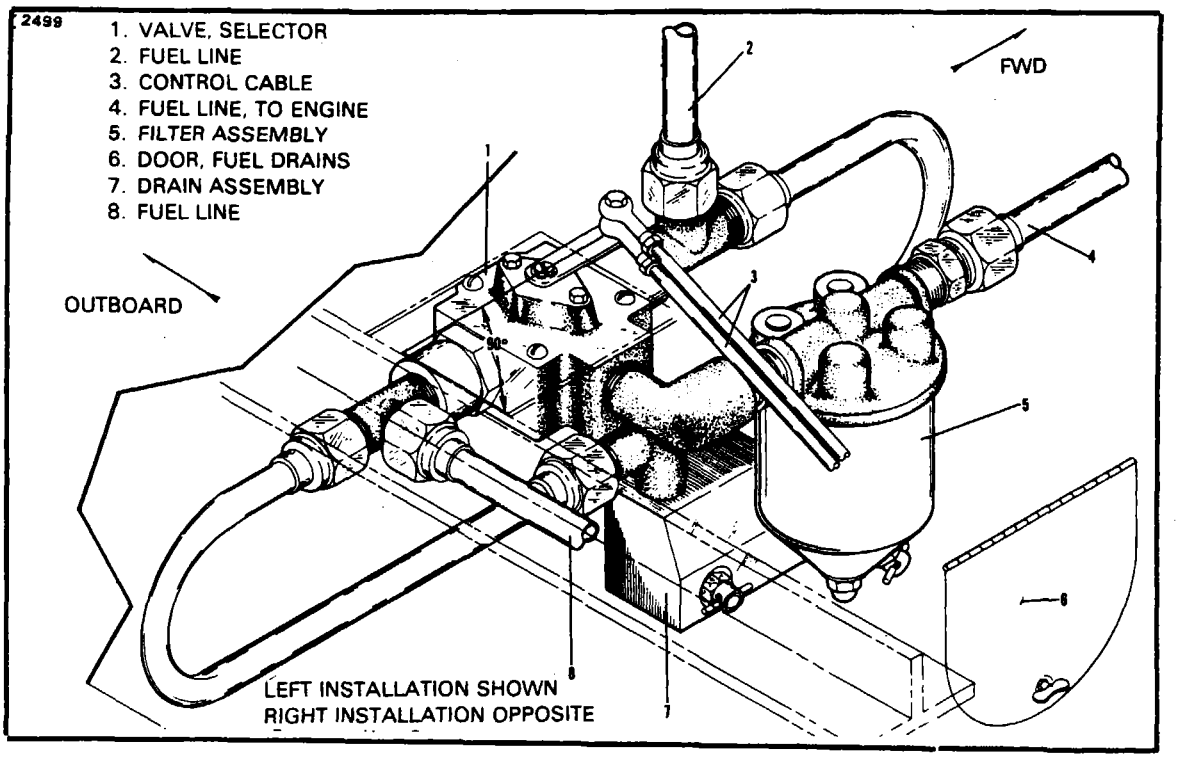

Figure 9-19. Fuel Selector Valve Installation
PA-23-235 and PA-23-250 (six place)
(Dukes P/N 3654-00-1, -2)

(e) Position the lever in the closed position and slowly apply 0 to 15 psi air pressure to port 3. Move the lever 8° clockwise and 8° counterclockwise. There should be no indication of leakage for ports 1 or 2 when the lever is at the closed position or at either 8° position.

d. Check the valve lever for ease of operation from the open position for port 1 to the open position for port 2 (or opposite). Shaft operating torque should not exceed 3 pounds. This includes the breakaway force. The test force must be applied at the lever hole.

9-40. INSTALLATION OF FUEL SELECTOR VALVE. (Refer to Figure 9-19.)

a. Assemble the line fittings, if previously removed, and the strainers to the selector valve. Apply Parker Sealube or equivalent to first thread on elbow.

b. Position the valve and strainer assembly in the mounting bracket and install the machine screws and self-locking nuts securing the unit in place. Do not install mounting screw in the forward inboard hole of the selector valve.

c. Connect the fuel lines to the valve and strainer fittings.

NOTE

On Serial Nos. 27-7954057 and up, reinstall two flexible push-pull control cable assemblies (with rod end bearings) in the reverse order previously removed from the control arm of the fuel selector valve, and adjust lengths per Paragraph 9-42 and the proceed with Step e following. Otherwise, (for Serial Nos. 27-7954056 and earlier) proceed with Step d following.

d. Connect the cable wire to the valve arm and adjust per Paragraph 9-41.
e. Fill the fuel cells and allow fuel to flow through the valve and strainer; check for leaks.
f. Install the aft bottom section of the nacelle.

9-41. ADJUSTMENT AND LUBRICATION OF FUEL SELECTOR VALVE. (PA-23-250 (six place) up to Serial Nos. 27-7954056 incl.)

a. Place the fuel control levers on the fuel control box in the OFF position. Check to be certain the control cable is connected at the control panel box and clamp at the spar.

b. Place the fuel valve in the OFF position. The fuel valve lever should be at a 90 degree angle to the spar. Operate the valve lever and check to be sure the valve detents in the OFF position.

c. Clamp the control cable to the spar in the fuselage and at the engine nacelle.
d. Connect and secure the control cable to the shutoff valve.
e. Lubricate the following points with Exxon Beacon 325 grease:
   1. At the attachment of the control cable to the valve.
   2. Inner member of the control cable.
   3. Attachment of control cable to the lever in the cockpit.

9-42. ADJUSTMENT AND LUBRICATION OF FUEL SELECTOR VALVE. (PA-23-250 (six place), Serial Nos. 27-7954057 and up.)

a. Check to be certain the rod end bearing of the control cable is connected at the control box.

b. With the fuel control lever on the control box held in the off position and the fuel valve in the off position, adjust the effective length of the control cable by proper positioning of the rod end bearing on the cable assembly and mount same to the control arm of the fuel selector valve.

NOTE

OFF position of the control arm is attained with its centerline at 90 degrees with the spar.

c. With the switch actuator (Figure 9-28) centered between the fuel tank switches and the selector valve arm at the OFF position adjust the effective length of the control cable (to the switch actuator) by proper positioning of the rod end bearing on the cable assembly and mount same to the control arm of the fuel selector valve.

d. Secure both rod end bearings to the control arm of the selector valve.
e. Lubricate the inner member of the control cables with Exxon Beacon 325 grease and the rod end bearings with MIL-L-7870.

9-43. FUEL SELECTOR VALVE CONTROL CABLES. (See Figure 9-27.) (PA-23-235, PA-23-250, PA-23-250 (six place), Serial Nos. 27-2000 to 27-7954056 incl.)

9-44. REMOVAL OF FUEL SELECTOR VALVE CONTROL CABLES. (Serial Nos. to 27-7954056 incl.)

a. Remove the outboard control cable by the following procedure:
1. Remove the top aft part of the nacelle by removing attaching screws.
2. Remove the access panel covering the main spar from the bottom section of the nacelle. (Refer to Access and Inspection Provisions, Section II.)
3. Remove the clamps holding the cable next to the selector valve.
4. Disconnect the cable from the selector valve arm.
5. Attach a fish line or similar material to the outboard end of the cable.
6. Remove the clamps holding the cable inside the fuselage on the forward side of the main spar.
7. Disconnect the control cable from the actuator arm on the main spar.
8. Remove the outboard cable drawing it inboard from the wing.

b. Remove the inboard control cable by the following procedure:
1. Remove the access panel covering the main spar from the bottom of the fuselage, if not previously removed. (Refer to Access and Inspection Provisions, Section II.)
2. Remove the clamps holding the cable to the main spar and inside the fuel control box.
3. Disconnect the cable from the actuator arm on the main spar.
4. Disconnect the cable from the control handle assembly inside the fuel control box.
5. Remove the cable.

9-45. INSTALLATION OF FUEL SELECTOR VALVE CONTROL CABLES. (Serial Nos. to 27-7954056 incl.)

a. The outboard cable may be installed by the following procedure:
1. Draw the cable from the fuselage through the wing to the nacelle.
2. Ascertain that the selector valve is in the OFF position and connect the cable end to the valve arm.

NOTE

If the inboard cable is also being installed, perform Steps 3 thru 6 simultaneously with Steps 3 thru 6 of Part b.

3. Position the actuator arm so the screw in the end is centered between the two fuel quantity switches.
4. Insert the cable end to the swivel fitting on the actuator arm.
5. Maintaining an OFF position of the selector valve and the centered position of the actuator arm, tighten the swivel fitting nut and safety with a cotter pin.
6. Install the cable clamps on the main spar and inside the nacelle.

b. The inboard cable may be installed by the following procedure:
1. Position the cable and connect it to the control handle inside the fuel control box.
2. Ascertain that the fuel control handle is in the OFF position.
3. Position the actuator arm so the screw in the end is centered between the two fuel quantity switches.
4. Insert the remaining cable end to the swivel fitting on the actuator arm.
5. Maintaining an OFF position of the control handle and the centered position of the actuator arm tighten the swivel fitting nut and safety with a cotter pin.
6. Install the cable clamps on the main spar and inside the fuel control box.

c. Check the operation of the cable and selector valve. (Refer to Figure 9-27.) Visually check control cable wires at the related swivel fittings for indications of binding, kinking, or bending; have someone in the cockpit operate fuel controls while mechanic inspects the swivel fittings for indications of binding, kinking and/or bending. Replace cables exhibiting any of the above conditions.

d. Check the adjustment of the fuel indicating switches. The actuating screw should be adjusted to actuate the switch and allow free play after actuating, so as not to damage the switch.

e. Install the access panel to the bottom of the fuselage and the top of the nacelle.

9-46. FUEL SELECTOR VALVE CONTROL CABLES. (See Figure 9-28.) (PA-23-250 (six place), Serial Nos. 27-7954057 and up.)

9-47. REMOVAL OF FUEL SELECTOR CONTROL VALVE CABLES. (Serial Nos. 27-7954057 and up.)

a. Gain access to the flexible push-pull fuel control cable assemblies as follows:
1. Release the top aft part of the nacelle by removing the attaching screws.
2. From the bottom section of the nacelle, remove the access panel covering the main spar.
3. From the bottom of the fuselage, remove the access panel covering the main spar and exposing the fuel quantity actuating switch arm.

b. Remove the flexible push-pull fuel control cable assemblies as follows:
1. Disconnect the outboard end of the push-pull cable assembly from the fuel selector control arm by removing the attaching hardware.
2. Disconnect the inboard end of the push-pull assemblies (one from the fuel quantity switch actuator arm and one from the internal arm on the fuel tank control lever) by removing the hardware securing the respective rod-end bearings.
3. Release the outboard ends of both push-pull cable assemblies by removing the cable anchor bracket holding the cable assemblies in place.

4. Release the inboard end of the cable assembly (connected to the fuel quantity switch actuator) by removing the cable retainer holding the cable assembly in place.

5. Attach a fish line or similar material to the outboard end of the cable. Remove the cable by drawing it inboard from the wing.

6. Release the inboard end of the cable assembly (connected to the fuel tank control lever) by removing the cable retainer holding the cable assembly in place.

7. Attach a fish line or similar material to the outboard end of the cable and remove the cable by drawing it inboard from the wing.

9-48. INSTALLATION OF FUEL SELECTOR CONTROL VALVE CABLES. (Serial Nos. 27-7954027 and up.)

a. Draw the cables from the fuselage outboard toward the nacelle.

b. Set the fuel selector valve in the OFF position (with the lever arm at 90 degrees to the wing spar as shown in Figure 9-19.)

c. Assemble and secure the rod-end bearings to the fuel selector valve arm using hardware previously removed. (Be sure the longer of the two control cable assemblies is mounted closest to the selector valve arm.)

CAUTION

Observe standard precautions regarding proper and sufficient thread engagement when assembling and securing rod-end bearings to the selector valve arm.

d. Secure the two cable assemblies in place using the dual cable anchor bracket and hardware previously removed.

e. Secure the sheaths of both cable assemblies within the fuselage, using one cable retainer each and hardware previously removed.

f. With the fuel selector valve arm at 90 degrees with the wing spar (OFF position) and the fuel quantity actuator arm set midway between the fuel quantity switches, set and secure the length of the cable to be connected to the fuel quantity actuator arm.

g. Secure the rod-end bearing to fuel quantity arm. Recheck position of fuel selector valve arm (at 90 degrees with spar) and switch actuator arm (midway between actuating switches). If necessary, readjust length and resecure cable assembly to actuator arm.

h. With the fuel selector lever arm at OFF position (90 degrees with spar) and the fuel tank selector lever in the cabin at "OFF" position, set and secure the length of the cable to be connected to the internal arm of the fuel tank selector lever.

i. Secure rod-end bearing to the internal arm of the fuel tank selector lever.

9-49. FUEL CROSSFEED VALVE.

9-50. REMOVAL OF CROSSFEED VALVE.

a. Remove the two front seats from the airplane.

b. Remove the attaching screws along the sides and bottom of the fuel control box.

c. Remove the crossfeed drain knob from the lower front of the fuel control box by one of the following procedures:

1. On PA-23-235, PA-23-250, and PA-23-250 (six place) airplanes with Serial Nos. 27-2000 to 27-2504, remove the knob by pulling it forward from the stem.

2. On PA-23-250 (six place) airplanes with Serial Nos. 27-2505 and up, remove the knob by removing the socket set screw from the bottom of the knob and pulling it forward from the stem.

d. On PA-23-250 (six place) airplanes with Serial Nos. 27-2505 and up, remove the crossfeed valve knob by unscrewing it from its handle on top of the control box.

e. Lean the box forward away from the main spar cover and remove the machine screws and self-locking nuts from the heater fuel valve handle.

f. Disconnect all quick disconnect fuel lines from the crossfeed valve, crossfeed drain and heater fuel valve.

g. Disconnect the spring from the crossfeed drain valve.

h. Disconnect the crossfeed drain line from the bottom of the crossfeed valve.

i. Remove the two machine screws and self-locking nuts securing the valve to its bracket.

j. Remove the crossfeed valve, crossfeed drain and heater fuel valve from the control box.

k. Separate the fuel valve from the other units.

9-51. DISASSEMBLY OF FUEL CROSSFEED VALVE. (Refer to Figure 9-20.)

a. Remove the end fitting (1) and "O" ring (2) by unscrewing it from the valve body (5).

b. Disconnect the control arm from the valve stem by removing the speed nut, washers and rivet.

c. Examine the exposed portion of the piston (6) for damage before removing it.

d. Remove the piston (6) by pushing it through the end fitting (1) end of the body assembly.

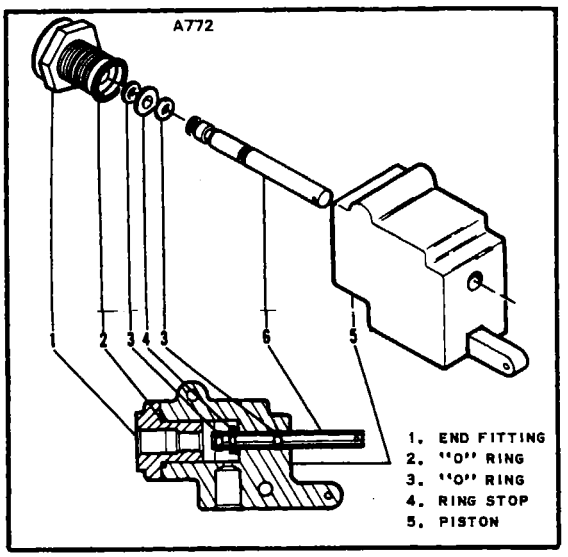

Figure 9-20. Fuel Crossfeed Valve

9-52. CLEANING, INSPECTION AND REPAIR OF FUEL CROSSFEED VALVE.

a. Clean the valve components in a suitable dry type cleaning solvent.

b. Inspect the valve for the following:

1. Check that the friction surfaces of the valve body and stem are free from nicks, dents and burrs.

2. Check that the stop on the piston is secure and undamaged.

3. Check that the threaded surfaces of the body and end fitting are not stripped or cross-threaded.

c. Repair to the valve is limited to reconditioning of parts, such as smoothing out minor nicks and scratches, and the replacement of "O" ring packings.

9-53. ASSEMBLY OF FUEL CROSSFEED VALVE. (Refer to Figure 9-20.)

a. Install new "O" rings (3) to the piston assembly (6).

b. Lubricate "O" rings (3) with lubricating oil (MIL-L-6082) and install the piston (6) to the body assembly (5).

c. Install the end fitting (1) with a new "O" ring (2) to the body assembly (5).

d. Connect the control arm to the piston using washers, rivet and a speed nut.

9-54. LEAK TEST OF CROSSFEED VALVE.

a. Connect the inlet port of the valve to a 50 psi air source.

b. Close valve, apply pressure to 50 psi and submerge in kerosene or a similar petroleum base fluid for two minutes.

c. There should be no evidence of leakage, through the valve port around the seat.

d. Disconnect air source and wipe fluid from exterior of valve.

9-55. INSTALLATION OF FUEL CROSSFEED VALVE.

a. Assemble the crossfeed drain, heater fuel valve and line fittings to the crossfeed valve.

b. Position the assembled unit inside the fuel control box and install the machine screws and self-locking nuts, securing the crossfeed valve to its bracket.

c. Connect the spring to the crossfeed drain valve.

d. Connect the crossfeed drain line to the bottom of the crossfeed valve and safety with MS20995-C32 wire.

e. Connect the fuel lines to the crossfeed valve, crossfeed drain and heater fuel valve.

f. Position the heater fuel knob and stem to the heater fuel valve handle and connect the two with machine screws and self-locking nuts.

g. On PA-23-250 (six place) airplanes with Serial Nos. 27-2505 and up, install the crossfeed knob to the valve handle on top of the control box.

h. Install the crossfeed drain knob to the stem on the lower front side of the control box by one of the following procedures:

1. On PA-23-235, PA-23-250, and PA-23-250 (six place) airplanes with Serial Nos. 27-2000 to 27-2504 incl., align the knob to the stem and press firmly in a parallel direction with the stem.

2. On PA-23-250 (six place) airplanes with Serial Nos. 27-2505 and up, position the knob on the stem with the pointed end to the right. Install the socket set screw in the bottom of the knob.

i. Operate the crossfeed system and check all fittings for evidence of fuel leakage.

j. Position the fuel control box to the main spar cover and install attaching screws.

k. Install the two front seats.

9-56. FUEL FILTER.

9-57. REMOVAL OF FUEL FILTER. The instructions given are for removal of the complete filter assembly from the airplane. For cleaning and servicing purposes only, refer to paragraphs 9-58 or 9-59 thru 9-61.

a. Drain the fuel cells on the side which the filter is to be removed and close the fuel selector valves. (Refer to Draining Fuel System, Section II.)

b. Remove the aft bottom section of the nacelle by removing attaching screws.

c. Disconnect the control cable or control rod from the selector valve by removing the cotter pin and nut or pin.

d. Disconnect the quick-disconnect fuel line fittings from the selector valve and filter.

e. Remove the attaching machine screws and self-locking nuts from the selector valve.

f. Remove the filter and selector valve from the airplane.

9-58. DISASSEMBLY, INSPECTION AND ASSEMBLY OF FUEL FILTER. (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.) (Refer to Figure 9-21.) If the filter assembly has been removed from the airplane, disregard steps a, b and j.

a. Move the fuel selector valve to the OFF position.

b. Open the fuel strainer access door on the bottom inboard side of the nacelle.

c. Cut the safety wire and loosen the round nut on the bottom of the strainer.

d. Swing the bail off to the side and remove the bowl.

e. Remove the bowl gasket and screen.

f. Inspect the screen and bowl quick drain. If the screen wire is broken or frayed, it should be replaced. If the quick drain has been leaking, the "O" ring should be replaced.

g. Install the screen and a new gasket to the strainer housing.

h. Position the bowl and bail, and tighten the round nut at the bottom of the bowl.

i. Safety the round nut and bail with MS20995-C32 safety wire.

j. Open the selector valve and check the strainer for leakage.

9-59. DISASSEMBLY OF FUEL FILTER ASSEMBLY. PA-23-250 (six place), Serial Nos. 27-2505 and up.) (Refer to Figure 9-22.)

a. Cut safety wire (16) and remove the cap nut (17) from the bottom of the filter bowl (13).

b. Take the bowl from the filter housing (1).

c. The bowl gasket (5) may be removed from the housing.

d. Loosen and remove both the check nut (11) and the nut (10) from the stud (12) that holds the filter cartridge subassembly.

e. Slide the filter cartridge from the stud. The filter discs (7) and washers (8) need not be separated from the element outlet tube (6) for normal cleaning.

f. If it is necessary to disassemble the filter cartridge, remove the retainer cup (9) from the outlet tube (5) and slide the discs (7) and washers (8) from the outlet tube. Do not use a screw driver or sharp tool that may damage the discs.

g. The filter by-pass assembly may be removed by using the proper size screw driver and turning out the relief valve seat (4). Then remove the check ball (3) and spring (2).

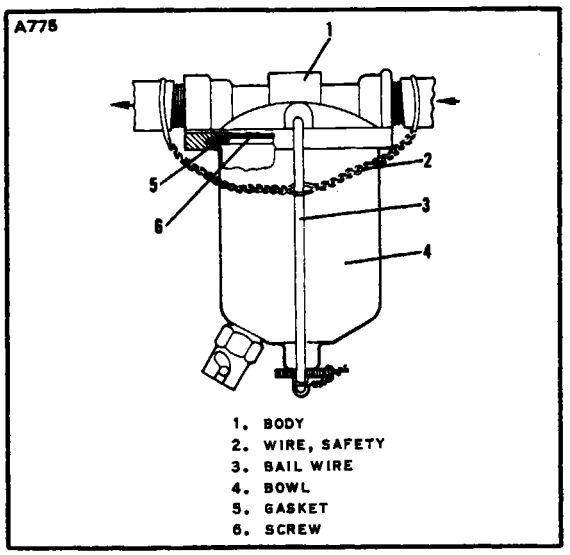

Figure 9-21. Fuel Filter PA-23-235; PA-23-250; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

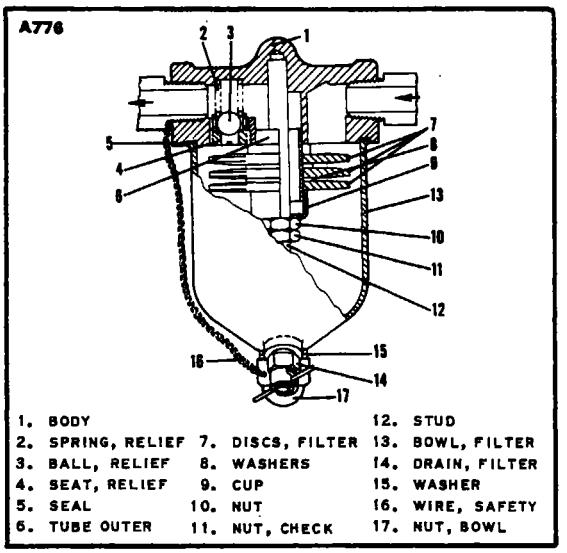

Figure 9-22. Fuel Filter PA-23-250 (Six place), Serial Nos. 27-2505 and up

9-60. CLEANING, INSPECTION AND REPAIR OF FUEL FILTER. (PA-23-250 (six place), Serial Nos. 27-2505 and up.) (Refer to Figure 9-22.)

a. Wash the element in oil solvent such as mineral spirits. (It is not necessary to remove discs from element outlet tube for normal cleaning.) Plug open ends of element outlet tube while washing to keep out dirt.

b. Inspect filter discs for damage and broken screens.

c. Check condition of bowl gaskets (5 and 15).

d. Check condition of bowl drain and drain "O" ring.

e. Check for corrosion of filter parts.

f. Check movement of by-pass valve.

g. Check condition of filter rubber shock mounts.

h. Normal repairs necessary for the filter are replacement of bowl gaskets and damaged filter discs.

9-61. ASSEMBLY OF FUEL FILTER. (PA-23-250 (six place), Serial Nos. 27-2505 and up.) (Refer to Figure 9-22.)

a. If removed, install by-pass valve spring (2), relief ball (3) and seat (4).

b. Place the filter cartridge (assembled) on the housing stud (12). Ascertain that the end of the outlet tube (6) has positioned itself in the filter body (1).

c. Secure the filter cartridge with nut (10) and check nut.

d. Place bowl gasket (5) on housing and install bowl (13), gasket (15) and cap

nut (16). Tighten the cap nut and safety.

e. Install the filter. If the filter was not removed, proceed to step g of paragraph 9-62.

9-62. INSTALLATION OF FUEL FILTER ASSEMBLY.

a. Assemble the fuel selector valve to the strainer, if previously removed.

b. Position the assembled unit inside the lower part of the nacelle.

c. Install machine screws and locking nuts securing the selector valve in place.

d. Connect the fuel lines to the filter and selector valve.

e. Connect the control cable or control rod to the selector valve. Check adjustment of the fuel selector valve cable as described in paragraphs 9-28 and 9-36.

f. Fill the fuel cell or cells.

g. Open the fuel selector valve allowing fuel to flow to the filter.

h. Check the fuel line fittings and filter for evidence of fuel leakage.

NOTE

Ensure fuel filter drain does not open when door is closed.

i. Install the bottom aft section of the nacelle.

9-63. ELECTRIC FUEL PUMPS.

9-64. PLUNGER FUEL PUMPS (BENDIX). (PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.)

9-65. REMOVAL OF FUEL PUMP.

a. Remove the inboard access panel on the nacelle that the fuel pump is to be removed from.

b. Determine that the fuel selector valve is in the OFF position.

c. Disconnect the electrical lead.

d. Disconnect the fuel lines from the pump fittings.

e. Remove the pumps by removing the nuts and bolts securing them to the mounting bracket.

9-66. DISASSEMBLY OF FUEL PUMP. (Refer to Figure 9-23.) The following procedure is given for complete disassembly of the fuel pump. For cleaning and servicing purposes only, refer to step 1 of a or b, then proceed to paragraph 9-67 for Cleaning, Inspection and Repair of Component Parts.

a. Early type pump:

1. Cut the safety wire and remove the bottom cover, gasket and filter screen from the pump.

NOTE

If the screen does not come out, use caution removing it from the pump housing so as not to damage it.

2. Remove the three screws securing the plunger spring cup inside the pump. Remove the cup and gasket.

3. Pull the plunger spring and plunger assembly from the pump with fingers.

CAUTION

Do not remove the buffer spring and valve from the plunger assembly.

Do not tamper with seal at center of mounting bracket at side of pump as it retains the dry gas, which surrounds the electric system, in the upper portion of the pump.

b. Late type pump:

1. Cut the safety wire and remove the bottom cover, gasket, magnet and filter screen from the pump.

NOTE

If the screen does not come out use caution removing it from the pump housing so as not to damage it.

2. Remove the retainer spring from the plunger tube using thin nose pliers to spread and remove the ends of the retainer from the tube.

3. Remove the washer, "O" ring seal, cup valve, plunger assembly from the pump.

CAUTION

Do not remove the buffer spring and valve from the plunger assembly.

Do not tamper with seal at center of mounting bracket at side of pump as it retains the dry gas, which surrounds the electric system, in the upper portion of the pump.

9-67. CLEANING, INSPECTION AND REPAIR OF FUEL PUMP.

a. Clean all parts with a suitable dry type solvent. If the plunger assembly does not come clean or there are any rough spots, polish gently with crocus cloth.

b. Inspect the pump for the following:

1. Check the filter screen for damage or distortion.

2. Gently touch the cup valve and check for freedom of movement. Do not disassemble.

3. Shake the plunger assembly and listen for clicks to indicate valve action.

4. On the late model pumps, check the condition of the "O" ring.

5. Check the condition of the cover gasket and plunger spring cup gasket.

c. Repair of the pump is limited to replacement of parts found defective during inspection.

9-68. RESISTANCE CHECK (PLUNGER TYPE PUMP). To check the resistance of the pump, connect an ohmmeter to the lead wire of the pump and the pump body. A reading of 4.87 to 6.4 ohms for a 14-volt pump should be obtained.

9-69. ASSEMBLY OF FUEL PUMP. (Refer to Figure 9-23.)

a. Early type pump:

1. Insert the plunger assembly (10) in the tube with the buffer spring end first. Check fit by slowly raising and lowering the plunger in the tube. It should move fully without any tendency to stick. If a click cannot be heard, the interrupter assembly is not functioning properly in which case the pump should be replaced.

2. Install the component parts in the following order: Cup valve, "O" ring seal, and washer. Install the retainer spring securing the components inside the pump housing.

3. Place the cover gasket and magnet in the bottom cover with the filter screw.

4. Carefully guide the screen around the plunger spring cup. The screen must fit snugly at both ends. Do not pinch or distort the screw. Draw the bottom cover tight with a wrench and safety.

b. Late type pump:

1. Insert the plunger spring assembly (10) in the tube with the buffer spring end first. Check fit by slowly raising and lowering the plunger in the tube. It should move fully without any tendency to stick. If a click cannot be heard, the interrupter assembly is not functioning properly in which case the pump should be replaced.

2. Install the plunger spring cup gasket (use a new one) and the plunger spring cup. Draw the screws reasonably tight, but do not over-tighten them. Be

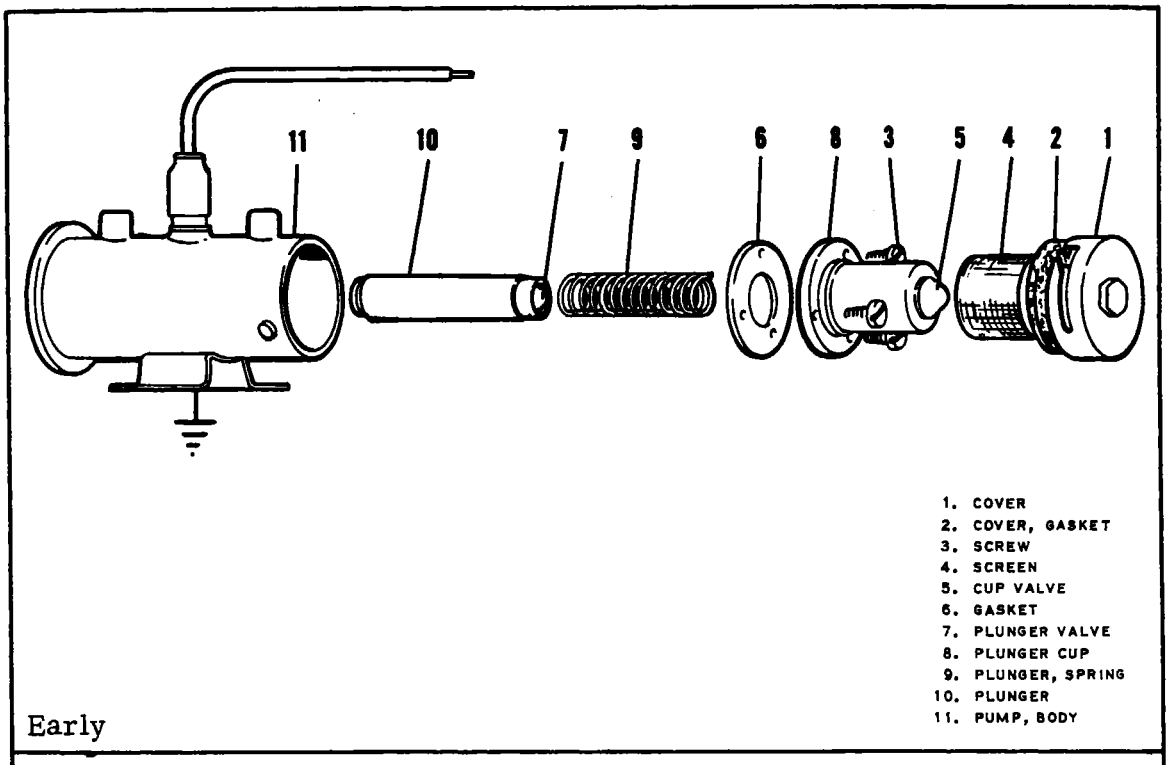

Figure 9-23. Bendix Electric Fuel Pumps (Early and Late)

sure the cup is not cocked to prevent the plunger from binding in the tube.

3. Place the filter screen around the bottom cover magnet.

4. Carefully guide the screen around the plunger spring cup. The screen must fit snugly at both ends. Do not pinch or distort the screen. Draw the bottom cover tight with a wrench and safety with MS20995-C32 wire.

9-70. INSTALLATION OF FUEL PUMP.

a. Position the fuel pumps inside the engine nacelle and secure to its mounting bracket with attaching bolts and nuts.

b. Connect the fuel lines to the pump and tighten.

c. Connect the electrical lead to the fuel pumps.

d. Turn fuel selector valve in the ON position.

e. Operate fuel pump and inspect for leaks.

f. Secure access panel to engine nacelle.

9-71. ADJUSTMENT OF ELECTRIC FUEL PUMP (BENCH TEST).

a. Ascertain that the pump is sufficiently lubricated to prevent damage if run dry for a period greater than five minutes.

b. Connect the electrical lead of one pump to a 14-volt dc power source.

c. Using a suitable container with the proper octane fuel, connect a fuel line from a container to the inlet side of the pump.

d. Connect another line from the outlet side of the pump to a pressure gauge and by-pass valve and back to the container.

e. Run the pump with the by-pass valve open until a steady flow of fuel is obtained. Then close the by-pass valve and check the pressure gauge for the proper reading of 4 to 4. 75 psi maximum, no flow.

f. Repeat steps b through e for the second fuel pump.

g. If the proper pressure is not obtained, the plunger spring may be replaced or it may be necessary to replace the complete pump assembly.

9-72. ADJUSTMENT OF ELECTRIC FUEL PUMP (IN AIRPLANE).

a. With the access panel removed and the fuel selector in the OFF position, remove the fuel line from the outlet end of the pump.

b. Connect a test line with a by-pass valve and pressure gauge to the outlet end of the pump to be checked.

c. Place a container below the pump to catch any fuel from the test line during the adjustment of the pump.

d. Disconnect the electrical lead to the pump that is not being checked.

e. Turn the fuel selector on, open the by-pass valve on the test line and start

the pump.

f. When a steady flow of fuel is obtained, close the by-pass valve and check the reading on the pressure gauge. It should read 4 to 4.75 psi maximum, no flow. Do not keep by-pass valve closed for more than one minute during pump operation and adjustment.

g. Repeat steps b through f for the other pump.

h. If the proper pressure is not obtained, the plunger spring may be replaced or it may be necessary to replace the complete pump assembly.

i. Reconnect the orignal fuel line to the pump. Open fuel selector and run the pump to check for any fuel leaks.

j. Shut off the pump, close the fuel selector and replace and secure the access panel.

9-73. ROTARY FUEL PUMPS (WELDON). (PA-23-250 (six place), Serial Nos. 27-2322 and up.

9-74. REMOVAL OF FUEL PUMPS.

a. Remove the top center section or access panel of the nacelle.

b. Determine that the fuel selector valve is in the OFF position.

c. Disconnect the fuel lines from the pump fittings.

d. Disconnect the electrical leads.

e. Remove the pump assembly by cutting the safety wire and removing the four attaching bolts inside the wheel well.

9-75. DISASSEMBLY OF FUEL PUMP. (Refer to Figure 9-24.)

Disassembly and assembly of the Weldon fuel pump should only be attempted when the below listed tools are available to the mechanic. Should these tools not be available, the pump should be returned to:

The Weldon Tool Co.
3000 Woodhill Road
Cleveland, Ohio 44104

Name	P/N or Description	Source
Seal Installation Tool	TP-617	Weldon Tool Co.
Seal Installation Tool	TP-723	Obtain Locally
Steel Rod	3/16" Dia. x 3" length	Obtain Locally
Fixture	15/16" I.D. x 5/8" Deep	Obtain Locally
Tube	13/16" I.D., 1 7/64" O.D. (Max.) x 1" Length (Min.)	Obtain Locally
Alignment Checking Tool	TP-793	Weldon Tool Co.

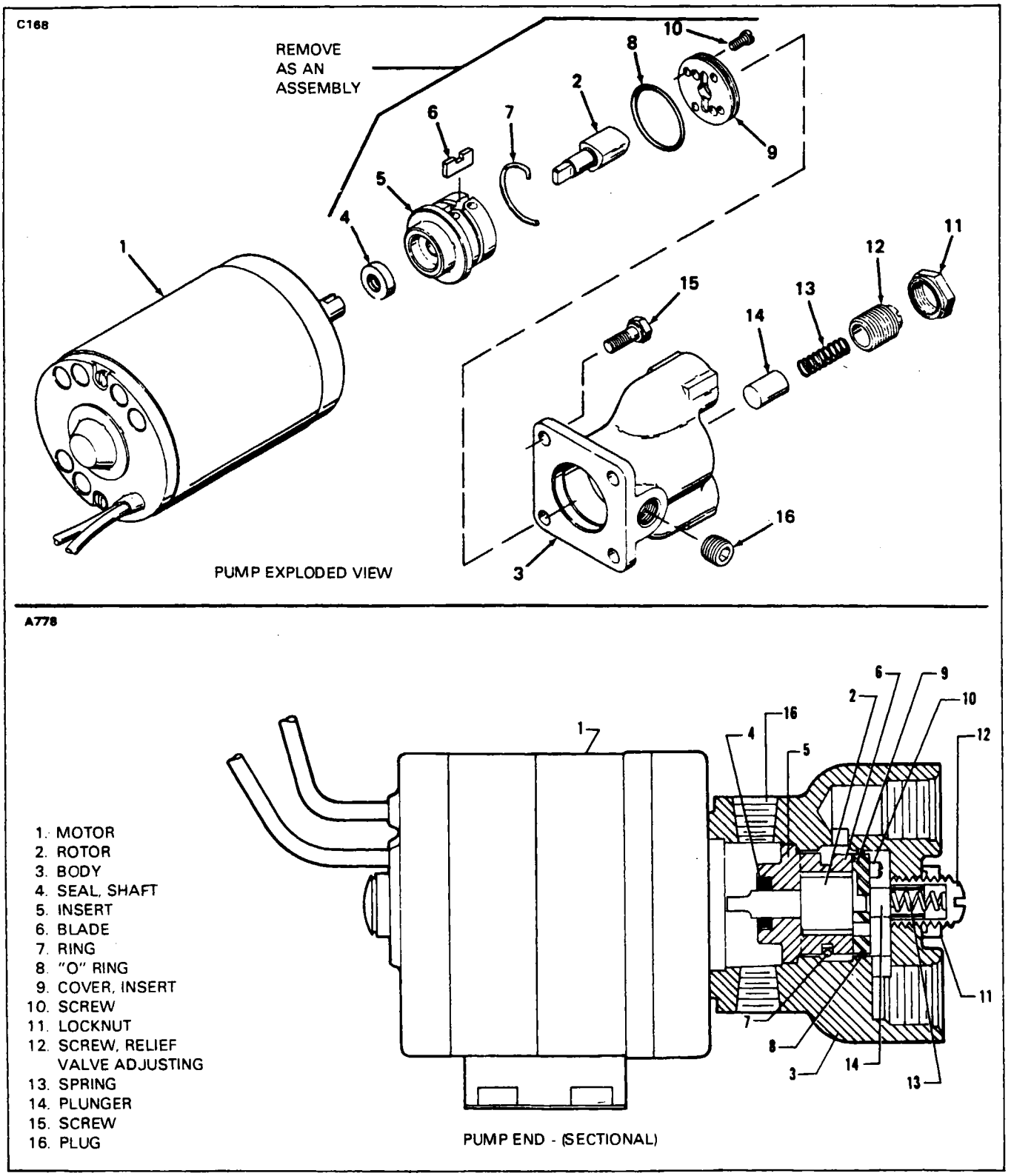

Figure 9-24. Weldon Rotary Fuel Pump

a. Remove the four screws which secure the pump assembly to the motor assembly.
b. Separate the motor assembly from the pump assembly.

NOTE

The drive motor is non-repairable. If defective, replace with new motor. Pump performance may be altered as a result of installing a new motor assembly. Therefore, retest is necessary and pressure relief valve adjustment may be required.

c. Remove locknut, adjusting screw, spring and plunger from end of pump assembly.
d. Insert a 3/16 inch diameter rod through the 1/2 inch tapped hole, from which the relief valve adjusting screw was removed and through the center hole in the insert cover until the rotor is contacted. Apply pressure to the rod with an arbor press to unseat and remove the pumping element from the pump housing. (Refer to Figure 9-24.)

NOTE

To facilitate reassembly, index the relative position of the insert cover to the insert. Also, note proper orientation of the two inlet holes in the insert cover to assist in proper reassembly.

e. Remove the screws which secure the insert cover to the insert and remove the cover.
f. Remove the rotor, blade retaining ring and blades from the insert.
g. To remove the shaft seal from the insert, clamp a simple fixture having a 15/16 inch diameter hole 5/8 inch deep, in a vise (A 15/16 inch socket wrench head may be used as a temporary fixture). Place the insert into the fixture with the shaft seal end up (Refer to Figure 9-24). Using a small screwdriver inserted in the shaft hole of the seal, pry the seal from the seal well. Use extreme caution to avoid damage to the seal well area.
h. Wash pump parts in clean solvent and dry with filtered compressed air.

9-76. INSPECTION AND REPAIR.

a. Inspect those areas from which parts have been removed. Smooth nicks, scratches and burrs in these areas to avoid damage to new seals.
b. Replace "O" rings and seals which have been removed.

NOTE

For detailed inspection procedures and a table of wear limits, refer to the Service Information Manual, Weldon Pump Model No. 33959-3 available from The Weldon Tool Co., 3000 Woodhill Road, Cleveland, Ohio 44104.

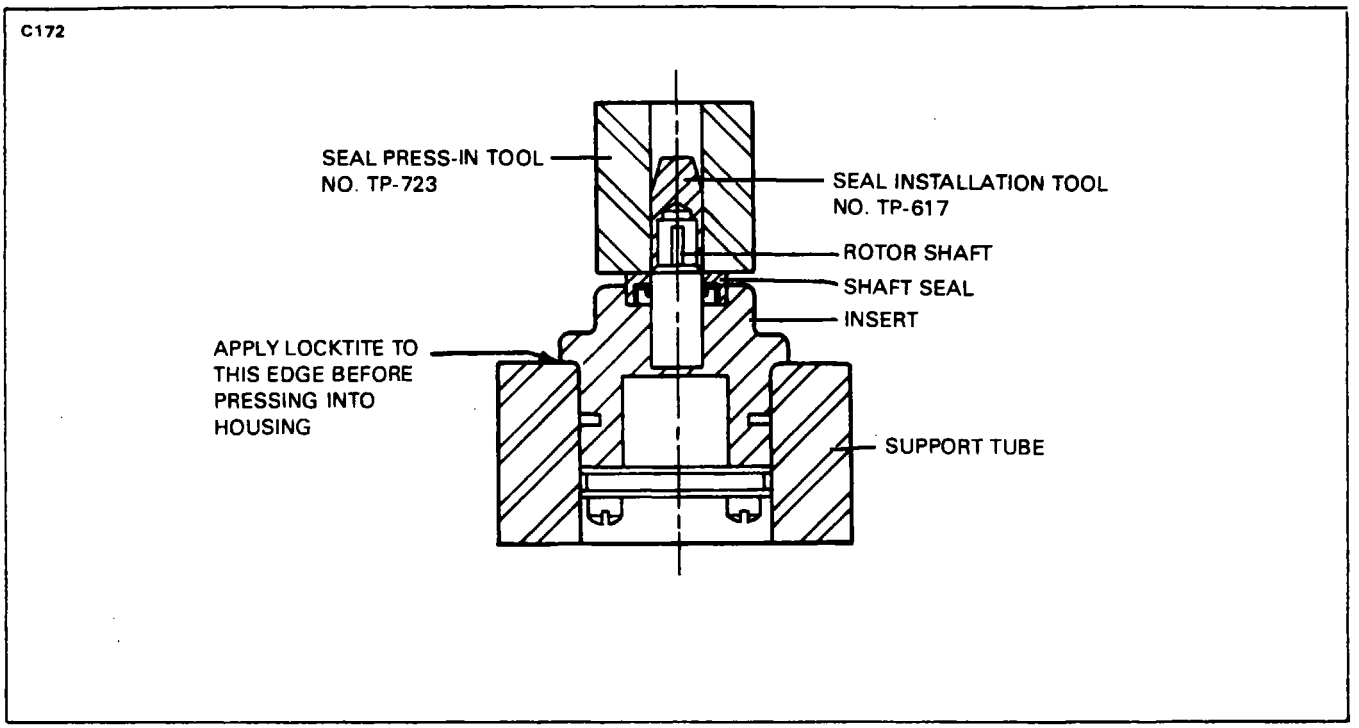

Figure 9-25. Shaft Seal Installation

9-77. ASSEMBLY OF FUEL PUMP (Refer to Figure 9-24.)

a. Install the blade retaining ring on the insert and install the blades.

b. Tilt the blades at an outward angle to allow the rotor to be installed and install the rotor.

c. Place a few drops of light oil on the end of the rotor and in the insert. Position the insert cover and secure with 3/8 inch screws. Torque to 10 inch lbs.

CAUTION

Earlier production fuel pumps usea a 1/4 inch long screw which requires 6 inch pounds of torque. Identify hardware before applying torque.

d. Place the insert in a 15/16 inch I.D. Support Tube (Refer to Figure 9-25).

e. Apply a coating of petroleum jelly to the shaft of the rotor, the shaft seal and Installation Tool No. TP-617.

f. Place Seal Installation Tool TP-617 over the rotor shaft.

g. Slip shaft seal assembly onto Tool TP-617 and bottom seal by hand.

h. With Tool TP-617 still in position, place Seal Installation Tool TP-723 over Tool TP-617.

i. Using an arbor press, push the shaft seal into seal well of insert until it is seated and square.

j. Remove the Seal Installation Tools from the insert. Install a new "O" ring on the insert cover and lubricate the "O" ring with petroleum jelly.

k. Apply Loctite 290 to the 1 1/8 inch "press fit" diameter of the insert assembly.

NOTE

Use a small amount of Loctite exercising care to prevent Loctite from getting into blade slot area of insert.

l. Start the insert assembly into the pump housing by hand to ensure proper alignment.

m. Using an arbor press against a suitable tube (refer to Tool list under "Disassembly" section), press the insert into housing until it is firmly seated.

NOTE

Improper alignment of the insert will cause binding between the rotor tang and motor shaft slot causing excessive motor current and early failure. Use Tool TP-793 (or similar tool) to check alignment. Should the pump shaft bind when the stem of the tool is turned and while the face of the tool is held tight against the pump flange, remove the insert asembly, clean the mating surfaces, re-install and recheck.

Fifteen minutes after installing insert, repress the insert to ensure that it has not moved upward due to the action of the "O" ring.

Allow Loctite to cure for four hours before testing pump.

n. Install locknut on adjusting screw. Place spring and plunger in adjusting screw and install in tapped hole of pump body. Tighten locknut.

CAUTION

The spring loaded poppet contacts the insert cover and provides pressure relief. Over-tightening of adjusting screw will prevent proper pressure relief by restricting return flow or by deforming cover.

o. Align the pump end assembly with the motor assembly. Ensure proper coupling between motor armature slot and pump rotor shaft. Secure pump and motor assemblies together using screws with Loctite 222.

p. Adjust pump pressure as described in "Adjustment of Electric Fuel Pump (Bench Test)."

9-78. INSTALLATION OF FUEL PUMP.

a. Position the fuel pump in the engine nacelle and secure with four attaching bolts up through the bottom of the wheel well. Safety the bolts.

b. Connect the fuel lines to the pump and tighten.

c. Connect the electrical leads.

d. Turn the selector valve to the ON position.

e. Operate the fuel pump and inspect for leaks.

f. Secure the center section or access panel of the engine nacelle.

9-79. ADJUSTMENT OF ELECTRIC FUEL PUMP (BENCH TEST). (Refer to Figure 9-26.)

a. Ascertain that the pump is sufficiently lubricated to prevent damage if run dry for a period greater than five minutes.

b. Connect the electrical leads to a 14-28-volt DC power source, depending on electrical system installation.

c. Using a suitable container with the proper octane fuel, connect a fuel line from a container to the inlet side of the pump.

d. Connect another line from the outlet side of the pump to a pressure gauge and bypass valve and back to the container.

e. Run the pump with the bypass valve open until a steady flow of fuel is obtained. Then close the bypass valve and check the pressure gauge for the proper reading of 26 +3 -0 psi, no flow. Do not keep the bypass valve closed for more than one minute during pump operation and adjustment.

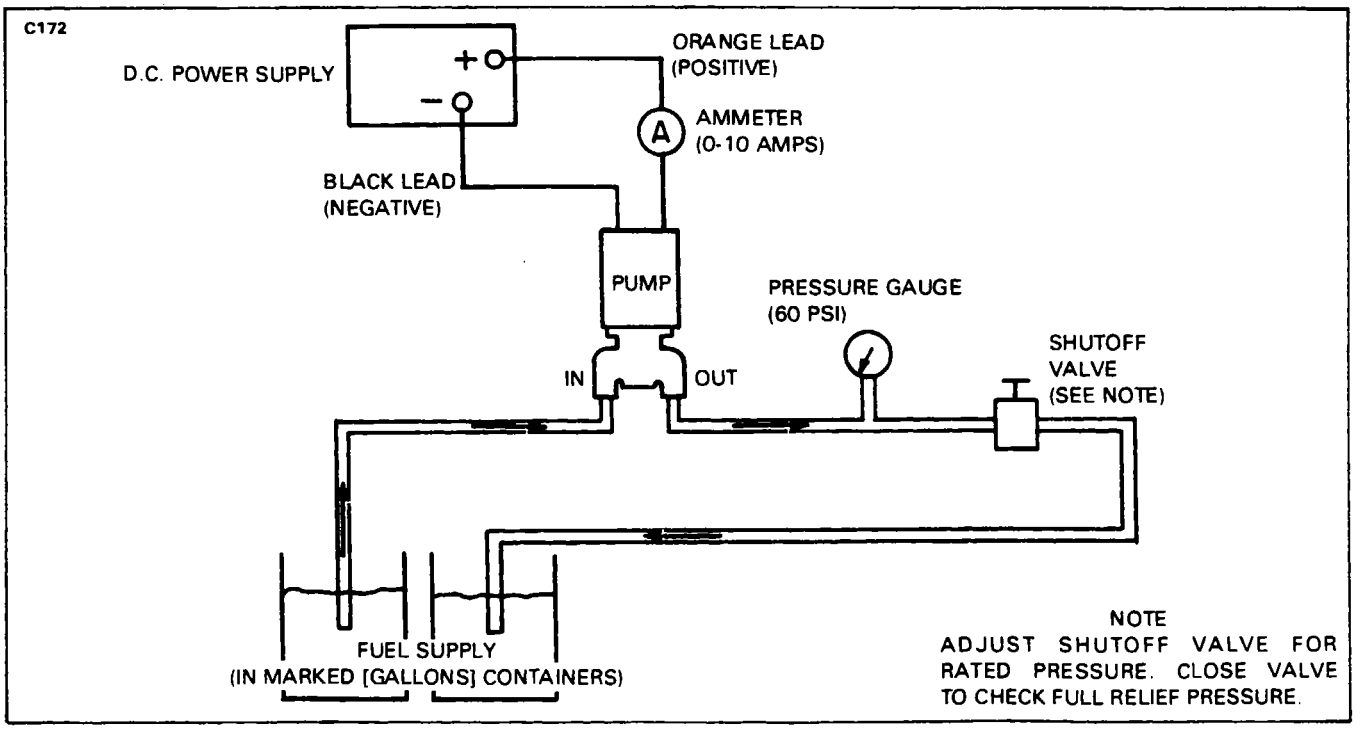

Figure 9-26. Bench Test Set-Up (Typical)

f. Loosen the locknut and turn the adjusting screw until there is a reading of 26 +3 -0 psi, no flow, on the gauge. Repeat steps e and f until the proper pressure is obtained.

g. Disconnect the power source from the pump and lock the adjustment screw with the locknut. Remove the fuel lines from the pump.

9-80. ADJUSTMENT OF ELECTRIC FUEL PUMP (IN AIRPLANE).

a. With the access panel removed and the fuel selector in the OFF position, remove the fuel line from the outlet end of the pump.

b. Connect a test line with a bypass valve and pressure gauge to the outlet end of the pump.

c. Place a container below the pump to catch any fuel from the test line during the adjustment of the pump.

d. Turn the fuel selector on; open the bypass valve on the test line and start the pump.

e. When a steady flow of fuel is obtained, close the bypass valve and check the reading on the pressure gauge. It should read 26 +3 -0 psi, no flow. Do not keep bypass valve closed for more than one minute during pump operation and adjustment.

f. Loosen locknut on adjusting screw and turn screw to obtain the proper pressure of 26 +3 -0 psi, no flow. Repeat steps g and h until adjustment is complete. Lock adjusting screw with locknut.

g. Turn off fuel pump and close fuel selector. Remove the test line from the pump.

h. Reconnect the original fuel line to the pump. Open fuel selector and run the pump to check for any fuel leaks.

i. Shut off the pump; close the fuel selector and replace and secure the access panel.

9-81. ENGINE PRIMER PUMP.

9-82. REMOVAL OF ENGINE PRIMER. (Refer to Figure 9-27.)

a. Disconnect the fuel lines from the primer behind the instrument panel.

b. Loosen the locknut (12) from behind the panel.

c. Unscrew the knurled face nut (10) and withdraw the pump handle (9) and piston (7) from the cylinder (5).

d. Remove the remaining portion of the primer.

9-83. DISASSEMBLY, CLEANING AND ASSEMBLY OF ENGINE PRIMER. (Refer to Figure 9-27.)

a. The primer may be further disassembled after removal by removing the screws (3), springs (2), and check balls (1) from the end of the cylinder housing.

b. Clean the primer parts with acetone or a dry type solvent.

c. Install new "O" rings to the piston (7) and lubricate with light motor oil.

d. Install the balls (1), springs (2) and screws (3) to the cylinder housing.

e. Insert the pump handle (9) and piston (7) into the cylinder (5), and finger tighten the knurled face nut (10).

f. Immerse the pump in gasoline and operate several times to insure proper operation.

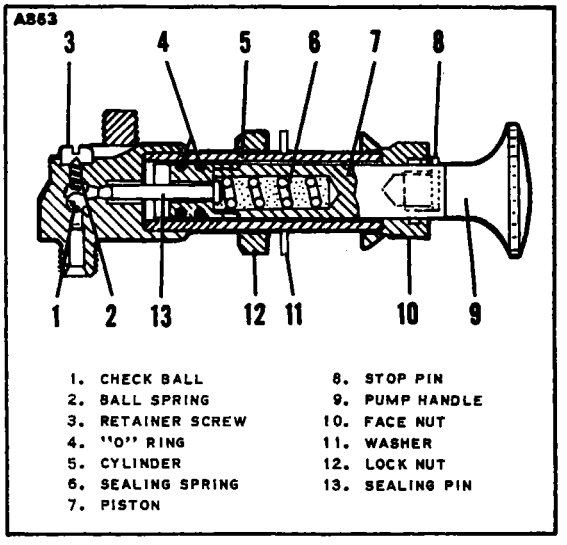

Figure 9-27. Engine Primer

9-84. INSTALLATION OF ENGINE PRIMER PUMP. (Refer to Figure 9-27.)

a. Remove the pump handle (9) and piston (7) by unscrewing the knurled face nut (10), if previously installed.

b. Insert the cylinder assembly through the back side of the panel.

c. Insert the piston into the cylinder (5) and tighten the knurled face nut.

d. Position the primer and tighten the locknut (12) on the cylinder behind the panel.

e. Connect the fuel lines to the primer.

f. Disconnect the primer line inside the engine compartment. Operate the pump to ascertain proper operation.

9-85. PRIME JETS.

a. To remove the prime jets, disconnect the supply line from each jet. With a deep socket and light pressure, remove the jet from the cylinder.

b. To clean the jet, soak in a carbon remover solution long enough to loosen any dirt and blow clean with air pressure in the direction opposite that of fuel flow. Do not use sharp objects or wire brush to clean the jet tube.

c. Install the jet finger tight to assure that the threads are not crossed and then torque 60 inch pounds. Align and install the fuel supply lines, tighten to a snug fit.

NOTE

Should further fuel stoppage of the primer system exist, check the supply lines for stoppage, bent or collapsed walls.

9-86. CLEANING FUEL SYSTEM.

a. To flush the fuel cells and selector valve, disconnect the fuel line at the carburetor or injector.

b. Select a fuel cell, turn on the electric fuel pump and flush fuel through the system until it is determined there is no dirt and foreign matter in the fuel valve or cell. During this operation, agitation of the fuel within the cell will help pick up and remove any dirt.

c. Repeat this procedure for each cell.

d. When all cells are flushed, clean all filters.

TABLE IX-I. FUEL SYSTEM TROUBLESHOOTING

Trouble	Cause	Remedy
Fuel gauge fails to indicate proper tank level.	Sender arm improperly positioned.	Bend sender arm to proper position.
	Incorrect resistance in sender.	Replace sender.
	Gauge inoperative.	Replace gauge.
	Incorrect resistance in gauge.	Replace gauge.
	Incomplete ground.	Check ground connections at fuel senders and security of sender mounting plate attaching bolts.
	Broken wire.	Check and repair.
	Fuel cell selector connections broken.	Repair or replace.
No fuel pressure indication.	No fuel in cells.	Fill fuel cells.
	Broken or disconnected lines.	Check for broken or disconnected lines. Replace or tighten where necessary.
	Fuel selector valve(s) not positioning properly.	Check selector valve(s) for proper travel and positioning.
	Filters dirty.	Clean filters.
	Defective fuel pressure gauge.	Replace gauge.

TABLE IX-I. FUEL SYSTEM TROUBLESHOOTING (cont.)

Trouble	Cause	Remedy
No fuel pressure indication (cont.).	Defective fuel pump.	Check pump(s) for fuel flow. Check diaphragm and relief valves in engine pump. Check plunger in "Bendix" electric fuel pumps. Check for obstruction in electric fuel pump(s). Check by-pass valve. Check for air leak in inlet lines.
	Defective gauge.	Replace gauge.
Pressure low or surges.	Blockage in fuel cell vent.	Check and clean fuel cell vent caps.
	Obstruction in inlet side of pump.	Trace lines and locate obstruction.
	Faulty engine driven pump.	Replace pump.
	Fuel selector valve(s) defective or improper positioning.	Check selector valves for proper operation and adjustment.
	Loose fuel line connection.	Check and tighten fuel line fittings where necessary.
Fuel valve leaking.	Defective "O" ring.	Replace "O" rings or valve.

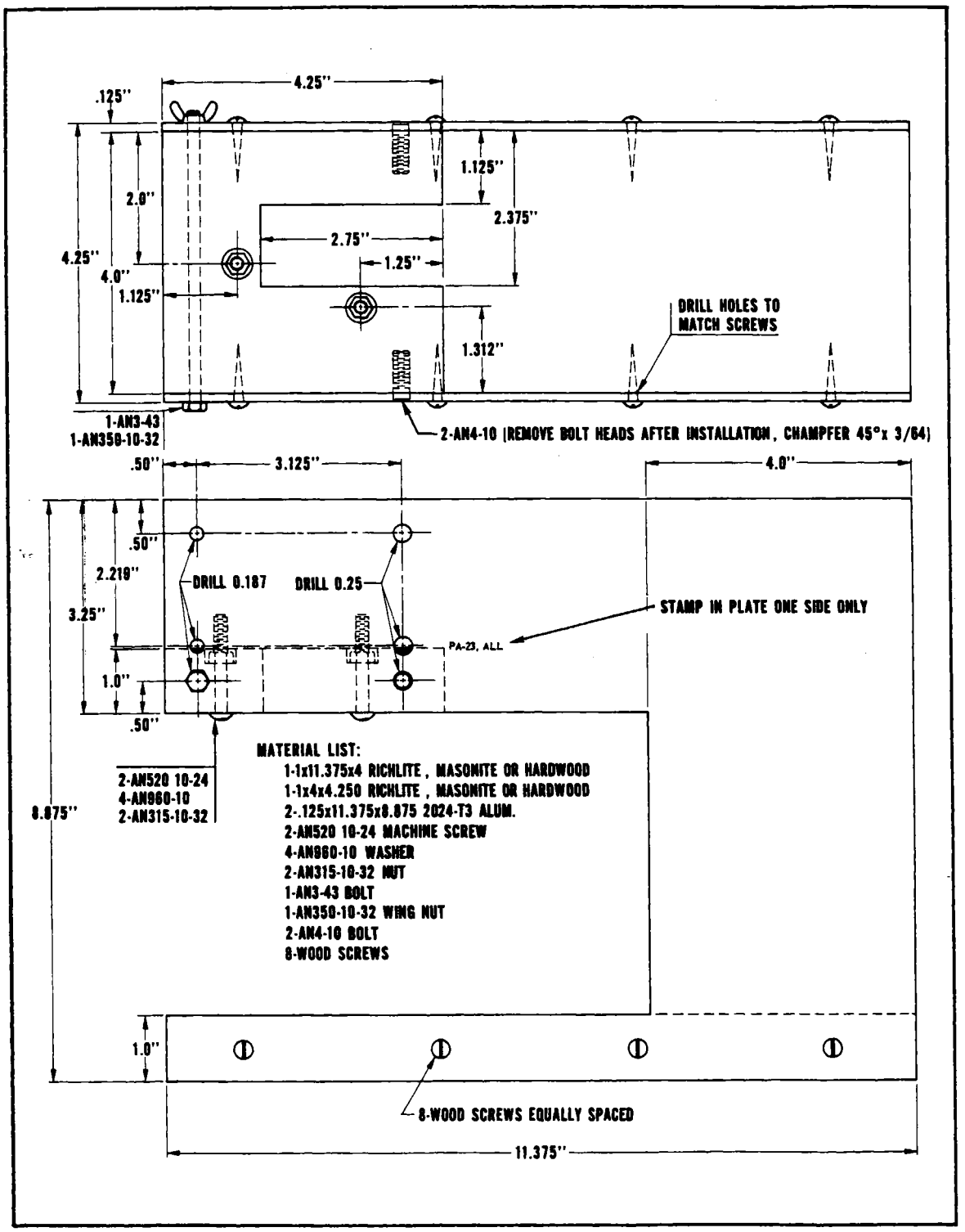

Figure 9-28. Fabricated Fuel Quantity Transmitter Checking Jig

TABLE IX-II. FUEL SYSTEM PRESSURES

ITEM	O-540-A SERIES	O-540-B SERIES	IO-540-C1B5	IO-540-J4A5	TIO-540-C1A
Carburetor Inlet Pressure	Desired 3 psi Maximum 8 psi Minimum .5 psi	Desired 3 psi Maximum 8 psi Minimum .5 psi			
Engine Driven Pump Inlet Pressure			Maximum 30 psi Minimum -2 psi	45 psi to -4 psi	45 psi to -4 psi
Injector Inlet Pressure			14 psi to 45 psi	18 psi to 45 psi	18 psi to 45 psi
Boost Pump Outlet Pressure with zero fuel flow			26^{+3}_{-0} psi	26^{+3}_{-0} psi	26^{+3}_{-0} psi
Maximum Nozzle Pressure with fuel flow gauge red line.			8.0 psi	8.0 psi	11.0 psi

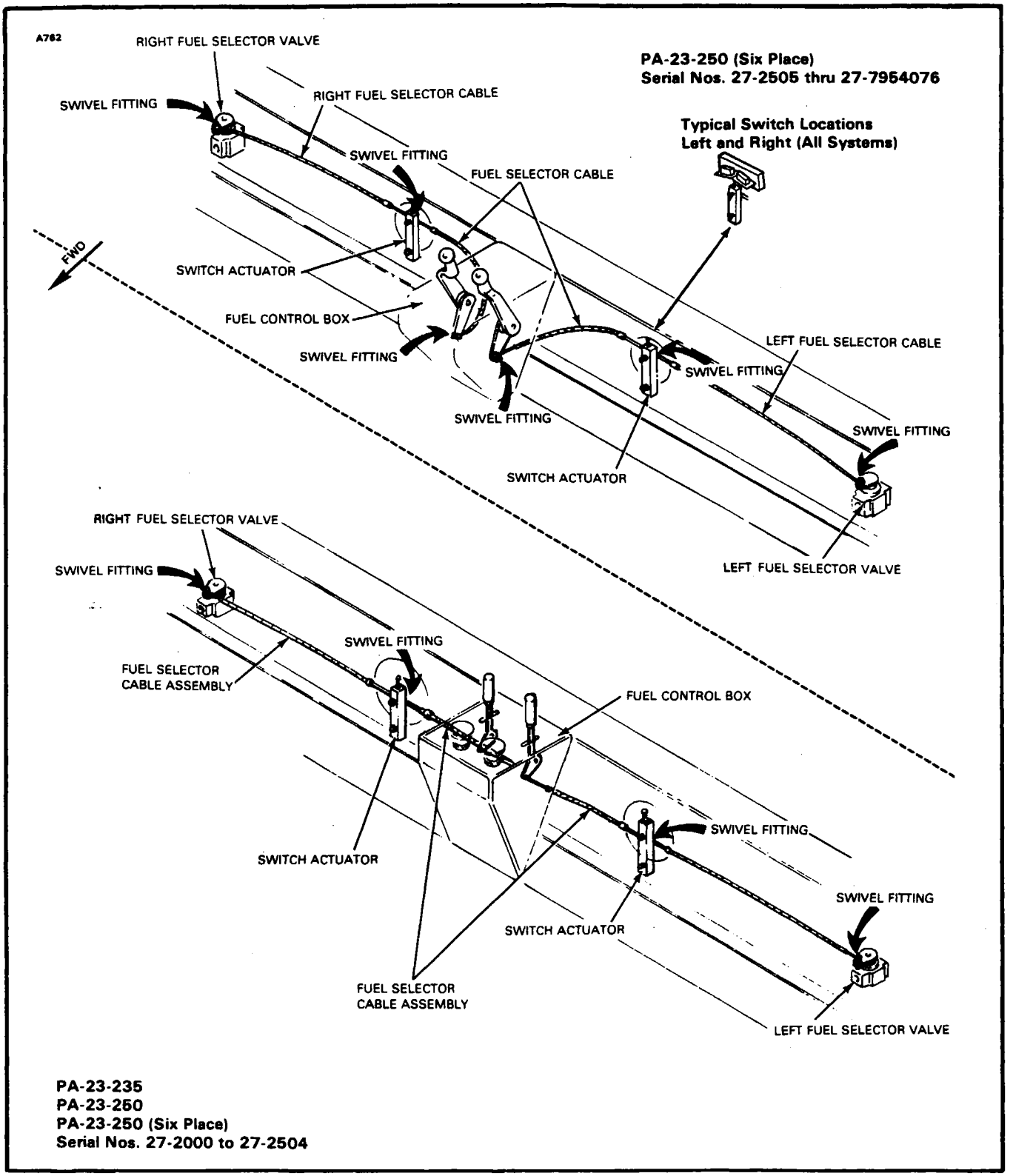

Figure 9-29. Fuel Selector Valve Control Cables, PA-23-235, PA-23-250 and PA-23-250 (six place), Serial Nos. 27-2000 thru 27-7954076

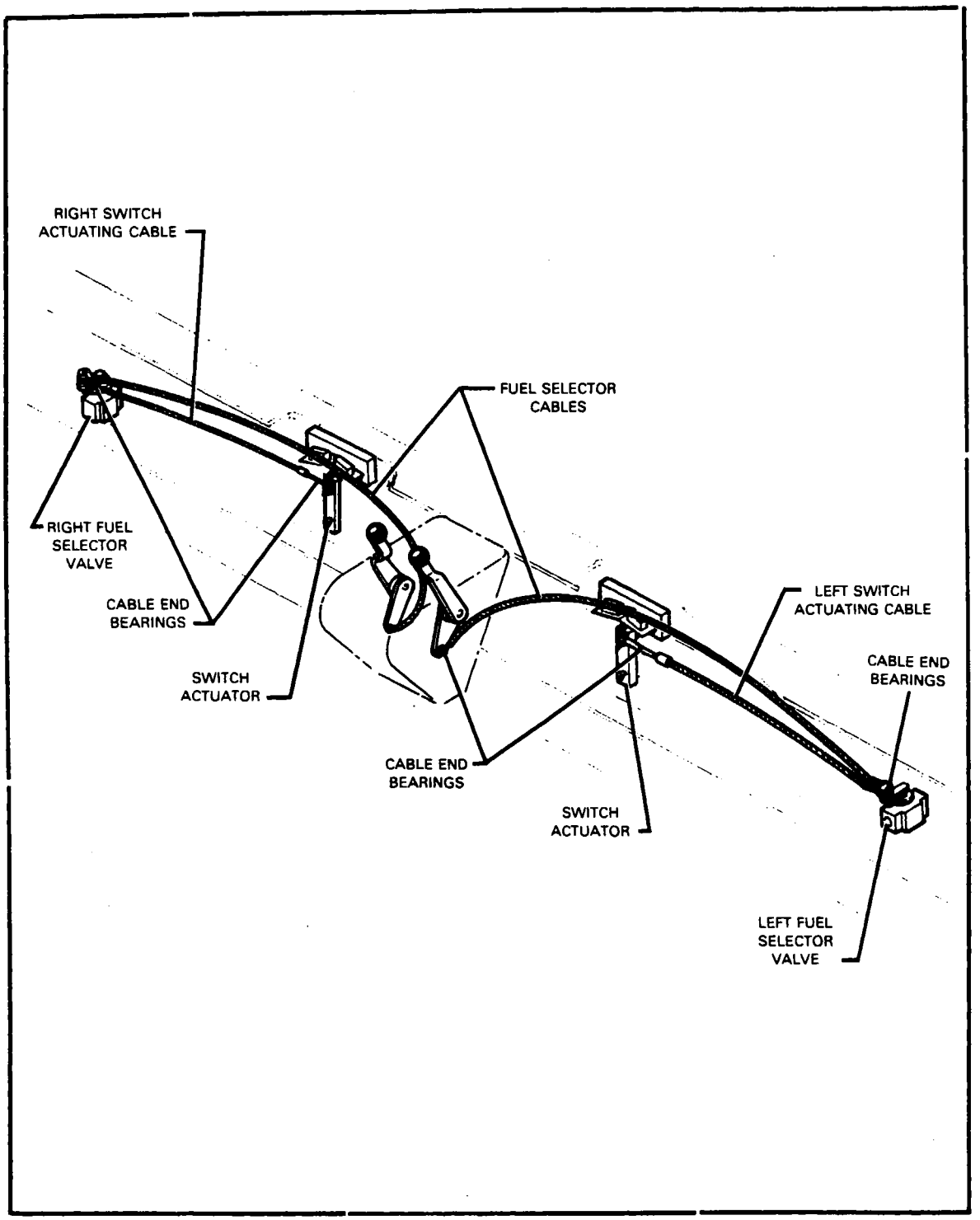

Figure 9-30. Fuel Selector Control Cables,
PA-23-250 (six place), Serial Nos. 27-7954077 and up