28 Fuel

CHAPTER 28

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CHAPTER 28 - FUEL

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CHAPTER 28 - FUEL

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GENERAL - DESCRIPTION AND OPERATION (Figure 1)

FUEL CELLS

The fuel system installation consists of an inboard main fuel cell and an outboard cell in the leading edge, a nacelle tank, a wing panel fuel cell in each wing and a wet wing tip tank (optional on serials P-348, P-365 and after). All of the fuel cells in each wing and wing tip are interconnected in order to make all of the usable fuel in each wing available to its engine when the fuel selector valve is turned ON. The interconnecting fuel cells are serviced either through the single filler on each wing or the filler in each of the optional wet wing tips, providing single point filling for each side. The combined capacity of the standard and optional systems is shown below:

SERIALS	*CAPACITY IN GALLONS*	*USABLE IN GALLONS*
P-3 thru P-195 inboard leading edge fuel cells unbaffled	207	192
P-3 and after with inboard leading edge baffled fuel cells	207	202
Optional fuel system P-348, P-365 and after	237	232

FUEL CROSSFEED

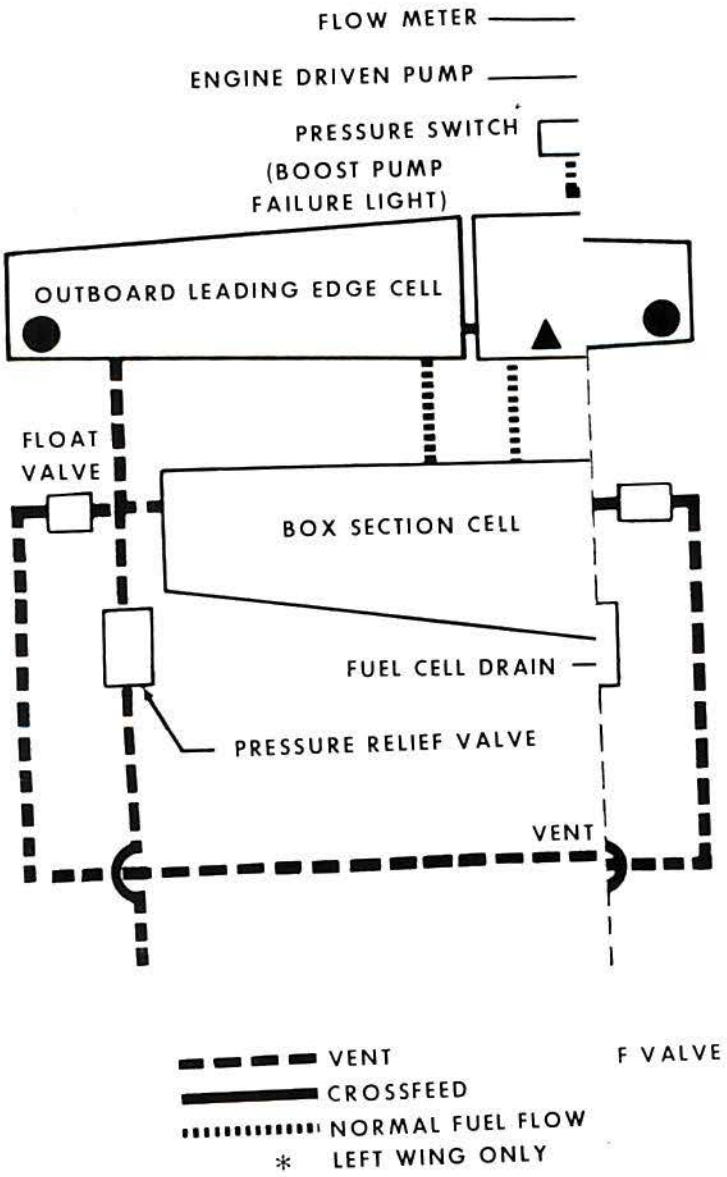
The separate identical fuel supplies for each engine are interconnected by crossfeed lines. During normal operation, each engine uses its own fuel pumps to draw fuel from its respective fuel tank arrangement. However, on crossfeed operations, the entire usable fuel supply of both wings can be consumed by either engine.

FUEL BOOST PUMPS

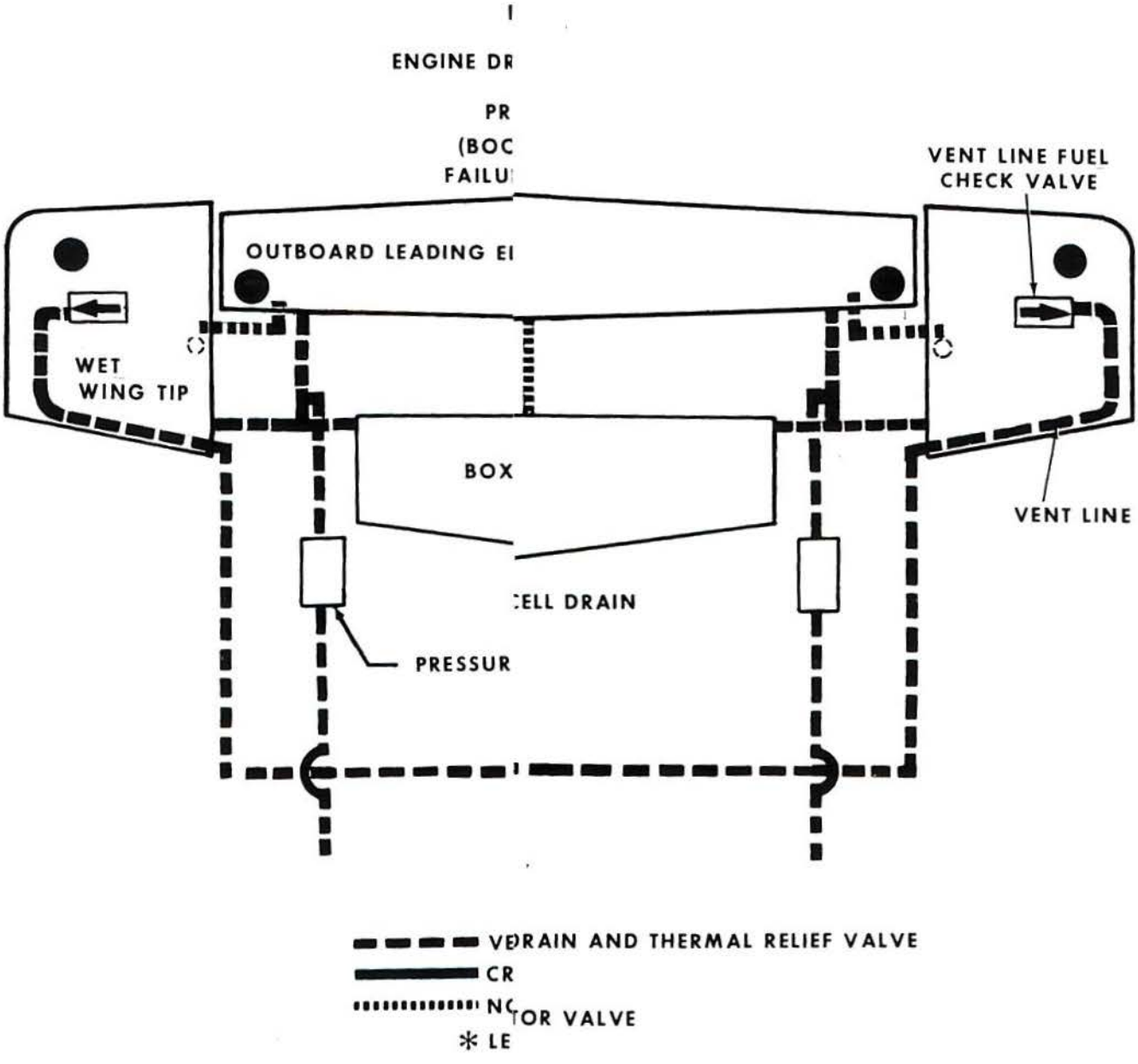
Submerged, tank-mounted fuel boost pumps are provided for each engine and are located in the inboard leading edge tanks. They are controlled by separate ON-OFF toggle switches located on the pilot's subpanel. The fuel boost pumps provide for near maximum engine performance should the engine-driven pump fail. Fuel boost pump failure is indicated by illumination of a FUEL PRESS light on the panel.

FUEL CELL DRAINS

The fuel system is drained by six snap-type drains under the wings. A drain is located in each inboard leading edge fuel cell, box section fuel cell and fuel strainer. An additional fuel strainer drain for the heater fuel line is located in the nose wheel well.



Fuel System Schematic
Figure 1



60–603–34

Optional Fuel System Schematic
(P-348, P-365 and after)
Figure 2

"END"

GENERAL - MAINTENANCE PRACTICES

FUEL HANDLING PRACTICES

When filling the aircraft fuel cells, always observe the following:

a. Service the fuel cells with 100/130 octane fuel or if not available, use 115/145 octane fuel (1, Chart 207, 91-00-00).

b. Make sure the aircraft is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

d. Do not insert the fuel nozzle more than 3 inches into the filler neck; to do so may cause damage to the rubber fuel cell.

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals depending on service conditions, fuel handling equipment and when operating in localities where there is an excessive amount of sand or dust.

Open each of the seven snap-type fuel drains daily to allow condensed moisture to drain from the system.

NOTE

If the cells are to remain unfilled for 10 days or more, apply a thin coating of light engine oil to the inside surface of the cell to prevent deterioration and cracking.

AIRCRAFT DEFUELING

To insure that all fuel is removed from the system, the fuel should be drained through the boost pumps. To expedite the defueling operation, the boost pumps may be used to pump the fuel out of the system. The following steps must be accomplished before energizing the pumps:

a. Apply external power to the aircraft electrical system.

b. Place the fuel selector valve in the "ON" position and the mixture lever in "IDLE CUT-OFF".

c. Remove the filler caps to vent the system.

d. Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.

e. Energize the boost pumps.

f. When fuel is no longer pumped from the aircraft, open the sump drains to complete the defueling operation.

"END"

STORAGE - MAINTENANCE PRACTICES

NACELLE FUEL CELL REMOVAL
(Figure 201)

a. Drain and purge the fuel cell.

b. Remove the fuel cell access plate (1), the forward access plate (2) and the vent line access plate (3).

c. Remove clamp from 3-inch interconnect tube in bottom of cell and the vent nipple clamp and interconnect line in wheel well.

d. Remove the fuel transmitter. (Refer to 28-40-00).

e. Unsnap the fuel cell and remove it from the nacelle cavity through the access hole (1).

NOTE

Tape edge of access hole to protect cell from damage during removal.

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

NACELLE FUEL CELL INSTALLATION

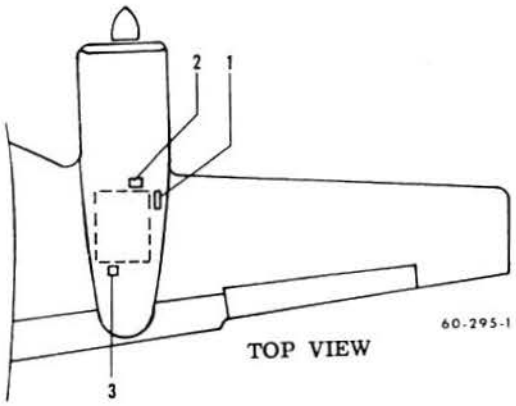
a. Carefully insert the fuel cell into the nacelle cavity, through access hole (1), and snap in place.

b. Install the fuel transmitter. (Refer to 28-40-00).

c. Install fuel cell access plate (1).

d. Connect 3-inch interconnect tube at bottom of fuel cell, and vent nipple and interconnect line in wheel well. Torque rubber fuel nipples and interconnect clamps to 25± 5 inch-pounds.

e. Install forward access plate (2) and vent line access plate (3).

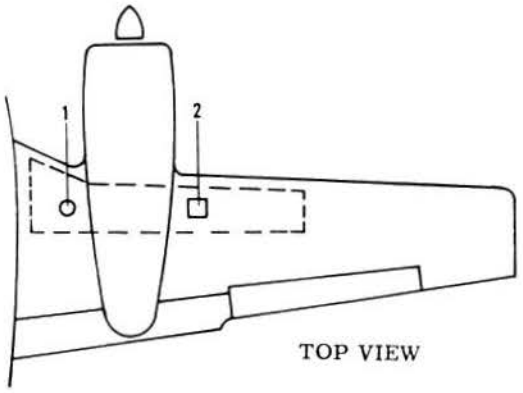


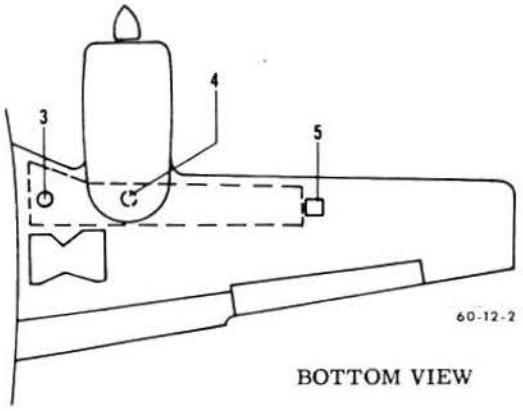
1. Fuel Cell Access and Transmitter
2. Forward Access Plate
3. Nacelle Vent Line Access Plate

Nacelle Fuel Cell Access Openings
Figure 201

INBOARD LEADING EDGE FUEL CELL REMOVAL
(Figure 202)

a. Drain and purge the fuel cell.





1. Access Plate and Transmitter.
2. Fuel Cell Access and Transmitter
3. Fuel Pump
4. Fuel Cell Access Plate (Under Removable Aft Nacelle Section)
5. Fuel Cell Access Plate

Inboard Leading Edge Fuel Cell Access Openings
Figure 202

b. Remove the inboard and outboard fuel transmitters. (Refer to 28-40-00).
c. Remove the fuel boost pump. (Refer to 28-20-00).
d. Remove the clamp and the fuel cell drain valve.

NOTE

On serials P-231 and after, a spacer is installed between the drain valve clamp and the fuel cell liner washer to prevent the drain valve from being pushed into the tank.

e. Remove the lower aft nacelle section and the fuel cell access plate (4).
f. Remove the cotter pin securing the flapper check valve assembly to the internal inboard interconnect. Remove the interconnect clamp.
g. Remove the outboard internal interconnect clamp through the fuel access hole (2).
h. Remove the fuel access plate (5).
i. Disconnect all fuel and vent plumbing.
j. Remove screws and bolts attaching the fuel cell outlet plate to the fuel cell.
k. Unsnap the fuel cell and remove the cell through the fuel access hole (2).

NOTE

Tape edge of fuel cell liner and access hole to prevent damage to the fuel cell.

l. Check the flapper check valve collar and valve hinge strap for parallelism within .03 inch. Check the valve for an opening of 35 ± 10 degrees.

NOTE

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

INBOARD LEADING EDGE FUEL CELL INSTALLATION

CAUTION

Exercise caution when installing baffled fuel cells to prevent damage to the flapper valve.

a. Carefully insert the fuel cell through the fuel cell access hole (2) and snap the cell in place.
b. Install the fuel cell outlet plate with screws and bolts. Torque to 20 to 30 inch-pounds. Safety wire the bolts.
c. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25 ± 5 inch-pounds.
d. Install the outboard internal interconnect clamp through fuel access hole (2).

NOTE

Torque interconnect clamps to 25 ± 5 inch pounds.

e. Install the inboard internal interconnect clamp.
f. Install the flapper check valve with a new cotter pin. Check the valve for freedom of movement and for proper seating.

NOTE

The flapper check valve must hinge downward.

g. Install the fuel cell access plate (4). Torque to 45 to 55 inch-pounds and safety wire.
h. Install the lower aft nacelle section.
i. Install the fuel cell drain valve and clamp.
j. Install the fuel boost pump. (Refer to 28-20-00).
k. Install the inboard and outboard fuel transmitters. (Refer to 28-40-00).

INSTALLATION OF VELCRO TAPE WITH REPLACEMENT FUEL CELLS (P-4 through P-195)

(Figure 203)

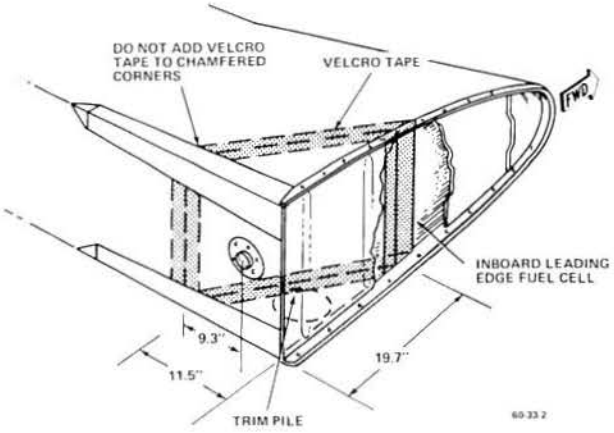
Aircraft that have or will have the existing inboard leading edge fuel cells replaced with spare fuel cells P/N 58-380030-7, 58-380030-8, 58-380030-9, and 58-380030-10 should install Kit 60-9002-3 S in the fuel cell liner top, bottom, root rib, and spar as described below and in Service Instructions No. 0585-281. If only one fuel cell is to be replaced, use Kit 60-9002-1 S for left hand installation and Kit 60-9002-2 S for right hand installation. Serials P-196 and after are delivered from the factory with the equivalent of Kit 60-9002-3 S installed.

a. Remove the fuel cell as described in INBOARD LEADING EDGE FUEL CELL REMOVAL.

NOTE

Aircraft that have had any of the above fuel cells installed do not require complete removal of the fuel cell. Access covers and inboard fittings should be removed and the inboard end

of the fuel cell pulled back far enough to allow installation of the velcro tape.



Installation of Velcro Tape
Figure 203

b. Lightly sand the surface that the velcro tape will be bonded to as shown in Figure 203 and thoroughly clean the sanded surface with toluol (22, Chart 207, 91-00-00).

c. Apply a coat of cement (39, Chart 207, 91-00-00) to the cleaned surface.

d. Activate the velcro tape by dipping into a bath of MIL-M-13999 methyl ethyl ketone (21, Chart 207, 91-00-00) and press the backing of the velcro tape to the cemented surfaces. Allow 15 minutes (minimum) for drying to ensure a good bond.

e. Position the fuel cell in place and press the velcro hook and pile together by pressing outward in the area of the velcro tape.

f. Inspect the flapper valve for freedom of movement under its own weight. If the flapper valve binds, refer to INBOARD LEADING EDGE FUEL CELL FLAPPER VALVE INSPECTION.

NOTE

Before closing the zipper, inspect the cavity inboard of the baffle for foreign material.

g. Close the zipper and refer to INBOARD LEADING EDGE FUEL CELL INSTALLATION for further instructions on installing the fuel cell.

NOTE

Installation of Kit 60-9002-3 S is required on a first time basis only. Repeat installations of the kit are unnecessary when new fuel cells are installed.

h. Make the appropriate log book entry.

i. After installation of baffled fuel cells, change the usable fuel placards on the filler caps and fuel selector valve as instructed in Service Instructions No. 0559-281.

INBOARD LEADING EDGE BAFFLED FUEL CELL - FLAPPER VALVE INSPECTION

On aircraft that are equipped with baffled fuel cells, the flapper valves should be inspected periodically (Beech Aircraft recommends that the inspection be accomplished at each annual inspection) for freedom of operation and proper seating. The inspection may be accomplished as follows:

a. Remove the fuel boost pump (refer to 28-20-00).

b. Open the zipper in the fuel cell baffle.

c. Locate the flapper valve in the lower aft portion of the baffle and determine whether the valve element is metal or phenolic.

d. If the flapper valve element is metal, it should be inspected and repaired, if necessary, as described below:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat flush against the valve plate.

2. If the flapper valve element binds and/or does not seat properly, the element arm could be bent. The arm can be straightened by placing a screwdriver between the arm and element and pressing the element toward the closed position.

3. If after straightening the arm, the element still binds and/or does not seat properly, the element should be removed and replaced with a new element. The element may be replaced by removing the two bolts from the upper part of the flapper valve assembly. The same attaching parts should be used to install the new element. The new flapper element should be inspected after installation, to determine that it was not damaged during installation which could cause it to bind and/or not seat properly.

e. If the flapper valve element is phenolic, it should be inspected and reworked, if necessary, as described below:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat flush against the valve plate.

2. If the flapper valve element binds and/or does not seat properly, the upper rear side of the element may be binding against the valve plate.

3. The flapper valve element may be relieved from binding by filing a small radius on the upper rear side of the element.

NOTE

A shop towel saturated with light oil may be placed directly below the flapper valve to absorb the phenolic dust during rework.

4. After determining that the flapper valve is functioning properly, thoroughly wipe the area in the vicinity of the flapper valve with an oil saturated shop towel.

f. Close the zipper in the main fuel cell baffle.
g. Clean the gasket contact areas on the fuel cell and the fuel boost pump.
h. Install the fuel boost pump (refer to 28-20-00).

BOX SECTION FUEL CELL REMOVAL
(Figure 204)

a. Drain and purge the fuel cell.
b. Remove the access plate (1).
c. Remove the inboard (2) and outboard (3) access plates on the underside of the wing.
d. Remove the fuel cell plates and remove the internal fuel cell interconnect clamps.

NOTE

On later Duke A60's, beaded interconnects are incorporated in the fuel system so that fuel cells aft of the main spar can be attached without opening the leading edge cavities.

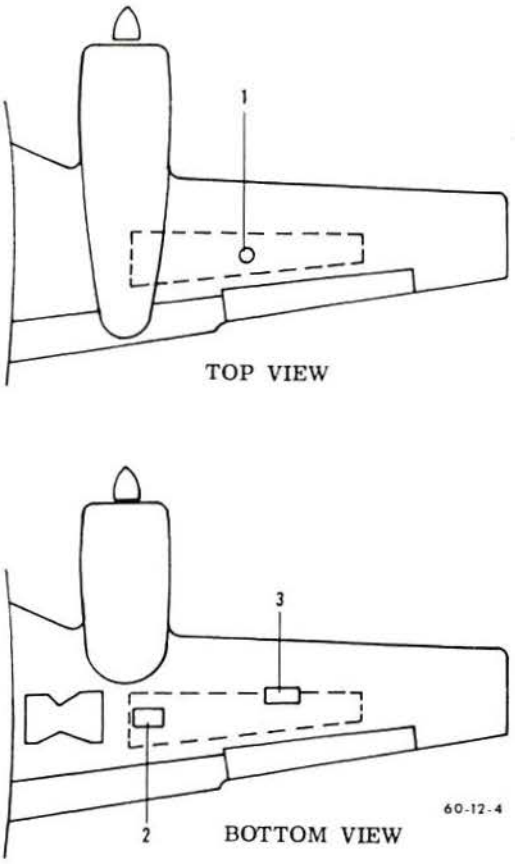
e. Disconnect the drain and vent plumbing.
f. Unsnap the fuel cell and remove it from the wing cavity through the outboard access hole (3).

NOTE

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

BOX SECTION FUEL CELL INSTALLATION

a. Carefully insert the fuel cell into the wing cavity through the outboard access hole (3), and snap in place.
b. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25± 5 inch-pounds.
c. Install the internal fuel cell interconnect clamps. Torque clamps to 25 ± 5 inch-pounds.
d. Install the inboard (2) and outboard (3) access plates on the underside of the wing. Torque access plates to 45 to 55 inch-pounds.
e. Install access plate (1).

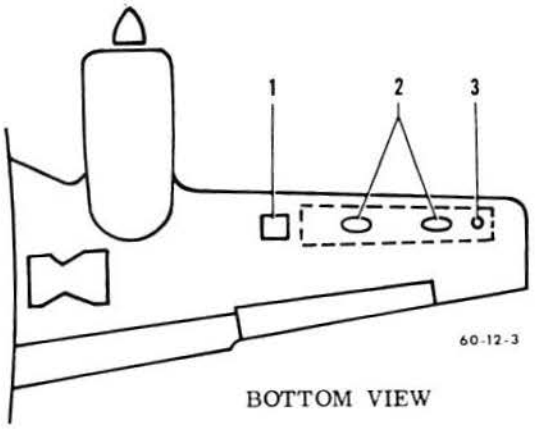


1. Access Plate
2. Box Section Cell Inboard Access
3. Box Section Cell Outboard Access

Box Section Fuel Cell Access Openings
Figure 204

OUTBOARD LEADING EDGE FUEL CELL REMOVAL
(Figure 205)

a. Drain and purge the fuel cell.
b. Remove the screws securing the filler neck (3) to the wing skin.
c. Remove the access plates (2) and the fuel and vent plumbing access plate (1) on the underside of the wing.
d. Disconnect the fuel and vent plumbing.
e. Remove the internal fuel cell interconnect clamps.



BOTTOM VIEW

1. Fuel Plumbing Access
2. Fuel Cell Access
3. Filler Neck

Outboard Leading Edge Fuel Cell Access Openings
Figure 205

f. Unsnap the fuel cell and remove it from the wing cavity through one of the access openings (2).

NOTE

Tape the edge of the access hole to protect the fuel cell during removal and installation. If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

OUTBOARD LEADING EDGE FUEL CELL INSTALLATION

a. Carefully insert the fuel cell into the wing cavity through access openings (2) and snap in place.

b. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25 ± 5 inch-pounds.

c. Install the internal fuel cell interconnect clamps. Torque clamps to 25 ± 5 inch-pounds.

d. Install the access plates (2) and plumbing access plate (1) on the under side of the wing. Torque the access plates to 45 to 55 inch-pounds.

e. Install the filler neck with a new gasket. Torque the bolts to 45 to 55 inch-pounds and safety wire.

NOTE

Use sealer (3, Chart 205, 91-00-00) between the skin and the adapter flange when installing the filler neck.

WET WING TIP REMOVAL

a. Disconnect external power from the airplane. Place battery and generator switches in the off position.

b. Defuel the airplane, to the point where fuel cannot be seen from the inboard filler position.

c. Remove access plates from the outboard lower wing.

d. Remove deice boot from wing tip leading edge (if installed). (Refer to Chapter 30).

e. Working through the access opening in the under side of the wing, loosen the clamps on the 3 inch fuel interconnect and vent lines.

f. Disconnect the electrical connections.

g. Support wing tip. Using a 1/8 inch drill bit, drill out rivets along the connecting strap and remove the strap.

h. Remove the support angle screws at the juncture of the wing tip and wing front and rear spar. Remove the wing tip.

WET WING TIP INSTALLATION

a. Disconnect external power from the airplane. Place battery and generator switches in the off position.

CAUTION

Support the wing tip on a platform which will give firm support but will allow some flexibility of movement of the wing tip to facilitate proper alignment. Protect the wing tip surface from scratches, dents and other damage during installation.

b. Support the wing tip in the proper position to attach to the wing. Connect the hoses from the wing to the 3 inch fuel interconnect and vent lines. Secure with clamps.

c. Connect electrical connections.

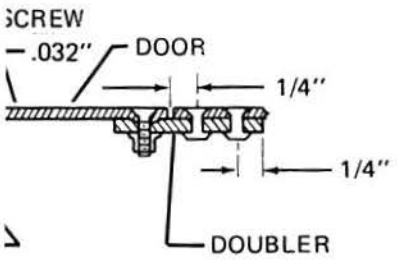
d. Move wing tip into position and secure support angles to the front and rear spars with screws.

e. Using MS20426AD3 rivets, rivet the connecting strap to both the wing and wing tip.

f. Install the deicer boots (if required). (Refer to Chapter 30.)

NOTE

Repair of the wet wing tip is permissible providing the damaged area is far enough from the rib to allow a doubler or plate to be installed. Holes cut to remove damaged area must be round or at least have generous radii. Should a stringer be damaged or fall within the repair area it must be bridged across and be attached to the repair.

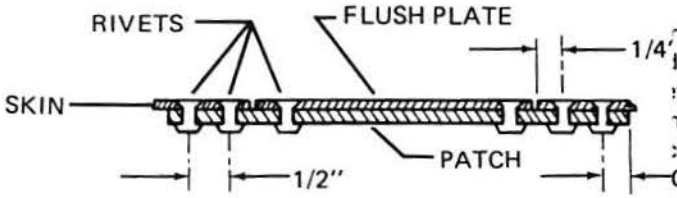


CAUTION

It must be realized the wet wing tip is a highly stressed area; consequently, the repair structure must be of equal capability.

ACCESSIBLE AREAS

- .032 2024 T3 Aluminum ALCLAD.
- .051 2024 T3 Aluminum ALCLAD.
- K1000-832 or equivalent.
- AN507-8R--length to be determined.
- AN426AD3--for attaching nut plates.
- AN426AD4--for attaching doubler.



n doubler and skin--1/4" E.D., 1/2" spacing
l rivets.
ws through doubler and door--3/8" E.D.,
nple door and countersink doubler.
ut on one side only in order to place it
Cut side of doubler to be placed on
ard side of repair.

REPAIR OF ACCESSIBLE AREAS

1. Rivets - AN426AD4-5
   Patch material - .032 2024 T3 Aluminum ALCLAD
   Plate material - .032 2024 T3 Aluminum ALCLAD
2. Two rows rivets through patch and skin (patch plate to be on inner surface of cell. --If the plate is too large for entry through access openings, use method for inaccessible area.)
3. Rivet E.D. 1/4"--spacing 1/2" between rows and rivets.
4. Fit flush plate and secure with only enough rivets to prevent filler from cracking.

60-608-1

Minor Wet Wing Tip Repair
Figure 206

g. Install and secure access plates.

h. Pressurize the fuel system using 0.50 + 0.25 - 0.00 psig. There should be no pressure loss in 15 minutes.

i. Fuel and restore electrical power to the airplane as required.

LEAK TEST
(Figure 207)

a. Ensure that all repairs to the wet wing tip are completed and sealed.

b. Connect pressure source to the wet wing tip as shown in Figure 207.

CAUTION

Ensure that the filler cap and access plate are secure. This test should be done when the wet wing tip is removed from the fuel system of the airplane.

c. Apply 3.73 ± 0.25 psig to the wet wing tip for 5 minutes.

d. Apply leak detector compound MIL-L-25567 (14, Chart 207, 91-00-00) to the outside of the wet wing tip.

e. Mark all leaks as indicated by bubbles.

f. Depressurize the wet wing tip, locate and repair leaks (see Figure 206).

g. Repeat the pressurization test procedure and repair leaks until there is no leakage.

h. Rinse leak detector compound off wet wing tip with clean water and wipe dry with clean cloths.

i. Install wet wing tip on airplane.

LEAKAGE CHECKS AND REPAIRS (WET WING TIP)
(Figure 208)

To classify the degree of leakage in a wet wing tip fuel cell, measure the size of the wet area around the leak. A more accurate measurement may be obtained by wiping the leakage clean and applying talcum powder in the area of the leak. After 30 minutes, recheck the area to determine if the leak classifies as a stain, seep, heavy seep or running leak as indicated in Figure 208. Fuel leaks must also be classified as to whether they occur in an open area or in an enclosed area to differentiate between those that require immediate repair and those not considered potential flight hazards.

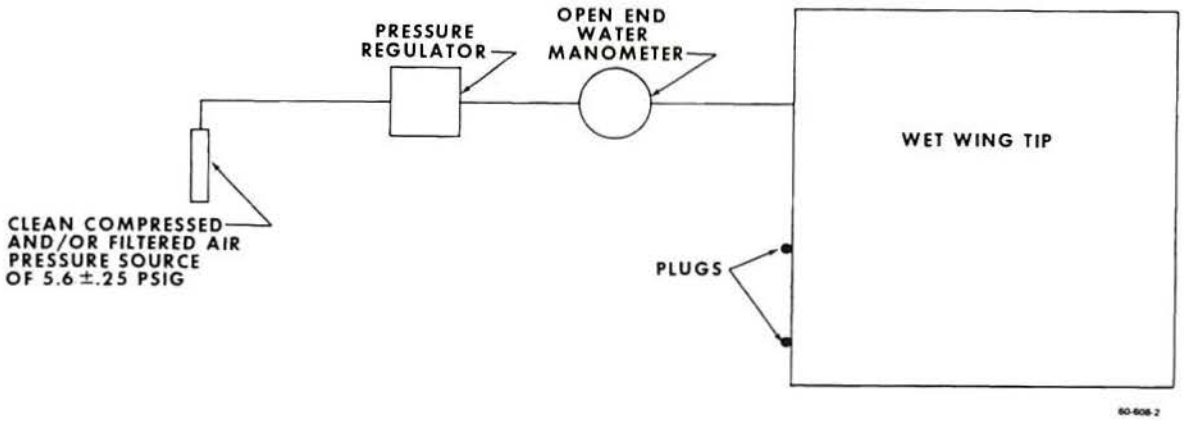
WARNING

Any leakage in an enclosed area, such as the wheel well, or in an area where the fuel will blow into the fuselage, requires grounding until repair is made.

a. Repair of heavy seeps or smaller leaks in an open area may be delayed until the airplane is down for other maintenance.

b. Any leakage in an enclosed area requires immediate grounding and repair.

c. Remove any sealant around the leak with a sharp, nonmetallic tool, such as a tool of chisel-shaped Formica.



Leak Test Set-up
Figure 207

Scarf the ends of the existing fillet so that a new sealant can form a continuous and smooth tie-in. PR-890B-1/2 (19, Chart 205, 91-00-00) or EC-1675B-1/2 (20, Chart 205, 91-00-00) is recommended for the sealing process. Thoroughly clean the area to be repaired with methyl ethyl ketone or naphtha prior to sealing. The following repairs are permissible:

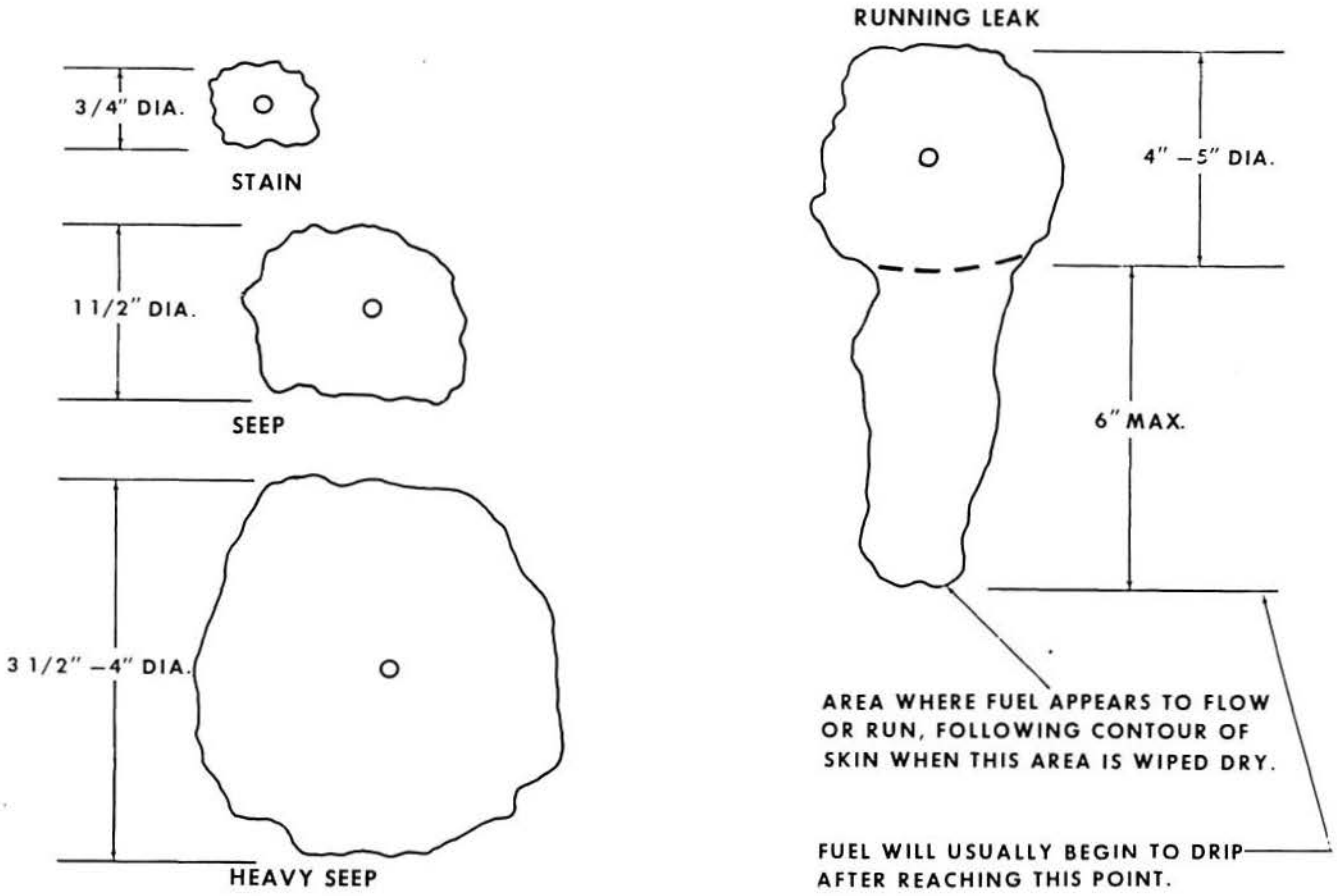
1. If the leakage is around a rivet, restrike the rivet. This can only be done once. If the leak persists, replace the rivet.
2. If the leakage is around a bolt with a gasket type seal, retorque the bolt. If the leak persists, replace the seal or the bolt.
3. If the leakage is at the gasket around an access opening or fitting, retorque the attaching hardware. If the leak persists, replace the gasket.

FUEL CELL LEAKAGE CHECK

Although the chemical test is more sensitive, either of the following test procedures may be used to detect leaks in the bladder cells.

a. Soapsuds Test.

1. Attach test plates to all fittings.
2. Inflate the cell with air to a pressure of 1/4 psi maximum.



Leakage of Wet Wing Tip Fuel Cell
Figure 208

3. Apply a soap and water solution to all repaired areas and any areas suspected of leakage. Bubbles will appear at any point where leakage occurs.

4. After test, remove all plates and wipe soap residue from the exterior of the cell.

b. Chemical Test

1. Attach test plates to all fitting openings except one.

2. Pour ammonia on the absorbent cloth in the ratio of 3 cc per cubic foot of cell capacity. Place the saturated cloth inside the cell and install the remaining test plate.

3. Make up a phenolphthalein solution as follows: add 40 grams phenolphthalein crystals to 1/2 gallon of ethyl alcohol, mix, then add 1/2 gallon of water.

4. Inflate the cell with air to a pressure of 1/4 psi maximum.

5. Soak a large white cloth in the phenolphthalein solution, then wring it out thoroughly and spread it smoothly on the outer surface of the cell. Press the cloth down to insure detection of minute leaks.

6. Check the cloth for red spots which will indicate a leak. Mark any leaks found and move the cloth to a new location. Repeat this procedure until the entire exterior surface of the cell has been covered. If red spots appear on the cloth, they may be removed by resoaking the cloth in the solution.

7. The solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed container to prevent evaporation and deterioration.

After the test, remove all plates and test equipment. Allow the cell to air out.

NOTE

In conducting the tests outlined above, the cell need not be confined by a cage or jig, providing the 1/4 psi pressure is not exceeded.

FUEL CELL REPAIR

GOODYEAR FUEL CELLS

The following items for field repairable injuries (inside or outside) are permissible. Damaged cells, not covered by these items should be returned to the Goodyear Tire And Rubber Company, Rockmart, Georgia, for repair.

a. Punctures.
b. Slits - to maximum 3 inch length.
c. Abraided holes.
d. Loose hangers and glove snaps (hot repair only).

Repair the fuel cell as follows:

a. Thoroughly clean the damaged area, (at least one square foot surrounding the injury) with methyl ethyl ketone solvent. Three washings are recommended to assure cleanliness.

b. Cut a patch from repair material furnished in repair Kit No. 2F1-2-31853, large enough to extend beyond damaged area by 2 inches in all directions. The patch should be thinned toward the edges.

c. Place the dull or gum stock side of the patch next to the cell. Wash the patch thoroughly in methyl ethyl ketone.

NOTE

No patch is required for loose hanger or glove snap repair, but heat must be used for curing.

d. Mix the cement in the following proportions and sequence. Use one quart can containing 272 grams of 2342C, heat if necessary to liquify. To this, add one can of 2233C (185cc) and stir until smooth (a minimum of 5 minutes is required).

e. Apply two evenly brushed coats of cement to the cell and patch surface. Allow 30 minutes drying time between the second coat and the application of patch (do not use cement after it has been mixed more than two hours).

f. Center repair patch over repair area and roll down firmly using the 1 inch stitcher. Start rolling from center of patch to the outside edge. This will remove any trapped air. Hanger or glove snap repairs use the same cementing and drying time as regular repair but will require heat for curing.

g. Place cellophane over repair and on inside of cell under repair. It is very important that the cellophane on the inside of the cell be placed under the repair area, thus preventing the two inside surfaces of the cell from being cemented together. Over the outside cellophane place the 1/4 inch cloth-backed foam rubber, cloth side up. Over the foam rubber place a 1/4 x 6 x 6 aluminum plate and place a "C" clamp (8 inch min. clamp) over the metal plate and underneath the work bench top. With patch and plate centered over repair area, tighten the "C" clamp until cement is forced out under edges of the repair (let cure for 72 hours).

NOTE

Air cured repairs are to be made at room temperature of approximately 75°F. Add 25% to the cure time for each 10° drop in temperature.

If heat is used for curing, insert element from No. 2F1-3-25721 cure iron (contained in Kit 2F1-2-31234) between "C" clamp and metal plate, then tighten "C" clamp until cement is forced out from edges of the patch. Cure for 2 hours at 240°F. Allow iron to cool for 15 to 20 minutes before removing. Remove iron, metal plate, foam rubber and cellophane. Dampen cellophane with water, using a sponge, and remove by peeling off. Loose edges of patch up to 1/4 inch maximum may be trimmed off and buffed smooth. Protect area of tank around buffed area with masking tape. Loose edges exceeding 1/4 inch may be recemented using the same cure procedure as previously used.

Storage and Handling: Prior to storage, clean the cell with warm water and soap. Dry and wrap in as small a package as possible and place in a cardboard box. Store in a cool dry room away from any electric motor that might be in operation.

Materials and Equipment needed for repair:

a. Air Cure: (Kit 2F1-2-31853)

QUANTITY	*NOMENCLATURE*	*GOODYEAR PART NO.*
2Qts.	Cement	2342C
2-1/2 Pts.	Mixture	2333C
2 Bottles	Mixture	2315C
2 (1 Pts.)	Methyl Ethyl Ketone	
1 Sheet 12" x 12"	Patch	BTC39
1 Sheet 12" x 24"	Cellophane	
1 Sheet 1/4 x 12" x 12"	Foam Rubber Cloth Back	

b. Heat Cure: (Kit No. 2F1-2-31234). Kit consists of all the above items listed in the air cure repair kit, plus the following items:

QUANTITY	*NOMENCLATURE*	*GOODYEAR PART NO.*
1	1" Paint Brush	
1	1" Stitcher	
1	Cure Iron (240°F)	2F1-3-25721
2	1/4" x 6" x 6" Aluminum Plate	

UNIROYAL FUEL CELLS

For repairs of Uniroyal fuel cells, refer to Uniroyal Handbook, Recommended Handling and Storage Procedures for Bladder Type Fuel and Oil Cells P/N FC 1473-73.

"END"

DISTRIBUTION - MAINTENANCE PRACTICES

FUEL BOOST PUMP REMOVAL

a. Drain and purge the fuel system for the appropriate wing.
b. Make sure the electrical power to the boost pump is off.
c. Remove the pump access cover on the underside of the wing.
d. Disconnect the electrical leads to the pump.
e. Cut the safety wire from around the retaining bolts and remove the bolts.
f. Pull the pump down far enough to gain access to the pump outlet line.
g. Disconnect the outlet line and remove the pump.

FUEL BOOST PUMP INSTALLATION

a. Clean the gasket contact areas on the fuel cell and the fuel pump.
b. Connect the fuel outlet line to the fuel boost pump.
c. Install the boost pump with new gaskets. Torque the bolts to 45 to 55 inch-pounds and safety wire.
d. Connect electrical leads to the pump.
e. Install the pump access plate on the underside of the wing.

ENGINE DRIVEN FUEL PUMP REMOVAL

a. Access to the engine-driven fuel pump is gained through the right cowl door on each nacelle.
b. The fuel pump is located at the rear, on the lower right side of the engine.
c. Disconnect the fuel inlet, outlet and drain plumbing from the pump. Remove the fuel pump heat shield.

NOTE

The 60-910031-3 elbow in the inlet port of the fuel pump is not a reusable part. Anytime the elbow is loosened or removed, it should be replaced with a new part.

d. Remove the pump retaining nuts and remove the pump.

ENGINE DRIVEN FUEL PUMP INSTALLATION

a. Install the fuel pump, on the lower rear right side of the engine, with a new gasket.
b. Connect fuel inlet, outlet and drain plumbing on the pump.
c. Install the fuel pump heat shield.
d. Close the right cowl door.

ENGINE DRIVEN FUEL PUMP ADJUSTMENT

a. The fuel pump is located at the rear, on the lower right side of the engine. Access is the right cowl door on each nacelle.
b. Install a fuel pressure gage (0-30 psi range) and a "T" fitting on the pressure side of the pump.
c. Break the safety wire and loosen the lock nut of the adjusting screw.
d. Disconnect and plug the air reference line from the engine pump.

NOTE

Allow the air reference line fitting on the fuel pump to remain open while adjusting the pressure on the pump.

e. Operate the engine at 2900 rpm and set the engine pump to 23 psi with the boost pump off.
f. Reinstall the air reference line to the pump.
g. Tighten the lock nut and safety wire.

FUEL SELECTOR VALVE REMOVAL

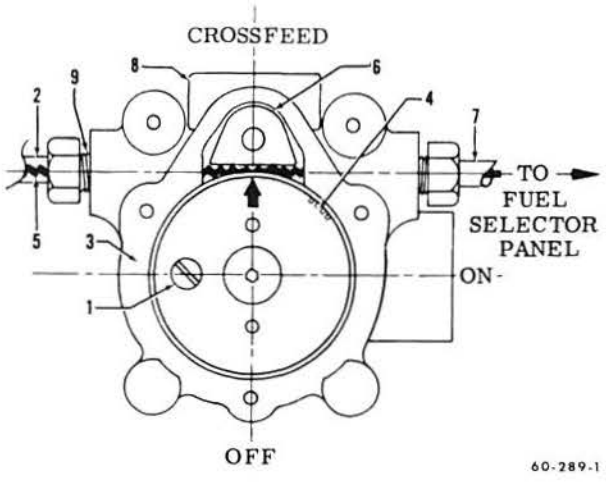
a. Drain the fuel system.
b. Place the aircraft on jacks and partially retract the gear until the inboard main gear door is fully extended.
c. Remove the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE REMOVAL).
d. Remove the fuel selector valve plumbing.
e. Remove the bolts securing the selector valve to the mounting bracket.

FUEL SELECTOR VALVE INSTALLATION

a. Position selector valve on the mounting bracket and install attaching bolts.
b. Lubricate threaded fittings with VV-P-236 petrolatum (Chart 208, 91-00-00).
c. Connect the fuel selector plumbing.
d. Install the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE INSTALLATION.)
e. Rig the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE RIGGING.)

FUEL SELECTOR VALVE CONTROL CABLE REMOVAL
(Figure 201)

a. Remove the cover plate (not shown), stop screw (1) and overtravel tube (2) from the valve gearbox (3) located in the wheel well.



Fuel Selector Valve
(LH Shown, Cover Plate Removed)

1. Stop Screw
2. Over Travel Tube
3. Selector Valve Gearbox
4. Selector Gear
5. Control Cable
6. Slider
7. Cable Housing
8. Cross Feed Port
9. Over Travel Port

Fuel Selector Valve
Figure 201

b. The cable may be removed through the overtravel port by rotating the selector gear.

FUEL SELECTOR VALVE CONTROL CABLE INSTALLATION

Refer to FUEL SELECTOR VALVE CONTROL CABLE RIGGING for installation procedures.

FUEL SELECTOR VALVE CONTROL CABLE RIGGING

(Figure 201 and 202)

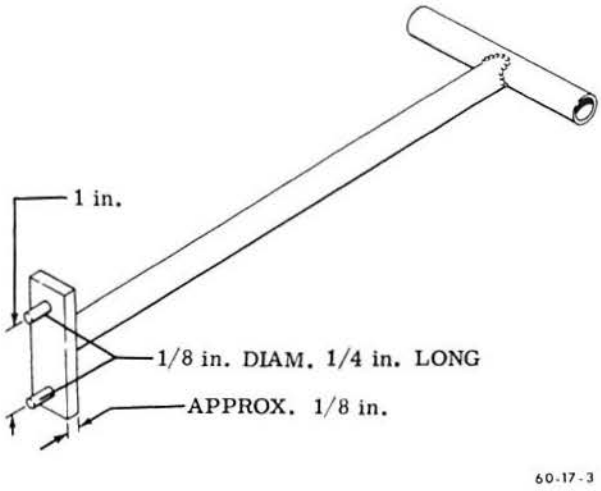
To aid in the rigging procedure, a locally manufactured "rigging tool" (see Figure 202) may be constructed for turning the selector gear. Tubing of 1/4 to 3/8 inch diameter is used for the handle and 1/8 inch steel pins are used for the protrusions which contact the selector gear.

a. Remove the cover plate (not shown), stop screw (1) and overtravel tube (2) from the fuel selector valve gearbox (3) located in the wheel well. (See Figure 201).

b. Using the rigging tool, set the selector gear (4) in the CROSSFEED position. The arrow on the selector gear should be positioned at 12 o'clock.

c. Set the selector handle pointer on the fuel selector panel 180° from the ON position and hold firmly in this position.

d. Insert the control cable (5) through the overtravel port and rotate the cable (LH thread) to engage two threads in the selector valve gear.



Rigging Tool
Figure 202

e. Rotate the selector gear 6-3/4 revolutions to feed the control cable through its housing up to the fuel selector panel gearbox in the pilot's compartment.

f. Screw the cable in (LH thread) until the cable end is 4.3 inches minimum to 4.5 inches maximum from the face of the overtravel port. It will be necessary to have someone hold the selector handle pointer in position until the control cable is engaged with the gears in the fuel selector panel.

g. Move the fuel selector handle pointer to the CROSSFEED position. The arrow on the selector gear should now be at the 12 o'clock position. The cable end should measure 2.7 inches minimum to 3.3 inches maximum from the overtravel port.

h. Install the stop screw and install and safety the overtravel tube. Place the selector handle in all positions to insure proper selection and operation.

i. Install and safety the cover plate. No lubricant is used on the fuel selector valve.

VENT FLOAT VALVE REMOVAL

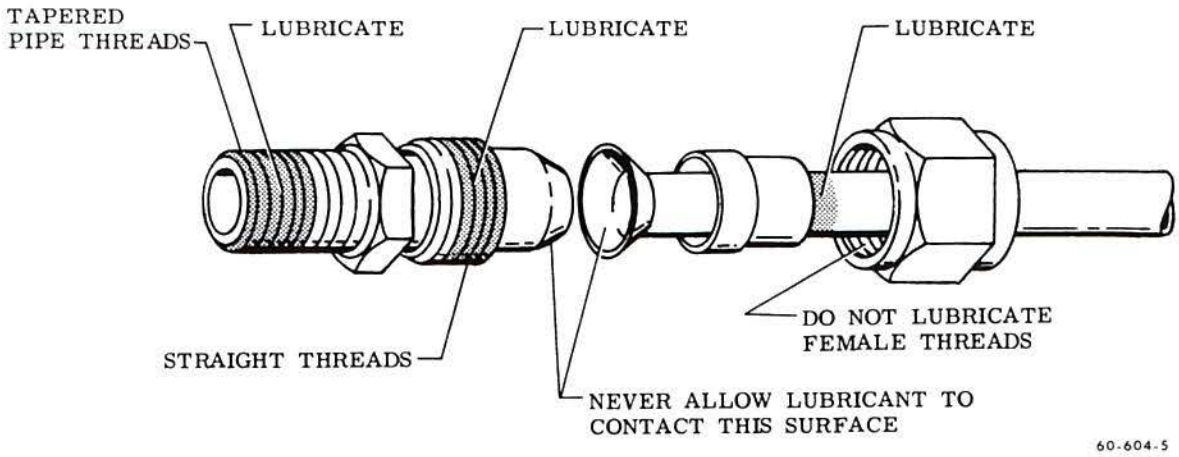
a. Remove the two access plates on the lower side of the wing tip.

b. Loosen the clamps and disconnect the three vent lines from the float valve.

c. Loosen the clamp securing the float valve in position.

NOTE

Mark the position of the float valve in the clamp. The float valve must be reinstalled in the same position to enable the float to function properly.



Lubrication of Flared Fittings
Figure 203

d. Remove the float valve from the clamp.

VENT FLOAT VALVE INSTALLATION

a. Position the float valve in the clamp in the same position as noted during removal. Torque the clamp to 25± 5 inch- pounds.

b. Connect the three vent lines to the float valve and torque the hose clamps to 25 ± 5 inch-pounds.

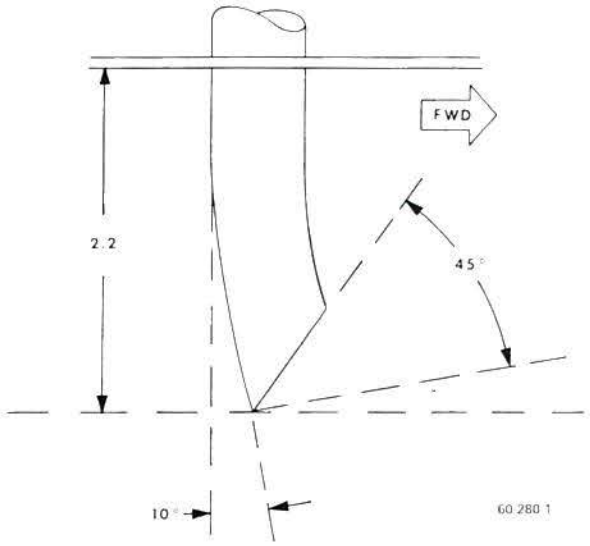
c. Install the two access plates on the lower side of the wing tip.

FLARED FITTINGS
(Figue 203)

When installing flared fittings and hoses, make sure the threads are properly lubricated with VV-P-236 petrolatum (Chart 208, 91-00-00). When previously installed fittings are removed, they should be wiped clean and relubricated before they are reinstalled. Torque all fittings in accordance with (Chart 204, 91-00-00).

EXTERNAL FUEL CELL VENT LINE
(Figure 204)

The end of the fuel vent lines should extend 10 degrees forward from vertical for a distance of 2.2 inches below the lower surface of the wing. The end of the line is scarfed at a 45 degree angle facing forward to ensure a positive vent pressure, for any other configuration would create a negative pressure that would pull the air, or air and fuel from the fuel cell.



Fuel Vent Line
Figure 204

"END"

INDICATING - MAINTENANCE PRACTICES

FUEL QUANTITY INDICATORS

Fuel quantity is measured by float type transmitter units which transmit the common level indication to a single indicator for each respective wing. Two transmitters are located in each inboard leading edge wing cell, one outboard and one inboard. One transmitter is located in each nacelle fuel cell.

FUEL TRANSMITTER REMOVAL

a. Remove fuel cell access plate. (See Figure 201 or 202, 28-10-00.)
b. Disconnect electrical wire at the transmitter.
c. Remove the bolts attaching the fuel transmitter to the fuel cell.
d. Cover the open fuel cell port to prevent entry of foreign materials.

FUEL TRANSMITTER INSTALLATION

a. Remove the cover from the fuel cell port. Clean the surfaces of the fuel cell and transmitter.
b. Install the fuel transmitter with a new gasket. Torque the attaching bolts to 25 ± 5 inch-pounds and safety wire.
c. Connect the electrical wire to the transmitter.
d. Install the fuel cell access plate.

NOTE

On airplanes serials prior to P-186, when AC transmitters are removed for replacement, install Rochester transmitters. When this is done, the remaining transmitters in the applicable wing and the printed circuit board must be replaced.

ADJUSTING AND TESTING FUEL GAGING SYSTEM

An external power unit regulated at 28.25 VDC should be connected to the airplane when checking and adjusting the fuel gages for proper indication in the full and empty positions.

a. Remove the access plates covering the fuel quantity transmitters.
b. To check the fuel gage for full readings it is necessary to substitute a resistor for the three transmitters on each side. On airplanes equipped with AC transmitters, a 90 ohm resistor is required; on airplanes equipped with Rochester transmitters, a 270 ohm resistor is required. The resistor may be connected as follows:

1. Connect the resistor to wire E13A20 (at inboard leading edge transmitter) and to E11B20 (at nacelle transmitter) for the right wing system.

2. Connect the resistor to wire E17A20 (at inboard leading edge transmitter) and to E15B20 (at nacelle transmitter case) for the left wing system.

Actual fuel level for this test is irrevalent.

NOTE

A potentiometer, located on the printed circuit board behind each fuel quantity gage, may be adjusted to obtain a full reading on the gage.

c. The empty reading on the fuel gage may be checked by jumping a 20 gage wire between the inboard leading edge transmitter and the nacelle transmitter. Connect wire E13A20 to E11B20 (right wing) and E17A20 to E15B20 (left wing). Fuel level for this test is irrelevant.
d. To check the transmitters for the proper resistance in the empty position, it is necessary to defuel the airplane. If the fuel gages do not read empty, measure the resistance of the transmitters in series.

1. Connect the lead of an ohmeter to the number 2 terminal of the inboard leading edge transmitter and the other lead to the number one terminal on the nacelle transmitter (right wing).
2. Connect the lead of an ohmeter to the number 2 terminal of the inboard leading edge transmitter and the other lead to the case terminal of the nacelle transmitter (left wing).

The total resistance for each side should be 0 to 0.5 ohms. If the total resistance is excessive, check each transmitter and/or associated wiring for the cause of high resistance.

e. To check the transmitters for the proper resistance in the full position, visually check to determine all tanks are full. If the fuel gage does not give a full indication, check the resistance total for each wing as in the preceding step.
f. With AC transmitters installed, the total resistance should be 90 ohms per wing; individual transmitters should register 30 ± 2 ohms. With Rochester transmitters installed, the total resistance should be 270 ohms per wing; individual transmitters should register 90 ± 2 ohms.
g. Replace the access covers.

FUEL FLOW INDICATOR

For fuel flow indicator refer to Chapter 73.

FUEL SIGHT GAGE (P-402 and after)

For conveniance during fueling operations there is a fuel sight gage installed in each wing. The gage is installed in the upper leading edge just outboard of each nacelle. The gage is of the mechanical float type and the indicated fuel quantity is in U.S. gallons.

FUEL SIGHT GAGE REMOVAL (P-402 and after)

a. Remove the screws in the access plate and remove the plate.

b. Remove the screws around the sight gage and remove the gage.

FUEL SIGHT GAGE INSTALLATION (P-402 and after)

a. Position the gasket and gage in place (the gage will fit only one way).

b. Install the attachment screws and torque to 25 inch-pounds.

c. Safety wire the attachment screws.

d. Install the access cover plate and secure with screws.

"END"