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R = REVISED, A = ADDED OR D = DELETED
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CHAPTER 28 - FUEL

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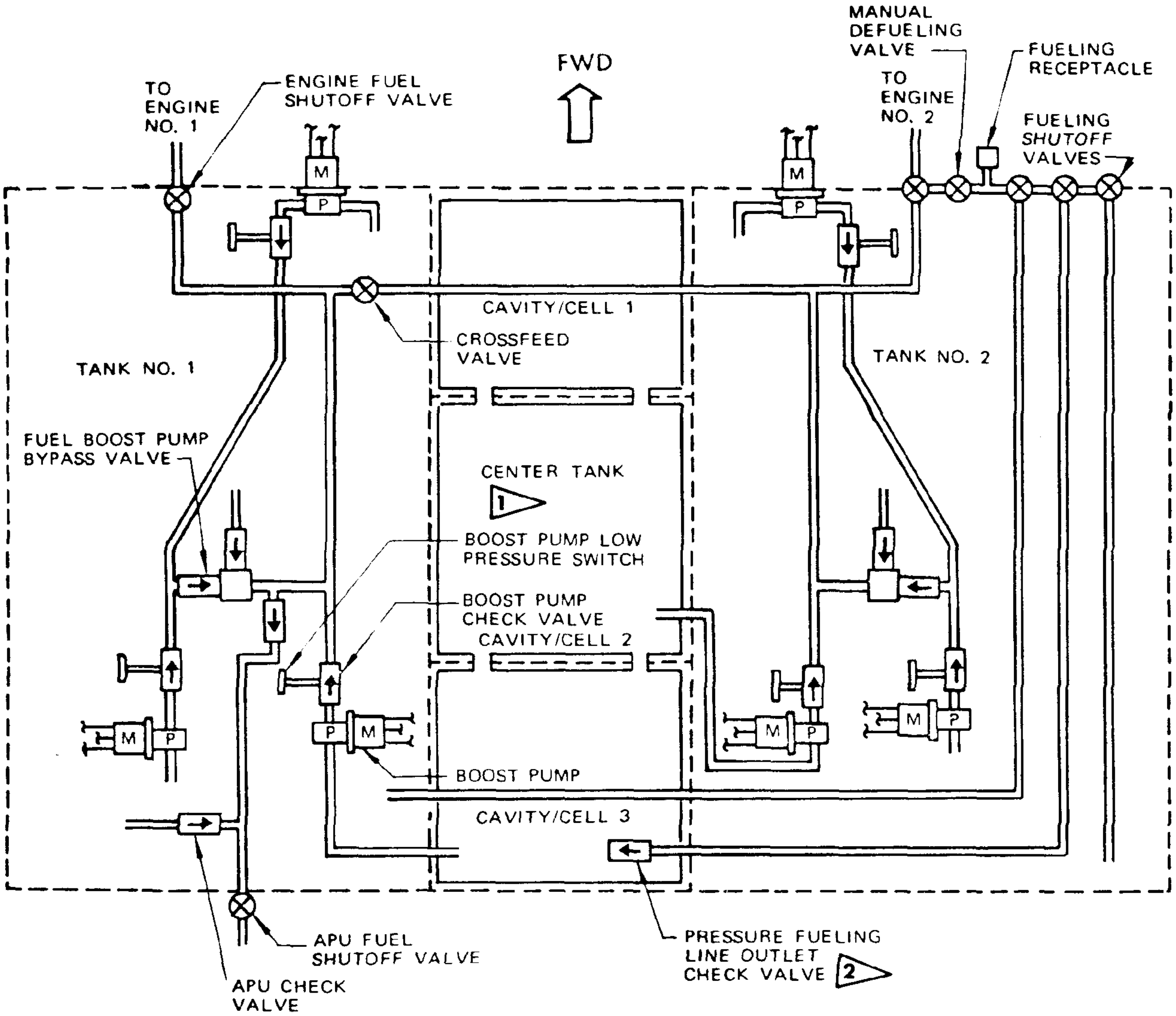
FUEL - DESCRIPTION AND OPERATION

1. General
   A. The purpose of the fuel system is to store and deliver fuel to the engines. Additional components and controls in the system provide for rapid (pressure) fueling and defueling. The tanks, lines, fittings and operating components in the system are compatible with all fuels meeting the engine manufacturer's specifications.
   B. All fuel is stored within vented areas of the wing and wing center section. The fuel storage area is divided into two integral fuel tanks (tanks No. 1 and 2) and a third tank (center tank) consisting of two or three removable fuel cells on some airplanes and an integral three cavity tank on other airplanes, see figure 1 for effectivity. Tanks No. 1 and 2 utilize the sealed wing structure to retain the fuel, while the center tank utilizes either a sealed wing structure, for the integral center tank, or bladder-type fuel cells. Airplanes with the integral center wing tank have a secondary fuel barrier coating on the outer surfaces of the upper panel and front spar for additional protection against fuel leaking into pressurized areas of the airplane. Fuel can be pumped into the tanks from a ground source through an underwing, pressure fueling station. The pressure fueling system provides rapid loading of all tanks simultaneously or each tank separately for partial or total filling. Rapid defueling of the tanks can be accomplished through the pressure-fueling receptacle. Only tanks No. 1 and 2 are provided with overwing fueling ports. An electronic (capacitance type) fuel quantity system is provided to indicate the amount of fuel contained in the tanks. A manual method of mechanical gauging (drip sticks) is also provided for use on the ground.
   C. Fuel is delivered from the tanks to the engines through a fuel feed system, which permits fuel to be supplied from any tank to one or both engines (Fig. 1). The fuel is pumped from the tanks by individually controlled, electric motor-driven boost pumps. Fuel from the pumps is normally delivered directly to the engines through fuel lines, or from pumps in any tank through a crossfeed manifold to both engines. Fuel from the pumps can also be delivered through a defueling valve into the fueling manifold. This interconnection allows the tank fuel boost pumps to pump fuel from the tanks for defueling operations, as well as for normal engine feed. Electrically operated valves provide for the control of shutoff and crossfeed in the system. All pump and valve controls, along with the instruments and indicating lights for monitoring the system are arranged on a system control panel located on the forward overhead panel. Figure 2 is a flow diagram of the system and also shows the general physical arrangement of components.

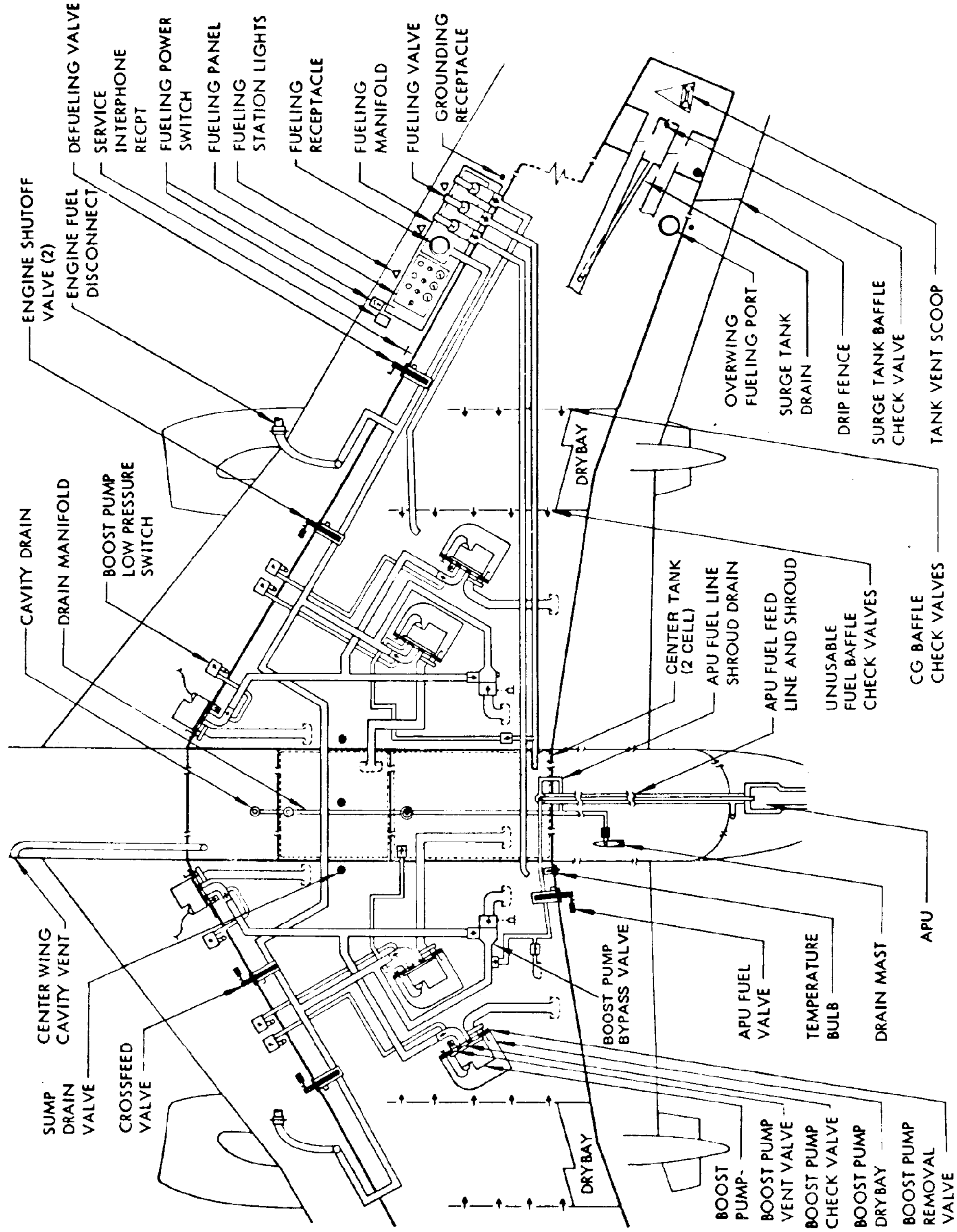
D. A fuel feed low pressure indicating light on the forward overhead panel, indicates inadequate engine boost pump output. A fuel temperature indicator, on the forward overhead panel, indicates fuel temperature in main tank No. 1.



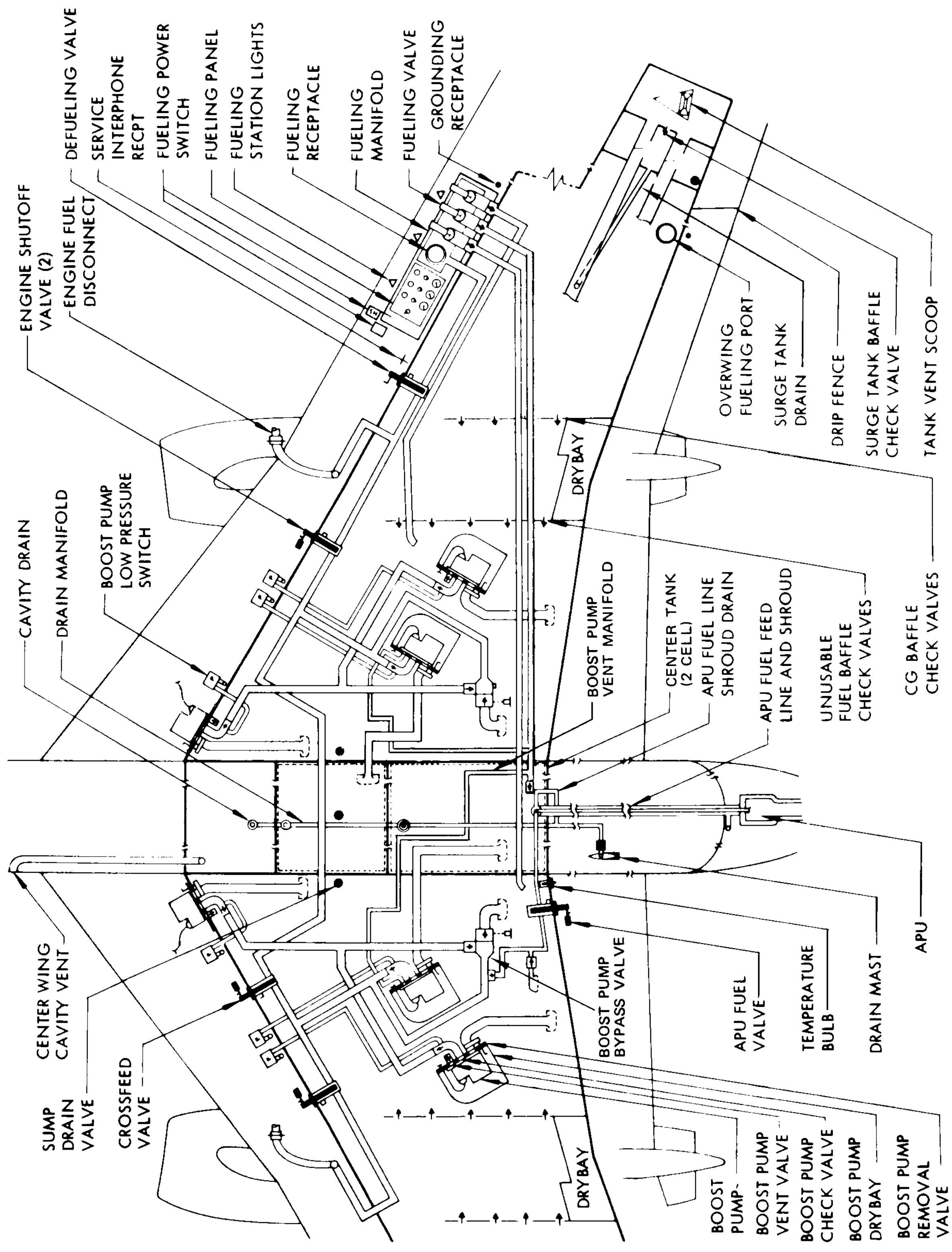
1 CENTER TANK CONFIGURATION:
2 BLADDER CELLS:
AR 737-287 ALL EXCEPT LV-LIU AND ON
3 BLADDER CELLS:
AR 737-287C
INTEGRAL (3 CAVITIES):
AR 737-287 LV-LIU AND ON

2 AR ALL EXCEPT LV-JMW THRU LV-JMY

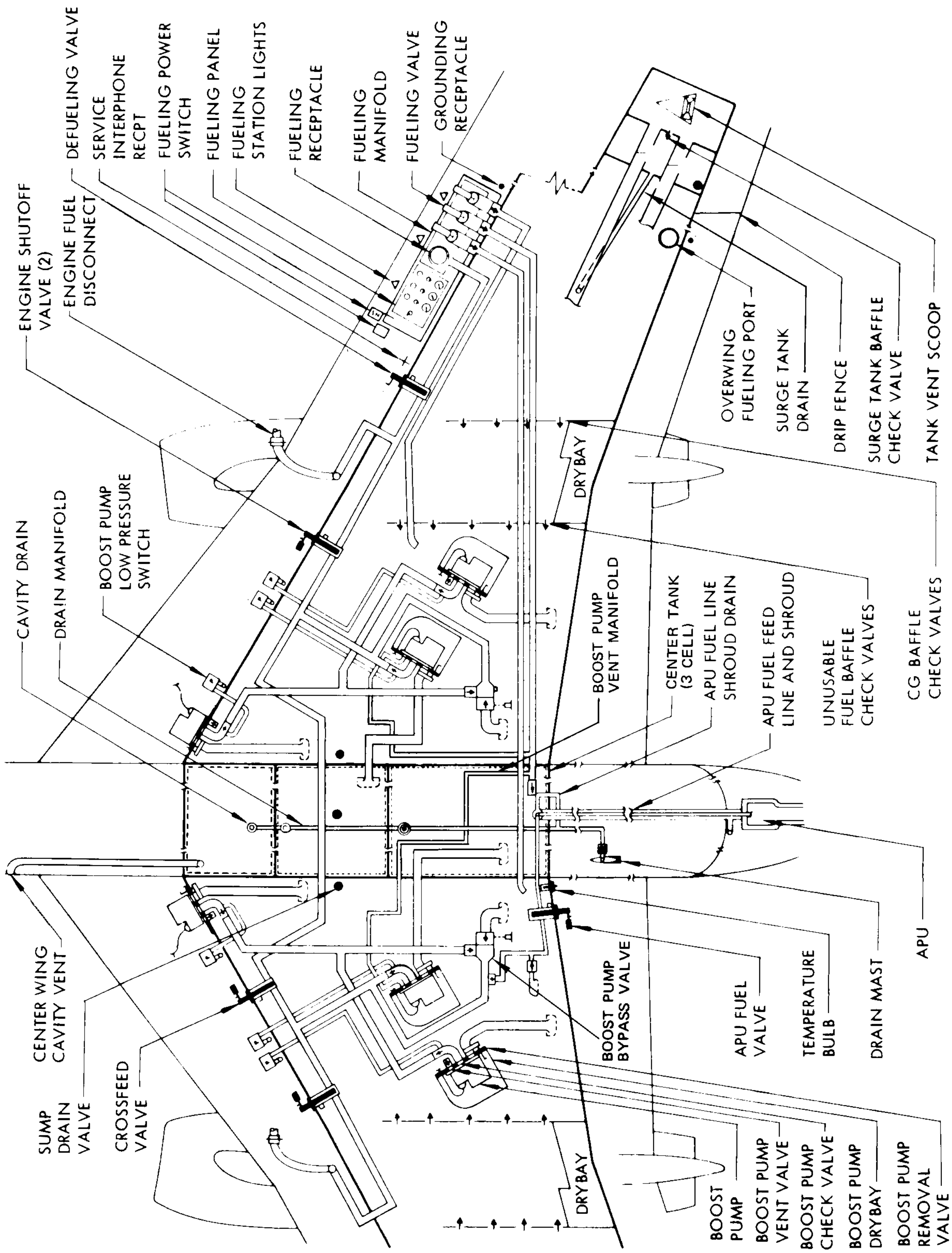
Fuel System Schematic
Figure 1



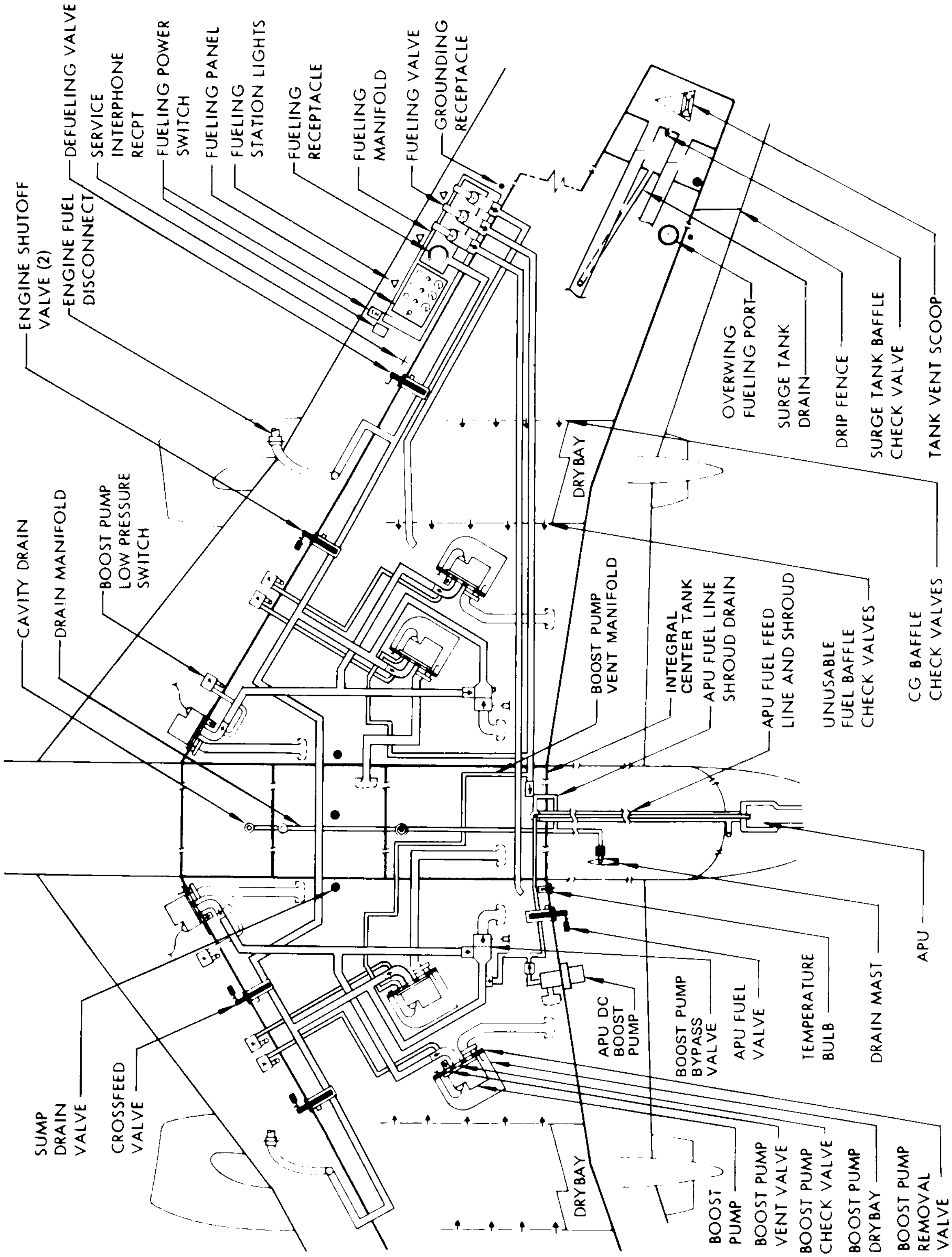
Fuel System Diagram
Figure 2 (Sheet 1)



Fuel System Diagram
Figure 2 (Sheet 2)



Fuel System Diagram
Figure 2 (Sheet 3)



Fuel System Diagram
Figure 2 (Sheet 4)

FUEL - MAINTENANCE PRACTICES

1. General
   A. This procedure has tasks for airworthiness limitation precautions, inspection and replacement of the electrical bonding jumpers in the fuel system.
2. Airworthiness Limitation Precautions
   A. General
      (1) Critical Design Configuration Control Limitations (CDCCLs)
         (a) All occurrences of CDCCLs found in this chapter of the AMM are identified by this note after each applicable CDCCL design feature:
            1) NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).
         (b) Design features that are CDCCLs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88, and can be found in Airworthiness Limitations (AWL) and Certification Maintenance Requirements (CMR) document, D6-38278-CMR. CDCCLs are a means of identifying certain design configuration features intended to preclude a fuel tank ignition source for the operational life of the airplane. CDCCLs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency. A critical fuel tank ignition source prevention feature may exist in the fuel system and its related installation or in systems that, if a failure condition were to develop, could interact with the fuel system in such a way that an unsafe condition would develop without this limitation. Strict adherence to configuration, methods, techniques, and practices as prescribed is required to ensure the CDCCL is complied with. Any use of parts, methods, techniques or practices not contained in the applicable CDCCL must be approved by the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

(2) Airworthiness Limitation Instructions (ALIs)
   (a) All occurrences of fuel tank system ALIs found in this chapter of the AMM are identified by this step after the General section in the applicable ALI inspection task:
      1) ALI - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on airworthiness limitation instructions (ALIs).
   (b) Inspection tasks that are ALIs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88, and can be found in Airworthiness Limitations (AWL) and Certification Maintenance Requirements (CMR) document, D6-38278-CMR. These ALIs identify inspection tasks related to fuel tank ignition source prevention which must be done to maintain the design level of safety for the operational life of the airplane. These ALIs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency. Strict adherence to methods, techniques and practices as prescribed is required to ensure the ALI is complied with. Any use of methods, techniques or practices not contained in these ALIs must be approved by the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

B. Access
   (1) Location Zones
      500 Left Wing
      600 Right Wing

C. Critical Design Configuration Control Limitations (CDCCLs)
   (1) Make sure you follow the procedures for items identified as CDCCLs.

      WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO ANY MAINTENANCE THAT MAY AFFECT A CDCCL. IF YOU DO NOT FOLLOW THE PROCEDURES, IT CAN INCREASE THE THE RISK OF AFUEL TANK IGNITION SOURCE.

D. Airworthiness Limitation Instructions (ALIs)
   (1) Make sure you follow the procedures for tasks identified as ALIs.

      WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO ANY MAINTENANCE THAT MAY AFFECT AN ALI. IF YOU DO NOT FOLLOW THE PROCEDURES, IT CAN INCREASE THE RISK OF A FUEL TANK IGNITION SOURCE.

3. Inspection of the Electrical Bonding Jumpers in the Fuel System

A. General

(1) This task gives the visual and mechanical inspections of the electrical bonding jumpers in the fuel system.

(2) Do not flex, bend or kink the bonding jumpers more than is necessary. If the bonding jumpers are moved too much, it can cause the loss of tin plating on the wire braid of the bonding jumper.

(3) When you inspect the bonding jumpers, you may see black or brown deposits on the wire braid. This can occur when there is deterioration of the tin plating on the bonding jumper and the copper in the wire reacts with the sulfur compounds in the fuel. This discoloration is not a problem unless the wire braid contains broken strands. If the bonding jumper has broken strands, then you must replace the bonding jumper.

(4) When you inspect the bonding jumpers, inspect for loose clamps and corrosion.

B. References

(1) SWPM 20-20-00, Electrical Bonds and Grounds

C. Electrical Bonding Jumper Visual Inspection

(1) Visually inspect the bonding jumper and clamp for color and deterioration.

(a) If the bonding jumper is silver in color, and free from black or brown deposits, then the bonding jumper is satisfactory.

(b) If the wire braid on the bonding jumper has black or brown deposits, then inspect the bonding jumper for broken strands.

1) If the wire braid does not have broken strands, then the bonding jumper is satisfactory.

2) If there are broken strands in the wire braid, then do the task: Electrical Bonding Jumpers in the Fuel System Replacement.

D. Electrical Bonding Jumper Mechanical Inspection

(1) Try to turn the bonding jumper lugs and tube clamps, if applicable, with light finger pressure.

(2) If the bonding jumper is loose, rework the electrical bond path (SWPM 20-20-00).

4. Electrical Bonding Jumpers in the Fuel System Replacement

A. References

(1) SWPM 20-20-00, Electrical Bonds and Grounds

B. Replace the Electrical Bonding Jumper

(1) Remove the bonding jumper.

(a) Keep all the parts necessary for the installation of the bonding jumper.

(2) For the bonding jumpers used to bond electrical equipment, follow the applicable installation procedure in the AMM.

(3) For the bonding jumpers used to bond mechanical equipment or tubing, install the new bonding jumper and hardware (SWPM 20-20-00).

(a) Make sure the mating surface(s) are correctly prepared.

(b) Make sure the bonding jumper installation gives adequate clearance from the structure, tubing or all fuel system parts.

NOTE: This will prevent abrasion.

(c) Do a check of the electrical integrity of the fuel system bond path.

NOTE: SWPM 20-20-00 defines the measurement processes necessary for installation of electrical bonding hardware. The fuel system tubing and components often incorporate multiple electrical bonds in series between the component and the primary structure. The measurement of the tubing or component bond is a separate requirement.

1) For bonding jumper hardware installations, do the resistance measurement for electrical intergrity (SWPM 20-20-00).

2) For the fuel system tubing or components, measure the total resistance from the tubing or component, to the adjacent primary structure.

a) Make sure the resistance is less than 0.10 ohms.

5. Fuel System Static Bond Path, No. 1 Tank - Inspection

A. References

(1) AMM 28-10-0/201, Fuel Tanks

(2) AMM 28-11-11/401, Wing Fuel Tank Access Panels

B. Procedure

(1) For the area in the No. 1 fuel tank between rib No. 1 (side-of-body rib at WBL 71.24) and rib No. 5 (at WBL 157.00), do these steps:

(a) Remove access panel No. 1 on the left wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 1 (AMM 28-10-0/201).

(c) Do this task for all bonding jumpers between rib No. 1 and rib No. 5: Inspection of the Electrical Bonding Jumpers in the Fuel System.

(d) If access is not necessary for subsequent tasks, install access panel No. 1 (AMM 28-11-11/401).

(2) For the area in the No. 1 fuel tank between rib No. 5 (rib at WBL 157.00) and rib No. 7 (rib at WBL 198.60), do these steps:

(a) Remove access panel No. 2 on the left wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 2 (AMM 28-10-0/201).

(c) Do this task for all bonding jumpers between rib No. 5 and rib No. 7: Inspection of the Electrical Bonding Jumpers in the Fuel System.

(d) If access is not necessary for subsequent tasks, install access panel No. 2 (AMM 28-11-11/401).

(3) For the area in the No. 1 fuel tank between rib No. 7 (rib at WBL 198.60) and rib No. 8 (rib at WBL 227.00), do these steps:

(a) Remove access panel No. 3 on the left wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 3 (AMM 28-10-0/201).

(c) Do this task for all bonding jumpers between rib No. 7 and rib No. 8: Inspection of the Electrical Bonding Jumpers in the Fuel System.

(d) If access is not necessary for subsequent tasks, install access panel No. 3 (AMM 28-11-11/401).

(4) For the area in the No. 1 fuel tank between rib No. 8 (rib at WBL 227.00) and rib No. 9 (rib at WBL 254.00), do these steps:

(a) Remove access panel No. 4 on the left wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 4 (AMM 28-10-0/201).

(c) Do this task for all bonding jumpers between rib No. 8 and rib No. 9: Inspection of the Electrical Bonding Jumpers in the Fuel System.

(d) If access is not necessary for subsequent tasks, install access panel No. 4 (AMM 28-11-11/401).

(5) For the area in the No. 1 fuel tank between rib No. 9 (rib at WBL 254.00) and rib No. 10 (rib at WBL 279.25), do these steps:
  (a) Remove access panel No. 5 on the left wing (AMM 28-11-11/401).
  (b) Go into the opening for access panel No. 5 (AMM 28-10-0/201).
  (c) Do this task for all bonding jumpers between rib No. 9 and rib No. 10: Inspection of the Electrical Bonding Jumpers in the Fuel System.
  (d) If access is not necessary for subsequent tasks, install access panel No. 5 (AMM 28-11-11/401).

(6) For the area in the No. 1 fuel tank between rib No. 10 (rib at WBL 279.25) and rib No. 11 (rib at WBL 304.50), do these steps:
  (a) Remove access panel No. 6 on the left wing (AMM 28-11-11/401).
  (b) Go into the opening for access panel No. 6 (AMM 28-10-0/201).
  (c) Do this task for all bonding jumpers between rib No. 10 and rib No. 11: Inspection of the Electrical Bonding Jumpers in the Fuel System.
  (d) If access is not necessary for subsequent tasks, install access panel No. 6 (AMM 28-11-11/401).

(7) For the area in the No. 1 fuel tank between rib No. 11 (rib at WBL 304.50) and rib No. 12 (rib at WBL 329.75), do these steps:
  (a) Remove access panel No. 7 on the left wing (AMM 28-11-11/401).
  (b) Go into the opening for access panel No. 7 (AMM 28-10-0/201).
  (c) Do this task for all bonding jumpers between rib No. 11 and rib No. 12: Inspection of the Electrical Bonding Jumpers in the Fuel System.
  (d) If access is not necessary for subsequent tasks, install access panel No. 7 (AMM 28-11-11/401).

(8) For the area in the No. 1 fuel tank between rib No. 12 (rib at WBL 329.75) and rib No. 13 (rib at WBL 355.00), do these steps:
  (a) Remove access panel No. 8 on the left wing (AMM 28-11-11/401).
  (b) Go into the opening for access panel No. 8 (AMM 28-10-0/201).
  (c) Do this task for all bonding jumpers between rib No. 12 and rib No. 13: Inspection of the Electrical Bonding Jumpers in the Fuel System.
  (d) If access is not necessary for subsequent tasks, install access panel No. 8 (AMM 28-11-11/401).

(9) For the area in the No. 1 fuel tank between rib No. 13 (rib at WBL 355.00) and rib No. 14 (rib at WS 453.00), do these steps:
  (a) Remove access panel No. 9 on the left wing (AMM 28-11-11/401).
  (b) Go into the opening for access panel No. 9 (AMM 28-10-0/201).

(c) Do this task for all bonding jumpers between rib No. 13 and rib No. 14: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 9 (AMM 28-11-11/401).

(10) For the area in the No. 1 fuel tank between rib No. 14 (rib at WS 453.00) and rib No. 15 (rib at WS 479.00), do these steps:
(a) Remove access panel No. 10 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 10 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 14 and rib No. 15: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 10 (AMM 28-11-11/401).

(11) For the area in the No. 1 fuel tank between rib No. 15 (rib at WS 479.00) and rib No. 16 (rib at WS 505.00), do these steps:
(a) Remove access panel No. 11 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 11 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 15 and rib No. 16: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 11 (AMM 28-11-11/401).

(12) For the area in the No. 1 fuel tank between rib No. 16 (rib at WS 505.00) and rib No. 17 (rib at WS 531.00), do these steps:
(a) Remove access panel No. 12 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 12 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 16 and rib No. 17: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 12 (AMM 28-11-11/401).

6. <u>Fuel System Static Bond Path, No. 2 Tank - Inspection</u>

A. References
(1) AMM 28-10-0/201, Fuel Tanks
(2) AMM 28-11-11/401, Wing Fuel Tank Access Panels

B. Procedure
(1) For the area in the No. 2 fuel tank between rib No. 1 (side-of-body rib at WBL 71.24) and rib No. 5 (rib at WBL 157.00), do these steps:
(a) Remove access panel No. 1 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 1 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 1 and rib No. 5: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 1 (AMM 28-11-11/401).

(2) For the area in the No. 2 fuel tank between rib No. 5 (rib at WBL 157.00) and rib No. 7 (rib at WBL 198.60), do these steps:
(a) Remove access panel No. 2 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 2 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 5 and rib No. 7: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 2 (AMM 28-11-11/401).

(3) For the area in the No. 2 fuel tank between rib No. 7 (rib at WBL 198.60) and rib No. 8 (rib at WBL 227.00), do these steps:
(a) Remove access panel No. 3 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 3 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 7 and rib No. 8: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 3 (AMM 28-11-11/401).

(4) For the area in the No. 2 fuel tank between rib No. 8 (rib at WBL 227.00) and rib No. 9 (rib at WBL 254.00), do these steps:
(a) Remove access panel No. 4 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 4 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 8 and rib No. 9: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 4 (AMM 28-11-11/401).

(5) For the area in the No. 2 fuel tank between rib No. 9 (rib at WBL 254.00) and rib No. 10 (rib at WBL 279.25), do these steps:
(a) Remove access panel No. 5 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 5 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 9 and rib No. 10: Inspection of the Electrical Bonding Jumpers in the Fuel System.

(d) If access is not necessary for subsequent tasks, install access panel No. 5 (AMM 28-11-11/401).

(6) For the area in the No. 2 fuel tank between rib No. 10 (rib at WBL 279.25) and rib No. 11 (rib at WBL 304.50), do these steps:
(a) Remove access panel No. 6 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 6 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 10 and rib No. 11: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 6 (AMM 28-11-11/401).

(7) For the area in the No. 2 fuel tank between rib No. 11 (rib at WBL 304.50) and rib No. 12 (rib at WBL 329.75), do these steps:
(a) Remove access panel No. 7 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 7 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 11 and rib No. 12: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 7 (AMM 28-11-11/401).

(8) For the area in the No. 2 fuel tank between rib No. 12 (rib at WBL 329.75) and rib No. 13 (rib at WBL 355.00), do these steps:
(a) Remove access panel No. 8 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 8 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 12 and rib No. 13: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 8 (AMM 28-11-11/401).

(9) For the area in the No. 2 fuel tank between rib No. 13 (rib at WBL 355.00) and rib No. 14 (rib at WS 453.00), do these steps:
(a) Remove access panel No. 9 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 9 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 13 and rib No. 14: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 9 (AMM 28-11-11/401).

(10) For the area in the No. 2 fuel tank between rib No. 14 (rib at WS 453.00) and rib No. 15 (rib at WS 479.00), do these steps:
(a) Remove access panel No. 10 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 10 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 14 and rib No. 15: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 10 (AMM 28-11-11/401).

(11) For the area in the No. 2 fuel tank between rib No. 15 (rib at WS 479.00) and rib No. 16 (rib at WS 505.00), do these steps:
(a) Remove access panel No. 11 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 11 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 15 and rib No. 16: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 11 (AMM 28-11-11/401).

(12) For the area in the No. 2 fuel tank between rib No. 16 (rib at WS 505.00) and rib No. 17 (rib at WS 531.00), do these steps:
(a) Remove access panel No. 12 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 12 (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers between rib No. 16 and rib No. 17: Inspection of the Electrical Bonding Jumpers in the Fuel System.
(d) If access is not necessary for subsequent tasks, install access panel No. 12 (AMM 28-11-11/401).

7. <u>Fuel System Static Ground Path, Center Tank - Inspection</u>

A. References
(1) AMM 28-10-0/201, Fuel Tanks
(2) AMM 28-11-31/401, Integral Center Tank Access Panel
(3) AMM 28-12-21/401, Center Tank Access Panel

B. Procedure
(1) For the center fuel tank, do these steps:
(a) Remove the access panel for the center tank (AMM 28-11-31/401 or AMM 28-12-21/401).
(b) Go into the center tank (AMM 28-10-0/201).
(c) Do this task for all bonding jumpers in the center tank: Inspection of the Electrical Bonding Jumpers in the Fuel System.

8. Fuel System Fault Current, No. 1 Tank - Inspection

A. References

(1) AMM 27-81-0/201, Leading Edge Flaps and Slats

(2) SWPM 20-20-00, Electrical Bonds and Grounds

B. Procedure

(1) Do these steps to do an inspection of the left boost pump for the center tank:

(a) Remove the access panel 7201 in the bottom wing skin to get access to the left boost pump for the center tank.

(b) Do a check of the electrical bond between the left fuel boost pump for the center tank and the airplane structure (SWPM 20-20-00).

1) Make sure the resistance is not more than 0.0002 ohm.

(c) Install the access panel 7201 for the boost pump.

(2) Do these steps to do an inspection of the boost pumps for the No. 1 tank:

(a) Remove the access panel 7203 in the bottom wing skin to get access to the aft boost pump for the No. 1 tank.

(b) Do a check of the electrical bond between the aft fuel boost pump for the No. 1 tank and the airplane structure (SWPM 20-20-00).

1) Make sure the resistance is not more than 0.0002 ohm.

(c) Install the access panel 7203 for the boost pump.

(d) For the forward fuel boost pump for the No. 1 tank on airplanes without leading edge flaps covering the fuel boost pump, remove the access panel 6303 on the lower surface of the wing leading edge to get access to the forward fuel boost pump for the No. 1 tank.

(e) For the forward fuel boost pump for the No. 1 tank on airplanes with leading edge flaps covering the fuel boost pump, extend the leading edge flaps (AMM 27-81-0/201) to get access to the forward fuel boost pump for the No. 1 tank.

WARNING: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

1) Install the flap locks on the leading edge flaps (AMM 28-81-0/201).

WARNING: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO INSTALL THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT INSTALL THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(f) Do a check of the electrical bond between the forward fuel boost pump for the No. 1 tank and the airplane structure (SWPM 20-20-00).
1) Make sure the resistance is not more than 0.0002 ohm.
(g) Install the access panel 6303 for the fuel boost pump if you removed it.
(h) Remove the flap locks from the leading edge flaps if you installed them (AMM 27-81-0/301).

WARNING: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO REMOVE THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT REMOVE THE SAFETY CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(i) Retract the leading edge flaps if they are extended (AMM 27-81-0/201).

WARNING: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

9. Fuel System Fault Current, No. 2 Tank - Inspection
A. References
(1) AMM 27-81-0/201, Leading Edge Flaps and Slats
(2) SWPM 20-20-00, Electrical Bonds and Grounds
B. Procedure
(1) Do these steps to do an inspection of the right boost pump for the center tank:
(a) Remove the access panel 7401 in the bottom wing skin to get access to the right boost pump for the center tank.
(b) Do a check of the electrical bond between the right fuel boost pump for the center tank and the airplane structure (SWPM 20-20-00).
1) Make sure the resistance is not more than 0.0002 ohm.

(c) Install the access panel 7401 for the boost pump.

(2) Do these steps to do an inspection of the boost pumps for the No. 2 tank:

(a) Remove the access panel 7403 in the bottom wing skin to get access to the aft boost pump for the No. 2 tank.

(b) Do a check of the electrical bond between the aft fuel boost pump for the No. 1 tank and the airplane structure (SWPM 20-20-00).

1) Make sure the resistance is not more than 0.0002 ohm.

(c) Install the access panel 7403 for the boost pump.

(d) For the forward fuel boost pump for the No. 2 tank on airplanes without leading edge flaps covering the fuel boost pump, remove the access panel 6403 on the lower surface of the wing leading edge to get access to the forward fuel boost pump for the No. 2 tank.

(e) For the forward fuel boost pump for the No. 2 tank on airplanes with the leading edge flaps covering the fuel boost pump, extend the leading edge flaps (AMM 27-81-0/201) to get access to the forward fuel boost pump for the No. 2 tank.

<u>WARNING</u>: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

1) Install the flap locks on the leading edge flaps (AMM 28-81-0/201).

<u>WARNING</u>: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO INSTALL THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT INSTALL THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(f) Do a check of the electrical bond between the forward fuel boost pump for the No. 2 tank and the airplane structure (SWPM 20-20-00).

1) Make sure the resistance is not more than 0.0002 ohm.

(g) Install the access panel 6403 for the fuel boost pump if you removed it.

(h) Remove the flap locks from the leading edge flaps if you installed them (AMM 27-81-0/301).

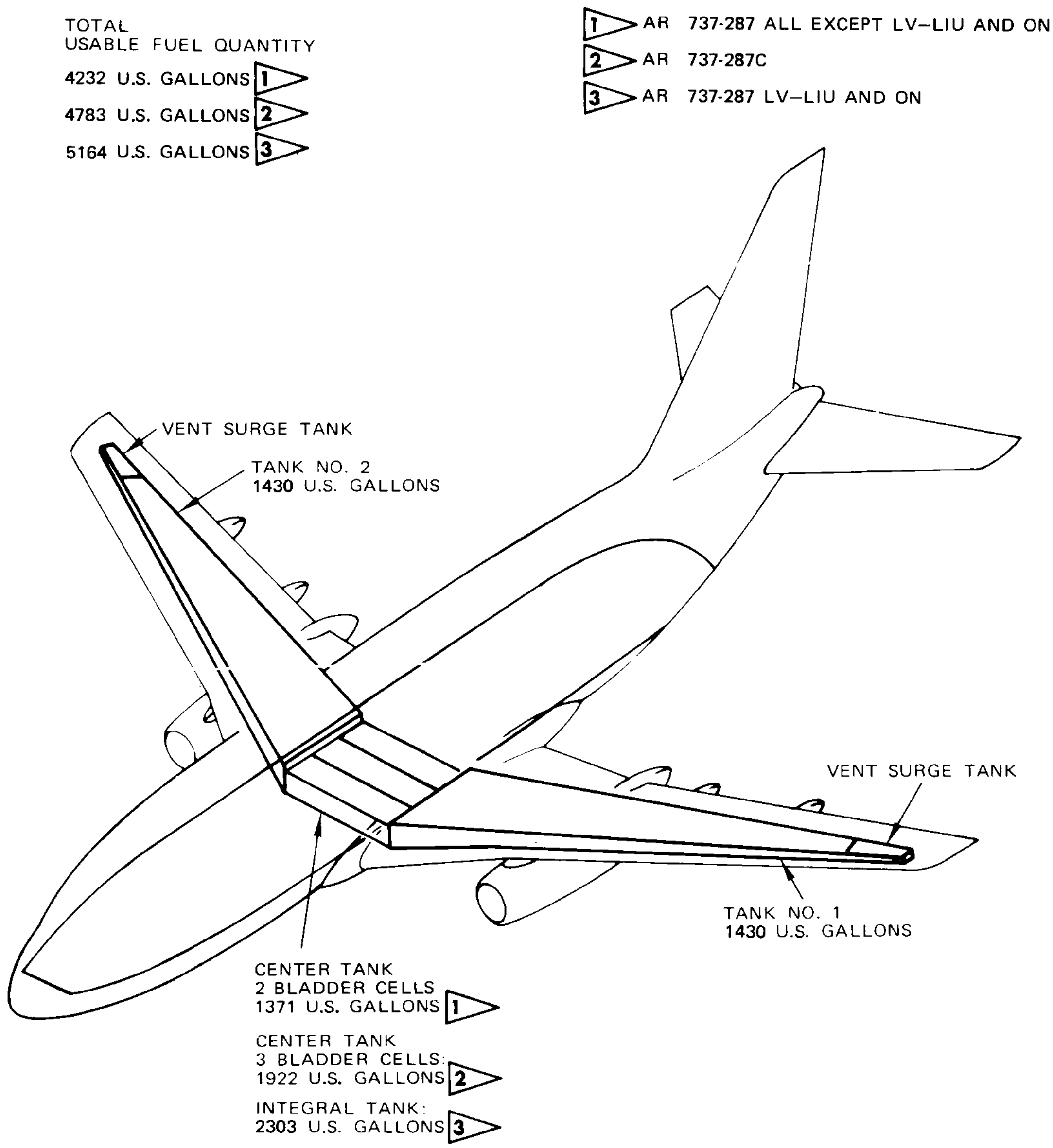
WARNING: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO REMOVE THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT REMOVE THE SAFETY CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(i) Retract the leading edge flaps if they are extended (AMM 27-81-0/201).

WARNING: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

STORAGE - DESCRIPTION AND OPERATION

1. General
    A. All fuel used by the engines and the auxiliary power unit (APU) is stored in the left and right wing (tanks No. 1 and 2) and in the wing center section (center tank) (Fig. 1). Integral (sealed structure) tanks and removable bladder cells are used for containing the fuel. For additional information, refer to AMM 28-11-0/001 and AMM 28-12-0/001.
    B. All fuel used by the engines and the auxiliary power unit (APU) is stored in the left and right wing (tanks No. 1 and 2) and in the wing center section (center tank) (Fig. 1). Integral (sealed structure) tanks and removable bladder cells are used for containing the fuel. For additional information, refer to 28-11-0, Integral Fuel Tanks - Description and Operation, and to 28-12-0, Removable Fuel Cells - Description and Operation.
2. Wing Tanks No. 1 and 2
    A. Wing tanks No. 1 and 2 are integral type and include the sealed structure between the front and rear spars and upper and lower skin from the root wing rib, near the junction of the airplane body, outboard to the wingtip surge tank.
3. Center Fuel Tank
    A. The center tank utilizes the space between the front and rear wing spars of the portion of wing section which passes through the airplane body. This space is divided into three bays by two spanwise beams. In some airplanes, two of the three bays contain removable bladder cells; in other airplanes, all three bays have bladder cells, and in a third configuration, the structure is sealed to make one integral tank (See Fig. 1 for effectivities).



Fuel Tank Arrangement
Figure 1

FUEL TANKS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains these tasks:
      (1) Purging and Fuel Tank Entry Precautions
      (2) Purging and Fuel Tank Entry
      (3) Fuel Tank Closure
   B. If you make a decision not to do this recommended procedure, you must have an approved alternate procedure. Make sure the conditions during the purging and fuel tank entry operations give sufficient protection to the persons and equipment used in this procedure. It is possible that local fire codes and standards make it necessary to use more restrictive procedures or more procedures than those given in the subsequent steps.
   C. The safety, fire and health limits in this procedure are used by Boeing at the manufacturing sites in the state of Washington. For fuel tank and confined space entry, Boeing is required to have an aircraft confined space entry program. This program is established to control the entry into confined spaces to protect the safety and health of persons who go into fuel tanks and other closed areas. Important requirements of the program include:
      (1) Identification and Warning Sign Placement
      (2) Observer Communication with Persons inside Confined Spaces
      (3) Entry Permit Requirements
      (4) Pre-entry Procedures
      (5) Entry Procedures
      (6) Emergency and Rescue Service
      (7) Fuel Tank Closure
      (8) Training
   D. It is recommended that a fuel tank entry program which complies with the local, state and national regulations be followed.
2. Purging and Fuel Tank Entry Precautions
   A. General
      (1) This procedure contains the precautions you must obey before you purge and enter the fuel tanks for maintenance. This task contains these procedures:
         (a) Purging and Fuel Tank Entry - Definitions
         (b) Purging and Fuel Tank Entry - Airplane Precautions
         (c) Purging and Fuel Tank Entry - Electrical Equipment Precautions
         (d) Purging and Fuel Tank Entry - Equipment Precautions
         (e) Purging and Fuel Tank Entry - Personnel Precautions
         (f) Purging and Fuel Tank Entry - Adverse Weather Precautions
      (2) The next task, Purging and Fuel Tank Entry, contains the steps you must follow when you purge and enter a fuel tank.

B. Purging and Fuel Tank Entry - Definitions

(1) Approved Persons:

(a) Persons who are trained and understand the dangers and procedures for fuel tank entry and are responsible to make sure the airplane, equipment and the environment is safe for maintenance operations.

(2) Approved Persons for Fuel Tank Entry:

(a) Persons who are trained and understand the dangers and procedures for fuel tank entry.

(3) Class I, Division 1, Hazardous Locations (or equivalent standard):

(a) Locations where ignitable concentrations of flammable gases or vapors can exist under standard operational conditions.

(b) Locations where ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations.

(c) Locations where ignitable concentrations of flammable gases or vapors can exist because of leakage.

(d) Locations where equipment problems or incorrect operation of equipment or processes can release ignitable concentrations of flammable gases or vapor, and can also cause failure of electrical equipment at the same time.

(4) Class I, Division 2, Hazardous Locations (or equivalent standard):

(a) Locations where flammable liquids or gases are handled, processed or used, but where the liquid, vapors, or gases will usually be in closed containers or closed systems. The containers or systems will not allow the release of liquid, gas or vapor in sufficient quantity to produce an ignitable fuel and air mixture unless the container or system fails or is damaged.

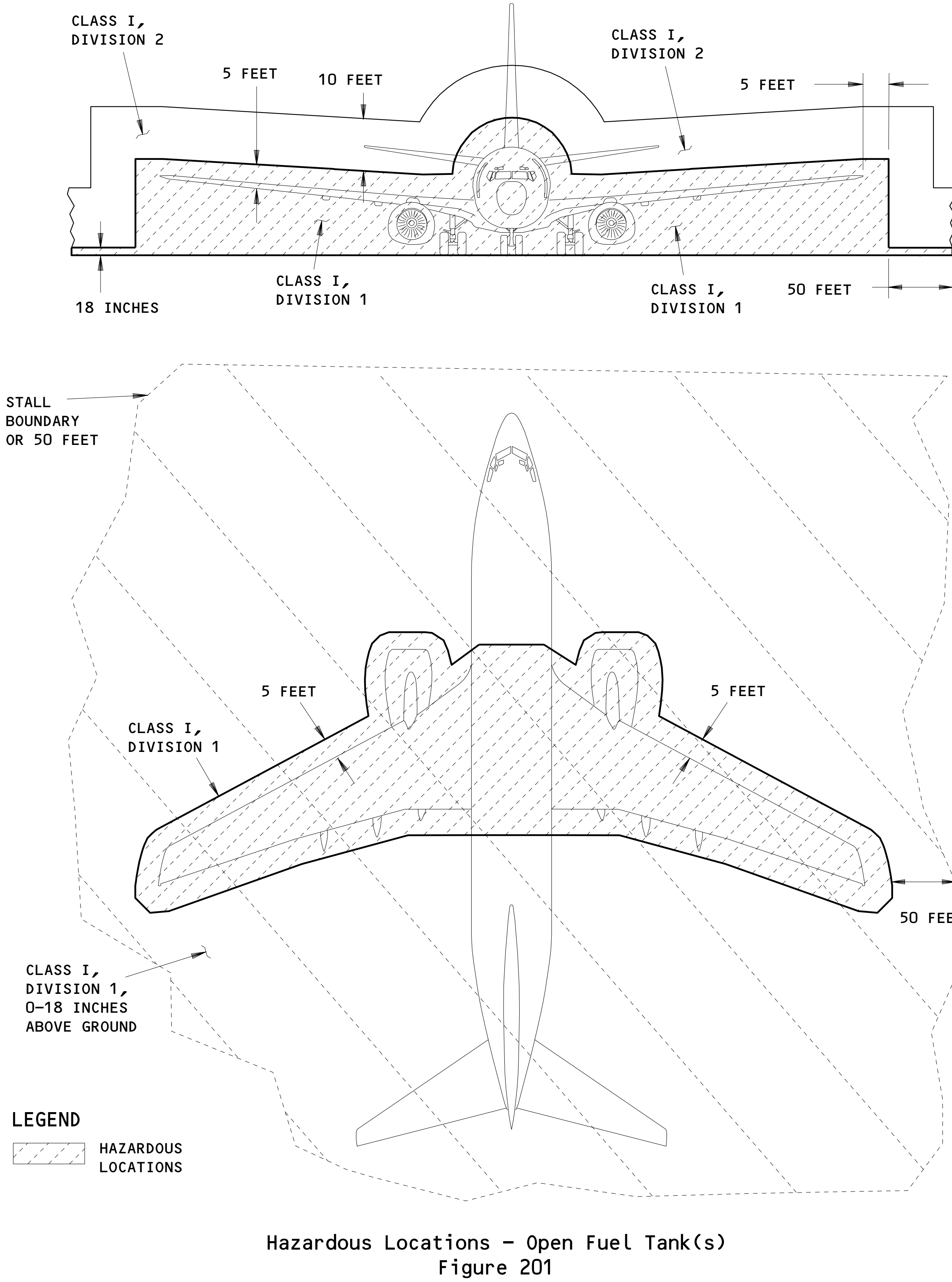
(5) Explosion-Proof Equipment:

(a) Equipment contained in a case that will not be damaged by an internal explosion caused by explosive vapors inside the unit.

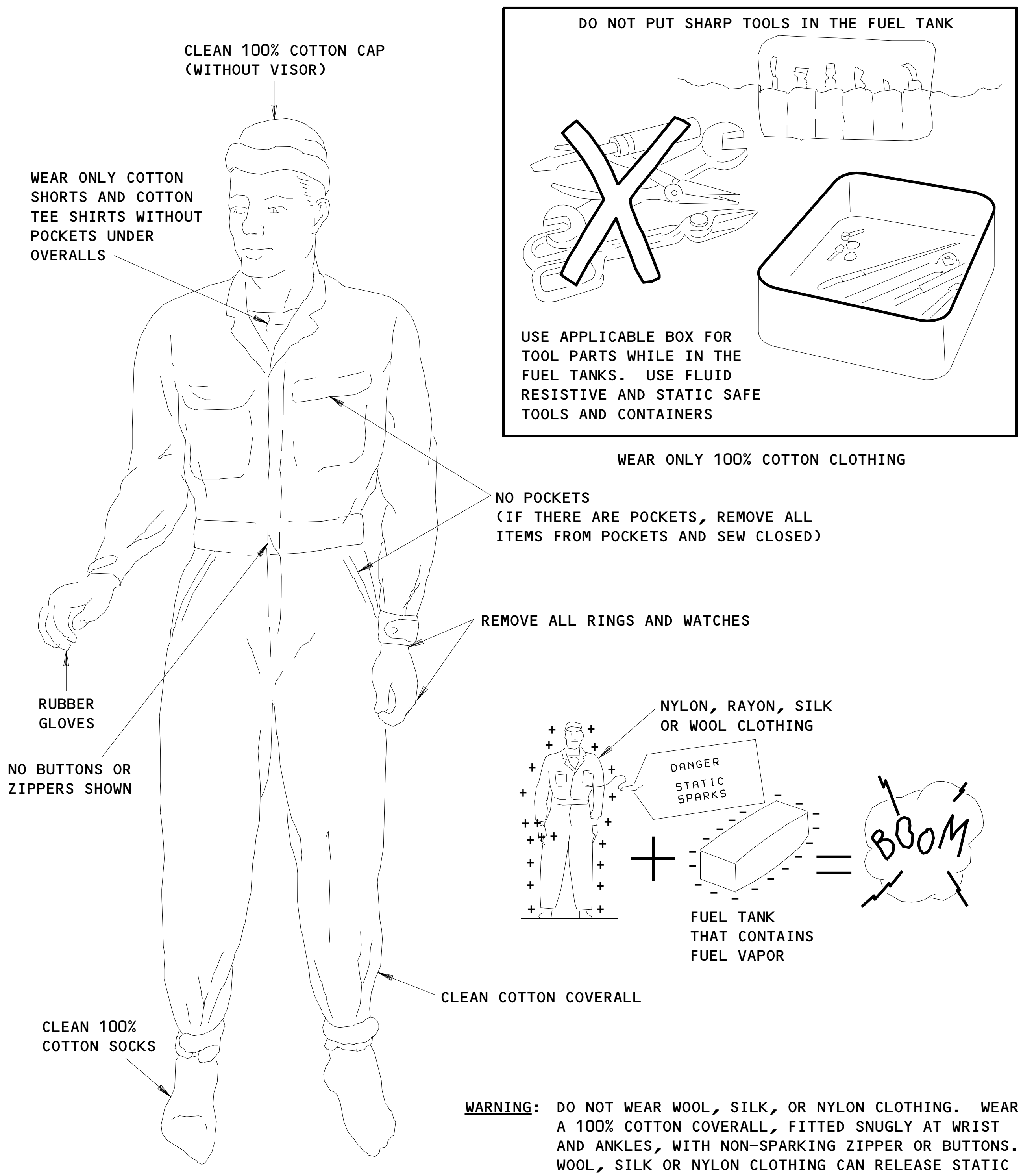
(b) Equipment which will not cause explosive vapors around the unit to ignite even when sparks, flashes or an explosion of vapor occurs inside the unit.

(c) Equipment which operates at an external temperature which will not cause explosive vapors around the unit to ignite.

(d) Equipment which has been approved by an independent testing Laboratory such as Underwriters Laboratories (UL) or Factory Mutual, for use in Class I Division 1 hazardous locations (or an equivalent standard).



Hazardous Locations - Open Fuel Tank(s)
Figure 201



__WARNING__: DO NOT WEAR WOOL, SILK, OR NYLON CLOTHING. WEAR A 100% COTTON COVERALL, FITTED SNUGLY AT WRIST AND ANKLES, WITH NON-SPARKING ZIPPER OR BUTTONS. WOOL, SILK OR NYLON CLOTHING CAN RELEASE STATIC ELECTRICITY AND CAUSE AN EXPLOSION.

Fuel Tank Entry Precautions
Figure 202

(6) Fire-Safe Condition:
   (a) 10% or less of the lower explosive limit (LEL).

FIRE-SAFE CONDITION
A FIRE-SAFE CONDITION OCCURS WHEN THE VAPOR CONCENTRATION IS LESS THAN 10 PERCENT OF THE LOWER EXPLOSIVE LIMIT (LEL).

(7) Health-Safe Condition:
   (a) An atmosphere where oxygen content is a minimum of 19.5% to a maximum of 23.5% by volume at sea level, and the vapor concentrations are below the permissible exposure limits (PEL).
(8) Because kerosene has a low vapor pressure, the concentrations are usually within the limits needed for a Health-Safe condition. Thus, you usually get very low (safe) values at usual temperatures (less than approximately 70°F).

(9) At tank temperatures of approximately 90°F, it is possible to get gas concentrations that are more than the health-safe value with kerosene.
(10) At tank temperatures of more than 90°F, it is possible to get gas concentrations that are more than the fire-safe value.
(11) It is also possible that a different type of fuel was kept in a tank that usually contains kerosene.
(12) If the purging procedure was not done, this causes high concentration values when you use the combustible gas indicator.
(13) Before you go into a fuel tank that contained JP-4 or JET B, wear a full-mask respirator with an attached breathing-air supply.

<u>WARNING</u>: THERE IS NOT HEALTH-SAFE LIMIT FOR JP-4/JET B FUEL WHICH CAN CONTAIN BENZENE. IT IS POSSIBLE THAT BENZENE CAUSES CANCER.

HEALTH-SAFE CONDITION		
A HEALTH-SAFE CONDITION OCCURS WHEN THE OXYGEN CONTENT IS A MINIMUM OF 19.5% TO A MAXIMUM OF 23.5% BY VOLUME AT SEA LEVEL, AND THE VAPOR CONCENTRATIONS ARE BELOW THESE PERMISSIBLE EXPOSURE LIMITS:		
Fuel	Permissible Exposure Level Total Hydrocarbons TWA *[1] (ppm)	Lower Explosive Level (percent)
Aviation Gasoline	300	1.0
Jet A Jet A-1 JP-5 JP-8	160 160 160 160	0.7 0.7 0.7 0.7
Jet A	200	0.8

*[1] TWA - Time Weighted Average

(14) Lower Explosive Limits (LEL):
(a) The minimum concentration of flammable vapors in air below which propagation of flame does not occur on contact with a source of ignition.

(15) Permissible Exposure Level (PEL):
(a) The time weighted average airborne concentrations of substances at which it is believed that nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, without adverse health effects.

<u>NOTE</u>: The PEL Limits used in this procedure are the PEL limits used by Boeing personnel during fuel tank entry. If the local PEL limits are more restrictive than the ones given in this procedure, use the equivalent local PEL limits.

(16) Purging or Purged (for Fuel Tank Entry):
(a) Purging an aircraft fuel tank is defined as the removal of any fuel or fuel vapor that remains after the fuel tanks are sumped. A purged fuel tank contains a nonflammable atmosphere that can be maintained by mechanical ventilation.

(17) Unwanted Sources of Ignition:
(a) Unwanted sources of ignition include:
1) Open flames (matches, cigarette lighters etc.)

2) Electrical equipment (lights, motors, sparks from engine exhaust etc.)
3) Frictional hot spots
4) Electromagnetic energy (radio transmissions or radars)
5) Static electricity
6) Lightning

C. Purging and Fuel Tank Entry - Airplane Precautions

(1) Do the maintenance on the fuel tanks in areas which allow the free movement of air, fire fighting equipment and other emergency equipment.

(2) A rope barrier must be placed around the airplane, to identify the Class I, Division 1 hazardous locations. See Figure 201 for the distance requirements. The rope barrier must include signs or placards which state: DANGER - OPEN FUEL TANKS.

(3) The airplane must be correctly grounded to an approved ground before you defuel the airplane or open any fuel tanks.

(4) Before the fuel tank access doors are opened, all of the electrical power to and from the airplane must be removed. Placards which state that power should not be restored on the airplane until the fuel tank(s) are closed should be attached to applicable locations.

WARNING: DO NOT USE AIRPLANE ELECTRICAL POWER WHEN FUEL TANK ACCESS DOORS ARE OPEN. A FIRE OR EXPLOSION CAN OCCUR IF FUEL VAPOR IS IGNITED BY SPARK(S) FROM ELECTRICAL EQUIPMENT. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(5) The main and APU batteries must be disconnected. Placards which state not to connect the batteries unit the fuel tanks are closed should be attached to all disconnected battery locations.

(6) All safety, support and maintenance equipment must be in place before you open the fuel tank access doors. Movement of equipment can cause sparks which can cause fuel vapors to ignite.

(7) No painting operations are permitted on airplanes with open fuel tanks.

D. Purging and Fuel Tank Entry - Electrical Equipment Precautions

(1) No radio or radar equipment should operate nearer to an open fuel tank than the distances specified in Table 201.

WARNING: FOLLOW THE SUBSEQUENT RADIO AND RADAR LIMITS. FAILURE TO FOLLOW THE SUBSEQUENT RADIO AND RADAR LIMITS CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

TABLE 201		
	SEPARATION DISTANCE (FEET)	
POWER (EIRP *[1]) OF EQUIPMENT TRANSMITTING RADAR OR RADIO *[2]	MAINTENANCE WITH OPEN FUEL TANKS PURGED	MAINTENANCE WITH OPEN FUEL TANKS NOT PURGED (or during purging)
More than 100 watts	200	200
25 to 100 watts	50	50
Less than 25 watts *[3]	10	50
Radiating ground approach control or pattern surveillance radar	300	300
Open flame, heat sources, lighted smoking material, and any other potential ignition sources	50	50

*[1] EIRP is Effective Isotropic Radiated Power in watts
*[2] This separation distance does not apply to airplane installed radio transmitters. Any limits on operations for the airplane VHF, SATCOM, HF, weather radar, etc., are listed in the airplane operations manuals.
*[3] This category includes mobile phones, pagers, two-way radios, etc. There are low power (explosion proof) radios that are approved for use in Class I division 1 hazardous locations that can be used safely in the vicinity of open, not purged, fuel cells and other areas contgaining fuel vapors.

(2) Fuel in the beam of operational high-powered radar which can produce a peak power density that exceeds 5 watts per square centimeter is hazardous. Electromagnetic energy of this intensity can ignite fuel vapors and cause a fire.

(3) Electrical equipment which is energized or operated within 50 feet horizontally and 18 inches or less above the ground of an open fuel tank, must be rated explosion-proof for Class I, Division 1 hazardous locations. This includes energized plugs and receptacles. For radio and radar equipment (transmitting equipment) see Table 201 for separation distance requirements.

WARNING: DURING OPEN FUEL TANK OPERATIONS, THE ENTIRE AREA AROUND THE AIRPLANE AND ANY ADJACENT AREAS THAT COULD COLLECT FUEL VAPORS ARE CLASSIFIED AS CLASS I DIVISION 1 HAZARDOUS LOCATIONS. THE HAZARDOUS LOCATION CLASSIFICATION APPLIES TO AIRPLANES BEFORE AND AFTER A FUEL TANK IS PURGED. THE CLASS I DIVISION 1 HAZARDOUS LOCATION EXTENDS FROM THE GROUND UP TO 18 INCHES ABOVE THE GROUND. ONLY USE ELECTRICAL EQUIPMENT WHICH IS APPROVED FOR THE APPLICABLE HAZARDOUS LOCATION.

(a) Figure 201 shows the different classification of hazardous locations around airplanes with open fuel tanks.

(4) Only use approved explosion-proof flashlight that operate correctly in the fuel tanks.

NOTE: The use of explosion-proof lights in or near an open fuel tank is permitted only by approved persons. The air in the fuel tank must be 10 percent or less of the lower explosive limit (LEL).

(5) Only use explosion-proof flood extension lights and power cords which are approved to supply external light.

(6) Do not connect or disconnect electrical equipment from energized outlets (within 100 feet of an open fuel tank) unless the equipment is fitted with explosion-proof plugs.

(7) Do not use electrical test equipment which can cause sparks in a fuel tank.

E. Purging and Fuel Tank Entry - Equipment Precautions

(1) All metal work platforms or stands used for entry into the fuel tanks or located within a 50-foot radius of an open fuel tank (before and after the fuel tank purging) must be bonded to the airplane and grounded to an approved earth ground.

(2) Before you use ventilation equipment, make sure the blower or venturi is connected to the airplane ground. The ventilation blower or the venturi must be explosion-proof.

(3) Air ducts must be bonded to form a continuous electrical conductor, and grounded in at least one place to a static electrical ground.

(4) If you use the ventilation equipment to exhaust fuel vapors from the tank, static build-up on or in the air ducts can reach a level where a spark can ignite the vapors and an explosion can occur. It is strongly recommended that the air ducts be coated inside and out with a conductive coating. Each section of the air duct must be correctly bonded to each other. Air ducts made from vinyl fabric are not recommended because vinyl is an insulator of static charges. If the air duct uses a metal helical wire to create a non-collapsible duct, make sure the wire is permanently attached to a metal or conductive plastic connection on each end of the duct section.

(5) Equipment used to ventilate the fuel tanks or provide warm or cool air must not be turned off with the air duct in the fuel tank. The fuel vapor from the fuel tank can enter the air duct and cause an explosion at the motor. Make sure the blower is on before you put the air duct in the fuel tank. Make sure the blower remains on until the air duct is removed from the fuel tank.

(6) When you remove an air duct from the fuel tank or disconnect the air duct at the blower, turn the duct 180 degrees away from the purging area, to stop the flow of fuel vapor into the air duct line.

(7) During fuel tank maintenance, make sure there is continuous mechanical ventilation. The fresh air flow from the ventilation equipment must maintain the oxygen levels between 19.5% and 23.5% by volume and the fuel vapor levels below 10% LEL (fire safe limit).

(8) Use a combustible gas indicator to monitor the environment inside the fuel tank. The indicator must be designed for Class I, Division 1 hazardous locations and calibrated for the correct type of jet fuel. The indicator must be securely attached to a ladder or stand at the fuel tank entry location. As an alternate procedure, you can take an additional combustible gas indicator into the fuel tank to monitor the environment where you will do the maintenance.

(9) Obey these precautions for equipment used to do maintenance in the fuel tanks:

  (a) Always use a checklist to record all equipment, tooling and material that you bring into the fuel tank. Use the checklist to make sure all maintenance items are removed before you close the fuel tank.

(b) Do not use steel wool in the fuel tank. A piece of wire from steel wool is a potential ignition source.
(c) Only use approved non-static plastic containers with rounded corners to hold tools and supplies.
(d) Keep all sharp edged tools in the container at all times when not in use.
(e) Only use cotton wipers (BMS15-5) in open fuel tanks. When you wipe up fuel in the fuel tanks, use cotton wipers (BMS15-5).

NOTE: Do not use paper towels or other paper products.

(f) Solvents, sealant, or other materials used in the fuel tank can be a health and fire hazard.
1) Use the correct protective equipment for the solvent or material that is used. Protective equipment includes:
a) Respirators
b) Face and eye protection
c) Protective clothes
d) Gloves
(g) Keep the quantity of solvents that you use to a minimum. Only bring enough solvent in the tank to complete the maintenance. Apply the solvent to a clean cotton wiper (BMS15-5), not the airplane structure or sealant. After you finish with the cotton wiper (BMS15-5), put the cotton wiper (BMS15-5) in a polyethylene bag or remove the it from the airplane. This will keep the solvent vapor to a minimum.
(h) Powered tools must be air-driven.
(i) Only use shop air or bottled air as a gas source for air-driven tools. Do not use nitrogen, oxygen, carbon dioxide (CO2) or any other non-air source of gas.

WARNING: ONLY USE SHOP AIR OR BOTTLED AIR AS THE SOURCE OF GAS TO POWER AIR-DRIVEN EQUIPMENT. GASES OTHER THAN SHOP OR BOTTLED AIR CAN REMOVE OXYGEN FROM A CLOSED AREA. IF YOU GO INTO A CLOSED AREA WITHOUT ENOUGH OXYGEN, YOU CAN BECOME UNCONSCIOUS OR IT CAN KILL YOU.

F. Purging and Fuel Tank Entry - Personnel Precautions (Fig. 202)
(1) Make sure the persons who will go into fuel tanks are approved persons for fuel tank entry.
(2) Make sure observers who will watch persons in the fuel tank(s) are approved as fuel tank entry observers.
(3) The fuel vapors in and from the fuel tank are explosive and hazardous to your health. The fuel tanks must be in a fire-safe condition when an initial fuel tank entry is made. You must wear an approved respirator with an air supply when you go into a fuel tank that is in a fire-safe condition. It is necessary to have a good flow of air through the fuel tank to get a fire-safe condition. The air must flow continuously during the fuel tank entry procedure.

(4) The fuel tank must be in a health-safe condition before you can go into the fuel tank without a breathing-air supply. When the fuel tank is in a health-safe condition, at a minimum, it is recommended that a half-mask respirator with an organic vapor filter be used. It is necessary to have a good flow of air through the fuel tank to get a health-safe condition. The air must flow continuously during the fuel tank entry procedure.

(5) Hydrocarbon fuels that touch the skin can remove protective oils. Without protective oils, the skin can become dry, chapped, cracked or possibly become infected. If a person breathes too much fuel vapor, the person can become dizzy, get a headache or lose his or her coordination. Jet fuel is composed of many different kinds of hydrocarbon molecules. Exposure to some of these molecules for a long time is known to cause cancer.

(6) Vapors from fuel or other materials (solvents etc.) used for fuel tank maintenance can replace oxygen from a confined area such as a fuel tank or dry bay. If a person goes into a confined area that contains fuel vapor (or other vapors) without a breathing-air supply, the person may not get enough oxygen. This may cause unconsciousness or death. Make sure the environment is continuously monitored with an approved combustible gas indicator.

(7) No one is permitted to go into or remain in a fuel tank if:
- (a) The flammable vapor concentration is more than 10% of the lower explosive limit
- (b) The oxygen content of the fuel tank is below 19.5% or above 23.5%
- (c) The air ventilation system fails
- (d) A strong fuel odor is noticed
- (e) A person feels any physical problems, such as trouble breathing, dizziness, irritation, confusion, lightheadedness, fullness in the head, ringing sensation on the ears, nausea, headache, difficulty in breathing, sensation of apparent suffocation, immobility, unusual behavior, failure to respond to communication, or other signs of illness.
- (f) There is an observed or reported hazard which may reduce the level of safety.

(8) Persons who work in or near an open fuel tank must not:
- (a) Slide metal objects, such as toot boxes, ladders, etc.
- (b) Carry matches or pocket warmers.
- (c) Wear shoes with metal clips or exposed nails.
- (d) Wear or use battery-operated devices such as hearing aids, electrical pacemakers or watches, pocket radios, cellular phones or paging equipment unless it is explosion-proof and permitted by approved persons.

(e) Use the tank wiring harnesses as handholds.

(9) Persons who work in an open fuel tank must wear approved fuel tank protective clothing. Protective clothing includes:

(a) Cotton coveralls with non-sparking zippers or buttons. Do not wear wool, silk, nylon or other synthetic clothing.

(b) Saranex coveralls are also approved for use in fuel tanks.

WARNING: COVERALLS THAT ARE COATED WITH SARANEX 23P WILL KEEP BODY HEAT IN. MAKE SURE THE TEMPERATURE IN THE FUEL TANK DOES NOT GET TOO HOT. IF THE FUEL TANK TEMPERATURE GETS TOO HOT, A PERSON IN SARANEX 23P COVERALLS CAN HAVE HEAT-RELATED DISORDERS. IF A PERSON BECOMES TOO HOT, GET THE PERSON OUT OF THE FUEL TANK. FIND OUT IF MEDICAL ATTENTION IS NECESSARY.

(c) Clean cotton boot socks or fuel cell boots.

NOTE: It is recommended that boot socks be worn over fuel cell boots when you stand in a fuel tank. This will reduce the chance that you will slip and fall down.

(d) Clean cotton head cover (doctor-type hats) with tie strings or a lint free shower-type cap with an attached elastic headband.

(e) Cotton or rubber gloves.

(10) Persons who work in or near an open fuel tank must not remove or change clothes near an open fuel tank. You can create sufficient static electricity in the clothes to cause fuel vapor to ignite.

(11) Persons who work in fuel tanks must wear the correct respiratory protection for the fuel tank conditions.

(a) Persons using respiratory protection must be trained and know the correct use and limitations of respiratory protection.

(b) An approved respirator with an attached breathing-air supply is necessary for each person who goes into a fuel tank that is in a fire-safe condition.

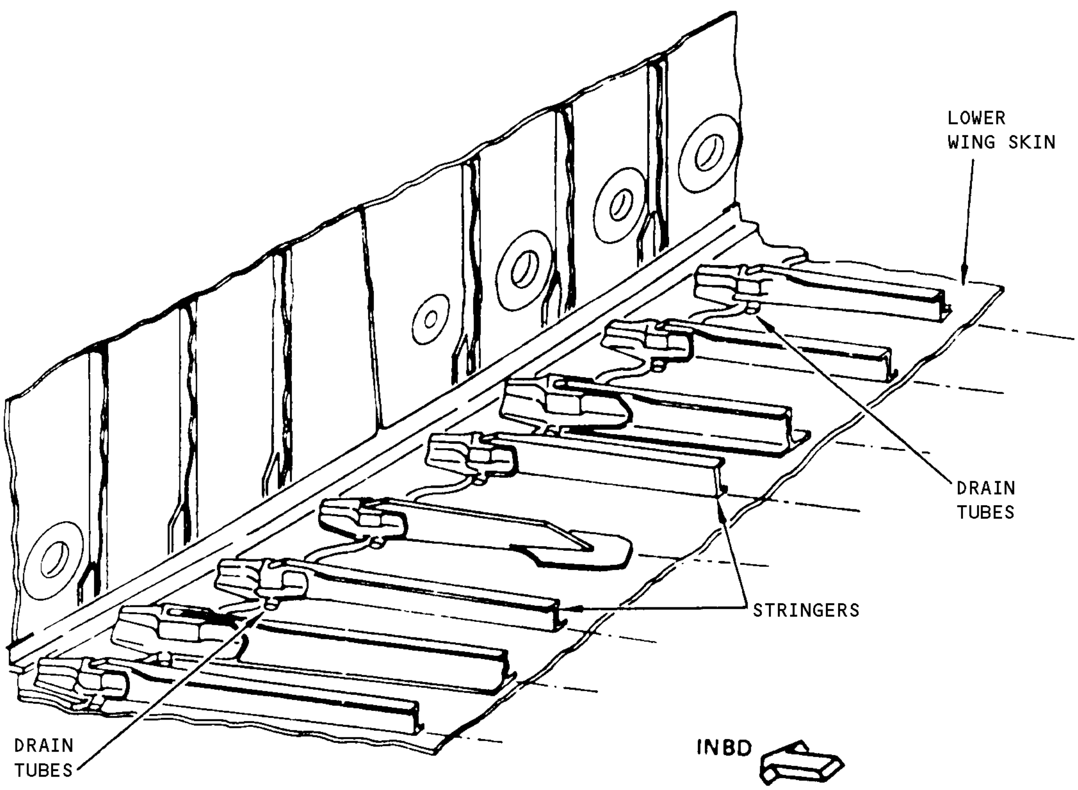
(c) An approved half-mask filter type respirator, at a minimum, is recommended for each person who goes into a fuel tank that is in a health-safe condition.

(d) Airline Hoods should be worn by persons if the respirator does not fit correctly due to facial hair or other facial configurations.

(12) At each fuel tank entry location there must be an observer who is outside of the fuel tank. The observer's responsibility is to make sure that person(s) in the fuel tank are safe. The observer must remain outside of the fuel tank in visual contact with the access opening. The observer must be able to communicate with the person(s) inside the fuel tank at all times.

(a) There are two ways the observer and the person(s) in the fuel tank can communicate:

1) A confined space communication system designed for aircraft fuel tank use.



Stringer Splice Fitting Drain Tubes
Figure 203

2) The observer and the person who will go into the tank can agree on a communication plan such as tugs on the safety rope at a set time interval.

(13) The observer must also keep a report that shows who is in the fuel tank and when that person comes out. A sign attached to the ladder or support equipment which states, "CAUTION - PERSONNEL INSIDE - MOVE NO EQUIPMENT", must be placed at the location of a fuel tank entry. When all of personnel in the tank come out, the observer should remove the sign or place it where it does not show.

(14) Many local, state and national regulatory agencies require a confined space entry permit to be signed and approved before a person goes into a fuel tank. A pre-entry checklist is often required by the confined space entry permit. It is recommended that a pre-entry checklist be used before you go into a fuel tank. Figure 207 is an example of a pre-entry checklist used at Boeing facilities.

G. Purging and Fuel Tank Entry - Adverse Weather Conditions

(1) When thunderstorms or lightning are within a 10 mile radius of the immediate area, open fuel tank maintenance procedures should stop. Persons inside of the fuel tanks should get out. Air ducts inside the fuel tanks should be removed and the power for all support equipment should be switched off. The fuel tank access openings must be closed.

(2) Strong wind conditions can cause a build-up of static electricity. Large charges of static electricity can develop on equipment while parked as a result of the movement of dust particles and air currents during strong wind conditions. Strong wind conditions can also cause the unwanted movement of items or equipment which can hit the airplane or injure persons. Wind gusts can damage the airplane structure. Fueling, defueling or open fuel tank maintenance procedures should stop if strong wind conditions are present.

3. <u>Purging and Fuel Tank Entry</u>

A. General

(1) This task contains these procedures:

(a) Prepare the Airplane for Fuel Tank Purging

(b) Prepare the Equipment for Fuel Tank Purging

(c) Fuel Tank Purging

(d) Fuel Tank Entry

(2) Make sure you read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

B. References

(1) AMM 12-11-0/201, Fuel Servicing

(2) AMM 12-31-21/201, Body Section 43 Access Doors and Panels

(3) AMM 20-40-11/201, Static Grounding

(4) AMM 24-21-21/401, APU Battery

(5) AMM 24-22-0/201, Manual Control (Apply Power)

(6) AMM 24-31-11/401, Storage Battery (Nickel-Cadmium)

(7) AMM 27-51-0/201, Trailing Edge Flaps

(8) AMM 27-81-0/201, Leading Edge Flaps and Slats

(9) AMM 28-11-11/401, Wing Fuel Tank Access Panels

(10) AMM 28-11-31/401, Integral Center Tank Access Panel

(11) AMM 28-12-21/401, Center Tank Access Panel
(12) AMM 28-12-31/401, Fuel Cell Access Panel
(13) AMM 28-23-0/201, Defueling
(14) AMM 32-00-01/201, Ground Lock Assemblies

C. Equipment

(1) Air Compressor-Explosion-proof, for use with the Lamb Air Mover (commercially available)

(2) Blower - Air Heater/Blower, Explosion-proof, Coats Model GH75-2, CAM Industries Inc., Kent, Washington USA

(3) Combustible gas indicator - explosion-proof; Use one of these indicators or equivalent:

(a) Innova FV Monitor, Model No. 72-0026-49
Thermo Electron Corporation (GasTech)
Franklin, Massachusetts USA
www.thermo.com/ih

(b) The following Gastech products are not available for purchase, but are satisfactory for monitoring the fuel tank environment:

1) Gastech GT series indicator
2) Gastech 1314 Super Surveyor
3) Gastech 1314 SMPN Super Surveyor

(4) Confined Space Communication System - use one of these systems (or equivalent):

(a) CS1-2000 or CS1-1000 Intrinsic Safe System
CON-SPACE COMMUNICATIONS INC.
PO BOX 1540 1160 Yew Ave
Blaine, Washington, USA

(5) Containers, plastic - Non-static material and rounded corners, used to hold tools or absorb fuel in the fuel tank

(6) Coveralls - use one of these approved coveralls:

(a) Cotton (100%) clothing (Fig. 202)
Aramark, Uniform Services
PO Box 3556
Seattle, Washington 98124
USA

(b) SARANEX 23-P, Film Laminated Tyvex Coveralls
Grainger District Sales Office
6725 Todd Boulevard
Seattle, Washington 98188-4771
USA

(7) Boots - Neoprene, Part Number RB35 (or equivalent)
Safety & Supply Co.
5510 E Marginal Way
Seattle, Washington, 98134 USA
Phone: (206) 762-8500

(8) Fire Extinguisher - 150 pounds, portable, wheeled (commercially available). Use one of these types of fire extinguishers:
- dry chemical
- carbon dioxide
- Halon

(9) Flashlight - Explosion-proof (commercially available)

(10) Respiratory equipment (use the applicable equipment) (Fig. 205)
   (a) Air Supply Hoses - commercially available
   (b) Breathing Air Supply - 125 psig maximum output Compressed Gas Association Commodity Specification G-7.1-1966 Grade D (or equivalent)
   (c) Regulator Unit - Biosystems Travelpanel 50 (or equivalent) Biosystems Inc., PO Box 158 Rock Fall, Connecticut, USA
   (d) Respirator - Full Face, Supplied Air Type Respirator North 85200 Series Full Facepiece continuous flow airline respirator (or equivalent)
   (e) Respirator - Half-Face, Organic Filter Type North 7700 Series Half Mask, North N7500-1 Organic Vapors Cartridge (or equivalent)
   (f) Respirator - Airline Hood North 85300 Series Disposable Airline Hood (or equivalent)

(11) Thermometer, alcohol (commercially available)

(12) Ventilation Equipment - use one of these (or equivalent):
   (a) Ventilation System - Fuel Cell - (BOE-501 or MAV-1C),
   Rhine Air Inc.,
   Santee, California, USA 92071
   Telephone: (619) 460-5928
   (b) Lamb Air Mover - Venturi 3-inch diameter, Mine Safety Appliances Company Pittsburgh, Pennsylvania

(13) F80145-4 - (recommended) center tank purge door (tank adapter assembly) or F80145-1 - (optional)

(14) F80144-1 Body Fuel Tank Purging Door Assembly (Fig. 208)

(15) F80080 - Testing Kit, fuel tanks and vent system

D. Consumable Materials

(1) G00034 Cotton Wiper - Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

E. Prepare the Airplane for Fuel Tank Purging

(1) Read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

WARNING: OBEY THE PURGING AND FUEL TANK ENTRY PRECAUTIONS. FAILURE TO OBEY THE FUEL TANK ENTRY PRECAUTIONS CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(2) Defuel the applicable fuel tank(s) (AMM 28-23-0/201).

WARNING: ON AIRPLANES WITH INTEGRAL CENTER WING TANK, ADJUST ATTITUDE OF AIRPLANE TO 1/4-DEGREE NOSE P, ZERO-DEGREE ROLL BEFORE DEFUELING OR SPILLAGE OF TRAPPED FUEL WILL OCCUR WHEN CENTER TANK ACCESS PANEL IS LOOSENED.

(3) Drain the fuel tank sumps (AMM 12-11-0/201).

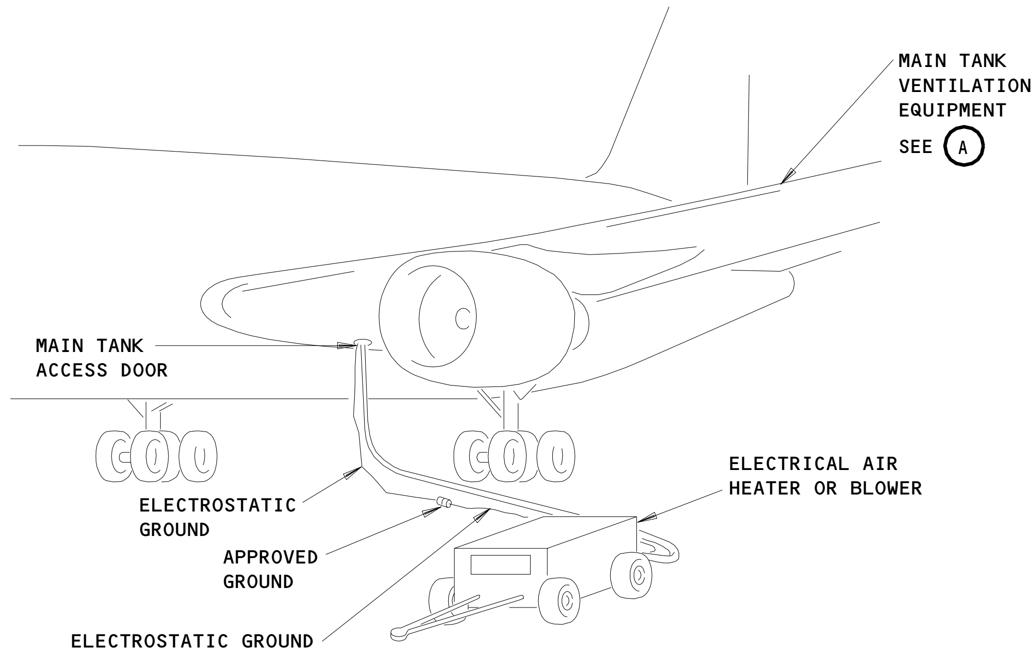
(4) Make sure the airplane is correctly grounded to an approved and identified ground (AMM 20-40-11/201).

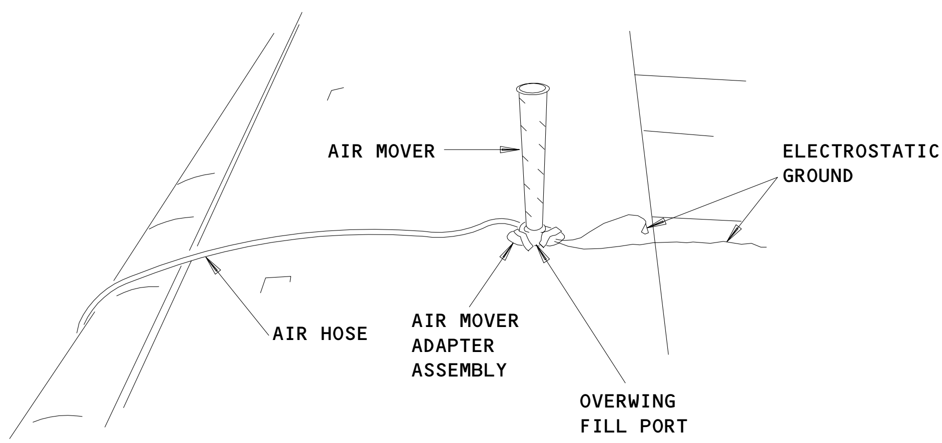
(5) Do the deactivation procedure for the trailing edge flaps (AMM 27-51-0/201).

WARNING: DO THE DEACTIVATION PROCEDURE FOR THE TRAILING EDGE FLAPS. ACCIDENTAL OPERATION OF THE TRAILING EDGE FLAPS COULD CAUSE INJURY TO PERSONS.

(6) Do the deactivation procedure of the leading edge slats (AMM 27-81-0/201).

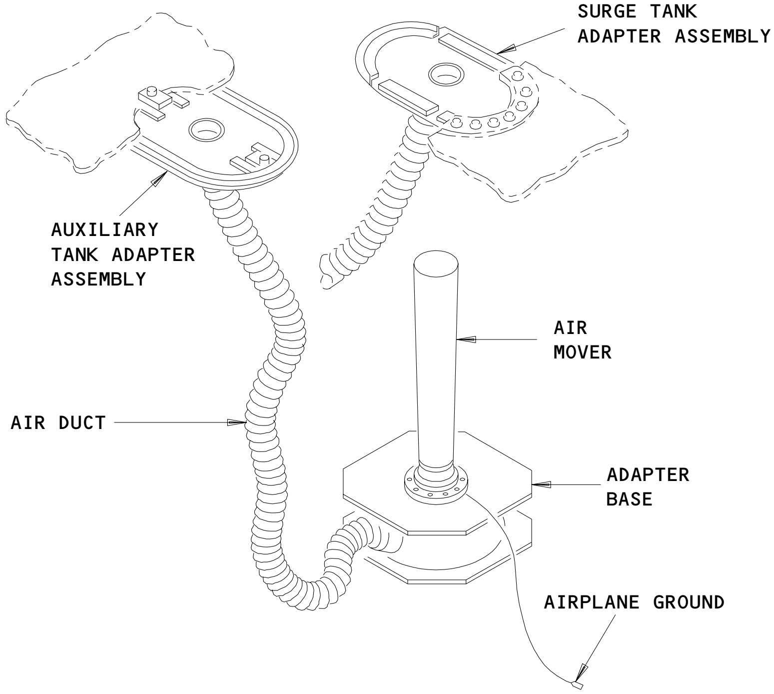
WARNING: DO THE DEACTIVATION PROCEDURE OF THE LEADING EDGE SLATS. IF THE LEADING EDGE SLAT OPERATES ACCIDENTALLY, IT CAN CAUSE INJURY.



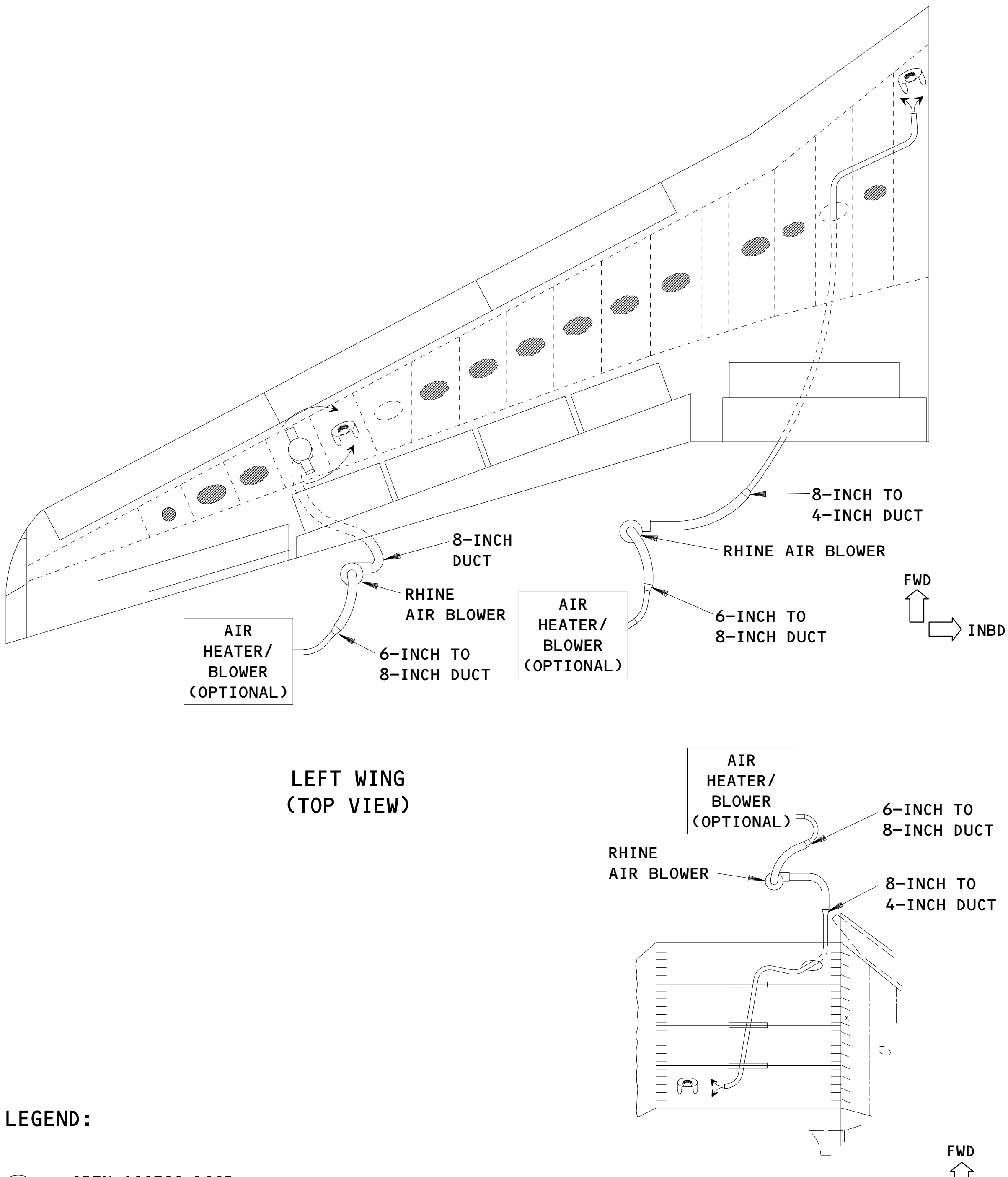


MAIN TANK VENTILATION EQUIPMENT
A

Tank Ventilation Equipment
Figure 204 (Sheet 1)



Tank Ventilation Equipment
Figure 204 (Sheet 2)



LEGEND:

- OPEN ACCESS DOOR
- CLOSED ACCESS DOOR
- PERSON IN TANK
- ACCESS DOOR ADAPTER

Tank Ventilation Equipment
Figure 204 (Sheet 3)

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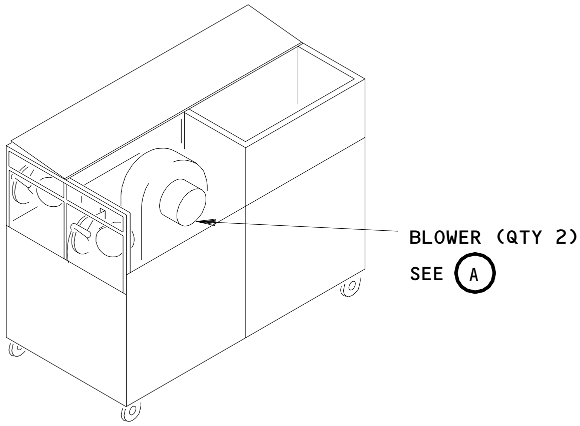
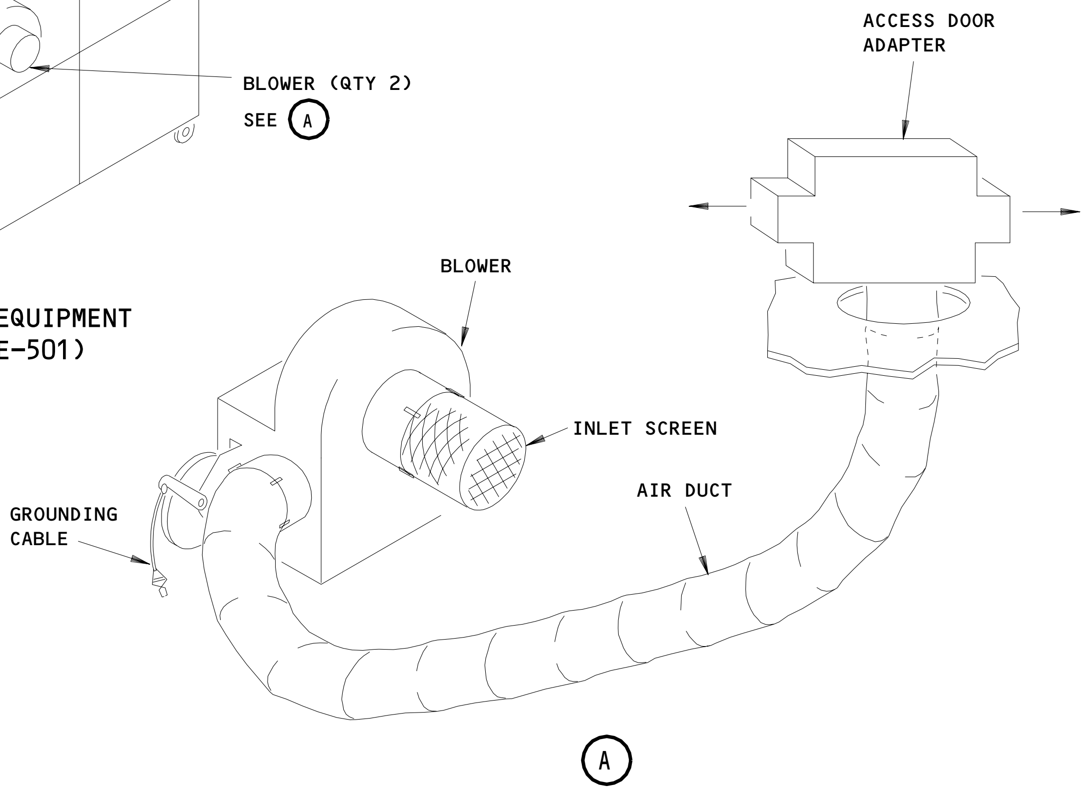
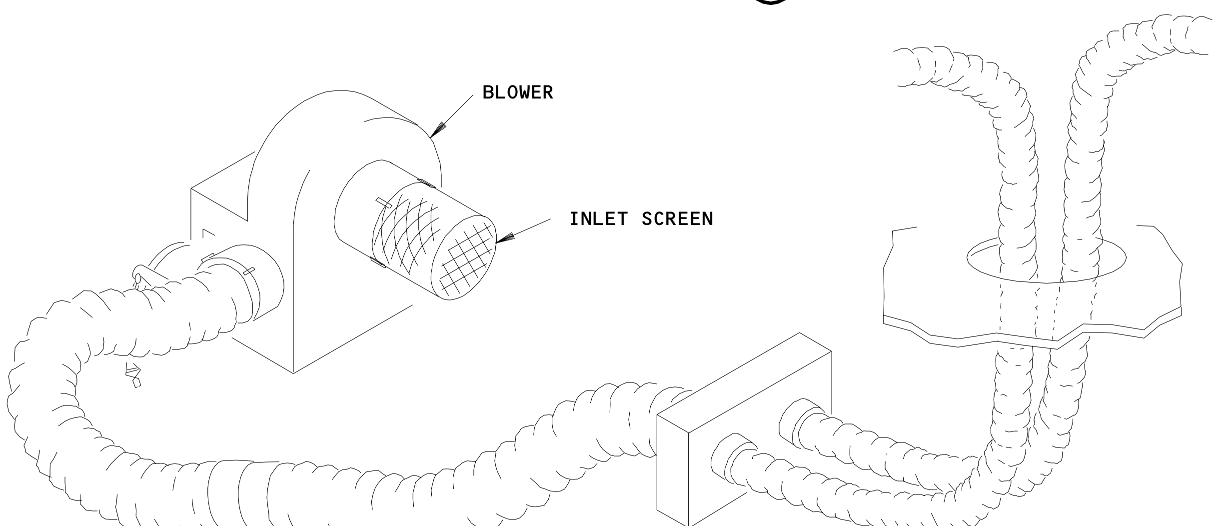


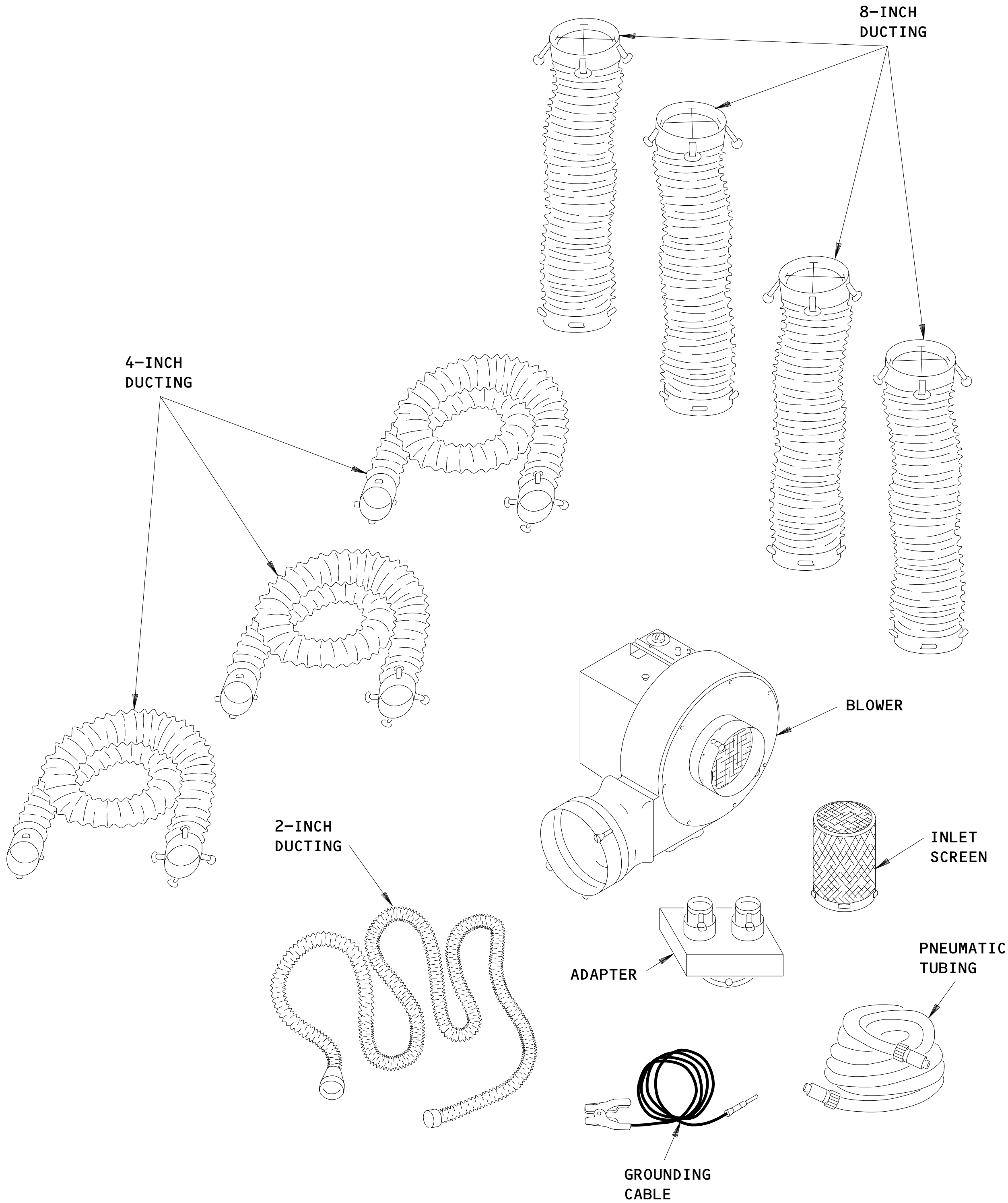
VENTILATION EQUIPMENT
(MODEL BOE-501)





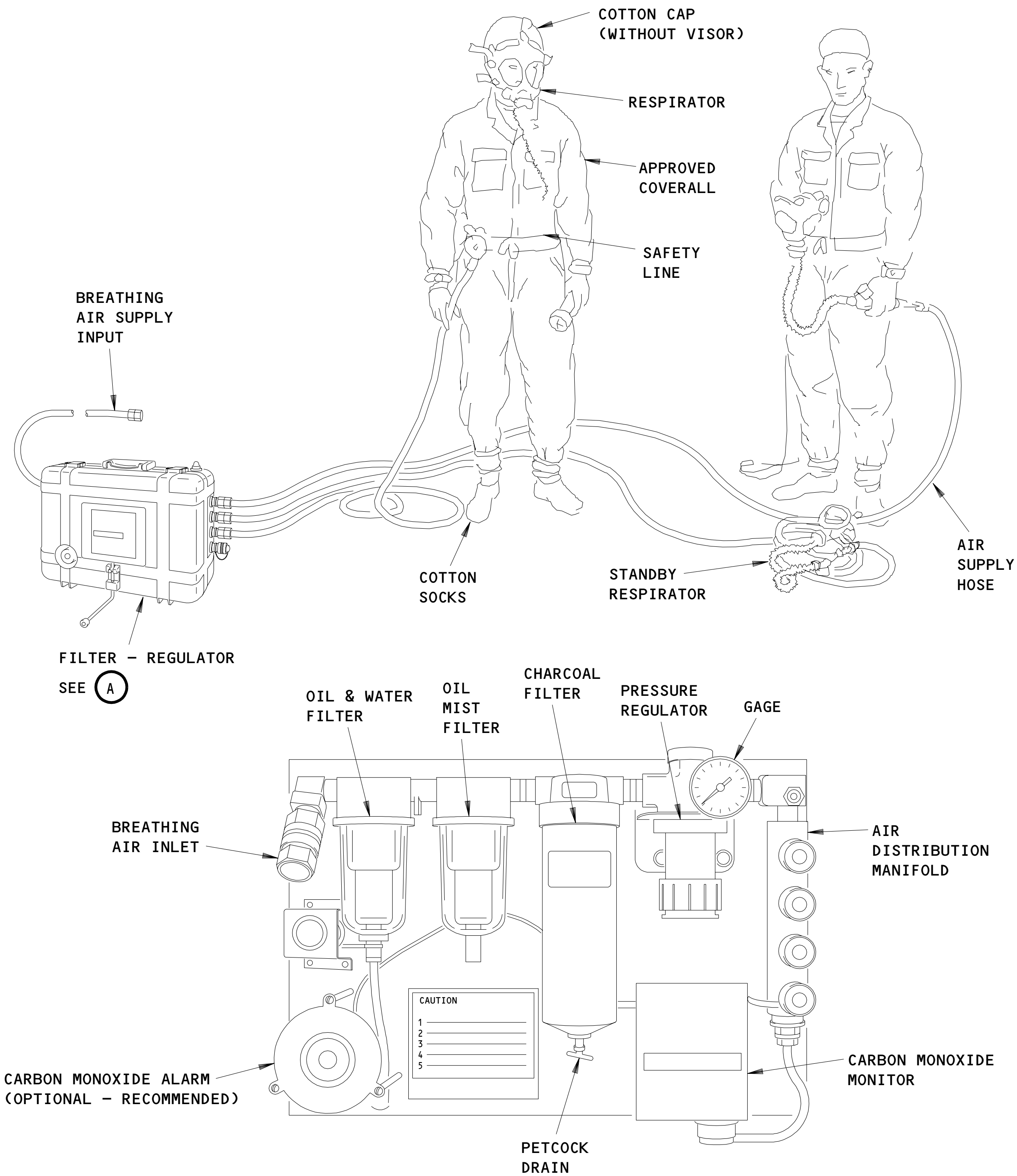
EXAMPLE CONFIGURATION FOR
VENTILATION EQUIPMENT (MODEL BOE-501)

Tank Ventilation Equipment
Figure 204 (Sheet 4)



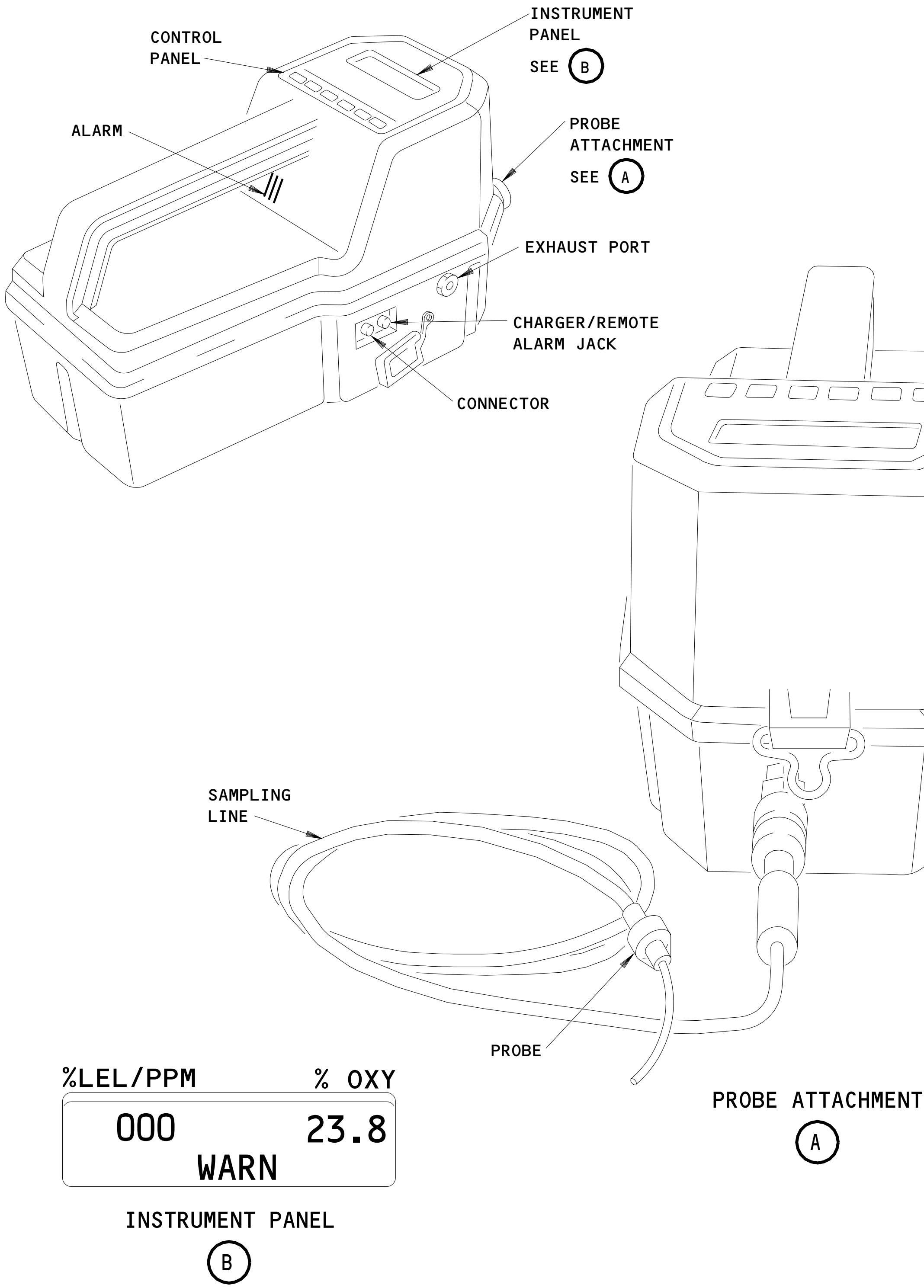
AVAILABLE VENTILATION EQUIPMENT

Tank Ventilation Equipment
Figure 204 (Sheet 5)



FILTER - REGULATOR
(EXAMPLE)
A

Respiratory Equipment and Clothing (Example)
Figure 205



Combustable Gas Indicator (Example)
Figure 206

EXAMPLE OF A WET FUEL CELL PRE-ENTRY CHECKLIST

This checklist must be completed prior to start of wet fuel cell entry and/or at shift change PRIOR to work assignment for the continuation of tank work started by a previous shift.

Wet Fuel Cell Entry Location

Area or Building: ________ Stall: ________ Airplane: ________ Tank: ________

Shift: ________ Date: ________ Supervisor: ________________________________

☐ 1. Airplane and adjacent equipment properly grounded.

☐ 2. Area secured and warning signs positioned.

☐ 3. Boost pump switches off and circuit breakers pulled and placarded.

☐ 4. No power on airplane: battery disconnected, external Power Cord disconnected from airplane, and external power receptacle placarded.

☐ 5. Radio and radar equipment off (see separation distance requirements).

☐ 6. Only approved explosion proof equipment and tools will be used for fuel cell entry (lights, blowers, pressure and test equipment, etc.).

☐ 7. Ensure requirements listed on Aircraft Confined Space Entry Permit are complied with, including appropriate personal protective equipment: OSH class 110 respirator at a minimum, approved coveralls, caps and foot coverings, and eye protection.

☐ 8. Trained attendant and confined space logsheet required for all wet fuel cell entries.

☐ 9. Aerators checked for cleanliness prior to use.

☐ 10. Sponges available for residual fuel mop out.

☐ 11. All plugs used have streamers attached.

☐ 12. Mechanical ventilation (venturis or blowers) installed to ventilate all open fuel cells.

NOTE: Ventilation system must remain in operation at all times while fuel cells are open. If ventilation system fails or any ill effects such as dizziness, irriation, or excessive odors are noted, all work shall stop and fuel cells must be evacuated.

☐ 13. Shop personnel entering cells and standby observers have current "fuel cell entry" certification cards. Certification requires the following training:
- Aircraft Confined Space Entry Safety
- Respirator Use and Maintenance
- Wet Fuel Cell Entry

☐ 14. Fire Department notified.

Meter Readings

☐ 15. Oxygen reading (%): ____________________ By: ______________________________

☐ 16. Fuel vapor level reading (ppm): ____________________ By: ______________________

☐ 17. Combustible gas meter (LEL) reading: ____________________ By (FD): ______________

I confirm that all entry requirements were met prior to any entry.

____ ______________________

Signature of Supervisor or Designee Date

Fuel Tank Pre-Entry Checklist (Example)
Figure 207

(7) Make sure the downlocks are installed on the nose and main landing gear (AMM 32-00-01/201).
(8) Open the doors for the landing gear and install the door locks (AMM 32-00-01/201).

WARNING: USE THE PROCEDURE IN AMM 32-00-01/201 TO INSTALL THE DOOR LOCKS. THE DOORS OPEN AND CLOSE QUICKLY AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(9) Put ropes around the airplane to identify the hazardous location areas (Fig. 201), and attach these signs with words you can see clearly written on both sides:
(a) DANGER - OPEN FUEL TANKS - NO SMOKING
(b) AUTHORIZED PERSONNEL ONLY
(10) Make sure the fuel pump switch lights on the overhead panel, P5, are in the off position, and attach DO-NOT-OPERATE tags.
(11) Open these circuit breakers on the P6 panel and attach DO-NOT-CLOSE tags:
(a) BOOST PUMP TANK - 1 FWD
(b) BOOST PUMP TANK - 2 FWD
(c) BOOST PUMP TANK - 1 AFT
(d) BOOST PUMP TANK - 2 AFT
(e) BOOST PUMP CTR TANK - LEFT
(f) BOOST PUMP CTR TANK - RIGHT
(12) Open the applicable circuit breakers for the system on which you will do maintenance.
(13) Look at the maintenance history of the airplane.
(a) Open the applicable circuit breakers for any system(s) that show a problem with wiring or electrical faults.
(14) Remove the electrical power from the airplane before you remove the fuel tank access panels (AMM 24-22-0/201).
(15) Do not supply electrical power again until you complete the task: Fuel Tank Closure.

WARNING: DO NOT USE AIRPLANE ELECTRICAL POWER WHEN FUEL TANK ACCESS PANELS ARE OPEN. A FIRE OR EXPLOSION CAN OCCUR IF FUEL VAPOR IS IGNITED BY SPARK(S) FROM ELECTRICAL EQUIPMENT. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(16) Disconnect the storage battery (AMM 24-31-11/401).
(17) Attach this sign to the battery location:
(a) OPEN FUEL TANKS - DO NOT CONNECT
(18) Attach this sign to the external power receptacle:
(a) OPEN FUEL TANKS - DO NOT PUT POWER ON

F. Prepare the Equipment for Fuel Tank Purging

(1) Read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

WARNING: OBEY THE PURGING AND FUEL TANK ENTRY PRECAUTIONS. FAILURE TO OBEY THE FUEL TANK ENTRY PRECAUTIONS CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(2) Make sure one of these portable fire extinguishers is available:
(a) one - 150 pound dry chemical wheeled extinguisher
(b) one - 150 pound CO2 wheeled extinguisher
(c) one - 150 pound Halon wheeled extinguisher

(3) Make sure the electrical equipment is approved and is appropriate for the hazardous location as shown in Fig. 201.

(4) Make sure all radio or radar equipment is off and locked out if it is closer than the minimum separation distance allowed in Table 201.

(5) Do these steps to prepare metal support equipment such as work platforms/stands, ladders etc:

NOTE: These steps apply to all metal support equipment within a 50-foot radius of an open fuel tank.

(a) All support equipment must be in place before you begin the fuel purging procedure.
(b) Bond the support equipment at an approved airplane bonding location.
(c) Ground the support equipment to the same earth ground as the airplane.

(6) VENTURI TYPE VENTILATION EQUIPMENT;
Do these steps to prepare the air ventilation equipment:
(a) For the main fuel tanks, do these steps (Fig. 204):
1) Go to the applicable left or right overwing fill port on top of the wing.
2) Connect an air supply hose to the air mover assembly.
3) Bond the air mover assembly to the airplane ground.
4) Remove the cap on the overwing fill port.

5) Install the air mover assembly in the overwing fill port.
6) Put the exhaust horn of the air mover in the overwing fill port vertically above the wing to let the fuel vapors leave the fuel tank.
7) Put the portable air compressor a minimum of 100 feet (30 meters) from the fuel tank that will be opened, unless the air compressor is explosion-proof.
8) Connect the air compressor to the air mover with the air supply hose.
9) Connect a power supply to the air compressor.

(b) For the integral center fuel tank or surge tanks, do these steps:
1) Assemble these ventilation equipment components (Fig. 204):
a) Tank adapter assembly (center tank purge door) (P/N F80145)
b) Air mover assembly
c) Air supply hose
2) Make sure each flexible air duct section is attached correctly and that each section is bonded correctly.
3) Set-up the air mover assembly away from the airplane.

WARNING: MAKE SURE THE AIR MOVER ASSEMBLY IS AWAY FROM THE AIRPLANE. POINT THE EXHAUST AIR FROM THE AIR MOVER EXHAUST HORN AWAY FROM THE AIRPLANE STRUCTURE. EXHAUST AIR FLOW ON THE AIRPLANE STRUCTURE CAUSES STATIC ELECTRICITY. STATIC ELECTRICITY CAN CAUSE THE IGNITION OF FUEL VAPOR AND CAUSE AN EXPLOSION. AN EXPLOSION CAN CAUSE INJURY OR DEATH TO PERSONS AND DAMAGE TO EQUIPMENT.

4) Ground the air mover assembly to the airplane ground.
5) Put the portable air compressor a minimum of 100 feet (30 meters) from the fuel tank that will be opened, unless the air compressor is explosion-proof.
6) Connect the air compressor to the air mover assembly with the air hose.
7) Connect a power supply to the air compressor.

(7) AIR BLOWER TYPE VENTILATION EQUIPMENT (BOE-501 OR EQUIVALENT);
Do these steps to prepare the air ventilation equipment for purging (Fig. 204):

(a) Set up the ventilation blower(s) in an area where the fuel tank entry will be made.
 1) Make sure the ventilation blower will be in an area free from fuel vapor when the access doors are open.

(b) Attach the static grounding cable on the ventilation blower(s) to an approved ground source.

(c) Do these steps to connect an air supply to the ventilation blower:
 1) If shop air is used, connect an air supply hose to the ventilation blower.
 2) If a portable air compressor is used, do these steps:
  a) Put the air compressor a minimum of 100 feet (30 meters), from the fuel tank that will be opened, unless the air compressor is explosion-proof.
  b) Connect an air supply hose from the air compressor to the ventilation blower.
  c) Connect the portable air compressor to a power source.

(d) Do these steps to connect the air ducts to the ventilation blower.
 1) Connect the eight inch (200 mm) air duct to the ventilation blower outlet port.
 2) Connect enough air duct segments to get to the access door where you will do maintenance.
 3) Use the attached bonding connections to electrically bond each air duct segment.

(e) For tank maintenance outboard of the engine, attach the access door adapter to the end of the air duct.

(f) For tank maintenance inboard of the engine, do these steps to prepare the air ducts that will go inside the fuel tank:

 NOTE: The air ducts will be positioned inside the fuel tank at the location where you will do the maintenance.

 1) Attach an adapter/reducer to the end of the eight inch (200 mm) air duct segments.
 2) Attach the four inch (100 mm) air ducts.
 3) Use the attached bonding connections to electrically bond each air duct segment.
 4) Make sure you have enough segments to route the air ducts to the maintenance area.

(8) HEATER AIR/BLOWER EQUIPMENT;
Do these steps to prepare the heater/air blower equipment for purging (if it is necessary):

NOTE: The use of a heater/air blower is for the comfort of persons in the fuel tank. It is not part of the air ventilation equipment which is used to remove hazardous fuel vapor during the fuel purging procedure. The heater/air blower is an optional component.

(a) Set-up the heater/air blower in the area where the fuel tank entry will be made.
  1) Make sure the heater/air blower will be in an area free from fuel vapor when the access doors are open.
(b) Attach the static grounding cable on the heater/air blower(s) to an approved ground source.
(c) Do these steps to connect an air supply to the blower:
  1) If shop air is used, connect an air supply hose to the heater/air blower.
  2) If a portable air compressor is used, do these steps:
    a) Put the air compressor a minimum of 100 feet (30 meters) from the fuel tank that will be opened, unless the air compressor is explosion-proof.
    b) Connect an air supply hose from the air compressor to the heater/air blower.
    c) Connect the portable air compressor to a power source.
(d) Do these steps to connect the air ducts to the heater/air blower.
  1) Connect the air duct to the heater/air blower outlet port.
  2) Connect enough air duct segments to get to the maintenance area.
  3) Connect the air duct segments to the inlet port on the ventilation blower (if it is necessary for your ventilation system set-up).
  4) Use the attached bonding connections to electrically bond each air duct segment.
(e) Connect a power supply to the heater/air blower.

(9) Do these steps to prepare the combustible gas indicator (Fig. 206):

WARNING: MAKE SURE THE COMBUSTIBLE GAS INDICATOR IS EXPLOSION-PROOF (CLASS I, DIVISION 1 OR EQUIVALENT STANDARD) AND IS SATISFACTORY FOR USE IN A FUEL TANK. IF YOU USE A COMBUSTIBLE GAS INDICATOR THAT IS NOT INTENDED FOR USE IN A FUEL TANK, AN EXPLOSION CAN OCCUR. AN EXPLOSION CAN CAUSE INJURY OR DEATH TO PERSONS AND DAMAGE TO EQUIPMENT.

NOTE: These steps are for the combustible gas indicators called out in the equipment section of this procedure. If you use a different combustible gas indicator, use the instruction manual supplied with the indicator.

(a) Make sure the indicator is calibrated for each of these scales:

NOTE: Make sure the GASTECH GT-series combustible gas indicators are labeled for calibration with hexane gas, and that the ppm range in the channel set-up menu is set to 5000 ppm hexane.

1) Oxygen
2) Lower Explosive Limit (LEL)
3) Parts Per Million (PPM)

(b) Make sure the calibration on the combustible scales are specific to hexane gas.

(c) Make sure the alarm values are set to these limits:
1) 160 PPM
2) 10% of the LEL
3) 19.5% oxygen by volume.

(d) Do these steps to make sure the combustible gas indicator operates correctly:
1) Make sure the indicator, sampling line, and sampling probe (with dust filter) are clean and not damaged.
2) Put the indicator switch to the ON position.
3) Make sure there is enough charge on the battery for the scheduled time in the fuel tank.
4) Let the indicator warm-up for 20 minutes before you look at the readings.
5) Adjust the indicator to zero in clean air for these scales:
a) Oxygen
b) PPM
c) LEL
6) If there is a negative value during the use of the indicator, adjust the indicator scale(s) to zero in clean air.

NOTE: Do not turn the indicator off before you adjust the scales.

(e) Do these steps to do a check of the alarms:
1) To do a check of the oxygen alarm, blow across the probe until the alarm goes off (19.5%).
2) To do a check of the PPM and LEL scales, hold the tip of the probe over a solvent bottle or some solvent on a rag until the alarm goes off.

(f) Put the combustible gas indicator on a stand or ladder next to the access door where you will enter the fuel tank.
1) To prevent the accidental movement of the combustible gas indicator, safely attach the indicator to the stand or ladder.

G. Fuel Tank Purging

(1) Read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

WARNING: OBEY THE PURGING AND FUEL TANK ENTRY PRECAUTIONS. FAILURE TO OBEY THE FUEL TANK ENTRY PRECAUTIONS CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(2) VENTURI TYPE VENTILATION EQUIPMENT;
Do these steps to install the air ventilation equipment (Fig. 204):

(a) For the main tanks, do these steps:
1) Remove one or more main tank access panels to have a good flow of air through the fuel tank (AMM 28-11-11/401).
2) Install rubber protectors around the openings of the main tank access panels.

(b) For the integral center tank and surge tanks, do these steps:
1) For the surge tank, remove the fuel tank access panels No. 13 and 14 (AMM 28-11-11/401).
2) For the integral center tank, remove the access panel (AMM 28-11-31/401).
3) Install the tank adapter assembly (F80145) on the tank access opening.

NOTE: This can not be done on access panel No. 14 for the surge tank.

(c) Start the air compressor to supply air to the air mover to give a good flow of air to the tank.

(3) AIR BLOWER TYPE VENTILATION EQUIPMENT (BOE-501 OR EQUIVALENT);
Do these steps to install the air ventilation equipment (Fig. 205):

(a) Start the ventilation blower before you put the air duct in the fuel tank.

WARNING: DO NOT STOP OR START THE VENTILATION BLOWER WHILE THE AIR DUCT IS IN THE FUEL TANK. THE FUEL VAPOR FROM THE FUEL TANK COULD CAUSE AN EXPLOSION AT THE BLOWER MOTOR. AN EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) For the surge tank and main tank outboard of W/S 433, do these steps:
1) At the location where you will do maintenance, remove three adjacent access panels (if possible) (AMM 28-11-11/401).

NOTE: Usually the middle access panel is the panel where you will go into the fuel tank.

2) Install rubber protectors around the openings of the fuel tank access panels.
3) Install the access door adapter through the access panel opening (the outboard access panel is the recommended access panel).
4) Bond the access door adapter to the airplane structure.
5) Make sure there will be a flow of air into the area where you will do the maintenance.

(c) For the main tank inboard of W/S 433, do these steps:
1) Remove the access panel where you will do the maintenance (AMM 28-11-11/401).
2) Install a rubber protector around the opening of the main tank access panel.
3) Put the air duct inside the access panel opening.

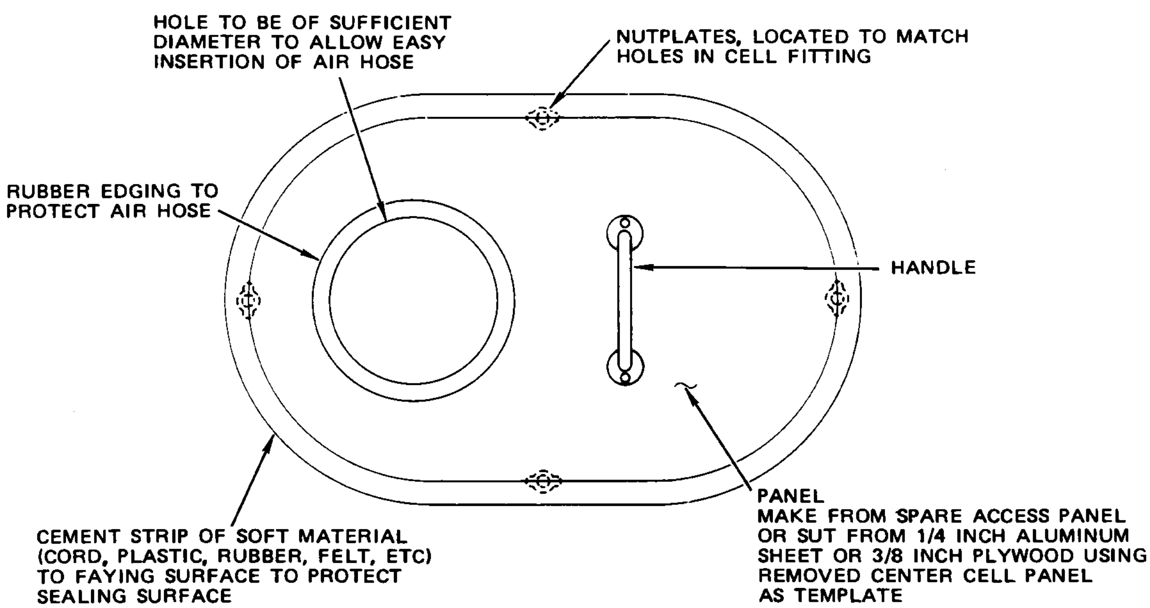
4) Use the pigtail on the end of the air duct to bond the air duct to the airplane structure.
5) Make sure there will be a flow of air into the area where you will do the maintenance.

(d) For the integral center tank and auxiliary tank(s) (if installed), do these steps:
1) Remove all of the center and auxiliary (if applicable) tank access panels (AMM 28-11-31/401, 28-14-11/401).
2) Attach the body fuel tank purging door assembly (F80144-1) (Fig. 208) to intercell access panel opening (if applicable).
3) Put the four inch air duct inside the open access door.
4) Use the pigtail on the end of the air duct to bond the air duct to the airplane structure.
5) Make sure there will be a flow of air into the area where you will do the maintenance.

(e) For center fuel tank bladder cells (if installed), do these steps:
1) On airplanes with one or two center fuel tank bladder cells, remove the center tank access panel (AMM 28-12-21/401).
2) Remove the fuel cell access panel (AMM 28-12-31/401).
3) Remove intercell access panel (AMM 28-12-41/401) and attach modified center fuel cell coverplate to intercell access panel opening (Fig. 208).
4) Use the pigtail on the end of the air duct to the airplane structure.
5) Make sure there will be a flow of air into the area where maintenance occurs.

(4) After the air supply has operated for approximately 30 minutes, put the sampling line of the combustible gas indicator (Fig. 206) as far into the fuel tank as possible.

NOTE: It is recommended that you take the combustible gas indicator value regardless of the type of fuel that was contained in the fuel tank. If the fuel tank had contained kerosene only, then the combustible gas indicator should show zero. This shows that the tank atmosphere is in fire-safe and health-safe condition.



Modified Center Fuel Cell Coverplate
Figure 208

(5) Wait 1 minute for each foot of sampling line before you take a reading.

(6) Use Table 202 to convert the values on the combustible gas indicator to the actual levels.

NOTE: If you use a combustible gas indicator that is not listed below, follow the manufacturer's instructions to get the actual values.

Combustion Gas Calculations
Table 202

COMBUSTIBLE GAS INDICATOR	FOR PPM MULTIPLY VALUE BY:	FOR LEL, MULTIPLY VALUE BY:
GASTECH 1314	2	3
GASTECH 1314SMPN	2	3
GASTECH GT SERIES	2	3

(7) When the combustible gas indicator shows the fuel vapor concentration is 10% or less of the lower explosive limit, you can put warm or cool air in the fuel tank through the tank access opening with an explosion-proof heater/air blower.

WARNING: DO NOT USE A HEATER/AIR BLOWER UNTIL THE FUEL VAPOR CONCENTRATION IS 10% OR LESS OF THE LOWER EXPLOSIVE LIMIT AS SHOWN BY A COMBUSTIBLE GAS INDICATOR. IF THE FUEL VAPOR CONCENTRATION IS NOT 10% OR LESS OF THE LOWER EXPLOSIVE LIMIT, IGNITION OF THE FUEL VAPORS COULD OCCUR.

NOTE: The use of warm or cool air is for the comfort of persons in the fuel tank. It is not part of the purging procedure.

(8) VENTURI TYPE VENTILATION EQUIPMENT;
For the integral center tank and surge tanks, do these steps:
(a) Disconnect and move the air hose and the tank adapter assembly (F80145) into the tank.

<u>NOTE</u>: This is so you can get access into the tank.

(b) Install a rubber cover to give protection to the access opening.

(9) Start the heater/air blower before you put the air duct in the fuel tank.

<u>WARNING</u>: DO NOT STOP OR START THE HEATER/AIR BLOWER WHILE THE AIR DUCT IS IN THE FUEL TANK. THE FUEL VAPOR FROM THE FUEL IS IN THE FUEL TANK. THE FUEL VAPOR FROM THE FUEL TANK COULD CAUSE AN EXPLOSION AT THE HEATER OR BLOWER MOTOR. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(10) Put the air duct for the heater/air blower in the fuel tank through the tank access opening.
(11) Bond the air duct to the airplane structure.
(12) Continue to have a good flow of air through the fuel tank with the air mover until you prepare to the close the fuel tank.
(a) Read the combustible gas indicator values every half hour or less.
(13) If fuel vapors get into the fuel tank that was in a fire-safe condition, get all persons out of the fuel tank until you make sure the air in the fuel tank is in a fire-safe condition again.
(14) Go into the fuel tank per the "Fuel Tank Entry" procedure to do maintenance.

H. Fuel Tank Entry
(1) Read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

<u>WARNING</u>: OBEY THE PURGING AND FUEL TANK ENTRY PRECAUTIONS. FAILURE TO OBEY THE FUEL TANK ENTRY PRECAUTIONS CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND DAMAGE TO EQUIPMENT.

(2) Complete the confined space entry permit (if it is a requirement).
(3) Use the pre-entry checklist (an example is given in Fig. 207).
(4) Do these steps to prepare the respirators for fuel tank entry:
(a) Use Table 203 to find out what level of respiratory protection is necessary.

(b) If the fuel tank is in a fire-safe condition, wear a full-face respirator with an attached breathing-air supply.

(c) If the fuel tank contained JP-4 or Jet B, wear a full-face respirator with an attached breathing-air supply.

WARNING: PUT ON AN APPROVED RESPIRATOR WITH ATTACHED BREATHING-AIR SUPPORT BEFORE YOU GO INTO A FUEL TANK THAT WAS FILLED WITH JP-4/JET B FUEL. THERE IS NO HEALTH-SAFE LIMIT FOR JP-4/JET B WHICH CAN CONTAIN BENZENE. IT IS POSSIBLE THAT BENZENE CAUSES CANCER.

NOTE: There is not a health-safe limit for JP-4 or Jet B.

(d) If the fuel tank is in a health-safe condition, wear a full face respirator with an attached breathing-air supply, or at a minimum, a half-face respirator with an organic vapor filter.

(e) Connect the subsequent respirators to the air support (Fig. 205):
1) One respirator for the person who goes into the fuel tank.
2) Two emergency rescue respirators.

(f) Make sure air gets to the respirators.

(g) Make sure the respirator system (regulator, mask etc.) is clean.

NOTE: When you use the respirator, you should regularly drain moisture from the filter on the regulator. If you drain dirt or oil from the filter, or if the air in the respirator smells bad, replace the filter.

(h) Make sure the emergency air supply and respirators operate correctly.

FIRE-SAFE CONDITION

A FIRE-SAFE CONDITION OCCURS WHEN THE VAPOR CONCENTRATION IS LESS THAN 10% OF THE LEL.

TABLE 203		
HEALTH-SAFE CONDITION A HEALTH-SAFE CONDITION OCCURS WHEN THE OXYGEN CONTENT IS A MINIMUM OF 19.5% TO A MAXIMUM OF 23.5% BY VOLUME AT SEA LEVEL, AND THE VAPOR CONCENTRATIONS ARE BELOW THESE PERMISSIBLE EXPOSURE LIMITS:		
Fuel	Permissible Exposure Level Total Hydrocarbons TWA *[1] (ppm)	Lower Explosive Level (percent)
Aviation Gasoline	300	1.0
Jet A Jet A-1 JP-5 JP-8	160	0.7
Jet B	200	0.8

*[1] TWA - Time Weighted Average

(5) Remove these items before you go into a fuel tank:
   (a) All jewelry - rings, bracelets, wrist watches etc.
   (b) Matches
   (c) Pocket warmers
   (d) Hearings aid devices or other battery operated equipment.

(6) Remove any clothes made of this material:
   (a) Wool
   (b) Silk
   (c) Nylon
   (d) Synthetic clothing.

(7) Put on these approved protective clothes (Fig. 202):
   (a) Cotton or SARANEX 23P coveralls (non-sparking zippers or buttons)
   (b) Clean cotton head cover
   (c) Approved cotton or rubber gloves
   (d) Safety glasses or face shield
   (e) 100% cotton socks and/or fuel cell boots

      CAUTION: DO NOT PUT ON COTTON SOCKS UNTIL YOU ARE TO GO INTO THE FUEL TANK. IF THE COTTON SOCKS ARE NOT CLEAN, YOU CAN CAUSE DAMAGE TO THE FUEL

(f) Put rubber bands around your wrists and ankles to hold clothes tight.

(8) Attach a safety line to the person who goes into the fuel tank.

(9) Make sure the person who goes into the fuel tank and the observer agree on safety signals.

(10) If a confined space communication system is used, attach the system.

(a) Do a check to make sure the system operates correctly.

(11) Put on the necessary respiration protection.

(12) Make sure the respirator operates.

(13) Do these steps if you are the observer:

(a) Make sure the confined space entry permit is complete and approved (if this is a requirement).

(b) Make a record that shows the time and who is inside the fuel tank.

(c) Attach this sign at the fuel tank entry location where it can be seen:

1) CAUTION - PERSONNEL INSIDE - MOVE NO EQUIPMENT

(d) Make sure you and the person who will go into the tank agree that the checklist items are complete.

(e) Make sure you and the person who will go into the tank agree on communication signals and set a communication time interval.

(f) Look at the filter-regulator to make sure the supplied air system operates correctly.

(g) Keep visual contact with the fuel tank entry location.

(h) Keep constant communication with the person in the fuel tank.

(i) Look at the combustible gas indicator to make sure the air in the fuel tank is at 10% or less of the lower explosive limit.

(j) Do not put your head in the fuel tank access hole unless you have the correct respirator on (for the condition of the tank) and there is another observer to watch you.

NOTE: This is considered the same as a fuel tank entry.

(k) Look out for any changes which could cause a dangerous condition.

(l) Make sure the person(s) in the fuel tank get out if there is a dangerous condition.

(14) Persons with respirators must touch the identified airplane ground to release static electricity before they go into the fuel tank.

(15) Go into the fuel tank.

(a) For the center tank, if all of the fuel tanks are not purged, it can be necessary to install plugs (F80080) in the vent tubes to prevent entry of fuel vapors from the other tanks.

(16) As an alternate procedure, you can take an additional combustible gas indicator into the fuel tank to monitor the environment where you will do the maintenance.

(17) If it is necessary for your air ventilation system, route the air duct to the maintenance area (Fig. 204).
(a) Bond the air duct to the airplane structure.
(18) The observer must keep in communication with the person(s) in the tank and watch for changes in conditions or a signal of danger.

WARNING: MAKE SURE TO WEAR THE CORRECT RESPIRATION PROTECTION FOR THE CONDITION OF THE FUEL TANK. PERSONS WHO BREATHE HIGH CONCENTRATIONS OF FUEL VAPOR CAN GET HEADACHES, FEEL SLEEPY OR FAINT. IF A PERSON'S BREATH SLOWS OR STOPS, SEND A PERSON FOR MEDICAL ASSISTANCE. GET THE PERSON OUT OF THE TANK IMMEDIATELY. START ARTIFICIAL RESPIRATION AT ONCE IF A PERSON'S BREATH STOPS. CONTINUE THE ARTIFICIAL RESPIRATION. PERSONS WITH HEADACHES, OR IRRITATION OF THE EYES OR SKIN SHOULD GET OUT OF THE FUEL TANK AT ONCE. JET FUELS CONTAIN SMALL QUANTITIES OF CHEMICAL ANTIOXIDANTS, METAL DEACTIVATORS AND CORROSION INHIBITORS. THESE CHEMICALS ARE IRRITANTS. IF SPLASHED INTO THE EYES, FLUSH THE EYES WITH WATER FOR A MINIMUM OF 15 MINUTES. LIFT THE UPPER AND LOWER EYELIDS FREQUENTLY TO REMOVE CHEMICALS. GET MEDICAL ASSISTANCE IMMEDIATELY.

WARNING: MAKE SURE THE TEMPERATURE IN THE FUEL TANK DOES NOT GET TOO HOT. IF THE FUEL TANK TEMPERATURE GETS TOO HOT, A PERSON IN THE FUEL TANK CAN HAVE HEAT-RELATED DISORDERS. IF A PERSON BECOMES TOO HOT, GET THE PERSON OUT OF THE FUEL TANK. FIND OUT IF MEDICAL ASSISTANCE IS NECESSARY.

WARNING: COVERALLS THAT ARE COATED WITH SARANEX 23P WILL KEEP BODY HEAT IN. CLOSELY MONITOR A PERSON IN SARANEX 23P COVERALLS FOR SIGNS OF HEAT-RELATED DISORDERS. IF A PERSON BECOMES TOO HOT, GET THE PERSON OUT OF THE FUEL TANK. FIND OUT IF MEDICAL ASSISTANCE IS NECESSARY.

(19) Do these steps to remove any fuel that remains in the fuel tank:

WARNING: MAKE SURE THERE IS A GOOD FLOW OF AIR WHEN YOU ARE IN THE FUEL TANK. DO NOT REMOVE THE RESPIRATOR WHILE YOU ARE IN THE FUEL TANK. DO NOT DO MAINTENANCE IN THE FUEL TANK UNTIL YOU REMOVE ALL FUEL FROM THE AREA. FUEL VAPORS CAN KILL YOU.

(a) Put the cotton wipers (BMS15-5) on the bottom of the fuel tank to absorb any fuel that remains in the tank.

(b) Count the number of cotton wipers (BMS15-5) as they are put into the fuel tank.
(c) Remove the cotton wipers (BMS15-5) when they are soaked.
(d) Count the number of cotton wipers (BMS15-5) as they are removed from the fuel tank.
(e) Make sure the counts agree.
(f) Make sure you remove all of the cotton wipers (BMS15-5) from the fuel tank.
(g) Follow approved procedures to dispose of or clean the fuel soaked cotton wipers (BMS15-5).

WARNING: OBEY THE APPROVED PROCEDURES FOR FUEL-SOAKED COTTON WIPERS (BMS15-5). PUT FUEL-SOAKED COTTON WIPERS (BMS15-5) IN APPROVED BARRELS ONLY. COTTON WIPERS (BMS15-5) THAT YOU USE TO CLEAN THE FUEL TANK CAN CAUSE FIRES. FIRES CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(20) Do the necessary repair or maintenance procedures.
(21) After you complete the maintenance, do this task: Fuel Tank Closure.

4. Fuel Tank Closure

A. General
(1) After you do the maintenance, do this task to close the fuel tank.
(2) Make sure you read and obey the precautions in this task: Purging and Fuel Tank Entry Precautions.

B. References
(1) AMM 24-21-21/401, APU Battery
(2) AMM 24-31-11/401, Storage Battery (Nickel-Cadmium)
(3) AMM 27-51-0/201, Trailing Edge Flaps
(4) AMM 27-81-0/201, Leading Edge Flaps and Slats
(5) AMM 28-11-11/401 Wing Fuel Tank Access Panels
(6) AMM 28-11-31/401, Integral Center Tank Access Panel
(7) AMM 28-12-21/401, Center Tank Access Panel
(8) AMM 28-12-31/401, Fuel Cell Access Panel
(9) AMM 32-00-01/201, Ground Lock Assemblies

C. Equipment
(1) Air Source, Regulated, Dry Filtered, 0-150 psig (commercially available)
(2) Air hose - (commercially available)
(3) Vacuum - industrial type, pneumatically powered, with attachments for cleaning the fuel tank interior (ATI Industries, 2425 West Vineyard Ave., Escondido, CA 92029) or equivalent

D. Consumable Materials
(1) G00034 Cotton Wiper - Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

E. Clean the Fuel Tank

(1) Each time you go into a fuel tank you must examine the fuel tank very carefully before you close it.

WARNING: REMOVE ALL MAINTENANCE ITEMS, AND UNWANTED MATERIAL FROM THE FUEL TANK BEFORE YOU CLOSE IT. EQUIPMENT, TOOLS, LOOSE HARDWARE, OR CONTAMINATION CAN CAUSE DAMAGE TO THE FUEL SYSTEM. METAL ITEMS ARE POSSIBLE IGNITION SOURCES. AN IGNITION SOURCE IN A FUEL TANK CAN CAUSE A FIRE OR AN EXPLOSION.

(2) Remove all of the equipment used to do the maintenance (for example: tools, solvent, containers, plugs, brushes, and other equipment).

NOTE: Keep a written record of all the tools, equipment, material, and persons when they go into and out of the fuel tank. Before you close the fuel tank, make sure the record shows there are no unwanted items in the tank.

(3) Use a cotton wiper (BMS15-5) to clean any unwanted solvents, liquids or grease.

(4) Use only shop air or bottled air as a gas source for air-driven tools. Do not use nitrogen, oxygen, carbon dioxide (CO2) or any other non-air source of gas.

WARNING: GROUND ALL OF THE EQUIPMENT AND THE HOSES USED IN THE FUEL TANK OR ADJACENT TO THE OPEN FUEL TANK. IF YOU DO NOT GROUND ALL OF THE EQUIPMENT AND HOSE, AN EXPLOSION CAN OCCUR.

WARNING: ONLY USE SHOP AIR OR BOTTLED AIR AS THE SOURCE OF GAS TO POWER AIR-DRIVEN EQUIPMENT. GASES OTHER THAN SHOP OR BOTTLED AIR CAN REMOVE OXYGEN FROM A CLOSED AREA. IF YOU GO INTO A CLOSED AREA WITHOUT ENOUGH OXYGEN, YOU CAN BECOME UNCONSCIOUS OR IT CAN KILL YOU.

(5) Use an air-driven vacuum to remove unwanted particles and pieces of used sealant.

F. Inspect the Fuel Tank
(1) Examine all of the repairs, sealant and finishes to make sure they are correct and complete.
(2) Make sure these components are free from unwanted material or objects:

WARNING: MAKE SURE YOU REMOVE ALL UNWANTED PARTICLES AND MATERIALS FROM THE FUEL TANK. UNWANTED MATERIALS CAN COLLECT IN THE FUEL TANK, WHICH CAN CAUSE A BLOCKAGE OR INCORRECT SYSTEM OPERATION, OR CREATE A POTENTIAL IGNITION SOURCE.

(a) Fuel and water drain holes and paths
(b) Fuel quantity indicating system components.
(3) Do a check of the areas of the tank that were accessed for any damage to in-tank components, bonding jumpers, wiring and structure.
(a) Repair any problems that you find.
(4) Do a final inspection of the fuel tank to make sure you removed all unwanted materials and equipment.

NOTE: Make sure the necessary approved persons do an inspection of the tank before you close it.

G. Close the Fuel Tank
(1) For the center tank, remove the plugs (F80080), if installed.
(2) If an air duct was used, move the air duct to the access door opening.
(3) Go out of the fuel tank.
(4) If you are the observer, do these steps:
(a) Make a report that states the time and that all persons are out of the tank.
(b) Remove the sign that states: CAUTION - PERSONNEL INSIDE TANK - MOVE NO EQUIPMENT.
(5) If a heater or ventilation blower was used, remove the air duct from the fuel tank.

WARNING: DO NOT STOP OR START THE HEATER/AIR BLOWER OR VENTILATION BLOWER WHILE THE AIR DUCT IS IN THE FUEL TANK. THE FUEL VAPOR FROM THE FUEL TANK COULD CAUSE AN EXPLOSION AT THE HEATER/AIR OR VENTILATION BLOWER MOTOR. AN EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAN CAUSE DAMAGE TO EQUIPMENT.

(6) Turn the air duct 180 degrees away from the open fuel tank.
(7) Stop the heater/air and ventilation blower if used.
(8) Stop the air compressor.
(9) Disconnect the air supply hose from the air mover or blower(s).
(10) VENTURI TYPE VENTILATION EQUIPMENT;
Do these steps to remove the air mover equipment:
(a) For the main tanks, do these steps:
1) Remove the air mover from the overwing fill port (Fig. 204).

2) Remove the ground from the air mover.
3) Remove the air mover adapter assembly from the overwing fill port.
4) Install the cap on the overwing fill port.
5) Install the applicable main tank access doors (AMM 28-11-11/401).

(b) For the surge tanks, do these steps:
1) Remove the tank adapter assembly from the opening of the surge tank access door.
2) Remove the air mover from the adapter base (Fig. 204).
3) Remove the ground from the air mover.
4) Install the surge tank access doors (AMM 28-11-11/401).

(c) For the center fuel tank, do these steps:
1) Remove the tank adapter assembly from the opening of the center tank access door.
2) Remove the air mover from the adapter base (Fig. 204).
3) Remove the ground from the air mover.
4) Install the center tank access doors (AMM 28-11-31/401).

(11) FOR AIR BLOWER TYPE VENTILATION EQUIPMENT;
Do these steps to remove the air blower equipment:

(a) For the main tanks, do these steps:
1) Remove the ventilation equipment from the airplane.
2) Remove the ground from the airplane to the ventilation blower.
3) Install the applicable main tank access doors (AMM 28-11-11/401).

(b) For the surge tank, do these steps:
1) Remove the ventilation equipment from the airplane.
2) Remove the ground from the airplane to the ventilation blower.
3) Install the surge tank access doors (AMM 28-11-11/401).

(c) For the integral center tank and auxiliary tank (if installed), do these steps:
1) Remove the ventilation equipment from the airplane.
2) Remove the ground from the airplane to the ventilation blower.
3) Install the center tank access doors (AMM 28-11-31/401) and auxiliary tank access doors (if applicable) (AMM 28-14-11/401).

(d) For center fuel tank bladder cells (if installed), do these steps:
   1) Remove the ventilation equipment from the airplane.
   2) Remove the ground from the airplane to the ventilation blower.
   3) On airplanes with one or two center fuel tank bladder cells, install the center tank access panel (AMM 28-12-21/401).
   4) Install the fuel cell access panel (AMM 28-12-31/401).

(12) Follow approved procedures to clean and return all respiratory equipment.

H. Put the Airplane Back to the Usual Condition

(1) Remove the downlocks from the landing gear doors and close the doors (AMM 32-00-01/201).

WARNING: USE THE PROCEDURE IN AMM 32-00-01/201 TO REMOVE THE DOWNLOCKS. DOORS OPEN AND CLOSE QUICKLY AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do the activation procedure for the trailing edge flaps (AMM 27-51-0/201).

WARNING: DO THE ACTIVATION PROCEDURE FOR THE TRAILING EDGE FLAPS. ACCIDENTAL OPERATION OF THE TRAILING EDGE FLAPS COULD CAUSE INJURY TO PERSONS.

(3) Do the activation of the leading edge slat procedure (AMM 27-81-0/201).

WARNING: MAKE SURE NO PERSONS ARE IN THE SLAT AREA WHEN YOU DO THE ACTIVATION OF THE LEADING EDGE SLAT PROCEDURE. IF PERSONS ARE IN THE SLAT AREA, INJURY CAN OCCUR.

(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel:
   (a) BOOST PUMP TANK - 1 FWD
   (b) BOOST PUMP TANK - 2 FWD
   (c) BOOST PUMP TANK - 1 AFT
   (d) BOOST PUMP TANK - 2 AFT
   (e) BOOST PUMP CTR TANK - LEFT
   (f) BOOST PUMP CTR TANK - RIGHT

(5) Remove DO-NOT-OPERATE tags from boost pump switch lights on right side panel, P6.

(6) Close any other circuit breakers that were opened for the Purging and Fuel Tank Entry task.

(7) Remove the tag and connect the airplane battery (AMM 24-31-11/401).

(8) Remove all precautionary signs and placards.

(9) Remove all support equipment, stands, ladders, ropes, etc.

AIRCRAFT USE OF FUELS CONTAMINATED WITH DYE

1. General
   A. Current engine manufacturers recommend limits for emergency usage of dye-contaminated aviation turbine fuel and actions to be taken if fuels contaminated with dye have been inadvertently delivered or loaded on aircraft.
   B. As of October 1993, the United States Environment Protection Agency (EPA) required that fuel not meeting the low sulfur requirements for diesel fuel (fuels having greater than 0.05% sulfur) must be dyed red. While jet fuels are exempt from this requirement, it does apply to diesel fuel intended for off-road uses and heating oils with higher sulfur contents. The use of dye in distillate fuels can lead to the possibility that jet fuel may be contaminated with dye.
   C. Incidents of extremely small concentrations of red dye in jet fuel at airports are continuing to occur. The likelihood of a major airport shutdown because of red dye contamination in jet fuel is a serious concern for the aviation industry.
   D. Due to the likelihood that an airport shutdown could occur due to red dye contamination, an industry committee, including engine, APU and airframe manufacturers with airlines and FAA representation, has been researching the effects of red dye. The industry committee has confirmed and agreed that limited use of contaminated fuel would be acceptable and the FAA has granted conditional approval for emergency use.
2. Limits for Emergency Usage
   A. Engine manufacturers recommend limits for emergency usage of dye-contaminated aviation turbine fuel, resulting when dye contaminated fuel enters the airport distribution system and it cannot be segregated or isolated for remediation without halting airport operations. Contaminated fuel containing a maximum of 0.41 milligrams per liter (0.14 pounds per 1000 bbls.) of C.I. Solvent Red 164 (or 2.5% of the full EPA-IRS mandated dye concentration specified for off-road high sulfur diesel fuel) is subject to the following restrictions and/or actions.
   B. Service Criteria:
      (1) The concentration of dye in the fuel will be measured in SITU and in at least three widely separated locations along the airport distribution system, using the PetroSpec Analyzer Model JT-100S or other instrumentation to verify the presence of red dye. Values of dye concentration are to be reported which then define the "emergency". All fuel samples must have 0.28 mg/l or less of red dye as indicated by the JT-100S analyzer or equivalent. This permits airline use of the fuel on an emergency basis. To obtain liquid re dye equivalent value, multiply the meter reading by 1.446 (1.446 X 0.28 = 0.41 mg/l). The PetroSpec analyzer model JT-100S in manufactured by Varlen Instruments Inc., 2777 Washington Boulevard, Bellwood, Illinois 60104 (Telephone 1-800-729-447; Fax 708-493-0116). At a later date, the JT-100S or equivalent measurement must be verified by a laboratory analysis of the fuel as in step C.(2) as follows.

(2) The number or fuel uplifts will be limited to three without restriction.

(3) The fourth fuel uplift will be followed immediately (within 48 hours) by contact with the engine manufacturer for maintenance action, which might include removal and inspection of critical fuel system components. Aircraft can remain in service, but no further uplifts of fuel contaminated with dye are allowed.

C. Reporting Requirements

(1) Report all uplift actions to the engine manufacturer on the same day that it occurs. Report details should include types of aircraft, numbers of aircraft, tail numbers, engine serial numbers and number of uplifts to each aircraft during the duration of the emergency.

(2) If the contaminated fuel system serves multiple airlines, only one set of samples for analysis need be taken from the point in the fuel system having the highest level of dye contamination. Secure samples of the dyed fuel in sufficient quantity, for tests defined by ASTM D1655, Standard Specification for Aviation Turbine Fuels, for Thermal Stability (test method D3241), Distillation (D86), Existent Gum (D381), Freeze Point D2386), and have the laboratory verify the concentration of dye in the fuel. Complete a full analysis of the fuel sample to all the characteristics of ASTM D1655. Report test results tot he engine manufacturers within 72 hours.

3. Fuel Exceeding Dye Contamination Limits

A. Aircraft serviced with dye contaminated fuel that exceeds the limit of 0.41 milligrams per liter (0.28 mg/l as indicated by the JT-100S analyzer or equivalent), will have the following actions performed:

(1) Do not start or operate the engines or APU.

(2) Completely defuel the aircraft down to the fuel tank sump levels.

(3) Drain the fuel tank sumps, leaving only trapped fuel.

(4) check the engine fuel filters and bowl for evidence of exposure tot he contaminated fuel and replace the filters is suspected.

(5) Refill the tanks with fresh uncontaminated fuel. For most airplane tanks, this should provide a diluted ration in the range of 10 to 1 of fresh fuel to trapped fuel.

(6) Draw fuel samples from the tank sumps and test. If these samples show evidence of continued contamination, repeat steps (2) thru (6). In extreme cases, mechanical cleaning of the tanks may be a prescribed option.
(7) If the samples from the tank sumps do not display evidence of contamination, start the engines and APU and run them until the contaminated fuel has been flushed from the fuel system and the engine and its controls have been shown to operate normally under all standard power settings. The individual engine manufacturers should be consulted for the particulars of any additional inspections or testing they might recommend.
(8) After operating the engine and APU, check the fuel filters and bowls.
(9) If no evidence of contamination is observed, the airplane may be considered ready for dispatch.
(10) If the engine fail to operate normally or contamination persists, additional engine inspections and test may be necessary. Each particular engine manufacturer should be consulted for the appropriate procedures.
(11) If the engines have been run on the contaminated fuel, apply the procedure described above and replace the engine fuel filters and clean the filter bowls.
(12) If the engine has been subjected to continuous or long-term exposure to fuel contaminated with dye, a thorough inspection of the engine fuel system and components, including fuel nozzles and turbine blades should be conducted. The individual engine and APU manufacturers should be consulted for appropriate procedures for the equipment.

INTEGRAL FUEL TANKS - DESCRIPTION AND OPERATION

1. General
   A. The integral fuel tanks provide the major portion of the fuel supply storage capacity on some airplanes, and the entire fuel supply storage on airplanes having an integral center tank. All airplanes have integral tanks in the interspar area of the left and right wing and are designated as tank No. 1 and No. 2 respectively. The integral center tank is contained within the interspar area of the wing section that passes through the airplane body (Fig. 1). Airplanes without the integral center tank utilize removable bladder cells in the center wing structure (Ref 28-12-0 D&O).
   B. The sealed structure of the wing and center section provides the fluid tight boundary of the integral fuel tanks. This is accomplished by a close fit of metal to metal parts and through the use of wing skin, spars, ribs, stiffeners, stringers, and doublers as the periphery of the tanks, and applying sealing materials at areas where these members join. Fillet sealing is used at the spars, fuel vent ducts, and skin splice stringers. Rivet seals are achieved by control and orientation of the driven head. Sealing materials are generally synthetic rubber, either in molded form (O-rings, gaskets, etc.), or in an uncured state (for brush or gun application). Use of sealant is held to a minimum to avoid excess weight.
   C. The wing ribs and spanwise beams in the integral tanks act as baffle plates to prevent excessive fuel surges. Two of the wing ribs in tanks No. 1 and 2 contain a series of baffle check valves to prevent fuel flow away from the fuel boost pumps. In the integral center tank, the spanwise beams in the center section integral tank contain fuel flow equalizing holes to allow a free flow of fuel between the beams.
   D. Fuel tanks No. 1 and 2 are each fitted with an overwing (gravity) filler port. The center tank does not have a gravity-type filler port due to the obstruction of the airplane body, and is pressure fueled only.
   E. The low points in integral tanks are fitted with fuel sump drain valves to permit draining accumulated water from the fuel tanks and for draining fuel from the sumps when a tank is defueled.

F. Located within all the fuel tanks are the fuel lines, vents, drains and sensing equipment required for operation and monitoring of the fuel system. Dry cavities within tanks No. 1 and 2 house all of the fuel boost pumps and associated valves except for tanks No. 1 and 2 FWD boost pumps which project into the tanks from the forward side of the front spar. Also mounted on the front spar and projecting into tank No. 1 or 2 are the engine shutoff valves, the crossfeed valve, the defueling valve and the boost pump low pressure switches. Access to the interior of the fuel tanks is provided through removable access panels. The access panels for tanks 1 and 2 are in the wing lower skin. Access openings in the tank ribs are provided for areas not accessible directly through the tank access panels.

G. The integral center tank is divided into three cavities by spanwise beams. The cavities are numbered 1, 2 and 3 starting with the forward cavity and going aft. An access panel in the bottom skin of No. 1 cavity provides access to wing center section cavity. Man-size openings in the spanwise beams provide access between cavities.

H. The wing center cavity has a secondary external barrier coating on the upper panel and front spar to prevent fuel vapor from entering the pressurized section of the fuselage. Fuel tanks use the sealed structure of the wing to maintain a fuel boundary. This is accomplished primarily by close metal to metal fit of all parts, by sealed fasteners, and by the application of sealing compound to the structure. Optimum sealing is made possible by the use of open section stiffeners throughout the wing which eliminate blind areas. Fillet sealing is used at the spars, fuel vent ducts, and skin splice stringers. Rivet seals are achieved by control and orientation of the driven head.

2. Fuel Tank Access Panels

A. Access to equipment located inside fuel tanks is provided by removable access panels, located between the wing ribs, in the wing lower skin. For ease in identifying the panels, and also referencing them throughout this chapter, they are numbered consecutively from the wing root outboard. The panels in the wing lower skin are numbered 1 thru 14 and one panel is located in wing center section.

B. The fuel tank access panels are cast aluminum or on airplanes incorporating SB 28-1064 and/or SB 28-1078, panels 2 and 3 and/or 1, 4, 5, and 6 are high impact resistant aluminum honeycomb. Cast and impact resistant panels are not interchangeable. The panels are mounted inside the tank. The panels are installed by inserting screws through a clamp ring on the outside, flush with wing panel and threading the screws into captive nuts in the access panel. A molded rubber seal ring fitted into a groove in the panel seal face provides a static-type fluid seal between the access panel and the wing skin.

C. Fuel tank access panels are electrically bonded to the wing structure by coating the knitted aluminum gasket and clamp ring with anticorrosion grease.

D. In addition to the fuel tank access panels, two smaller panels in each wing provide access to the fuel boost pumps. These panels do not provide access to the interior of the fuel tanks (Ref 28-22-0).

3. Rib and Spanwise Beam Access Openings (Fig. 3)

A. Rib Access Openings

(1) Access to some of the equipment located inside the fuel tanks is not directly possible through the fuel tank access panels. To obtain access to this equipment, personnel must enter the tank through the nearest access panel and go through rib access openings into the areas between ribs where no access panel is provided. The access openings in ribs installed at wing buttock lines (WBL) 135.5 and 183.4 are covered by access panels which must be removed to allow entry into otherwise inaccessible areas within the wing. The panels must be reinstalled once work within these areas is complete.

B. Spanwise Beam Access Openings (Integral Center Tank)

(1) Spanwise beam access openings provide access between cavities. There are no baffle panels installed on the openings.

4. Filler Cap Assembly

A. The filler caps seal the filler ports utilized during overwing fueling operations. Each cap assembly consists of a flush fitting cap with a locking device and an adapter the exterior filler port (Fig. 4).

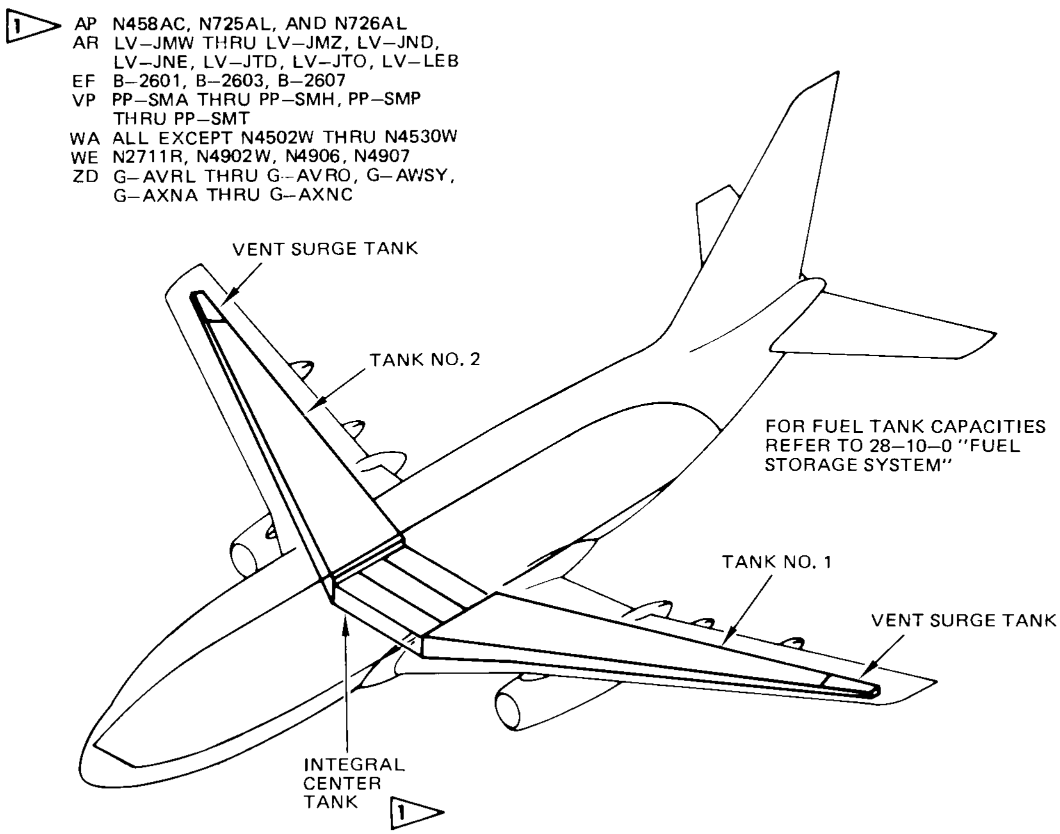
B. The filler cap assemblies are located on top of the wing. The filler cap is attached to the adapter on the exterior filler port by rotating the cap clockwise to a stop, this compresses the O-ring, in the cap, against the inside of the adapter to seal the filler port opening.

C. Filler ports and caps are provided for fuel tanks No. 1 and 2 only.

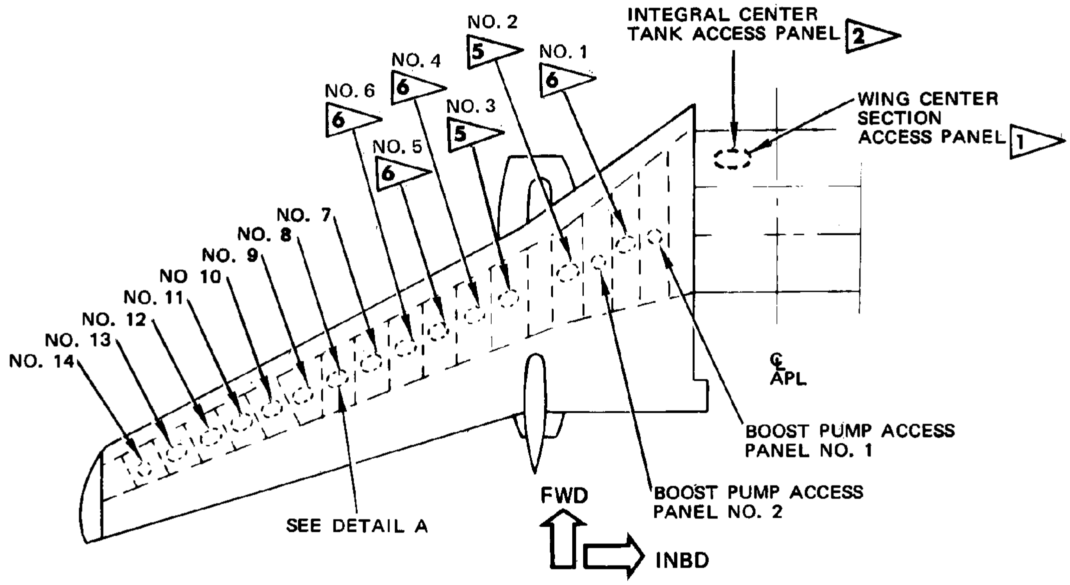
5. Baffle Check Valves

A. Baffle check valves are installed in No. 1 and 2 fuel tanks at the bottom of the ribs at wing buttock line 157.0, 227.0 and 557.0. When the airplane is in a nose high or a wing low attitude, the baffle check valves reduce the rate of fuel flow toward the wing tips thereby maintaining fuel in the boost pump area of the wing and improving airplane trim stability. Each baffle check valve is hinged at the top and opens in the inboard direction only. The valve flapper is free swinging and aligns itself automatically with the valve seat when it closes (Fig. 5).

B. Access to the four baffle check valves at the bottom of the rib at wing buttock line 157.0 is obtained through fuel tank access panel No. 1 and rib access opening No. 3. Access to the four baffle check valves at the bottom of the rib at wing buttock line 227.0 is obtained through fuel tank access panel No. 3. Access to the one baffle check valve at the bottom of the rib at wing buttock line 557.0 is obtained through fuel tank access panel No. 13.



Integral Fuel Tank Location
Figure 1



1 AR LV-JMW THRU LV-JMZ, LV-JND LV-JNE, LV-JTD, LV-JTO, LV-LEB
EF B-2601, B-2603, B-2607

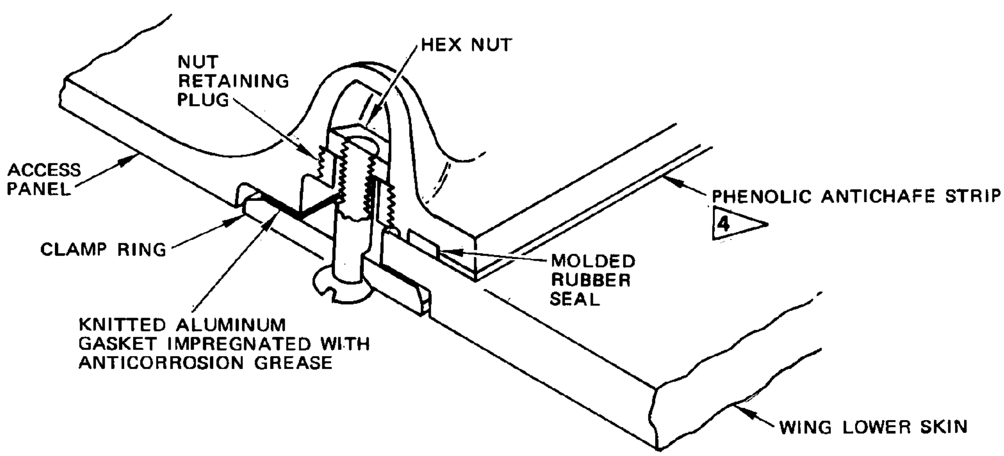
2 AR, EF ALL EXCEPT 1

3 TYPICAL FOR ACCESS PANELS NO. 1 THRU 14 AND INTEGRAL CENTER TANK ACCESS PANEL

4 NOT INSTALLED ON HIGH IMPACT RESISTANT ACCESS PANELS

5 HIGH IMPACT RESISTANT ACCESS PANELS INSTALLED ON AIRPLANES INCORPORATING SB 28-1064

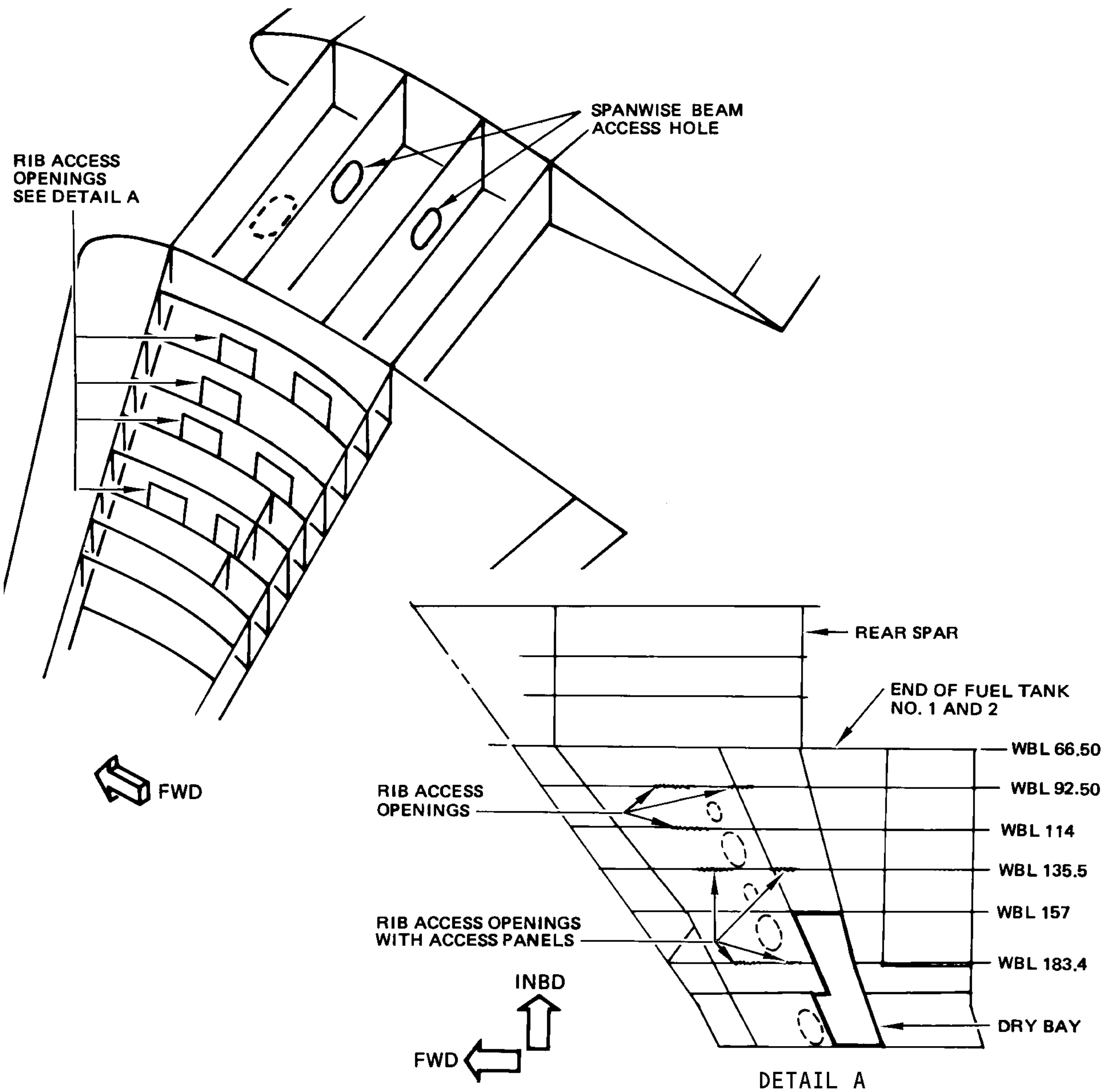
6 HIGH IMPACT RESISTANT ACCESS PANELS INSTALLED ON AIRPLANES INCORPORATING SB 28-1078



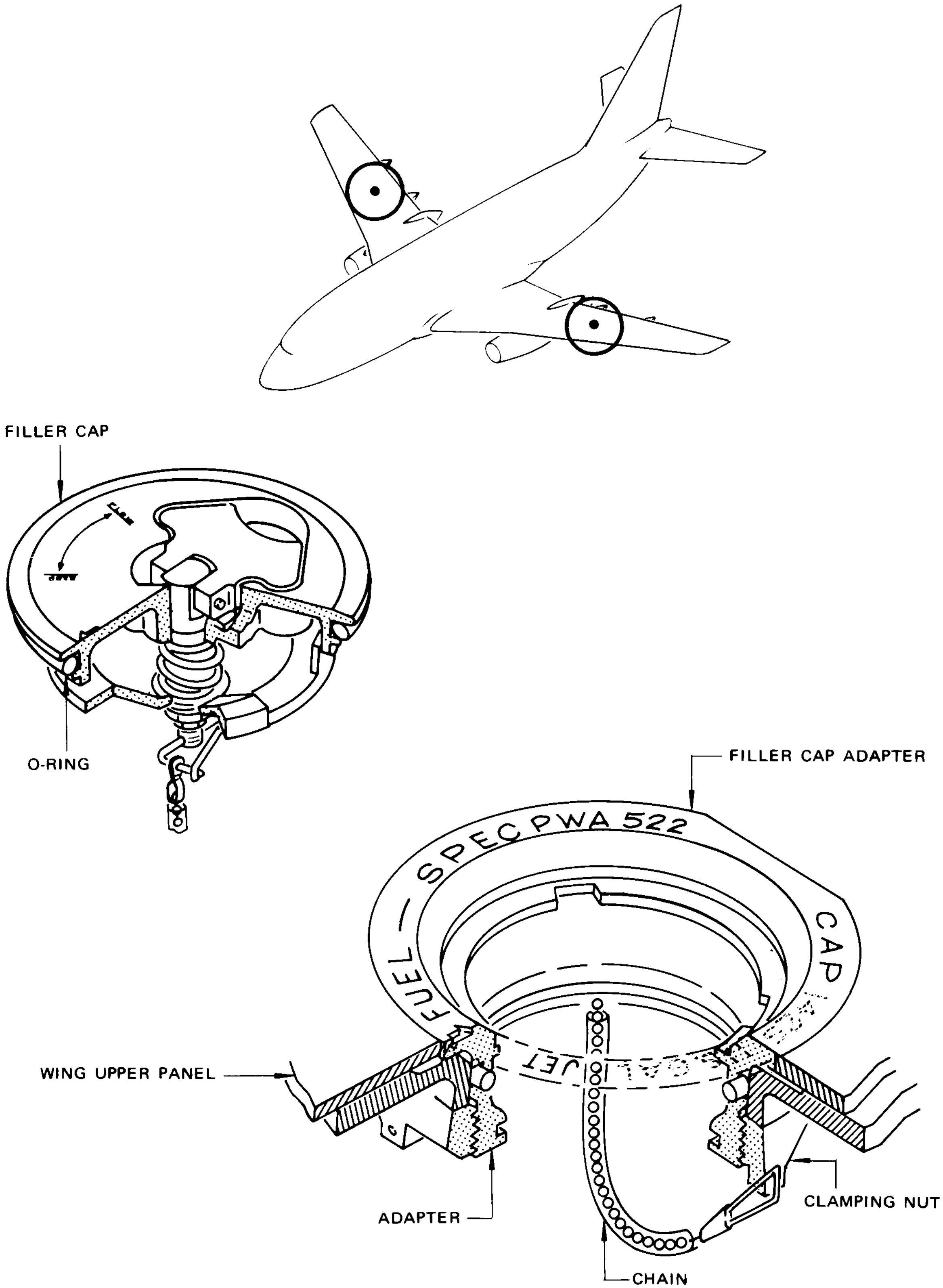
TYPICAL TANK PANEL ATTACHMENT 3

DETAIL A

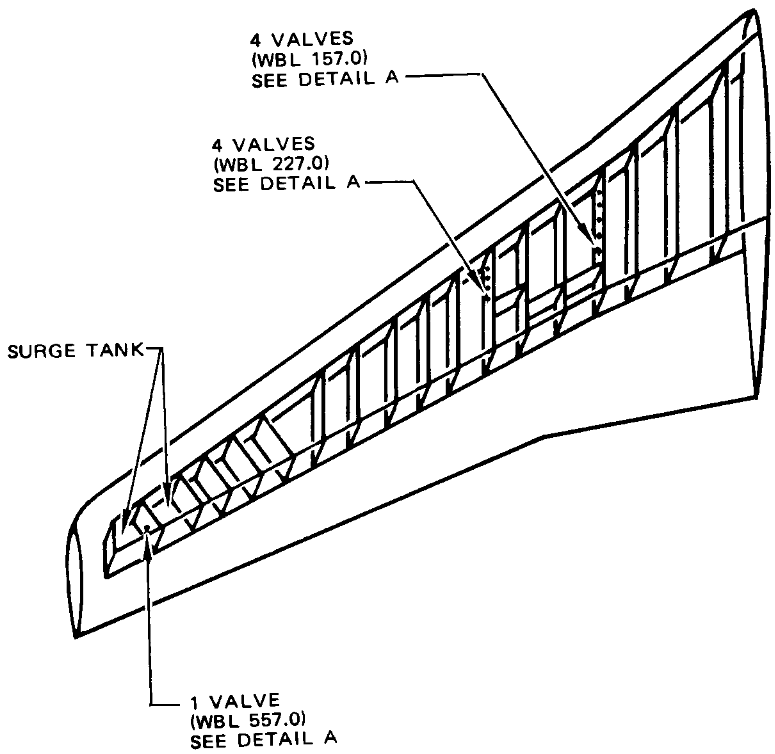
Fuel Tank Access Panels
Figure 2

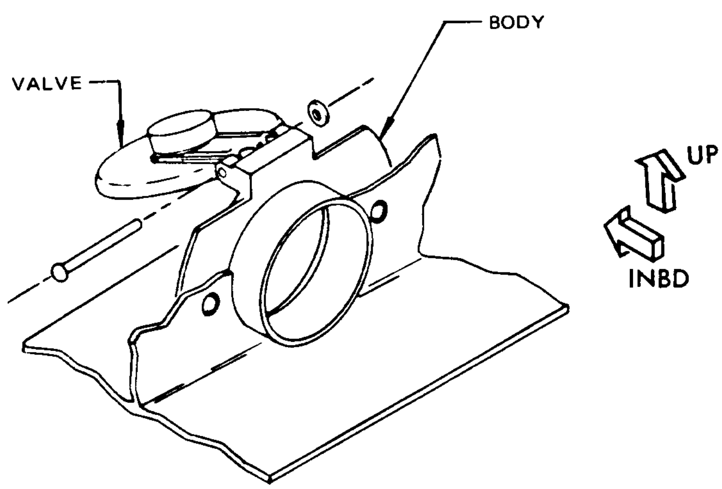


Rib Access Openings
Figure 3



Fuel Tank Filler Cap Assembly
Figure 4





DETAIL A

Baffle Check Valves
Figure 5

6. Fuel Sump Drain Valve

A. Fuel sump drain valves are installed at the low points of the fuel and fuel surge tanks for draining accumulated moisture from each tank and for draining trapped fuel remaining after defueling. The sump drain valves used for the tank No. 1 and 2, including surge tank sump drains, are different than the sump drain valve used for the integral center tank. (See figure 6.)

(1) The sump drain valves, used for tanks No. 1 and 2, including surge tanks, are spring-loaded closed, poppet-type valves flush mounted in the wing lower skin. A screen over the valve inlet protects the unit from contaminants which may block the drain passages. The valve incorporates a flapper valve which allows the poppet assembly to be removed without draining the fuel tank. To drain the fuel sump, the poppet is pushed up to Open the valve and allow fuel to drain through the drain hole in the center of the valve. A 9/16-inch tube may be used to push up on the poppet to facilitate draining fluid into a container.

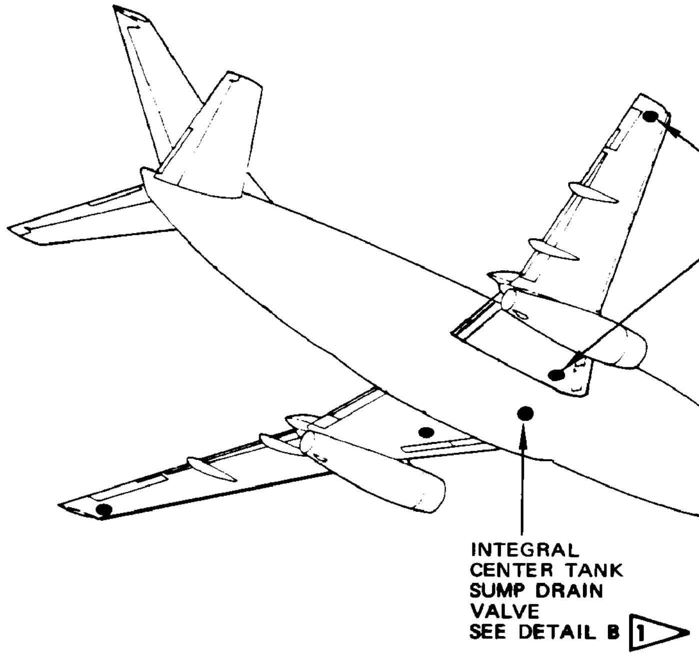
(2) The sump drain valve, used for the integral center fuel tank, is a spring-loaded closed, flapper-type check valve mounted in the wind center section lower skin. A sump drain assembly connects the valve upper housing with the lower body section of the airplane through the keel beam area. The sump drain assembly contains a cam-lock plunger to lift the flapper valve off its seat and allow drainage. To drain the fuel sump, open the hinged access door in the lower body section stenciled SUMP DRAIN, insert a broad-bladed screwdriver in slot, and turn and push up on plunger. To close, release plunger, allow slot to align fore and aft, and secure access door.

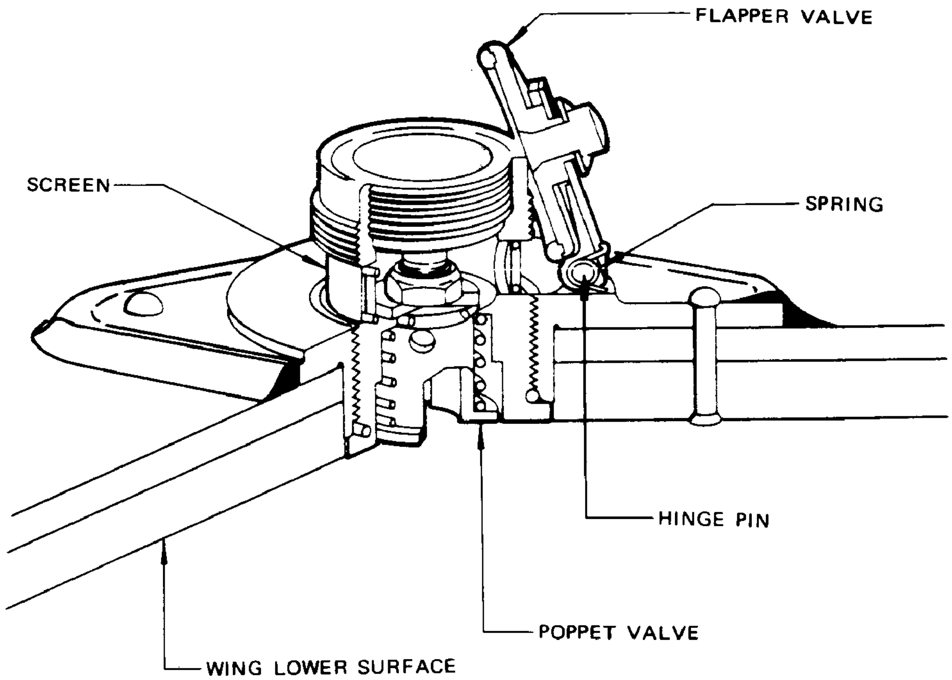
7. Fuel Tank Sealing

A. General

(1) Integral fuel tank sealing is the means by which the structural members of the wing can be made to form a fuel-tight tank. This is accomplished through the use of wing skin, spars, ribs, stiffeners, and doublers as the periphery of the tanks, and applying sealing materials at areas where these members join. Sealing materials are generally synthetic rubber; either in molded form (O-rings, gaskets, etc.), or in an uncured state (for brush or gun application). Use of sealant is held to a minimum to avoid excess weight. Refer to Chapter 57 for structural details.

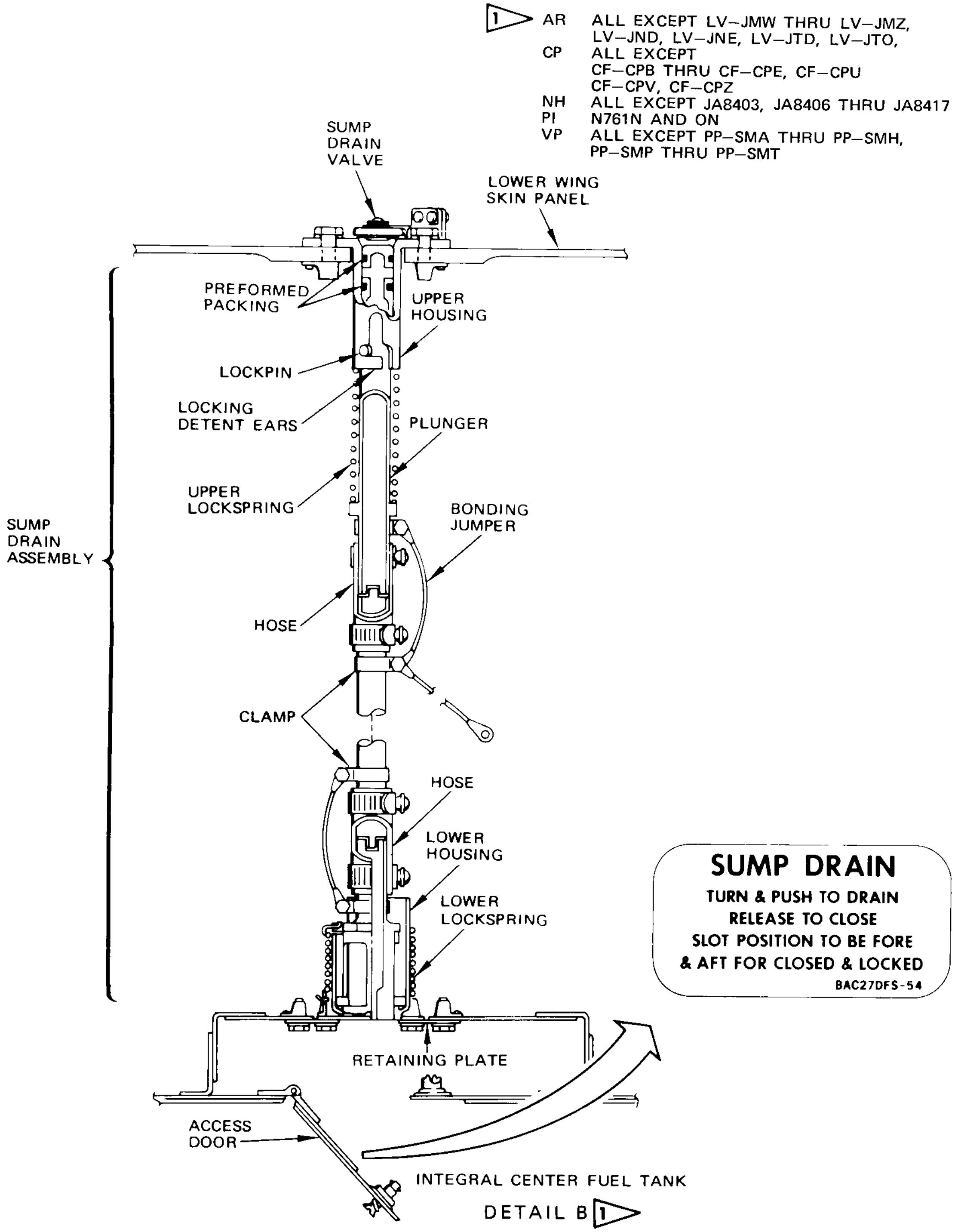
(2) Fuel tanks use the sealed structure of the wing to maintain a fuel boundary. This is accomplished primarily by close metal to metal fit of all parts, by sealed fasteners, and by the application of sealing compound to the structure. Optimum sealing is made possible by the use of open section stiffeners throughout the wing which eliminate blind areas. Fillet sealing is used at the spars, fuel vent ducts, and skin splice stiffeners. Rivet seals are achieved by control and orientation of the driven head.





DETAIL A

Fuel Sump Drain Valve
Figure 6 (Sheet 1)



Fuel Sump Drain Valve
Figure 6 (Sheet 2)

(3) Assembly of spar webs, chords, and rib end attachments permit fillet sealing on the tank side. All fillets are on-pressure side seals and are located at areas of minimum deflection. Fasteners installed through the tank end ribs are double sealed. This is because pressure develops on either side of the tank at different times. Bolts or lockbolts are used in high load areas and are sealed with seal cups and filleting materials.

(4) Molded rubber seals are used to seal fuel tank access panels. O-rings are used to seal removable plumbing fittings, primary tension bolts, and fuel system components which penetrate the fuel tank walls.

B. Definition of Sealing Terms:

(1) ABSOLUTE SEAL - A level of sealing which requires that all seams, joggles, slots, holes, and fasteners that pass through the seal plane be sealed.

(2) CAULKING -- The process of plugging a hole or channel with fiberglass cloth impregnated with sealant.

(3) BACKUP SEAL -- A secondary seal which offers support to a primary seal.

(4) BASE COMPOUND -- The major component of a sealing material used in conjunction with corresponding curing compound to produce a fuel resistant sealant.

(5) CURING COMPOUND (ACCELERATOR) -- Internal curing agent for sealants.

(6) EMERGENCY SEAL -- A seal which backs up a primary seal so as to become functional when primary seal failure occurs and safely controls leakage.

(7) FAYING SURFACE SEAL -- A seal effected by the sandwiching of sealant between mating surfaces of assemblies.

(8) FIRST FILLET -- A small bead of sealant applied over the precoat to ensure complete contact and cover seams or joints.

(9) FULL BODIED FILLET -- A combination of first and second fillet.

(10) INJECTION -- Filling of holes or channels by forcing sealant into a void or cavity.

(11) ISOLATION SEAL -- A seal placed for the purpose of confining and tracing fuel leakage.

(12) PREASSEMBLY SEAL -- Sealant material applied during assembly of structure, such as a faying surface or prepack seal.

(13) PRECOAT -- A thin layer of brushable sealant applied on the surface to be sealed for improving adhesion qualities of the first fillet.

(14) PREPACKED SEAL -- A quantity of sealant applied prior to assembly which fills voids and cavities.

(15) PRIMARY SEAL -- Applied sealant directly in line of contact with fuel.

(16) RAISED SEAL PLANE -- A new seal plane established at a point farther from the tank exterior than the original seal plane to repair a preassembly seal.

(17) RE-ENTRANT FILLET EDGE -- An overlapping quantity of sealant not in close contact with adjacent sealant or structure which is a potential leak source through the seal plane.
(18) REPAIR SEAL -- A seal placed for the purpose of limiting the amount of sealing required to repair a fuel leak.
(19) SEALANT -- Mixture of base compound and curing compound (accelerator) which will cure to a firm fuel-resistant material.
(20) SEAL PLANE -- The interior surfaces of the tank, comprised of structure, sealed fasteners, and sealant, which actually contain the fuel.
(21) SEALANT STOP BOLT -- Bolt installed through an injection seal to provide support for a seal.
(22) SECOND FILLET -- A bead of sealant applied over the first fillet.
(23) SECONDARY SEAL -- Sealant applied behind and in conjunction with a primary seal to confine fuel.
(24) SQUEEZE-OUT LIFE -- Length of time sealant remains suitable for structure assembly in faying surface seal application.
(25) TACK-FREE TIME -- That point of time in the curing of a sealant or a topcoat at which the material does not stick to a dry knuckle pressed lightly against the sealant or topcoat and withdrawn.
(26) TOPCOAT -- A continuous film which offers corrosion protection to metal surfaces and general protection for sealant against bacteria present in hydrocarbon fuels.
(27) WET-SIDE SEALING -- Sealing which is accomplished by applying sealant to fasteners or seams on the fuel side (wet side or inside) of a fuel tank.
(28) FAIRING TOOL -- A tool used to form a sealant fillet. Any clean tool that will achieve an acceptable fillet may be used.

C. Typical Example of Seal Planes (Fig. 7)

(1) The basic principle of fuel tank sealing is the establishment of a seal plane. The seal plane encompasses the tank structure and sealed components beyond which fuel is not permitted. Typical examples of seal planes are as follows:

(a) The most common example of using fasteners to obtain the seal plane is in the stringer to skin application shown in detail A. The fuel is held in the tank by the metal to metal fit of the rivet head upset into a countersunk hole. Leaks in these areas are caused by leaking fasteners. This principle is also used in rib attachments to the spars as shown in detail B.

(b) In areas where the skin is spliced, the seal plane cannot be maintained by fasteners alone, because fuel would still flow under the stringer and leak out at the splice. To prevent this the seal plane is raised by the addition of fillet seals along the stringer as shown in detail C. Leaks in this area would be caused by a breakdown of the fillet seal.

(c) In areas where several parts axe fastened together, such as a skin splice at a stringer, the seal plane is kept close to the skin by the use of prepack seals. In this case, the prepacked seal is applied at the chamfered corners of the angles during assembly as shown in detail D. This eliminates fillet sealing along the edges of the vertical legs of the angles and around the non-self-sealing rivets. Note that failure of any of the seals would result in fuel leakage between mating surfaces and out through the skin splice or out between the fastener shank and the hole.

(d) An absolute seal is required to isolate the spanwise vent ducts from all surrounding areas. The ducts must be sealed against external leakage and also against leakage between the vent system and the fuel tanks. Detail E, shows a typical vent duct seal plane application. The enlarged view shows that the seal plane is maintained by self-sealing rivets and by sealant. The upset head of the rivets prevent fuel in the vent duct from seeping out. Fillet sealing along the edges of the vent duct prevents fuel from entering the duct through these two points. Fuel in the vents is also prevented from leaking back into the tank.

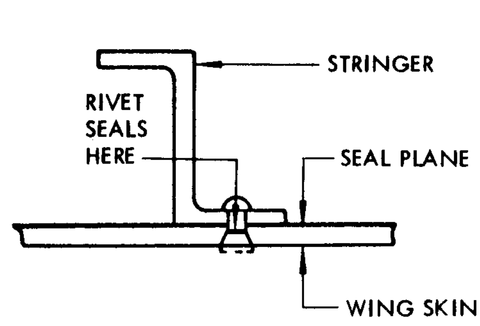
D. Types of Seals (See figure 8.)

(1) Emergency Seals

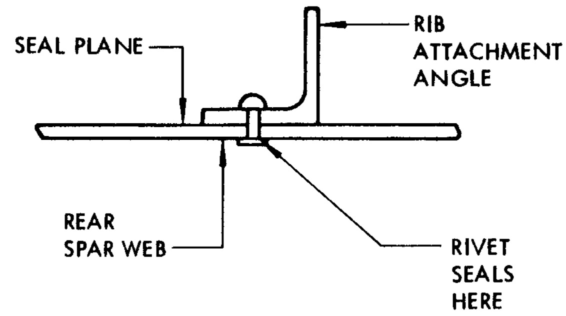
(a) Emergency seals are used as a backup seal to direct flow of fuel to an external drain in the event of a primary seal failure. The removable fuel cells (when installed) in the wing center section are considered primary seals.

(2) Fillet Seal

(a) The basic sealant application to fuel tank structure is the fillet seal. Fillet seals are used to cover structural joints along stiffeners, stringers, tank walls, and wing spars, and to seal around fittings on tank walls and in corners. The dimensions shown in figure 9 represent typical finished fillet shapes for various gages. Fillets conform to the dimensions as nearly as possible since the shape of a fillet determines how long it will last in service. A typical application of fillet seals in a tank corner is also shown in figure 9.



DETAIL A



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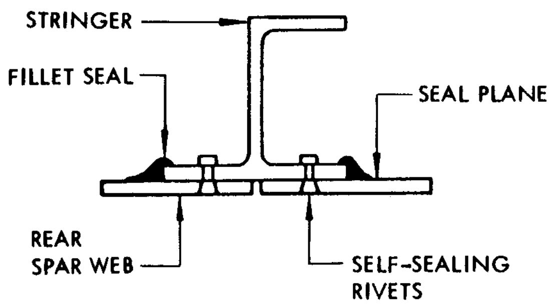
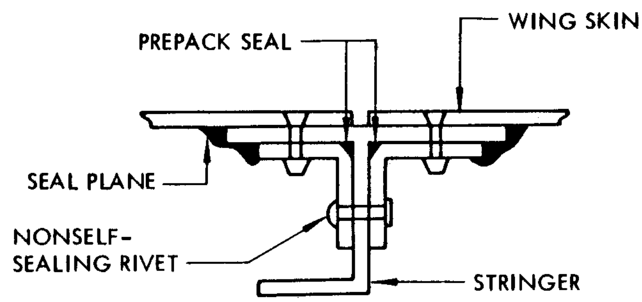
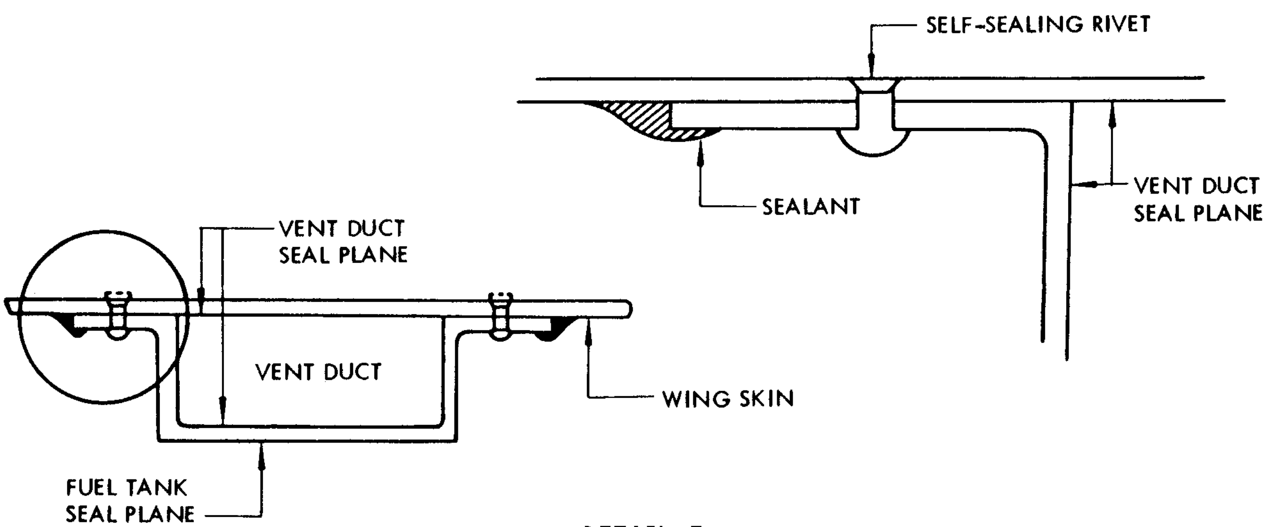


DETAIL C

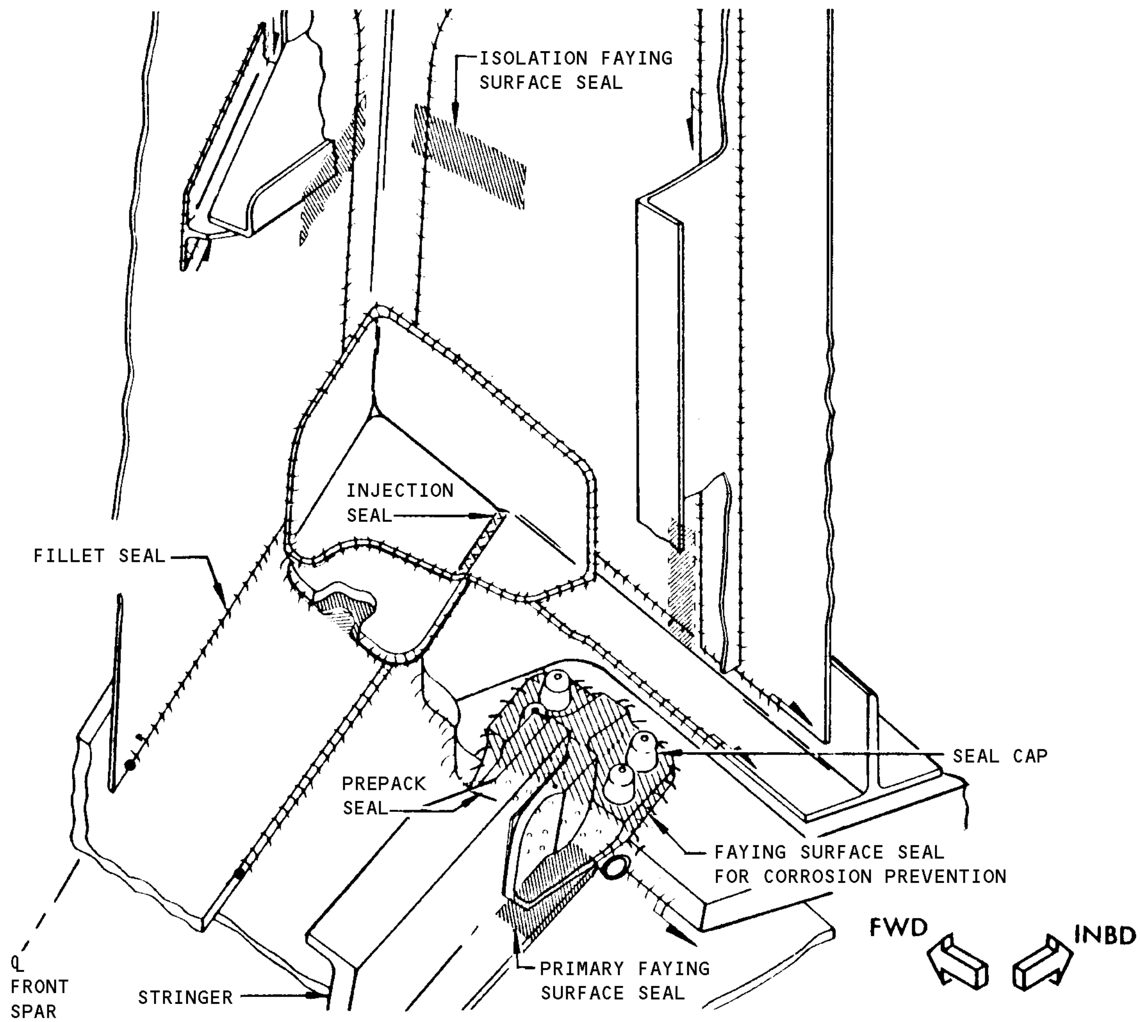


DETAIL D

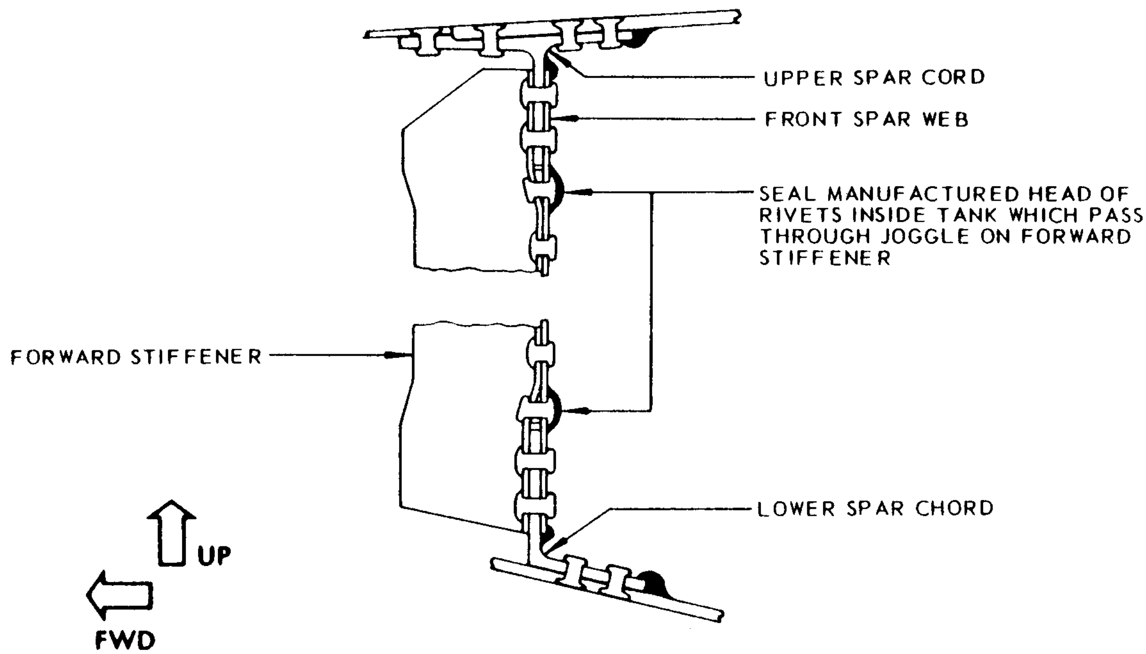


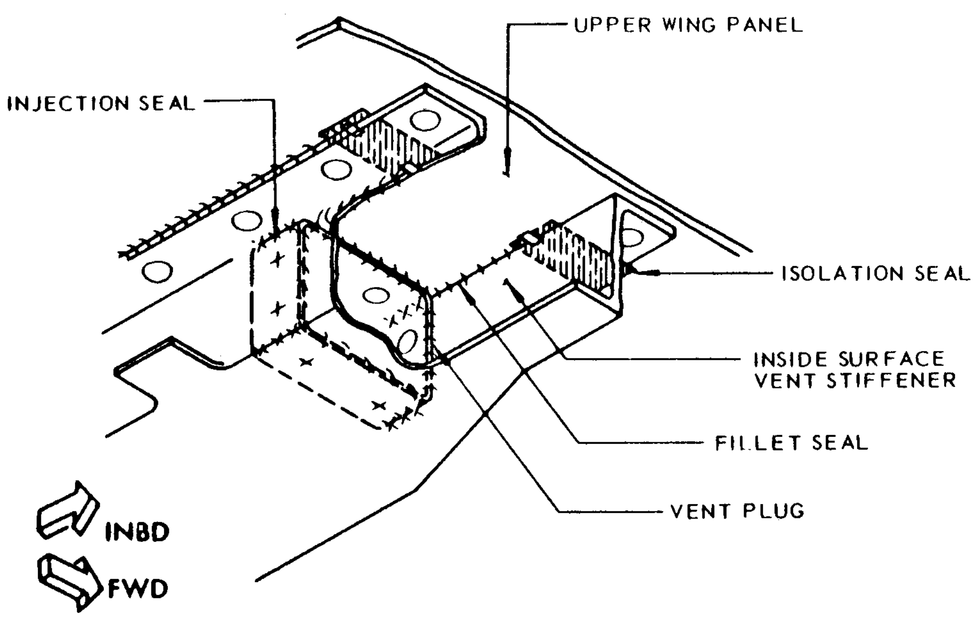
DETAIL E

Fuel Tank Seal Plane Details
Figure 7

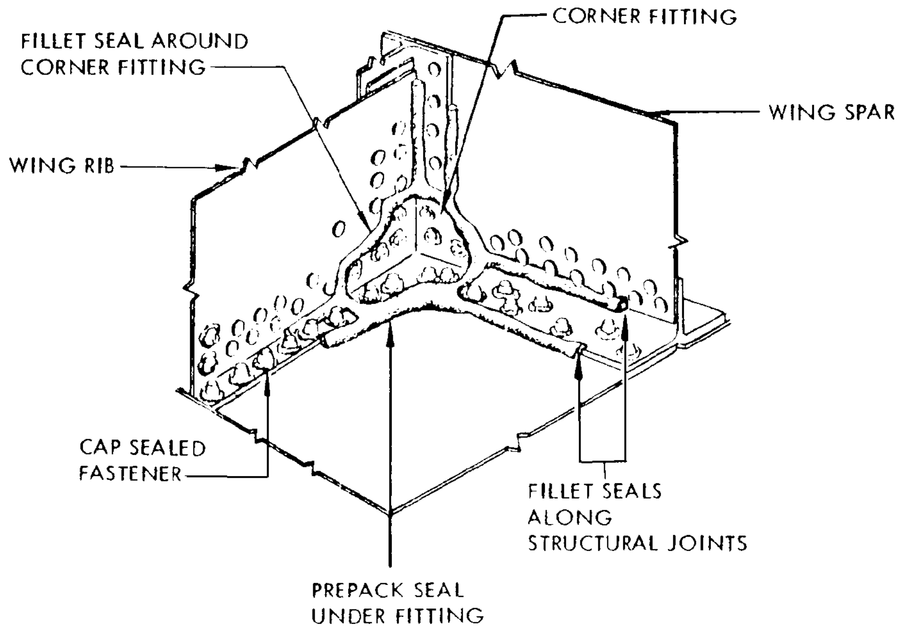


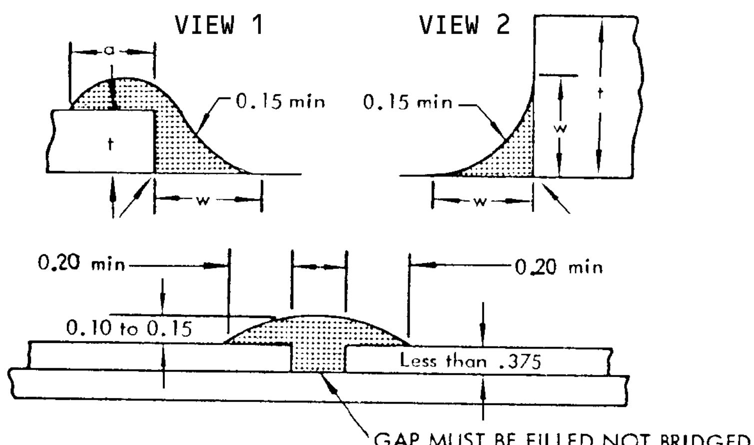
Integral Fuel Tank Seals
Figure 8 (Sheet 1)





Integral Fuel Tank Seals
Figure 8 (Sheet 2)





VIEW	t	w	a
1	.040	.25 to .50	w-t
1	.125	.25 to .50	w-t
1	.250	.35 to .50	w-t
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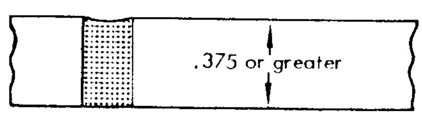
2	.50	.35 to .50	0

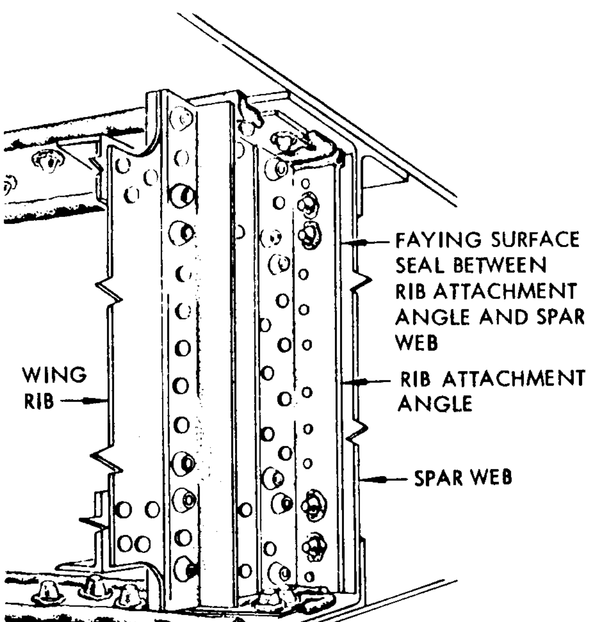


Fuel Tank Fillet Seals
Figure 9

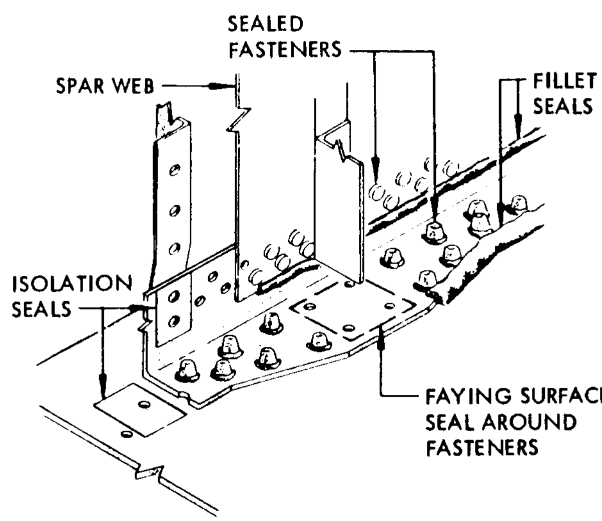
(3) Faying Surface Seals (See Figure 10.)
   (a) Faying surface seals perform several functions in fuel tank sealing. As primary seals they are used between surfaces where an absolute seal cannot be economically obtained by the use of sealed fasteners and fillets. A faying surface seal around a fastener prevents the fuel from reaching the fastener area. It does not entirely seal the fastener which must also be sealed. Faying surface seals are especially used to seal areas that will be hard or impossible to seal after assembly. Faying surface seals are also frequently used as isolation seals between the front and rear spar chords and wing skin. They are spaced along the spar chord. Therefore a leak along the spar chord can be isolated between the seal that had stopped the flow of fuel and forced it into view and the next isolating seal upstream. Isolation seals will be found only in dry areas, that is, areas beneath structure where primary sealing is designed to prevent fuel from flowing.

(4) Injection Seals (Fig. 11)
   (a) Holes, joggles, channels, and other voids caused by buildup of structure in the fuel tank boundaries are normally filled by injection seals. Injection seals may be applied to provide continuity where fillet seals are interrupted by structure. Holes, joggles, and channels along seams which are to be fillet sealed are also injected full of sealant to provide a backup seal to support the primary fillet seal. Voids and channels of large cross sections are packed with caulking (the process of plugging a hole or channel with fiberglass cloth impregnated with sealant) to provide additional strength to the seal.

(5) Prepack Seals
   (a) Prepack seals are used to fill voids in the tank structure which cannot be reached by the injection method. These voids are packed with sealant before they are closed by the assembly of structural members.

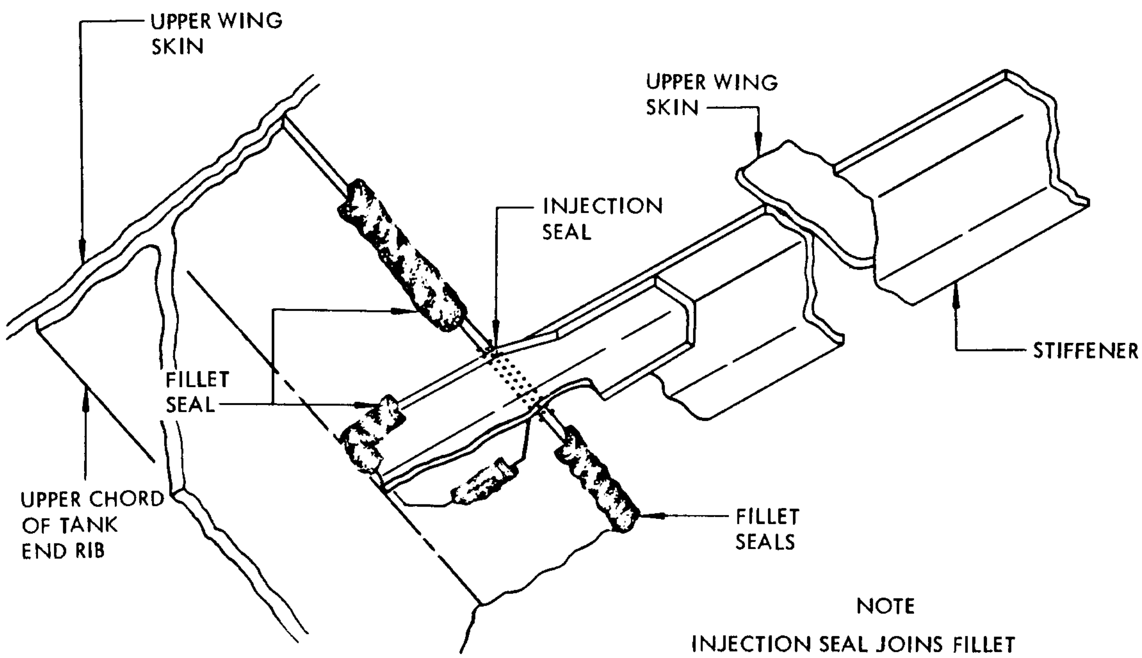


PRIMARY SEALS



ISOLATION SEALS

Faying Surface Seals
Figure 10



Injection Seals
Figure 11

(6) Self-Sealing Rivets (See figure 12.)

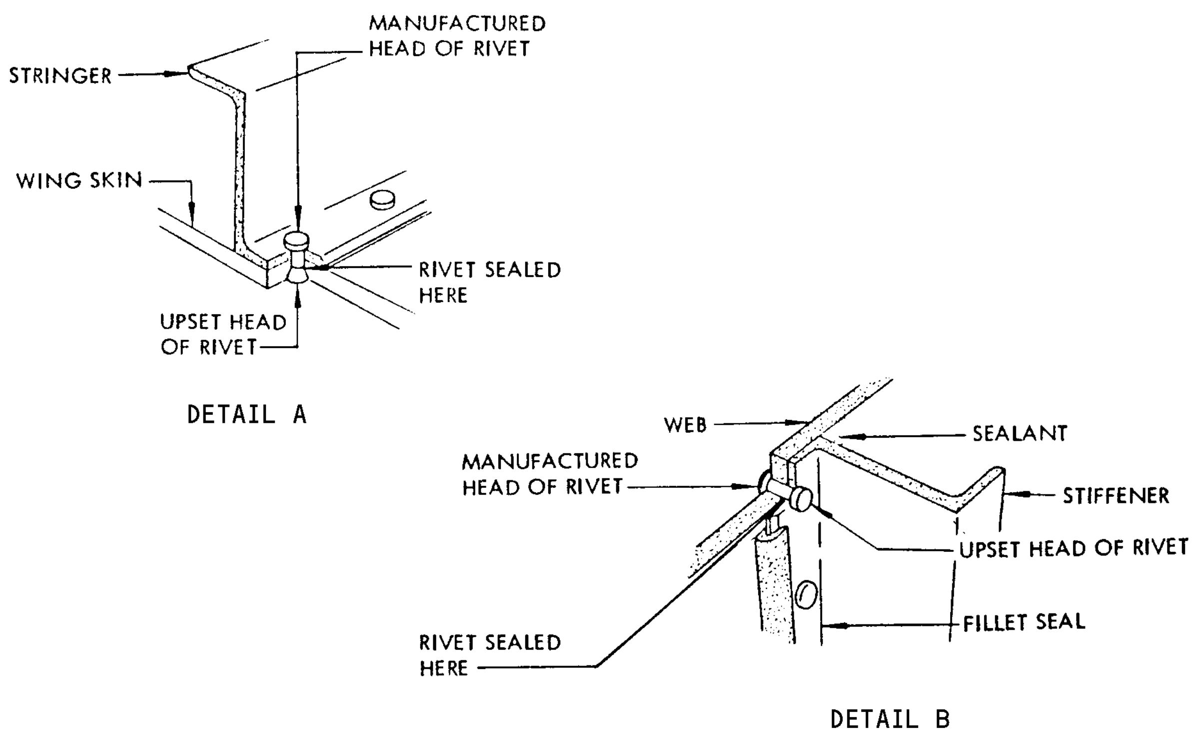
(a) Aluminum alloy rivets are used extensively in fuel tank structure. These rivets are considered self-sealing only if correctly installed. The hole clearance is critical and close tolerance rivets are installed in close tolerance holes. The orientation of rivets and their position with respect to the seal plane is also critical. Detail A, illustrates a typical installation of a self-sealing rivet. This rivet is upset into a countersunk close tolerance hole. To seal, the rivet must be driven high, which means that the upset head is slightly larger than the countersunk portion of the hole. The portion of the countersunk head which protrudes above the skin is then removed with a rivet shaver. Actual sealing of the rivet takes place around the bucked head at the bottom of the countersink. This is important in determining how the rivet should be oriented on the seal plane. Countersunk or round head rivets installed in a close tolerance hole and bucked in the normal manner are also considered self-sealing. Sealing of the rivet takes place around the shank just under the bucked head as shown in detail B.

(7) Fastener Seals (See Figure 13.)

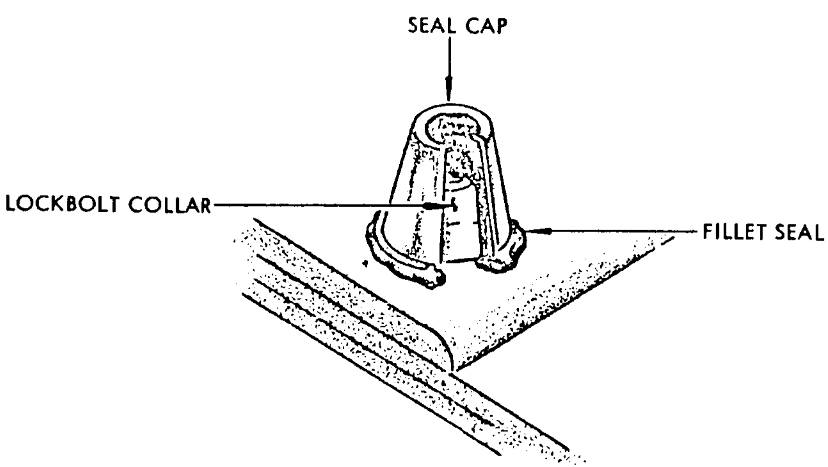
(a) Since lockbolts are not self-sealing, sealant must be applied to prevent leakage. The most common application of sealant is to the end of the fastener on the "wet" side of the tank structure. Current practice dictates that fillet seals and seal caps be used. Repairs to leaking lockbolts should conform to this method.

(8) O-ring Seals (See figure 14.)

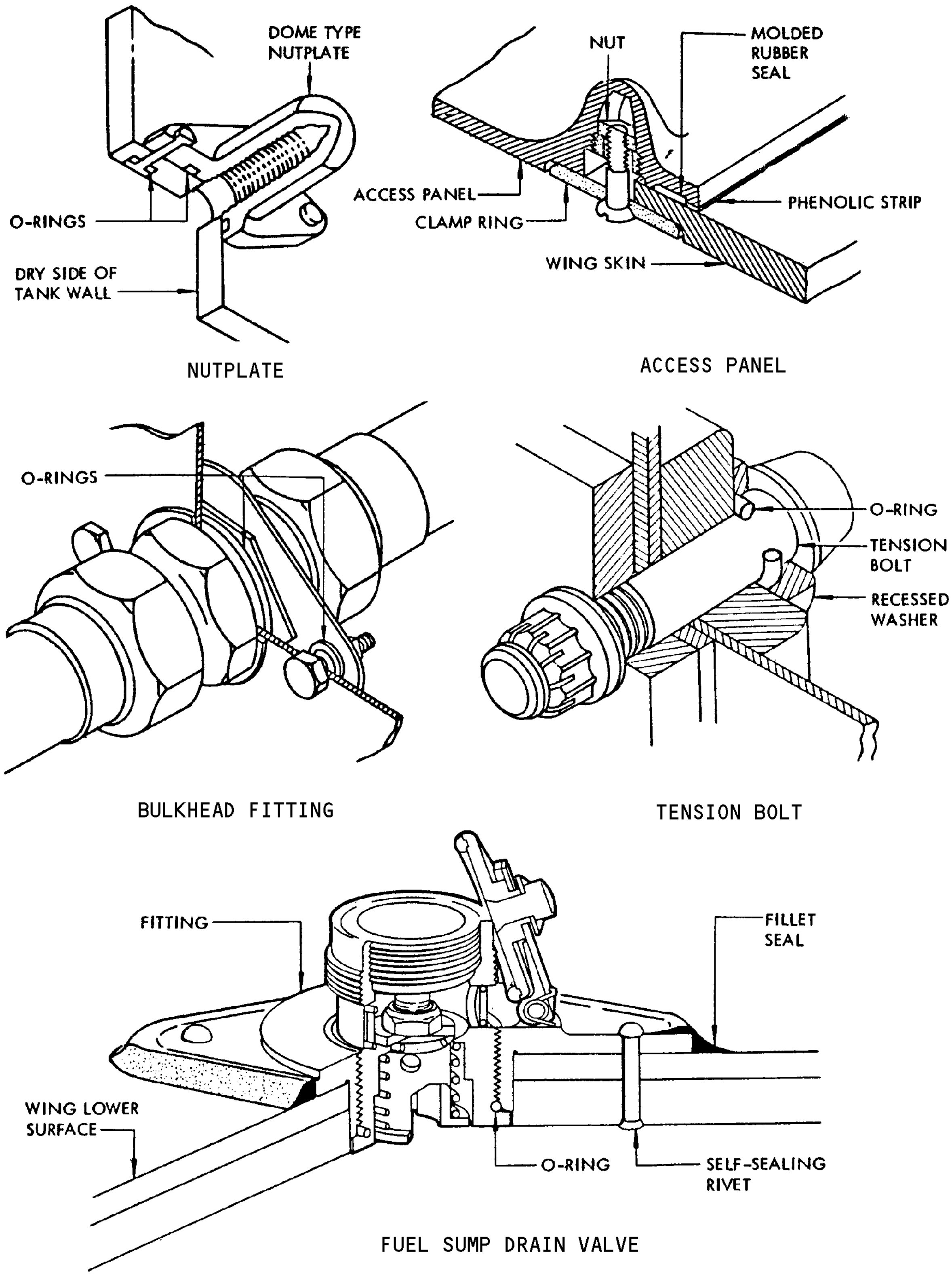
(a) The type of sealing used for removable components which penetrate the fuel tanks is determined by their use in the tank structure. Bolts which carry primary tension loads are sealed with O-rings installed under special washers. Bolts that require removal in service are sealed with standard seal washers. Other bolts are sealed by applying seal caps or fillets of sealant to the end of the bolt on the "wet" side of the tank. Where bolts that protrude through the tank wall are used to secure removable components to the outside surface of the tank wall, self-sealing nutplate installations are used to provide fastener sealing. The nutplate installation consists of a dome type, O-ring sealed, nutplate installed with O-ring sealed rivets installed in a single thickness of material. Fuel sump drain valves and fuel quantity measuring sticks are installed in fittings attached to the wing lower skin in each fuel tank. The fittings are attached to the wing skin by self-sealing rivets and the fittings are sealed by a fillet seal around their periphery. Sealing between the drain valves or measuring sticks and their fittings is accomplished by installing O-rings during installation. Bulkhead fittings in the fuel lines are sealed with O-rings in a similar manner. Fuel tank access panels are sealed by a molded rubber seal ring between the panel and the wing skin.



Rivet Sealing
Figure 12



Lockbolt Sealing
Figure 13



NUTPLATE

ACCESS PANEL

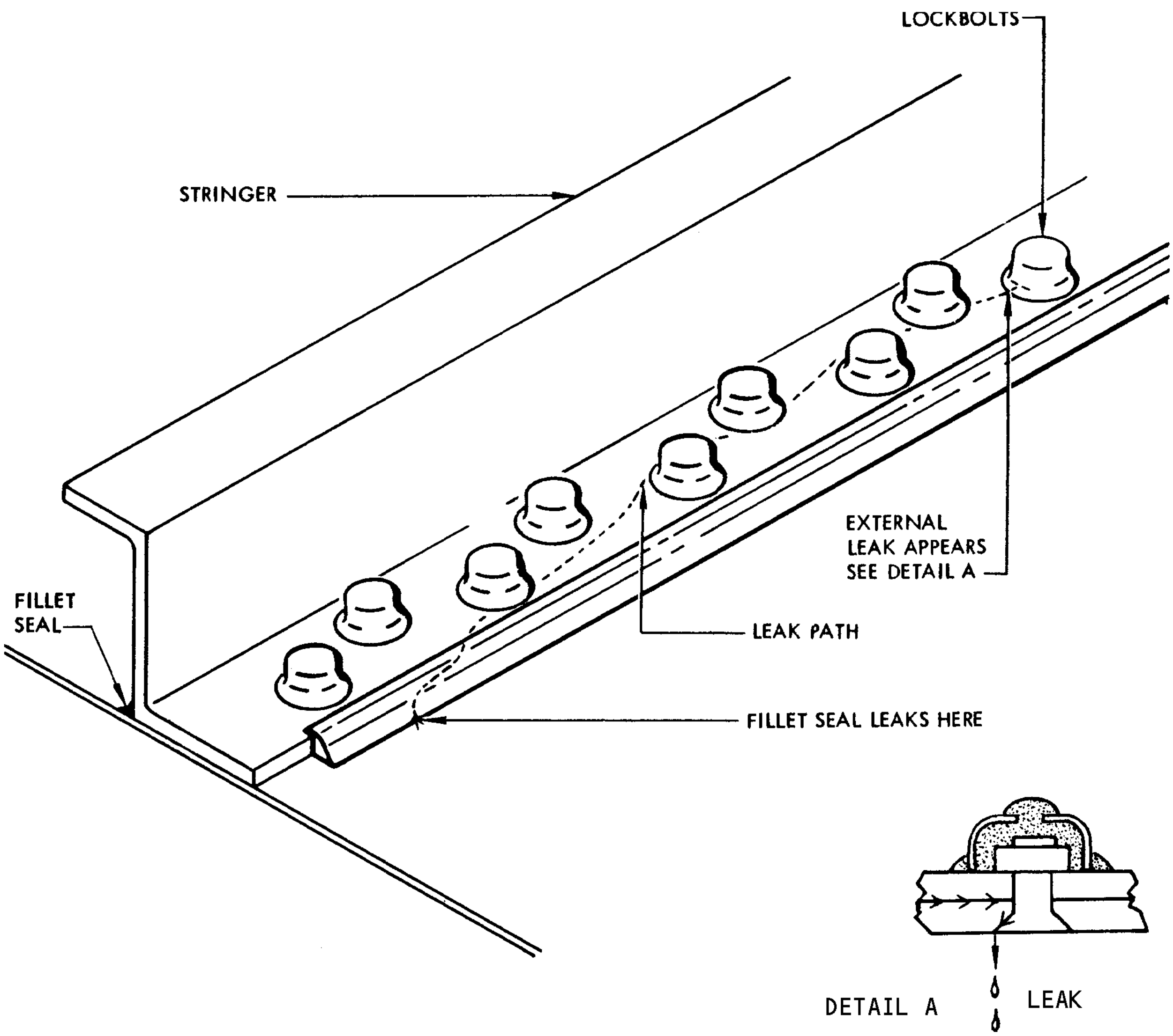
BULKHEAD FITTING

TENSION BOLT

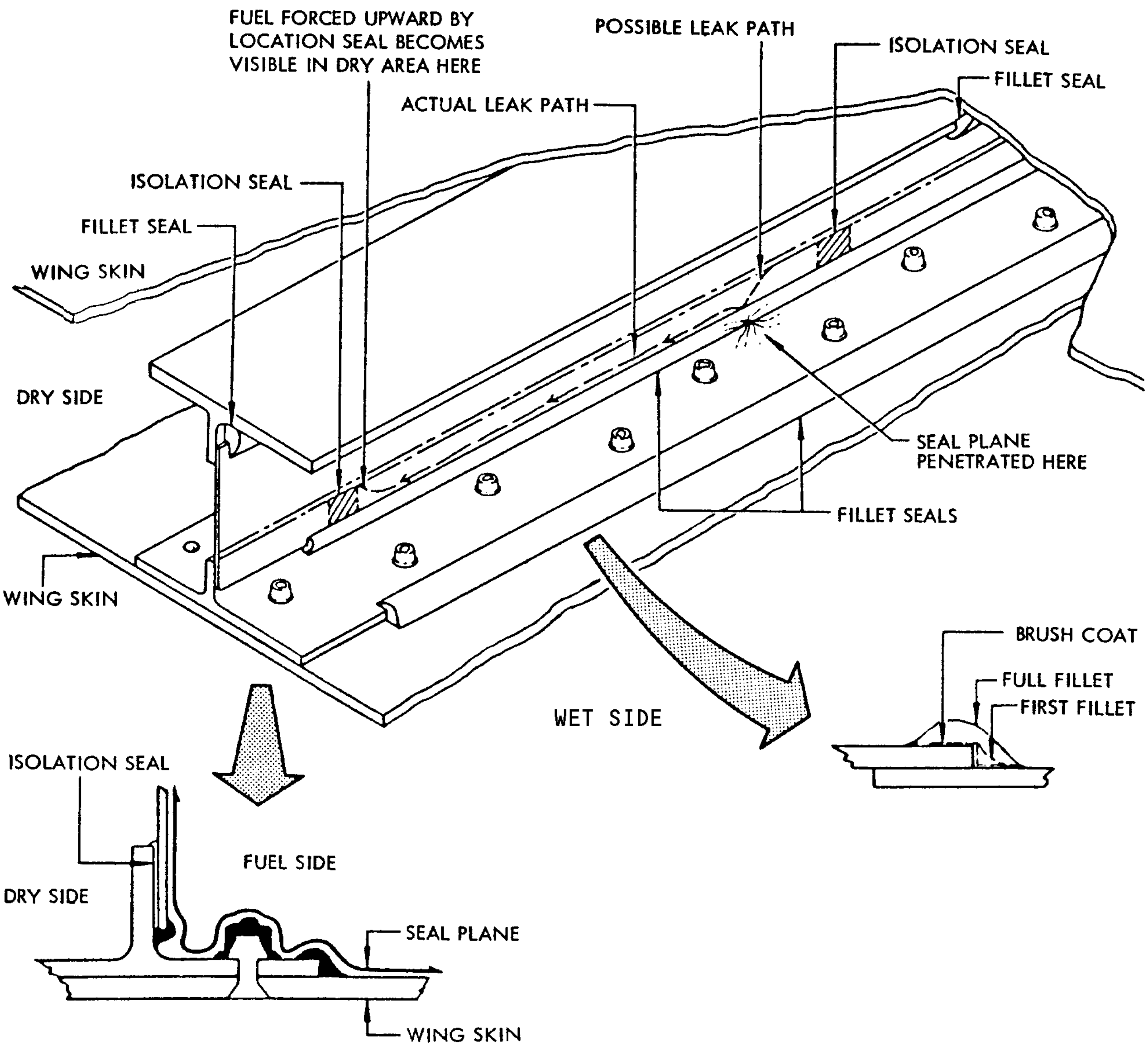
FUEL SUMP DRAIN VALVE

Fuel Tank Removable Component Seals
Figure 14

8. Integral Fuel Tank Leak Detection
   A. Fuel has a very low surface tension and viscosity; therefore, it is able to penetrate the slightest flaw in the seal plane. Because fuel under pressure will flow in all directions, sealing is made a problem involving three dimensions. Figure 15 illustrates a typical fuel leak situation in the seal plane. Fuel flowing under the sealed stringer will eventually reach a point where it can penetrate the wing skin. The seal plane is maintained by a continuous fillet along the entire length of the stringer and in the area of the lockbolts.
   B. Isolation seals assist in locating leaks by limiting the distance fuel can flow between structural members. Figure 16 illustrates a typical leak situation on a wing spar. Fuel from this type of leak has been found to travel in the spar area instead of becoming visible near the point of seal plane penetration. However, when the leaking fuel reaches an isolation seal, it is forced outwards and becomes visible. In this case the leak path is confined to the area between the two isolation seals shown in figure 16. It is not necessary to know the location of these seals. Knowing the location of the seals will, however, greatly assist in the location of seal plane penetration.
9. Leak Evaluation and Re-pair Requirements
   A. Fuel leakage from a tank is divided into four groups to provide a means of evaluating the safety of flying the airplane with fuel leaks present. The four groups are stain, seep, heavy seep, and running leak. Each group is determined by a visual examination of wetted area around the leak source. Wetted areas must be wiped clean after each examination for accurate re-evaluation of leak. The size patterns of leaks illustrated in figures 17 and 18 are based on an examination 15 minutes after leak was first noticed and area wiped clean. In figure 17 the four groups of leaks are evaluated as follows:
      (1) A stain is a leak where the wetted area is not over 1-1/2 inches wide after the time interval noted above has elapsed.
      (2) A seep is a leak where the wetted area is not over 4 inches after time interval noted above has elapsed.
      (3) A heavy seep is a leak where the wetted area is no larger than 6 inches after the time interval noted above has elapsed.



Typical Fillet Seal Leak
Figure 15



Typical Effect of Isolation Seal
Figure 16

(4) A running leak is any leak in excess of a heavy seep. Fuel will usually reappear immediately after being wiped dry and can run or drip from a surface.

B. Figure 18 gives in tabulated form the various leakage categories and the repair actions required.

WARNING: CAREFUL EXAMINATION MUST BE MADE TO ENSURE THE LEAK IS NOT PROGRESSING TO A CRITICAL AREA OF THE AIRPLANE, OR THERE IS NO POSSIBILITY OF FUEL BEING BLOWN INTO THE FUSELAGE AREAS.

10. Causes of Leaks

A. Improper Preparation of Surface

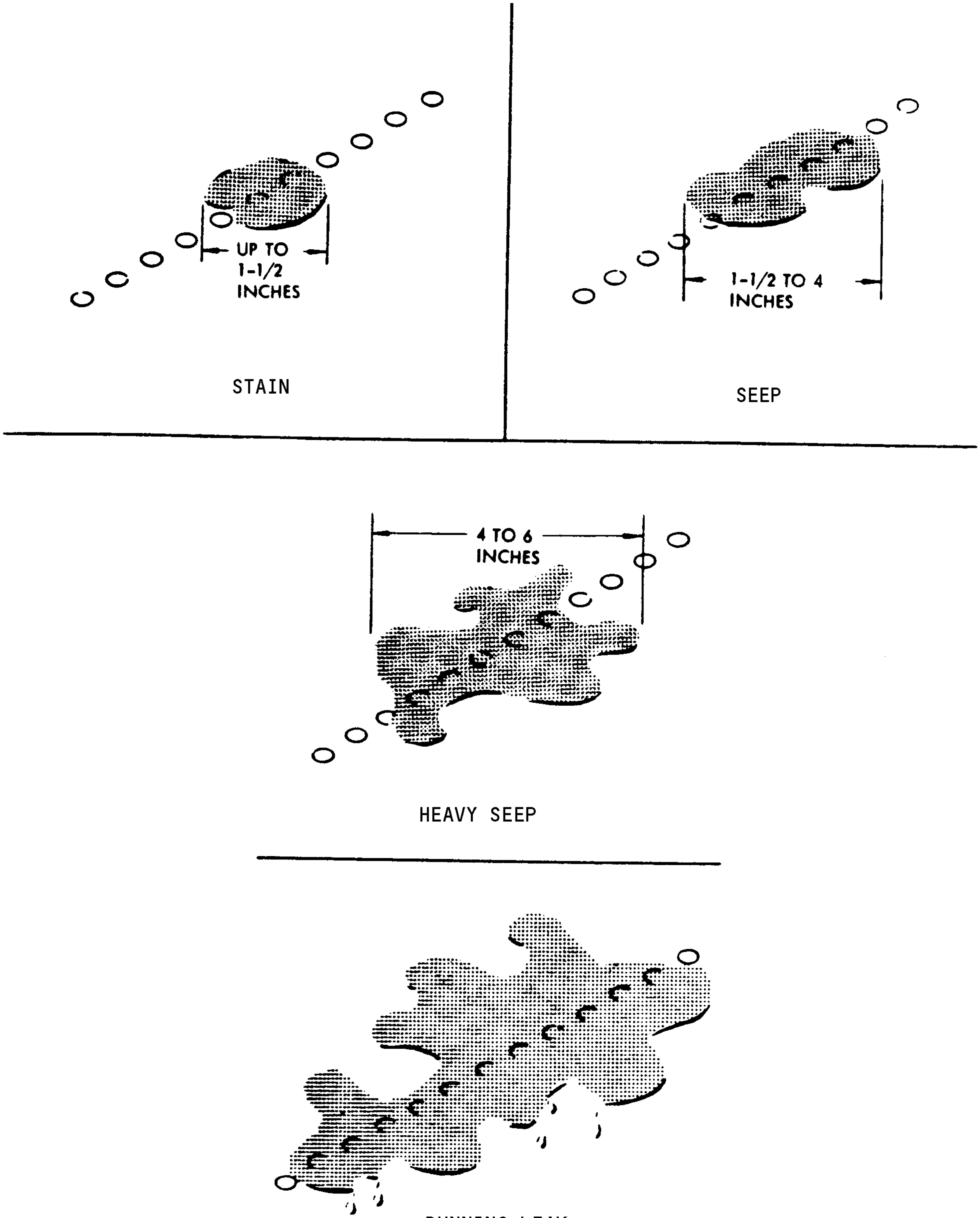
(1) Leakage exists only when a fault in the sealing provides a path through the sealant barrier (seal plane). Since jet fuel has a low surface tension and viscosity., it can leak through extremely small openings and travel for a considerable distance. Foreign material such as grease, metal chips, human hair, loose paint, wax, or oil will reduce the adhesive bond sufficiently to cause premature failure. All surfaces must be completely free of foreign material before sealant is applied.

B. Improper Mixing or Storage of Sealants

(1) Synthetic rubber forms the base for most sealing compounds. The manufacturer adds different ingredients that control strength, curing time, plasticity, work life, and fuel resistance. Sealants are supplied in two parts; base material and curing compound (accelerator). Extreme care must be taken to ensure that only the proper proportions and the curing compound (accelerator) recommended by the manufacturer axe used. Any variation from the manufacturer's instructions will change the physical properties of the mixture. This may produce a seal failure and tank leakage. Sealing compounds can be stored on the shelf before mixing with curing compound. After a specified period of time it is outdated and is tested for curing capabilities before use. Some sealants can be stored under refrigeration for short times after being mixed with curing compound After the storage time on mixed sealant has elapsed it must be discarded. Old sealant will not flow or stick properly thereby producing an unsatisfactory sealing job and a leak.

C. Improper Application of Sealants

(1) Application of sealant is important. The manufacturer's recommendations must always be followed. When a brush precoat is recommended it must be applied. Elimination of precoat or any steps in sealant application impair the sealant's ability to seal properly. Air bubbles in sealant burst in time and provide a void or pin hole for fuel to leak through. If structure gaps are bridged, instead of being filled, voids in sealant are left. Re-entrants provided by overlapping sealant and lack of good faired contact with all surfaces will allow a leak in time. Application of sealant not in accordance with the manufacturer's recommendations will cause integral tank leaks.



Fuel Leak Size Patterns
Figure 17

LEAKAGE LOCATION	STAIN	SEEP	HEAVY SEEP	RUNNING LEAK
Exposed, well-ventilated locations where leaking fuel cannot contact an ignition source, such as upper and lower wing surfaces not covered by fairings.	1	1	2	3
Semi-enclosed, partially-ventilated locations such as rear spar at trailing edge flaps, front spar at krueger flaps, wheel wells, and refueling bay.	1	2 Two places maximum	3	3
Enclosed, unventilated locations such as dry bay, air conditioning bay, and wing/body fairing; and front spar where covered by fairings and/or panels.	2	3	3	3
Exterior boost pump cavity. For the aft main and center fuel boost pumps, remove the applicable fuel boost pump access panel to find the leakage location.	1	2 One place maximum	3	3
Aft main and center tank fuel boost pump conduit, in the fuel boost pump housing or on the spar.	5	5	5	5
Wing center section tank pressurized zone (AMM 28-12-0 for wing center section removable fuel cell leakage allowance).	4	4	4	4

1 No repair procedure is necessary. Examine the fuel leak frequently to make sure it does not get larger.

2 It is not necessary to repair the fuel leak immediately. Examine the fuel leak frequently to make sure it does not get larger. Make the necessary repairs during the next applicable scheduled maintenance.

3 Repair the fuel leak immediately to a minimum of 1 or 2 classification.

4 Repair the fuel leak immediately. No fuel leakage is permitted.

5 Repair the fuel leak immediately. No fuel leakage is permitted. Do an inspection of the fuel boost pump wiring and conduit (AMM 28-22-41/401). Repair or replace the wiring and conduit per the requirements of AMM 28-22-41/601.

Fuel Leak Evaluation
Figure 18

D. Loose Fastener
   (1) Loose fasteners may initiate a fuel leak by allowing movement in a fabricated assembly. Excess movement may crack faying surface seals which will provide a fuel path through the seal plane. Loose rivets will not maintain a self-sealing status. The integral fuel tank design incorporates interference fits in close tolerance holes for fasteners installed in tank boundaries. All replacements of these fasteners must maintain this requirement.

E. Improper Installation of Fittings
   (1) Fittings and connections that are attached or pass through tank boundaries are sealed with O-rings. When O-rings are installed they can be pinched, scored, twisted, or otherwise improperly installed, causing leaks.

11. Methods of Leak Detection

A. The following methods are acceptable means of tracing a leak from where it appears on the outside of an integral fuel tank to the source on the inside. The methods appear in the order of increasing difficulty and they should be tried in that order, if possible.

CAUTION: THE VACUUM METHOD SHOULD ONLY BE USED AS A LAST RESORT, SINCE IT IS POTENTIALLY HAZARDOUS TO STRUCTURE.

NOTE: Refer to Integral Fuel Tank - Trouble Shooting for detail description of the following methods.

   (1) Visual Method
      (a) The area inside the tank from which the leak appears to be coming is examined. Examination may reveal the cause of leakage in the form of missing or faulty sealing. In many instances, this method will not reveal the cause of leakage and the following method will prove to be the most rapid.
   (2) Air Hose and Internal Bubble Method
      (a) A stream of air is directed at the point of leakage on the outside of the tank while at the same time the suspected area inside the tank is brushed with soap solution.

      CAUTION: DO NOT USE A SOLUTION WHICH WILL CORRODE ALUMINUM OR DETERIORATE THE SEALANT. SOLUTION MUST BE WIPED CLEAN AFTER CHECK.

(3) Air Hose and External Bubble Method
(a) This method is the same as the internal bubble method, except that the air is applied at the inside point and the soap solution applied at the outside.
(4) Dye Injection Method
(a) This method is particularly useful when very small leaks cannot be detected by the air methods. Dye is forced through the leak path into the tank from the exterior leak point. One man enters the tank to observe the flow of dye from the internal leak source. The flow of dye can more readily be detected if fluorescent dye and an ultra-violet light, which causes the dye to glow, is used.
(5) Internal Pressure and Bubble Method
(a) If the dye injection test fails to show the leak source, the exterior outflow point should be verified by the pressure test. For test procedure, refer to Integral Fuel Tank ? Trouble Shooting.

WARNING: DO NOT EXCEED THE MAXIMUM SAFE PRESSURE OF 5.20 PSIG. THE PRESSURE TEST WILL VERIFY BOTH THE TANK AND THE OUTFLOW POINT. THE TANK MUST BE CLOSED AND SEALED TO DO THIS PROCEDURE. WHEN THE TANK IS CORRECTLY PRESSURIZED, IF BUBBLE SOLUTION APPLIED TO THE EXTERIOR LEAK POINT INDICATES THE EXTERIOR OUTFLOW POINT TO BE DIFFERENT FROM THE ONE USED IN THE DYE INJECTION TEST, THEN THE DYE INJECTION TEST SHOULD BE REPEATED USING THE NEW OUTFLOW POINT.

(6) Hollow Bolt Method
(a) The hollow bolt method of leak detection can be used to locate leaks in areas of structural buildup. The hollow bolt may be used with air and bubble method or dye injection.

INTEGRAL FUEL TANK - TROUBLESHOOTING

1. General
   A. Integral fuel tank fuel leaks are usually the result of improper fitting installation, failed or damaged sealant, improperly installed or damaged O-rings, loose fasteners, and electrical or equipment installations that pass through tank boundaries not being properly installed.
   B. Fuel leakage from a tank is divided into four groups to provide a means of evaluating the safety of flying the airplane with fuel leaks present. The four groups are stain, seep, heavy seep, and running leak. Refer to 28-11-0 AP for size patterns and evaluation of leaks.
   C. The various methods used to locate a leak are described in detail in subsequent paragraphs.
2. Equipment and Materials
   A. Flashlight - explosionproof
   B. Ultraviolet Light, explosionproof - EXP1525/50-Ultraviolet Light, Rice Safety Equipment, Seattle, Washington
   C. Extension Light - P/N MIL-L-83762
   D. Fuel tanks leak detection dyes
      (1) Fluorescent Dye - Intense Green (OS-31) or Bluish White (OS-80) (Ref 20-30-51)
      (2) Nonfluorescent Dye - Automate Red BSF (Ref 20-30-51)
   E. Testing Device - P/N F71329
   F. Pressure box (fabricated) (Fig. 102)
   G. White talcum powder
   H. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   I. Leak detection solutions
      (1) Turco Car Shampoo - Turco Products, Inc., Seattle, Washington
      (2) Tereco 210 (thin), Tereco 211 (thick), and Tereco 602 - Technical Research Co., Seattle, Washington
   J. B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
   K. Air supply - 90 to 100 psig
   L. Air supply - 0 to 10 psig
   M. Camel-hair brush
   N. Closure plugs and cover items

      CAUTION: ATTACH RED, COTTON WEBBING, STREAMERS TO ALL PLUGS AND CLOSURE ITEMS USED IN THE TANKS.

      (1) One Structural Vent Plug - F80080-100 or 7TE65-46517
      (2) One Vent Scoop Closure Plug - F80080-88 or 9TE65-45412
      (3) One Surge Tank Drain Tube Plug Assembly - F80080-55
      (4) Two Drain Check Valve Plugs - F80080-112 or 10TE65-46517
      (5) One Float Valve Closure Plug - F80080-8
      (6) Two Tube Plug Assemblies - F80080-49
      (7) One Structural Vent Cover Assembly - F80080-56
   O. Surge Tank Pressure Door Assembly - F80080-82 or F80080-5

P. Center Integral Wing Tank Pressure Test Door - F80172-7, F80172-1 or F80148-1
Q. Water Safety Relief Manometer - F72951-1 (recommended) or F70208-1 (Fig. 105)
R. Bypass Lock Assembly - ME65-16713
S. Wing Dry Bay Pressurization Test Equipment - F80258

3. Localizing External Fuel Leaks - Talcum Powder Method

A. General

(1) Before defueling and entering any fuel tank which has a fuel leak, attempt to locate and isolate all fuel leaks in the affected tank. If leak is suspected of being in the upper part of the tank, above the normal full level, carefully overfill tank by manually depressing override button on the fueling shutoff valve. Override button should be released the instant fuel is detected at the surge tank sump drain valve.

CAUTION: LIMIT OVERFILLING TO ONE FUEL TANK AT A TIME AND DO NOT OVERFILL TANK IF TEMPERATURE EXTREMES ARE LIABLE TO BE ENCOUNTERED. EXPANSION SPACE FOR FUEL IN OVERFILLED TANK IS LIMITED TO VOLUME OF SURGE TANK AND ANY EXCESS FUEL WILL SPILL ON GROUND.

(2) Every effort should be made to isolate and repair all fuel leaks regardless of classification (Ref par. 9., 28-11-0, Description and Operation) each time a tank is opened to repair a leak. If leak involves both the primary seal through the wing structure and the secondary seal through secondary barrier sealant coating, used on integral center wing section, the leak should be treated as two separate failures to be localized and repaired independently.

B. Prepare for Leak Localization

(1) Remove aerodynamic smoother if applied over affected seams or joints.
(2) If center tank upper surface is to be checked on airplanes with integral center wing tank, remove seats, carpet, and floor panels in passenger cabin as required to expose center wing tank upper panel from front to rear spar and from left BBL 70.85 to right BBL 70.85.
(3) If center tank lower surface is to be checked on airplanes with integral center wing tank, open air conditioning equipment bay doors. Remove air conditioning equipment as necessary to check center tank lower surface (Ref Chapter 21).

C. Localize Leak

(1) Wipe leak area dry using a cotton wiper (BMS15-5). Blow out all wet seams and corners.

CAUTION: HOLD AIR HOSE 1/2 INCH MINIMUM FROM STRUCTURE TO PREVEMT DAMAGE TO SEALS THAT ARE NOT FAULTY.

(2) Remove aerodynamic smoother if applied over affected seams or joints. Wipe leak area dry using a cotton wiper (BMS15-5). Blow out all wet seams and corners.

(3) Dust suspected area immediately with talcum powder using a soft bristle camel hair brush.

(4) Observe dusted area carefully for signs of discoloration around fasteners or on surface of secondary barrier sealant coating if used.

(5) Mark each leak point and repeat same procedure at successive locations until each external leak is localized.

(6) Determine extent of leak path and pinpoint origin.

(a) Study wing structure and decide possible paths of fuel from point of origin to point of detection.

NOTE: Any structural buildup is a possible leak path and fuel may flow in structure outside tank boundaries.

(b) If leak penetrates secondary barrier seal coating on integral center tank upper surface or outer face of center section front spar, failure of both primary and secondary seals is indicated. Strip secondary sealant coating as necessary to expose leak path through structure and pinpoint origin.

NOTE: Both secondary barrier sealant leak and leak through structure must be repaired independently.

(7) If leak point cannot be determined by the above methods, the internal pressure and bubble method should be used as a last resort (Ref par. 5).

4. Determining Nonsealant Leaks
   A. General
      (1) Fuel leaks in the main tanks will often be the result of improper installation of tubing components at tank boundaries. Leaks may also be found at electrical connections that pass through the front and rear spars. Fittings that are attached to ribs at tank ends are sealed with O-rings as are all other connections and fittings that pass through any tank boundary. Stiffeners, and rib end fittings at the front and rear spars, are sealed in part by fasteners that attach them to the wing skin and spars. These are all possible leak sources. Equipment and tube connection leaks at tank ends and along the spars will almost always be caused by a faulty O-ring or improper installation.
5. Locating Leak Source in Defueled Tank
   A. Defuel affected tank and prepare it for entry (Ref 28-23-0, 28-10-0, Maintenance Practices).
   B. Remove fuel tank access panels from bays suspected to contain source of leak (Ref 28-11-11, 28-11-31, Removal/Installation).
   C. Examine suspected leak area carefully for faults in sealing such as cracked or loose fillets, pinholes, re-entrants, or loose fasteners. Use mirrors to observe seals which are not otherwise completely visible.
   D. Check fillets suspected of poor adhesion by rubbing faired edges with a pencil eraser or by the application of air at a maximum of 100 psig through a nozzle placed a minimum of - inch from fillet.

      NOTE: Fillets which have poor adhesion should be removed immediately. Cut a section through the loose fillet and strip off by pulling it away from the structure. Continue to strip off fillet until it pulls apart. A fillet which has proper adhesion will pull apart rather than pull away from tank structure.

   E. Check locations where injection seals have been installed to provide continuity for fillet seals.
   F. Look for channels which might have been bridged by sealant rather than filled.
   G. Check tank structure for cracks or distortion.
   H. Visible defect in sealing or structure is not necessarily origin of fuel leak. Any defect should be repaired to prevent subsequent deterioration and fuel leakage. If the leak source has not been definitely located by visual inspection, one of the following methods should be used.
   I. Backblowing Procedure to Find the Internal Leaks
      (1) If leak source has not been definitely isolated by a visual check, it may be revealed by the application of a soap solution to inside of tank.
         (a) Prepare the tank that has the leak for entry as described in Fuel Storage System Maintenance Practices, 28-10-0.
         (b) Two persons are necessary to do this task:
            1) One person must be out of the tank at the external location of the leak.
            2) One person must go into the tank and find the internal location of the leak.

3) If the external leak location is near the side-of-body rib, the leak can be in the center tank or the wing tank.

NOTE: It is a faster procedure to put a person in the center tank and in the wing tank at the same time to look for the internal leak.

(c) The two persons must agree on a procedure to communicate.
(d) One person must go into the tank to a location near the external leak location.

NOTE: The person out of the tank can knock on the airplane skin to make it easier for the other person to find the correct location.

1) The person that goes into the tank must have these items:
   a) An explosionproof flashlight
   b) Noncorrosive soap solution (bubble bath)
   c) Marking pen (Berol Filmograph or equivalent)

(e) The person in the tank must apply the soap solution to a large area near the external location of the leak.

NOTE: The internal leak can easily be as far as three feet from the external location of the leak that you found before. Examine the internal surface of the tank for loose sealant or bad sealant or a bad fastener. This can help you make a decision about where to look for the internal leak, If the external leak location is a fastener, find the fastener on the internal surface of the tank. Examine this fastener before you try to find the leak in a different location.

1) If the external leak location is a skin joint, examine the fillet seal on the nearest splice stringer.

NOTE: Splice stringers are stringers that cover the joints of the airplane skin. Faying surface seals ("isolation seals") are applied at intervals of 30 inches along the splice stringers. These seals are applied between the splice stringers and the airplane skin. Their purpose is to keep the length of a leak path along a splice stringer to a limit of approximately 30 inches. Leak paths and backblowing paths do not usually go through these isolation seals.

2) If the external leak location is the front or the rear spar, examine the fillet seals on the internal surface of that spar.

3) If the external leak location - the boundary between the wing tank and the center tank, look for leaks in these two tanks.

NOTE: It is a good procedure to put one person in the wing tank and one person in the center tank. These two persons must look for internal leaks in the fillet seals on each side of the rib. Examine the full length of all of the fillet seals. It is possible for the head pressure of the fuel in the tank to cause fuel to show at an external location that is higher than the internal leak location

(f) The person in the tank must tell the person out of the tank when to blow air through the external leak.

NOTE: Agree on a system of knocks. For example, the person in the tank knocks one time to start the backblowing, two times if he finds the leak, three times if the leak is not found.

(g) The person out of the tank must use an air supply with a nozzle to blow air through the external leak location (Fig. 101).

NOTE: The external leak location can be a hole in the aerodynamic smoother, a bad fastener, or an open seam in one of the spars, or the side-of-body rib.

1) If the leak is small, it can be necessary to use the maximum pressure (100 psi).
2) If the leak is larger, it is easier to find the leak with less pressure (for example, 50 psi or less).
3) Look for bubbles that show the location of the leak.
4) It is also possible to feel for blowing air to find the leak.
5) Find all leak locations on the internal surface of the fuel the tank.

NOTE: It is possible that three or four internal leaks are related to one external leak location. Make a signal to the person out of the tank to stop the backblowing procedure when you find all of the leaks.

(2) Make a mark on these leak locations with the marking pen.

NOTE: If you are not sure you found the correct leak path, you can apply the bubble solution to the external leak location and blow air through the internal leaks. If air blows through the external leak location, you found the correct leak path.

(a) If you find a leak in a self-sealing fastener, refer to 28-11-0/801 for procedures to do a temporary repair of self-sealing fasteners with leaks.

NOTE: Self-sealing fasteners are frequently used in the fuel tank. These fasteners have a plastic collar that prevents fuel flow. They are not covered with sealant. Do not put sealant on these fasteners unless you find one with a leak. The only permanent repair of a self-sealing fastener with a leak is to remove the used fastener and install a new one (Ref Structural Repair Manual).

(b) Remove soap solution from in tank.

J. Pressure Box Application

(1) To locate small leaks which require application of air pressure for longer periods of time, a pressure box may be fabricated. (See figure 102).

CAUTION: MAXIMUM PRESSURE ALLOWABLE IN THE BOX IS 4 PSIG. THE AIRPLANE WING MUST NOT BE LOWERED BY ANY MEANS WHILE BOX IS IN POSITION. EXAMPLE: FUEL TANKS MUST NOT BE REFUELED OR TIRE PRESSURES REDUCED.

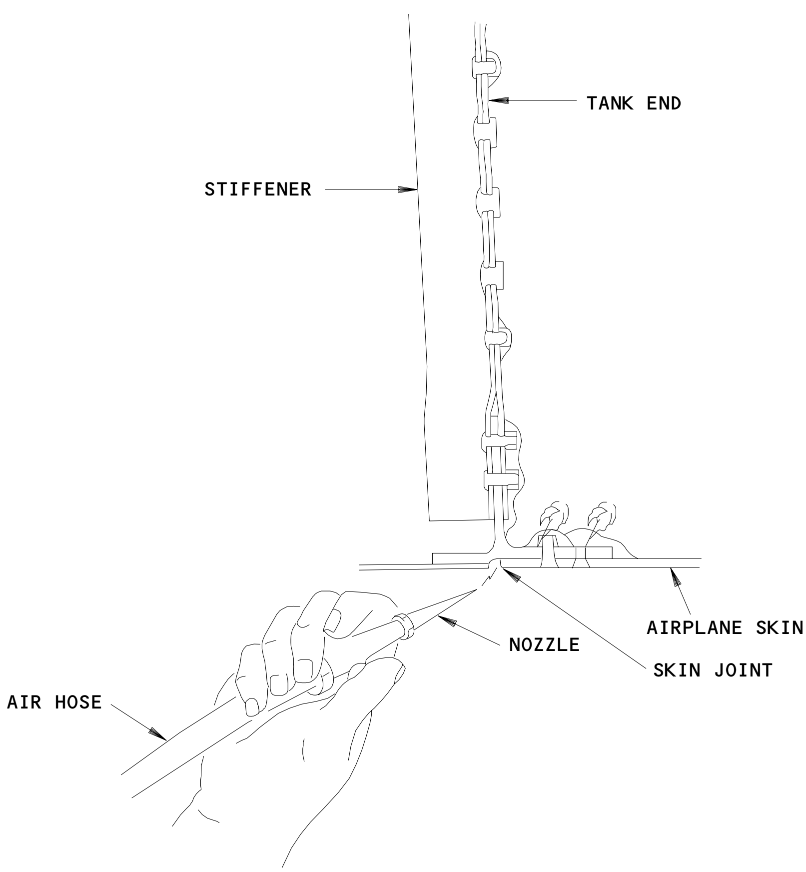
EXCESSIVE JACKING UP OF BOX MUST BE AVOIDED.

APPLY AIR PRESSURE TO BOX SIMULTANEOUSLY WITH APPLICATION OF LOAD TO THE BOX TO PREVENT DAMAGE TO WING PANEL.

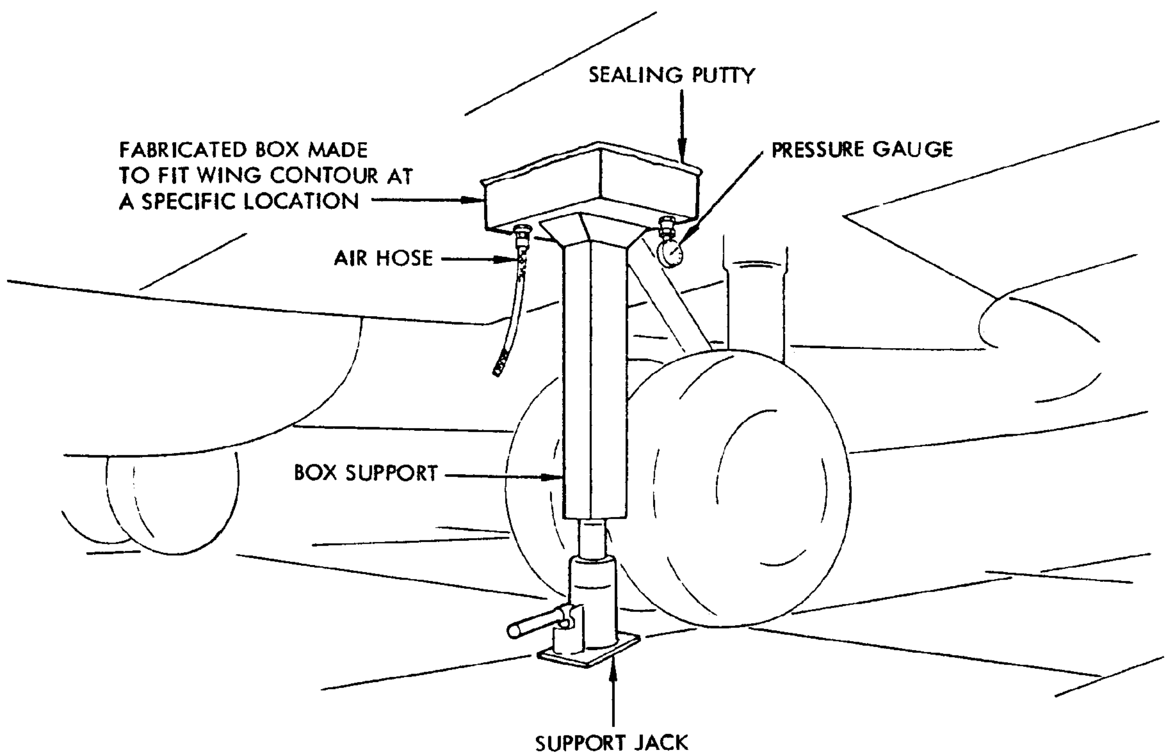
K. Dye Injection Method

(1) This method consists on injecting dyed fuel through the external leak point to the leak source inside the tank by use of a leak tracing device (Fig. 103). Use nonfluorescent red dye in concentrations of up to 2 fluid ounces per 100 gallons of fuel.

(2) Intense green or bluish white fluorescent dye mixed 1-ounce dye to 1-gallon fuel, and an ultraviolet light, may also be used for this method of leak detection.



Leak Detection Air Hose and Bubble Method
Figure 101



Pressure Box Application
Figure 102

(3) With tank prepared for entry per 28-10-0, Maintenance Practices, and leakage tracing device F71329 located as close as practical to test area, proceed as follows:

(a) Follow instructions in lid of leakage tracing device for use of items in the box. If a substitute tool is used follow applicable instructions in order to obtain the desired results.

(b) After complying with all tank safety precautions (Ref 28-10-0 MP), enter tank and observe suspected leak area for indication of dye.

CAUTION: MONITOR DYE CONTAINER GAUGE AND EQUIPMENT WHILE IT IS IN POSITION.

(c) Continue dye pressure application, as long as required, to allow dyed fuel to travel leak path.

(d) When dye appears inside tank, mark point of appearance.

(e) Trace possible leak path or paths and locate possible seal plane penetration. A sketch of possible leak paths should be made to aid in coordinating sealing repair and prevent the possibility of overlooking an isolation, or prepack seal in the structure.

L. Internal Pressure and Bubble Method

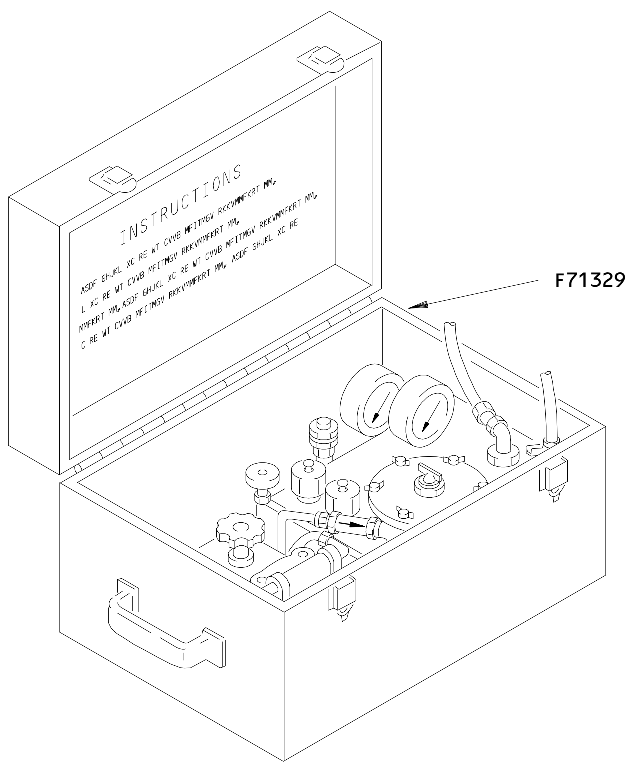
(1) Where difficulty is experienced localizing leaks on outside surface of wing, fuel tank may be pressurized and a bubble solution applied to the wing. Appearance of bubbles, should reveal the external leak points.

WARNING: DO NOT USE PRESSURIZATION METHOD UNTIL ALL OTHER METHODS HAVE FAILED. DO NOT EXCEED MAXIMUM SAFE PRESSURE OF 5.20 PSIG. OBSERVE ALL SAFETY PRECAUTIONS FOR TANK ENTRY PER 28-10-0, FUEL STORAGE SYSTEM - MAINTENANCE PRACTICES.

NOTE: Size of leak may be such that bubbles form very slowly. Constant observation may be required to detect leak.

(2) Prepare Main Tank No. 1 or 2, or Integral Center Tank for Leak Check - Pressure Method.

WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.



Leakage Tracing Device
Figure 103

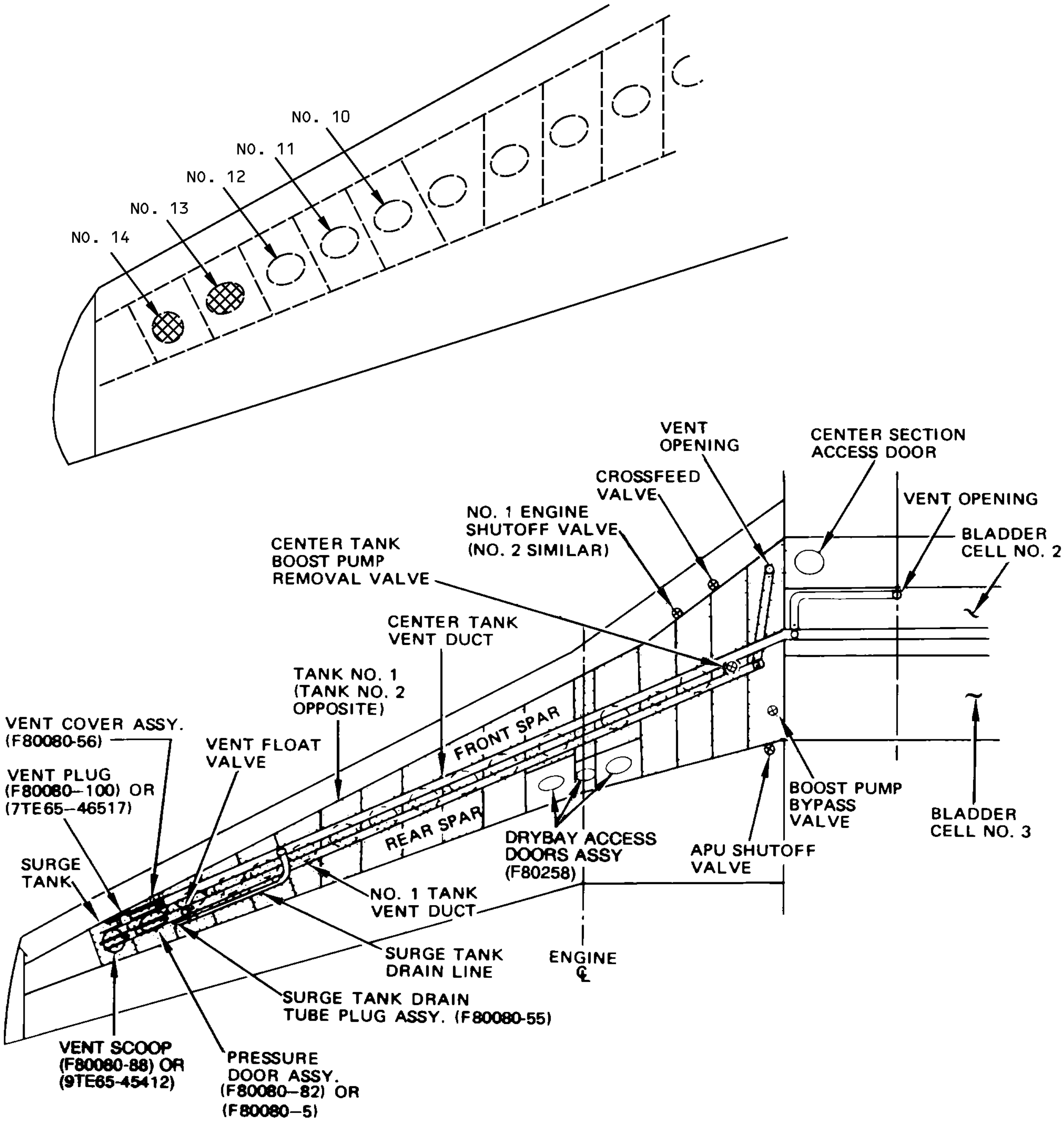
(a) Prepare Main Tank No. 1 or 2 (Fig. 104).

NOTE: Check of either main tank includes its respective surge tank.

1) Prepare tank for entry by defueling and purging tank (Ref 28-23-0 and 28-10-0 MP).
2) Manually close center tank boost pump removal valve.
   a) For tank No. 1, close LH pump valve through access panel No. 7201.
   b) For tank No. 2, close RH pump valve through access panel No. 7401.
3) Manually close boost pump bypass valve, for the tank being checked, by removing access plug from lower wing surface, inserting valve lock ME65-16713, and pulling plunger down.
4) Ensure the following valves are closed:
   a) APU fuel valve
   b) Crossfeed manifold valve
   c) Engine shutoff valve
5) Remove wing fuel tank access panels No. 13 and 14 (Ref 28-11-11 R/I).
6) Enter surge tank through No. 13 panel and block off center tank vent duct and surge tank drain.
   a) Install vent plug, F80080-100 or 7TE65-46517, in center tank vent duct.
   b) Install structural vent cover assembly, F80080-56, in rectangular slot in center tank vent duct.
   c) Install surge tank drain tube plug assembly, F80080-55, on opening to surge tank drain line.
7) Remove blower and air mover used for tank purging and ventilation.
8) Install Surge Tank Pressure Door Assembly F80080-82 or F80080-5 in access opening No. 13 (Ref 28-11-11 R/I).
9) Install Vent Scoop Closure Plug F80080-88 or 9TE65-45412 in access opening No. 14.
10) Install filler cap on overwing fueling port.
11) The tank is now ready for leak testing by the pressure method (Ref par. 5.L.(3)).

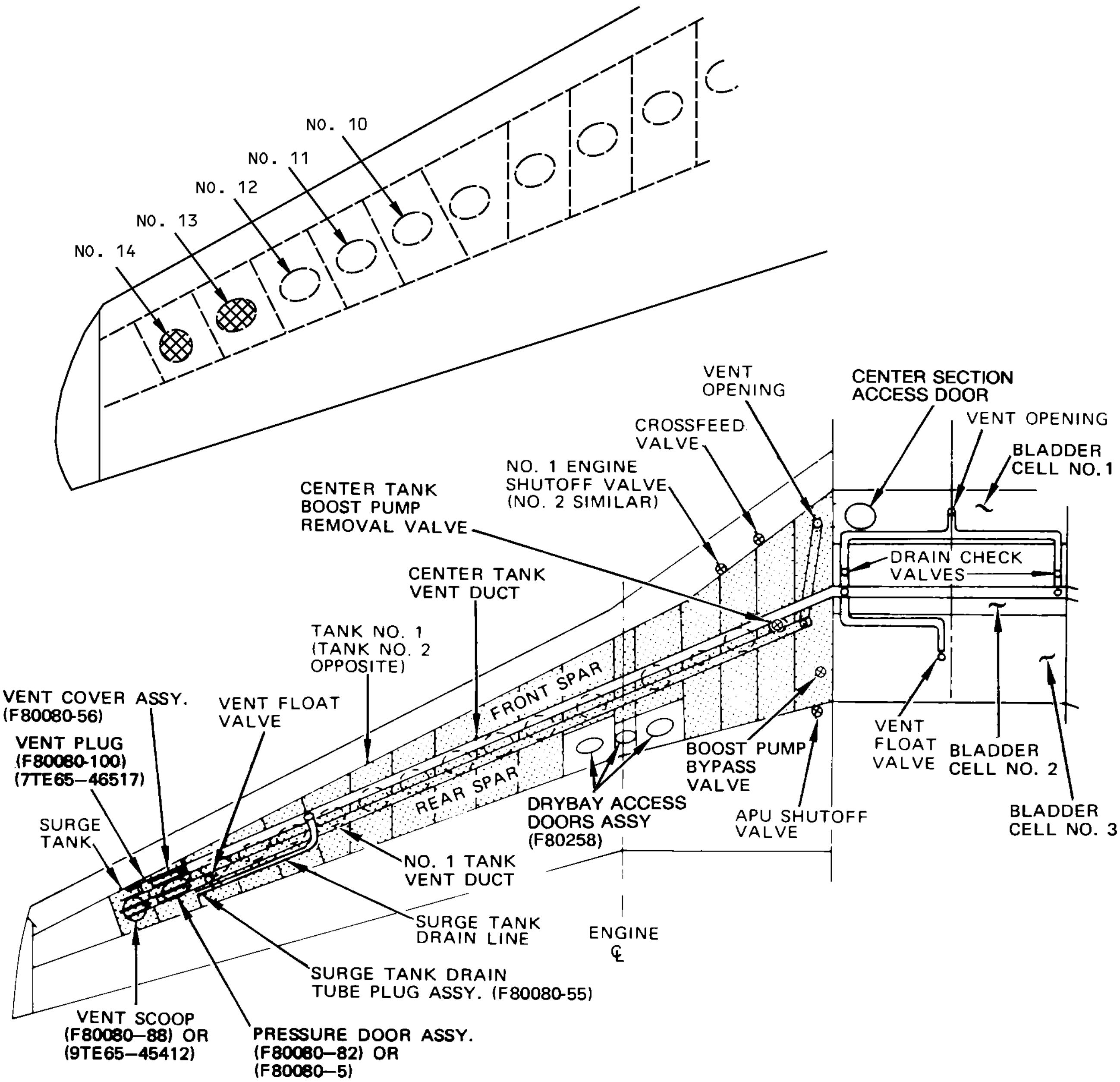
(b) Prepare Integral Center Tank (Fig. 104)

1) Prepare tank for entry by defueling and purging tank (Ref 28-23-0 and 28-10-0-MP).
2) Manually close LH and RH center tank boost pump removal valves using access panels No. 7201 and 7401, respectively, in wing lower surface.
3) Remove center wing tank access panel (Ref 28-11-31 R/I).



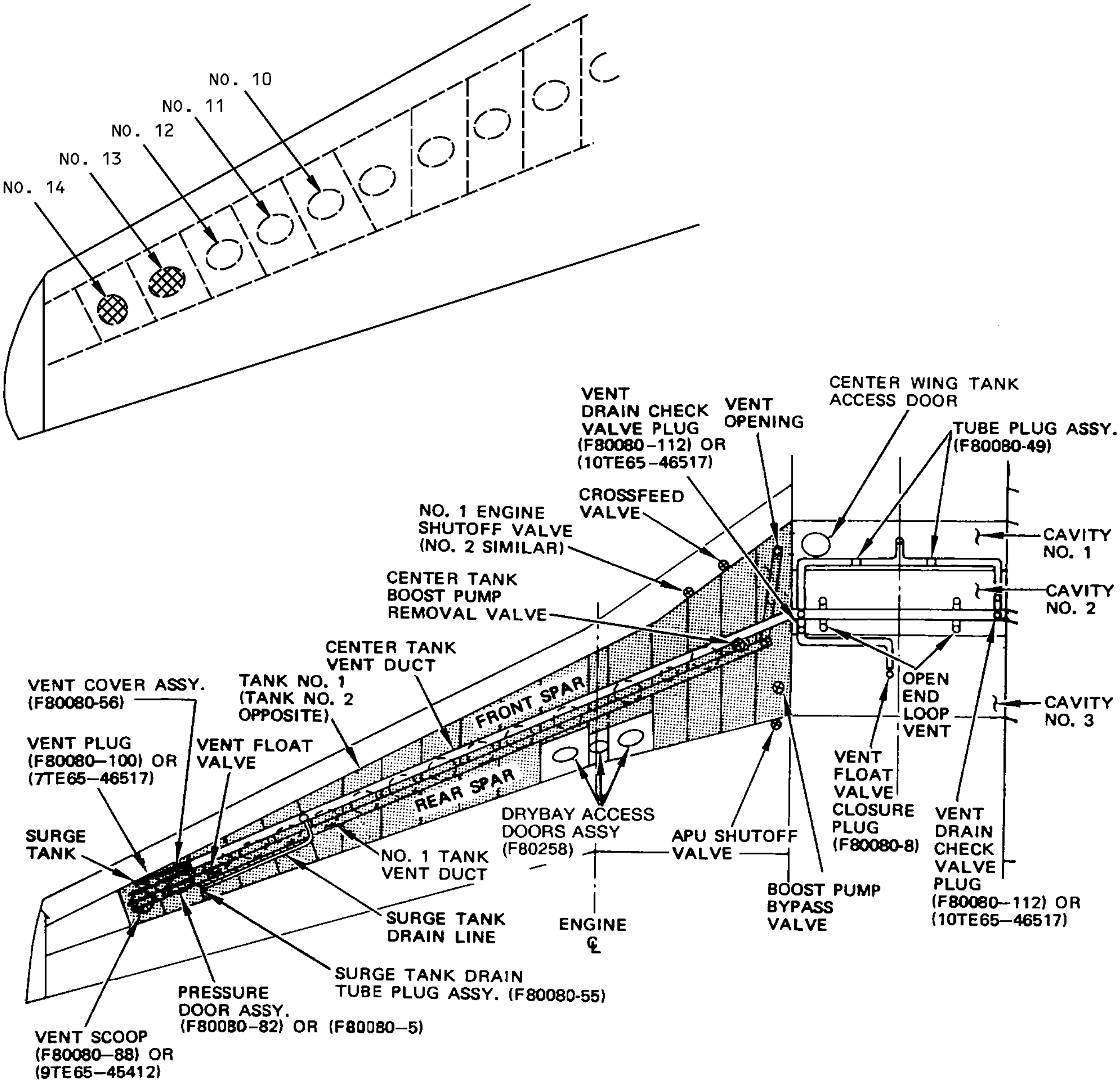
NOTE: NUMBERS IN PARENTHESIS ARE TOOL NUMBERS OF CLOSURE ITEMS. WHERE TWO ARE LISTED, THE FIRST IN ORDER IS PREFERRED.

Integral Tank Pressure Check Configuration
Figure 104 (Sheet 1)



NOTE: NUMBERS IN PARENTHESIS ARE TOOL NUMBERS OF CLOSURE ITEMS. WHERE TWO ARE LISTED, THE FIRST IN ORDER IS PREFERRED.

Integral Tank Pressure Check Configuration
Figure 104 (Sheet 2)



NOTE: NUMBERS IN PARENTHESIS ARE TOOL NUMBERS OF CLOSURE ITEMS. WHERE TWO ARE LISTED, THE FIRST IN ORDER IS PREFERRED.

EFFECTIVITY	
AR	737-287 LV-LIU AND ON
FL	N7340F THRU N7346F, N7385F, N7391F THRU N7398F
IN	EI-ASL AND ON
NH	ALL EXCEPT JA8403, JA8406 THRU JA8417

Integral Tank Pressure Check Configuration
Figure 104 (Sheet 3)

470328

4) Block off float valve, in center wing cavity No. 3, by installing a float valve closure plug, F80080-8, between valve float arm and float down stop.
5) Block off two vent drain check valves, in center wing cavity No. 2, by installing two drain valve plugs, F80080-112 or 10TE65-46517, on lower end of valves.

NOTE: Omit plugging vent drain check valves on LH and RH open end loop vent ducts in cavity No. 2.

6) Plug forward vent tube in center wing cavity No. 1.
   a) Remove bonding jumpers and uncouple center section vent tube (tee) from connecting LH and RH vent tubes.
   b) Remove clamps holding center section vent tube to spanwise beam and remove bolt holding tube support bracket to stringer. Remove tube.
   c) Install tube plug assemblies, F80080-49, in the two open ends of remaining LH and RH vent tubes.
7) Remove blower and air mover used to ventilate tank.
8) Install center integral wing tank pressure test door, F80172-7, F80172-1 or F80148-1 (Ref 28-11-31 R/I). Attach pressure source and measurement connections.
9) The tank is now ready for leak testing by the pressure method (Ref par. 5.L.(3)).

(3) Perform Leak Check
   (a) Connect the safety relief manometer (Fig. 105) to the tank test door.

   WARNING: MAKE SURE THAT SAFETY RELIEF MANOMETER OPERATES SAFELY BY BLOWING INTO MANOMETER HOSE AND NOTING THAT WATER LEVEL FLUCTUATES. CHECK THAT OPEN END OF MANOMETER IS COMPLETELY FREE OF ANY OBSTRUCTION.

   (b) Connect pressure hose to air valve on tank test door.
   (c) On preferred manometer (Fig. 105), fill manometer with water to fill mark corresponding to desired pressure. On alternate manometer (Fig. 105), fill manometer with water to height H corresponding to test pressure (Fig. 105, 106).

   CAUTION: DRAIN MANOMETER COMPLETELY IMMEDIATELY AFTER PRESSURE CHECKING IN COLD WEATHER. MAKE CORRECTION TO WATER COLUMN HEIGHT WHEN USING ANTIFREEZE SOLUTION.

   NOTE: Use of colored water or a small floating ball facilitates observation of water level in manometer. Antifreeze solution may be used when pressure checking in very cold weather.

(d) Open air valve and apply 4.0 psi air pressure to the tank. Observe water level and partially close air valve to slow down movement of lower level as it approaches lower bend of manometer tube.

<u>CAUTION</u>: MONITOR THE EQUIPMENT AT ALL TIMES TO MAKE SURE 4 PSI PRESSURE IS NOT EXCEEDED. DAMAGE TO THE AIRPLANE COULD OCCUR IF MORE THAN 4 PSI PRESSURE IS USED.

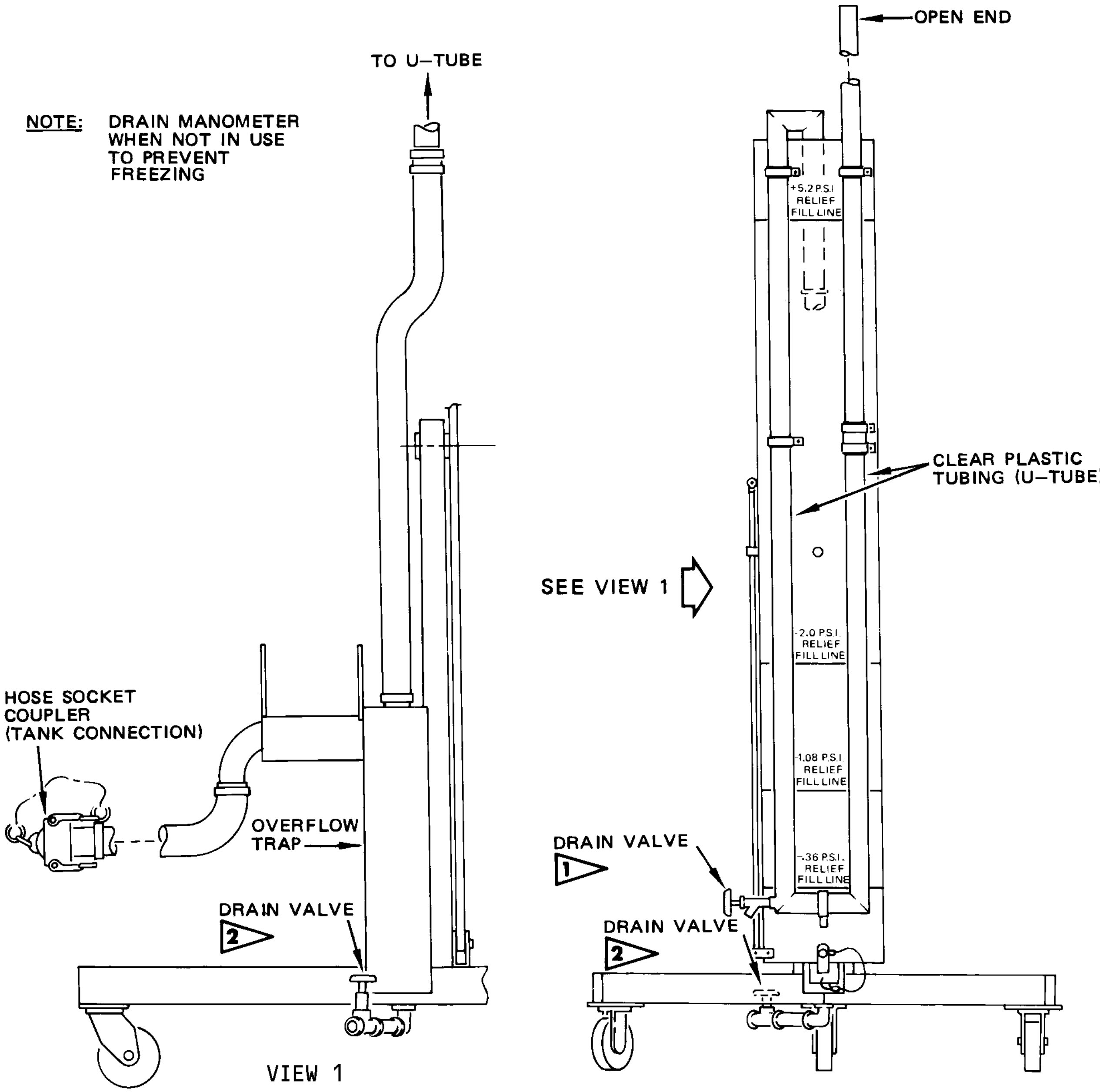
(e) Close air valve as soon as the lower level passes the bend. The upper level should not reach open end or upper bend of manometer.
(f) Apply bubble solution on the outside surface of the wing in the area you think there is a leak.

(4) Mark location of bubbles, remove bubble solution from surface with a damp cotton wiper (BMS15-5), and depressurize tank.
(a) Remove all plugs and test equipment and return tank to normal configuration.

(5) Establish internal leak source using one of the methods described in preceding text.

M. Hollow Bolt Methods for Use in Areas of Structural Buildup
(1) Hollow Bolt - Air Bubble Method. (Try this method prior to Hollow Bolt Dye Injection Method.)
(a) Prepare tank for entry per Fuel Storage System Maintenance Practices, 28-10-0.
(b) Remove a good fastener and install hollow bolt fastener in fastener hole (See Figure 107). All removal and installations to be in accordance with Structural Repair Manual.
(c) With air bleed hose clamp closed, connect regulated air pressure supply. The air supply should come either through a F71329 leakage tracing device or have a safety relief manometer fitted into the system.
(d) Apply soap solution to suspected leak area inside tank.
(e) Apply 4 psi air pressure.

<u>CAUTION</u>: MONITOR EQUIPMENT AT ALL TIMES TO ENSURE THAT 4 PSI PRESSURE IS NOT EXCEEDED.

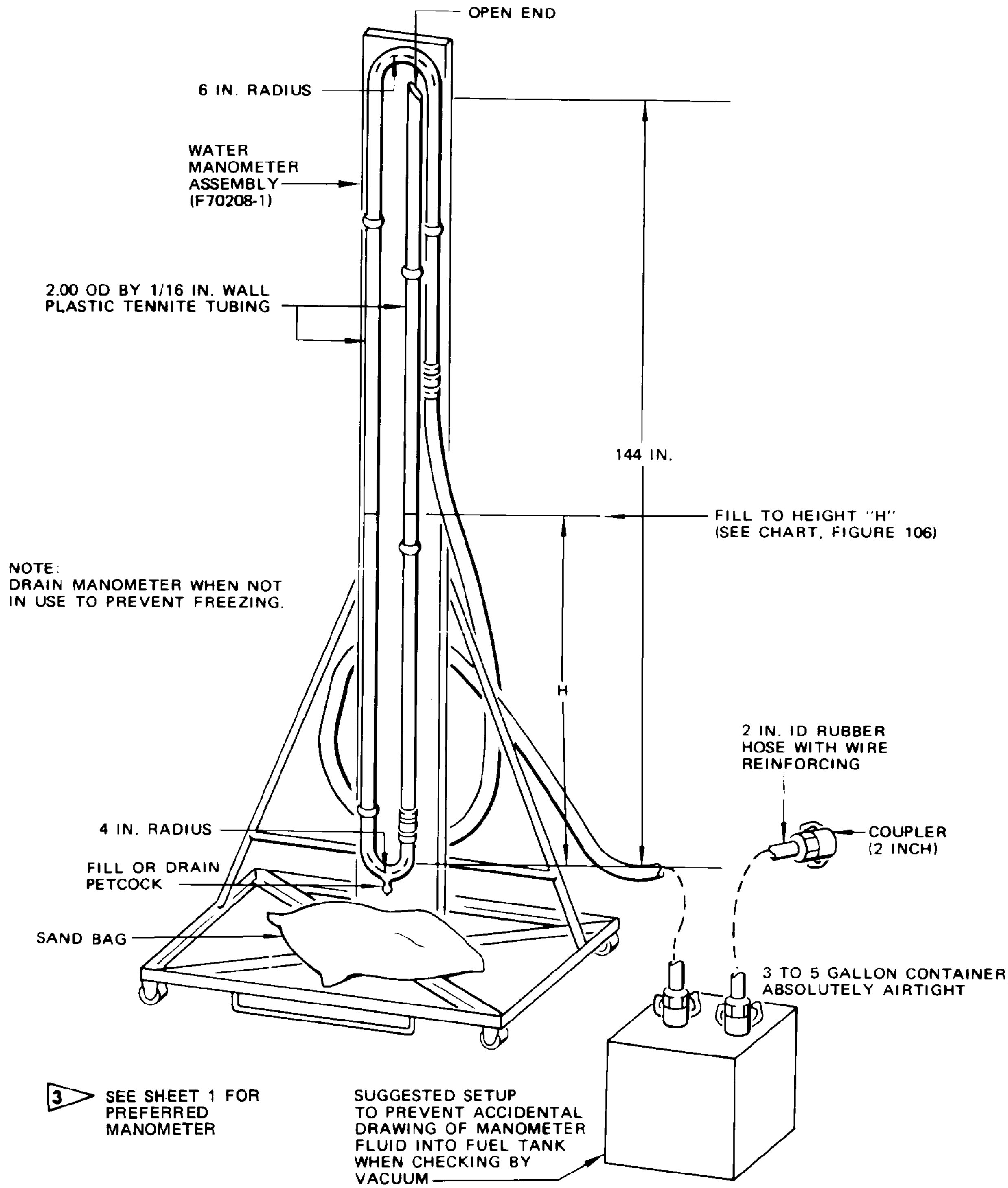


PREFERRED SAFETY RELIEF MANOMETER

1 USE VALVE TO ADJUST FILL LEVEL AND TO DRAIN TUBING

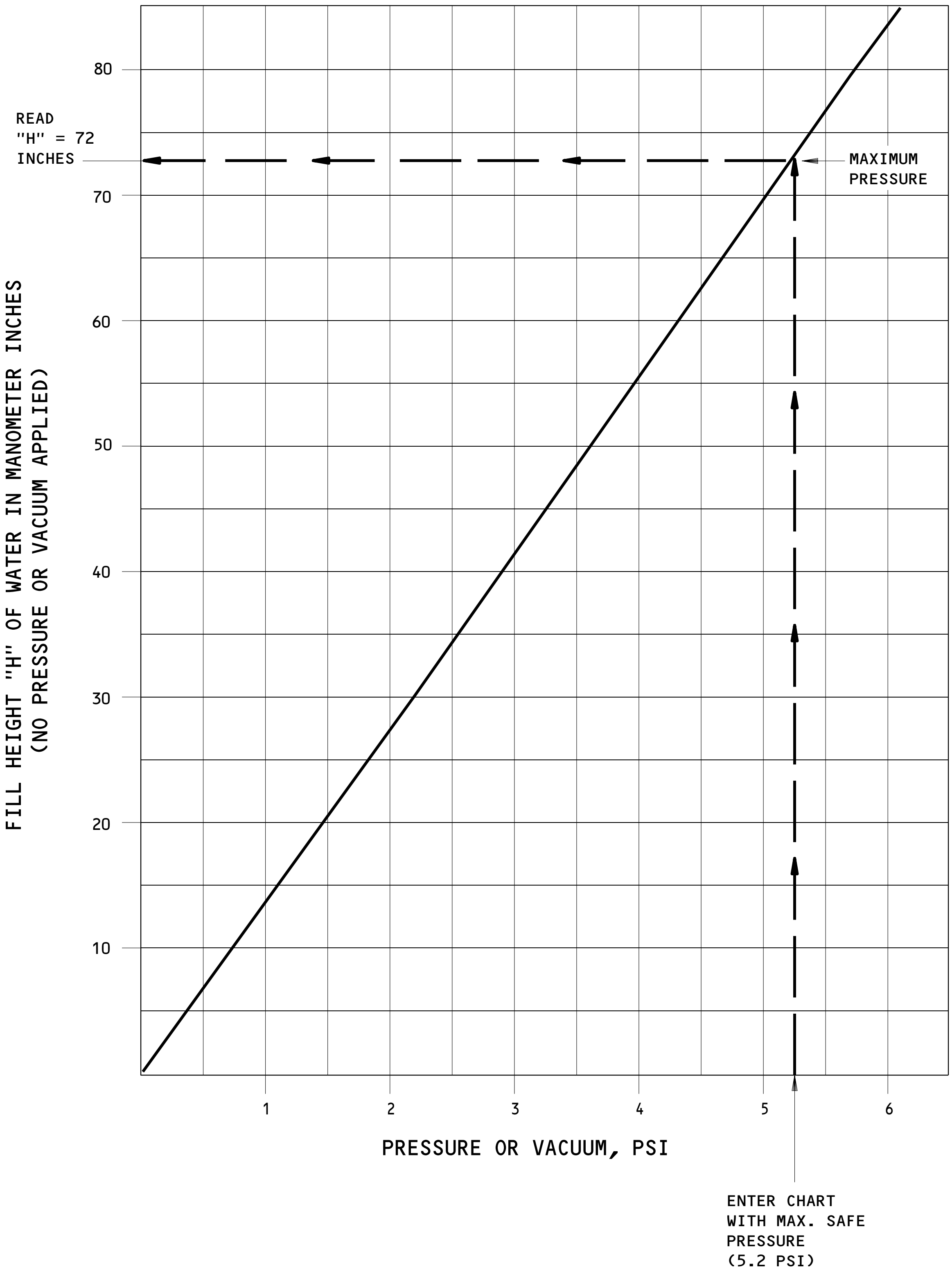
2 USE VALVE TO DRAIN OVERFLOW TRAP

Water Safety Relief Manometer
Figure 105 (Sheet 1)



ALTERNATE SAFETY RELIEF MANOMETER 3

Water Safety Relief Manometer
Figure 105 (Sheet 2)



Manometer Water Column Pressure Chart
Figure 106

(f) Mark leak points inside tank and remove all evidence of soap solution. If results are not obtained within approximately 20 minutes, try the hollow bolt dye injection method.

N. Hollow Bolt Dye Injection Method
(1) If leakage tracing device F71329 was used in preceding test, follow instructions on box cover for applying dye and air pressure to the bolt. If substitute equipment was used, proceed as required to obtain the desired results.
(2) Suggested dyes are:
(a) Intense green or bluish-white fluorescent dye solution to be used with an ultra-violet light. Use 1 ounce of either color to 1 gallon of fuel.
(b) If an ultra-violet light is not used, use red nonfluorescent dye in concentrations of up to 2 fluid ounces per 100 gallons of fuel.
(3) When dye appears in tank, mark point of penetration.

O. Locating Equipment or Fitting Leaks - Talcum Powder Method
(1) This procedure deals only with determining whether or not a leak is caused by equipment or fitting leaks at the tank boundaries. If equipment or fittings are not the leak source, it must come from a compound sealed or fastener sealed origin. Proceed as follows:
(a) Have talcum powder and a thick bristled camel hair brush for dusting powder on suspected leak source available. Also plenty of clean dry cotton wipers (BMS15-5).
(b) Wipe up leak area thoroughly with a cotton wiper (BMS15-5).
(c) Wipe connection thoroughly using three or four changes of the cotton wiper (BMS15-5) in the process. It must be completely dry.
(d) Immediately dust connection with talcum powder.
(e) First trace of fuel touching talcum will cause it to change color. Consequently, area must be kept under constant watch.
(f) If no change is immediately apparent in talcum, wipe surrounding area that was previously wiped dry and dust talcum over entire area.
(g) Observe dusted area closely for first signs of color change in talcum.

(h) If talcum changes color at connection, leak has been isolated. See applicable section for removal and installation of component.
(i) If fuel discolors talcum at another location, for instance at lockbolt or rivet installation, there is a possibility of it being a contributor to the leak also. Leaks in bottom of wing around access doors can usually be attributed to a faulty O-ring in access door.

P. Wing Dry Bay Pressurization Method
(1) Defuel and purge fuel tank having dry bay with fuel leak (Ref 28-23-0 MP, 28-10-0 MP).
(2) Remove fuel tank access panels 7202, 7204, 7205, and 7206 (left side) or 7402, 7404, 7405, and 7406 (right side), as applicable (Ref 28-11-11 R/I).
(3) Remove dry bay access panels 7215, 7216, and 7217 (left side) or 7415, 7416, and 7417 (right side) from wing upper surface.
(4) Install rubber stoppers in inboard and outboard dry bay drain holes.
(5) Install test doors on dry bay access openings.
(6) Apply and maintain 4 psi air pressure to fitting on dry bay test door.
(7) Enter fuel tank and apply bubble solution to area suspected of containing leak source. Observe area closely for signs of bubbling solution.
(8) If bubbles are observed, mark area inside tank and continue test until area has been completely covered.
(9) Wipe up bubble solution using damp cotton wipers (BMS15-5).
(10) If steps (6) thru (8) have not resulted in discovery of leak source, perform the following:
(a) Remove air pressure source and allow dry bay to return to ambient pressure.
(b) Remove dry bay test door and cover leak exit point in dry bay with spray-on fluorescent dye.
(c) Reinstall test door and apply 4 psi air pressure to door fitting.
(d) Enter tank with explosionproof ultraviolet light and examine dry bay area for evidence of dye.
(e) Mark leak entry point inside fuel tank.
(11) Remove rubber stoppers from dry bay drain holes.
(12) Remove test doors and install dry bay access panels.
(a) Clean the mating surfaces of the dry bay access panels and the wing skin with MEK or another approved solvent (Ref 28-11-0 AR).
(b) Apply the parting agent to the mating surface of the dry bay access panels (Ref BAC5000).

(c) When the parting agent is dry to the touch, apply BMS 5-45, Class B sealant to the cleaned mating surface of the wing skin.

(d) Attach the dry bay access panels to the wing skin within the sealant application time.

(13) If internal leak point is detected, refer to 28-11-0 AR for repair procedures.

(14) Install fuel tank access doors.

6. Leak Path Analysis

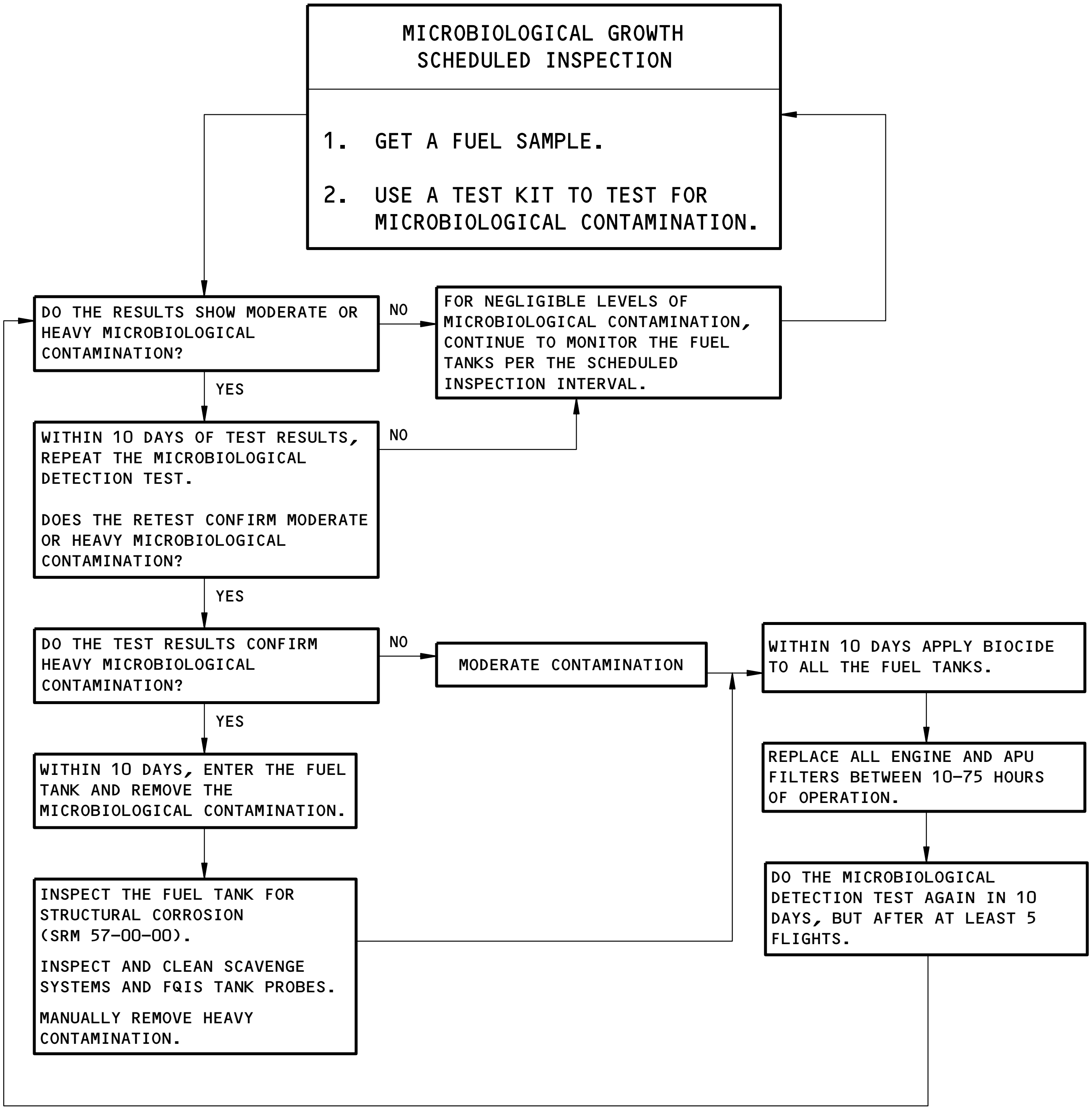
A. After the external leak point and the internal leak source have been located, the point of seal plane penetration must be traced. The area where bubble or dye appears internally should indicate true point of seal plane penetration, except in case of a hidden seal failure. In many cases failure of an injection, prepack, or hidden type seal, will allow fuel to enter and travel within structure to appear at a point quite distant from leak source. Repairing apparent leak area, where bubbles or dye appear, and not failed hidden seal may mean a temporary fix which will have to be redone frequently until true point of penetration of seal plane is located. To prevent this situation, a fuel leak should be studied for all possible leak paths between external and internal appearance points.

NOTE: As an alternative to repairing a hidden seal, the seal plane may be raised.

B. The seal plane is the barrier that prevents escape of fuel from tank. When this seal plane is penetrated the faying surfaces of all structure on the other side of seal plane becomes wet. Wetted area extends in all directions from point of penetration until it is stopped by an injection, faying surface, or prepack type hidden seal. Fillet seals act as sides to a channel formed in the structure through which fuel will flow. Since there are no seals on other side of seal plane, any fuel that has penetrated seal plane will leak out where least resistance exists. For instance, a row of fasteners in channel may be wet, but leak will appear at only one fastener. If leaking fastener were sealed, then fastener having next least resistance will leak, and so on. Studying leak path will show how fuel got from point of seal plane penetration to outside. To get a thorough understanding of leak, study tank structure and sealant.

INTEGRAL FUEL TANKS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains these tasks:
      (1) Detection Test for Microbial Growth
      (2) Treatment of Fuel Tanks Contaminated With Microbial Growth
      (3) Biocide Treatment of Fuel Tanks - Metered Injection Cart
      (4) Biocide Treatment of Fuel Tanks - Overwing Fill Port
      (5) Microbial Growth Removal - Manual Removal Method
      (6) Microbial Growth Removal - Pressure Washer Method
   B. Contamination in fuel tanks and structural corrosion can result from the presence of microorganisms, which live and multiply at the interface of fuel and water.
   C. Figure 201 provides an overview of actions necessary to detect, treat and remove microbial contamination. CPM 20-62-00, Preventative Methods, gives more information about microbial growth and the microbial growth prevention program.
2. Detection Test for Microbial Growth (Fig. 201)
   A. General
      (1) Use a microbial detection kit or laboratory standard test to check the fuel/water samples taken from each fuel tank. A positive result for microbial contamination requires action that may include a biocide treatment or physical removal of the growth from the fuel tanks.
      (2) These are the approved test kits:
         (a) FUELSTAT
         (b) Easicult Combi
         (c) MicrobMonitor 2
         (d) HY-LiTE Jet A-1 Fuel Test
         (e) The fuel samples can also be sent to a laboratory for testing. IP385 is the Institute for Petroleum's test for microbial contamination.
      (3) All instructions supplied with the detection kits should be followed closely. It is important to retest if a detection test shows microbial contamination. Differences in the fuel/water sample and the ability of the detection kits to consistently measure the level of microbial growth make it important to retest and verify test results. Do not compare the test results between the different types of detection kits.
      (4) All time intervals listed in this task are recommendations. There is no MMEL or scheduled maintenance requirements for testing for microbial contamination.
   B. References
      (1) AMM 12-11-05/301, Fuel Tank Sumping
      (2) CPM 20-62-00, Preventative Methods



NOTE: IF THE DETECTION TEST SHOWS MICROBIAL GROWTH, THEN DO THE SCHEDULED INSPECTION TEST MORE OFTEN.

AFTER A TREATMENT WITH BIOCIDE, DON'T TEST AGAIN UNTIL YOU FLY AT LEAST 5 FLIGHTS. THIS IS TO MAKE SURE THE FUEL TREATED WITH BIOCIDE IS FULLY REMOVED FROM THE FUEL TANKS BEFORE THE NEXT TEST.

IF THE BIOCIDE TREATMENT IS NOT EFFECTIVE USING A 1/3 FUEL LOAD, USE A BIOCIDE TREATMENT WITH A FULL FUEL LOAD AND USE THE MAXIMUM SOAK TIME. THE CONTAMINATION MAY BE TOWARDS THE TOP OF THE TANK.

Microbial Growth - In Fuel Tanks
Figure 201

C. Equipment
(1) Microbial Contamination Test Kits:
Use one of these:
(a) MicrobMonitor2
Hemel Hempstead, UK
Tel: +44 (0) 1442 225711
Fax: +44 (0) 1442 223960
Email: microbmonitor2@bp.com
(b) Fuelstat Resinae
Conidia Bioscience (Manufacturer)
Bakeham Lane, Egham, Surrey, TW20 9TY, UK
Tel: +44 (0) 1491 829012
Fax: +44 (0) 1491 829100
Email: info@conidia.com
or
SATAIR A/S - Amagerlandevej 147A, 2770 Kastrup, Denmark
SATAIR USA Inc - 4260 Frontage Rd, Atlanta, Georgia USA
SATAIR ASIA PTE Ltd - 8 Loyang Link, Singapore
Transworld Aviation Ltd - Jebel Ali Free Zone, Dubai, UAE
(c) Easicult Combi
Orion Diagnostica (Manufacturer)
P.O. Box 83, 02101 Espoo, Finland

Tel: 358-9-429-2888
Fax: 358-9-429-2794
or
Metalworking Chemicals & Equipment Co., Inc
P.O. Box 990, 34 Main Street, Lake Placid
New York USA 12946
Tel: (518) 523-2355
Fax: (518) 523-2821
(d) FQS HY-LiTE Jet A-1 Fuel Test
Merck KGaA, Germany
Distributor: Fuel Quality Services Inc.
P.O. Box 1380
Flowery Branch, GA 30542
Tel USA: 1-800-827-9790
Fax USA: 770-967-9982
www.fqsinc.com
(2) Use one of these:
(a) Fuel Sampling Kit, P/N 100-1028-04 (or equivalent)
Shaw Aero Devices, Inc.
3580 Shaw Boulevard
Naples, Florida 34117-8408
Tel: (941) 304-1000
Fax: (941) 304-1088
Email: www.shawaero.com
(b) A12001-14 Fuel Sampling Equipment
(3) Fuel sample bottle - glass or fuel-resistant plastic
(4) Protective equipment:
(a) Eye protection

(b) Clean fuel resistant gloves
(c) Clean protective outerwear.

D. Consumable Materials
(1) B00130 Alcohol - Isopropyl, to clean the equipment
(2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

E. Clean the Fuel Sampling Equipment
(1) You must wear protective equipment when you clean, sample and test for microbial growth. Protective equipment includes:
(a) Eye protection
(b) Clean fuel resistant gloves
(c) Clean protective outerwear.
(2) Do these steps to clean the fuel sampling equipment:
(a) Mix a solution of one part tap water to three to four parts isopropyl alcohol.
(b) Clean these items with the alcohol solution:
1) Sump drain tool
2) Sump drain container
3) Fuel sample container (if reused)
(c) Air dry the fuel sampling equipment.
(d) Make sure the fuel sampling equipment is free from residue alcohol.
(e) Protect the containers from contamination.
(3) Do these steps to clean the sump drain area:
(a) Mix a solution of one part water to three to four parts isopropyl alcohol.
(b) Thoroughly clean the exterior area of the fuel sump drain with the alcohol solution.
(c) Air dry the sump area.
(d) Repeat for each sump drain.

F. Collect the Fuel Sample
(1) Make sure the sump drain container and the fuel sample container are clean and dry.
(2) Do these steps to collect a fuel sample:

NOTE: Each fuel sample must be collected separately for each fuel tank and stored in separate sample containers.

(a) Use the fuel sump drain to get a fuel sample (AMM 12-11-05/301).
(b) Fill the sump drain container with approximately one quart (one liter) of fuel.
(c) If possible, make sure the fuel sample contains some visible water (free water) and some fuel.
(d) Pour the fuel from the sump drain container into the fuel sample container.
(e) Do not add any additives, such as food coloring, to identify the presence of water.
(3) After you collect the fuel sample, do these steps:
(a) Install the cover on the sample container.

(b) Label each fuel sample with a date, airplane and fuel tank identification.
(c) Protect the fuel samples from contamination.
(4) Continue to collect fuel samples for the remaining tanks.
(a) Clean the fuel sampling equipment again before you collect a new sample.
(b) Make sure to collect a fuel sample from each tank.

G. Microbial Growth Detection Test
(1) Test the sample within 6 hours of collection if possible, but no more than 24 hours after collection.

NOTE: After you collect the fuel sample, any microbial growth in the sample will start to die.

(2) Use one of the approved test kits to test the fuel samples.
(3) Follow all instructions supplied with the test kit.

NOTE: Some test kits will not function correctly if fuel is tested. Even traces of fuel can coat the test slide and prevent the microbes from growing. Other test kits can test either fuel or free water, but free water is recommended.

H. Initial Test Results
(1) Use the data supplied with the test kit to define the level of microbial growth:
(a) Negligible contamination
(b) Moderate contamination
(c) Heavy contamination
(2) If the test confirms negligible levels of contamination, then do these steps:
(a) Continue with the usual operations.
(b) Continue to test the aircraft at the usual intervals.
(3) If the initial test results are positive for moderate or heavy levels of microbial contamination, then do these steps:
(a) Within 10 days (after receipt of test results) get a new fuel sample.
(b) Repeat the microbial detection test with the same test method.
(c) Confirm the level of microbial contamination.

I. Retest Results
(1) If the retest confirms negligible levels of microbial contamination, then do these steps:
(a) Continue with the usual operations.
(b) Continue to test the aircraft at the usual intervals.
(2) If the retest confirms moderate levels of microbial contamination, then do these steps:
(a) Within 10 days (after receipt of test results) schedule a biocide treatment to kill the microbial growth.
(b) Do the subsequent task for moderate levels of contamination.

(3) If the retest confirms heavy levels of microbial contamination, then do these steps:
(a) Within 10 days (after receipt of test results) schedule a task to go into the fuel tank(s) to inspect and remove the microbial growth.
(b) Do the subsequent task for heavy levels of microbial contamination.

3. Treatment of Fuel Tanks Contaminated With Microbial Growth (Fig. 201)

A. General
(1) A positive result for moderate or heavy levels of microbial contamination requires action that may include a biocide treatment or physical removal of the growth from the fuel tanks.
(2) All time intervals listed in this task are recommendations. There is no MEL or scheduled maintenance requirements for testing for microbial contamination.

B. References
(1) AMM 12-11-05/301, Fuel Tank Sumping
(2) AMM 28-10-0/201, Fuel Tanks
(3) AMM 28-23-0/201, Defueling
(4) AMM 49-31-21/301, Low Pressure Fuel Filter
(5) AMM 49-31-81/301, High Pressure Fuel Filter
(6) SRM 51-00-00
(7) SRM 57-00-00, Wings

C. Equipment
(1) Protective outer clothing to prevent skin contact with microbial contamination:
(a) Fuel and solvent resistant gloves
(b) Saranex suit
(c) Neoprene boots
(d) Respirator - Half face canister style respirators (minimum), U.S. Bureau of Mines Approved or equivalent

D. Treatment of Fuel Tanks with Moderate Levels of Microbial Contamination

NOTE: It is recommended to apply biocide to all tanks within 10 days after positive results for moderate levels of microbial contamination.

(1) Within 10 days (after receipt of positive test results) do these steps:
(a) Do a biocide treatment for all of the fuel tanks.
(b) Return the airplane to service.
(c) Make sure all of the biocide treated fuel has been burned through the engines (a minimum of five flights).
(d) After 10 to 75 hours, replace or service these items:
1) Engine fuel filter
2) APU low pressure fuel filter element (AMM 49-31-21/301).
3) APU high pressure fuel filter (AMM 49-31-81/301)
(2) After the biocide treatment do these steps:
(a) Wait for 10 days after the biocide treatment.
(b) Get a new fuel sample for each tank.
(c) Do the microbial growth detection test again.

(d) If the tests show that the biocide treatment was not successful, do these steps:
  1) Completely fill the fuel tanks with biocide treated fuel.
  2) Use the maximum soak time:
    a) Biobor JF - 72 Hours
    b) Kathon FP 1.5 - 24 Hours

(e) If the tests show that the biocide treatment was successful, then continue to test the aircraft at the usual intervals.

E. Treatment of Fuel Tanks with Heavy Levels of Microbial Contamination

NOTE: If the detection test (and retest) confirms heavy levels of microbial contamination, then do this procedure. It is recommended to do a fuel tank entry within 10 days after positive results for heavy levels of microbial contamination.

(1) Within 10 days (after receipt of test results) schedule a task to inspect the fuel tank(s) for microbial growth.

(2) Do these steps to prepare for the fuel tank inspection:

WARNING: CAREFULLY DO ALL THE SAFETY PROCEDURES TO GO INTO A FUEL TANK. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE SAFETY PROCEDURES.

(a) Defuel and drain the applicable fuel tank(s) (AMM 28-23-0/201).
(b) Prepare for a fuel tank entry (AMM 28-10-0/201).
(c) Make sure the fuel tank has a sufficient flow of air.
(d) Put on this protective gear to prevent contact with microbial growth:

WARNING: WEAR AN APPROVED RESPIRATOR AND PROTECTIVE CLOTHING BEFORE YOU ENTER A FUEL TANK CONTAMINATED WITH MICROBIAL GROWTH. IF YOU BREATHE AIR CONTAMINATED WITH MICROBIAL GROWTH RESIDUE OR ALLOW THE MICROBIAL GROWTH TO TOUCH YOUR SKIN, POSSIBLE HEALTH PROBLEMS CAN OCCUR.

  1) Respirator - Half face canister style respirators (minimum)
  2) Eye protection
  3) Fuel resistant gloves
  4) Saranex suit
  5) Neoprene boots

(e) Go into the fuel tank (AMM 28-10-0/201).

(3) Examine the fuel tank for microbial growth:
(a) Microbial growth usually occurs at the fuel/water interface in the fuel tanks.
(b) Microbial growth can also occur in other areas such as vertical surfaces and convex shapes such as fuel tubing.
(c) Microbial growth can appear in a variety of colors.
(d) If a tank is wet with fuel, the microbial growth can appear as a smooth slimy transparent gel material.

(e) If a tank is dry, the microbial growth can appear as a dark solid material on the tank surfaces.
(f) Microbial growth can cause the tank protective primer coating to appear stained.

(4) Microbial growth is usually found in these areas:
(a) The bottom of the tank where water collects.
(b) The lower surfaces of the wing structure (stringers, spars, ribs etc).
(c) The top surfaces of the tubing.
(d) The flow holes and the drain tubes.
(e) Areas where water is possibly trapped.
(f) Inside or around fuel system components.

(5) Do these steps if you find microbial growth:
(a) Do the applicable task to remove the microbial growth:
1) Microbial Growth Removal - Manual Removal Method
2) Microbial Growth Removal - Pressure Washer Removal Method
(b) Examine the fuel tank structure for corrosion (SRM Chapter 57).

(6) Do these steps after you clean the fuel tank:
(a) Do the inspection for the remaining tanks that have tested positive for microbial growth.
(b) Go out of and close the fuel tank (AMM 28-10-0/201).
(c) Do one of these tasks to do a biocide treatment of the fuel tanks:
1) Biocide Treatment of Fuel Tanks - Metered Injection Cart
2) Biocide Treatment of Fuel Tanks - Overwing Fill Ports (Alternate Method)
(d) Return the airplane to service.
(e) Within 10 days, get a new fuel/water sample and do the microbial detection test again.

NOTE: This test is necessary to make sure the microbial growth removal and biocide treatment processes have reduced the level of microbial contamination to an acceptable level.

(f) Make sure all of the biocide treated fuel has been burned through the engines (a minimum of five flights).
(g) After 10 and before 75 flight hours, replace these items:
1) Engine fuel filter
2) APU low pressure fuel filter (AMM 49-31-21/301)
3) APU High Pressure Fuel Filter (AMM 49-31-81/301)

(7) After the biocide treatment do these steps:
(a) Wait for 10 days after the biocide treatment.
(b) Get a new fuel sample for each tank.
(c) Do the microbial growth detection test again.
(d) If the tests show that the biocide treatment was not successful, do these steps:
1) Completely fill the fuel tanks with biocide treated fuel.
2) Use the maximum soak time:
a) Biobor JF - 72 Hours
b) Kathon FP 1.5 - 24 Hours

(e) If the tests show that the biocide treatment was successful, then continue to test the aircraft at the usual intervals.

4. Biocide Treatment of Fuel Tanks - Metered Injection Cart

A. General

(1) There are two methods to add biocide treatment to the fuel tanks:
(a) Metered injection cart
(b) Overwing fuel port

(2) Do this task if a metered injection cart is available.

(3) If you need to add biocide without a metered injection cart, then do the overwing fill port task.

(4) There are two types of metered-injection carts:
(a) Adjustable metered injection cart
(b) Non-adjustable metered injection cart

(5) ADJUSTABLE METERED INJECTION CART;
This type of metered injection cart is equipped with an adjustable concentration setting. You can adjust the concentration setting from tank to tank.

(6) NON-ADJUSTABLE METERED INJECTION CART;
This type of metered injection cart is not field adjustable. You cannot adjust the concentration setting from tank to tank. You can recalibrate the cart (in a maintenance shop) to achieve the desired 270 ppm concentration for Biobor JF or 100 ppm concentration for Kathon FP 1.5. To account for the typical fuel remaining on-board after a flight, a procedure is given to recalibrate the cart to 1.5 times the usual setting. This method will allow the correct concentration of treated fuel to be added to the fuel tanks.

(7) Biocide treatment is used to kill microbial growth within the fuel tank. The process requires that the biocide be mixed at a specified concentration with fuel and allowed to soak for a period of time. After soaking, the biocide treated fuel may be burned through the engines.

(8) Two biocidal fuel additives are certified by the airframe and engine manufactures. These are:
(a) Biobor JF - manufactured by Hammonds
(b) Kathon FP 1.5 - manufactured by Rohm & Haas Company

NOTE: Biobor JF and Kathon FP 1.5 have not been approved in some geographic areas. Local regulatory agencies should be consulted with respect to approval status.

(9) Obey all Health and Safety precautions specified by the manufacturer related to the use of biocide.

(10) It is recommended to do this task with no fuel or a minimum fuel load (after a flight, before fuel servicing). It is not necessary to defuel the aircraft before you begin the biocide treatment.

B. References

(1) AMM 12-11-01/301, Fuel Servicing
(2) AMM 12-11-02/301, Pressure Refueling
(3) AMM 12-11-05/301, Fuel Tank Sumping
(4) AMM 28-23-0/201, Defueling
(5) AMM 49-31-21/301, Low Pressure Fuel Filter

(6) AMM 49-31-81/301, High Pressure Fuel Filter
(7) CPM 20-62-00

C. Equipment
(1) Cart - Hydrant, Portable, Biocide Injection (or equivalent)
Model 800 (Manufactured by Hammonds)
Mil-International Inc
Vendor Code 3Z256
(2) Cart, Hydrant, portable, metered injection of jet fuel additives
Model #69-10-04-999 (or equivalent) manufactured by Lubrizol

Lubrizol Performance Systems Inc
2000 Northfield Court
Roswell, GA 30076
(770) 475-1900
(770) 475-1717 (Fax number)

D. Consumable Materials
(1) Biocide - Use one of these fuel additives:
(a) G00452 - Biobor JF, Biocide
(b) G02347 - Kathon FP 1.5 biocide, Rohm and Haas Company, Pennsylvania, USA (215) 592-3000

Distributor for Kathon FP 1.5,
Fuel Quality Services, Inc.
Georgia, USA
(770) 967-9790
(770) 967-9982 (Fax number)

E. Biocide Precautions
(1) Obey these personnel precautions:
(a) Do not breathe or touch the biocide fuel additive.

WARNING: DO NOT BREATHE BIOCIDE VAPOR OR TOUCH THE BIOCIDE FUEL ADDITIVE. IF YOU BREATHE THE VAPORS OR TOUCH THE BIOCIDE FUEL ADDITIVE, IT CAN CAUSE HEALTH PROBLEMS. CONSULT THE MANUFACTURES MSDS.

(b) During maintenance with biocide fuel additives, wear these protective equipment items:
1) Eye protection
2) Fuel resistant gloves
3) Protective outerwear
(c) Do not sump the fuel tanks when biocide has been added to the fuel tank(s). A high concentration of biocide will be present at the sump drain.
(2) Obey these biocide additive precautions:
(a) Obey all requirements specified by the manufacturer related to the use of the biocide.

(b) Do not exceed the maximum allowable concentration of biocide (parts per million) in a fuel tank.

CAUTION: DO NOT EXCEED THE MAXIMUM CONCENTRATION OF BIOCIDE. DAMAGE TO THE ENGINES CAN OCCUR IF THE BIOCIDE CONCENTRATION IS ABOVE THE MAXIMUM LIMIT.

(c) If the concentration exceeds the limit, then add more untreated fuel to dilute the biocide concentration.
(d) If you exceed the maximum allowable concentration of biocide in a fuel tank and you cannot dilute the concentration with untreated fuel, then contact the engine manufacturer for corrective action.
(e) If you spill biocide, then do these steps:
1) Immediately contain the spill area.
2) Use cotton wiper (BMS15-5) and water to clean the area.
3) Use the correct procedures to dispose of the material.

F. Prepare for the Biocide Treatment
(1) Sump the fuel tanks (AMM 12-11-05/301).
(2) Do one of these procedures:
(a) Apply the Biocide to the Fuel Tanks - Adjustable Metered
(b) Apply the Biocide to the Fuel Tanks - Non-adjustable Metered Injection

G. Apply the Biocide to the Fuel Tanks - Adjustable Metered Injection
(1) Obey the biocide precautions.
(2) Use the instructions provided with the metered injection cart to connect the cart to the refueling equipment.
(3) Do these steps to calculate the metered injection setting:
(a) Use Table 201 to determine the final biocide concentration.

NOTE: Table 201 gives the final concentration of biocide allowed in the fuel tank. This is the maximum concentration of biocide that can be run through the engines. You must adjust the metered injection setting to achieve the correct concentration of biocide.

NOTE: If you add a biocide concentration that is much lower than the maximum concentration, the biocide treatment must soak longer and is not as effective in killing the microbial growth.

(b) Use Table 202 to calculate the biocide concentration setting for each fuel tank.
(c) The metered injection cart setting depends on these variables:
1) Type of biocide used.
2) Quantity of untreated fuel in the fuel tank.
3) Quantity of treated fuel to be uplifted into the fuel tank.

Table 201	
BIOCIDE	CONCENTRATION
BIOBOR JF	270 ppm by weight
KATHON FP 1.5	100 ppm by volume

Table 202	
METERED INJECTION CART SETTING	
BIOBOR JF	KATHON FP 15
$C(uf) = \frac{270\ (FOB + UPLIFT)}{UPLIFT}$	$C(uf) = \frac{100\ (FOB + UPLIFT)}{UPLIFT}$
C(uf) = Concentration of fuel to be uplifted FOB = Untreated fuel quantity on-board UPLIFT = Fuel quantity with metered biocide to be added NOTE: Fill each tank to a minimum of 1/3 full.	

(4) Adjust the metered injection cart:
  (a) Use the instructions provided with the metered injection cart to adjust the cart.
  (b) Set the injection setting to achieve the desired biocide concentration.
(5) Plan the refueling operation:
  (a) Each tank must be filled to a minimum of 1/3 full.
(6) Do these steps to add the biocide:
  (a) Open the refuel valve(s) for one tank only (AMM 12-11-02/301).
  (b) Begin the refuel operation (AMM 12-11-02/301).

(c) Make sure the correct biocide concentration is mixed with the fuel and added to the fuel tank.
(d) Refuel the tank to the desired fuel load.
(e) Make sure the tank is filled a minimum of 1/3 full.
(f) Stop the refuel operation (AMM 12-11-02/301).
(g) Do the biocide calculation again and adjust the injection cart setting for the next tank (Table 202).
(h) Continue to apply the treated fuel to all fuel tanks.
(7) Do this procedure: Biocide Treatment Soak Time

H. NO FUEL ON-BOARD;
Apply the Biocide to the Fuel Tanks - Non-Adjustable Metered Injection
(1) Do this procedure if all of the fuel tanks are empty before you begin to add the biocide treated fuel.
(2) Obey the biocide precautions.
(3) Do these steps to calibrate the metered injection cart:
(a) Use the instructions provided with the metered injection cart to calibrate the equipment.

NOTE: The equipment is not field adjustable. The calibration must be done in a maintenance shop.

(b) Calibrate the concentration setting to the applicable value:
1) Biobor JF - 270 ppm by weight
2) Kathon FP 1.5 - 100 ppm by volume
(c) Use the instructions provided with the metered injection cart to connect the cart to the refueling equipment.
(4) Plan the refueling operation:
(a) Plan the refuel operation to maintain the center of gravity within the limits per the weight and balance manual.
(b) Each tank must be filled to a minimum of 1/3 full.
(5) Do these steps to add the biocide:
(a) Open the refuel valves in sequence to maintain the airplane within the center of gravity limits.
(b) Begin the refuel operation (AMM 12-11-02/301).
(c) Make sure the correct biocide concentration is mixed with the fuel and added to the fuel tank.
(d) Fill each fuel tank to a minimum of 1/3 full.
(e) Stop the refueling operation (AMM 12-11-02/301).
(6) Do this procedure: Biocide Treatment Soak Time

I. AIRPLANES WITH INTEGRAL CENTER TANKS AND UNTREATED FUEL ON-BOARD;
Apply the Biocide to the Fuel Tanks - Non-Adjustable Metered Injection
(1) Do this procedure if there is less than 5,170 lbs (2,250 kgs) of untreated fuel on-board before you begin to add the biocide treated fuel.
(2) Obey the biocide precautions.

(3) Do these steps to distribute the untreated on-board fuel:
   (a) Transfer all of the fuel to the center tank (AMM 28-23-0/201).
   (b) If necessary, refuel the center tank with untreated fuel until the tank is 1/3 full, 5,170 lbs (2,250 kgs) (AMM 12-11-02/301).
(4) Do these steps to calibrate the metered injection cart:
   (a) Use the instructions provided with the metered injection cart to calibrate the equipment.

   NOTE: The equipment is not field adjustable. The calibration must be accomplished in a maintenance shop.

   (b) With 5,170 lbs (2,250 kgs) of untreated fuel on-board, calibrate the concentration setting to 1.5 times the maximum concentration:
      1) Biobor JF - 405 ppm by weight
      2) Kathon FP 1.5 - 150 ppm by volume
   (c) Use the instructions provided with the metered injection cart to connect the cart to the refueling equipment.
(5) Do these steps to add the biocide:
   (a) Open the refuel valves for the center tank only (AMM 12-11-02/301).
   (b) Begin the refuel operation (AMM 12-11-02/301).
   (c) Completely fill the center tank with treated fuel.
   (d) After the treated and untreated fuel is mixed in the tank, the concentration of biocide will be correct.
   (e) Distribute the biocide treated fuel in the center tank to all other tanks (AMM 28-23-0/201).
   (f) Make sure each fuel tank is a minimum of 1/3 full.
(6) Obey the biocide precautions.
(7) Allow the biocide treatment to soak per the applicable minimum time given in Table 203.

Table 203

BIOCIDE	SOAK TIME
BIOBOR JF	36 - 72 HOURS
KATHON FP1.5	12 - 24 HOURS

(8) These factors affect how quickly the biocide kills the microbial growth:
   (a) The longer the soak time, the better the biocide will work.
   (b) Additional soak time may be required for low temperatures.

(c) A low concentration of biocide is not as effective in killing microbial growth.

NOTE: If the concentration of biocide is too low, the microbes can become resistant to the biocide.

(9) During the soak time, do not move the airplane or operate the fuel pumps or APU pumps.

J. Post-Biocide Treatment Maintenance Actions

(1) After the biocide soak time, return the airplane to service.

NOTE: The biocide treated fuel is burned through the engines.

(2) After 10 and before 75 flight hours, replace these filters:

NOTE: If one engine filter shows high levels of particulates, replace the other filters before the next flight.

(a) Engine fuel filter
(b) APU low pressure fuel filter (AMM 49-31-21/301).
(c) APU high pressure fuel filter (AMM 49-31-81/301)

(3) Within 10 days, but after at least five flights, do the microbial growth detection test again.

(4) If the tests show that the biocide treatment was not successful, then do these steps:
(a) Completely fill the fuel tanks with biocide treated fuel.
(b) Use the maximum soak time:
1) Biobor JF - 72 Hours
2) Kathon FP 1.5 - 24 Hours

5. <u>Biocide Treatment of Fuel Tanks - Overwing Fill Ports (Alternate Method)</u>

A. General

(1) If metered fuel injection equipment is not available, you can add the biocide treatment into the fuel tanks through the overwing ports.
(2) You must calculate and add the correct quantity of biocide treatment to the fuel tanks.
(3) After you add the biocide treatment to tanks No. 1 and 2, you must transfer the treated fuel to the other tanks.

B. References

(1) AMM 12-11-02/301, Pressure Refueling
(2) AMM 20-40-11/201, Static Grounding
(3) AMM 27-81-0/201, Leading Edge Flaps and Slats
(4) AMM 28-23-0/201, Defueling
(5) AMM 49-31-21/301, Low Pressure Fuel Filter
(6) AMM 49-31-81/301, High Pressure Fuel Filter

C. Equipment
(1) Container - Metal, suitable for adding Biocide
(2) Funnel - Metal, suitable for adding Biocide at the overwing fill port

D. Consumable Materials
(1) Biocide - Use one of these fuel additives:
(2) G00452 - Biobor JF, Biocide
(3) G02347 - Kathon FP 1.5 Biocide, Rohm and Haas Company, Philadelphia, PA, (215) 592-3000
(4) Obey these personnel precautions:
(a) Do not breathe or touch the biocide fuel additive.

WARNING: DO NOT BREATHE BIOCIDE VAPOR OR TOUCH THE BIOCIDE FUEL ADDITIVE. IF YOU BREATHE THE VAPORS OR TOUCH THE BIOCIDE FUEL ADDITIVE, IT CAN CAUSE HEALTH PROBLEMS. CONSULT THE MANUFACTURES MSDS.

(b) During maintenance with biocide fuel additives, wear these protective equipment items:
1) Eye protection
2) Fuel resistant gloves
3) Protective outerwear
(c) Do not sump the fuel tanks when biocide has been added to the fuel tank(s). A high concentration of biocide will be present at the sump drain.
(5) Obey these biocide additive precautions:
(a) Obey all requirements specified by the manufacturer related to the use of the biocide.
(b) Do not exceed the maximum allowable concentration of biocide (parts per million) in a fuel tank.

CAUTION: DO NOT EXCEED THE MAXIMUM CONCENTRATION OF BIOCIDE. DAMAGE TO THE ENGINES CAN OCCUR IF THE BIOCIDE CONCENTRATION IS ABOVE THE MAXIMUM LIMIT.

(c) If the concentration exceeds the limit, then add more untreated fuel to dilute the biocide concentration.
(d) If you exceed the maximum allowable concentration of biocide in a fuel tank and you cannot dilute the concentration with untreated fuel, then contact the engine manufacturer for corrective action.
(e) For Biobor JF; Do not exceed the maximum concentration of the biocide fuel additive to the fuel tanks. A large concentration of the biocide fuel additive can make salt deposits in the fuel tanks.

(f) If you spill biocide, then do these steps:
1) Immediately contain the spill area.
2) Use sponges and water to clean the area.
3) Use the correct procedures to dispose of the material.

E. Prepare the Fuel System for the Biocide Treatment

(1) Make sure the total fuel load is within these limits:
(a) Minimum - approximately 1/3 the total fuel capacity (all tanks)
(b) Maximum - total fuel capacity for the tanks No. 1 and No. 2.
(c) Obey the maximum allowable fuel quantity when you use the wing tank overwing fill ports.
(d) If it is necessary, add fuel to the tanks No. 1 and No. 2 to make sure minimum fuel quantity is available (AMM 12-11-02/301).

(2) Transfer all of the onboard fuel evenly between the tanks No. 1 and No. 2 (AMM 28-23-0/201).

(3) Transfer all of the on-board fuel into the center tank (AMM 28-23-0/201).

(4) If the on-board fuel quantity exceeds the total capacity of the center tank, then transfer the extra fuel evenly between the tanks No. 1 and 2.

NOTE: Transfer enough fuel into the tanks No. 1 and 2 to make sure the tanks are a minimum of 1/3 full.

F. Prepare the Overwing Fill Ports for the Biocide Treatment

(1) Extend the leading edge flaps and install the leading edge flap locks (AMM 27-81-0/201).

WARNING: INSTALL THE LEADING EDGE FLAP LOCKS TO PREVENT INADVERTANT OPERATION OF THE FLAPS. THE FLAPS CAN MOVE QUICKLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(2) Connect a grounding cable from an approved earth ground to an approved electrical ground point on the airplane (static ground) (AMM 20-40-11/201).

WARNING: YOU MUST GROUND THE AIRPLANE TO AN APPROVED EARTH GROUND BEFORE YOU REMOVE THE OVERWING FILL CAP. IF YOU DO NOT OBSERVE THIS PROCEDURE, A STATIC SPARK CAN CAUSE A FIRE OR EXPLOSION TO OCCUR.

(3) Position pads on the wing surface to prevent damage.

(4) Do these steps to make a spill containment barrier around the overwing fill port:
(a) Position a sheet of plastic around the overwing fill port.

(b) Use sandbags to hold down the plastic.
(c) Adjust the sheet to make a spill containment barrier.

G. Calculate the Quantity of Biocide to Add to the Fuel
(1) For Biobor JF:
(a) Multiply the quantity of fuel in pounds by 0.004 to get the fluid ounces of Biobor JF.
(b) Multiply the quantity of fuel in kilograms by 0.26 to get the milliliters of Biobor JF.
(2) For Kathon FP 1.5:
(a) Multiply the quantity of fuel in pounds by 0.0000149 to get the gallons of Kathon FP 1.5
(b) Multiply the quantity of fuel in kilograms by 0.1245 to get the milliliters of Kathon FP 1.5

H. Add the Biocide to the Fuel Tanks
(1) Obey the biocide precautions.
(2) Do not exceed the maximum allowable concentration of biocide (parts per million) in a fuel tank (Table 204).

Table 204

BIOCIDE	CONCENTRATION
BIOBOR JF	270 ppm by weight
KATHON FP 1.5	100 ppm by volume

(3) Pour the correct quantity of biocide for a single tank into an approved 5-gallon metal container.
(4) Fill the metal container with fuel.
(5) Connect the biocide container and funnel to an approved airplane bonding point (AMM 20-40-11/201).

WARNING: BOND THE OVERWING FILL PORT FUNNEL AND BIOCIDE CONTAINER TO THE AIRCRAFT BEFORE THE OVERWING FILL CAP IS REMOVED. THIS CONNECTION MUST REMAIN IN PLACE UNTIL AFTER THE TANK FILL CAP IS REPLACED. IF YOU DO NOT OBSERVE THIS PROCEDURE, A STATIC SPARK CAUSING A FIRE OR EXPLOSION CAN OCCUR.

(6) Do these steps to add the biocide to the fuel tank:

CAUTION: KEEP ALL LOOSE OBJECTS AWAY FROM THE FILL PORT. REMOVE ANY OBJECTS FROM YOUR SHIRT POCKET (PENS, CIGARETTES, LIGHTERS ETC.) BEFORE YOU OPEN THE FILL CAP. IF AN OBJECT DOES FALL INTO THE FUEL TANK, FIND AND REMOVE THE OBJECT IMMEDIATELY. UNWANTED OBJECTS IN THE FUEL TANK CAN CAUSE DAMAGE TO IN-TANK EQUIPMENT AND ELECTRICAL WIRING.

(a) Open the overwing fill port for the tank No. 1.
(b) Install the funnel in the overwing fill port.
(c) Pour the biocide into the fuel tank.
(d) Install the overwing fill cap.
(e) Remove the equipment used to add biocide to the overwing port.
(f) Repeat these steps for the tank No. 2.

(7) Remove all of the equipment used to add the biocide additive.

I. Distribute the Biocide Treated Fuel to the Center Tank
(1) Plan the distribution of the fuel:
(a) Make sure each tank contains a minimum of 1/3 of the total capacity of the tank.
(b) Make the center of gravity remains within limits.
(c) Maintain an even distribution between opposite tanks.
(2) Transfer fuel to all of the fuel tanks (AMM 28-23-0/201).

J. Put the Airplane Back to the Usual Condition
(1) Disconnect the grounding cable from the airplane to the earth ground (AMM 20-40-11/201).
(2) Remove the leading edge flap locks and retract the leading edge flaps (AMM 27-81-0/201).

WARNING: BE CAREFUL WHEN YOU REMOVE THE LEADING EDGE FLAP LOCKS. THE FLAPS CAN MOVE QUICKLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

K. Biocide Treatment Soak Time
(1) Obey the biocide precautions.
(2) Allow the biocide treatment to soak per the applicable minimum time given in Table 205.

Table 205	
BIOCIDE	SOAK TIME
BIOBOR JF	36 - 72 HOURS
KATHON FP1.5	12 - 24 HOURS

(3) These factors affect how quickly the biocide kills the microbial growth:
(a) The longer the soak time, the better the biocide will work.
(b) Additional soak time may be required for low temperatures.
(c) A low concentration of biocide is not as effective in killing microbial growth.

NOTE: If the concentration of biocide is too low, the microbes can become resistant to the biocide.

(4) During the soak time, do not move the airplane or operate the fuel pumps or APU pumps.

L. Post-Biocide Treatment Maintenance Actions
(1) After the biocide soak time, return the airplane to service.

NOTE: The biocide treated fuel is burned through the engines.

(2) After 10 and before 75 flight hours, replace these filters:

NOTE: If one engine filter shows high levels of particulates, replace the other filters before the next flight.

(a) Engine fuel filter
(b) APU low pressure fuel filter (AMM 49-31-21/301).
(c) APU high pressure fuel filter (AMM 49-31-81/301).
(3) Within 10 days, but after at least five flights, do the microbial growth detection test again.
(4) If the tests show that the biocide treatment was not successful, then do these steps:
(a) Completely fill the fuel tanks with biocide treated fuel.
(b) Use the maximum soak time:
1) Biobor JF - 72 Hours
2) Kathon FP 1.5 - 24 Hours

6. Microbial Growth Removal - Manual Removal Method
   A. General
      (1) There are two methods to remove the microbial growth. If the fuel tank inspection shows that the area that is contaminated is small, then do this task to manually remove the contamination.
      (2) If the fuel tank inspection shows that the contamination area is large or the area is inaccessible (manual removal is not practical), then do this task: Microbial Growth Removal - Pressure Washer Method.
   B. Reference
      (1) AMM 28-10-0/201, Fuel Tanks
      (2) SRM 57-00-00, Wings
   C. Equipment
      (1) Brush - fiber
      (2) Protective outer clothing to prevent skin contact with microbial contamination:
         (a) Fuel and solvent resistant gloves
         (b) Saranex suit
         (c) Neoprene boots
      (3) Respirator - Half face canister style respirators (minimum), U.S. Bureau of Mines Approved or equivalent
   D. Consumables
      (1) B00130 Alcohol - Isopropyl
      (2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   E. Prepare to Remove the Microbial Growth
      (1) Do this procedure after you have completed this task: Microbial Growth Fuel Tank Inspection.
      (2) Prepare the fuel tank for a tank entry (AMM 28-10-0/201).

WARNING: CAREFULLY DO ALL THE SAFETY PROCEDURES TO GO INTO THE FUEL TANKS. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE SAFETY PROCEDURES.

      (3) Make sure the fuel tank has a sufficient flow of air.

WARNING: MAKE SURE THERE IS A GOOD FLOW OF AIR IN THE FUEL TANK WHERE YOU WILL REMOVE THE MICROBIAL GROWTH. A GOOD FLOW OF AIR WILL PREVENT THE BUILD-UP OF ISOPROPYL ALCOHOL VAPOR THAT IS USED TO REMOVE THE MICROBIAL GROWTH. ISOPROPYL ALCOHOL IS FLAMMABLE AND TOXIC.

      (4) Put on this protective gear to prevent contact with microbial growth:

WARNING: WEAR AN APPROVED RESPIRATOR AND PROTECTIVE CLOTHING BEFORE YOU ENTER A FUEL TANK CONTAMINATED WITH MICROBIAL GROWTH. IF YOU BREATHE AIR CONTAMINATED WITH MICROBIAL GROWTH RESIDUE, OR ALLOW THE MICROBIAL GROWTH TO TOUCH YOUR SKIN, IT IS POSSIBLE THAT HEALTH PROBLEMS CAN OCCUR.

(a) Respirator - Half face canister style respirators (minimum)
(b) Fuel and alcohol resistant gloves
(c) Eye protection
(d) Saranex suit
(e) Neoprene boots

F. Remove the Microbial Growth - Manual Method
(1) Go into the fuel tank (AMM 28-10-0/201).
(2) Do these steps to remove the microbial growth:
(a) Use a fiber brush to loosen the contamination.
(b) Apply isopropyl alcohol to a clean cotton wiper (BMS15-5).
(c) Use the minimum quantity of isopropyl alcohol that is necessary.
(d) Use the cotton wiper (BMS15-5) to remove the microbial growth.
(e) Put any used cotton wipers (BMS15-5) in a plastic bag to reduce the isopropyl alcohol vapor in the tank.
(f) Use an air hose or a wire to make sure the flow hole areas are free of unwanted material.
(g) Use an air hose with a nozzle (90 psi maximum) to blow any material from the inlet screen on the water and fuel scavenge pumps.
(3) Do a visual check of the fuel tank structure for corrosion.
(a) If you find corrosion, then repair the damage (SRM 57-00-00).

G. Put the Airplane Back to the Usual Condition
(1) Install any panels or structure that you removed.
(2) Go out of and close the fuel tank (AMM 28-10-0/201).
(3) Do this task: Biocide Treatment of the Fuel Tanks.

7. Microbial Growth Removal - Pressure Washer Method

A. General
(1) There are two methods to remove the microbial growth. If the fuel tank inspection shows that the area that is contaminated is small, then do this task: Microbial Growth Removal - Manual Removal Method.
(2) If the fuel tank inspection shows that the contamination area is large or the area is inaccessible (manual removal is not practical), then use the pressure washer method to remove the contamination.
(3) If you use a pressure washer you must remove all of the in-tank FQIS components and use care not to damage the fuel tank sealant. After you finish the procedure make sure all the water is removed and the tank is completely dried.

B. References
(1) AMM 28-10-0/201, Storage
(2) AMM 28-11-0/701, Integral Fuel Tanks
(3) AMM 28-11-0/801, Integral Fuel Tanks
(4) AMM 28-11-11/401, Wing Fuel Tank Access Panels
(5) AMM 28-11-21/401, Wing Sump Drain Valve
(6) AMM 28-11-31/401, Integral Center Tank Access Panel
(7) AMM 28-11-41/401, Integral Center Tank Sump Drain Assembly and Sump Drain Valve
(8) AMM 28-41-21/401, Fuel Quantity Tank Units and Compensator
(9) AMM 28-41-21/701, Tank Units and Compensator Units
(10) SRM 57-00-00, Wings

C. Consumables
   (1) B00130 Alcohol - Isopropyl
   (2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
D. Equipment
   (1) Gloves - applicable for hot water cleaning
   (2) Protective Clothing - Waterproof pants, boots, jacket with hood
   (3) Pressure Washer - Hot Water - Surface impact requirement (Maximum):
       Temperature: 160°F (70°C)
       Pressure: 100 psi (690 kpa)
       Flow: 3 to 5 gallons (11 to 20 liters) per minute
   (4) Respirator - Full face canister style respirators (minimum), U.S. Bureau of Mines Approved or equivalent
   (5) Source of hot water
   (6) Vacuum cleaner - air powered, wet/dry
E. Hot Water Pressure Washer - Precautions
   (1) The person in the fuel tank must have these items for protection:

       WARNING: OBEY THESE PRECAUTIONS WHEN YOU CLEAN THE FUEL TANK WITH A HOT WATER PRESSURE WASHER. HOT WATER CAN BURN YOU AND HIGH TEMPERATURES IN THE TANK CAN CAUSE HEAT-RELATED HEALTH PROBLEMS. USE THE CORRECT PRESSURE WASHER TECHNIQUE TO PREVENT DAMAGE TO THE FUEL TANK SEALS.

       (a) Heat protective gloves
       (b) Waterproof outer gloves
       (c) Waterproof coat and pants
       (d) Water-proof and heat protective hood
       (e) A full face mask
       (f) Protective gear to protect against breathing or touching microbial growth
       (g) A hot water line that closes automatically when you release it ("deadman" control switch).
   (2) The fuel tank observer must monitor the person in the tank for signs of health problems related to overheating.
   (3) Use air movers to have a good flow of air in the tanks.
   (4) While you clean, continue to move air through the tank.
   (5) Make sure to use the correct pressure washer technique:
       (a) Use a spray of approximately 100 psi maximum at the tank surface.
       (b) Keep the time you point the nozzle at one position to a minimum.
       (c) Move the spray through an area at approximately 6 inches per second.
       (d) Many fast passes are better than one slow pass.
       (e) Do not point the spray at the feathered edge of the seal compound.

           NOTE: This loosens the joint.

(f) If you put heat or water pressure on the sealant for a long time, you can damage the sealant.

F. Prepare the Tank for the Hot Water Pressure Washing

(1) Prepare to go into the fuel tank (AMM 28-10-0/201).

WARNING: CAREFULLY DO ALL THE SAFETY PROCEDURES TO GO INTO THE FUEL TANKS. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE SAFETY PROCEDURES.

(2) Remove the applicable access doors for the fuel tank in the area that you must clean (AMM 28-11-11/401, AMM 28-11-31/401).

(3) Remove the necessary fuel tank equipment and support brackets to get access to the area that you must clean.

(4) Put on this protective gear to prevent contact with microbial growth:

WARNING: WEAR AN APPROVED RESPIRATOR AND PROTECTIVE CLOTHING BEFORE YOU ENTER A FUEL TANK CONTAMINATED WITH MICROBIAL GROWTH. IF YOU BREATHE AIR CONTAMINATED WITH MICROBIAL GROWTH RESIDUE, OR ALLOW THE MICROBIAL GROWTH TO TOUCH YOUR SKIN, IT IS POSSIBLE THAT HEALTH PROBLEMS CAN OCCUR.

(a) Respirator - Half face canister style respirators (minimum)
(b) Fuel resistant gloves
(c) Saranex coveralls
(d) Neoprene boots

(5) Remove these components for the tank(s) to be cleaned:

NOTE: Make a component removal record.

(a) Sump drain valve (AMM 28-11-21/401 or AMM 28-11-41/401).
(b) FQIS tank units and compensators (AMM 28-41-21/401)

(6) Put a protective cover on these fuel system components and attach a REMOVE BEFORE FLIGHT TAG:
(a) Fuel pump inlets
(b) Scavenge and water ejector pump inlets
(c) Scavenge pump inlets
(d) Bypass valve inlets

(7) Clean the tank units and compensator unit (AMM 28-41-21/701).

G. Pressure Wash the Fuel Tank

(1) Put on this protective gear to protect against the hot water pressure spray:

WARNING: OBEY ALL OF THE APPLICABLE PRECAUTIONS WHEN YOU CLEAN THE FUEL TANK WITH PRESSURIZED HOT WATER. INJURIES FROM THE PRESSURIZED HOT WATER OR DAMAGE TO THE FUEL TANK CAN EASILY OCCUR.

(a) Respirator - Full face canister style respirators (minimum)
(b) Heat protective gloves
(c) Waterproof outer gloves

(d) Waterproof pants, coat and boots
(e) Waterproof and heat protective hood
(f) A full face mask.

(2) Use the pressure washer to clean the fuel tank:
(a) Start at the outboard end of the tank.
(b) Hold the nozzle at a distance between 6 and 10 inches (150-250 mm) from the tank surface.
(c) Position the nozzle at a 45 degree angle to the tank surface.
(d) Point the nozzle in the direction of the access opening and the drain valve opening.
(e) Continue to clean in the direction of the drain valve opening and the access opening.
(f) Only use enough spray to remove the microbial growth.
(g) Use short bursts, not a continuous flow.
(h) Move the loose microbial growth and any unwanted material to the inboard end of the tank and out of the openings.
(i) Complete the pressure washing of the fuel tank.

(3) After you pressure wash the fuel tank, do these steps:

CAUTION: MAKE SURE YOU REMOVE ALL OF THE WASTE PARTICLES CAUSED BY THE FUEL TANK CLEANING. THE UNWANTED MATERIAL CAN CAUSE A BLOCKAGE OF THE EJECTOR AND SCAVENGE PUMPS AND STOP THE OPERATION OF THESE SYSTEMS.

(a) Use an air hose with a nozzle (90 psi maximum) to blow any material from the inlet screen on the water and fuel scavenge pumps.
(b) Use an air hose or a wire to make sure the flow hole areas are free of loosened microbial growth or unwanted material.
(c) For the outboard main tanks, make sure that the drain hole in the midspar web is clear.

(4) Repeat these steps to pressure wash the remaining tanks as necessary.

H. Restore the Fuel Tank

(1) Remove the water from the fuel tank:
(a) Continue to have a good flow of air until the tank is dry.
(b) Use an air-powered vacuum cleaner to remove the water.
(c) Mop-up any water that remains with a cotton wiper (BMS15-5).
(d) Continue to move air through the fuel tanks until all moisture is removed.

(2) Do a check of the fuel tank for damage:
(a) Do a visual check of the fuel tank structure for corrosion.
1) If you find corrosion, then repair the damage (SRM 57-00-00).
(b) Do a visual check for missing or damaged fuel tank sealant.
1) If there is damage, repair the sealant (AMM 28-11-0/801).
(c) Do a visual check for missing or loose fuel tank protective finish (topcoat).
1) If there is loose finish, do this task: Application of Corrosion Resistant Finish (AMM 28-11-0/701).

I. Put the Airplane Back to Its Usual Condition
   (1) Remove the fuel tank cleaning equipment and material.
   (2) Install these components:
      (a) Sump drain valve (AMM 28-11-21/401 or AMM 28-11-41/401).
      (b) FQIS Tank Units and Compensators (AMM 28-41-21/401)
   (3) Install the support brackets and the fuel tank equipment that you removed.
   (4) Remove the protective covers from these fuel system components:
      (a) Fuel pump inlets
      (b) Bypass valve inlets

J. Put the Airplane Back to the Usual Condition
   (1) Install any panels or tank structure removed for access.
   (2) Go out of and close the fuel tank (AMM 28-10-0/201).
   (3) Make sure there is no fuel leakage (AMM 28-11-0/801).
   (4) Do this task: Fuel Transfer to Remove Air Pockets from the Engine Fuel Feed Line Adjacent to the Defueling Valve (AMM 28-23-0/201).

      WARNING: DO THE FUEL TRANSFER PROCEDURE TO REMOVE AIR POCKETS. AIR POCKETS CAN CAUSE THE ENGINE TO STOP IN FLIGHT.

   (5) Do this task: Biocide Treatment of the Fuel Tanks.

INTEGRAL FUEL TANKS - INSPECTION/CHECK

1. General
   A. This procedure contains these tasks:
      (1) Fuel System Helitest Leak Detection
      (2) External Wires Over the Center Tank Inspection
2. Fuel System Helitest Leak Detection
   A. General
      (1) A leak detection system using helium as a tracer gas provides easier detection than more traditional methods.
      (2) Helium is a non-toxic, inert gas which does not react chemically with any other element, making it safe. Due to its small molecular mass, helium penetrates the smallest gaps. It is readily detectable due to a low concentration in the atmosphere.
      (3) Pressurized helium around a leak point is forced back up the leak channel precisely and quickly locating the leak source.
   B. Equipment and Materials
      (1) Consumables
         (a) B01002 Solvent, General Cleaning of Solvent Resistant Organic Coatings - Series 82 (AMM 20-30-82/201)
         (b) G50004 Tape, Vacuum - SMS126 or SMS127
         (c) G00252 Material, Plastic Sheet (polyethylene) -L-P-512
         (d) G02329 Tape, High-Speed -3M #434
         (e) Airplane Structure Cleaning Solvents (Series 82), AMM 20-30-82/201
         (f) Fuel Tank Maintenance, AMM 28-11-0/201
         (g) Fuel Tank Approved Repairs, AMM 28-11-0/801
         (h) Defueling Maintenance Practices, AMM 28-23-0/201
      (2) Equipment
         (a) Helitest Wing Kit - Varian Vacuum Products, Inc., 121 Hartwell Ave., Lexington, MA 02173, Phone 1-800-882-7426 (USA only)
         (b) Helium - Compressed, Industrial Grade, Standard Cylinder
         (c) Regulator - Pressure and Gage for Helium Cylinder
         (d) Ventilation Equipment - Positive and Negative (to control and evacuate helium)
         (e) Source - Compressed Air (to blow dry areas)
   C. Procedure
      (1) Do the following steps to find external leaks and to make a map of them:

         NOTE: A precise map of the leak(s) must be made for this procedure.

         (a) Clean the external wing surface around the leak area.
         (b) Use solvent to remove grease from the area.
         (c) Dry the area.
         (d) Apply a mapping agent to the area.
            1) Use talcum powder or a similar powder for a mapping agent.
         (e) For running leaks, do the following steps:
            1) Find the leak origin.

2) Stop the fuel flow with mastic or tape to ensure there are no other fuel flow paths.

(f) When the leak is found, remove the seat from the leak site and find the leak origin precisely within the seal.

(2) Defuel the leaking tank. Refer to Fuel Tank Defueling and/or Tank-to-Tank Fuel Transfer (AMM 28-23-0/201).

(3) Prepare the leaking tank for purging and entry (AMM 28-10-0/201).

(4) Apply compressed air to the external leak point to force back the fuel faster and to dry the area.

(5) Completely clean and dry the external leak point with solvent to attain the best tape adhesion.

NOTE: This step is important for successful leak detection.

(6) Do one of the following steps:

(a) Build a custom compression chamber around the external leak point with a plastic film.

(b) If it is possible, install one of the pressure cups supplied in the Helitest Wing Kit to contain the helium pressure on the outer tank surface.

(7) Install tape (SM5126 or SM5127) around the leak area or the pressure cup.

(8) If building a custom chamber, do the following steps:

(a) Cut a piece of material, L-P-512, to the size of the chamber formed by the tape, SM5126 or SM5127.

(b) Set the plastic over the vacuum tape.

(c) Work the plastic to make sure it sticks well to the vacuum tape.

(d) Make sure the chamber is as small as possible.

NOTE: A small chamber can contain more helium pressure than a larger one.

(e) Trim the plastic with a razor knife following the outline of the vacuum tape.

(9) Do the following steps to connect the helium supply to the custom chamber:

(a) Wrap the helium injection tube with vacuum tape to form a 2-inch diameter flange 1 to 2 inches from the end of the tube.

(b) Slice a small hole in the plastic chamber and put the helium tube in the hole.

(c) Work the vacuum tape flange on the injection tube so it sticks well and seals the plastic chamber.

(10) If using a pressure cup, attach the helium injection tube to the cup with the fittings supplied in the kit.

(11) Apply tape, 3M #434 or equivalent, over the plastic chamber or pressure cup and work it well for the best adhesion.
(a) Use a sufficiently large quantity of tape, 3M #434, to reinforce the plastic helium chamber so it can handle more pressure.
(12) Set up the Helitest Wing Kit and purge the lines with helium to remove air.

NOTE: Refer to the instructions supplied with the kit.

(13) Carefully and slowly apply about 0.2 psig helium pressure to the chamber.

NOTE: Start with low pressure and then slowly increase the pressure. Less helium is necessary for larger leaks than for smaller leaks. Too much helium will flood the fuel tank. Inspect the chamber of rubber cub to make sure there is no leakage. If it leaks too much, rebuild the chamber because the helium can interfere with the detector.

(14) Put negative ventilation around the helium chamber to draw away leaking helium to make sure it does not interfere with the detector by drifting into the tank.

NOTE: This step is important for successful leak detection. Use positive pressure if negative pressure is not available, but make sure the helium is removed from the area and does not go into the tank where the detector probe is used.

(15) Permit the helium to soak into the leak path into the leak path for 10-15 minutes before tank entry.

WARNING: KEEP THE DETECTOR AND THE PUMP AWAY FROM THE TANK. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

NOTE: Time is necessary to push the remaining fuel out of the tank path and start the flow of helium from the external leak point to the internal leak point.

(16) The Helitest detector and the auxiliary pump must be kept away from the open fuel tank at all times.
(17) Enter the tank with the Helitest Visual Probe (intrinsically safe for Class I, Div I areas).

(18) Slowly interrogate the inside of the tank around the expected area of the leak.

CAUTION: DO NOT PUT THE PROBE INTO FUEL PUDDLES. IT CAN CAUSE DAMAGE TO THE INSTRUMENT.

NOTE: Patience is important. With a systematic approach, slowly move away from the suspected leak area until the exact leak location is found.

(19) If there is a puddle of fuel in the suspected leak area, use compressed air to dry the area.
(a) Build rag dams to soak up additional running fuel.
(b) Completely dry hidden areas.
(c) If fuel is drawn into the Helitest probe, immediately remove the probe to a safe area and permit the probe to operate until all the fuel is vaporized.
1) Disconnect the visual probe gas line and permit it to run dry also.
2) Replace the wet filter on the visual probe tip with a dry filter.
3) Do not shut the Helitest off while contaminated with fuel because permanent damage can occur.

(20) If the leak is not found, increase the helium pressure to 0.6 psig, and then 1.2 psig.
(a) Continue to increase the helium pressure in similar increments until the leak is found.

NOTE: The compression chamber can hold 2 to 5 psig maximum. The maximum pressure depends on the size of the chamber. A smaller chamber can hold a larger pressure.

(21) When the leak is found, repair it with the applicable repair procedure (AMM 28-11-00/801).

(22) After the leak repair, perform another test with the Helitest equipment before removing the helium chamber from the outside of the tank.

NOTE: This procedure makes sure the leak was repaired correctly.

(23) Do the following steps to put the repaired area back to its usual condition:
(a) Remove the pressure chamber or pressure cup and the tape.
(b) Clean the area around the leak with solvent, Series 82 (AMM 20-30-82/201).

(24) Do this same procedure with the Helitest equipment for other leaks.

3. External Wires Over the Center Tank Inspection

A. General

(1) ALI - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on airworthiness limitation instructions (ALIs).

B. References

(1) AMM 24-22-0/201, Manual Control

(2) AMM 53-21-0/401, Passenger Cabin Floors

C. Prepare for the Inspection

(1) Remove electrical power from the airplane (AMM 24-22-0/201).

(2) Disconnect the battery connector from the battery.

(3) To get access to the top of the center tank from Station 540 to Station 664, do these steps:

(a) Remove the seats.

(b) If applicable, remove the class partitions.

(c) Remove the carpets.

(d) If applicable, remove the floor proximity lighting.

(e) Remove the passenger cabin floor panels (AMM 53-21-0/401).

D. External Wires Over the Center Tank Inspection

(1) Do a detailed inspection of the wire bundles routed on the main deck over the center tank and under the floor beams between Station 540 and Station 664.

(a) Look for these items:

1) Damaged clamps,

2) Wire chafing,

3) Wire bundles that are in contact with the surface of the center tank.

(b) If you find any of these discrepencies, repair per the Standard Wiring Practices Manual D6-54446 (SWPM 20-10-11).

E. Put the Airplane Back to Its Usual Condition

(1) Install the passenger cabin floors panels (AMM 53-21-0/401).

(2) If applicable, install the floor proximity lighting.

(3) Install the carpets.

(4) If applicable, install the class partitions.

(5) Install the seats.

(6) Connect the battery connector to the battery.

(7) Supply electrical power if it is necessary (AMM 24-22-0/201).

INTEGRAL FUEL TANKS - CLEANING/PAINTING

1. General
   A. This section contains information on the following subjects:
      (1) Integral fuel tank cleaning, fungus and corrosion removal.
      (2) Application of corrosion resistant finish.

      NOTE: The application of corrosion resistant material over repaired integral fuel tank sealant material is covered in AMM 28-11-00/801.

2. Integral Fuel Tank Cleaning, Fungus and Corrosion Removal
   A. General
      (1) Integral fuel tanks may become corroded by fungus growth, present in hydrocarbon fuels, becoming attached to lower surfaces of tanks. Fungus may be manually removed from tank surfaces by entering tank and or removed with a pressure washer (AMM 28-11-00/201). The use of a pressure washer helps remove fuel fumes and find loose or deteriorated topcoat by causing poorly bonded topcoat to peel or blister.
      (2) While tanks are still wet, presence of fungus is evident as a black sludge or slimy material. When tanks are dry, presence of fungus is evident as solid deposits on tank surfaces. These deposits may turn light brown when dry. If fungus is present, it is usually limited to lower panel of the wing and areas immediately adjacent to lower panel where water accumulates. In addition, fungus growth may contribute to corrosion of structure. If corrosion is found, refer to Structural Repair Manual, Chapter 51, General Repair Procedures.
   B. Equipment and Materials
      (1) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
      (2) Steam Nozzle - Trigger T-Jet, Spraying Systems Co., Bellwood, Illinois

      NOTE: It is recommended teflon bushing supplied with this nozzle be replaced with a locally fabricated brass bushing. Nozzle is designed to have a source of saturated steam and a source of cold water attached; each supply to be adjusted by a set of valves to maintain a working spray of approximately 100 psi, with a temperature not to exceed 150°F, 6 inches from nozzle end.

(3) Full face supplied air type respirator, U.S. Bureau of Mines Approved

C. Clean the Integral Fuel Tank

(1) Defuel and purge the applicable fuel tank (AMM 28-23-0/201, AMM 28-10-0/201).

(2) Remove the fuel sump drain valve (AMM 28-11-21/401).

(3) Remove the wing access panels (AMM 28-11-11/401, AMM 28-11-31/401, as applicable).

(4) Remove interfering fuel tank equipment, support brackets, and substructure as necessary to improve accessibility.

(5) Do the task: Microbial Growth Removal - Pressure Washer Method (AMM 28-11-00/201).

(6) Make sure the tank is free of all loosened fungus.

(7) Mop up all residual water.

(8) Ventilate with air movers until tank is dry (approximately 3 hours). Use same equipment as for purging ventilation (AMM 28-10-0/201).

(9) Check all fuel tank surfaces for corrosion and remove it if found.

(a) Light surface corrosion can be removed by rubbing surface with fine abrasive paper or a cotton wiper (BMS15-5).

(b) If corrosion cannot be fully removed by abrasive paper or cotton wipers (BMS15-5), use a mechanical removal method such as dry abrasive blasting with glass beads to remove corrosion - caused below surface pits (Ref Structural Repair Manual, Chapter 51, General Repair Procedures).

CAUTION: USE STRUCTURAL REPAIR MANUAL TO ASSESS POSSIBLE STRUCTURAL WEAKENING DUE TO PENETRATION OF CORROSION AND REPAIR STRUCTURE AS NECESSARY.

(10) Examine the fuel tank for sealant damage and repair as necessary (AMM 28-11-0/801).

(11) Examine the fuel tank for damage to the corrosion resistant finish and repair as necessary per the "Application of Corrosion Resistant Finish" task.

D. Put the Airplane Back to Its Usual Position

(1) Remove all foreign material, tools, solvent containers, cotton wipers (BMS15-5) and brushes remaining in tank from cleaning and repair operations.

(2) Install all substructure, support brackets, and fuel tank equipment which was removed.
(3) Install the fuel sump drain valve (AMM 28-11-2/401).
(4) Install the fuel tank access panels (AMM 28-11-11/401, AMM 28-11-31/401, as applicable).

3. Application of Corrosion Resistant Finish

4. Application of Corrosion Resistant Finish (Topcoat)

A. Corrosion resistant finish or topcoat is applied as a protective coating to fuel tank internal structural surfaces, especially bottom and lower sides of tank.

B. Corrosion resistant finish is applied as a protective coating to fuel tank internal structural surfaces, especially bottom and lower sides of tank.

(1) BMS 10-20 type II and MIL-C-27725 are two kinds of corrosion resistant material which are approved for internal fuel tank use. An advantage of BMS 10-20 type II finish material is that additional BMS 5-45 sealant repairs may be made, if necessary, after application of the finish material provided it is fully cured by heat per Fig. 703 before the sealant is applied. The MIL-C-27725 and non-heat cured BMS 10-20 material can only be used as a topcoat after any sealant installation is complete.
(2) After corrosion removal, a zinc rich protective coating is preferred in addition to the BMS 10-20 coating. The complete zinc rich coating includes a primer coat of heat cured BMS 10-20 (Fig. 702, using only CURE TIME PRIOR TO SEALING), a coat of zinc rich epoxy primer and a topcoat of BMS 10-20. For local touch up and general refinishing, the primer coat of BMS 10-20 may be omitted.

C. Equipment and Material

(1) Tape, Pressure Sensitive - 3M No. 250, 1-inch width, Minnesota Mining and Mfg. Co.
(2) Scrapers-(for removal of loose paint) wood or plastic
(3) Abrasive paper - 100 to 400 grit aluminum oxide, wet or dry
(4) Abrasive discs - 100 to 400 grit, 3M Scotchbrite, Minnesota Mining and Mfg. Co.
(5) Abrasive pad (Ref 20-30-51)
    (a) Aluminum oxide abrasive - Scotch Brite Sheet, TYPE A.
    (b) Aluminum oxide nylon pad, TYPE F.
    (c) Aluminum oxide - Bear-Tex
    (d) Aluminum oxide - Microlon

(6) Cleaning Solvent (Ref 20-30-31)
  (a) B01013 Cleaning Solvent, Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)

  WARNING: DO NOT GET SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEET (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(7) Explosionproof air blower, with sufficient flexible hose to reach all areas in the fuel tanks. The capacity must be 90-100 cubic feet per minute (Rhine Air, Inc., 10744 Prospect Avenue, Suite A, Santee, CA 92071)
(8) Explosionproof centrifugal exhaust fan with 125-150 cubic feet per minute capacity and approximately 75 feet of 3-inch diameter flexible suction hose plus sufficient delivery hose to carry exhausted air outside hangar or work area (Rhine Air, Inc., 10744 Prospect Avenue, Suite A, Santee, CA 92071)

WARNING: MAKE SURE THE CAPACITY OF THE EXHAUST FAN IS MORE THAN THE CAPACITY OF THE AIR BLOWER. THIS WILL MAKE SURE THERE IS A GOOD FLOW OF AIR. THE CORROSION RESISTANT FINISH IS A POISONOUS AND FLAMMABLE COMPOUND WHICH CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(9) Full face supplied air type respirator, U.S. Bureau of Mines approved
(10) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
(11) Neoprene or rubber gloves
(12) Alodine application equipment
  (a) Alodine 600 powder - MIL-C-5541 (SRM 51-10-2)
  (b) Distilled water - 1 gallon containers
  (c) Stainless steel container
  (d) Brush, swab, sprayer, blotting paper or cotton wipers (BMS15-5) for application
(13) Corrosion resistant finish for integral fuel tanks
  (a) BMS 10-20, Type II (preferred) (Ref 20-30-41)

  NOTE: BMS 10-20, Type II is mutually compatible with preferred fuel tank sealant BMS 5-45

1) 454-4-1, Bostik West
(b) MIL-C-27725 (Ref 20-30-41)

CAUTION: USE MIL-C-27725 FINISH MATERIAL ONLY AS A TOPCOAT.

1) 823-011 or 823-730, DeSoto Chemical Coatings, Inc.
2) PR-1560M, PR-1560MC, PR-1560MK, Products Research Co.
(c) Zinc rich epoxy primer
1) base, 463-6-28, Bostik
2) catalyst, X-344, Bostik
3) thinner, TL-52, Bostik
(14) Vacuum cleaner, industrial type, pneumatically powered, with attachments for cleaning fuel tank interior (ATI Industries, 2425 West Vineyard Ave., Escondido, CA 92029)
(15) Volume measuring containers, with graduations for volume measurement of finish material and curing agents
(16) Balance scale with set of graduated weights accurate to ± 0.4 ounce or ± 10 grams, for weight measurement of finish material and curing agents
(17) Cans with lids - For temporary storage of mixed finish material
(18) Labels - For identifying mixed batches of finish material placed in item (15) cans
(19) Spatulas - For mixing small batches of finish material
(20) Shaker - Red Devil multidirectional
(21) Masking tape
(22) Paint brushes - If used for finish application
(23) Spray Equipment - DeVilbiss Model MBC or JGA, The DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio (Recommended for large area application of corrosion resistant finish).

D. Prepare for Application of Corrosion Resistant Finish
(1) Defuel and purge the applicable tank (AMM 28-23-0/201, AMM 28-10-0/201).

WARNING: OBEY ALL PRECAUTIONS FOR PURGING AND FUEL TANK ENTRY.

(2) Remove the fuel tank access panels to get access to the fuel tank AMM 28-11-11/401, AMM 28-11-31/401, as applicable).
(3) Set up air blower and flexible hose to ventilate work area inside wing. Use exhaust fan and hoses to convey exhaust air from wing to unoccupied space outside work area or hangar. Connect hoses and nozzles to electrical ground.

WARNING: PROVIDE ELECTRICAL GROUND FOR VENTILATION EQUIPMENT IN OR NEAR OPEN FUEL TANK OR SPARK MAY SET OFF FIRE OR EXPLOSION.

(4) Examine internal tank surfaces for evidence of fungus (mildew) and corrosion. If found, clean tank thoroughly (Ref par. 2., this section).

NOTE: A slimy, black coating on tank inner surfaces, soon after defueling, indicates fungus contamination. After continued drying, coating becomes solid and may turn a light brown color.

(5) Remove all loose finish by scraping with wood or plastic scrapers and sanding with abrasive pad, aluminum oxide abrasive paper or abrasive discs. Remove any sealant as necessary to allow loose paint removal.
   (a) Using pressure sensitive tape, check surfaces adjacent to loose finish areas for loose finish. Also check any other questionable areas with tape.
      1) Apply a strip of pressure sensitive tape to test surface. Press tape down uniformly and firmly.
      2) Yank the tape off surface in one abrupt motion perpendicular to surface.
      3) Examine surface and tape for any evidence of finish removal or blistering. If found, remove all affected finish per par. (5) above.
(6) Abrade all finished areas, which are to be recoated, with wet abrasive paper, 400 grit. Feather any adjacent painted areas using wet abrasive paper, 400 grit.
(7) Wipe surfaces clean of all residue using cotton wipers (BMS15-5) soaked in cleaning solvent. Wipe dry with other (dry) cotton wipers (BMS15-5).
(8) Vacuum clean tank to remove flakes of old finish, pieces of old sealant, lint and miscellaneous foreign matter.
(9) If alodine metal surface treatment has been worn off or damaged, the metal surface must be realodized before new finish material is applied.

CAUTION: USE ONLY ALODINE 600 TO REPAIR ALUMINUM WING SURFACES. PRIMER ADHESION PROBLEMS CAN OCCUR IF OTHER ALODINE SOLUTIONS ARE USED.

   (a) Apply an alodine layer to the surface with Alodine 600 (SRM 51-10-2).
(10) If sealing is required due to finish removal, par. 3.C.(5), reapply sealant as necessary (Ref 28-11-0 AR).
(11) Ensure that all finish application equipment and fuel tank surfaces to be coated are perfectly clean. If in doubt, clean equipment in MEK solvent and clean tank surfaces with BMS 11-7 or Series 93 solvent immediately prior to finish application.

(12) Check to ensure that storage life of unmixed corrosion resistant compounds has not expired and that sufficient finish material is available to complete the application.

(a) Storage life of BMS 10-20, Type II is 12 months at 40 to 90°F (4.4 to 32.2°C) from date of manufacture.

(b) Storage life of MIL-C-27725 corrosion preventive coatings.

1) Storage life of DeSoto 823-011 or 823-730 is 12 months at 50 to 90°F (10.0 to 32.2°C) from date of manufacture.

2) Storage life of Products Research Co. PR-1560M, PR-1560MC, PR-1560MK is 6 months at 50 to 90°F (10.0 to 32.2°C) from date of manufacture.

(c) Mask, as necessary, any non-structural fuel tank equipment areas which are in, or adjacent to, the area which is to receive the finish application.

CAUTION: REMOVE ALL MASKING TAPE AFTER FINISH APPLICATION IS COMPLETED OR FUEL FEED BOOST PUMP SUCTION INLETS MAY BECOME CLOGGED.

NOTE: Corrosion resistant finish must not be used on electrical bonding surfaces, clamps, O-ring surfaces, valves, measuring sticks, tank and compensator units, wiring, boost pumps, filler caps, or other nonstructural equipment.

(13) Ensure that finish application temperature will be maintained at 50-100°F (10.0-37.8°C) with less than 85 percent relative humidity throughout the application process (brush or spray).

E. Apply Corrosion Resistant Finish

WARNING: THE AREA IN WHICH CORROSION RESISTANT FINISH IS APPLIED SHOULD BE WELL VENTILATED. DO NOT GET IN EYES OR ON SKIN. WASH HANDS BEFORE EATING. KEEP AWAY FROM IGNITION SOURCES.

(1) Using respirators, mix corrosion resistant finish compounds.

WARNING: SOME OF THE MATERIALS USED IN MIXING BMS 10-20 TYPE II OR MIL-C-27725 FINISH COMPOUNDS ARE TOXIC, FLAMMABLE, AND OTHERWISE HAZARDOUS. ALL MIXING MUST BE DONE IN VENTILATED AREAS BY QUALIFIED PERSONNEL WEARING RESPIRATORS. PERSONS NOT WEARING RESPIRATORS MUST LEAVE THE AREA.

(a) Condition unmixed materials to 60 to 90°F (15.6 to 32.2°C) prior to mixing.

(b) Agitate base component for 10 minutes in shaker.
(c) Measure out proportionate volumes of base and catalyst, plus reducer or thinner if spray application is desired, as specified (Fig. 701).
1) For zinc rich epoxy primer, use 7 parts base (Bostik 463-6-28) to 1 part catalyst (Bostik X-344). Thinner may be used (Bostik Thinner TL-52) up to 1 part max.
(d) Thoroughly mix the zinc rich base inertial to assure that the zinc particles are in suspension.
(e) Brush, swab, sprayer, blotting paper or cotton wipers (BMS15-5) for application
(2) Wipe surfaces clean of all residue using cotton wipers (BMS15-5) soaked in cleaning solvent. Wipe dry with other (dry) cotton wipers (BMS15-5).

MANUFACTURER	COMPONENT	METHOD OF APPLICATION				
		SPRAY			BRUSH	
		MFGR DESIGNATION	PARTS BY VOLUME	VISCOSITY ZAHN NO. 1 77 ±2°F	MFGR DESIGNATION	PARTS BY VOLUME
Bostik West (BMS 10-20 Type II)	Base Catalyst Reducer	454-4-1 CA-109 TL-52	3 1 approx 1	31-40 seconds	454-4-1 CA-109	3 1
DeSoto (MIL-C-27725)	Base Activator Reducer	823-011 910-099 020-037	4 1 approx 4	31-40 seconds	823-011 910-099 020-037	4 1 0-4
	Base Activator Reducer	823-730 910-702 020-707	4 1 approx 4	31-40 seconds	823-730 910-702 020-707	4 1 0-4
Products Research (MIL-C-27725)	--- ---	Part A Part B	1 2	31-40 seconds	Part A Part B	1 2

(a) Mix base and catalyst, plus reducer as needed. Allow 1 hour induction time (30 minutes for zinc rich primer) prior to application. Maximum pot life is 8 hours at 75 ±5°F (23.9 ±2.8°C) for BMS 10-20 and MIL-C-27725, and 6 hours for zinc rich primer.

(b) Immediately after mixing, mark container with date and hour of mixing and date and hour pot life expires.

NOTE: Keep containers of mixed corrosion resistant finish compound tightly closed while waiting for application, or contents will gradually thicken and gel.

(3) Apply finish.
(a) By brush (suitable for small areas).
1) Apply thin film (approximately 0.0005 inch) with soft bristle paint brush, brush in one direction as much as practicable.
a) Avoid fast scrubbing motions or repeated brushing out of wet compound which may produce air bubbles, pickups, or voids.
2) Allow to dry for a minimum of 30 minutes.
3) Apply second thin film in same manner as first coat.
4) Ensure that applied finish overlaps any adjacent topcoating previously applied.
a) Saturate a cotton wiper (BMS15-5) with JP-4 as applicable.
b) Apply the cotton wiper (BMS15-5) to surface to be checked and allow solvent or fuel to flood area.
(b) By spray (recommended for large areas).
1) Set spray gun to 40 psi air pressure and 5 to 10 psi fluid pressure.
2) Spray finish material on entire surface to be coated in a wet, continuous film.
3) Allow to dry for a minimum of 30 minutes.
4) Apply second coat in same manner as first coat.
5) Ensure that applied finish overlaps any adjacent topcoating previously applied.
(4) Apply zinc rich epoxy primer.
(a) Apply primer by spray or brush (Ref par. (2)).

NOTE: Zinc rich primer must be stirred almost continually during application to prevent zinc settling.

1) Apply 1.5 to 2.0 mils (dry film thickness) to lower surface and to a height sufficient to cover all exposed surfaces of lower stringers.
2) Do not apply to the seal surfaces at tank openings or to O-ring seals.

(b) Allow zinc rich primer to cure not less than 1 hour before entering tank.

(c) Within 8 hours overcoat zinc rich primer with 0.0006 to 0.0016 inch thick BMS 10-20.

(5) Cleanup after corrosion resistant finish application.

(a) Clean equipment with MEK immediately after use.

(b) Soak brushes in MEK immediately after use. Discard brushes when bristles become stiff.

WARNING: SUPPLY PLENTY OF VENTILATION WHEN USING METHYL ETHYL KETONE (MEK), AS THIS SOLVENT IS HIGHLY TOXIC.

(6) Cure corrosion resistant finish

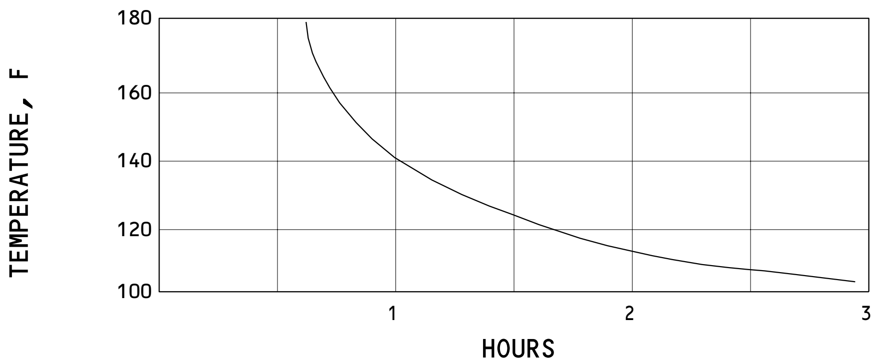
(a) Cure BMS 10-20 and MIL-C-27725 finish coatings per Fig. 702
1) Cure time can be shortened by using elevated temperatures and, with some finish compounds, by increasing relative humidity (R.H.) (Fig. 703 thru 706).

(b) If zinc rich coating is applied, cure for a minimum of 12 hours at 65°F or above prior to fuel exposure.

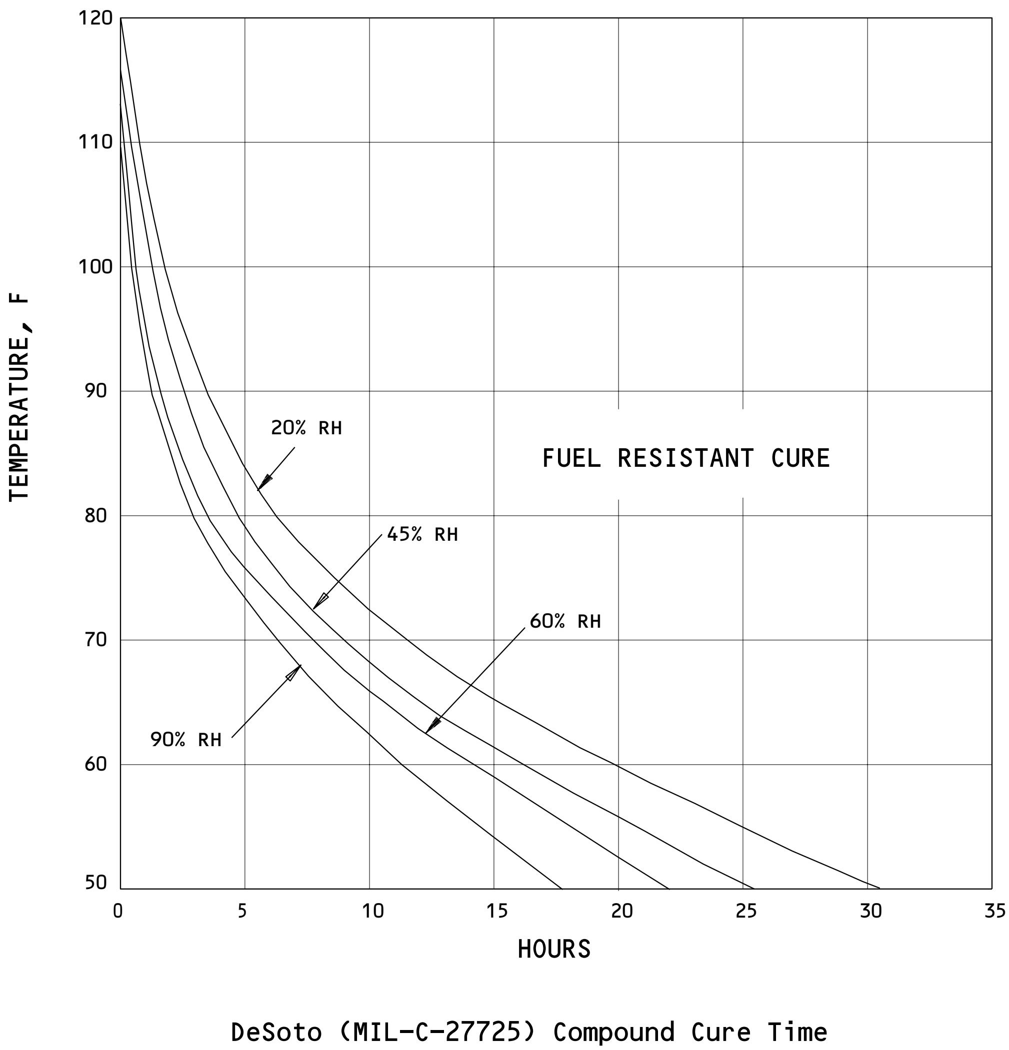
(c) Perform the following fuel or solvent resistance check to verify cure completion.
1) JP-4 fuel resistance test.
a) Saturate a cotton wiper (BMS15-5) with JP-4 as applicable.
b) Apply the cotton wiper (BMS15-5) to surface to be checked and allow solvent or fuel to flood area.
c) Using hard pressure rub the area 100 strokes, counting each movement in one direction as a stroke.
d) Observe whether coating is removed so that metal is exposed (unsatisfactory). If metal is not exposed, cure is satisfactory.

CORRESION RESISTANT FINISH (BY MFGR)	CURE TIME PRIOR TO FUEL EXPOSURE *[1]	CURE TIME PRIOR TO TRAFFIC	CURE TIME PRIOR TO ASSEMBLY *[1]	CURE TIME PRIOR TO SEALING
Bostik West (BMS 10-20 Type II)	12 hours at 65°F or above or Fig. 703 *[2]	12 hours at 65°F or above or Fig. 703 *[2]	12 hours at 65°F or above or Fig. 703 *[2]	Fig. 703 *[2]
DeSoto (MIL-C-27725)	Fig. 701 *[2]	24 hours at 65°F or above	Fig. 705 or 240 hours at 65°F or above *[2]	Not Applicable
Products Research (MIL-C-27725)	Fig. 702	24 hours at 65°F or above	240 hours at 75°F and min of 30% relative humidity	Not Applicable

*[1] Verify cure completion by performing fuel resistance check (Ref Par. 3.D.(5)(c)).
*[2] Allow at least 30 minutes drying at application temperature prior to curing at higher temperatures.



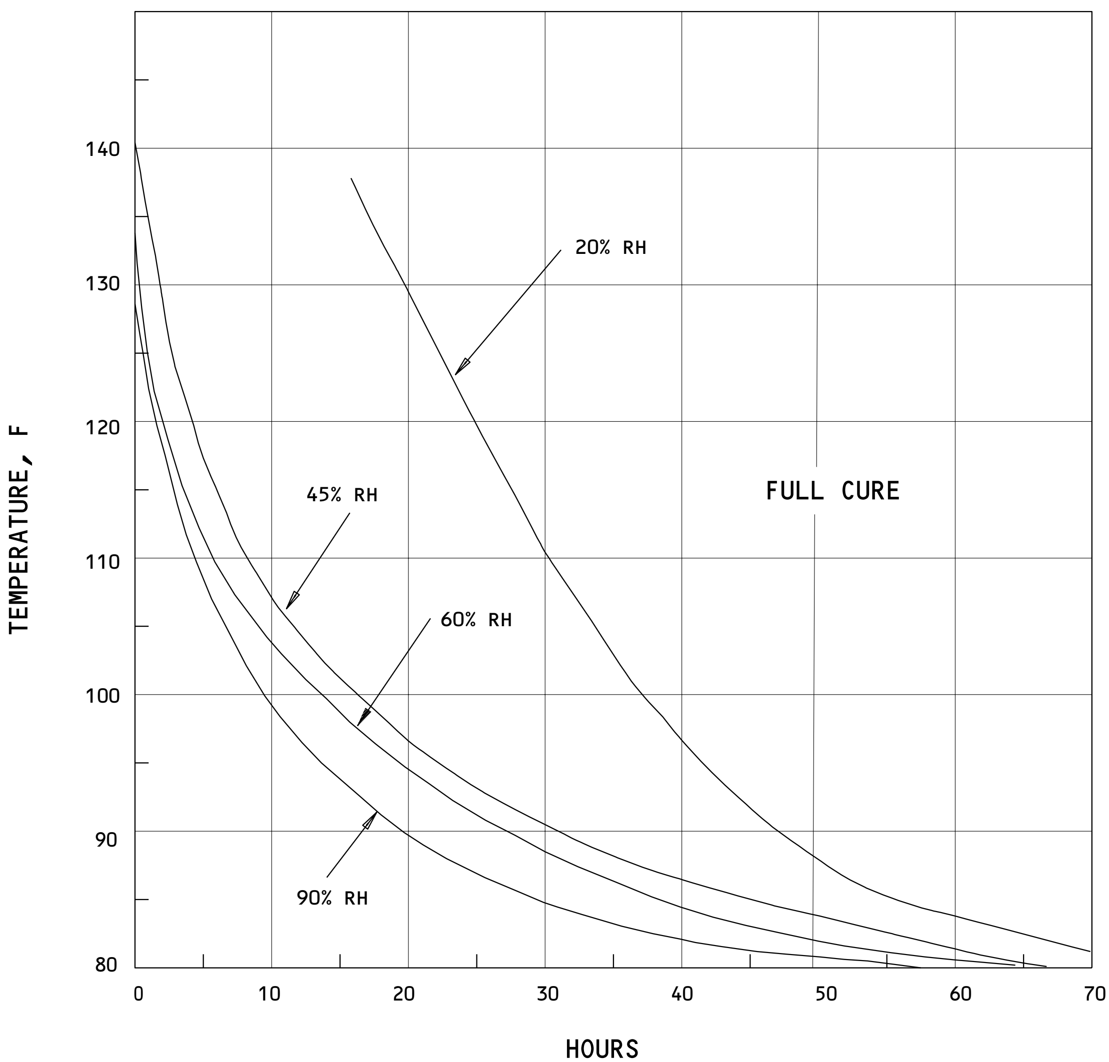
Bostik West (BMS 10-20 Type II) Compound
Cure Time as Affected by Temperature
Figure 703



DeSoto (MIL-C-27725) Compound Cure Time
Figure 701 (Sheet 1)

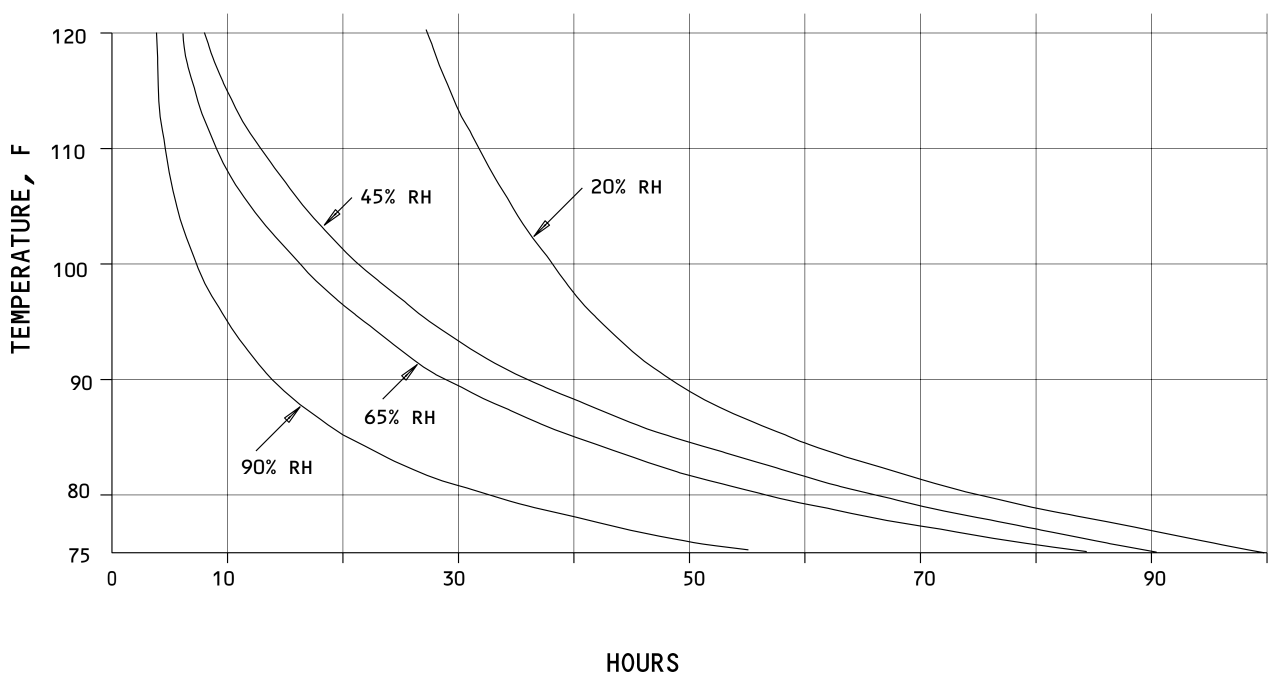
E. Return Airplane to Normal

(1) Check to ensure that all masking tape has been removed from fuel tank and tank equipment.
(2) Replace any substructure, support brackets, and fuel tank equipment removed to improve accessibility.
(3) Check to ensure that all tools, rags, air movers, hoses, and other equipment is removed from fuel tank.
(4) Install fuel tank access panels (Ref 28-11-11, 28-11-31, Removal/Installation, as applicable).



DeSoto (MIL-C-27725) Compound Cure Time
Figure 701 (Sheet 2)

% REL HUMIDITY	TEMP. °F	
	65	70
20	392	228
45	376	212
65	344	184
90	240	124



Products Research (MIL-C-27725) Compound Cure Time
Figure 702

INTEGRAL FUEL TANKS - APPROVED REPAIRS

1. General
   A. This section contains information on the following subjects:
      (1) Causes of leaks
      (2) Leak evaluation and repair requirements
      (3) Repair of sealant leaks in tank structure
      (4) Non sealant leaks approved repairs
      (5) Examination and closure of repaired fuel tanks
      (6) Fueling repaired integral fuel tanks
      (7) Secondary fuel barrier sealant approved repairs
   B. These procedures include the preparation, handling and curing of sealant and finish materials, and the application of corrosion resistant finishes in the tank interior. The sealant and preferred finish materials listed for use in this section are mutually compatible, i.e., the fully cured corrosion resistant finish may be used as a primer coating, prior to application of the sealant, or it can be used as a top coat to be sprayed or brushed over the sealant. Previously applied top coatings should be stripped down to bare metal in sealant repair area unless old coating is known to be compatible with new sealant.

      CAUTION: DO NOT APPLY SEALANT OVER EXISTING TANK SURFACE FINISH UNLESS COMPATIBILITY IS KNOWN.

   C. For repair of corrosion resistant finish where sealant repair is not required, refer to 28-11-0, integral fuel tanks CP.
2. Cause of Leaks
   A. Most leaks in integral tank structure can usually be traced to one or more of the following:
      (1) Improper Preparation of Surface
         (a) All surfaces must be free of foreign material such as grease, metal chips, hair, loose paint, or wax which can affect bonds sufficiently to cause failure. Since jet fuel has low surface tension and viscosity, it can penetrate small openings and seep considerable distances.
      (2) Improper Mixing or Storage of Sealant
         (a) Synthetic rubber forms the base for most sealing compounds. The manufacturer adds ingredients to control strength, cure time, plasticity, work life, and fuel resistance.

(3) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   (a) Brush, swab, sprayer, blotting paper or cotton wiper (BMS15-5) for application.
   (b) Clean all surfaces, including sealant, from which topcoating was removed using clean cotton wipers (BMS15-5) saturated with B01013 solvent, series 93 (AMM 20-30-93/201).
   (c) Wipe dry with a clean cotton wiper (BMS15-5).
   (d) Repeat steps (b) and (c) until the cotton wiper (BMS15-5) remains clean.
   (e) Clean surface with clean brush and cotton wiper (BMS15-5) saturated with B01013 solvent, series 93 (AMM 20-30-93/201). Cleaning area should overlap adjacent sealant area so that total area is at least twice as wide as area to be covered with sealant.
   (f) Apply B01013 solvent, series 93 (AMM 20-30-93/201) with saturated cotton wipers (BMS15-5); then wipe dry with a clean, dry cotton wiper (BMS15-5). Repeat until the dry cotton wiper (BMS15-5) remains clean.
   (g) Sealants are supplied in two parts; base material and accelerator. Extreme care must be taken to ensure that only the proper portions and the accelerator recommended by the manufacturer are used. Variation from the manufacturer's instructions will change physical properties of the mixture which may produce a seal failure and tank leak.
   (h) Sealing compounds have a specified shelf life. After a specified period of time, it must be tested for curing capacities before use. Some sealants can be stored under refrigeration for short times after being mixed with accelerator, but must be discarded after the storage time is elapsed. Old sealant will not flow or stick properly, thereby producing an unsatisfactory seal and a leak.
(4) Improper Application of Sealants
   (a) Sealant application is important. Follow all manufacturer's instructions. A brush precoat must be applied when recommended. Proper sealing will be impaired if any steps in sealant application are eliminated. Air bubbles in sealant cause voids or pin holes and possible fuel leaks. If structure gaps are bridged instead of filled it will leave a void in sealant. Overlapping sealant and lack of faired contact with all surfaces will be cause for leak.
(5) Loose Fasteners
   (a) Loose fasteners may initiate a fuel leak by allowing movement in a fabricated assembly. Excess movement may crack faying surface seals and provide a fuel path through the seal plane. Loose rivets will not maintain a self-sealing status. Sealant or a seal cup will not adhere to a loose bolt or lockbolt.

(6) Improper Installation of Fittings
   (a) Fittings and connections attached to or passing through tank boundaries are sealed with O-rings. When installing O-rings, they can be pinched, scored, twisted, or otherwise improperly installed, causing a fuel leak.

3. Leak Evaluation and Repair Requirements
   A. For information on how to evaluate a leak as it relates to leakage rate and appropriate action to be taken, refer to 28-11-0 D&O.
   B. Typical Repair Requirements
      (1) Failed fillet or fastener seal - Faulty sealant material must be removed, surfaces thoroughly cleaned, and new sealant applied to produce a seal of the same size and shape as the original seal.
      (2) Failed faying surfaces or prepack seal - These seal types require disassembly of structure or removal of fasteners. Accomplish such removals as directed in the Structural Repair Manual. Another repair method for this type of leak is to raise the seal plane. The new seal plane must completely isolate the failed seal from fuel, but the seal plane should not be raised an extensive amount. In many cases, structure removal and replacement is the best method.
      (3) Failed injection seal - All faulty sealant material must be removed and channel must be thoroughly clean. Channels must be completely filled with sealant. Trapped air causes a void and is cause for rejeection of sealing job. As an option the failed injection seal may be repaired by raising the seal plane.

4. Repair of Sealant Leaks in Tank Structure
   A. Sealant repair requires the use of toxic and flammable material for cleaning or surface sealant or finish application. The importance of providing adequate ventilation and observing fire safety precautions can not be over emphasized.

      WARNING: PROVIDE ADEQUATE VENTILATION AND OBSERVE ALL FIRE SAFETY PRECAUTIONS WHEN USING TOXIC AND FLAMMABLE MATERIALS.

   B. Equipment and Materials

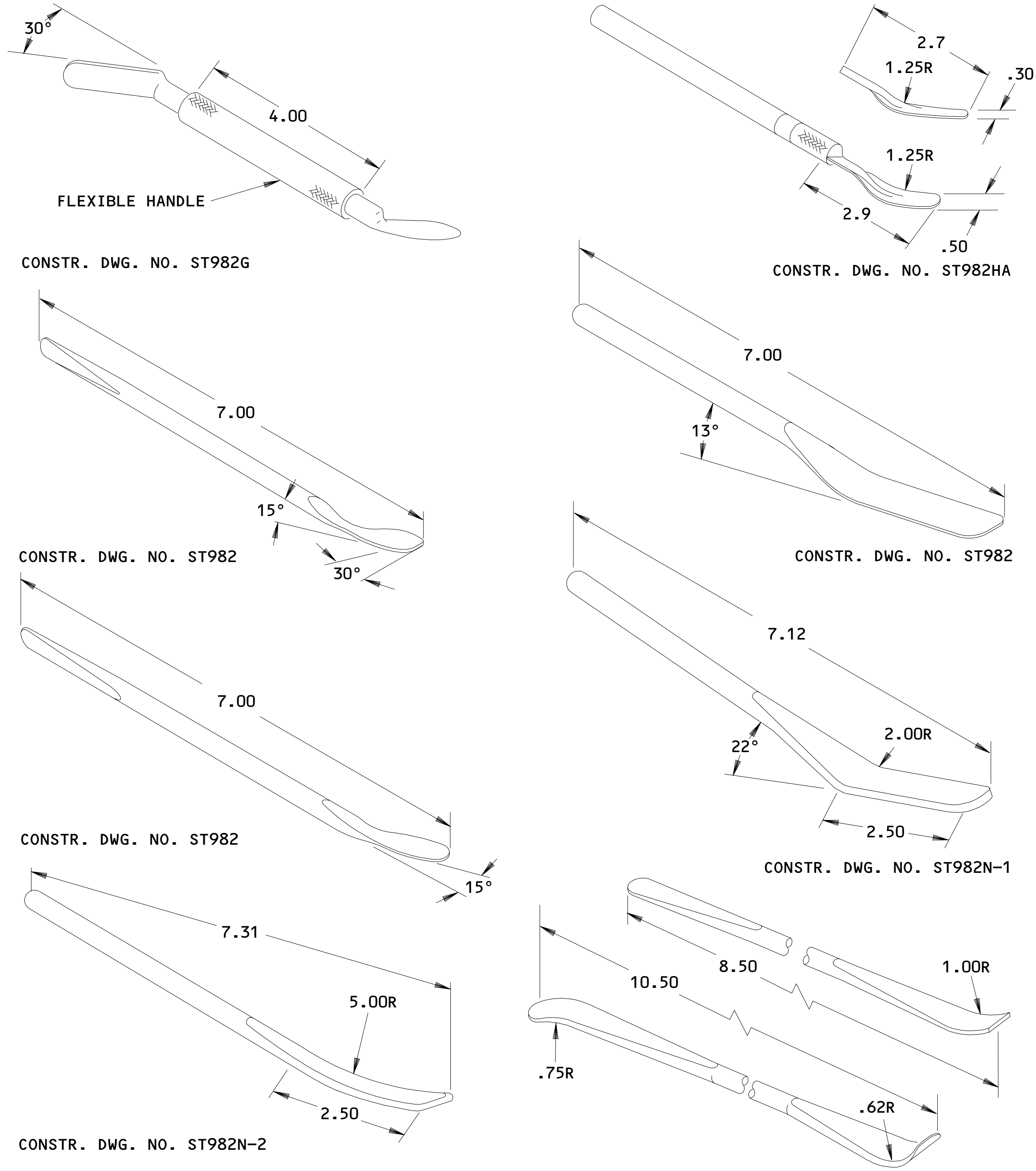
      NOTE: All equipment used for application of sealing compound must be clean. All equipment used must be cleaned thoroughly after each sealing job. Two part compounds, those mixed with an activator, will harden and make cleaning of equipment extremely difficult.

      (1) Sealant removal and fairing tools (Fig. 801)
      (2) Paint brushes
      (3) Neoprene or rubber gloves
      (4) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
      (5) Pipe cleaners
      (6) Funnel brush
      (7) Polyethylene wash for bottles, nozzles, cartridges, and plungers
      (8) Sealing gun
      (9) Sealing tool (Fig. 802)

(10) Explosion proof air blower, with sufficient flexible hose to reach all areas inside fuel tanks. Capacity to be 90 to 100 cubic feet per minute
(11) Explosion proof centrifugal exhaust fan, capacity to be 125 to 150 cubic feet per minute, and approximately 75 feet of 3-inch diameter flexible suction hose, plus sufficient delivery hose to carry exhausted air outside hangar or working area

<u>WARNING</u>: MAKE SURE THE CAPACITY OF THE EXHAUST FAN IS MORE THAN THE CAPACITY OF THE AIR BLOWER. THIS WILL MAKE SURE THERE IS A GOOD FLOW OF AIR. THERE ARE POISONOUS AND FLAMMABLE COMPOUND WHICH CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

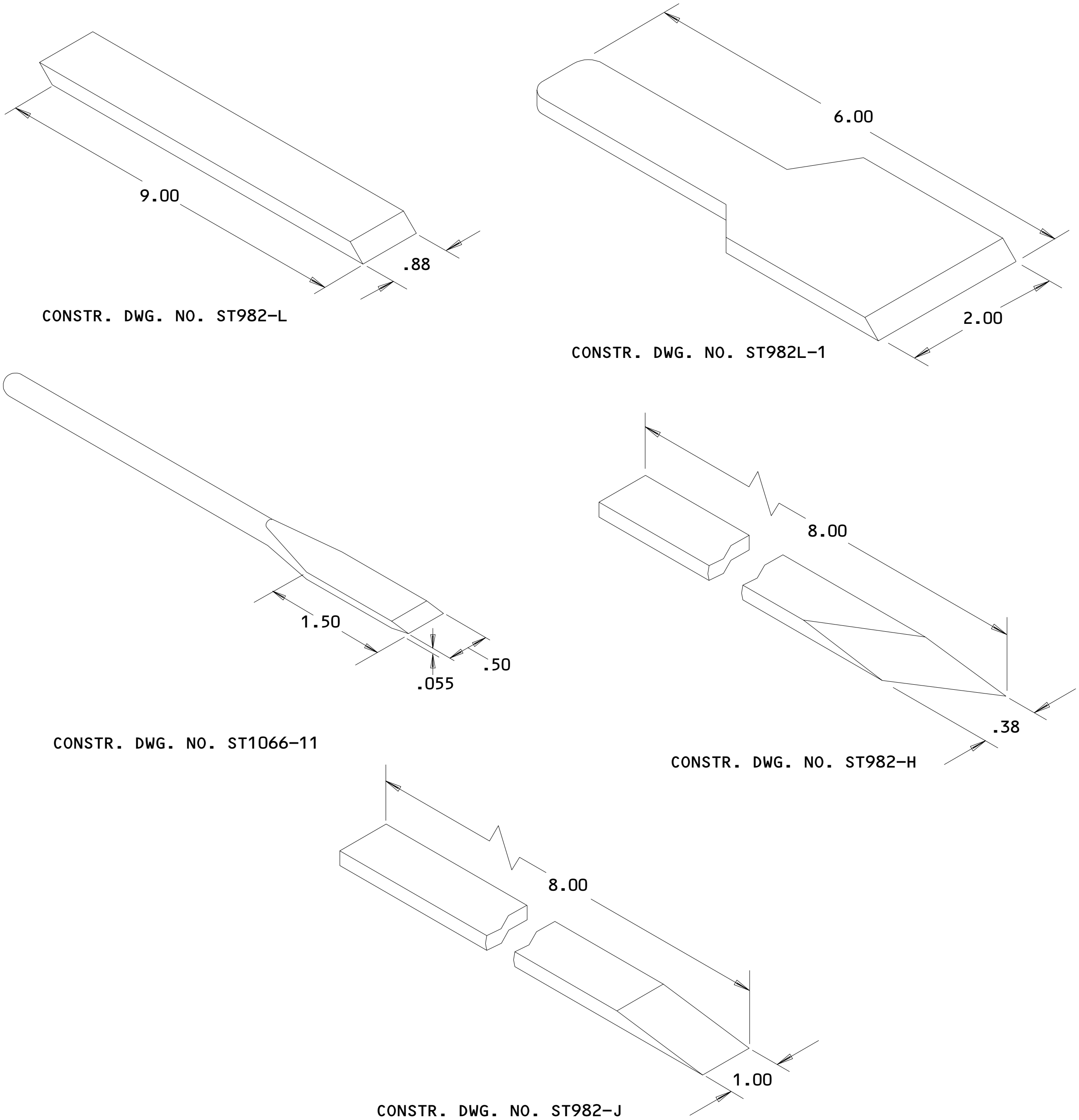
(12) Full Face Supplied Air Type Respirator, U.S. Bureau of Mines Approved
(13) Abrasive pad (Ref 20-30-51)
    (a) Aluminum oxide abrasive - Scotch Brite Sheet, TYPE A.
    (b) Aluminum oxide nylon pad, TYPE F.
    (c) Aluminum oxide - Bear-Tex
    (d) Aluminum oxide - Microlon
(14) Abrasive Paper - 320 grit or finer
(15) B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201).
(16) Sealant BMS 5-26 Type II: Class A - For brush application; Class B - For sealing gun application; Class C - For extrusion gun, roller. Spatula application (Ref 20-30-11).
(17) Sealant PR 1826, Class B-1/2 or B-1/4, dark gray, available in 6-ounce semkits with primer
(18) Sealant PR 1828, Class B-1/2 or B-1/4, white, available in 6-ounce semkits
(19) Proseal 860, Class B-1/6, Products Research Co.
(20) Cement and Catalyst - Eastman 910 (Ref 20-30-11)
(21) Balance scale with set of graduated weights accurate to ± 0.4 ounce or ± 10 grams - For weight measurements of sealant and curing agent
(22) Click Patch Kit - Semco, 5454 San Fernando Rd., Glendale, CA 91203
(23) Click Patch Adhesive - BAC 5010 Type 44 or Type 71 quick cure
(24) Volume measuring containers - with graduations for volume measurement of sealant and finish material and curing agents
(25) Spatulas - Assorted for mixing small batches of sealant and finish material and for application of sealant
(26) Shaker - Red Devil multidirectional
(27) Cans with lids - For temporary storage of mixed sealant and finish material
(28) Refrigerator/freezer - For extending usability range of mixed sealant or finish material (if desired)
(29) Alodine Application Requirements:
    (a) Alodine 600 Powder - MIL-C-5541 (SRM 51-10-2)
    (b) Distilled water - 1-gallon containers
    (c) Stainless steel container



SEALANT FAIRING TOOLS

NOTE: SEALANT FAIRING TOOLS MAY BE MADE
OF 1/4 INCH DIAMETER BRONZE OR STEEL
WELDING ROD AND MAY BE PLATED TO
IMPROVE THE SMOOTHNESS

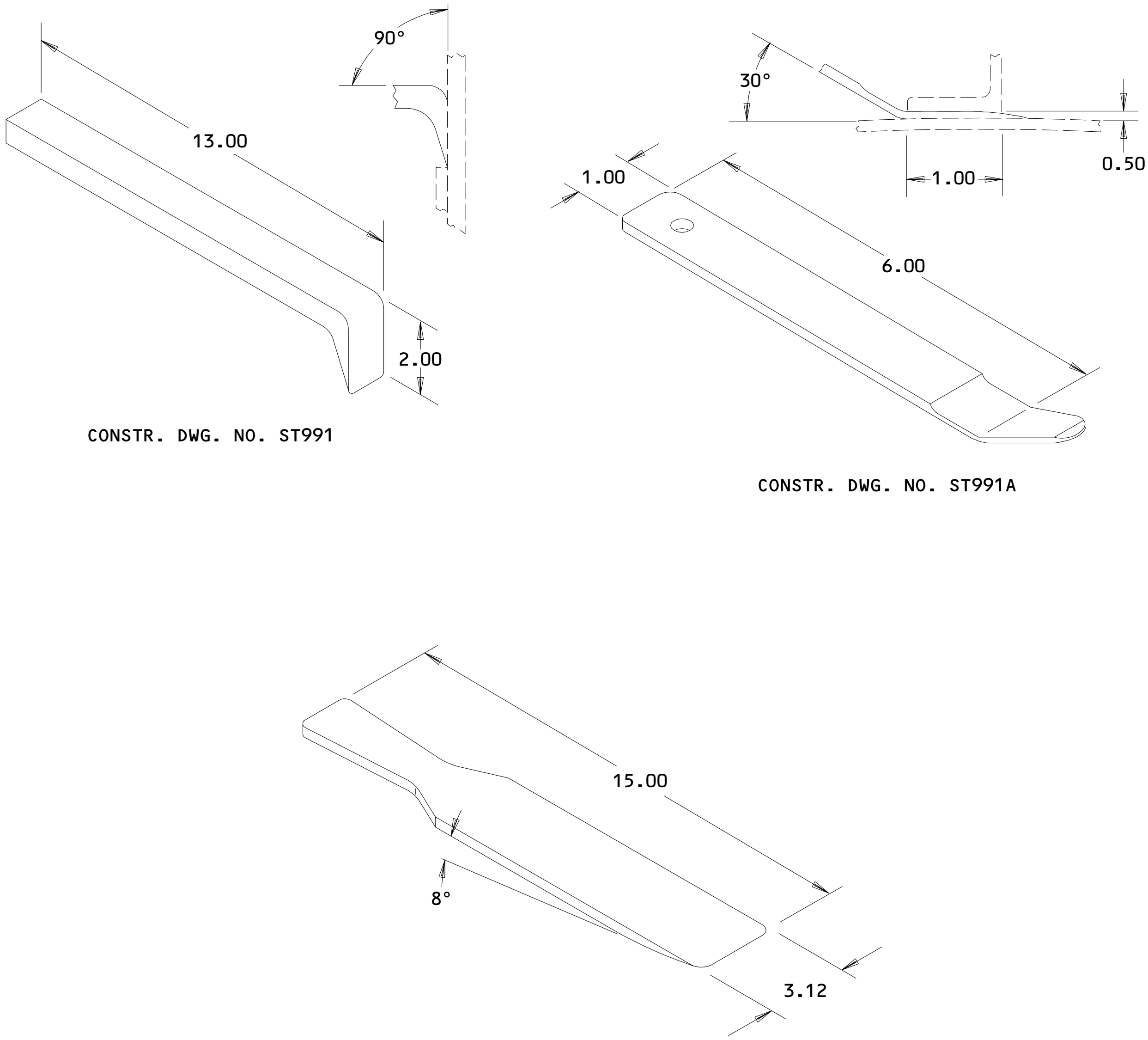
Sealant Removal and Fairing Tools
Figure 801 (Sheet 1)



SEALANT REMOVAL AND CUTTING TOOLS

NOTE: SEALANT REMOVAL AND CUTTING TOOLS SHOULD BE MADE OF HARDWOOD OR METAL NO HARDER THAN 2024-T3 ALUMINUM TO REDUCE THE POSSIBILITY OF DAMAGING THE STRUCTURE

Sealant Removal and Fairing Tools
Figure 801 (Sheet 2)



CONSTR. DWG. NO. ST991

CONSTR. DWG. NO. ST991A

CONSTR. DWG. NO. ST991F

SEALANT CLEANING AND REMOVAL TOOLS

NOTE: SEALANT REMOVAL AND CUTTING TOOLS SHOULD BE MADE OF HARDWOOD OR METAL NO HARDER THAN 2024-T3 ALUMINUM TO REDUCE THE POSSIBILITY OF DAMAGING THE STRUCTURE

Sealant Removal and Fairing Tools
Figure 801 (Sheet 3)

(d) Brush, swab, sprayer, blotting paper or cotton wipers (BMS15-5) for application.

(30) Corrosion Resistant Finish for Integral Fuel Tanks

(a) BMS 10-20, Type II (preferred) (Ref 20-30-41)

NOTE: BMS 10-20, Type II is mutually compatible with BMS 5-26 Type II and Proseal 860 sealants. Precoat is optional when you use Pro-Seal 860, B 1/6 sealant. A special adhesion promoter is recommended before the use of Pro-Seal 860, B 1/6 sealant. Obey the manufacturers instructions.

1) 454-4-1, Bostik-Finch, Inc.

(b) MIL-C-27725 (Ref 20-30-41)

CAUTION: USE MIL-C-27725 FINISH MATERIAL ONLY AS TOP COATING.

1) 823-011 or 823-730, DeSoto Chemical Coatings, Inc.

2) PR-1560M, PR-1560MC, PR-1560MK, Products Research Co.

(31) Spray Equipment - DeVilbiss Model MBC or JGA, The DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio (recommended for large area application of corrosion resistant finish)

(32) Labels - For identifying mixed batches of sealant or finish material placed in item (23) cans

C. Prepare for Fuel Tank Repair

(1) Defuel and purge applicable tank (Ref 28-23-0, 28-10-0 MP).

WARNING: OBSERVE ALL PRECAUTIONS FOR PURGING AND FUEL TANK ENTRY.

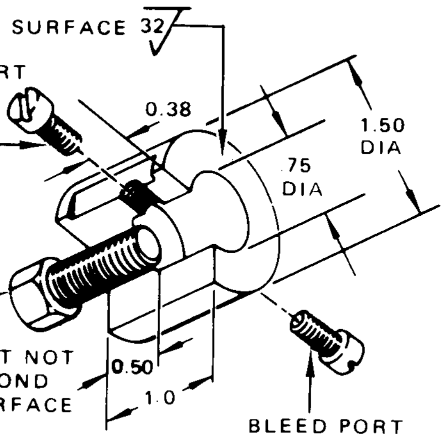
(2) Using sealant cutting tools (Fig. 801), remove faulty sealant.

(a) Cut faulty section from fillet (Fig. 802). Slope cuts at ends of section for new sealant to lap remaining portions of old fillet. Avoid abrupt changes in cross section.

(b) If fillet adhesion is good, it is not necessary to cut sealant down to bare metal. Assure all loose cuts or flaps are removed.

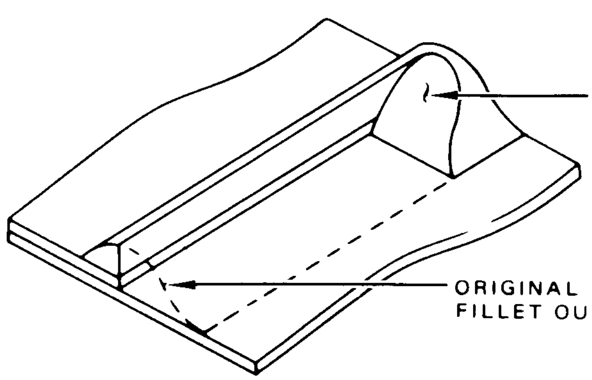
(c) If faulty sealant involves fillet sealed fasteners, cut around fastener base using sealant cutting tool (Fig. 801) and separate sealant from fastener head by pulling sealant with pliers. Cut away any remaining sealant.

NOTE: Small quantities of sealant which adhere firmly to fastener need not be removed.



NOTE: USE OF TOOL IS SHOWN IN FIGURE 816

Sealing Tool for Leaking Rivet
Figure 802



Fillet Seal Removal
Figure 802

(d) If leak involves faulty injection seal, remove sealant from short injection channel with a hooked wire and small cutting tools. Clear injection channel all the way through since trapped air will prevent complete filling of channel with new sealant. Exercise care not to damage structure.

NOTE: Longer injection channels require structure disassembly (Ref Structural Repair Manual). Faulty injection seal may be repaired by raising seal plane to isolate faulty seal from fuel.

(3) For faulty prepack or faying surface sealant, disassemble structure surrounding faulty sealant (Ref Structural Repair Manual) and remove sealant with cutting tools and plastic scrapers.

NOTE: If it is not desired to disassemble structure, leak may be repaired by raising seal plane to isolate faulty sealant from fuel if affected area is not too large.

(4) If surface was previously topcoated, remove all topcoat from sealant repair area unless it is known that topcoat consists of BMS 10-20, Type II finish material.

(a) Using abrasive paper, remove old coating until either bare metal or sealant (in good condition) is exposed.

WARNING: DO NOT GET SOLVENT IN MOUTH, EYES, OR ON SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(b) Clean all surfaces, including sealant, from which topcoating was removed using clean cotton wipers (BMS15-5) saturated with B01013 solvent, series 93 (AMM 20-30-93/201).

(c) Wipe dry with a clean cotton wiper (BMS15-5).

(d) Repeat step (b) and (c) until the dry cotton wiper (BMS15-5) remains clean.

(5) Remove all old sealant precoat from repair area unless it is known that precoat is BMS 5-26, Type II or Proseal 860 material in good condition.

WARNING: DO NOT GET SOLVENT IN MOUTH, EYES, OR ON SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(a) Remove old precoat with abrasive pad and B01013 solvent, series 93 (AMM 20-30-93/201).

(b) Clean surface with clean brush and cotton wiper (BMS15-5) saturated with B01013 solvent, series 93 (AMM 20-30-93/201). Cleaning area should overlap adjacent sealant area so that total area is at least twice as wide as area to be covered with sealant.

(c) Apply B01013 solvent, series 93 (AMM 20-30-93/201) with saturated cotton wiper (BMS15-5); then wipe dry with clean, dry cotton wiper (BMS15-5). Repeat until the dry cotton wiper (BMS15-5) remains clean.

(6) Ensure that all fasteners in area of sealant repair are installed and tight unless assembly after application of faying surface sealant is required before final fastener installation and tightening. Retorquing of bolts after sealing is not permitted in most cases.

(7) If alodine metal surface treatment has been worn off or damaged, the metal surface must be realodized before new sealant or finish material is applied.

CAUTION: USE ONLY ALODINE 600 TO REPAIR ALUMINUM WING SURFACES. PRIMER ADHESION PROBLEMS CAN OCCUR IF OTHER ALODINE SOLUTIONS ARE USED.

(a) Apply an alodine layer to the surface with Alodine 600 (SRM 51-10-2).

(8) Immediately prior to applying sealant, clean surface with BMS 11-7 or Series 93 solvent and wipe dry.

NOTE: Do not allow cleaners to dry on surface. Do not touch area with fingers.

D. Prepare, Apply, and Cure Sealants and Corrosion Resistant Finish

(1) The importance of mixing, handling, or storing of sealants or finish material cannot be over-emphasized. Deviations from accepted procedures are not permitted since a poor seal may cause loss of an airplane and human lives. Mix components thoroughly as directed by the manufacturer. Do not mix brush type sealants until ready to use for they have a short work life. The use of thinners is not allowed in sealant. Keep sealant covered when not used.

CAUTION: IF SEALANT OR FINISH MATERIAL DOES NOT GO ON SMOOTHLY, DISCARD IT TO PREVENT THE POSSIBILITY OF POORLY SEALED OR TOPCOATED REPAIRS.

(2) Storing Unmixed Sealant Compound

(a) Unmixed packaged sealant stored longer than 6 months is outdated and should be retested prior to using. A satisfactory check for outdated sealant is to mix a container of base material with its curing compound and, at room temperature, determine the time required for a sample application to become tack-free. Compare this time with the maximum allowable tack-free time given in the applicable sealant specification. If this time exceeds the maximum allowable, sealant should be discarded. Sealant should be stored at temperatures between 50°F (10°C) and 80°F (26.7°C) for best results.

(3) Mixing Sealant Compound

(a) Mix only the amount of sealant required for the job to be done. A balance scale with graduated weights should be available for mixing unless the small kits with proper amount of curing compound and sealant in one package are used. All equipment used in the mixing process must be clean.

WARNING: SEALANT MATERIALS ARE HIGHLY TOXIC. ALL MIXING MUST BE DONE IN WELL VENTILATED AREAS.

NOTE: Identify sealant required in the repair area before mixing.

1) Place amount of base compound to be used on scale and balance with weights.
2) Add to weights an additional amount of weight to give curing compound-to-base compound ratio called out on manufacturer's sealant container.

NOTE: The mixing of BMS 5-26, Type II, Class B-2, may be modified by using an accelerator-to-base ratio range of 8.4:100 to 16.8:100 by volume or 10:100 to 20:100 by weight. The 10:100 ratio is standard for B-2 sealant. The 20:100 ratio results in a material with an application time of approximately 1/2 hour and a cure time of approximately 6 hours at 77°F and 50 percent relative humidity.

3) Balance scale by adding curing compound on top of base compound.

NOTE: Always use curing compound with base compound from same repair kit. Do not mix contents of one repair kit with that of another kit.

4) Mix curing compound and base compound until homogeneous indicated by sealant of solid uniform color. If mixing machine is not available use clean spatula.

CAUTION: AVOID INCORPORATING AIR INTO SEALANT DURING MIXING PROCESS.

5) Place sealant in tube or can which was cleaned with B01013 solvent, Series 93 (AMM 20-30-93/201), and sealant is now ready for use.

(b) Storing mixed sealant compound

1) The usability range of mixed sealant may be extended beyond the normal application time by refrigerated storage immediately after mixing. Ensure that sealant to be stored in refrigerator or dry-ice box is placed in sealed container identified as to mix date, sealant designation, class, supplier, and expiration date of usage. Reject sealant stored over 21 days at -41°F (-40°C) and reject sealant stored over 7 days at -20°F (-28.9°C).

CAUTION: DO NOT REFRIGERATE MIXED SEALANT A SECOND TIME AFTER THAWING.

(4) Sealant application time

(a) The application time of mixed sealant compounds is the usability range of the sealant and is usually designated by a dash number after class, i.e., BMS 5-26, Class B-2 designates sealant with an application time of 2 hours at 77°F and 50 percent relative humidity.

(5) Sealant squeeze-out life

(a) Squeeze out life is the length of time sealant remains suitable for structure assembly in faying surface seal applications. Time, shown in Fig. 803, is the maximum time interval allowed between initial thaw-out of frozen material or mixing of non-frozen material and the final fastening of mating surfaces.

(6) Sealant curing

(a) Sealant must be allowed a minimum cure time, per Fig. 803, before resuming maintenance operations in tank or filling tank with fuel.

SEALANT	CLASS	APPLICATION TIME (MIMIMUM) HOURS [1]	TACK-FREE TIME (MIMIMUM) HOURS [1]	SQUEEZE-OUT LIFE (MINIMUM) HOURS [1]	CURING TIME (MINIMUM) HOURS [1]
PROSEAL 860 [3]	B-1/6	1/6	1.5 [2]	--	4
PR-1826 [4]	B-1/4	1/4	1	--	2
PR-1828 [4] [6]	B-1/2	1/2	2.5	--	3
BMS 5-45	A-2 (GRADE 1)	2	36	--	72
	A-2 (GRADE 2)	2	24	--	48
	B-1/2 [7]	1/2	10	--	12
	B-2	2	12	6	24
	C-24 [5]	8	--	24	168
	C-48 [5]	12	--	48	336
	C-168 [5]	48	--	168	1,344

[1] AT 77°F (25°C) AND 50 PERCENT RELATIVE HUMIDITY AMBIENT CONDITIONS. OTHER TEMPERATURE AND RELATIVE HUMIDITY CONDITIONS WILL CHANGE THE TIME.

[2] DO NOT LET FUEL TOUCH THE SEALANT UNTIL IT IS NOT TACKY FOR A MINIMUM OF 2 HOURS.

[3] WHEN YOU USE PROSEAL 860, DO NOT USE A PRECOAT. PROSEAL 860 IS RECOMMENDED FOR SMALL REPAIRS ONLY, DUE TO ITS SHORT APPLICATION TIME. AVAILABLE FROM COURTAULDS AEROSPACE, GLENDALE, CALIFORNIA.

[4] USE TO REPAIR FILLET SEALS OF BMS 5-45. AVAILABLE FROM COURTAULDS AEROSPACE, GLENDALE, CALIFORNIA.

[5] USED WITH FAYING SURFACE SEALS THAT HAVE A LONG SQUEEZE-OUT LIFE.

[6] THIS SEALANT IS WHITE. THUS, IT IS EASY TO SEE THE REPAIRED AREA.

[7] MIX BMS 5-45, CLASS B-2 SEALANT WITH A 20:100 ACCELARATOR/BASE BY WEIGHT OR GET THIS SEALANT PRE-MIXED.

Sealant Usable Time
Figure 803

(b) Ideal conditions for curing are provided by a well ventilated area with ambient temperature of 77°F (25°C). Humidity is a very important factor in cure times and the relative humidity in the area should be known at all times sealant operations are in progress. Desired relative humidity is 50 +5%. Humidity below 40 percent retards curing so that it may be necessary to circulate moistened warm air 120°F (49°C) maximum temperature over the sealed area, or prewarm structure to be sealed, or both. Water added to the air to increase humidity must contain less than 100 parts per million total solids and less than 10 parts per million of chlorides. Curing time may be reduced by circulating warm air, not exceeding 120°F (48.9°C), over sealant or prewarming applicable structure to not exceed 120°F (48.9°C).

<u>WARNING</u>: USE OF WARM AIR IS EXTREMELY DANGEROUS UNLESS ALL SAFETY PRECAUTIONS ARE OBSERVED. NEVER START OR STOP AIR BLOWER WITH AIR HOSE INSIDE FUEL TANK.

<u>CAUTION</u>: SEALANT SHALL NOT BE APPLIED WHEN STRUCTURE TEMPERATURE IS BELOW 50°F (10°C) OR ABOVE 140°F (60°C).

(c) Using the values in Fig. 803 with relative humidity kept constant, times vary according to temperature in that for every 20°F (11.1°C) rise, the tack-free and cure times are approximately one-half as long and for every 20°F (11.1°C) drop, the tack-free and cure times are approximately doubled.

<u>CAUTION</u>: IF SEALING IS BEING ACCOMPLISHED WHERE HUMIDITY IS HIGH, TEMPERATURE OF METAL SURFACE BEING SEALED MUST EXCEED AMBIENT TEMPERATURE TO PREVENT CONDENSATION OF WATER ON SURFACE TO BE SEALED. THIS SURFACE MUST BE DRY.

(7) Storing unmixed corrosion resistant finish compounds.
  (a) Storage life of BMS 10-20, Type II is 12 months at 40 to 90°F (4.4 to 32.2°C) from date of manufacture.
  (b) Storage life of MIL-C-27725 corrosion preventive coatings.
    1) Storage life of DeSoto 823-011 or 823-730 is 12 months at 50 to 90°F (10.0 to 32.2°C) from date of manufacture.
    2) Storage life of Products Research Co. PR-1560M, PR-1560MC, PR-1560MK is 6 months at 50 to 90°F (10.0 to 32.2°C) from date of manufacture.

(8) Mixing corrosion resistant finish compounds

WARNING: SOME OF THE MATERIALS USED IN MIXING BMS 10-20 TYPE II OR MIL-C-27725 FINISH COMPOUNDS ARE TOXIC, FLAMMABLE, AND OTHERWISE HAZARDOUS. ALL MIXING MUST BE DONE IN VENTILATED AREAS BY QUALIFIED PERSONNEL WEARING RESPIRATORS. PERSONS NOT WEARING RESPIRATORS MUST LEAVE THE AREA.

(a) Conditions unmixed materials to 60 to 90°F (15.6 to 32.2°C) prior to mixing.
(b) Measure out proportionate volumes of base and catalyst, plus reducer or thinner if spray application is desired, as specified.

MANUFACTURER	COMPONENT	METHOD OF APPLICATION				
		SPRAY			BRUSH	
		MFGR DESIGNATION	PARTS BY VOLUME	VISCOSITY ZAHN NO. 1 77 ±2°F	MFGR DESIGNATION	PARTS BY VOLUME
Bostik-Finch (BMS 10-20 Type II)	Base Catalyst Reducer	454-4-1 CA-109 TL-52	3 1 approx 1	31-40 seconds	454-4-1 CA-109	3 1
DeSoto (MIL-C-27725)	Base Activator Reducer	823-011 910-099 020-037	4 1 approx 4	31-40 seconds	823-011 910-099 020-037	4 1 0-4
	Base Activator Reducer	823-730 910-702 020-707	4 1 approx 4	31-40 seconds	823-730 910-702 020-707	4 1 0-4
Products Research (MIL-C-27725)	--- ---	Part A Part B	1 2	31-40 seconds	Part A Part B	1 2

(c) Agitate base component for 10 minutes in Red Devil multi-directional shaker.
(d) Mix base and catalyst, plus reducer as needed. Allow 1 hour induction time prior to application. Maximum pot life is 8 hours at 75 ±5°F (23.9 ±2.8°C).
(e) Immediately after mixing, mark container with date and hour of mixing and date and hour pot life expires.

<u>NOTE</u>: Keep containers of mixed corrosion resistant finish compound tightly closed, while waiting for application, or contents will gradually thicken and gel.

(9) Curing corrosion resistant finish compound
(a) Cure all finish coatings.

CORROSION RESISTANT FINISH (BY MFGR)	CURE TIME PRIOR TO FUEL EXPOSURE *[1]	CURE TIME PRIOR TO TRAFFIC	CURE TIME PRIOR TO ASSEMBLY *[1]	CURE TIME PRIOR TO SEALING *[2]
Bostik-Finch (BMS 10-20 Type II)	12 hours at 65°F or above or Fig. 807 *[3]	12 hours at 65°F or above or Fig. 807 *[3]	12 hours at 65°F or above or Fig. 807 *[3]	Fig. 807 *[3]
DeSoto (MIL-C-27725)	Fig. 808 *[3]	24 hours at 65°F or above	Fig. 804 or 240 hours at 65°F or above *[3]	Not Applicable
Products Research (MIL-C-27725)	Fig. 8104	24 hours at 65°F or above	240 hours at 75°F and min of 30% relative humidity	Not Applicable

*[1] Verify cure completion by performing fuel resistance check (Ref par. 4.D.(9)(c)).
*[2] Verify cure completion by performing MEK resistance check (Ref par. 4.D.(9)(c)).
*[3] Allow at least 30 minutes drying at application temperature prior to curing at higher temperatures.

(b) Cure time can be shortened by using elevated temperatures and, with some finish compounds, by increasing relative humidity (R.H.) (Fig. 807 thru 810).

(c) Perform the following fuel or solvent resistance check to verify cure completion.

1) Methyl Ethyl Ketone (MEK) or JP-4 fuel resistance test.

a) Saturate a cotton wiper (BMS15-5) with MEK or Series 93 or JP-4 as applicable.

b) Apply the cotton wiper (BMS15-5) to the surface to be checked and allow the solvent or fuel to flood area.

c) Using hard pressure rub the area 100 strokes, counting each movement in one direction as a stroke.

d) Observe whether coating is removed so that metal is exposed (unsatisfactory). If metal is not exposed, cure is satisfactory.

(10) To apply a new fillet seal, do the steps that follows:

(a) BMS 5-26 Type II Class B sealant is used to apply all fillet seals after a precoat of BMS 5-26 Type II Class A-2 sealant.

NOTE: Precoat is optional when you use Pro-Seal 860, B 1/6 sealant. A special adhesion promoter is recommended before the use of Pro-Seal 860, B1/6 sealant. A special primer is used with PR-1826 sealant. Obey the manufacturers instructions.

1) To assure selecting correct tools for job to be done, set up a locally fabricated condition to simulate the job. This can usually be done with cardboard or similar material.

(b) Apply a precoat of properly accelerated Class A-2 sealant to the surface with a stiff bristled brush. Scrub well into crevices and over entire length to be sealed (Fig. 811). Precoat should cover an area 1/2 inch wide on each side of seam. No ridges or voids are allowed.

NOTE: If you let the precoat fully cure, clean with MEK solvent or Series 93 solvent before you apply the fillet seal. It is not necessary to let the precoat cure unless the precoat and the selant you use for a fillet seal are from different manufacturer product lines. For example, do not use a precoat of BMS 5-26, Type II, Class A-2 with a fillet seal of PR-1826.

(c) Apply a small fillet of BMS 5-26 Class B sealant, or other approved sealant with an extrusion gun (Fig. 806).

(d) When a nozzle tip is used it shall point into the seam and shall be maintained nearly perpendicular to the line of travel.

CAUTION: SEALANT MUST BE APPLIED CAREFULLY TO AVOID TRAPPING AIR IN FILLET. OPERATE GUN SO THAT A BEAD OF SEALANT IS CONTINUALLY FORCED AHEAD OF NOZZLE TIP IN THE DIRECTION OF NOZZLE TRAVEL.

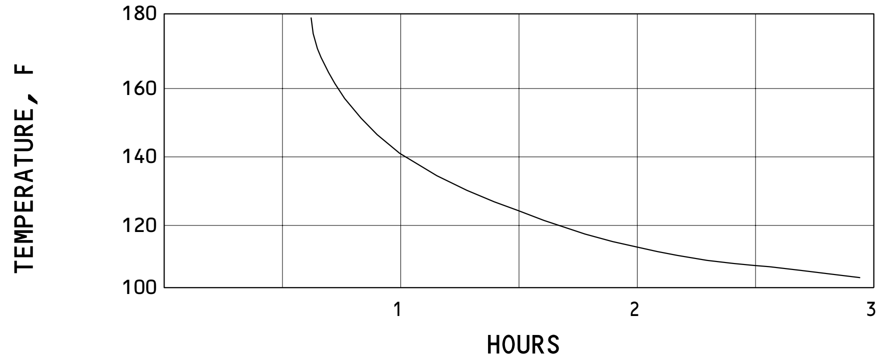
(e) Using a fillet fairing tool press the first fillet firmly into position (Fig. 813). Work the entire beaded section.

NOTE: Fairing tool must be clean. Use no solution or lubricant to make it slide smoothly over sealant. Wipe tool frequently with clean gauze to aid in fairing operation.

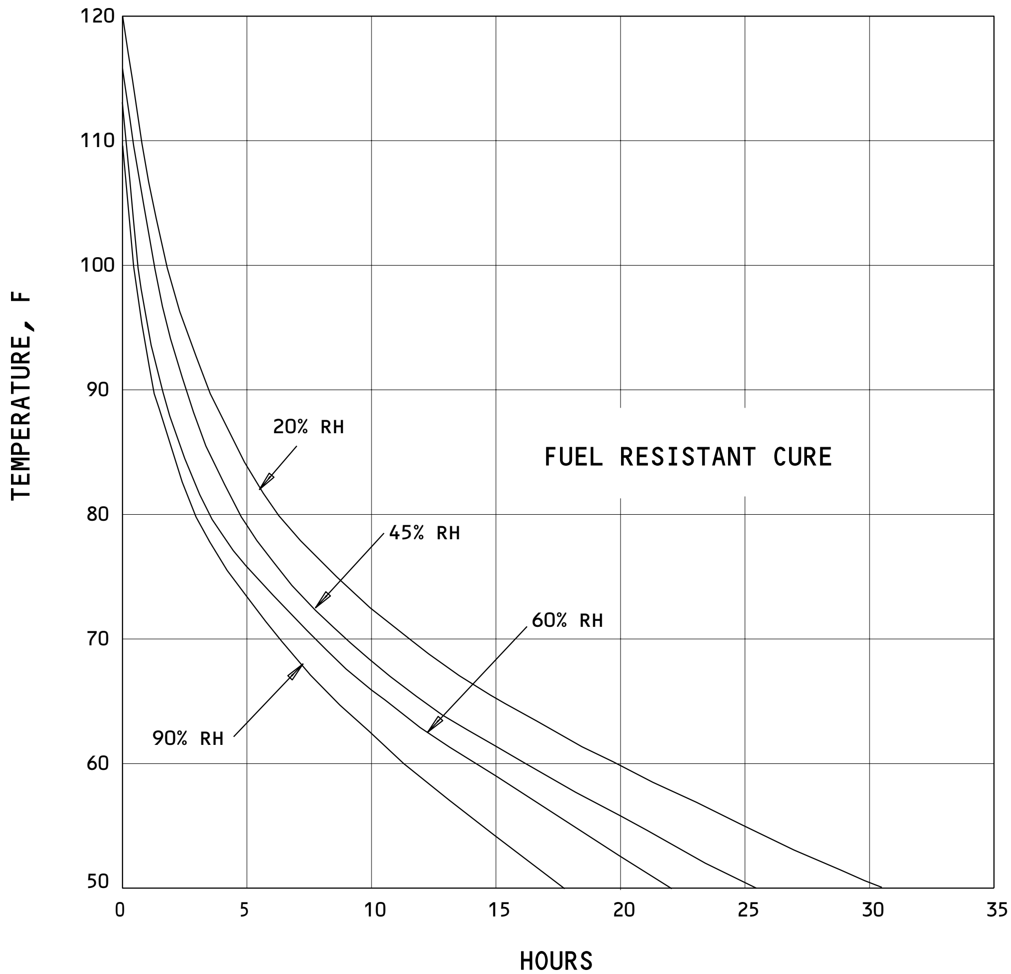
(f) If first fillet has cured but is not clean, then it must be cleaned before application of a second fillet.

(g) Apply second application of Class B sealant to produce a full bodied fillet (Fig. 807). A larger nozzle will be required than was used for first fillet. If an extruded nozzle head is used, make cuts in nozzle to fit fillet conforming to dimensions in Fig. 808. Use a fairing tool to make sealant conform to full-bodied fillet dimensions if an extruded head nozzle is not used. Remove all air bubbles or re-entrant seal edges. Do not use different sealants for the first fillet and the second fillet.

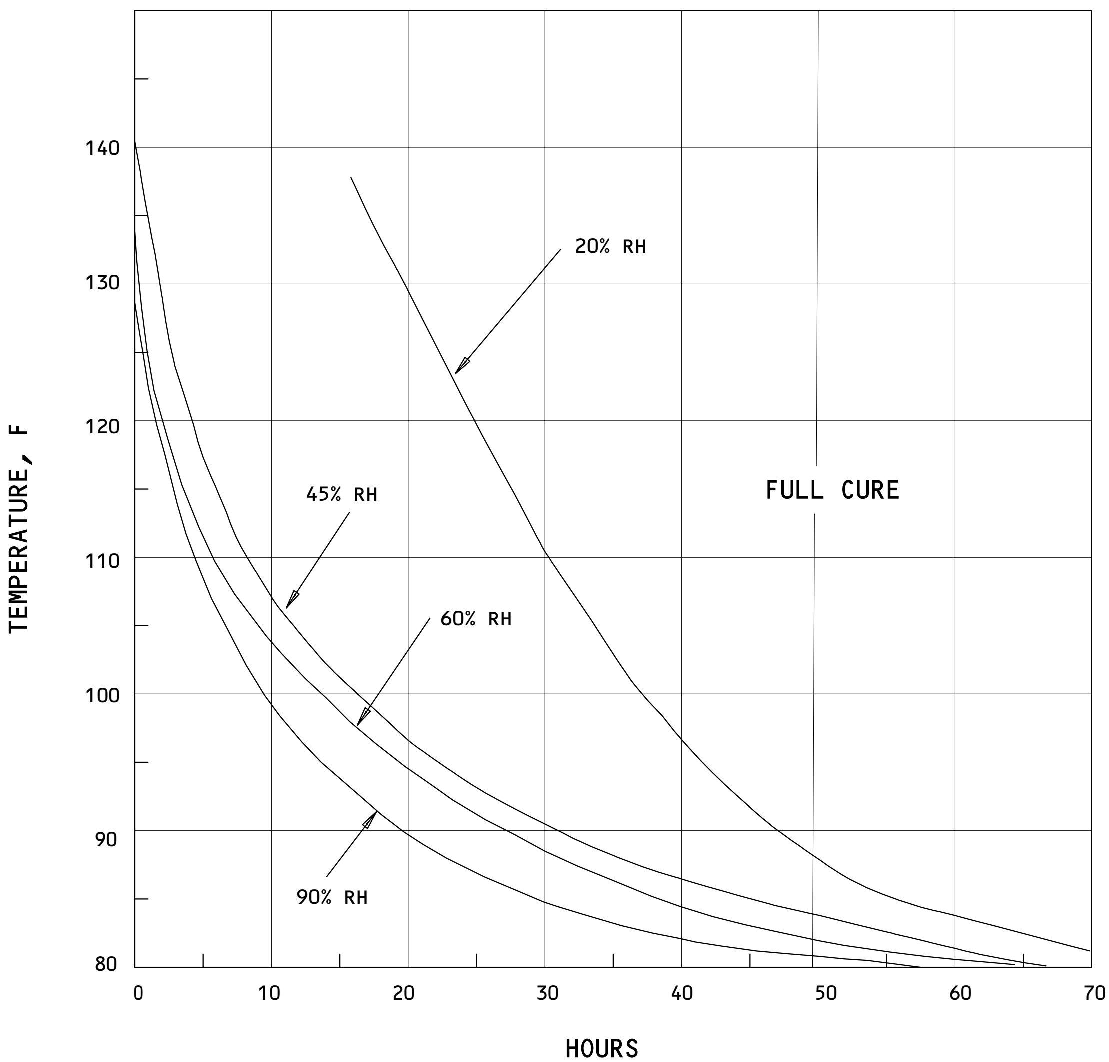
NOTE: Good sealant application requires patience as well as proper technique. Keep sealing gun nozzle close to prevent air bubbles. If a fillet extrusion head is used, it shall be pressed firmly against the part in such a position that maximum thickness of fillet will be directly over the edge.



Bostik-Finch (BMS 10-20 Type II) Compound
Cure Time as Affected by Temperature
Figure 807

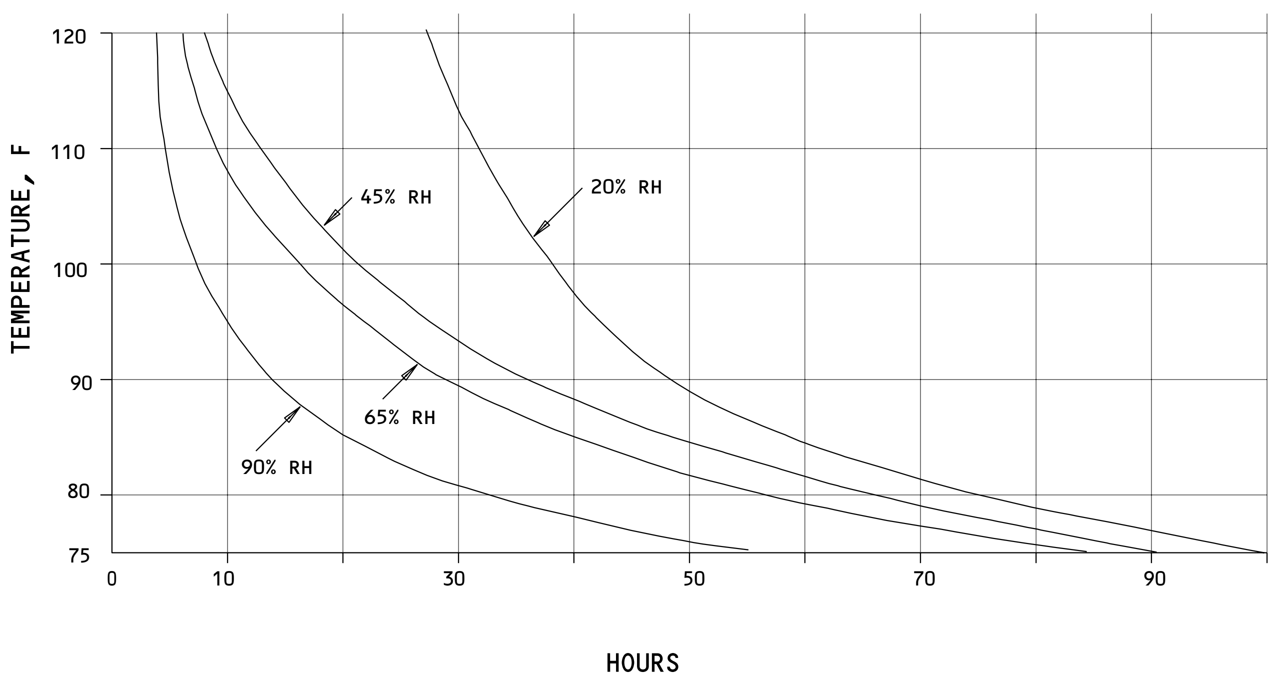


DeSoto (MIL-C-27725) Compound Cure Time
Figure 804 (Sheet 1)

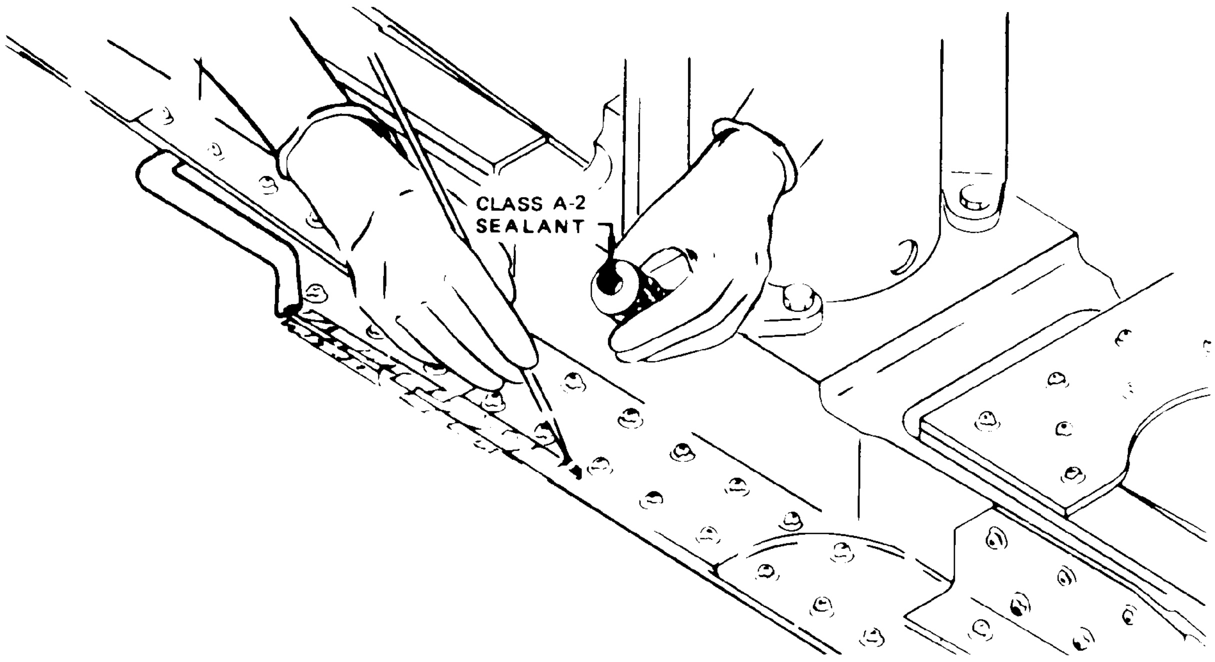


DeSoto (MIL-C-27725) Compound Cure Time
Figure 804 (Sheet 2)

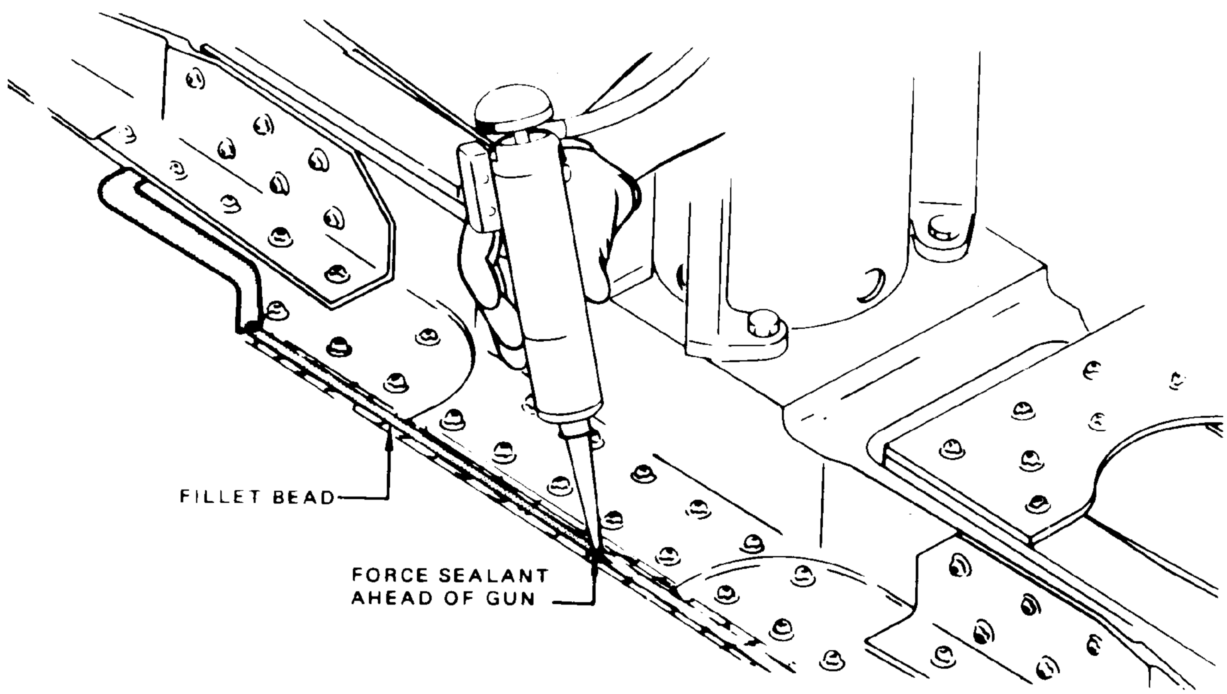
% REL HUMIDITY	TEMP. °F	
	65	70
20	392	228
45	376	212
65	344	184
90	240	124



Products Research (MIL-C-27725) Compound Cure Time
Figure 805



Application of Precoat
Figure 811



Application of First Fillet
Figure 806

(h) Apply corrosion resistant finish (topcoat) (Ref par. 4.D.(15)) as required.

(11) Repair fastener seals (ref Structural Repair Manual).

(a) Repair self-sealing rivets.

1) Self-sealing rivets are used extensively in skin panels in the integral tank area. If a leak is discovered at a rivet, a permanent repair should be made by replacing the rivet. A temporary repair can be made by either: injecting sealant around the rivet with a locally obtained tool (Fig. 809); or injecting sealant around the rivet with a temporary repair tool (Fig. 817) and a rivet gun; or installing a click patch. Make a permanent repair the next time the tank is entered.

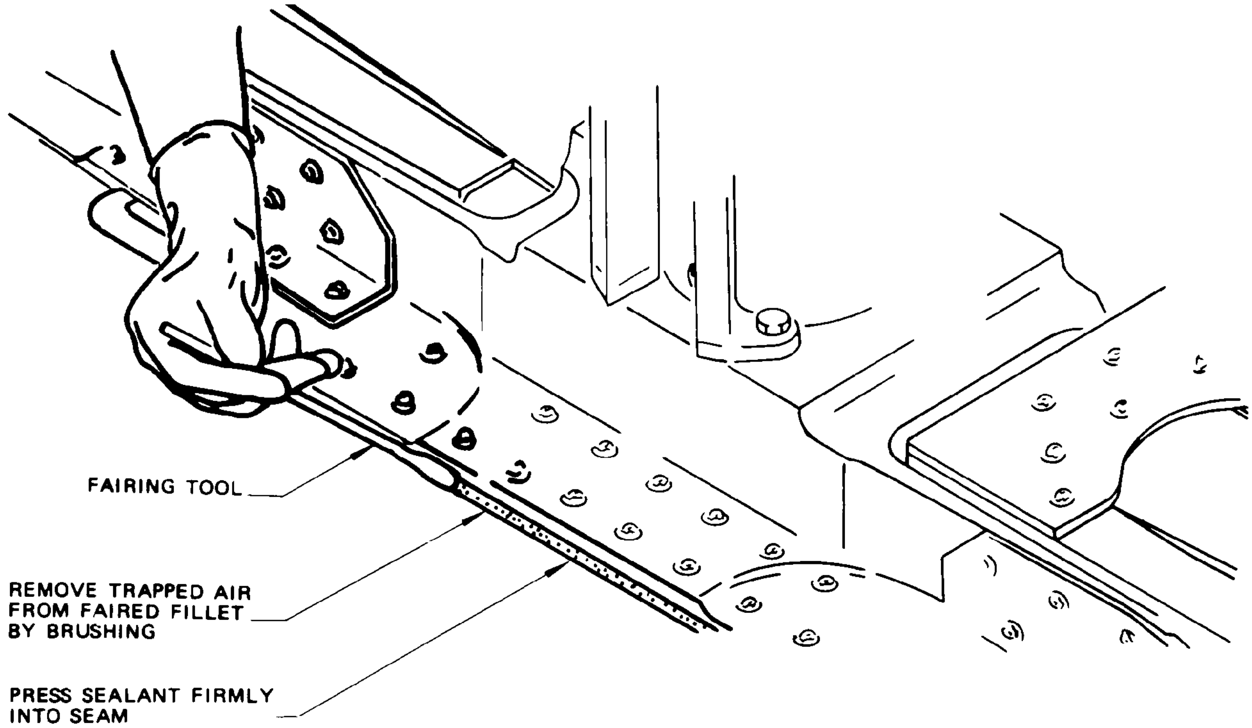
2) The first method of temporary repair may be accomplished by forcing sealant into the fuel leak path from a position outside the tank, using locally fabricated tool. An adapter is cemented to the wing skin and sealant forced into the leak path by piston-like pressure exerted as a pressure bolt is turned.

3) The second method used a fuel system self-sealing rivet temporary repair tool F70230 (Fig. 817) with a rivet gun supplying pressure required to force sealant around leaking rivet.

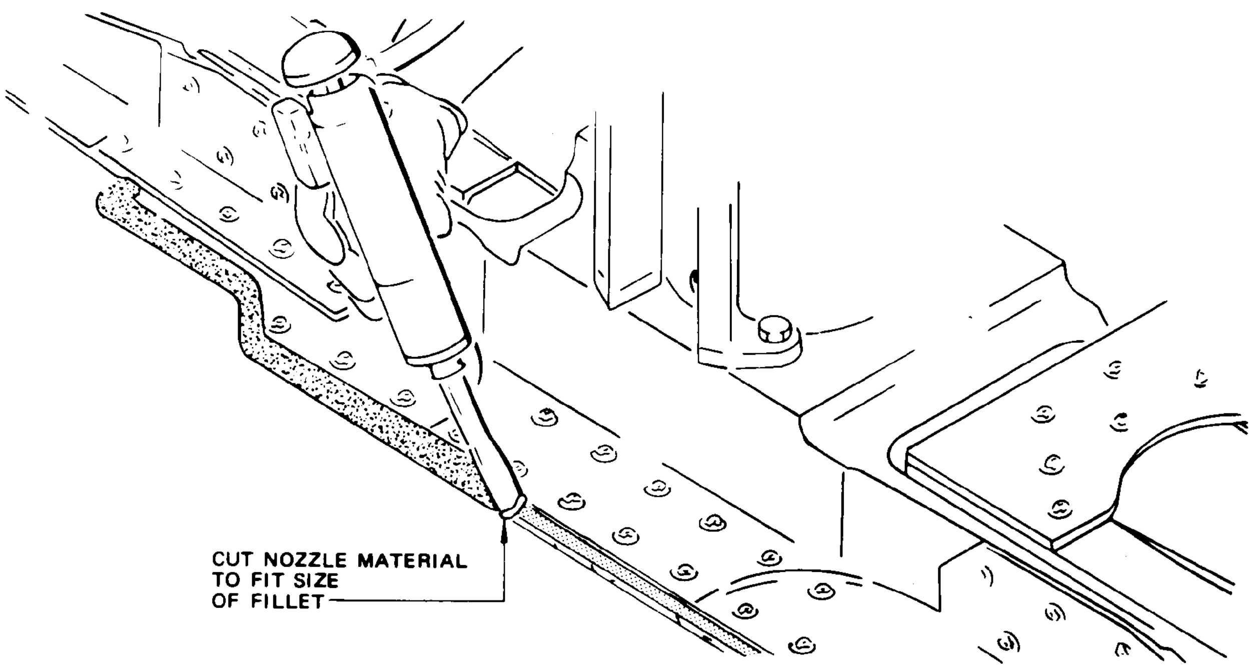
4) The third method uses a Click Patch repair kit to temporarily repair fuel leaks through Class C (Heavy Seep). The kit is a one shot throw away and consists of solvent wipe, scotch brite pad, quick setting epoxy adhesive, spatula, mixing plate, a click patch, (either a flat disc for flush fasteners, or a hatted disc for protruding rivets or bolts), and an illustrated instruction sheet. All material for making repair is in kit. However, BAC 5010 Type 44 or Type 71 quick cure adhesive is preferred over that provided in kit.

CAUTION: DO NOT USE TYPE 71 ON BARE METAL. CORROSION MAY RESULT.

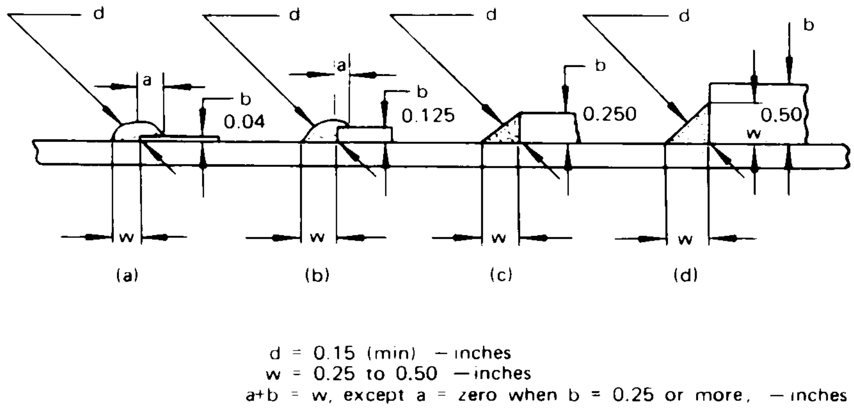
5) Click Patch repairs are subject to the following restrictions:

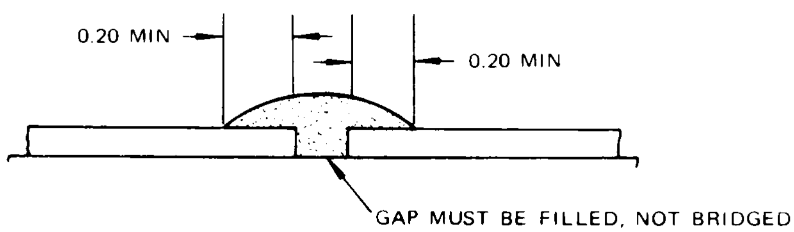


Pressing First Fillet Into Seam
Figure 813

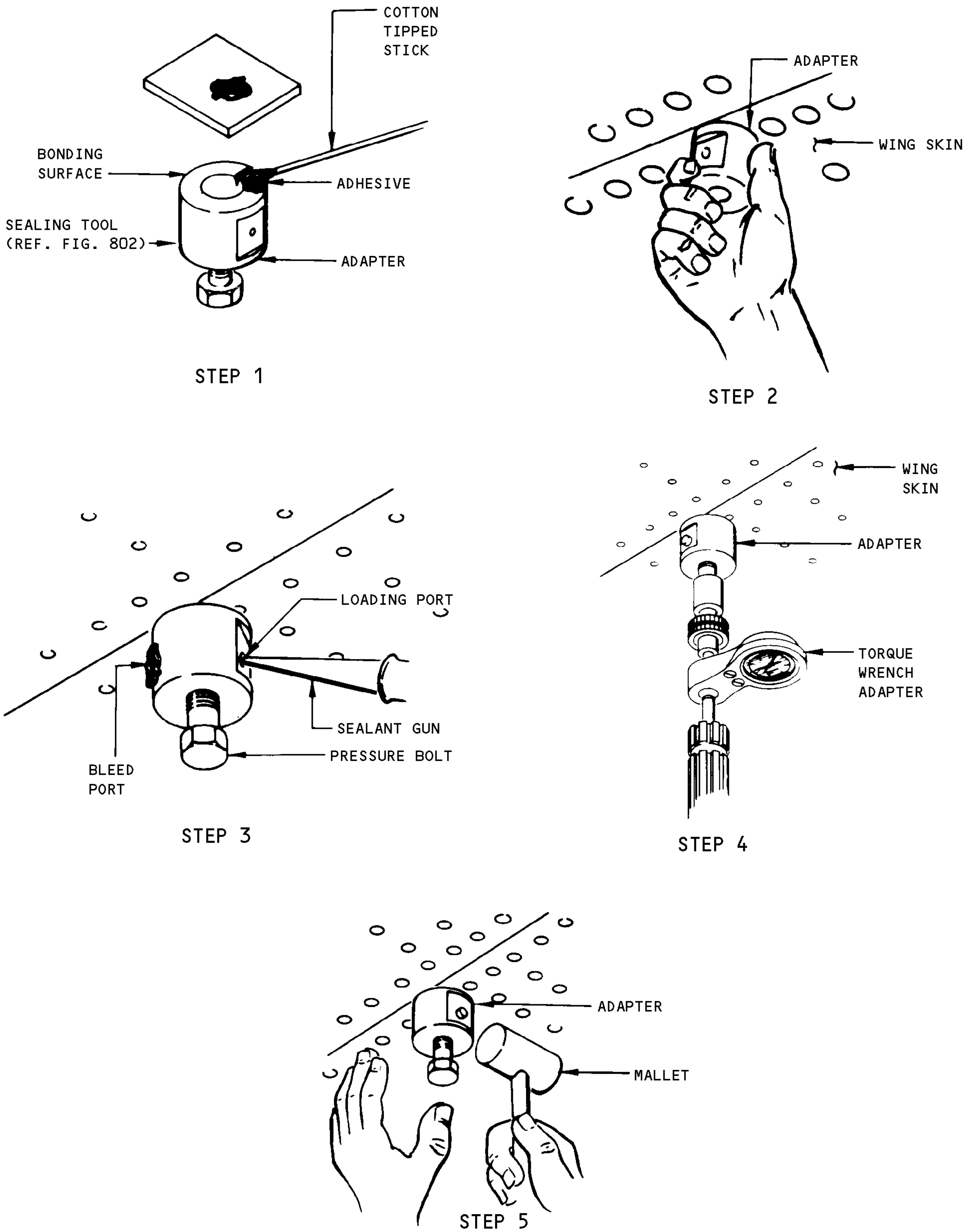


Application of Final Fillet
Figure 807





Re-entrants Fillet and Dimensions of Full Bodied Fillet
Figure 808



Temporary Repair of Self-Sealing Rivets
Figure 809

a) Installation should only be accomplished after determination that there are no structural cracks in the general area of the leak.
b) Click Patch size limited to 1.25 inches in diameter.
c) Click Patches are considered an interim repair and a permanent repair must be made at next convenient opportunity.

(b) Apply sealant to self-sealing rivets using locally fabricated tool for temporary repair (Fig. 802, 816).

NOTE: For fuel leaks at mechanically sealed rivets only.

1) Clean surface of adapter using emery cloth if necessary.
2) Strip paint from around leaking fastener. Clean surface with B01013 solvent, Series 93 (AMM 20-30-93/201). Do not touch surface with fingers after cleaning.

WARNING: DO NOT GET SOLVENT IN MOUTH, EYES, OR ON SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

3) Using a cotton-tipped stick, apply a thin coat of Eastman 910 adhesive to bonding surface of adapter (Fig. 809, Step 1).

WARNING: DO NOT ALLOW ADHESIVE TO BE IN CONTACT WITH THE SKIN, AS IT IS INJURIOUS TO SKIN.

4) Center adapter over fastener and firmly press adapter against wing skin for 10 seconds. Release hold on adapter and allow it to stand for 15 minutes.
5) Remove screw from loading port and back off bleed port screw until one more turn will remove it.

6) Remove pressure bolt, allow any accumulated fuel to drain, and reinstall bolt approximately 12 turns (1/2 inch).
7) Inject Class A-2 sealant in loading port until it exudes from bleed port (Step 3). Tighten load and bleed screw.
8) Tighten pressure bolt to 5 lb-in. and maintain for 5 minutes (step 4).
9) Remove adapter by tapping side of adapter with a small hammer or mallet (step 5) and check rivet for leakage.
10) Clean sealant from wing and adapter using B01013 solvent, Series 93 (AMM 20-30-93/201). Do not attempt to clean adhesive from wing surface; adhesive will weather off in 1 to 2 weeks.

(c) Apply sealant to self-sealing rivets using a rivet gun for temporary repair.
1) Strip paint from around rivet leak, using emery cloth or an approved chemical paint remover.
2) Clean tool and surface of wing with B01013 solvent, Series 93 (AMM 20-30-93/201). Do not touch surface with fingers after cleaning.
3) Mark surface of wing to indicate position of temporary repair tool (Fig. 817) during use.
4) Fill tool with prepared Class A-2 sealant.
5) Insert tool into a small rivet gun.
6) Place O-ring of tool on wing skin in marked location.
7) Actuate rivet gun for several minutes to force sealant around leaking rivet.

CAUTION: ALWAYS KEEP TOOL PERPENDICULAR TO WING SKIN TO PREVENT SKIN DAMAGE.

8) Check repair for leaks. If leak persists repeat the process and recheck. If rivet has to be replaced, refer to structural repair manual.
9) Clean sealant from tool and wing with B01013 solvent, Series 93 (AMM 20-30-93/201) taking care not to disturb freshly sealed area.

(d) Apply fillet seal to sealed fasteners.
1) Apply a precoat of properly accelerated Class A-2 sealant to fastener and area extending 1/2 inch in all directions from fastener. Use a stiff bristled brush and scrub sealant on surfaces and into crevices.

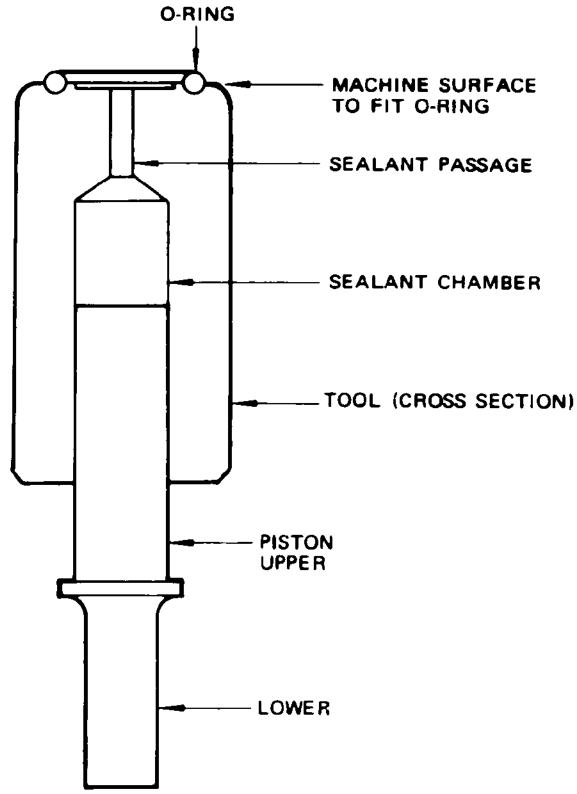
2) Allow precoat to cure until tack-free.
3) Using an extrusion gun or spatula, apply a coat of Class B sealant around and over fastener.
4) Work sealant with fairing tool until fillet seal dimensions given in Fig. 810 are obtained.
5) Carefully inspect for holes, bubbles, or voids in sealant. If any of these exist, repeat procedure.
6) Apply corrosion resistant finish (topcoat) (Ref par. 4.D. (15)) as required.

(e) Repair metal covered sealed fasteners.

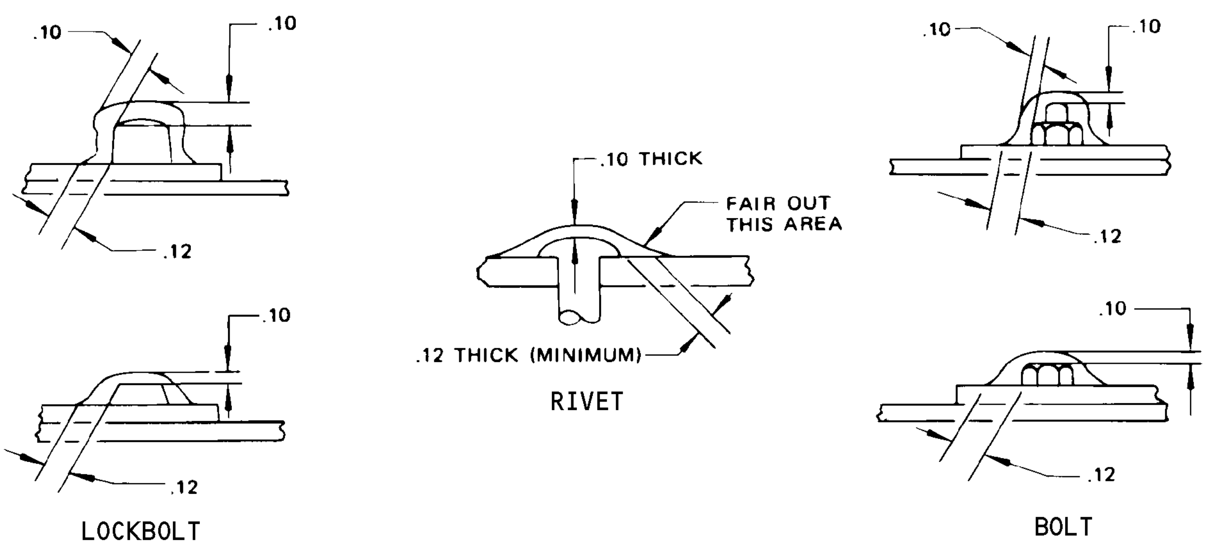
1) Using a sealant cutting tool, cut around and under seal cover, to separate sealant from structure.
2) Grasp seal cover with pliers and pull up and away from fastener end. Most of sealant should be removed by this process.
3) Cut away remaining sealant. Small quantities of sealant which adhere firmly to fastener need not be removed.
4) Clean seal covers, fastener ends, and structure area with cleaning solvent.
5) Apply precoat to area using Class A-2 sealant. Brush into crevices with smooth strokes of brush, leaving no ridges or voids.
6) Using correct size and shape of seal cover, fill cover two-thirds full of Class B sealant with a sealing gun or clean spatula (Fig. 819). Sufficient sealant must be used to ensure extrusion around base and through hole in top.
7) Press sealant in cover to ensure no void is left.
8) Press cover down over fastener until flange on cover contacts structure (Fig. 819).
9) Fair extruded sealant around top of cover removing excess sealant. Use clean cotton wipers (BMS15-5) for wiping fairing tool.
10) Holding cover in position, fair extruded sealant around base flange. Keep cover centered over bolt. Do not let it move.

    NOTE: When adjacent seal covers, structure, or sealant fillets interfere with normal application of a seal cover, up to 25 percent of the area of the cover to be applied may be trimmed around the base and up the sides to facilitate a fit. The same procedure as steps 6) thru 10) above shall be observed. Fig. 811 has dimensions of finished job.

11) Apply corrosion resistant finish (topcoat) (Ref par. 4.D. (15)) as required.



Fuel System Self-Sealing Rivets Temporary Repair Tool (F70230)
Figure 817



Dimensions of Fasteners Fillet Seals (Inches)
Figure 810

(12) Apply injection seals.
(a) Apply a new injection seal or raise seal plane to isolate faulty seal from fuel.
(b) Apply new injection seal.
1) The following tools are required: pipe cleaners, fairing tool, and an extrusion gun with injection nozzle attached.
2) Check that channel is thoroughly cleaned.
3) Apply a precoat of Class A-2 sealant to channel surfaces using pipe cleaners or a long bristled pencil brush.

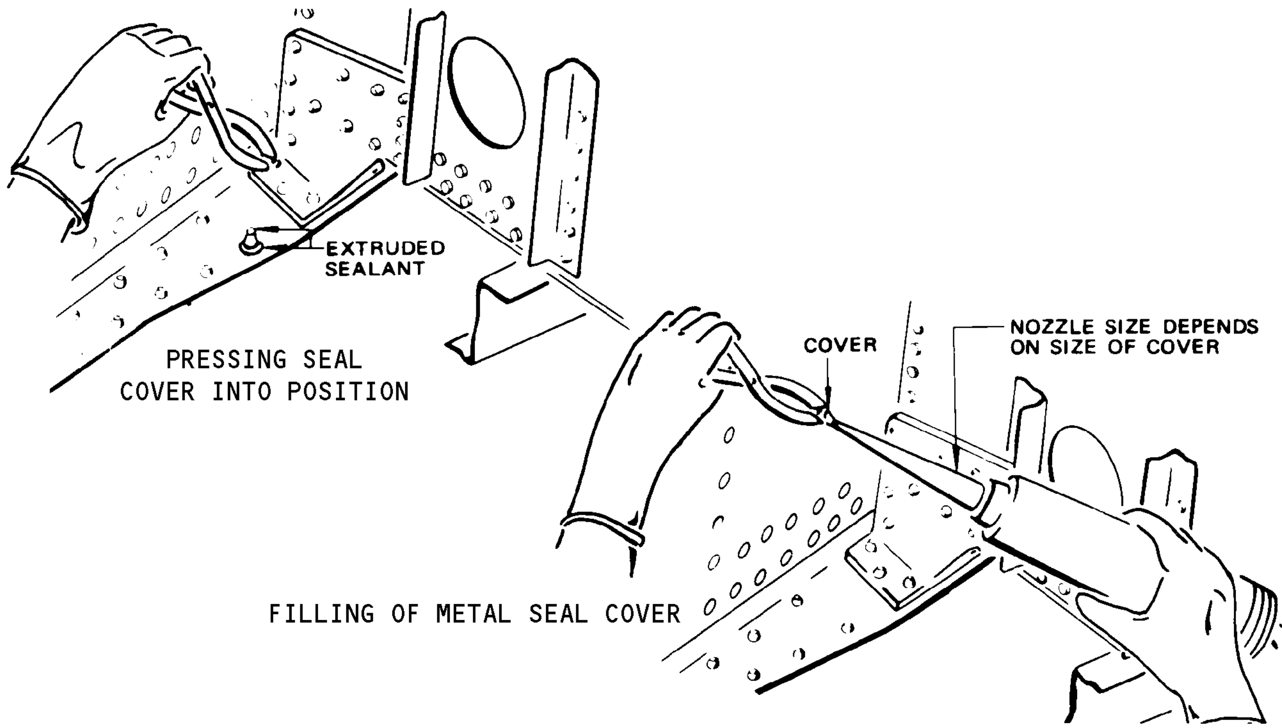
NOTE: Do not plug channel with Class A-2 sealant. This will prevent flow of final injection sealant into cavity. If channel cross section is 0.07-inch or less, precoat need not be applied.

4) Inject Class B sealant into one end of channel and fill until sealant emerges from all other openings. Completely fill joggles and channels that require continuity of seal or block-off seal (Fig. 821).

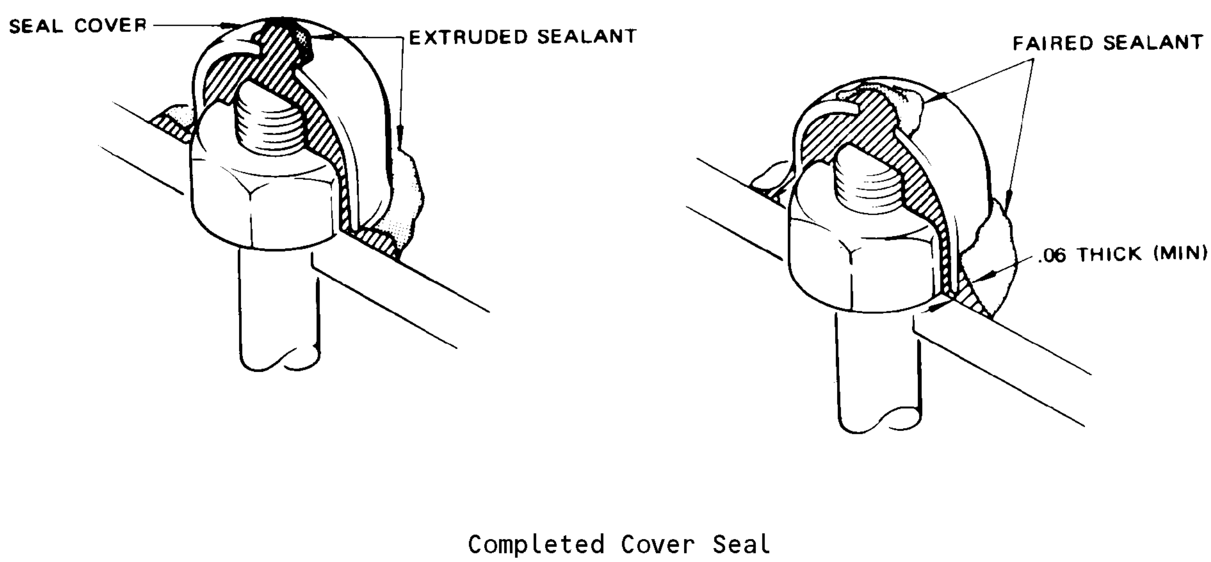
CAUTION: ENSURE THAT GUN HAS ENOUGH SEALANT FOR A COMPLETE SEAL AT ONE INJECTION WITHOUT STOPPING. STOPPING AND STARTING WILL CAUSE AIR BUBBLES IN SEAL AND IS CAUSE FOR REJECTION OF JOB.

5) Remove excess sealant with a fairing tool and smooth out ends of seal.
6) Inspect finished job for poor adhesion or air bubbles.
7) Sealant must be faired out gradually into area that is to be fillet sealed.
8) Apply corrosion resistant finish (topcoat) (Ref par. 4.D.(15)) as required.

(13) Apply prepack and faying surface seals.
(a) Apply prepack seal.
1) Apply coat of Class B sealant to one of the parts. Shape sealant with a fairing tool to general contours of cavity. Sufficient sealant must be applied to ensure complete filling of the cavity (Fig. 812).
2) Assemble parts within sealant work life (Fig. 803).
3) Apply corrosion resistant finish (topcoat) (Ref par. 4.D.(15)) as required.
(b) Apply faying surface sealant.
1) Apply a coat of Class B sealant to one faying surface with an extrusion gun or a spatula. Spread sealant over entire surface to obtain a uniform coating approximately 1/32 inch thick (Fig. 823).



Metal Seal Cover Installation
Figure 819



Completed Cover Seal
Figure 811

2) Assemble parts within sealant work life.
3) Fair out extruded sealant to leave a smooth fillet along joint.

NOTE: Sufficient sealant must be applied to ensure a continuous extrusion on both sides of joint after assembly of faying surfaces.

4) Apply corrosion resistant finish (topcoat) (Ref par. 4.D.(15)) as required.

(14) Raising the seal plane.

(a) As an option to replacing an injection, prepack, or faying surface seal, the seal plane may be raised (relocated) to isolate the failed seal from fuel.

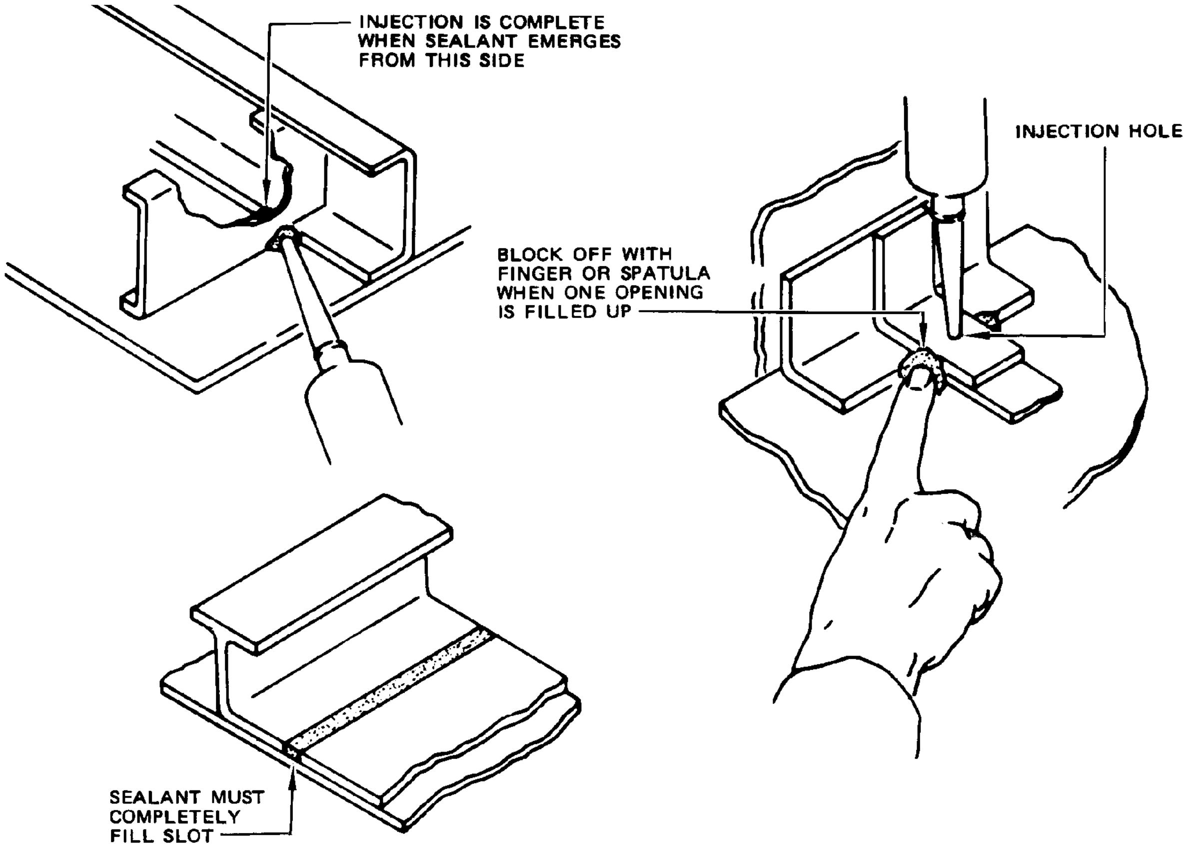
1) Structure surrounding failed seal must be carefully reviewed to determine the point to which seal plane must be raised. New seal plane will be established by fillet sealing around structure that surrounds seal and sealing fasteners which pass through structure. Fig. 813 shows a typical repair of a failed seal by raising the seal plane. Raising the seal plane can involve an extensive amount of sealant addition so in many cases structure removal and replacement of failed seal will be the best action.

(15) Apply corrosion resistant finish (topcoating) by brush or spray.

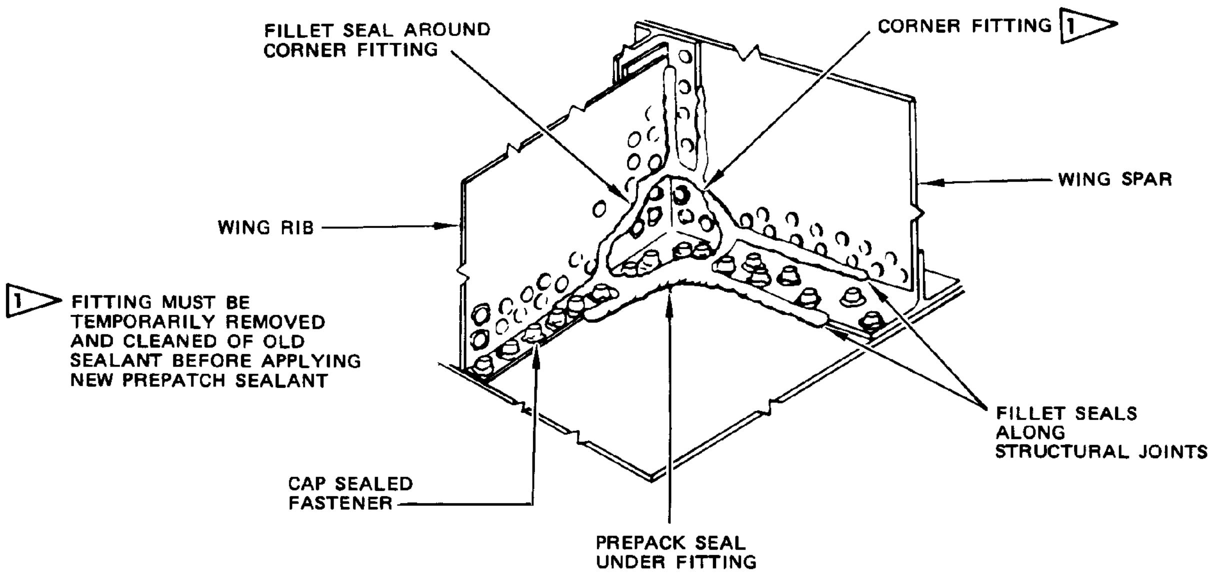
WARNING: THE AREA IN WHICH CORROSION RESISTANT FINISH (TOPCOATING) IS APPLIED SHOULD BE WELL VENTILATED. DO NOT GET IN EYES OR ON SKIN. WASH HANDS BEFORE EATING. KEEP AWAY FROM IGNITION SOURCES.

NOTE: Corrosion resistant finish is applied to tank internal structural surfaces, especially bottom and lower sides of tank. It may be applied as a topcoat over surfaces of previously applied sealant which has cured to at least a tack-free condition or it can be applied directly over metal surfaces. Only BMS 10-20 Type II material can be applied before, as well as after, the application of sealant. MIL-C-27725 material can only be used as a top coat finish after any necessary sealant repair is complete.

(a) Made sure that all application equipment and fuel tank surfaces to be coated are perfectly clean. If in doubt, clean equipment and tank surfaces with B01013 solvent, Series 93 (AMM 20-30-93/201), solvent immediately before you apply the finish.

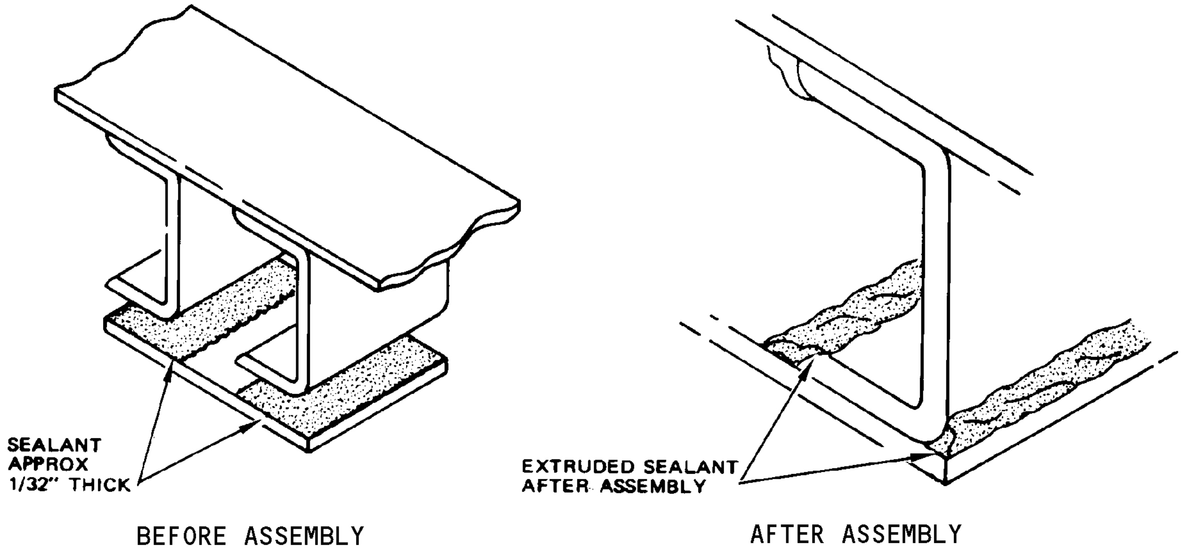


Injection Seal Application
Figure 821

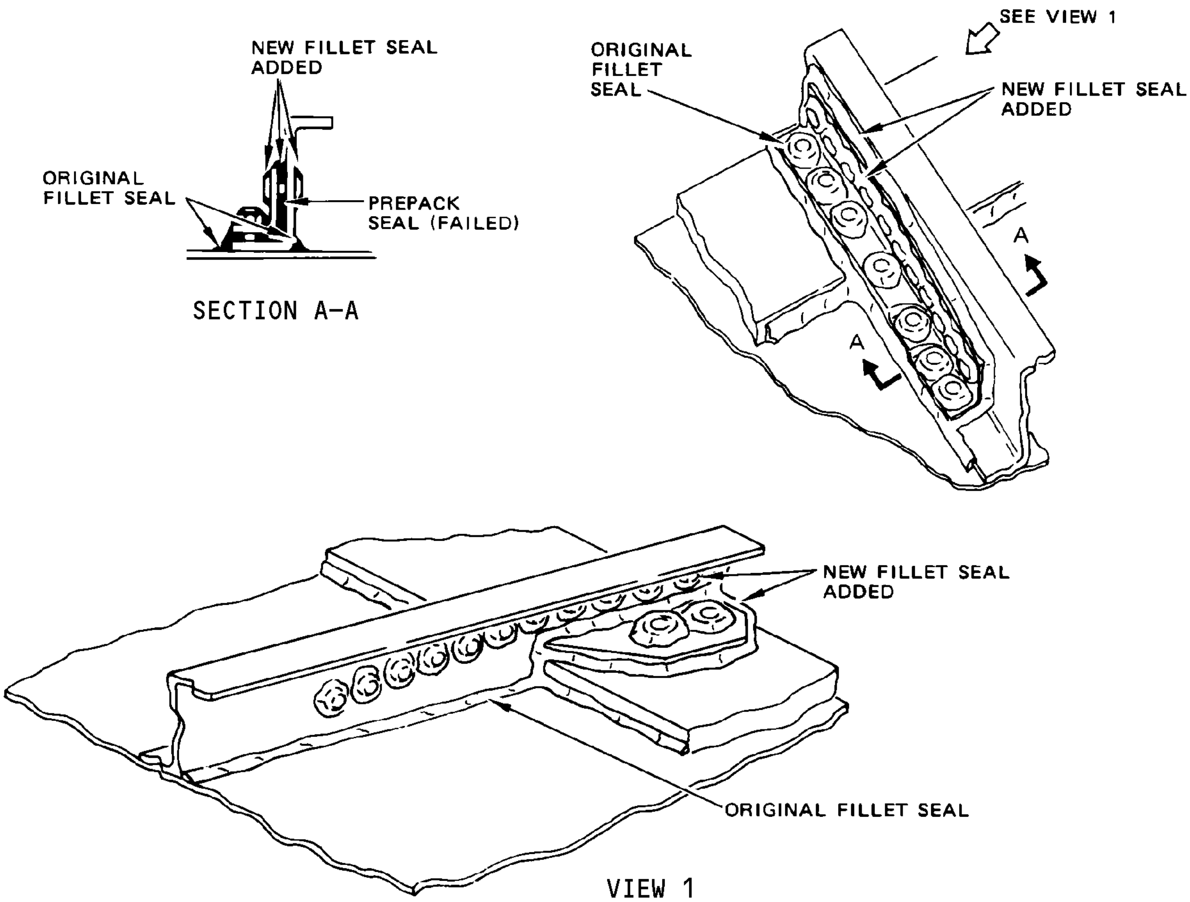


Typical Combination of Pre-pack and Fillet Seals
Figure 812

470363



Faying Surface Seal
Figure 823



Raising the Seal Plane to Repair a Failed Prepack Seal
Figure 813

(b) Check that sufficient finish material is available to complete application.
(c) Deleted
(d) Mask, as necessary, any non-structural fuel tank equipment areas which are in, or adjacent to, the area which is to receive the finish (topcoating) application.

<u>CAUTION</u>: REMOVE ALL MASKING TAPE AFTER FINISH APPLICATION IS COMPLETED OR FUEL FEED BOOST PUMP SUCTION INLETS MAY BECOME CLOGGED.

<u>NOTE</u>: Corrosion resistant finish (topcoating) must not be used on bonding surfaces, clamps, O-ring surfaces, valves, measuring sticks, tank and compensator units, wiring, boost pumps, filler caps, or other non-structural equipment.

(e) Ensure that finish application temperature will be maintained at 50-100°F (10.0-37.8°C) with less than 85 percent relative humidity throughout the application process (brush or spray).
(f) Apply finish (topcoating) by brush.
  1) Apply thin film (approximately 0.0005 inch) with soft bristle paintbrush, brush in one direction as much as practicable.
    a) Avoid fast scrubbing motions or repeated brushing out of wet compound which may produce air bubbles, pickups, or voids.
  2) Allow to dry for a minimum of 30 minutes.
  3) Apply second thin film in same manner as first coat.
  4) Ensure that applied finish overlaps any adjacent topcoating previously applied.
(g) Apply finish (topcoating) by spray.
  1) Set spray gun to 40 psi air pressure and 5 to 10 psi fluid pressure.
  2) Spray finish material on entire surface to be coated in a wet, continuous film.
  3) Allow to dry for a minimum of 30 minutes.
  4) Apply second coat in same manner as first coat.
  5) Ensure that applied finish overlaps any adjacent topcoating previously applied.
(h) Cleanup after corrosion resistant finish (topcoating) application.
  1) Clean equipment with B01013 solvent, Series 93 (AMM 20-30-93/201) immediately after use.

2) Soak brushes in B01013 solvent, Series 93 (AMM 20-30-93/201) immediately after use. Discard brushes when bristles become stiff.

WARNING: DO NOT GET SOLVENT IN MOUTH, EYES, OR ON SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

5. Nonsealant Leaks Approved Repairs

A. General

(1) The repair of nonsealant leaks consists of repairing leaks around removable plumbing fittings, primary tension bolts, tank access doors and fuel system components that penetrate fuel tank walls. These items are either sealed by O-rings or by molded rubber seals. If seals are damaged and leaking they should be replaced. Any surface damaged during O-ring and sealant removal must be realodized before new O-rings or sealants are installed (Ref par. 4.C.(7)).

B. Equipment and Materials

(1) Air Blower (Explosionproof), with sufficient flexible hose to reach all areas inside fuel tank. Capacity to be 90 to 100 cubic feet per minute
(2) Exhaust Fan (Explosionproof Centrifugal), with approximately 75 feet of 3-inch diameter flexible suction hose and sufficient delivery hose to carry exhausted air outside hangar or working area.
(3) Respirator (Full Face Supplied Air Type) - U.S. Bureau of Mines Approved
(4) Gasoline (white) - VV-G-109 (Ref 20-30-31)
(5) Naphtha - TT-N-95 (Ref 20-30-31)
(6) B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
(7) Petrolatum - VV-P-236 (Ref 20-30-21)
(8) Rubber Cement - B.F. Goodrich No. 4 (Ref 20-30-11)

C. Prepare Tank for Non-Sealant Leak Repair

(1) Defuel and purge applicable tank (Ref 28-10-0, 28-23-0 MP)
(2) Position air blower and exhaust fan at least 30 feet from open tank (Fig. 814).
(3) Insert end of supply hose from air blower into overwing filler port. Support end of hose as required with shot bags.
(4) Insert sufficient suction hose into tank to enable end of hose to be located as close as possible to work area.
(5) Position end of delivery hose from exhaust fan outside of hangar, downwind and clear of doorway.
(6) Attach approved ground wire to all hoses in contact with airplane and ground to an approved grounding provision.

(7) Start air blower and exhaust fan.

(8) Enter tank taking in required tools and replacement parts, such as O-rings, gaskets, rivets, etc.

NOTE: Keep all tools and spare parts in a plastic or cardboard container to prevent damage to sealant material.

(9) Keep exhaust duct end as close as practical to work area while work is in progress.

D. Repair of Nonsealant Leaks

(1) O-rings are used to seal removable plumbing fittings, primary tension bolts, fuel tank access doors, and fuel system components which penetrate fuel tank walls. Some fuel tank access doors are sealed with a molded rubber seal ring, if any of these seals develop a leak the door should be replaced. You can replace the rubber seal on high impact resistant access panels without replacing the door (Ref 28-11-11/801). You must replace the entire door if the seal on a cast aluminum door develops a leak. If any O-ring seals develop a leak, they should be replaced as follows:

(a) Install O-ring.

1) Obtain proper O-ring replacement. Ascertain that cure date is less than 48 months prior to current date.

2) Remove used O-ring from assembly.

3) Clean O-ring groove and flat surface of the two assembly parts with B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201). Wipe dry with a clean cotton wiper (BMS15-5) (Fig. 815).

WARNING: KEEP CLEANERS AND SOLVENTS AWAY FROM HEAT, SPARKS, AND OPEN FLAME. USE WITH ADEQUATE VENTILATION. KEEP CONTAINERS CLOSED WHEN NOT IN USE. AVOID BREATHING OF VAPORS OR CONTACT WITH SKIN.

4) Examine O-ring groove and adjoining flat surface for cuts, scratches, dents, distortions, and foreign material. Defective fittings must be repaired or replaced.

5) Check new O-ring for defects; if defective, discard it.

6) Stamp rubber cure date of O-ring on assembly in which it is installed.

7) Check O-ring fit in groove. See Fig. 815 for proper fit.

8) Install O-ring and assemble part.

9) In the assembly of parts where difficulty is experienced holding an O-ring in position, it may be cemented into the groove as follows:
   a) Clean and examine parts as directed in steps 3) thru 7).
   b) Apply a light coating of B.F. Goodrich No. 4 rubber cement.
   c) Apply a light coating of the same cement to the surface of the O-ring.

      NOTE: B.F. Goodrich No. 4 rubber cement can be thinned by adding white gasoline, W-G-109 or naptha, TT-N-95.

   d) When cement on O-ring and in the groove becomes "tacky," turn O-ring, cement side down, and press into groove.
   e) Remove excess cement from flat surface of fitting by rubbing the thumb or finger over the surface. Cement will roll or peel off.
   f) Assemble parts.

      NOTE: As an option a thing film of petrolatum VV-P-236 may be applied to O-ring.

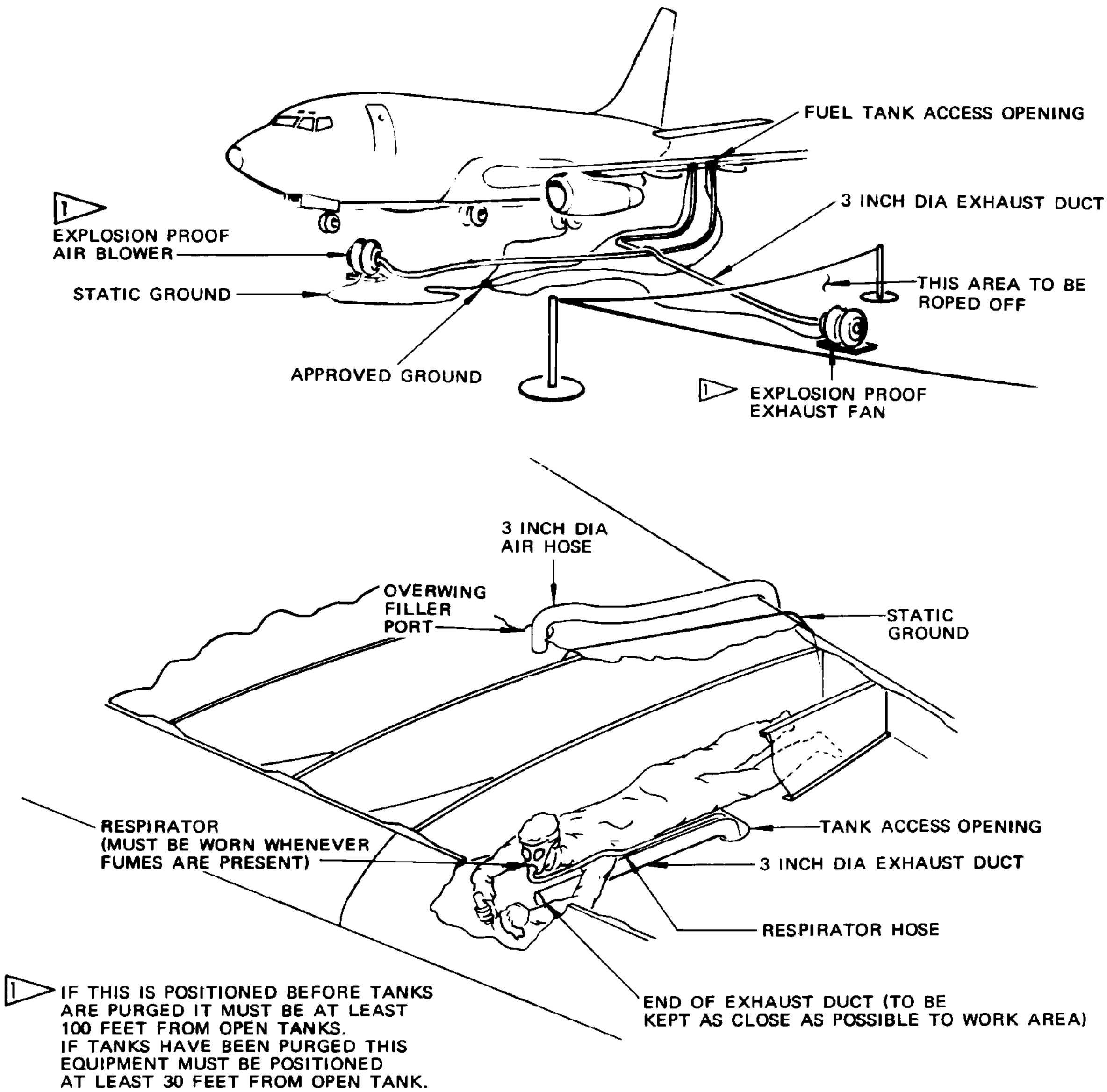
6. Examination and Closure of Repaired Fuel Tanks

A. Any time an integral fuel tank has been entered it must be given a very thorough examination before closure. If repair sealant has been applied, the tanks must be carefully cleaned and examined before closure. The following steps shall be used for closure of repaired integral fuel tanks.

WARNING: COMPLY WITH ALL TANK ENTRY PRECAUTIONS AS GIVEN IN 28-10-0, MAINTENANCE PRACTICES.

(1) Remove all coverplates, plugs, and equipment used in leak isolation tests.
(2) Remove all tools, solvent containers, cotton wipers (BMS15-5), and brushes used for sealant repairs.

    NOTE: A check list should be maintained recording all tools, equipment, material, and personnel as they enter and leave the tank. The check list should be verified before tank closure.



Fuel Tank Ventilation
Figure 814

(3) Vacuum clean the repaired tank thoroughly to remove lint and pieces of old sealant. If tank is wet with fuel, wipe the contaminated areas clean with cotton wipers (BMS15-5).

WARNING: ALL EQUIPMENT AND HOSES USED IN OR NEAR THE OPENED FUEL TANK MUST BE PROPERLY GROUNDED.

(4) Examine all repair sealant and topcoating for proper application.
(5) Replace any rib braces or structure removed for accessibility.
(6) Install access doors.

7. Fueling Repaired Integral Fuel Tanks

A. Integral fuel tanks repaired and topcoated shall not be refueled until topcoating has cured. Under normal conditions, 12 hours at a minimum of 65°F is required for the topcoat to cure before fueling.

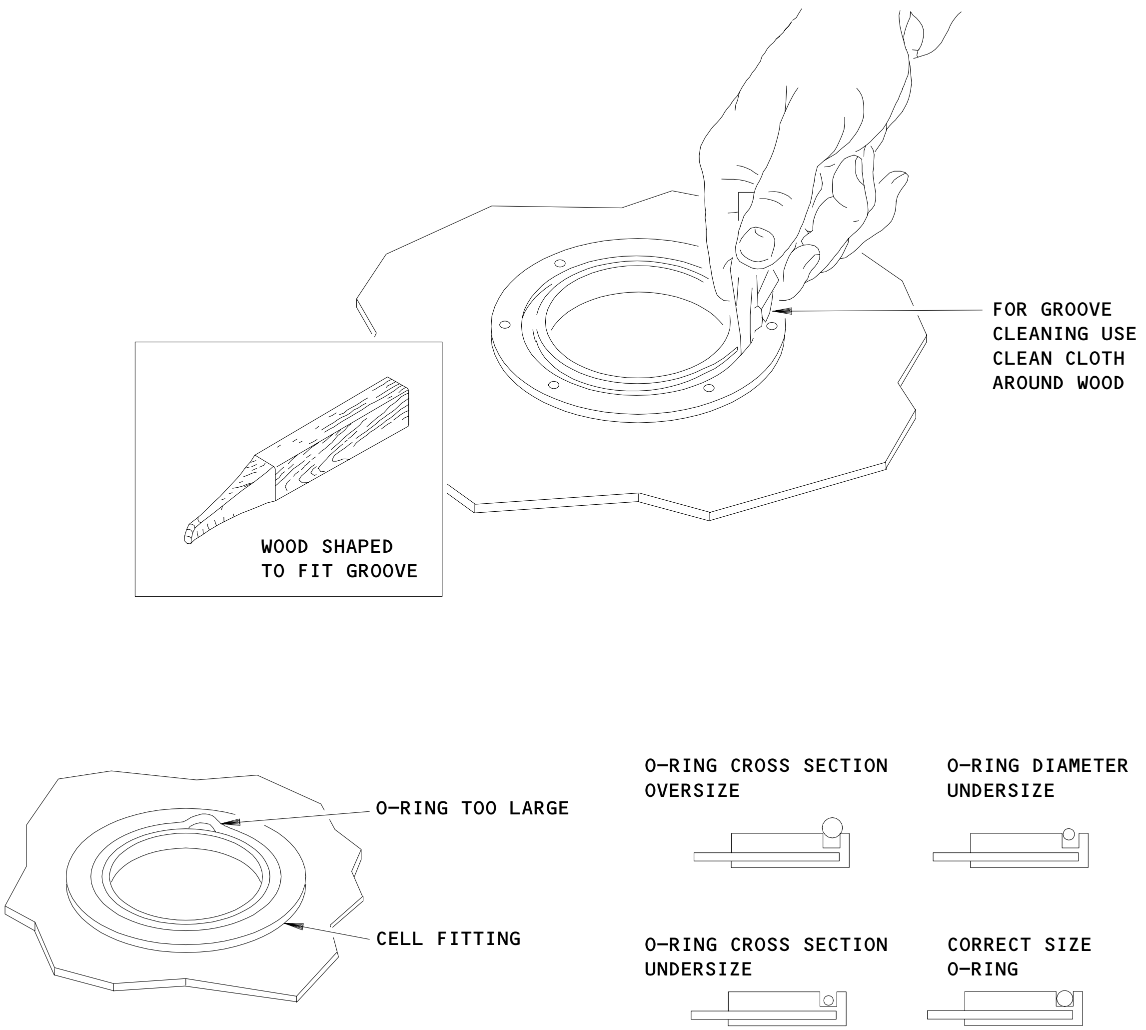
B. Integral fuel tanks repaired without topcoating may be refueled when the sealant becomes tack-free providing pressure of the refueling stream is not directed against the new sealant.

(1) Fill repaired integral tank with fuel (Ref 12-11-0, Fuel Servicing). Check the external leak area periodically for 1 hour. There shall be no leakage.
(2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

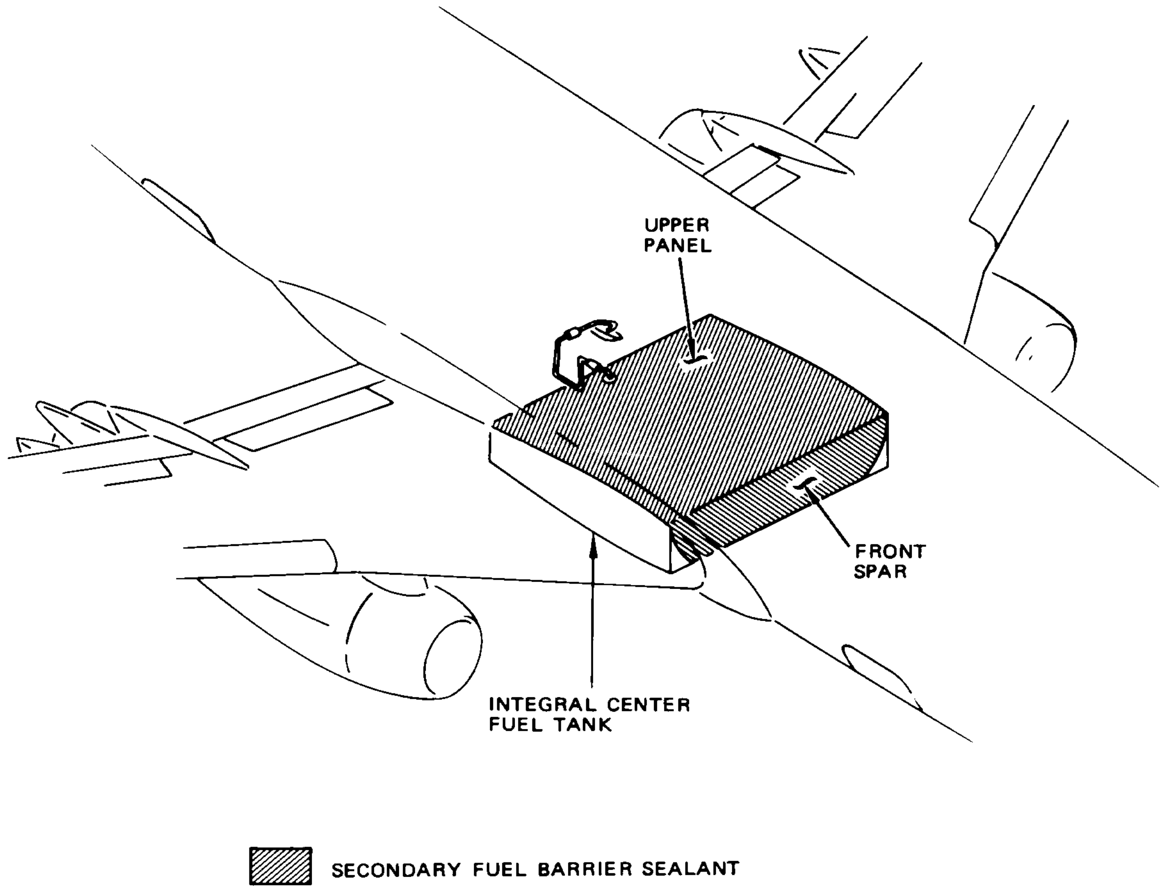
(a) Clean surface to be topcoated with a clean cotton wiper (BMS15-5) wetted with B01013 Solvent - final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201). Wipe surface dry with a clean cotton wiper (BMS15-5) before solvent evaporates.

NOTE: This step shall be repeated until no soils are visible on the cotton wiper (BMS15-5). There may be some pickup of yellow pigment on previously coated surfaces. This is not considered soil.

(3) Remove all tools, solvent containers, cotton wipers (BMS15-5), and brushes used for sealant repairs.
(4) Vacuum clean the repaired tank thoroughly to remove lint and pieces of old sealant. If tank is wet with fuel, wipe the contaminated areas clean with a cotton wiper (BMS15-5).



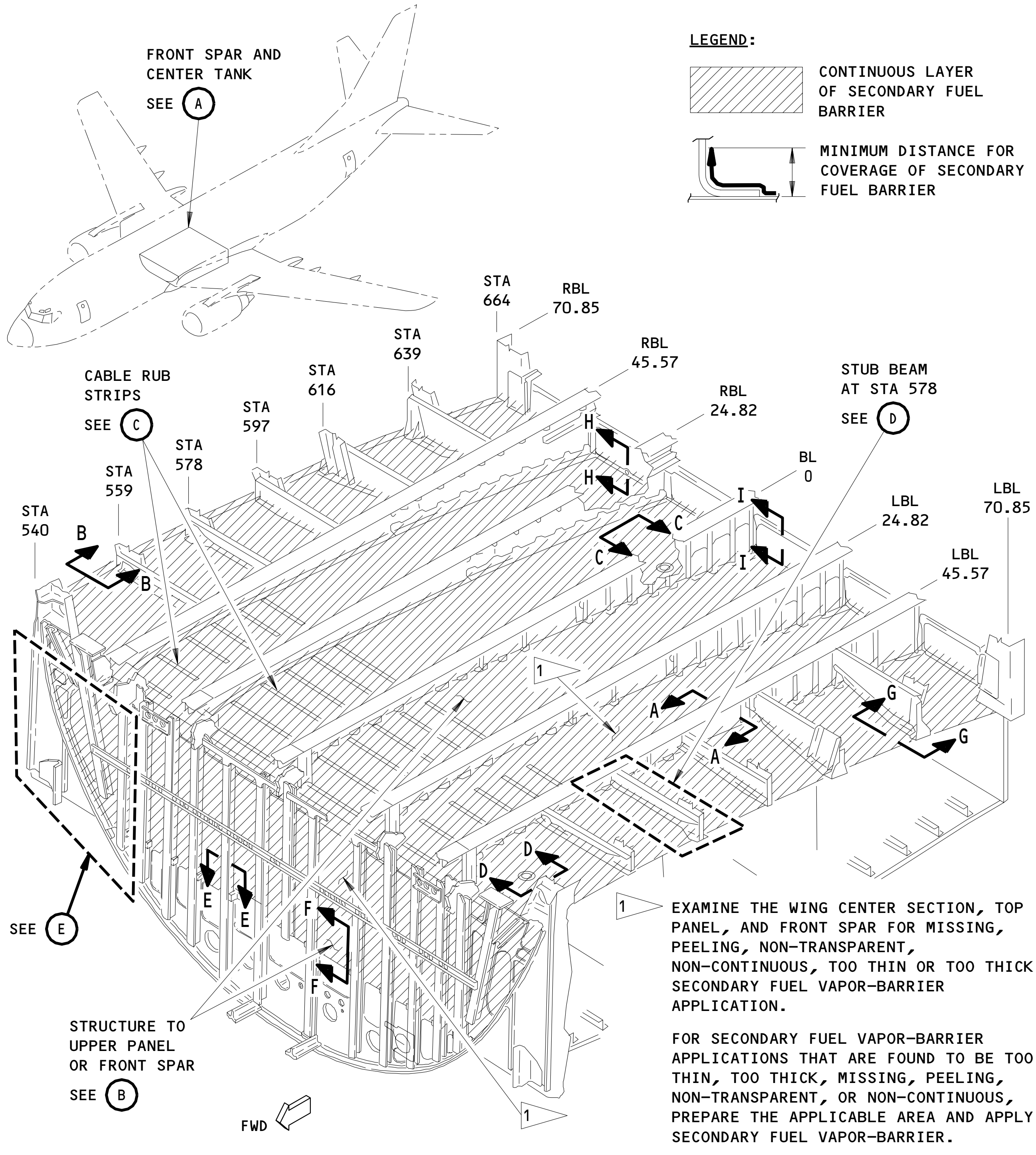
O-Ring Groove Preparation and Fit
Figure 815



EFFECTIVITY

AR ALL EXCEPT LV-JMW THRU LV-JMZ, LV-JND, LV-JNE, LV-JTD, LV-JTO, LV-LEB
PI N761N AND ON
VP ALL EXCEPT PP-SMA THRU PP-SMH, PP-SMP THRU PP-SMT
WE ALL EXCEPT N2711R, N4902W, N4906, N4907
ZD ALL EXCEPT G-AVRL THRU G-AVRO, G-AWSY, G-AXNA THRU G-AXNC

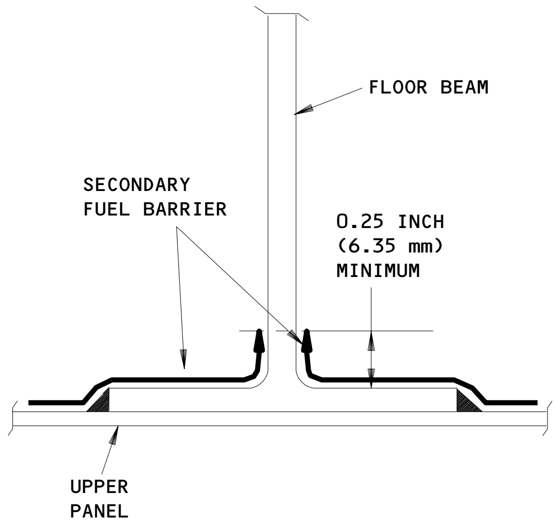
Secondary Fuel Barrier Sealant Repair
Figure 816



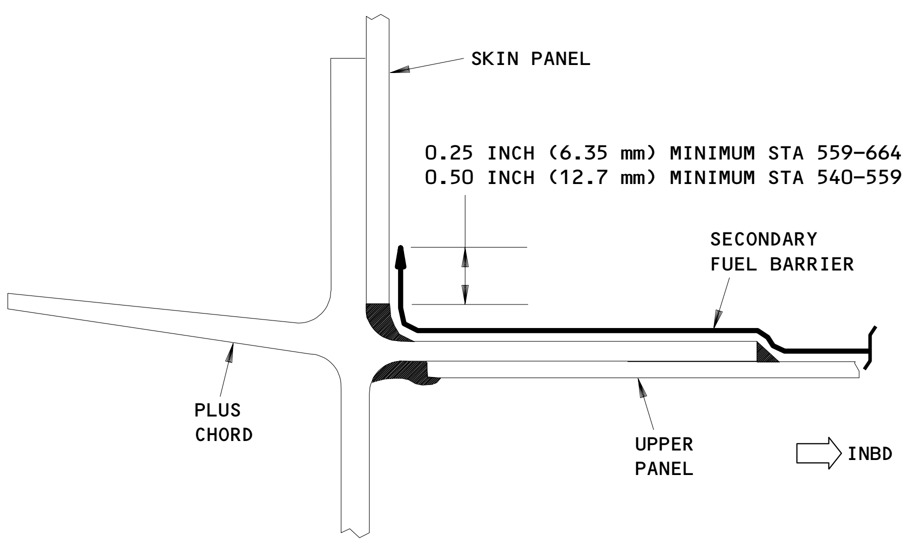
FRONT SPAR AND CENTER TANK (EXAMPLE)

A

Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 1)

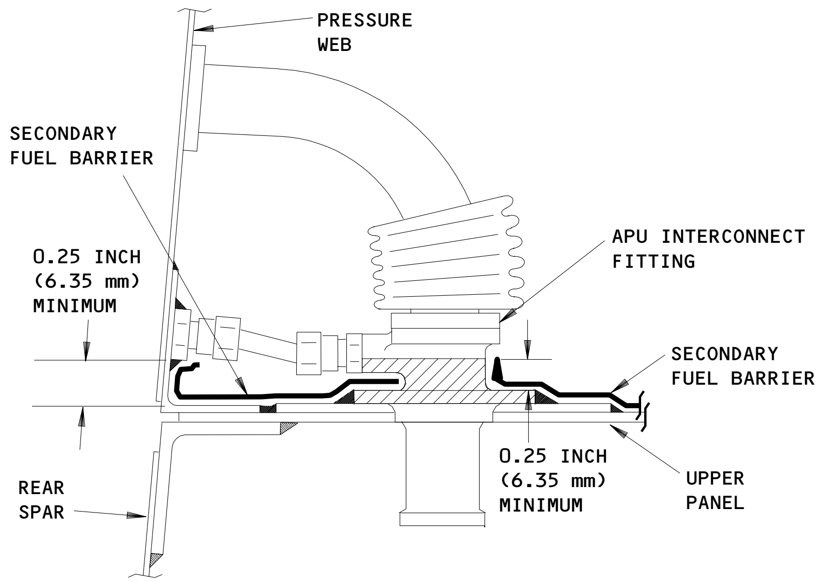


FLOOR BEAM LOWER CHORD TO UPPER PANEL
(EXAMPLE)
A-A

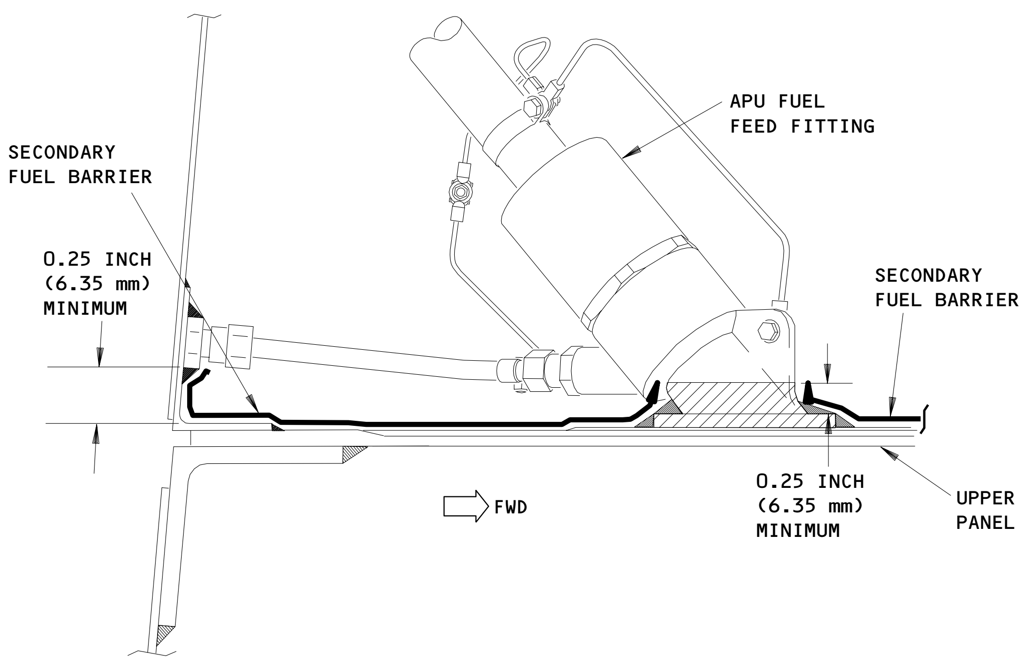


LONGITUDINAL EDGE OF THE UPPER PANEL
(RIGHT IS SIDE SHOWN, LEFT SIDE IS ALMOST THE SAME)
(EXAMPLE)
B-B

Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 2)



APU FUEL FEED FITTING AND PRESSURE WEB 1
C-C

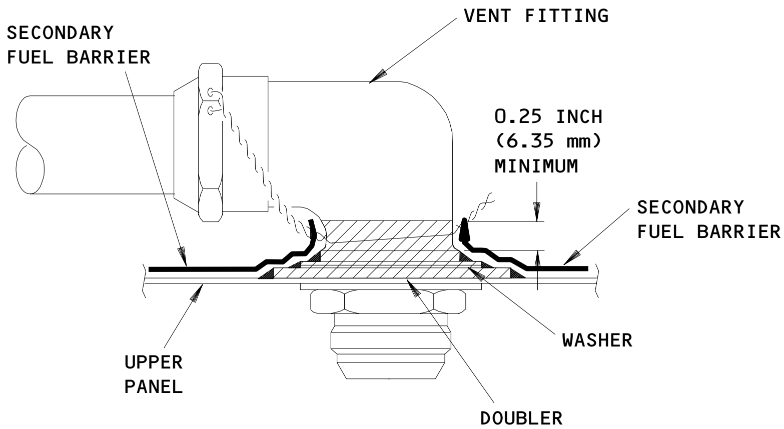


APU FUEL FEED FITTING AND PRESSURE WEB 2
C-C

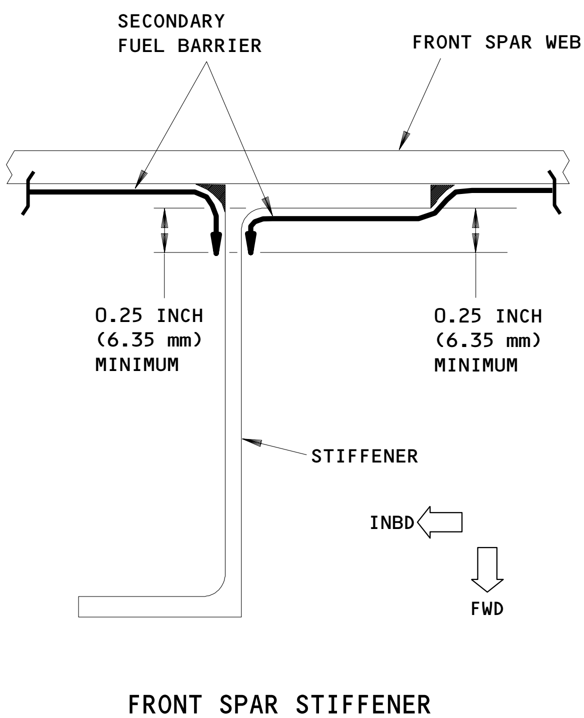
1 FUEL LINE SHROUD WITH BELLOWS

2 FUEL LINE SHROUD WITHOUT BELLOWS

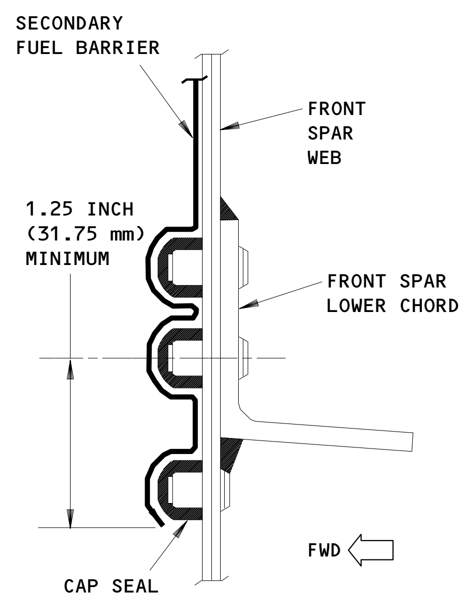
Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 3)



VENT FITTING
D-D

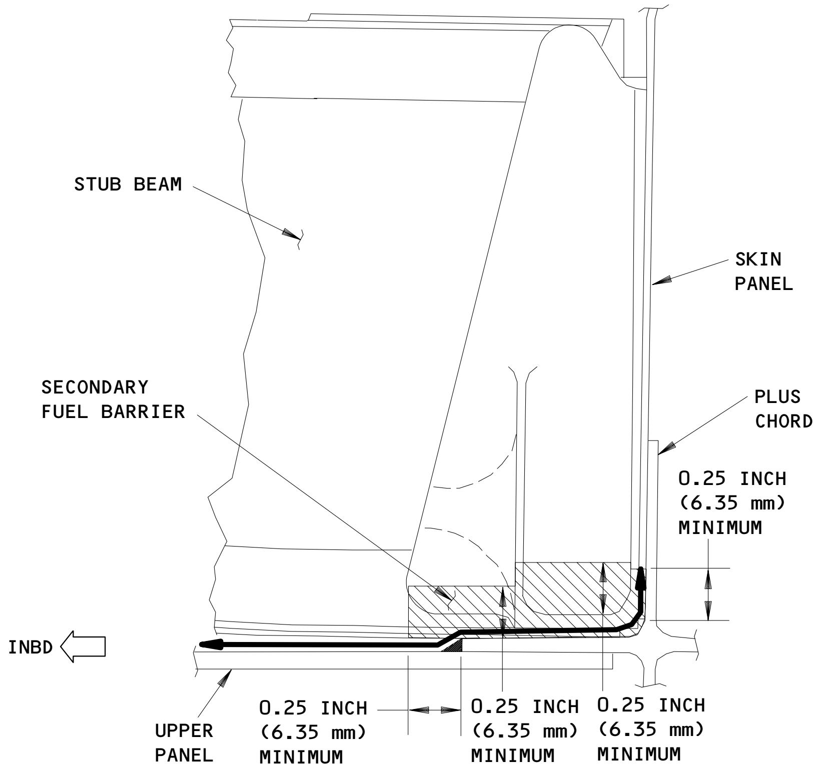


FRONT SPAR STIFFENER
(EXAMPLE)
E-E

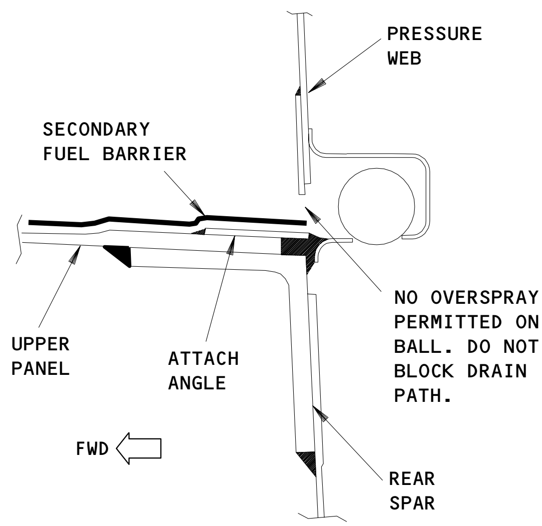


F-F

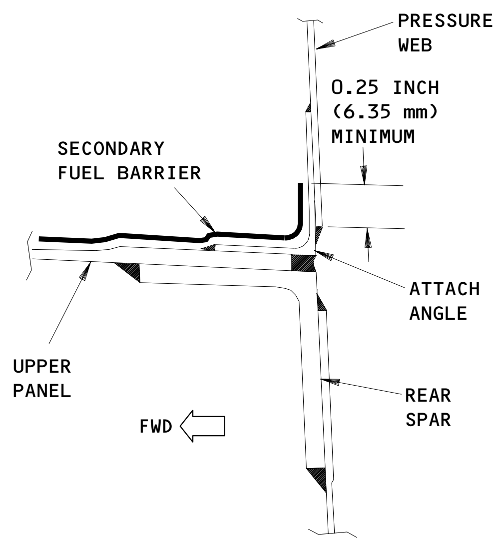
Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 4)



STUB BEAM AT STA 639
(LEFT SIDE IS SHOWN, RIGHT SIDE IS OPPOSITE)
(STUB BEAMS AT STA 597 AND 616 ARE ALMOST THE SAME)
G-G

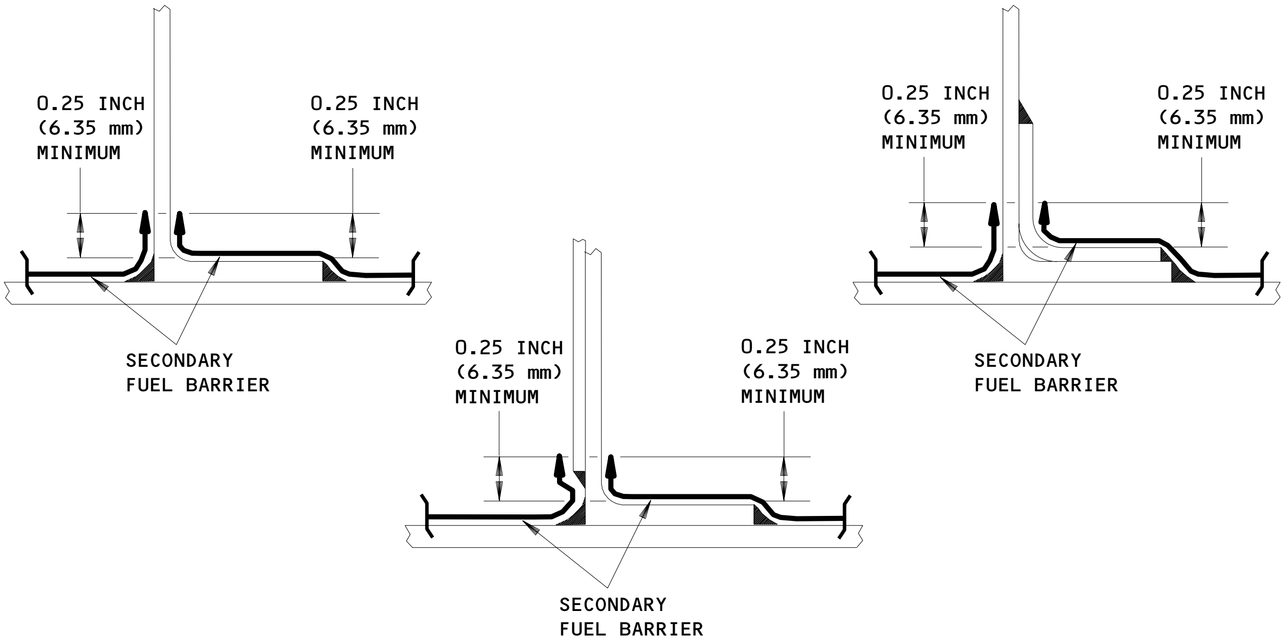


(EXAMPLE, 2 LOCATIONS)
H-H

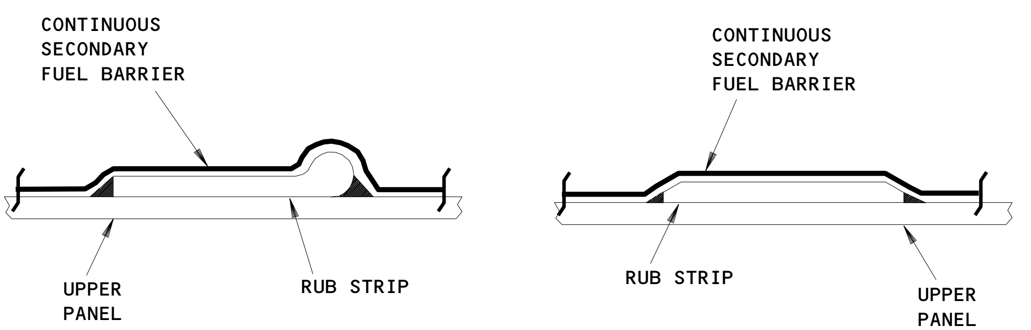


(EXAMPLE FOR PRESSURE WEB)
I-I

Secondary Fuel Barrier Sea4ant Repair
Figure 817 (Sheet 5)

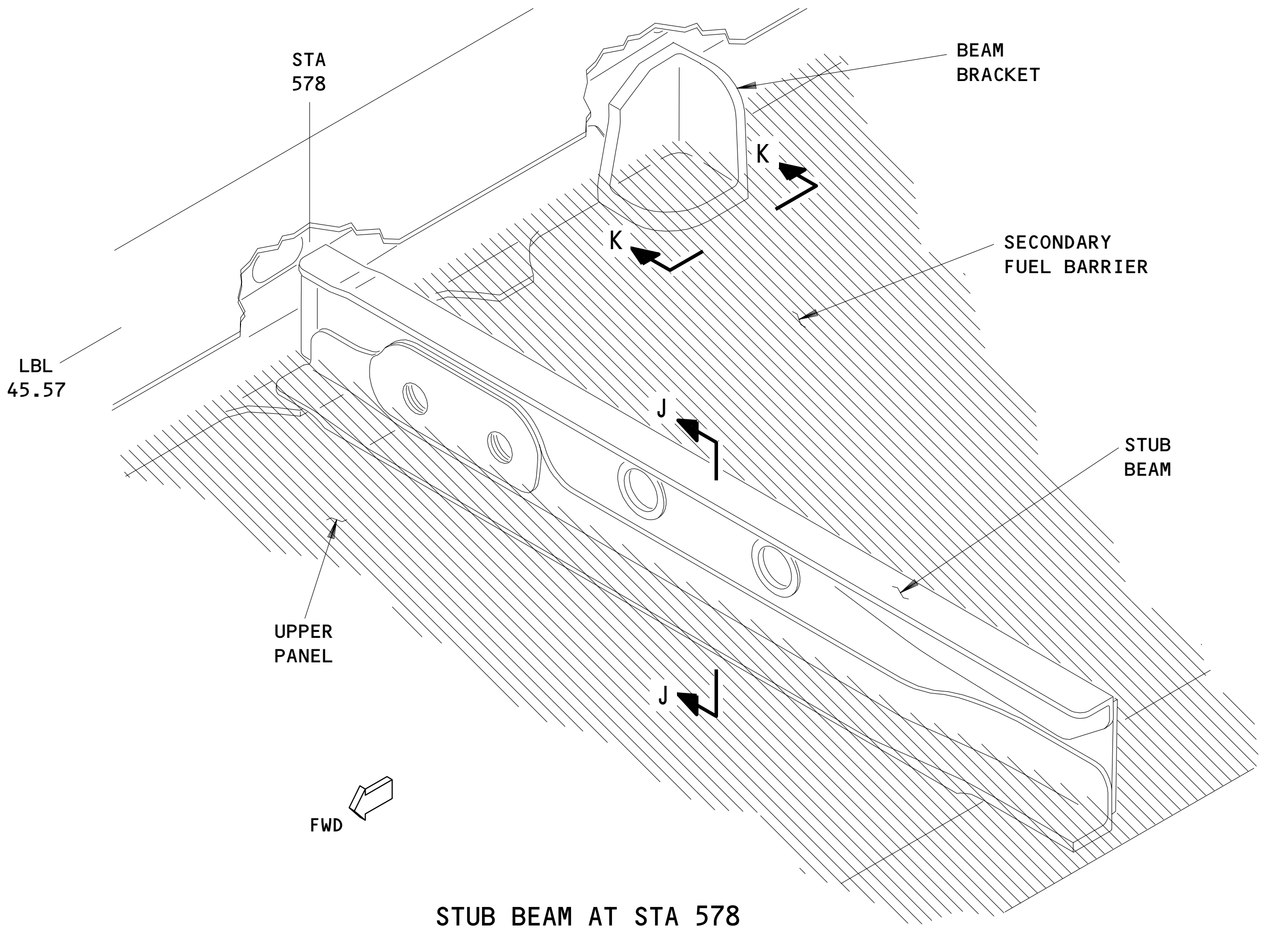


STRUCTURE TO UPPER PANEL OR FRONT SPAR
(EXAMPLE)
B



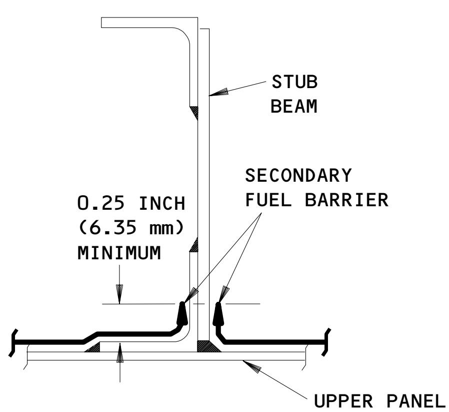
CABLE RUB STRIPS
(EXAMPLE)
C

Secondary Fuel Barrier Sea4ant Repair
Figure 817 (Sheet 6)

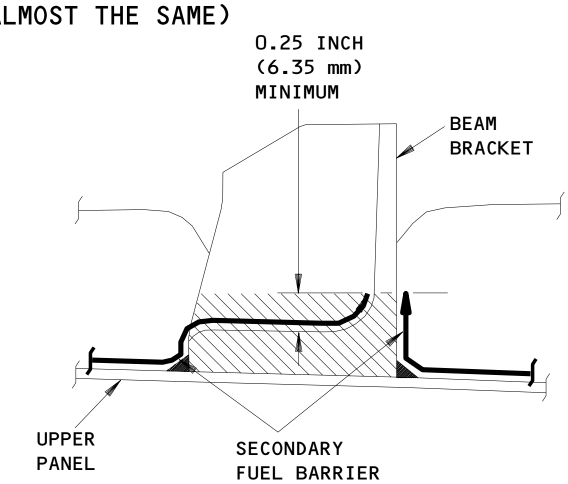


STUB BEAM AT STA 578
(LEFT IS SIDE SHOWN, RIGHT SIDE IS OPPOSITE)
(STUB BEAM AT STA 559 IS ALMOST THE SAME)

D

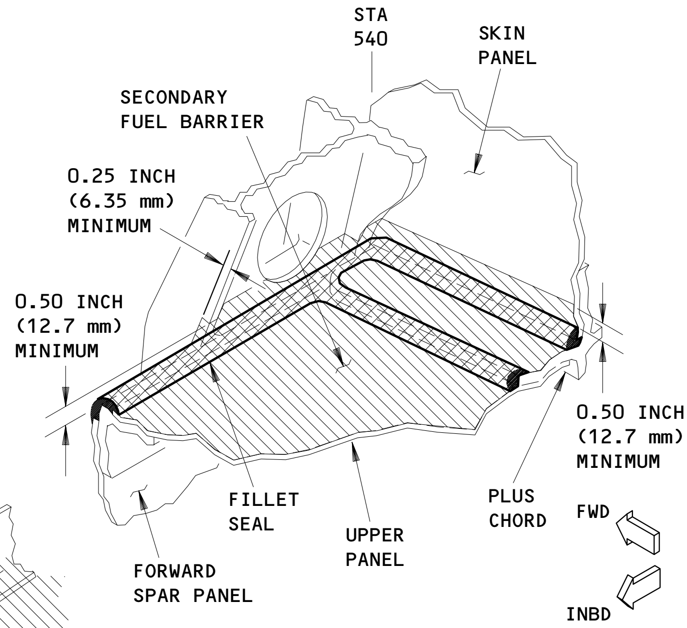


J-J

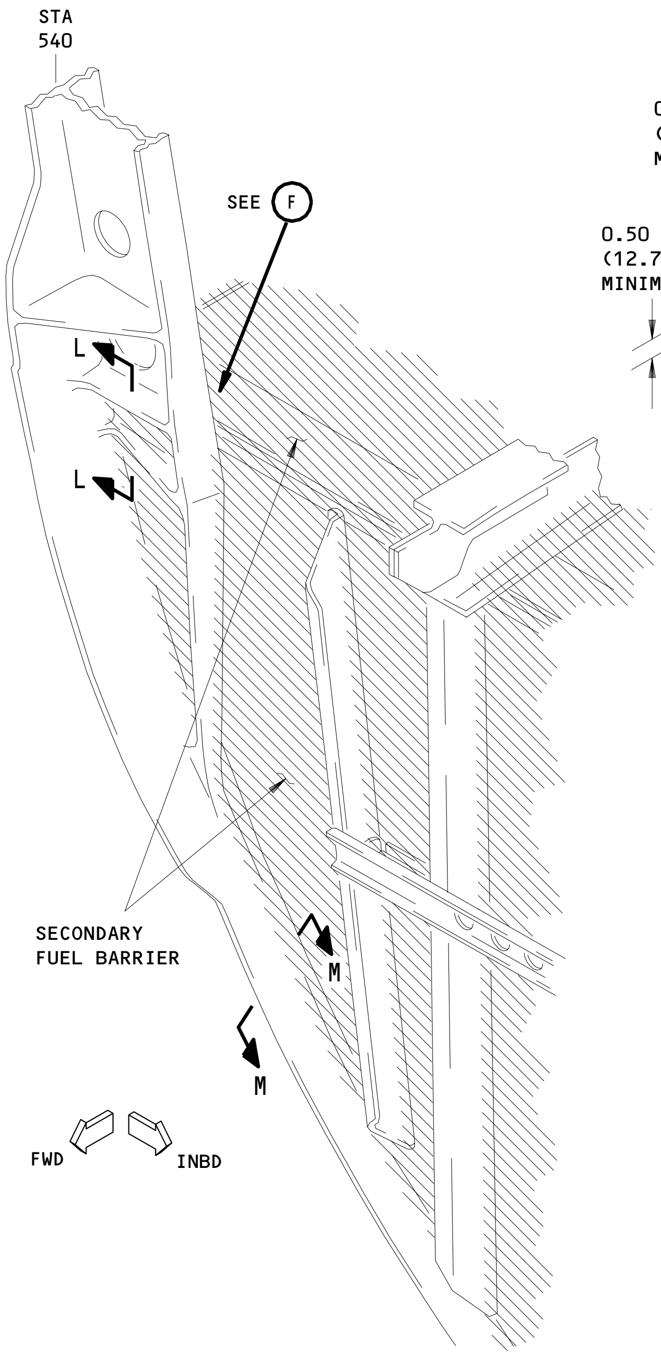


K-K

Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 7)



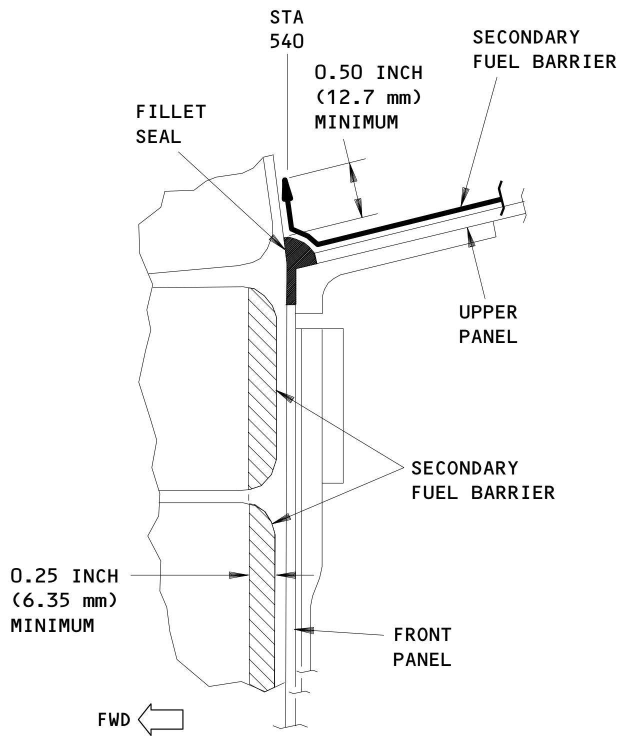
F



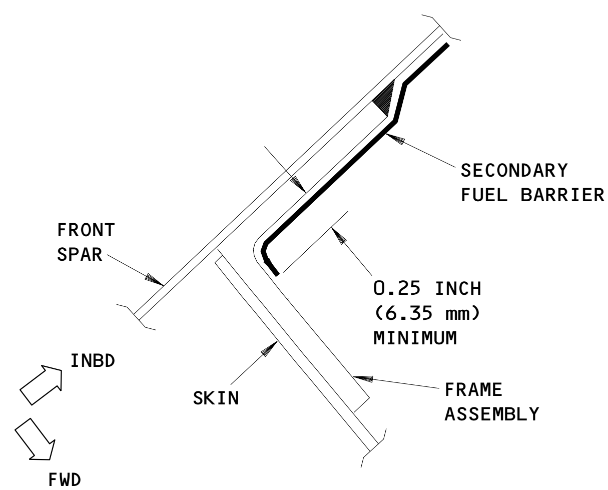
(RIGHT SIDE IS SHOWN, LEFT SIDE IS OPPOSITE)

E

Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 8)

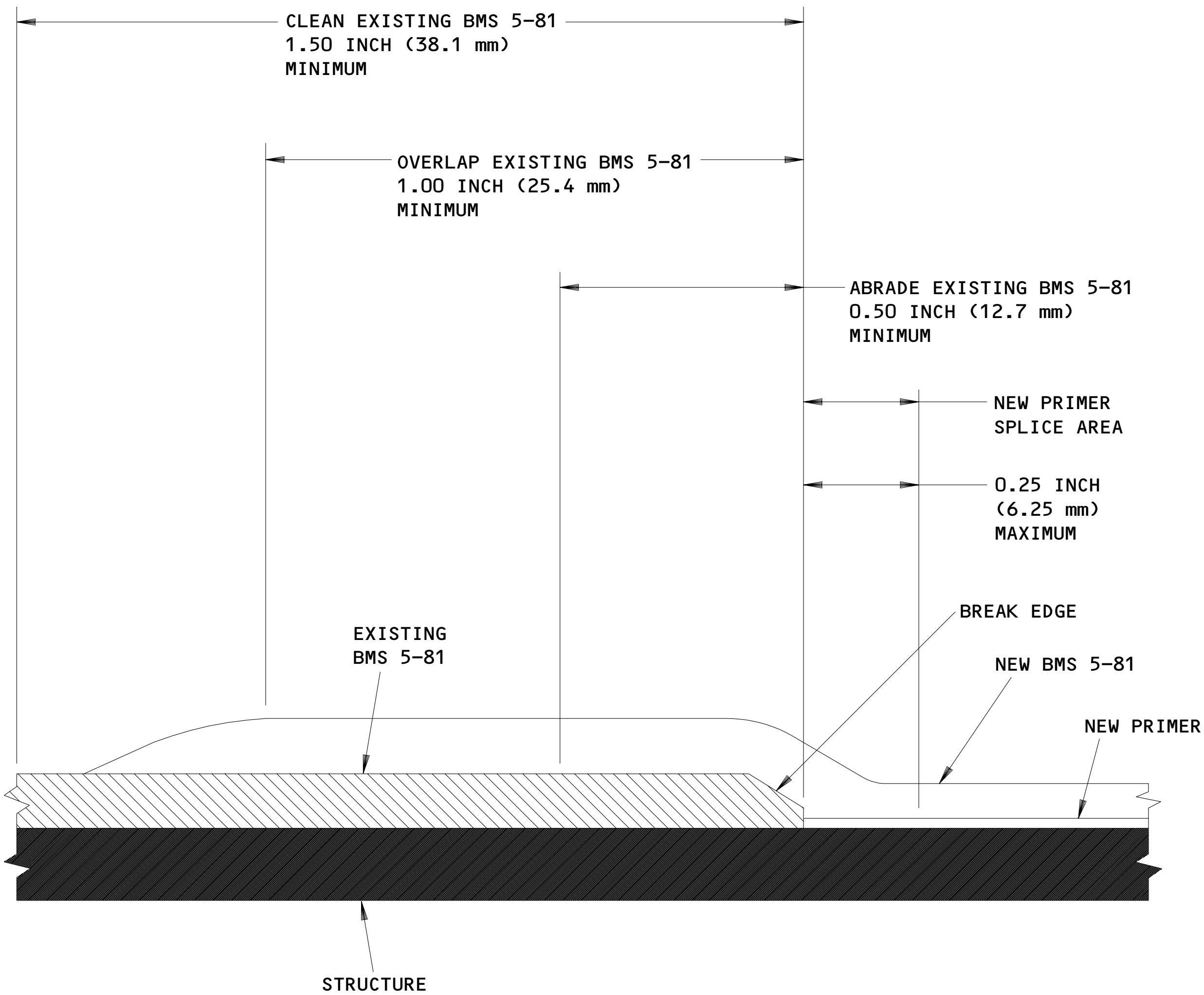


L-L



M-M

Secondary Fuel Barrier Sealant Repair
Figure 817 (Sheet 9)



Splice Surface Area Preparation Secondary Fuel Barrier
Figure 818

8. Approved Repair of the Secondary Fuel Barrier Sealant (Fig. 817, 810)

A. General

(1) If there is leakage in the secondary fuel barrier, the leakage must be repaired before the airplane is released for flight.

(2) Secondary fuel barrier sealant is a polyurethane (Type II) material applied to the front and upper exterior surface of the center fuel tank.

B. Equipment

(1) 602-816 - Dualscope Thickness Measurement Instrument, Model MP20, Vendor Code: 9U437

(2) 602-128 - Pencil-Type, Thickness Measurement Probe, Model ETA3.3H, Vendor Code: 9U437

C. Consumable Materials

(1) A00015 Sealant - BMS 5-81, Type II

(2) A00184 Solvent - BMS 11-7

(3) B00137 - Abrasive paper, 180 grit or finer

(4) B00148 Solvent - Methyl Ethyl Ketone (MEK) - ASTM D740

(5) B00660 Solvent - Methyl Propyl Ketone (MEK) - BMS 11-9

(6) C00259 Primer - BMS 10-11, Type I (yellow)

(7) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

(8) G00215 Flat, bristle brush

D. Reference

(1) AMM 28-11-0/701, Integral Fuel Tanks

(2) AMM 51-21-21/701, Prepaint Cleaning and Treatment

(3) AMM 51-21-41/701, Alodine Coating

(4) AMM 53-31-0/201, Seals and Sealing

E. Access

(1) Location Zones

133 Wing Center Section (Left)

134 Wing Center Seciton (Right)

F. Repair of the Secondary Fuel Barrier Sealant

S 398-002

(1) Where the secondary fuel barrier sealant or secondary fuel barrier sealant and primer have damage, do these steps:

(a) Remove any disbonded sealant and primer with cutting tools.

(b) To refinish bare metal surfaces, if it is necessary, do these steps:
1) Prepare the surface (AMM 51-21-21/701).
2) Apply alodine 600 (AMM 51-21-41/701).

(2) To make areas with sharp or rough edges smooth, one of these types of sealants were applied to certain surfaces ofthe fuel tank:

WARNING: DO NOT BREATHE THE FUMES FROM THE SECONDARY FUEL BARRIER SEALANT (BMS 5-81, TYPE II). KEEP THE SEALANT AWAY FROM SPARKS, FLAME OR HEAT. THE SEALANT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY OR DAMAGE.

CAUTION: DO NOT APPLY THE SECONDARY FUEL BARRIER SEALANT (BMS 5-81, TYPE II), IF THE AIR TEMPERATURE IS LESS THAN 60°F (15°C) OR THE RELATIVE HUMIDITY IS MORE THAN 95 PERCENT. THE SEALANT WILL NOT CURE CORRECTLY IF THE TEMPERATURE AND RELATIVE HUMIDITY CONDITIONS ARE NOT IN THE LIMITS.

NOTE: The exact application of these sealants is specified in drawings 65-46961 and 65-47810.

(a) BMS 5-26, Type II
(b) BMS 5-45
(c) BMS 5-95
(d) BMS 5-142
(e) Before you apply the primer (BMS 10-11) and sealant (BMS 5-81), it may be necessary to repair or replace the sealant to make areas that have sharp or rough edges smooth (AMM 51-31-00/201).

(3) Clean a minimum of 1.5 inches (38 mm) along edge of cured BMS 5-81 coating with clean cotton wiper (BMS15-5) soaked with one of these solvents:

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS AND PROPER HANDLING PROCEDURES.

(a) BMS 11-7
(b) MPK, BMS 11-9
(c) MEK, ASTM D740
(4) Rub the area dry with a clean, cotton wiper (BMS15-5).
(5) Break the edge of the cured BMS 5-81 sealant as shown (Fig. 811) with aluminum oxide abrasive pager (180 to400 grit) or a plastic, bristled, bottle brush.
(6) Rub the BMS 5-81 coating with the abrasive paper a minimum of 0.5 inch (13 mm) beyond the edge to be joined to make the surface rough.
(a) As an alternative, to sanding, you can wipe the BMS 5-81 coating with BMS 11-9 solvent.

NOTE: This solvent sufficiently softens the surface of the BMS 5-81 to add more sealant. Other solvents cannot be used.

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS AND PROPER HANDLING PROCEDURES.

(7) If you used sandpaper, clean the area with particles left by the sanding with a clean, cotton wiper (BMS15-5), soaked with one of these solvents:
(a) BMS 11-7
(b) MPK, BMS 11-9
(c) MEK, ASTM D740

S 168-003
(8) Rub the area dry with a clean, dry cotton wiper (BMS15-5).
(a) Apply one coat of the BMS 10-11 primer with a brush, up to the existing edge of cured BMS 5-81 sealant with the tolerances shown in Fig. 810.
1) Spray application of BMS 10-11 primer can be used for large areas (AMM 28-11-00/701).
(b) Air dry the BMS 10-11 primer as shown in Table 801 before you apply the BMS 5-81 sealant.

TABLE 801			
BMS 10-11 TYPE I, PRIMER	BMS 5-81 TYPE II, SEALANT	OVERCOAT TIME *[1] *[2]	
		MINIMUM	MAXIMUM *[3]
Grade A	Class 1	30 minutes	48 hours *[4]
Grade E	Class 1	30 minutes	48 hours *[4]
Grade A	Class 2	30 minutes	3.5 hours *[4]
Grade E	Class 2	30 minutes	3.5 hours *[4]

*[1] Overcoat time is for freshly applied BMS 10-11 or reactivated BMS 10-11.
*[2] If the surface is cured beyond 48 hours, clean and reactivate the cured surface to be coated (AMM 51-21-21/701).
*[3] You must do the reactivation of the primer if BMS 5-81 is not applied before the maximum overcoat time, or if it has contamination.
*[4] To do reactivation of contaminated BMS 10-11 primer that is not fully cured, you must let the primer cure to a state of solvent resistance. Solvent resistance is when the primer cannot be removed from the base coating when you rub it 15 times with heavy pressure and a large force with a cottton wiper BMS15-5, soaked with BMS 11-7 solvent.

S 368-004
(9) Prepare the BMS 5-81 sealant as follows:
(a) The material must be supplied in pre-measured kits with the correct mix ratio.
(b) Make sure the base resin and catalyst are each homogeneous, free from lumps or jelled particles.
(c) Make sure the base component is clear. If the base component becomes cloudy, do these steps:
1) Heat the material in an oven at a temperature between 120 and 130°F (48.9 and 54.4°C) for 60 to 70 minutes.
2) At the end of the exposure time, take the material out of the oven.
3) Let the material cool to a temperature between 60 and 80°F (15 and 26.7°C) before you use it.
(d) At any time when a base container is opened, and the base material will not be used, discard the container.

(e) Before you combine the necessary quantities of base resin and accelerator, mix the base resin and the accelerator, each in its container, to make sure each is homogeneous.

CAUTION: BE CAREFUL WHEN YOU MIX AND MAKE THE SEALANT SMOOTH TO KEEP AIR BUBBLES TO A MINIMUM. AIR BUBBLES CAN MAKE THE SEALANT DIFFICULT TO APPLY.

(f) Carefully combine the total contents of the base and accelerator containers.
1) Stir the mixture slowly until it is completely mixed.

S 398-005
(10) Do these steps to apply the BMS 5-81 sealant:

CAUTION: DO NOT ADD ANY THINNER BUT METHYL ETHYL KETONE. PROBLEMS WITH THE SECONDARY FUEL BARRIER CAN OCCUR IF YOU USE A DIFFERENT THINNER.

(a) If it is necessary to make the BMS 5-81 sealant thinner, add MEK solvent.
1) Do not add MEK solvent in a quantity more than 40 percent by volume of the mixed unthinned sealant.
(b) Do not apply the BMS 5-81 sealant when the air temperature or temperature of the structure to be sealed is less than 65°F (19°C).
(c) Make sure that the BMS 5-81 sealant that has not been cured does not get colder than 60°F (17°C) until the cured dry-through time (Table 802).
(d) Make sure the combined thickness of the applied sealant and the primer layer is 0.012 to 0.017 inch (0.30 mm to 0.43 mm).

NOTE: These dimensions include a 0.002 inch (0.05 mm) layer of primer.

CAUTION: DO NOT PERMIT THE THICKNESS OF THE APPLIED SEALANT AND PRIMER LAYER TO BE MORE THAN 0.022 INCH (0.56 MM) OR LESS THAN 0.007 INCH (0.18 MM). DAMAGE TO EQUIPMENT CAN OCCUR.

1) In some cases, dry sealant thickness of more than 0.015 inch (0.38 mm) or less than 0.010 inch (0.25 mm) can occur. These conditions are acceptable, but the thickness must not be less than 0.007 inch (0.18 mm) or more than 0.022 inch (0.56 mm).

NOTE: These dimensions include a 0.002 inch (0.05 mm) layer of primer.

(e) Apply a minimum of two layers of BMS 5-81 sealant with a flat, bristle brush.

NOTE: At 77 ±5°F (25 ±2.8°C) and 50 ±5 percent relative humidity, the approximate application time of BMS 5-81, Class 1 sealant is 120 minutes. The approximate application time of BMS 5-81, Class 2 sealant is 30 minutes. Higher temperatures make the application time shorter. Lower temperatures make the application time longer.

(f) Apply an overlap of BMS 5-81 sealant over the existing secondary fuel barrier layer of cured BMS 5-81 sealant to a minimum of 1.0 inch (25.4 mm) (Fig. 820).

(g) For large areas, BMS 5-81 sealant can also be applied with a spray application.
   1) If multiple layers are applied, permit a flash-off time of 15-45 minutes between layers to prevent solvent entrapment and bubble formation.
   2) In difficult spray areas or where fade-out of the sealant is necessary, you can apply one layer with a flat, bristle brush to get smooth coverage over the area. Wait for a flash-off time of 15-45 minutes before you apply the subsequent layer with a spray application.

(h) For horizontal surfaces, let the sealant dry a minimum of 1/2 hour between layers.

(i) For vertical surfaces, let the sealant dry a minimum of 2 hours between layers.

(j) Thickness measurement instrument, 602-816, and thickness measurement probe, 602-128, can be used to make sure the sealant and primer layer has the correct thickness.

NOTE: It is not possible to measure the thickness of the sealant layer without the primer layer.

S 398-008

(11) Cure the sealant.

(a) The cure rates of the sealant are as follows:

TABLE 802 BMS 5-81 CURE RATES				
	CURE CONDITIONS			
	DRY HARD (HOURS) *[1]		DRY THROUGH (HOURS) *[2]	
CURE TEMPERATURE	TYPE II, CLASS 1	TYPE II, CLASS 2	TYPE II, CLASS 1	TYPE II, CLASS 2
75 ±5°F (23.8 ±2.8°C)	50	8	96	24
100 ±5°F (37.8 ±2.8°C)	18	2.5	36	3.5
125 ±5°F (51.7 ±2.8°C)	7.5	1.5	15	2.5
150 ±5°F (65.6 ±2.8°C)	2.5	1.5	5	2

*[1] Condition where metal particles do not bond to the sealant.
*[2] Conditi on where sealant is sufficiently hard to prevent damage when walked on with boot socks.

S 758-009

(12) Do these steps to do a test to make sure the secondary fuel barrier is in a dry-through condition:

(a) On a horizontal section of structure, put your thumb horizontally on the newly applied secondary fuel barrier with your arm in a vertical straight line from the wrist to the shoulder.

(b) While you put as much pressure on your thumb with your arm, turn your thumb through an angle of 90 degrees in theplane of the barrier.

(c) If there is no loosening, detachment, wrinkling or other distortion of the barrier, then the film is in dry-through condition.

WING FUEL TANK ACCESS PANELS - REMOVAL/INSTALLATION

1. General
   A. The elliptical-shaped access panels, No. 1 thru 13 (Fig. 401), provide access to internal structure or equipment inside tanks No. 1 and 2. Circular-shaped access panels No. 14 serve as the air vent scoop for the fuel vent system as well as providing access to the outboard portion of each surge tank. Mounting details, and sealing gaskets are different for the two types of access panels.

CML 2. Removal/Installation of Access Panels 1 thru 13 (Fig. 401)
   A. Equipment and Materials
      (1) Anticorrosion Grease - MIL-G-25537 or BMS3-38 (AMM 20-30-21/201)
      (2) Aliphatic Naphtha - TT-N-95
      (3) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Prepare Fuel Tank Access Panel for Removal
      (1) Defuel the applicable tank (AMM 28-23-0/201). Purge the tank if entry is planned (AMM 28-10-0/201).

      WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

      (2) On panels equipped with measuring sticks, pull measuring stick out to its limiting stop.
   C. Remove Fuel Tank Access Panel
      (1) When you remove the access panel with surge tank flame arrestor pressure relief valve installed (panel No. 13, Fig. 402) (All airplanes POST-SB 28-1026 or POST-SB 28-1131), make sure the relief valve is in open position (AMM 28-13-41/401).

      WARNING: DO NOT ATTEMPT TO REMOVE ACCESS PANEL WITH RELIEF VALVE IN CLOSED POSITION. VALVE OPENING MECHANISM CONTAINS A POWERFUL, FAST ACTING SPRING CAN EASILY BE UNLATCHED CAUSING SEVERE INJURY IF FINGERS ARE CAUGHT BETWEEN VALVE PARTS. A LOUD, STARTLING NOISE IS NORMAL WHEN VALVE OPENS.

      (2) Support clamp ring and remove mounting screws (Fig. 401). Place screws in a container.
      (3) Remove clamp ring and knitted aluminum gasket, and place in flat container. Use care in handling.

(4) Push up on access panel and remove from fuel tank. On access panels with surge tank flame arrestor pressure relief valve installed, use slot cutouts in skin to guide access panel from surge tank.

CAUTION: DO NOT PRY OFF PANEL. IF PANEL STICKS, LOOSEN BY TAPPING AROUND EDGE WITH RUBBER MALLET. THE LOWER SURFACE OF THE ACCESS PANEL FLANGE AND THE UPPER SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING ARE SEALING SURFACES. DO NOT SCRATCH OR DAMAGE. HANDLE ACCESS PANEL WITH RELIEF VALVE INSTALLED (NO. 13) WITH CARE OR DAMAGE TO SENSITIVE RELIEF VALVE MAY OCCUR.

(5) Install rubber protector around wing skin access panel opening.

D. Prepare Fuel Tank for Access Panel Installation
(1) Check open tank for foreign material such as tools, metal cuttings, and any other debris.
(2) Clean open tank, as necessary, then proceed with access panel installation.

E. Prepare Fuel Tank Access Panel for Installation
(1) Remove rubber protector from access panel opening.
(2) Thoroughly clean access panel opening and access panel sealing surface using a clean cotton wiper (BMS15-5) moistened with naphtha.
(3) Clean clamp ring and knitted aluminum gasket using a clean cotton wiper (BMS15-5) moistened with naphtha.
(4) Check lip and skin around access panel opening for corrosion. If corrosion is found, refer to Structural Repair Manual.
(5) Do a check of the knitted aluminum gasket for serviceability.
(a) Replace the gasket if any of the subsequent conditions exist:
1) Fastener holes torn
2) Elogated out of shape
3) More than 10% of strands broken through thickness of gasket in one area.
(6) If gasket is not serviceable, replace as follows:
(a) Place aluminum gasket carrier tray package face up on a flat surface.

(b) Position clamp ring over gasket (countersunk end of holes face up) so clamp ring and gasket holes align. Press clamp ring on gasket until clamp ring is firmly in contact with gasket.

NOTE: Holes are not symmetrical.

(c) Remove clamp ring, gasket, and release strip from carrier tray as a unit. Place unit, gasket side up, on a flat surface.
(d) Peel release strip from gasket.

F. Install Fuel Tank Access Panel
(1) HIGH IMPACT RESISTANT ACCESS PANELS INSTALLED ON AIRPLANES WITH SB 28-1064;
The No. 2 and No. 3 access panels on each side of the wings are high impact resistant access panels. These panels must not be replaced with standard access panels.
(2) HIGH IMPACT RESISTANT ACCESS PANELS INSTALLED ON AIRPLANES WITH SB 28-1078;
The No. 1, No. 4, No. 5 and No. 6 access panels on each side of the wings are high impact resistant access panels. These panels must not be replaced with standard access panels.
(3) Place access panel inside tank and position it over opening. On access panels with surge tank flame arrestor pressure relief valve installed, (Panel 13, Fig. 401) (airplanes incorporating SB28-1026 or SB28-1131), use slot cutouts in skin to allow inserting access panel into surge tank opening.

NOTE: Access panels No. 13, when fitted with pressure relief valve, will only fit on the inboard surge tank openings.

(4) If the aluminum gasket originally removed is reused, make sure the anti-corrosion compound is applied to both sides of the gasket when it is installed.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: Insufficient anti-corrosion compound could leave voids that can collect moisture and excessive anti-corrosion compound could squeeze out on to the lower wing surface.

(5) Apply a thin layer (0.010-0.015 inch/0.25-0.38 mm) of anticorrosion compound to the flat surface of the wing skin that touches the aluminum gasket (Fig. 401).

(6) Position gasket and clamp ring and install mounting screws, starting from centerline and working toward ends of panel; removing excess grease from mounting screws.

CAUTION: EXCESS ANTI-CORROSION COMPOUND AHEAD OF MOUNTING SCREWS MAY DAMAGE PANEL BECAUSE OF THE HYDRAULIC PRESSURE GENERATED BY THE ANTI-CORROSION COMPOUND.

(7) Tighten mounting screws to 35 to 50 inch-pounds (4.0-5.6 Nm).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: Start to tighten the mounting bolts from the centerline to the outboard direction and equally in both directions (Fig. 402).

(8) On access panels No. 1, 4, 6, 8, and 10 (Fig. 402) equipped with measuring sticks, push measuring stick in and secure for flight.

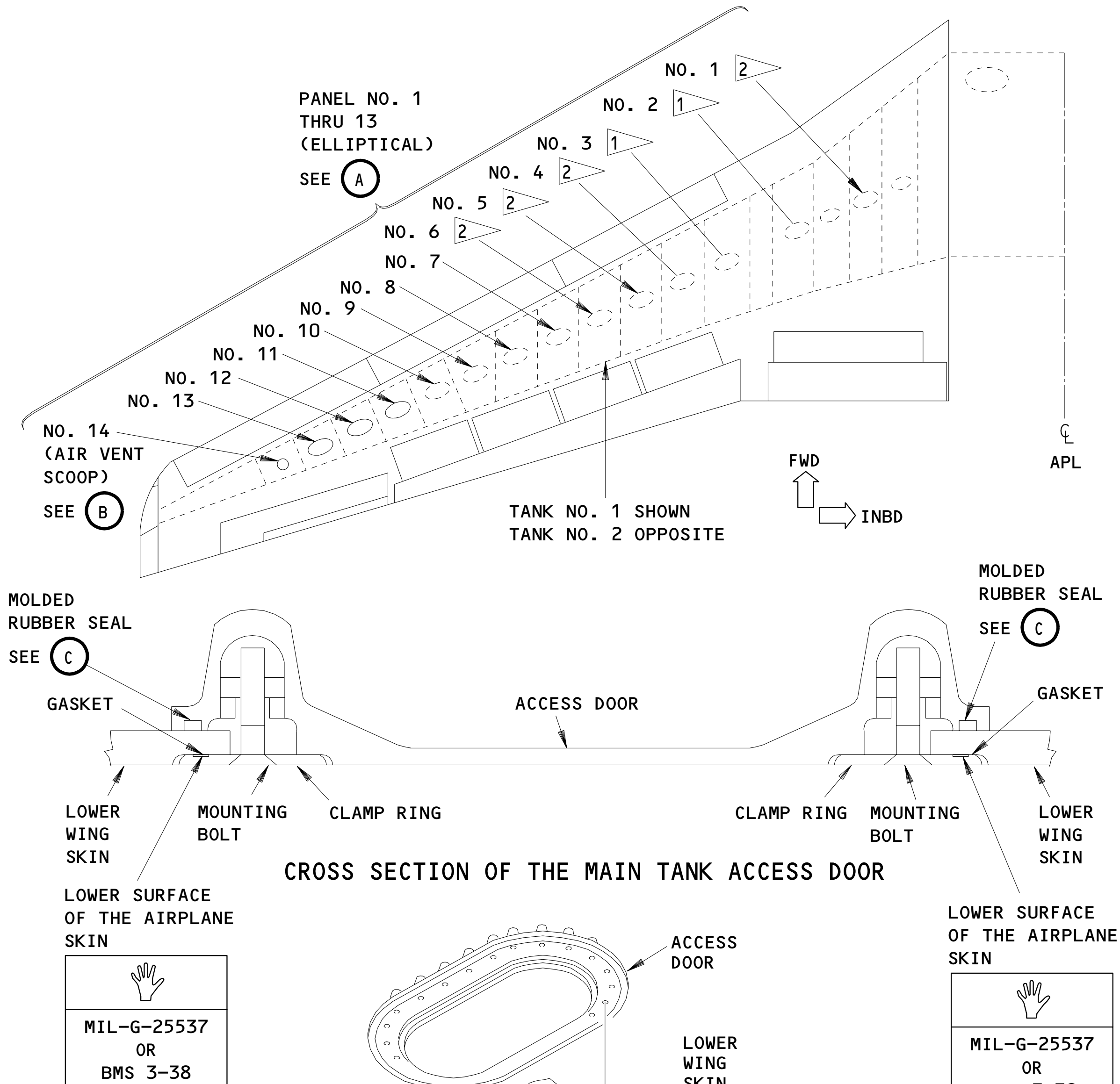
CAUTION: MAKE SURE THE ACCESS PANEL IS INSTALLED IN THE CORRECT DIRECTION. IF THE INDEX NOTCH ON THE ACCESS PANEL DOES NOT ALIGN WITH THE INDEX NOTCH IN THE OPENING, A FUEL LEAK CAN OCCUR.

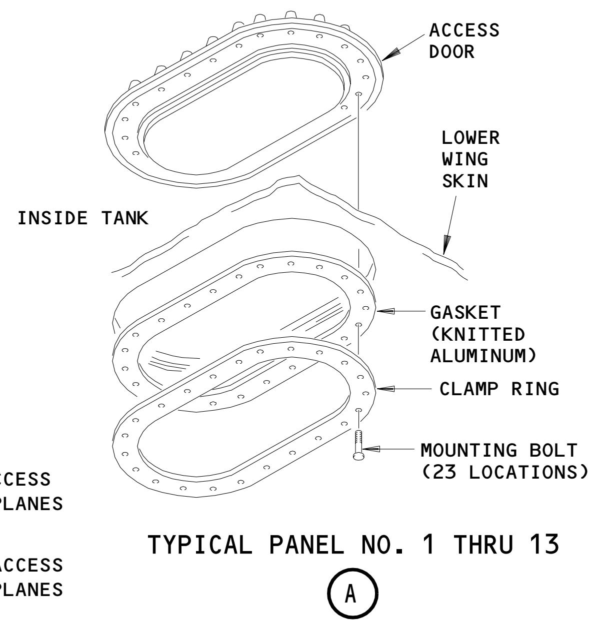
NOTE: The No. 10 panel is 2 inches narrower than the other measuring stick-equipped access panels.

(9) If access panel No. 13 (Fig. 402) with pressure relief valve was installed, check actuation pressure of the relief valve (AMM 28-13-41/601)

3. Removal/Installation of Access Panels No. 14 (Fig. 401)

A. Equipment and Materials
(1) Aliphatic Naphtha - TT-N-95





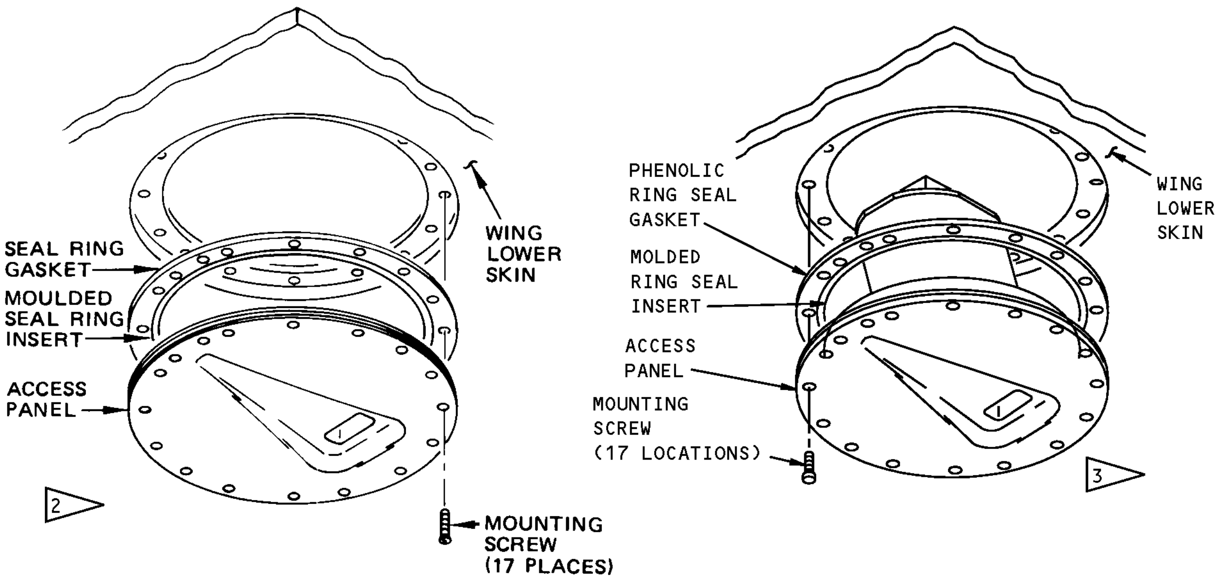
NOTE: PANEL NO. 1, 4, 6, 8, AND 10 HAVE DRIPSTICK INSTALLED

NOTE: APPLY A THIN LAYER (0.010 TO 0.015 INCH) OF GREASE TO THE LOWER SURFACE OF THE WING SKIN THAT TOUCHES THE ALUMINUM GASKET (REFER TO THE TEXT)

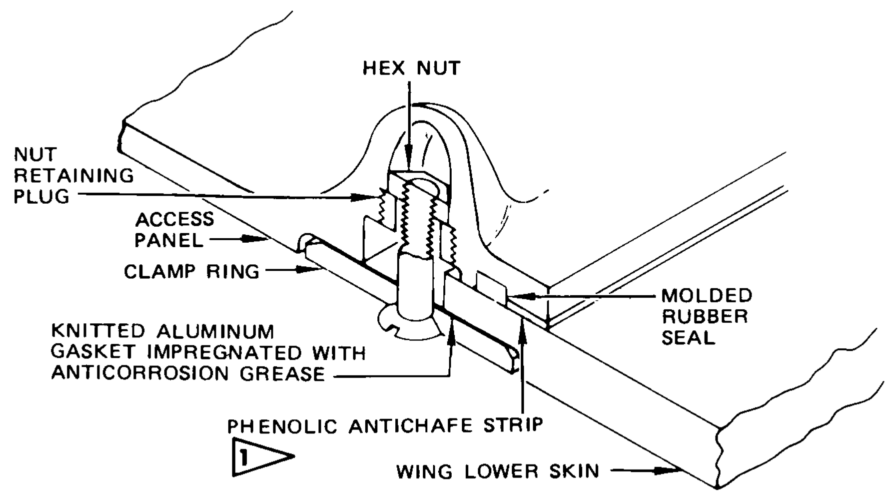
1 HIGH IMPACT RESISTANT ACCESS PANELS INSTALLED ON AIRPLANES WITH SB 28-1064

2 HIGH IMPACT RESISTANCE ACCESS PANELS INSTALLED ON AIRPLANES WITH SB 28-1078

Fuel Tank Access Panel Installation
Figure 401 (Sheet 1)



AIR VENT SCOOP ACCESS PANEL (NO. 14)
DETAIL B



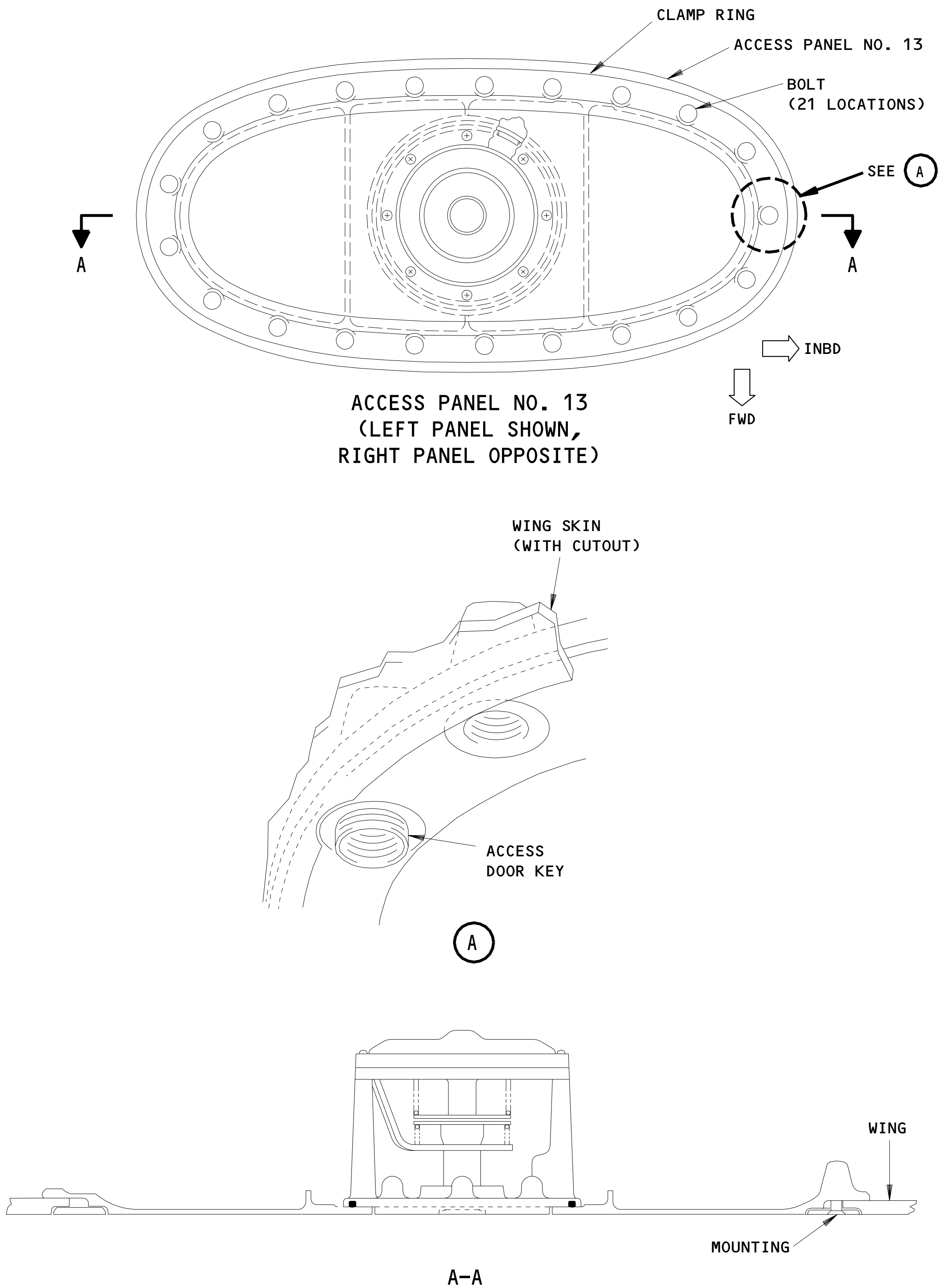
DETAIL C

1 NOT INSTALLED ON HIGH IMPACT RESISTANT ACCESS PANELS

2 AIRPLANES NOT INCORPORATING SB 28-1026 OR SB 28-1131. (WITHOUT FLAME ARRESTOR)

3 AIRPLANES INCORPORATING SB 28-1026 OR SB 1131. (WITH FLAME ARRESTOR)

Fuel Tank Access Panel Installation
Figure 401 (Sheet 2)



Fuel Tank Access Panel No. 13
Figure 402

470402

(2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
(3) Mild detergent and water
(4) Air gun with 90 to 100 psig air supply
(5) D00504 Grease - Petrolatum

B. Prepare Fuel Tank Access Panel (No. 14) for Removal
(1) Same as 2.B.(1).

C. Remove Fuel Tank Access Panel (No. 14)
(1) Support access panel and remove mounting screws.
(2) Work access panel free of gasket seal, tip panel as required to allow air vent stack to pass out through opening in wing, and remove panel from airplane.

CAUTION: DO NOT PRY ACCESS PANEL LOOSE, IF STUCK, OR CRITICAL SEALING SURFACE MAY BE DAMAGED.

D. Prepare Surge Tank for Access Panel Installation
(1) Same as 2.D.

E. Prepare Fuel Tank Access Panel No. 14 for Installation
(1) Check flame arrestor or screen, if installed, at top of air vent stack for evidence of foreign matter and clogging. Clean, if necessary, in water and detergent and air dry with compressed air gun.
(2) Thoroughly clean access panel opening and access panel sealing surface using a clean cotton wiper (BMS15-5) moistened with naphtha.
(3) Clean the countersinks on the access panel.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(4) Check phenolic seal ring gasket for serviceability; especially check condition of molded seal ring inserts. Replace gasket if condition is poor or doubtful.
(5) Apply a thin layer of petrolatum, D00504 to the molded rubber seal.

NOTE: This will prevent damage to the rubber seal during subsequent access panel removal. It will also be easier to remove the access panel.

F. Install Fuel Tank Access Panel (No. 14)
(1) Position seal ring gasket on access panel outer flange ensuring that mounting screw holes in panel and gasket match all the way around. Insert a few mounting screws to hold gasket in place.

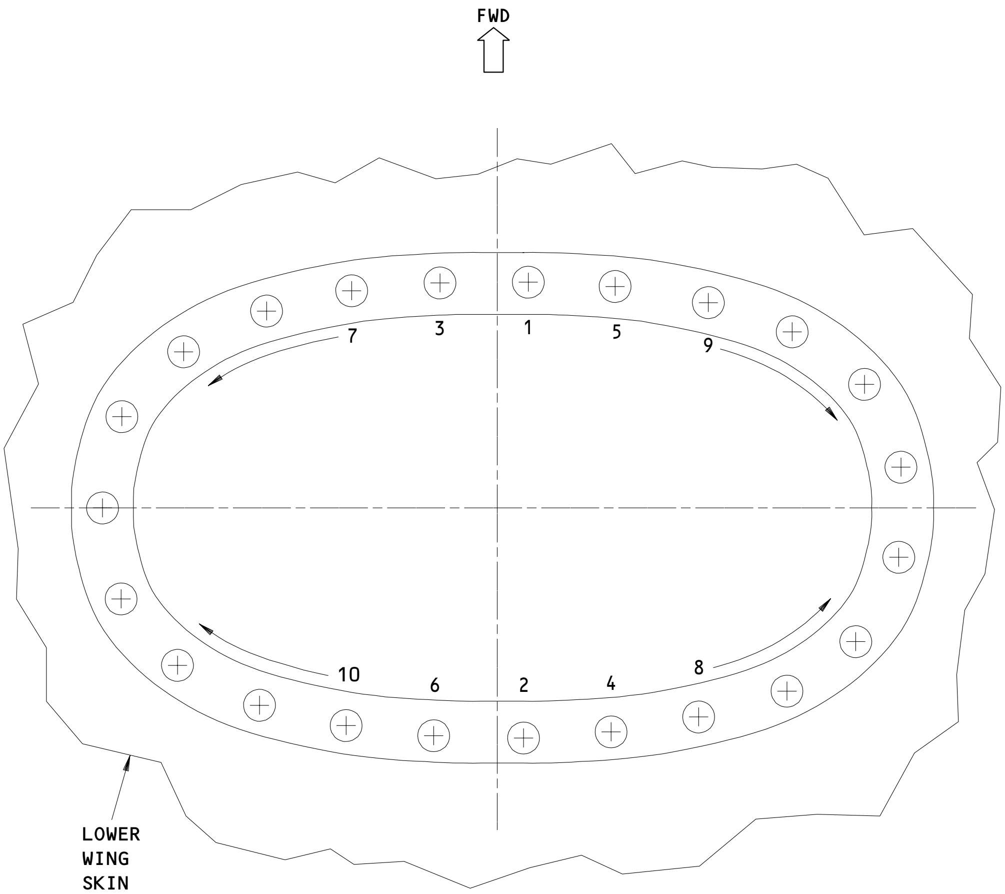
NOTE: Mounting screw holes in access panel are not symmetrically spaced.

(2) Guide air vent stack through opening in wing and align access panel mounting screw holes with matching holes in wing opening. Engage a few mounting screws to hold panel and gasket in position.

(3) Install remaining mounting screws and tighten all screws evenly to a torque range of 63 to 77 inch-pounds (7.1 - 8.7 Nm).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: On airplanes with a vent scoop flame arrestor, the surface of the vent scoop access panel protrudes 0.06 inch ± 0.02 inch out from the surface of the airplane skin when the access panel is installed correctly. This acceptable misfairing is permitted because of the increased weight of the access panel with the flame arrestor installed.

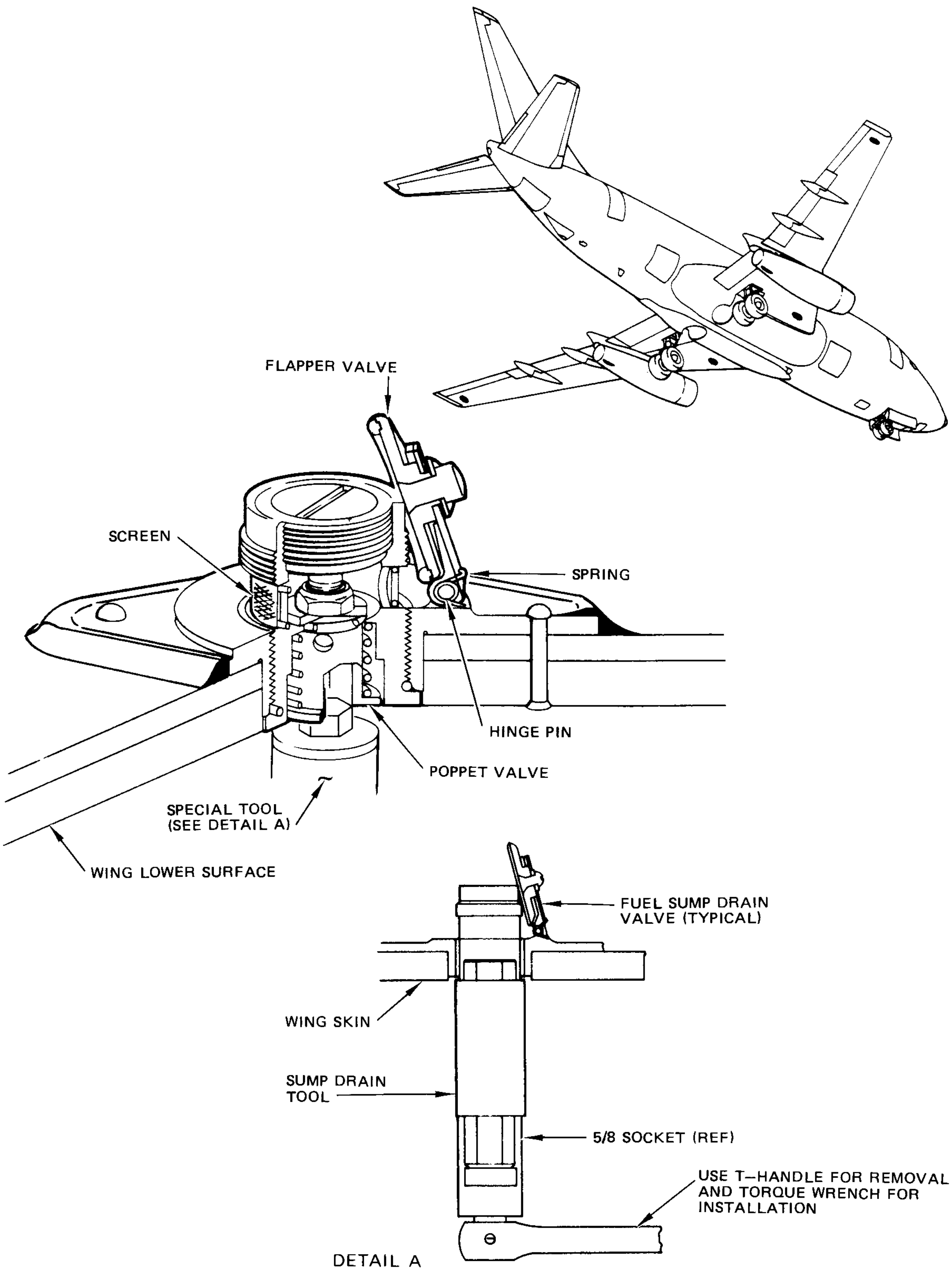


NOTE: TORQUE THE MOUNT BOLTS IN THE SEQUENCE SHOWN BY THE NUMBERS. THIS WILL MAKE SURE FUEL DOES NOT LEAK AROUND THE ACCESS PANEL.

Access Panel Mount Bolt Torque Pattern
Figure 403

FUEL SUMP DRAIN VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Tool for Removing Sump Drain Valve, SE28-1103 (Boeing)
   B. Cleaning Solvent, P-S-661
   C. Dry Film Lubricant, SFL 4396 (Ref 20-30-21)
2. Remove Fuel Sump Drain Valve (Fig. 401)
   A. Insert drain valve tool into valve assembly making certain hexagonal surfaces of tool engage with valve body.
   B. While exerting an upward force on tool, to prevent fuel leakage, unscrew and remove valve body from valve boss.
3. Install Fuel Sump Drain Valve (Fig. 401)
   A. Wash drain valve in solvent until screen and drain valve are free of all foreign material.
   B. Lightly lubricate new O-rings with fuel and position O-rings on drain valve.
   C. Coat internal and external threads with dry film lubricant.
   D. Insert sump drain valve tool into drain portion of valve assembly taking care to engage hexagonal surfaces of tool with mating valve surfaces.
   E. Maintaining an upward force on tool to prevent fuel leakage, screw drain valve assembly into valve boss. Tighten to torque of 200 to 300 pound-inches.



Fuel Sump Drain Valve Installation (Typical)
Figure 401

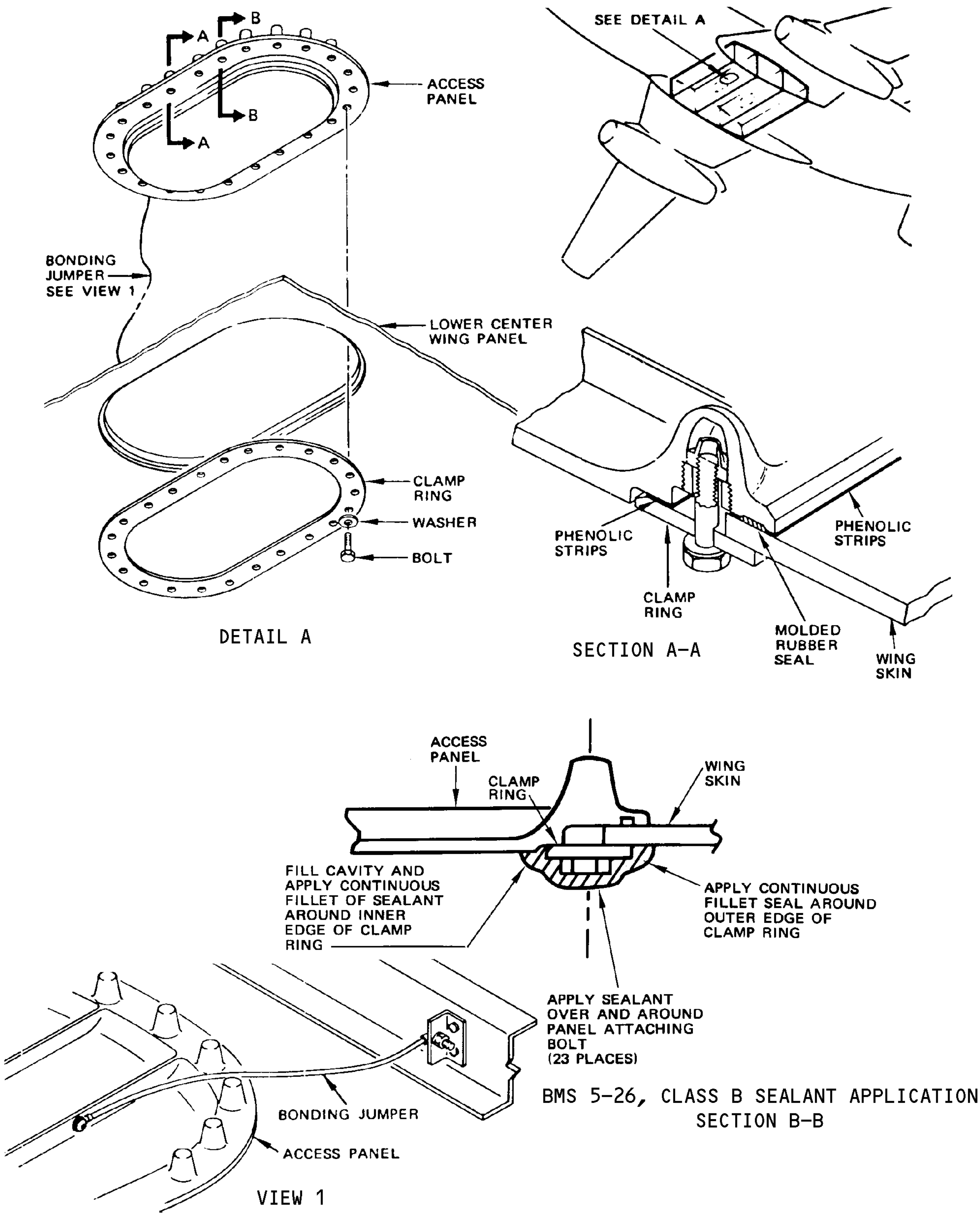
INTEGRAL CENTER TANK ACCESS PANEL - REMOVAL/INSTALLATION

1. General
   A. An access panel in the center wing cavity lets persons go into the center wing fuel tank for maintenance. The cavity access opening is found in the lower skin (Fig. 401).
   B. The tank access panel is cast aluminum and provides a primary fluidtight seal by use of a molded rubber seal fitted into a groove on the panel mating surface. A phenolic strip is bonded to the outer edge of the panel to prevent chafing of lower wing skin. A clamp ring is used to distribute the attaching bolt load and protect the outer lip in the skin opening. A bonding jumper is used to electrically ground the panel to the structure. A secondary seal is provided by an application of sealant material over the heads of all attaching bolts and as a fillet around the inner and outer edges of the clamp ring after each installation of the panel.
   C. The access panel must provide a fueltight seal to prevent fuel leaking on air conditioning equipment. External fuel leakage around the clamp ring indicates a failure of both the primary and secondary seals and should be corrected immediately.
2. Equipment and Materials
   A. Solvent - Methyl Ethyl Ketone (MEK), TT-M-261
   B. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   C. B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
   D. Sealant removal, cutting, and fairing tools (AMM 28-11-0/801)
   E. Sealant - BMS 5-45, Class B
   F. Bonding meter (AMM 20-22-01/601)
3. Remove Center Tank Access Panel (Fig. 401)
   A. Remove air conditioning equipment as necessary to gain access to center tank access panel (Ref Chapter 21).
   B. Defuel and purge fuel tank (Ref 28-23-0 and 28-10-0 MP).

      WARNING: FUEL AND FUEL VAPORS CONSTITUTE A POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS FOR DEFUELING, PURGING AND FUEL TANK ENTRY.

   C. Using sealant cutting and removal tools, strip coating and fillets of sealant material from heads of panel attaching bolts and edges of clamp ring.
   D. Remove access panel mounting bolts, washers and clamp ring.
   E. Push up on panel to break seal, tip panel and guide through opening. Disconnect bonding jumper from panel.

      CAUTION: DO NOT PRY OFF PANEL. IF PANEL STICKS, LOOSEN BY TAPPING AROUND EDGE WITH RUBER MALLET. PRYING MAY DAMAGE CRITICAL SEALING SURFACES.



Center Tank Access Panel
Figure 401

F. Install rubber protectors around access panel opening.

CAUTION: PROTECT SEAL SURFACE EDGE OF ACCESS OPENING BEFORE ENTRY IS MADE INTO CAVITY OR CELL. DAMAGE TO A CRITICAL SEALING SURFACE MAY RESULT FROM CONTACT WITH TOOLS AND EQUIPMENT IF EDGE IS LEFT UNPROTECTED.

4. Prepare Fuel Tank For Access Panel Installation
   A. Check open tank for foreign material such as tools, metal cuttings, and any other debris.
   B. Clean open tank, as necessary, then proceed with access panel installation.
5. Install Center Tank Access Panel (Fig. 401)
   A. Remove rubber protector from access panel opening.
   B. Remove any remaining sealant and thoroughly clean edge margin of access panel opening and access panel sealing surfaces using a clean, cotton wiper (BMS15-5) moistened with MEK or Series 93 solvent.

WARNING: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA.

   C. Clean clamp ring using a clean, cotton wiper (BMS15-5) moistened with MEK or Series 93 solvent.
   D. Examine the access panel and make sure the phenolic strips and the molded seal ring are installed and in good condition. Replace the panel if condition is poor or doubtful.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

CAUTION: DO NOT APPLY CEMENTS OR SEALERS OF ANY KIND TO RUBBER SEAL OR SEALING SURFACES.

   E. Connect bonding jumper to access panel, tilt panel through opening and align with bolt holes.
   F. Position clamp ring and install bolts and washers. Tighten bolts evenly to 30-40 pound-inches.
   G. Fill center wing tank with fuel and ensure that there is no leakage at access panel.
   H. Apply BMS 5-45 sealant material over panel attaching bolts and as fillet around inner and outer edges of clamp ring (AMM 28-11-0/801).
   I. Re-install a11 air conditioning equipment removed to get access to the center tank access panel (AMM Chapter 21).

INTEGRAL CENTER TANK SUMP DRAIN ASSEMBLY AND SUMP DRAIN VALVE - REMOVAL/INSTALLATION

1. General
   A. The sump drain valve is a spring-loaded, flapper type check valve installed inside the center tank at the lower center of the second bay. The valve seat is part of the upper housing (Fig. 401) and is not readily removable as the adhesive between the mounting flange sealing surfaces must be stripped to remove the upper housing.
   B. The drain assembly, including the spring-loaded plunger, is removable from outside the airplane in the body keel beam area. The valve and drain assembly may be removed and installed separately; however, the drain assembly should be removed to leak check the valve after valve installation.
2. Equipment and Materials
   A. Bonding meter (Ref 20-22-01 I/C)
3. Remove Sump Drain Assembly (Fig. 401)
   A. Open air conditioning bay access door in order to gain access to the drain assembly (Ref Chapter 21). Access is gained through lightening holes in keel beam.
      (1) Detach bonding jumper from airplane structure.
      (2) Open hinged access door on bottom of keel beam.
      (3) Remove bolts and washers holding retaining plate to lower housing.
   B. Remove bolts and washers holding retaining plate to drain well structure and remove plate.
   C. Rotate drain assembly clockwise until it releases from upper housing. Remove drain assembly by lowering it straight down. Discard packing or O-rings.
4. Install Sump Drain Assembly (Fig. 401)
   A. Install two new O-rings, lightly lubricated with fuel, on drain assembly.
   B. Guide drain assembly up through hole in drain well structure and insert end into upper housing.
   C. Rotate drain assembly until lockpin slides into slot. Turn drain assembly counterclockwise until pin engages detent.

      CAUTION: USE CARE WHEN ENGAGING DRAIN ASSEMBLY IN UPPER HOUSING TO AVOID BENDING OR SPREADING LOCKING DETENT EARS.

   D. Install retaining plate on lower housing with four bolts and washers.
   E. Align holes and secure retaining plate to drain well structure with two bolts and washers.

F. Actuate sump drain to open and closed position to ensure freedom of operation without binding.

NOTE: Fuel will drain from open drain assembly if tank contains fuel. Have suitable container ready to catch drainage.

G. Close sump drain access door.
H. Attach drain assembly bonding jumper to airplane structure.
I. Check electrical bond between sump drain and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.010 ohm.
J. Close air conditioning bay access door (Ref Chapter 21, Air Conditioning).

5. Remove Sump Drain Valve (Fig. 401)
A. Defuel and purge fuel tank (Ref 28-23-0, 28-10-0 MP).

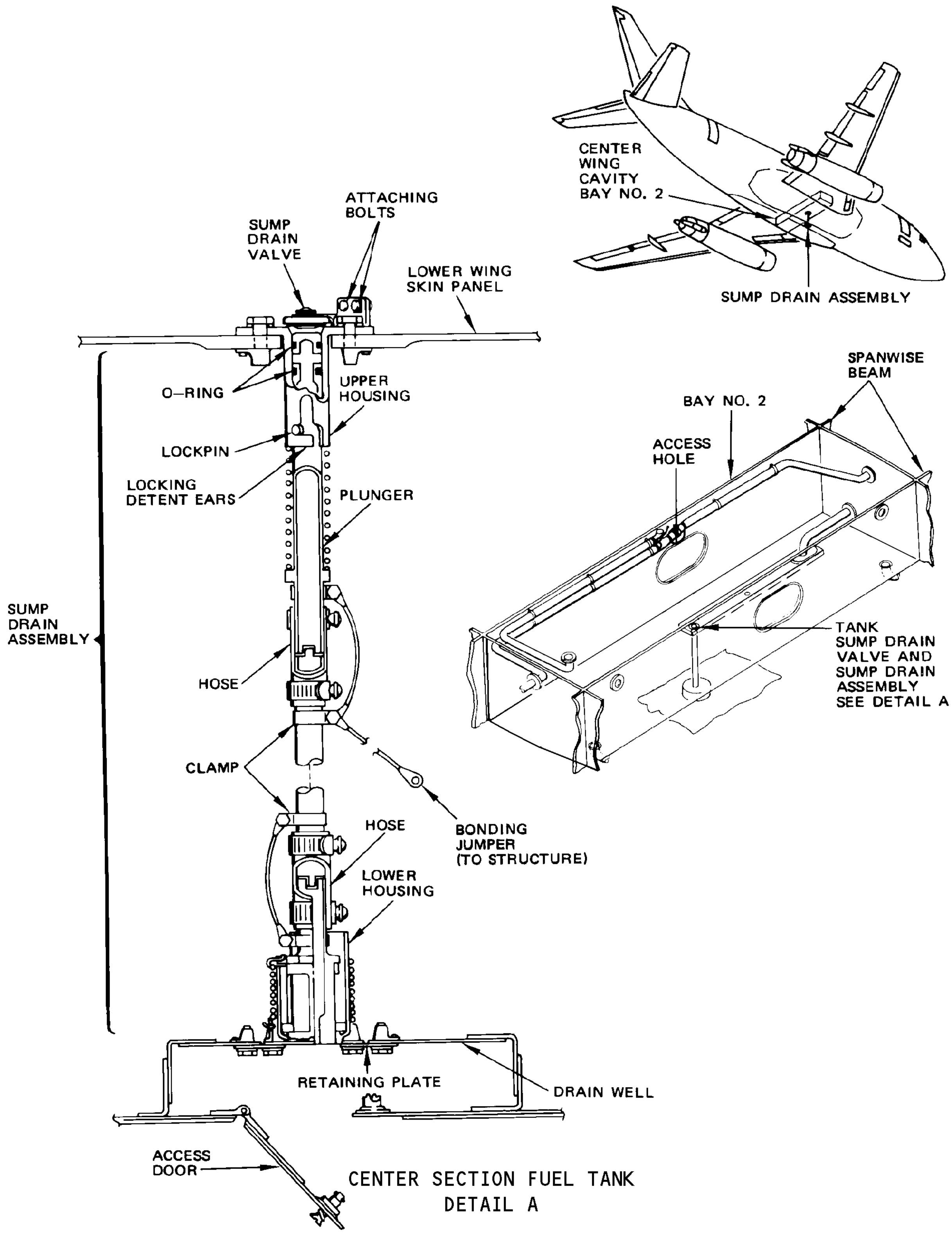
WARNING: EXPLOSIVE AND TOXIC DANGERS OF VAPORS IN VICINITY OF FUEL TANKS WHICH HAVE CONTAINED FUEL ARE OF SUCH POTENCY THAT SEVERAL PRECAUTIONS MUST BE FOLLOWED BY PERSONNEL BEFORE ENTERING ANY WETTED OR DRY TANK FOR MAINTENANCE PURPOSES.

B. Gain access to bay No. 2 of integral center tank.
(1) Ensure that rubber protectors are placed around access panel opening.
(2) Remove shoes and put on a pair of tank boot socks just prior to entering tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.
(3) Enter fuel tank using properly protected lights.

WARNING: USE ONLY EXPLOSIONPROOF SHIELDED LIGHTS IN AND AROUND OPEN FUEL TANK.

(4) Mopup residual fuel before working in tank.
(5) Install rubber protectors in spanwise beam access hole.
C. Hold valve in place against spring tension while removing two sets of nuts, washers, and bolts, and remove sump drain valve.
D. Wipe valve seat clean, on upper housing, and check to ensure that sealing surface is in good condition.

6. Install Sump Drain Valve (Fig. 401)
A. Hold valve in place against spring tension and install two sets of bolts, washers, and nuts. Ensure that valve centers in seat correctly and that flapper action is unrestricted.
B. Remove all tools and equipment from bay and tank. Remove rubber protectors from access openings.
C. Install access panel (Ref 28-11-31, Removal/Installation).



Center Tank Sump Drain Assembly and Drain Valve Installation
Figure 401

D. Remove drain assembly (refer to step 3), fill tank with fuel, and check to ensure no leakage at outlet of upper housing.

<u>CAUTION</u>: HAVE SUITABLE CONTAINER READY TO CATCH ANY LEAKING FUEL.

E. Install drain assembly per step 4.

WING ROOT RIB ACCESS DOOR - REMOVAL/INSTALLATION

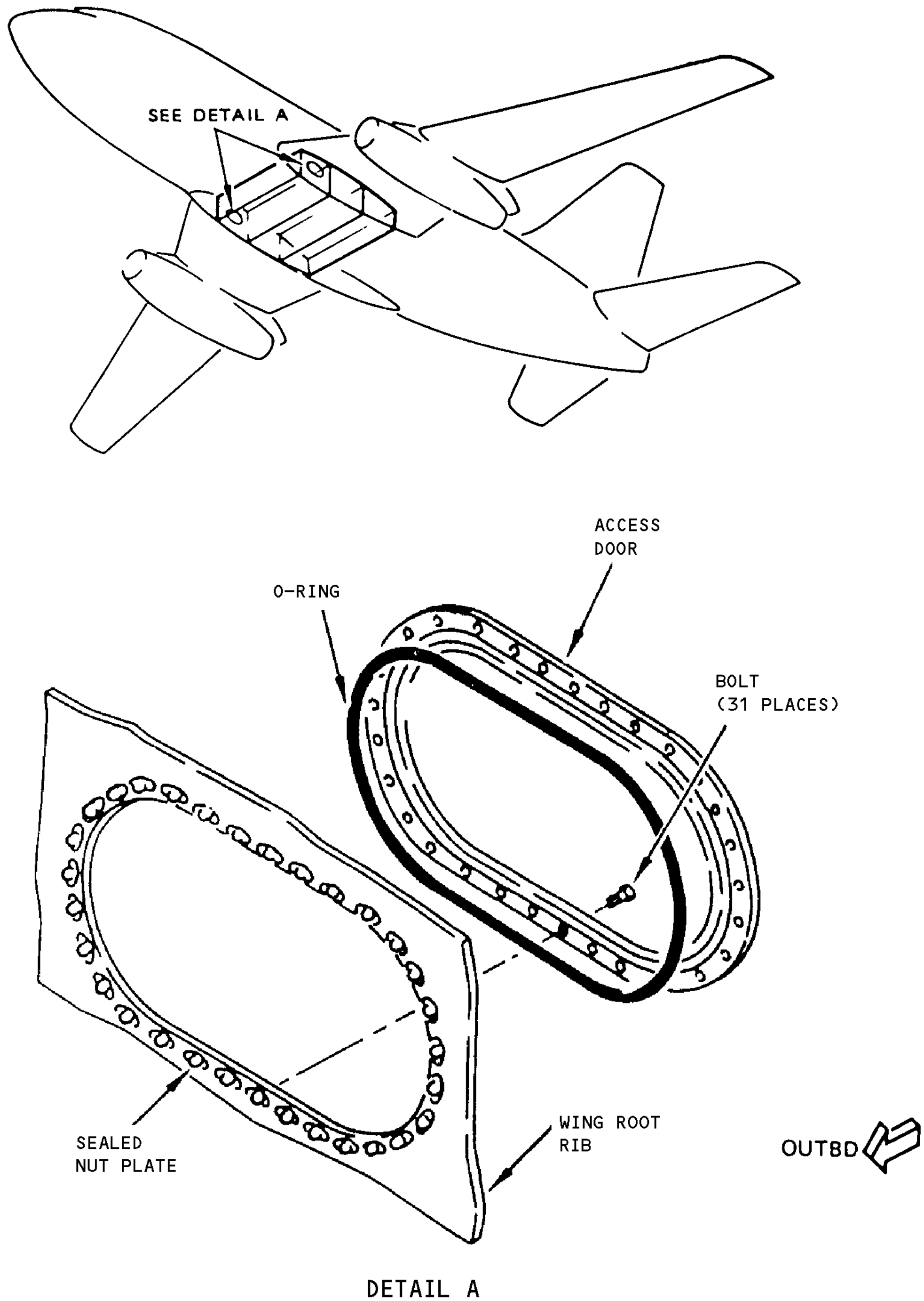
1. Prepare to Remove Wing Root Rib Access Door
   A. Gain access to access door.
      (1) Airplanes with one or two cells in center tank:
         (a) Remove center tank access panel (Ref 28-12-21).
         (b) Defuel and purge applicable wing tank (Ref 28-23-0 and 28-10-0 MP).

            WARNING: FUEL AND FUEL VAPORS CONSTITUTE A POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

         (c) Enter center wing cavity No. 1.
      (2) Airplanes with three cells in center tank:
         (a) Defuel and purge center tank and applicable wing tank (Ref 28-23-0 and 28-10-0 MP).
         (b) Remove center tank fuel cell No. 1 (Ref 28-12-13).
      (3) Airplanes with integral center tank:
         (a) Defuel and purge center tank and applicable wing tank (Ref 28-23-0 and 28-10-0 MP).
         (b) Remove center tank access panel (Ref 28-11-31).
         (c) Enter center tank.
2. Remove Wing Root Rib Access Door (Fig. 401)
   A. Remove access door mounting bolts.
   B. Remove and discard access door O-ring.
   C. Protect sealing surfaces of panel and rib opening from scratching or other damage.

   NOTE: The use of an edge protector around access opening is recommended.

3. Install Wing Root Rib Access Door (Fig. 401)
   A. Remove access opening edge protector, if installed.
   B. Check that sealing surface is clean and install new O-ring.
   C. Install access door mounting bolts, and torque bolts 60 to 70 inch-pounds.
   D. Service main wing tank and check for leaks.
   E. On airplanes with one or two cells in center tank, install center tank access panel (Ref 28-12-21).
   F. On airplanes with three cells in center tank, install fuel cell No. 1 (Ref 28-12-13).
   G. On airplanes with integral center tank, install center tank access panel (Ref 28-11-31).



Wing Root Rib Access Door Installation
Figure 401

ACCESS PANELS IN RIB NO. 5 - REMOVAL/INSTALLATION

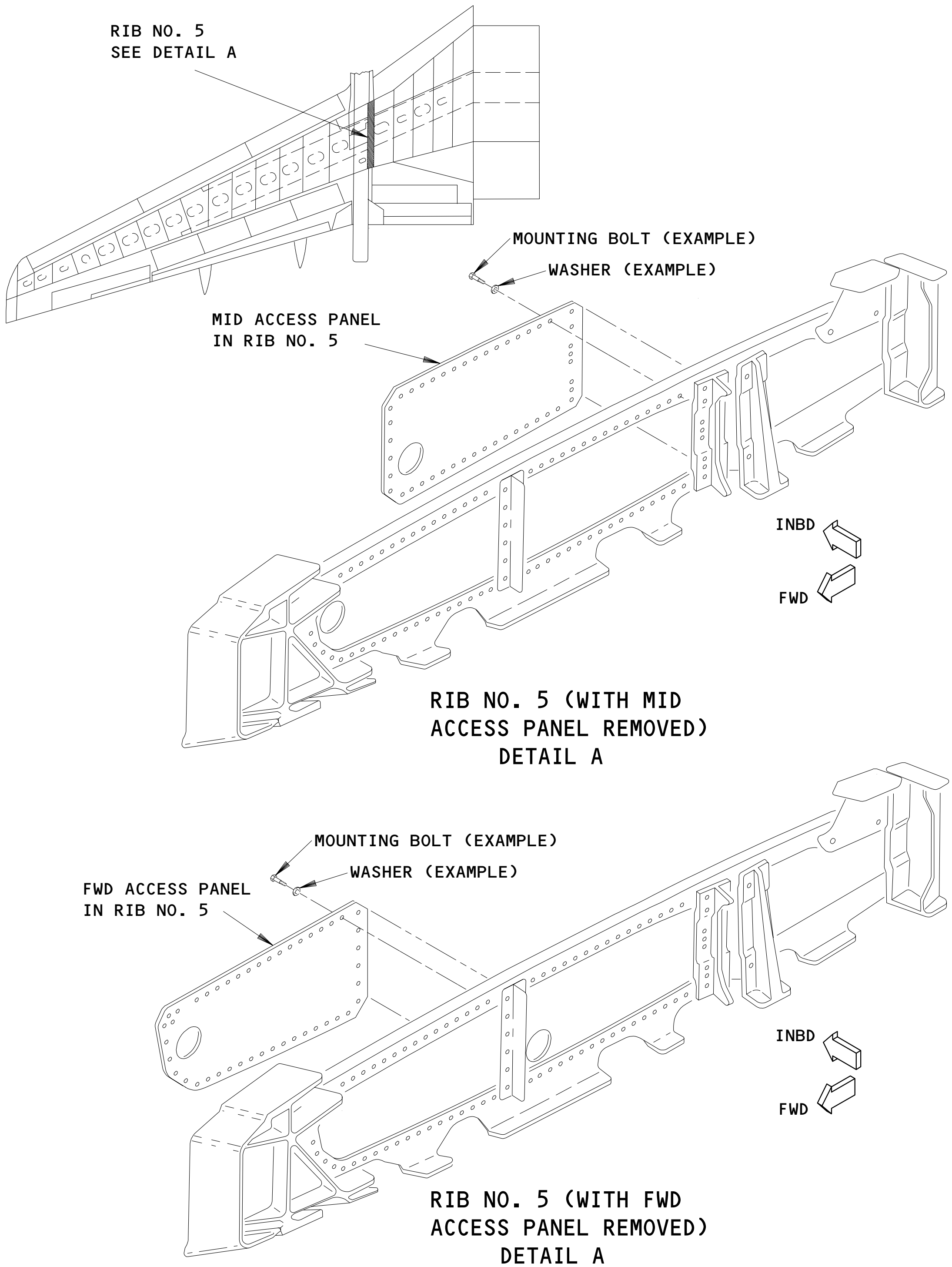
1. General
   A. This procedure has two tasks:
      (1) The removal of one of the access panels in rib No. 5 (the rib at WBL 183.4)
      (2) The installation of one of the access panels in rib No. 5 (the rib at WBL 183.4)
      (3) Only one of the access panels can be removed from this rib at one time. The remaining access panel is necessary to support the wing structure.
2. Remove Access Panels in Rib No. 5 (Fig. 401)
   A. Prepare to go into the applicable wing tank (AMM 28-10-00/201).

      WARNING: CAREFULLY DO ALL THE SAFETY PROCEDURES TO DEFUEL THE FUEL TANK AND TO GO INTO IT. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE SAFETY PROCEDURES.

   B. Remove the No. 2 access panel for the applicable wing tank (AMM 28-11-11/401).
   C. Go into the applicable wing tank.
   D. Remove the mounting bolts from the forward or the middle access panel in Rib No. 5.

      CAUTION: DO NOT REMOVE THE TWO ACCESS PANELS AT THE SAME TIME. DAMAGE TO THE AIRPLANE CAN OCCUR.

   E. Put protection on the mating surfaces of the panel and the rib opening to protect from scratches or other damage.
3. Install Access Panels in Rib No. 5 (Fig. 401)
   A. Remove the rubber cover that gives protection for the access opening, if one is installed.
   B. Make sure the mating surfaces of the access panel and the rib are clean.
   C. Attach the access panel to the opening with the mounting bolts.
   D. Tighten the mounting bolts to the applicable standard torque (AMM 20-50-11/201).
   E. Install the wing tank access door No. 2 that you removed before (AMM 28-11-11/401).



CAUTION: DO NOT REMOVE THE TWO ACCESS PANELS (WEBS) AT THE SAME TIME. DAMAGE TO THE WING CAN OCCUR.

Rib Access Panel Installation
Figure 401

OVERWING FILL PORT - REMOVAL/INSTALLATION

1. General
   A. There are two overwing fill ports, one in each main fuel tank (Fig. 401). Each overwing fill port is found on the upper surface of the wing.
   B. This procedure contains two tasks. This first task removes the overwing fill port. The second task installs the overwing fill port.
2. Remove the Overwing Fill Port (Fig. 401)
   A. Equipment
      (1) Spanner Wrench - ST2580-302
      (2) Maintenance mats, commercially available
   B. References
      (1) AMM 28-10-0/201, Fuel Storage System (Purging and Entry)
      (2) AMM 28-11-11/401, Wing Fuel Tank Access Panels
      (3) AMM 28-23-0/201, Defueling
   C. Procedure
      (1) Defuel the applicable fuel tank (AMM 28-23-0/201).
      (2) Do the Purging and Fuel Tank Entry procedure (AMM 28-10-0/201).

      WARNING: OBEY THE FUEL TANK ENTRY PRECAUTIONS. INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE FUEL TANK ENTRY PRECAUTIONS.

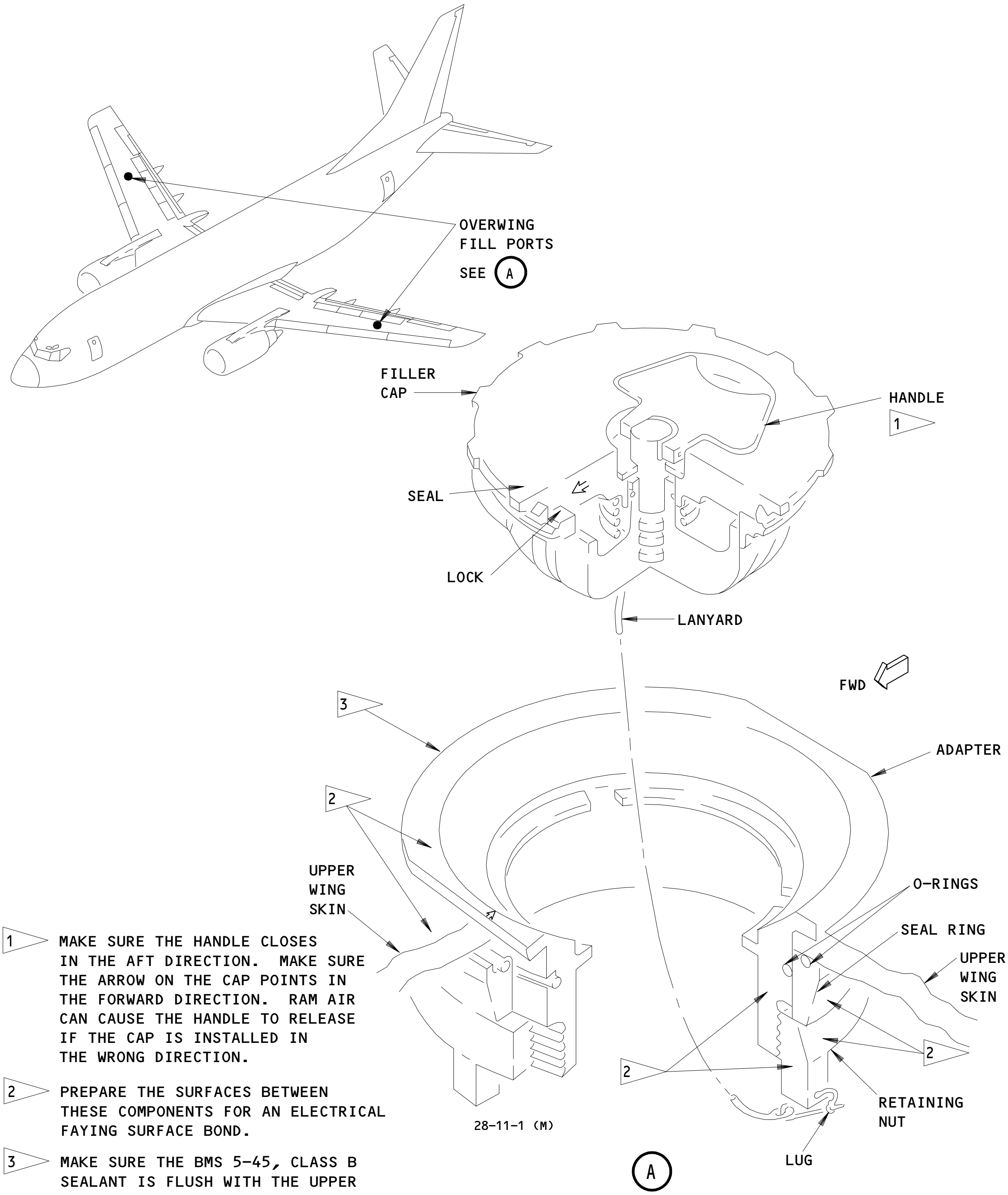
      (3) Remove wing fuel tank access panel No. 9 for the applicable wing (AMM 28-11-11/401).
      (4) Put maintenance mats on the surface of the wing in the areas you will work.

      CAUTION: PUT MAINTENANCE MATS IN THE AREAS WHERE PERSONS WORK. THE MAINTENANCE MATS PREVENT DAMAGE TO THE WING PANELS.

      (5) Remove the filler cap from the overwing fill port.
      (6) Disconnect the detach lanyard from the lug on the retaining nut.
      (7) Remove the sealant (if any) from around the adapter.
      (8) Go into the fuel tank (AMM 28-10-0/201).

      WARNING: OBEY THE FUEL TANK ENTRY PRECAUTIONS. INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE FUEL TANK ENTRY PRECAUTIONS.

      (9) Do these steps from inside the fuel tank:
         (a) Remove the lockwire between the retaining nut and the airplane structure.
         (b) Use the spanner wrench and remove the retaining nut from the adapter.
         (c) Remove the seal ring from the adapter.



1 MAKE SURE THE HANDLE CLOSES IN THE AFT DIRECTION. MAKE SURE THE ARROW ON THE CAP POINTS IN THE FORWARD DIRECTION. RAM AIR CAN CAUSE THE HANDLE TO RELEASE IF THE CAP IS INSTALLED IN THE WRONG DIRECTION.

2 PREPARE THE SURFACES BETWEEN THESE COMPONENTS FOR AN ELECTRICAL FAYING SURFACE BOND.

3 MAKE SURE THE BMS 5-45, CLASS B SEALANT IS FLUSH WITH THE UPPER SURFACE OF THE WING.

Overwing Fill Port Installation
Figure 401

(d) Remove the O-ring from the seal ring.
1) Discard the O-ring.

(10) Go out of the fuel tank to lift and remove the adapter through the opening in the upper wing skin.

(11) Remove the O-ring from the adapter.
(a) Discard the O-ring.

3. Install the Overwing Fill Port (Fig. 401)

A. Equipment
(1) Spanner Wrench - ST2580-302
(2) Bonding meter

B. References
(1) AMM 12-11-0/201, Fuel Servicing
(2) AMM 28-10-0/201, Fuel Storage System (Purging and Entry)
(3) AMM 28-11-1/601, Integral Fuel Tanks
(4) AMM 28-11-11/401, Wing Fuel Tank Access Panels
(5) SWPM 20-20-00, Electrical Bonds and Grounds

C. Consumable Materials
(1) D00250 Petrolatum - VV-P-236
(2) A00767 Sealant - BMS5-45, Class B

D. Prepare to Install the Overwing Fill Port
(1) Prepare these surfaces for an electrical faying surface bond, Fig. 401 (SWPM 20-20-00):
(a) Upper wing skin that mates with the adapter
(b) Mating surfaces between the retaining nut and the seal ring
(c) Mating surfaces between the retaining nut and the adapter
(2) Wipe surfaces clean of all residue using cotton wipers (BMS15-5).

E. Procedure
(1) Obey the fuel tank entry precautions (AMM 28-10-0/201).

WARNING: OBEY THE FUEL TANK ENTRY PRECAUTIONS. INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE FUEL TANK ENTRY PRECAUTIONS.

(2) Do these steps to install the O-rings:
(a) Apply petrolatum to the new O-rings.
(b) Install a new O-ring in the groove of the adapter.

(c) Install a new O-ring in the groove of the seal ring.

(3) Put and hold the adapter in the opening in the upper wing skin.

CAUTION: MAKE SURE THE ADAPTER AND CAP ARE INSTALLED IN THE CORRECT DIRECTION. IF THE ADAPTER AND CAP ARE NOT INSTALLED IN THE CORRECT DIRECTION, RAM AIR CAN CAUSE THE CAP TO RELEASE DURING FLIGHT.

(a) Make sure that the handle closes in the aft direction.
(b) Make sure the arrow on the cap points in the forward direction.

(4) Put a seal ring on the adapter.

(5) Do these steps from inside the fuel tank:

NOTE: Two persons are necessary to do these steps.

(a) Install the retaining nut with the spanner wrench.
(b) Tighten the retaining nut to a torque of 30-40 foot-pounds (41-54 Nm).
(c) Measure the bonding resistance between the overwing filler adapter and the upper wing skin from outside the tank (SWPM 20-20-00).
   1) Make sure the resistance is less than 0.5 milliohm.
(d) Measure the bonding resistance between the retaining nut and the adapter from inside the tank (SWPM 20-20-00).
   1) Make sure the resistance is less than 10.0 milliohms.
(e) Measure the bonding resistance between the retaining nut and the seal ring from inside the tank (SWPM 20-20-00).
   1) Make sure the resistance is less than 10.0 milliohms.
(f) Install the lockwire between the lug on the retaining nut and the tab on the airplane structure.
(g) Attach the lanyard on the filler cap to the Lug on the retaining nut.

(6) Install the filler cap on the overwing fill port.

(7) Remove the equipment used to purge and ventilate the fuel tank (AMM 28-10-0/201).

(8) Go out of and close the fuel tank (AMM 28-10-0/201).

(9) Install the No. 9 wing fuel tank access panel (AMM 28-11-11/401.
(10) Apply BMS5-45, Class B sealant around the adapter outside of the fuel tank.
(a) Make sure the sealant is flush with the upper surface of the wing skin.
(11) Remove the maintenance mats.
(12) Refuel the fuel tank (AMM 12-11-0/201).
(13) Make sure there are no fuel leaks (AMM 28-11-0/601).

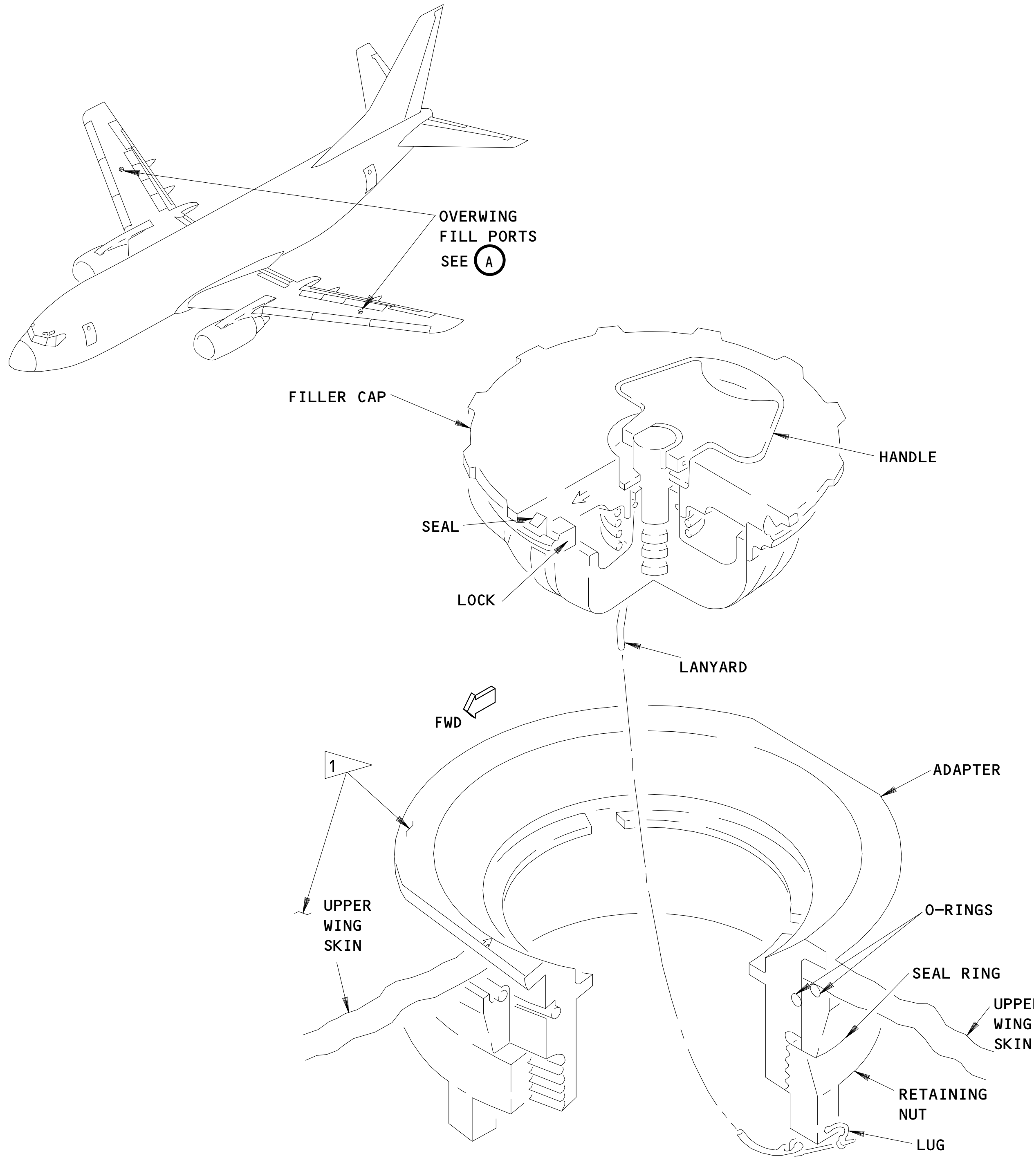
OVERWING FILL PORT - INSPECTION/CHECK

1. General
   A. This procedure contains instructions to do a bonding resistance check for each overwing fill port.
2. Overwing Fill Port - Bonding Resistance Check (Fig. 601)
   A. References
      (1) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter, Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
      (2) Maintenance mats, commercially available
   C. Access
      (1) Location Zones
          305 Left Fuel Tank
          405 Right Fuel Tank

   D. Procedure
      (1) Put maintenance mats on the surface of the wing in the areas you will work.

      CAUTION: PUT MAINTENANCE MATS IN THE AREAS WHERE PERSONS WORK. THE MAINTENANCE MATS PREVENT DAMAGE TO THE WING PANELS.

      (2) Measure the bonding resistance between the adapter of the overwing fill port and the upper wing skin (SWPM 20-20-00).
         (a) Make sure the resistance is 0.005 ohm (5 milliohms) or less.
      (3) Remove the maintenance mats.



1 THE RESISTANCE FROM THE OVERWING FILL PORT TO THE UPPER WING SKIN IS 0.005 OHMS OR LESS.

Overwing Fill Port Resistance Check
Figure 601

REMOVABLE FUEL CELLS (CENTER TANK) - DESCRIPTION AND OPERATION

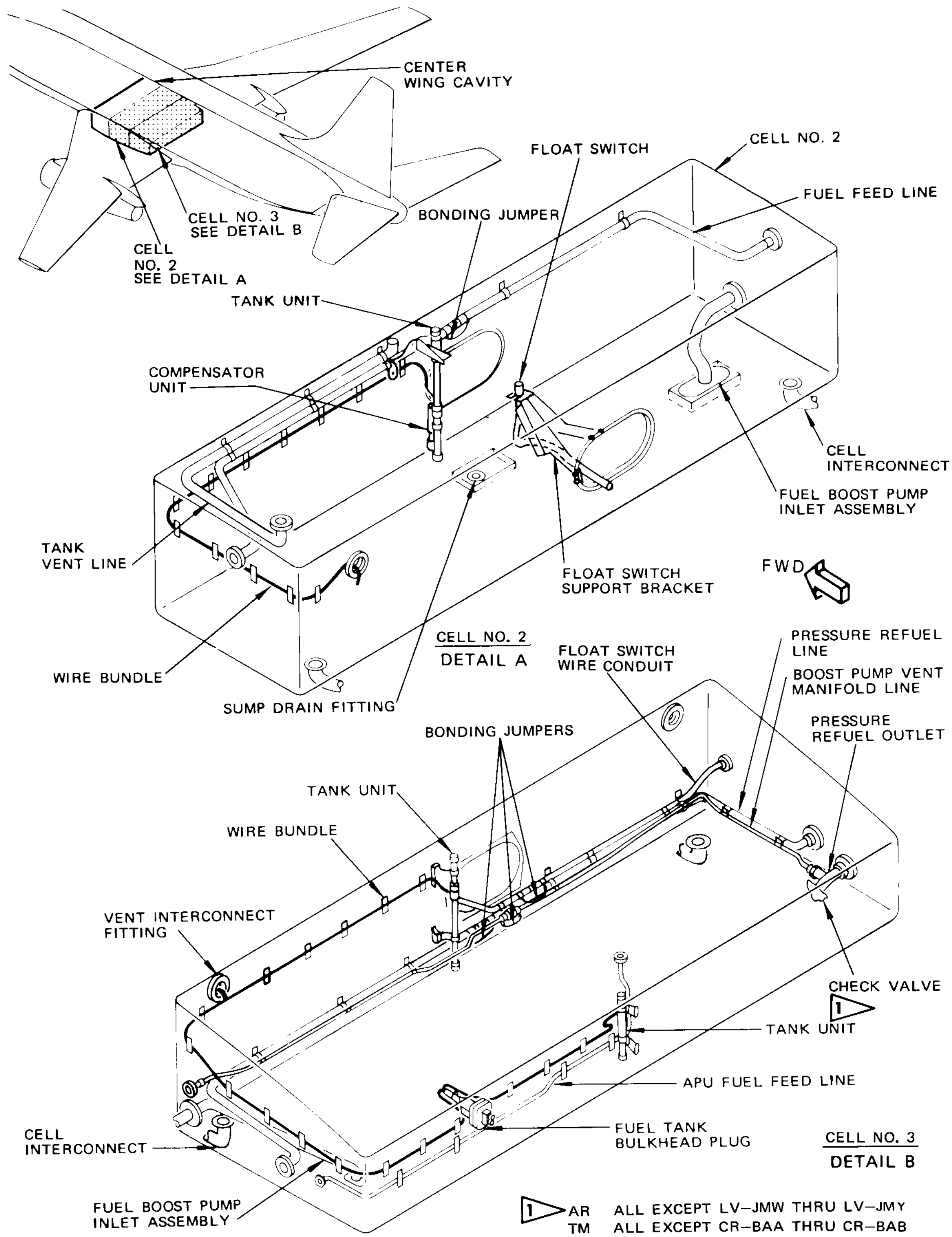
1. General
   A. The center tank may consist of one, two, or three removable (bladder-type) fuel cells installed within a compartmented wing center section. For the number of fuel cells installed, refer to 28-10-0, Storage - Description and Operation. Backing boards are installed between the lower stiffeners and the cells for protection and to obtain maximum usable fuel (Ref Chapter 57, Center Wing Cavity Backing Boards).
   B. A drain system for the wing center cavities prevents accumulation of fluids from condensation or from fuel leakage. A vent system, independent from the tank vent system, maintains cavity pressure within structural and removable cell limits during all phases of operation. The combined vent and drain systems ventilate the cavities during flight (Ref 28-13-0).
   C. The lowest point in any center tank configuration is connected to a fuel sump drain to permit draining accumulated water from the tank, and draining fuel from the sump when the tank is defueled. This installation is independent of the cavity drain system.
2. Wing Center Section
   A. The wing center section is divided into three cavities by spanwise beams and each cavity may accommodate a removable cell. The cavities are numbered 1, 2 and 3 starting with the forward cavity and going aft.
   B. Openings in the spanwise beams provide for intercell and intercavity access. An access panel in the bottom of No. 1 cavity provides access to the wing center section cavities, and removable cells.
   C. The wing center cavities are isolated from each other by sealing the structure in the bottom and the portion of the spanwise beams to confine any fuel leakage to the respective cavity. This facilitates locating a leak and directs leakage or accumulated condensation to the drain system.
   D. Each cavity drains to a manifold terminating at a mast so fluids drain clear of the airframe and aft of the main landing gear. Also connected to the drain manifold is the APU fuel line shroud drain.
3. Removable Fuel Cells
   A. The center tank consists of two or three removable fuel cells. (See figure 1.) The fuel cells are installed in cavities No. 2 and 3 for a two cell configuration and in cavities No. 1, 2, and 3 for a three cell configuration. Fittings in the fuel cell provide openings for the passage of fuel lines into and through the fuel cell, fuel tank access, center tank venting, and for sump drainage. All fuel cell fittings are metal fittings molded to and forming the surface of cell opening. Each fitting or its mating surface has a groove for the installation of a rubber O-ring. To function as a fuel tight seal, the O-ring must be compressed between two smooth surfaces. Some fittings are made fuel tight by the use of seal washers under the bolt heads.

B. The center tank fuel cells are a non-self-sealing removable (bladder type) rubber cell and of very lightweight construction. Three primary layers of material, cemented together, make up a fuel cell. These are a nylon fabric liner, a nylon barrier, and a nylon fabric outer ply. The inner liner contains the fuel and also serves as a protective cover for the nylon film barrier preventing the fuel from diffusing through the cell wall. The outer retainer ply gives strength to the cell and also gives protection to the nylon barrier. The inner liner and outer ply are made of rubber impregnated nylon fabric. This material is very strong but must not be subjected to sharp objects, chafing, or rubbing against any material tending to damage the thin rubber sections.

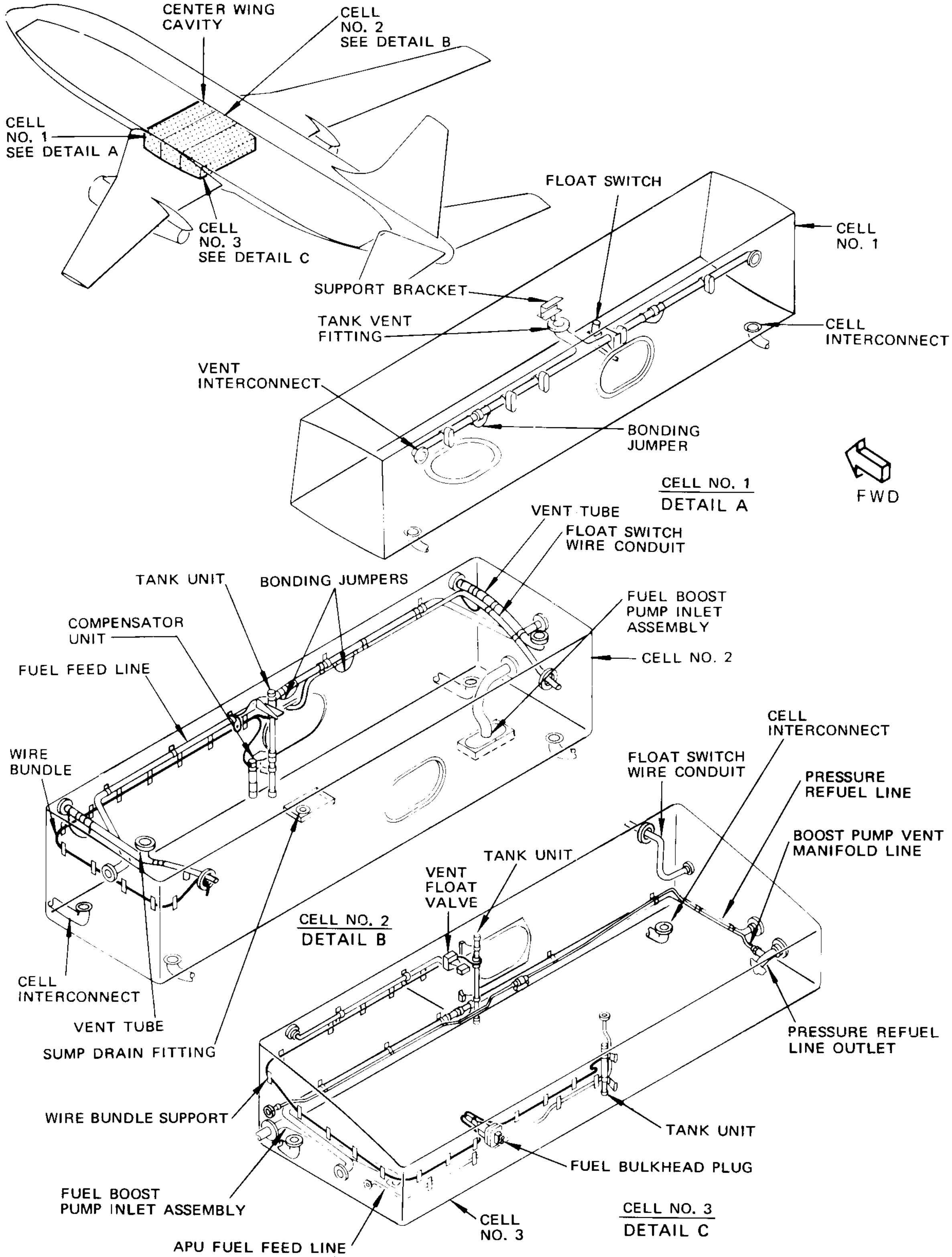
C. The fuel cells are attached to cavity structure by means of cell hangers, lacing ferrules, and cell fittings. If the cell material is maintained at a moderate temperature and humidity, the cell may be completely collapsed, folded, and remain folded for an indefinite period of time. When properly collapsed and folded, the cell may be removed from the cell cavity through the normal cavity access opening without the removal of any structural components. While the cell is being collapsed and folded, caution shall be exercised to avoid bending or distorting the various cell fittings.

D. An access opening in the bottom of cavity No. 1 allows access to the wing center section and fuel cells. Access openings are provided in bottom and aft side of cell No. 1, both sides of cell No. 2, and the forward side of cell No. 3. An access panel securing the fuel cell to the cutout in cavity No. 1 floor covers the access opening in the bottom of cell No. 1 (three cell configuration). The access opening in the forward side of cell No. 2 (two cell configuration) is covered by an access panel securing the fuel cell to the cutout in the spanwise beam.

E. A float switch is installed in cell No. 2 of the two cell configuration and in cell No. 1 of the three cell configuration to prevent spillage during fueling operations when the tank is full.



Removable Fuel Cells (Center Tank)
Figure 1 (Sheet 1)



Removable Fuel Cells (Center Tank)
Figure 1 (Sheet 2)

REMOVABLE FUEL CELLS (CENTER TANK) - TROUBLESHOOTING

1. General
   A. Troubleshooting of removable fuel cells will be concerned with the tracing and locating of fuel leaks. A thorough knowledge of the installation of the fue1 cells, related equipment and tubing, and the arrangement of the cavity drain system (Fig. 102), is the most important factor in detecting and locating a fuel leak. Another important factor in detecting cell leakage is the condition (deterioration) of the inner surface of the cell, especially in the immediate vicinity of the bonded tank fittings. Fingernail check is made to determine deterioration. Deterioration of the cell bonding in these areas can lead to separation of rubber bond from fittings and eventual fuel leakage.
   B. Each cavity in the wing center section has a flush-mounted drain at the lowest point in the cavity. The individual drains are connected to a common manifold terminating at a drain mast. The APU shroud drain line also connects to this manifold.
   C. The wing center section cavities are isolated from each other by sealing the structure in the bottom and the lower portion of the spanwise beams to confine any fuel leakage to the respective cavity. Damaged sealant, leaking fasteners, or leaking plumbing connections could allow fuel to leak into a cavity not occupied by a fuel cell. The No. 2 cavity drain is the lowest point in the wing center section, therefore the drain hose should be removed and checked for leakage whenever fuel is observed coming from the drain mast whether a cell is installed or not. Leaks of this type will require a thorough checking of cavity sealing and plumbing installations.
   D. The following trouble shooting chart outlines a general procedure for tracing and locating fuel leaks and can be applied to any wing center tank configuration. It is advisable to attempt to localize a fuel leak before draining and opening the wing center tank.
2. Removable Fuel Cell Troubleshooting Chart

   WARNING: FUEL AND FUEL VAPORS CONSTITUTE A POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS FOR TANK ENTRY AND CLOSURE (REF 28-10-0, MAINTENANCE PRACTICES).

   WARNING: FUEL AND FUEL VAPORS CONSTITUTE A POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS FOR TANK ENTRY AND CLOSURE (REF 28-10-0, MAINTENANCE PRACTICES).

3. From page 102

With fuel in wing center tank, observe wing center section drain outlet for dripping fuel. IF -

LESS THAN 40 DROPS OF FUEL PER MINUTE - Observe drain outlet frequently and note any change in dripping rate. If leakage approaches, but does not exceed 40 drops/minute, keep under close observation and correct at earliest possible convenience.

40 DROPS OR MORE OF FUEL PER MINUTE - Disconnect APU fuel feed line shroud drain line. IF -

SHROUD DRAIN LINE IS NOT LEAKING - Disconnect No. 2 and 3 cavity drain lines from drain manifold. Check for dripping fuel. IF -

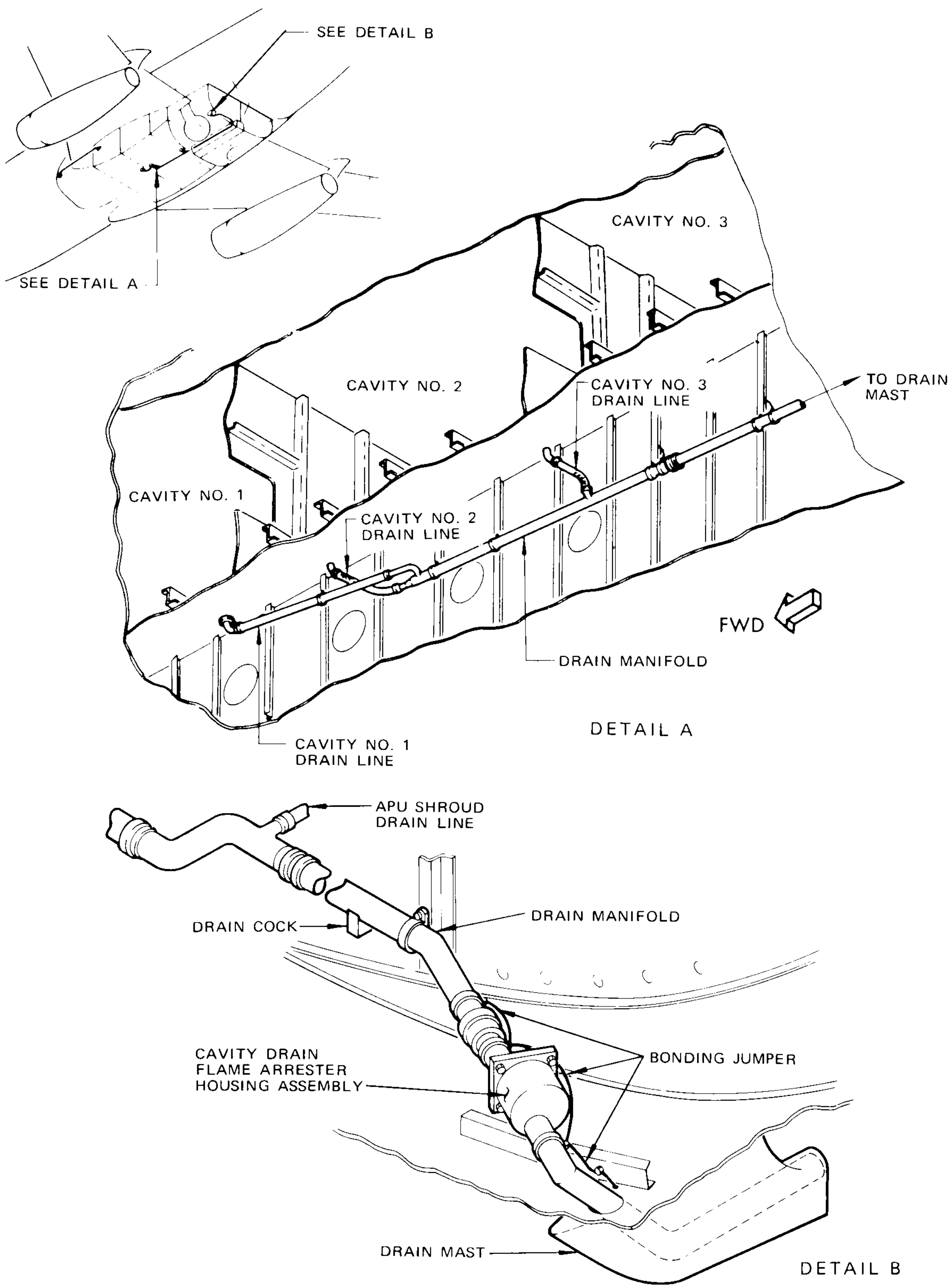
SHROUD DRAIN LINE IS LEAKING - Do the "In-Service Operational Check" portion of the APU Fuel Feed Line Leakage Check (AMM 28-22-81/601).

Continued on page 103
Page 103 *[1]
Page 104 *[2]

*[1] Airplanes with two bladder cells:
AR LV-JMW thru LV-JMZ, LV-JTD, LV-JTO, LV-LEB
FL ALL EXCEPT N7382F
IR EP-IRF, EP-IRG
PV CF-EPL, CF-EPR
PW CF-PWC thru CF-PWE, CF-PWM
ZD G-AVRL, G-AVRM

*[2] Airplanes with three bladder cells:
AR LV-JND, LV-JNE
FL N7382F
IR EP-IRH

Removable Fuel Cells (Center Tank) - Troubleshooting
Figure 101



Center Wing Cavity Drain System
Figure 102

REMOVABLE FUEL CELLS (CENTER TANK) - INSPECTION/CHECK

1. Center Tank Check
   A. General
      (1) This section consists of two inspection procedures: a check on the condition of the bond around the various cell fittings; and a pressure check of the fuel cell (cell removed from airplane).
      (2) The check of the interior surface condition of the cell will be referred to as the "fingernail test." By running fingernail over bonded surface of cell fittings one can readily determine whether deterioration of the bond is present.
      (3) When removable fuel cells have been removed and replaced, the center tank shall be pressure-checked to assure proper installation prior to fueling.
2. Interior Bonding of Fuel Cell Fittings Check (Fingernail Test)
   A. Defuel and purge fuel center tank (Ref 28-23-0, 28-10-0, Maintenance Practices).
   B. Gain access to tank (bladder cell).
   C. Move fingernail in scraping position over bonded surfaces of cell fittings.

      NOTE: If fingernails glide smoothly over bonded surface of fitting, cell can be considered to be in good condition. If fingernails dig into surface (the surface has consistency of art gum or chewing gum), the bond is beginning to deteriorate.
      Deterioration of bonding material can also be detected by a change in color. Deteriorated bonding will have changed from a light yellowish-tan color to a dark reddish-brown.

   D. If deterioration is detected, fuel cell must be removed and repaired or replaced.
   E. If fuel cell found in good condition, return airplane to normal configuration.
3. Prepare Center Tank for Check
   A. Equipment and Materials
      (1) Air pressure source capable of supplying 5.0 psi
      (2) Special fittings and plugs as necessary
      (3) Water manometer board (5 psi)t
      (4) Means of measuring atmospheric pressure changes
      (5) Pressure Test Door - F80175-1

B. Install plugs in vent openings. Ensure that safety streamers are attached.

CAUTION: ATTACH SAFETY STREAMERS MADE OF HEAVY RED COTTON WEBBING TO ALL CLOSURE ITEMS PRIOR TO INSTALLING SUCH ITEMS IN THE AIRPLANE.

C. Close center tank boost pump removal valves.
D. Install pressure test door in place of access panel and make necessary connections for pressure input and measurement.

4. Check Center Tank

CAUTION: MAXIMUM INTERNAL PRESSURE IS 5 ±0.2 PSI AND -10 INCHES OF WATER.

A. Apply 5 ±0.2 psi air pressure through connections in pressure test door.
B. Allow 30-minute time for bladder cell growth and temperature to stabilize.
C. There shall be no leakage for 15 minutes after cell growth and temperature stabilized and allowance has been made for atmospheric temperature/pressure changes.

5. Restore Center Tank to Normal Configuration
A. Remove all plugs from vent and drain openings.

CAUTION: SERIOUS DAMAGE CAN OCCUR TO AIRPLANE STRUCTURE WHEN PERFORMING PRESSURE FUELING OPERATION IF VENT SYSTEM CLOSURE ITEMS ARE NOT REMOVED AFTER COMPLETING PRESSURE CHECK.

B. Disconnect pressure input and measurement connections and remove pressure test door from tank access opening.
C. Install original access door.
D. Open center tank boost pump removal valves.

REMOVABLE FUEL CELL - STORAGE

1. General
   A. In the event the cell must be stored after repair, or before repairs can be carried out, steps must be taken to preserve the inner cell wall, to prevent checking or cracking of the impregnated rubber coated innerliner.
   B. The cells should remain in their containers until ready to be installed. Containers may be stacked but not to the extent the bottom container is collapsed. Stock should be arranged so the oldest cells are used first.
   C. Cells should be protected from sunlight, exposure, grit, dirt, and other foreign materials at all times.
2. Fuel Cell Handling
   A. Equipment and Materials
      (1) Moistureproof paper, polyethylene material, or canvas
      (2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
      (3) Container - suitable to hold fuel cell without crushing
      (4) Masking tape
      (5) Supply of clean cotton wipers (BMS15-5).
   B. Handling of Fuel Cell
      (1) Removable fuel cells must be handled with extreme care as they can easily be damaged. The following handling precautions must be complied with:
         (a) Leave fuel cell in shipping crate, package, or container until required. Do not stack unpacked cells.
         (b) It will be necessary to fold or collapse the cells in order to install or remove them from airplane cavities. This will not be detrimental to cell providing temperature is not below 20°F.
         (c) Before removing cell from crate, check for any sharp objects or nails ripping or penetrating fuel cell (Fig. 201).
         (d) Carry cell from one location to another preferably in folded condition.

            CAUTION: DO NOT DRAG A FUEL CELL. DO NOT USE CELL FITTINGS FOR LIFTING. DO NOT STEP OR STAND ON A FOLDED CELL.

         (e) Unfold or fold fuel cell on smooth, clean canvas, cardboard, or plastic covered padded surface, larger than the cell. (See figure 201).
         (f) All cell fitting openings must be covered with cardboard or lint-free paper secured in place with tape, to protect sealing surfaces. (See step 1, figure 202.)
         (g) When folding cell into package small enough to enter fuel cell access opening, or for storage purposes, proceed as follows:
            1) Fold sides of cell inward, approximately in center. (See step 2, figure 202.)
            2) Overlap side folds.

3) Tie with cotton web straps. Use easily disengaged slip knot. (See step 3, figure 202.)

(h) Make sure rubber protectors are installed around access opening. (See step 4, figure 202.)

(i) Fold fuel cell just prior to inserting or removing from airplane cavity. Have sufficient manpower available to handle cell without letting it buckle.

CAUTION: DO NOT FOLD A CELL ABUSIVELY OR UNNECESSARILY. DO NOT FOLD ACROSS OR BESIDE ANY FITTING.

3. Fuel Cell Storage

A. Equipment and Material

(1) SAE 10-20 engine oil

B. Prepare Fuel Cell for Storage

(1) Cells which have contained fuel should be preserved in the following manner prior to placing them in storage.

(a) Clean cell by washing thoroughly with warm water.

(b) The innerliner or inner surface of the cell should be coated with a light coat of SAE 10-20 engine oil. Do not permit oil to pool or puddle; remove any excess that remains after application.

NOTE: Cell material BTC 49 and BTC 69 do not require protective coating of engine oil.

(c) After the application of oil, cover all fitting openings with protective covers made of cardboard or other suitable material, taped into place over the fitting seal surface.

CAUTION: FUEL CELL FITTING SURFACES ARE CRITICAL SEALING AREAS. A SCRATCHED SURFACE MAY RESULT IN A FUEL LEAK. HANDLE FUEL CELL WITH EXTREME CARE.

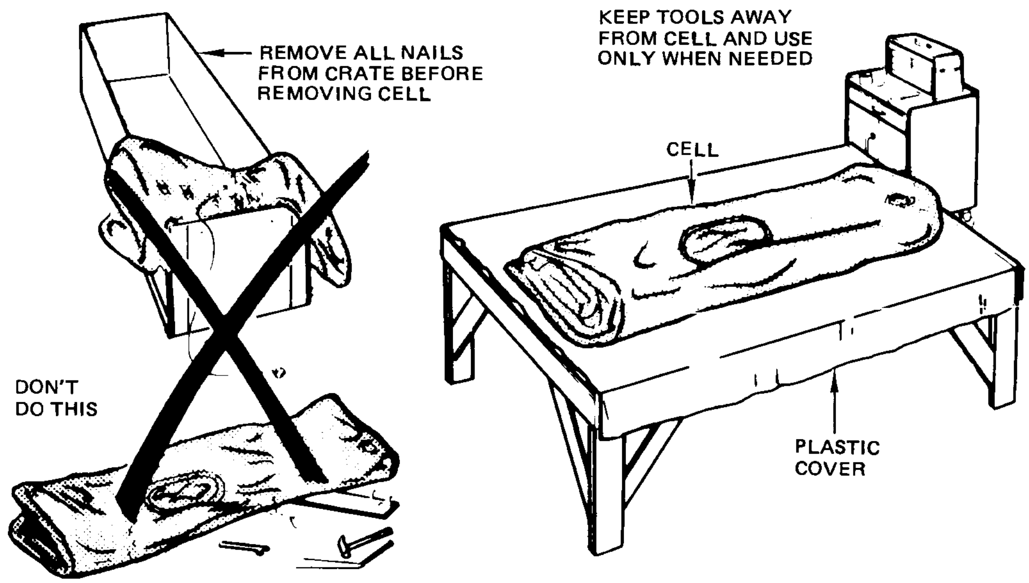
C. Store Fuel Cell

(1) Fold cell as smoothly and lightly as possible with least number of folds, and with wadding between folds.

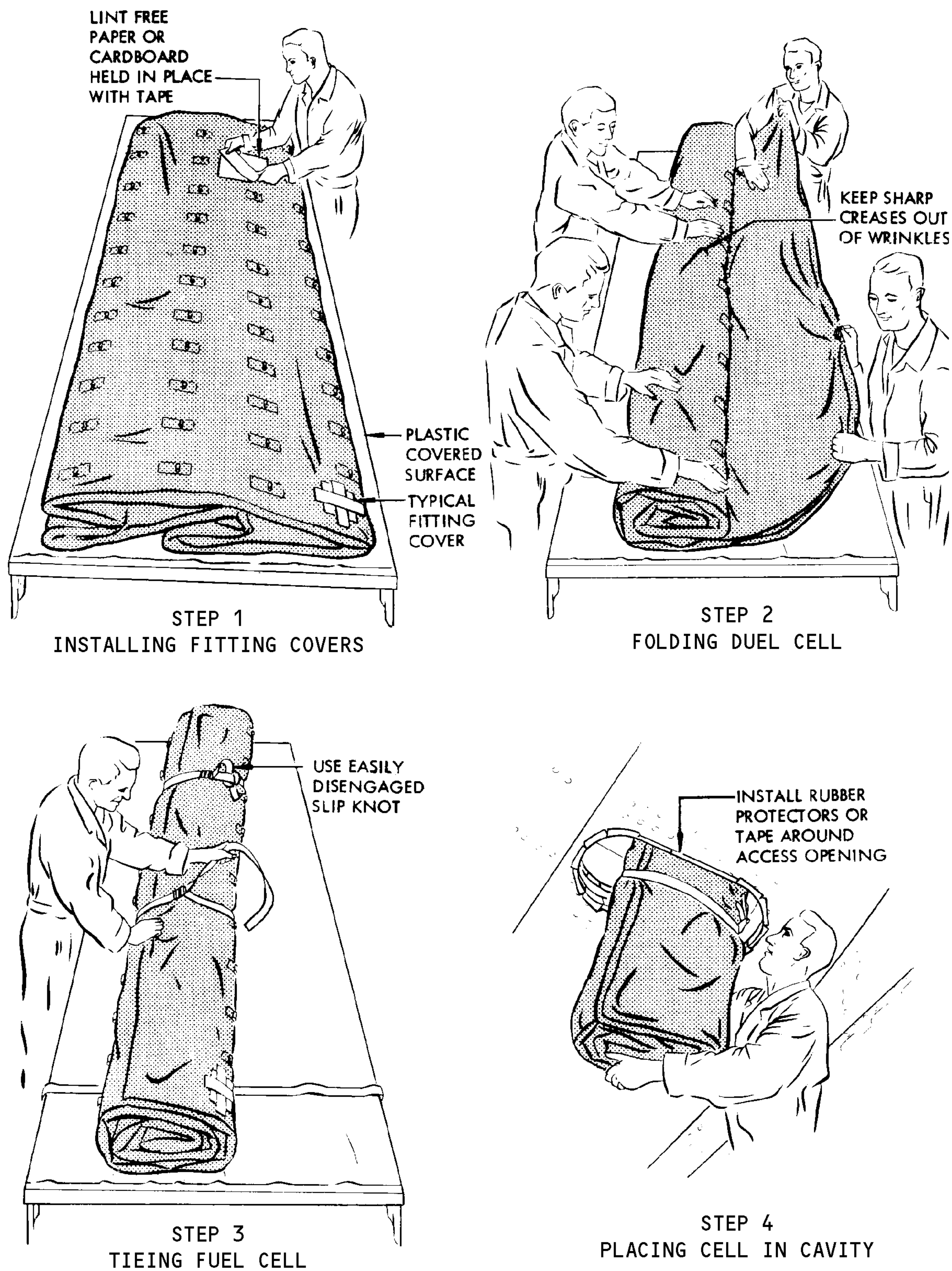
(2) Select a container which is same size as folded cell. This should be done to ensure that cell does not shift when container is moved.

(3) Check container for foreign material that might damage cell. Line container with cardboard or heavy paper.

(4) Wrap cell in moisture-proof paper and place it in container. If necessary, place paper in container to fill up all voids to ensure that cell will not shift.



Fuel Cell Handling
Figure 201



Handling Fuel Cells
Figure 202

(5) Store container in a suitable storage area, away from direct sunlight, with temperature maintained between 55°F and 80°F (12.8°C and 26.7°C) at a moderate humidity.

(6) Maximum storage shelf life of cells stored with conditions as noted above are as follows:

Cell Material *[1]	Maximum Storage Shelf Life
BTC 17 (Nitrile) BTC 49 (Vithane) BTC 69 (Vithane)	Expired 4 years to indefinite Indefinite

*[1] Identify cell material by examining stencil nameplate on inside of cell opposite access openings.

(7) Check cells for use after storage.
   (a) Cells must be thoroughly inspected before final determination is made of a stored cell's suitability for use. Reject any cell which has either hardened, brittle material or soft, gummy material which cannot pass the "fingernail test" (Ref 28-12-0, Inspection/Check).

REMOVABLE FUEL CELLS - INSPECTION/CHECK

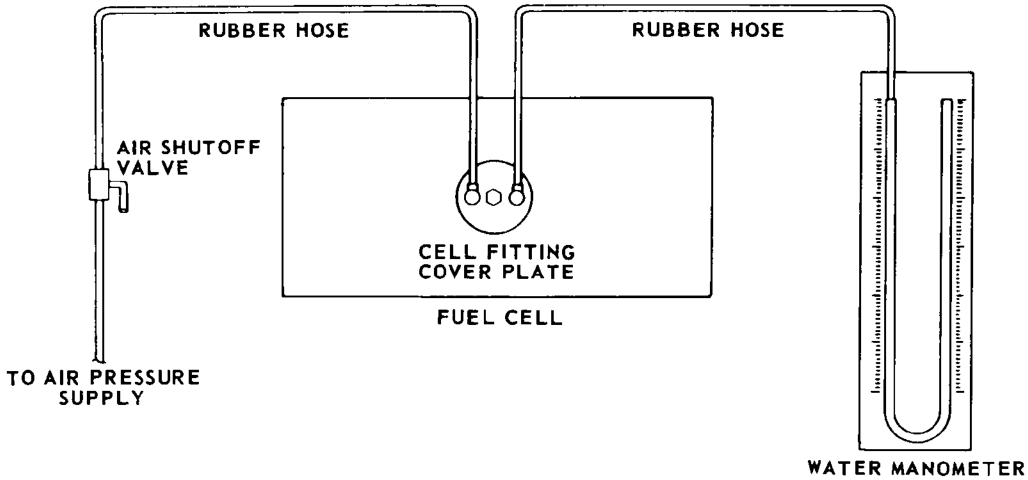
1. General
   A. This section consists of two inspection procedures: a check on the condition of the bond around the various cell fittings; and a pressure check of the fuel cell (cell removed from airplane).
   B. The check of the interior surface condition of the cell will be referred to as the "fingernail test." By running fingernail over bonded surface of cell fittings one can readily determine whether deterioration of the bond is present.
   C. The fuel cell must be pressure-checked after repair of fuel cell damage extending through the cell wall, or to locate fuel leaks. All cell openings must be closed with closure plates and rubber expansion plugs. One closure plate shall have fittings for connecting air pressure source and manometer line. Two methods of leak detection with pressure checking are described: The soap-bubble method and the ammonia method.
   D. After installation in the center wing cavity, fuel cells must be pressure checked again (Ref 28-11-0 TS).
2. Interior Bonding of Fuel Cell Fittings Check (Fingernail Test)
   A. Defuel and purge fuel tank (Ref 28-23-0, 28-10-0 MP).
   B. Gain access to tank (bladder cell).
   C. Move fingernail in scraping position over bonded surfaces of cell fittings.

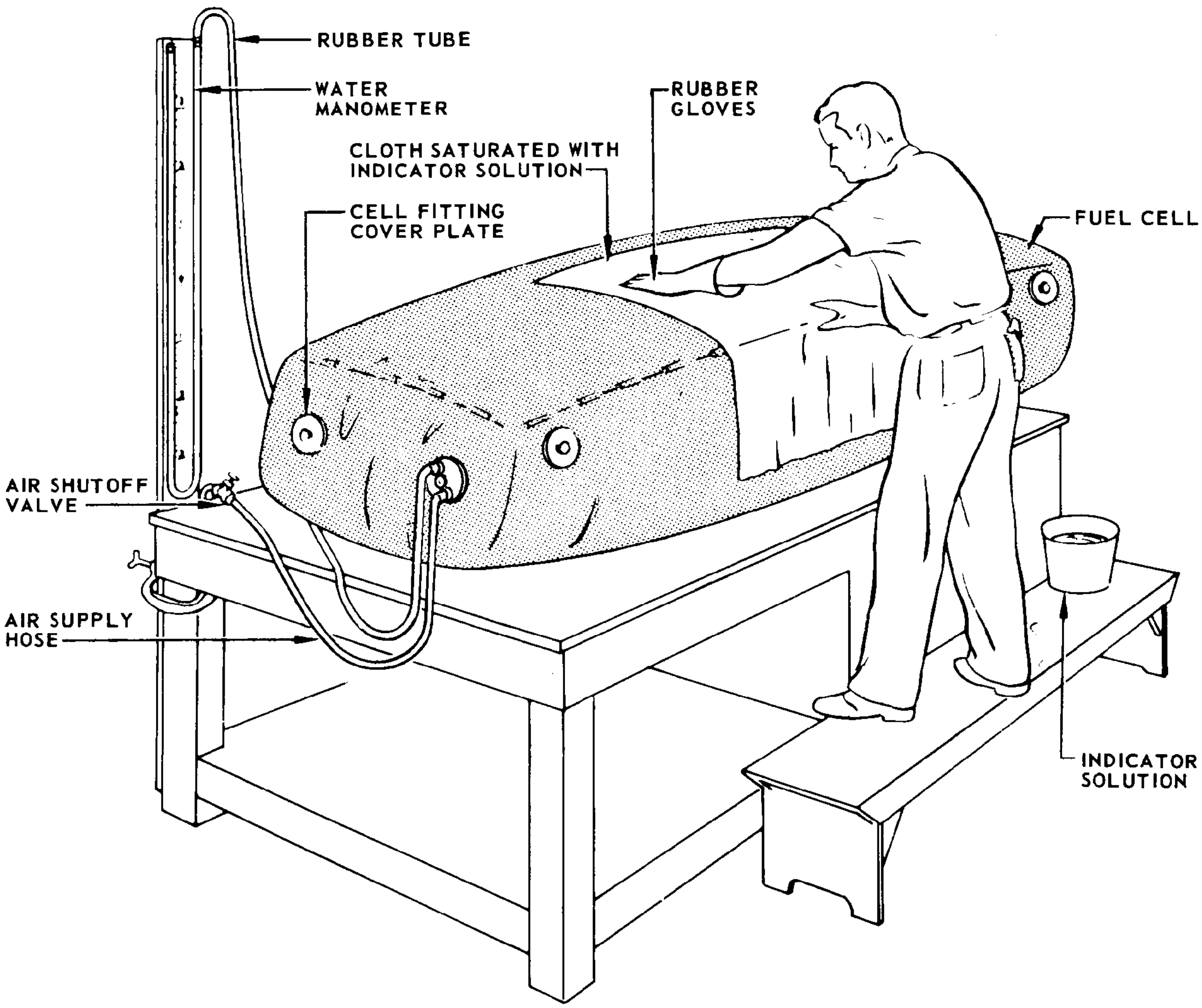
      NOTE: If fingernails glide smoothly over bonded surface of fitting, cell can be considered to be in good condition. If fingernails dig into surface (the surface has consistency of art gum or chewing gum), the bond is beginning to deteriorate. Deterioration of bonding material can also be detected by a change in color. Deteriorated bonding will have changed from a light yellowish-tan color to a dark reddish-brown.

   D. If deterioration is detected, fuel cell must be removed and repaired or replaced.
   E. If fuel cell found in good condition, return airplane to normal configuration.
3. Removable Fuel Cells Pressure Check
   A. Special Tools and Equipment
      (1) Closure plates - aluminum plates 1/4 inch thick; sizes to suit fuel cell fittings bolt circle and/or O-ring groove dimensions. One of the plates has air pressure and manometer fittings.

         NOTE: Closure plates must have rounded edges and a smooth surface in O-ring area.

      (2) Plugs - rubber type expansion plugs





Fuel Cell Chemical Leak Test
Figure 601

(3) Air pressure source - capable of supplying up to 1 psig
(4) Manometer - 15-inch water type, open end "U" manometer
(5) Rubber gloves
(6) Torque wrench - snap-on type (0-150 inch-pound)
(7) Silver colored pencil-marking (Eagle brand)
(8) Soap - liquid type, commercial hand soap
(9) Phenolphthalein crystals
(10) Ammonia - commercial or household ammonia (28% concentration)
(11) Ethyl alcohol
(12) Brush - large camel hair brush (6 inches approximately)
(13) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

B. Prepare Fuel Cell for Pressure Check (Fig. 601)
(1) Remove fuel cell from center wing cavity (Ref Removal/Installation).

WARNING: FUEL AND FUEL VAPORS CONSTITUTE POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS FOR TANK ENTRY AND CLOSURE (REF 28-10-0 MP).

(2) Place fuel cell upon a smooth, clean work table.
(3) Cover all openings, except the one that will have the air pressure line attached, with closure plates or plug the holes with rubber expansion plugs. Torque values for the fasteners are 50 to 70 pound-inches.

WARNING: FUEL CELLS WHICH HAVE CONTAINED FUEL CONTAIN DANGEROUS EXPLOSIVE AND TOXIC VAPORS. USE ONLY EXPLOSIONPROOF AND SHIELDED LIGHTS. AVOID PROLONGED INHALING OF VAPORS.

C. Pressure Check Fuel Cell
(1) Soap-Bubble Method
(a) Plug the remaining opening with the closure plate having connections for air pressure line and manometer tube.
(b) Attach air pressure line and manometer tube and introduce 1/2-psi pressure (14 inches of water measured on the open "U" type manometer) into the cell.
(c) Make a soap solution by adding liquid hand soap to water (approximately 20 parts of water to 1 of soap).
(d) With large camel hair brush, apply soap solution to the entire exterior surface of the fuel cell. Check entire surface and around fittings for bubbling or expanding bubbles.

NOTE: Bubbles caused by painting the solution can easily be distinguished from bubbles caused by leaks because the latter will continue to expand if leakage is present. Examine cell carefully during this operation.

(e) Mark any observed leaks with a silver colored pencil.
(f) After completion of test, wash soap solution completely from the inflated cell and dry with a clean cotton wiper (BMS15-5) before deflating.
(g) All leaks in a fuel cell must be repaired (Ref 28-12-1, 28-12-2, 28-12-3 AR).

(2) Ammonia Method

CAUTION: RUBBER GLOVES MUST BE WORN DURING THIS PROCEDURE.

(a) Pour commercial or household ammonia (28% concentration) on absorbent cotton wiper (BMS15-5) at the rate of 3 cubic centimeters per cubic foot of cell capacity, with a minimum of 10 cc's.
(b) Place a saturated cotton wiper (BMS15-5) inside the cell and plug the opening with the closure plate having connections for air pressure line and manometer tube.
(c) Soak cotton wipers (BMS15-5) in an indicator solution made up of 1/2 gallon of water, 1/2 gallon of ethyl alcohol and 40 grams of phenolphthalein crystals.
(d) Wring out the cotton wipers (BMS15-5) thoroughly and spread them smoothly on the cell surface over area to be checked. Press the cotton wipers (BMS15-5) down to ensure detection of minute leaks.
(e) Inflate the cell with air to a pressure of 1/2 psi maximum (14 inches of water measured on the open "U" type manometer).

CAUTION: DO NOT EXCEED 1/2-PSI PRESSURE UNLESS A CAGE OR JIG IS USED.

(f) Leakage through the fuel cell wall will be indicated by the appearance of red spots on the cotton wipers (BMS15-5).
(g) Resoak the cotton wipers (BMS15-5) in the indicator solution to remove the red spots and reuse in progressively checking all area of the fuel cell. Mark all leak areas with a silver colored pencil.

NOTE: Check the fitting locations closely making certain that any leaks at these points are not caused by improper installation of the closure plates.

(h) After the test, remove all plates and test equipment. Allow cell to air out before entering.
(i) All leaks in the fuel cell must be repaired (Ref 28-12-11, 28-12-12, 28-12-13 AR).

REMOVABLE FUEL CELLS (GOODYEAR BTC-17) - APPROVED REPAIRS

1. General
   A. The fuel cell repair work outlined below is limited to the repair of Goodyear bladder cells constructed of BTC-17 (identify cell construction material by examining stencil nameplate on inside of cell opposite access opening) material and with damage which can be repaired by the "hot" or "cold" method using cements, without the use of jigs or molds. The hot repair method requires the use of heating units for curing. In the cold repair method, the cement is air cured.
   B. These repairs are designed to make the fuel cell serviceable in the shortest possible time after leakage or damage is discovered. No temporary repair procedures are to be used.
   C. Normally, the fuel cell must be removed from the cavity for repairs. However, injuries on the interior surface of the cell wall may be satisfactorily repaired, providing they are definitely surface injuries and no penetration through the nylon barrier or cell wall has been made.
   D. The repair of Goodyear bladder cells is restricted to authorized personnel. Authorized personnel are those who have been certified and trained by Goodyear representatives or those who have received their training from persons who have been certified.

      NOTE: Manufacturers procedures and recommendation should be followed if different from or not indicated in the following procedures.

   E. Following a leak repair, the cell should be leak checked before installation (Ref 28-12-10, Inspection/Check).
   F. Fuel Cell Repair Limitations

      NOTE: Approved fuel cell repair materials are limited to materials specified in these procedures and materials subsequently specified by Goodyear.

      (1) Fuel cell repairs permitted are as follows:
         (a) Punctures - Small cuts or holes extending through the cell wall which are less than 4 inches in length or diameter.

(b) Blisters and/or ply separations.
   1) Blisters may or may not affect the serviceability of a fuel cell. Many factors should be considered before making a decision to repair or leave a fuel cell with blisters in service. Pattern location, size, and leakage are the main factors affecting a fuel cell with blisters. Blisters on the bottom and lower sides of the cell are subject to more pressure from the head of fuel than those in the top and upper sides of the cell. The following general rules may be used as a guide in determining the serviceability of a fuel cell containing blisters:
      a) Fuel cells which have blisters, acquired while in service, 1 inch or less in diameter and located in the cell walls, which have not leaked, need not be repaired.
      b) All other blisters should be repaired.
(c) Channels, loose seams, loose accessory parts, ferrules (fitting flanges, etc.).
(d) Removal and replacement of ferrules or fittings (not to include vent and drain fittings, intercell access opening fittings or access panel fittings).
(e) Small cuts and holes, which do not damage the nylon barrier, less than 4 inches in length or diameter.
(f) Scrapes or scuffing on cell surfaces.
(g) Cell fitting surface damage.

(2) Fuel cell repairs not permitted are as follows:
(a) Replacement, relocation or addition of a cell fitting, except interconnect fittings.
(b) All injuries occurring in a corner formed by three interconnecting planes.
(c) Any repair which affects the interchangeability of the fuel cell.
(d) Holes or cuts larger than 4 inches diameter or length.

(3) Repairs which appear to exceed the scope of the repair procedures listed must be referred to the fuel cell manufacturer for evaluation. When difficult contours are encountered and repair material FT-136 cannot be used, return the cell to manufacturer for repair.

G. Materials Handling
(1) All materials, including cells, are to be protected from dirt contamination, sunlight, exposure, and excessive heat or cold while in storage. Storage temperature should be from +30°F to +85°F.

(2) The repair cement, code 1895C, referred to in this text is prepared just prior to using by mixing one quart of 1492C with 25cc of 1465C accelerator. Smaller quantities may be obtained by mixing half amounts accurately measured.

CAUTION: CODE 1895C CEMENT REQUIRES THOROUGH MIXING TO OBTAIN FULL ADHESIVE VALUES.

(3) Repair cement 1895C has a pot life of 16 hours after mixing.
(4) The unmixed 1492C and 1465C have a shelf life of 6 months from date of packaging.

CAUTION: ALL CONTAINERS USED FOR CEMENTS OR SOLVENTS SHOULD BE PROPERLY IDENTIFIED.

H. Cell Handling

NOTE: Prevent needless damage by exercising common sense in all handling of cells.

(1) Folding or collapsing of cells is necessary to place them in containers for storage, install in airframe cavities, or carry from place to place. Temperature during this operation should be 20°F or above.
(2) Protect fitting seal surface from contact with cavities during removal or installation. Use protective covers over fitting seal when practical.
(3) Do not carry cells by fittings. Maintain original cell contours or folds when folding for crating, installing in airframe cavities, or handling in the repair area.
(4) The cells to be repaired should be placed on a well lighted table. Maintain natural contours, if possible, while repairing. Prevent contact with sharp edges, corners, dirty floors, or other surfaces.
(5) Do not stack cells unless they are in containers.

I. Cell Repair Precautions
(1) Remove shoes before entering a cell. Protect cell from tools, hot lights, etc., when working inside or around cell.
(2) Avoid stepping on folds or creases in cells.
(3) Repair area must be well ventilated.

WARNING: DO NOT PERMIT SMOKING OR OPEN FLAME NEAR REPAIR AREA OR CELLS.

(4) Avoid contamination from foreign material, dust, etc.
(5) Avoid trapping air during all stitching operations.

2. Hot Repair Procedure

A. Equipment and Materials

NOTE: Accessories and fittings for replacement will be ordered in accordance with requirements of the individual cell. Phenol plates, phenol plate assemblies, and phenol test equipment can be ordered as required by customer. Group 1 (Material) and Group 2 (Equipment) are packaged as complete groups and should be ordered as Group 1, Group 2, or both.

(1) Repair Kit 2Fl-3-35213 (Group 2 Equipment) Goodyear Tire and Rubber Company, Aviation Products Division, Akron, Ohio 44316. The repair kit consists of the following items:
- (a) Abrasive cloth, 120 grit, aluminum oxide, three-m-ite, elektro-cut (1 sheet)
- (b) Abrasive cloth, 320 grit, aluminum oxide, three-m-ite, elektro-cut (1 sheet)
- (c) Balloon or broad cloth, white (2 yards)
- (d) C-clamps, 6 inch (6)
- (e) Polyethylene pail, 8 to 10 quarts (1)
- (f) Paint brush, 1 inch (1)
- (g) Roller, 1/4 inch x 3/4 inch diameter flat gooseneck (1), Hoggson Pettis, New Haven, Connecticut
- (h) Stitcher, 1/32 inch x 3/4 inch diameter gooseneck (1), Hoggson Pettis, New Haven, Connecticut
- (i) Scale, 12 inch, straightedge (1)
- (j) Scissors, 4 inch, curved nail (1 pair)
- (k) Shears, 10 inch snub nose (1 pair)
- (l) Electric Timer, Rhodes Mark Time # 78105, or equivalent (1)
- (m) Light, Vapor Proof, with 25 foot cord (1)
- (n) Motor, Electric, Black and Decker #725, 2250 RPM, 1.9A 115 valve, or equivalent (1)
- (o) Abrasive Arbor, Dumore R421003, 1/4 inch drive, 1 inch diameter x 1 inch length, or equivalent (1)
- (p) Sanding Sleeve, 3M three-m-ite, 1 inch x 1 inch 80-100 grit or equivalent (6)
- (q) Heated Repair Iron, 290 degrees temperature setting. Drawing 2F1-2-25721 (1)
- (r) Soft Aluminum Plates, 1/8 inch thick, 6 inch x 6 inch (6)
- (s) Filler Plug. Drawing 2F1-2-14251 (1)

(2) Neoprene Rubber Gloves

(3) Silver colored Marking Pencil

(4) Goodyear Repair Kit 2F1-3-35123 (Group 1 Materials) Goodyear Tire and Rubber Company, Aviation Products Division, Akron, Ohio 44316. The repair kit consists of the following items:
   (a) Repair Material - FT-136, Reinforced Sandwich Nylon - 2 square yards
   (b) Airfoam, 1/4 inch fabric backed - 2 square yards
   (c) Repair Cement - Code 1492C - 1 quart
   (d) Accelerator for 1492C Cement - Code 1465C - 25cc
   (e) Lacquer - Code 5053C - 1 quart
   (f) B01013 Solvent, Series 93 (AMM 20-30-93/201) - 1 quart
   (g) Soapstone, Powdered or Mica - 2 pounds
   (h) Ethyl Alcohol - Commercial Grade, 95% denatured - 2 gallons
   (i) Phenophthalein - Analytical Grade - 2 ounces
   (j) Ammonia - Commercial Grade, 27% Concentrate - 1 pint
(5) Alodine 600 Solution
(6) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

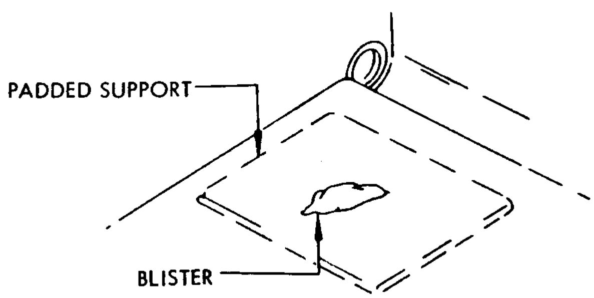
B. Prepare to repair Fuel Cell
(1) Defuel and purge fuel tank prior to entering cell (Ref to 28-23-0, Defueling and 28-10-0, Fuel Storage System - MP).
(2) If cell must be removed from cavity for repair, refer to Removable Fuel Cells - Removal/Installation for this procedure.

WARNING: FUEL CELLS WHICH HAVE CONTAINED FUEL CONTAIN DANGEROUS EXPLOSIVE AND TOXIC VAPORS. USE ONLY EXPLOSION-PROOF AND SHIELDED LIGHTS. POWER TOOLS MUST BE AIR-DRIVEN. WEAR A COTTON COVERALL SNUG AT WRISTS AND ANKLES, WITH NON-SPARKING ZIPPER. REMOVE SHOES AND WEAR THERMO SOCKS.

(3) Place fuel cell upon a smooth, clean, padded work table, if removed from airplane cavity for repair.

NOTE: Repair work on fuel cells must be accomplished in a warm dry place. Ideal conditions for cell repair are 70 to 80°F with 50% humidity. High humidity and low temperature will cause moisture condensation to form on cemented surfaces and make adhesion of repair patches impossible.

(4) Cells must be thoroughly cleaned with warm water before attempting any repair.
(5) After cleaning, the fuel cell must be thoroughly dried. The process can be hastened by keeping the cell in a warm dry place and using an air hose inside the cell.
(6) Support the fuel cell around the injury so that the cell will be in a natural flat position during repair. Supports shall be smooth, well padded and clean. (See figure 801.)



Fuel Cell Support Pad
Figure 801

C. Repair Fuel Cell

(1) Tools to be used in the repair of fuel cells are illustrated in figure 802.

NOTE: The use of a hypodermic needle is prohibited in all fuel cell repairs.

(2) Materials to be used in the repair of fuel cells are listed in paragraph 2.A. (4) and (5).

(3) Stir cement thoroughly before using and stir frequently while in use to maintain proper consistency. Cements which are jellied, lumpy, too thin or possess any abnormal characteristics should not be used.

(4) Hot Repair Method

(a) Holes or Cuts Extending Through Cell Wall (smaller than 4 inches in length or diameter).

1) Cut and trim loose ply and jagged edges of the injury by skiving away the loose material to form a smoothly rounded outline. The skived edges shall be tapered approximately 1/4 inch. (See figure 803.)

2) Prepare repair patches. (See detail A, figure 803.)

a) For inside cell surface, cut a cover patch of FT-136 repair material to extend at least 1 1/2 inches in all directions from edge of injury.

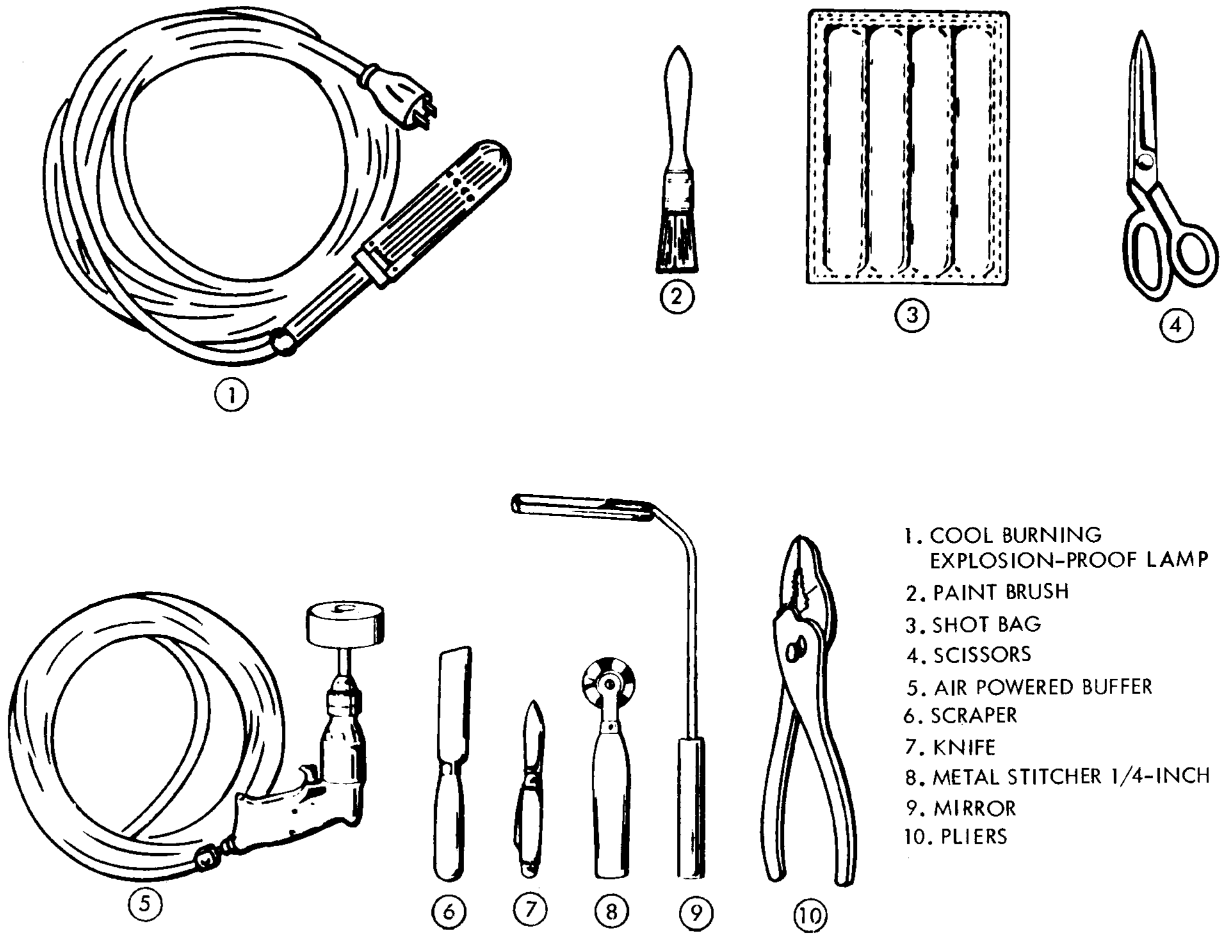
b) For outside cell surface, cut a cover patch of repair material to extend at least 2 inches in all directions from edge of injury.

NOTE: All patches shall be cut by skiving the edge. Each patch shall have a smoothly rounded outline. (See detail A, figure 804.)

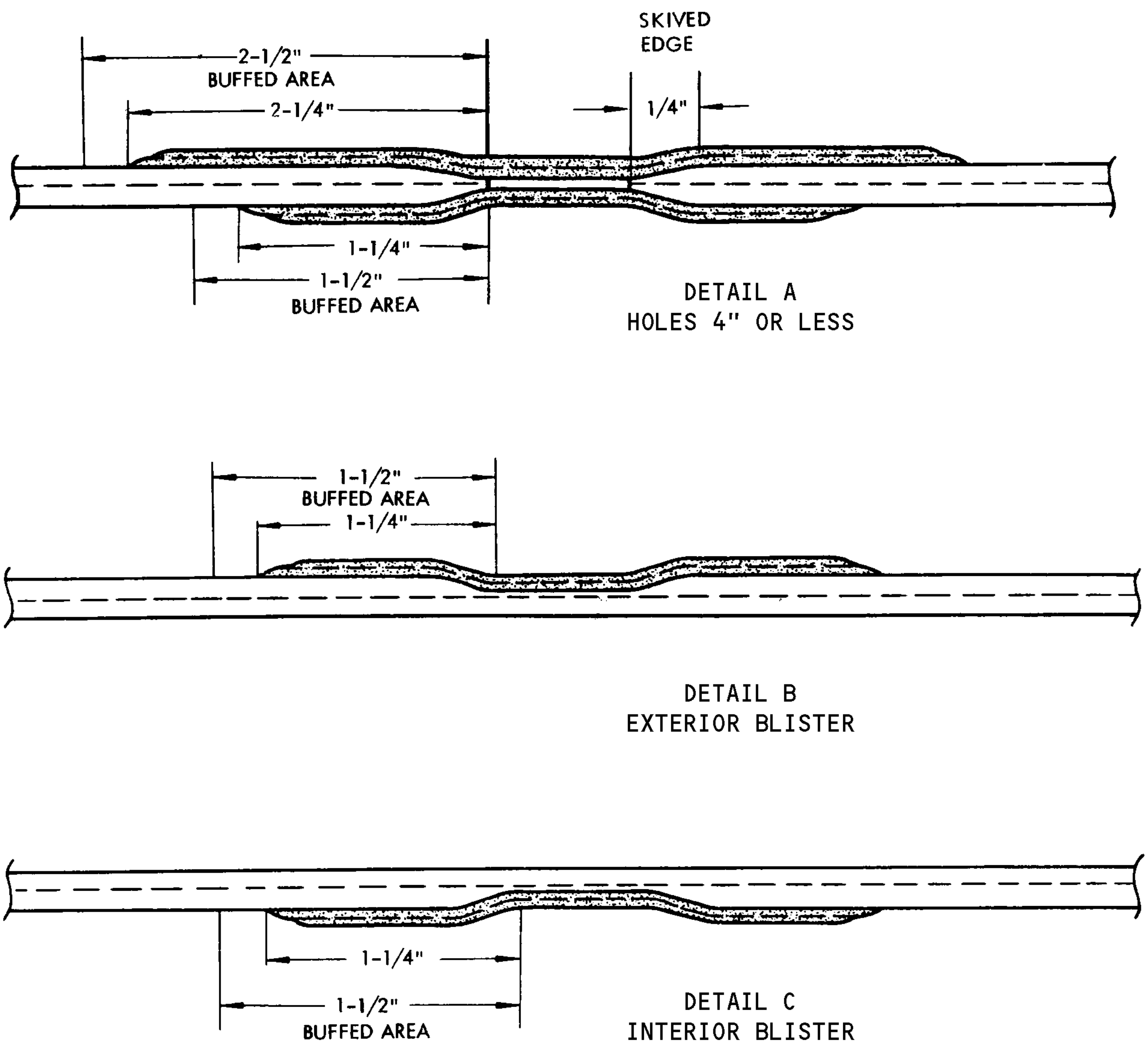
c) Lightly buff the "down" side only of the two repair patches.

NOTE: For buffing, use an air-powered buffer, or hand sander, with a fine emery cloth of 120 grit.

d) Wash the buffed surface of each patch using a clean cotton wiper (BMS15-5) moistened with solvent, until all buffing dust is removed.



Fuel Cell Repair Tools
Figure 802



Fuel Cell Patch Requirements
Figure 803

3) Lightly buff inside and outside cell surface around injured area to remove shine from cell surface.

NOTE: Buffing for any repair must not extend more than 1/4 inch in all directions beyond the patch outline. Use an air-powered buffer, or hand sand the area, with a fine emery cloth of 120 grit. Use only enough pressure to remove gloss on cell surface. Extreme care must be taken not to injure cell further while buffing.

4) Wash the buffed areas, using a clean cotton wiper (BMS15-5) moistened with solvent. Wash until all grit and buffing dust is removed.

WARNING: THE VAPORS FROM SOLVENTS AND RUBBER CEMENTS ARE DANGEROUSLY TOXIC. AVOID PROLONGED INHALING OF THESE VAPORS.

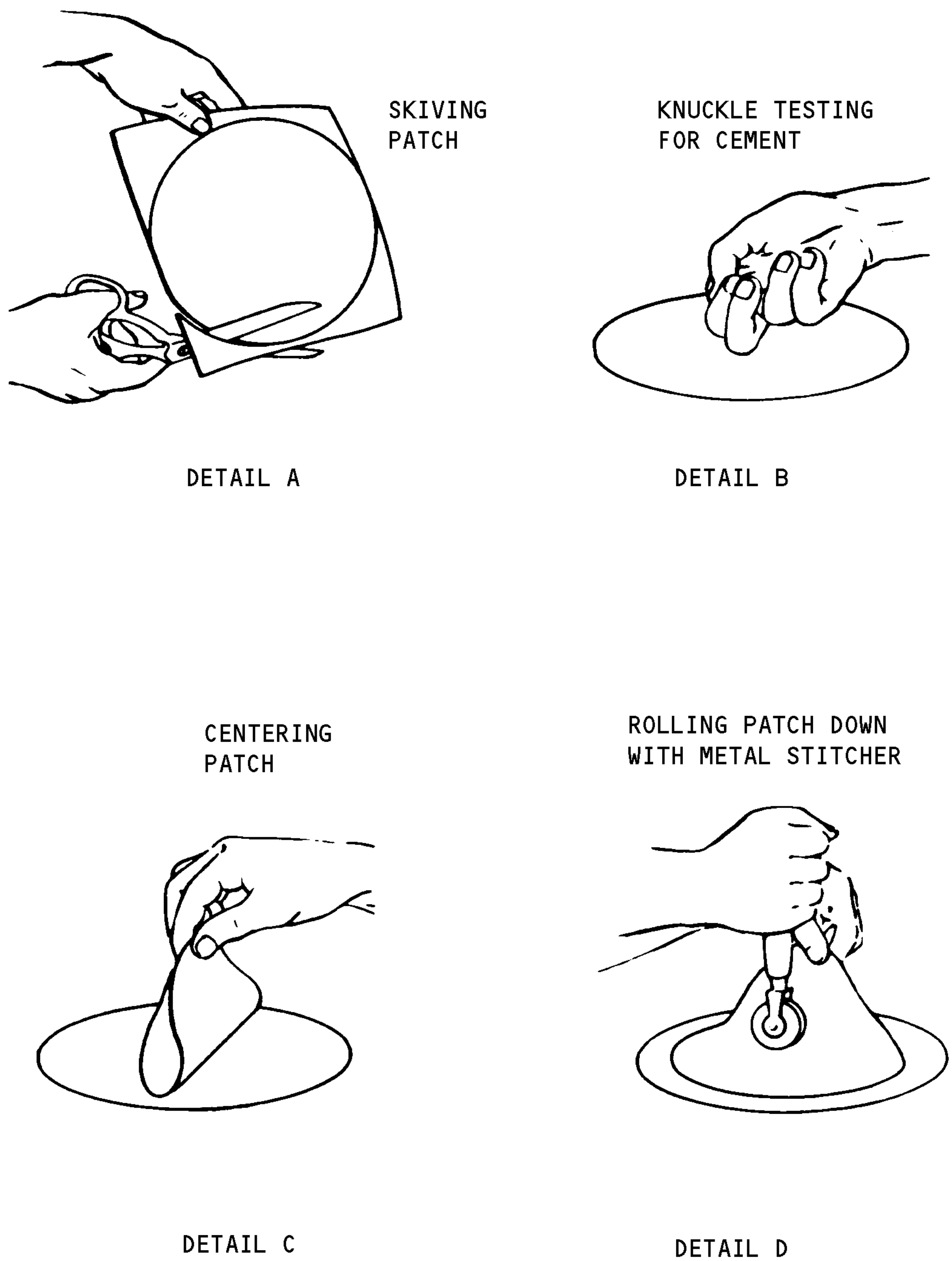
5) Apply patch to outside cell surface.
   a) Apply four coats of Code 1895C cement evenly and thinly, to the outside buffed surface of the cell and one side of the larger repair patch, with paint brush.
   b) Allow each coat to dry completely.

   NOTE: To determine if the cement is dry, press a knuckle gently against the surface and withdraw it. If no cement sticks to the knuckle the surface is dry. (See detail B, figure 804.)

   c) Center the repair cover patch over the cell injury immediately after fourth coat is dry to touch. Do not allow air to be trapped under patch.

   NOTE: Trapped air blisters may be removed by using a looped wire wet with solvent, Series 93 (AMM 20-30-93/201), snaked under cover patch to blister. Close opening created between cell wall and cover patch with fingers behind loop as wire is slowly withdrawn.

   d) Roll patch firmly down starting at the center of the patch and working to the outer edge. Dust with soapstone to prevent sticking during cure. (See details C and D, figure 804.)



Fuel Cell Patch Application
Figure 804

e) Cover one smooth surface of two 1/8-inch thick aluminum plates with 1/4-inch fabric backed airfoam, fabric side out. Use tape to hold airfoam in place.

CAUTION: PLATES MUST BE LARGER THAN THE COVER PATCH. AIRFOAM MUST LAP EDGES OF PLATE FOR PROTECTION.

f) Fold cell adjacent to cover patch.
g) Place prepared plates, one over cover patch area and one on opposite side, fabric side against cover patch or cell surface.
h) Center a heated repair iron on plate over cover patch. Secure assembly with a C-clamp. Tighten clamp finger-tight.

CAUTION: MAKE SURE THAT CELL FOLD IS NOT CLAMPED BETWEEN PLATES. THIS WOULD CAUSE A HARD PERMANENT CREASE.

i) Connect repair iron into electric outlet and cure for 60 minutes.
j) After cure time has elapsed, allow repair iron to cool to touch, then remove C-clamps.
k) Check entire patch for blistering or poor adhesion.

NOTE: Any patch showing signs of blistering or poor adhesion must be removed with a clean, cotton wiper (BMS15-5) moistened with solvent. If the patch is undamaged it may be reworked.

l) Paint all outside cover patches with one coat of outside lacquer, Code 5053C.

6) Apply patch to inside cell surface.
   a) Repeat steps 5)a) through 5)l) above and apply smaller repair patch to inside cell surface.
7) Pressure test fuel cell for leakage before installation in airplane cavity and filling with fuel. Refer to Removable Fuel Cells - Inspection/Check.

NOTE: All hot patch repairs may be inspected, air tested, and installed as soon as the repair is cool.

(b) Blisters and Hole or Cut not Extending through Cell Wall
    1) Repair interior or exterior surface blister, hole, or cut.
        a) Cut and trim loose ply and jagged edges of the injury by skiving away the loose material to form a smoothly rounded outline. (See figure 803, details B and C).
        b) Cut a patch of FT-136 repair material to extend 1-1/2 inches in all directions from edge of injury.
        c) Apply patch to inside and outside surface of cell. Use procedure described in paragraph 2.C., steps (4)(a)1) through (4)(a)7).

(c) Loose Seams
    1) If an effective bond width of one inch is maintained, the loose seam may be trimmed.
    2) If the effective bond width is less than one inch, prepare the cell for repair using procedures described in paragraph 2.B.
    3) Apply repair patch to inside or outside cell surface, depending upon location of injury. Use procedure described in paragraph 2.C., steps (4)(a)1) through (4)(a)7).

(d) Fuel Cell Lacing Ferrule Repair
    1) Remove damaged lacing ferrule as follows:
        a) Mark exact location of lacing tab with silver-colored marking pencil.
        b) Apply a small quantity of solvent to the outer edge of the lacing tab collar to loosen it.

WARNING: DO NOT GET SOLVENT IN MOUTH, EYES, OR ON SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

        c) Raise and loosen the tab collar edge with a blunt tool or knife with rounded end. (See detail A, figure 805).
        d) Pull on the loosened edge of the tab collar with a pair of pliers while applying more solvent between lacing tab collar and cell. (See detail B, figure 805)
        e) Progressively remove lacing tab from cell surface.
    2) Clean the area thoroughly with solvent and allow to dry completely.

3) Buff an area on the cell surface one inch larger all around than the size of the lacing ferrule collar.

CAUTION: EXERCISE EXTREME CARE IN BUFFING SO THAT OUTER PLY OF FUEL CELL IS NOT DAMAGED. USE AIR-POWERED BUFFER OR BUFF BY HAND WITH 120 GRIT EMERY CLOTH.

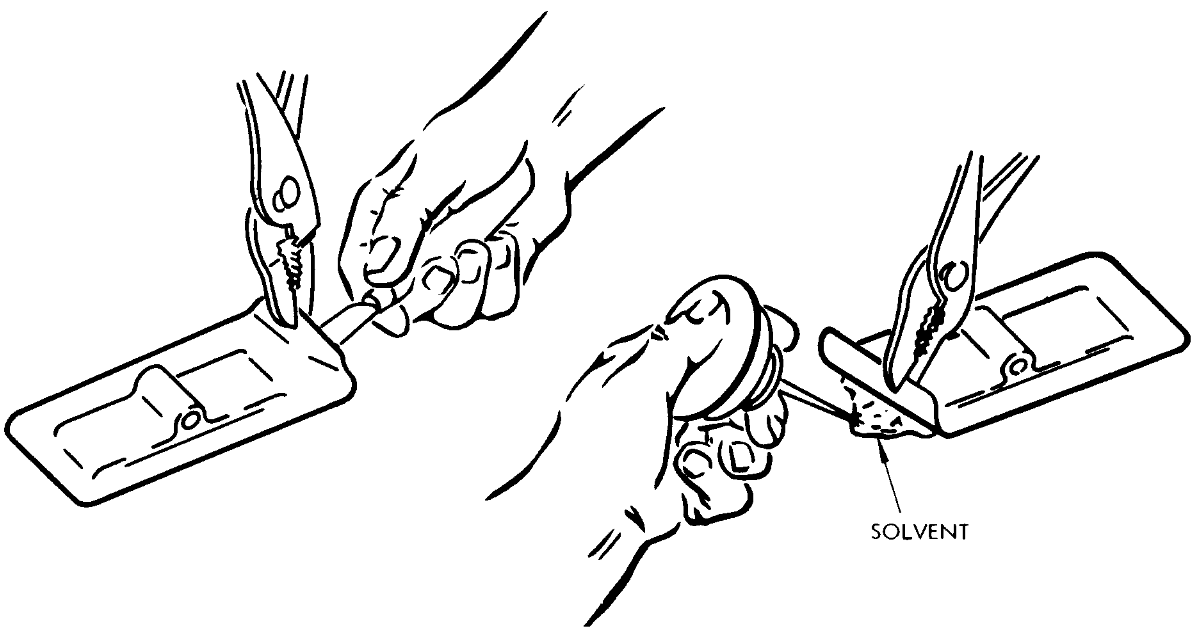
4) Buff the "down" side of the new lacing ferrule.
5) Apply four even coats of 1895C repair cement each to the buffed area of the cell and the "down" side of the new lacing tab.
6) Allow both cemented surfaces to dry completely between coats.

NOTE: To determine if the cement is dry, press a knuckle gently against the surface and withdraw it. If no cement sticks to the knuckle the surface is dry enough. (See detail B, figure 804.)

7) Position lacing ferrule on fuel cell in same position as old lacing tab.
8) Roll lacing tab collar firmly down with 1/32-inch metal stitcher or 1/4-inch roller, starting from the center and working to the outer edge to remove trapped air.
9) Prepare a 1/8-inch aluminum plate by cutting out a hole in the plate to clear the protruding ferrule tube. Cover with 1/4-inch fabric backed airfoam, fabric side out. Use tape to hold airfoam in place.
10) Prepare a back-up plate similar to step 9), except that a hole is not required.
11) Place aluminum plates, prepared in steps 9) and 10) above, over the new ferrule and the backup plate on the opposite surface of the cell wall.

CAUTION: CARE MUST BE TAKEN TO ENSURE THAT THE AIRFOAM EXTENDS BEYOND THE PLATE IN ALL DIRECTIONS.

12) Apply a heated repair iron to each side of the ferrule tube and secure with a C-clamp. Tighten C-clamp finger-tight.
13) Connect repair iron into electric outlet and cure for 60 minutes.
14) After cure time has elapsed, allow repair iron to cool to touch, then remove C-clamps.



DETAIL A

DETAIL B

Fuel Cell Lacing Ferrule Removal
Figure 805

15) Check repair for blistering or poor adhesion.

NOTE: Any repair showing signs of blistering or poor adhesion must be reworked.

16) Paint repair with one coat of outside lacquer, Code 5053C.

(e) Loose Fitting Flange (Inside or Outside Cell Surface)

1) Buff the cell and the "down" surface of the loose flange lightly.

CAUTION: EXERCISE EXTREME CARE IN BUFFING SO THAT FURTHER DAMAGE TO CELL DOES NOT RESULT. USE 120 GRIT EMERY CLOTH WITH AN AIR-POWERED BUFFER OR HAND SANDER.

2) Wash the buffed area using a clean cotton wiper (BMS15-5) moistened with solvent. Wash until all buffing dust and grit is removed.

3) Apply four coats of 1895C repair cement to each surface using a paint brush. Allow cement to dry completely between coats.

NOTE: To determine if cement is dry, press a knuckle gently against the cemented surface and withdraw it. If no cement sticks to the knuckle, the surface is dry. (See detail B, figure 804.)

4) Stitch down the loose flange. Use a 1/4-inch roller or 1/32-inch metal stitcher.

5) Cover one smooth surface of two 1/8-inch thick aluminum plates with 1/4-inch fabric backed airfoam, fabric side out. Use tape to hold airfoam in place.

CAUTION: PLATES MUST BE LARGER THAN DAMAGED AREA. AIRFOAM MUST LAP EDGES OF PLATE FOR PROTECTION.

6) Place prepared plates, one over the repaired area and one on opposite side, fabric side against repaired surface or cell surface.

7) Center a heated repair iron on plate over repaired area. Secure assembly with a C-clamp. Tighten clamp finger-tight.

8) Connect repair iron into electric outlet and cure for 60 minutes.
9) After cure time has elapsed, allow repair iron to cool to touch, then remove C-clamps.
10) Check repair for blistering or poor adhesion.

NOTE: Any repair showing signs of blistering or poor adhesion must be reworked.

11) Paint all outside repairs with one coat of outside lacquer, Code 5053C.

(f) Fuel Cell Fitting Replacement - Two Flange Type

NOTE: All multiplane fittings such as vent, drain, or raised interconnect door fittings should be returned to the manufacturer for repair.

1) On the fuel cell wall, mark exact location of fitting by drawing distinct straight lines at 90 degrees through center of fitting to be removed and new fitting. Use silver-colored marking pencil.
2) Cut fitting out of the cell by cutting around the edge of the metal insert with a knife held perpendicular to the cell wall.
3) Remove the outside fitting flange using pliers and solvent or by buffing away the flange.
4) Buff the interior and exterior cell wall surface around the hole. The interior buffed area to be approximately 2-3/4 inches larger diameter than the flange diameter. The exterior buffed area to be approximately one inch larger diameter than the flange diameter. Buff the edge of hole smooth and adjust to the fitting throat. Wash entire buffed area with a clean cotton wiper (BMS15-5) moistened with solvent to remove dirt and buffing dust.
5) Use four coats 1895C repair cement on each contacting surface of the cell wall and fitting flanges. Allow to dry thoroughly after each coat of cement is applied.
6) Buff both surfaces of the bottom flange, the inside surface of the top flange, the fitting throat and approximately 1/2 inch in from the edge on the outside surface of the top flange.
7) Insert the fitting into the hole and line up with previously marked rotation lines on fuel cell wall.
8) Activate the cement using a clean cotton wiper (BMS15-5) moistened with solvent. The tack point is very critical. Avoid activating too large an area at one time.

9) When cement is tacky, stitch the fitting flange down starting at the throat and working toward the edge. Do not trap air. Stitch one flange completely down before starting on the second flange.
10) Cut the inside collar of FT-136 repair material. It is to lap onto the fitting flange 1-1/4 (±1/8) inches and the cell wall 1-1/4 (±1/8) inches. Buff gum side of repair material and clean with solvent.
11) Cement the collar and contacting area of the fitting and cell wall with four coats of 1895C repair cement. Allow to dry thoroughly after each coat of cement.
12) Activate the cemented areas using a clean cotton wiper (BMS15-5) moistened with solvent. (See step 8)
13) Stitch down thoroughly. Do not trap air. (See step 9).
14) Make two 1/8-inch aluminum plates with an inside diameter equal to the fitting throat being replaced. The outside diameter of the plate is to be 1/2 inch larger than the inside collar, or approximately 3-1/4 inches larger than the flange diameter. Chamfer sharp edges with a file.
15) Cut two plate pads from 1/4-inch fabric-backed airfoam 1/2 inch larger than the outside diameter of plate and 1/2 inch smaller than the inside diameter of plate. Center pad on plate, fabric side out and tape in place with masking tape or other suitable tape. Dust fabric surface with soapstone and rub into the cotton wiper (BMS15-5).
16) Center the padded plates over applied fitting, one inside and one outside, and tape in position to restrict movement. The dusted fabric side is to be against the repair.
17) Apply as many heating units as possible to both plates. Stagger units inside and out to distribute heat equally. Use C-clamps to exert approximately 40 psi on the plate surface. Do not allow heating units to extend off the plate. On small diameter fittings one large bolt and two large washers can be used for pressure.
18) Plug in the cure irons and cure for 2-1/2 hours.
19) Cool curing irons and cell until cool enough to handle without gloves. Any method of cooling may be used.
20) Remove irons and plates and inspect repair for possible defects.
21) Any loose collar edges may be trimmed provided there is a minimum lap of one inch.
22) Any looseness under the collar may be repaired by inserting the looped end of a wire under the collar and into the area of separation. Use solvent to loosen the collar and allow the loop to enter. Use the wire to push cement into the loose area.
    a) When loose area and the channel are full of cement, push the excess cement out of the channel by probing the collar.

b) Start at the loose area and work to the edge of the collar.
c) Apply cure plates and irons to cover the repaired area. Tighten the C-clamps and plug in the cure irons for 1 hour.
d) Allow to cool as above and remove irons and plates. As an alternate, the area may be air cured by clamping the plates on the defects and allowing it to set for 12 hours.

CAUTION: MAXIMUM NUMBER OF REPAIR CURES ON A SPECIFIC AREA IS THREE.

NOTE: If proper curing irons are not available, cell must be returned to manufacturer for fitting replacement.

(g) Fuel Cell Fitting Replacement - Single Flange Type
1) On the fuel cell wall, mark exact location of fitting by drawing distinct straight lines at 90 degrees through center of fitting to be removed and new fitting. Use silver-colored marking pencil.
2) Cut fitting out of the cell by cutting around the edge of the metal insert with a knife held perpendicular to the cell wall.
3) Buff the edge of the cutout hole on a bevel to the outside surface of the cell wall. Buff the cell exterior surface one inch larger diameter than the hole.
4) Buff the interior cell surface 2-3/4 inches larger diameter than the hole. Wash all buffed areas with a clean cotton wiper (BMS15-5) and solvent to remove dirt and buffing dust.
5) Buff both surfaces of the fitting flange and clean with solvent.
6) Use four coats 1895C repair cement on each contacting surface of the cell wall and fitting flange. Allow to dry thoroughly after each coat of cement is applied.
7) Insert the fitting into the hole and line up with previously marked rotation lines. Fitting is inside cel1 against first ply.

8) Activate the cement using a clean cotton wiper (BMS15-5) moistened with solvent. The tack point is very critical. Avoid activating too large an area at one time.
9) When cement is tacky, stitch the fitting flange down starting at the throat and working toward the edge. Do not trap air.
10) Cut the inside collar of FT-136 repair material. It is to lap onto the fitting flange 1-1/4 (±1/8) inches and the cell wall 1-1/4 (±1/8) inches. Buff gum side of FT-136 material and clean with solvent.
11) Cut a donut ring collar of FT-136 repair material 3/4-inch wide to fit over exterior cut edge of hole and against edge of fitting seal surface.
12) Cement the collars and contacting area of the fitting and cell wall with four coats 1895C repair cement. Allow to dry thoroughly after each coat of cement.
13) Activate the cemented areas using a clean cotton wiper (BMS15-5) moistened with solvent.
14) Stitch collars down thoroughly in their respective locations. Do not trap air.
15) Make two 1/8-inch aluminum plates with an inside diameter equal to the fitting throat being replaced. The outside diameter of one plate is to be 1/2 inch larger than the inside collar. Chamfer sharp edges with a file.
16) Cut two plate pads from 1/4-inch fabric-backed airfoam 1/2 inch larger than the outside diameter of plate and1/2 inch smaller than the inside diameter of plate. Center pad on plate, fabric side out and tape in place with masking tape or other suitable tape. Dust fabric surface with soapstone and rub into the cotton wiper (BMS15-5).
17) Center the padded plate over applied fitting, one inside and one outside, and tape in position to restrict movement. The dusted fabric side is to be against the repair.
18) Apply as many heating units as possible to inside plate. Stagger units inside to distribute heat equally. Use C-clamps to exert approximately 40 psi on the plate surface. Do not allow heating units to extend off the plate. On small diameter fittings, one larger bolt and two larger washers can be used for pressure.
19) Plug in cure irons and cure for 2-1/2 hours.

20) Cool curing irons and cell until cool enough to handle without gloves. Any method of cooling may be used.
21) Remove irons and plates and inspect repair for possible defects.
22) Any loose collar edges may be trimmed provided there is a minimum lap of one inch.
23) Any looseness under the collar may be repaired by inserting the looped end of a wire under the collar and into the area of separation. Use solvent to loosen the collar and allow the loop to enter. Use the wire to push cement into the loose area.
    a) When loose area and the channel are full of cement, push the excess cement out of the channel by probing the collar.
    b) Start at the loose area and work to the edge of the collar.
    c) Apply cure plates and irons to cover the repaired area. Tighten the C-clamps and plug in the cure irons for 1 hour.
    d) Allow to cool as above and remove irons and plates. As an alternate, the area may be air cured by clamping the plates on the defect and allowing it to set for 12 hours.

    CAUTION: MAXIMUM NUMBER OF REPAIR CURES ON A SPECIFIC AREA IS THREE.

    NOTE: If proper curing irons are not available, cell must be returned to manufacturer for fitting replacement.

D. Restore Fuel Cell to Normal Configuration
   (1) Remove all tools, cotton wipers (BMS15-5), and materials used in repairing fuel cell.
   (2) Clean cell thoroughly with clean cotton wipers (BMS15-5) dampened with water.
   (3) If cell has been removed from airplane for repair, prepare it for reinstallation. Refer to Removable Fuel Cells - Removal/Installation.

3. Cold Repair Procedure
   A. Equipment and Materials
      (1) Same as Hot Repair Procedure List except for the Heated Repair Iron and Soft Aluminum Plates.

B. Prepare to Repair Fuel Cell
   (1) Defuel and purge fuel tank prior to entering cell. Refer to 28-23-0, Defueling and 28-10-0, Fuel Storage System - Maintenance Practices.
   (2) If cell must be removed from cavity for repair, refer to Removable Fuel Cells - Removal/Installation for this procedure.

   WARNING: FUEL CELLS WHICH HAVE CONTAINED FUEL CONTAIN DANGEROUS EXPLOSIVE AND TOXIC VAPORS. USE ONLY EXPLOSION-PROOF AND SHIELDED LIGHTS. POWER TOOLS MUST BE AIR-DRIVEN. WEAR A COTTON COVERALL SNUG AT WRISTS AND ANKLES, WITH NON-SPARKING ZIPPER. REMOVE SHOES AND WEAR THERMO SOCKS.

   (3) Place fuel cell upon a smooth, clean, padded work table, if removed from airplane cavity for repair.

   NOTE: Repair work on fuel cells must be accomplished in a warm dry place. Ideal conditions for cell repair are 70 to 80°F with 50% humidity. High humidity and low temperature will cause moisture condensation to form on cemented surfaces and make adhesion of repair patches impossible.

   (4) Cells must be thoroughly cleaned with warm water before attempting any repair.
   (5) After cleaning, the fuel cell must be thoroughly dried. The process can be hastened by keeping the cell in a warm dry place and using an air hose inside the cell.
   (6) Support the fuel cell around the injury so that the cell will be in a natural flat position during repair. Supports shall be smooth, well padded and clean (Fig. 801).

C. Repair Fuel Cell
   (1) Tools to be used in the repair of fuel cells are illustrated in figure 802.

   NOTE: The use of a hypodermic needle is prohibited in all fuel cell repairs.

   (2) Materials to be used in the repair of fuel cell are listed in paragraph 2.A.(4) and (5).
   (3) Stir cement thoroughly before using and stir frequently while in use to maintain proper consistency. Cements which are jellied, lumpy, too thin or possess any abnormal characteristics should not be used.
   (4) Use the same procedure as called out in Hot Repair Procedure except do not apply heat.
   (5) All "cold patch" repairs must be sealed by applying two coats of 1895C repair cement to cover repaired area, including the buffed surface. Allow the first coat to dry completely before applying second coat.

(6) Allow fuel cell to remain undisturbed for 24 hours before handling.

NOTE: Clamping is not required on repair.

(7) Coat outside cover patches with one coat of outside lacquer, code 5053C after 24-hour air cure time has elapsed.
(8) All "cold patch" repairs must air cure for 72 hours before fueling.
(9) Cell Fitting Surface Damage
(a) Lightly buff the area with a fine abrasive (crocus cloth or equivalent) to remove any scratches or gouges.

CAUTION: FUEL CELL FITTING SURFACE IS A CRITICAL SEALING AREA. ENSURE THAT FLATNESS IS MAINTAINED DURING BUFFING PROCEDURE. DO NOT ATTEMPT TO REPAIR ANY DAMAGE WHICH EXTENDS INTO O-RING GROOVE.

(b) Treat the reworked surface with Alodine 600 solution without dilution or adulteration, as follows:

WARNING: ALODINE SOLUTION IS A CORROSIVE CHEMICAL, AND CAN CAUSE SEVERE BURNS TO SKIN AND EYES. RUBBER GLOVES MUST BE WORN WHEN HANDLING THIS SOLUTION. AVOID SPLASHING. SOLUTION SPLASHED IN THE EYES MUST BE WASHED OUT WITH WATER FOLLOWED BY AN EYE-WASH OF BORIC ACID; OBTAIN MEDICAL AID IMMEDIATELY.

1) Mask off a 2-inch area surrounding the buffed fitting surface with adhesive cloth tape.
2) Clean the buffed fitting surface by wiping thoroughly with a clean cotton wiper (BMS15-5) saturated with solvent.
3) Cold rinse the surface thoroughly with a clean cotton wiper (BMS15-5) moistened with clean water.
4) Apply alodine solution to the repaired surface with a nylon brush. Solution must be thin enough to be applied evenly and liberally.

CAUTION: CARE MUST BE TAKEN THAT ALODINE SOLUTION DOES NOT COME IN CONTACT WITH ANY UNMASKED AREA OF THE FITTING OR THE FUEL CELL WALL. DO NOT ATTEMPT TO BRUSH THE SOLUTION OUT LIKE PAINT.

5) Maintain a continuous wet film of alodine for a minimum of five minutes. A visible light golden color coating should be produced.

6) Remove excess alodine solution by thoroughly flushing with clean cold water followed by lightly wiping with clean cotton wiper (BMS15-5) or warm air drying.

CAUTION: SWABS USED FOR APPLYING RO REMOVING ALODINE SOLUTION CONSTITUTES A FIRE HAZARD WHEN DRY. IMMEDIATELY AFTER USE, THEY SHOULD BE THOROUGHLY SOAKED IN WATER BEFORE DISCARDING. WASH THE NYLON BRUSH OUT IN CLEAN WATER.

D. Restore Fuel Cell to Normal Configuration
   (1) Remove all tools, cotton wipers (BMS15-5), and materials used in repairing fuel cell.
   (2) Clean cell thoroughly with a clean cotton wiper (BMS15-5) dampened with water.
   (3) If cell has been removed from airplane for repair, prepare it for installation, Refer to Removable Fuel Cells-Removal/Installation.

REMOVABLE FUEL CELLS (TWO CELL) - REMOVAL/INSTALLATION

1. General
   A. The fuel cell is supported in the airplane cavity on a backing board and is tied to the cavity structure by lacing cords strung through lacing tabs on the cell, and eyebolts and anchor fittings on the structure. To facilitate installation, the anchor and support points for the cords are identified by a letter and number system as shown in lacing diagrams for the cell. As an example, the support point with a square box followed by A1 (Fig. 406), means cord A is anchored at that point. Nomenclature A2, A3, A4 indicates the sequence of lacing to be followed for cord A. The last, or tie-off point is identified by the highest number in the series and a triangular symbol.
2. Removal/Installation Fuel Cell No. 2
   A. Equipment and Materials
      (1) Nylon Lacing Cord - MIL-C-5040, Type III
      (2) Solvent - Methyl Ethyl Ketone (MEK), TT-M-261 (Ref 20-30-31)
      (3) Sealant - BMS 5-45
      (4) Sealant - BMS 5-32
      (5) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
      (6) Cement - Rubber Cement No. 4, B.F. Goodrich Co., Los Angeles, California
      (7) Fuel Resistant Tape - SJ8566X, Polyurethane Film Tape (Ref 20-30-51)
      (8) Polyurethane Pads - Goodyear Tire and Rubber Co., Los Angeles, California, or Akron, Ohio
      (9) Commercial type vacuum cleaner
      (10) Camel-hair brush
      (11) Plastic bucket (2 or 3 gallons)
   B. Prepare to Remove Fuel Cell No. 2
      (1) Defuel airplane (tank No. 1, tank No. 2 and center tank) and purge center fuel tank (Ref 28-23-0 and 28-10-0, Maintenance Practices).

         WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

      (2) Remove air conditioning equipment as necessary to gain access to cavity No. 1 access panel (Ref Chapter 21).
      (3) Remove cavity No. 1 access panel then remove access panel to cell No. 2 in spanwise beam (Ref 28-12-21, 28-12-31, Removal/Installation).

         WARNING: USE ONLY EXPLOSION-PROOF SHIELDED LIGHTS IN AND AROUND FUEL CELLS. DO NOT ALLOW LIGHT TO REST AGAINST CELL WALL.

(4) Remove shoes and put on a pair of tank boot socks just prior to entering the tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.
(5) Mop up residual fuel with a cotton wiper (BMS15-5) before working in cell.

C. Remove Fuel Cell No. 2 (Fig. 401)

NOTE: At least two men are required to perform a fuel cell removal or installation.

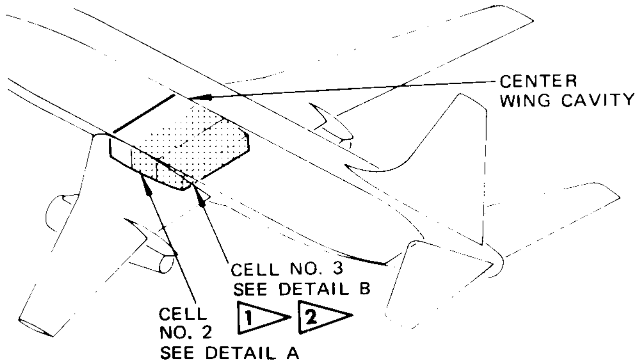
(1) Place all fasteners in a cardboard or plastic container. From inside cavity No. 1, remove access panel to fuel cell No. 2. Exercise care so access panel does not drop and damage fuel cell.

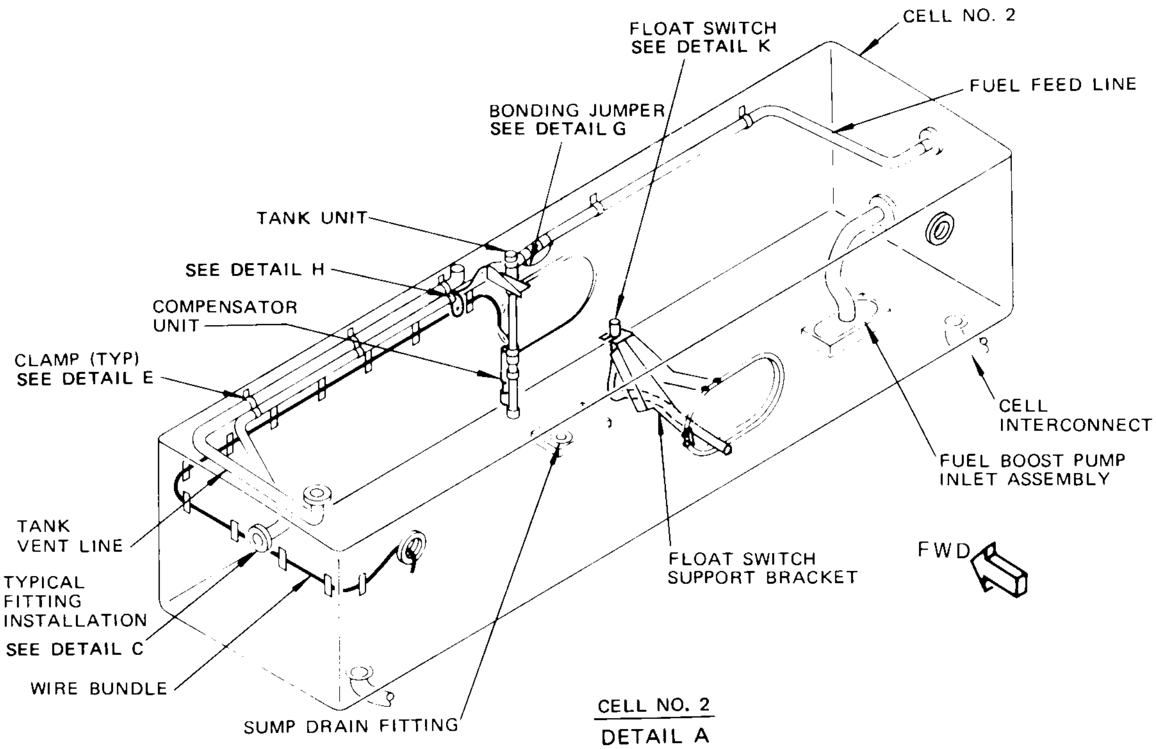
CAUTION: WHEN MOVING AROUND IN A FUEL CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(2) Ensure that GRD FUELING and FUEL QTY circuit breakers on P6 panel are in open position. Disconnect wires from tank unit and compensator unit(s).

CAUTION: DO NOT LEAVE ELECTRICAL POWER ON WITH WIRES DISCONNECTED. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

(3) Remove tank unit and compensator unit (Ref 28-41-21, Removal/Installation).
(4) Remove intercell access door between cell No. 2 and cell No. 3, if installed (Ref 28-12-41, Removal/Installation).
(5) Remove disconnected wires from loops and pull into cell No. 3. Roll in neat roll and stow for installation.
(6) Remove fuel feed line.
    (a) Remove clamps holding fuel feed line.

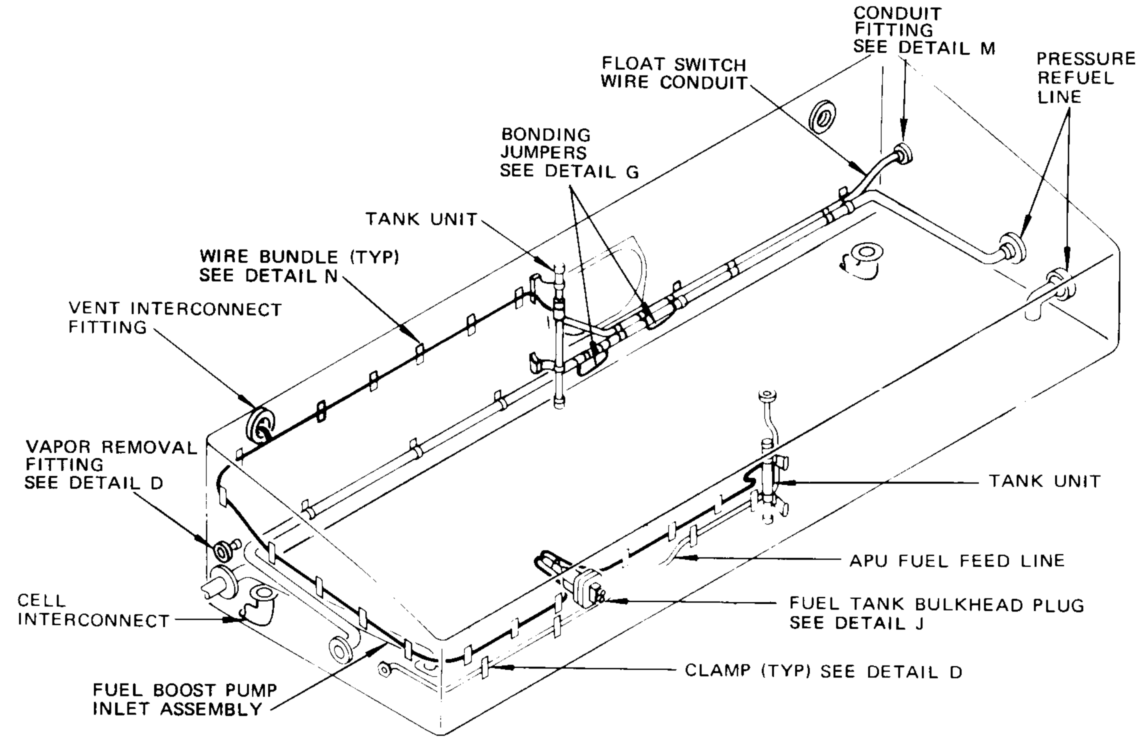




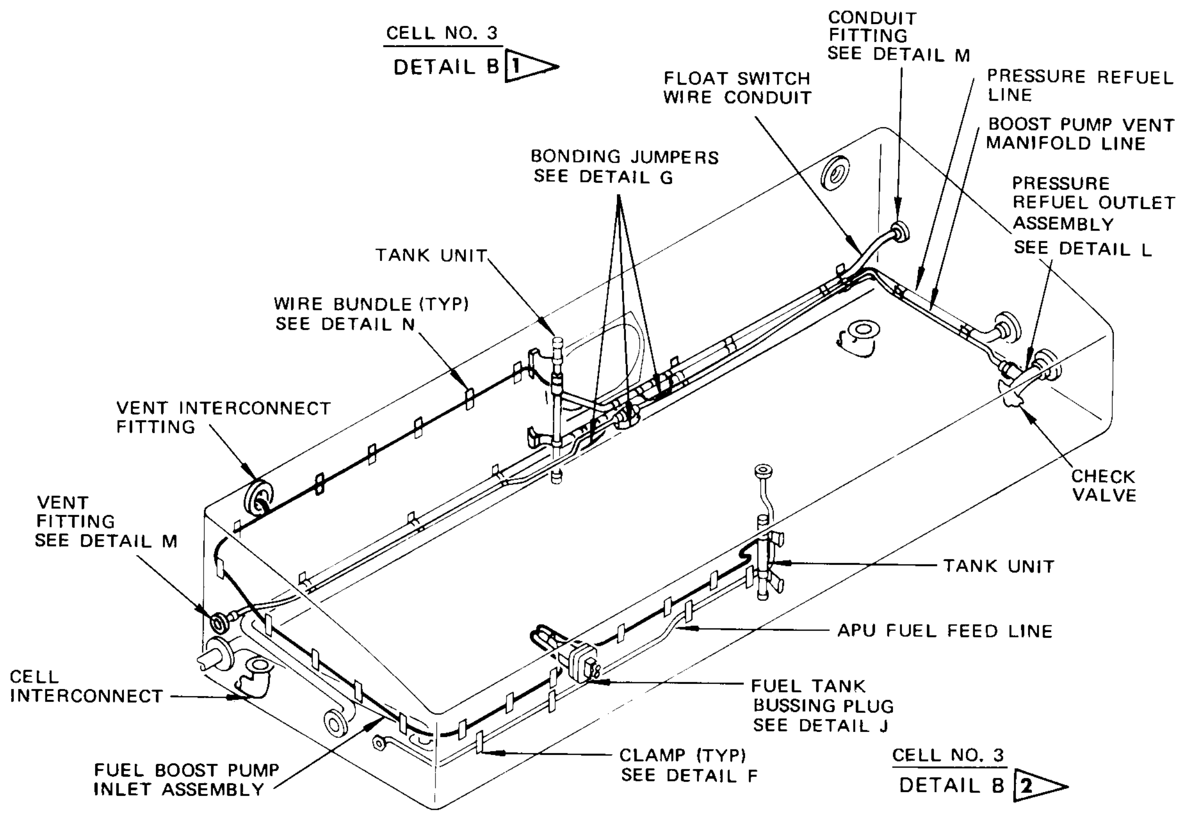
1 AR LV-JMW THRU LV-JMY
TM CR-BAA, CR-BAB

2 AR ALL EXCEPT 1
TM ALL EXCEPT 1

Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 1)

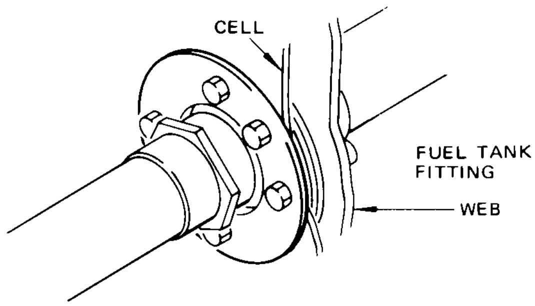


CELL NO. 3
DETAIL B 1



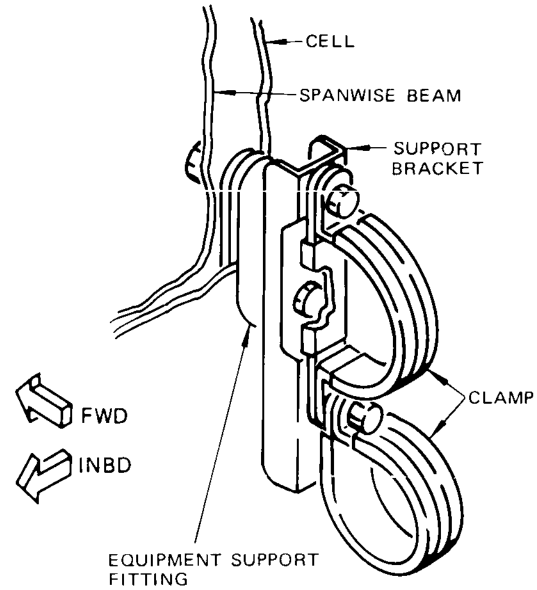
CELL NO. 3
DETAIL B 2

Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 2)

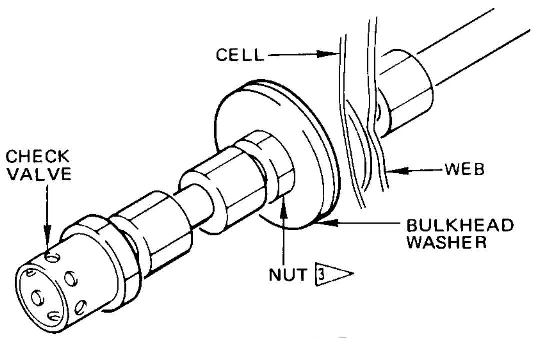


TYPICAL TUBE FITTING INSTALLATION

DETAIL C

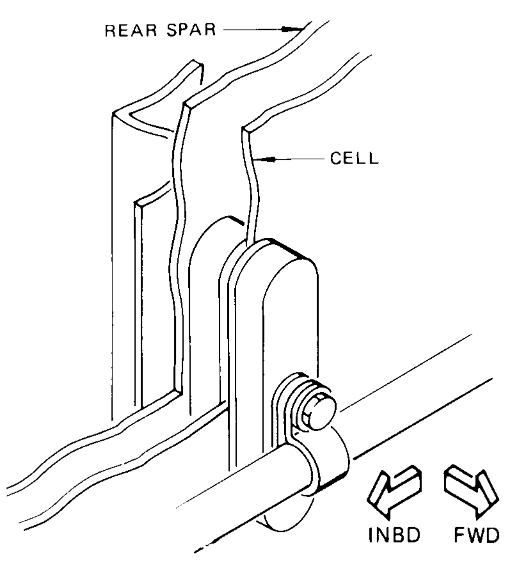


DETAIL E

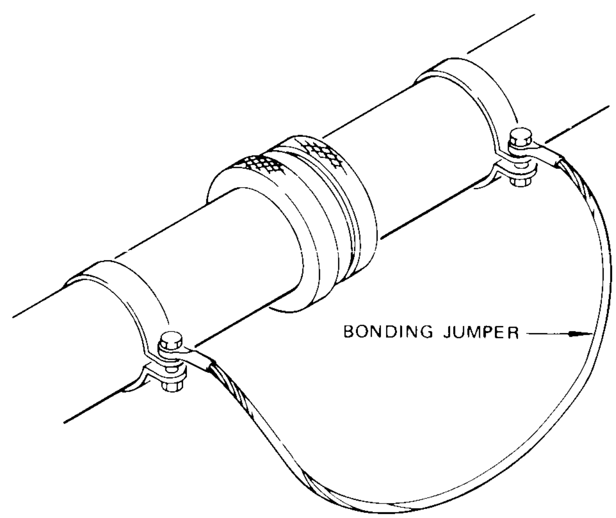


DETAIL D

3 TIGHTEN TO TORQUE RANGE OF 100-125 INCH-POUNDS
(CELL SIDE ONLY)

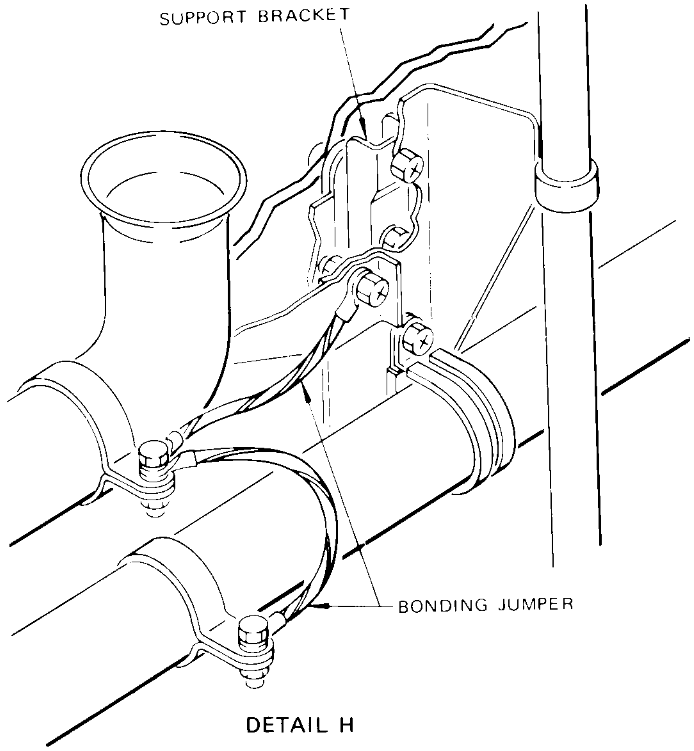


DETAIL F

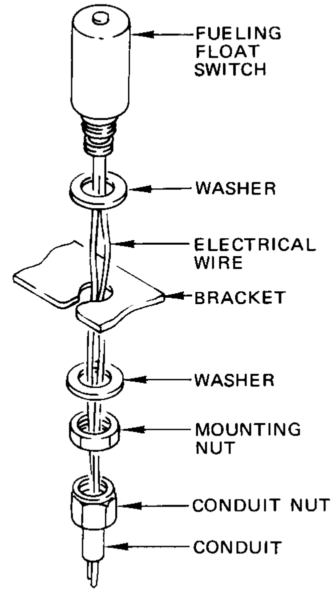


DETAIL G

Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 3)



DETAIL H



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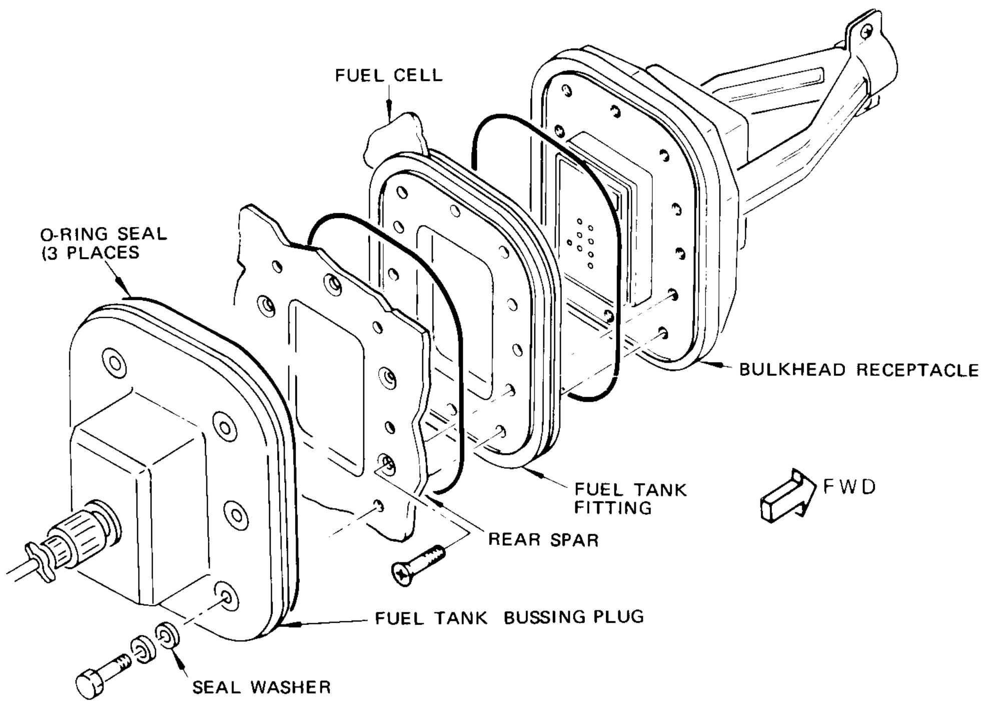
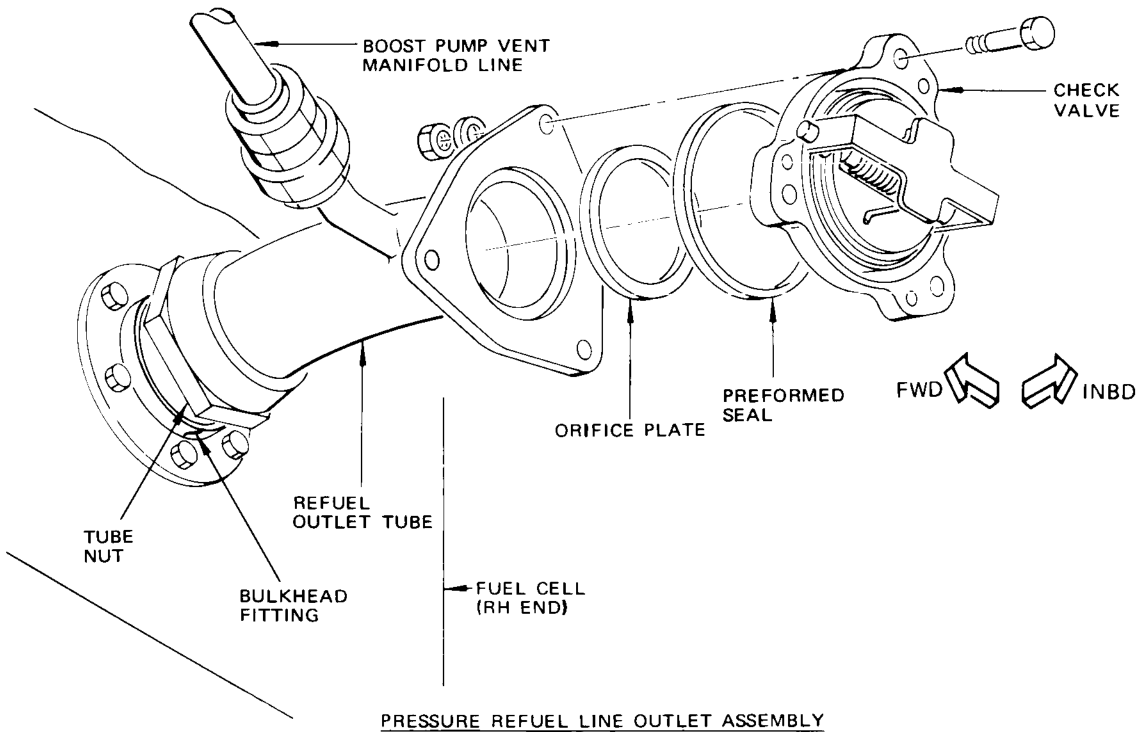
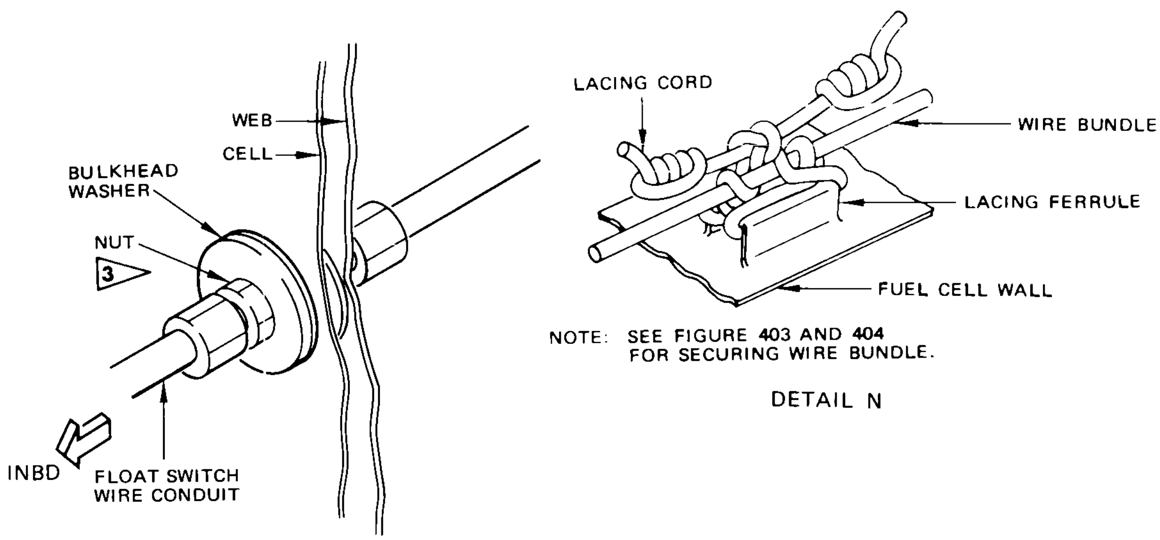


DETAIL J

Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 4)



PRESSURE REFUEL LINE OUTLET ASSEMBLY
DETAIL L



NOTE: SEE FIGURE 403 AND 404 FOR SECURING WIRE BUNDLE.

DETAIL N

3 TIGHTEN TO TORQUE RANGE OF 100-125 INCH-POUNDS (CELL SIDE ONLY)

DETAIL M

Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 5)

(b) Disconnect bonding jumpers and separate fuel feed line at cell access opening. Have bucket ready to catch approximately 1 gallon of fuel.
(c) Disconnect tubing at fitting on left end of cell.
(d) Disconnect tubing at fitting on right end of cell.
(e) Carefully move tube through access opening into cavity No. 1. Cover both ends of tube.

(7) Remove right fuel boost pump inlet assembly and cover both ends of line.
(8) Remove vent line clamps from forward left side of cell.
(9) Remove bolts attaching vent line to top of cell. Remove line and cover both ends.

NOTE: Place all loose parts in marked containers to prevent loss of parts or damage to cell, and to facilitate installation.

(10) Disconnect fuel feed line from fitting at left end of cell.
(11) Remove clamps and left section of fuel feed line. Cover both ends of tube.
(12) Remove bolts attaching cell to fuel feed line fitting at left end of cell.
(13) Disconnect fuel feed line from fitting at right end of cell.
(14) Remove clamps and right section of fuel feed line. Cover both ends of tube.
(15) Remove bolt attaching cell to fuel feed line fitting at right end of cell.
(16) Remove fuel boost pump inlet assembly. Cover both ends of assembly.
(17) Remove all plumbing support brackets.
(18) Remove bolts from sump drain fitting.
(19) Remove fueling float switch from bracket and stow in cell No. 3.
(a) Disconnect conduit nut at float switch and detach all bonding jumpers and clamps on cell 2 cell 3 conduit section.
(b) Disconnect cell 2 cell 3 conduit section from cell 3 conduit section at union in cell 3 near access opening.
(c) Remove float switch mounting nut and remove float switch from bracket by passing wires through slot in bracket. Support switch to relieve wire strain. Replace washers and nut loosely on switch.

(d) Pull slack wires through conduit until enough freedom is gained to maneuver float switch and conduit section out of cell 2. Stow switch and conduit in cell No. 3.

WARNING: IF NECESSARY TO CUT WIRES TO REMOVE FLOAT SWITCH, LOCATE CUT OUTSIDE OF CONDUIT NEAR WING FRONT SPAR. AN EXPLOSION HAZARD COULD OCCUR FROM SPLICE WITHIN CONDUIT.

NOTE: If wire slack is insufficient to permit moving float switch and conduit into cell No. 3 or cell No. 3 is to be removed also, wires must be cut near splice and float switch removed. Refer to 28-21-71, Fueling Float Switch - Removal/Installation.

(20) Remove float switch support bracket from intercell access opening.
(21) Remove equipment support fitting bolts from inside cavity No. 1.
(22) Remove bolts securing cell No. 2 access opening fitting to spanwise beam.
(23) Remove bolts securing access opening fitting between cell No. 2 and cell No. 3.
(24) Untie lacing at all tie-off points around access opening.
(25) Push in on cell at access opening to get slack in lacing cords. Cords will slip through eyebolts.
(26) Untie lacing at under side of cell as work progresses around cell.
(27) Crawl into cavity and unlace cell.
(28) Remove cords from cell, roll into a neat coil, tie with masking tape and hang at individual anchor points. Any frayed or damaged cord must be replaced with a new chord.
(29) Cover edges of access opening, cell will pass when removed, with tape or rubber extrusion.
(30) Cover all fuel cell fitting openings with a cotton wiper (BMS15-5) held in place with tape.
(31) Fold cell for removal from cavity (Ref 28-12-10, Storage).

(32) Remove fuel cell from airplane cavity, taking care to prevent cell from rubbing against structure.

(33) Following removal, the cell is to be cleaned inside and outside with a clean cotton wiper (BMS15-5) moistened with water and repaired and stored as necessary (AMM 28-12-10/801, AMM 28-12-15/801, AMM 28-12-10/201).

D. Prepare to Install Fuel Cell No. 2

(1) Prepare fuel cell cavity for cell installation.

(a) Check cavity backing board for raw edges, cracks or otherwise defective or damaged areas. There shall be no raw edges of backing board in contact with cell. Check that all edges of backing board and all lap splices are taped. Refer to Center Wing Cavity Backing Boards, Chapter 57, for replacement of damaged backing boards. If application of new tape is necessary, use Polyken No. 214 black tape per JAN-P-127, type I, grade B.

(b) Check that there are no sharp edges or corners on structure in areas where chafing of fuel cell during handling and service is possible. Round or bevel sharp edges or corners. Tape (Polyken No. 214 black tape) may be used to cover edges of structure or web laps. Web laps of 0.05 or less need not be protected if the edge of the lap, adjacent to the cell, has a broken or rounded edge.

(c) Check that protruding or irregular structure (for example, threaded parts) have adequate coating of sealant for chafing protection. If coating is required, apply BMS 5-32 sealant per applicable instructions in Section 28-11-0.

(d) On all access openings through which cell must pass during installation, cover edges with tape or rubber extrusion to prevent cell from rubbing against structure.

<u>CAUTION</u>: THE SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING IS A SEALING SURFACE. A SCRATCH MAY RESULT IN A FUEL LEAK. OPENING MUST HAVE PROTECTORS (RUBBER EXTRUSION OR EQUIVALENT) INSTALLED IMMEDIATELY AFTER ACCESS PANEL IS REMOVED.

(e) Replace all backing board screws having damaged, sharp, or jagged recesses. Assure screws are the right lengths.

(f) Clean the cavity thoroughly. Use a vacuum cleaner to clean all surfaces of structure where chips, dirt, grit, or any foreign material may be lodged.

(2) Prepare fuel cell for installation.

(a) If cell has been in storage, check for condition of cell and expiration of shelf life (Ref 28-12-10, Storage). Reject any cell in doubtful condition or having an expired shelf life.

(b) Unfold and handle cell carefully. Comply with fuel cell handling precautions (Ref 28-12-10, Storage).

(c) Wipe outside and inside surface of cell with damp clean cotton wiper (BMS15-5). While wiping, check surfaces for scratches, cuts, abrasions, or obvious damage.

NOTE: It is not necessary to clean new fuel cells if they are installed promptly after removing from containers.

(d) Check all lacing tabs to ensure holes will accommodate nylon lacing cord.

(e) Check external (sealing) surface of each cell fitting to ensure it is clean and free of nicks and scratches.

1) If new cell is being installed, remove metallic tape discs used during shipping. Should any adhesive from tape be transferred to surface of fitting, it should be removed with gasoline.

2) Remove rubber particles and foreign material by cleaning sealing surfaces with a swab lightly dampened with methyl ethyl ketone.

CAUTION: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA. EXERCISE EXTREME CARE TO ENSURE NO METHYL ETHYL KETONE IS SPILLED ON THE FUEL CELL.

(f) Install new O-rings in all fuel cell fitting grooves (Fig. 402). Proceed as follows:

1) Obtain O-ring directly from envelope and check cure date, inspect for cuts, scratches, nicks, or damage. Destroy used or defective O-rings.

2) Clean cell fitting O-ring groove. Use a pointed wood stick with sharp end covered with a clean cotton wiper (BMS15-5) dampened with methyl ethyl ketone. Check O-ring groove for cuts, scratches, dents, distortion, and foreign material (step 1). If O-ring groove is defective, cell fitting must be replaced (Ref 28-12-10, or 28-12-15, Approved Repairs).

3) Check O-ring fit in cell fitting O-ring groove. O-ring should fit groove correctly with no distortion or kinks.

4) Apply light coating of B.F.Goodrich No. 4 rubber cement to O-ring groove with camel hair brush.

5) When cement in O-ring groove becomes "tacky," press O-ring into groove.

6) Roll excess cement from flat surface of cell fitting with finger or thumb.
7) Allow cement to dry for approximately 15 minutes before installing fitting.

(g) Tape cotton wiper (BMS15-5) patches over all bulkhead fittings after O-rings have been installed. This will protect the O-rings during installation of the cell.

(h) Prepare new lacing cords, to replace the discarded ones. (See figure 403.)

1) Lay out the cord lengths between the anchor and tie-off points shown on the cell lacing diagram. Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.
2) Prepare end of new lacing cord for installation. Proceed as follows:

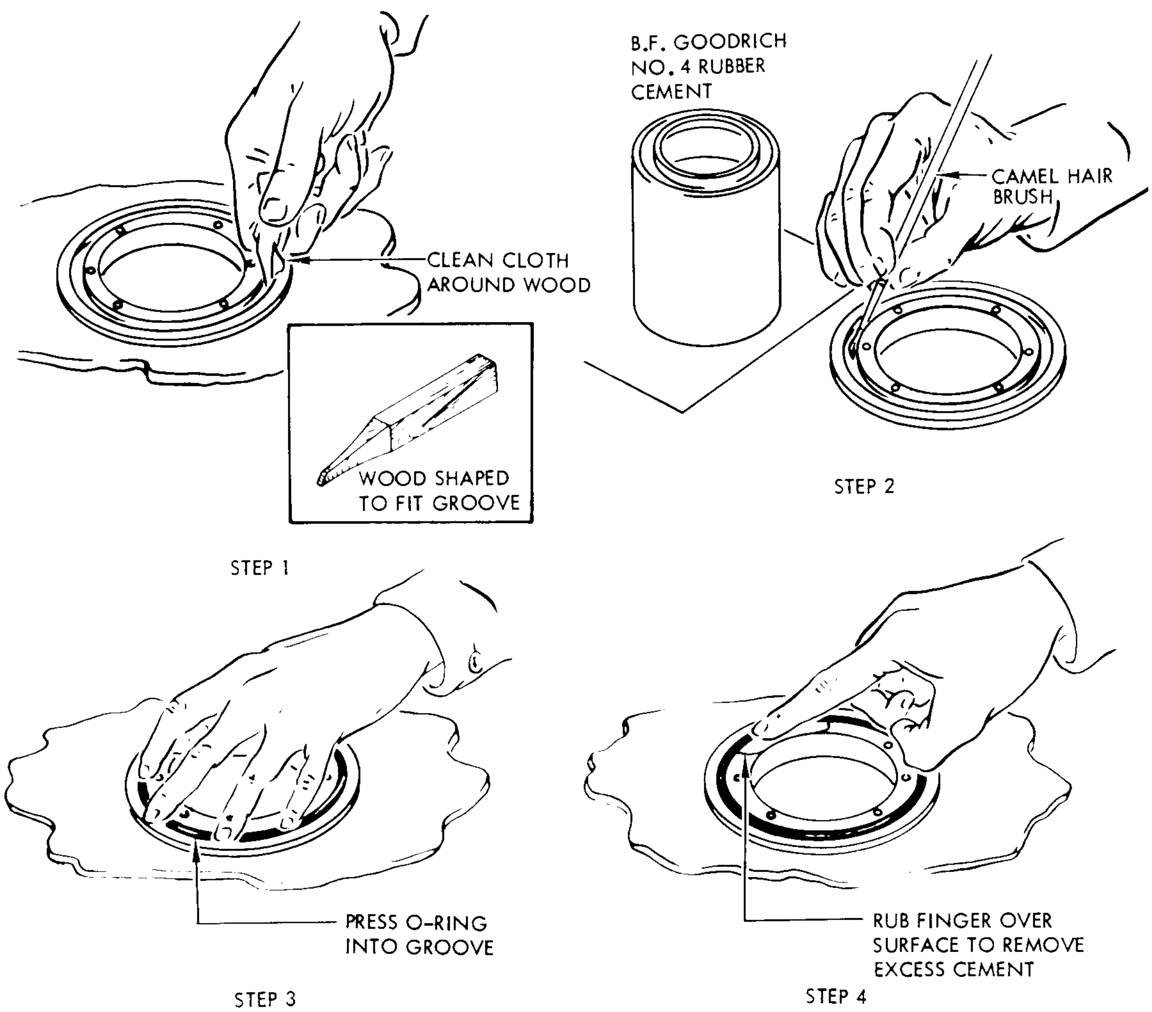
<u>WARNING</u>: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (See step 1.)
b) Roll melted end on any flat surface (step 2) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

<u>WARNING</u>: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (steps 3 and 4).
d) Coil the new lacing cord into a small roll, tie with tape and attach one end to the applicable anchor point in the cell cavity. See figure 404 for method of attaching and tying cord.

(i) Fold, tie and place fuel cell in the cavity as described in the handling precautions. Refer to 28-12-10, Fuel Cell - Storage.



O-Ring Installation
Figure 402

(h) Prepare new lacing cords, to replace the discarded ones. (See figure 403.)

1) Lay out the cord lengths between the anchor and tie-off points shown on the cell lacing diagram. Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.

2) Prepare end of new lacing cord for installation. Proceed as follows:

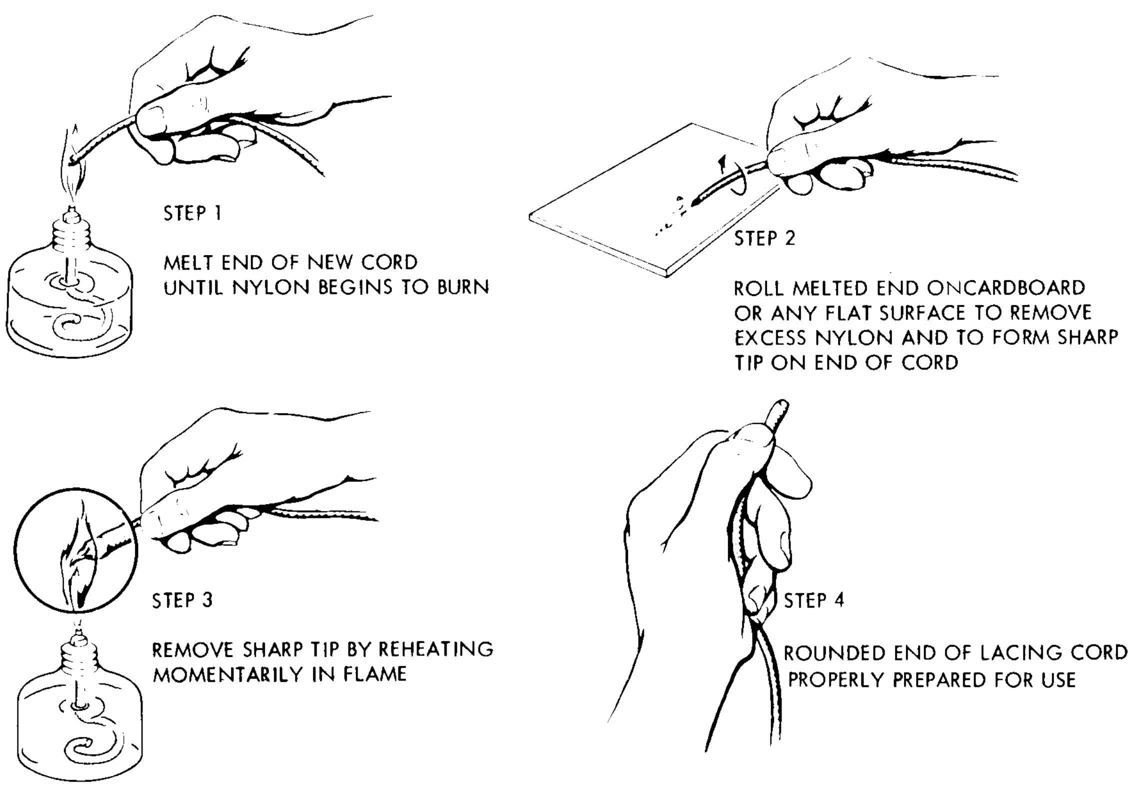
WARNING: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (See step 1.)

b) Roll melted end on any flat surface (step 2) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

WARNING: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (steps 3 and 4).



Preparing End of Fuel Cell Lacing Cord for Installation
Figure 403

(j) Remove the cotton web straps and unfold the cell.

(k) Remove the cotton wiper (BMS15-5) patches over bulkhead cell fittings. Check that new O-rings are properly installed.

E. Install Fuel Cell No. 2 (See figure 405, steps 1 thru 9.)

NOTE: Cavity must be cleaned just prior to cell installation. At least two men are required to install a fuel cell.

(1) Lace cord A to its tie-off point and tie loosely. (See figure 406.) The tie-off point for A will now be the anchor point for B; lace B to its tie-off point and tie-off. This allows cell to drape in the cavity.

CAUTION: LACING CORDS ARE TO BE TIGHTENED ENOUGH TO HOLD CELL IN PLACE BUT NOT SO TIGHT THAT CELL IS DISPLACED. IN CERTAIN AREAS, IF FIRST CORDS INSTALLED ARE TIGHTENED EXCESSIVELY, FINAL LACING MAY NOT PULL TANK INTO PLACE AND DIFFICULTY IN INSTALLING FITTING MAY BE ENCOUNTERED.

(2) Lace cords C, E, El, D, and H to their tie-off points, in that order. Take up slack in each cord and tie-off.

(3) Lace cords F, G, J, and K to their tie-off points and tie loosely.

(4) Install equipment support fitting bolts.

(5) Take up slack in cords F, G, J, and K and tie-off.

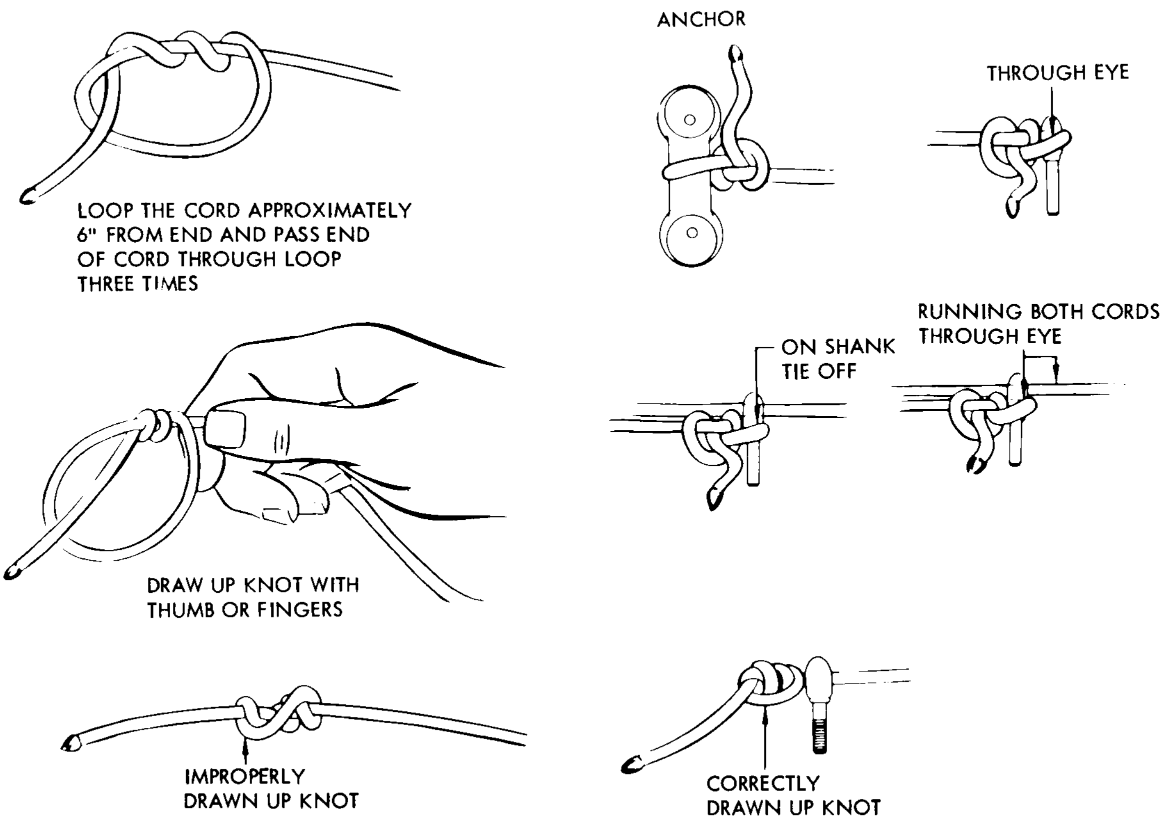
(6) Lace cord L to L3 and cord M to its tie-off point and tie loosely.

(7) Lace cord N to N2 and cord S to its tie-off point and tie loosely.

(8) Enter the cell.

CAUTION: WHEN MOVING AROUND INSIDE THE CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(9) From inside the cell, loosely install bolts in all fittings on the left end of the cell, including vent fittings in top and aft side of cell. Do not tighten bolts (Fig. 407).



Fuel Cell Laces and Knots
Figure 404 (Sheet 1)

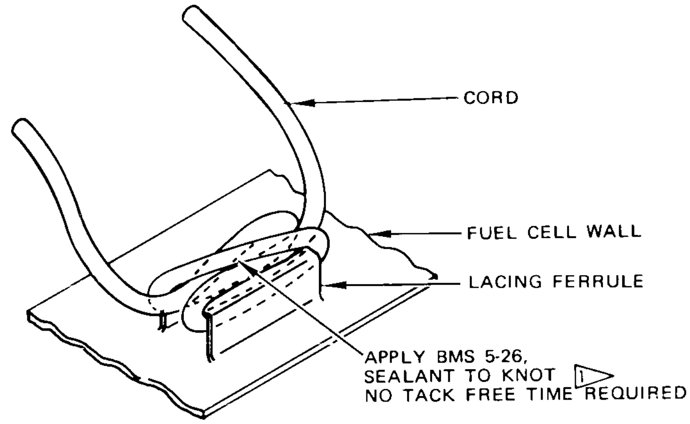
NOTE:

STEPS I, II, AND III ARE TO BE USED ONLY FOR SECURING WIRE BUNDLES TO INTERIOR SURFACES OF REMOVABLE BLADDER CELLS.

PREDETERMINE CORD LENGTH FUSE CORD ENDS. SEE FIGURE 403.

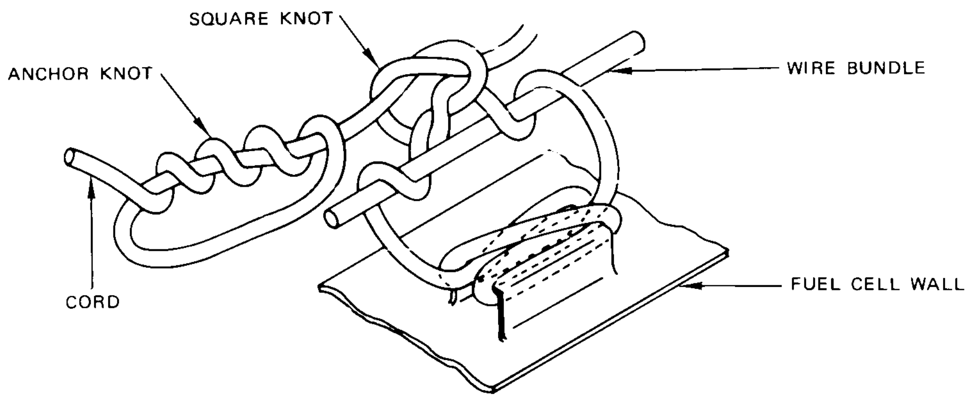
CAUTION:

ACCOMPLISH AT A SAFE DISTANCE FROM FUEL CELL AND/OR AIRPLANES



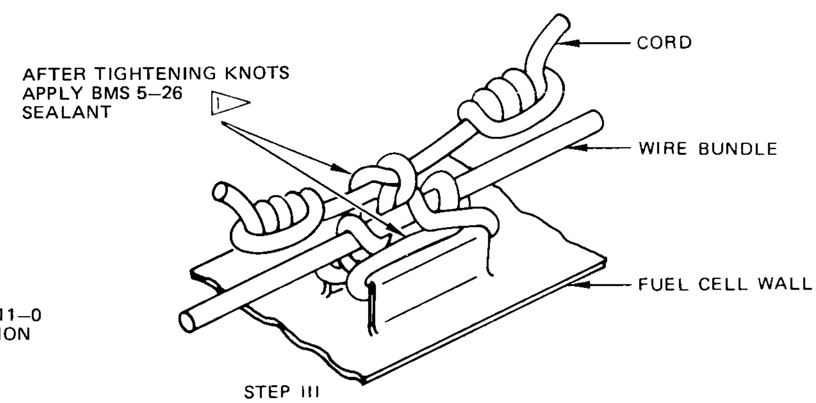
STEP I

TIE CORD TO FUEL CELL LACING FERRULE AND SEAL KNOT



STEP II

WARP CORD AROUND WIRE BUNDLE,
TIE SQUARE KNOT
TIE ANCHOR KNOT ON BOTH CORD ENDS

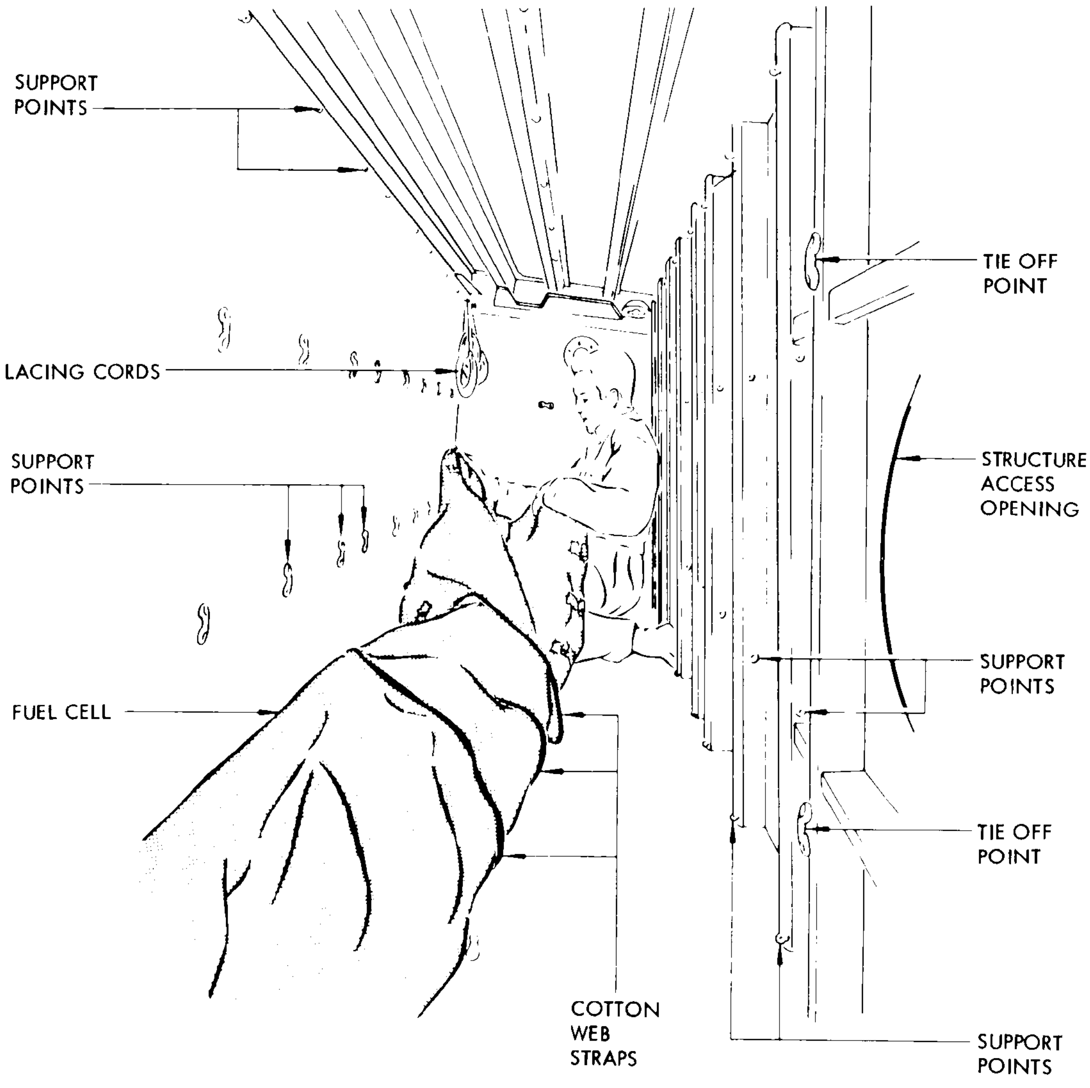


1 REFER TO 28–11–0 FOR APPLICATION INSTRUCTIONS

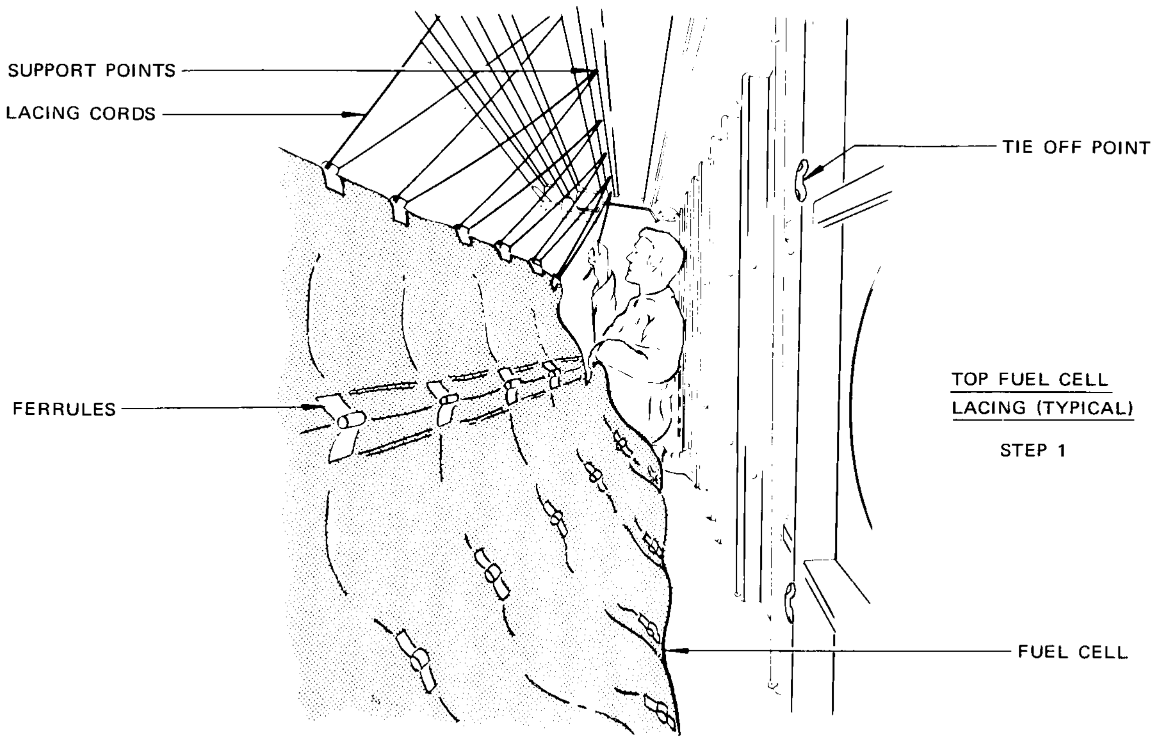
STEP III

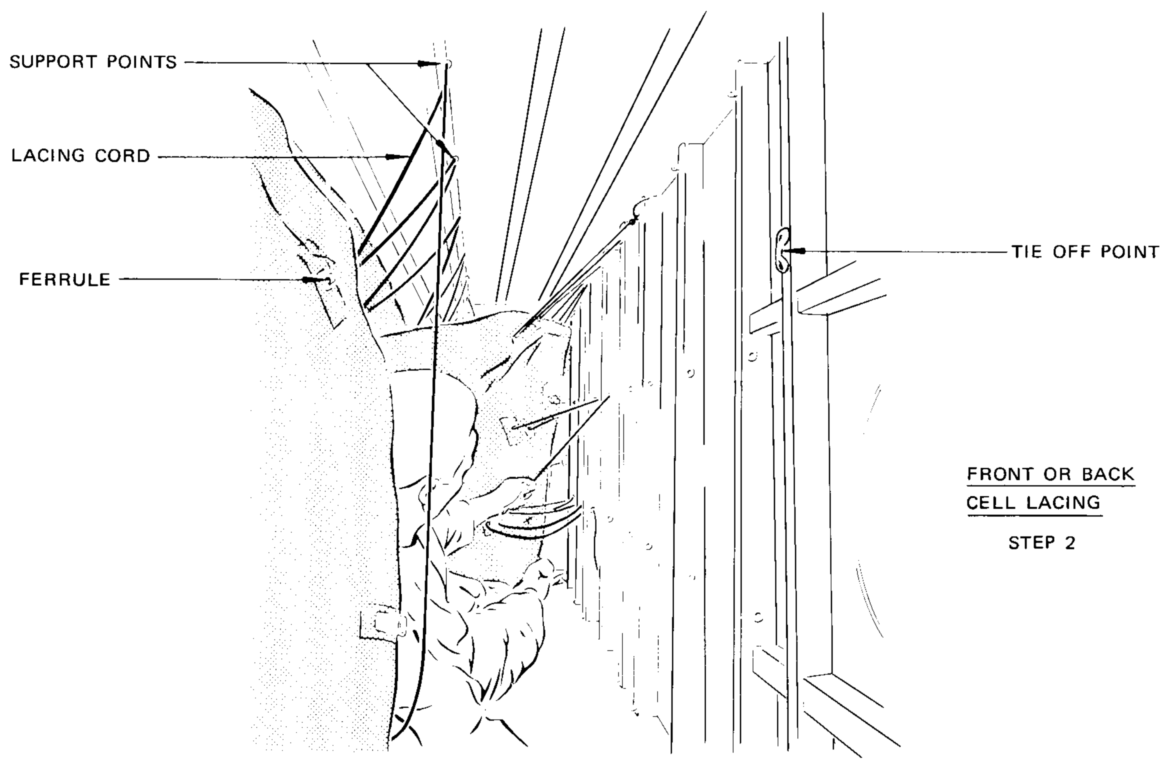
FINISHED KNOT.
APPLY SEALANT

Fuel Cells Laces and Knots
Figure 404 (Sheet 2)

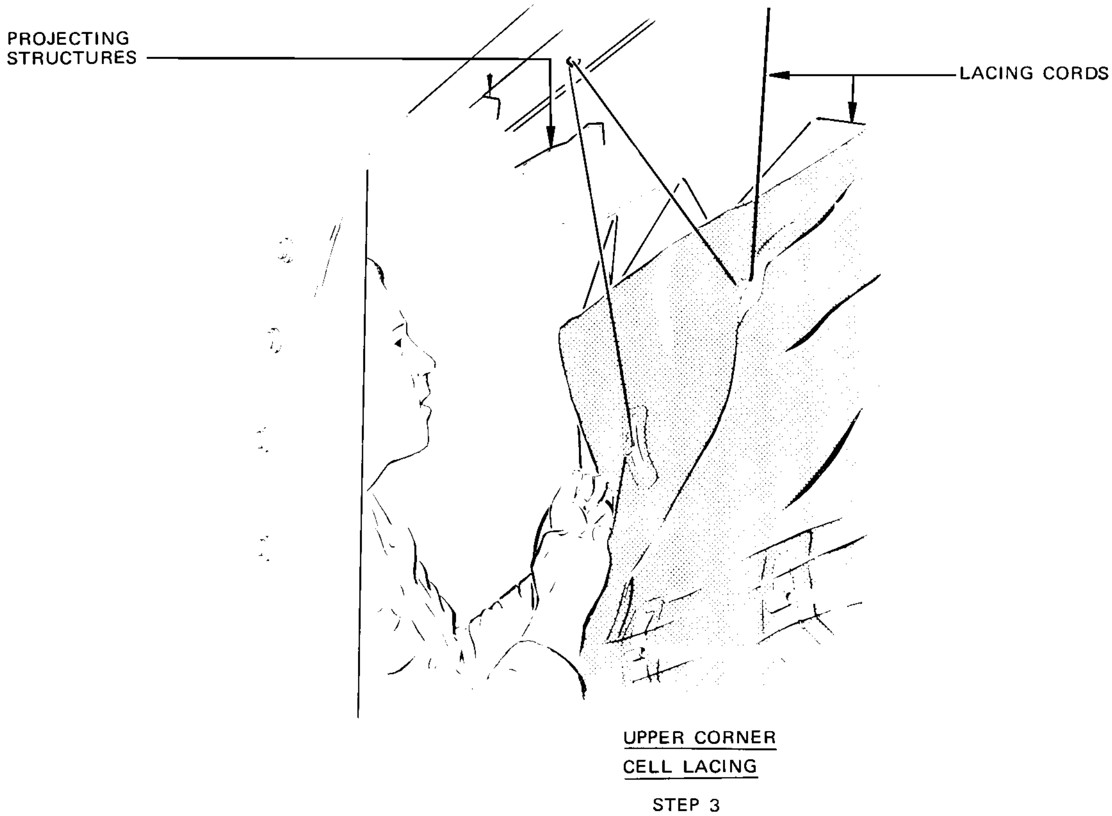


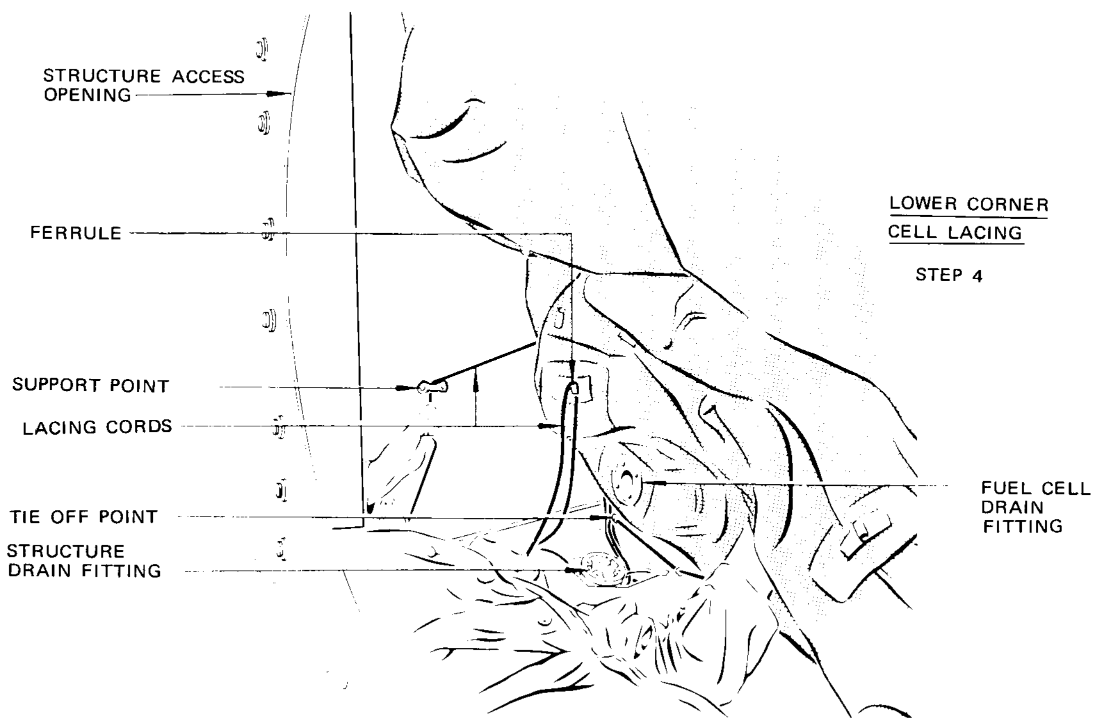
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 1)



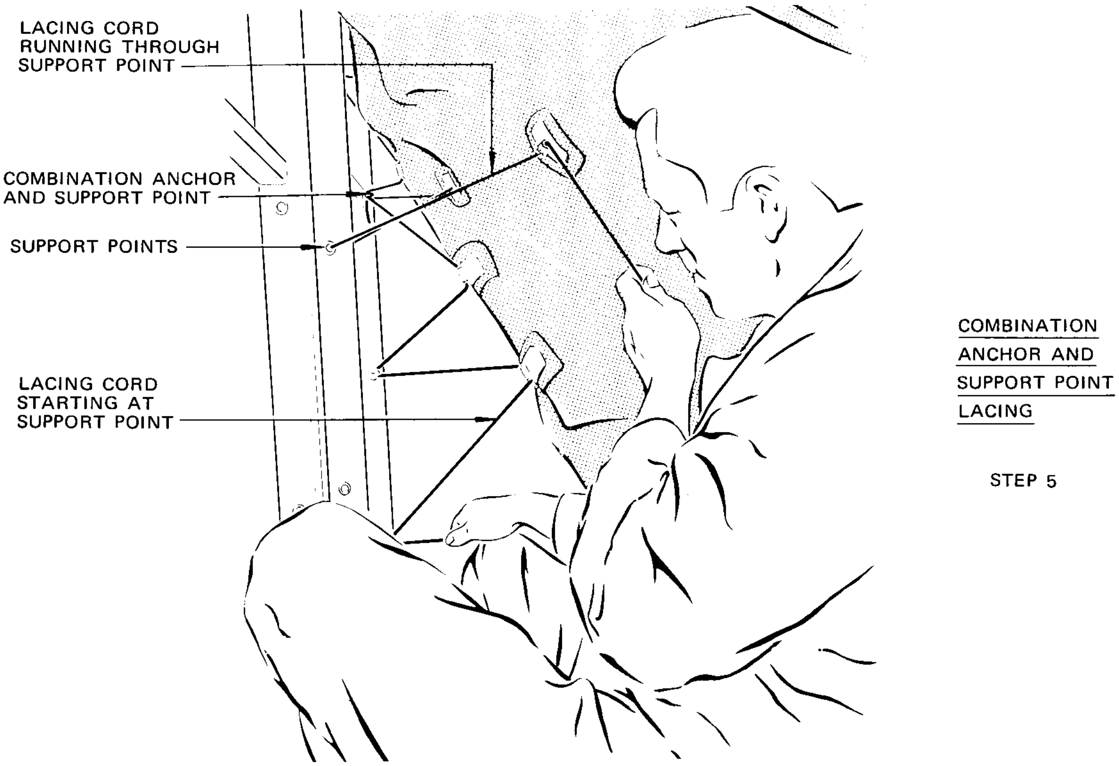


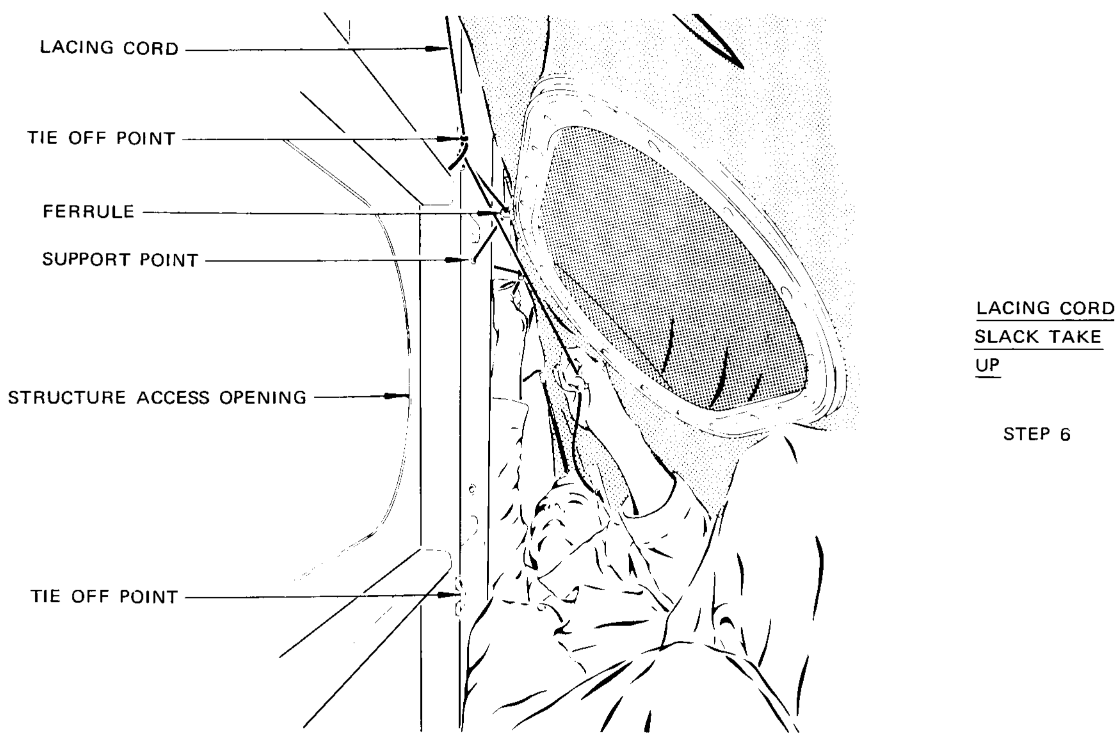
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 2)



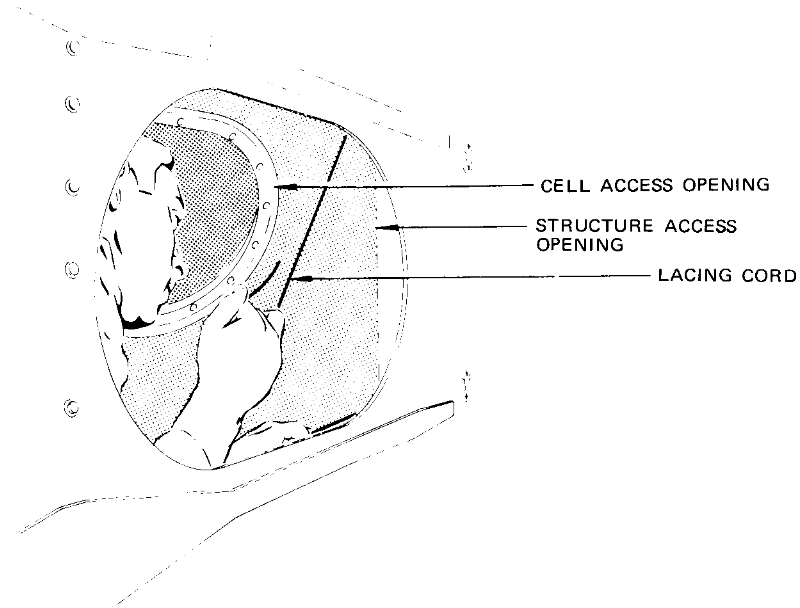


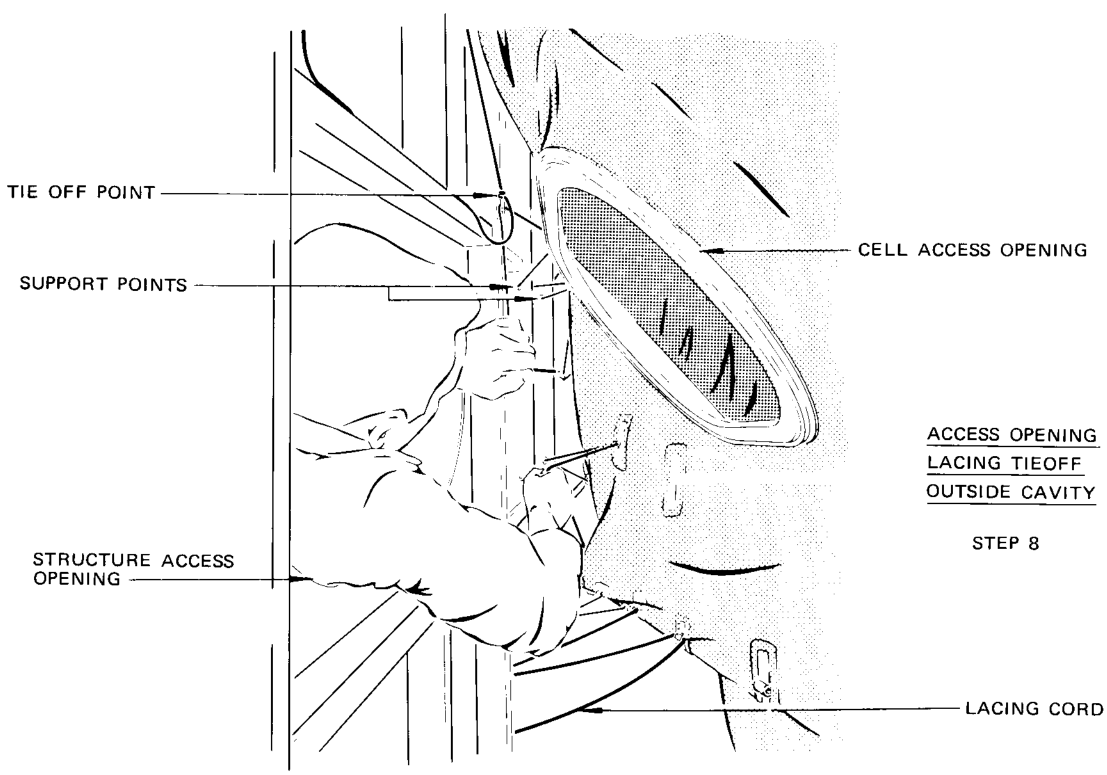
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 3)



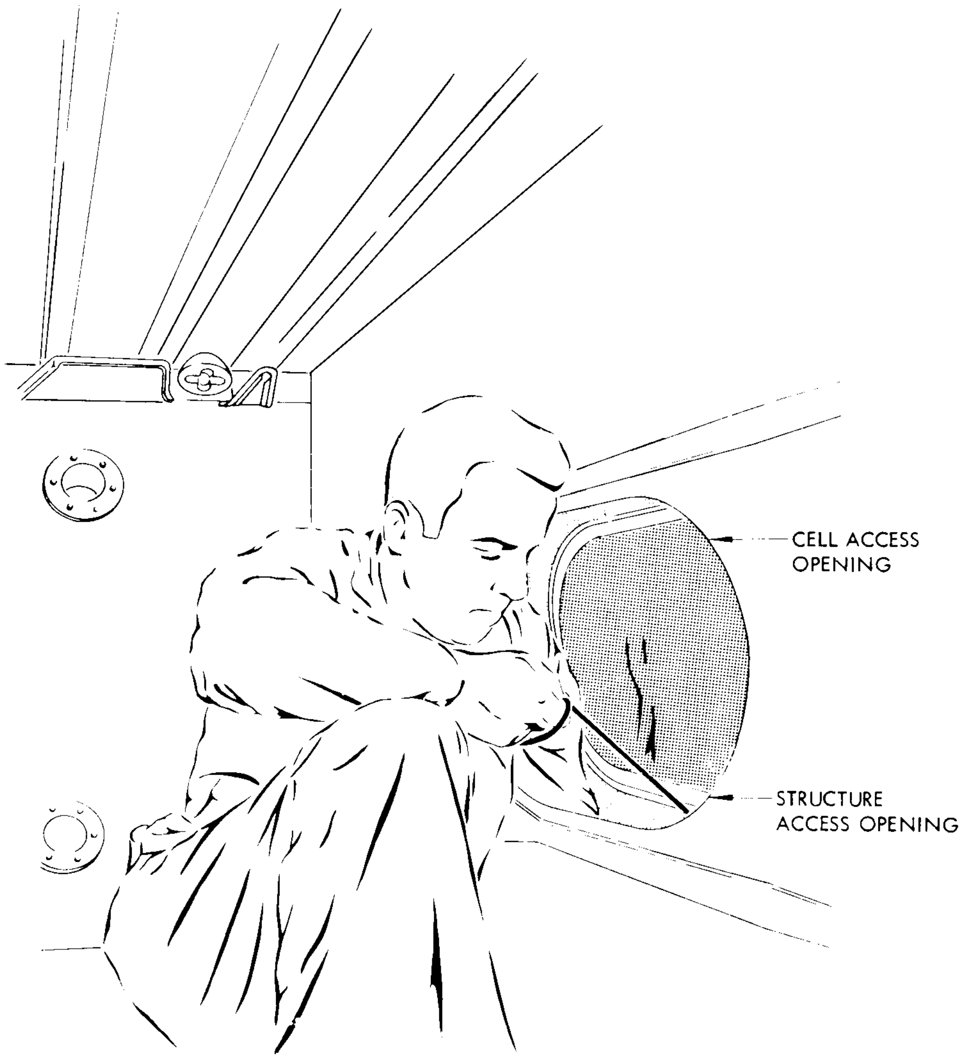


Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 4)





Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 5)



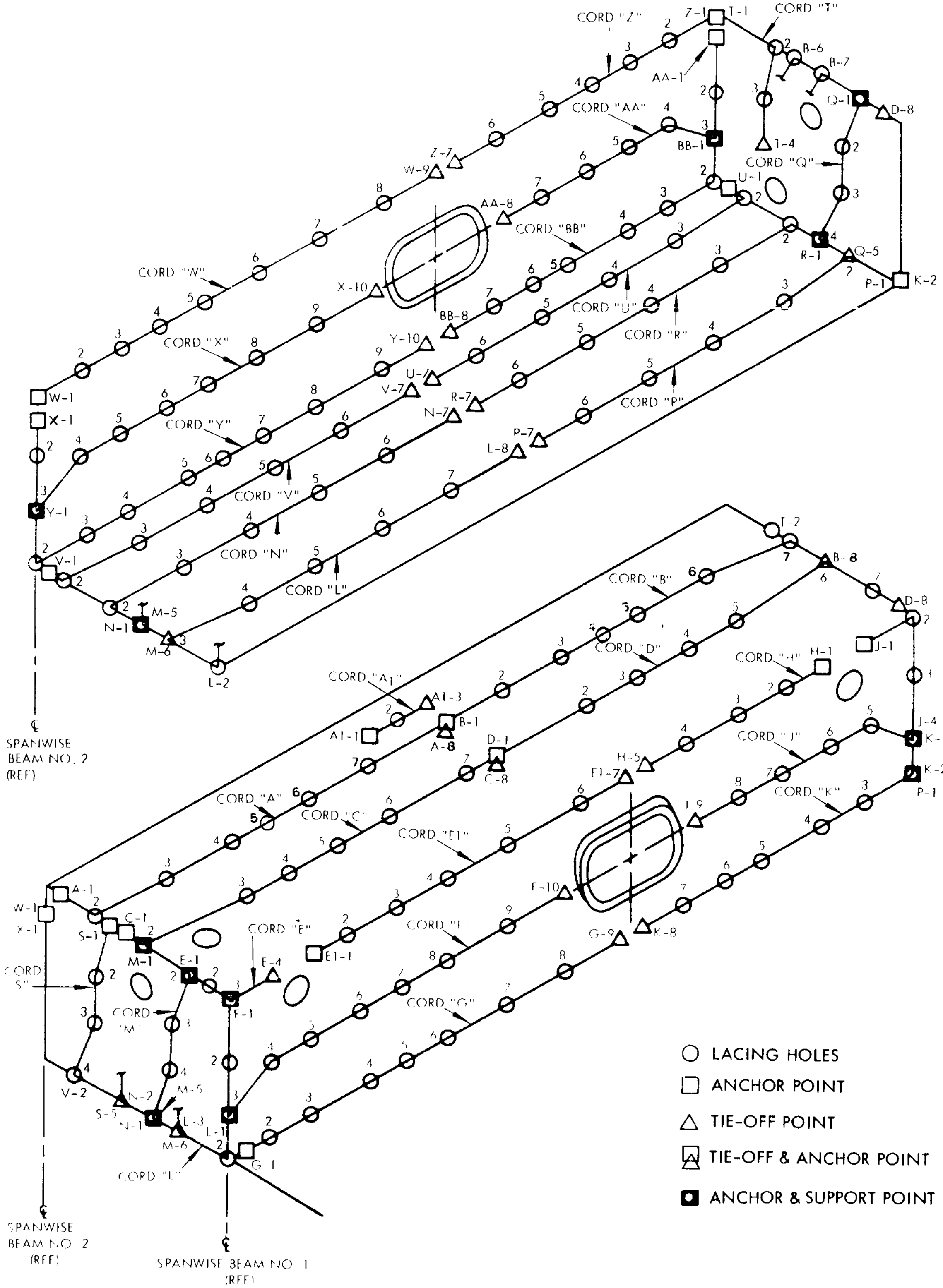
FINAL LACING TIEOFF

STEP 9

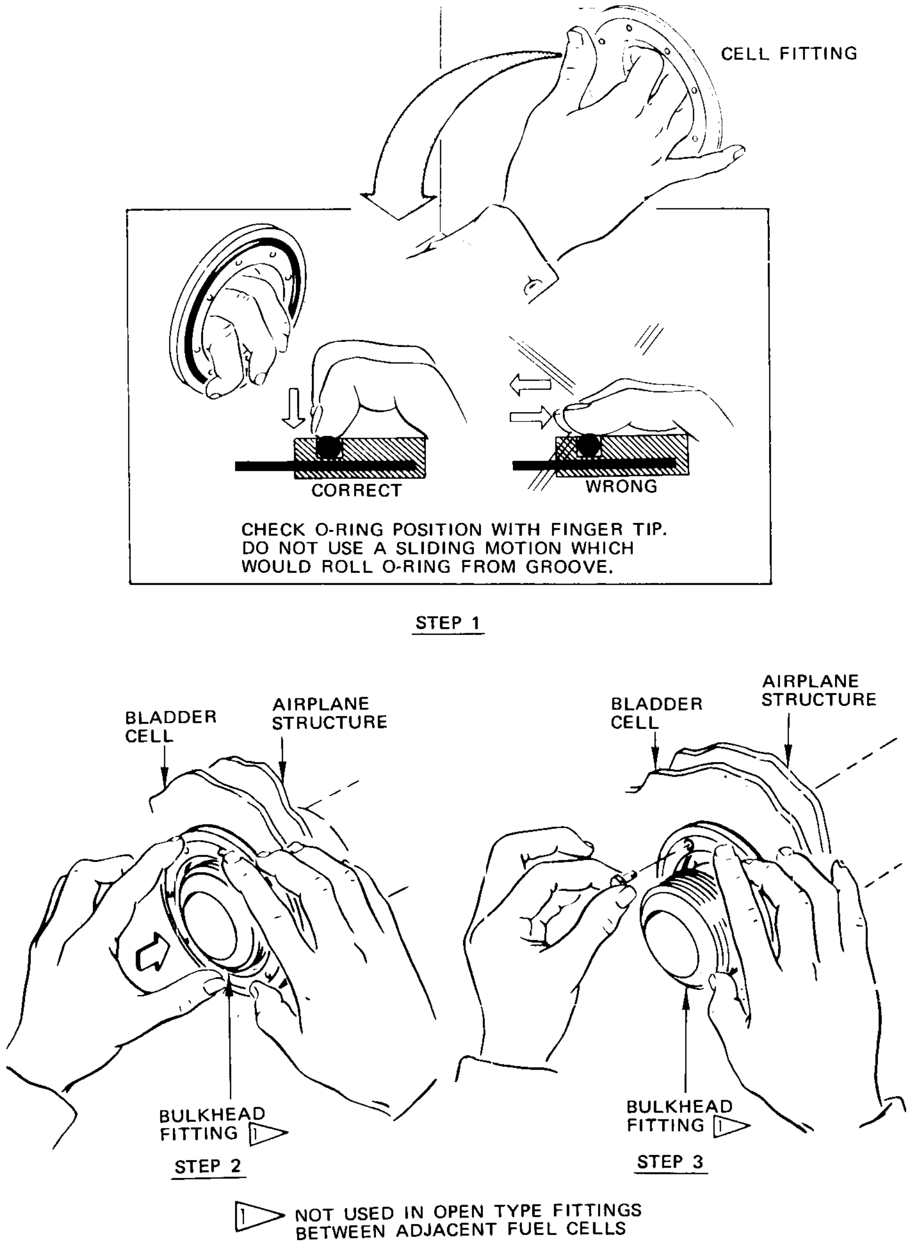
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 6)

(10) Simultaneously take up slack in cords M and S and tie-off.
(11) Lace cord L to its tie-off point and tie-off.
(12) Lace cord N to its tie-off point and tie-off.
(13) Lace cord V to its tie-off point and tie-off.
(14) Lace cord W to tie-off point and tie loosely.
(15) Lace cord X to its tie-off point and tie loosely.
(16) Lace cord Y to its tie-off point and tie-off.
(17) Lace cords P, Q, and R to their respective tie-off points and tie-off.
(18) From inside cell, loosely install bolts in all fittings on the right side of the cell, including vent interconnect fitting on aft side of cell. Do not tighten bolts.
(19) Lace cords T and U to their respective tie-off points and tie-off.
(20) Lace cords Z and AA to their respective tie-off points and tie-off.
(21) Lace cord BB to its tie-off point and tie-off.
(22) Lace cord A to its tie-off point and tie-off.
(23) Take up slack in cords W, X, Z, and AA and tie-off.
(24) Torque all bolts in fittings 50 to 70 inch-pounds.

F. Install Plumbing Inside Fuel Cell (Fig. 401).
(1) Install sump drain fitting.
(2) Install all plumbing support brackets and lockwire.
(3) Install bolts in right fuel pump inlet fitting.
(4) Install fuel feed line and lockwire connections. Attach any bonding jumpers removed.
(5) Check electrical bond across fuel feed line bonding jumpers per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(6) Install tank vent fitting in top of cell.
(7) Install tank vent line.
(8) Install right fuel pump inlet assembly.
(9) Install tank unit and compensator unit (Ref 28-41-21, R/I).
(10) Place fueling float switch support bracket in position on aft access opening fitting. Install bolts in both forward and aft access opening fittings.
(11) Route wire bundle stowed in cell No. 3 back through vent interconnect fitting into cell No. 2.
(12) Tie wire bundle to lacing ferrules provided for installation (Fig. 403 and 404).



No. 2 Cell Lacing Diagram
Figure 406



Fuel Cell Fitting Installation
Figure 407

(13) Connect wires at tank unit and compensator unit.
(14) Install fueling float switch on support bracket.

NOTE: If float switch wires were cut and float switch removed, install switch per 28-21-71, R/I.

(a) From cell No. 3 maneuver float switch and forward end of cell 2 cell 3 conduit section through access opening into cell No. 2.
(b) Drop mounting nut and one washer down on wires and place float switch in support bracket with one washer on top of bracket. Install bottom washer and nut on float switch.
(c) Connect cell 2 cell 3 conduit section to union in cell No. 3 and to float switch in cell No. 2.
(d) Install conduit clamps and bonding jumpers.
(e) Check electrical resistance across float switch conduit bonding jumper per 20-22-01 I/C. Resistance shall not exceed 0.0025 ohm.

(15) Install access panel (Ref 28-12-31 R/I).

3. Removal/Installation Fuel Cell No. 3

A. Equipment and Materials
(1) Nylon Lacing Cord - MIL-C-5040, Type III
(2) Solvent - Methyl Ethyl Ketone (MEK), TT-M-261 (Ref 20-30-31)
(3) B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
(4) Sealant - BMS 5-45
(5) Sealant - BMS 5-32
(6) Cement - Rubber Cement No. 4, B.F. Goodrich Co., Los Angeles, California
(7) Fuel Resistant Tape - SJ8566X, Polyurethane Film Tape (Ref 20-30-51)
(8) Commercial type vacuum cleaner
(9) Camel-hair brush
(10) Plastic bucket (2 or 3 gallons)
(11) Bonding meter (Ref 20-22-01 I/C)

B. Prepare to Remove Fuel Cell No. 3
(1) Defuel airplane (tanks No. 1, 2, and center tank) and purge center fuel tank (Ref 28-23-0 and 28-10-0, Maintenance Practices).

WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

(2) Ensure GRD FUELING and FUEL QTY circuit breakers on P6 panel are in open position. Disconnect electrical connector from fuel tank bussing plug, remove bolts, and remove plug (Fig. 401).

CAUTION: DO NOT LEAVE ELECTRICAL POWER ON WITH CONNECTOR DISCONNECTED. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH. BE EXTREMELY CAREFUL WITH RECEPTACLE PINS AND/OR SOCKETS. THE RECEPTACLE IS A PART OF THE FUEL TANK WIRING HARNESS ASSEMBLY. DAMAGE TO THE RECEPTACLE WILL RESULT IN THE REMOVAL OF THE COMPLETE HARNESS ASSEMBLY.

(3) Remove screws attaching removable fuel cell bulkhead receptacle to rear spar and fuel cell fitting.
(4) Remove equipment support fitting bolts for cell No. 3 located in wheel well.
(5) Remove air conditioning equipment as necessary to gain access to cavity No. 1 access panel (Ref Chapter 21).
(6) Remove cavity No. 1 access panel (Ref 28-12-21, Removal/Installation).

WARNING: USE ONLY EXPLOSION PROOF SHIELDED LIGHTS IN AND AROUND FUEL CELLS. DO NOT ALLOW LIGHT TO REST AGAINST CELL WALL.

(7) Remove shoes and put on a pair of tank boot socks just prior to entering the tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.
(8) Mop up residual fuel before starting to work in cell.

C. Remove Fuel Cell No. 3

NOTE: At least two men are required to perform a fuel cell removal or installation.

(1) Place all fasteners in a cardboard or plastic container. From inside cavity No. 1, remove access panel to fuel cell No. 2 (Ref 28-12-31, Removal/Installation). Exercise care so access panel does not drop and damage fuel cell.

CAUTION: WHEN MOVING AROUND IN A FUEL CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(2) Disconnect wires at tank unit and compensator unit in cell No. 2.
(3) Remove tank units and compensator unit from forward end of cell No. 2 (Ref 28-41-21, Removal/Installation).
(4) Remove fueling float switch and wiring from support bracket in cell No. 2 (Ref 28-21-71, Removal/Installation).
(5) Remove clamps and bonding jumpers and remove float switch conduit from cell 2 and 3.
(6) Remove float switch support bracket.
(7) Remove tank unit from forward end of cell No. 3 (Ref 28-41-21, Removal/Installation).
(8) Remove boost pump vent manifold line (Fig. 401 for effectivity).
  (a) Detach clamps holding boost pump vent manifold line to tank No. 1 pressure refuel line.
  (b) Disconnect bonding jumper and separate vent manifold line at cell access opening using a suitable container to catch any trapped fuel.
  (c) Disconnect left tubing at left side of cell. Catch trapped fuel.
  (d) Disconnect right tubing at branch line of pressure refuel line outlet assembly (Fig. 401, Detail 1). Catch trapped fuel.
  (e) Cover tube open ends and remove tubing from cell.

CAUTION: USE CARE IN MANEUVERING LENGTHS OF TUBING OUT OF CELL AND CENTER TANK CAVITIES TO AVOID DAMAGE TO TUBING AND SURROUNDINGS.

(9) Remove main tank No. 1 pressure refuel line (Fig. 401).
  (a) Detach clamps holding pressure refuel line to inside of cell.
  (b) Disconnect bonding jumper and separate fuel line at cell access opening. Have bucket ready to catch approximately 1 gallon of fuel.
  (c) Disconnect tubing at fitting on left side of cell.
  (d) Disconnect tubing at fitting on right side of cell.
  (e) Cover tube open ends and remove tubing from cell.

CAUTION: USE CARE IN MANEUVERING LENGTHS OF TUBING OUT OF CELL AND CENTER TANK CAVITIES TO AVOID DAMAGE TO TUBING AND SURROUNDINGS.

(10) Remove pressure refuel line outlet or refuel line outlet assembly, as applicable, on right side of cell, terminating inside of fuel cell. Cover all openings of line outlet or assembly. Remove bolts from fitting.
(11) Remove left fuel boost pump inlet assembly and cover both ends of line.
(12) Remove clamps and APU fuel feed line, catching any trapped fuel. Cover both ends.
(13) Remove tank unit from aft end of cell. Refer to 28-41-21, Tank Units and Compensator Units - Removal/Installation.
(14) Remove bulkhead receptacle and wire bundle.
(15) Remove bolts from tank vent interconnect fitting at forward left side of cell.

NOTE: Place all loose parts in marked containers to prevent loss of parts or damage to cell and to facilitate installation.

(16) Remove bolts from the left fuel boost pump inlet fitting.
(17) Remove bolts from cell interconnect fitting at forward lower left corner of cell.
(18) Remove bolts from pressure refuel line fittings at left and right side of tank.
(19) Remove bulkhead nut and washer from vapor removal fitting on left side of cell.
(20) Remove bulkhead nut and washer from wire conduit fitting from right side of cell.
(21) Remove bolts from tank vent interconnect fitting from forward right side of cell.
(22) Remove bolts from cell interconnect fitting from forward lower right corner of cell.
(23) Remove bolts securing cell No. 2 access opening to cell No. 3 access opening.
(24) Remove bolts securing cell No. 3 access opening fitting to spanwise beam to gain access to lacing tie-off points around opening.
(25) Untie lacing at all tie-off points around both access openings.

(26) Push in on cell at access opening to get slack in lacing cords. Cords will slip through eyebolts.
(27) Remove equipment support fitting bolts for cell No. 3 from inside cavity No. 2.
(28) Untie lacing at under side of cell No. 3 as work progresses around cell.
(29) Crawl into cavity and unlace cell.
(30) Remove cords from cell, roll into a neat coil, tie with masking tape and hang at individual anchor points. Any frayed or damaged cord must be replaced with a new cord.
(31) Cover edges of access opening, cell will pass when removed, with tape or rubber extrusion.
(32) Cover all fuel cell fitting openings with lint-free paper or cardboard held in place with tape.
(33) Cover all fuel cell fitting openings with a cotton wiper (BMS15-5) held in place with tape.
(34) Fold cell for removal from cavity (Ref 28-12-10, Storage).
(35) Remove fuel cell from airplane cavity, taking care to prevent cell from rubbing against structure.
(36) Clean cell, inside and out, with a clean cotton wiper (BMS15-5) moistened with water. Repair and store cell as required (Ref 28-12-10, Approved Repairs, and 28-12-10, Storage).
(37) Following removal, the cell is to be cleaned inside and outside with a clean cotton wiper (BMS15-5) moistened with water and repaired and stored as necessary (AMM 28-12-10/801, AMM 28-12-15/801, AMM 28-12-10/201).

D. Prepare to Install Fuel Cell No. 3
(1) Prepare fuel cell cavity for cell installation.
(a) Check cavity backing board for raw edges, cracks or otherwise defective or damaged areas. There shall be no raw edges of backing board in contact with cell. Ensure all edges of backing board and all lap splices are taped. Refer to Chapter 57, Center Wing Cavity Backing Boards, for replacement of damaged backing boards. If application of new tape is necessary, use fuel resistant tape.

(b) Ensure there are no sharp edges or corners on structure in areas where chafing of fuel cell during handling and service is possible. Round or bevel sharp edges or corners. Tape (Polyken No. 214 black tape) may be used to cover edges of structure or web laps. Web laps of 0.05 or less need not be protected if the edge of the lap, adjacent to the cell, has a broken or rounded edge.

(c) Ensure protruding or irregular structure (for example, threaded parts) have adequate coating of sealant for chafing protection. If coating is required, apply BMS 5-32 sealant per applicable instructions in Section 28-11-0.

(d) On all access openings cell must pass during installation, cover edges with tape or rubber extrusion to prevent cell from rubbing against structure.

CAUTION: THE SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING IS A SEALING SURFACE. A SCRATCH MAY RESULT IN A FUEL LEAK. OPENING MUST HAVE PROTECTORS (RUBBER EXTRUSION OR EQUIVALENT) INSTALLED IMMEDIATELY AFTER ACCESS PANEL IS REMOVED.

(e) Replace all backing board screws having damaged, sharp, or jagged recesses. Ensure screws are the right lengths.

(f) Clean the cavity thoroughly. Use a vacuum cleaner to clean all surfaces of structure where chips, dirt, grit, or any foreign material may be lodged.

(2) Prepare fuel cell for installation.

(a) If cell has been in storage, check for condition of cell and expiration of shelf life (Ref 28-12-10, Storage). Reject any cell in doubtful condition or having expired shelf life.

(b) Unfold and handle cell carefully. Comply with fuel cell handling precautions (Ref 28-12-10, Storage).

(c) Wipe outside and inside surface of cell with damp clean cotton wiper (BMS15-5). While wiping, check surfaces for scratches, cuts, abrasions, or obvious damage.

NOTE: It is not necessary to clean new fuel cells if they are installed promptly after removing from containers.

(d) Check all lacing tabs to ensure holes will accommodate nylon lacing cord.

(e) Check external (sealing) surface of each cell fitting to ensure it is clean and free of nicks and scratches.

1) If new cell is being installed, remove metallic tape discs used during shipping. Should any adhesive from the tape be transferred to the surface of the fitting, it should be removed with gasoline.

2) Remove rubber particles and foreign material by cleaning sealing surfaces with a swab lightly dampened with methyl ethyl ketone.

<u>CAUTION</u>: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA.

EXERCISE EXTREME CARE TO ENSURE NO METHYL ETHYL KETONE IS SPILLED ON THE FUEL CELL.

(f) Install new O-rings in all fuel cell fitting grooves. (See figure 402.) Proceed as follows:

1) Obtain O-ring directly from envelope and check cure date, inspect for cuts, scratches, nicks, or damage. Destroy used or defective O-rings.

2) Clean cell fitting O-ring groove. Use a pointed wood stick with sharp end covered with clean cotton wiper (BMS15-5) dampened with methyl ethyl ketone. Check O-ring groove for cuts, scratches, dents, distortion, and foreign material. (See step 1.) If O-ring groove is defective, cell fitting must be replaced. See Removable Fuel Cells-Approved Repairs.

3) Check O-ring fit in cell fitting O-ring groove. O-ring should fit groove correctly with no distortion or kinks.

4) Apply light coating of B.F. Goodrich No. 4 rubber cement to O-ring groove with camel hair brush.

5) When cement in O-ring groove becomes "tacky" press O-ring into groove.

6) Roll excess cement from flat surface of cell fitting with finger or thumb.

7) Allow cement to dry for approximately 15 minutes before installing fitting.

(g) Tape cotton wiper (BMS15-5) patches over all bulkhead fittings after O-rings have been installed. This will protect the O-rings during installation of the cell.

(h) Prepare new lacing cords, to replace the discarded ones. (See figure 403.)

1) Lay out the cord lengths between the anchor and tie-off points shown on the cell lacing diagram. (See figure 408.) Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.

2) Prepare end of new lacing cord for installation. Proceed as follows:

WARNING: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (See step 1.)

b) Roll melted end on any flat surface (step 2) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

WARNING: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (steps 3 and 4).

d) Coil the new lacing cord into a small roll, tie with tape and attach one end to the applicable anchor point in the cell cavity. See figure 404 for method of attaching and tying cord.

(i) Fold, tie, and place fuel cell in the cavity as described in the handling precautions. Refer to 28-12-10, Fuel Cell - Storage.

(j) Remove the cotton web straps and unfold the cell.

(k) Remove the cotton wiper (BMS15-5) patches over bulkhead cell fittings. Ensure new O-rings are properly installed.

E. Install Fuel Cell No. 3 (Fig. 405, steps 1 thru 9).

NOTE: Cavity must be cleaned just prior to cell installation. At least two men are required to install a fuel cell.

(1) Lace cord A to its tie-off point and tie loosely (Fig. 408). The tie-off point for A will now be the anchor point for B; lace B to its tie-off point and tie off. This allows cell to drape in the cavity.

<u>CAUTION</u>: LACING CORDS ARE TO BE TIGHTENED ENOUGH TO HOLD CELL IN PLACE BUT NOT SO TIGHT CELL IS DISPLACED. IN CERTAIN AREAS, IF FIRST CORDS INSTALLED ARE TIGHTENED EXCESSIVELY, FINAL LACING MAY NOT PULL TANK INTO PLACE AND DIFFICULTY IN INSTALLING FITTINGS MAY BE ENCOUNTERED.

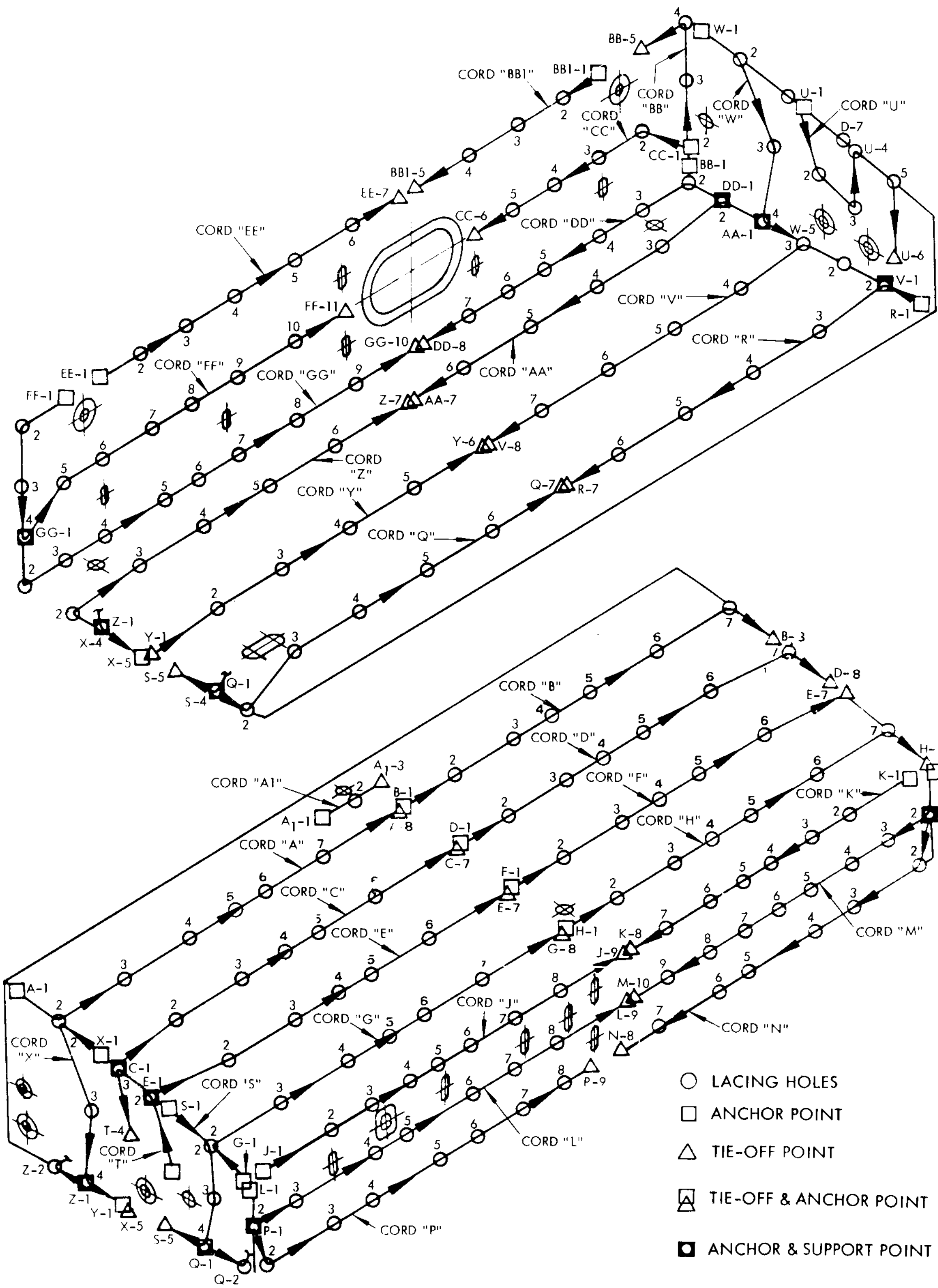
(2) Lace cords C, E, G, J, and L to their tie-off points, in that order. Take up slack in each cord and tie off.
(3) The tie-off points for C, E and G will now be the anchor points for D, F and H respectively. Lace D, F, H, K, and M to their tie-off points and tie off.
(4) Lace cord T to its tie-off point and tie off.
(5) Lace cord U and cord X to their tie-off points and tie off.
(6) Lace cord Q to Q2 and cord Z to Z2.
(7) Enter the cell.

<u>CAUTION</u>: WHEN MOVING AROUND INSIDE THE CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(8) From inside cell, check O-ring seal position on all left side cell fittings (Step 1, Fig. 407,). Guide cell fittings in place on their respective bulkhead fittings in adjacent structure (step 2).

<u>CAUTION</u>: ENSURE LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

(a) On fittings with bolted flange, install bolts leaving bolts loose (Fig. 407, step 2). On fittings with plain flange, install bulkhead washer and nut, leaving nut loose (Fig. 401).
(9) Simultaneously lace cords S and N to their tie-off points and tie off.
(10) Lace cord P to its tie-off point and tie off.
(11) Lace cord Q completely, take up slack in cord and tie off.
(12) Lace cord Y to its tie-off point and tie loosely.
(13) Lace cord R to its tie-off point and tie off.
(14) Lace cords W and V to their tie-off points and tie loosely.
(15) Enter cell and repeat step (8) for all fittings on right side of cell.
(16) Take up slack in cords V, W, and Y and tie off.



No. 3 Cell Lacing Diagram
Figure 408

(17) Lace cord Z to its tie-off point and tie off.
(18) Lace cords AA, DD, and GG to their respective tie-off points and tie off.
(19) Lace cord FF to its tie-off point and tie loosely.
(20) Lace cord EE to its tie-off point and tie loosely.
(21) Lace cord BB to its tie-off point and tie off.
(22) Lace cord CC to its tie-off point and tie loosely.
(23) Lace cord BB1 to its tie-off point and tie loosely.
(24) Lace cord Al to its tie-off point and tie off.
(25) Install equipment support fitting bolts for cell No. 3 from inside cavity No. 2.
(26) Take up slack in cords FF, EE, CC, and BB, and tie off.
(27) Take up slack in cords at cell No. 2 interconnect access opening and tie off.
(28) Torque all bolts in fittings 50 to 70 inch-pounds. Tighten all bulkhead nuts in plain flange-type fittings 100 to 125 inch-pounds.
(29) Install equipment support fitting bolts for aft side of cell No. 3 from wheel well area.

F. Install Plumbing Inside Fuel Cell (Fig. 401)
(1) Install support brackets for main tank No. 1 pressure refuel line.
(2) Install support brackets for APU fuel feed line.
(3) Install main tank No. 1 pressure refuel line.
(a) Connect right tubing at bulkhead fitting on right side of cell, leaving tubing nut loose.
(b) Connect left tubing at bulkhead fitting on left side of cell and to right tubing section at cell access door.
(c) Tighten left and right tubing at sides and at cell access door.
(d) Install bonding jumper, clamps, and lockwire.
(e) Check electrical bond across pressure refuel line coupling per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(4) Install bolts in vent interconnect fittings and tighten to a torque range of 50 to 70 inch-pounds.
(5) Install APU fuel feed line.
(6) Install bolts in left cell interconnect fitting and tighten to a torque range of 50 to 70 inch-pounds.
(7) Install left fuel boost pump inlet assembly.

(8) Install check valve on left vapor removal fitting for airplanes not having boost pump vent manifold line (see Fig. 401 for effectivity).
(9) Install bolts in right cell interconnect fitting and tighten to a torque range of 50 to 70 inch-pounds.
(10) Install pressure refuel line outlet or pressure refuel outlet assembly on right side of cell (see Fig. 401 for effectivity).
 (a) For outlet assembly, ensure that check valve and correct orifice plate are installed on outlet end of tube.
 (b) Place outlet assembly in position, with branch line outlet facing forward, and engage threads of tube nut with bulkhead fitting. Leave tube nut loose.
(11) Install boost pump vent manifold line (see Fig. 401 for effectivity).
 (a) Connect right tubing at branch line connection of pressure refuel outlet assembly (Fig. 401). Leave tube nut loose.
 (b) Connect left tubing at left side of cell and to right tubing near cell access door. Leave tube nuts loose.
 (c) After checking tube alignment, tighten all three tube nuts and install bonding jumper at center connection.
 (d) Attach clamps holding boost pump vent manifold line to tank No. 1 pressure refuel line.
 (e) Check electrical bond across boost pump vent manifold line center connection per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(12) Hold pressure refuel outlet assembly in alignment and tighten tube nut left loose in step (10)(b).
(13) Install tank units on forward and aft ends of cell No. 3 (Ref 28-41-21, R/I).
(14) Install bulkhead receptacle and wire bundle in cell No. 3 (Fig. 401, 403 and 404.). Route remainder of wire bundle through left vent interconnect fitting into cell No. 2.
(15) Connect wires to tank units in cell No. 3.
(16) Place fueling float switch support bracket in position on cell No. 2 aft access opening fitting. Install bolts through bracket and install remaining bolts connecting cell No. 2 and 3 access opening fittings to spanwise beam. Tighten all bolts to a torque range of 50 to 70 pound-inches.

(17) Connect the two sections of fueling float switch electrical conduit together and to fitting at upper right side of cell No. 3. Install conduit clamps and bonding jumpers.
(18) Check electrical bond across float switch conduit bonding jumping per 20-22-01, I/C. Resistance shall not exceed 0.0025 ohm.
(19) Install fueling float switch in support bracket (Ref 28-21-71, R/I).
(20) Install wire bundle in cell No. 2 (Fig. 401, 403, and 404.)
(21) Check cell No. 3 for any tools or foreign material. Wipe down interior of cell with water- dampened, clean cotton wiper (BMS15-5).
(22) Install tank unit and compensator unit on forward side of cell No. 2 and connect electrical wires to unit terminals (Ref 28-41-21, R/I).
(23) Install bulkhead unit on rear spar mounting pad, accessible in left main wheel well area, and connect electrical connector.
(24) Check cell No. 2 for any tools or foreign material. Wipe up any dirt with clean, cotton wiper (BMS15-5).
(25) Install fuel cell access panel on front end of cell No. 2 (Ref 28-12-31, R/I).
(26) Install center tank access panel (Ref 28-12-21, R/I).
(27) Prior to final fueling of center tank, check fuel cells for leakage (Ref 28-12-0, I/C).
(28) Fuel center tank and check fuel shutoff at proper quantity level. (Ref 28-21-0, A/T).

REMOVABLE FUEL CELLS (THREE CELL) - REMOVAL/INSTALLATION

1. General
   A. The fuel cell is supported in the airplane cavity on a backing board and is tied to the cavity structure by lacing cords strung through lacing tabs on the cell, and eyebolts and anchor fittings on the structure. To facilitate installation, the anchor and support points for the cords are identified by a letter and number system as shown in lacing diagrams for the cell. As an example, the support point with a square box followed by A1 (Fig. 406), means that cord A is anchored at that point. Nomenclature A2, A3, A4 indicates the sequence of lacing to be followed for cord A. The last, or tie-off point is identified by the highest number in the series and a triangular symbol.
2. Removal/Installation Fuel Cell No. 1
   A. Equipment and Materials
      (1) Nylon Lacing Cord - MIL-C-5040, Type III
      (2) Solvent - methyl ethyl ketone
      (3) Sealant - BMS 5-45, Class B-1/2
      (4) B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
      (5) Sealant - BMS 5-32
      (6) Cement - Rubber Cement No. 4, Sovereign Adhesives, 123 W. Bartges St., P.O. Box 5471, Akron, OH 44311
      (7) Polyken - JAN-P-127 #214 Black Type I, Grade B
      (8) Polyurethane Pads - Goodyear Tire and Rubber Co., Los Angeles, California, or Akron, Ohio
      (9) Commercial type vacuum cleaner
      (10) Camel-hair brush
      (11) Plastic bucket (2 or 3 gallons)
      (12) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Prepare to Remove Fuel Cell No. 1
      (1) Defuel airplane (tank No. 1, tank No. 2, and center tank) and purge center fuel tank (Ref 28-23-0, 28-10-0, Maintenance Practices).

      WARNING: EXPLOSIVE AND TOXIC DANGERS OF VAPORS IN VICINITY OF FUEL TANKS WHICH HAVE CONTAINED FUEL ARE OF SUCH POTENCY THAT SEVERAL PRECAUTIONS MUST BE FOLLOWED BY PERSONNEL BEFORE ENTERING ANY WETTED OR DRY TANK FOR MAINTENANCE PURPOSES.

      (2) Remove air conditioning equipment as necessary to gain access to fuel cell access panel (Ref Chapter 21).
      (3) Remove fuel cell access panel (Ref 28-21-31, Removal/Installation).

      WARNING: USE ONLY EXPLOSION PROOF SHIELDED LIGHTS IN AND AROUND FUEL CELLS. DO NOT ALLOW LIGHT TO REST AGAINST CELL WALL.

      (4) Remove shoes and put on a pair of tank boot socks just prior to entering the tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.

(5) Mop up residual fuel before working in cell.

C. Remove Fuel Cell No. 1 (Fig. 401)

CAUTION: WHEN MOVING AROUND IN A FUEL CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

NOTE: At least two men are required to perform a fuel cell removal or installation. Place all fasteners or loose parts in cardboard or plastic containers.

(1) Remove fueling float switch from bracket and stow in cell No. 2.
  (a) Disconnect conduit nut at float switch and detach all bonding jumpers and clamps on cell 1 cell 2 conduit section.
  (b) Disconnect cell 1 cell 2 conduit section from cell 2 conduit section at union in cell 2 near access opening.
  (c) Remove float switch mounting nut and remove float switch from bracket by passing wires through slot in bracket. Support switch to relieve wire strain. Replace washers and nut loosely on switch.
  (d) Pull slack wires through conduit until enough freedom is gained to maneuver float switch and conduit section out of cell 1. Stow switch and conduit in cell No. 2.

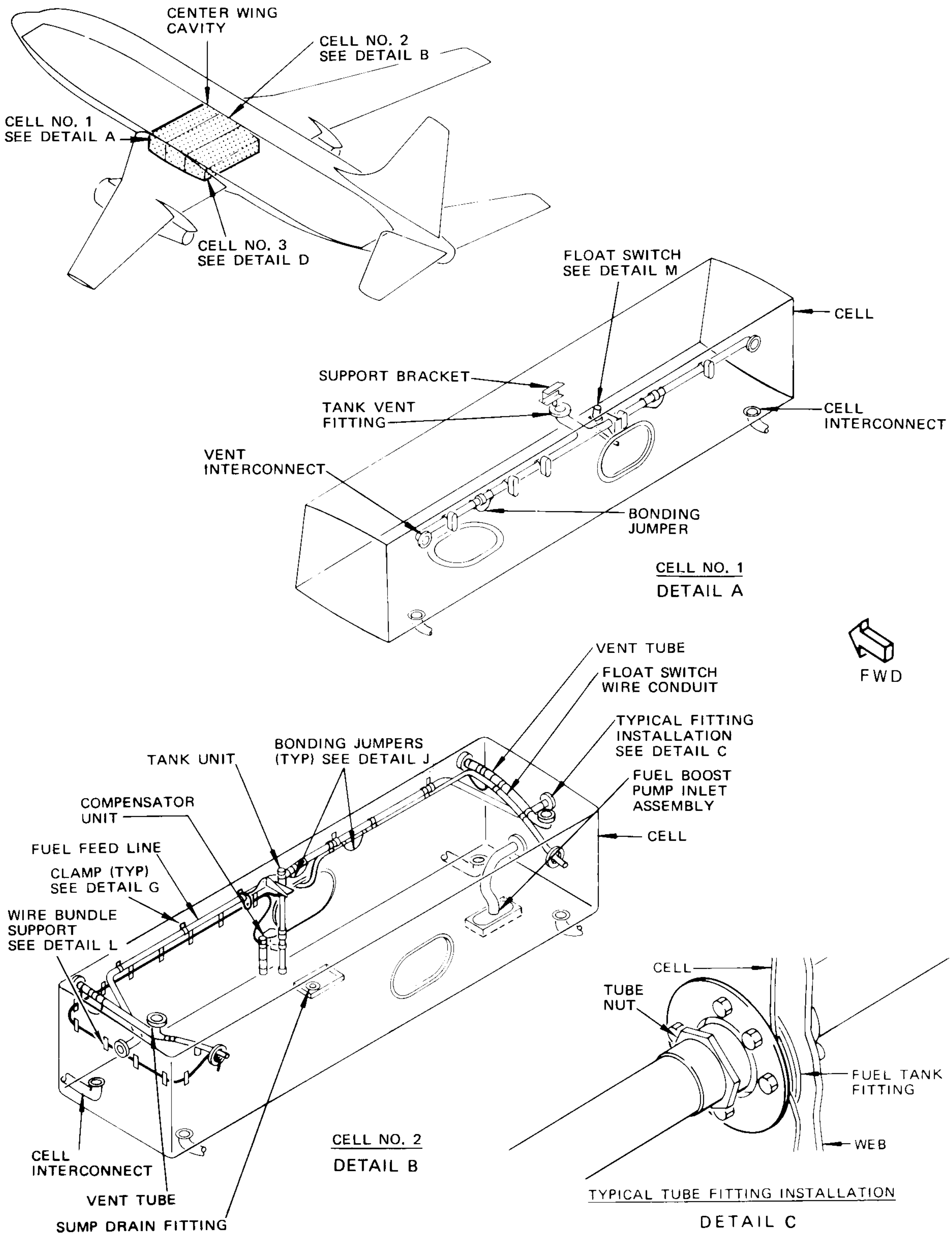
  WARNING: IF NECESSARY TO CUT WIRES TO REMOVE FLOAT SWITCH, LOCATE CUT OUTSIDE OF CONDUIT NEAR WING FRONT SPAR. AN EXPLOSION HAZARD COULD OCCUR FROM SPLICE WITHIN CONDUIT.

  NOTE: If wire slack is insufficient to permit moving float switch and conduit into cell No. 2 or cell No. 2 or 3 is to be removed also, wires must be cut near splice and float switch removed. Refer to 28-21-71, Fueling Float Switch - Removal/Installation.

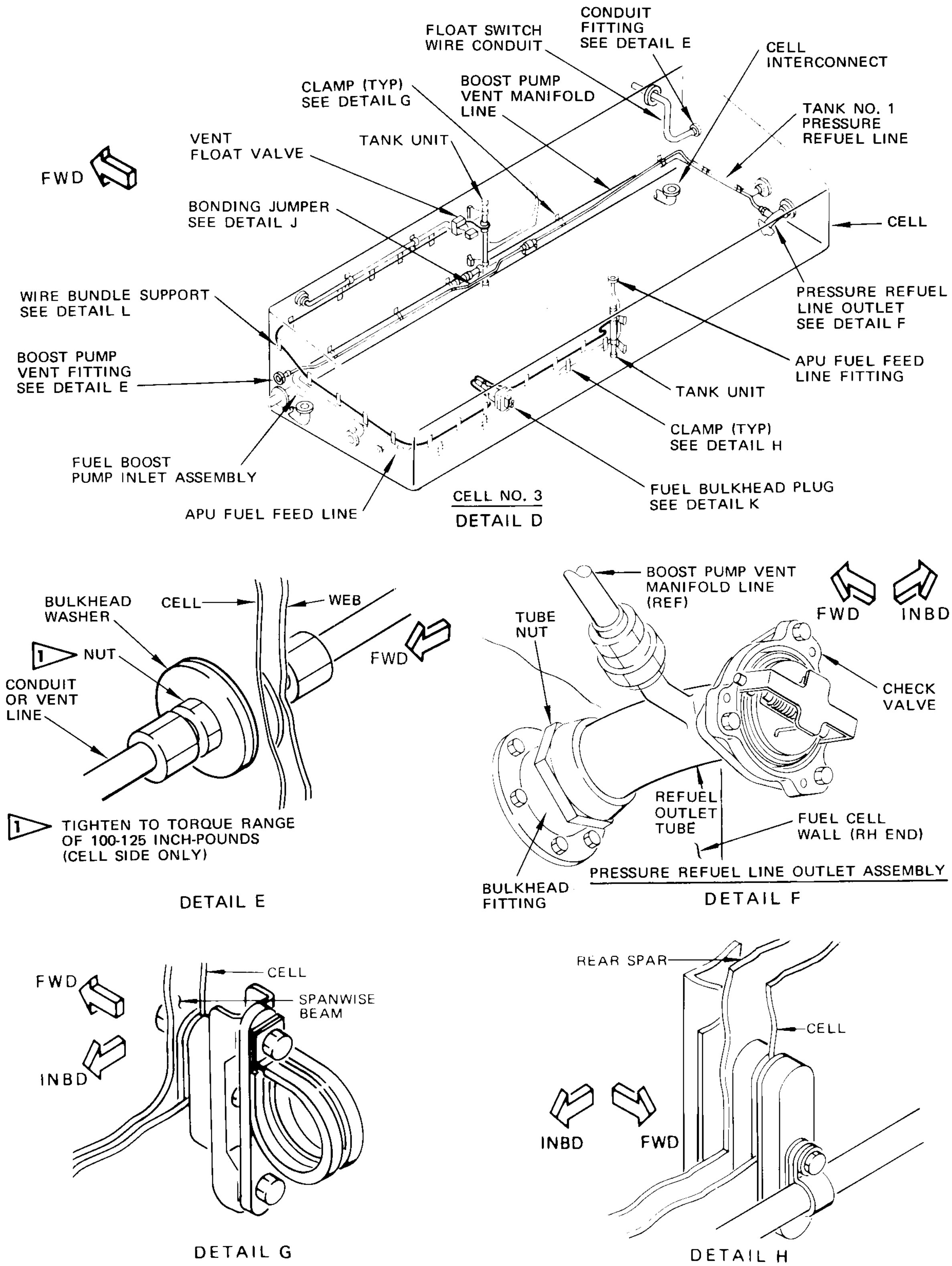
(2) Remove float switch bracket.
(3) Remove vent line from aft side and top of cell.
  (a) Remove clamps holding vent line in place.
  (b) Remove bonding jumpers.
  (c) Remove bolt from fitting in top of tank.
  (d) Disconnect tubing at left side and above intercell access opening.
  (e) Disconnect tubing at right side and above intercell access opening.

(f) Remove tee section of tubing from fuel cell. Cover all ends of the tubing.
(g) Enter cell No. 2 and disconnect vent line on left side of cell. Remove line by pulling it through cell vent interconnect fitting into cell No. 1. Cover both ends of tubing.
(h) While in cell No. 2 disconnect vent line on right side of cell. Remove line by pulling it through cell vent interconnect fitting into cell No. 1. Cover both ends of tubing.

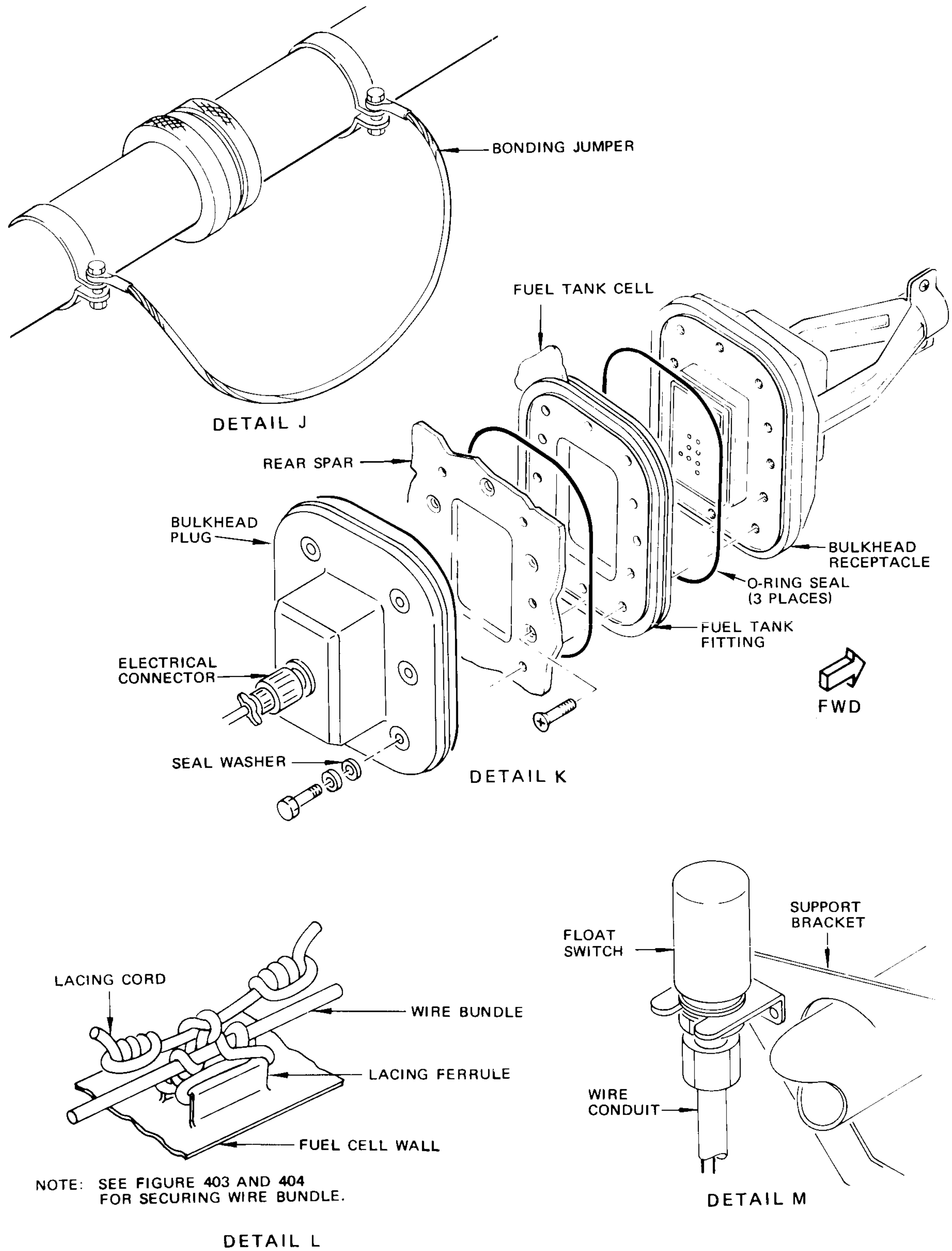
(4) Remove bolts from vent interconnect fittings.
(5) Remove bolts from cell interconnect fittings.
(6) Remove bolts securing access opening fitting between cell No. 1 and cell No. 2.
(7) Untie lacing at all tie-off points around access opening for cell No. 2.
(8) From inside of cell No. 1 push in on cell No. 2 at access opening to get slack in lacing cords.
(9) Remove the equipment support fitting bolts for cell No. 1 from the spanwise beam between cells No. 1 and 2.
(10) From inside of cell No. 2 push in on cell No. 1 at access opening to get slack in lacing cords.
(11) Untie lacing at under side of cell as work progresses around cell.
(12) Crawl into cavity and unlace cell.
(13) Remove cords from cell, roll into a neat coil, tie with masking tape and hang at individual anchor points. Any frayed or damaged cord must be replaced with a new cord.
(14) Cover edges of access opening, through which cell will pass when removed, with tape or rubber extrusion.
(15) Cover all fuel cell fitting openings with a cotton wiper (BMS15-5) held in place with tape.
(16) Fold cell for removal from cavity (Ref 28-12-10, Storage).
(17) Remove fuel cell from airplane cavity, taking care to prevent cell from rubbing against structure.
(18) Following removal, the cell is to be cleaned inside and outside with a clean cotton wiper (BMS15-5) moistened with water and repaired and stored as necessary (AMM 28-12-10/801, AMM 28-12-15/801, AMM 28-12-10/201).



Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 1)



Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 2)



Fuel Cell Plumbing and Fitting Installation
Figure 401 (Sheet 3)

D. Prepare to Install Fuel Cell No. 1

(1) Prepare fuel cell cavity for cell installation.

(a) Check cavity backing board for raw edges, cracks, or otherwise defective or damaged areas. There shall be no raw edges of backing board in contact with cell. Check that all edges of backing board and all lap splices are taped. Refer to Center Wing Cavity Backing Boards, Chapter 57, for replacement of damaged backing boards. If application of new tape is necessary, use Polyken No. 214 black tape per JAN-P-127, type I, grade B.

(b) Check that there are no sharp edges or corners on structure in areas where chafing of fuel cell during handling and service is possible. Round or bevel sharp edges or corners. Tape (Polyken No. 214 black tape) may be used to cover edges of structure or web laps. Web laps of 0.05 or less need not be protected if the edge of the lap, adjacent to the cell, has a broken or rounded edge.

(c) Check that protruding or irregular structure (for example, threaded parts) have adequate coating of sealant for chafing protection. If coating is required, apply BMS 5-32 sealant per applicable instructions in Section 28-11-0.

(d) On access opening through which cell must pass during installation, cover edges with tape or rubber extrusion to prevent cell from rubbing against structure.

CAUTION: THE SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING IS A SEALING SURFACE. A SCRATCH MAY RESULT IN A FUEL LEAK. OPENING MUST HAVE PROTECTORS (RUBBER EXTRUSION OR EQUIVALENT) INSTALLED IMMEDIATELY AFTER ACCESS PANEL IS REMOVED.

(e) Replace all backing board screws that have damaged, sharp, or jagged recesses. Assure that screws are the right length.

(f) Clean the cavity thoroughly. Use a vacuum cleaner to clean all surfaces of structure where chips, dirt, grit, or any foreign material may be lodged.

(g) Clean thoroughly all flange surfaces of tubing bulkhead fittings, where there is metal-
to-metal contact, to ensure positive electrical bonding of tubing and fittings to airplane structure. If necessary, spot clean faying surfaces with abrasive or stainless steel rotary brush.

(2) Prepare fuel cell for installation.

(a) If cell has been in storage, check for condition of cell and expiration of shelf life (Ref 28-12-10, Storage). Reject any cell in doubtful condition or which has expired shelf life.

(b) Unfold and handle cell carefully. Comply with fuel cell handling precautions (Ref 28-12-10, Storage).

(c) Wipe outside and inside surface of cell with damp clean cotton wiper (BMS15-5). While wiping, check surfaces for scratches, cuts, abrasions, or obvious damage.

<u>NOTE</u>: It is not necessary to clean new fuel cells if they are installed promptly after removing from containers.

(d) Check all lacing tabs to ensure that hole will accommodate nylon lacing cord.

(e) Check external (sealing) surface of each cell fitting to ensure it is clean and free of nicks and scratches.

1) If new cell is being installed, remove metallic tape discs used during shipping. Should any adhesive from the tape be transferred to the surface of the fitting, it should be removed with gasoline.

2) Remove rubber particles and foreign material by cleaning sealing surfaces with a swab lightly dampened with methyl ethyl ketone.

<u>CAUTION</u>: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA. EXERCISE EXTREME CARE TO ASSURE THAT NO METHYL ETHYL KETONE IS SPILLED ON THE FUEL CELL.

(f) Install new preformed packing in all fuel cell fitting grooves (Fig. 402). Proceed as follows:

1) Obtain preformed packing directly from envelope and check cure date, inspect for cuts, scratches, nicks, or damage. Destroy used or defective preformed packing.

2) Clean cell fitting O-ring groove. Use a pointed wood stick with sharp end covered with clean cotton wiper (BMS15-5) dampened with methyl ethyl ketone. Check O-ring groove for cuts, scratches, dents, distortion, and foreign material. (See step 1.) If O-ring groove is defective, cell fitting must be replaced. See Removable Fuel Cells - Approved Repairs.

3) Check O-ring fit in cell fitting O-ring groove. O-ring should fit groove correctly with no distortion or kinks.

4) Apply light coating of B.F. Goodrich No. 4 rubber cement to O-ring groove with camel hair brush.
5) When cement in O-ring groove becomes "tacky" press O-ring into groove.
6) Roll excess cement from flat surface of cell fitting with finger or thumb.
7) Allow cement to dry for approximately 15 minutes before installing fitting.

(g) Tape cotton wiper (BMS15-5) patches over all bulkhead fittings after O-rings have been installed. This will protect the O-rings during installation of the cell.

(h) Prepare new lacing cords, to replace the discarded ones. (See figure 403.)

1) Lay out the cord lengths between the anchor and tie-off points shown on the cell lacing diagram. Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.
2) Prepare end of new lacing cord for installation. Proceed as follows:

<u>WARNING</u>: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (See step 1.)
b) Roll melted end on any flat surface (see step 2.) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

<u>WARNING</u>: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (steps 3 and 4).
d) Coil the new lacing cord into a small roll, tie with tape and attach one end to the applicable anchor point in the cell cavity. See figure 404 for method of attaching and tying cord.

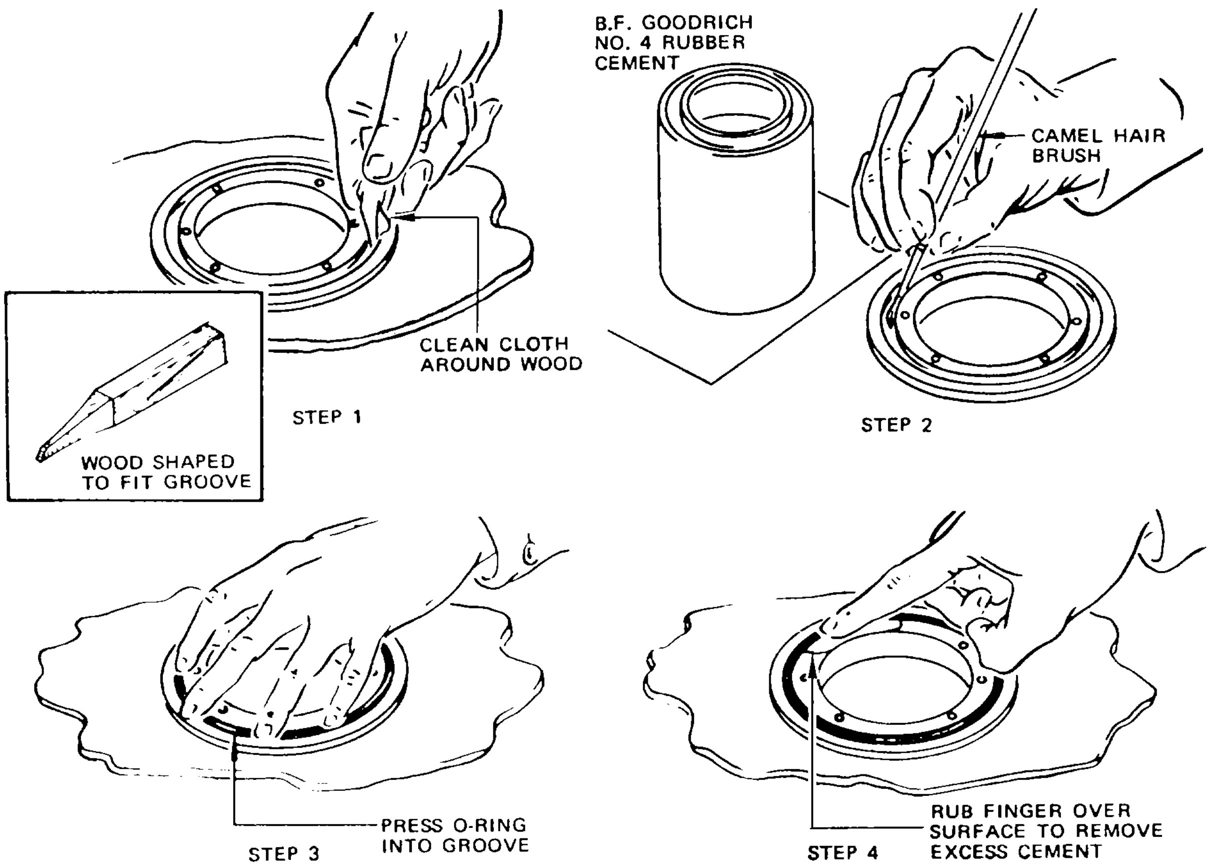
(i) Fold, tie, and place fuel cell in the cavity as described in the handling precautions. Refer to 28-12-10, Fuel Cell - Storage.

(j) Remove the cotton web straps and unfold the cell.

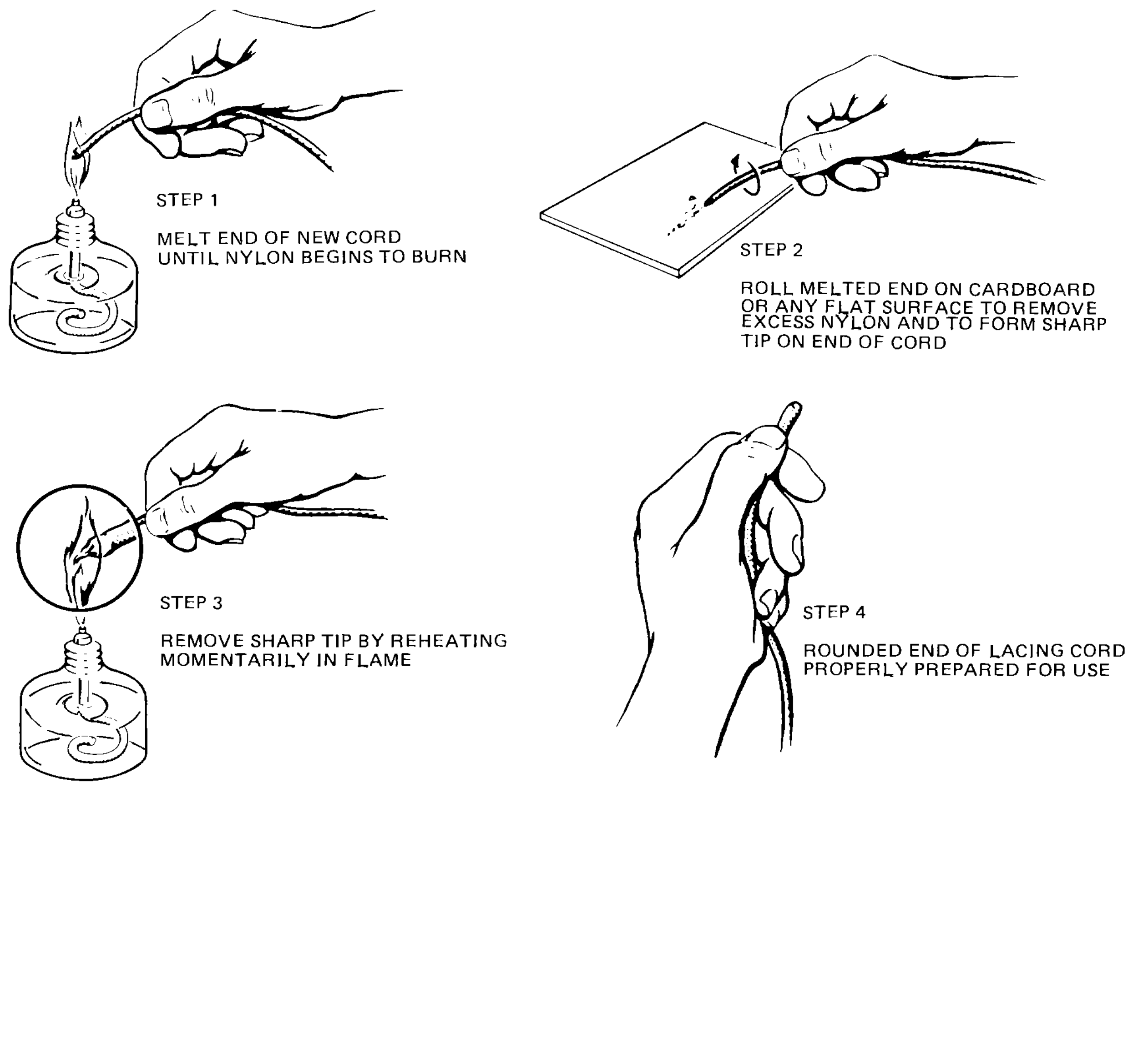
(k) Remove patches over bulkhead cell fittings. Check that new O-rings are properly installed.

E. Install Fuel Cell No. 1 (See figure 405, steps 1 through 9.)

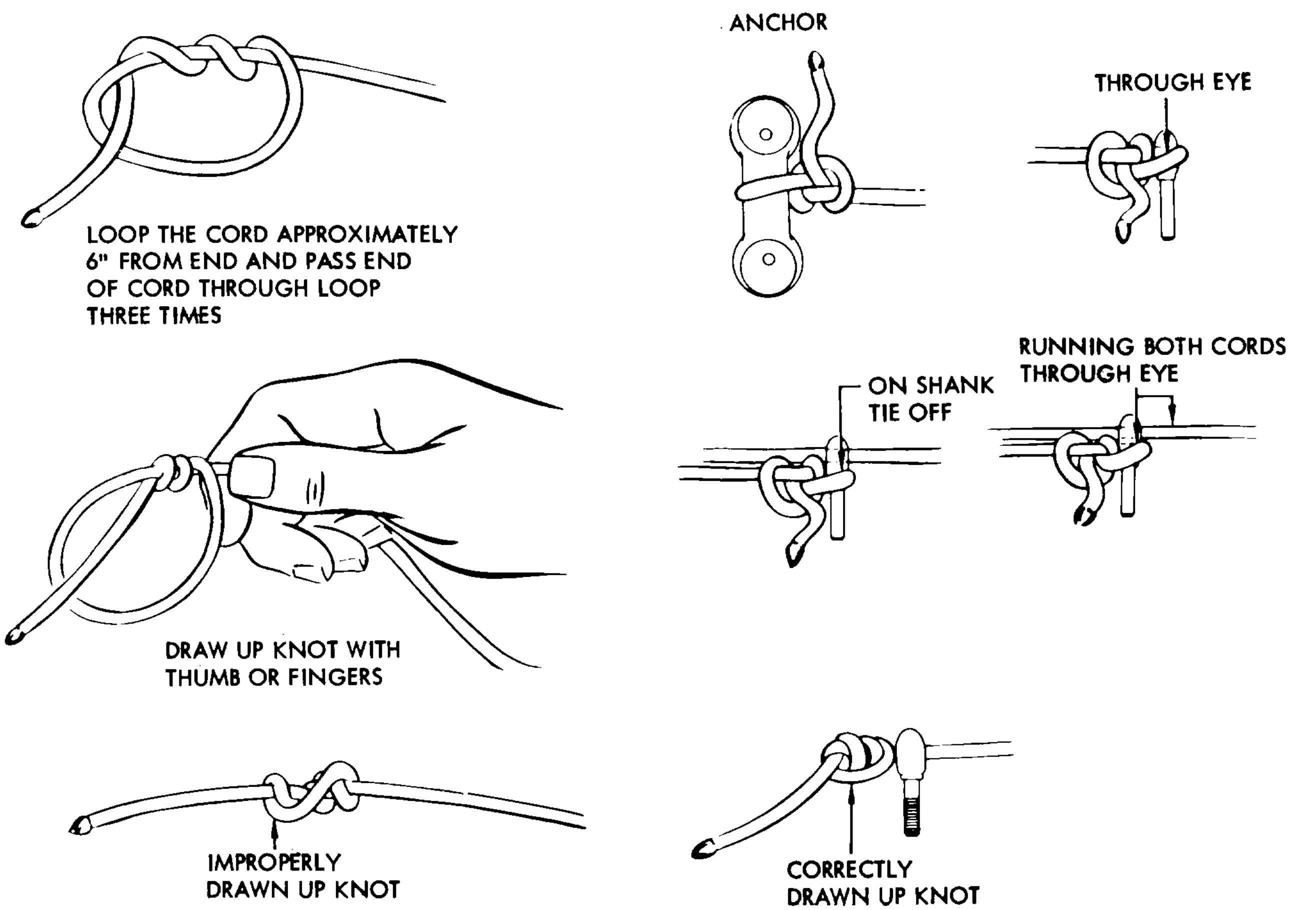
<u>NOTE</u>: Cavity must be cleaned just prior to cell installation. At least two men are required to install a fuel cell.



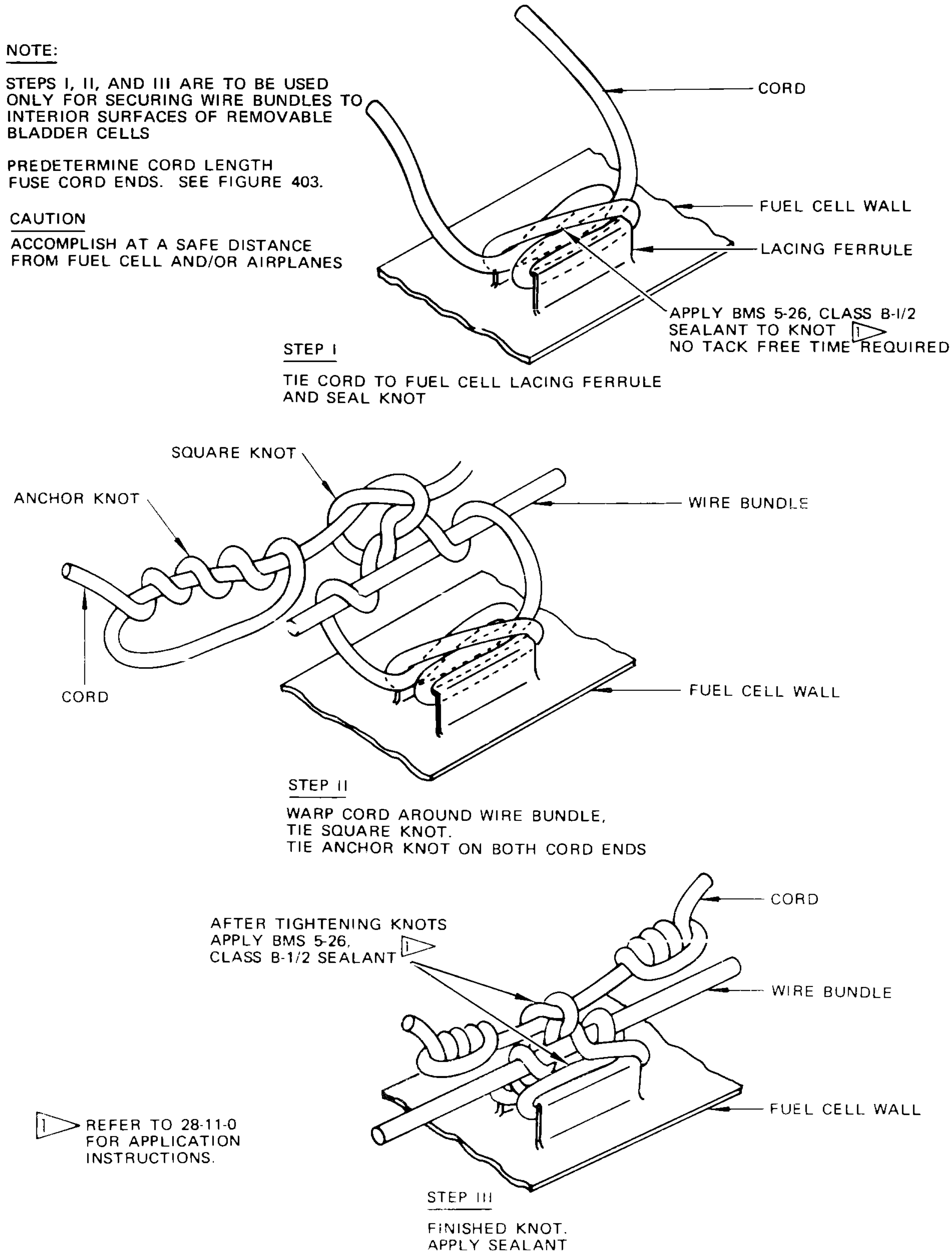
O-Ring Installation
Figure 402



Preparing End of Fuel Cell Lacing Cord for Installation
Figure 403



Fuel Cell Laces and Knots
Figure 404 (Sheet 1)



Fuel Cell Laces and Knots
Figure 404 (Sheet 2)

(1) Lace cord A to its tie-off point and tie-off. (See figure 406.) The tie-off point for A will now be the anchor point for B; lace B to its tie-off point and tie-off. This allows cell to drape in the cavity.

CAUTION: LACING CORDS ARE TO BE TIGHTENED ENOUGH TO HOLD CELL IN PLACE BUT NOT SO TIGHT THAT CELL IS DISPLACED. IN CERTAIN AREAS, IF FIRST CORDS INSTALLED ARE TIGHTENED EXCESSIVELY, FINAL LACING MAY NOT PULL TANK INTO PLACE AND DIFFICULTY IN INSTALLING FITTING MAY BE ENCOUNTERED.

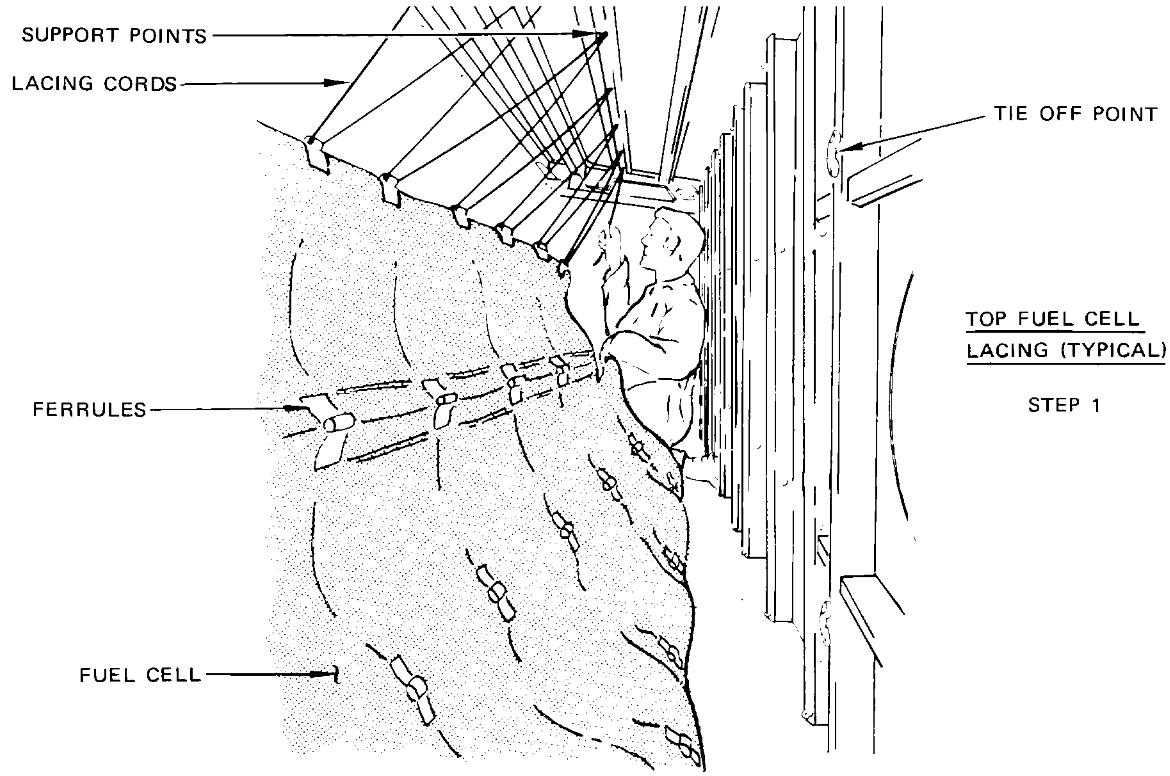
(2) Lace cords C, E, V, D, F, H, and T to their tie-off points, in that order. Take up slack in each cord and tie off.
(3) Lace cord U to U3.
(4) Lace cord A1 to its tie-off point and tie off.
(5) Lace cord L to its tie-off point and tie off.
(6) Lace cord M to its tie-off point and tie loosely.
(7) Lace cord J to its tie-off point and tie off.
(8) Lace cord G to its tie-off point and tie off.
(9) Lace cord K to its tie-off point and tie loosely.
(10) Install equipment support fittings on spanwise beam.
(11) Lace cord N to its tie-off point and tie loosely.
(12) Lace cord R to R3.
(13) Lace cord Q, U and R to their tie-off point and only tie off cord Q.
(14) Lace cord S to S3.
(15) Lace cord P to its tie-off point and tie off.
(16) Tie off cords U and R.
(17) Lace cord W to W3.
(18) Complete lacing of cords S and W to their respective tie-off points and tie off.
(19) Enter the cell.

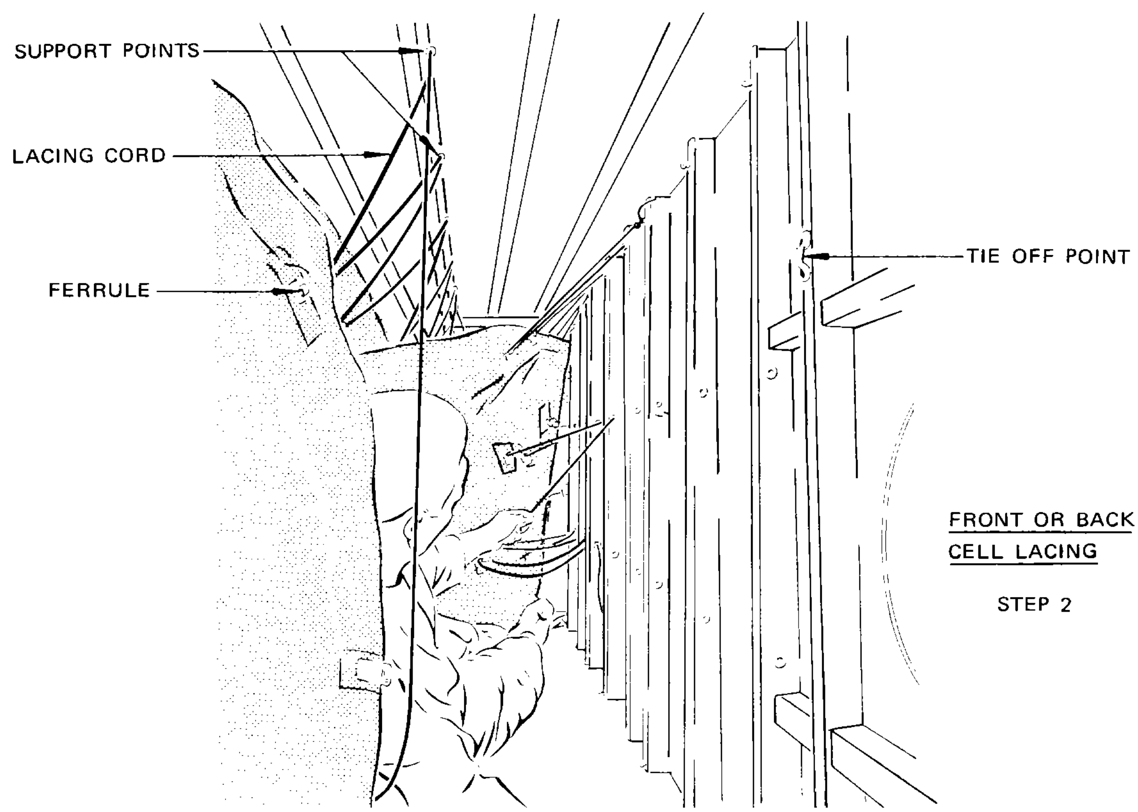
CAUTION: WHEN MOVING AROUND INSIDE THE CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(20) From inside the cell, loosely install bolts in vent interconnect fittings in the top and aft side of the cell. Do not tighten bolts.

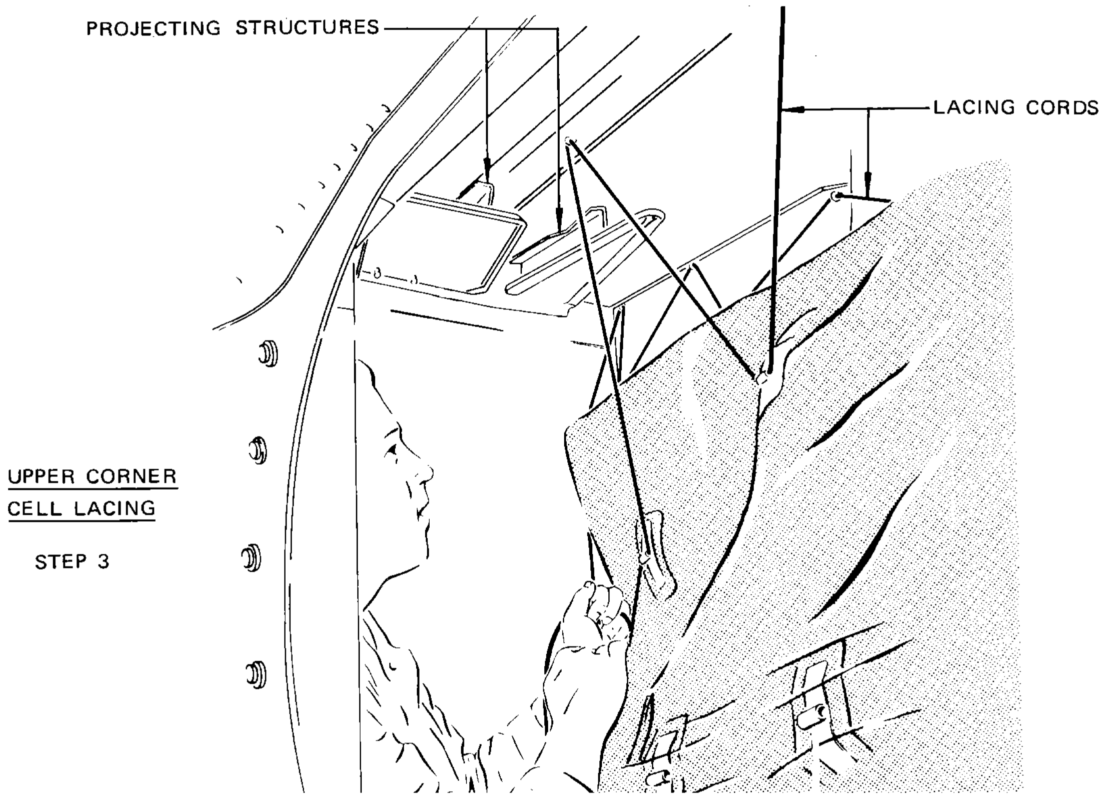
CAUTION: ENSURE THAT LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

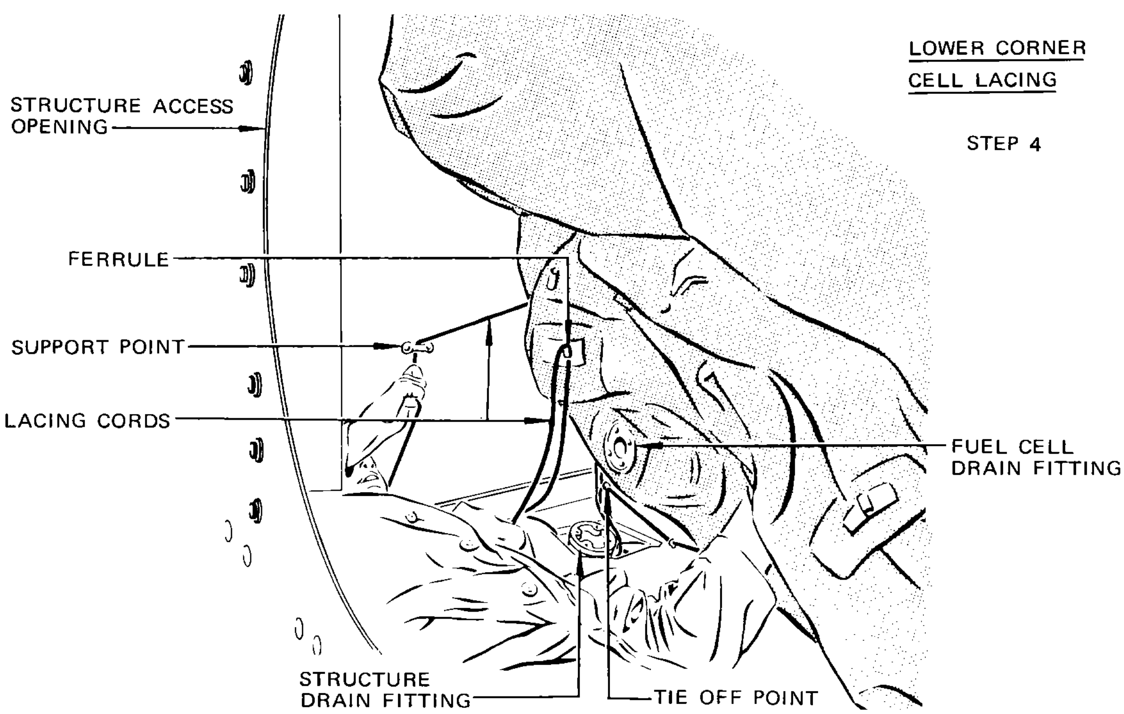
(21) Simultaneously take up slack in cords M, N, and K and tie off.
(22) Torque all bolts in fittings 50 to 70 pound-inches.
(23) Install all plumbing support brackets and lockwire.



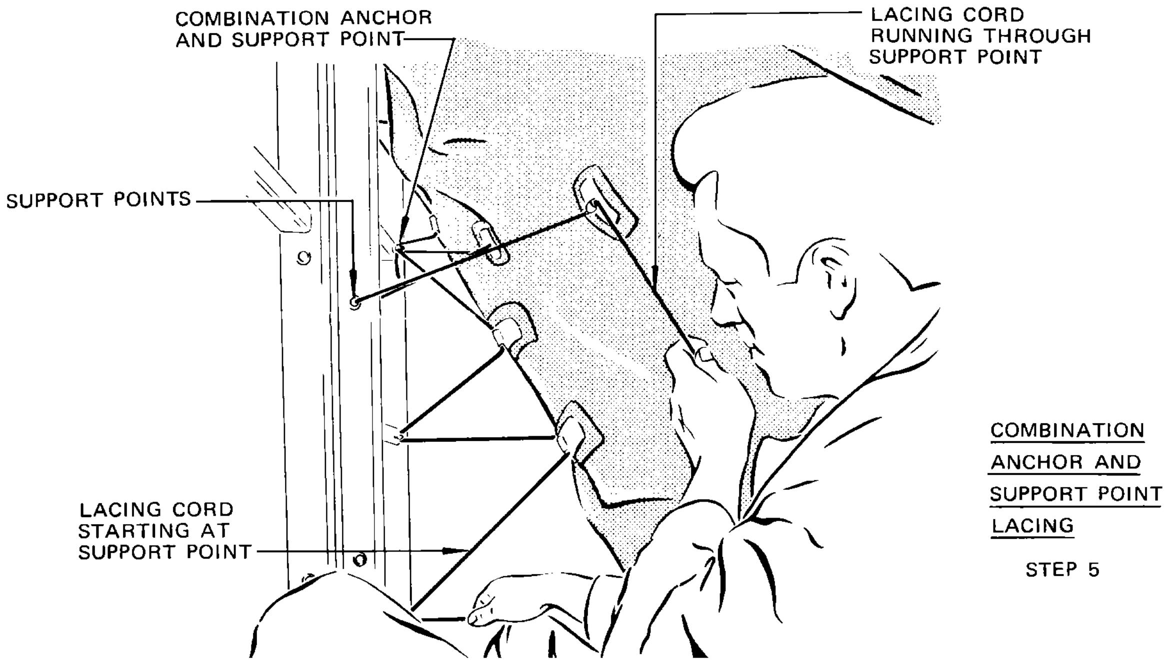


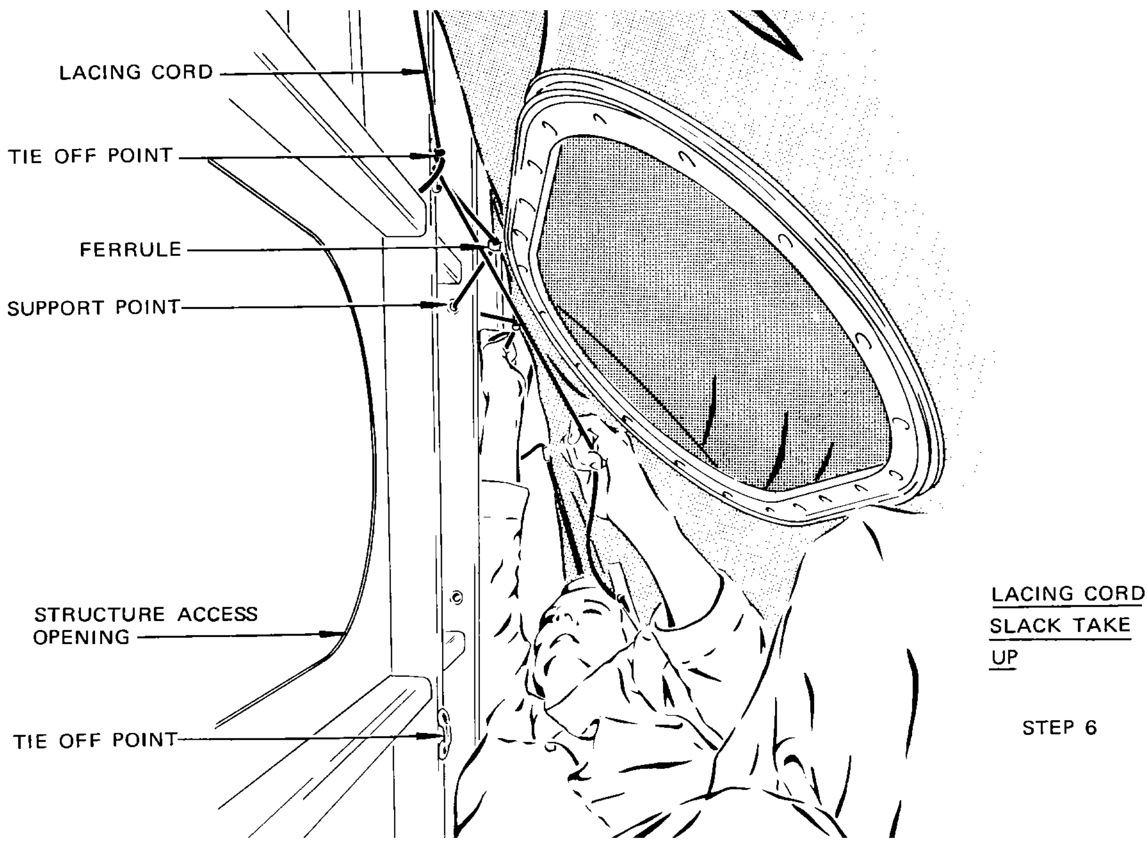
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 1)



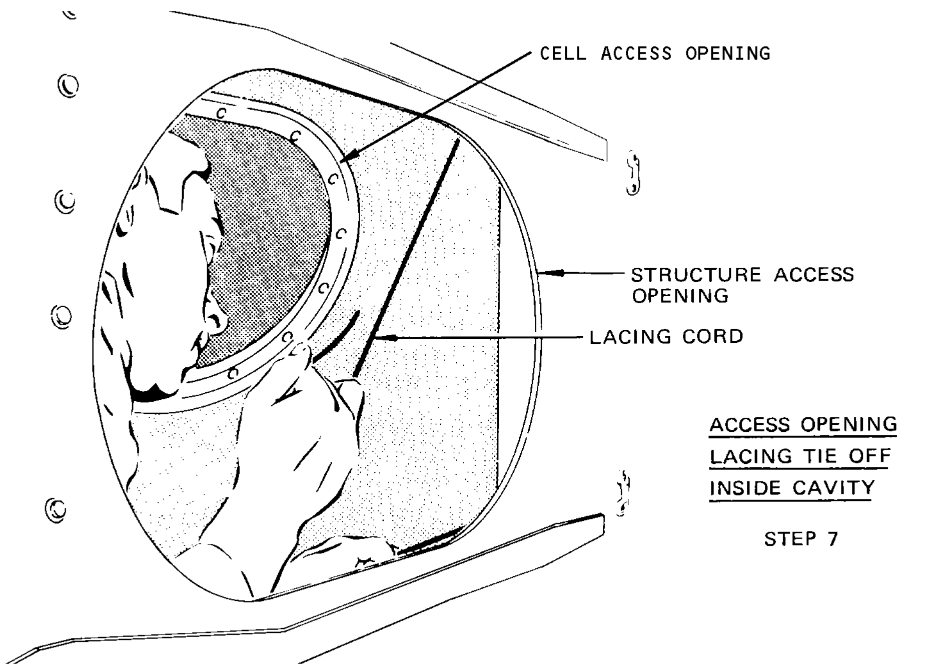


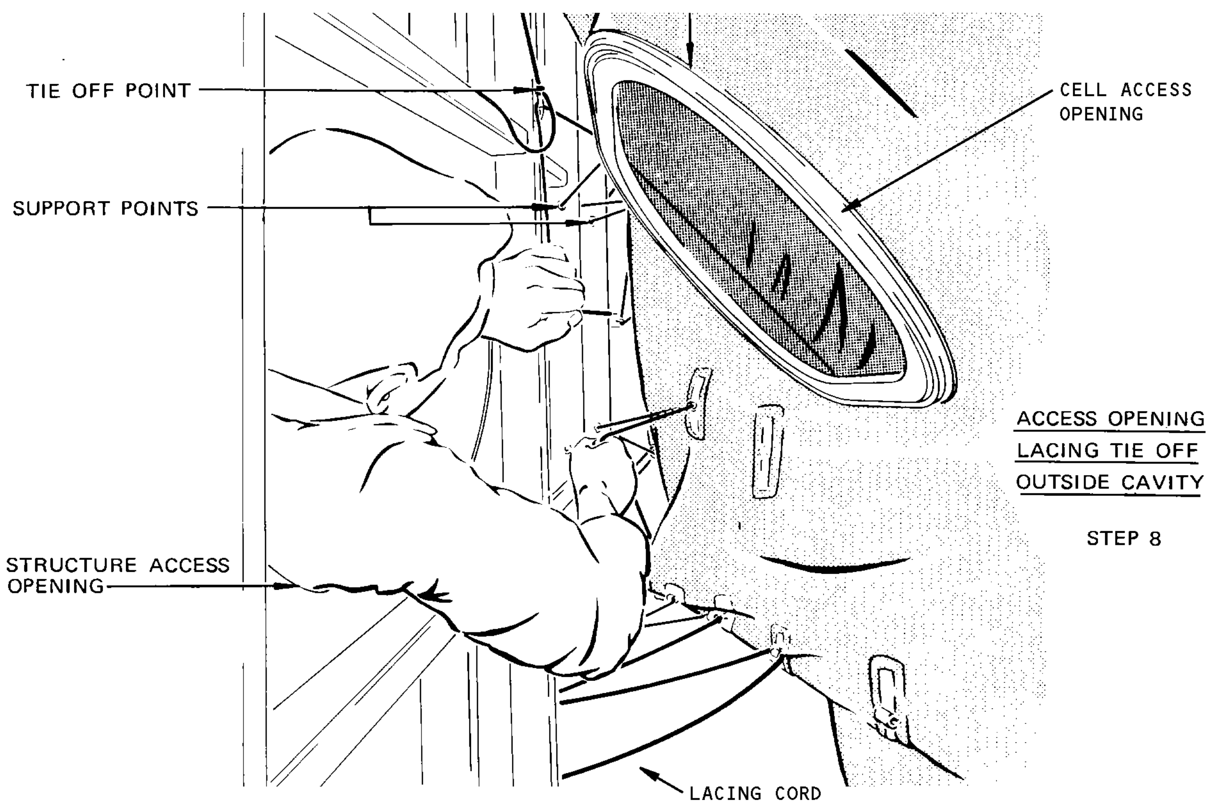
Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 2)



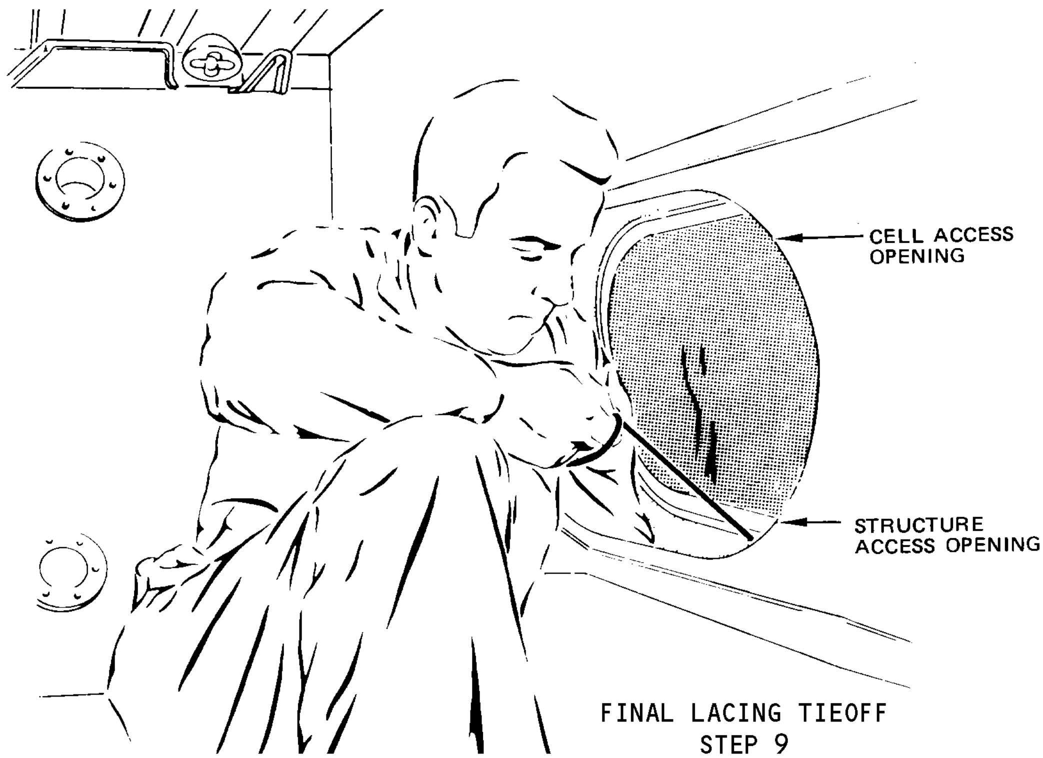


Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 3)

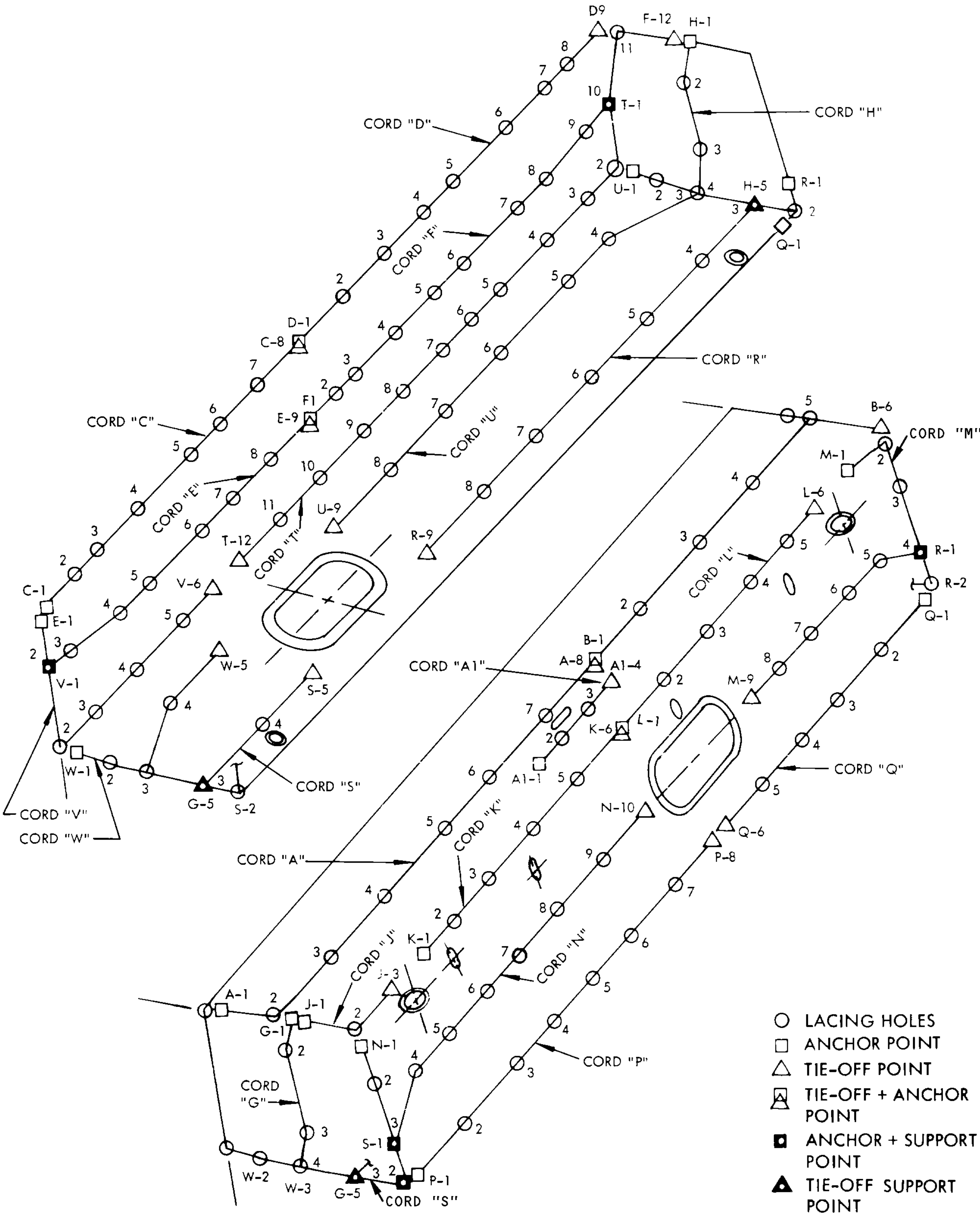




Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 4)



Fuel Cell Unfolding and Lacing
Figure 405 (Sheet 5)



No. 1 Cell Lacing Diagram
Figure 406

(24) With a water dampened and clean cotton wiper (BMS15-5), wipe down the interior of the cell. Check for any loose pieces of lockwire or any foreign material left in cell.
(25) Install bolts in access opening fitting between cells No. 1 and 2.
(26) Install bolts in access opening in bottom of cell.
(27) Put end of vent line through left cell vent interconnect fitting into cell No. 2. Connect vent line in cell No. 2.
(28) Put end of vent line through right cell vent interconnect fitting into cell No. 2. Connect vent line in cell No. 2.
(29) Connect tee section to both vent lines above intercell access opening and lockwire.
(30) Install bolt in vent line bracket at top of cell.
(31) Install bonding jumpers.
(32) Install clamps that hold vent line.
(33) Check electrical bond across vent line bonding jumpers per 20-22-01, I/C. Resistance shall not exceed 0.0l0 ohm.
(34) Install bolts in both cell interconnect fittings.
(35) Install fueling float switch.
(a) Install float switch support bracket.

<u>NOTE</u>: If float switch wires were cut and float switch removed, install switch per 28-21-71, R/I.

(b) From cell No. 2, maneuver float switch and forward end of cell 1 cell 2 conduit section through access opening into cell No. 1.
(c) Drop mounting nut and one washer down on wires and place float switch in support bracket with one washer on top of bracket. Install bottom washer and nut on float switch.
(d) Connect cell 1 cell 2 conduit section to union in cell No. 2 and to float switch in cell No. 1.
(e) Install conduit clamps and bonding jumpers.
(f) Check electrical bond across float switch conduit bonding jumpers per 20-22-01, I/C. Resistance shall not exceed 0.0025 ohm.
(36) With a water dampened and clean cotton wiper (BMS15-5), wipe down the interior of the cell. Check for any loose pieces of lockwire, tools, or any foreign material left in cell.
(37) Install fuel cell access panel (Ref 28-12-31, R/I).
(38) Replace any air conditioning equipment removed to gain access to fuel cell access panel (Ref Chapter 21).
(39) Prior to fueling center tank, check fuel cell for leakage (Ref 28-12-0, I/C).

3. <u>Removal/Installation Fuel Cell No. 2</u>
A. Equipment and Materials
(1) Nylon Lacing Cord - MIL-C-5040, Type III
(2) Solvent - methyl ethyl ketone
(3) Sealant - BMS 5-45, Class B-1/2

(4) Sealant - BMS 5-32
(5) B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
(6) Cement - Rubber Cement No. 4, B.F. Goodrich Co., Los Angeles, California
(7) Polyken - JAN-P-127 #214 Black Type I, Grade B
(8) Pllyurethane Pads - Goodyear Tire and Rubber Co., Los Angeles, California, or Akron, Ohio
(9) Commercial type vacuum cleaner
(10) Camel hair brush
(11) Plastic bucket (2 or 3 gallon)
(12) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

B. Prepare to Remove Fuel Cell No. 2

(1) Defuel airplane (tank No. 1, tank No. 2, and center tank) and purge center fuel tank. Refer to 28-26-0, Defueling and 28-10-0, Fuel Storage System - Maintenance Practices.

WARNING: EXPLOSIVE AND TOXIC DANGERS OF VAPORS IN VICINITY OF FUEL TANKS WHICH HAVE CONTAINED FUEL ARE OF SUCH POTENCY SEVERAL PRECAUTIONS MUST BE FOLLOWED BY PERSONNEL BEFORE ENTERING ANY WETTED OR DRY TANK FOR MAINTENANCE PURPOSES.

(2) Remove air conditioning equipment as necessary to gain access to cavity No. 1 access panel. Refer to Chapter 21, Air Conditioning.
(3) Remove fuel cell access panel (Ref 28-12-31, Removal/Installation).

WARNING: USE ONLY EXPLOSIONPROOF SHIELDED LIGHTS IN AND AROUND FUEL CELLS. DO NOT ALLOW LIGHT TO REST AGAINST CELL WALL.

(4) Remove shoes and put on a pair of tank boot socks just prior to entering the tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.
(5) With a cotton wiper (BMS15-5) mop up the residual fuel before working in the cell.

C. Remove Fuel Cell No. 2 (Fig. 401)

NOTE: At least two men are required to perform a fuel cell removal or installation.

(1) Place all fasteners in a cardboard or plastic container.

CAUTION: WHEN MOVING AROUND IN A FUEL CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(2) Remove fueling float switch (Ref 28-21-71, Removal/Installation).

WARNING: DO NOT REMOVE FLOAT SWITCH BY PULLING SLACK WIRE FROM CONDUIT AND CUTTING UNLESS WIRE IS TO BE REPLACED. A SPLICE WITHIN CONDUIT IS AN EXPLOSION HAZARD.

(a) Disconnect conduit clamps and bonding jumpers in cell No. 2.
(b) Disconnect conduit at couplings and remove from cells No. 1, 2 and 3.

(3) Remove fuel feed line.
(a) Remove clamps holding fuel feed line and float switch conduit.
(b) Disconnect bonding jumper and separate fuel feed line at cell access opening. Have container ready to catch approximately 1 gallon of fuel.
(c) Disconnect tubing at fitting on left end of cell.
(d) Disconnect tubing at fitting on right end of cell.
(e) Carefully move tubing through access opening into cell No. 1. Cover ends of tubing.

(4) Ensure GRD FUELING and FUEL QTY circuit breakers on P6 panel are in open position. Remove tank unit and compensator unit from cell No. 2 (Ref 28-41-21, Removal/Installation).

CAUTION: DO NOT LEAVE ELECTRICAL POWER ON WITH CONNECTOR DISCONNECTED. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

(5) Remove wire bundle from loops and pull into cell No. 3. Stow wire bundle in a neat roll until reinstallation.
(6) Remove right fuel boost pump inlet assembly and cover both ends of line.
(7) Remove vent lines in cell No. 2.
 (a) Remove bonding jumper and disconnect vent line just aft of right vent interconnect fitting.
 (b) Remove bolts attaching vent tube to top of cell.
 (c) Remove vent tube and cover both ends.
 (d) Remove bonding jumper and disconnect vent line just aft of left vent interconnect fitting.
 (e) Disconnect vent line at reducer fitting.
 (f) Remove vent tube and cover both ends.
(8) From inside cell No. 1 remove the bonding jumpers from vent line.
 (a) Disconnect vent lines at connection above intercell access opening.
 (b) Remove clamps and pull tubing through vent interconnect fitting into cell No. 1. Cover all ends of tubing.
(9) From inside cell No. 3, remove the vent float valve.
 (a) Remove clamps holding vent line and pull it into cell No. 2. Cover both ends of tubing.
(10) Remove bolts attaching cell to fuel feed line fitting at left end of tank.
(11) Remove bolts attaching cell to fuel feed line fitting at right end of tank.
(12) Remove all plumbing support brackets.
(13) Remove sump drain fitting from tank sump.
(14) Remove bolts attaching cell No. 1 access opening fitting to cell No. 2 access opening fitting.
(15) Push in on cell No. 1 at access opening to get slack in lacing cords.
(16) Remove equipment support fitting bolts for cell No. 2 from spanwise beam.
(17) Remove bolts securing cell No. 2 access opening fitting to spanwise beam to gain access to lacing tie-off points around opening.

(18) Remove bolts attaching cell No. 2 to cell No. 3 access opening fitting.
(19) Untie lacing at all tie-off points around access openings.
(20) Push in on cell at access opening to get slack in lacing cords. Cords will slip through eyebolts.
(21) Untie lacing at under side of cell as work progresses around cell.
(22) Crawl into cavity and unlace cell.
(23) Remove cords from cell, roll into a neat coil, tie with masking tape and hang at individual anchor points. Any frayed or damaged cord must be replaced with a new cord.
(24) Cover edges of access opening, through which cell will pass when removed, with tape or rubber extrusion.
(25) Cover all fuel cell fitting openings with a cotton wiper (BMS15-5) held in place with tape.
(26) Fold cell for removal from cavity (Ref 28-12-10, Storage).
(27) Remove fuel cell from airplane cavity, taking care to prevent cell from rubbing against structure.
(28) Following removal, the cell is to be cleaned inside and outside with a clean cotton wiper (BMS15-5) moistened with water. Repair cell, if necessary, and store until used (Ref 28-12-10, 28-12-15, Approved Repairs and 28-12-10, Storage).

D. Prepare to Install Fuel Cell No. 2
(1) Prepare fuel cell cavity for cell installation.
(a) Check cavity backing board for raw edges, cracks or otherwise defective or damaged areas. There shall be no raw edges of backing board in contact with cell. Check that all edges of backing board and all lap splices are taped. Refer to Chapter 57, Center Wing Cavity Backing Boards, for replacement of damaged backing boards. If application of new tape is necessary, use Polyken No. 214 black tape per JAN-P-127, type I, grade B.
(b) Check that there are no sharp edges or corners on structure in areas where chafing of fuel cell during handling and service is possible. Round or bevel sharp edges or corners. Tape (Polyken No. 214 black tape) may be used to cover edges of structure or web laps. Web laps of 0.05 or less need not be protected if the edge of the lap, adjacent to the cell, has a broken or rounded edge.

(c) Check that protruding or irregular structure (for example, threaded parts) have adequate coating of sealant for chafing protection. If coating is required, apply BMS 5-32 sealant per applicable instructions in Section 28-11-0.

(d) On all access openings through which cell must pass during installation, cover edges with tape or rubber extrusion to prevent cell from rubbing against structure.

CAUTION: THE SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING IS A SEALING SURFACE. A SCRATCH MAY RESULT IN A FUEL LEAK. OPENING MUST HAVE PROTECTORS (RUBBER EXTRUSION OR EQUIVALENT) INSTALLED IMMEDIATELY AFTER ACCESS PANEL IS REMOVED.

(e) Replace all backing board screws that have damaged, sharp, or jagged recesses. Assure that screws are the right length.

(f) Clean the cavity thoroughly. Use a vacuum cleaner to clean all surfaces of structure where chips, dirt, grit, or any foreign material may be lodged.

(g) Clean thoroughly all flange surfaces of tubing bulkhead fittings, where there is metal-to-metal contact, to ensure positive electrical bonding of tubing and fittings to airplane structure. If necessary, spot clean faying surfaces with abrasive or stainless steel rotary brush.

(2) Prepare fuel cell for installation.

(a) If cell has been in storage, check for condition of cell and expiration of shelf life (Ref 28-12-10, Storage). Reject any cell in doubtful condition or which has expired shelf life.

(b) Unfold and handle cell carefully. Comply with fuel cell handling precautions (Ref 28-12-10, Storage).

(c) Wipe outside and inside surface of cell with damp clean cotton wiper (BMS15-5). While wiping, check surfaces for scratches, cuts, abrasions, or obvious damage.

NOTE: It is not necessary to clean new fuel cells if they are installed promptly after removing from containers.

(d) Check all lacing tabs to ensure that hole will accommodate nylon lacing cord.

(e) Check external (sealing) surface of each cell fitting to ensure it is clean and free of nicks and scratches.

1) If new cell is being installed, remove metallic tape discs used during shipping. Should any adhesive from the tape be transferred to the surface of the fitting, it should be removed with gasoline.

2) Remove rubber particles and foreign material by cleaning sealing surfaces with a swab lightly dampened with methyl ethyl ketone.

<u>CAUTION</u>: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA. EXERCISE EXTREME CARE TO ASSURE THAT NO METHYL ETHYL KETONE IS SPILLED ON THE FUEL CELL.

(f) Install new O-rings in all fuel cell fitting grooves (Fig. 402). Proceed as follows:

1) Obtain O-ring directly from envelope and check cure date, inspect for cuts, scratches, nicks, or damage. Destroy used or defective O-rings.

2) Clean cell fitting O-ring groove. Use a pointed wood stick with sharp end covered with clean cotton wiper (BMS15-5) dampened with methyl ethyl ketone. Check O-ring groove for cuts, scratches, dents, distortion, and foreign material (step 1). If O-ring groove is defective, cell fitting must be replaced (Ref 28-12-10, or 28-12-15, Approved Repairs).

3) Check O-ring fit in cell fitting O-ring groove. O-ring should fit groove correctly with no distortion or kinks.

4) Apply light coating of B.F. Goodrich No. 4 rubber cement to O-ring groove with camel hair brush.

5) When cement in O-ring groove becomes "tacky" press O-ring into groove.

6) Roll excess cement from flat surface of cell fitting with finger or thumb.

7) Allow cement to dry for approximately 15 minutes before installing fitting.

(g) Tape cotton wiper (BMS15-5) patches over all bulkhead fittings after O-rings have been installed. This will protect the O-rings during installation of the cell.

(h) Prepare new lacing cords, to replace the discarded ones. (Fig. 403)

1) Lay out the cord lengths between the anchor and tie-off points shown on the cell lacing diagram. Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.

2) Prepare end of new lacing cord for installation. Proceed as follows:

<u>WARNING</u>: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (Step 1)

b) Roll melted end on any flat surface (Step 2) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

<u>WARNING</u>: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (Steps 3 and 4).

d) Coil the new lacing cord into a small roll, tie with tape and attach one end to the applicable anchor point in the cell cavity. See figure 404 for method of attaching and tying cord.

(i) Fold, tie and place fuel cell in the cavity as described in the handling precautions. Refer to 28-12-10, Fuel Cell - Storage.

(j) Remove the cotton web straps and unfold the cell.

(k) Remove the cotton wiper (BMS15-5) patches over bulkhead cell fittings. Check that new O-rings are properly installed.

E. Install Fuel Cell No. 2 (Fig. 405, steps 1 thru 9)

<u>NOTE</u>: Cavity must be cleaned just prior to cell installation. At least two men are required to install a fuel cell.

(1) Lace cord A to its tie-off point and tie loosely (Fig. 408). The tie-off point for A will now be the anchor point for B; lace B to its tie-off point and tie off. This allows cell to drape in the cavity.

CAUTION: LACING CORDS ARE TO BE TIGHTENED ENOUGH TO HOLD CELL IN PLACE BUT NOT SO TIGHT THAT CELL IS DISPLACED. IN CERTAIN AREAS, IF FIRST CORDS INSTALLED ARE TIGHTENED EXCESSIVELY, FINAL LACING MAY NOT PULL TANK INTO PLACE AND DIFFICULTY IN INSTALLING FITTING MAY BE ENCOUNTERED.

(2) Lace cords C, E, E1, F, G, D, H, J, and K to their tie-off points, in that order. Take up slack in each cord and tie off.
(3) Lace cord L to L3 and cord M to its tie-off point and tie loosely.
(4) Lace cord N to N2 and cord S to its tie-off point and tie loosely.
(5) Enter the cell.

CAUTION: WHEN MOVING AROUND INSIDE THE CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

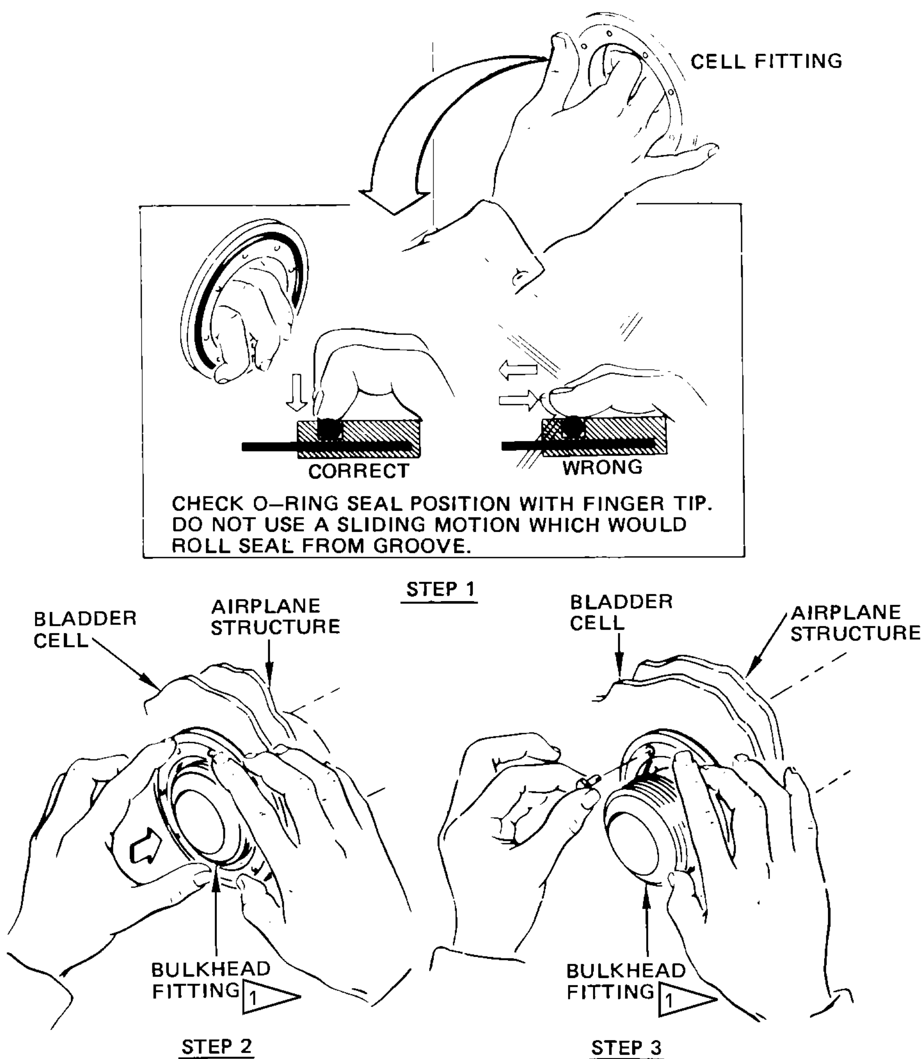
(6) From inside the cell, loosely install bolts in all fittings on the left end of the cell and in intercell access fitting between cell No. 2 and 3. Do not tighten bolts (Fig. 407).

CAUTION: ENSURE THAT LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

(7) Simultaneously take up slack in cords M and S and tie off.
(8) Lace cord L to its tie-off point and tie off.
(9) Lace cord N to its tie-off point and tie off.
(10) Lace cord V to its tie-off point and tie off.
(11) Lace cord W to tie-off point and tie loosely.
(12) Lace cord X to its tie-off point and tie loosely.
(13) Lace cord Y to its tie-off point and tie off.
(14) Lace cords P, Q, and R to their respective tie-off points and tie off.
(15) From inside cell, loosely install bolts in all fittings on the right end of the cell. Do not tighten bolts.

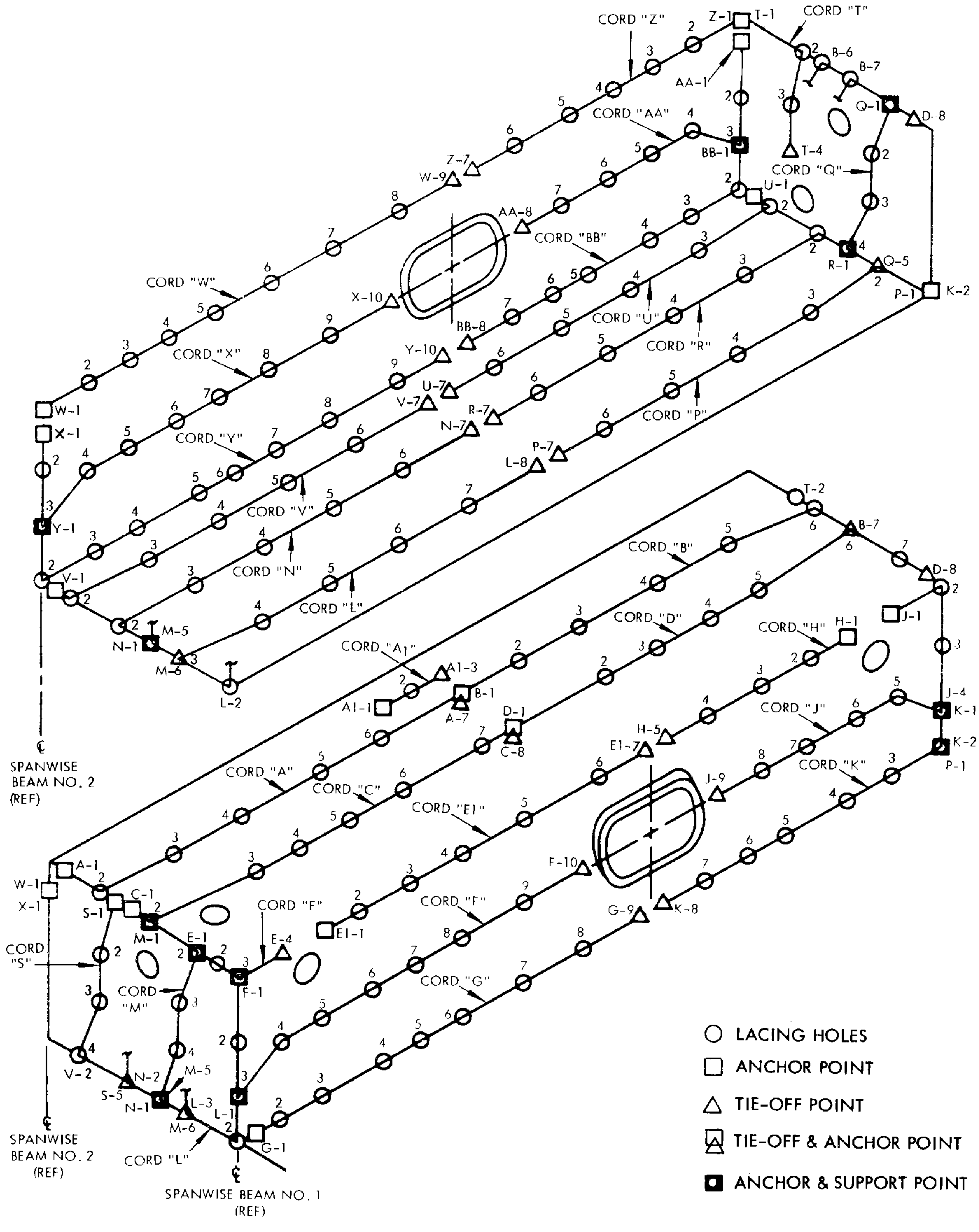
CAUTION: ENSURE THAT LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

(16) Lace cords T and U to their respective tie-off points and tie off.



1 NOT USED IN OPEN TYPE FITTINGS BETWEEN ADJACENT FUEL CELLS

Fuel Cell Fitting Installation
Figure 407



No. 2 Cell Lacing Diagram
Figure 408

(17) Lace cords Z and AA to their respective tie-off points and tie loosely.
(18) Lace cord BB to its tie-off point and tie off.
(19) Lace cord Al to its tie-off point and tie off.
(20) Install equipment support fitting bolts through the spanwise beam from inside cavity No. 1.
(21) Take up slacks in cords W, X, Z, and AA and tie off.
(22) Install bolts in intercell access fitting between cell No. 1 and cell No. 2.
(23) Torque all bolts in fittings 50 to 70 pound-inches.
(24) Install sump drain fitting.
(25) Install all plumbing support brackets and lockwire.
(26) Install fuel feed line and lockwire. Attach any bonding jumpers removed.
(27) Check electrical bond across fuel feed line bonding jumpers per 20-22-0l, I/C. Resistance shall not exceed 0.010 ohm.
(28) Install right fuel boost pump inlet assembly.
(29) Install vent lines in cell No. 2.
  (a) From inside cell No. l, put end of vent tubes through vent interconnect fittings (both right and left) into cell No. 2 Connect other end to vent line above intercell access opening and lockwire.
    1) Install bonding jumpers.
    2) Install clamps that hold vent tube to support brackets.
  (b) Put small vent line through left vent interconnect fitting into cell No. 3.
  (c) From inside cell No. 3 install clamps that hold vent tube to support brackets.
    1) Install vent float valve.
  (d) Install vent tube on left side of cell between reducer and vent tube coming in from cell No. 1 and lockwire. Connect tube to fitting in top of cell.
  (e) Install vent tube on right side at fitting in top of cell. Connect other end of tube to tube coming in from cell No. 1 and lockwire.
  (f) Install bonding jumpers.
  (g) Check electrical bond across vent tube bonding jumpers per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(30) Install tank unit and compensator unit (Ref 28-41-21, R/I).
(31) Install wire bundle in cell No. 2 (Fig. 403, 404).
(32) Connect wires to tank and compensator unit(s).
(33) Install float switch wire conduit in cells No. 3, 2 and 1 and install conduit clamps and bonding jumpers.
(34) Check electrical bond across float switch conduit bonding jumpers per 20-22-01, I/C. Resistance shall not exceed 0.0025 ohm.
(35) Install float switch on bracket in cell No. 1 (Ref 28-21-71, R/I).

(36) With a water-dampened and clean cotton wiper (BMS15-5), wipe down the interior of the cell. Check for any loose pieces of lockwire, tools, or any foreign material left in cell.
(37) Install access panel (Ref 28-12-31, R/I).
(38) Replace any air conditioning equipment removed to gain access to center tank access panel (Ref Chapter 21).
(39) Prior to fueling center tank, check fuel cell for leakage (Ref 28-12-0, I/C).

4. Removal/Installation Fuel Cell No. 3

A. Equipment and Materials
(1) Sealant - BMS 5-32
(2) Cement - Rubber Cement No. 4, B.F. Goodrich Co., Los Angeles, California
(3) Polyken - JAN-P-127 #214 Black Type I, Grade B
(4) Polyurethane pads - Goodyear Tire and Rubber Co., Los Angeles, California, or Akron, Ohio
(5) Commercial type vacuum cleaner
(6) Camel hair brush
(7) Plastic bucket (2 or 3 gallon)
(8) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

B. Prepare to Remove Fuel Cell No. 3
(1) Defuel airplane (tank No. 1, tank No. 2, and center tank) and purge center fuel tank (Ref 28-23-0, 28-10-0 Maintenance Practices).

WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

(2) Ensure that GRD FUELING and FUEL QTY circuit breakers on P6 panel are in open position. Disconnect electrical connector from fuel tank bussing plug and remove plug from rear spar (Fig. 401).

CAUTION: DO NOT LEAVE ELECTRICAL POWER ON WITH CONNECTORS DISCONNECTED. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

(3) Remove screws attaching removable fuel cell bulkhead receptacle to rear spar and fuel cell fitting.

CAUTION: BE EXTREMELY CAREFUL WITH RECEPTACLE PINS AND/OR SOCKETS. THE RECEPTACLE IS A PART OF THE FUEL TANK WIRING HARNESS ASSEMBLY. DAMAGE TO THE RECEPTACLE WILL RESULT IN THE REMOVAL OF THE COMPLETE HARNESS ASSEMBLY.

(4) Remove equipment support fitting bolts for cell No. 3, located in wheel well.

(5) Remove air conditioning equipment as necessary to gain access to fuel cell access panel (Ref Chapter 21).

(6) Remove fuel cell access panel (Ref 28-12-31, Removal/Installation).

<u>WARNING</u>: USE ONLY EXPLOSIONPROOF SHIELDED LIGHTS IN AND AROUND FUEL CELLS. DO NOT ALLOW LIGHT TO REST AGAINST CELL WALL.

(7) Remove shoes and put on a pair of tank boot socks just prior to entering the tank. Do not allow socks to pick up any metal shavings or dirt from ladder or aerostand.

C. Remove Fuel Cell No. 3 (See figure 401.)

<u>NOTE</u>: At least two men are required to perform a fuel cell removal or installation.

(1) Place all fasteners in a cardboard or plastic container.

<u>CAUTION</u>: WHEN MOVING AROUND IN A FUEL CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(2) Remove tank units from cell No. 3 (Ref 28-41-21, Removal/Installation). Remove tank and compensator unit from cell No. 2, if necessary.

(3) Remove vent line and float valve.

(4) Remove fueling float switch and conduit.
   (a) Remove float switch from bracket in cell No. 1 (Ref 28-21-71, Removal/Installation.
   (b) Remove clamp and bonding jumper on cell 2/cell 3 section of conduit and uncouple conduit section from union in cell No. 2 and fitting in cell No. 3. Remove conduit section from cell.

(5) Disconnect and remove wire bundle from cell No. 2. Pull wire through vent interconnect fitting into cell No. 3.

(6) Remove wire bundle and bulkhead receptacle from cell No. 3. Stow until reinstallation.

(7) Remove boost pump vent manifold line.
   (a) Detach clamps holding boost pump vent manifold line to tank No. 1 pressure refuel line.
   (b) Disconnect bonding jumper and separate vent manifold line at cell access opening using a suitable container to catch any trapped fuel.
   (c) Disconnect left tubing at left side of cell. Catch trapped fuel.
   (d) Disconnect right tubing at branch line of pressure refuel line outlet assembly (detail F). Catch trapped fuel.
   (e) Cover tube open ends and remove tubing from cell.

   CAUTION: USE CARE IN MANEUVERING LENGTHS OF TUBING OUT OF CELLS AND CENTER TANK TO AVOID DAMAGE TO TUBING AND SURROUNDINGS.

(8) Remove main tank No. 1 pressure refuel line.
   (a) Detach clamps holding pressure refuel line to inside of cell.
   (b) Disconnect bonding jumper and separate fuel line at cell access opening. Have container ready to catch approximately 1 gallon of fuel.
   (c) Disconnect tubing at fitting on left side of cell.
   (d) Disconnect tubing at fitting on right side of cell.
   (e) Cover tub e open ends and remove tubing from cells and out of airplane.
(9) Loosen tube nut and remove pressure refuel line outlet assembly, on right side of cell, leaving check valve attached. (See detail F.) Cover both ends and branch of outlet assembly.
(10) Remove LH fuel boost pump inlet assembly and cover both ends of line.
(11) Remove APU fuel feed line.
   (a) Detach clamps holding APU fuel feed line to aft interior of cell.
   (b) Disconnect tubing at left side of cell. Catch any trapped fuel.

(c) Disconnect tubing at fitting in upper surface of cell. Cover both ends and remove tubing.

(12) Remove bolts from tank vent interconnect fitting from forward left side of cell.

NOTE: Place all loose parts in marked containers to prevent loss of parts or damage to cell and to facilitate installation.

(13) Remove bolts from the left fuel boost pump inlet fitting.
(14) Remove bolts from cell interconnect fitting from forward lower left corner of cell.
(15) Remove bolts from pressure refuel line fitting at left side of cell.
(16) Remove boost pump vent fitting bulkhead nut and washer from left side of cell.
(17) Remove bolts from two pressure refuel line fittings at right side of tank.
(18) Remove conduit fitting bulkhead nut and washer from right side of cell.
(19) Remove bolts from tank vent interconnect fitting from right side of cell front end.
(20) Remove bolts from cell interconnect fitting from forward lower right corner of cell.
(21) Remove bolts securing access opening fittings between cell No. 2 and cell No. 3.
(22) Remove bolts securing access opening fitting for cell No. 3 to spanwise beam to gain access to lacing tie-off points around opening.
(23) Untie lacing at all tie-off points around access opening for cell No. 2 and cell No. 3.
(24) Push in on cell at access openings to get slack in lacing cords. Cords will slip through eyebolts.
(25) Remove equipment support fitting bolts for cell No. 3 from inside cavity No. 2.
(26) Untie lacing at underside of cell No. 3 as work progresses around cell.

(27) Crawl into cavity and unlace cell.

(28) Remove cords from cell, roll into a neat coil, tie with masking tape and hang at individual anchor points. Any frayed or damaged cord must be replaced with a new cord.

(29) Cover edges of access opening, through which cell will pass when removed, with tape or rubber extrusion.

(30) Cover all fuel cell fitting openings with a cotton wiper (BMS15-5) held in place with tape.

(31) Fold cell for removal from cavity (Ref 28-12-10, Storage).

(32) Remove fuel cell from airplane cavity, taking care to prevent cell from rubbing against structure.

(33) Following removal, the cell is to be cleaned inside and outside with a clean cotton wiper (BMS15-5), moistened with water and repaired and stored as necessary (AMM 28-12-10/801, AMM 28-12-15/801, AMM 28-12-10/201).

D. Prepare to Install Fuel Cell No. 3

(1) Prepare fuel cell cavity for cell installation.

(a) Check cavity backing board for raw edges, cracks or otherwise defective or damaged areas. There shall be no raw edges of backing board in contact with cell. Check that all edges of backing board and all lap splices are taped. Refer to Chapter 57, Center Wing Cavity Backing Boards, for replacement of damaged backing boards. If application of new tape is necessary, use Polyken No. 214 black tape per JAN-P-127, type I, grade B.

(b) Check that there are no sharp edges or corners on structure in areas where chafing of fuel cell during handling and service is possible. Round or bevel sharp edges or corners. Tape (Polyken No. 214 black tape) may be used to cover edges of structure or web laps. Web laps of 0.05 or less need not be protected if the edge of the lap, adjacent to the cell, has a broken or rounded edge.

(c) Check that protruding or irregular structure (for example, threaded parts) have adequate coating of sealant for chafing protection. If coating is required, apply BMS 5-32 sealant (Ref 28-11-0, Approved Repairs).

(d) On all access openings through which cell must pass during installation, cover edges with tape or rubber extrusion to prevent cell from rubbing against structure.

CAUTION: THE SURFACE OF THE SKIN AROUND THE ACCESS PANEL OPENING IS A SEALING SURFACE. A SCRATCH MAY RESULT IN A FUEL LEAK. OPENING MUST HAVE PROTECTORS (RUBBER EXTRUSION OR EQUIVALENT) INSTALLED IMMEDIATELY AFTER ACCESS PANEL IS REMOVED.

(e) Replace all backing board screws that have damaged, sharp, or jagged recesses. Assure that screws are the right length.

(f) Clean the cavity thoroughly. Use a vacuum cleaner to clean all surfaces of structure where chips, dirt, grit, or any foreign material may be lodged.

(g) Clean thoroughly all flange surfaces of tubing bulkhead fittings, where there is metal-to-metal contact, to ensure positive electrical bonding of tubing and fitting to airplane structure. If necessary, spot clean faying surfaces with abrasive or stainless steel rotary brush.

(2) Prepare fuel cell for installation.

(a) If cell has been in storage, check for condition of cell and expiration of shelf life (Ref 28-12-10, Storage). Reject any cell in doubtful condition or which has expired shelf life.

(b) Unfold and handle cell carefully. Comply with fuel cell handling precautions (Ref 28-12-10, Storage).

(c) Wipe outside and inside surface of cell with damp clean cotton wiper (BMS15-5). While wiping, check surfaces for scratches, cuts, abrasions, or obvious damage.

NOTE: It is not necessary to clean new fuel cells if they are installed promptly after removing from containers.

(d) Check all lacing tabs to ensure that hole will accommodate nylon lacing cord.

(e) Check external (sealing) surface of each cell fitting to ensure it is clean and free of nicks and scratches.

1) If new cell is being installed, remove metallic tape disks used during shipping. Should any adhesive from the tape be transferred to the surface of the fitting, it should be removed with gasoline.

2) Remove rubber particles and foreign material by cleaning sealing surfaces with a swab lightly dampened with methyl ethyl ketone.

CAUTION: METHYL ETHYL KETONE IS TOXIC. USE ONLY IN WELL VENTILATED AREA.
EXERCISE EXTREME CARE TO ASSURE THAT NO METHYL ETHYL KETONE IS SPILLED ON THE FUEL CELL.

(f) Install new O-rings in all fuel cell fitting grooves. (See figure 402.) Proceed as follows:

1) Obtain O-ring directly from envelope and check cure date, inspect for cuts, scratches, nicks, or damage. Destroy used or defective O-rings.

2) Clean cell fitting O-ring groove. Use a pointed wood stick with sharp end covered with clean cotton wiper (BMS15-5) dampened with methyl ethyl ketone. Check O-ring groove for cuts, scratches, dents, distortion, and foreign material. (See step 1.) If O-ring groove is defective, cell fitting must be replaced. Refer to Removable Fuel Cells - Approved Repairs.

3) Check O-ring fit in cell fitting O-ring groove. O-ring should fit groove correctly with no distortion or kinks.

4) Apply light coating of B.F. Goodrich No. 4 rubber cement to O-ring groove with camel hair brush.

5) When cement in O-ring groove becomes "tacky" press O-ring into groove.

6) Roll excess cement from flat surface of cell fitting with finger or thumb.
7) Allow cement to dry for approximately 15 minutes before installing fitting.

(g) Tape cotton wiper (BMS15-5) patches over all bulkhead fittings after O-rings have been installed. This will protect the O-rings during installation of the cell.

(h) Prepare new lacing cords, to replace the discarded ones. (See figure 403.)

1) Lay out the cord lengths between the anchor an d tie-off points shown on the cell lacing diagram. Allow an additional 24 inches in length for tying off and anchoring and for the slack between lacing locations.
2) Prepare end of new lacing cord for installation. Proceed as follows:

<u>WARNING</u>: THIS LACING CORD PREPARATION MUST BE PERFORMED IN AN EXPLOSION PROOF AREA.

a) Melt ends of new cord until nylon begins to burn. (Refer to step 1.)
b) Roll melted end on any flat surface (refer to step 2) to remove excess nylon and to form sharp tip on end of cord. Do not touch hot nylon with the bare fingers.

<u>WARNING</u>: SEVERE BURNS WILL RESULT FROM PERSONAL CONTACT WITH HOT NYLON.

c) Remove sharp tip formed in step 2 by reheating momentarily in flame (steps 3 and 4).
d) Coil the new lacing cord into a small roll, tie with tape and attach one end to the applicable anchor point in the cell cavity. See figure 404 for method of attaching and tying cord.

(i) Fold, tie, and place fuel cell in the cavity as described in the handling precautions. Refer to 28-12-10, Fuel Cell - Storage.

(j) Remove the cotton web straps and unfold the cell.
(k) Remove the cotton wiper (BMS15-5) patches over bulkhead cell fittings. Check that new O-rings are properly installed.

E. Install Fuel Cell No. 3 (See figure 405, steps 1 through 9.)

NOTE: Cavity must be cleaned just prior to cell installation. At least two men are required to install a fuel cell.

(1) Lace cord A to its tie-off point and tie loosely. (See figure 409.) The tie-off point for A will now be the anchor point for B; lace B to its tie-off point and tie off. This allows cell to drape in the cavity.

CAUTION: LACING CORDS ARE TO BE TIGHTENED ENOUGH TO HOLD CELL IN PLACE BUT NOT SO TIGHT THAT CELL IS DISPLACED. IN CERTAIN AREAS, IF FIRST CORDS INSTALLED ARE TIGHTENED EXCESSIVELY, FINAL LACING MAY NOT PULL TANK INTO PLACE AND DIFFICULTY IN INSTALLING FITTING MAY BE ENCOUNTERED.

(2) Lace cords C, E, G, J, and L to their tie-off points, in that order. Take up slack in each cord and tie off.
(3) The tie-off points for C, E, G, J, and L will now be the anchor points for D, F, H, K, and M respectively. Lace D, F, H, K, and M to their tie-off points and tie off.
(4) Lace cord T to its tie-off point and tie off.
(5) Lace cord U and cord X to their tie-off points and tie off.
(6) Lace cord Q to Q2 and cord Z to Z2.
(7) Enter the cell.

CAUTION: WHEN MOVING AROUND INSIDE THE CELL, DO NOT STEP ON OR OTHERWISE APPLY PRESSURE TO A CREASE OR A FOLD. BE CAREFUL NOT TO DROP TOOLS INSIDE CELL.

(8) From inside cell, check O-ring seal position on all left side cell fittings (Step 1, Fig. 407). Guide cell fittings in place on respective bulkhead fittings in adjacent structure (step 2).

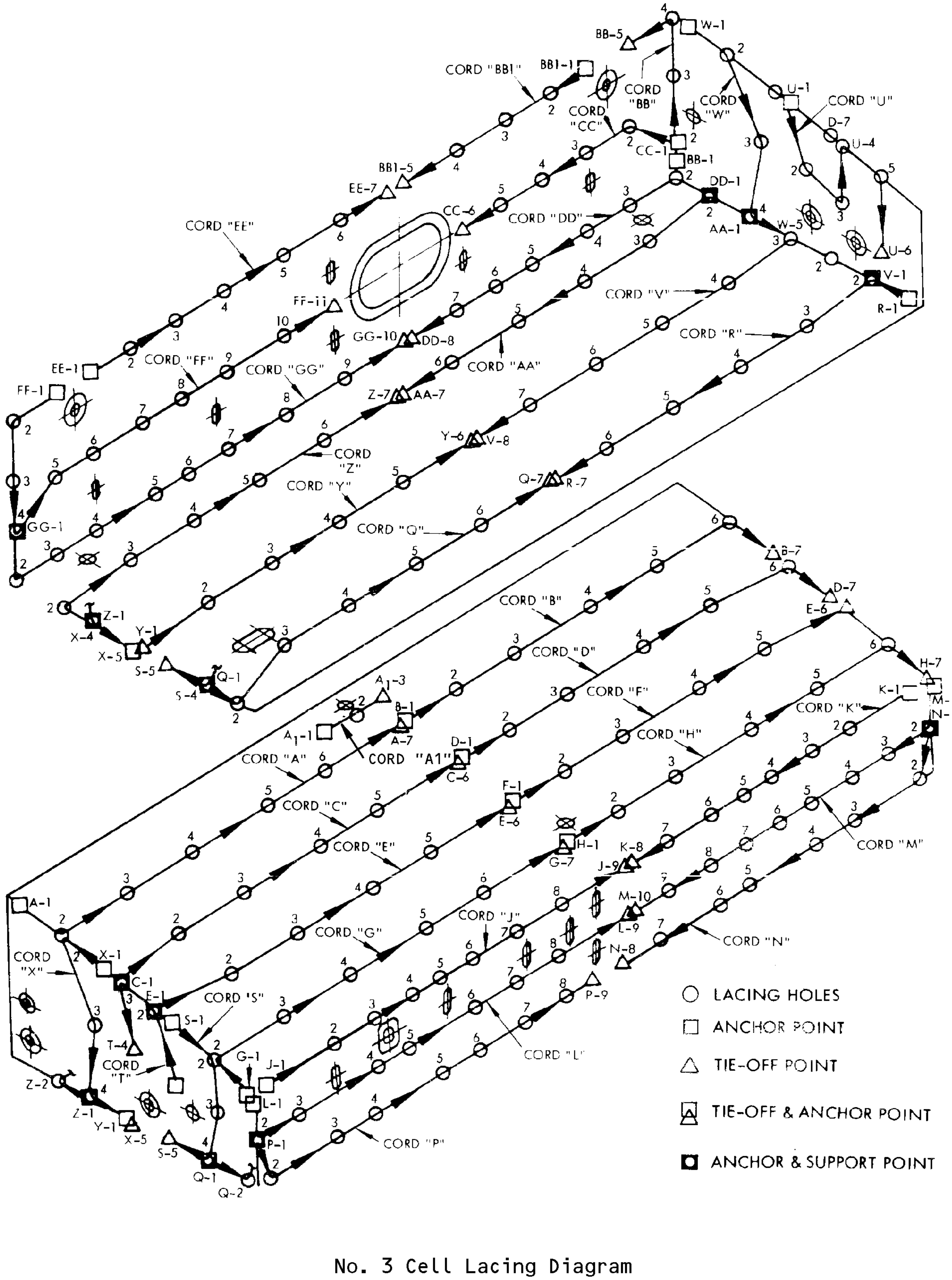
CAUTION: ENSURE THAT LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

(a) On fittings with bolted flange, install bolts, leaving bolts loose (Step 2, Fig. 407). On fittings with plain flange, install bulkhead washer and nut, leaving nut loose (Detail E, Fig. 401).

(9) Simultaneously lace cords S and N to their tie-off points and tie off.
(10) Lace cord P to its tie-off point and tie off.
(11) Lace cord Q completely, take up slack in cord and tie off.
(12) Lace cord Y to its tie-off point and tie loosely.
(13) Lace cord R to its tie-off point and tie off.
(14) Lace cords W and V to their tie-off points and tie loosely.
(15) Repeat step 4.E.(8) for all right side cell fittings and APU upper fitting.
(16) Take up slack in cords V, W, and Y and tie off.
(17) Lace cord Z to its tie-off point and tie off.
(18) Lace cords AA, DD, and GG to their respective tie-off points and tie off.
(19) Lace cord FF to its tie-off point and tie loosely.
(20) Lace cord EE to its tie-off point and tie loosely.
(21) Lace cord BB to its tie-off point and tie off.
(22) Lace cord CC to its tie-off point and tie loosely.
(23) Lace cord BB1, to its tie-off point and tie loosely.
(24) Lace cord Al, to its tie-off point and tie off.
(25) Install equipment support fitting bolts for cell No. 3 from inside cavity No. 2.
(26) From inside cell, guide vent interconnect cell fittings in place on spanwise bean bulkhead fittings . Install bolts loosely (Fig. 407).

<u>CAUTION</u>: ENSURE THAT LACING DOES NOT GET CAUGHT BETWEEN CELL FITTINGS AND MATING SURFACES AS IMPROPER POSITION OF LACING MAY CAUSE FUEL LEAKAGE.

(27) Take up slack in cords FF, EE, CC, and BB1, and tie off.
(28) Take up slack in cords at cell No. 2 intercell access opening and tie off.



No. 3 Cell Lacing Diagram
Figure 409

(29) Tighten all bolts in bolted flange-type fittings, 50 to 70 pound-inches.
(30) Tighten all bulkhead nuts in plain flange-type fittings, 100 to 125 pound-inches.
(31) Install equipment support fitting bolts for aft side of cell No. 3 from wheel well area.

F. Install plumbing inside fuel cell No. 3 (Fig. 401)
(1) Install support brackets for main tank No. 1 pressure refuel line, vent line, and APU fuel feed line.
(2) Install main tank No. 1 pressure refuel line.
(a) Connect right tubing at bulkhead fitting on right side of cell, leaving tubing nut loose.
(b) Connect left tubing at bulkhead fitting on left side of cell and to right tubing section at cell access door.
(c) Tighten left and right tubing at sides and at cell access door.
(d) Install bonding jumper, clamps, and lockwire.
(e) Check electrical bond across bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(3) Install left fuel boost pump inlet assembly and lockwire connections.
(4) Install pressure refuel outlet assembly on right side of cell (Detail F, Fig. 401).
(a) Ensure that check valve is installed on outlet end of tube.
(b) Place outlet assembly in position, with branch line outlet facing forward, and engage threads of tube nut with bulkhead fitting. Leave tube nut loose.
(5) Install boost pump vent manifold line.
(a) Connect right tubing at branch line connection of pressure refuel outlet assembly (Detail F, Fig. 401). Leave tube nut loose.
(b) Connect left tubing at left side of cell and to right tubing near cell access door. Leave tube nuts loose.
(c) After checking tube alignment, tighten all three tube nuts and install bonding jumper at center connection.
(d) Attach clamps holding boost pump vent manifold line to tank No. 1 pressure refuel line.

(e) Check electrical bond across bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.

(6) Hold pressure refuel outlet assembly in alignment and tighten tube nut left loose in step 4.F.(4)(b).

(7) Position tank vent line with vent float valve to bulkhead vent interconnect fitting, at forward left side of cell, engage tube nut, and tighten. Install tube clamps and bonding jumper.

(8) Connect APU fuel feed line to bulkhead fittings at left side and upper rear of cell. Attach clamps.

(9) Install section of float switch wire conduit.

(a) Position section of conduit with forward end projecting through upper right interconnect opening into cell No. 2.

(b) Couple conduit to union in cell No. 2 and to bulkhead fitting in upper right side of cell No. 3.

(c) Attach conduit clamp and bonding jumper in cell No. 2.

(d) Check electrical bond across bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.

G. Install electrical equipment inside cell (Fig. 401).

(1) Position bulkhead receptacle on fuel cell fitting with O-ring seal in place (Detail K, Fig. 401). Align receptacle and cell fitting to mounting pad on rear spar and install bolts.

NOTE: Use work positions inside cell and in left wheel well to install bulkhead receptacle.

(2) Tie wire bundle to lacing ferrules on cell No. 3 (Fig. 403, 404). Route remaining portion of wire bundle through left vent interconnect fitting into cell No. 2.

(3) Install the tank units on the forward and aft ends of cell No. 3 and connect the wires to the units (AMM 28-41-21/401). If removed, install the tank unit and compensator unit in cell No. 2 and connect the wires to the units.

(4) Install the float switch in the bracket in cell No. 1 (AMM 28-21-71/401).

H. Do a check of the center tank tank unit and compensator unit resistance and capacitance (AMM 28-41-21/501).

I. Install bulkhead plug unit (Ref 28-41-41, Removal/Installation).
J. Wipe down interior of cell with water-dampened cotton wiper (BMS15-5). Check for tools, pieces of lockwire, or any foreign material left in cell.
K. Install the access panel (AMM 28-12-31/401).
L. Before you refuel the center tank, do a check of the fuel cell for leakage (AMM 28-12-0/601).
   (1) Tighten the left and right tubing at sides and at cell access door.
   (2) Install the bonding jumper, clamps, and lockwire.
   (3) Check electrical bond across pressure refuel line bonding jumper (AMM 20-22-01/601). Resistance shall not exceed 0.010 ohm.
   (4) Install left fuel boost pump inlet assembly and lockwire connections.
   (5) Install pressure refuel outlet assembly on right side of cell (Detail F, Fig. 401).
      (a) Ensure that check valve is installed on outlet end of tube.
      (b) Place outlet assembly in position, with branch line outlet facing forward, and engage threads of tube nut with bulkhead fitting. Leave tube nut loose.
   (6) Install boost pump vent manifold line.
      (a) Connect right tubing at branch line connection of pressure refuel outlet assembly (Detail F, Fig. 401). Leave tube nut loose.
      (b) Connect left tubing at left side of cell and to right tubing near cell access door. Leave tube nuts loose.
      (c) After checking tube alignment, tighten all three tube nuts and install bonding jumper at center connection.
      (d) Attach clamps holding boost pump vent manifold line to tank No. 1 pressure refuel line.
      (e) Check electrical bond across vent manifold line bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
   (7) Hold pressure refuel outlet assembly in alignment and tighten tube nut left loose in step (4)(b).
   (8) Position tank vent line with vent float valve to bulkhead vent interconnect fitting, at forward left side of cell, engage tube nut, and tighten. Install tube clamps and bonding jumper.
   (9) Check electrical bond across tank vent line bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
   (10) Connect APU fuel feed line to bulkhead fittings at left side and upper rear of cell. Attach clamps.

(11) Install section of float switch wire conduit.
   (a) Position section of conduit with forward end projecting through upper right interconnect opening into cell No. 2.
   (b) Couple conduit to union in cell No. 2 and to bulkhead fitting in upper right side of cell No. 3.
   (c) Attach conduit clamp and bonding jumper in cell No. 2.
   (d) Check electrical bond across float switch conduit bonding jumper per 20-22-01, I/C. Resistance shall not exceed 0.0025 ohm.

REMOVABLE FUEL CELLS (GOODYEAR BTC-49 AND BTC-69) - APPROVED REPAIRS

1. General
   A. The following procedure establishes approved practices for repair of low temperature Vithane fuel cells manufactured by the Goodyear Tire and Rubber Company. These cells are bladder construction type known as construction BTC-49 and BTC-69. Identify cell construction by examining stencil nameplate on inside of cell opposite access openings. This procedure is written specifically for repair of this construction and variations of the same and is not applicable to any other type construction.
   B. Any violation of the procedures as outlined below will void the Goodyear Tire and Rubber Company warranty.
   C. The repair of Goodyear low temperature Vithane cells is restricted to authorized personnel. Authorized personnel are those who have been certified and trained by Goodyear representatives, or those who have received their training from persons who have been certified and trained by Goodyear representatives.
   D. Following a leak repair, the cell should be leak checked before installation (Ref 28-12-10, Inspection/Check).
   E. Materials Handling
      (1) All materials are to be protected from dirt contamination, sunlight, and excessive heat or cold while in storage. Containers are to be tightly capped and stored between +30°F to +85°F temperature.
      (2) The repair cement referred to in this text is prepared immediately prior to use by mixing repair cement (320gms) with cross-linker (81cc).

      CAUTION: REPAIR CEMENT REQUIRES THOROUGH MIXING TO OBTAIN FULL ADHESIVE VALUES.

      (3) Repair cement has a pot life of 20 minutes after mixing. Unmixed cement has a shelf like of 6 months from date of packaging.

      CAUTION: ALL CONTAINERS FOR CEMENTS AND SOLVENTS SHOULD BE CPROPERLY IDENTIFIED.

   F. Cell Handling
      (1) Prevent needless damage by exercising common sense care in all handling of cells.
      (2) Folding or collapsing of cells is necessary to place them in containers for storage, install in airframe cavities and carry from place to place.
      (3) Protect fitting seal surface from contact with cavities during removal or installation. Use protective covers over fitting seal when practical.

(4) Remove shoes before entering cell, and protect cell from tools, hot lights, etc. when working inside or around them.
(5) Avoid stepping on folds or creases in cells.
(6) Do not carry cells by fittings. Maintain original cell contours or folds when refolding for boxing, rolling to insert in airframe cavities, or handling in the repair area.
(7) Cells to be repaired should be placed on well-lighted table. Maintain natural contours, if possible, while repairing. Prevent contact with sharp edges, corners, dirty floors, or other surfaces.
(8) Repair area must be well ventilated.

WARNING: DO NOT PERMIT SMOKING OR OPEN FLAME NEAR REPAIR AREA OR CELLS.

(9) Do not stack cells.
(10) Store cells as follows:
  (a) Fold cells smoothly and lightly as possible with minimum number of folds. Place protective wadding between folds.
  (b) Wrap cell in moisture-proof paper and place it in suitable container. Do not crowd cell in container. Use wadding to prevent movement.
  (c) Stack boxed cells to allow access to oldest cells first. Do not allow stacks to crush bottom boxes. Leave cells in boxes until used.
  (d) Storage area must be cool, +30 to +85°F, and free of exposure to sunlight, dirt, and damage.
  (e) Used cells must be cleaned with soap and warm water prior to storage. Dry, and box as outlined above.

2. Equipment and Materials
 A. Equipment

NOTE: Following items of equipment can be obtained as part of Repair Kit 2F1-3-37813. They are identified as Group 2 Materials.

(1) Cement brush - 1 inch
(2) Measuring cup (250 ml)
(3) Aluminum plates - 1/4 x 6 x 6 inches (4 each)
(4) Cure iron (set at 240°F) (2F1-3-25721-1) (optional)
(5) B01013 Solvent, Series 93 (AMM 20-30-93/201), pint cans (2 each)

(6) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
(7) Release film (plastic wrap or cellophane type) (sheet 12 x 24 inches)
(8) Foam rubber cloth back (sheet 12 x 12 inches). Quantity: 2 sheets.

NOTE: Cure iron 2F1-3-25721-1 comes in two different temperature settings. Check that iron being used has 240°F temperature stamp on it.
Accessories - order per individual cell requirements.
Phenol plates, phenol plate assemblies and phenol test equipment can be order as required by customer.
Alodine 600 is to be ordered as required from cell manufacturer or from local stock.

B. Materials
(1) Repair Kit - 2F1-3-37813 (Group 1 Materials).
Available from: Aero Parts and Services, 2742 Burbank St, Dallas, Texas 75235
Ph: 1-800-635-9535 Fax: (214) 358-3835
Aero Hardware, 130 Business Park Drive, Armonk, New York 10504
Ph: (914) 273-8550 Fax: (914) 273-8612
Reliance Aero Products, 116 Row 3, Lafayette, Louisiana 70508
Ph: (318) 234-3995 Fax: (318) 234-4294
(a) 80C27 repair cement (1 pint cans, 320gms in each can). Quantity: 8 cans.
(b) 80C28 cross-linker (4 oz bottles, 81cc in each bottle). Quantity: 8 bottles.
(c) B01013 Solvent, Series 93 (AMM 20-30-93/201) (1 pint cans). Quantity: 2 cans.
(d) FT-192 repair fabric (sheet 12 x 12 inches). Quantity: 2 sheets.
(e) Manual AP#368 (latest issue).
(2) Alodine 600
(3) Fuel cell accessories - Order per individual cell requirements.

3. Repair Fuel Cell
A. General
(1) Repair fuel cell damage that is in accord with the following limitations by the application of repair patches.
(a) Repair fabric is for repair of simple contours only. That is, contour should have two plane curvature only. Patches referred to in this text are of this material.
(b) Inside patches are to lap defect edges 2 inches in each direction.
(c) Outside patches are to lap defect 2-1/4 inches in each direction.
(d) Outside patches are to be applied and cured prior to applying an inside patch.
(e) Blisters between inner liner and fabric larger than 1/4 inch in diameter require an outside and an inside patch.

(f) Separations between outer plies larger than 1 inch in diameter require an outside and inside patch. Holes and punctures require an outside and inside patch.
(g) Slits or tears up to 3 inches maximum length require an outside and inside patch.
(h) External abraded or scuffed areas without fabric damage require an outside patch only.
(i) A loose lap may be trimmed, provided that a 1 inch effective bond remains.
(j) Air cure repair patches are to remain clamped and undisturbed for 72 hours at room temperature of approximately 75°F.

CAUTION: FOR EACH 10° DROP IN TEMPERATURE FROM 75°F, ADD 25 PERCENT CURE TIME. EXAMPLE: AT 64°F, CURE FOR 90 HOURS.

(k) All heat cured patches are ready for use when cool.
(l) Fitting repairs are confined to loose flange edges, seal surface rework and missing coat stock.
(m) The maximum number of heat cure repairs in the same area is four. Patches shall not overlap. Maximum patch size shall not exceed 7 inches diameter. If several injuries are found in the same area, further investigation to determine cause of damage should be made.
(n) Patches shall have 100% adhesion.

B. Repair Patch Application - Optional Cure Method
(1) Prepare exterior cell wall and exterior patch first. Cut repair patch material to size required to ensure proper lap over injury in all directions. (See limitations.) Hold shears at an angle to produce a beveled edge (feather) patch. Round corners of patch. Dull side or gum contact face of repair patch should be the largest surface after beveling.
(2) Wash 1 square foot of cell wall surrounding injury and contact side of repair patch with a clean cotton wiper (BMS15-5) soaked with B01013 solvent, Series 93 (AMM 20-30-93/201).

CAUTION: DO NOT GET SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(3) Abrade cell wall surface about injury and contact side of patch with fine emery cloth to remove shine.
(4) Repeat B01013 solvent, Series 93 (AMM 20-30-93/201) washings two more times, a total of three washings each surface.

(5) Tape a piece of release film inside cell over injury.
(6) When all the above preparatory work has been done and cell has been positioned for patch application on repair table, mix cement (179cc) with the cross-linker (45cc), and stir mixture thoroughly.
(7) Brush one even coat of mixed repair cement on the cell wall around injury and on the contact side of repair patch. Allow to dry for 15 minutes.
(8) Repeat a second mixing of repair cement and brush a second coat.

CAUTION: DO NOT USE FIRST CAN OF MIXED CEMENT FOR THIS COAT.

(9) Allow cement to dry approximately 5 minutes and then center patch over injury. Lay repair patch by applying pressure on surface from center or edge without trapping air. Hold the unrolled portion of repair patch off the cemented surface until roller contact ensures an air free union. At this time repair patch may be moved by hand on wet surface to improve laps. Do not lift repair patch, slide it.

CAUTION: MAKE SURE RELEASE FILM INSIDE CELL OVER INJURY REMAINS IN PLACE AS ANY CEMENT WILL STICK CELL WALLS TOGETHER WITHOUT IT AS A SEPARATOR.

(10) Cover one smooth surface each of two aluminum plates (plates must be larger than patch), with 1/4 -inch fabric backed airfoam, fabric side out. Tape airfoam in place. Foam must cover edges of plate for protection.
(11) Fold cell adjacent to patch and place prepared plates, one over repair patch, and one on opposite side.
(12) Center a cure iron on the plate over the repair patch. Secure the assembly with a C-clamp. Tighten by hand. Check cement flow to determine pressure.

CAUTION: MAKE SURE THAT CELL FOLD IS NOT CLAMPED BETWEEN PLATES. THIS WOULD CAUSE A HARD PERMANENT CREASE. ALSO MAKE SURE THAT PATCH DOES NOT MOVE WHEN CLAMP IS TIGHTENED.

(13) Connect cure iron into electric outlet and cure repair for 2 hours. After 2 hours cure, unplug cure iron from outlet and allow iron to cool 15 minutes. Then remove C-clamp. Wet release tape to remove from repair.
(14) Inside patch is applied same as above procedure, except for size of repair patch (see limitations), after outside patch has been cured.

CAUTION: SUCCESS OF APPLYING BOTH AN OUTSIDE AND INSIDE REPAIR PATCH SIMULTANEOUSLY IS DOUBTFUL, AND NOT RECOMMENDED.

C. Repair Patch Application - Air Cure Method
 (1) Follow procedure for heat cure method, except omit cure iron and cure each patch per air cure limitations (minimum 72 hours).
D. Rework of Metal Fitting - Sealing Surfaces
 (1) Rub off roughness of affected area with a fine file or fine emery cloth. Treat reworked area.
 (2) Clean metal surface using a clean cotton wiper (BMS15-5) dipped in B01013 solvent, series 93 (AMM 20-30-93/201). Moisten cleaned surface with clean cotton wiper (BMS15-5) dipped in water. Apply alodine 600 solution, undiluted, to the affected area with a small nylon brush. Allow solution to dry until a light golden color appears. When coating has been formed, remove excess solution by wiping with a clean water moistened cotton wiper (BMS15-5). Wipe dry.

WARNING: DO NOT ALLOW SOLUTION TO COME IN CONTACT WITH HANDS, EYES OR CLOTHING.

E. Accessory Replacement
 (1) Obtain cured repair accessory from manufacturer.
 (2) Mark location of old accessory and preserve markings for guide lines to locate new part.
 (3) Remove old accessory by gradually loosening an edge with a blunt probe like instrument.
 (4) When a loose edge is created, grasp accessory by loose edge with pliers and gently pull accessory off cell wall. Be careful not to pull cell lap open while peeling accessory off. Pull from blind side of a cell lap toward the exposed edge.
 (5) Buff the cell surface under accessory with emery cloth to smooth roughness and prepare for cement.

NOTE: Removal of old accessory will probably leave an uneven cavity and surface.

 (6) Prepare replacement accessory by buffing and washing contact surface. Also wash cell surface. (See repair patch.)
 (7) Apply mixed repair cement to both surfaces being sure to level cavity left by removal of old accessory.
 (8) Roll new accessory into place with a repair patch and place suitable padded plates in position to ensure adequate pressure when clamped. Use cellophane separator to prevent cement sticking in the wrong place.
 (9) Cure as with repair patch using either cure method.
F. Defects Repair
 (1) Blisters
  (a) Remove loose material by buffing or trimming. Apply an outside and inside repair patch.

(2) Holes, Punctures, Cuts, Tears, and Deep Abraded Areas
  (a) Trim away any ragged material and apply an outside and an inside repair patch.
(3) Loose Seams
  (a) Buff loose edge and contact surface with emery cloth. Wash three times with B01013 solvent, Series 93 (AMM 20-30-93/201). Apply mixed cement two coats as with repair patch. Clamp and cure. Either method may be used. See repair patch. Loose seams may be trimmed if minimum lap remains.
(4) Loose Fitting Flange - Inside
  (a) Buff edge of flange and contact surface under flange. Apply mixed repair cement, cellophane, padded plates and clamp. Follow procedure as outlined for repair patch, except for patch itself.
(5) Missing Coat
  (a) Buff surface with emery cloth. Wash three times with B01013 solvent, Series 93 (AMM 20-30-93/201). Apply mixed cement two coats as with repair patch. Clamp and cure. Either method described in repair patch may be used.
(6) Looseness Against Metal
  (a) Prepare metal as per metal fitting-sealing surfaces. Apply mixed cement and cure.

CENTER TANK ACCESS PANEL - REMOVAL/INSTALLATION

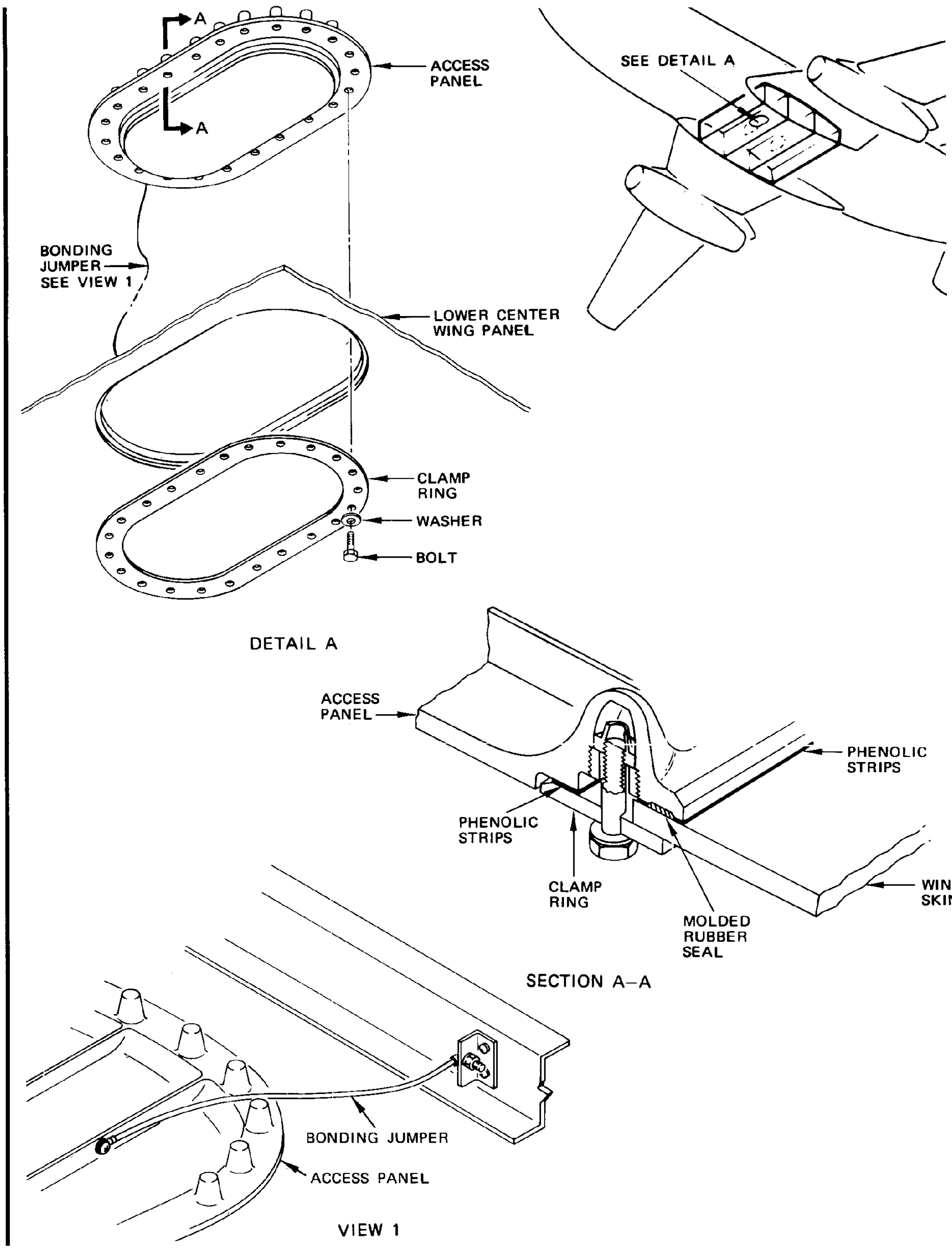
1. General
   A. An access panel is provided in the center wing cavity to allow personnel to enter the center wing cavities and/or fuel cells for maintenance. The cavity access opening is located in the lower skin of cavity No. 1. On airplanes with three bladder cells installed, a fuel cell access panel provides direct access into cell No. 1 (AMM 28-12-31/401) and the access opening in the lower skin is left open.
   B. The tank access panel is cast aluminum and provides a fluidtight seal by use of a molded rubber seal fitted into a groove on the panel mating surface. A phenolic strip is bonded to the outer edge of the panel to prevent chafing of lower wing skin. A clamp ring is used to distribute the attaching bolt load and protect the outer lip in the skin opening. A bonding jumper is used to electrically ground the panel to the structure.
   C. The access panel should provide a fueltight seal in the event of cel1 leakage into the wing center cavities. External fuel leakage around the clamp ring should be corrected immediately and the source of the leakage located and eliminated.
2. Equipment and Materials
   A. Bonding meter (AMM 20-22-01/601)
   B. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   C. Solvent - aliphatic naphtha TT-N-95 (AMM 20-30-31/201)
3. Remove the Center Tank Access Panel (Fig. 401)
   A. Remove the air conditioning equipment as necessary to get access to the center tank access panel (AMM Chapter 21).
   B. Remove access panel mounting bolts, washers and clamp ring.
   C. Push up on panel to break seal, tip panel and guide through opening. Disconnect bonding jumper from panel.

      CAUTION: DO NOT PRY OFF PANEL. IF PANEL STICKS, LOOSEN BY TAPPING AROUND EDGE WITH RUBBER MALLET. PRYING MAY DAMAGE CRITICAL SEALING SURFACES.

   D. Install rubber edge protector around access panel opening.

      CAUTION: PROTECT SEAL SURFACE EDGE OF ACCESS OPENING BEFORE ENTRY IS MADE INTO CAVITY OR CELL. DAMAGE TO A CRITICAL SEALING SURFACE MAY RESULT FROM CONTACT WITH TOOLS AND EQUIPMENT IF EDGE IS LEFT UNPROTECTED.

4. Install the Center Tank Access Panel (Fig. 401)
   A. Remove rubber edge protector from access panel opening.
   B. Thoroughly clean edge margin of access panel opening and access panel sealing surfaces using a clean, cotton wiper (BMS15-5) moistened with solvent.
   C. Clean clamp ring using a clean, cotton wiper (BMS15-5) moistened with solvent.



Center Tank Access Panel
Figure 401

D. Check access panel for serviceability of phenolic strips and molded seal ring. Replace panel if condition is poor or doubtful.

CAUTION: DO NOT APPLY CEMENTS OR SEALERS OF ANY KIND TO RUBBER SEAL OR SEALING SURFACES.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

E. Connect bonding jumper to access panel.
F. Do a check of the electrical bond between the access panel and the airplane structure (AMM 20-22-01/601).
   (1) Make sure the resistance is 0.010 ohm (10 milliohms) or less.
G. Tilt panel through opening and align with bolt holes.
H. Position clamp ring and install bolts and washers. Tighten bolts evenly to a final torque range of 10 to 20 inch-pounds over and above driving force.
I. Re-install all air conditioning equipment removed to get access to the center tank access panel (AMM Chapter 21).

FUEL CELL ACCESS PANEL - REMOVAL/INSTALLATION

1. General
   A. An upright-mounted access panel is provided to gain access into fuel bladder cell(s) on airplanes with one or two cells. A horizontal-mounted access panel is provided in the bottom of cell No. 1,directly over the center tank access opening, to gain access into fuel bladder cells on airplanes with three cells. Only one fuel cell access panel is used per airplane regardless of center fuel tank configuration.
   B. The cell access panel is solid cast aluminum and provides a fluid-tight seal when bolted to the fuel cell fitting against an O-ring seal or sealing gasket. On the upright installation, the access panel is equipped with a grab handle as an aid against dropping during panel removal/installation.
2. Equipment and Materials
   A. Aliphatic Naphtha - TT-N-95, or equivalent
   B. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
3. Prepare to Remove Fuel Cell Access Panel
   A. Remove air conditioning equipment as necessary to gain access to center tank access opening (Ref Chapter 21).
   B. On ALL EXCEPT airplanes with three bladder cells, remove center tank access panel (Ref 28-12-21).
   C. Defuel and purge fuel tank (Ref 28-23-0 and 28-10-0, Maintenance Practices).

   WARNING: FUEL AND FUEL VAPORS CONSTITUTE A POTENTIAL HEALTH AND EXPLOSION DANGER. OBSERVE ALL PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

4. Remove Fuel Cell Access Panel (Fig. 401)
   A. On ALL EXCEPT airplanes with three bladder cells, gain access to center wing cavity No. 1 for two bladder cell airplanes or cavity No. 2 for one bladder cell airplanes.
   B. Remove 20 access panel mounting bolts. On upright panel installation, hold handle before last bolts are removed to guard against panel falling and damaging cell.
   C. Push up or in on panel to break seal , tip panel and guide through opening. Remove sealing gasket. On horizontal panel installation, remove and discard O-ring seal.

   CAUTION: DO NOT PRY OFF PANEL. IF PANEL STICKS, LOOSEN BY TAPPING AROUND EDGE WITH RUBBER MALLET. PRYING MAY DAMAGE SEALING SURFACES.

D. Protect sealing surfaces of panel and cell fitting from scratching or other damage.

NOTE: The use of a rubber edge protector around cell access opening is recommended.

5. Install Fuel Cell Access Panel (Fig. 401)

A. Remove access opening edge protector, if installed.

B. Thoroughly clean the sealing surfaces using a clean, cotton wiper (BMS15-5) moistened with naphtha. On horizontal panel installation, clean O-ring groove in cell fitting.

C. Check condition of sealing gasket and replace if condition is poor or doubtful . On horizontal panel installation, install new O-ring seal in cell fitting groove.

D. Place sealing gasket around cell fitting.

NOTE: On upright panel installation, place sealing gasket between cell fitting and access panel. On horizontal installation, place sealing gasket between cell fitting and airplane structure.

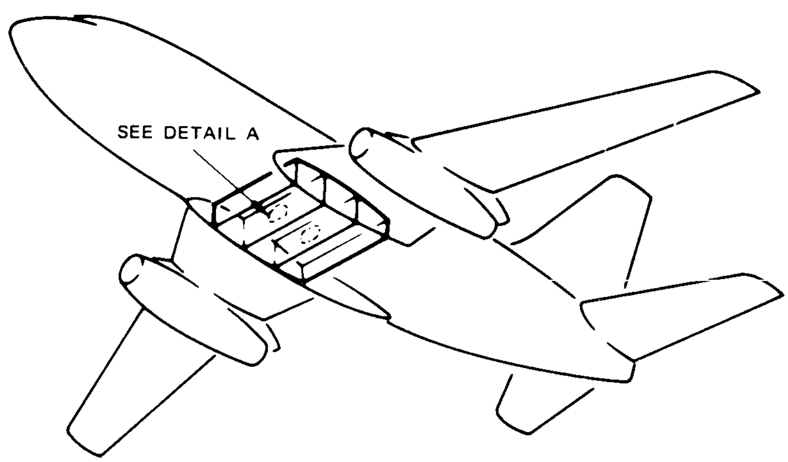
E. Tilt panel through opening and align with bolt holes. On upright panel installation, hold panel in place with handle until at least two opposite located bolts are installed and partially tightened.

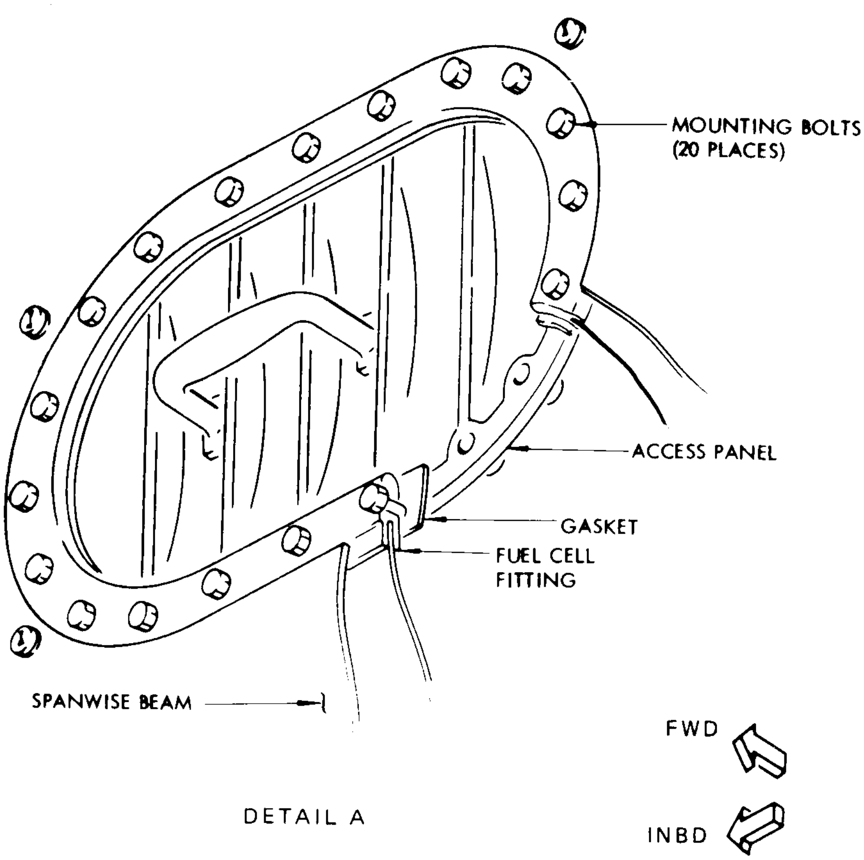
F. Install access panel mounting bolts and tighten gradually to a final torque range of 50 to 70 inch-pounds.

G. Service tank with sufficient fuel to cover access panel and check for leaks.

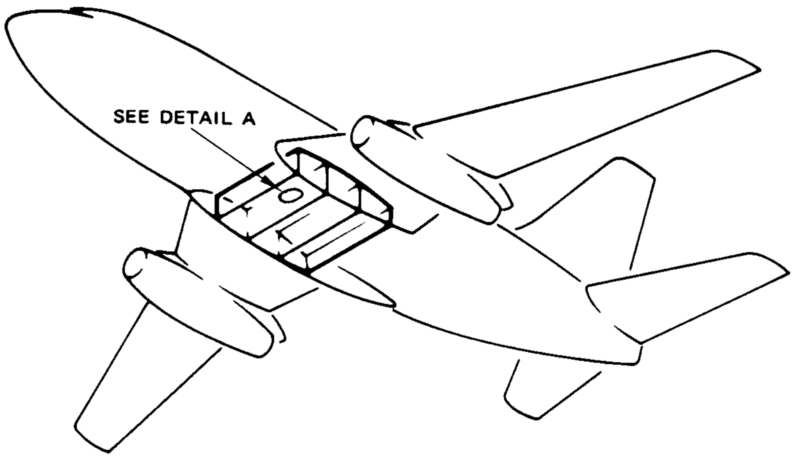
H. On ALL EXCEPT airplanes with three bladder cells, install center tank access panel (Ref 28-12-21).

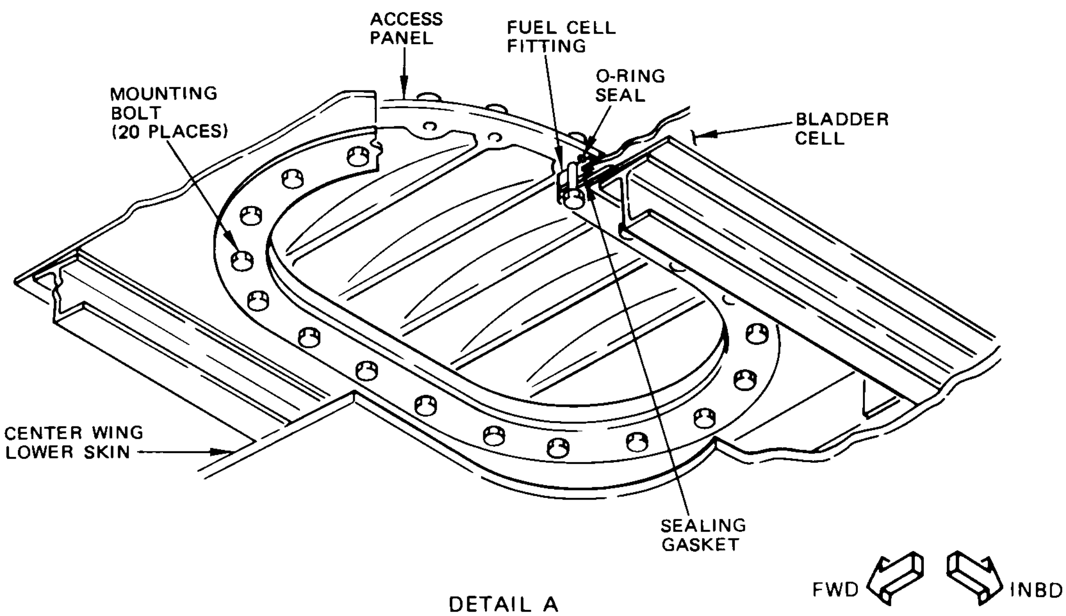
I. Install any air conditioning equipment removed to gain access to center tank access panel (Ref Chapter 21).





Fuel Cell Access Panel Installation
Figure 401 (Sheet 1)





DETAIL A

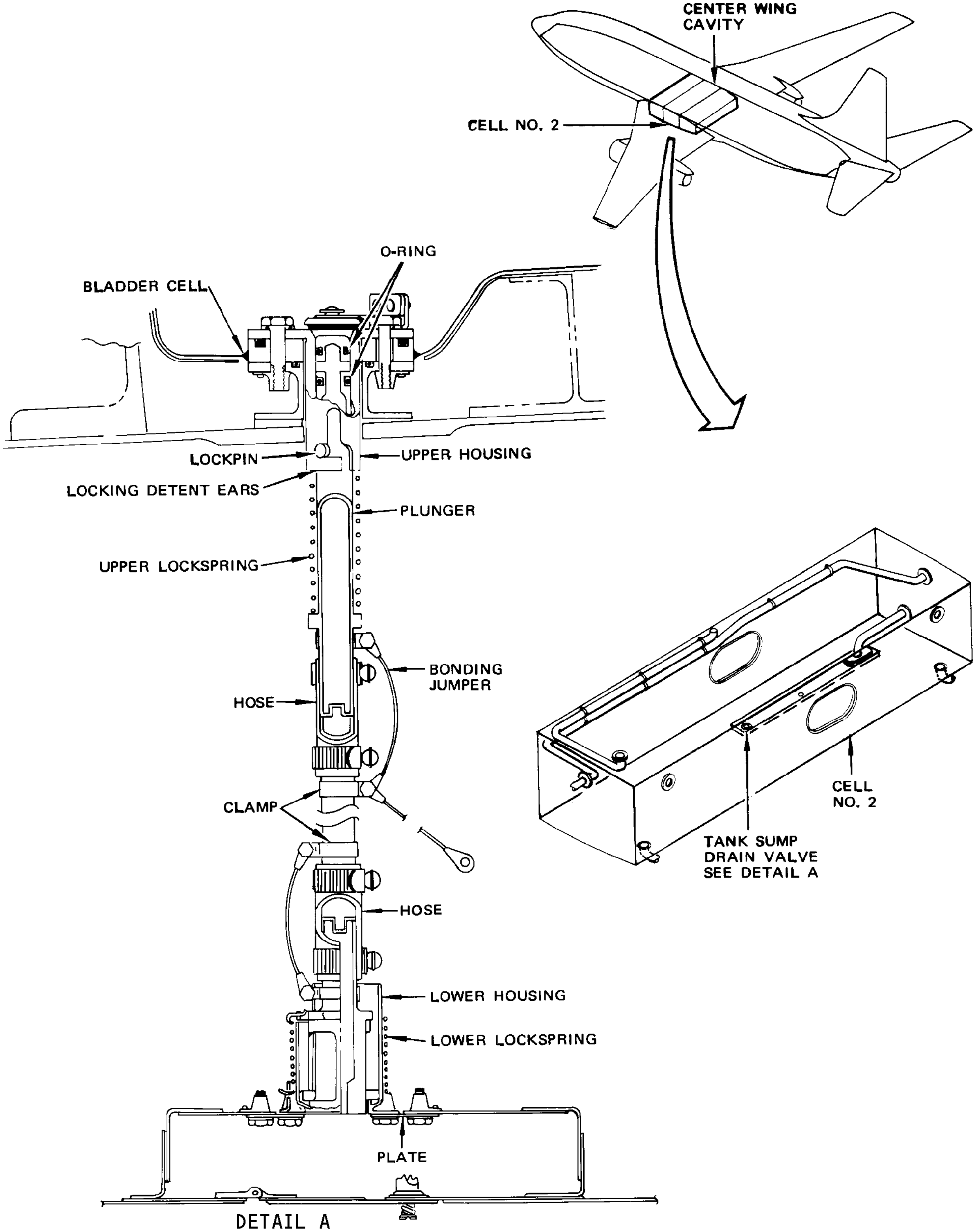
Fuel Cell Access Panel Installation
Figure 401 (Sheet 2)

CENTER TANK SUMP DRAIN VALVE - REMOVAL/INSTALLATION

1. General
   A. A sump drain valve is installed in the lowest point of the fuel tank for draining accumulated moisture, and for draining trapped fuel from the sump when tank is defueled.
   B. The valve is a spring loaded, flapper type remotely operated valve.
2. Equipment and Materials
   A. Bonding meter (AMM 20-22-01/601)
   B. Grease - Petrolatum VV-P-236
3. Remove Center Tank Sump Drain Valve (Fig. 401)
   A. Open the air conditioning bay access door in order to gain access to the two bonding jumpers on the valve. Access is gained through lightening holes in the keel beam.
   B. Remove bonding jumpers.
   C. Open access door on bottom of keel beam that is stenciled sump drain.
   D. Remove the six bolts holding a plate in place and remove the plate.
   E. Rotate valve clockwise until it releases. Remove valve by lowering it straight down.
4. Install Center Tank Sump Drain Valve (Fig. 401)
   A. Lubricate O-rings on upper end of valve assembly lightly with grease.
   B. Insert valve through opening. Push up until valve engages upper valve housing. Slide lockpin into slot and turn valve counterclockwise until pin engages detent.

      CAUTION: EXERCISE CARE WHEN ENGAGING VALVE IN UPPER HOUSING TO PRECLUDE BENDING OR SPREADING LOCKING DETENT EARS.

   C. Install six bolts holding valve lower housing plate in place.
   D. Actuate valve to open and closed position. Valve shall not bind when actuated.
   E. Close sump drain access door.
   F. Install bonding jumpers.
   G. Check electrical bond between sump drain assembly and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
   H. Close air conditioning bay access door.



Center Tank Sump Drain Valve Installation
Figure 401

FUEL VENT SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The fuel vent system prevents damage to the wing structure by providing positive venting of all fuel tanks, regardless of airplane attitude. For airplanes with removable bladder cells in the wing center section, the vent system also provides venting of the wing center cavity. During flight, the system also helps decrease fuel evaporation and assists the fuel boost pumps by providing a small positive pressure head on the fuel. Venting of the integral fuel tanks is accomplished with sealed hat-shaped upper wing skin stiffener ducts connected to vent surge tanks (Fig. 1). The surge tanks are in turn vented overboard through ram air vent scoops.
   B. Removable bladder cells, on some airplanes, and an integral center tank, on other airplanes, both within the wing center section, are vented through an opening in the forward cell or cavity vent tube. The vent tube connects with a spanwise duct running to the vent surge tanks. Airplanes with the integral center tank have a local open-ended loop vent tube at each side of the center tank to vent air trapped on the rear side of the spanwise duct. On airplanes with removable bladder cells, the wing center cavities are vented through vent and drain lines to overboard outlets on the side and bottom of the fuselage. The cavity vent system guards against the accumulation of the moisture or fuel leakage.
   C. During flight, impact pressure is applied to the ram air vent scoop. The pressure is then transmitted through the vent ducts to the expansion space in each tank to maintain a positive pressure on the fuel. Since the expansion space will shift with varying airplane attitudes, the wing tank vent ducts are provided with inboard and outboard port openings to ensure that at least one port will be open to the expansion space in any normal airplane attitude. The inboard port is open at all times, and the outboard port is protected by a float valve, to prevent fuel from entering the vent system during certain airplane attitudes, and flowing overboard. Fuel which enters the vent system during rapid attitude changes, will flow into the vent surge tank. When normal flying attitude is established, the fuel will flow through a surge tank drain line into the center tank vent channel and through a check valve into the center tank.
   D. If a fueling shutoff valve fails to close during pressure fueling, the vent lines will carry the excess fuel overboard, to prevent overpressurizing the tanks, as long as the fuel nozzle pressure is not in excess of 55 psi. A wing fence, located on the wing lower surface inboard of the vent scoop, prevents fuel spillage from traveling inboard along the wing either on the ground or in flight.

2. Fuel Vent Scoop
   A. The fuel vent scoops, located in the outboard half of the vent surge tanks, are the overboard vents for the vent system. Each scoop consists of a recessed ram air scoop mounted in a lower wing surface access panel, and a 5-inch standpipe assembly. The diverging walls of the standpipe act as a plenum chamber ensuring ram air will be applied to the vent system during all flight attitudes of the airplane. On some airplanes, a screen is installed at the top of the standpipe to prevent the entrance of large insects, birds, or foreign matter. Due to the design of the scoop, icing conditions have minimum effect on ram air pressure.
3. Vent Surge Tank
   A. A 30-gallon surge tank outboard of each wing tank provides fuel surge capacity for the vent system. The purpose of the surge tank is to accommodate fuel surges during rapid attitude changes of the airplane. This integral tank incorporates a connection to atmosphere through the vent scoop and a drain line connection to the center tank vent duct. Fuel will flow through the vent duct into the center tank (Fig. 1).
4. Vent System Sealing
   A. The wing tank vent system is sealed in all areas where fuel leakage might occur. Seal applications are designed to prevent external leakage and also to prevent leakage between tank and vent areas. Sealing is accomplished by the use of a sealant compound which is applied around structural fasteners, between faying surfaces, and along the edges of structural members and equipment. All vent system tubing and equipment is electrically bonded to the airframe with bonding jumpers or by faying surface bonding. Sealing application, leak detection and isolation, and sealing repairs for any portion of the vent system require special techniques and procedures (Ref 28-11-0 AR).
5. Vent Ducts
   A. Two spanwise vent ducts, formed by sealed hat-shaped upper wing skin stiffeners, connect with the vent surge tank and run inboard. The aft duct terminates near the wing root and is connected to a vent tube, which runs forward and terminates near the upper wing surface and the front spar, to provide a vent for the integral wing tank. The forward duct connects to a vent duct passing through the wing center section cavity No. 2, and forms a continuous duct connecting both left and right surge tanks. Center tank bladder cell(s) are vented by tubing runs and cell vent interconnect fittings. Airplanes with the integral center tank are vented by tubing runs with bracketed clamps at the tube transfer holes in the spanwise beams; no vent interconnect or bulkhead fittings are necessary at these places. All center cell vent tubing is connected to the spanwise vent duct in cavity No. 2 (Fig . 1).

B. Two spanwise vent ducts, formed by sealed hat-shaped upper wing skin stiffeners, connect with the vent surge tank and run inboard. The aft duct terminates near the wing root and is connected to a vent tube, which runs forward and terminates near the upper wing surface and the front spar, to provide a vent for the integral wing tank. The forward duct connects to a vent duct passing through the wing center section cavity No. 2, and forms a continuous duct connecting both left and right surge tanks. Center tank bladder cell(s) are vented by tubing runs and cell vent interconnect fittings. Airplanes with the integral center tank are vented by tubing runs with bracketed clamps at the tube transfer holes in the spanwise beams; no vent interconnect or bulkhead fittings are necessary at these places. All center cell vent tubing is connected to the spanwise vent duct in cavity No. 2 (Fig. 1).

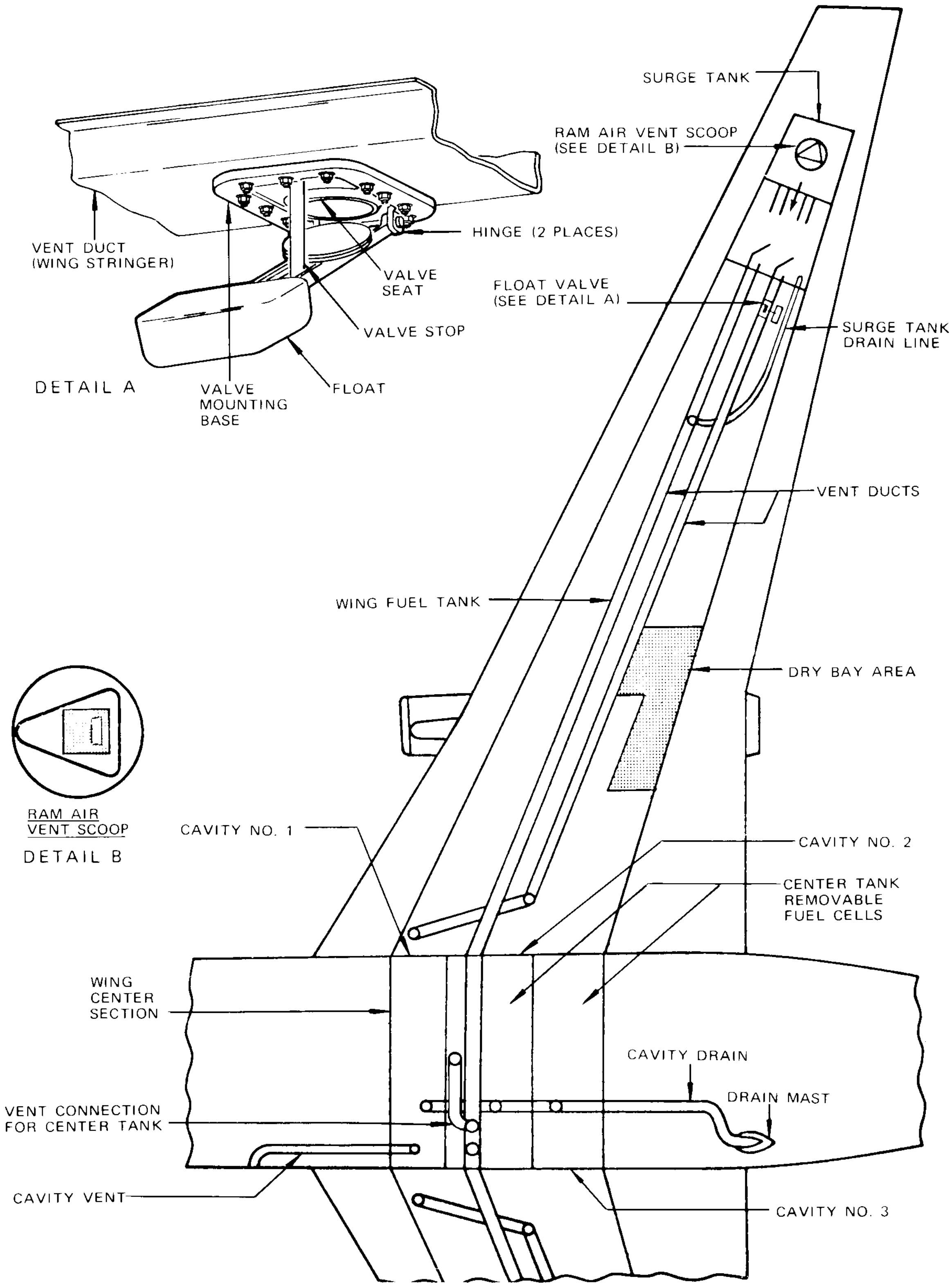
6. Fuel Vent Float Valve

A. The fuel vent float valve prevents fuel from entering the vent port located in the outboard vent duct of the wing tank. The valve consists of a float mounted on an arm hinged to a mounting base. The mounting base is installed over the vent port on the lower surface of the sealed vent duct (Fig. 1). A valve stopper attached to the float arm incorporates a seal which contacts and seals the vent port when the valve is closed. The valve is held in the normally open position by the weight the float and float arm against a stop attached to the valve mounting base. The stop limits the downward travel of the float. As fuel rises in the tank, the float rises closing the valve aperture. When the fuel level recedes, the valve reopens.

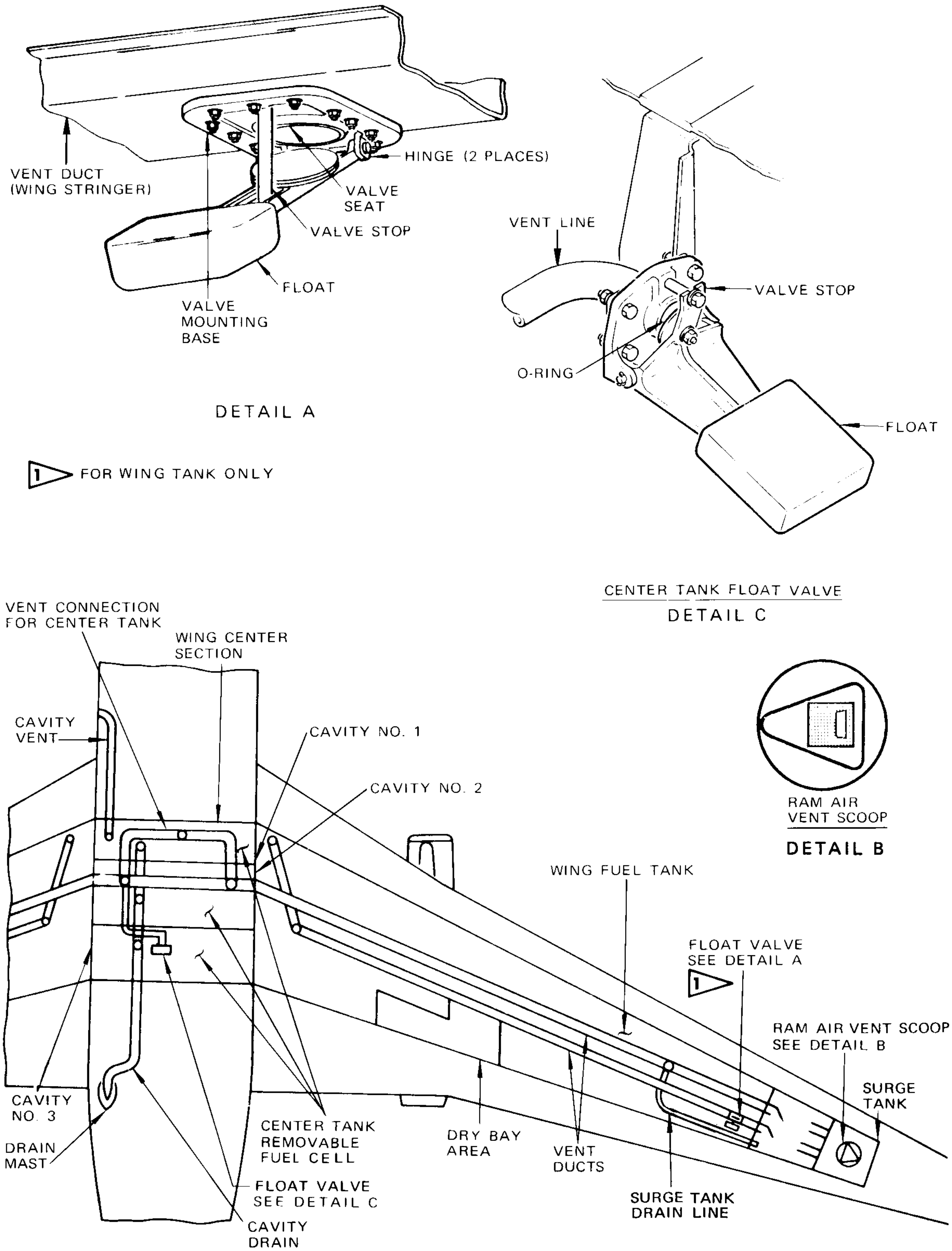
B. On airplanes with three bladder cells or an integral center tank, a fuel vent float valve is mounted at a high level in center tank bladder cell No. 3 or in cavity No. 3 to prevent fuel from entering the vent tubing. The valve is similar in function and detail to the tank No. 1 and 2 float valve described above except for the valve seat and stop details (Fig. 1).

7. Center Wing Cavity Drain and Vent (Bladder cell installation only)

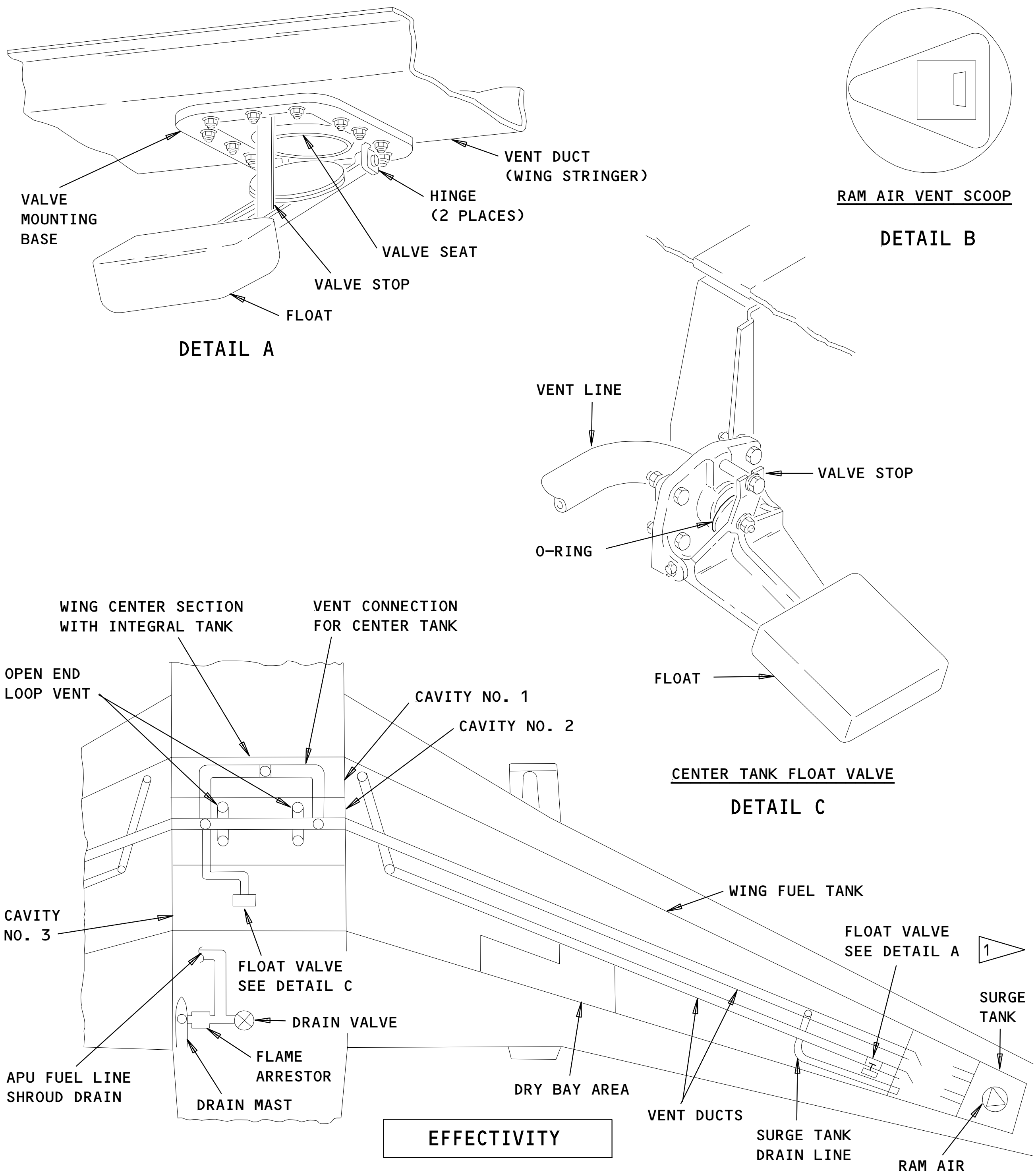
A. For airplanes with bladder cells, a drain system is provided for the wing center cavities to prevent an accumulation of fluids from condensation or from leakage (Fig. 2). Drain fittings, one in each cavity, are located in the lower skin panel. Beneath the lower panel, the plumbing consists of hoses from cavities No. 1, 2, and 3 connected to a drain manifold which runs aft under the wing center section, through the main wheel well and turns outboard terminating in a drain mast in the left wing-body fillet fairing. The drain manifold includes a flame arrester. A drain cock is installed in the lower side of the line running along the left main wheel well aft bulkhead. The drain cock can be opened to allow drainage of any accumulated fuel or moisture that has not discharged through the drain mast. The drain cock must be closed when draining is completed. The cavity drain system is not affected by cell configuration (number of bladder cells installed).



Fuel Vent System
Figure 1 (Sheet 1)



Fuel Vent System
Figure 1 (Sheet 2)



EFFECTIVITY

AR ALL EXCEPT LV-JMW THRU LV-JMZ, LV-JND,
LV-JNE, LV-JTD, LV-JTO, LV-LES
IN ALL EXCEPT EI-ASA THRU EI-ASH
PW ALL EXCEPT CF-PWC THRU CF-PWE, CF-PWM, CF-PWP
NH ALL EXCEPT JA8403, JA8406 THRU JA8417

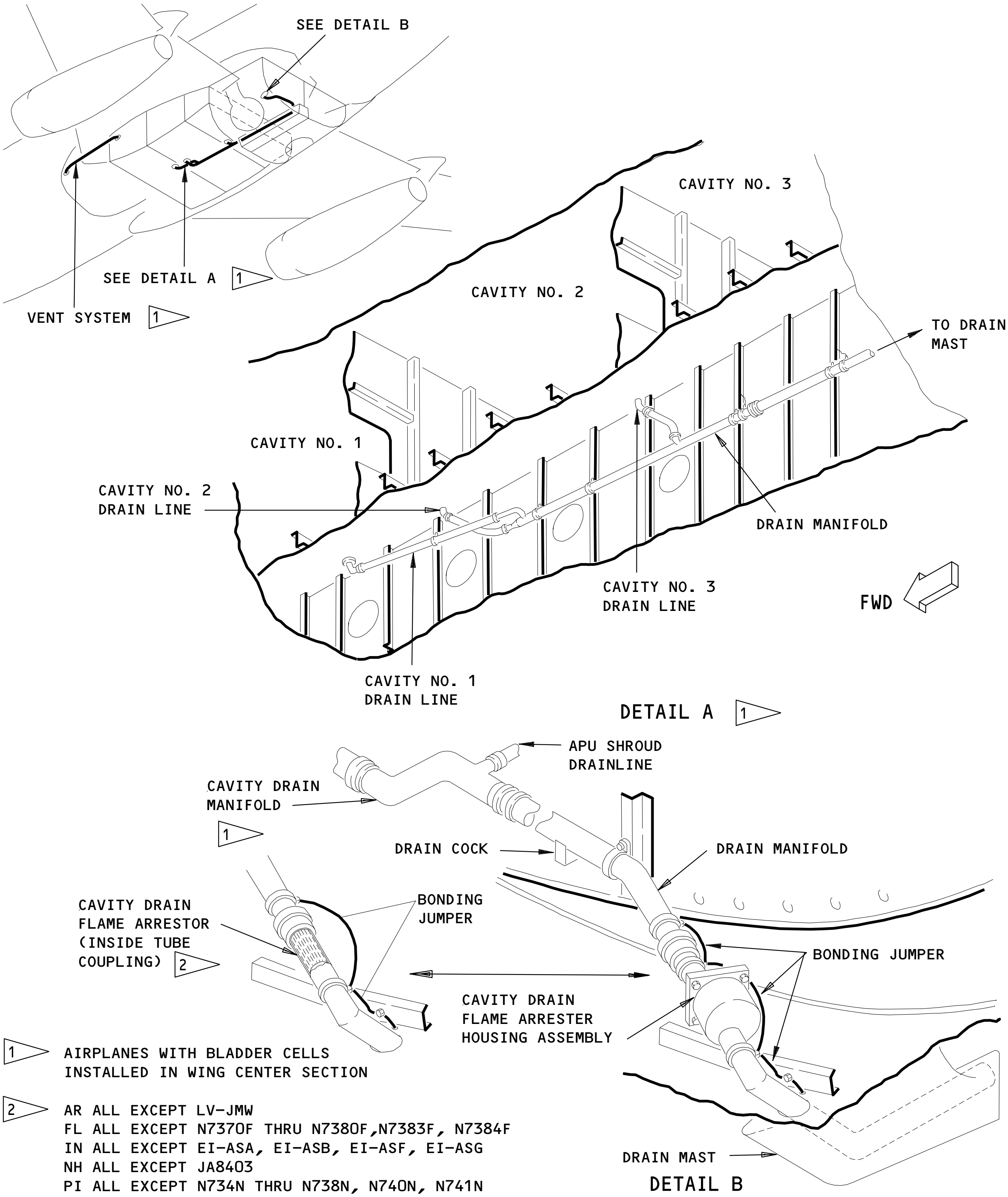
1 FOR WING TANK ONLY

Fuel Vent System
Figure 1 (Sheet 3)

B. The center wing section is vented through a line connecting the top of cavity No. 1 to a port in the left side of the fuselage forward of the wing (Fig. 2). During flight, a slight positive pressure at this port provides an airflow which ventilates the cavities. Ventilation is provided to all cavities since the spanwise beams are open at the top outboard corners.

8. APU Fuel Line Shroud Drain

A. Airplanes with bladder cells or with integral center section fuel tank have an APU shroud drain line connected to a drain mast in the left wing-body fillet fairing. For the bladder cell installation, the APU shroud drain line tees into the center wing cavity drain manifold (Fig. 2).



1 AIRPLANES WITH BLADDER CELLS INSTALLED IN WING CENTER SECTION

2 AR ALL EXCEPT LV-JMW
FL ALL EXCEPT N7370F THRU N7380F,N7383F, N7384F
IN ALL EXCEPT EI-ASA, EI-ASB, EI-ASF, EI-ASG
NH ALL EXCEPT JA8403
PI ALL EXCEPT N734N THRU N738N, N740N, N741N
N743N THRU N747N

Center Wing Cavity Drain System
Figure 2

FUEL VENT SYSTEM - INSPECTION/CHECK

1. Fuel Vent System Pressure Check
   A. General
      (1) The fuel vent system must be pressure checked after any maintenance which may have affected the system or after a fuel leak has been traced to the system.
      (2) The pressure check is accomplished by closing all fuel shutoff valves and blocking off the vent ram air scoops and internal vent openings including float valves, check valves, and vent line drain holes. Air pressure of 5.0 ±0.2 psi is then applied to the system through a hose connection.

         CAUTION: THE MAXIMUM INTERNAL PRESSURE THE VENT SYSTEM, WING TANKS AND CENTER TANK CELLS MAY BE SUBJECTED IS 5.20 PSI AND -10 INCHES OF WATER.

      (3) Ambient temperature and atmospheric pressure should be stable during system pressure checks.
   B. Equipment and Materials
      (1) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
      (2) Ground air supply - 0 to 5 psi
      (3) Water Safety Relief Manometer - F72951-1 (preferred) or F70208-1 (Fig. 603)
      (4) Fuel vent closure items:

         CAUTION: ATTACH SAFETY STREAMERS MADE OF HEAVY RED COTTON WEBBING TO ALL CLOSURE ITEMS PRIOR TO INSTALLING SUCH ITEMS IN THE AIRPLANE.

         NOTE: Use the following listed closure items or equivalents. These items may be obtained as Fuel Tank and Vent System Testing Kit F80080-53 *[1] , and Testing Kit F80070-54 *[2]. Two kits are required to check the center tank vent system.

         (a) One Structural Vent Plug - F80080-100 (preferred) or 7TE65-46517 (Kit -53, -54)

*[1] AR 737-287 Series; TM 737-2Bl Series
*[2] AR 737-287C Series; TM 737-281C Series

         (b) Two Vent Scoop Closure Plugs - F80080-88 (preferred) or 9TE65-45412 (Kit -53, -54)
         (c) One Vent Drain Hole Plug - F80080-10 (Kit -53 only)
         (d) One Surge Tank Pressure Door Assembly - F80080-82 (preferred) or F80080-5 (Kit -53, -54)
         (e) One Center Tank Vent Plug - F80080-92 (preferred) or 9TE65-46517 (Kit -53 only)

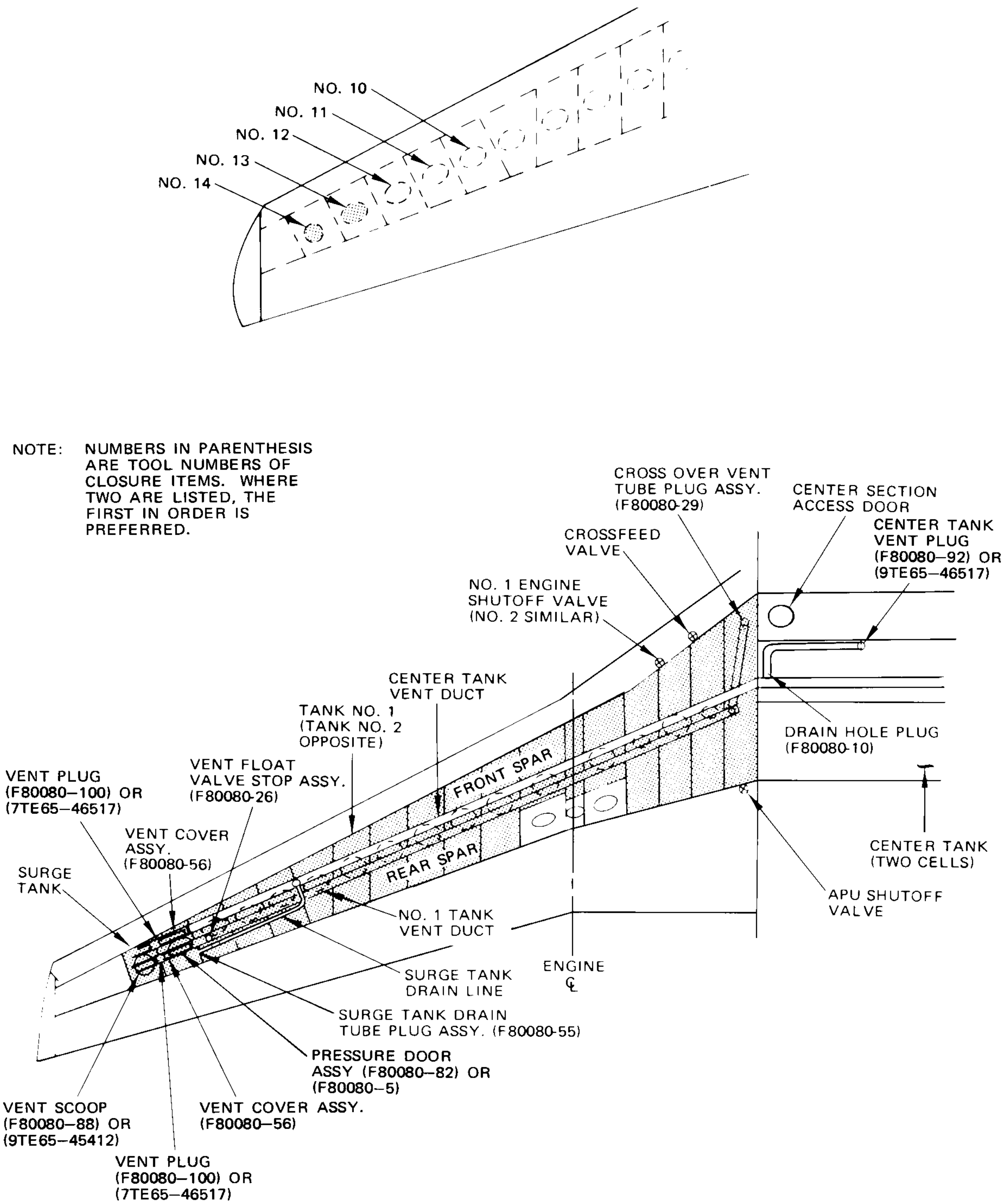
(f) One Surge Tank Drain Tube Plug Assy. - F80080-55 (Kit -53, -54)
(g) Two Drain Valve Plugs - F80080-112 (preferred) or 10TE65-46517 (Kit -54 only)
(h) One Vent Float Valve Stop Assembly - F80080-26 (Kit -53, -54)
(i) One Crossover Vent Tube Plug Assembly - F80080-29 (Kit -53, -54)
(j) One Center Tank Vent Plug - F80080-7 (Kit -54 only)
(k) One Float Valve Closure Plug - F80080-8 (Kit -54)
(l) Two Structural Vent Cover Assemblies - F80080-56 (Kit -53, -54)

C. Prepare for Vent System Pressure Check

<u>WARNING</u>: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

(1) Fuel Tank No. 1 or 2 Vent System (Fig. 601).
(a) Defuel and purge the surge tank and wing tank for entry on the side of the airplane to be checked (AMM 28-23-0/201, AMM 28-10-0/201).
(b) Remove the wing fuel tank access panels No. 1, 12, 13 and 14 (AMM 28-11-11/401).
(c) Enter wing tank through No. 1 panel and rib access openings No. 2 and No. 1. Block off wing tank vent and drain hole by installing a crossover vent tube plug assembly F80080-29 in inboard end of vent.
(d) Enter surge tank through No. 13 panel and block off center tank vent duct and surge tank drain.
1) Install structural vent plug, F80080-100 or 7TE65-46517, in center tank vent (FWD) duct.
2) Install structural vent cover assembly, F80080-56, in rectangular slot in center tank (FWD) vent duct.
3) Install surge tank drain tube plug assembly, F80080-55, on opening to surge tank drain line.
(e) Block off No. 13 panel opening by installing a surge tank pressure door assembly F80080-82 or F80080-5 (AMM 28-11-11/401).
(f) Block off No. 14 panel opening by installing a vent scoop closure plug, F80080-88 or 9TE65-45412.
(g) Enter main tank through No. 12 panel opening to gain access to vent float valve. Block off float valve by installing vent float valve stop assembly F80080-26.

(2) Center Wing Vent System - Two Bladder Cells Installed (Fig. 601)
(a) Ensure surge tanks and center wing cells No. 2 and 3, are prepared for tank entry (Ref 28-23-0, 28-10-0, Maintenance Practices).



Fuel Vent System Pressure Check
Figure 601 (Sheet 1)

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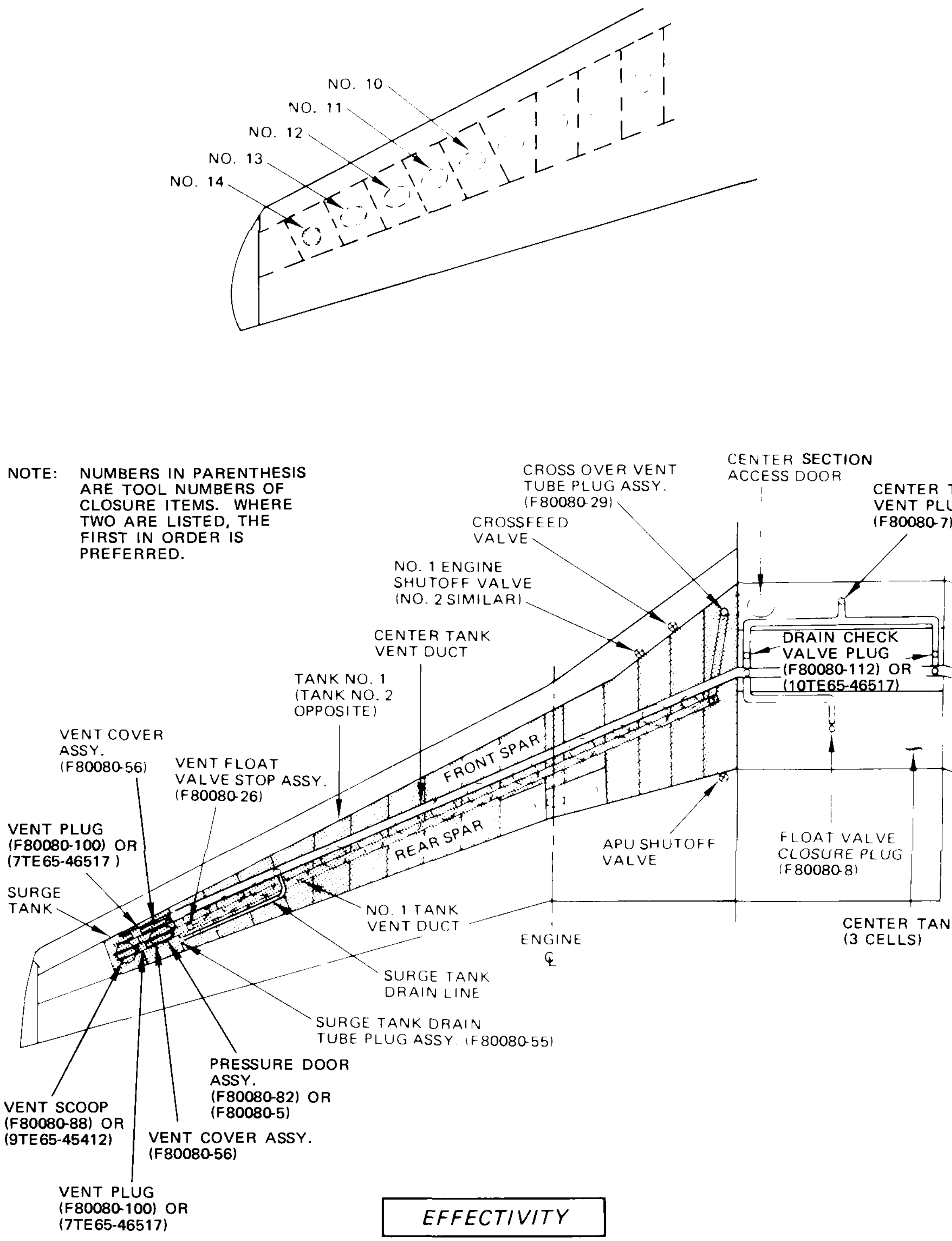
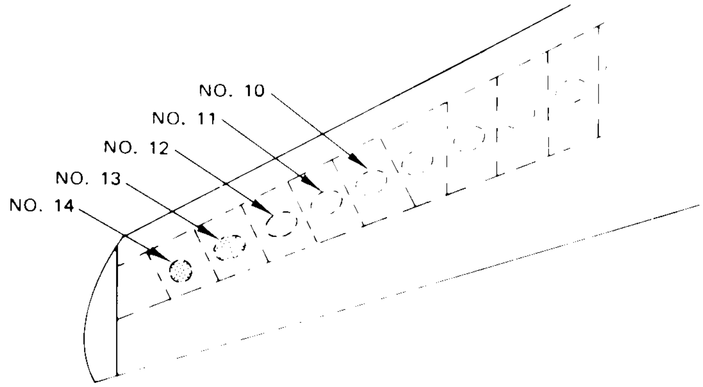


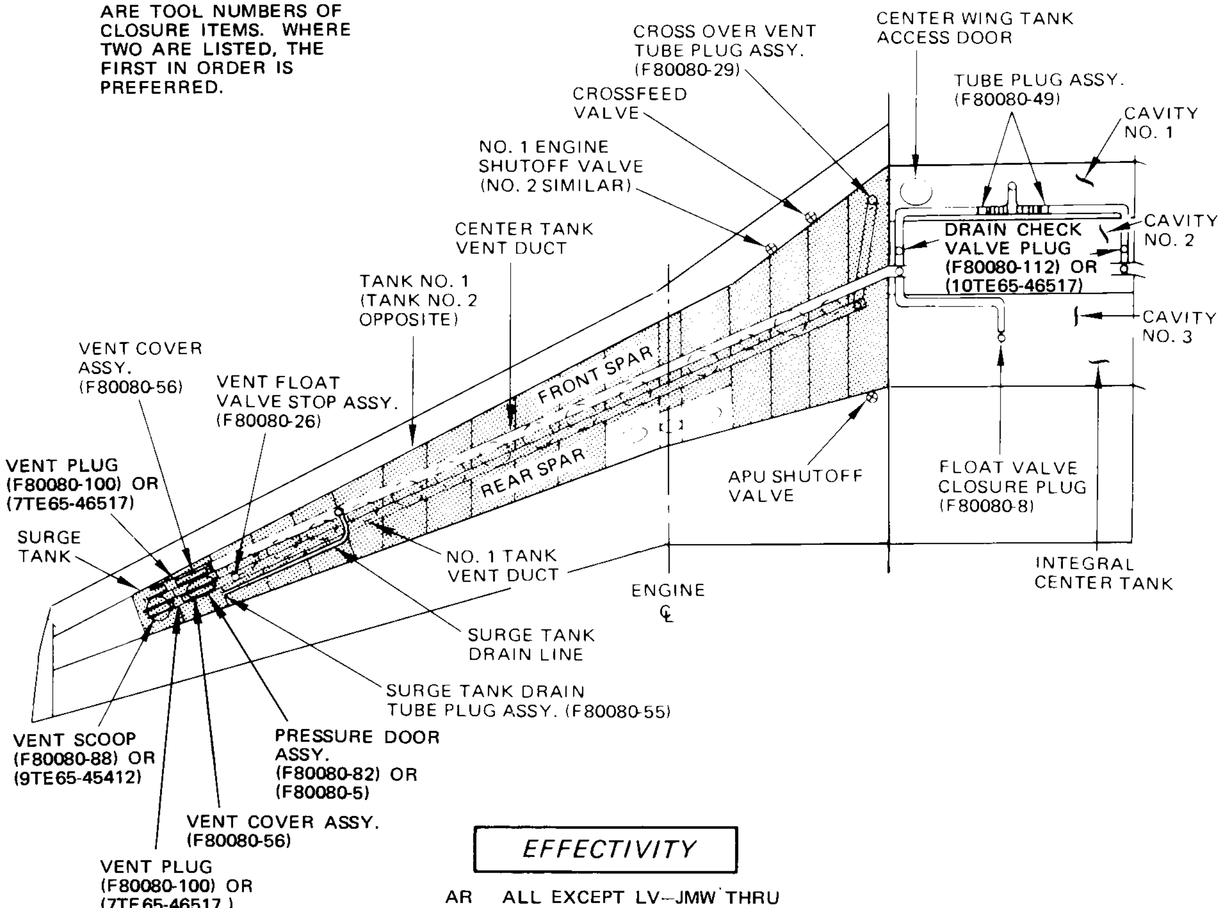
EFFECTIVITY

AR	737–287C SERIES
TM	737–2B1C SERIES

Fuel Vent System Pressure Check
Figure 601 (Sheet 2)



NOTE: NUMBERS IN PARENTHESIS ARE TOOL NUMBERS OF CLOSURE ITEMS. WHERE TWO ARE LISTED, THE FIRST IN ORDER IS PREFERRED.



EFFECTIVITY

AR	ALL EXCEPT LV–JMW THRU LV–JMZ, LV–JND, LV–JNE, LV–JTD, LV–JTO, LV–LEB
FL	N7340F THRU N7346F, N7385F N7391F THRU N7398F
IN	ALL EXCEPT EI–ASA THRU EI–ASH
PI	N761N AND ON
NZ	ZK–NAP, ZK–NAR
TS	N70721, N70722

Fuel Vent System Pressure Check
Figure 601 (Sheet 3)

(b) Remove left and right wing fuel tank access panels No. 13 and 14 (Fig. 601) (Ref 28-11-11, Removal/Installation).
(c) Remove wing center section access panel (Ref 28-12-21 Removal/Installation).
(d) Remove fuel cell No. 2 access panel (Ref 28-12-31, Removal/Installation).
(e) Enter cell No. 2 through wing center section access opening and cell access opening to gain access to vent tube. Block off vent tube by installing a center tank vent plug, F80080-92 or 9TE65-46517 in end of vent tube orifice. Block off vent tube drain hole by installing a vent drain clamp plug, F80080-10 on vent tube at drain hole location.
(f) Enter left wing surge tank through No. 13 panel and block off No. 1 tank vent duct.
  1) Install structural vent plug, F80080-100 or 7TE65-46517, in tank No. 1 (aft) vent duct.
  2) Install structural vent cover assembly, F80080-56, in rectangular slot in tank No. 1 (aft) vent duct.
(g) Repeat step (f) above for right wing.
(h) Block off No. 13 panel opening in left or right wing by installing a surge tank pressure door assembly, F80080-82 or F80080-5. Reinstall panel No. 13 in wing opposite to that chosen for pressure door installation.
(i) Block off No. 14 panel opening in left wing by installing a vent scoop closure plug, F80080-88 or 9TE65-45412.
(j) Repeat step (i) above for right wing.

(3) Center Wing Vent System - Three Bladder Cells Installed (Fig. 601)
(a) Ensure surge tanks, center wing cells No. 1, 2, and 3 are prepared for tank entry (Ref 28-23-0, 28-10-0, Maintenance Practices).
(b) Remove left and right wing fuel tank access panels No. 13 and 14 (Ref 28-11-11, Removal/Installation).
(c) Remove wing center section fuel cell access panel (Ref 28-12-31, Removal/installation).
(d) Enter cell No. 3 to gain access to vent float valve. Block off float valve by installing a float valve closure plug, F80080-8, between valve float arm and float down stop.
(e) Enter cell No. 2 to gain access to vent drain check valves. Block off two check valves by installing two drain valve plugs, F80080-112 or loTE65-46517 on lower end of valves.
(f) Enter cell No. 1 to gain access to forward vent tube orifice. Block off orifice by installing a center tank vent plug F80080-7 over vent tube orifice.

(g) Enter left wing surge tank through No. 13 panel and block off No. I tank vent duct.
   1) Install structural vent plug, F88080-100 or 7TE65-46517, in tank No. 1 (aft) vent duct.
   2) Install structural vent cover assembly, F80080-56, in rectangular slot in tank No. 1 (aft) vent duct.

(h) Repeat step (g) above for right wing.

(i) Block off No. 13 panel opening in left or right wing by installing a surge tank pressure door assembly, F80080-82 or F80080-5. Reinstall panel No. 13 in wing opposite to that chosen for pressure door assembly installation.

(j) Block off No. 14 panel opening in left wing by installing a vent scoop closure plug, F80080-88 or 9TE65-45412.

(k) Repeat step (J) above for right wing.

(4) Center Wing Vent System - Integral Center Tank (Fig. 601)

(a) Ensure surge tanks and center wing tank are prepared for tank entry (Ref 28-23-0 and 28-10-0, Maintenance Practices).

(b) Remove left and right wing fuel tank access panels No. 13 and 14 (Ref 28-11-11, Removal/Installation).

(c) Remove center wing tank access panel to gain access to center tank cavities (Ref 28-11-31, Removal/Installation).

(d) Block off float valve, in center wing cavity No. 3, by installing a float valve closure plug, F80080-8, between valve float arm and float down stop.

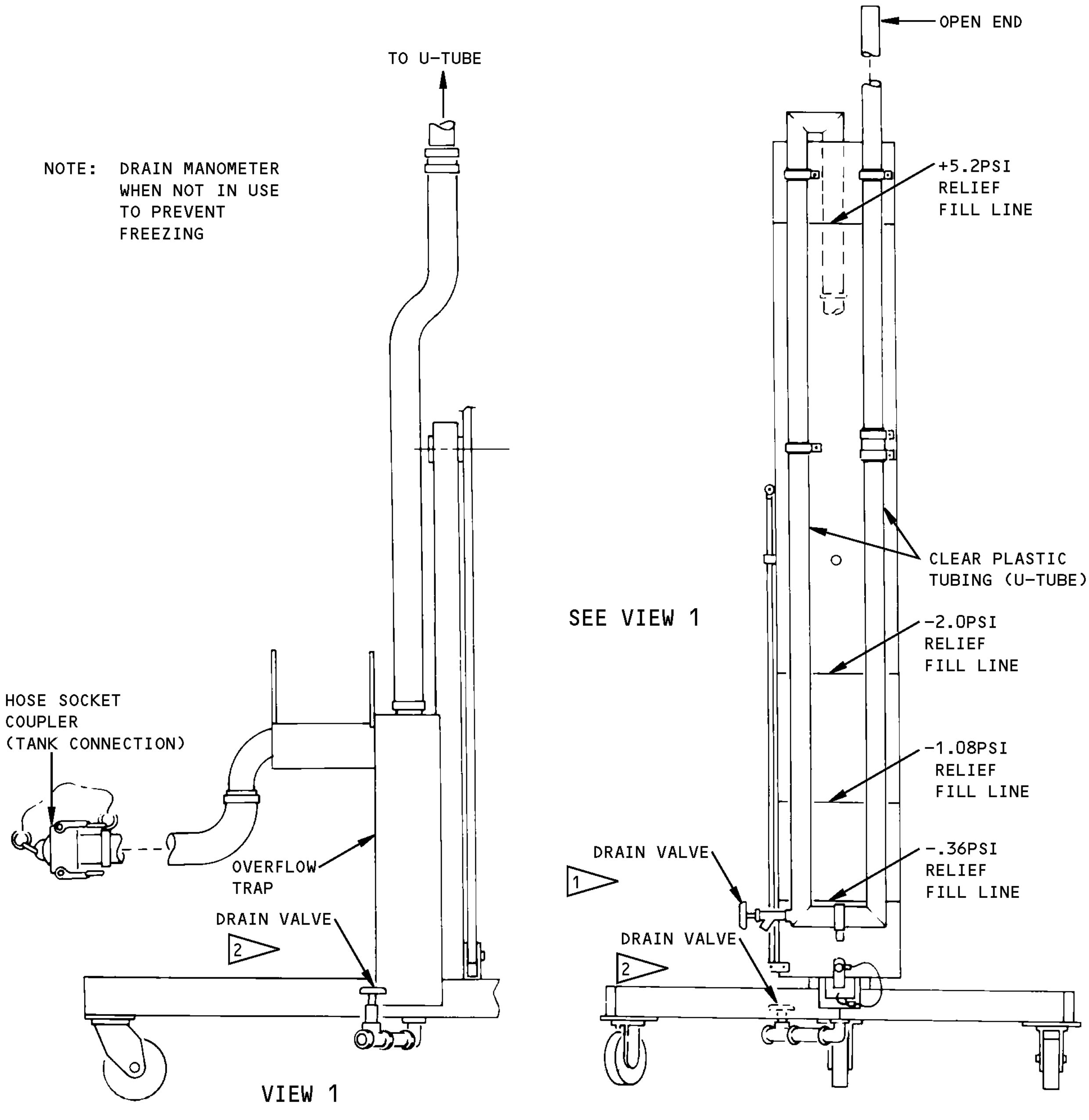
(e) Block off two vent drain check valves, in center wing cavity No. 2, by installing two drain valve plugs, F80080-112 or 10TE65-46517, on lower end of valves.

(f) Plug forward vent tube in center wing cavity No.1.
   1) Remove bonding jumpers and uncouple center section vent tube (tee) from connecting LH and RH vent tubes.
   2) Remove clamps holding center section vent tube to spanwise beam and remove bolt holding tube support bracket to stringer. Remove tube.
   3) Install tube plug assemblies, F80080-49, in the two open ends of remaining LH and RH vent tubes.

(g) Enter left wing surge tank through No. 13 panel and block off No. 1 tank vent duct (aft).
   1) Install a structural vent plug, F80080-100 or 7TE65-46517, in outboard end of vent.
   2) Install a structural vent cover assembly, F80080-56, in rectangular slot in vent duct.

(h) Repeat step (g) above for right wing.

(i) Block off No. 13 panel opening in left or right wing by installing a surge tank pressure door assembly, F80080-82 or F80080-5. Reinstall panel No. 13 in wing opposite to that chosen for pressure door assembly installation.

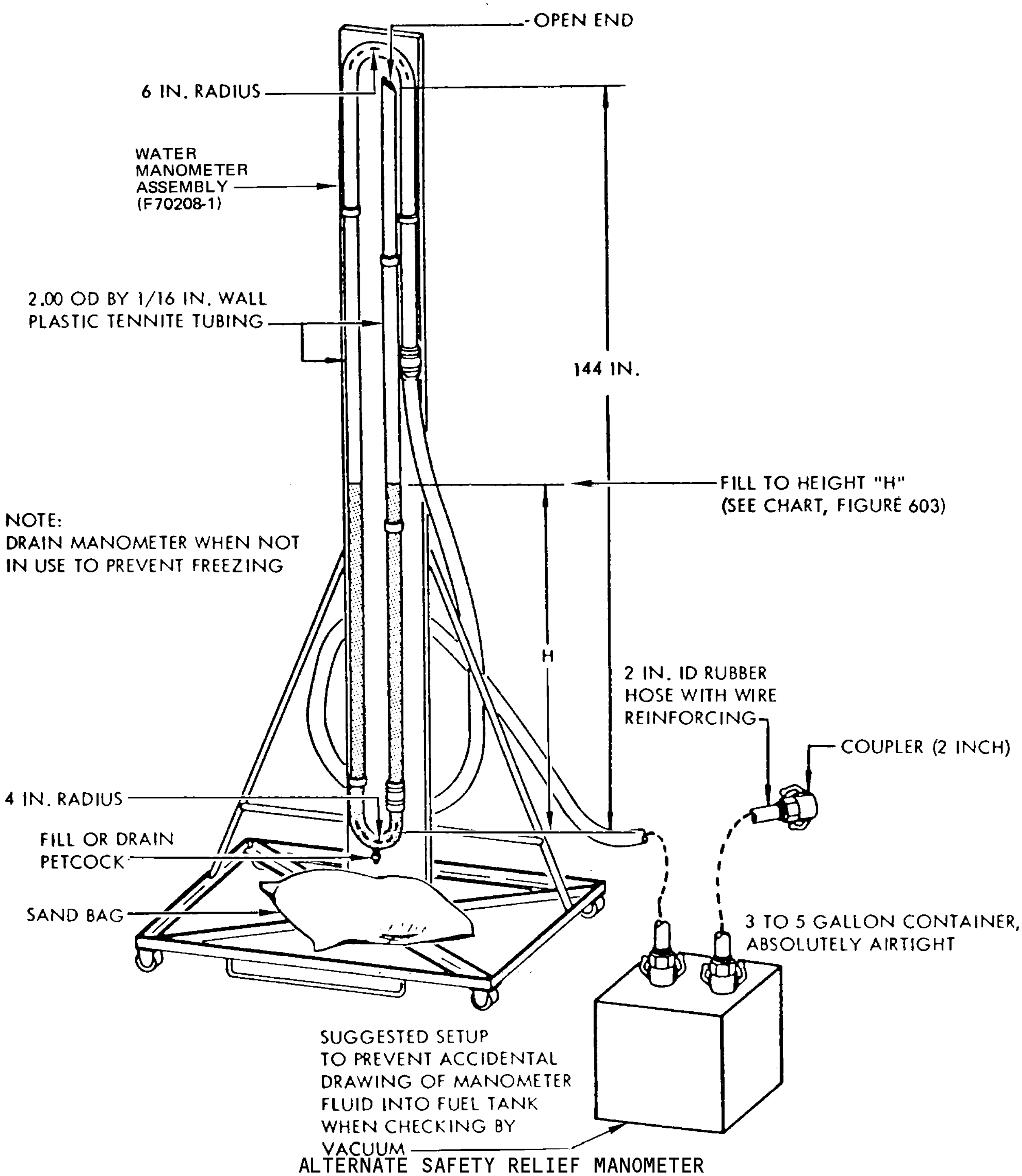


PREFERRED SAFETY TO ADJUST FILL LEVEL AND TO DRAIN TUBING

1 USE VALVE TO ADJUST FILL LEVEL AND TO DRAIN TUBING

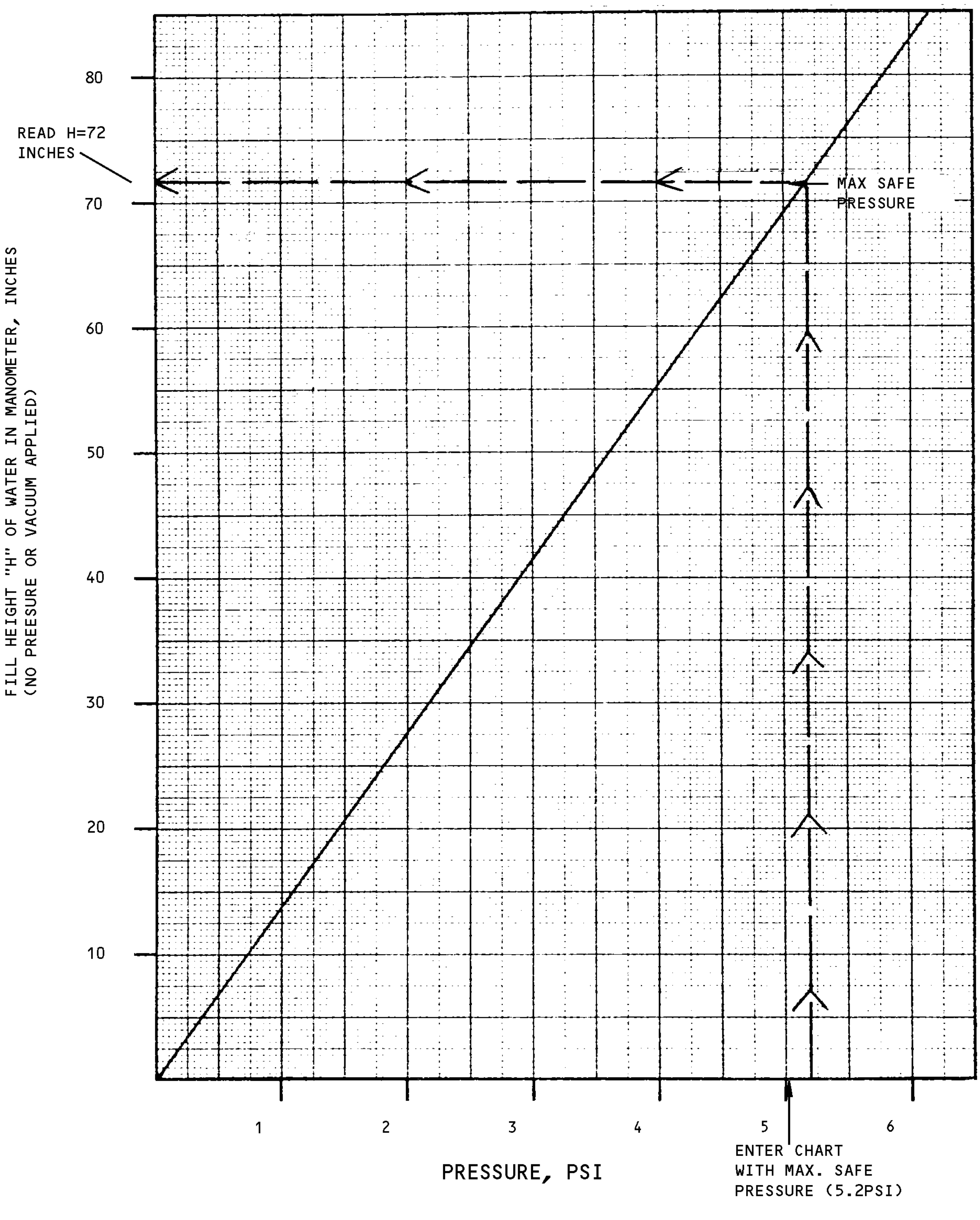
2 USE VALVE TO DRAIN OVERFLOW TRAP

Water Safety Relief Manometer
Figure 602



ALTERNATE SAFETY RELIEF MANOMETER

Water Safety Relief Manometer Assembly
Figure 603



NOTE: USE WITH F70208-1 MANOMETER (ALTERNATE)

Manometer Water Column Pressure Chart
Figure 604

(j) Block off No. 14 panel opening in left wing by installing a vent scoop closure plug, F80080-88 or 9TE65-45412.

(k) Repeat step (j) above for right wing.

D. Pressure Check Fuel Vent System

(1) Connect ground air supply and water safety valve manometer (Fig. 603) to fittings on surge tank pressure door assembly.

(2) Adjust water level or set water height in manometer to relieve (pullover) at 5.2 psi (Fig. 603, 604).

(3) Pressurize vent system to 5.0 ±0.2 psi (Fig. 604). Allow approximately 30 minutes for pressure and temperature to stabilize.

(4) Maintain 5.0 ±0.2 psi on system and check manometer for pressure drop. Maximum allowable leakage is 1.0 inch of water in 15 minutes.

(5) If excessive pressure drop occurs indicating leakage, check that vent system closure items are installed satisfactorily and repeat step (4) above.

(6) If excessive leakage continues, check vent channel with a noncorrosive soap solution. Apply solution to outside of vent channel and appearance of bubbles should reveal the external leak point(s).

(a) Mark location of bubbles, remove bubble solution from surface with a damp cotton wiper (BMS15-5), and depressurize vent channel.

(b) Repair the leak (AMM 28-11-0/801).

(c) Repeat pressure check to determine leak has been eliminated.

(7) After completing check, remove all vent system closure items and restore system to normal configuration.

WARNING: SERIOUS DAMAGE CAN OCCUR TO AIRPLANE STRUCTURE WHEN PERFORMING PRESSURE FUELING OPERATION IF VENT SYSTEM CLOSURE ITEMS ARE NOT REMOVED AFTER COMPLETING PRESSURE CHECK.

(8) On airplanes with integral center tank, install center section vent tube in center wing cavity No. 1. Ensure that O-ring seals are installed before connecting tube couplings. Install clamps, bracket bolt, and bonding jumpers.

(9) Check electrical bond between center section vent tube and connecting tube per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.

(10) Ensure that tools and equipment are removed from all tanks.

(11) Install fuel tank No. 1 and 2 access panels (Ref 28-11-11).

(12) On airplanes with bladder cells in center tank, install access panels (Ref 28-12-21, 28-12-31, as applicable).

(13) On airplanes with integral center tank, install center wing tank access panel (Ref 28-11-31).

FUEL VENT FLOAT VALVE - REMOVAL/INSTALLATION

WARNING: COMPLY WITH ALL TANK ENTRY PRECAUTIONS (REF 28-10-0, MAINTENANCE PRACTICES).

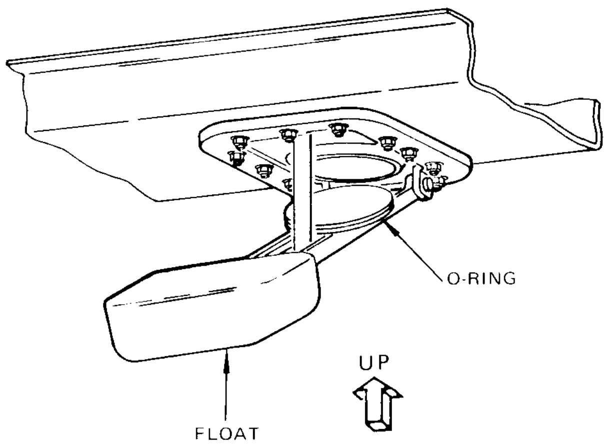
1. Remove Fuel Vent Float Valve (Fig. 401)
    A. Defuel and purge fuel tank (Ref 28-23-0,. 28-10-0, Maintenance Practices).
    B. Remove main or center fuel tank access panels as necessary to gain access to float valve (Ref 28-11-11, 28-11-31 or 28-12-31, Removal/Installation).
    C. Remove bolts securing float valve to structure.
    D. Remove float valve.
2. Install Fuel Vent Float Valve (Fig. 401)
    A. Install O-ring seal in O-ring groove on float valve.
    B. Hold float valve in position and install bolts.

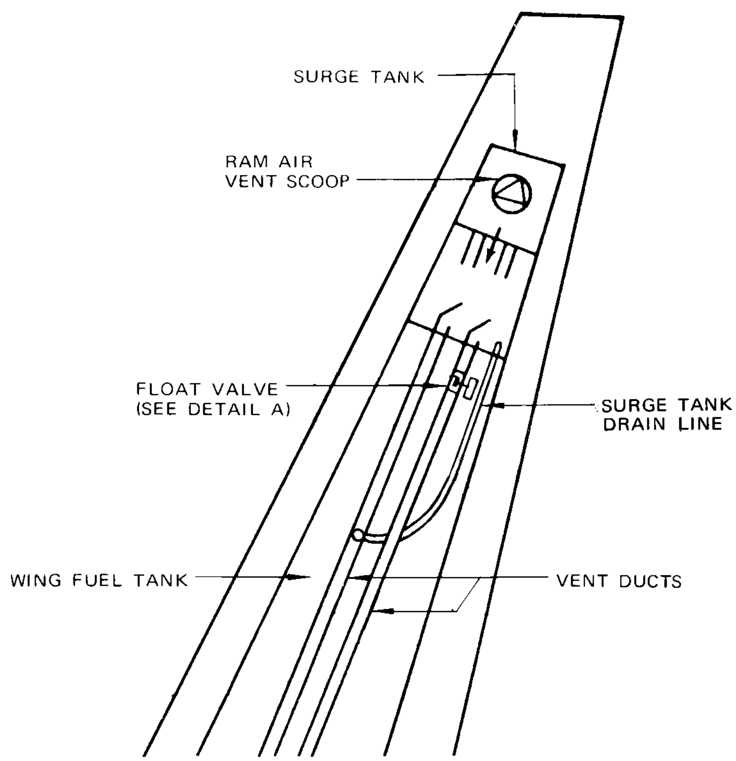
        NOTE: Assure that no color coding tape is left on any component within the fuel tank.

    C. Check tank for cleanliness.
    D. Install access panel(s) (Ref 28-11-11, 28-11-31, or 28-12-31, Removal/Installation).

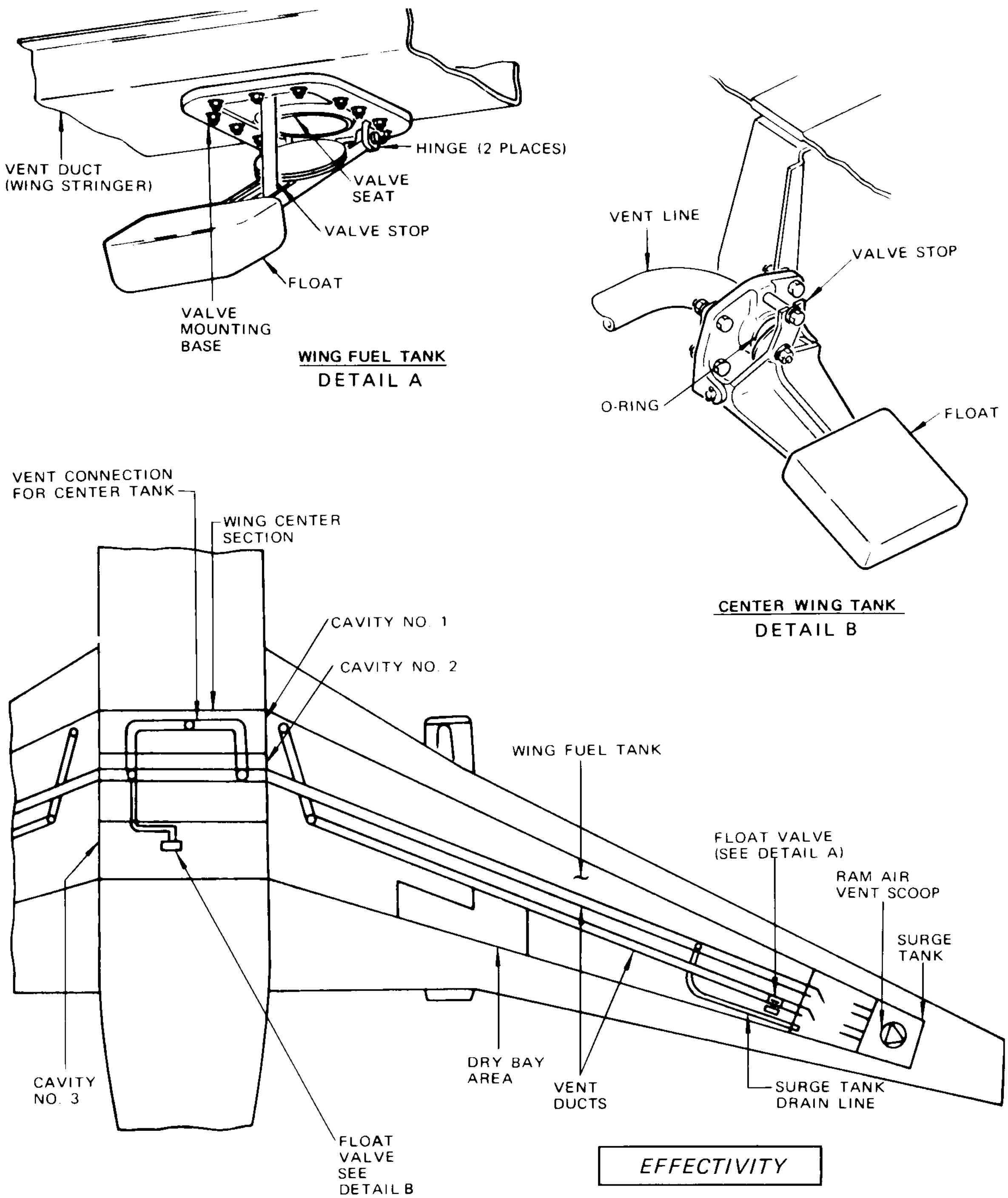
EFFECTIVITY

AR	LV-JMW THRU LV-JMZ, LV-JTD, LV-JTO, LV-LEB
AQ	N21SW THRU N23SW
CP	CP-CFB THRU CF-CPU
IN	EI-ASA THRU EI-ASH
NZ	ALL EXCEPT ZK-NAP, ZK-NAQ
PW	CF-PWC THRU CF-PWE, CF-PWM





Fuel Vent Float Valve Installation
Figure 401 (Sheet 1)



EFFECTIVITY	
AQ	ALL EXCEPT N21SW THRU N23SW
AR	ALL EXCEPT LV-JMW THRU LV-JMZ, LV-JTD, LV-JTO, LV-LEB
NZ	ZK-NAP, ZK-NAQ
PI	N761N AND ON
WE	ALL EXCEPT N2711R, N4907

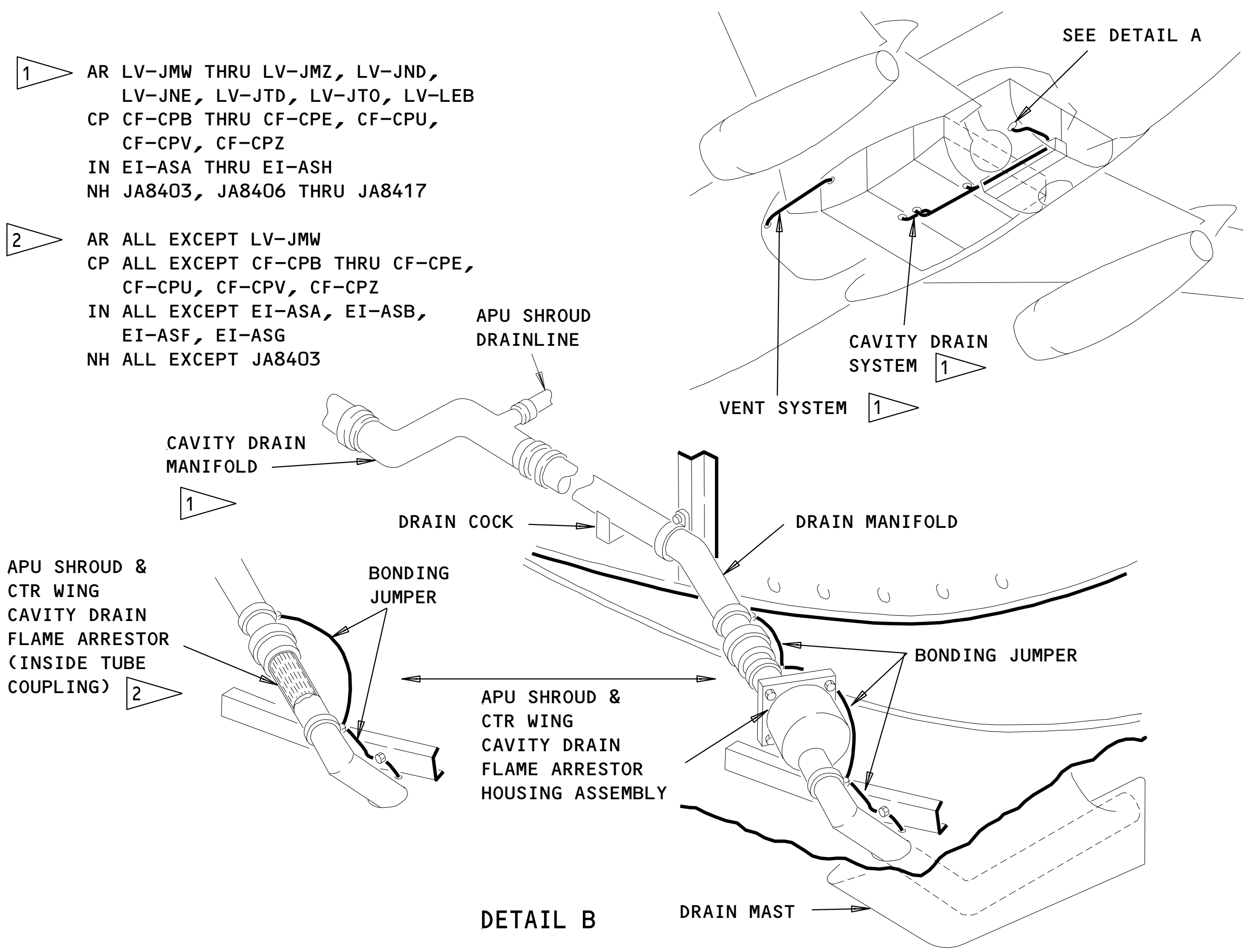
Fuel Vent Float Valve Installation
Figure 401 (Sheet 2)

CENTER WING CAVITY - INSPECTION/CHECK

1. Center Wing Cavity and APU Shroud Drain System Check
   A. Drain System
      (1) A drain cock for the APU shroud drain and, on all airplanes with removable bladder cells, the drain system of the center wing cavity is located in the drain line in the left main wheel well immediately upstream from the flame arrestor. The drain cock must be opened periodically to check for accumulated fluids not discharged through the drain mast.
      (2) The center wing cavity drain system flame arrestor assembly (APU shroud drain system flame arrestor) can be cleaned by removing the assembly and immersing it in a mild cleaning bath and using an air gun to free any clogged cells.
      (3) Gain access to drain cock through left main wheel well.
      (4) Open drain cock and allow accumulated fluids to discharge.
      (5) Close drain cock.

CENTER WING CAVITY - INSPECTION/CHECK

1. Center Wing Cavity and APU Shroud Drain System Check
   A. General
      (1) A drain cock for the APU shroud drain and, on all airplanes with removable bladder cells, the drain system of the center wing cavity is located in the drain line in the left main wheel well immediately upstream from the flame arrestor. The drain cock must be opened periodically to check for accumulated fluids not discharged through the drain mast.
      (2) The center wing cavity drain system flame arrestor assembly (APU shroud drain system flame arrestor) can be cleaned by removing the assembly and immersing it in a mild cleaning bath and using an air gun to free any clogged cells.
   B. Check Center Wing Cavity and APU Shroud Drain System
      (1) Gain access to drain cock through left main wheel well.
      (2) Open drain cock and allow accumulated fluids to discharge.
      (3) Close drain cock.



Center Wing Cavity and APU Shroud Drain System
Figure 601

AIR VENT SCOOP FLAME ARRESTOR - REMOVAL/INSTALLATION

1. General
   A. A cellular-core, stainless steel flame arrestor unit is installed on the top flange of the air vent scoop access panel air stack (Fig. 401). If the flame arrestor cells are clogged with dirt and foreign matter the flame arrestor can usually be cleaned, without removing the arrestor, by immersing the whole access panel assembly into a mild cleaning bath and using an air gun to free any clogged cells.
   B. If it is necessary to remove the flame arrestor, the mounting flange must be resealed upon reinstallation.
2. Equipment and Materials
   A. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Paint brush, small
   C. Solvent - Methyl ethyl ketone (MEK), TT-M-261
   D. B01013 Solvent - Final Cleaning Prior to Fuel Tank Sealing (Series 93) (AMM 20-30-93/201)
   E. Sealant removal, cutting, and fairing tools (Ref par. 3.A., AMM 28-11-0/801)
   F. Sealant - BMS 5-45, Class A
   G. Sealant - BMS 5-45 , Class B
   H. Sealing gun or tube for applying fillet sealant material
3. Remove the Flame Arrestor
   A. Make sure the airplane is adequately grounded to an approved and identified ground.
   B. Unless fuel tank is defueled and purged, perform the following safety checks:
      (1) Remove electrical power from airplane and do not restore power until fuel tank is closed and safe.
      (2) Disconnect battery and attach sign which reads, OPEN FUEL TANKS - DO NOT CONNECT.
      (3) Rope off area around outboard section of wing and post clearly visible signs which read DANGER - OPEN FUEL TANKS.
      (4) Ensure there is no residual fuel in surge tank by opening sump drain and draining any remaining fuel into a suitable container.
   C. Remove the air vent scoop access panel (AMM 28-11-11/401).
   D. Using sealant cutting and removal tools, strip sealant from around flame arrestor mounting flange.
   E. Remove the flame arrestor attaching bolts and discard the seal washers.

4. Install Flame Arrestor (Fig. 401)
   A. Remove any remaining sealant and thoroughly clean mounting flanges using a clean, cotton wiper (BMS15-5) moistened with MEK or Series 93 solvent.

      WARNING: METHYL ETHYL KETONE (MEK) IS TOXIC. USE ONLY IN WELL-VENTILATED AREA.

      NOTE: Metal contacting surfaces between flame arrestor and air vent stack flange must be clean to ensure electrical bonding of no higher than 0.010 ohm maximum resistance.

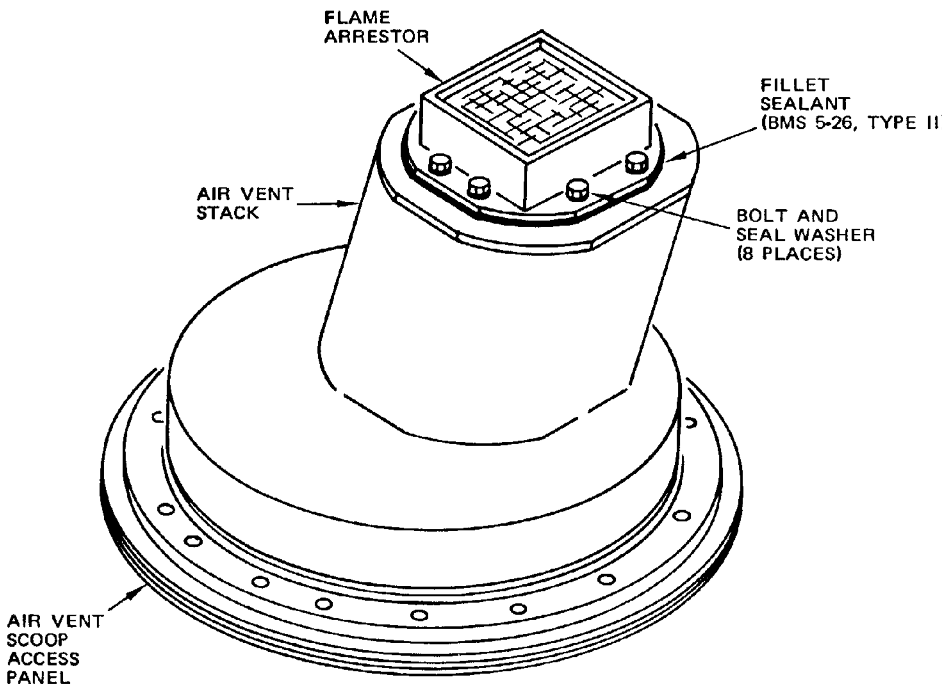
   B. Ensure cells of flame arrestor are unrestricted to airflow; clean, if necessary.
   C. Install flame arrestor on air vent stack flange using a new seal washer under the head of each bolt.
   D. Do a check of the electrical bond between the flame arrestor and the flange on the air vent stack.

      NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

      (1) Make sure the resistance is 0.010 ohm (10 milliohms) or less.

         NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

   E. Apply brush coat of BMS 5-45, Class A sealant material to the flange edge areas of the flame arrestor and air vent stack (Ref 28-11-0, Approved Repairs, except omit requirement to realodize affected surfaces). Coating may overlap fillet seal edge margin by 0.050 inch.
   F. At any time after application of brush coat BMS 5-45, apply BMS 5-45, Class B fillet sealant around flange edge as shown in Fig. 401. Use gun or tube for dispensing sealant (Ref 26-11-0, Approved Repairs).
   G. Install air vent scoop access panel (Ref Removal/Installation).
   H. If disconnected, reconnect battery and remove all warning signs.

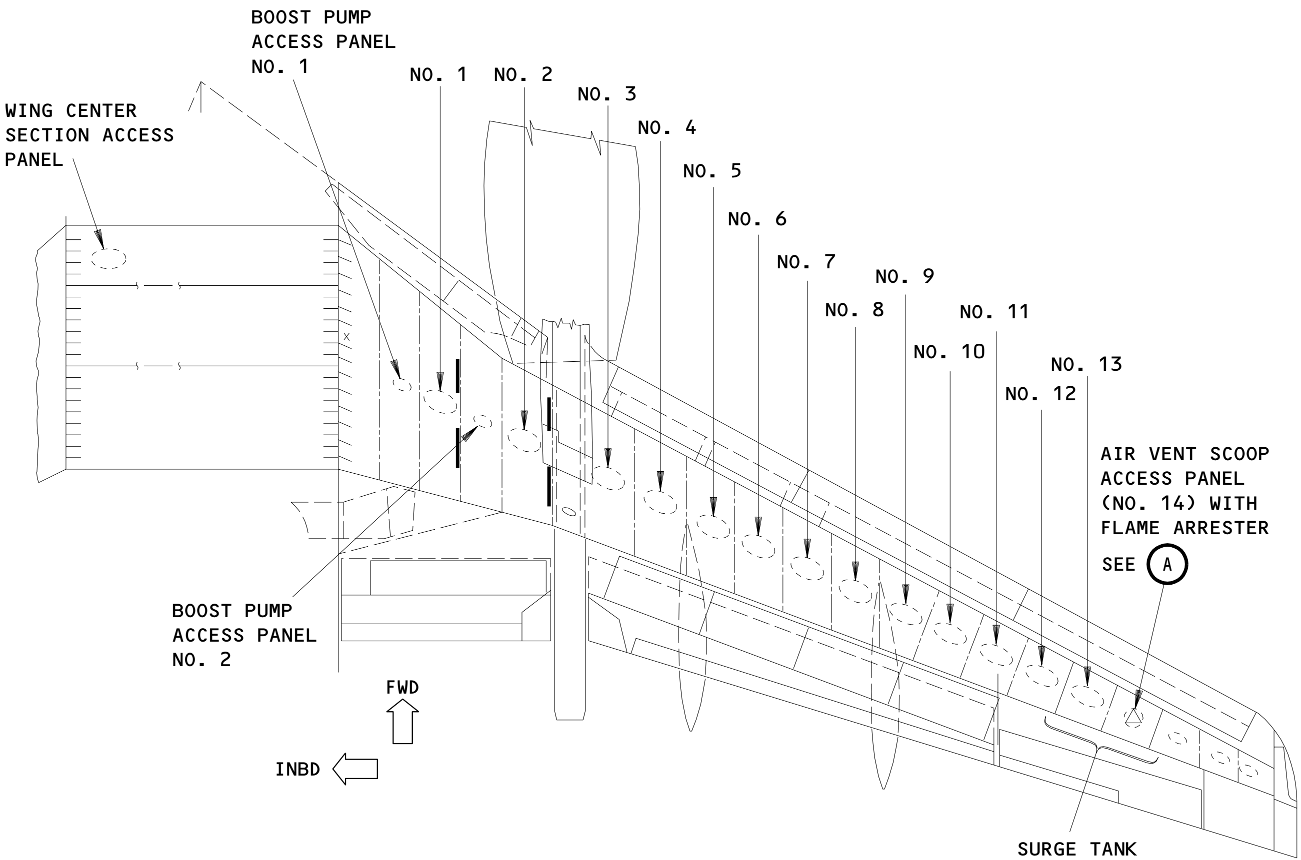


Air Vent Scoop Flame Arrestor Installation
Figure 401

AIR VENT SCOOP FLAME ARRESTOR - INSPECTION/CHECK

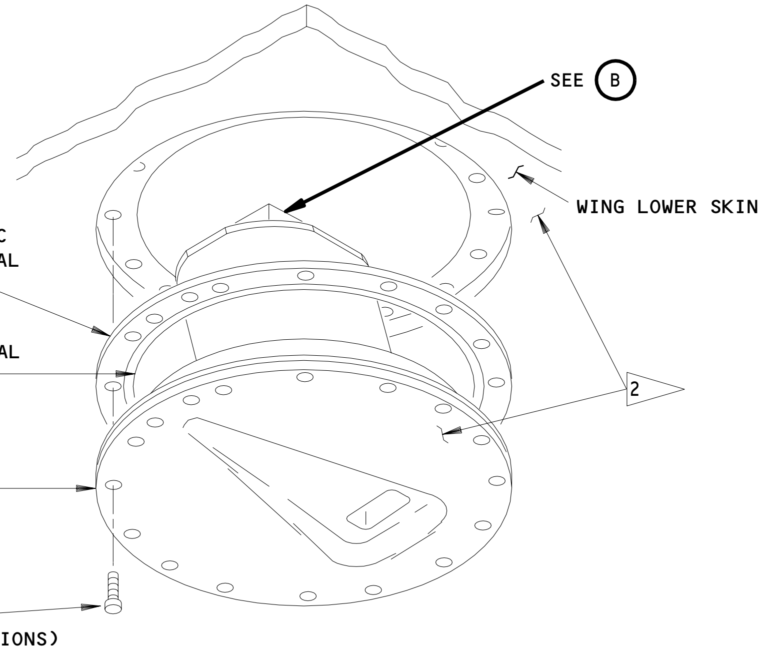
1. General
   A. This procedure contains a task to do a bonding resistance check of the air vent scoop flame arrester.
   B. A cellular-core, stainless steel flame arrestor unit is installed on the top flange of the air vent scoop access panel air stack. If the flame arrestor cells are clogged with dirt and foreign matter the flame arrestor can usually be cleaned, without removing the arrestor, by immersing the whole access panel assembly into a mild cleaning bath and using an air gun to free any clogged cells.
2. Air Vent Scoop Flame Arrester - Bonding Resistance Check (Fig. 601)
   A. References
      (1) AMM 28-11-11/401, Wing Fuel Tank Access Panels
      (2) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zones
          304 Left Fuel Vent Surge Tank
          404 Right Fuel Vent Surge Tank

   D. Procedure
      (1) Remove the access panel No. 14, for the air vent scoop (AMM 28-11-11/401).
      (2) Do a check of the bonding resistance between the air vent stack and the air vent scoop access panel (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.010 ohm (10 milliohms) or less.
      (3) Do a check of the bonding resistance between the air vent scoop access panel and the lower wing skin (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.005 ohm (5 milliohms) or less.
      (4) Install the access panel No. 14 for the air vent scoop (AMM 28-11-11/401).



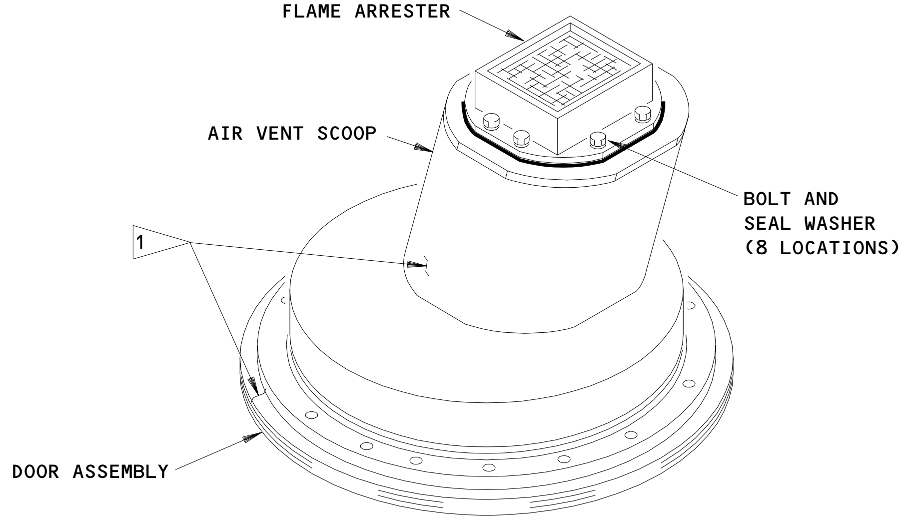
TANK NO. 2 IS SHOWN
(TANK NO. 1 IS OPPOSITE)

Air Vent Scoop Flame Arrester Resistance Check
Figure 601 (Sheet 1)



AIR VENT SCOOP ACCESS PANEL (NO. 14)
WITH FLAME ARRESTER

A



B

1 THE RESISTANCE FROM THE AIR VENT SCOOP TO THE DOOR ASSEMBLY IS 0.01 OHM OR LESS.

2 THE RESISTANCE FROM THE DOOR ASSEMBLY TO THE LOWER WING SKIN IS 0.005 OHMS OR LESS.

Air Vent Scoop Flame Arrester Resistance Check
Figure 601 (Sheet 2)

SURGE TANK FLAME ARRESTOR PRESSURE RELIEF VALVE - REMOVAL/INSTALLATION

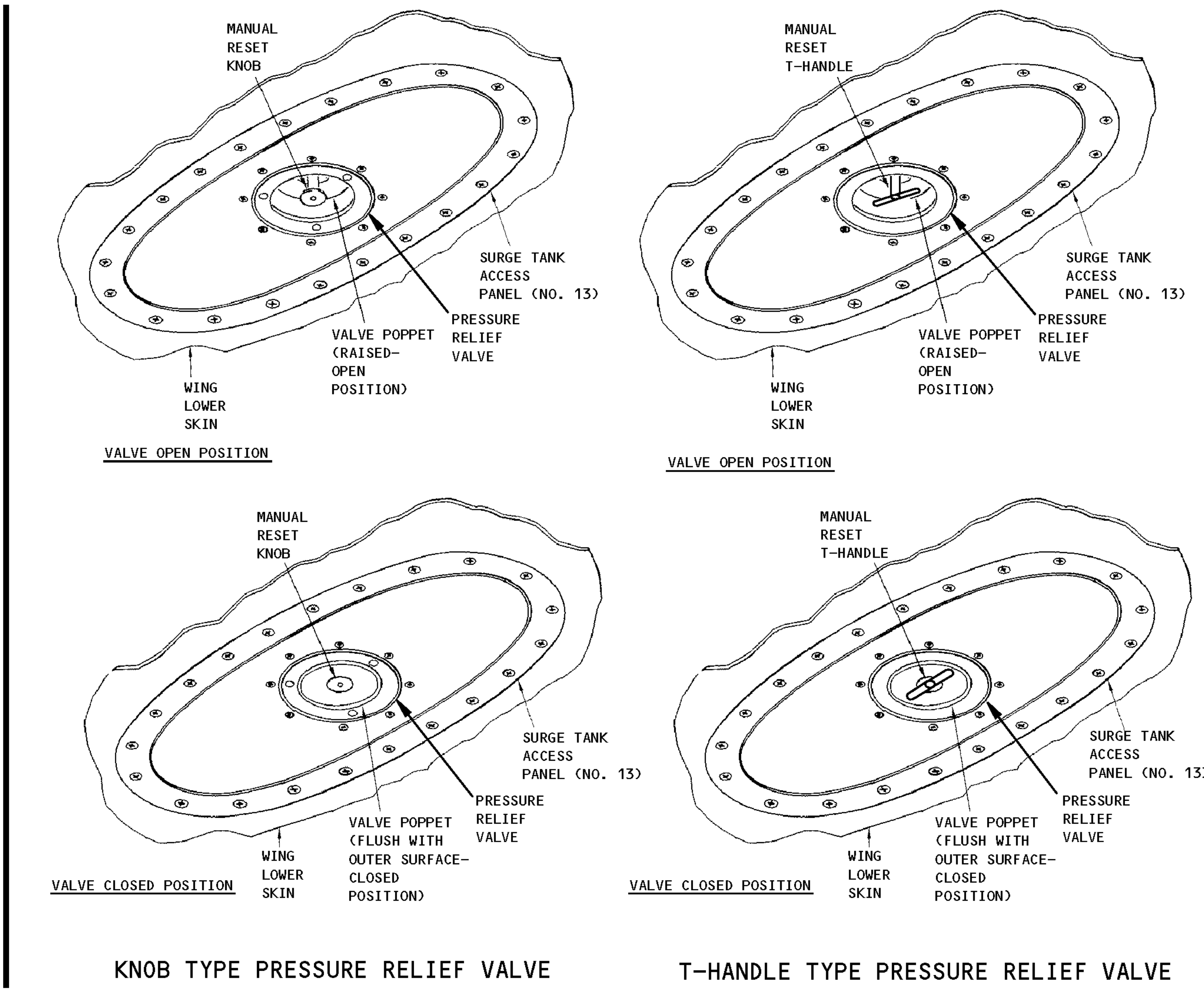
1. General
   A. A removal of relief valve may be unnecessary if valve actuation malfunction is suspected. A positive and negative pressure differential check on valve actuation can be performed without removing valve or its access panel from the airplane (AMM 28-13-41/601).
2. Equipment and Materials
   A. Aliphatic Naphtha - TT-N-95
   B. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
3. Prepare to Remove the Relief Valve
   A. Obey all purging and fuel tank entry precautions (AMM 28-10-0/201).
   B. Make sure that there is no residual fuel in surge tank by opening sump drain and draining any remaining fuel into a suitable container.
   C. Trip relief valve into open position (if not already open).

      NOTE: An open valve will have poppet positioned above the wing lower skin surface with the manual reset knob (or T-handle) and stem protruding down below poppet. When valve is closed, outer surface of poppet and reset knob (or T-handle) are flush with access panel and wing lower skin surface (Fig. 401).

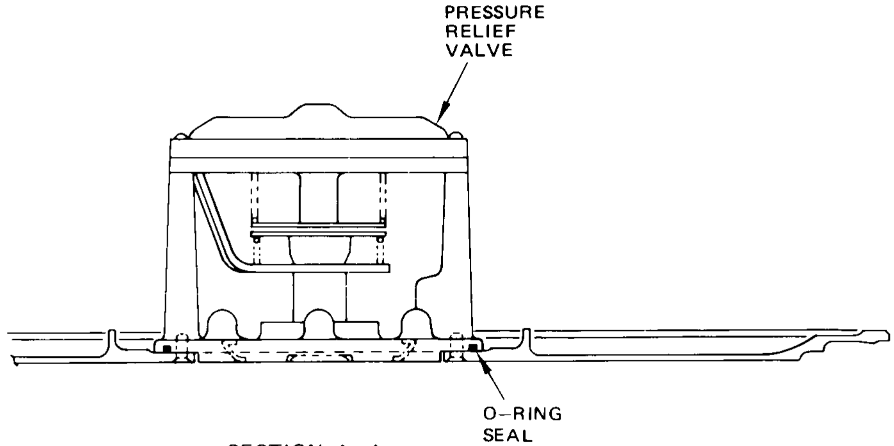
      (1) On airplanes with reset knob, insert end of tube (a common drinking straw can be used) into one of three pressure sensing holes in outer face of valve (Fig. 402). Hold fingers firmly over remaining two sensing holes and blow forcibly into the tube until valve trips. On airplanes with T-handle, insert a screwdriver into the pressure sense hole in the valve and push up until the valve trips.

         WARNING: DO NOT ATTEMPT TO REMOVE ACCESS PANEL WITH RELIEF VALVE IN CLOSED POSITION. VALVE OPENING MECHANISM CONTAINS A POWERFUL, FAST ACTING SPRING WHICH CAN EASILY BE UNLATCHED CAUSING SEVERE INJURY IF FINGERS ARE CAUGHT BETWEEN VALVE PARTS. A LOUD, STARTLING NOISE IS NORMAL WHEN VALVE OPENS.

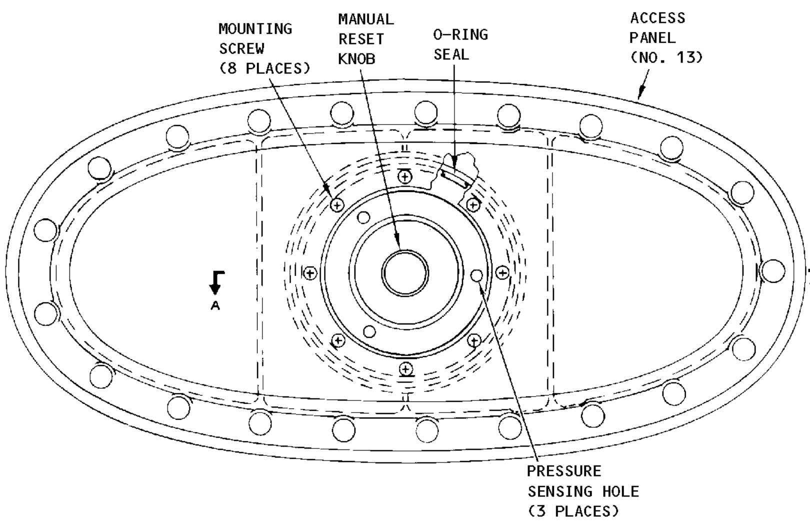
4. Remove the Relief Valve
   A. Remove the access panel (No. 13) from surge tank (AMM 28-11-11/601).
   B. Remove the eight mounting screws and separate the relief valve from the access panel (Fig. 402).
   C. Remove the O-ring seal from the flange groove and discard.



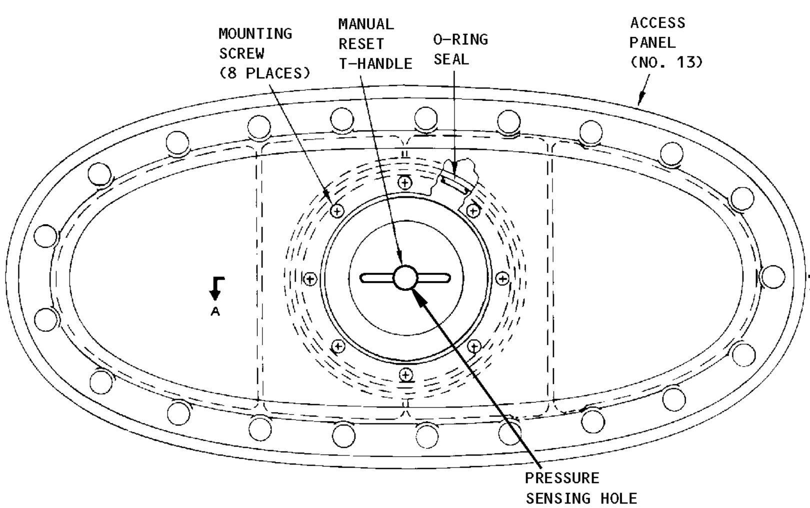
Surge Tank Flame Arrestor Pressure Relief Valve Position Identification
Figure 401



SECTION A-A



KNOB TYPE RELIEF VALVE



T-HANDLE TYPE RELIEF VALVE

Surge Tank Flame Arrestor Pressure Relief Valve Installation
Figure 402

5. Install Relief Valve (Fig. 402)

WARNING: RELIEF VALVE SHOULD BE STORED, HANDLED, AND INSTALLED ONLY WHEN VALVE IS IN THE OPEN (SPRING RELAXED) POSITION AS SEVERE INJURY TO FINGERS CAN RESULT FROM INADVERTENT SPRING RELEASE.

A. If relief valve is found to be in closed position, trip valve open using method in par. 3.C. above. Use care to handle valve on outer housing only if in closed position.
B. Thoroughly clean O-ring groove and mounting surface of relief valve and valve mounting surfaces on access panel using a clean, cotton wiper (BMS15-5) moistened with naphtha.
C. Install O-ring seal, lightly lubricated with fuel, in groove on relief valve flange.
D. Position relief valve on access panel and install eight mounting screws.
E. Tighten the mounting screws evenly to a standard value of 30-35 in/lb (3.4-4.0 Nm).
F. Measure the bonding resistance from the pressure relief valve to the access door.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(1) Make sure the resistance is 1 ohm (1000 milliohms) or less.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

G. Install the access panel on the airplane (AMM 28-11-11/401).
H. If the valve is open, use the manual reset knob (or T-handle) to close the valve poppet (AMM 28-13-41/601).
I. Do a check of the relief valve actuation (AMM 28-13-41/601).
J. If it is not necessary, remove the precautionary signs and put the airplane back to its usual position.

SURGE TANK FLAME ARRESTOR PRESSURE RELIEF VALVE - INSPECTION CHECK

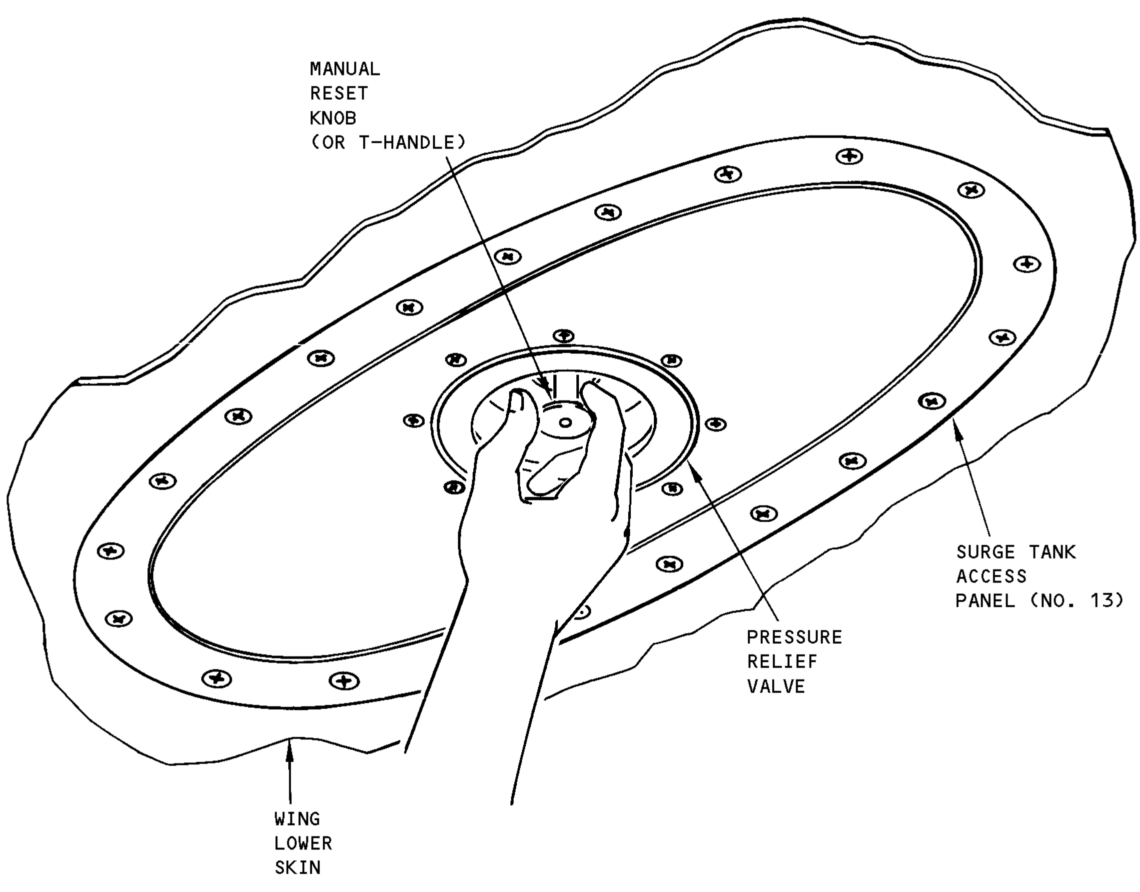
1. General
   A. This procedure has these tasks:
      (1) Close the relief valve manually.
      (2) Pressure check of the relief valve.
      (3) Pressure relief valve - bonding resistance check.
   B. The relief valve, if actuated to the open position, will bypass the normal air vent scoop in the fuel vent system. Once open, from an abnormal positive or negative pressure differential, the valve must be manually closed. The actuation pressure check is made with the valve installed in the airplane, using special equipment attached to the external skin of the airplane.
2. Close the Relief Valve Using Manual Reset
   A. Check for open relief valve by examining poppet position at center of elliptical access panel adjacent to air vent scoop at each wing tip.

      NOTE: An open valve will have poppet positioned above the wing lower skin surface with the manual reset knob (or T-handle) and stem protruding down below poppet.

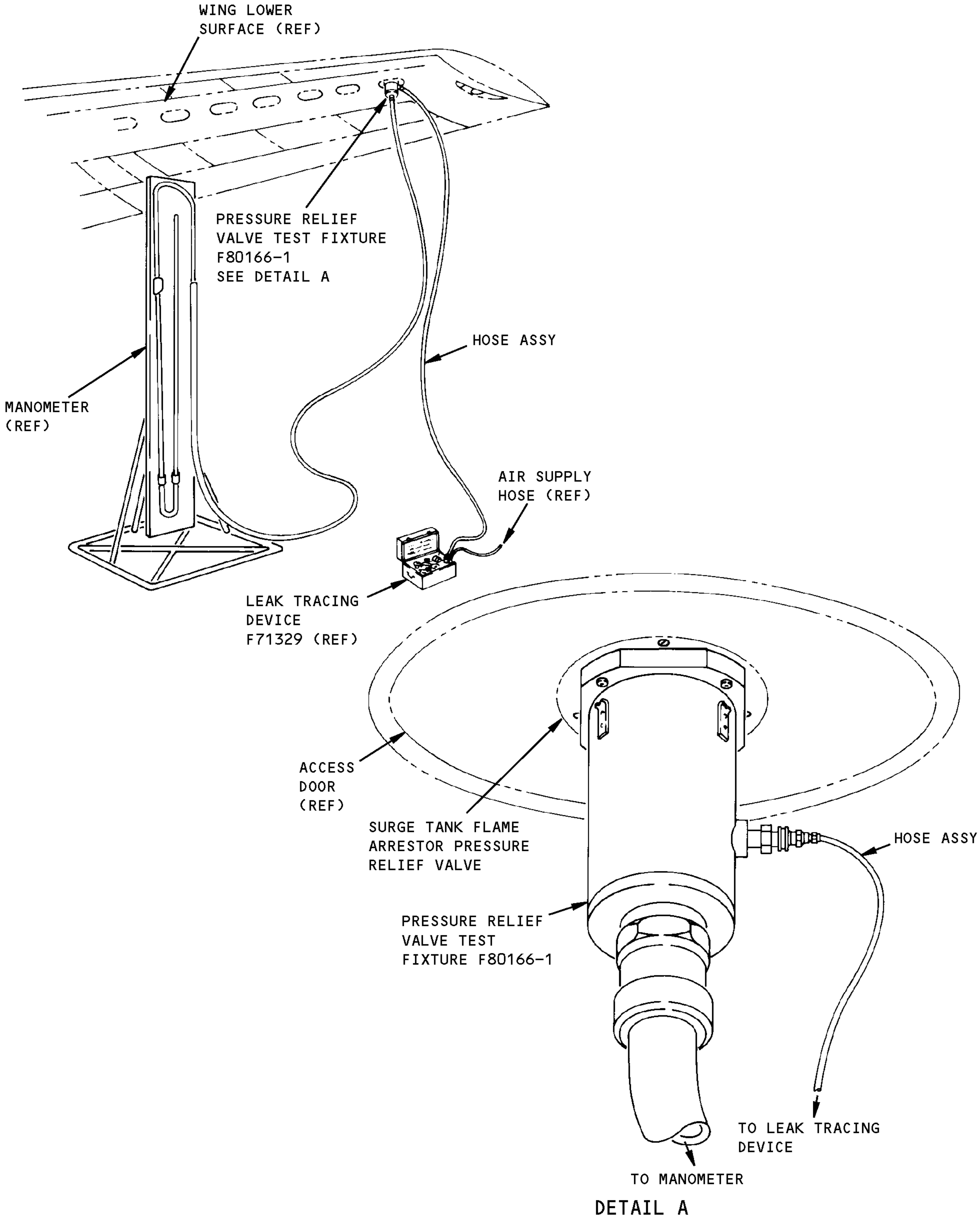
   B. Manually reset relief valve poppet to closed position (Fig. 601).
      (1) Do a check for blockage around the pressure relief valve before you reset it.
      (2) Grasp manual reset knob (or T-handle) and pull downward until outer face of poppet is flush with skin.
      (3) Relax downward pull gradually to ensure poppet is latched in closed position then continue to relax pull gradually until return spring retracts reset knob (or T-handle) into recess.

         NOTE: Outer face of reset knob (or T-handle) and poppet should all be flush with wing lower skin in final closed position.

3. Relief Valve Actuation Pressure Check (Fig. 602)
   A. Equipment and Materials
      (1) Test Fixture, Pressure Relief Valve - F80166-1
      (2) Leak Tracing Device - F71329
      (3) Pressure monitoring device - 0-5 psig (0-138 inches of water/0-34.5 kPa) Use one of these or equivalent:
         (a) Water Safety Relief Manometer - F72951-1 (recommended)
         (b) DigiMano 2000 Available from: Netech Corporation 60 Bethpage Drive Hicksville, NY 11801, USA
      (4) Air supply - 0-10 psig (0-68.9 kPa)
   B. Prepare for Pressure Check
      (1) Make sure the relief valve is in the closed position. Manually reset to the closed position, if open (Ref par. 2.).
      (2) Install the F80166 test fixture on the relief valve.
         (a) Remove, at 90-degree intervals, four of the eight mounting screws that attach the relief valve to the surge tank access panel.



Surge Tank Flame Arrestor Pressure Relief Valve Manual Reset
Figure 601



Surge Tank Flame Arrestor Pressure Relief Valve
Figure 602

(b) Put the test fixture against the relief valve with MS29513-154 O-ring seal installed in the test fixture flange groove.

NOTE: MS29513-154 O-ring seal is part of test fixture assembly.

(c) Attach the test fixture to the relief valve using four MS16998-31 screws in place of the regular mounting screws removed in 3.B.(2)(a).

NOTE: MS16998-31 screws are part of test fixture assembly.

(3) Attach hose of the pressure gage or water safety relief manometer to the adapter fitting at bottom of the F80166-1 test fixture.
(a) Make sure there are no air leaks in the hose or the fittings.
(4) Connect F80166-1 hose assembly to F71329 leak tracing device.

NOTE: F71329 leak tracing device is used only to adjust and control application of pressure or vacuum to relief valve.

(5) Connect the air supply to the F71329 device.

C. Do the Pressure Check
(1) Slowly apply increasing positive pressure to the test fixture until the relief valve opens as detected by sound and/or manometer level suddenly equalizing.
(a) Make sure the relief valve stays closed from 0-4 inches of water total manometer displacement (0-0.144 psig pressure gage change/0-1.0 kPa pressure gage change) and opens between 4 and 16 inches of water (0.144-0.557 psig/1.0-3.98 kPa).
(2) Turn off the pressure and remove the test fixture from the relief valve.
(3) Do the procedure to manually reset the pressure relief valve to the closed position.

NOTE: Do a check for blockage before you reset the pressure relief valve.

(4) Re-install the test fixture on the relief valve.
(5) Slowly apply increasing negative pressure (vacuum) to test fixture until relief valve opens as detected by sound and/or manometer level suddenly equalizing.
(a) Make sure the relief valve stays closed from 0 to -55.4 inches of water total manometer displacement (0 to -2.0 psig pressure gage change/0 to -15.7 kPa pressure gage change) and opens between -55.4 and -74.8 inches of water (-2.0 to -2.70 psig/-13.8 to -18.6 kPa).
(6) Turn off the vacuum source.

D. Put the Airplane Back to Its Usual Condition
(1) Disconnect the pressure gage or manometer and leak tracing device and remove them from the area.

(2) Remove the test fixture from the relief valve and re-install the four regular mounting screws. Stow the fixture.
(3) Do the procedure to manually reset the pressure relief valve to the closed position.

NOTE: Do a check for blockage before you reset the pressure relief valve.

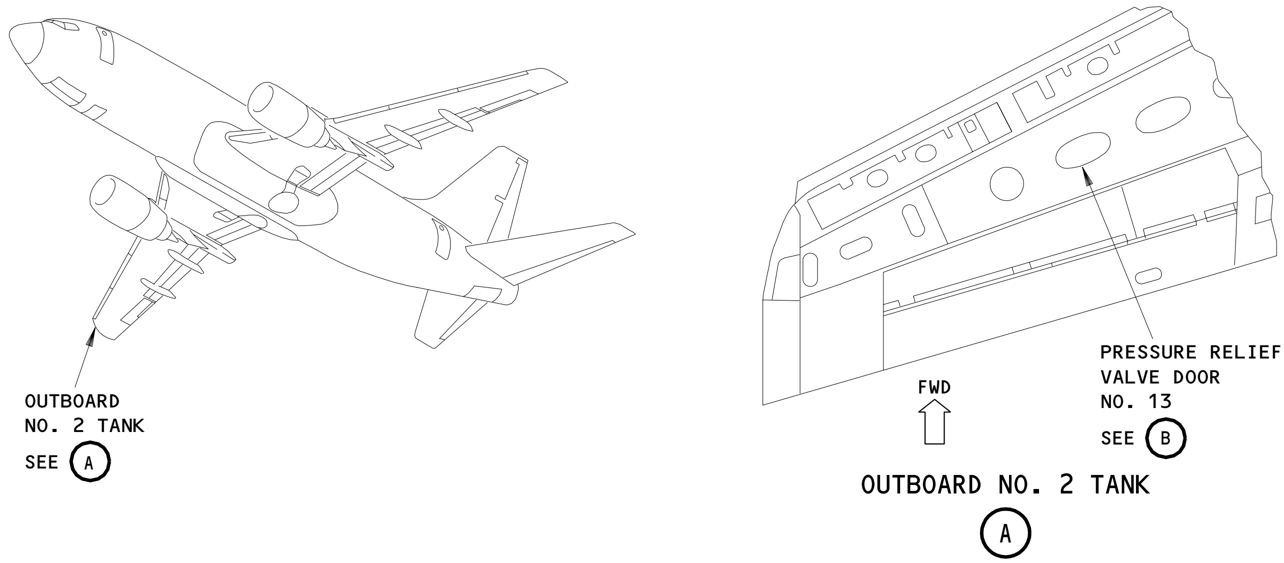
4. Pressure Relief Valve - Bonding Resistance Check (Fig. 603)
A. References
(1) AMM 28-11-11/401, Wing Fuel Tank Access Panels
(2) SWPM 20-20-00, Electrical Bonds and Grounds
B. Equipment
(1) Bonding Meter - Use one of these:
(a) Bonding Meter - Model T477W
Avtron Manufacturing Inc.
Cleveland OH
(b) Bonding Meter - Model M1
(Serial Number A0000112 and subsequent)
BCD Electronics Ltd.
Vancouver Canada
C. Access
(1) Location Zones

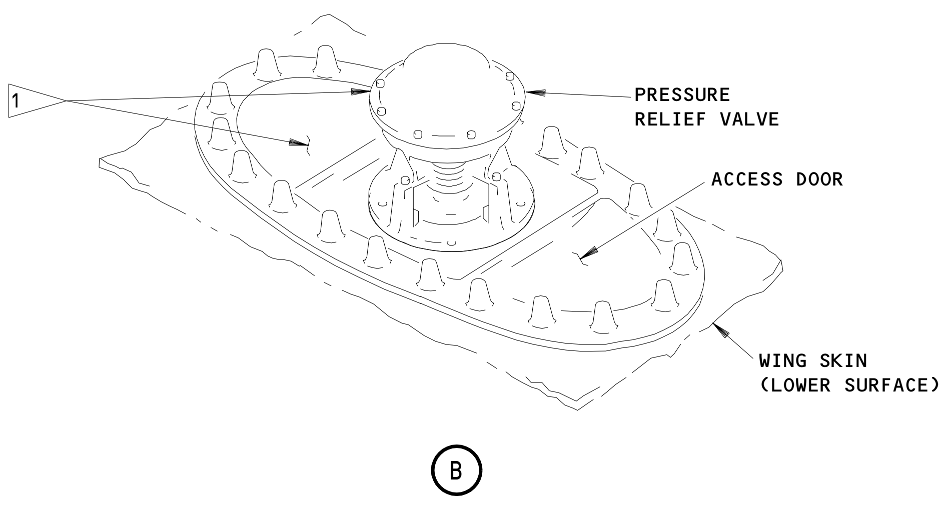
304	Right Fuel Vent Surge Tank
404	Left Fuel Vent Surge Tank

(2) Access Panels

7101L	Left Wing Surge Tank Access Door
7501R	Right Wing Surge Tank Access Door

D. Procedure
(1) Remove the surge tank access panel No. 13, 7101L or 7501R, from the surge tank (AMM 28-11-11/401).
(2) Do a check of the bonding resistance between the pressure relief valve and the surge tank access panel (on the wet side of the access panel) (SWPM 20-20-00).
(a) Make sure the bonding resistance is 0.010 ohm (10 milliohms) or less.
(3) Install the surge tank access panel No. 13, 7101L or 7501R, from the surge tank (AMM 28-11-11/401).



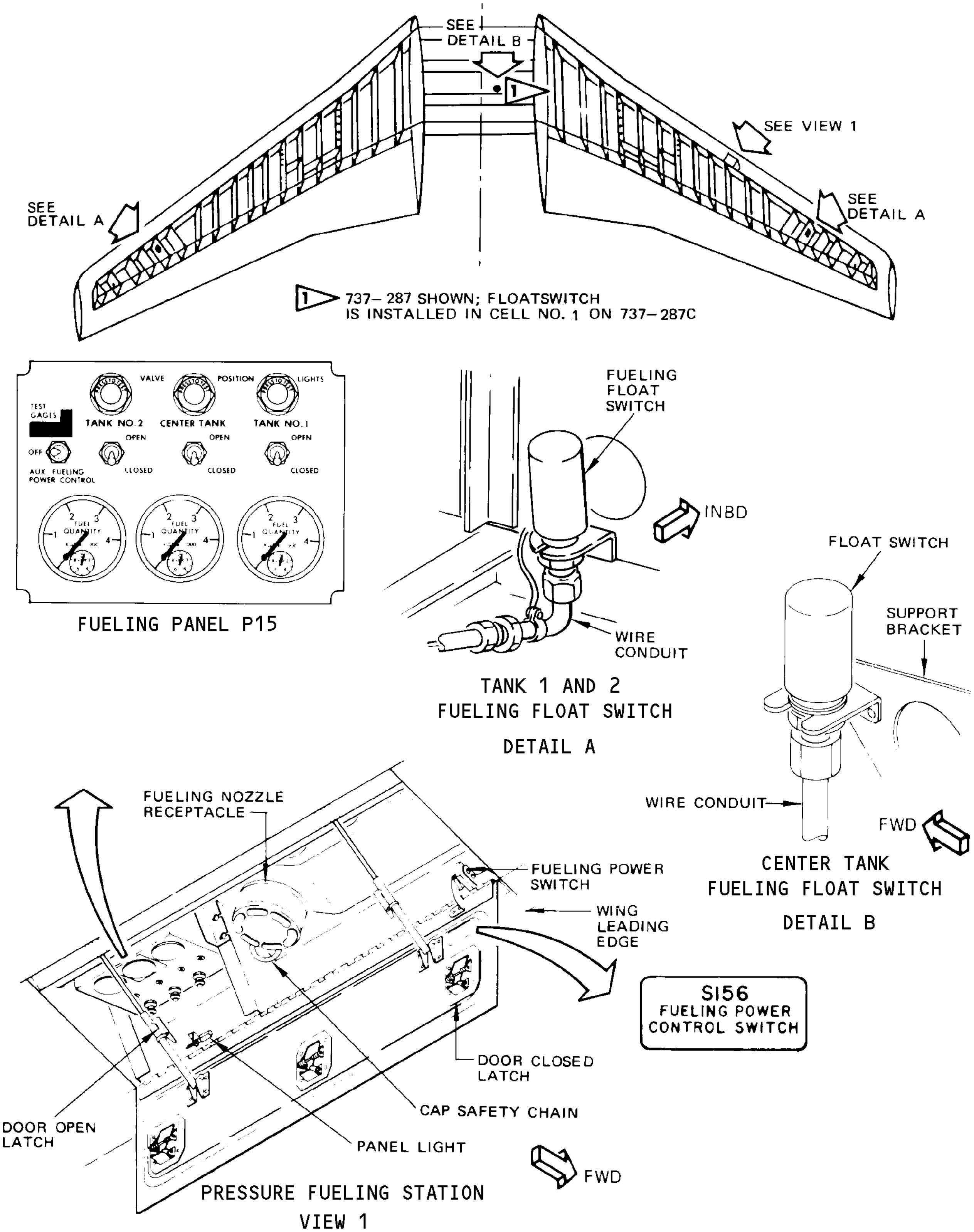


1 THE RESISTANCE FROM THE PRESSURE RELIEF VALVE TO THE ACCESS DOOR IS 0.01 OHM OR LESS.

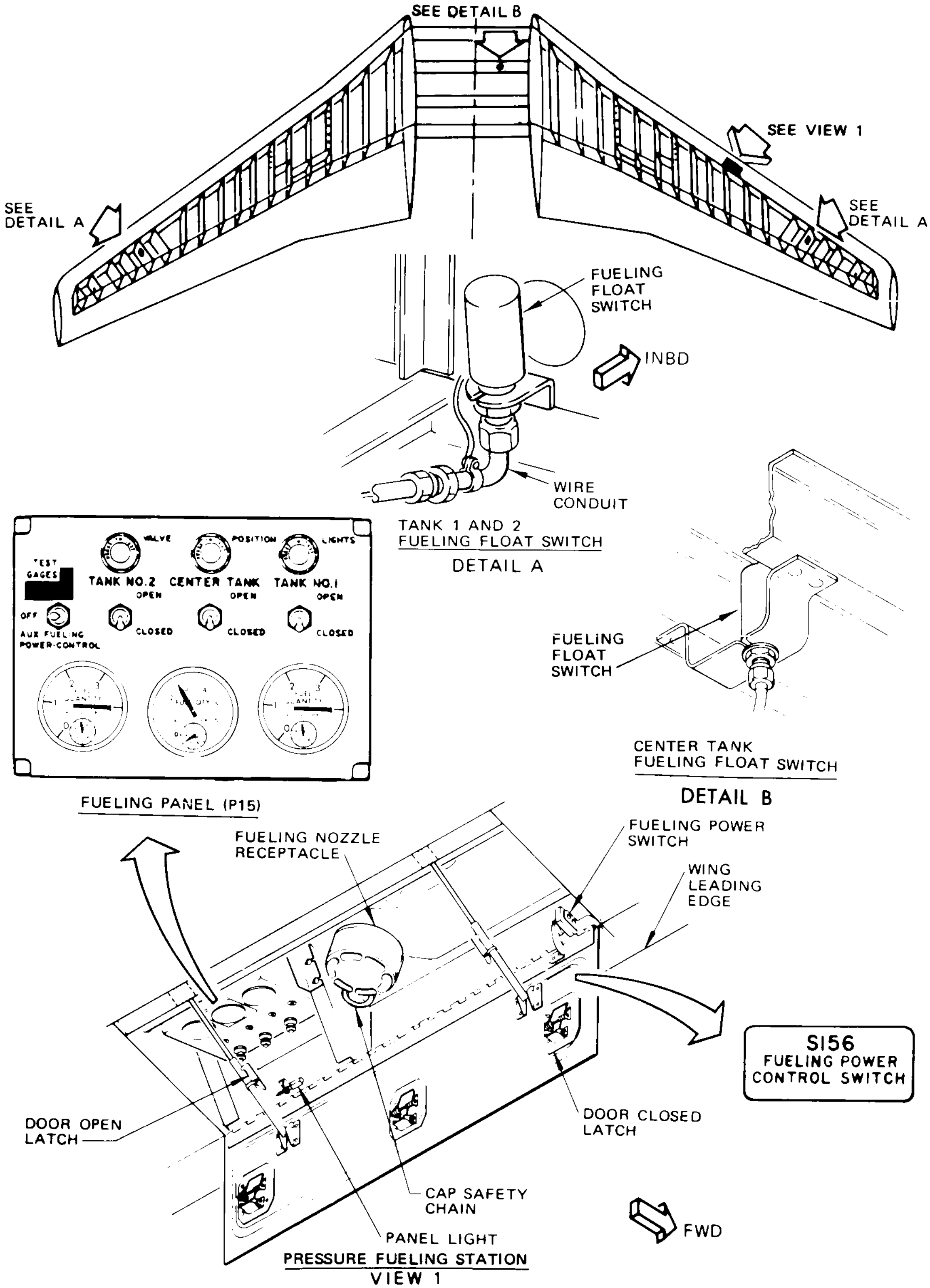
Surge Tank Pressure Relief Valve Resistance Check
Figure 603

PRESSURE FUELING SYSTEM - DESCRIPTION AND OPERATION

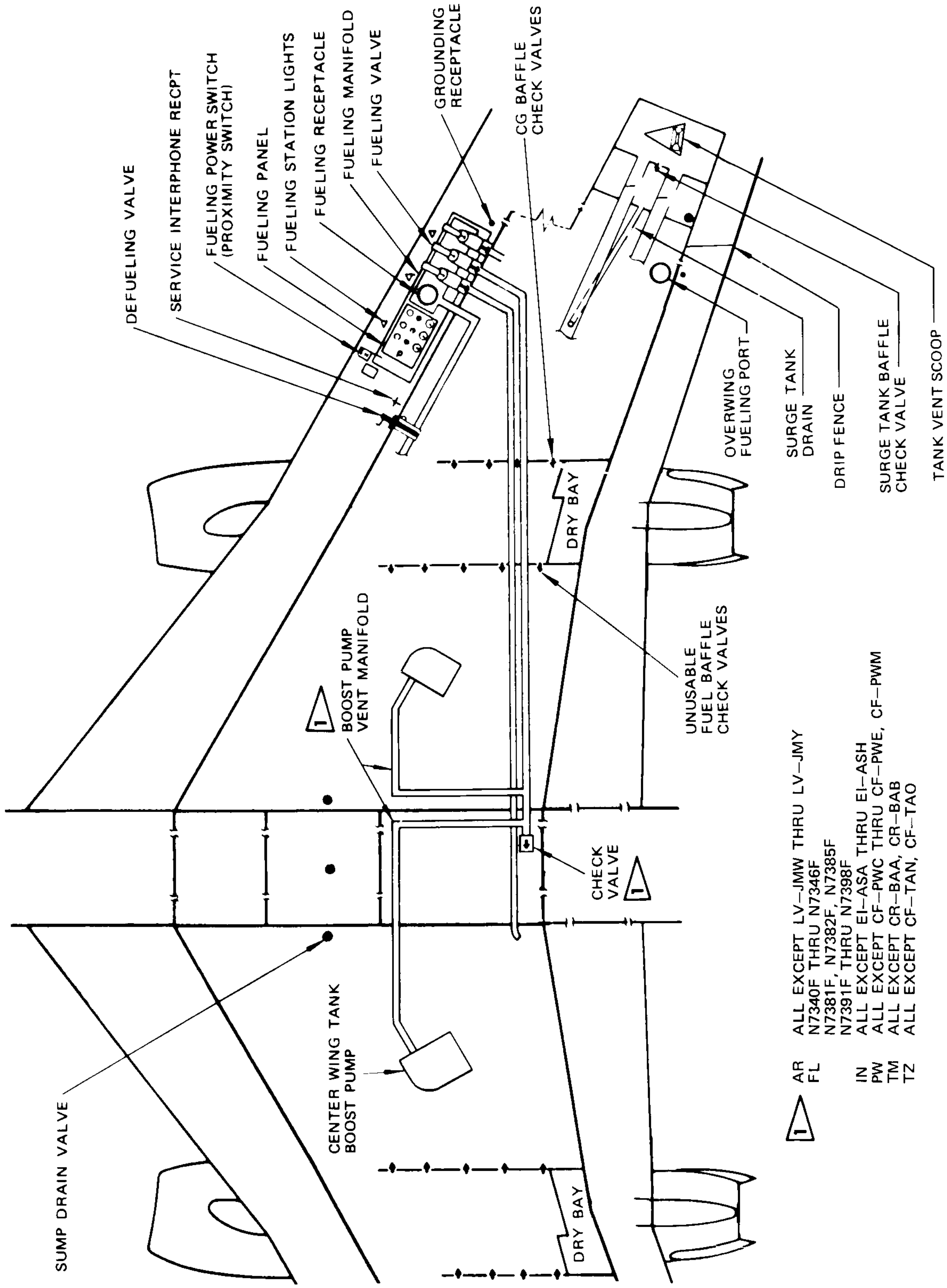
1. General
   A. The pressure fueling system provides a rapid means of filling the fuel tanks on the aircraft. The pressure fueling system distributes fuel under pressure from the fueling station in the right wing to the fuel tanks, through a system of fueling lines and valves (Fig. 1 and 2). The fueling rate is 500 gpm at a delivery pressure of 55 psig.
   B. The fueling station is equipped with a fueling receptacle, a fueling manifold, a fueling power control switch, three fueling station illumination lights, one fueling indicator test switch, three fueling shutoff valves, fueling line check valves, fueling shutoff valve switches, fueling quantity indicator s and indicator lights (Fig. 1). Each tank is equipped with a float switch to provide automatic fueling shutoff when a fuel tank becomes full of fuel.
   C. The fueling operation consists of coupling the fueling hose nozzle to the fueling receptacle, opening the electrical fueling shutoff valves and pumping fuel into the fuel tanks. The fueling quantity indicators allow the servicing personnel to fill the tanks to a predetermined level when a full fuel load is not required.
2. Fueling Receptacle
   A. A single fueling receptacle mounted on a manifold on the forward face of the wing front spar provides the means of connecting the fueling hose to the pressure fueling system (Fig. 1). The receptacle consists of a fueling hose adapter connected to the fueling receptacle manifold and a cap and a spring-loaded valve. The fueling hose adapter has mating lugs which couple with and secure the fueling hose. When the hose is coupled to the adapter, a plunger in the hose nozzle opens the spring-loaded valve to allow fuel to flow into the tanks.
   B. When not in use, the fueling receptacle is covered and sealed by a receptacle cap. The cap engages the lugs on the fueling hose adapter in the same manner as the fueling hose; when the cap is in position, the seal in the cap is forced against the adapter to seal the inlet to the adapter. To prevent loss, the cap is secured to the adapter with a piece of chain.
3. Fueling Receptacle Manifold
   A. The fueling receptacle manifold is mounted on the forward surface of the wing front spar and is the collection and distribution center for the pressure fueling system (Fig. 1). The manifold consists of a cast aluminum unit having one inlet and four outlet ports. The inlet port is connected to the fueling receptacle. The inboard outlet port is connected to the crossfeed line and the three outboard outlet ports are connected to the fueling lines.



Pressure Fueling System Component Location
Figure 1 (Sheet 1)



Pressure Fueling System Component Location
Figure 1 (Sheet 2)



Pressure Fueling System Flow Diagram
Figure 2

4. Fueling Power Control Switch
   A. The fueling power control switch (Fig. 1) automatically provides 28-volt dc electric power to the fueling shutoff valve switches when the fueling station access door is opened. Closing the door removes electric power from the valve switches which allows the fueling valves to close in case the switches were inadvertently left in the valve open position after fueling. The fueling power control switch is located at the forward, outboard corner of the fueling station and consists of a fixed sensor (magnetic switch) and movable actuator (magnet) which moves with the hinged fueling station access door. For positive switch actuation/deactuation the air gap adjustment between the sensor and the actuator magnet is important (AMM 28-21-81/401).
5. Fueling Shutoff Valve
   A. Three fueling shutoff valves are mounted in the fueling receptacle manifold to provide the means for controlling fuel distribution to the fuel tanks during refueling (Fig. 1). Each valve is an electric, solenoid-actuated, shutoff valve. The valve is spring-loaded to the closed position with a manual override pushbutton. The manual override pushbutton on the valve solenoid provides a manual method of opening the valve when the valve is not energized.
   B. The valves are operated by 28-volt dc power and are controlled by the float switch when a full tank is sensed, or by individual switches on the fueling control panel for fueling control at any fuel level. Valve position lights mounted on the fueling panel are illuminated any time the valve solenoid is energized (Fig. 3).
6. Fueling Control Panel
   A. The fueling control panel is located in the fueling bay and contains all the controls required for operation of the pressure fueling system (Fig. 1). Components mounted on the panel are three fueling quantity indicators, fueling shutoff valve switches and fueling shutoff valve OPEN indicator lights and one fueling indicator test switch. Three illumination lights mounted one on each side of the control panel and one outboard of the fueling receptacle provide illumination for the fueling bay.
   B. The fueling quantity indicators provide an indication of the fuel quantity in the individual tanks. The indicators are connected to their corresponding fuel quantity indicators on the center instrument panel and obtain their signals from the fuel quantity indicating system tank units (Ref 28-41-0). The indicators test switch provides a means of checking if the indicators are operating. Placing the switch to TEST GAGES position will cause the pointer of an operating indicator to move toward zero, or below zero if tank is empty. The test switch may be placed to AUX FUELING POWER CONTROL to bypass the fueling power control switch should it become inoperative.

C. The fueling shutoff valve switches control the operation of the shutoff valves. If the switches are unintentionally left in the OPEN position after fueling is completed, closing the fueling bay door automatically removes electrical power from the switches causing the fueling valves to move to the closed position. Valve op- en lights mounted adjacent to the shutoff valve switches are illuminated any time the respective fueling shutoff valve is open.

7. Fueling Float Switch

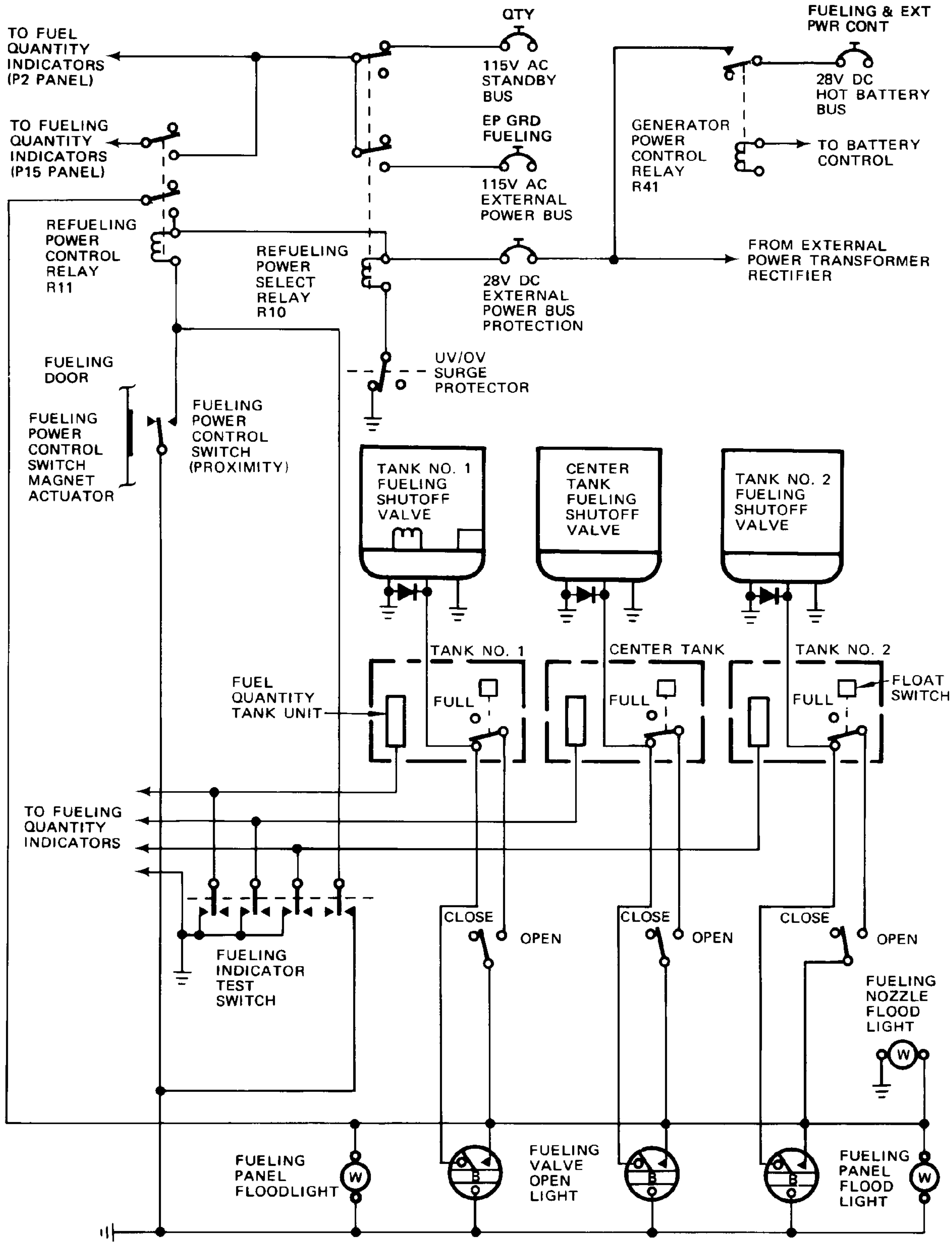
A. Fueling float switches, one for each fuel tank, prevent the fuel tanks from being overfilled. During pressure fueling, with a shutoff valve switch in the OPEN position and the fuel tank less than full, the float switch closes the fueling circuit to open the valve and illuminate the light. When the float switch senses a full fuel tank, power is discontinued to the fueling shutoff valve and the valve open light, to close the shutoff valve and to extinguish the light (Fig. 3).

8. Operation

A. The pressure fueling system controls consist of a fueling indicator test switch and fueling shutoff valve switches on the fueling control panel. Electrical power required for pressure fueling the airplane is 115 volts ac and 28 volts dc, obtained from the battery APU, or an external power source (Fig. 3). The dc power is supplied through the float switch to the fueling valve circuit, and the ac power to the fueling quantity indicators. When a full fuel load is required, the float switches close the fueling valves automatically when the tanks are full. When a partial fuel load is required, the fueling quantity indicators are monitored, and the fueling valves are closed by manually positioning the fueling valve switches to OFF when the desired fuel quantity is aboard the airplane.

B. Prior to starting actual fueling, the fueling-valve-open light bulbs should be tested by pressing each light cover. If the fueling quantity indicators are being used they should be tested for operation by actuating the fueling indicator test switch. If the indicators are working, operation of the switch will cause the pointer to move towards zero. After completing the check of the instruments, the cap can be removed from the fueling receptacle and the fueling hose connected. Opening the appropriate fueling valves makes the airplane ready to receive fuel. Starting the pumping operation pressurizes the fueling lines, allowing fuel to flow into the tanks (Fig. 2).

C. If external power is connected, the fueling quantity indicators wil1 record the fuel quantity in the tanks. If a partial fuel load is required, the fueling shutoff valves are closed when the indicators show the required amount of fuel is in the tanks. If the fueling shutoff valves are not closed, fuel will continue to flow into the tanks until they are full. When a tank reaches the full condition, the fueling float switch cuts off electrical power to the pressure fueling system shutoff valve solenoid to close the valve (Fig. 3). When the flow meter on the fueling truck no longer indicates fuel flow, all the tanks are full. After turning off the fueling truck pump the fueling hose can be disconnected and the receptacle cap replaced.



Pressure Fueling System Circuit
Figure 3

PRESSURE FUELING SYSTEM - TROUBLESHOOTING

1. General
   A. The following troubleshooting procedures are based on the performance of the pressure fueling system during a routine fuel servicing (refueling) operation and are presented in tree-type format. The fueling steps (heavy-line boxes) are connected by shaded arrows to show the OK condition path. When all steps in the OK condition path check out, the system is operable.
   B. When a fueling step does not produce normal results, follow the NOT OK line to the box containing the trouble symptom. Turn to the procedure indicated and continue to follow a single line by analyzing the results of each fueling step until the required corrective action is determined. Perform the specified corrective action; then repeat the step at which the failure was encountered.
   C. All troubleshooting procedures are based on the assumption that wiring is OK and that electrical power is available. If the corrective action in the procedure does not correct the problem, check wiring continuity per applicable diagram in the Wiring Diagram Manual (WDM).
   D. Malfunctions of the fueling shutoff valves can be due to either mechanical or electrical trouble within valve, or within DC float switch which senses shutoff level in fuel tank. If shutoff of fueling flow does not occur at normal full tank capacity but will stop by placing fueling shutoff valve switch in CLOSE position, the source of the trouble is probably in the float switch. Fuel shutoff calibration is usually unnecessary since shutoff level is set by the float switch which is installed on a non-adjustable mounting bracket. If consistent high or low shutoff levels are experienced, look for bent, damaged, or incorrect float switch mounting bracket.
2. Prepare for Troubleshooting
   A. For more accurate determination of fueling shutoff fuel quantities and comparison with previous measured fuel quantities, it is recommended that airplane be placed in normal attitude (0 degree roll and 1 degree nose down).
   B. Check that fuel tank(s) for troubleshooting are empty (Ref 28-23-0, Maintenance Practices) or have a known quantity of fuel, less than 88% full.
   C. Provide pressure fueling source (Ref 12-11-0, Fuel Servicing - Pressure Fueling) but do not connect to fueling receptacle. Fueling truck or hydrant system should have an accurate flowmeter for measuring fuel input.
   D. Provide external electric power (Ref Chapter 24, Electrical Power).
   E. Check that GROUND EP REFUELING and FUEL QUAN circuit breakers on P6 circuit breaker panel are closed.

Prepare system for trouble shooting per par. 2. Open fueling station access door and maintain in fully open position. Check that floodlights illuminate and fueling quantity indicators provide fuel quantity indication. IF -

NOT OK — FLOODLIGHTS FAIL TO ILLUMINATE - PROCEDURE 1

NOT OK — FLOODLIGHTS ILLUMINATE, BUT FUELING QUANTITY INDICATORS INOPERATIVE - PROCEDURE 2

OK

Press-to-test all fueling valve light covers and check that all light bulbs illuminate in turn. IF -

NOT OK — VALVE POSITION INDICATOR LIGHT DOES NOT ILLUMINATE - Replace defective indicator bulb(s).

OK

Hold test switch in TEST GAGES position. Check that fueling quantity indicator pointers drive down scale. IF -

NOT OK — FUEL QUANTITY INDICATOR READS LOW, RUNS AGAINST EMPTY STOP, OR IS SLUGGISH. Refer to 28-41-0, Trouble Shooting.

OK

Place fueling shutoff valve switches in CLOSE position. Attach fueling source nozzle to receptacle at fueling station, place fueling shutoff valve switches in OPEN position and start fueling operation. Check for normal flow of fuel into each tank by observing fueling indicator pointer progressing upscale. IF -

NOT OK — NO INDICATION OF FUEL ENTERING TANK - PROCEDURE 3

OK

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 1)

OK

Place fueling shutoff valve switches in CLOSE position. Check that all fuel flow into tanks has ceased. IF -

NOT OK — FUEL FLOW INTO TANK CONTINUES - PROCEDURE 4

OK

Place fueling shutoff valve switches in OPEN position and resume fueling operation. Allow fueling to continue until valve position lights extinguish and fueling stops. Check that fueling quantity indicators show full tank readings. IF -

NOT OK — FUELING OPERATION STOPS TOO EARLY OR TOO LATE - PROCEDURE 5

OK

Pressure fueling system operative.

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 2)

PROCEDURE 1

FLOODLIGHTS DO NOT ILLUMINATE - Hold test gage switch in AUX FUELING POWER CONTROL position. Observe that floodlights illuminate, then release test gage switch.
IF -

OK - Check that magnet is properly installed on actuator bracket and that uniform gap between magnet face and switch sensor (Ref 28-21-81) is maintained throughout traverse of panel door from closed to open position. IF -

OK - Replace fueling power control switch.

NOT OK - Replace missing or improperly installed magnet or replace actuator bracket assembly with magnet installed. Set gap as specified (Ref 28-21-81).

NOT OK - Check for 28V DC power at pin A2 of R11 refueling power control relay at either E3 electrical shelf or at right P6 load control center. IF -

OK - Replace R11 refueling power control relay.

NOT OK - Check wiring.

PROCEDURE 2

FLOODLIGHTS ILLUMINATE BUT FUELING QUANTITY INDICATORS INOPERATIVE - Check for 115V AC at pin A2 of R10 refueling power select relay at E3 electrical shelf.
IF -

OK - Replace R11 refueling power control relay at E3 electrical shelf or P6 right load control center.

NOT OK - Replace R10 refueling power select relay.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 3)

PROCEDURE 3

NO INDICATION OBSERVED OF FUEL ENTERING TANK - Check corresponding valve position indicator light for illumination. IF -

OK - Check for 28V DC at pin 3 of corresponding fueling shutoff valve. IF -

OK - Replace pressure fueling shut-off valve (Ref 28-21-52, R/I).

NOT OK - Check electrical continuity from pin 3 on fueling valve to splice at end of red wire and repair as necessary.

NOT OK - Check for 28V DC at terminal No. 3 of the fueling shutoff valve switch. IF -

OK - Replace fueling (DC) float switch at full fuel level position in fuel tank (Ref 28-21-71, R/I).

NOT OK - Replace fueling shutoff valve switch.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 4)

PROCEDURE 4

FUEL FLOW INTO TANK CONTINUES AFTER VALVE SWITCH IS PLACED IN CLOSE POSITION. Check that corresponding valve position indicator light is extinguished. IF -

OK - Replace fueling shutoff valve (Ref 28-21-52, R/I).	NOT OK - Replace fueling shutoff valve switch.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 5)

PROCEDURE 5

FUELING OPERATION STOPS TOO EARLY OR TOO LATE - Check for equal fuel quantity readings between fueling quantity indicator and measuring stick (dripstick) or fueling facility meter data. IF -

OK - Defuel tank to empty condition or to known quantity residual fuel. Repeat fueling input until fueling valve position lights extinguish and fueling stops. Check for repeat of previous fueling operation final fuel quantity. IF -

NOT OK - Check fuel quantity indicating system and adjust as necessary (Ref 28-41-0, A/T).

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

OK - (Fuel quantities repeat). Defuel, purge, and gain access to fuel tank and check fueling float switch for bent or incorrect level mounting bracket. Repair or replace bracket as necessary.

NOT OK - (Fuel quantities do not repeat). Replace DC fueling float switch (Ref 28-21-71, R/I).

Pressure Fueling System - Troubleshooting
Figure 101 (Sheet 6)

PRESSURE FUELING SYSTEM - ADJUSTMENT/TEST

1. Pressure Fueling System - Test
   A. Test Pressure Fueling System
      (1) Make sure the airplane is grounded (Ref 20-40-11, Airplane Maintenance Practices (Static Grounding)).

         WARNING: MAKE SURE THE AIRPLANE AND THE FUELING TRUCK ARE ELECTRICALLY BONDED BEFORE FUELING OR DEFUELING. MAKE SURE THE AIRPLANE AND ALL WORK STANDS IN USE ARE GROUNDED AND BONDED BEFORE DOING FUEL TANK OR FUEL SYSTEM MAINTENANCE. REFER TO THE PARAGRAPH ON STATIC GROUNDING PROCEDURE. CORRECT ELECTROSTATIC GROUNDING AND BONDING PREVENTS STATIC ELECTRICITY DISCHARGES AND POSSIBLE FIRE OR EXPLOSION.

      (2) Connect a grounding cable from the fueling vehicle and other fuel equipment being used for tank maintenance to an approved and identified static ground.
      (3) Connect a bonding cable from the fueling vehicle to an approved electrical grounding or bonding connection on the airplane.

         NOTE: If the fueling vehicle has a permanently attached V or Y grounding cable, connect one part of the V or Y to an approved, identified ground. Then connect the other part of the V or Y cable to an approved electrical bonding or grounding point on the airplane.

      (4) Connect external electrical power to airplane (Ref Chapter 24).
      (5) Open fueling station access door and verify that pressure fueling nozzle floodlights, fueling panel floodlight, and fueling quantity indicators illuminate.
      (6) Press fueling valve position PRESS-TO-TEST light cover and verify that all light bulbs are operating.
      (7) Hold fueling quantity test switches on TEST GAGES position and verify that all indicators are operating, then release switch.
      (8) Remove fueling receptacle cap and examine receptacle for damage that may affect proper sealing of fuel nozzle.
      (9) With suitable container under receptacle, press poppet valve in receptacle and verify that there is no binding and that it seats properly.
      (10) Press manual override pushbutton on No. 1, center, and No. 2 tank fueling shutoff valve and verify that valves open without binding.
      (11) Place tank No. 1 fueling shutoff valve switch to OPEN; verify that valve position light illuminates.

(12) Place tank No. 1 fueling shutoff valve switch to CLOSE; verify that valve position light extinguishes.
(13) Repeat steps (11) and (12) for remaining tanks.
(14) Disarm fueling door proximity switch by inserting a 2-inch by 1/2-inch strip of thin mild steel, approximately 0.06-inch thick, between the magnet and proximity switch on the fueling control station door. Verify that the one panel and two nozzle flood lights at fueling station extinguish.
(15) Place fueling quantity test switch to AUX FUELING POWER - CONTROL and verify that fueling station lights illuminate. Return switch to OFF.
(16) Remove metal strip used to disarm fueling door proximity switch. Check that the sensing gap between switch actuator magnet and proximity switch is within 0.08 ±0.02 inch in width.
(17) Install fueling hose nozzle grounding jack; couple hose nozzle to fueling receptacle and verify that they seal properly.
(18) Verify that all fueling shutoff valves are closed; start pumping fuel. The source shall not develop more than 55 psi at receptacle under any flow conditions. Verify that there is no leakage at fuel nozzle seal, receptacle, manifold fittings or fueling shutoff valves.
(19) Using manual override pushbutton, slowly, open and close the fueling shutoff valves and verify that there is no binding under fueling conditions. Make certain that all fueling shutoff valves are closed (truck or hydrant flowmeter indicates no flow) before proceeding.
(20) Place No. 1 tank fueling shutoff valve switch to OPEN; proceed to fuel tank.
(21) Check fuel truck or hydrant system flow indicator and tank No. 1 fueling quantity indicator to verify that fuel has started.
(22) Continue fueling tank until DC float switch closes fueling shutoff valve.
(23) Place No. 1 tank fueling shutoff valve switch to CLOSE.
(24) Repeat steps (20) thru (23) for remaining tanks.

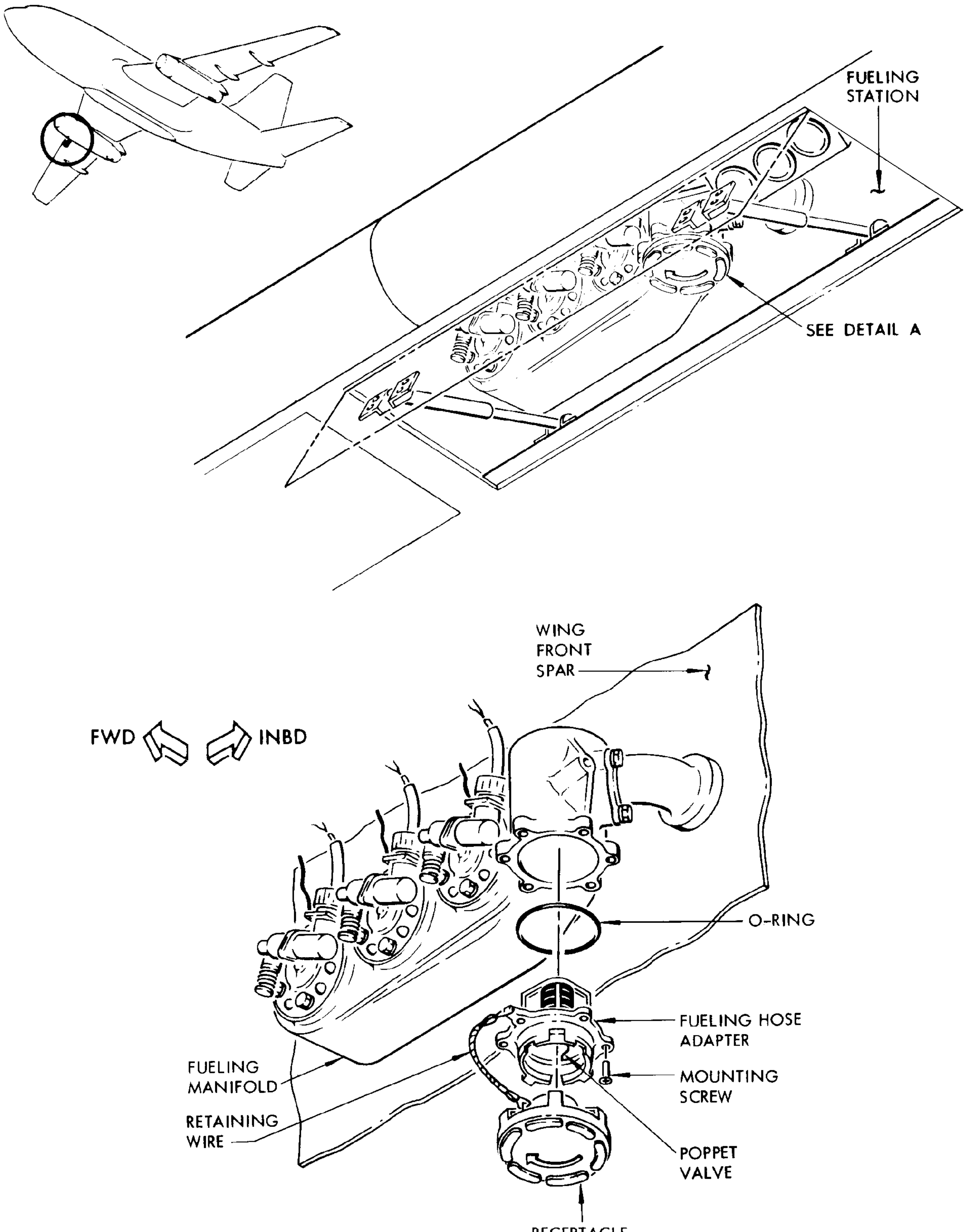
B. Restore Airplane to Normal Configuration
(1) Stop fueling truck or hydrant flow.
(2) Disconnect fueling hose grounding jack and fueling hose; in that order.
(3) Replace receptacle cap and wipe up any spilled fuel at fueling station.
(4) Close fueling station access door.
(5) Remove electrical power if no longer required.

FUELING RECEPTACLE - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Aliphatic naphtha
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
2. Prepare Fueling Receptacle for Removal
   A. Open fueling station access door.
   B. Check that manual defueling valve is closed.
   C. Remove electrical power from airplane.
   D. Pull circuit breakers for fueling shutoff valves and fuel quantity indicators on P6 circuit breaker panel.
   E. Remove receptacle cap (Fig. 401).
   F. With suitable container under receptacle, press poppet valve in receptacle and allow all residual fuel to drain from receptacle and manifold.
3. Remove Fueling Receptacle
   A. Remove mounting screws from fueling hose adapter.
   B. Pull fueling hose adapter straight down until valve is clear of manifold.
4. Prepare Fueling Receptacle for Installation
   A. Clean all machined surfaces and O-ring grooves on manifold and fueling hose adapter with naphtha and wipe dry with Cotton Wiper (BMS15-5).
   B. Fit new O-ring, lightly lubricated with fuel, into groove on fueling hose adapter (Fig. 401).
5. Install Fueling Receptacle
   A. Insert valve of fueling hose adapter into manifold. Rotate adapter until bolt holes align with holes in manifold.

      CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN ROTATING ADAPTER.

   B. Install fueling hose adapter mounting screws. Tighten all screws equally, keeping flanges of adapter and manifold parallel to each other.
   C. Press poppet valve and check that valve opens without binding. Check that valve closes easily when upward pressure is removed.
   D. Install receptacle cap.
   E. Close fueling station door.



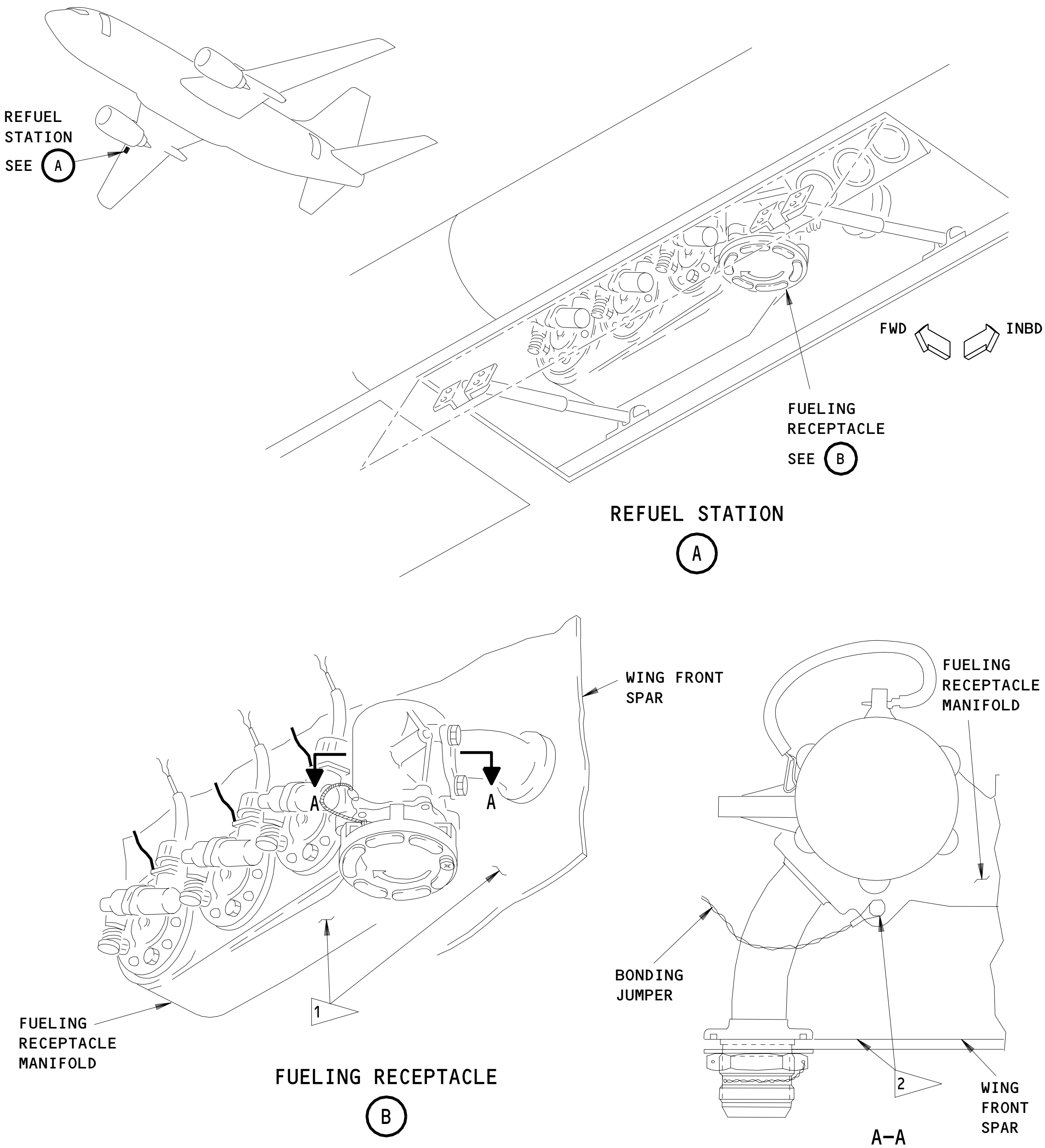
Fueling Receptacle Installation
Figure 401

FUELING RECEPTACLE - INSPECTION/CHECK

1. Fueling Receptacle Bonding Resistance Check (Fig. 601)
   A. References
      (1) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zone
          402 Right Wing Outboard Leading Edge

      (2) Access Panel
          6540 Refueling Station Access Panel

   D. Procedure
      (1) Open the access door, 6540, for the refuel station.
      (2) Measure the bonding resistance between the fueling receptacle and the structure (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.002 ohm (2.0 milliohms) or less.
      (3) Measure the bonding resistance between the bonding jumper for the fueling manifold and the structure (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.002 ohm (2.0 milliohms) or less.
      (4) Close the access door, 6540, for the refuel station.



1 THE RESISTANCE FROM THE FUELING RECEPTACLE MANIFOLD TO THE WING FRONT SPAR IS 0.002 OHM OR LESS.

2 THE RESISTANCE FROM THE BONDING JUMPER TERMINAL TO THE WING FRONT SPAR IS 0.002 OHMS OR LESS.

Fueling Receptacle Resistance Check
Figure 601

FUELING MANIFOLD - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Aliphatic naphtha
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
   C. Bonding meter (Ref 20-22-01, I/C)
2. Prepare Fueling Manifold for Removal
   A. Remove electrical power from airplane.
   B. Pull circuit breakers for fueling shutoff valves and fuel quantity indicators on P6 circuit breaker panel.
   C. Open fueling station access door (Fig. 401).
      (1) Remove pin attaching outboard linkage assembly to fueling station access door.
   D. Check that manual defueling valve is closed.
   E. Evacuate fuel from manifold.
      (1) Remove receptacle cap.
      (2) With suitable container under receptacle, press poppet valve in receptacle and allow residual fuel to drain from receptacle and manifold.
      (3) Install receptacle cap.
   F. Disconnect electrical plug from fueling shutoff valves.
3. Remove Fueling Manifold
   A. Disconnect bonding jumper from fueling shutoff valves and manifold (Fig. 401).
   B. Remove fueling shutoff valves (Ref 28-21-52, Removal/Installation).

      NOTE: If fueling receptacle is to be removed, refer to 28-21-12, Fueling Receptacle - Removal/Installation.

   C. Remove bolts attaching manifold to check valve and elbow assembly.
   D. Support manifold and remove bolts attaching manifold to leading edge support members.
   E. Withdraw manifold assembly through fueling station access door.
4. Prepare Fueling Manifold for Installation
   A. Clean machined surfaces of manifold, O-ring groove of check valve and elbow assemblies with naphtha; wipe dry with cotton wipers (BMS15-5).
   B. Install new O-ring, lightly lubricated with fuel, on check valve and elbow assemblies.
5. Install Fueling Manifold
   A. Position manifold between leading edge support members and insert support bolts finger-tight.

      CAUTION: DO NOT DISLODGE OR PINCH O-RING.

      NOTE: Do not install washers on support bolts at this time.

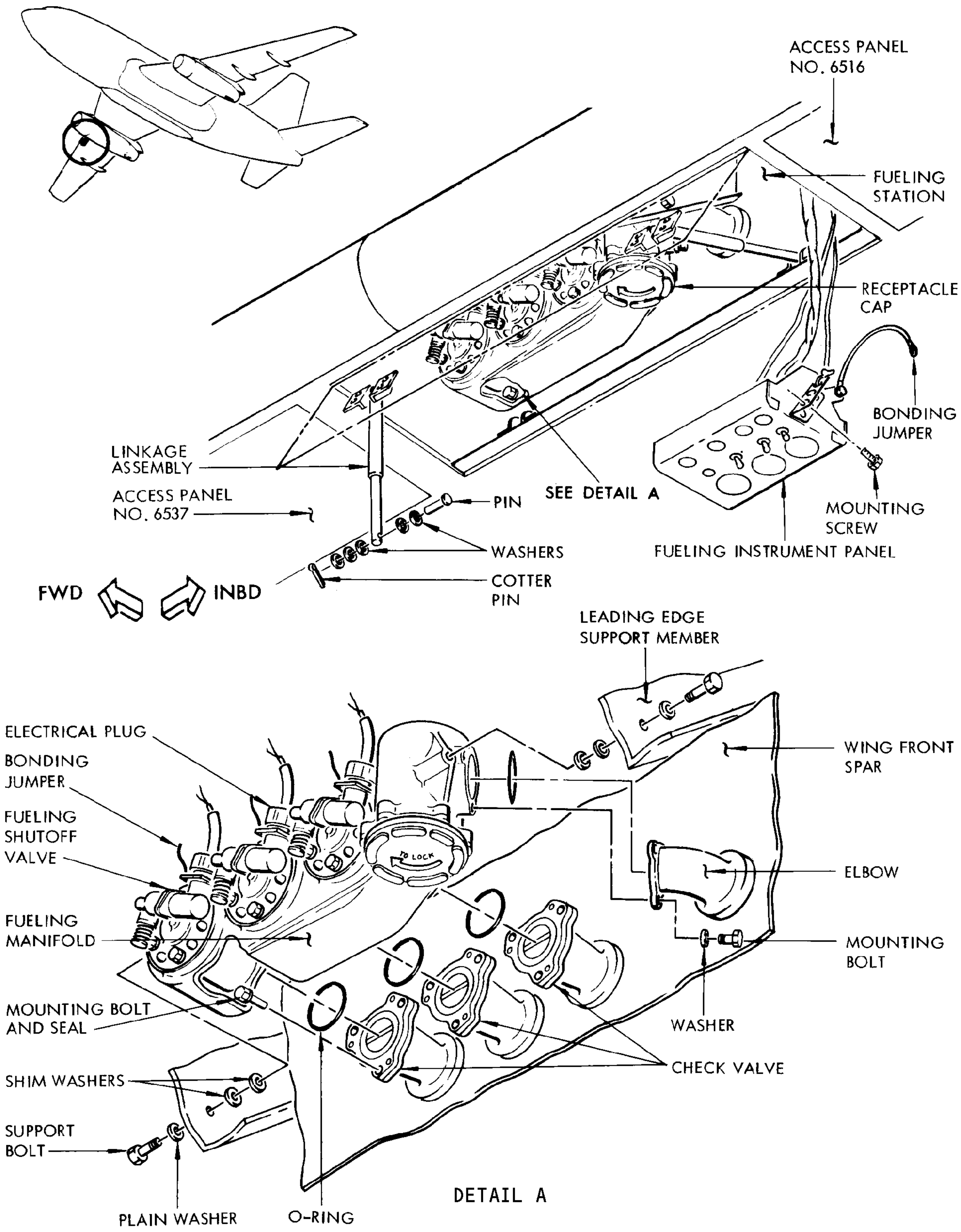
   B. Insert bolts attaching manifold to check valve and elbow assemblies. Tighten all bolts equally.

C. Remove support bolts and reinstall with plain and shim washers.

NOTE: Use shim washers as required to prevent straining manifold or leading edge support members when bolts are tightened.

D. Connect bonding jumper to fueling shutoff valves and manifold.
E. Check electrical bond between manifold and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.0010 ohm.

6. Restore Airplane to Normal Configuration
A. Connect the electrical plug to the fueling shutoff valves.
B. Install the fueling shutoff valve (AMM 28-21-52/401).
C. Install the fueling receptacle if it is removed (AMM 28-21-12/401).
D. Install the pin and washers that attach the linkage assembly to the access door.



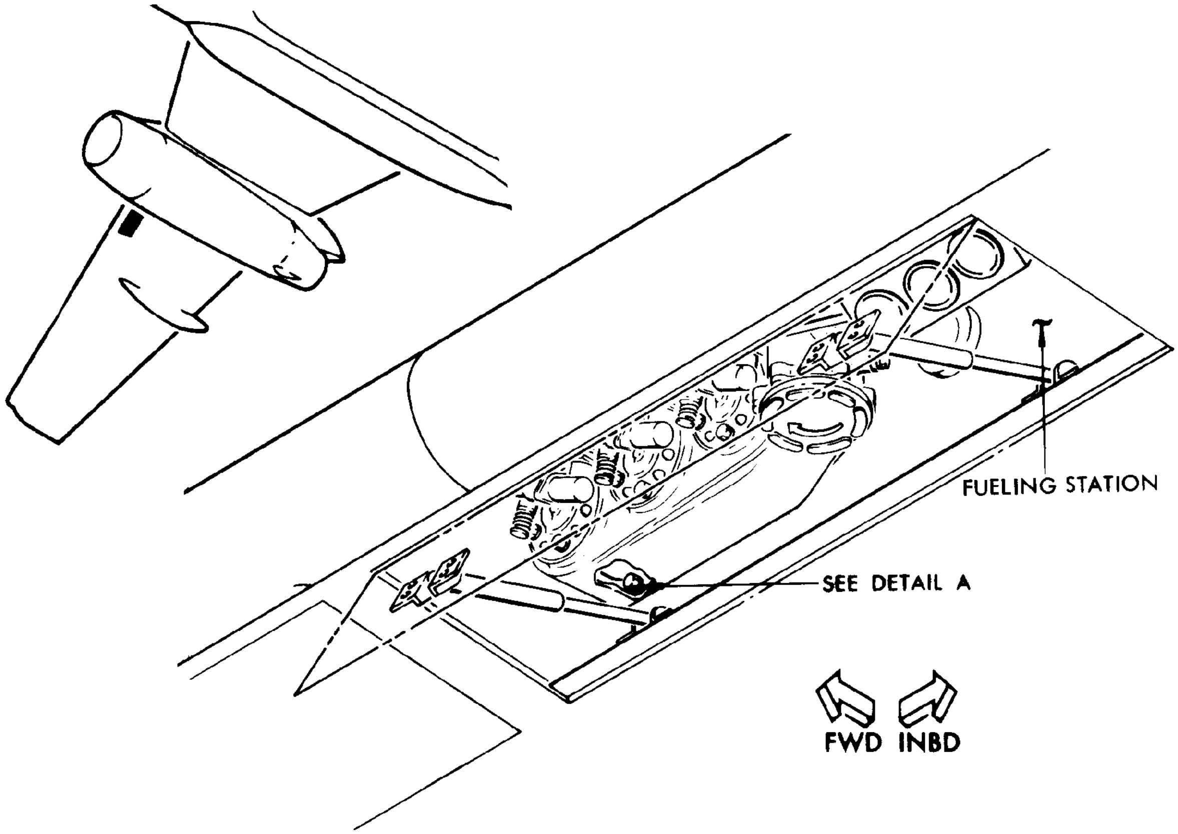
Fueling Manifold Installation
Figure 401

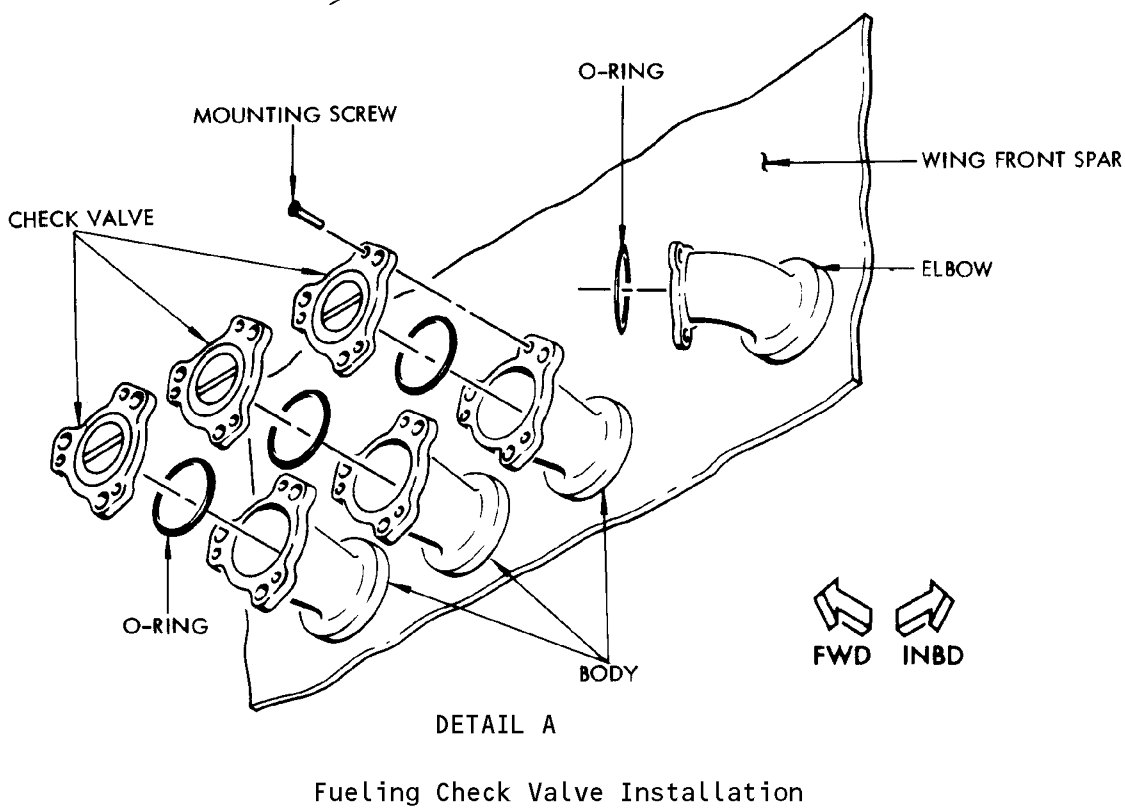
FUELING CHECK VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Aliphatic naphtha
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
2. Remove Check Valve
   A. Defuel applicable fuel tank for check valve removal. Refer to 28-23-0, Defueling.
   B. Check that manual defueling valve is closed.
   C. Remove manifold. Refer to 28-21-22, Fueling Manifold - Removal/Installation.
   D. Place suitable container under check valve to catch fuel drip.
   E. Remove screws attaching check valve. (See figure 401.)
   F. Remove check valve.
3. Install Check Valve
   A. Clean machined surface of body assembly and O-ring groove of check valve with naphtha; wipe dry with cotton wipers (BMS15-5).
   B. Install new O-ring, lightly lubricated with fuel, on check valve (side with poppet valve).
   C. Place check valve on body assembly and rotate until screw holes align with holes in body assembly.

      CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN ROTATING CHECK VALVE.

   D. Install check valve mounting screws. Tighten all screws equally, keeping check valve parallel to flange of body assembly.
   E. Install manifold. Refer to 28-21-22, Fueling Manifold - Removal/Installation.





DETAIL A

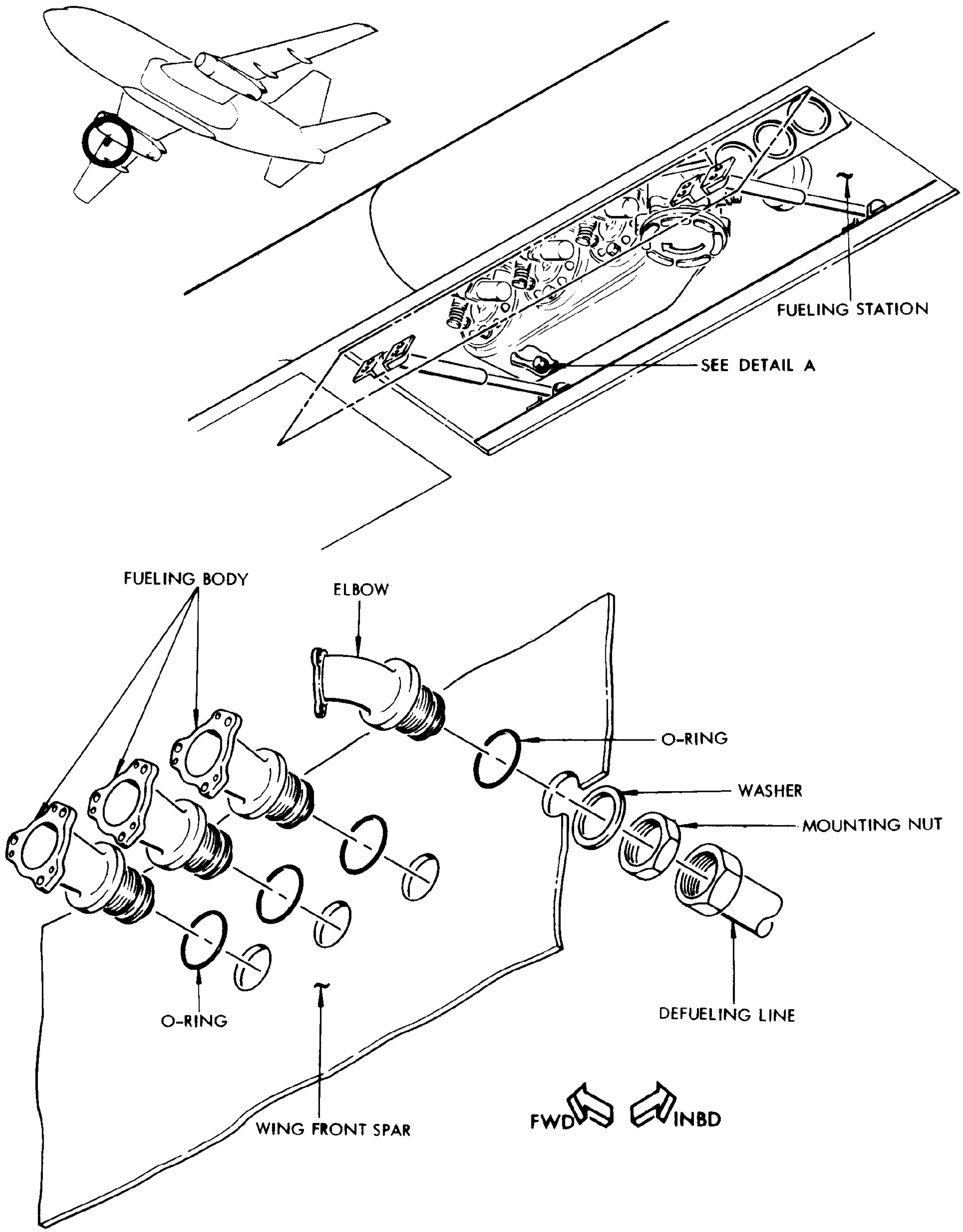
Fueling Check Valve Installation
Figure 401

FUELING BODY OR ELBOW ASSEMBLY - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Aliphatic Naphtha - TT-N-95
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
2. Remove Body or Elbow Assembly
   A. Defuel and purge fuel tank No. 2. In addition, defuel applicable fuel tank for removal of CTR or No. 1 body assembly. Refer to 28-23-0, Defueling - Maintenance Practices and 28-10-0, Fuel Storage System - Maintenance Practices.
   B. Remove fueling manifold. Refer to 28-21-22, Fueling Manifold - Removal/Installation.
   C. Remove fuel tank access panels in fueling station area to provide access to rear of wing front spar. Refer to 28-11-11, Fuel Tank Access Panel - Removal/Installation.
   D. With one man removing applicable fueling or defueling line and body or elbow assembly mounting nut and washer at rear of front spar, second man, located outside fuel tank, support and remove body or elbow assembly. (See figure 401.)
3. Install Body or Elbow Assembly
   A. Clean O-ring grooves of body or elbow assembly and both sides of front spar opening with naphtha, wipe dry with cotton wipers (BMS15-5).
   B. Install new O-ring, lightly lubricated with fuel, into groove on body or elbow assembly.
   C. With man outside fuel tank to insert body or elbow assembly through opening in front spar, second man, in tank, install washer and nut on body or elbow assembly. Tighten nut finger-tight.

      CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN INSERTING BODY OR ELBOW ASSEMBLY.

   D. Install check valve assembly if removed. Refer to 28-21-32, Fueling Check Valve - Removal/Installation.
   E. Install fueling manifold. Refer to 28-21-22, Fueling Manifold - Removal/Installation.
   F. Tighten nut on body or elbow assembly and attach applicable fueling or defueling line.
   G. Install fuel tank access panels.



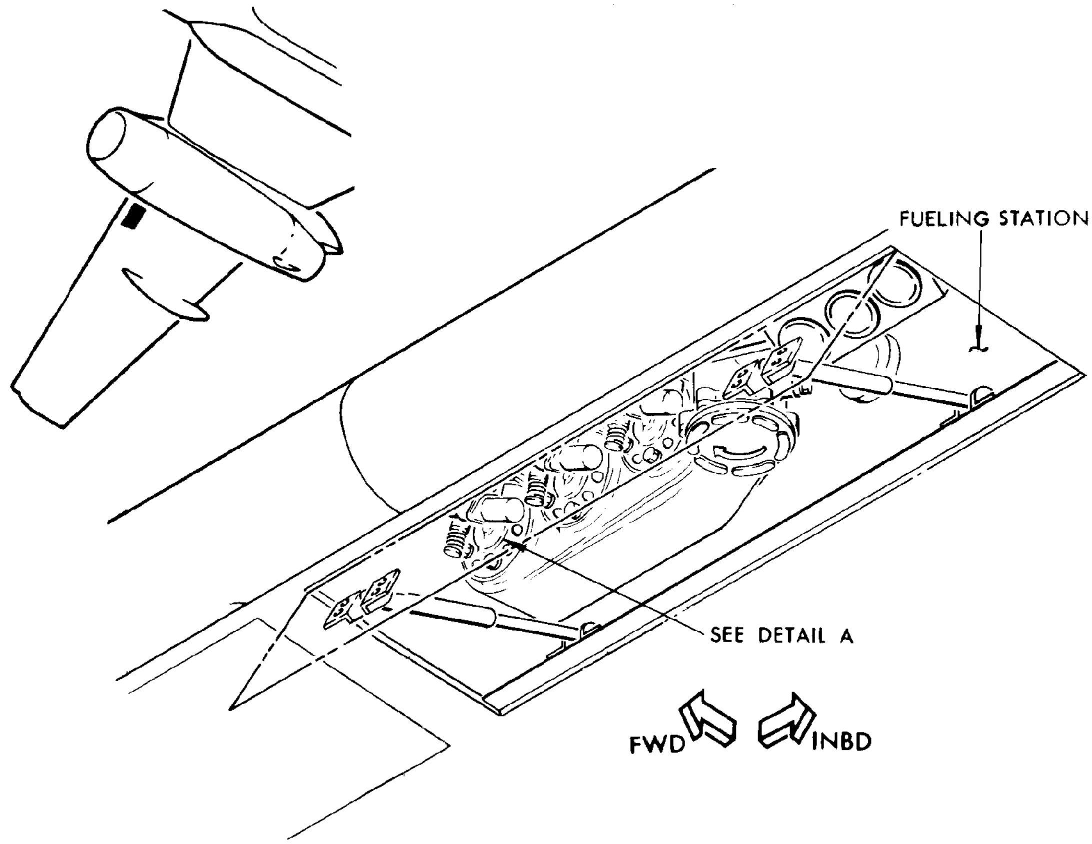
Fueling Body/Elbow Assembly
Figure 401

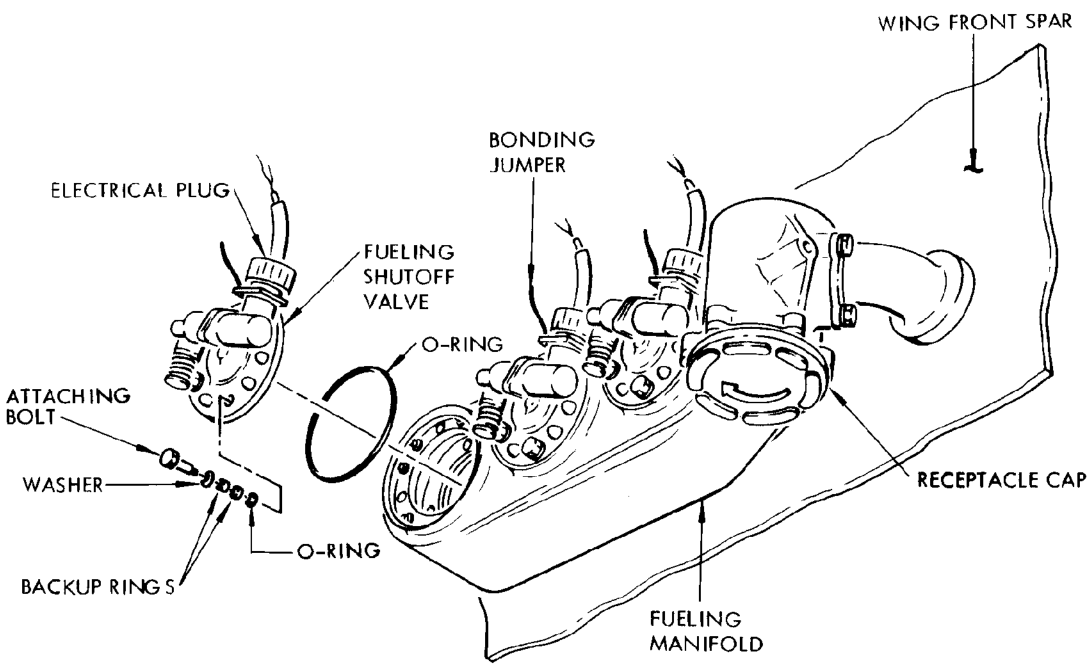
FUELING SHUTOFF VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Cleaning solvent - Aliphatic Naphtha TT-N-95 (Ref 20-30-31)
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
   C. Bonding meter (Ref 20-22-01 I/C)
   D. Container for fuel
2. Prepare Fueling Shutoff Valve for Removal
   A. Open fueling station access door.
   B. Check that manual defueling valve is closed.
   C. Remove electrical power from airplane.
   D. Check that all fueling shutoff valve switches at fueling station are in CLOSE position, then open circuit breakers for fueling shutoff valves and fuel quantity indicators on P6 circuit breaker panel.
   E. Remove receptacle cap (Fig. 401).
   F. With suitable container under receptacle, press poppet valve in receptacle and allow residual fuel to drain from receptacle and manifold.
   G. Install receptacle cap.
   H. Disconnect electrical plug from fueling shutoff valve.
   I. Disconnect bonding jumper from fueling shutoff valve.
   J. Place suitable container under fueling shutoff valve to catch fuel drip.
3. Remove Fueling Shutoff Valve
   A. Support fueling shutoff valve and remove bolts attaching valve to fueling manifold.
   B. Withdraw fueling shutoff valve from fueling manifold.
4. Prepare Fueling Shutoff Valve for Installation
   A. Clean attaching bolts, washers, and backup rings with naphtha; wipe dry with cotton wipers (BMS15-5).
   B. Install washer and backup rings on attaching bolts. Install new O-ring, lightly lubricated with fuel, on attaching bolts.
   C. Clean machined surfaces of manifold and shutoff valve with naphtha; wipe dry with cotton wipers (BMS15-5).
   D. Install new O-ring, lightly lubricated with fuel, on shutoff valve.
5. Install Fueling Shutoff Valve
   A. Lightly lubricate shutoff valve O-ring with fuel and insert valve into manifold. Rotate valve until boltholes align with holes in manifold.

      CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN ROTATING FUELING VALVE.

   B. Lightly lubricate attaching bolt O-ring with fuel and insert into fueling valve. Tighten all bolts equally.
   C. Connect bonding jumper to fueling shutoff valve.
   D. Connect electrical plug to fueling shutoff valve.
   E. Check electrical bond between fueling shutoff valve and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.0010 ohm.
   F. Close fueling station access door.





DETAIL A

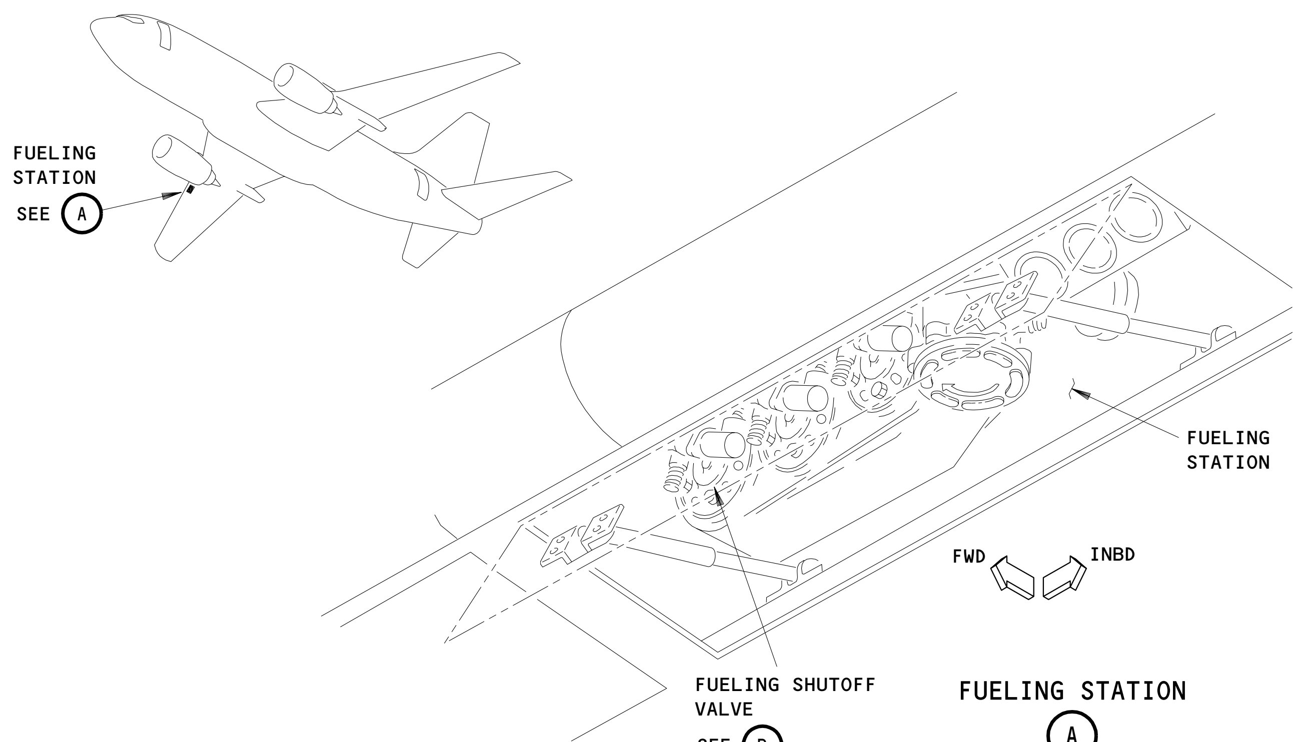
Fueling Shutoff Valve Installation
Figure 401

FUELING SHUTOFF VALVE - INSPECTION/CHECK

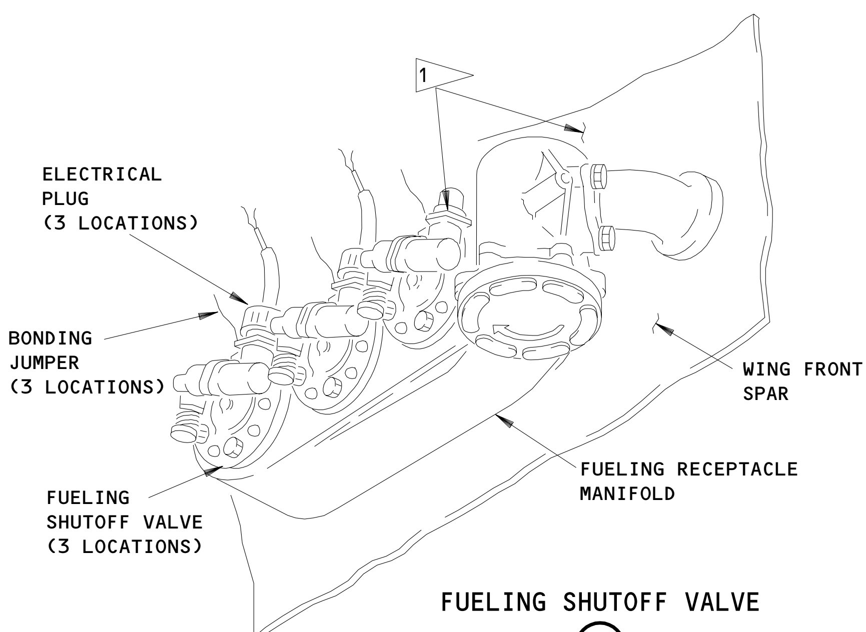
1. Fueling Shutoff Valve Bonding Resistance Check (Fig. 601)
   A. References
      (1) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T447W
             Avtron Manufacturing Inc.
             Cleveland, OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver, Canada
   C. Access
      (1) Location Zone
          402 Right Wing Outboard Leading Edge

      (2) Access Panel
          6540 Refueling Station Access Panel

   D. Procedure
      (1) Open the access door, 6540, for the refuel station.
      (2) Disconnect the electrical connector from the shutoff valve.
      (3) Measure the bonding resistance between the connector flange and the spar web (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.001 ohm (1.0 milliohm) or less.
      (4) Reconnect the electrical connector to the shutoff valve.
      (5) Close the access door, 6540, for the refuel station.



FUELING STATION
A



FUELING SHUTOFF VALVE
B

1 THE RESISTANCE FROM THE CONNECTOR FLANGE TO THE WING FRONT SPAR IS 0.001 OHM OR LESS.

Fueling Shutoff Valve Resistance Check
Figure 601

FUELING FLOAT SWITCH - REMOVAL/INSTALLATION

1. General
    A. A float switch is used in each fuel tank to sense full level and terminate fueling during fueling operations. Electrical wiring to the switches is enclosed in conduit with fuel-tight connections. Wiring splices are located close to the respective conduit bulkhead fitting at the wing front spar.
    B. There are two types of float switches that can be installed. The Type I float switch (PRE-SB 28-1141) has a red float shell. The Type II float switch (POST-SB 28-1141) has a green float shell. In the tanks No. 1 and No. 2, the Type II float switch must be replaced if the float switch is replaced. In the center tank, the conduit for the Type II float switch contains a liner which must be replaced each time the float switch is replaced. Service Bulletin 28-1141 replaces the Type I float switch with the Type II float switch installation.

    NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

2. Equipment and Materials
    A. Leading Edge Flap Actuator Locks - F80048-89 (Preferred), F80048-90 (Preferred), F80048-84 (Alternate), and F80048-36 (Alternate)
    B. Wire puller, conduit
    C. Fuel Conduit Fill Kit P/N 08045-260 or 08045-265
    D. Dispensing Gun P/N 221828, 221830, 220847, or 229004
3. Prepare for Removal
    A. Defuel and purge the applicable fuel tank (AMM 28-23-0/201, AMM 28-10-0/201).

    WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

    NOTE: If maintenance is necessary on the float switch conduit for the center tank, you must defuel and purge both the center tank and tank No. 2.

    B. Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

    WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

    C. Make sure the fueling shutoff valves at the fueling station are closed.

D. Disconnect external electrical power, if connected.
   (1) On airplanes with removable fuel cells, to get access to the center tank, remove the access panel located in the bottom of cavity No. 1 followed by removal of fuel cell access panel, as required to enter cell containing center tank float switch (AMM 28-12-21/401, AMM 28-12-31/401).
E. Get access to float switches as follows (Fig. 401):
   (1) To get access to the float switch in tank No. 1 or 2, remove the fuel tank access panel No. 11 (AMM 28-11-11/401).
   (2) On airplanes with integral center tank, to get access to the center tank and float switch, remove the access panel in the bottom of cavity No. 1 (AMM 28-11-31/401).

4. AIRPLANES WITH TYPE I FLOAT SWITCH;
   Remove the Fueling Float Switch
   A. Outside the fuel tank, separate the float switch wires from wire bundle, forward of front wing spar, and locate splice (Fig. 401).
   B. Cut the wires at convenient point near splice allowing sufficient wire length to make new splice. Tag wires for identification.
   C. If necessary to allow larger passage for pulling wire, remove the conduit nut, nylon grommet and rubber grommet (installed on wing tank float switch) from fitting on front spar (Detail A, Fig. 401).
   D. Inside the fuel tank, unscrew conduit nut at base of float switch.
   E. Unscrew the float switch mounting nut. Lift the switch up from the bracket and out to the side allowing wires to pass through slot in bracket. Reinstall nut and washers loosely.

      NOTE: On some center tank installations, it is only necessary to loosen mounting nut to allow threaded base of switch to pass out through wide slot in bracket.

   F. Hold or restrain the float switch from falling and pull the switch wires out through the conduit.

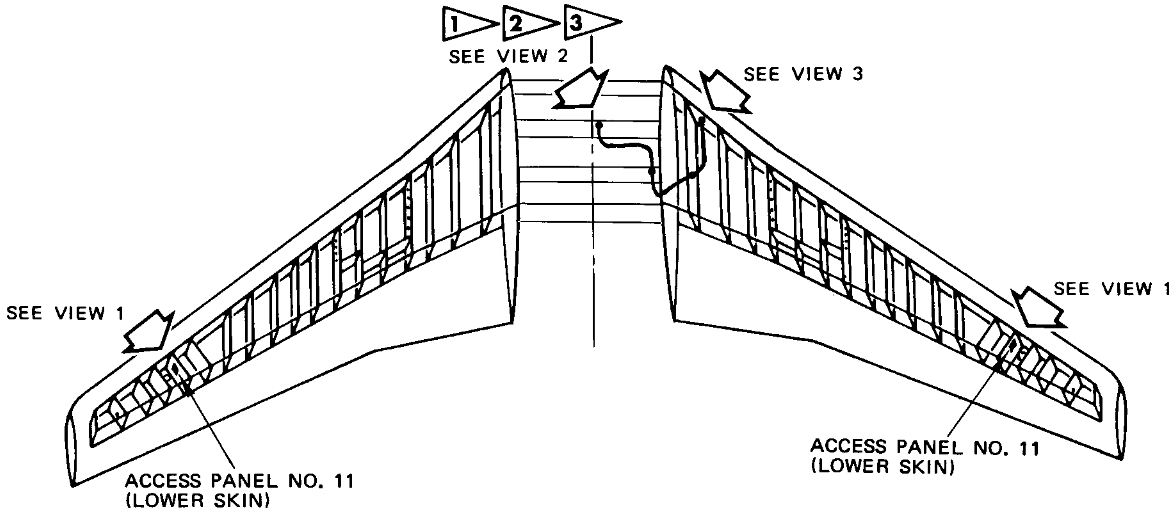
      CAUTION: IN CENTER TANK, USE CARE TO PREVENT DAMAGE TO CELL OR LOWER SKIN FROM FALLING TOOLS OR LOOSE TANK COMPONENTS.

      NOTE: Wires for center tank float switch are 22-24 feet long.

   G. Coil up the wire and remove the switch from the tank.

5. AIRPLANES WITH TYPE I FLOAT SWITCH;
   Install the Fueling Float Switch
   A. Slip washers and mounting nut on float switch wires and install loosely on switch. Put the switch in position in the fuel tank.
      (1) 737-200 AIRPLANES WITHOUT VOLUMETRIC TOP-OFF UNITS;
          For the fueling float switch in the center tank, do these steps:

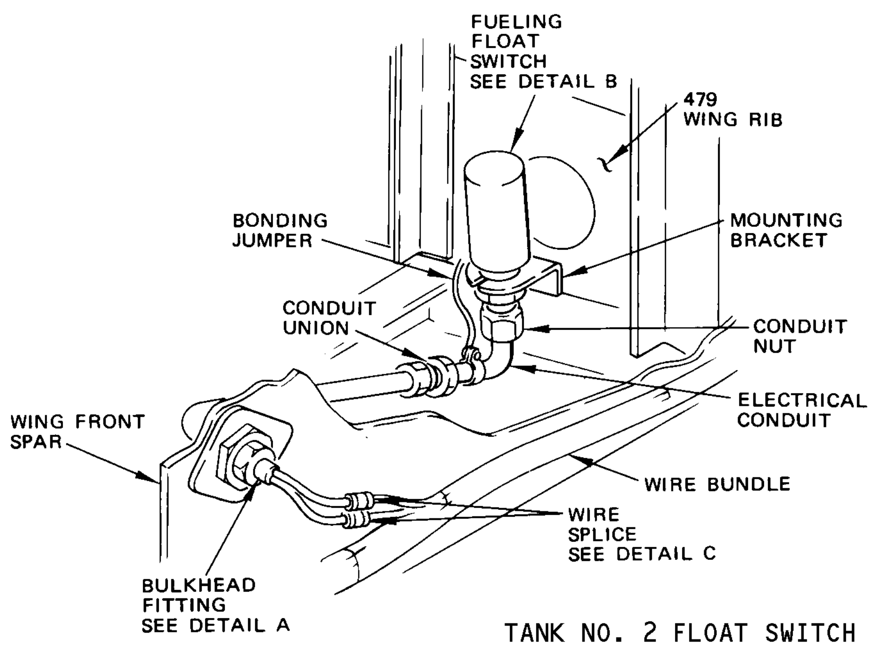
          CAUTION: AIRCRAFT FLOAT SWITCH WIRING MAY EXHIBIT EXCESSIVE WEAR ON CENTER TANK.



1 CENTER TANK FLOAT SWITCH IN CELL NO. 2:
AR LV-JMW THRU LV-JMZ, LV-JTD, LV-JTO, LV-LEB

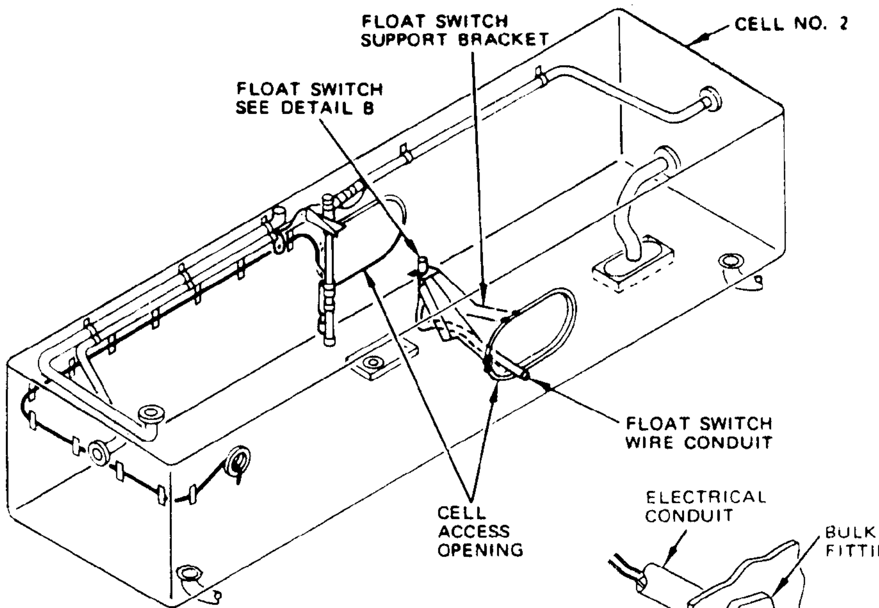
2 CENTER TANK FLOAT SWITCH IN CELL NO. 1 (SHOWN):
AR LV-JND, LV-JNE

3 CENTER TANK FLOAT SWITCH IN CAVITY NO. 2 (INTEGRAL TANK):
AR ALL EXCEPT 1 2



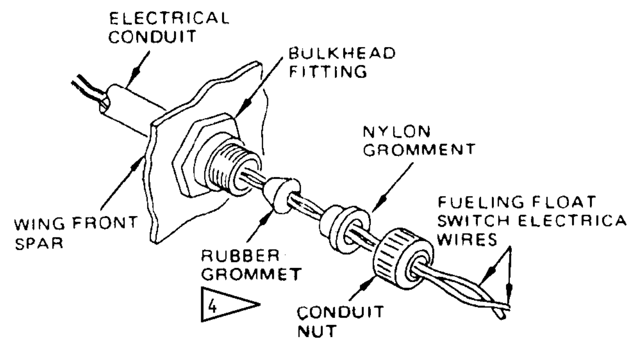
TANK NO. 2 FLOAT SWITCH (SHOWN)
TANK NO. 1 FLOAT SWITCH (OPPOSITE)
VIEW 1

Fueling Float Switch Installation (Type I)
Figure 401 (Sheet 1)

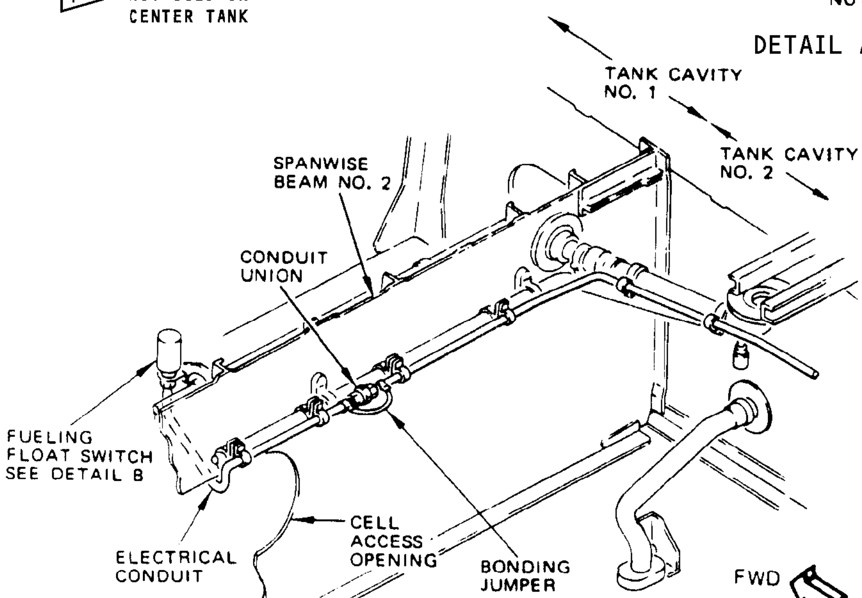


FLOAT SWITCH INSTALLATION IN CENTER TANK WITH TWO BLADDER CELLS
VIEW 2 [1]

[4] NOT USED ON CENTER TANK

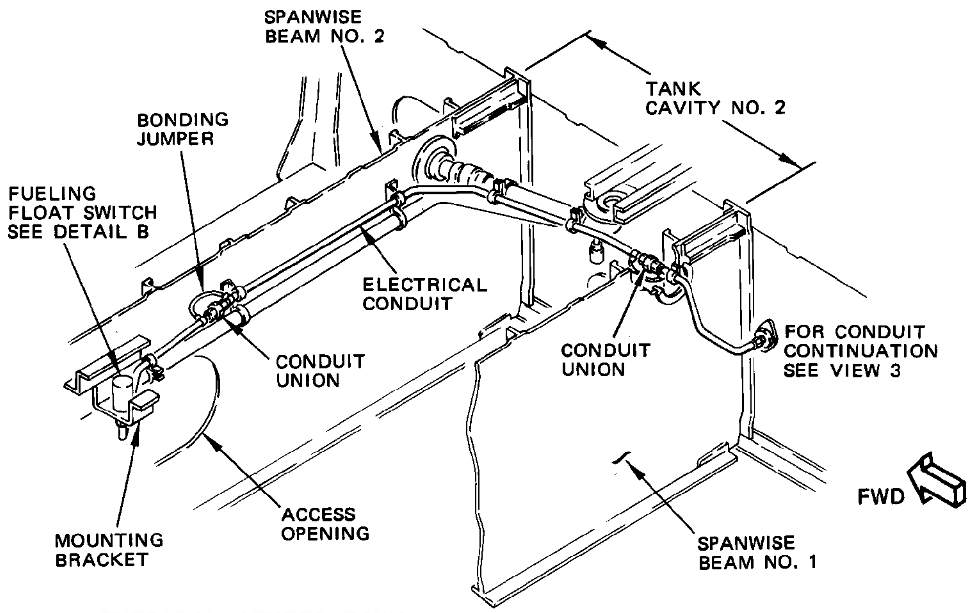


DETAIL A

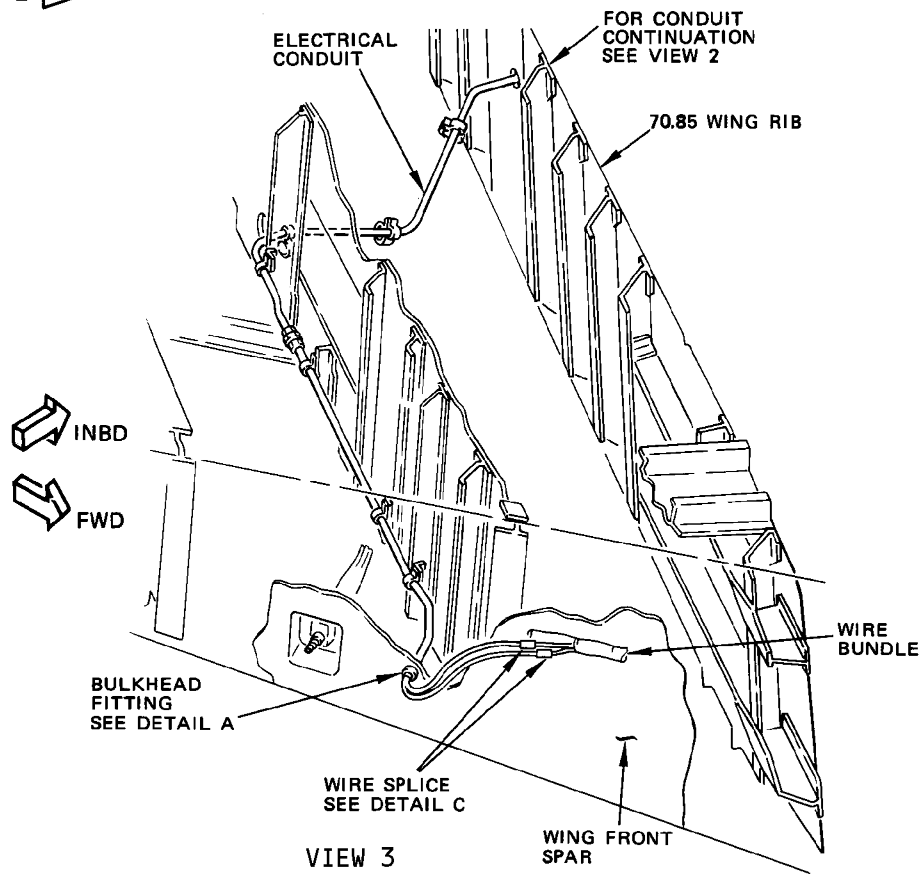


FLOAT SWITCH INSTALLATION IN THREE BLADDER CELL CENTER TANK
VIEW 2 [2]

Fueling Float Switch Installation (Type I)
Figure 401 (Sheet 2)

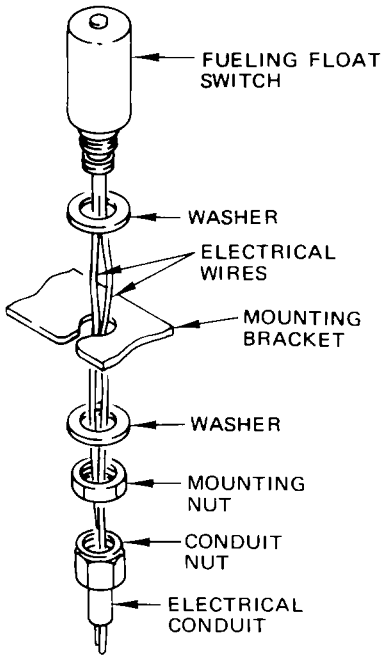


INTEGRAL CENTER TANK
FLOAT SWITCH INSTALLATION
VIEW 2 3

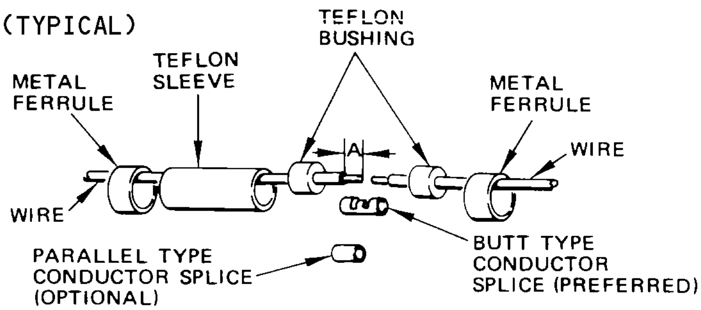


VIEW 3

Fueling Float Switch Installation (Type I)
Figure 401 (Sheet 3)

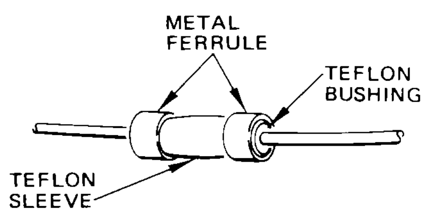


FUELING FLOAT
SWITCH INSTALLATION (TYPICAL)
DETAIL B



UNASSEMBLED

CONDUCTOR SPLICE TYPE	BARE WIRE DIMENSION A
BUTT	1/4 (± 1/32) INCH
PARALLEL	5/16 (± 1/32) INCH



ASSEMBLED

MOISTURE PROOF SPLICE

DETAIL C

Fueling Float Switch Installation (Type I)
Figure 401 (Sheet 4)

(a) Make sure the necessary Teflon sleeve is installed on the float switch wire bundle before you pull the wiring through the conduit (SB 737-28-1132).

(b) Do an inspection of the wiring and the conduit (AMM 28-21-71/601).

(c) Install or re-install the Teflon sleeving if it is necessary (AMM 28-21-71/601) (SB 737-28-1132).

B. Attach wire puller to float switch wires and pull wires through conduit until ends extend out through bulkhead fitting on front wing spar. Use care to prevent kinks in wire or damage to insulation.

WARNING: DO NOT ATTEMPT TO SHORTEN FLOAT SWITCH WIRES TO LOCATE SPLICE WITHIN CONDUIT. AN EXPLOSION HAZARD COULD RESULT IF SPLICE DEVELOPS AN ELECTRICAL SHORT

C. Inside fuel tank, drop mounting nut and one of the two washers down on float switch wires. Guide wires through slot in mounting bracket and position threaded base of switch in bracket (Fig. 401).

NOTE: On some center tank installations, it is only necessary to loosen mounting nut. Bracket slot is wide enough to accommodate threaded base of float switch.

D. Install washer and nut. Ensure that a washer is positioned on upper and lower surface of mounting bracket.

E. Restrain switch from turning to prevent twisting wires while nut is tightened. Secure nut with lockwire.

F. Connect electrical conduit to float switch and secure conduit nut with lockwire.

G. Outside the fuel tank put the rubber grommet (installed on the wing tank float switch), nylon grommet and the conduit nut over the end of the float switch wires and install on the end of the bulkhead union on the wing front spar (Fig. 401, Detail A).

H. Prior to splicing float switch wires, perform continuity check of float switch using ohmmeter outside of fuel tank at front spar bulkhead fitting location. Continuity shall not exist between electrical wires of float switch when switch fuel float is raised manually to simulate a full tank.

I. Connect float switch wires to matching airplane wires using moisture-proof splices (Detail C, Fig. 401).

J. Install wire clamps as necessary and secure wires to existing wire bundle forward of front spar. Ensure that there is no interference with forward wing flap travel.

6. AIRPLANES WITH TYPE II FLOAT SWITCH;
   Remove the Fueling Float Switch (Fig. 402, 403)
   A. Tank No. 1 or No. 2 Fueling Float Switch and Conduit Removal (Type II) (Fig. 402)
      (1) Prepare to cut the wires that go the float switch.
         (a) From out of the fuel tank, separate the wires that go to float switch from the wire bundle, forward of the wing front spar.
         (b) Find the splice in the wires that go to the float switch.
      (2) Cut the wires at a good point adjacent to the splice.
         (a) Make sure the wire has a sufficient length for a new splice.
         (b) Put a tag on the wires to identify them.
      (3) Do these steps to remove the float switch conduit:

         NOTE: It is necessary to remove the conduit each time you remove the float switch.

         (a) Loosen and remove the coupling ring (17) to permit the float switch cable to move freely.
         (b) With one person in the tank and one person out of the tank, loosen and remove the bolts (16), nuts (14), washers (24, 26, 27) and packings (25) that attach the retainer (22).

            NOTE: This step protects the retainer (22) from damage while you loosen the conduit mounting nut (18).

         (c) Pull the retainer back from the front spar.
         (d) From out of the fuel tank, loosen the bulkhead conduit mounting nut (18).
         (e) From in the fuel tank, loose and remove the conduit captive nut (15).
         (f) Disconnect the bonding jumper (2) from the ground stud of the float switch.
         (g) Disconnect the bonding jumper (5) from the conduit (7).
         (h) Loosen the mounting nut (3) for the float switch.
         (i) Separate the float switch from the conduit and from the conduit liner sufficiently to remove the float switch and conduit from the bracket.
         (j) Disengage the conduit from the bulkhead.
         (k) Pull the remaining wiring through the bulkhead and remove the float switch and the conduit from the tank as a unit.
   B. Center Tank Fueling Float Switch Removal (Type II) (Fig. 403)
      (1) Prepare to cut the wires that go the float switch.
         (a) From out of the fuel tank, separate the wires that go to float switch from the wire bundle, forward of the wing front spar.
         (b) Find the splice in the wires that go to the float switch.

(2) Cut the wires at a good point adjacent to the splice.
    (a) Make sure the wire has a sufficient length for a new splice.
    (b) Put a tag on the wires to identify them.
    (c) Loosen and remove the drain port (35) to permit the float switch cable to move freely.
(3) Do these steps to remove the float switch:

    CAUTION: IN THE CENTER TANK, DO NOT LET THE TOOLS OR THE TANK COMPONENTS FALL. DAMAGE TO THE FUEL CELL OR THE BOTTOM SKIN CAN EASILY OCCUR.

    (a) Loosen the mounting nut (42) from the float switch.
    (b) Hold the float switch with its attaching parts and do not let it fall while you pull the wires for the float switch out of the conduit.
    (c) Make loops in the wire make the wire and float switch easy to move.
    (d) Remove the float switch from the fuel tank.
(4) From out of the fuel tank, pull the formed section of the conduit liner forward out of the conduit with needle-nosed pliers or a similar tool.
(5) Cut off the formed end of the conduit liner.

    NOTE: This step makes is easier to pull the conduit liner out of the conduit from inside the tank.

(6) From in the tank, pull the conduit liner out of the conduit from the end that was attached to the float switch.
(7) Remove the conduit liner from the fuel tank.
    (a) Discard the liner.

7. AIRPLANES WITH TYPE II FLOAT SWITCH;
   Float Switch Installation (Fig. 402, 403)
   A. Equipment
      (1) C28012-1 Test Assembly - Float Switch Conduit
      (2) Installation Tool - Adapter P/N: 21A00355-1 (SB 28A1141 - part of kit # 26A00001 - liner system) or equivalent

(3) Installation Tool - Adapter P/N: 21A00355-1 or equivalent
(4) Puller - wire, to pull wires through the electrical conduit
(5) Ohmmeter - to measure electrical continuity
(6) Splices - moistureproof, to connect wires
(7) Syringe - small, to remove fluid from the float switch conduit
(8) Equipment to fill the conduit with grease:

NOTE: This equipment, including the necessary grease (MIL-G-27617, Type I) is available as a kit from Castrol Inc., 16715 Von Karman Ave., Suite 230, Irvine, CA, 92714.

(9) Tube - plastic, maximum outer diameter 0.25 inches, approximately 24 inches long
(10) Gun - dispensing, to put grease into the tube, available from Andpak-EMA, Inc., 1860 Dobbin Drive, San Jose, CA 95133.

B. References
(1) AMM 27-81-00/201, Leading Edge Flaps
(2) AMM 28-11-11/401, Wing Fuel Tank Access Panels
(3) AMM 28-11-31/401, Center Tank Access Panel
(4) AMM 28-21-00/501, Pressure Fueling
(5) SWPM 20-30-12

C. Consumable Materials
(1) A00247 Sealant - Chromate Type, BMS 5-95, Type II
(2) A00767 - BMS 5-45, Class B
(3) D00173 Grease, MIL-G-27617, Type I, Type II, Type III, or Type IV
(4) D00504 Grease, Petrolatum - VV-P-236
(5) G00150 Tape - Teflon Permacel P-421
(6) G50152 Tape - BMS 13-54, Type III, Class 1

D. AIRPLANES WITH TYPE II FLOAT SWITCH;
Tank No. 1 or No. 2 Float Switch Installation Procedure (Fig. 402)
(1) Get a new float switch.

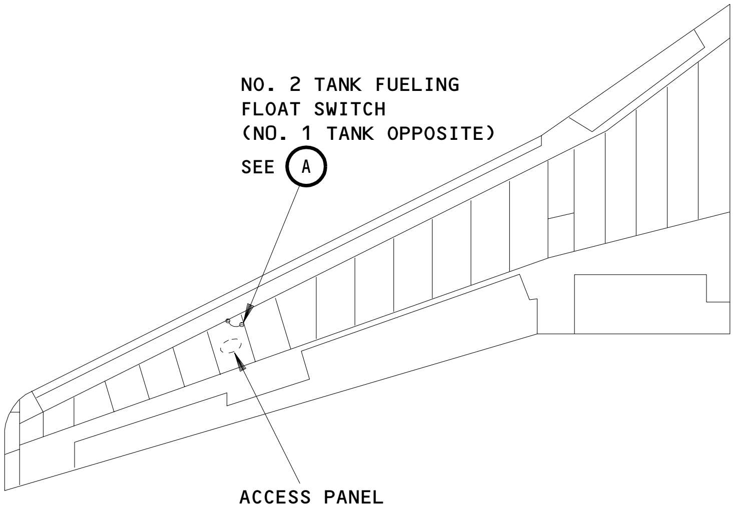
NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

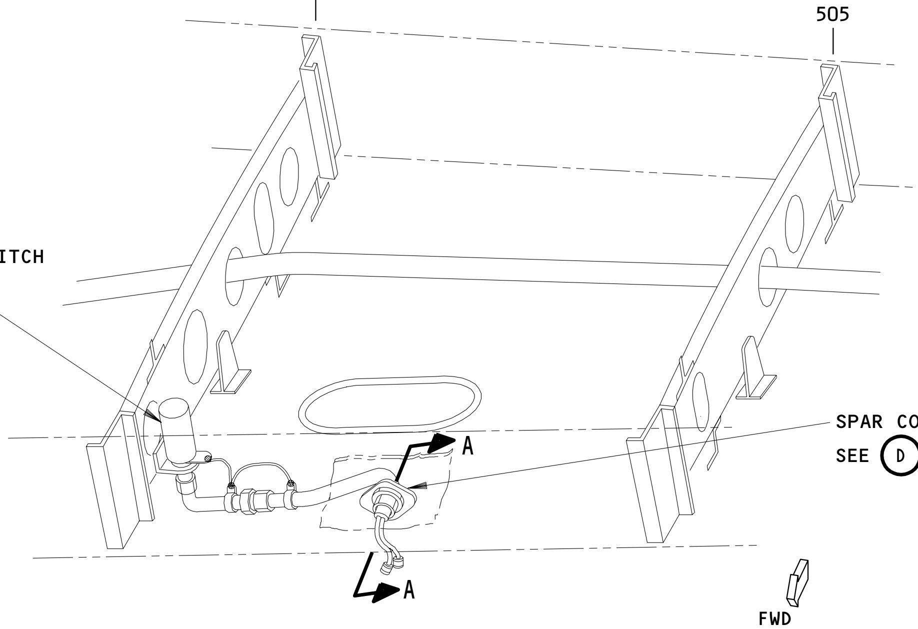
(2) For the float switch in the tank No. 1 or No. 2, separate the float switch from the conduit and from the liner adapter sufficiently to slide the float switch cable into the bracket slot.

CAUTION: SEPARATE THE FLOAT SWITCH FROM THE CONDUIT JUST ENOUGH TO SLIP THE FLOAT SWITCH CABLE INTO THE BRACKET SLOT WHILE KEEPING THE LINER FROM SLIDING OUT OF THE CONDUIT. TOO MUCH SEPARATION CAN CAUSE LOSS OF MOISTURE SEAL IN THE CONDUIT.

(3) Put the electrical cable for the float switch into the slot on the float switch mounting bracket.
(4) Lubricate the O-ring (21) with grease, VV-P-236 and install it on the bulkhead union (20).

(5) Put the bulkhead union with the O-ring (21) and retainer (22) into the hole in the front spar.
   (a) Make sure the liner extends out of the union sufficiently to be attached to the coupling ring subsequently.
(6) Install the float switch mounting nut (3) and the washer (13).
   (a) Tighten the mounting nut (3) with your hand only.
(7) Install the conduit captive nut (8).
   (a) Tighten the conduit captive nut (8) with your hand only.
(8) From out of the tank, install the washer (23) and the conduit mounting nut (18) on the bulkhead union (20).
   (a) Turn the bulkhead union (20) to mate with the retainer (22) as positioned for installation.
   (b) Tighten the conduit mounting nut (18) to a torque of 342-378 inch-pounds (38.6-42.7 Nm).
(9) Install the retainer (22) with the bolts (16), washers (24, 26, 27), packings (25), and nuts (14).
(10) Inside the tank, put the center of the float switch bonding lug hole at a location that causes the minimum torsional load of the switch cable.
(11) Do these steps to tighten the parts that attach the float switch:
   (a) Tighten the float switch mounting nut (3) to a torque of 266-294 inch-pounds (30-33.2 Nm).
   (b) Tighten the float switch conduit captive nut (8) to a torque of 266-294 inch-pounds (30-33.2 Nm).
   (c) Tighten the conduit join captive nut (11) to a torque of 275-280 inch-pounds (31.1-31.6 Nm).
   (d) Tighten the union conduit captive nut (19) to a torque of 266-294 inch-pounds (30-33.2 Nm).
   (e) Loosen the float switch mounting nut (3) sufficiently to relax the torque temporarily.
   (f) Loosen the union union conduit captive nut (19) sufficiently to relax the torque temporarily.
   (g) Loosen the float switch conduit captive nut (8) sufficiently to relax the torque temporarily.
   (h) Loose the conduit join captive nut (11) sufficiently to relax the torque temporarily.
   (i) The final torque for each of these nuts must be witnessed and written in the maintenance records for the airplane:
      1) Tighten the float switch mounting nut (3) to a final torque of 266-294 inch-pounds (30-33.2 Nm).
      2) Tighten the conduit captive nut for the float switch to a final torque of 266-294 inch-pounds (30-33.2 Nm).
      3) Tighten the union conduit captive nut (19) to a final torque of 266-294 inch-pounds (30-33.2 Nm).
      4) Tighten the conduit join captive nut (11) to a final torque of 275-280 inch-pounds (31.1-31.6 Nm).
   (j) Make sure the final torque for each of these nuts is written in the maintenance records.

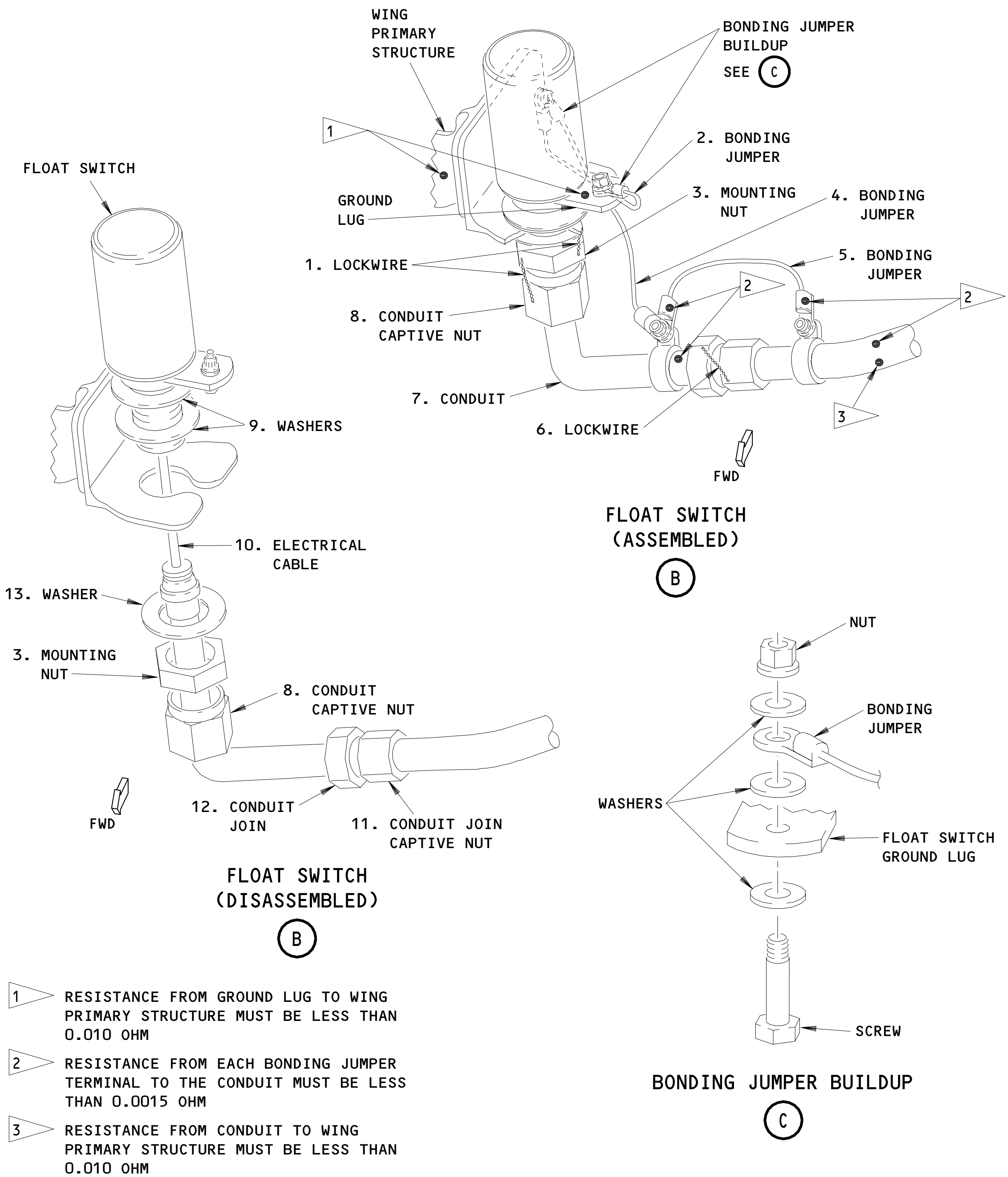




NO. 2 TANK FUELING FLOAT SWITCH

A

Main Tank Float Switch and Conduit Installation (Type II)
Figure 402 (Sheet 1)

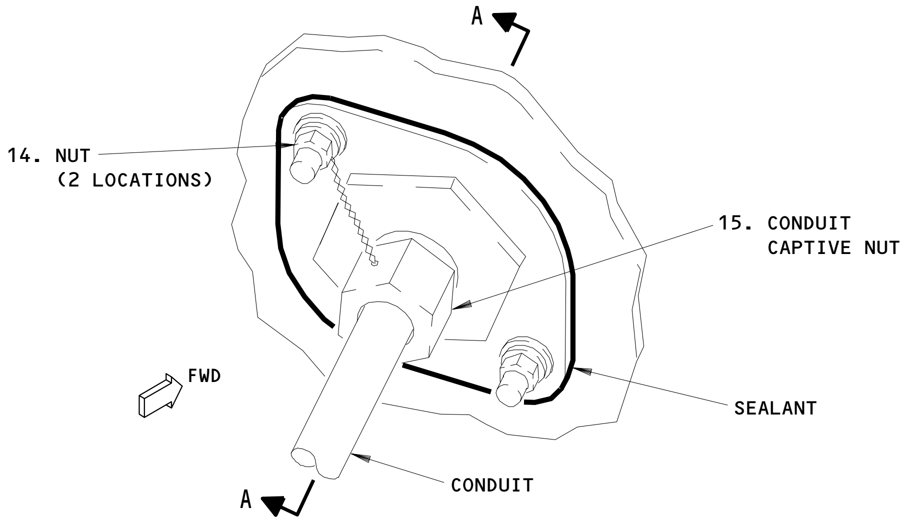


1 RESISTANCE FROM GROUND LUG TO WING PRIMARY STRUCTURE MUST BE LESS THAN 0.010 OHM

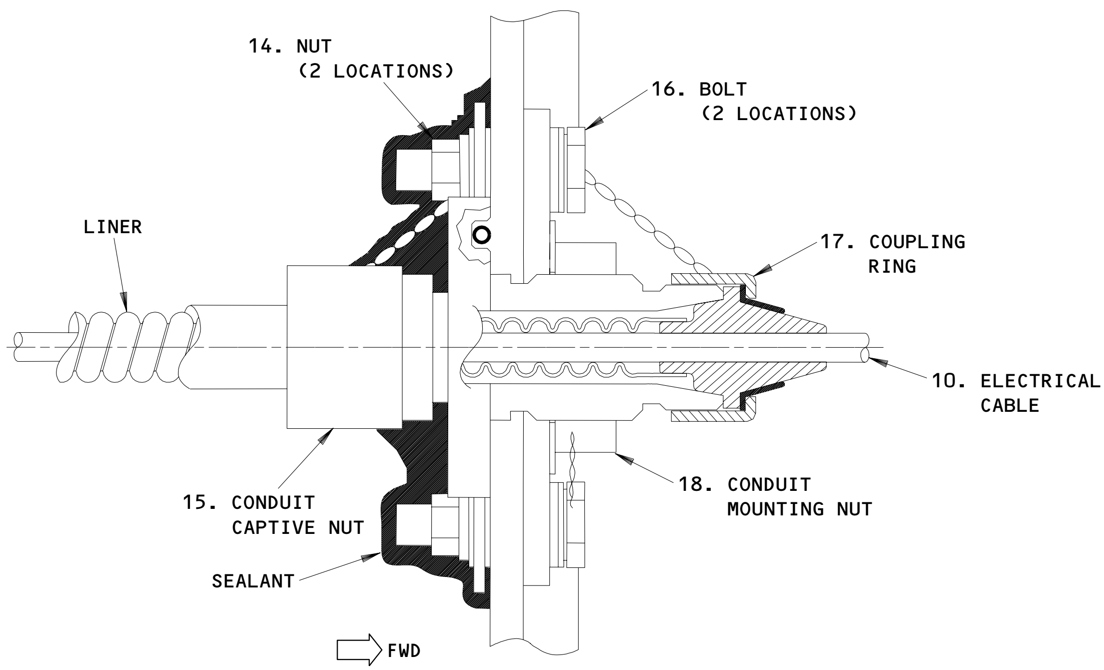
2 RESISTANCE FROM EACH BONDING JUMPER TERMINAL TO THE CONDUIT MUST BE LESS THAN 0.0015 OHM

3 RESISTANCE FROM CONDUIT TO WING PRIMARY STRUCTURE MUST BE LESS THAN 0.010 OHM

Main Tank Float Switch and Conduit Installation (Type II)
Figure 402 (Sheet 2)

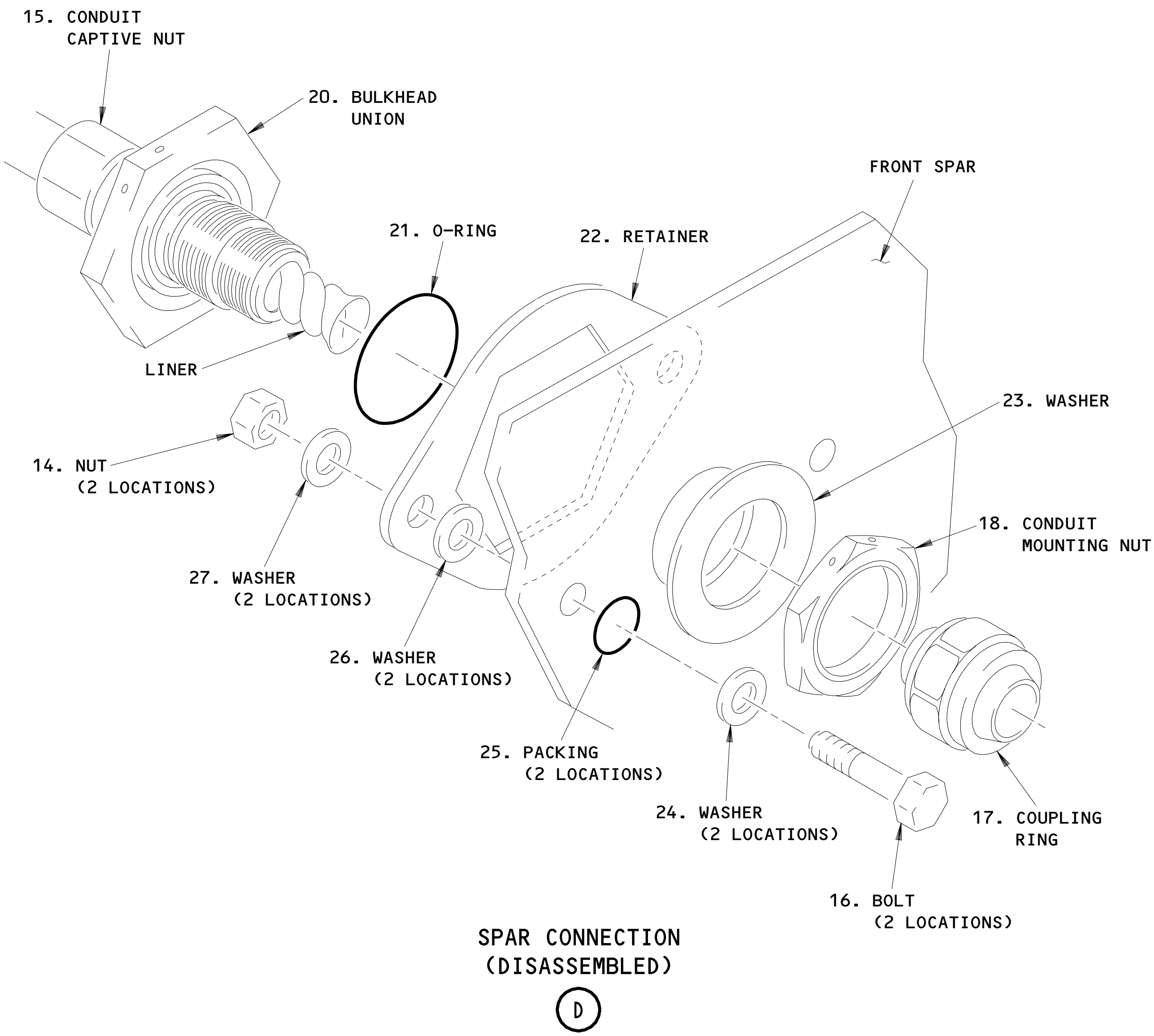


SPAR CONNECTION
(ASSEMBLED)
D

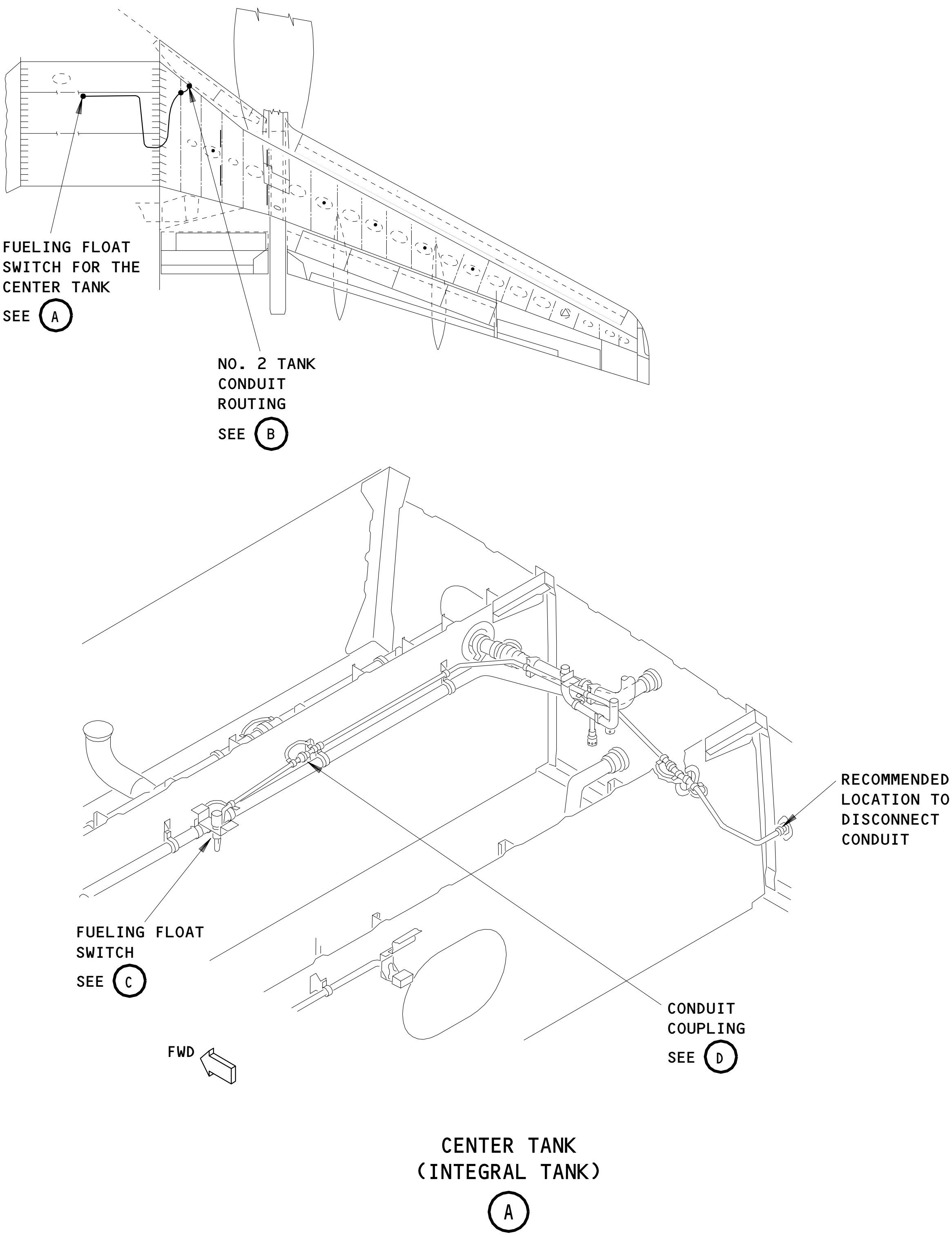


A-A

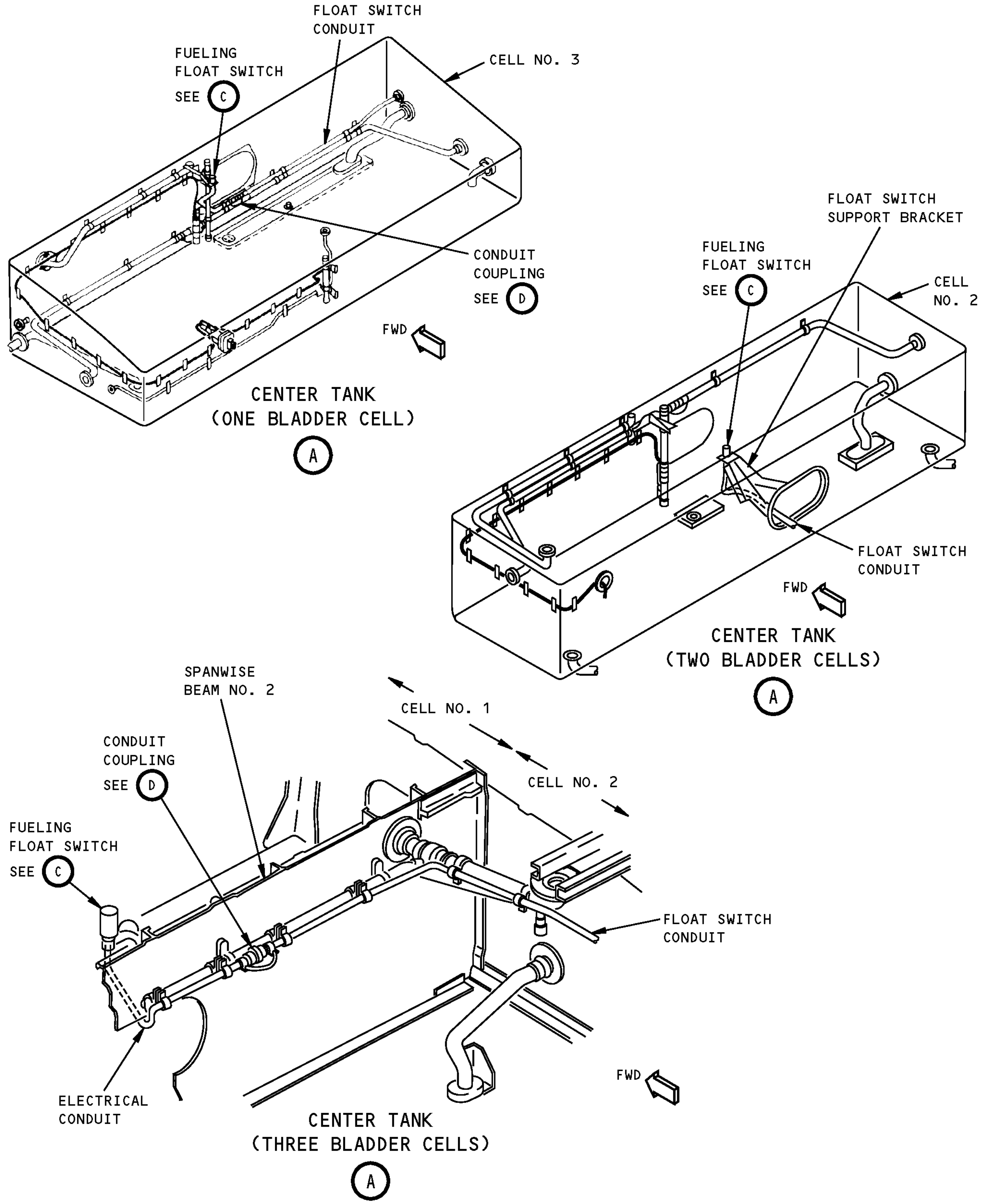
Main Tank Float Switch and Conduit Installation (Type II)
Figure 402 (Sheet 3)



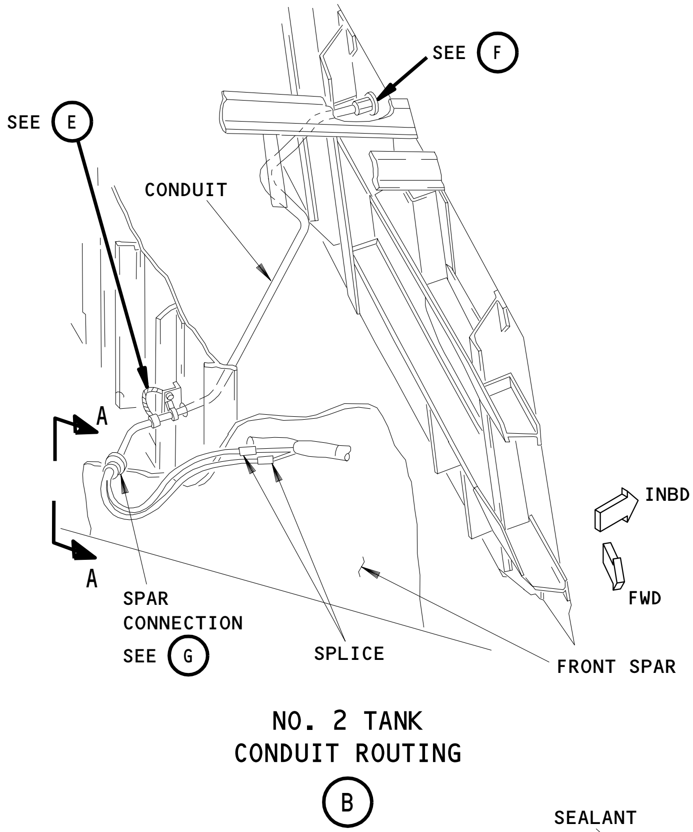
Main Tank Float Switch and Conduit Installation (Type II)
Figure 402 (Sheet 4)

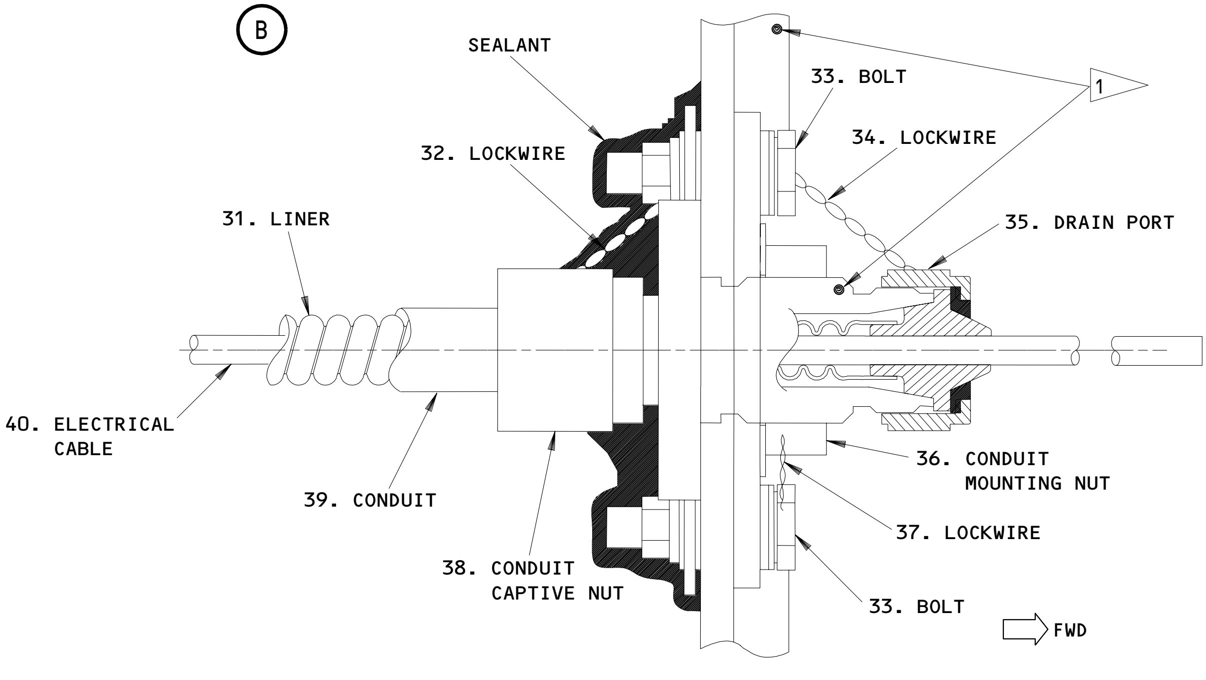


Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 1)



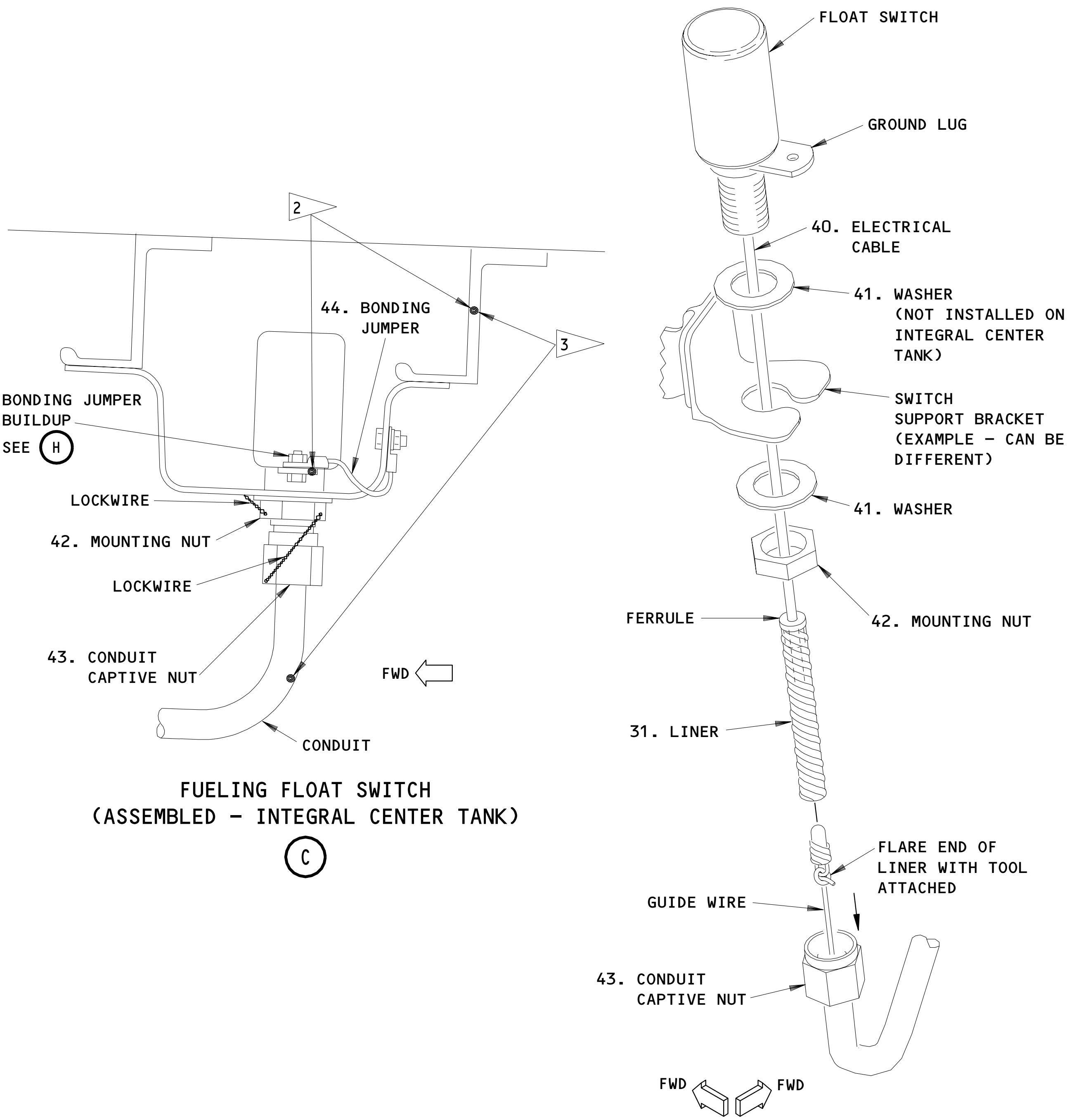
Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 2)





1 RESISTANCE FROM THE FLOAT SWITCH CONDUIT TO THE FRONT SPAR MUST BE LESS THAN 0.010 OHM

Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 3)



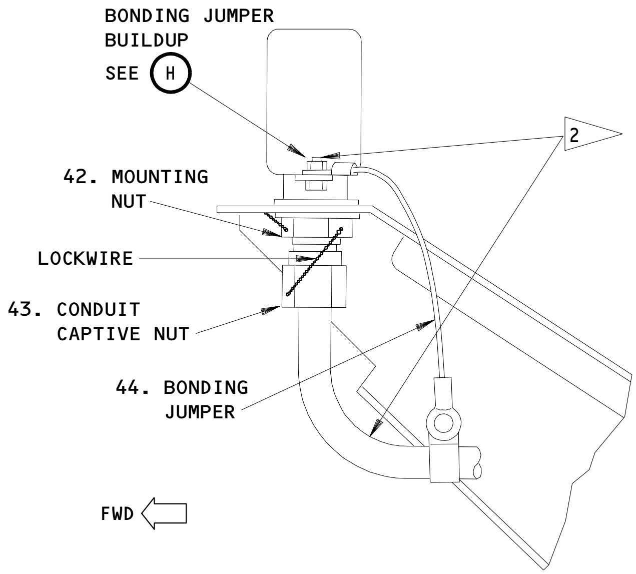
FUELING FLOAT SWITCH
(ASSEMBLED - INTEGRAL CENTER TANK)
C

FUELING FLOAT SWITCH
(DISASSEMBLED)
C

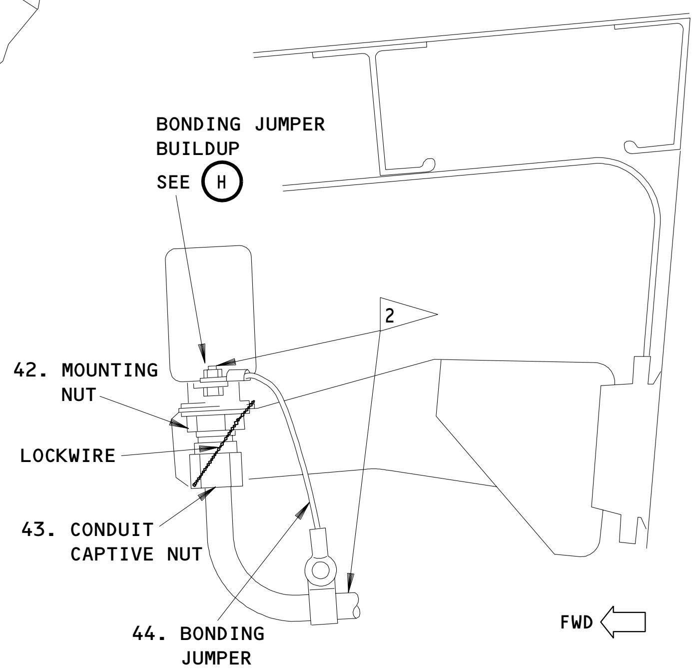
2 RESISTANCE FROM THE FLOAT SWITCH LUG AND WING PRIMARY STRUCTURE (INTEGRAL TANK) OR CONDUIT (BLADDER CELL TANK) IS LESS THAN 0.010 OHM

3 RESISTANCE FROM CONDUIT TO WING PRIMARY STRUCTURE MUST BE LESS THAN 0.010 OHM

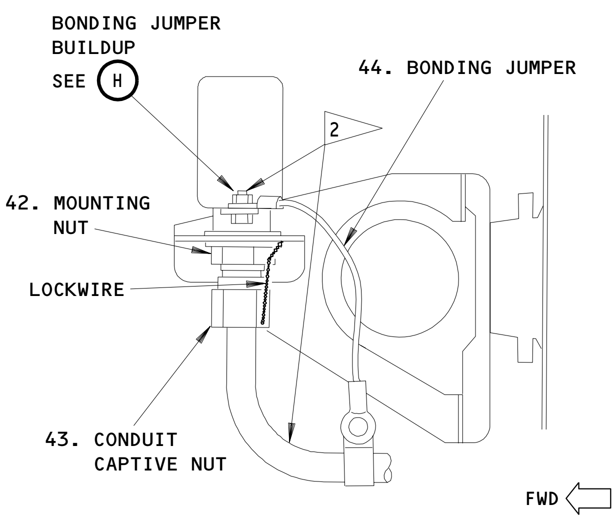
Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 4)



FUELING FLOAT SWITCH
(ASSEMBLED - TWO CELL CENTER TANK)
C

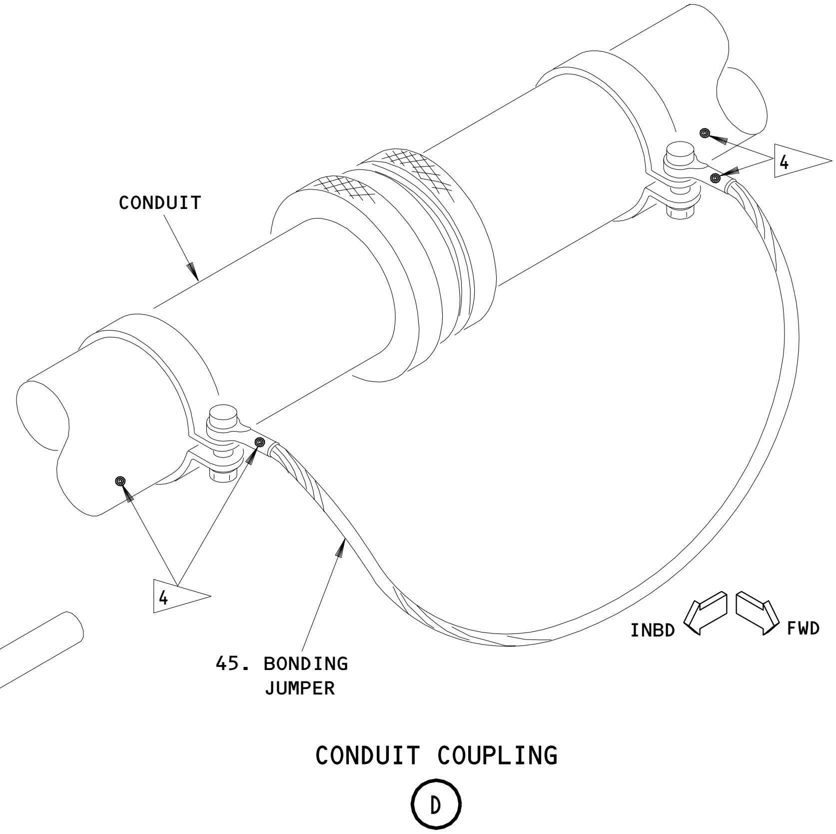


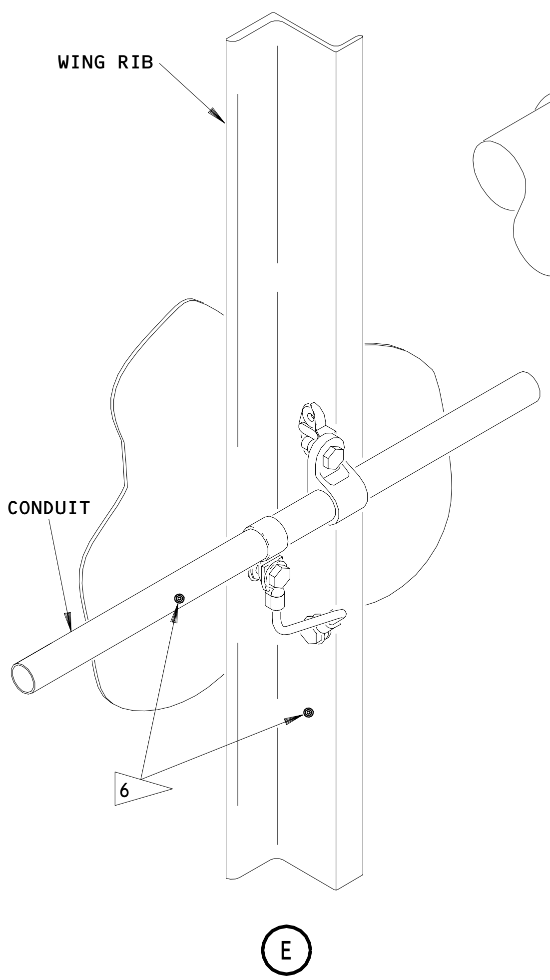
FUELING FLOAT SWITCH
(ASSEMBLED - ONE CELL CENTER TANK)
C

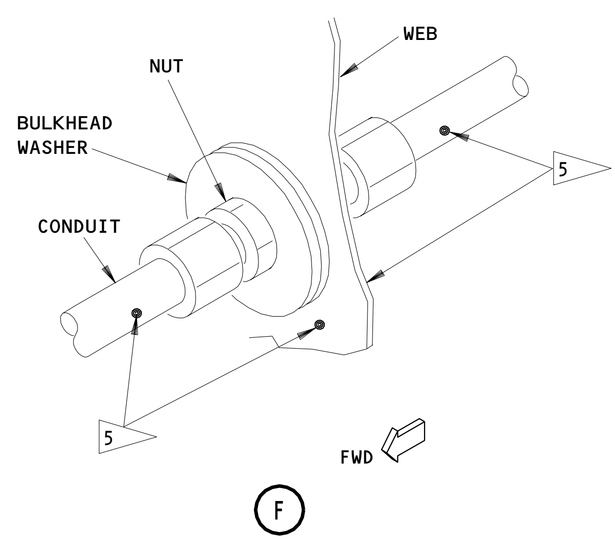


FUELING FLOAT SWITCH
(ASSEMBLED - THREE CELL CENTER TANK)
C

Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 5)





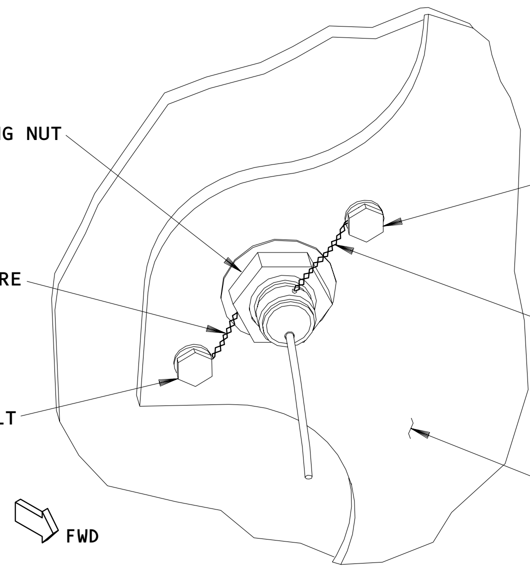


4 RESISTANCE FROM THE TERMINAL LUG TO THE CONDUIT MUST BE LESS THAN 0.010 OHM

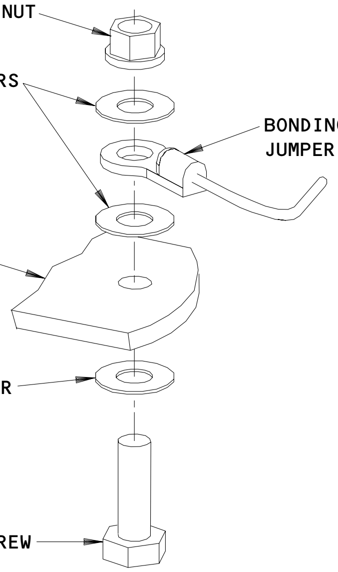
5 RESISTANCE FROM THE CONDUIT TO THE FUEL TANK SUPPORT WEB MUST BE LESS THAN 0.010 OHM

6 RESISTANCE FROM CONDUIT TO THE WING RIB MUST BE LESS THAN 0.010 OHM

Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 6)



SPAR CONNECTION
G



SPAR CONNECTION
H

Center Tank Float Switch Installation (Type II)
Figure 403 (Sheet 7)

(12) Out of the fuel tank, install the coupling ring (17) on the end of the bulkhead union (20).
(a) Make sure the grommet end of the coupling ring (17) is firmly installed inside the clear liner.
(b) Tighten the coupling ring (17) to a torque of 32-38 inch-pounds (3.6-4.3 Nm).
(13) Do these steps to install the bonding jumpers (SWPM 20-20-00):
(a) Install the bonding jumper (2) on the ground lug for the float switch.
1) Choose a jumper whose length will prevent too much loose bonding jumper after the bonding jumper is installed.
(b) Install the other end of the bonding jumper (2) on the ground lug on the switch bracket.
(c) Install the bonding jumper (4) on the ground lug on the switch support bracket.
(d) Install the other end of the bonding jumper (4) on the conduit with the clamp, screw, washer and nut.
1) Adjust the jumper lug position as necessary to remove the loose part of the bonding jumper.
(14) Measure the resistance from the float switch ground lug to the primary structure of the wing rib (SWPM 20-20-00).
(a) Make sure the resistance is less than 0.01 ohm.
(15) At the conduit join, measure the resistance from the bonding jumper terminal to the conduit.
(a) Make sure the resistance is less than 0.0015 ohm.
(16) Measure the resistance between the conduit and the primary structure of the wing rib.
(a) Make sure the resistance is less than 0.010 ohm.
(17) Install lockwire in these locations:
(a) Install lockwire from the bulkhead conduit captive nut (15) to the nut (14) (AMM 20-10-191/401).
(b) Install lockwire from the mounting nut (3) for the float switch to the float switch bracket (AMM 20-10-191/401).
(c) Install lockwire from the conduit captive nut (8) to the mounting nut (3) (AMM 20-10-191/401).
(d) Out of the tank, install lockwire from the conduit mounting nut (18) to the bolt (16) (AMM 20-10-191/401).
(e) Install the lockwire from the coupling ring (17) to the bolt (16) (AMM 20-10-191/401).
(18) Do this step to apply sealant at the spar connection.
(a) Apply a full-bodied layer of sealant around the retainer, retainer hardware, conduit and conduit connector with BMS 5-45, Class B sealant.
(19) Do these steps to splice the float switch electrical cable to the airplane wire harness:
(a) Cut the float switch electrical cable as necessary to permit a wire splice to the airplane wire harness without leaving more than 1.0 inch (25.4 mm) of excess wire.
(b) Splice the float switch electrical cable to the airplane wire harness with the applicable crimp tool (SWPM 20-30-12).

(c) Put two layers of electrical splice tape over the splice to prevent damage from water and fuel.

E. AIRPLANES WITH TYPE II FLOAT SWITCH;
Center Tank Float Switch Installation Procedure (Fig. 403)

(1) Do these steps to install the liner (31) and the electrical cable (40) in the conduit (39):

WARNING: INSTALL A NEW LINER EVERY TIME THE CONDUIT IS REPLACED AND EVERY TIME THE FLOAT SWITCH IS REPLACED. THE LINER IS NECESSARY TO KEEP THE FLOAT SWITCH WIRING SAFE FROM CONTACT WITH FUEL. IF THE WIRING CONTACTS FUEL, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(a) Put the installation tool into the non-ferrule end of the liner.
(b) Attach a guide wire (10 feet or 3 meters in length) to the installation tool.
(c) At the end of the conduit adjacent to the float switch, push the guide wire through the conduit until the guide wire comes out of the far end of the conduit at the front spar.
(d) Insert the electrical cable for the float switch into the ferrule end of the liner until it touches the installation tool at the other end of the liner.
(e) Put the liner and the float switch electrical cable into the open end of the conduit as a single unit.

NOTE: Loosen and turn the conduit tubes as necessary to insert the conduit liner and electrical cable.

(f) Pull on the guide wire and push on the liner and electrical cable together.
(g) Turn the liner as necessary to make it easier to put the liner and electrical cable into the conduit.
(h) Continue to put the liner and electrical cable into the conduit until the liner adapter is seated inside the conduit.
(i) Remove the installation tool and guide wire and discard them.
(j) If you moved or turned any of the conduit tubs during the installation of the conduit liner and electrical cable, do these steps:
1) Tighten any conduit joints that you loosened to a torque of 266-294 inch-pounds (30-33.2 Nm).
2) Loosen the conduit nut again to relax the torque.
3) The subsequent step must be witnessed and written in the maintenance documentation for the airplane.
4) Tighten the conduit nut again to a final torque of 266-294 inch-pounds (30-33.2 Nm).

5) Make sure the final torque is written in the maintenance records.
6) Put a lockwire on the conduit nuts that you tightened.

(2) Do these steps to trim and flare the end of the liner.

CAUTION: BE CAREFUL NOT TO DAMAGE THE ELECTRICAL CABLE IN THE CONDUIT WHILE YOU WORK WITH THE LINER. DAMAGE TO EQUIPMENT CAN OCCUR.

(a) Hold the end of the liner that extends out of the front spar bulkhead union so the liner adapter is seated firmly in the conduit.
(b) Pull the float switch electrical cable back out of the liner just enough so that the end of the electrical cable is inside the union.
(c) Trim the liner at 90° to its centerline so that 0.750 ±0.125 inch (19 ±3.17 mm) extends out of the union when the liner adapter is firmly seated inside the conduit.
(d) With the tool 04E00063, flare the liner.
1) Form the cut end of the liner to accept the shoulder of the drain port assembly.
2) After you form the cut end of the tube assembly, the edge perimeter of the tube assembly must be even to within ± 0.060 inch (± 1.5 mm)
(e) Push the float switch electrical cable out past the trimmed end of the liner.
(f) Pull any extra electrical cable out through the liner.

(3) Get a new float switch.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(4) Install the float switch in the bracket with the float switch mounting nut (42) and washer(s) (41).
(a) Permit the ground lug at the base of the float switch to turn to its natural position where the torsional load is at a minimum.
(b) Make sure the float switch ground lug does not touch the float switch mounting bracket.
(c) Tighten the float switch mounting nut (42) to a torque of 266-294 inch-pounds (30-33.2 Nm).
1) Do not let the float switch turn while you tighten the nut.

(5) Do these steps to connect the conduit to the float switch with the float switch conduit captive nut (43).
(a) Apply grease, VV-P-236, to the threads of the conduit captive nut.
(b) Tighten the conduit captive nut to a torque of 266-294 inch-pounds (30-33.2 Nm).
(c) Loosen the conduit captive nut again to relax the torque.

(d) The subsequent step must be witnessed and written in the maintenance documentation for the airplane.
(e) Tighten the conduit captive nut again to a final torque of 266-294 inch-pounds (30-33.2 Nm).
(f) Make sure the final torque is written in the maintanence records.

(6) Do these steps to complete the installation of the float switch:
(a) Clean the bonding surface on the float switch ground lug with cleaning method 1 (SOPM 20-11-03),
(b) Clean the bonding surface on the float switch bracket (integral tank) or conduit clamp (bladder cell tank) with cleaning method 1.
(c) Install the bonding jumper (44) on the float switch ground lug with the screw, nut and washers.
(d) Install the other end of the bonding jumper on the float switch bracket (integral tank) or conduit clamp (bladder cell tank) with screw, nut, and washers.

NOTE: AIRPLANES WITH BLADDER CELL TANK; Position the conduit clamp to remove excess slack from the bonding jumper.

(7) Measure the resistance from the float switch lug to the wing primary structure (integral tank) or the conduit (bladder cell tank) (SWPM 20-20-00).
(a) Make sure the resistance is less than 0.010 ohms.

(8) AIRPLANES WITH INTEGRAL TANKS;
Measure the resistance from the float switch conduit to the wing primary structure (SWPM 20-20-00).
(a) Make sure the resistance is less than 0.010 ohm.

(9) Install lockwire in these locations:
(a) Install lockwire from the bracket to the float switch mounting nut (42).
(b) Install lockwire from the float switch mounting nut (42) to the conduit captive nut (43).

(10) Out of the tank, remove the lockwire that attaches the conduit mounting nut (36) at the front spar to the bolt (33) for the retainer.

(11) Make sure the conduit mounting nut (36) at the front spar is tightened to a torque of 342-388 inch-pounds (38.6-43.8 Nm).

(12) Measure the resistance between the two terminals of the bonding jumper (45) and the float switch conduit (View D).
(a) Make sure the resistance is less than 0.010 ohm.

(13) Measure the resistance between the float switch conduit and the two sides of the web (View F).
(a) Make sure the resistance is less than 0.010 ohm.

(14) Measure the resistance between the float switch conduit and the wing rib (View E).
(a) Make sure the resistance is less than 0.010 ohm.

(15) Measure the resistance between the float switch conduit and the front spar (View A-A).
(a) Make sure the resistance is less than 0.010 ohm.

(16) Do these steps to do a pressure test of the conduit and float switch:

(a) Install a fitting into the center tank float switch conduit at the front spar to let you do the pressure test.

NOTE: The float switch cable and the end of the convoluted tube that comes out of the union must be inserted into the test fitting to let the conduit be pressurized.

(b) Attach a pressure source to the fitting.

NOTE: The pressure source must be able to supply and control pressures from 0 to 6 psig. It must have an absolute accuracy of ± 1 psig and be capable of showing change in pressure of 0.005 psig.

(c) Pressurize the float switch conduit to 5 ±1 psig.
(d) Close the test bench shutoff valve to hold the pressure in the conduit.
(e) Permit the pressure to become stable for 1-2 minutes.
(f) Make a record of the pressure in the conduit.
(g) Make sure the pressure in the conduit is 5 ±1 psig.
(h) Permit the conduit to hold pressure for 1-2 minutes.
(i) Make a record of the pressure in the conduit.
(j) Make sure the pressure is ± 0.05 psig of the pressure at the start of the test.
(k) Slowly reduce the pressure from the float switch conduit.
(l) Remove the test fitting from the center tank float switch conduit.

(17) Before you install the drain port assembly, make sure it is witnessed that the liner is installed in the conduit.

NOTE: The liner is important to the safety of the float switch installation. This is the last step where a person can make sure it is installed and document that fact.

(a) Make sure the installation of the liner in the conduit is written in the maintenance records for the airplane.

(18) Do these steps to install the drain port assembly:

(a) Put the float switch electrical cable into the hole in the drain port assembly.

(b) Slide the drain port assembly along the electrical cable to the front spar bulkhead union.

(c) Install the drain port on the front spar bulkhead union.

NOTE: Make sure the drain port shoulder is seated in the formed liner.

(d) Tighten the drain port (35) to a torque of 9.0-11.0 inch-pounds (1-1.2 Nm).

(e) Install lockwire from the drain port (35) to the bolt (33).

(f) Install lockwire from the conduit mounting nut (36) to the bolt (33).

(19) Do these steps to splice the float switch electrical cable to the airplane wire harness:

(a) Cut the electrical cable as necessary to permit a wire splice to the airplane wire harness with less than 1.0 inch (25.4 mm) of excess wire.

(b) Splice the float switch electrical cable to the airplane wire harness with the applicable crimp tool (SWPM 20-30-12).

(c) Put two layers of electrical splice tape over the splice to prevent damage from water and fuel.

8. Put the Airplane Back to Its Usual Condition

A. Install the access panels that you removed to get access to the fuel tank.

(1) For tank No.1 or No. 2, refer to AMM 28-11-11/401.

(2) Install the slat access panel (if applicable).

(3) For the integral center tank (if applicable), refer to AMM 28-11-31/401.

(4) For the center tank with removable bladder cells (if applicable), refer to AMM 28-12-21/401 and AMM 28-12-31/401.

B. Fill the tank with fuel and do a check for fueling switch cutoff (AMM 28-21-0/501).

C. With fuel in the tank, do a check for fuel leakage at the conduit bulkhead fitting; no leakage is permitted (AMM 28-21-71/601).

NOTE: To do a leak check of the conduit for the center tank float switch, make sure the center tank and tank No. 2 are filled with fuel.

D. Remove the leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAP CAN MOVE QUICKLY AND CAUSE SERIOUS INJURY TO PERSONS.

E. If installed, remove the tank No. 2 boost pump bypass valve lock and replace the access plug in the wing lower skin.

FUELING FLOAT SWITCH - INSPECTION/CHECK

1. General
   A. Electrical wiring to the float switches is enclosed in the conduit with fuel-tight connections. Wiring splices are located close to the respective conduit bulkhead fittings at the wing front spar.
   B. This procedure gives the instructions to inspect the fueling float switch conduit located at the wing front spar station 494, external to the fuel tank, inspect the center tank fueling float switch wiring, and inspect the center tank float switch electrical conduit.
2. AIRPLANES PRE-SL 28-42 AND PRE-SB 28A1141 (TYPE I FLOAT SWITCH);
   Wing Tank Float Switch Inspection/Check
   A. Equipment and Materials
      (1) Leading Edge Flap Actuator Locks - F80048-89 (Preferred), F80048-90 (Preferred), F80048-84 (Alternate), and F80048-36 (Alternate)
      (2) Flexible plastic tubing 1/4 inch or less outside diameter and vacuum source such as syringe
   B. Prepare for Inspection
      (1) Extend the flaps and install leading edge flap locks (AMM 27-81-0/201).

      WARNING: FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

      (2) Check that the fueling shutoff valves at the fueling station are closed.
      (3) Disconnect the external electrical power, if connected.
   C. Wing Tank Float Switch Inspection
      (1) Make sure wing tanks are full of fuel.
      (2) Get access to the wing tank float switch wires at the wing front spar station 494, external to the fuel tank.
         (a) Remove slat access panel No. 6223/6523.
      (3) Visually inspect the bulkhead union for signs of fuel leakage.
      (4) If leakage is present do the steps that follow (Fig. 601):
         (a) From the outer side of the wing tank located at the wing front spar remove these components (Fig. 601).
            1) Remove the conduit nut.
            2) Remove the nylon grommet.
            3) Remove the rubber grommet.
         (b) Do a check to see if the leakage is from the inner surface of the conduit or the bulkhead union seal.
         (c) Use the flexible plastic tube and the vacuum source (a small syringe) to do the steps that follow.

(d) Remove the water or fuel that collected in the bottom of the conduit.
1) Put the flexible tube approximately 16 inches into the conduit.
2) Make sure the flexible tube is at the lowest point in the conduit.
3) Examine the fluid that you remove to see if the fluid contains fuel.
4) Fuel found in the conduit is an indication that there is a leak in the conduit.

(e) Defuel the applicable fuel tank (AMM 28-23-00/201).

(f) Do this procedure: Fuel Tank Purging and Entry (AMM 28-10-00/201).

<u>WARNING</u>: OBEY ALL OF THE TANK PURGING AND ENTRY PRECAUTIONS. INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(g) Remove the access panel, No. 11, for the applicable tank (AMM 28-11-11/401).

(h) Remove the float switch conduit (AMM 28-21-71/401) to do an inspection.

(i) If the fuel leakage is from the conduit, replace the necessary parts of the conduit assembly.

(j) If the leakage is from the bulkhead union, do these steps:
1) Examine the bulkhead union to see if it is serviceable.
2) Install a new O-ring on the bulkhead union.
3) Clean the bulkhead surface where the O-ring is to seal.

(k) Install the float switch conduit (AMM 28-21-71/401).

D. Put the Airplane Back to Its Usual Condition

(1) Replace the tank access panels (AMM 28-11-11/401).

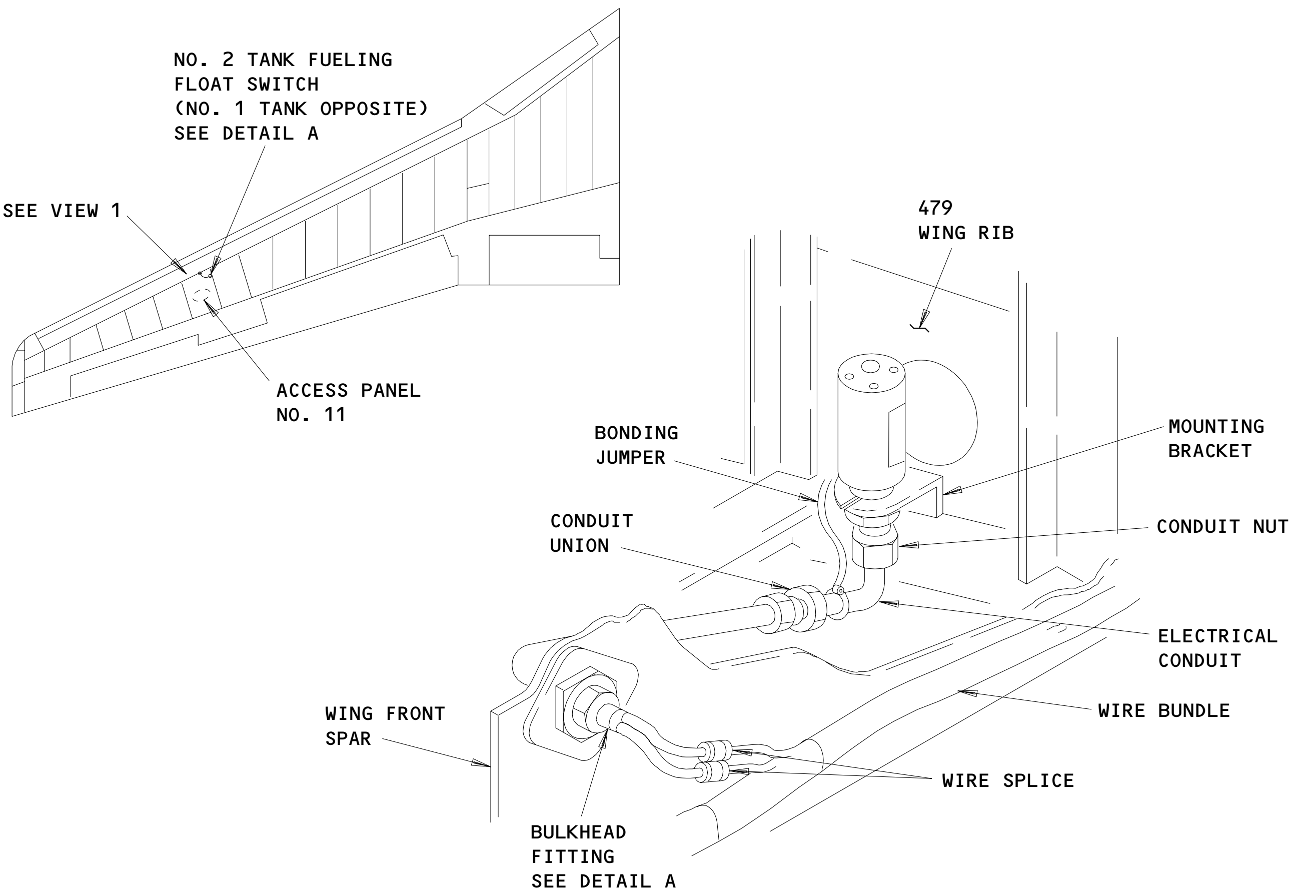
(2) Install the slat access panel No. 6223/6523.

(3) Fill the tank with fuel and check the bulkhead union for signs of fuel leakage.

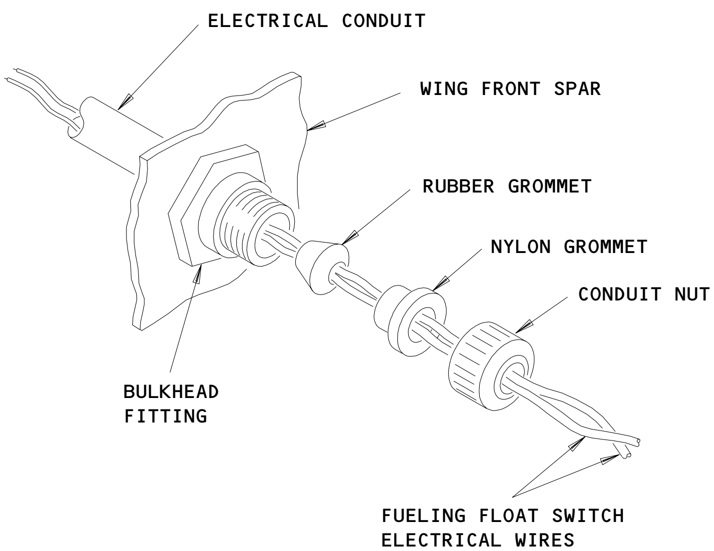
(4) With fuel in the wing tank, check the D.C. fueling float switch cutoff (AMM 28-21-0/501).

(5) Remove the leading edge flap locks (AMM 27-81-0/201).

<u>WARNING</u>: BE CAREFUL WHEN YOU REMOVE THE LEADING EDGE FLAP LOCKS. LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.



TANK NO. 2 FLOAT SWITCH (SHOWN)
TANK NO. 1 FLOAT SWITCH (OPPOSITE)
VIEW 1



DETAIL A

D.C. Fueling Float Switch Inspection Check
Figure 601

3. 737-200 AIRPLANES WITHOUT VOLUMETRIC TOP-OFF UNITS;
Center Tank Fueling Float Switch Wiring Inspection

A. Equipment
   (1) Megohmmeter - Quad Tech 1864 (or equivalent), must be able to read resistance at 500 VDC

B. Consumable Materials
   (1) Sealant - Proseal 860
   (2) BMS13-54 (or equivalent) - string or tape, 75 feet minimum, 150 feet recommended, to pull the wires through the sleeves and conduit.
   (3) Wire - Lockwire or stiff electrical wire, 25 feet to pull the wires through the sleeves

C. Procedure
   (1) Remove the fueling float switch from the center fuel tank (AMM 28-21-71/401).

NOTE: If you plan to re-install the same float switch, then put a mark on the wires where they come out of the conduit (at the front spar). You must make this mark so that you know where you can tie the string to the wires when you pull the wires back in the conduit. There must be no string or tape remaining in the conduit.

NOTE: Cut the float switch wires at the splices shown in the maintenance manual. Keep the float switch wires as long as possible.

NOTE: Attach a strong string to the wires, at the front spar, before you pull them out of the conduit. If you use lacing tape, it is recommended that you use two or more strands. It is possible that one piece of lacing tape is too weak.

NOTE: It will be necessary to go into the center fuel tank. Usually, it will not be necessary to go into the No. 2 fuel tank.

(2) Look carefully at the area of the wire that was installed in the conduit.

(a) If you find any sign of electrical arcing on the wires, then you must do one of these two options:

NOTE: Arcing can show as very small blackened holes in the insulation, or as deformation or pitting of the copper wire. Worn areas with a black material around the edge is not a sign of arcing. The black material is aluminum oxide.

1) OPTION 1:

a) Replace the section of the electrical conduit where the arcing occurred (AIPC 28-20-00-26, AIPC 28-20-00-28).

2) OPTION 2:

a) Do this task: Electrical Conduit Inspection (AMM -21-71/601).

(3) If you smell or see fuel on the electrical wires, then you must find and correct the leak.

(a) If the leak is caused by damage to the conduit, then replace the damaged conduit.

(4) If the wires do have any sign of electrical arcing and there is no copper wire showing, then you can re-use the old float switch.

(5) If you find locations on the wires where the insulation has wear, then you must replace the float switch with a new one before 15,000 flight hours (SB 28-1132),

(6) The insulation has wear if you can see a dent or low spot in the insulation.

(7) If you will re-use the old float switch, then do this test of the switch insulation:

WARNING: DO NOT DO THIS TEST ON OR NEAR THE AIRPLANE. THIS TEST USES HIGH VOLTAGES THAT CAN MAKE A SPARK. IF YOU ARE NEAR THE AIRPLANE, THE SPARK CAN CAUSE IGNITION OF FUEL VAPORS.

(a) Remove the insulation from the ends of the float switch wires.

(b) Temporarily connect the ends of the two float switch wires together.

(c) Connect a megohm meter between the ends of the wires and the float switch housing.

NOTE: Make sure the probe tips from the meter go through the anodized layer on the float switch housing. If the probe tip does not go through the anodized layer and touch the aluminum, they you will not get the correct measurement.

1) You must connect to the part of the housing that is a bump in the center of the top of the float switch.
2) Do not connect to outer cover or the threaded end of the switch.

(8) Measure the resistance between the wires and the float switch housing at 500 VDC.
(a) If the resistance is less than 200 megohms, then you must replace the float switch.
(b) Disconnect the megohm meter from the float switch and disconnect the two float switch wires from each other.

(9) Apply Proseal 860 sealant to the top of the float switch.

NOTE: Precoat is optional when you use Pro-Seal 860, B 1/6 sealant. A special adhesion promoter is recommended before the use of Pro-Seal 860, B1/6 sealant. Obey the manufacturers instructions.

(a) Apply a small quantity of the sealant with a brush.
(b) Put it on the area where the anodized layer was broken by the probe tips.
(c) Refer to AMM 28-11-0/801 for data on how to apply sealant.

(10) Use compressed air (30 psi maximum) to blow dirt out of the conduit.

(11) Do these steps to install a TFE-2X14SW Teflon sleeve over each wire of the float switch (one wire per sleeve):

CAUTION: DO NOT SHRINK THE TEFLON SLEEVE WITH HEAT. HEAT CAN CAUSE DAMAGE TO THE INSULATION ON THE WIRE.

(a) Cut two pieces of TFE-2X14SW sleeve to the correct length of 18 feet.
(b) It is not possible to push the wires on the float switch through the sleeve. It is recommended to do these steps to install the sleeves:
1) Push a wire (referred to as the fish wire), such as lock wire or a stiff electrical wire, through the TFE-2X14SW sleeve.
2) Tie the float switch wire to the fish wire with a string.
a) It is recommended that you use the knot shown in Figure 603.

3) Pull the float switch wire through the TFE-2X14SW sleeve with the fish wire.
   a) Pull until the TFE-2X14SW sleeve touches the sleeve that is a part of the float switch.

      NOTE: This is easiest with two people, one to pull the fish wire, and the other to hold the opposite end of the sleeve.

4) If the float switch wires are shorter than the sleeve, then do this steps:
   a) Cut the sleeve so that about one inch of wire shows, at the free ends of the wire.
5) Push the sleeve farther on the wire, until you can remove the string.
6) Remove the string from the wire, and pull the sleeve back up the wire.

(12) Do these steps to install a TFE-2X6TW Teflon sleeve over the two TFE-2X14SW sleeves (one sleeve with both wires in it):

CAUTION: DO NOT SHRINK THE TEFLON SLEEVE WITH HEAT. HEAT CAN CAUSE DAMAGE TO THE INSULATION ON THE WIRE.

(a) Cut a piece of TFE-2X6TW sleeve to the correct length of 18 feet.
(b) Do these recommended steps to install the sleeve:
   1) Push a wire (referred to as the fish wire), such as lock wire or a stiff electrical wire, through the TFE-2X6TW sleeve.
   2) Use the fish wire to pull two strings through the TFE-2X6TW sleeve.
   3) Tie one string to each TFE-2X14SW sleeve.

      NOTE: The knot shown in Figure 603 is recommended

      NOTE: If you are re-installing the old float switch, then start the knot at a location that will be about 3 inches outside of the conduit on the airplane. Use the mark you made before you removed the wire from the airplane to find this location

4) Pull one of the float switch wires and its TFE-2X14SW sleeve through the TFE-2X6TW sleeve with the string.
   a) Pull until the TFE-2X14SW sleeve touches the sleeve that is a part of the float switch.

      NOTE: This is easiest with two people, one to pull the string, and the other to hold the opposite end of the sleeve.

5) Pull the second float switch wire and its TFE-2X16SW sleeve through the TFE-2X6TW sleeve with the string.
   a) Pull until the TFE-2X6TW sleeve toughes the base of the float switch.

      NOTE: Keep the strings tied to the wires. You will use this string to help pull the wires back through the conduit.

6) Do not cut the TFE-2X6TW sleeve.
   a) Keep the full length of sleeve until the float switch is installed in the airplane.

(13) Install the float switch in the airplane with the procedure in AMM 28-21-71/401 and with these additional steps:
   (a) Tie a short string around the TFE2X6TW sleeve.

      NOTE: It is recommended to use the knot shown in Fig. 603.

      If you are re-installing the old float switch, then start the knot at a location that will be there about 3 inches outside of the conduit on the airplane. Use the mark you made before you removed the wire from the airplane to find this location.

   (b) Tie the strings you installed previously to the strings you have through the conduit.

      NOTE: Remember to put the nut and washers over the wires (AMM 28-21-71/401).

(c) Pull the wires through the conduit.
   1) Disconnect the conduit at one location (AMM 20-10-51/401).

      NOTE: If you try to pull the wires through the full length of the conduit at one time. the string or wire can break.

(d) Some airplanes have a rubber plug in the fitting at the front spar.
   1) If your airplane had this rubber plug, do not re-install it.

      NOTE: Removing the plug permits the Teflon sleeve to come out of the conduit.

(e) After the wires are in the conduit, cut the TFE-2X6TW sleeve and the wires so that they are sufficiently long to tie the wire bundle on the front spat.
   1) You must tie a minimum of 3 inches of the sleeve to the wire bundle with a minimum of four ties.

      NOTE: If the float switch wires are too short, then make a small cut in the TFE-2X6TW sleeve. Push the wires out of this cut and splice them. When you complete the splice, push the wires back in the sleeve. Use tape (or equivalent) to seal the cut in the sleeve.

   2) When you splice the float switch wires, make a moistureproof splice in a fuel vapor area as shown in SWPM 20-30-12.

D. Put the Airplane Back to Its Usual Condition
   (1) Do the steps in AMM 28-21-71/401 to put the airplane back to its usual condition.

4. 737-200 AIRPLANES WITHOUT VOLUMETRIC TOP-OFF UNITS;
   Center Tank Float Switch Electrical Conduit Inspection

A. Equipment
   (1) Source - Air pressure, regulated, able to supply 20 psi
   (2) Gage - Pressure, 0-20 to 0-50 psi (or equivalent)
   (3) Plug - BACP20AU8 or MS21913-8 (or equivalent), to plug the end of the conduit where the float switch was removed.
   (4) Valve - Shutoff, to shut off the air supply
   (5) Plumbing - To connect the pressure gage and the valve to the float switch conduit and to an air supply. The thread on the conduit is 3/4 16.

B. Inspection Procedure - To Be Used With the Float Switch Wiring Inspection When the Wiring is Removed
(1) Use the necessary fittings to plug one end of the electrical conduit and to connect a pressure gage and air supply to the other end of the electrical conduit.
(2) Pressurize the electrical conduit to approximately 20 psi and shut off the supply of air.
(3) After 5 (five) minutes, with no supply of air, make sure the pressure gage does not show a decrease in pressure.

NOTE: You must connect the pressure gage so that it shows the pressure in the electrical conduit, even when the air supply is shut off.

(4) If you find leakage, then you must replace the section of the electrical conduit where the leak is before the next flight.
(5) If you do not find a leak, then it is not necessary to replace the electrical conduit immediately. However if you found indications of arcing (in the task: Fuel Float Switch Wiring Inspection), then refer to SB 28-1132 for more data about the necessary inspection intervals.

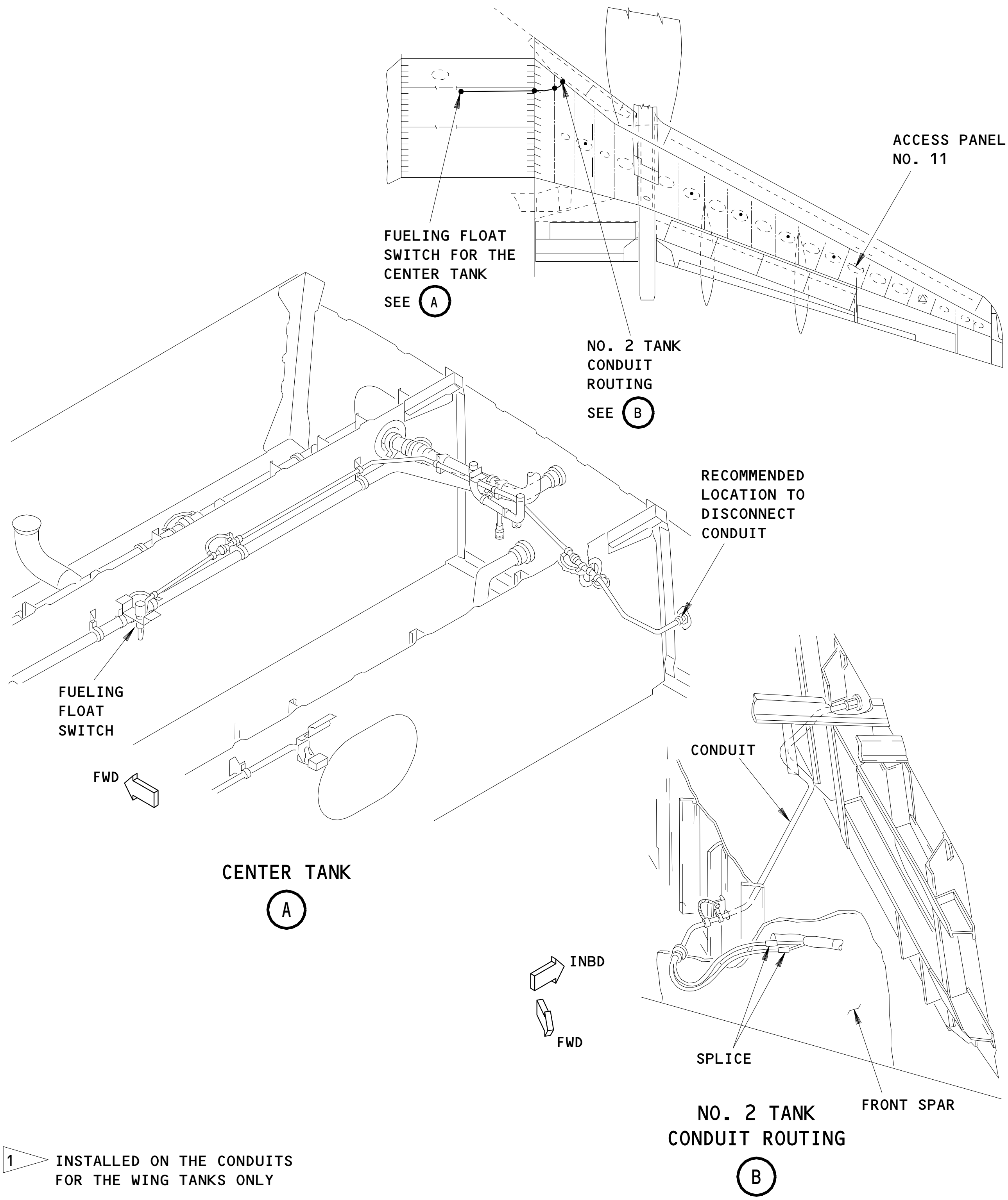
C. Inspection Procedure - To Be Used When the Wiring is not Removed
(1) Do these steps to do an inspection for the fuel leaks from the electrical conduit:
(a) Fill the center tank with fuel.
(b) Fill the No. 2 tank to a minimum of half full.

NOTE: After you finish this inspection, but before you move the airplane, move fuel between the tanks until the airplane is correctly balanced.

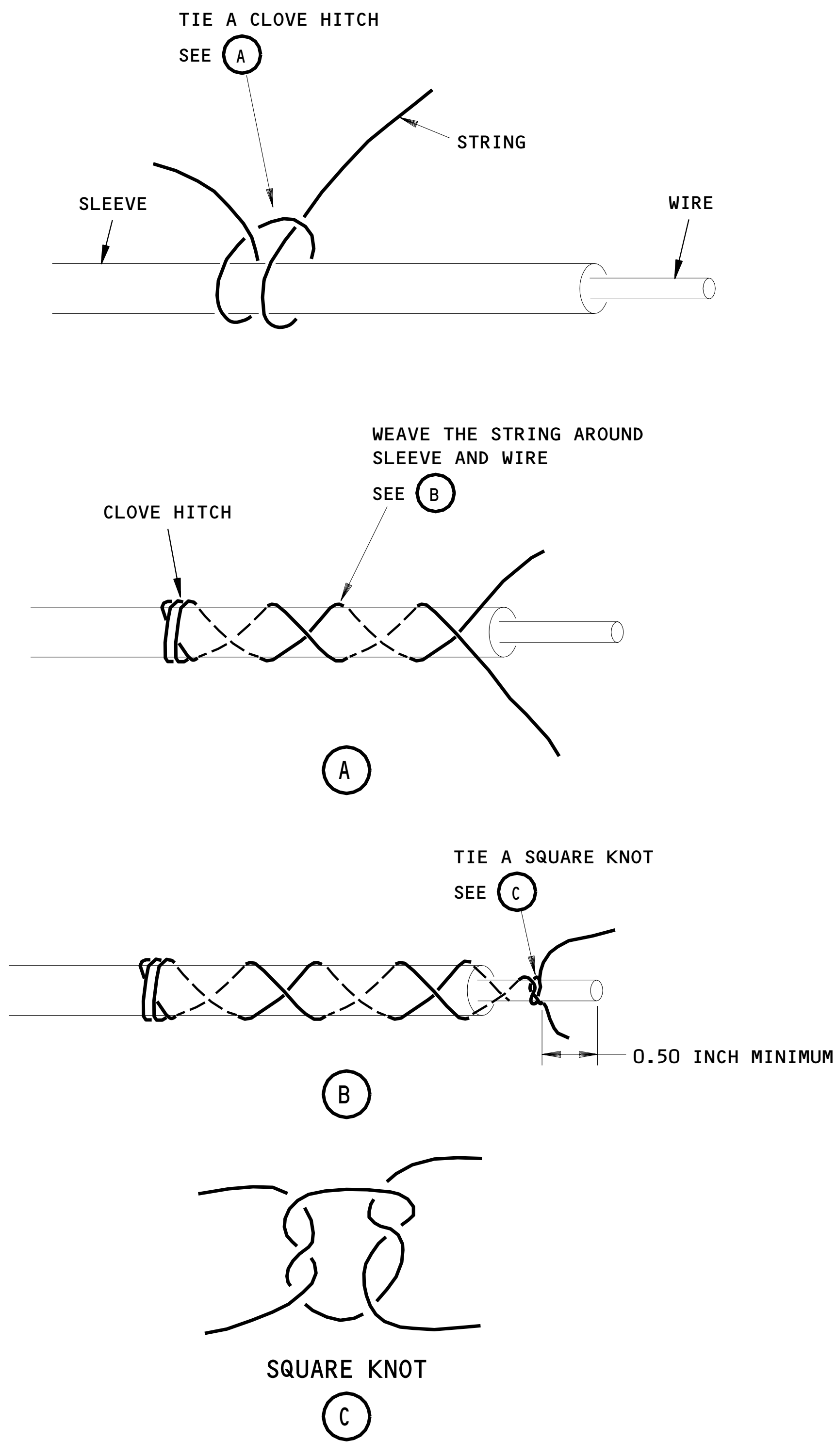
(c) Wait for 5 (five) minutes and then make sure there is no fuel leakage from the electrical conduit at the front spar.
(d) If you find leakage, then you must replace the section of the electrical conduit where the leak is before the next flight.

5. AIRPLANES POST-SB 28A1141 (TYPE II FLOAT SWITCH);
Center Tank Drain Port Inspection (Fig. 604)

A. General
(1) There are two types of float switches that can be installed. TheType I float switch installation has a red float shell. The Type II float switch has a green float shell. Service Bulletin (SB) 28A1141 replaces the Type I float switch installation with the Type II float switch installation. The conduit for the Type I float switch does not contain a liner. This task is applicable only for the Type II float switch conduit.



Fueling Float Switch and Conduit Inspection
Figure 602



Center Tank Float Switch (Type II) Drain Port
Figure 603

(2) This task does an inspection of the drain slots in the drain port. It also makes sure the conduit liner is installed and the conduit does not have leakage.

B. Procedure

(1) Do these steps to remove the drain port:
  (a) Remove the lockwire from the drain port.
  (b) Loosen the drain port from the conduit and slide it along the electrical cable away from the bulkhead union on the front spar.

(2) Do these steps to examine the six (6) drain slots of the drain port and clean then if it is necessary:
  (a) With a flashlight, make sure each of the six slots in the drain port are not blocked.
  (b) If any of the drain slots are blocked, clean them with compressed air.
    1) Apply compressed air from the side of the drain port that is towards the fuel tank when it is installed.
    2) Make sure the blockage is removed and the six slots are open to permit drainage of the conduit.

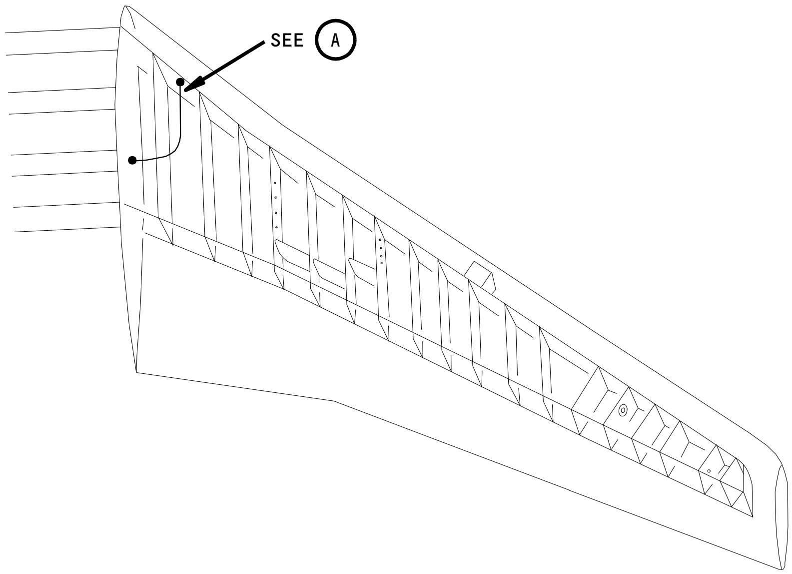
(3) Make sure there is no indication of fuel leakage from the conduit.

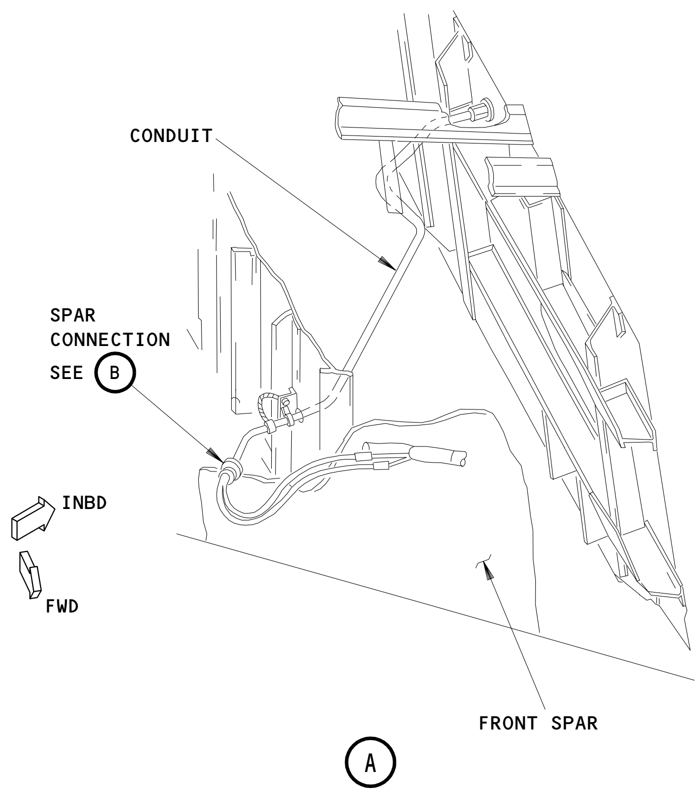
(4) Make sure a liner (clear, convoluted plastic tube) is installed in the conduit.

(5) Do these steps to re-install the drain port:
  (a) Slide the drain port assembly along the electrical cable to the bulkhead union on the front spar.
  (b) Install the drain port on the bulkhead union on the front spar.

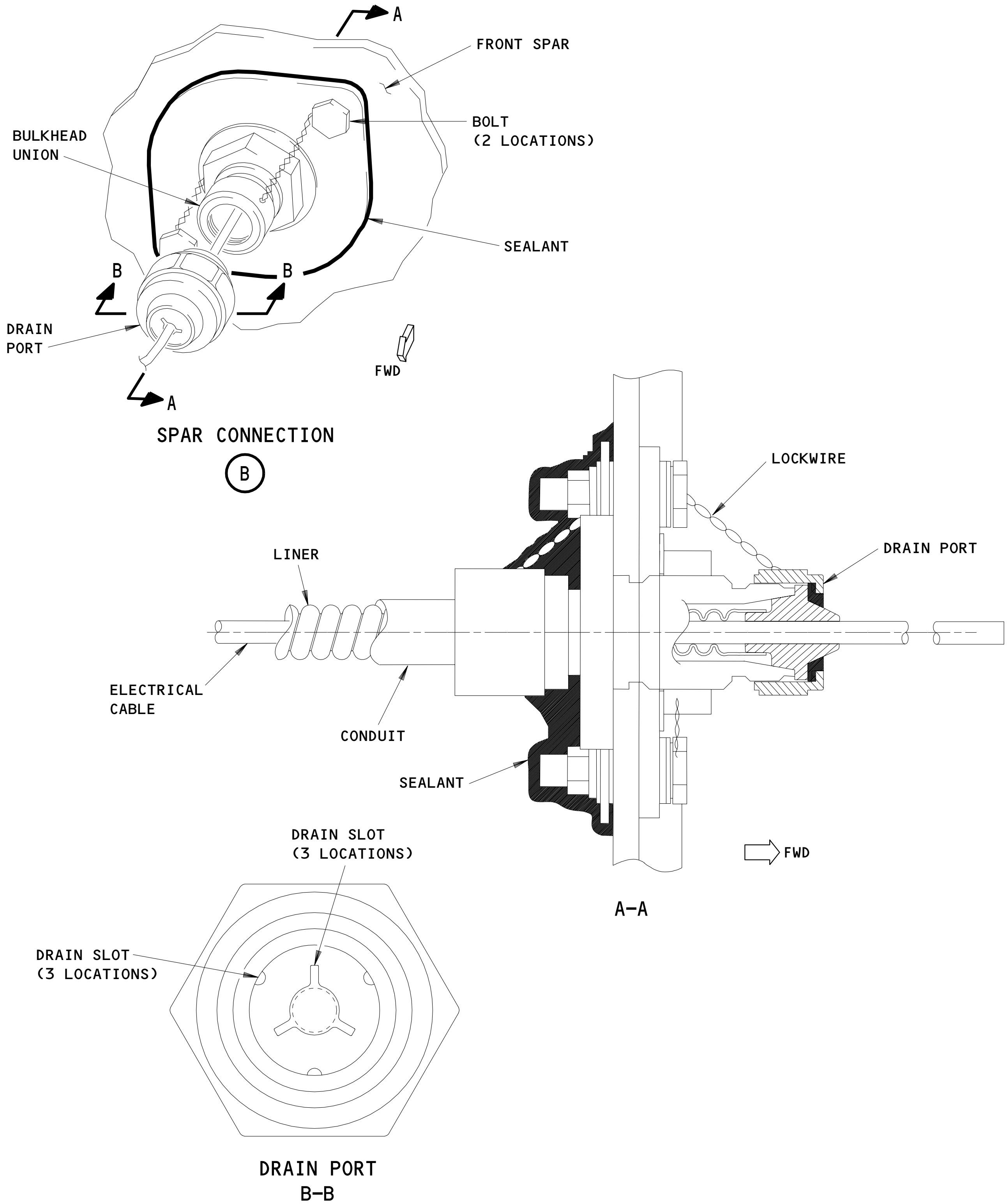
NOTE: Make sure the drain port shoulder is seated inside the formed liner.

  (c) Tighten the drain port to a torque of 9.0-11.0 inch-pounds (1.02-1.24 Nm).
  (d) Install lockwire from the coupling nut to the bolt (AMM 20-10-191/401).





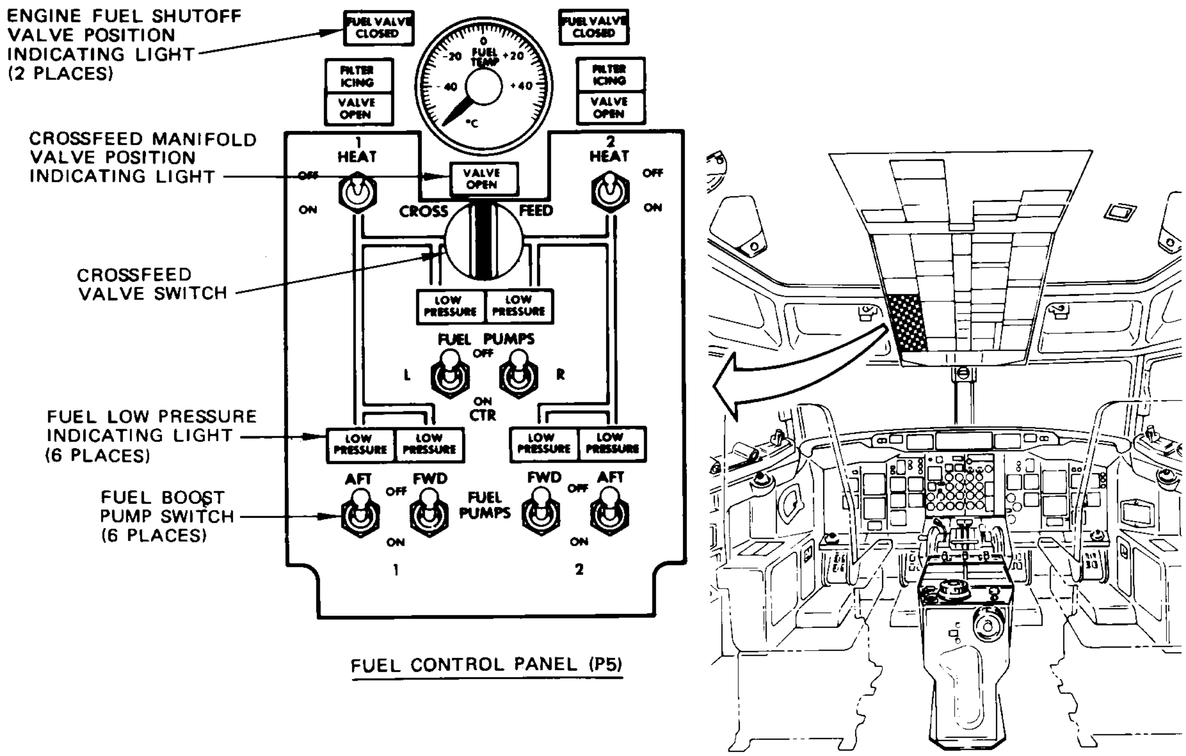
Center Tank Float Switch (Type II) Drain Port
Figure 604 (Sheet 1)

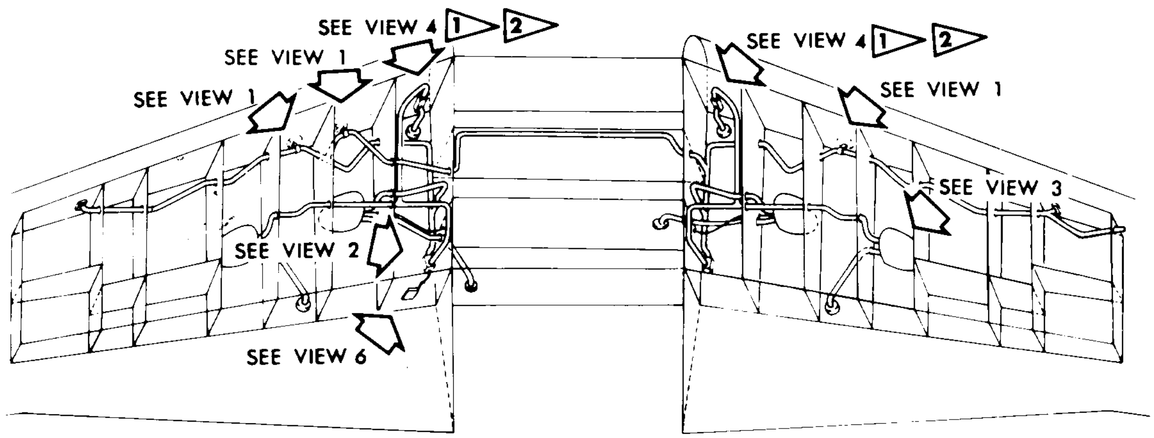


Center Tank Float Switch (Type II) Drain Port
Figure 604 (Sheet 2)

ENGINE FUEL FEED SYSTEM - DESCRIPTION AND OPERATION

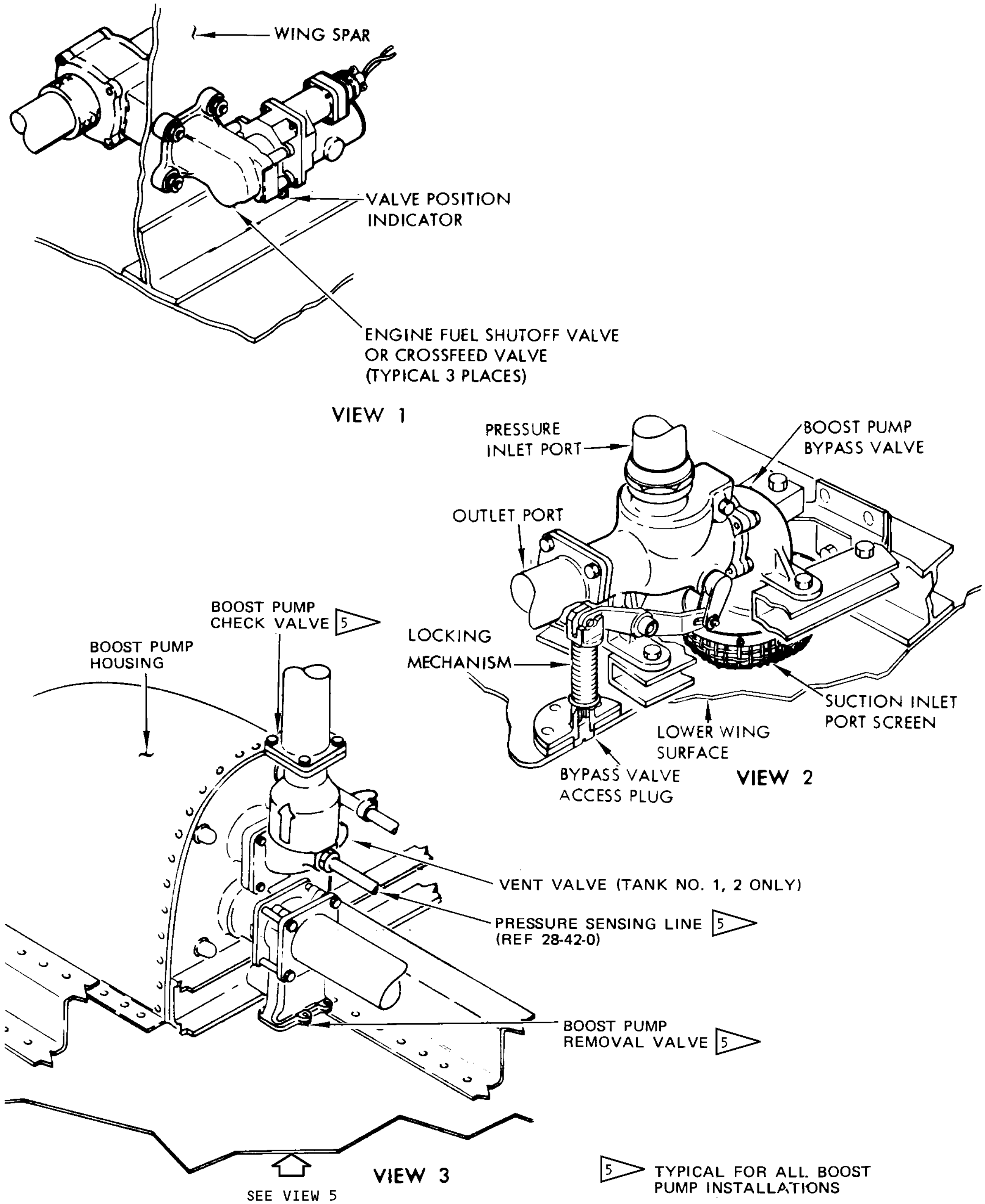
1. General
   A. The primary function of the fuel feed system is to pump fuel from the fuel tanks to the engines. A minor function is to pump or transmit fuel from tank No. 1 to the APU. The system can be used for transferring fuel from one tank to the other during ground operations only. It is also used for defueling the tanks for ground maintenance.
   B. The engine fuel feed system consists of two boost pumps for each tank, one check valve downstream of each boost pump, one boost pump removal valve for each boost pump, a boost pump bypass valve for each main tank, two engine fuel shutoff valves one in the line to each engine, and one fuel crossfeed valve. The boost pump removal valve permits removal of the boost pump without defueling the tank. The boost pump bypass valve allows an engine to continue operation by drawing fuel directly from a tank in the event both boost pumps are not operating. The engine fuel shutoff valves are energized through the fire switches and when closed will result in an engine shutdown. On some airplanes, the engine start levers can be used to open or close the shutoff valves in addition to the fire switches. The fuel crossfeed valve is used to connect the fuel feed system of one wing to the system in the other wing. The fuel crossfeed valve also permits fuel transfer, with airplane on the ground, from one wing tank to the other and permits defueling the entire fuel system through the pressure fueling nozzle.
   C. Controls and indicators for the engine fuel feed system are located on the forward overhead panel and consists of a boost pump switch for each boost pump; a low pressure light for each boost pump to indicate operating status of the boost pump; a position indicating light for each fuel shutoff valve; and a fuel crossfeed valve control switch and position indicating light (Fig. 1). The engine fuel shutoff valve is normally open and with the crossfeed valve closed and the boost pumps turned on, the low pressure lights will be off and fuel supplied to the engine fuel control unit.
   D. The portion of the fuel feed system used for the APU consists of a fuel shutoff valve and fuel feed lines, some of which are shrouded. The APU fuel shutoff valve prevents unwanted line drainback or pressurization of the APU system during APU shutdown. A check valve is installed in the inlet line, upstream of the shutoff valve, to prevent backflow if the tank No. 1 boost pumps are supplying the pressure to the APU feed line.



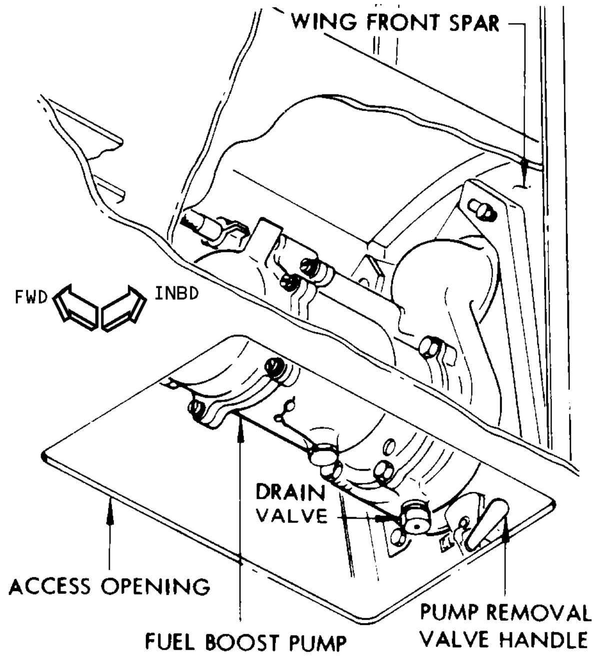


1	AR	LV-JMW THRU LV-JMZ, LV-JND, LV-JNE
	AQ	N21SW THRU N23SW
	FL	ALL EXCEPT N7340F THRU N7349F, N7382F, N7385F, N7391F THRU N7398F
	IC	VT-EAG THRU VT-EAM
	IN	EI-ASA THRU EI-ASH
	NZ	ZK-NAC THRU ZK-NAE ZK-NAJ THRU ZK-NAM
2	ALL EXCEPT 1	
	FL	N7340F THRU N7349F, N7382F, N7385F, N7391F THRU N7398F

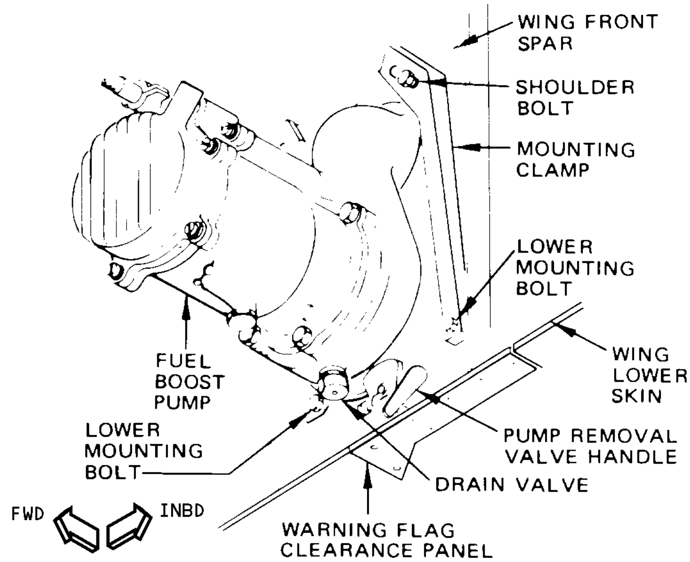
Engine Fuel Feed System Component Location
Figure 1 (Sheet 1)



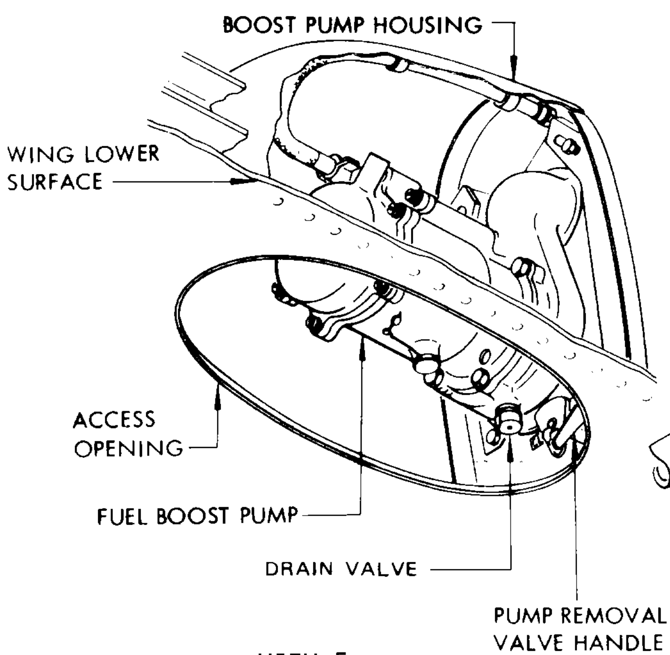
Engine Fuel Feed System Component Location
Figure 1 (Sheet 2)



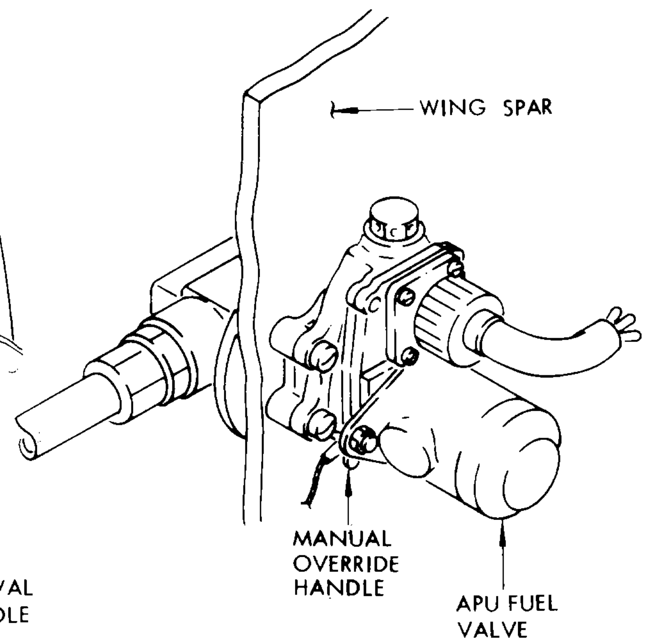
VIEW 4 1



VIEW 4 2



VIEW 5



VIEW 6

Engine Fuel Feed System Component Location
Figure 1 (Sheet 3)

2. Engine Fuel Shutoff Valve
   A. Two engine fuel shutoff valves mounted on the wing front spar provide the means of shutting off the fuel supply to the engines. The valve for engine No. 1 is in the left wing, and the valve for engine No. 2 is in the right wing. Each valve is an electric motor-driven slide shutoff valve with a manual override handle. The manual override handle provides a visual check of the valve position and a manual method of positioning the valve when the electric motor is not energized. To limit the pressure buildup in the fuel lines, the valve housing incorporates a thermal relief valve (Fig. 2).
   B. The valves are operated by 28-volt dc power and are controlled by the fire switches on the aft electronics panel. On some airplanes (Fig. 6) the valve is also controlled by a mechanically operated switch actuated by the engine start lever on the aisle stand. The valve is energized to close whenever the start lever is in cutoff position. Position lights on the overhead panel are illuminated any time the valve motor is energized.
3. Fuel Boost Pump
   A. The fuel boost pumps deliver fuel under pressure from a tank to its respective engine or through the crossfeed valve to the other engine. Each pump is a centrifugal type pump driven by an ac motor controlled by a separate switch on the overhead panel. Each pump is isolated from the fuel tank by being installed in a pump housing within a tank or on the forward side of the front spar.
   B. Fuel enters the pump through a wire mesh screen at the suction tube inlet then flows through a manually operated pump removal valve. The pump removal valve allows removal of a pump without draining the tank. A portion of the fuel being pumped is circulated through the pump to act as a lubricant for the bearings and a coolant for the motor. Fuel is discharged from the pump through the boost pump check valve. A small vent valve vents the pump casing to the fuel tank. Access to the vent valve is gained by defueling, purging and entering the applicable fuel tank.
4. Fuel Boost Pump Removal Valve
   A. The fuel boost pump removal valve permits removing the fuel boost pump without defueling the tank. The valves are manually operated slide shutoff valves and are located in the inlet line to each fuel boost pump. The valve control shaft passes through the wall of the boost pump housing so that the valve may be operated from the outside of the fuel tank.

5. Fuel Boost Pump Check Valve

A. The fuel boost pump check valve closes the boost pump outlet line when the pressure drops below a predetermined amount, thus preventing reverse fuel flow to the boost pump. Main tank boost pump check valves differ from center tank boost pump check valves as the cracking pressure for main tank boost pump check valves is approximately 12 psi and cracking pressure for center wing tank boost check valves is approximately 1.3 psi. The valve consists of a spring-loaded-closed flapper valve mounted in a housing. The housing has three ports: fuel in, fuel out and a pressure sensing port. The pressure sensing port is located upstream of the flapper valve and is connected to the boost pump low pressure switch. Refer to fuel feed low pressure indicating system, 28-42-0. The valves are located inside the fuel tank on the wall of the boost pump housing (Fig. 1). Access to the valves is gained by defueling, purging and entering the applicable fuel tank.

6. Boost Pump Bypass Valve

A. A boost pump bypass valve allows the engines to draw fuel from a tank by suction in case of complete boost pump failure in that tank (Fig. 1). The valve also allows defueling the tanks by suction through the manually-operated defueling valve. The valve consists of an L-shaped housing having a pressure inlet port, a suction inlet port, and an outlet port. Both inlet ports contain a normally closed flapper type check valve. A screen on the suction port prevents foreign material from entering the feed system lines. The valve in the suction port may be manually locked in the closed position, from outside the fuel tank, by a mechanism protruding through the wing lower surface (Fig. 3).

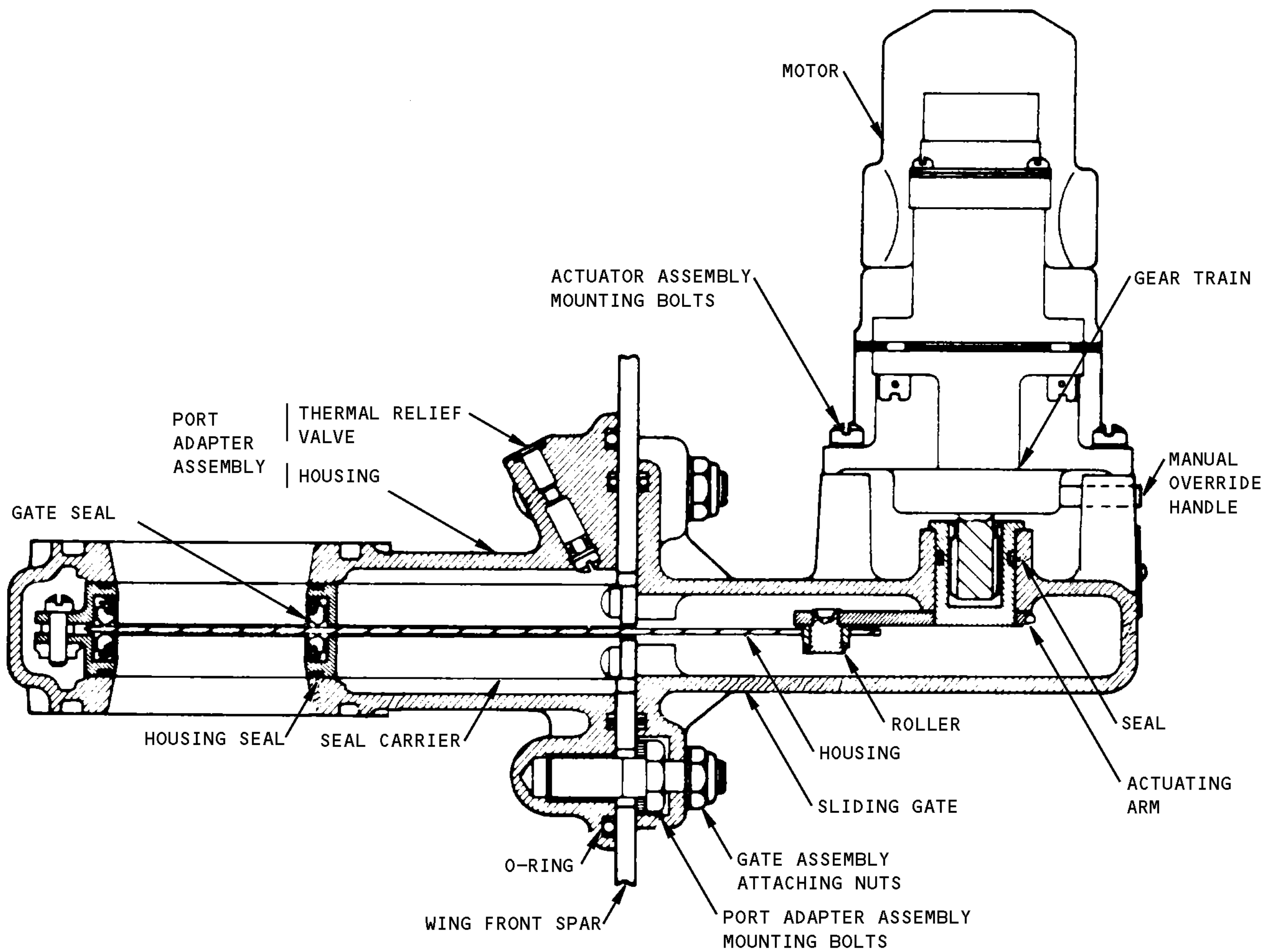
B. With boost pump pressure applied, the check valve in the pressure inlet port will be open and the check valve in the suction port will be closed, allowing the fuel to be pumped to the engine. With suction applied to the outlet port, the valve in the suction port will be open and the valve in the pressure inlet port will be closed, allowing the engine to draw fuel from the tank.

7. APU Fuel Shutoff Valve

A. The APU fuel shutoff valve is mounted on the left wing rear spar and controls delivery of fuel from tank No. 1 to the APU (Fig. 1). The valve is an electric motor-driven rotary gate valve with a manual override handle. The manual override handle provides a visual check of the valve position and a manual method of positioning the valve when the electric motor is not energized. To limit pressure buildup in the fuel lines, the valve housing incorporates a thermal relief valve. The valve is operated by 28-volt dc power and is controlled by the APU master switch.

8. Fuel Lines and Couplings

A. The lines transferring fuel from the tanks to the engine are fabricated from seamless aluminum alloy tubing, and are connected to the various fuel system components by standard unions, couplings or flanges. The lines in the wings are mainly located inside the fuel tank boundaries.



Engine Fuel Shutoff Valve
Figure 2

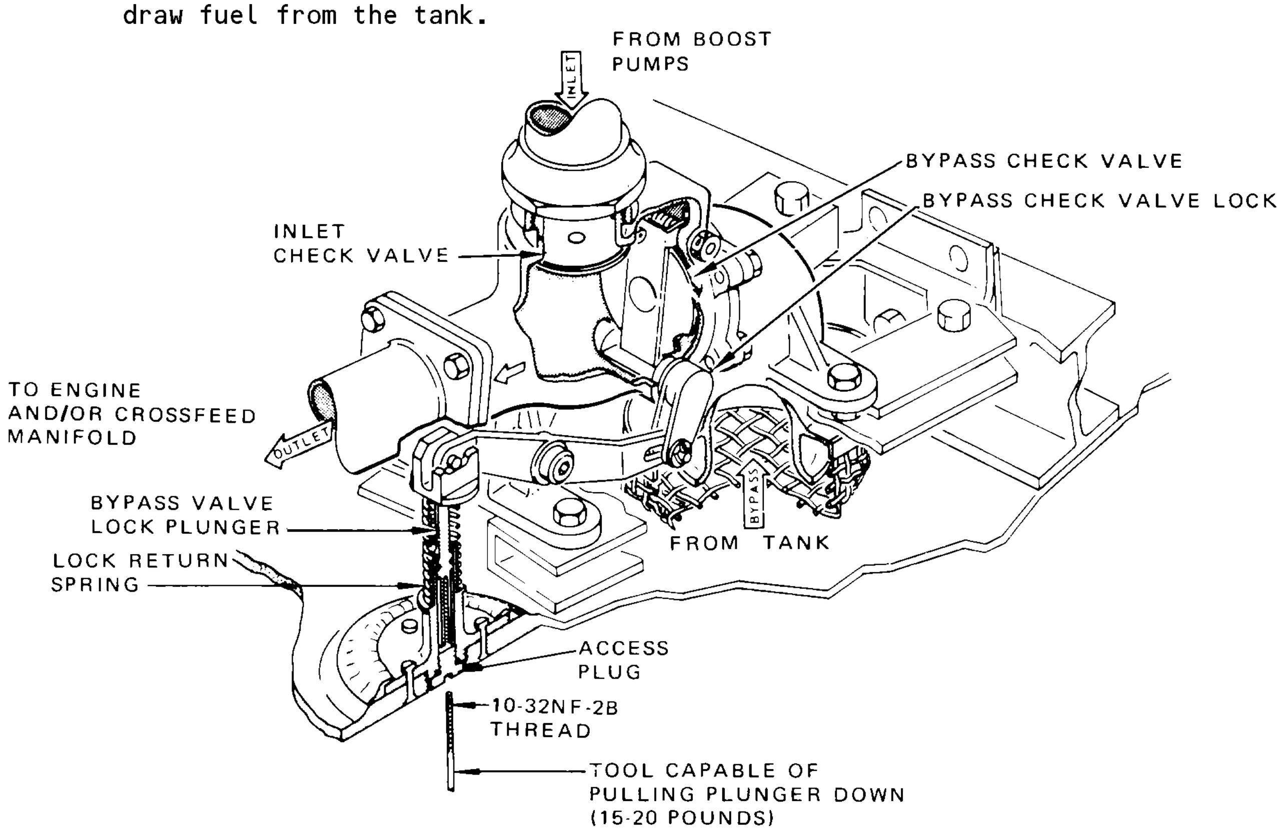
6. Fuel Crossfeed Valve

   A. A fuel crossfeed valve provides the means of directing fuel to both engines. The valve is mounted on the wing front spar in the left wing. This valve is the same design as the engine fuel shutoff valve. (See paragraph 2 and figure 2.)

7. Boost Pump Bypass Valve

   A. A boost pump bypass valve allows the engines to draw fuel from a tank by suction in case of complete boost pump failure in that tank. (See figure 1.) The valve also allows defueling the tanks by suction through the manually-operated defueling valve. The valve consists of an L-shaped housing having a pressure inlet port, a suction inlet port, and an outlet port. Both inlet ports contain a normally closed flapper type check valve. A screen on the suction port prevents foreign matierial from entering the feed system lines. The valve in the suction port may be manually locked in the closed position, from outside the fuel tank, by a mechanism that protrudes through the wing lower surfaces. (See figure 3.)

   B. With boost pump pressure applied, the check valve in the pressure inlet port will be open and the check valve in the suction port will be closed, allowing the fuel to be pumped to the engine. With suction applied to the outlet port, the valve in the suction port will be open and the valve in the pressure inlet port will be closed, allowing the engine to draw fuel from the tank.



Boost Pump Bypass Valve
Figure 3

B. The APU fuel line from the point line leaves wing center cell to the bulkhead connection on the APU shroud is mainly a flexible hose enclosed in a metal fuel line shroud. The fuel line continues from the APU shroud to the APU fuel control but is not separately shrouded for this distance.

9. Operation

A. The engine fuel shutoff and fuel crossfeed manifold valves are operated by 28-volt dc motors receiving their power from circuit breakers on circuit breaker panel P6. The fuel boost pumps are driven by 115-volt three-phase electric motors obtaining their ac power from circuit breakers on circuit breaker panel P6 (Fig. 4). Pumps in the same tank do not receive their power from the same bus. The pump power sources have been arranged so loss of power to one bus will only affect one pump for each tank.

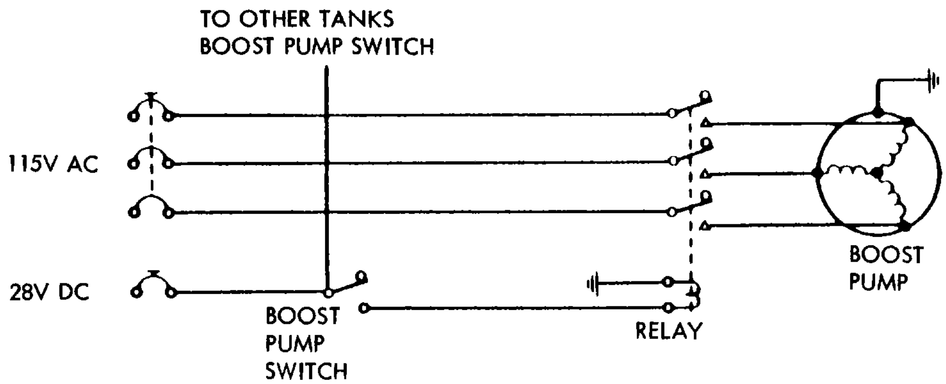
B. The engine fuel feed system will supply fuel to the engines by a direct tank-to-engine feed or from any tank to either or both engines through the crossfeed valve. To obtain direct tank-to-engine feed, the fuel crossfeed valve is closed, the engine fuel shutoff valves are opened and the boost pumps are started. To obtain a crossfeed, the fuel crossfeed valve and the engine fuel shutoff valves are opened (Fig. 5).

C. The center tank boost pumps override main tank boost pumps since pressure from main tank boost pumps has to overcome a boost pump check valve cracking pressure of 12 psi, while center tank boost pumps have only a 1.3-psi check valve cracking pressure to overcome.

D. In case of an engine fire, control of the engine fuel shutoff valves is assumed by the fire switches on the aft electronics panel. When the fire switches are placed in the FIRE position, the respective engine fuel shutoff valve is closed (Fig. 6). On some airplanes placing the engine start lever to cutoff position will also close the respective engine fuel shutoff valve.

E. When the crossfeed valve is in the closed position, the crossfeed valve position indicating light is not illuminated (Fig. 7). When the engine fuel shutoff valves are in the open position, the engine fuel shutoff position indicating lights are not illuminated. When the crossfeed manifold valve or the engine fuel shutoff valves are traveling from open to close or from close to open, the applicable position indicating lights on the overhead panel are brightly illuminated. When the crossfeed valve is in the full open position, the applicable position indicating light is dimly illuminated. When the engine fuel shutoff valves are in the closed position, the applicable position indicating lights are dimly illuminated. The crossfeed or engine fuel shutoff valve indicating light will remain brightly illuminated if valve fails to reach position corresponding to panel switch position.

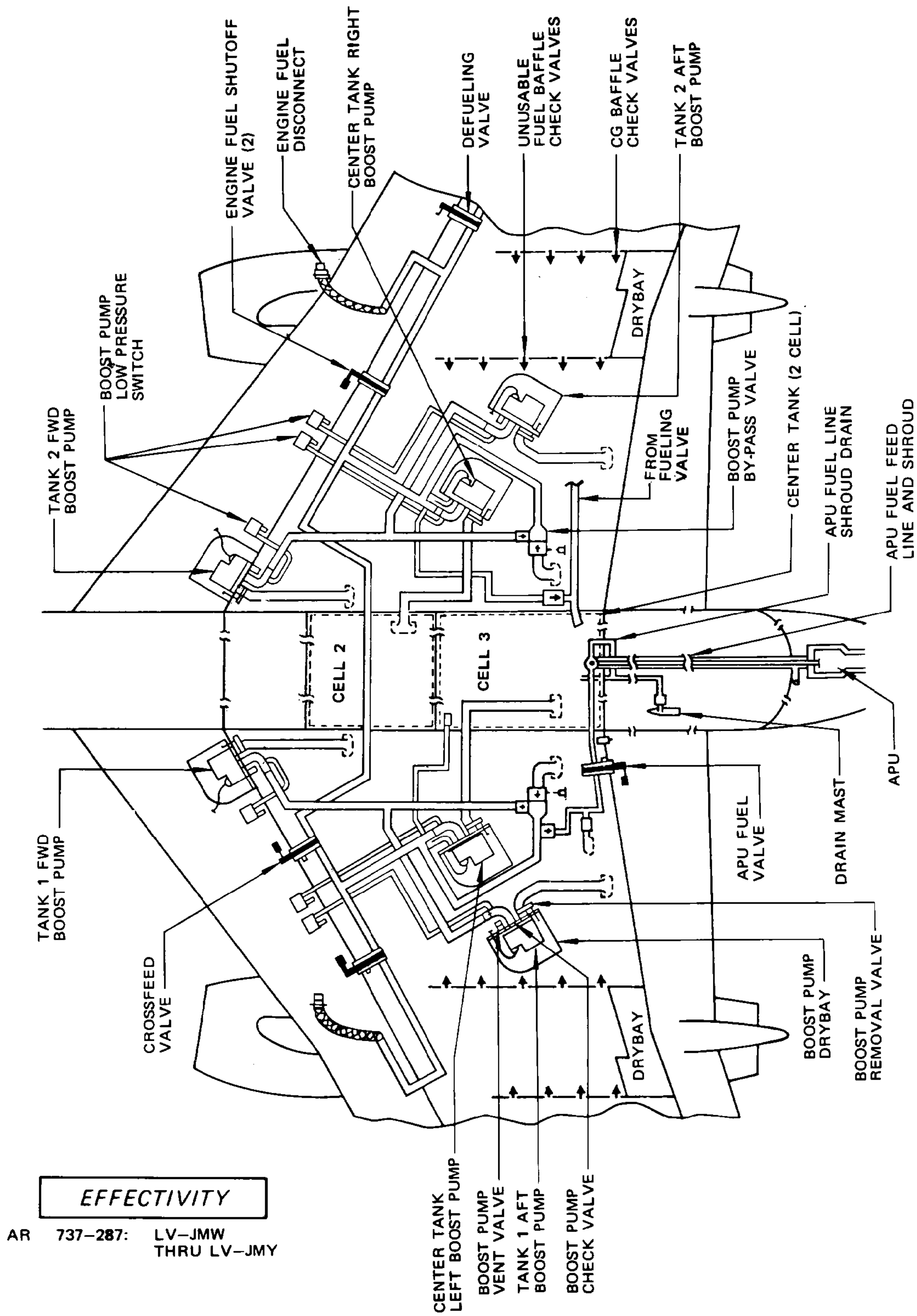
F. The APU fuel shutoff valve is controlled by the APU master switch. The APU fuel valve is closed when the fire switches are energized.



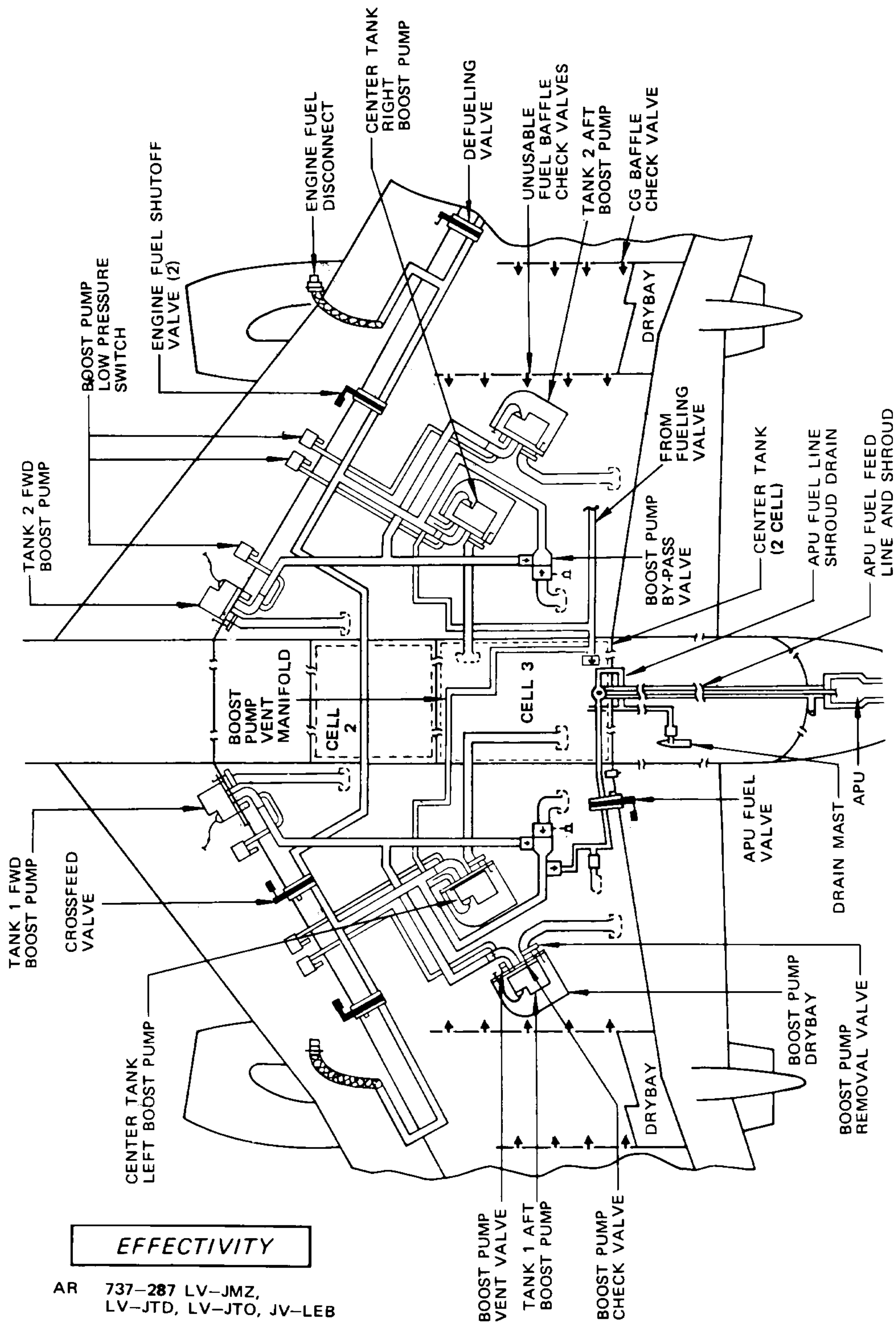
TYPICAL CIRCUIT FOR ONE BOOST PUMP IN A GIVEN TANK. OTHER BOOST PUMP CIRCUIT SAME BUT WITH SEPARATE SOURCE OF POWER AS SHOWN IN TABLE BELOW

	BOOST PUMP POWER SOURCE					
FUEL TANK	28V DC BUS NO.		115V AC BUS NO.			
	1	2	TRANSFER BUS NO. 1	1	2	TRANSFER BUS NO. 2
1	AFT PUMP	FWD PUMP	AFT PUMP	FWD PUMP		
2	FWD PUMP	AFT PUMP			FWD PUMP	AFT PUMP
CENTER	LEFT PUMP	RIGHT PUMP		RIGHT PUMP	LEFT PUMP	

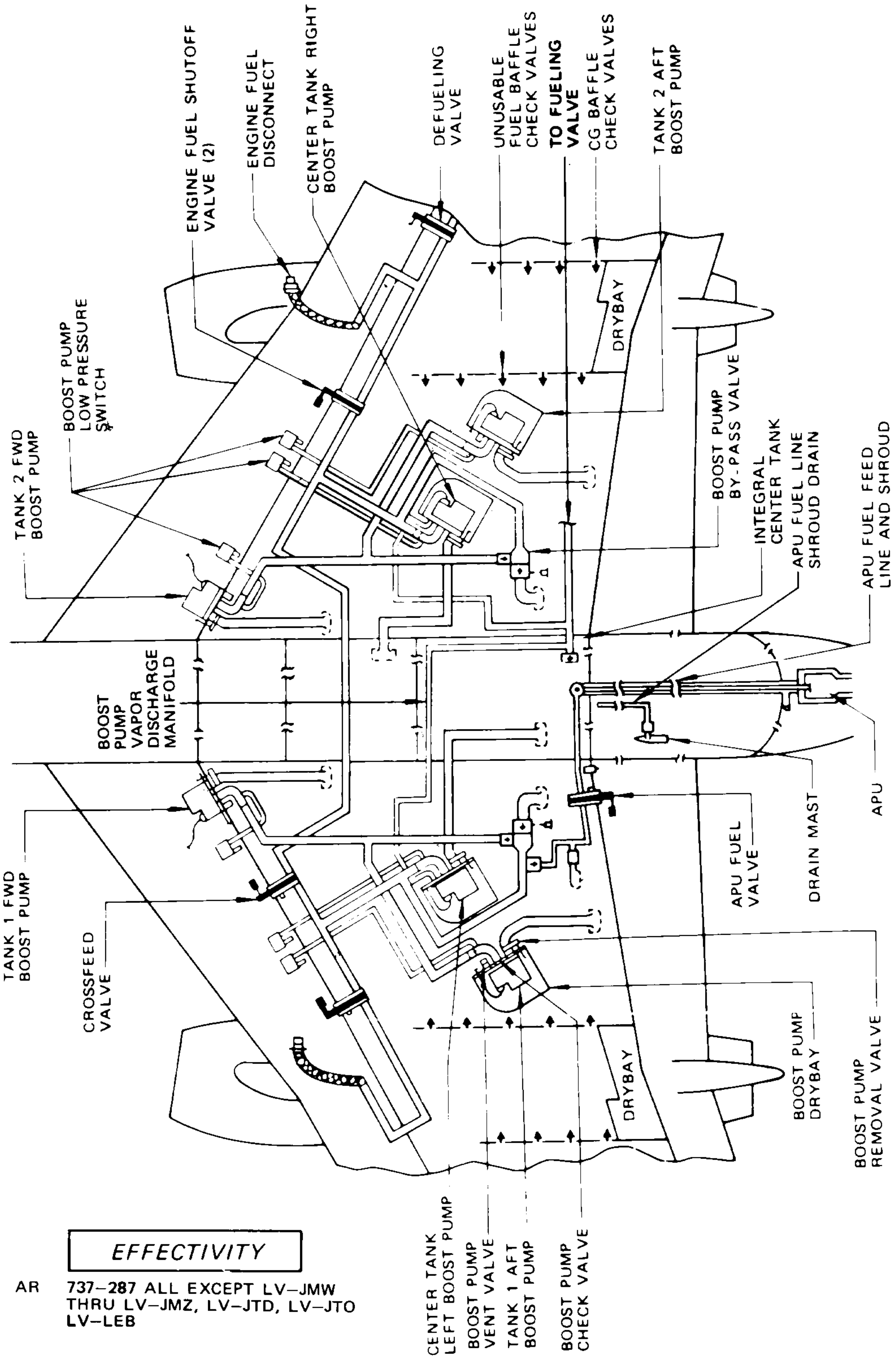
Boost Pump Circuit
Figure 4



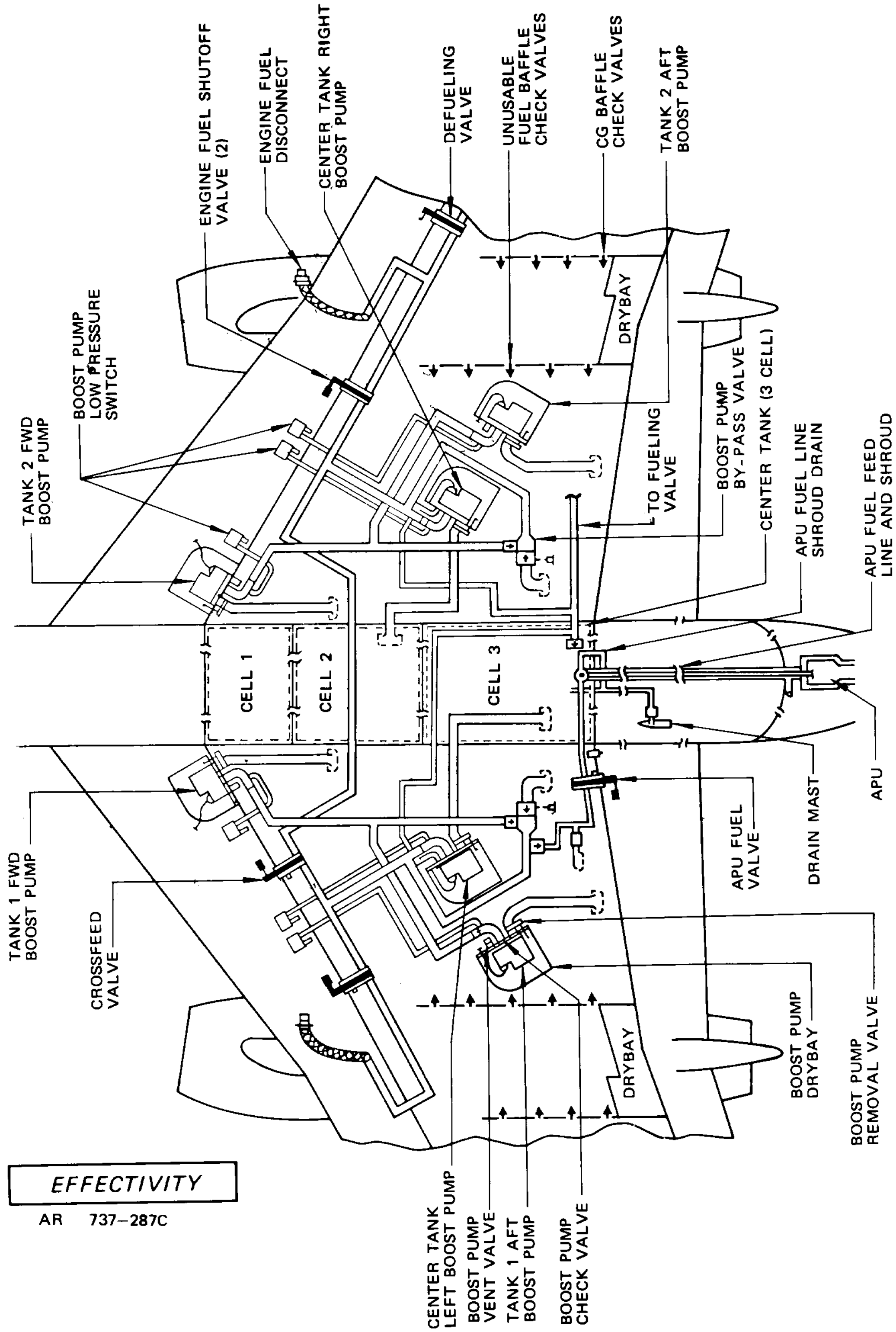
Engine Fuel Feed System Flow Diagram
Figure 5 (Sheet 1)



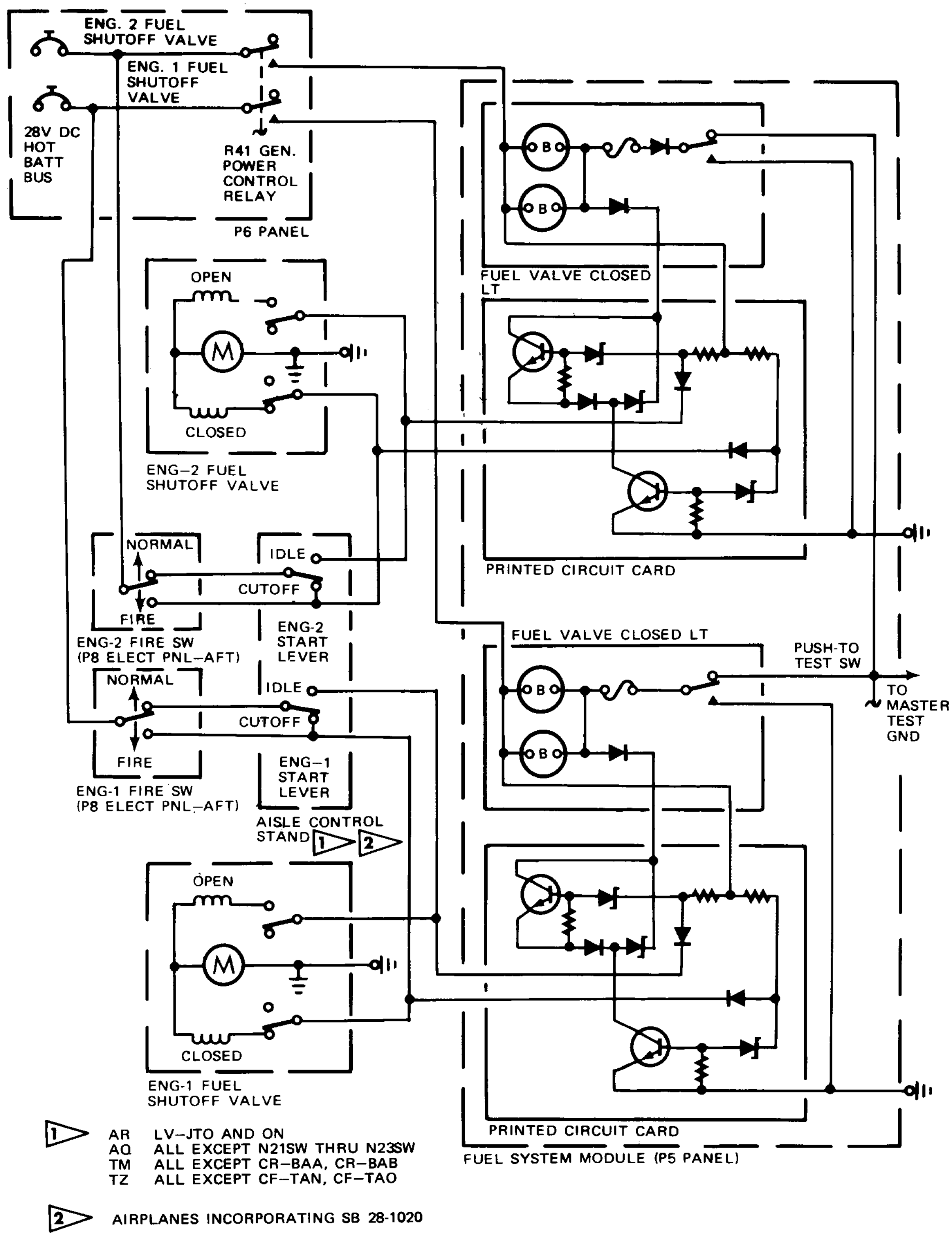
Engine Fuel Feed System Flow Diagram
Figure 5 (Sheet 2)



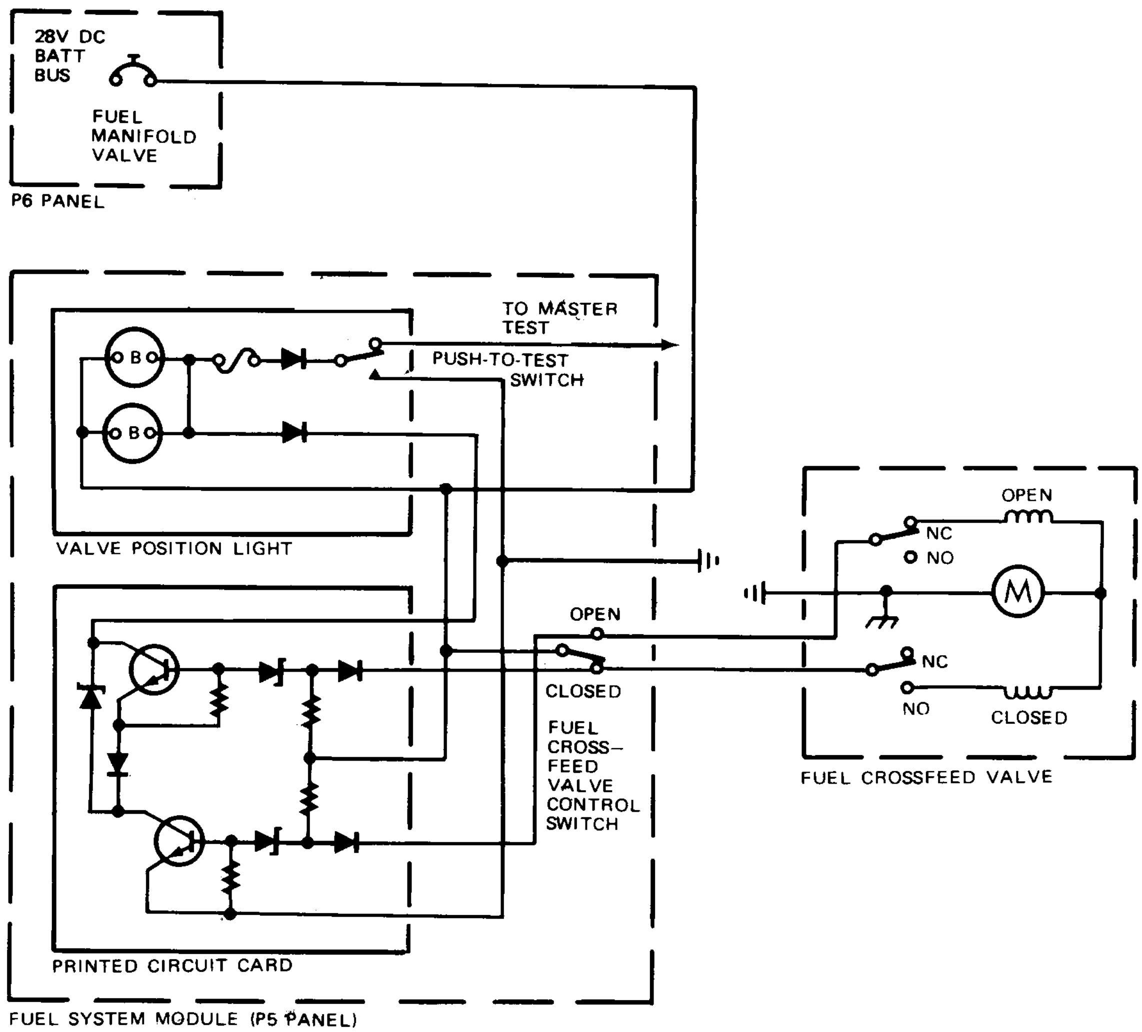
Engine Fuel Feed System Flow Diagram
Figure 5 (Sheet 3)



Engine Fuel Feed System Flow Diagram
Figure 5 (Sheet 4)



Engine Fuel Shutoff Valve Circuit
Figure 6



Fuel Crossfeed Valve Circuit
Figure 7

ENGINE FUEL FEED SYSTEM - TROUBLESHOOTING

1. General
   A. The following troubleshooting procedures are based on performance of system functional checks and are presented in tree-type format. The functional steps (heavy-line boxes) are connected by shaded arrows to show OK condition path through successful performance responses. When all steps in condition path indicate an OK response, fuel feed system is operable.
   B. When a functional check step does not indicate an OK response, follow the NOT OK line to the thin-line box containing applicable trouble symptom. Turn to procedure indicated and follow a single line from box to box by analyzing results of each step until required corrective action is determined. Perform specified corrective action and repeat step at which failure was encountered.
   C. All electrical type troubleshooting procedures are based on assumption that wiring is OK and that electrical power is available. If corrective action in troubleshooting procedure fails to correct problem, check wiring continuity per applicable diagram in Wiring Diagram Manual (WDM).
   D. Malfunctions of engine fuel shutoff valves or crossfeed manifold valve can be due to either mechanical or electrical trouble within valve. If valve fails to fully open or close, try completing valve opening or closing by using manual override handle. If normal pressure on handle is all that is necessary to complete valve travel, trouble is probably electrical and can be checked by substituting a known operable motor/actuator assembly on the valve (AMM 28-22-11/401). If a definite bind or jam is felt when attempting valve actuation with manual override, trouble is mechanical but still might be located within motor/actuator assembly. This should be checked out by unbolting motor/actuator assembly and trying override handle movement on the bench. If movement is normal, the mechanical trouble must be within gate assembly or port adapter, the latter of which can only be replaced by complete defueling of tank.
   E. References in troubleshooting boxes, refer to applicable chapter - section - subject of the 737 maintenance manual unless reference includes the abbreviation "WDM" in which case the 737 wiring diagram manual should be consulted.
2. Prepare for Troubleshooting
   A. Equipment
      (1) Electric test set - ohmmeter/voltmeter, 28 V-DC/115 V-AC

B. Procedure

(1) Make sure each fuel tank contains a minimum of 700 pounds (350 kilograms) of fuel.

(2) Connect external electric power to the airplane (AMM 24-22-0/201).

(3) Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

WARNING: MAKE SURE PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS BEFORE YOU EXTEND OF RETRACT THE FLAPS. THE FLAPS CAN MOVE QUICKLY WITH THE HYDRAULIC POWER REMOVED. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

WARNING: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO INSTALL THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT INSTALL THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(4) Make sure the manual defueling valve is closed.

(5) Make sure the APU master switch, on the forward overhead panel P5, is in the OFF position.

(6) Make sure all fuel boost pump switches, on the forward overhead panel P5, are in OFF position.

(7) Make sure the crossfeed valve switch, on the P5 panel, is in the CLOSED position.

(8) AIRPLANES WITH ENGINE START LEVER CONTROL OF THE ENGINE FUEL SHUTOFF VALVES (PRR32056 OR POST-SB 28-1020);
Make sure the engine fire switches on the aft electronic panel (P8) are in the NORMAL (non-fire) position (switches full-in).

(9) AIRPLANES WITHOUT ENGINE START LEVER CONTROL OF THE ENGINE FUEL SHUTOFF VAVLES (PRE-SB 28-1020);
Put the engine fire switches on the aft electronic panel (P8) in the FIRE position (pulled out).

(10) Install collars and DO-NOT-CLOSE tags on all open fuel boost pump circuit breakers:

WARNING: IF ONE OF THE 115 VAC BOOST PUMP CIRCUIT BREAKERS IS OPEN, DO THE STEPS IN FIGURE 101 TO FIND THE PROBLEM. DO NOT CLOSE THE CIRCUIT BREAKER WITHOUT DOING THESE STEPS. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCL's).

(11) Make sure these circuit breakers on the P6 panel are closed, unless they have collars:
(a) SHUTOFF VALVE ENG 1
(b) SHUTOFF VALVE ENG 2
(c) FWD BOOST PUMP TANK 1
(d) FWD BOOST PUMP TANK 2
(e) AFT BOOST PUMP TANK 1
(f) AFT BOOST PUMP TANK 2
(g) BOOST PUMP CTR TANK LEFT
(h) BOOST PUMP CTR TANK RIGHT
(i) MANIF VALVE (crossfeed valve)
(j) PANEL & INSTRUMENT 28 V
(k) MASTER CAUTION ANNUNCIATOR (NO. 1 and BAT)
(l) DIM & TEST

(12) AIRPLANES WITH ENGINE START LEVER CONTROL OF THE ENGINE FUEL SHUTOFF VALVES (PRR32056 OR POST-SB 28-1020);
Make sure the engine start levers on the aisle stand are in the CUT-OFF position.

(13) To do a check of all the fuel feed system indicator lights, operate the master dim and test circuits and actuate the press-to-test indicator lights.

3. Troubleshoot the Fuel Feed System

WARNING: DO NOT CLOSE A CIRCUIT BREAKER FOR A FUEL PUMP THAT OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

Do a check of the 115V AC circuit breakers for the boost pumps. Make sure the circuit breakers are closed. IF -

NOT OK — BOOST PUMP 115V AC CIRCUIT BREAKER IS OPEN [1] - Install a collar and a DO-NOT-CLOSE tag on the circuit breaker (Fig. 107, 107A).

OK

Prepare system for trouble shooting per applicable step in general section. Check that both engine fuel shutoff valves are fully closed and that respective indicator lights are illuminated dim. IF -

NOT OK — INDICATOR LIGHT IS ILLUMINATED BRIGHT - Disconnect electrical plug at front spar-mounted engine fuel shutoff valve and check for electrical continuity between pin sockets B and D on valve. IF -

OK - Replace engine fuel shutoff valve (AMM 28-22-11/401).

NOT OK - Replace P5-2 fuel system module (WDM 28-21-01).

NOT OK — INDICATOR LIGHT IS OFF - Replace fuse in fuel valve indicator light assembly and check light for dim illumination. IF -

NOT OK - Replace diode in indicator light assembly or replace entire light assembly.

OK

(CONTINUED NEXT PAGE)

[1] CDCCL - REFER TO THE TASK: AIRWORTHINESS LIMITATION PRECAUTIONS (AMM 28-00-00/201) FOR IMPORTANT INFORMATION ON CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL'S).

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 1)

OK

ON AIRPLANES WITH ENGINE START LEVER CONTROL OF ENGINE FUEL SHUTOFF VALVES; With engine ignition circuit breakers in OPEN position, place engine start levers in IDLE position. Check that respective valve position indicating light illuminates bright while valve is in transit and extinguishes after reaching full open. IF -

ON AIRPLANES WITHOUT ENGINE START LEVER CONTROL OF ENGINE FUEL SHUTOFF VALVES; Place engine fire switches in NORMAL (non-fire) position. Check that respective valve position indicating light illuminates bright while valve is in transit and extinguishes after reaching full open. IF -

NOT OK — ENGINE FUEL SHUTOFF VALVE DOES NOT OPERATE - (Fig. 102).

NOT OK — VALVE POSITION INDICATING LIGHT DOES NOT ILLUMINATE BRIGHT IN TRANSIT - Replace fuel system module P5 (WDM 28-21-01).

NOT OK — VALVE POSITION INDICATING LIGHT DOES NOT EXTINGUISH WHEN VALVE OPENING MOTION STOPS - Check engine fuel shutoff valve for full open position. IF -

- OK - Replace fuel system module P5 (WDM 28-21-00).
- NOT OK - Trouble shoot valve per applicable step in general section and replace faulty assembly (AMM 28-22-11/401).

OK

(CONTINUED NEXT PAGE)

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 2)

OK

Pull engine fire switches to FIRE position. Check that engine fuel shutoff valves immediately close and that indicator lights illuminate bright with valves in transit and turn dim with valves in closed position. IF -

NOT OK — ENGINE FUEL SHUTOFF VALVE DOES NOT OPERATE - (Fig. 103)

NOT OK — VALVE POSITION INDICATING LIGHT DOES NOT ILLUMINATE BRIGHT IN TRANSIT - Replace fuel system module P5 (WDM 28-21-01).

NOT OK — VALVE POSITION INDICATING LIGHT ILLUMINATION DOES NOT CHANGE FROM BRIGHT TO DIM WHEN VALVE CLOSING MOTION STOPS - Check engine fuel shutoff valve for full closed position. IF -

OK - Replace fuel system module P5 (WDM 28-21-01).

NOT OK - Trouble shoot valve per applicable step in general section and replace faulty assembly (AMM 28-22-11/401).

OK

(CONTINUED NEXT PAGE)

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 3)

OK

ON AIRPLANES WITH ENGINE START LEVER CONTROL OF ENGINE FUEL SHUTOFF VALVES; return engine start levers to CUTOFF and, on all airplanes, push engine fire switches back to NORMAL. Place crossfeed manifold valve switch on P5 overhead panel in OPEN position. Check that crossfeed valve indicator light is illuminated bright while in transit and changes to dim when valve reaches full open. IF -

NOT OK — CROSSFEED MANIFOLD VALVE DOES NOT OPERATE - Check for 28V DC at pin A of crossfeed valve electrical connector. IF -

- OK - Trouble shoot crossfeed valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-21/401).
- NOT OK - Check for 28V DC at pin 20 of P5 fuel system module connector. IF -
  - OK - Replace crossfeed manifold valve switch on P5 overhead panel.
  - NOT OK - Check MANIF circuit breaker and electrical connector between P5 and P6 (right) panels. Repair or replace as necessary (WDM 28-22-01).

NOT OK — VALVE POSITION INDICATING LIGHT DOES NOT ILLUMINATE BRIGHT IN TRANSIT - Replace fuel system P5 module (WDM 28-21-01).

NOT OK — VALVE POSITION INDICATING LIGHT ILLUMINATION DOES NOT CHANGE FROM BRIGHT TO DIM WHEN VALVE OPENING MOTION STOPS - Check crossfeed valve for full open position. IF -

OK

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 4)

OK - Replace fuel system module P5 (WDM 28-22-01).

NOT OK - Trouble shoot crossfeed valve per par. 1.D. and replace faulty valve assembly (AMM 28-22-21/401).

OK

Place crossfeed manifold valve switch in CLOSED position. Check that crossfeed valve indicator light illumination changes from dim to bright and then is extinguished as valve moves from full open to full closed. IF -

NOT OK — CROSSFEED MANIFOLD VALVE DOES NOT OPERATE - Check for 28-V DC at pin B of crossfeed valve electrical connector. IF -

OK - Trouble shoot crossfeed valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-21/401).

NOT OK - Replace crossfeed manifold valve switch on P5 overhead panel.

NOT OK — VALVE POSITION INDICATING LIGHT DOES NOT ILLUMINATE BRIGHT IN TRANSIT - Replace fuel system P5 module (WDM 28-21-01).

NOT OK — VALVE POSITION INDICATING LIGHT BRIGHT ILLUMINATION IS NOT EXTINGUISHED WHEN VALVE CLOSING MOTION STOPS - Check crossfeed valve for full closed position. IF -

OK

(Continue next page)

Continued next page

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 5)

OK - Replace fuel system module P5 (WDM 28-22-01).

NOT OK - Trouble shoot crossfeed valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-21/401).

OK

Turn on engine boost pumps, one at a time 2 . Check that as each boost pump comes up to pressure, corresponding low pressure warning light extinguishes. IF -

NOT OK — BOOST PUMP DOES NOT OPERATE (As confirmed by sound and feel at respective pump dry bay or forward spar location) - (Fig. 104)

NOT OK — LOW PRESSURE WARNING LIGHT DOES NOT EXTINGUISH - (Fig. 105)

OK

Turn off engine boost pumps for each fuel tank, one pump at a time 3 . Check that, as second boost pump for a given tank is turned off, MASTER CAUTION and FUEL annunciator lights illuminate. IF -

NOT OK — MASTER CAUTION AND FUEL ANNUNCIATOR LIGHTS DO NOT ILLUMINATE WHEN SECOND BOOST PUMP IN TANK IS TURNED OFF - (Fig. 106)

OK

(CONTINUED NEXT PAGE)

2 To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank. Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

3 Use PUMP CONT switches for tank No. 1 and 2 boost pumps. Use CENTER TANK BOOST PUMP LEFT and CENTER TANK BOOST PUMP RIGHT circuit breakers for center fuel tank.

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 6)

OK

Top-off each fuel tank with fuel until automatic shutoff occurs. With crossfeed manifold valve CLOSED, start each engine and run at ground idle for 10 minutes. Shut engines off and measure amount of fuel necessary to refill each tank to automatic fuel shutoff. Check that center tank boost pump override prevented fuel from being consumed from tank No. 1 or 2. IF -

NOT OK

FUEL CONSUMED FROM TANK NO. 1 OR 2 - Check that boost pump, adjacent to main fuel tank where fuel consumption occured, is properly primed (AMM 28-22-41/401). IF -

OK - Probable stuck or high restriction check valve for center tank boost pump adjacent to wing tank where fuel was consumed. Replace center tank boost pump check valve (AMM 28-22-71/401).

NOT OK _ Reprime boost pump per AMM 28-22-41/401.

OK

Fuel feed system operable.

Engine Fuel Feed System - Troubleshooting
Figure 101 (Sheet 7)

ENGINE FUEL SHUTOFF VALVE DOES NOT OPERATE - Check for 28V DC electric power at pin A of shutoff valve electrical connector. IF -

OK - Trouble shoot shutoff valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-11/401).

NOT OK - Check for 28V DC at C terminal of aisle stand start lever switch. IF -

OK - Check for 28V DC at NC terminal of start lever switch. IF -

NOT OK - Check for 28V DC at pin 22 of engine fire switch on P8 aft electronic panel. IF -

OK - Check electrical continuity through pin 19 at P5 overhead panel electrical connector and repair as necessary.

NOT OK - Check calibration of start lever switch actuation vs engine start lever travel (AMM 28-22-111/501, or AMM 28-22-112/501). IF -

OK - Replace start lever switch (AMM 28-22-111/401) and recheck engine fuel shutoff valve operation.

NOT OK - Adjust switch actuation in relation to start lever travel (AMM 28-22-111/501, or AMM 28-22-112/501) and recheck engine fuel shutoff valve operation.

OK - Push in firmly on fire switch knob to ensure fire switch is in NORMAL position. Check fire switch pin 23 for 28V DC. IF -

NOT OK - Check electrical continuity thru pin 2 or 11 at Sta 270 electrical connector and repair as necessary.

OK - Cycle fire switch from NORMAL to FIRE to NORMAL several times and recheck for 28V DC at pin 23. If electrical continuity is not always positive between pins 22 and 23, replace switch (Ref Chapter 26).

NOT OK - Replace engine fire switch (Ref Chapter 26).

Engine Fuel Shutoff Valve Does Not Operate
Figure 102 (Sheet 1)

ENGINE FUEL SHUTOFF VALVE DOES NOT OPERATE - Check for 28V DC electric power at pin A of shutoff valve electrical connector. IF -

OK - Trouble shoot shutoff valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-11/401).

NOT OK - Check for 28V DC at pin 23 of fire switch. IF -

OK - Check electrical continuity thru pin 18 or 19 at Sta 27 or electrical connector, SM43 or SM44 splice in P5 overhead panel, and thru pin 10 at Sta 270L electrical connector and repair as necessary.

NOT OK - Check for 28V DC at pin 22 of fire switch. IF -

OK - Push in firmly on fire switch knob to ensure fire switch is in NORMAL position. Check for 28V DC at pin 23 of fire switch. IF -

NOT OK - Check electrical continuity thru pin 2 or 11 at Sta 270, SM36 or SM37 splice, and ENG. -1 or -2 FUEL SHUTOFF VALVE circuit breakers on P6 panel and repair as necessary.

OK - Cycle fire switch from NORMAL-to-FIRE-to-NORMAL several times and recheck for 28V DC at pin 23. If electrical continuity is not always positive between pins 22 and 23, replace switch (Ref Chapter 26)

NOT OK - Replace engine fire switch (Ref Chapter 26).

Engine Fuel Shutoff Valve Does Not Operate
Figure 102 (Sheet 2)

ENGINE FUEL SHUTOFF VALVE DOES NOT OPERATE - Check for 28V DC electric power at pin B of shutoff valve electrical connector. IF -

OK - Trouble shoot shutoff valve per applicable step in general section and replace faulty valve assembly (AMM 28-22-11/401).

NOT OK - Check for 28-V DC at pin 22 of engine fire switch. IF -

OK - Replace engine fire switch (Ref Chap 26).

NOT OK - An intermittent ON/OFF power condition must be present as electric power must have been supplied to pin 22 in order to open engine fuel shutoff valve. Look for loose connector pins, defective wiring splice in right load control center or faulty engine No. 1 or 2 fuel shutoff valve circuit breaker and repair or replace as necessary (WDM 28-21-01).

Engine Fuel Shutoff Valve Does Not Operate
Figure 103

ENGINE BOOST PUMP DOES NOT OPERATE - Check for 115-V AC, 3-phase, power at boost pump electrical connector. IF -

OK - Replace boost pump (AMM 28-22-41/401).

NOT OK - Check for 115V AC, 3-phase power at A2, B2, C2 pins of electrical connector to respective boost pump relay at P6 load control center. IF -

OK - Check for 28V DC at pin X2 of respective boost pump relay. IF -

NOT OK - Check for faulty boost pump 115V AC, 3-phase circuit breaker at P6 panel and repair or replace as necessary.

OK - Replace boost pump relay .

NOT OK - Check for 28V DC at pin 6 of the electrical connector for the respective boost pump control switch, P5 fuel system module. IF -

OK - Replace respective boost pump control switch.

NOT OK - Check for faulty 28V DC circuit breaker FUEL CONT-1 FWD-2 AFT CTR RIGHT, or FUEL CONT-1 AFT-2 FWD CTR LEFT and replace as necessary.

Engine Boost Pump Does Not Operate
Figure 104

LOW PRESSURE WARNING, MASTER CAUTION, AND FUEL ANNUNCIATOR LIGHTS DO NOT EXTINGUISH - Check that boost pump removal valve is open. IF -

OK - Remove electrical connector from respective low pressure switch - check that lights extinguish. IF -

NOT OK - Open boost pump removal valve and recheck that lights extinguish.

OK - Replace low pressure switch (AMM 28-42-11/401).

NOT OK - Replace fuel system P5 module.

Low Pressure Warning, Master Caution, and Fuel Annunciator Lights Do Not Extinguish
Figure 105

MASTER CAUTION AND FUEL ANNUNCIATOR LIGHTS DO NOT ILLUMINATE WHEN SECOND BOOST PUMP IN TANK IS TURNED OFF - Check each boost pump by sound and feel that pump is not operating. IF -

OK - (Both pumps in tank are not operating.) Trouble shoot master warning and caution lights (AMM 33-15-0/101) and repair or replace as necessary.

NOT OK - (Boost pump is still operating.) Check for zero-V DC at pin X2 of respective boost pump relay. IF -

OK - Replace respective boost pump relay.

NOT OK - Boost pump switch must be stuck in ON position; replace switch.

Master Caution and Fuel Annunciator Lights Do Not Illuminate
When Second Boost Pump In Tank is Turned Off
Figure 106

WARNING: DO NOT CLOSE A CIRCUIT BREAKER FOR A FUEL PUMP THAT OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

BOOST PUMP 115V AC CIRCUIT BREAKER IS OPEN [1] - Make sure the circuit breaker has a collar and DO-NOT-CLOSE tag installed. If it is not full, refuel the applicable No. 1 or No. 2 tank until it is full and the center tank (for the fuel boost pump in the center tank) has a minimum of 1000 pounds (450 kilograms) (AMM 12-11-01/301). Visually inspect each end of the electrical conduit for the fuel boost pump and the area around it, to make sure that there is no indication of fuel leakage. IF -

- NOT OK — Remove and examine the fuel boost pump wiring in the conduit. Examine the electrical conduit (AMM 28-22-41/601). Find and repair the source of the fuel leakage.
- OK ↓

Disconnect the electrical connector for the applicable fuel boost pump. Examine the airplane and fuel boost pump sides of the connector for damage. IF -

- NOT OK — Repair any problems that you find.
- OK ↓

If the fuel boost pump wiring conduit inspection (AMM 28-22-41/601 or SB 28A1263) was done in the previous 5000 flight hours and the boost circuit breaker has not opened more than two times in the previous 90 days, you do not need to do this step: Remove and examine the fuel boost pump wiring in the conduit. Make sure there is no damage to the fuel boost pump wiring and Teflon sleeves (AMM 28-22-41/601). IF -

- NOT OK — Replace the fuel boost pump wiring in the conduit and Teflon sleeves.
- OK ↓

(CONTINUED NEXT PAGE)

[1] CDCCL - REFER TO THE TASK: AIRWORTHINESS LIMITATION PRECAUTIONS (AMM 28-00-00/201), FOR IMPORTANT INFORMATION ON CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL'S).

Boost Pump 115V AC Circuit Breaker is Open
Figure 107 (Sheet 1)

OK

Do not reconnect the electrical connector. Remove the DO-NOT-CLOSE tag and collar from the applicable fuel boost pump circuit breaker. Close the circuit breaker for the applicable fuel boost pump. Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the circuit breaker remains closed. IF -

NOT OK — 115V AC CIRCUIT BREAKER OPENS (TRIPS) WITH PUMP DISCONNECTED (Fig. 108).

OK

Install the fuel boost pump wiring in the conduit, if removed. Reconnect the electrical connector. Put the applicable fuel boost pump switch to the ON position. [2] Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the circuit breaker remains closed. IF -

NOT OK — Replace the fuel boost pump (AMM 28-22-41/401). Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable boost pump to the OFF position. Make sure the circuit breaker remains closed. IF-

NOT OK — Replace the fuel boost pump relay (WDM 28-23-01). Put the applicable fuel boost pump to ON position. Wait five minutes. Put the applicable fuel boost to OFF position. Make sure the circuit breaker remains closed.

OK

OK

Make sure the LOW PRESSURE lights for the center tank are off. Make sure the LOW PRESSURE lights for the No. 1 and No. 2 tanks are on.

[2] To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank. Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

Boost Pump 115V AC Circuit Breaker is Open
Figure 107 (Sheet 2)

WARNING: DO NOT CLOSE A CIRCUIT BREAKER FOR A FUEL PUMP THAT OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

BOOST PUMP 115V AC CIRCUIT BREAKER IS OPEN [1] - Make sure the circuit breaker has a collar and DO-NOT-CLOSE tag installed. Make sure the applicable No. 1 and No. 2 fuel tank has a minimum of 2000 pounds (900 kilograms) of fuel (AMM 12-11-01/301). Visually inspect the fuel boost pump and area around the fuel boost pump for fuel leakage. IF -

NOT OK — Find and repair the source of the fuel leakage.

OK

Disconnect the electrical connector for the applicable fuel boost pump. Examine the airplane and pump sides of the electrical connector for damage. IF -

NOT OK — Repair any problems that you find.

OK

Do not reconnect the electrical connector. Remove the DO-NOT-CLOSE tag and collar from the applicable fuel boost pump circuit breaker. Close the circuit breaker for the applicable fuel boost pump. Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the circuit breaker remains closed. IF -

NOT OK — 115V AC CIRCUIT BREAKER OPENS (TRIPS) WITH PUMP DISCONNECTED - (Fig. 108A)

OK

(CONTINUED NEXT PAGE)

[1] CDCCL - REFER TO THE TASK: AIRWORTHINESS LIMITATION PRECAUTIONS (AMM 28-00-00/201), FOR IMPORTANT INFORMATION ON CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL'S).

Boost Pump 115V AC Circuit Breaker is Open
Figure 107A (Sheet 1)

OK

Reconnect the electrical connector. Put the applicable fuel boost pump switch to the ON position. [2] Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the circuit breaker remains closed. IF -

NOT OK — Replace the fuel boost pump (AMM 28-22-41/401). Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the circuit breaker remains closed. IF -

NOT OK — Replace the applicable fuel boost pump relay (WDM 28-23-01). Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump to the OFF position. Make sure the circuit breaker remains closed.

[2] To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank. Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

Boost Pump 115V AC Circuit Breaker is Open
Figure 107A (Sheet 2)

WARNING: DO NOT CLOSE A CIRCUIT BREAKER FOR A FUEL PUMP THAT OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

115V AC CIRCUIT BREAKER OPENS (TRIPS) WITH PUMP DISCONNECTED. 1 - Make sure the applicable No. 1 or No. 2 fuel tank is full and the center tank (for the fuel boost pump in the center tank) has a minimum of 1000 pounds (450 kilograms) (AMM 12-11-01/301). Make sure the electrical connector for the fuel boost pump is disconnected. Do these steps for the applicable fuel boost pump: replace the fuel boost pump relay, remove the DO-NOT-CLOSE tag and collar, close the 115V AC circuit breaker, and put the fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the 115V AC circuit breaker remains closed. IF -

- OK
- NOT OK — Replace the open 115V AC circuit breaker. Close the new circuit breaker. Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the new circuit breaker remains closed. IF -
  - OK
  - NOT OK — Do a wiring check between the applicable fuel boost pump and the related fuel boost pump relay (WDM 28-23-01). IF -
    - NOT OK — Replace the wiring.
    - OK — Do a wiring check between the open 115V AC circuit breaker and the related fuel boost pump relay (WDM 28-23-01). IF -
      - NOT OK — Replace the wiring.
      - OK

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1 CDCCL - REFER TO THE TASK: AIRWORTHINESS LIMITATION PRECAUTIONS (AMM 28-00-00/201), FOR IMPORTANT INFORMATION ON CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL'S).

115V AC Circuit Breaker Opens (Trips) with Pump Disconnected
Figure 108 (Sheet 1)

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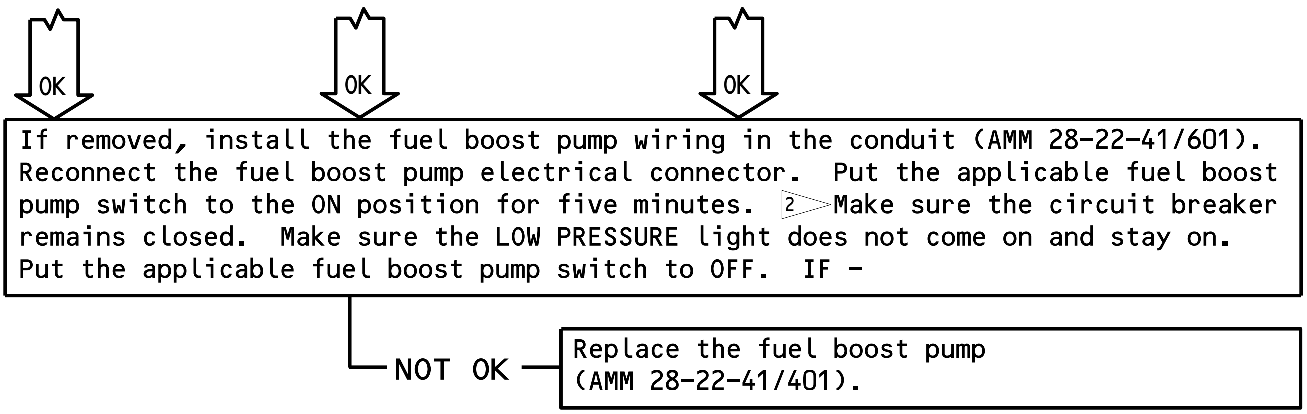


2 To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank. Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

115V AC Circuit Breaker Opens (Trips) with Pump Disconnected
Figure 108 (Sheet 2)

WARNING: DO NOT CLOSE A CIRCUIT BREAKER FOR A FUEL PUMP THAT OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

115V AC CIRCUIT BREAKER OPENS (TRIPS) WITH PUMP DISCONNECTED [1] - Make sure the applicable No. 1 or No. 2 tank has a minimum of 2000 pounds (900 kilograms) of fuel (AMM 12-11-01/301). Do not reconnect the electrical connector. Do these steps for the applicable fuel boost pump: replace the fuel boost pump relay, close the 115V AC circuit breaker, and put the fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the 115V AC circuit breaker remains closed. IF -

NOT OK — Do not reconnect the electrical connector. Replace the open 115V AC circuit breaker. Close the new circuit breaker. Put the applicable fuel boost pump switch to the ON position. Wait five minutes. Put the applicable fuel boost pump switch to the OFF position. Make sure the new circuit breaker remains closed. IF -

NOT OK — Do not reconnect the electrical connector. Do a wiring check between the applicable fuel boost pump and the related fuel boost pump relay (WDM 28-23-01). IF -

NOT OK — Replace the wiring.

OK

Do not reconnect the electrical connector. Do a wiring check between the open 115V AC circuit breaker and the related fuel boost pump relay (WDM 28-23-01). IF -

NOT OK — Replace the wiring.

OK

OK

OK

(CONTINUED NEXT PAGE)

[1] CDCCL - REFER TO THE TASK: AIRWORTHINESS LIMITATION PRECAUTIONS (AMM 28-00-00/201), FOR IMPORTANT INFORMATION ON CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL'S).

115V AC Circuit Breaker Opens (Trips) with Pump Disconnected
Figure 108A (Sheet 1)

OK

OK

OK

Reconnect the fuel boost pump electrical connector. Put the applicable fuel boost pump switch to the ON position for five minutes. 2 Make sure the circuit breaker remains closed. Make sure the LOW PRESSURE light does not come on and stay on. Put the applicable fuel boost pump switch to OFF. IF-

NOT OK — Replace the fuel boost pump (AMM 28-22-41/401).

2 To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank. Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

115V AC Circuit Breaker Opens (Trips) with Pump Disconnected
Figure 108A (Sheet 2)

4. Restore Airplanes to Normal
   A. Remove leading edge flap locks (AMM 27-81-0/201).

      WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   B. Remove electrical power if it is not necessary.

ENGINE FUEL FEED SYSTEM - MAINTENANCE PRACTICES

1. General
   A. This procedure has these tasks:
      (1) Engine Fuel Suction Feed - Operational Test
      (2) Engine Fuel Feed Lines/Fittings Vacuum Test
      (3) Engine Fuel Feed Lines/Coupling Pressure Test
      (4) Check Valve Leakage Troubleshooting
   B. Two procedures, an engine fuel suction feed (engine run) operational test and a vacuum test, are given to do a check of the engine fuel feed lines and fittings. The engine fuel suction feed operational test requires specific fuel quantities, but no special equipment. The vacuum test requires special test equipment and empty fuel tanks.
2. Engine Fuel Suction Feed - Operational Test
   A. General
      (1) Do this task on the ground while the engines operate at an idle.
      (2) As an alternative to this task, you can do a test for the engine fuel suction feed using the Engine Fuel Feed Lines/Fittings Vacuum Test.
   B. Check fuel quantities are as follows:
      (1) Tanks No. 1 and 2 - 1600 ±100 lbs (725 ±45 kgs)
      (2) Center tank - No restriction
   C. If center tank contains fuel, manually close center tank boost pump removal valves. Refer to AMM 28-22-41/401 for valve handle access.
   D. Make sure that the fuel crossfeed valve is closed.
   E. Start both engines (AMM 71-09-100/201).
      (1) Use the fuel quantity listed in this task.
   F. Operate the engines, with the boost pumps on, at IDLE for a minimum of 2 minutes.

      NOTE: Extend the engine warm up time under very cold ambient conditions.

      (1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

         WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

         (a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

            NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

   G. After 2 minutes, make a record of the N1, N2, and fuel flow for each engine.

H. One engine at a time, turn off the applicable boost pumps.
I. Operate the engines at IDLE for a minimum of 5 minutes.
J. Monitor N1, N2, and fuel flow for deterioration or fluctuation. If deterioration or fluctuation is noted, do the vacuum test per par. 3.
K. Shut down the engines.
L. Open the center tank boost pump removal valves (if closed).

NOTE: Make sure the removal valve is open before installing boost pump access panel.

3. Engine Fuel Feed Lines/Fittings Vacuum Test
A. Equipment
(1) Vacuum Pump
(2) Vacuum Gage, 0-30 In Hg, accurate to + 1 inch
(3) Catch Tank - 5-gallon, capable of withstanding one atmosphere of vacuum
(4) Lock assembly - ME 65-16713
(5) Adapter - MS24398-16-6
(6) Plug - MS21913-16
(7) Shutoff valve
(8) Tee - 3/8 inch
(9) Hose - 3/8 inch
B. Prepare for Test
(1) Defuel the airplane (AMM 28-23-0/201).
(2) Manually close all boost pump removal valves. Refer to AMM 28-22-41/401 for valve handle access.
(3) Manually close the boost pump bypass valves by removing access plugs and inserting lock assembly (ME 65-16713).
(4) Make sure that refueling valves and defueling valve are closed.
(5) Make sure that engine fuel shutoff valves and crossfeed valve are open.
(6) Drain engine fuel feed lines into 5-gallon container by opening fuel filter drain port. Close drain port and lockwire (AMM 71-00/401).
(7) Disconnect each engine fuel feed hose at its lower end.
C. Do the Vacuum Test
(1) Connect the vacuum test equipment (Fig. 201) to one of the disconnected engine fuel feed hoses.
(2) Install the plug (MS 24404-16) in other disconnected engine fuel feed hose.
(3) With shutoff valve (Fig. 201) open, start vacuum pump. Apply 17-18 inches mercury. If unable to obtain 17-18 IN-HG, proceed to step (5).
(4) Close shutoff valve (Fig. 202) and shutoff vacuum pump. Monitor vacuum gage for 5 minutes.
(a) If vacuum change is less than 1 IN-HG in 5 minutes, proceed to par. D.
(b) If vacuum change is greater than 1 IN-HG in 5 minutes, proceed to (5).
(5) Purge and get access to all fuel tanks (AMM 28-10-0/201).

(6) With vacuum pump operating and shutoff valve fully open, do a check of the fuel feed lines and couplings for audible air leaks (Fig. 202).
  (a) If coupling is leaking, disassemble coupling, replace O-rings, and reassemble coupling (AMM 28-22-141/401).
  (b) If fuel line is leaking replace or repair leaking or damaged fuel line (AMM 28-22-141/401).

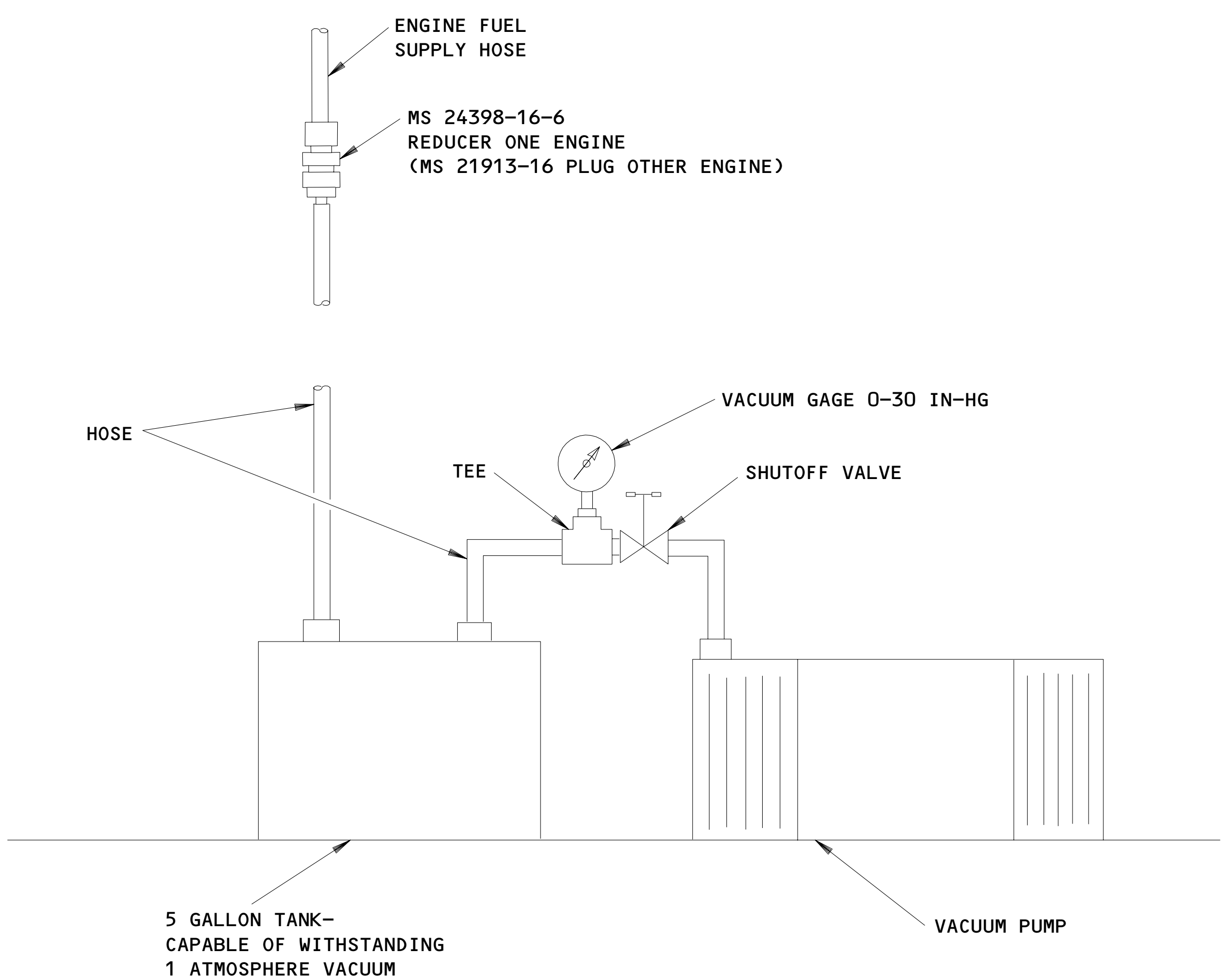
  NOTE: Verify joint alignment and proper clamping on any disturbed lines.

(7) Repeat steps (3) and (4).

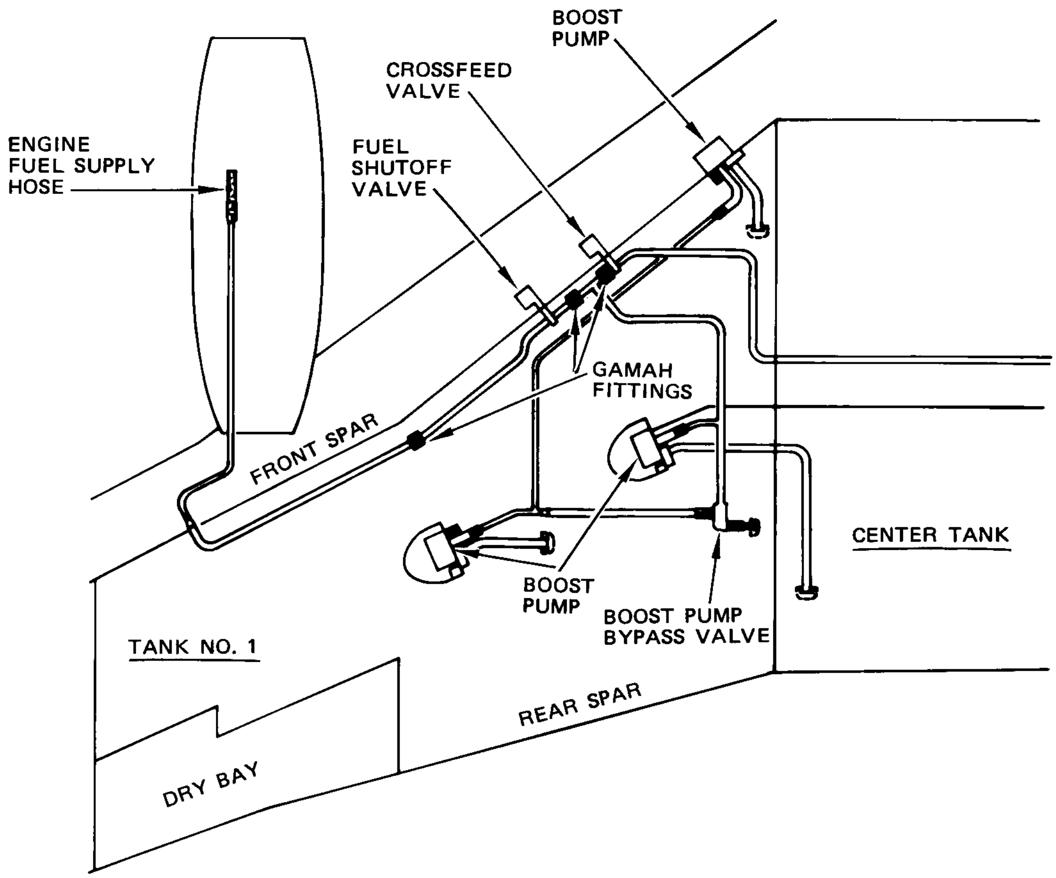
D. Put the Airplane Back to Its Usual Condition
(1) Remove the vacuum test equipment.
(2) Remove the plug and reconnect both engine fuel feed hoses.
(3) Remove the lock assembly and install the boost pump bypass valve access plugs.
(4) Manually open all boost pump removal valves.
(5) Install fuel tank access panels and boost pump access panels.

NOTE: Make sure the removal valve is open before installing boost pump access panel.

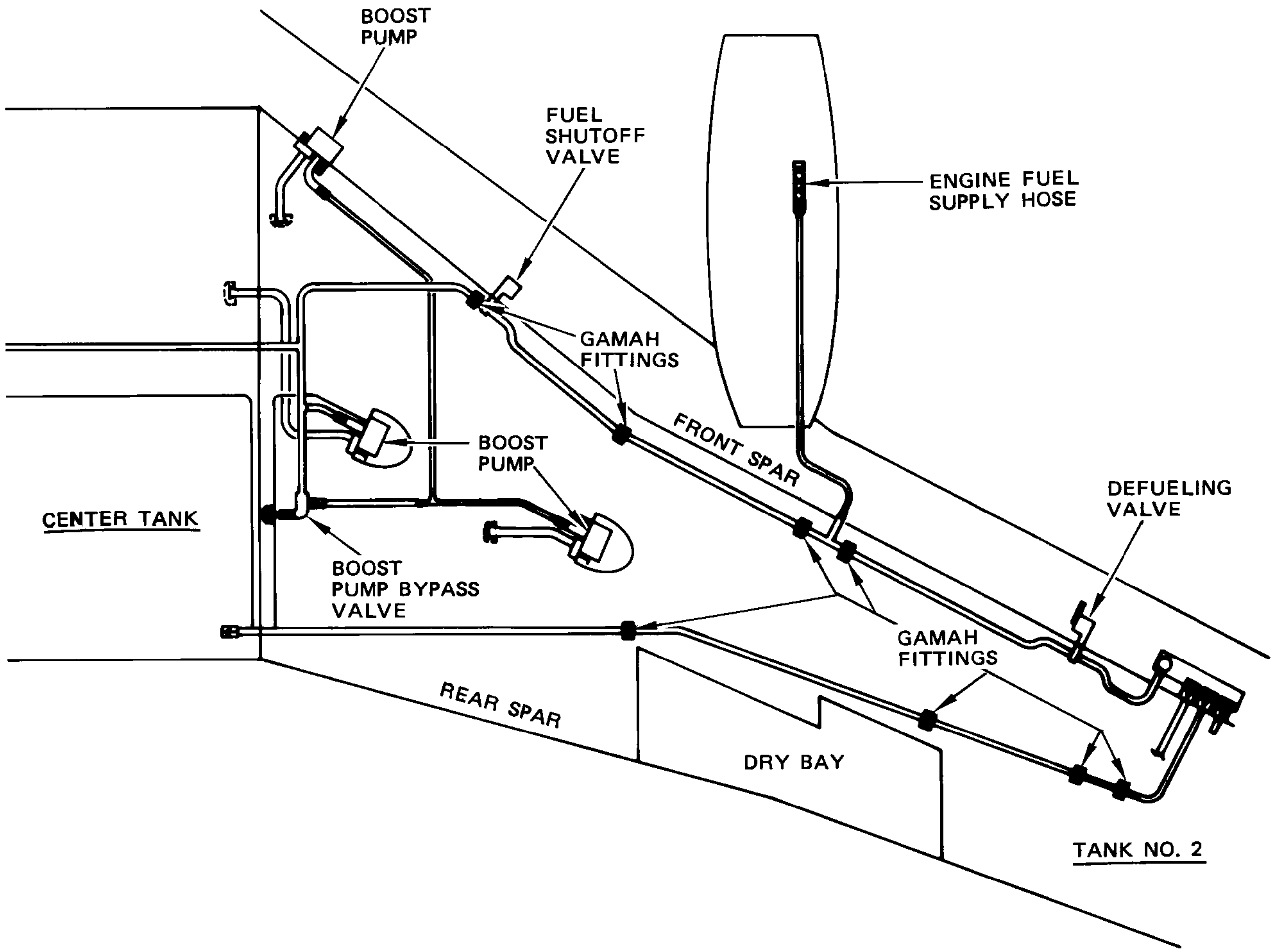
(6) Do the Engine Fuel Suction Feed Operational Test.



Vacuum Test Equipment
Figure 201



Engine Fuel Feed System
Figure 202 (Sheet 1)



Engine Fuel Feed System
Figure 202 (Sheet 2)

4. Check Valve Leakage Troubleshooting

A. General

(1) This task does a pressure check to find out if one of the APU fuel-feed check valves has a leak. Leakage in the primary APU fuel-feed check valve, the bypass APU check valve, or the pressure relief valve (if installed) in the APU fuel-feed line is found and isolated.

B. Equipment

(1) Pressure Gage - 0-100 psi (0-689 kPa)

(2) Hose

C. Leak Test for the Primary APU Fuel Check Valve, the Bypass APU Check Valve, and the APU Pressure Relief Valve

(1) Set the APU master switch, on the P5 forward overhead panel to the OFF position and attach a DO-NOT-OPERATE tag.

(2) Set the No. 1 AFT FUEL PUMPS switch, on the P5 forward overhead panel, to the OFF position.

(3) Open this circuit breaker and attach a DO-NOT-CLOSE tag:

(a) E3-3 Electrical Shelf, APU Control Unit

(4) Do these steps to open the APU cowl door:

(a) Open the latches for the APU cowl door.

(b) Open the APU cowl door.

(c) Connect the door support rods.

(5) Do these steps to remove the lower shroud:

WARNING: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

(a) Hold the lower shroud and open the shroud latches.

(b) Remove the lower shroud.

(6) Do these steps to install the equipment on the fuel line:

(a) Remove the fuel supply hose from the inlet fuel tube to the fuel control pump assembly.

(b) Attach the tee fitting to the inlet fuel tube.

(c) Attach the fuel supply hose to one side of the tee fitting.

(d) Attach the hose to the other side of the tee fitting.

(e) Attach the pressure gage to the hose.

(7) Supply external electrical power to the airplane (AMM 24-22-0/201).

NOTE: The ac power is necessary to operate the fuel boost pump for the No. 1 fuel tank.

(8) Set the No. 1 AFT FUEL PUMPS switch, on the P5 forward overhead panel, to the ON position.

(a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(9) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
(a) E3-3 Electrical Shelf, APU Control Unit
(10) Set the APU master switch to the ON position.

NOTE: Do not move the APU master switch to the START position. It is not necessary to start the APU.

(11) Monitor the fuel pressure to make sure there are no leaks:
(a) Make sure the fuel pressure at the pressure gage is approximately 20 psig (138 kPa).
(b) Set the No. 1 AFT FUEL PUMPS switch, on the P5 forward overhead panel, to the OFF position.
(c) Make sure the fuel pressure at the pressure gage does not decrease:
1) Monitor the fuel pressure on the pressure gage for 5 minutes.
2) If there is not a decrease in pressure during the 5-minute time, then these check valves do not have leakage:
a) APU Primary Check Valve
b) APU Bypass Check Valve
c) APU Pressure Relief Valve (if installed)
3) If there is a decrease in fuel pressure, then do these steps to isolate the leakage in the APU fuel system:
a) Set the No. 1 AFT FUEL PUMPS switch on the P5 overhead panel to the ON position.
b) Make sure the pressure on the pressure gage is approximately 20 psig.
c) Set the APU master switch to the OFF position.
d) Set the No. 1 AFT FUEL PUMPS switch, on the P5 forward overhead panel, to the OFF position.
e) Monitor the fuel pressure on the pressure gage for 5 minutes.
f) If there is a decrease in fuel pressure, correct all leaks or damage to the APU fuel system between the APU shutoff valve and the APU.
g) If there is no decrease in fuel pressure, then after you complete this procedure, do the procedure described below: "Leak Check of the APU Bypass Check Valve and Pressure Relief Valve".
(d) Loosen the nut on the hose to bleed the fuel pressure.

(12) Remove the external electrical power from the airplane (AMM 28-24-0/201).
(13) Make sure the APU master switch is set to OFF.
(14) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
  (a) E3-3 Electrical Shelf, APU Control Unit
(15) Remove the equipment from the fuel line:
  (a) Remove the pressure gage from the hose.
  (b) Remove the hose from the tee fitting.
  (c) Remove the fuel supply hose from the tee fitting.
  (d) Remove the tee fitting from the inlet fuel tube.
  (e) Install the fuel supply hose on the inlet fuel tube of the fuel control and pump assembly.
(16) Do these steps to install the lower APU shroud:

CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCH (5 MM) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS, AND LOWER SHROUD. BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

  (a) Hold the lower shroud against the upper shroud.
  (b) Close the shroud latches.
(17) Close the APU cowl door:
  (a) Disconnect the door support rods.
  (b) Put the door support rods in the clips on the APU cowl door.
  (c) Close the APU cowl door.
  (d) Close the latches for the APU cowl door.
(18) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
  (a) E3-3 Electrical Shelf, APU Control Unit
(19) Make sure the APU master switch is set to OFF.

D. Leak Check for the APU Bypass Valve and the Pressure Relief Valve (If Installed)
(1) Set the APU master switch, on the P5 forward overhead panel, to the OFF position and attach a DO-NOT-OPERATE tag.
(2) Set the No. 1 AFT FUEL PUMP switch, on the P5 forward overhead panel, to the OFF position.
(3) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
  (a) E3-3 Electrical Shelf, APU Control Unit
(4) Supply external electrical power to the airplane (AMM 24-22-0/201).
(5) Set the L CTR FUEL PUMPS switch to ON.
  (a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

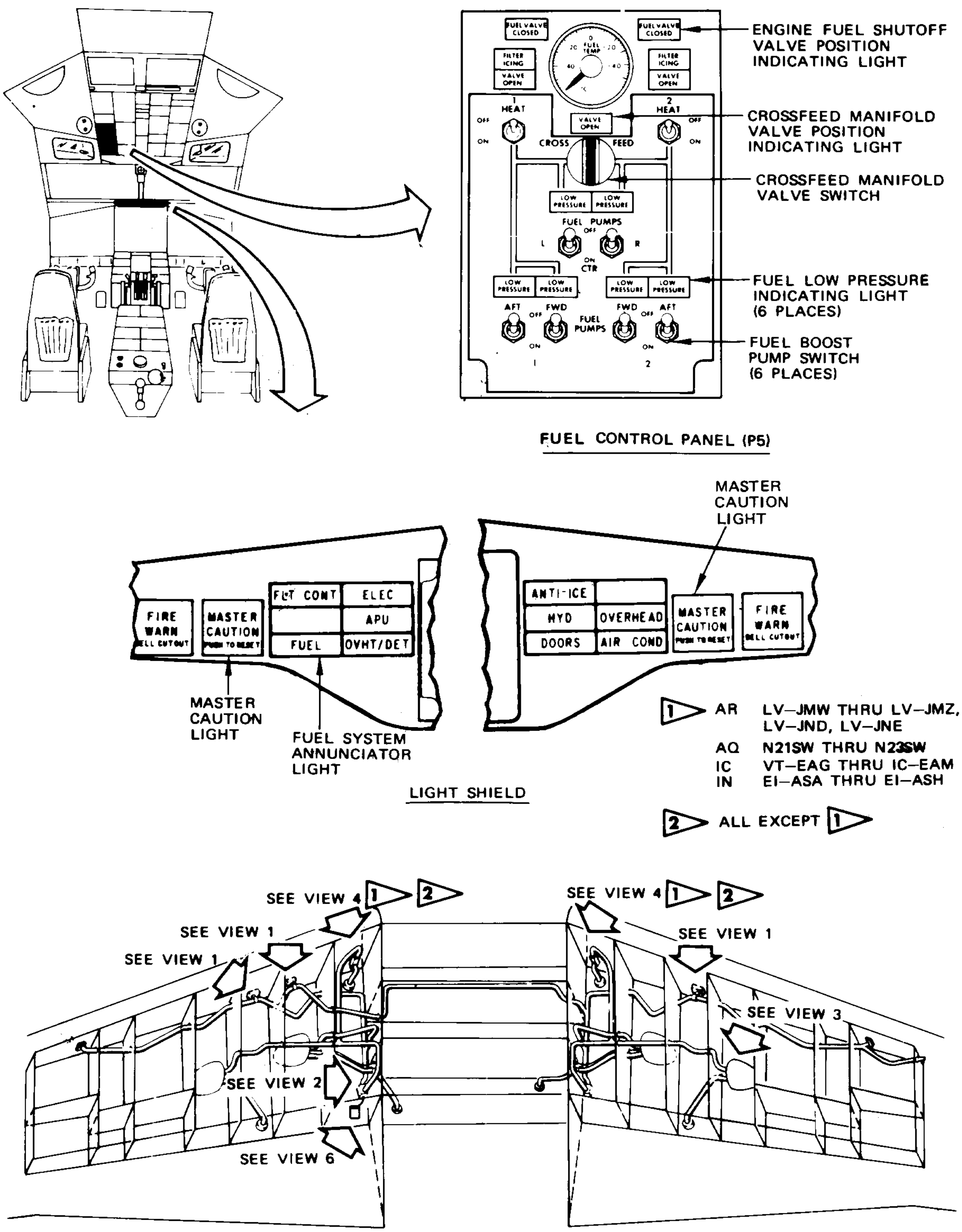
(6) Monitor the fuel quantities in the center tank an the No. 1 tank for fuel transfer from the center tank to the No. 1 tank for a minimum of two hours.
   (a) If the pressure relief valve (if installed) has leakage, it can cause a fuel transfer of approximately 20 pounds (10 kilograms) per hour.
   (b) If the bypass check valve has leakage, it can cause a transfer of approximately 2500 pounds (1140 kilograms) per hour.
   (c) If there is no fuel transfer, and leakage was found in the APU fuel system between the fuel tank and the APU shutoff valve, then there is problem with the main APU fuel check valve.
(7) Set the L CTR FUEL PUMPS switch to OFF.
(8) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
   (a) E3-3 Electrical Shelf, APU Control Unit
(9) Set the APU master switch, on the P5 forward overhead panel, back to the OFF position.

ENGINE FUEL FEED SYSTEM - ADJUSTMENT/TEST

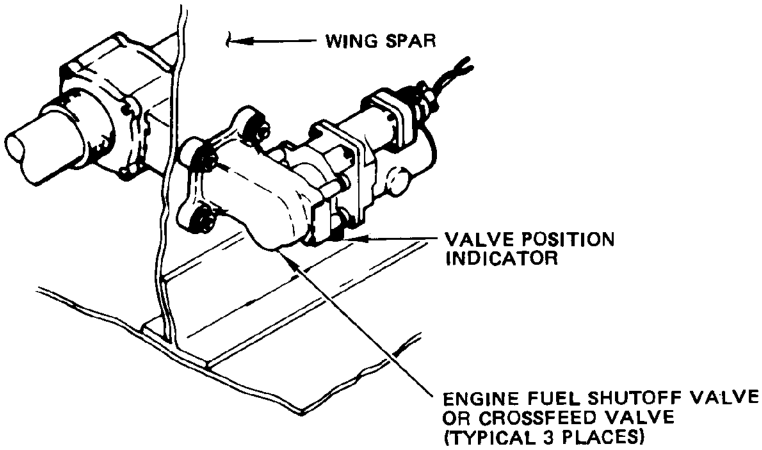
1. General
   A. This procedure has a task for the functional test of the auto shutoff system for the center fuel boost pumps (POST-SB 28A1228).
2. Engine Fuel Feed System Test
   A. General
      (1) The engine fuel feed system test provides a leak test for the fuel feed system, and a functional test of the fuel boost pumps and all fuel control valves. A test of the fuel system portion of the master caution light system is included in the fuel boost pump functional test.
   B. Engine Fuel Shutoff Valve Test
      (1) Prepare for engine fuel shutoff valve test.
         (a) Connect external electrical power to the airplane (AMM 24-22-0/201).
         (b) Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

WARNING: OBEY THE LOCK INSTALLATION PROCEDURE. THE FLAPS MOVE QUICKLY. THE FLAPS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

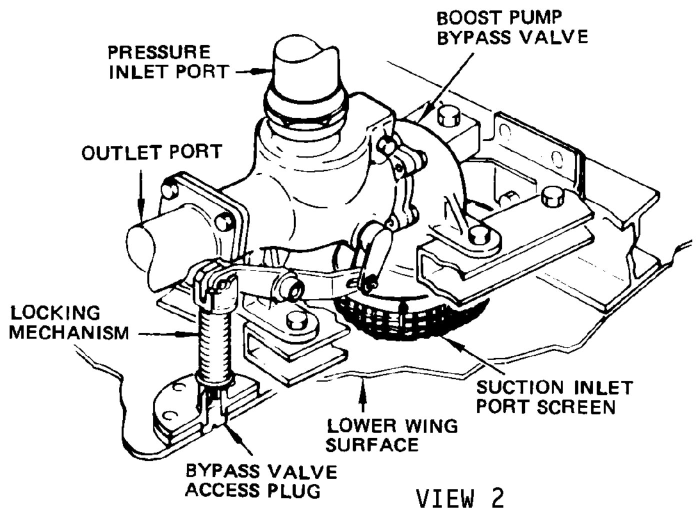
      (2) AR LV-JMW thru LV-JMZ, LV-JND, LV-JNE, LV-JTD;
          IC VT-EAG thru VT-EAM PRE-SB 28-1020;
          IN EI-ASA thru EI-ASH;
          Test engine fuel shutoff valve (on airplanes without engine start lever actuated engine fuel shutoff valve switches).
         (a) Press-to-test engine No. 1 fuel shutoff valve position indicating light on forward overhead panel. Make sure that bulbs illuminate (Fig. 501).
         (b) Pull engine No. 1 fire switch, on aft electronic panel (P8), to FIRE position. Visually check position indicator on valve and make sure that valve has fully closed.
         (c) Make sure that valve position indicating light illuminates bright while valve is in transit and that light dims when valve has reached the closed position.
         (d) Push in engine No. 1 fire switch. Visually check position indicator on valve and make sure that valve has fully opened.
         (e) Make sure that valve position indicating light illuminates bright while valve is in transit and that light extinguishes when valve has reached the open position.
         (f) Repeat steps (a) thru (e) for engine No. 2 fuel shutoff valve.
      (3) Test engine fuel shutoff valve (airplanes with engine start lever actuated engine fuel shutoff valve switches).
         (a) Position battery switch on P5 panel to ON. Valve position indicating lights should illuminate (dim). Open engine ignition system circuit breakers on P6 panel.



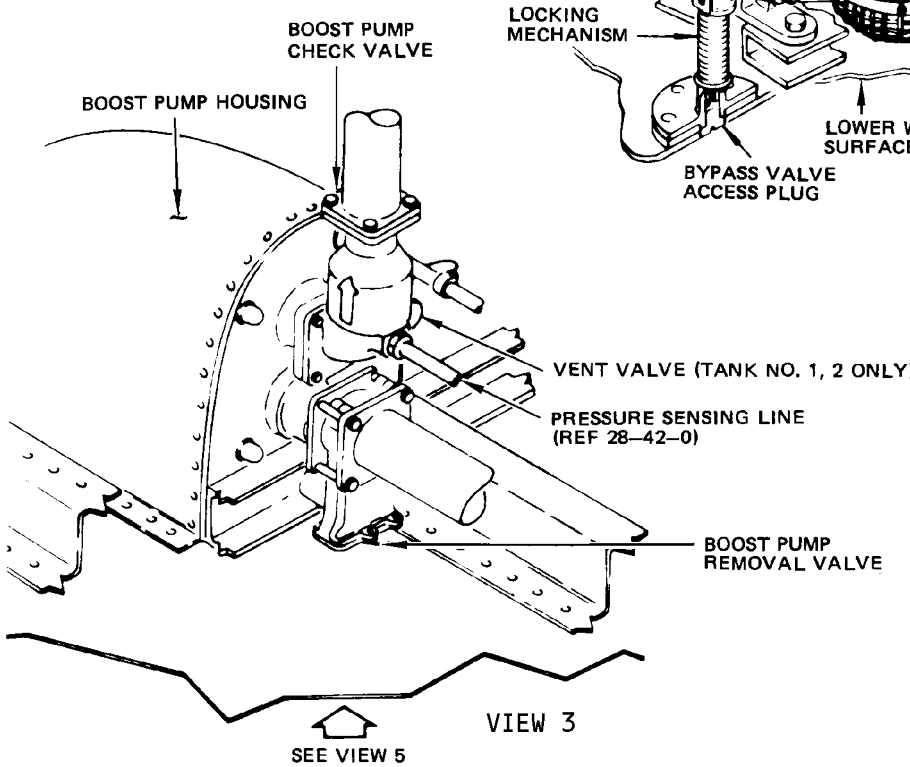
Engine Fuel Feed System Installation
Figure 501 (Sheet 1)



VIEW 1

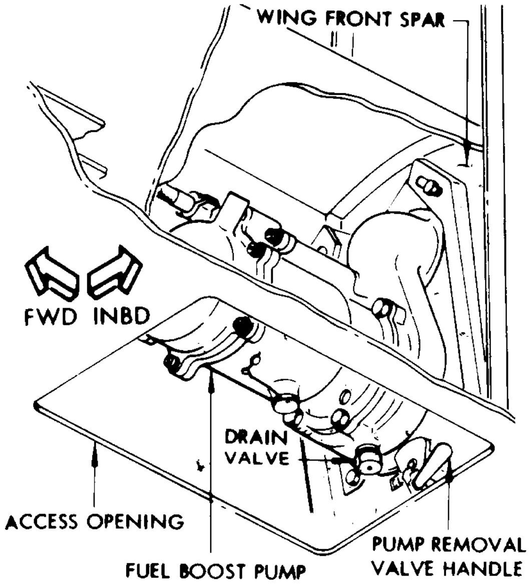


VIEW 2

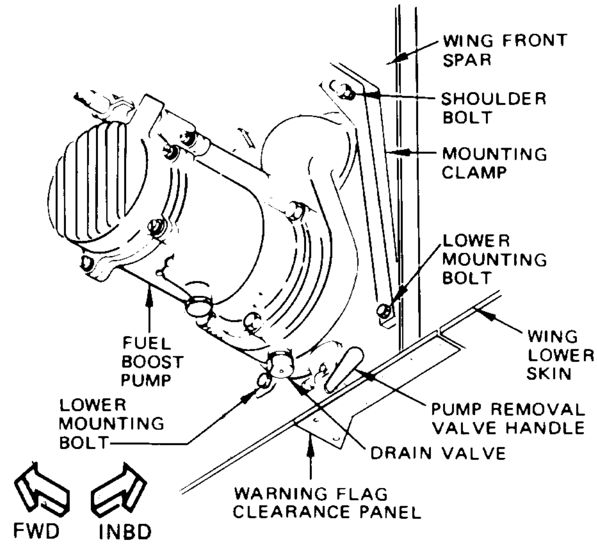


VIEW 3

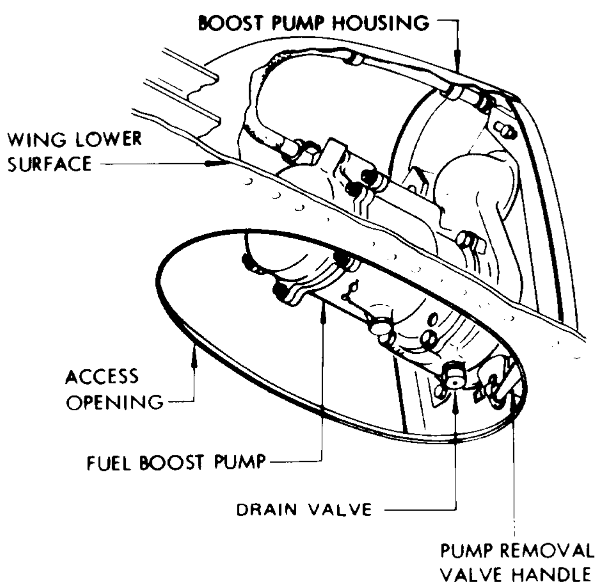
Engine Fuel Feed System Installation
Figure 501 (Sheet 2)



VIEW 4 1

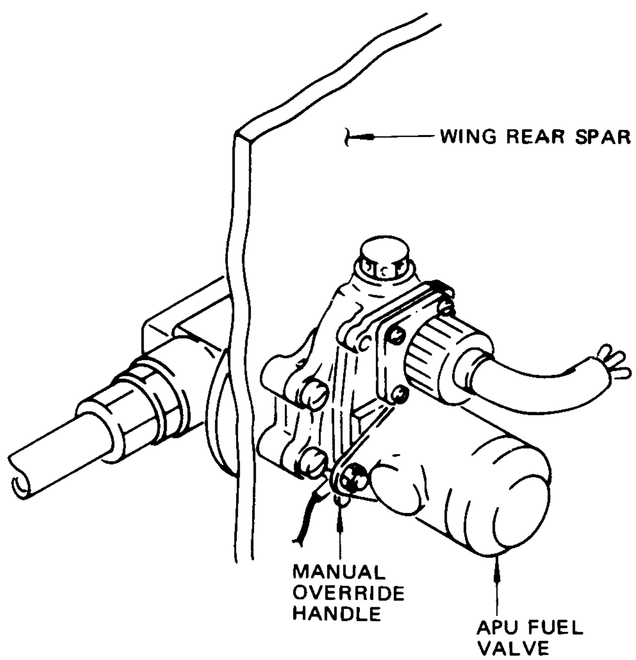


VIEW 4 2



VIEW 5

Engine Fuel Feed System Installation
Figure 501 (Sheet 3)



VIEW 6

Engine Fuel Feed System Installation
Figure 501 (Sheet 4)

(b) Visually check position indicator on both engine fuel shutoff valves and verify that valves are fully closed.

(c) Advance engine No. 1 start lever 1.00 inch *[1] or 1.80 inch *[2] from CUTOFF position. Make surethat respective valve position indicating light illuminates bright while valve is in transit and extinguishes after reaching full open. Verify full opening of valve by observing position indicator on valve. Also, visually check engine No. 2 fuel shutoff valve and fuel crossfeed valve to ensure no actuation.

(d) Slowly advance start lever from final position reached in step (c) until IDLE position is attained. Make sure that valve remains open, with no tendency to close, throughout travel.

NOTE: Valve should be closed whenever engine start lever is in CUTOFF position. Valve should open when start lever is 0.25 to 1.00 *[1] or 1.80 *[2] inch from lever CUTOFF detent position and should remain open up to and including IDLE detent position (AMM 28-22-111/501 or AMM 28-22-112/501).

(e) Pull engine No. 1 fire switch, on aisle stand P8 panel, to FIRE position. Make sure that the respective valve position indicating light is illuminated bright (valve-in-transit) and then dims to indicate valve fully closed. Verify valve closed position by observing indicator on valve.

(f) Push in engine No. 1 fire switch to NORMAL position. Make sure that valve indicating light is illuminated bright (valve-in-transit) and then extinguishes to indicate valve fully open. Verify valve open position by observing indicator on valve.

(g) Return engine start lever to CUTOFF position. Make sure that valve position indicating light is illuminated bright (valve-in-transit) and then dims to indicate valve fully closed. Verify valve closed position by observing indicator on valve.

(h) Repeat steps (c) thru (g) for engine No. 2 fuel shutoff valve.

(i) Position BAT switch on P5 panel to OFF. Make sure that valve position indicating lights extinguish.

*[1] ALL EXCEPT *[2]

*[2] IC VT-EHE and on, plus ZD, IC, IN and AR POST-SB 28-1035; ZD G-BJCT thru G-BKHF

(4) Restore Airplane to Normal Configuration
(a) Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(b) Remove external electrical power, if no longer required.

C. Fuel Crossfeed Valve Test
(1) Prepare for fuel crossfeed valve test.
(a) Connect external electrical power to airplane (AMM 24-22-0/201).
(b) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(2) Test Fuel Crossfeed Valve
(a) Press-to-test crossfeed valve position indicating light on forward overhead panel. Make sure that bulbs illuminate (Fig. 501).
(b) Place crossfeed valve switch, on forward overhead panel, in the OPEN position. Visually check position indicator on valve and make sure that valve has fully opened.
(c) Make sure that valve position indicating light illuminates bright while valve is in transit and that light dims when valve has reached the full open position.
(d) Place crossfeed valve switch in the CLOSED position. Visually check position indicator on valve and make sure that valve has fully closed.

(3) Restore Airplane to Normal Configuration
(a) Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(b) Remove external electrical power, if no longer required.

D. Fuel Boost Pump Test
(1) Prepare Fuel Boost Pump for Test
(a) Connect external electrical power to airplane (AMM Chapter 24, Electrical Power).

(b) Make sure that each fuel tank contains at least 700 pounds or 350 kilograms of fuel.
(c) Make sure that the manual defueling valve is closed.
(d) Make sure that APU master switch, on forward overhead panel, is in OFF position.
(e) Make sure that all fuel boost pump switches, on forward overhead panel, are in OFF position (Fig. 501).
(f) Make sure that crossfeed valve switch, on forward overhead panel, is in CLOSED position.
(g) Close lighting circuit breaker INDICATOR LTS MASTER DIMMING BUS and master caution bus circuit breakers FUEL, ANNUNCIATOR NO. 1, and BAT on P6 panel.
(h) Make sure that all circuit breakers are open in systems having master caution annunciator lights on cockpit lightshield (Fig. 501).
(i) If MASTER CAUTION and system annunciator lights are illuminated, depress either right or left MASTER CAUTION light. Make sure that all lights extinguish.
(j) Close fuel system circuit breakers on P6 panel:
1) FWD BOOST PUMP TANK 1
2) FWD BOOST PUMP TANK 2
3) AFT BOOST PUMP TANK 1
4) AFT BOOST PUMP TANK 2
5) BOOST PUMP CTR TANK LEFT
6) BOOST PUMP CTR TANK RIGHT
7) ENG 1 SHUTOFF VALVE
8) ENG 2 SHUTOFF VALVE
9) MANIF VALVE
(k) Pull engine fire switches on aft electronic panel (P8) to FIRE position to close engine fuel shutoff valves.
(l) Push either MASTER CAUTION light. Make sure that FUEL annunciator and MASTER CAUTION lights are off and boost pump LOW PRESSURE indicator lights remain on.
(m) Push the FUEL annunciator light and make sure that FUEL annunciator and MASTER CAUTION lights come on.
(n) Close master DIM AND TEST circuit breaker on P6 panel.
(o) Place the LIGHTS switch on overhead panel P2 in DIM position. Make sure that MASTER CAUTION, FUEL annunciator, and boost pump LOW PRESSURE indicator lights dim.
(p) Place the LIGHTS switch in BRT position. Make sure that lights return to original brightness.
(q) Press-to-test center tank boost pump LOW PRESSURE indicating lights on forward overhead panel P5. Make sure the bulbs come on.

(2) Test of the Fuel Boost Pump
(a) Put the tank No. 2 FWD boost pump switch on P5 panel in the ON position.
1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switches to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(b) Check for fuel pressure buildup and make sure by noting that pump LOW PRESSURE indicating light on P5 panel goes off.
1) If light does not go off, refer to fuel boost pump reprime procedure (AMM 28-22-41/401).
(c) When pump LOW PRESSURE indicating light goes off, return FWD boost pump switch to OFF position. Make sure that indicating light comes on.
(d) Repeat steps (a) thru (c) for tank No. 1 AFT boost pump and tank No. 2 FWD and AFT boost pumps with only one pump operating at a time.
(e) Open BOOST PUMP CTR TANK RIGHT circuit breaker on P6 panel.
(f) Put the R CTR tank fuel boost pump switch in ON position.
(g) Make sure that pump LOW PRESSURE indicating light comes on.
(h) Close BOOST PUMP CTR TANK RIGHT circuit breaker.

(i) Check for fuel pressure buildup and verify by noting that pump LOW PRESSURE indicating light on P5 panel goes off. If light does not go off, put the boost pump switch to the OFF position and refer to fuel boost pump reprime procedure (AMM 28-22-41/401).

(j) When pump LOW PRESSURE indicating light goes off, return the R CTR tank fuel boost pump switch to OFF position. Make sure that indicating light stays off.

(k) Repeat steps (e) thru (j) for L CTR tank fuel boost pump.

(l) Put all six fuel boost pump switches on the P5 panel in the ON position.

1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

<u>WARNING</u>: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

<u>NOTE</u>: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(m) Make sure that all LOW PRESSURE indicating lights on P5 panel go off. Make sure that MASTER CAUTION and FUEL annunciator lights go off and proceed immediately to following steps (n) thru (r).

(n) Return tank No. 1 FWD boost pump switch to OFF, then return tank No. 1 AFT boost pump switch to OFF.

(o) Make sure that respective LOW PRESSURE indicating light comes on as each switch returns to OFF and the MASTER CAUTION and FUEL annunciator lights come on as soon as two boost pumps for same tank are not operating.

(p) Return tank No. 1 boost pump switches to ON position and repeat steps (l) thru (o) for tank No. 2 fuel boost pumps.

(q) Return tank No. 2 boost pump switches to ON position and repeat steps (l) thru (o) for center tank fuel boost pumps using the center tank RIGHT and LEFT boost pump circuit breakers on P6 panel to control boost pumps.

(r) Return all fuel boost pumps remaining ON to OFF position.

(3) Restore airplane to normal.

(a) Push engine fire switches on P8 panel to NORMAL position to open engine fuel shutoff valves.

(b) Open fuel system circuit breakers on P6 panel:
1) FWD BOOST PUMP TANK 1
2) FWD BOOST PUMP TANK 2
3) AFT BOOST PUMP TANK 1
4) AFT BOOST PUMP TANK 2
5) BOOST PUMP CTR TANK LEFT
6) BOOST PUMP CTR TANK RIGHT
7) ENG 1 SHUTOFF VALVE
8) ENG 2 SHUTOFF VALVE
9) MANIF VALVE

(c) Open master DIM AND TEST circuit breaker on P6 panel.

(d) Open INDICATOR LTS MASTER DIMMING BUS and master caution bus FUEL, ANNUNCIATOR NO.1 and BAT circuit breakers on P6 panel, if no longer required.

(e) Remove external electrical power, if no longer required.

E. Fuel Boost Pump Removal Valve, Vent Valve, and Check Valve and Pressure Fueling Line Outlet Check Valve Test

(1) General

(a) The boost pump removal, vent, and check valves and pressure fueling line outlet check valves are tested by opening the boost pump drain cock and checking for fuel leakage. All three valves will leak through the same drain cock making it difficult to isolate the valve that is malfunctioning. As the fuel boost pump check valve can be isolated to a degree it should be tested first. If the fuel boost pump check valve is eliminated as the source of leakage, the replacement of the boost pump removal valve and/or boost pump vent valve will be a matter of judgment.

(2) Prepare Boost Pump Removal Valve, Vent Valve, and Check Valve and Pressure Fueling Line Outlet Check Valve for Test

(a) Connect electrical power to airplane (AMM Chapter 24).

(b) On airplanes not having leading edge flaps covering fwd boost pumps, remove fuel boost pump access panels No. 6303L, 7201L, 7203L, 6403R, 7401R, and 7403R.

(c) On airplanes having leading edge flaps covering fwd boost pumps:
1) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

<u>WARNING</u>: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

2) Remove fuel boost pump access panels No. 7201L, 7203L, 7401R, and 7403R.
3) Also remove small clearance panels from wing lower skin, below main tank fwd boost pump removal valve handles (Fig. 501).

CAUTION: CLEARANCE PANEL MUST BE REMOVED OR DAMAGE TO REMOVAL VALVE WARNING SIGNAL MAY RESULT WHEN VALVE CLOSING IS ATTEMPTED.

(d) Check that each fuel tank contains fuel to cover valves as shown in Table 1.
(e) Check that manual defueling valve is closed.
(f) Make sure that APU master switch, on forward overhead panel, is in OFF position.
(g) Place crossfeed valve switch, on forward overhead panel, in OPEN position.

(3) Test boost pump removal valve, vent valve, and check valve.
(a) Place suitable container under drain cock of tank No. 1 forward fuel boost pump (Fig. 501).

BOOST PUMP	VALVE	MIN. FUEL QUANTITY U.S.GAL	TANK CONFIGUR-ATIO <-- ON -->	BOOST PUMP	VALVE	MIN. FUEL QUANTITY U.S. GAL.
FWD	VENT	250	1 OR 3 CELL			
			OR	L, R	REMOVAL	900
FWD	REMOVAL	100	INTEGRAL			
AFT	VENT	450	2 CELL *[1]	L, R	VENT	710
AFT	REMOVAL	350	2 CELL *[2]	L	VENT	710
CR			2 CELL *[2]	R	TLVENT	FULLCR1080
			3 CELL *[3]	L	VENT	FULL
			3 CELL *[3]	R	VENT	1140
			INTEGRAL *[4]	L	VENT	2100
			INTEGRAL *[4]	R	VENT	

*[1] AR LV-JMW thru LV-JMY
*[2] AR LV-JMZ, LV-JTD, LV-JTO, LV-LEB
*[3] AR LV-JND, LV-JNE
*[4] AR ALL EXCEPT *[1], *[2], *[3]

(b) Close the fuel boost pump removal valve.

(c) Open the fuel boost pump drain cock. After residual fuel in the boost pump drains, fuel flow shall stop.

(d) Put one of the other fuel boost pump switches in ON position and pressurize the fuel line. Fuel shall not flow from the drain cock.

NOTE: If fuel flows from drain cock and the flow increases when the fuel line is pressurized, a malfunction of the fuel boost pump check valve is indicated. If fuel flow does not increase when the fuel line is pressurized, a malfunction of the boost pump removal valve or vent valve is indicated.

1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

<u>WARNING</u>: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

(e) Put the switch, of fuel boost pump used to pressurize the line, to OFF position.
(f) Open the fuel boost pump removal valve. Fuel shall flow from the drain cock.
(g) Close the fuel boost pump drain cock.
(h) Repeat steps (a) thru (g) for remaining fuel boost pumps.

1) On airplanes with center tank boost pump vapor discharge lines routed to pressure refuel line *[1], when testing valves in a center tank boost pump, be sure to close both center tank boost pump removal valves. Do not use other center tank boost pump to pressurize system or fuel recirculation through vapor discharge lines will occur and fuel will flow from drain cock.

<u>NOTE</u>: Vent valves are not used in center tank boost pumps with vapor discharge lines routed to pressure refuel line *[1].

(4) Restore Airplane to Normal Configuration
(a) Place crossfeed valve switch, on forward overhead panel, in CLOSED position.
(b) Install fuel boost pump access panels.

<u>NOTE</u>: Insure that boost pump removal valve is open before installing boost pump access panel.

(c) If removed, install clearance panels for fwd boost pump removal valve handles. Make sure that retaining chain is not pinched between panel and stringers before tightening screws.
(d) Remove electrical power, if no longer required.

F. Fuel Tank No. 1 and 2 Fuel Boost Pump Bypass Valve Test (using fueling truck)

(1) Equipment and Materials

(a) Lock Assembly, Fuel Boost Pump Bypass Valve - ME65-16713 (two each)

(2) Prepare Boost Pump Bypass Valve for Test

(a) Connect electrical power to airplane (AMM Chapter 24).

(b) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(c) Remove fuel boost pump access panels No. 6303L, 7201L, 7203L, 6403R, 7401R and 7403R, as applicable.

NOTE: Access panels No. 6303L and 6403R are not used on airplanes having leading edge flaps covering fwd boost pumps.

*[1] AR ALL EXCEPT LV-JMW thru LV-JMY;
MD ALL EXCEPT 5R-MFA;
ND CF-NAP, CF-NAW, C-GNDL, plus airplanes POST-SB 28-1018;
PV ALL EXCEPT CF-TAN, CF-TAO;
TM ALL EXCEPT CR-BAA, CR-BAB;
ZD ALL EXCEPT G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC

(d) Open manual defueling valve.

(e) Remove cap from pressure fueling receptacle, and connect hose from fueling truck.

(f) Make sure that each fuel tank contains at least 150 gallons of fuel.

(g) Remove applicable fuel boost pump bypass valve access plugs in wing lower surface.

(3) Test Fuel Tank No. 1 Fuel Boost Pump Bypass Valve

(a) Close all six fuel boost pump removal valves.

(b) Place crossfeed valve switch, on forward overhead panel, in the OPEN position.

(c) Using lock assembly, lock tank No. 2 boost pump bypass valve in close position.

(d) Install lock assembly on tank No. 1 boost pump bypass valve operating rod. Lock tank No. 1 bypass valve.

(e) Apply suction from fueling truck. No fuel shall be drawn from tank.

(f) Unlock tank No. 1 boost pump bypass valve. Fuel flow from tank shall start.
(g) Stop suction from fueling truck.
(h) Open all fuel boost pump removal valves.

NOTE: If tank No. 2 boost pump bypass valve is to be tested do not open the three boost pump removal valves in tank No. 2.

(i) Remove lock assemblies from boost pump bypass valve operating rods.

NOTE: If tank No. 2 boost pump bypass valve is to be tested do not remove lock assembly from tank No. 2 bypass valve.

(j) Place crossfeed valve switch, on forward overhead panel in the CLOSED position.

(4) Test Fuel Tank No. 2 Fuel Boost Pump Bypass Valve
(a) Close all three fuel boost pump removal valves in tank No. 2.
(b) Make sure that fuel crossfeed valve, on forward overhead panel, is in the CLOSED position.
(c) Install lock assembly on tank No. 2 boost pump bypass valve operating rod. Lock tank No. 2 bypass valve.
(d) Apply suction from fueling truck. No fuel shall be drawn from tank.
(e) Unlock boost pump bypass valve. Fuel flow from tank shall start.
(f) Stop suction from fueling truck.
(g) Open all fuel boost pump removal valves.
(h) Remove lock assembly from boost pump bypass valve operating rod.

(5) Restore Airplane to Normal Configuration
(a) Install fuel boost pump bypass valve access plugs.
(b) Disconnect suction hose from fueling receptacle and install cap.
(c) Close manual defueling valve.
(d) Install fuel boost pump access panels.

NOTE: Make sure that boost pump removal valve is open before installing boost pump access panel.

(e) If removed, install small clearance panels below main tank FWD boost pump removal valve handles. Make sure that retaining chain is not pinched between panel and stringers before tightening screws.

(f) Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(g) Remove electrical power, if no longer required.

G. Fuel Boost Pump Bypass Valve Test (using airplane engines)

(1) Test Fuel Boost Pump Bypass Valve

(a) Make sure fuel crossfeed valve on forward overhead panel is in the CLOSED position (Fig. 501).

NOTE: When performing this test, a direct tank to engine fuel feed must be used.

(b) Start engine No. 1 (AMM Chapter 71, Power Plant).

(c) With engine running at idle, place L CTR tank and tank No. 1 boost pump switches on forward overhead panel in the OFF position.

(d) Make sure the fuel flow to engine is uninterrupted.

NOTE: If fuel flow decreases and a possible engine flameout is indicated, shut down engine by placing start lever in CUTOFF position.

(e) Advance thrust lever to 93% N2 position (90% takeoff thrust) and monitor fuel flow and engine operation.

(f) Make sure fuel flow increases and engine operates normally at 93% N2 position.

NOTE: At first indication of power loss, shut down engine (AMM 71-09-100/201).

(g) Return thrust lever to idle position and ensure engine runs normally.

(h) Put the L CTR tank and tank No. 1 boost pump switches to ON position.

1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(i) Stop the engine (AMM Chapter 71, Power Plant).
(j) If engine had to be shut down due to lack of fuel, do the bypass valve test per par. F.
(k) Repeat steps (a) thru (j) for tank No. 2 boost pump bypass valve, except substitute:
1) Engine No. 2 for engine No. 1
2) R CTR tank boost pump switch for L CTR tank boost pump switch
3) Tank No. 2 boost pump switches for tank No. 1 boost pump switches
(l) Results of the test of tank No. 2 boost pump bypass valve shall be the same as the tank No. 1 boost pump bypass valve test.

H. Fuel Feed System Leak Test
(1) Prepare Fuel Feed System for Leak Test
(a) Connect electrical power to airplane.
(b) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

(c) Make sure all fuel boost pump switches, on the forward overhead panel, are in OFF position.
(d) Make sure the engine fuel shutoff valves are open (Fig. 501).
(e) Make sure the manual defueling valve is closed.
(f) Put the crossfeed valve switch, on forward overhead panel, in OPEN position.
(g) Manually open the APU fuel valve.

(2) Test Fuel Feed System for Leaks
(a) Put the tank No. 1 FWD boost pump switch in ON position.
1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(b) When boost pump low pressure indicating light goes off, check the following points for fuel leaks.
1) Engine fuel shutoff valve on left wing front spar.
2) Crossfeed valve on left wing front spar.
3) Engine fuel shutoff valve on right wing front spar.
4) Manual defueling valve on right wing front spar.

NOTE: If fuel continues to leak, replace the engine fuel shutoff valve or the crossfeed valve.

5) Center cavity/APU fuel line shroud drain mast.
6) APU fuel valve on left wing rear spar.
7) APU fuel line shroud drain port at rear of airplane.
(c) Put the tank No. 1 FWD boost pump switch in OFF position.
(3) Restore Airplane to Normal Configuration
(a) Manually close APU fuel valve.
(b) Place crossfeed valve switch, on forward overhead panel, in CLOSED position.
(c) Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(d) Determine whether there is any further need for electrical power on airplane, if not, remove power.

I. Test APU Fuel Shutoff Valve
(1) Prepare for APU fuel shutoff valve test.
(a) Connect external electrical power to airplane (AMM 24-22-0/201).

(b) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

<u>WARNING</u>: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(c) Open APU FIRE EXT BOTTLE circuit breaker on P6 panel and attach DO-NOT-CLOSE identifier.

<u>CAUTION</u>: ACCIDENTAL DISCHARGE OF APU FIRE BOTTLE CAN OCCUR IF CIRCUIT BREAKER IS NOT OPENED.

(d) Close APU CONT circuit breaker on P6 panel.
(e) Close INDICATOR LTS MASTER DIMMING control cabin lighting circuit breaker on P6 panel.
(f) Position BAT switch, on forward overhead panel (P5), to ON.

(2) Test APU fuel shutoff valve.
(a) Place APU master switch to ON position.
(b) Make sure that valve override handle moves to OPEN position.
(c) Pull APU fire handle on engine and APU fire control module on P8 panel.
(d) Make sure that valve override handle moves to CLOSE position.
(e) Push fire handle into the stowed position.
(f) Make sure that valve override handle moves to OPEN position.
(g) Pull APU remote fire handle on the APU remote fire control panel P28 in the right wheel well.
(h) Make sure that valve override handle moves to CLOSE position.
(i) Push APU fire handle to stowed position.
(j) Make sure that valve override handle moves to OPEN position.
(k) Place APU master switch in OFF position.
(l) Make sure that valve override handle moves to CLOSE position.

(3) Restore airplane to normal.
(a) Remove DO-NOT-CLOSE identifier and close P6 panel APU FIRE EXT BOTTLE circuit breaker.

<u>CAUTION</u>: CIRCUIT BREAKER MUST BE CLOSED FOR APU FIRE EXTINGUISHING SYSTEM TO BE OPERATIONAL.

(b) Open INDICATOR LTS MASTER DIMMING control cabin lighting circuit breaker on P6 panel.
(c) Position BAT switch, on forward overhead panel (P5), to OFF.

(d) Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(e) Remove electrical power, if no longer needed (AMM 24-22-0/201).

3. AIRPLANES WITH AUTO SHUTOFF SYSTEM (POST-SB 28A1228);
Center Fuel Boost Pump Auto Shutoff Functional Test

A. General
(1) ALI - Refer to task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on airworthiness limitation instructions (ALIs).
(2) You need two people to do this test. One person in the flight compartment and one person in the main equipment center.

B. References
(1) AMM 12-11-01/301, Fuel - Servicing
(2) AMM 28-22-0/201, Manual Control

C. Equipment
(1) Stopwatch - commercially available

D. Prepare for the Functional Test
(1) Make sure that electrical power is applied to the airplane (AMM 24-22-0/201).
(2) Make sure there is a minimum fuel quantity of 2000 pounds (910 kilograms) in the center fuel tank.
(a) Refuel the tank if it is necessary (AMM 12-11-01/301).
(3) Make sure that the fueling station access door on the right wing is closed.
(4) Make sure these circuit breakers are closed:
(a) Main Equipment Center, Miscellaneous Relay Box, J2802:
1) FUEL CONT AUTOSHUT OFF CTR LEFT
2) FUEL CONT AUTOSHUT OFF CTR RIGHT
(b) Right Load Control Center, P6;
1) 6E5, BOOST PUMP CTR TANK LEFT
2) 6D5, BOOST PUMP CTR TANK RIGHT
3) 6E3, FUEL CONT NO. 1 AFT, NO. 2 FWD, CTR L
4) 6E7, FUEL CONT NO. 1 FWD, NO. 2 AFT CTR R
5) 6D10, MASTER CAUTION FUEL SYSTEM
6) 6D11, MASTER CAUTION ANNUNCIATOR BAT

7) 6D12, MASTER CAUTION ANNUNCIATOR NO. 1

(5) Make sure that these boost pump switches on the overhead panel, P5, are in the OFF position:

NOTE: This will make sure the auto shutoff system is reset.

(a) L CTR
(b) R CTR

(6) Make sure that one person is in the flight compartment with a stopwatch and one person is in the main equipment center.
(a) Make sure that they are in communication with each other.

E. Auto Shutoff Functional Test for the Left Center Fuel Boost Pump

(1) Put the L CTR boost pump switch on the overhead panel, P5, to the ON position.
(2) Make sure that the LOW PRESSURE light for the left center fuel boost pump goes off.
(3) In the main equipment center, at the miscellaneous relay box, J2802, put and hold, for 1 to 5 seconds, the left center auto shutoff test switch, S3318, to the CENTER-LEFT position and release it.
(4) In the flight compartment, make sure the LOW PRESSURE light for the left center fuel boost pump stays off.
(5) Make sure that the person in the flight compartment sets the stopwatch to zero.
(6) When the person in the main equipment center, at the miscellaneous relay box, J2802, puts and holds the left center auto shutoff test switch, S3318, to the CENTER-LEFT position, start the stopwatch.
(7) In the flight compartment, when the LOW PRESSURE light for the left center fuel boost pump on the P5 panel comes on, stop the stopwatch.
(8) Make sure the stopwatch shows 15 ±2 seconds.
(9) In the main equipment center, at the miscellaneous relay box, J2802, release the left center auto shutoff test switch, S3318.
(10) In the flight compartment, make sure the LOW PRESSURE light for the left center fuel boost pump stays on.
(11) Put the L CTR boost pump switch to the OFF position.

F. Auto Shutoff Functional Test for the Right Center Fuel Boost Pump

(1) Put the R CTR boost pump switch on the overhead panel, P5, to the ON position.
(2) Make sure that the LOW PRESSURE light for the right center fuel boost pump goes off.

(3) In the main equipment center, at the miscellaneous relay box, J2802, put and hold, for 1 to 5 seconds, the right center auto shutoff test switch, S3321, to the CENTER-RIGHT position and release it.
(4) In the flight compartment, make sure that the LOW PRESSURE light for the right center fuel boost pump stays off.
(5) Make sure that the person in the flight compartment sets the stopwatch to zero.
(6) When the person in the main equipment center, at the miscellaneous relay box, J2802, puts and holds the right center auto shutoff test switch, S3321, to the CENTER-RIGHT position, start the stopwatch.
(7) In the flight compartment, when the LOW PRESSURE light for the right center fuel boost pump on the P5 panel comes on, stop the stopwatch.
(8) Make sure that the stopwatch shows 15 ±2 seconds.
(9) In the main equipment center, at the miscellaneous relay box, J2802, release the right center auto shutoff test switch, S3321.
(10) In the flight compartment, make sure that the LOW PRESSURE light for the right center fuel boost pump stays on.
(11) Put the R CTR boost pump switch to the OFF position.

G. Master Caution Functional Test for the Center Tank Fuel Boost Pumps
(1) In the flight compartment, put the L CTR and R CTR boost pump switches on the overhead panel, P5, to the ON position.
(2) Make sure that the LOW PRESSURE lights for the left and right center fuel boost pumps go off.
(3) Push the MASTER CAUTION light on the left or right light shield, P7, to reset the master caution panel.
(a) Make sure that the left and right MASTER CAUTION lights are off.
(b) Make sure that the FUEL annunciator light on the left light shield is off.
(4) To make sure that the master caution function of the left center fuel boost pump operates correctly, do these steps:
(a) Make sure that the stopwatch shows zero.
(b) In the main equipment center, at the miscellaneous relay box, J2802, put and hold the left center auto shutoff test switch, S3318, to the CENTER-LEFT position.
(c) In the flight compartment, make sure that the LOW PRESSURE light for the left center fuel boost pump comes on in approximately 15 seconds.
(d) When the person in the main equipment center releases the left center auto shutoff test switch, S3318, start the stopwatch.
(e) When the MASTER CAUTION and FUEL annunciator lights in the flight compartment come on, stop the stopwatch.
(f) Make sure that the stopwatch shows 10 ±2 seconds.
(g) Put the L CTR boost pump switch on the P5 panel to the OFF position and then to the ON position.
(h) Make sure that the LOW PRESSURE lights for the left and right center fuel boost pumps are off.
(i) Push the MASTER CAUTION light on the right lightshield to set the master caution panel again.
1) Make sure that the left and right MASTER CAUTION lights are off.

2) Make sure that the FUEL annunciator light on the left lightshield is off.

(5) To make sure that the master caution function of the right center fuel boost pump operates correctly, do these steps:

(a) Make sure that the stopwatch shows zero.

(b) In the main equipment center, and the miscellaneous relay box, J2802, put and hold the right center auto shutoff test switch, S3321, to the CENTER-RIGHT position.

(c) In the flight compartment, make sure that the LOW PRESSURE light for the right center fuel boost pump comes on in approximately 15 seconds.

(d) When the person in the main equipment center releases the right center auto shutoff test switch, S3321, start the stopwatch.

(e) When the MASTER CAUTION and FUEL annunciator lights in the flight compartment come on, stop the stopwatch.

(f) Make sure that the stopwatch shows 10 ±2 seconds.

(g) Put the R CTR boost pump switch on the P5 panel to the OFF position and then to the ON position.

(h) Make sure that the LOW PRESSURE lights for the left and right center fuel boost pumps are off.

(i) Push the MASTER CAUTION light on the right light shield to set the master caution panel again.

1) Make sure that the left and right MASTER CAUTION lights are off.

2) Make sure that the FUEL annuciator light on the left light shield is off.

(6) Put the L CTR and R CTR boost pump switches on the P5 panel to the OFF position.

(7) Make sure that the LOW PRESSURE lights for the left and right center fuel boost pumps are off.

ENGINE FUEL FEED SYSTEM - CLEANING/PAINTING

1. General
   A. This procedure is used to flush the engine fuel feed system fuel lines.
2. Engine Fuel Feed System Fuel Line Flushing
   A. Equipment and Materials
      (1) Catch Tank - 55-gallon, one each engine
      (2) Catch Tank - 5-gallon, suitable for draining engine fuel feed lines
      (3) Adapter - MS24398-16-6
      (4) Hose - 3/8 inch, length suitable to reach catch tank
   B. Prepare for Flushing
      (1) Make sure that engine fuel shutoff valves and crossfeed valve are open.
      (2) Drain engine fuel feed lines into 5-gallon container by opening fuel filter drain port. Close drain port and lockwire (Ref 71-00 R/I).
      (3) Disconnect each engine fuel feed hose at its lower end. Install adapter and route hose to 55-gallon catch tank.
      (4) Check that boost pump switches on P5 panel are in OFF position.
      (5) Check that circuit breakers FUEL CONT NO. 1 AFT NO. 2 FWD, CTRL, FUEL CONT NO. 1 FWD, NO. 2 AFT, and CTR R on P6 panel are closed.
   C. Flush Engine Fuel Feed System Fuel Lines
      (1) Provide electrical power (Ref 24-22-0 MP).
      (2) Position each boost pump switch to ON, one at a time, for 10 seconds.

         WARNING: OPERATING ANY BOOST PUMP FOR LONGER THAN 10 SECONDS MAY OVERFILL CATCH TANK.

   D. Restore Airplane to Normal
      (1) Remove electrical power if no longer required.
      (2) Remove adapter and hose, and reconnect engine fuel feed hoses.

ENGINE FUEL SHUTOFF VALVE - REMOVAL/INSTALLATION

1. General
   A. Removal/installation of both engine fuel shutoff valves is the same, the only difference being location. The No. 1 engine fuel shutoff valve is mounted on the left wing front spar and No. 2 on the right wing front spar.
   B. The fuel shutoff valve is composed of three major assemblies: actuator assembly, gate assembly, and port adapter assembly. The actuator assembly is bolted to the gate assembly and may be replaced separately or with the gate assembly as an assembled unit. Replacement of the port adapter assembly requires removal of the actuator and gate assemblies and complete defueling of the applicable fuel tank.
2. Equipment and Materials
   A. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Grease, Aircraft, High Temperature - MIL-G-3545 (AMM 20-30-21/201)
   C. Leading Edge Flap Actuator Locks - F80048-36
   D. Cleaning Solvent - Aliphatic Naphtha TT-N-95 (AMM 20-30-31/201)
   E. Lock Assembly Fuel Boost Pump Bypass Valve - ME65-16713
   F. Bonding meter (AMM 20-22-01/601)
   G. Insulation Tape - MIL-I-23594B (AMM 20-30-51/201)
3. Prepare for Removal
   A. Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

      WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. THE FLAPS MOVE QUICKLY AND CAN CAUSE INJURY TO PERSONS.

   B. Open engine fuel shutoff valve circuit breakers (P6).
4. Removal/Installation of Engine Fuel Shutoff Valve Actuator Assembly
   A. Remove Engine Fuel Shutoff Valve Actuator Assembly
      (1) Disconnect electrical plug from valve (Fig. 401).
      (2) Disconnect bonding jumper from valve.
      (3) Support actuator assembly and remove mounting bolts.

         CAUTION: IF ACTUATOR ASSEMBLY IS NOT SUPPORTED WHEN REMOVING BOLTS, THE SPLINED SHAFTS MAY BE DAMAGED.

      (4) Carefully slide actuator assembly away from gate assembly until output shaft is clear of mating part; lift actuator assembly clear.
   B. Install Engine Fuel Shutoff Valve Actuator Assembly
      (1) Lightly coat splines of output shaft with grease.
      (2) Align actuator assembly output shaft with gate assembly input shaft, rotate output shaft until index spline lines up with index spline in input shaft.

(3) Insert end of output shaft into input shaft, then carefully slide output shaft into input shaft until actuator mounting flange contacts gate assembly.

CAUTION: TO AVOID DAMAGE TO SPLINED SHAFTS, ACTUATOR ASSEMBLY MUST BE SUPPORTED SO THAT WEIGHT IS NOT ON SHAFT.

(4) If actuator assembly mounting holes do not line up with mating holes, carefully rotate actuator assembly until holes are aligned.
(5) Install actuator assembly mounting bolts.
(6) Connect bonding jumper to actuator assembly.
(7) Connect electrical plug to actuator assembly. Make sure any slack in wire bundle is used in a drip loop between plug and nearest clamp and not between clamps. If necessary, loosen last three clamps and reposition slack.

CAUTION: MAKE SURE WIRE BUNDLE HAS BEEN PROTECTED FROM CHAFING BY AN OVERWRAP OF TAPE FROM CONNECTOR PLUG TO JUST BEYOND THIRD CLAMP.

NOTE: Tape used for overwrap is applied with 50% overlap.

(8) Do a check of the electrical bond between the actuator assembly and the airplane structure (AMM 20-22-01/601).
(a) Make sure the resistance is 0.0025 ohm (2.5 milliohms) or less.
(9) Do a check of the functional operation of the shutoff valve (AMM 28-22-0/501).

5. Removal/Installation of Engine Fuel Shutoff Valve Gate Assembly
A. Make sure crossfeed manifold valve is closed.
B. Remove fuel boost pump bypass valve access plug, for tank numbered same as valve being removed, and install lock assembly to close bypass valve.
C. Remove Engine Fuel Shutoff Valve Gate Assembly
(1) Disconnect electrical plug from valve (Fig. 401).
(2) Disconnect bonding jumper from valve.
(3) Place suitable container under valve to catch fuel.
(4) Remove gate assembly attaching nuts and washers.
(5) Carefully withdraw gate assembly from opening in front spar and lift clear.

NOTE: If port adapter assembly is not being removed, check that its mounting bolts were not loosened during removal of gate assembly attaching nuts.

D. Install Engine Fuel Shutoff Valve Gate Assembly
(1) Clean O-ring groove in gate assembly housing and machined surface of front spar with solvent, wipe dry with a cotton wiper (BMS15-5).

(2) Install new O-ring, lightly lubricated with fuel, into groove on gate assembly housing.
(3) Carefully insert gate assembly into port adapter through opening in front spar.
(4) Install gate assembly attaching nuts and washer. Torque 50 to 70 pound-inches.
(5) Connect electrical plug to actuator assembly. Ensure that any slack in wire bundle is utilized in a drip loop between plug and nearest clamp and not between clamps. If necessary, loosen last three clamps and reposition slack.

CAUTION: MAKE SURE THAT WIRE BUNDLE HAS BEEN PROTECTED FROM CHAFING BY AN OVERWRAP OF TAPE FROM CONNECTOR PLUG TO JUST BEYOND THIRD CLAMP.

NOTE: Tape used for overwrap is applied with 50% overlap.

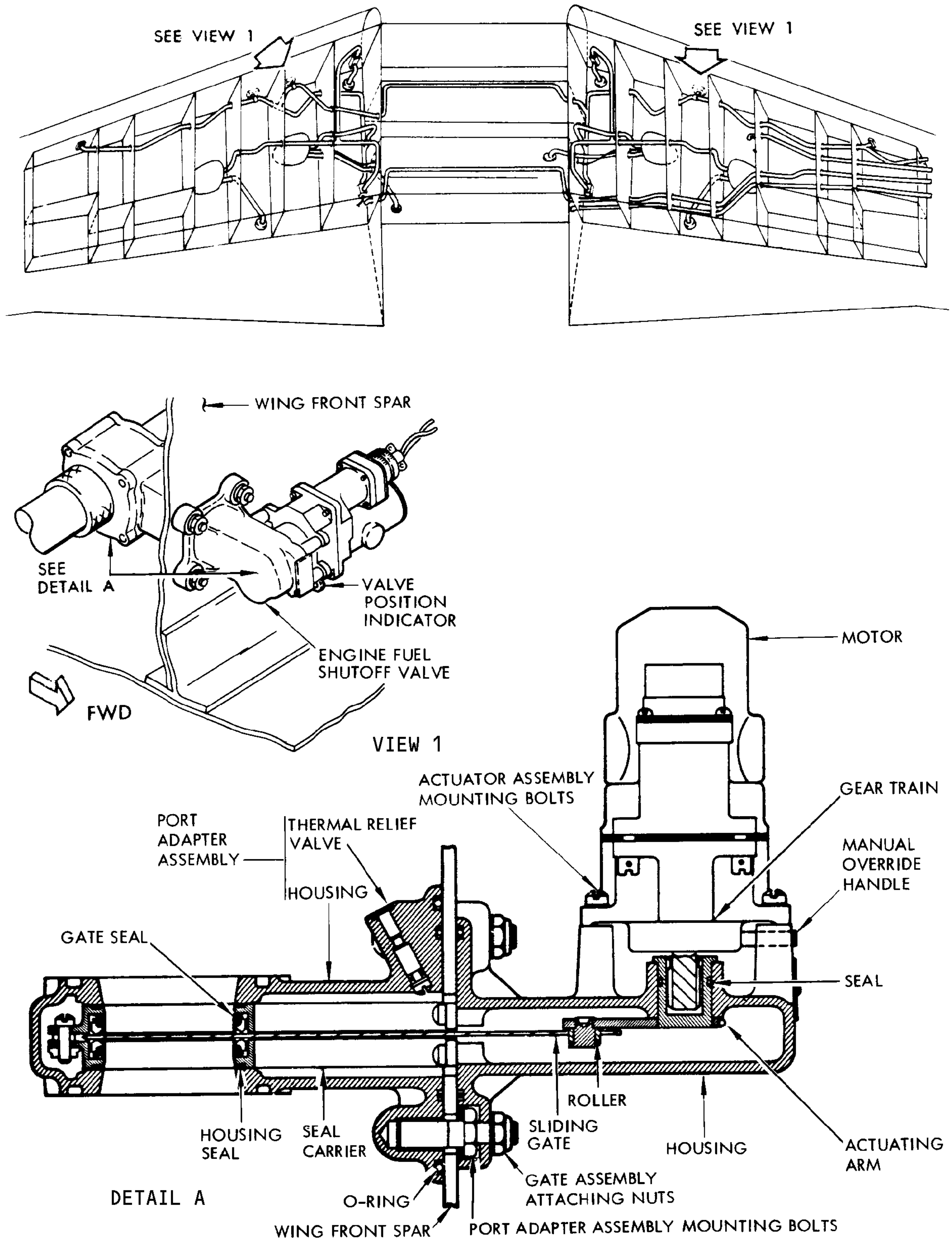
(6) Connect bonding jumper to actuator assembly.
(7) Do a check of the electrical bond between the actuator assembly and the airplane structure (AMM 20-22-01/601).
(a) Make sure the resistance is 0.0025 ohm (2.5 milliohms) or less.
(8) Open fuel boost pump bypass valve by removing lock assembly and install access plug.
(9) Do a leak check and a check of the functional operation of the shutoff valve (AMM 28-22-0/501).

6. Removal/Installation of Engine Fuel Shutoff Valve Port Adapter Assembly

A. Defuel and purge the applicable fuel tank (AMM 28-23-0/201, AMM 28-10-0/201).
B. Remove the applicable fuel tank access panel No. 1 to get access to the rear of the wing front spar (AMM 28-11-11/401).
C. Remove Engine Fuel Shutoff Valve Port Adapter Assembly
(1) Perform steps 5.C.(1) thru 5.C.(5) to remove gate assembly.
(2) Gain access to valve through access panel No. 1 and remove bolts attaching fuel line flanges to port adapter assembly.
(3) With one man inside fuel tank supporting port adapter assembly, second man, outside fuel tank, remove port adapter assembly mounting bolts and washers (Fig. 401).

CAUTION: DO NOT ALLOW ADAPTER ASSEMBLY TO FALL, DAMAGE TO WING SKIN OR FUEL TANK SEALING MAY RESULT.

(4) Slide port adapter assembly from between fuel line flanges and lift clear.
D. Install Engine Fuel Shutoff Valve Port Adapter Assembly
(1) Clean O-ring grooves and machined surfaces of port adapter, fuel line flanges, and front spar with solvent and wipe dry with a cotton wiper (BMS15-5).



Engine Fuel Shutoff Valve Installation
Figure 401

(2) Install new O-rings, lightly lubricated with fuel into grooves on port adapter assembly.
(3) Carefully slide port adapter assembly into position between fuel line flanges.

CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN INSERTING PORT ADAPTER ASSEMBLY.

(4) Install bolts attaching fuel line flanges to adapter assembly.
(5) From outside fuel tank, install port adapter assembly mounting bolts and washers and torque 100 to 140 pound-inches.
(6) Perform steps 5.D.(1)thru 5.D.(7) to install gate assembly.
(7) Install the fuel tank access panel (AMM 28-11-11/401).
(8) Do a leak check and a check of the functional operation of shutoff valve (AMM 28-22-0/501).

7. Restore Airplane to Normal

A. Remove the leading edge flap locks and retract the flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

B. Close engine fuel shutoff valve circuit breakers (P6).

ENGINE FUEL SHUTOFF VALVE - INSPECTION/CHECK

1. General
   A. This procedure contains instructions to do a bonding resistance check for each engine fuel shutoff valve.
2. Engine Fuel Shutoff Valve - Bonding Resistance Check (Fig. 601)
   A. References
      (1) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zones

303	Left Wing Inboard Leading Edge
305	Left Fuel Tank
403	Right Wing Inboard Leading Edge
405	Right Fuel Tank

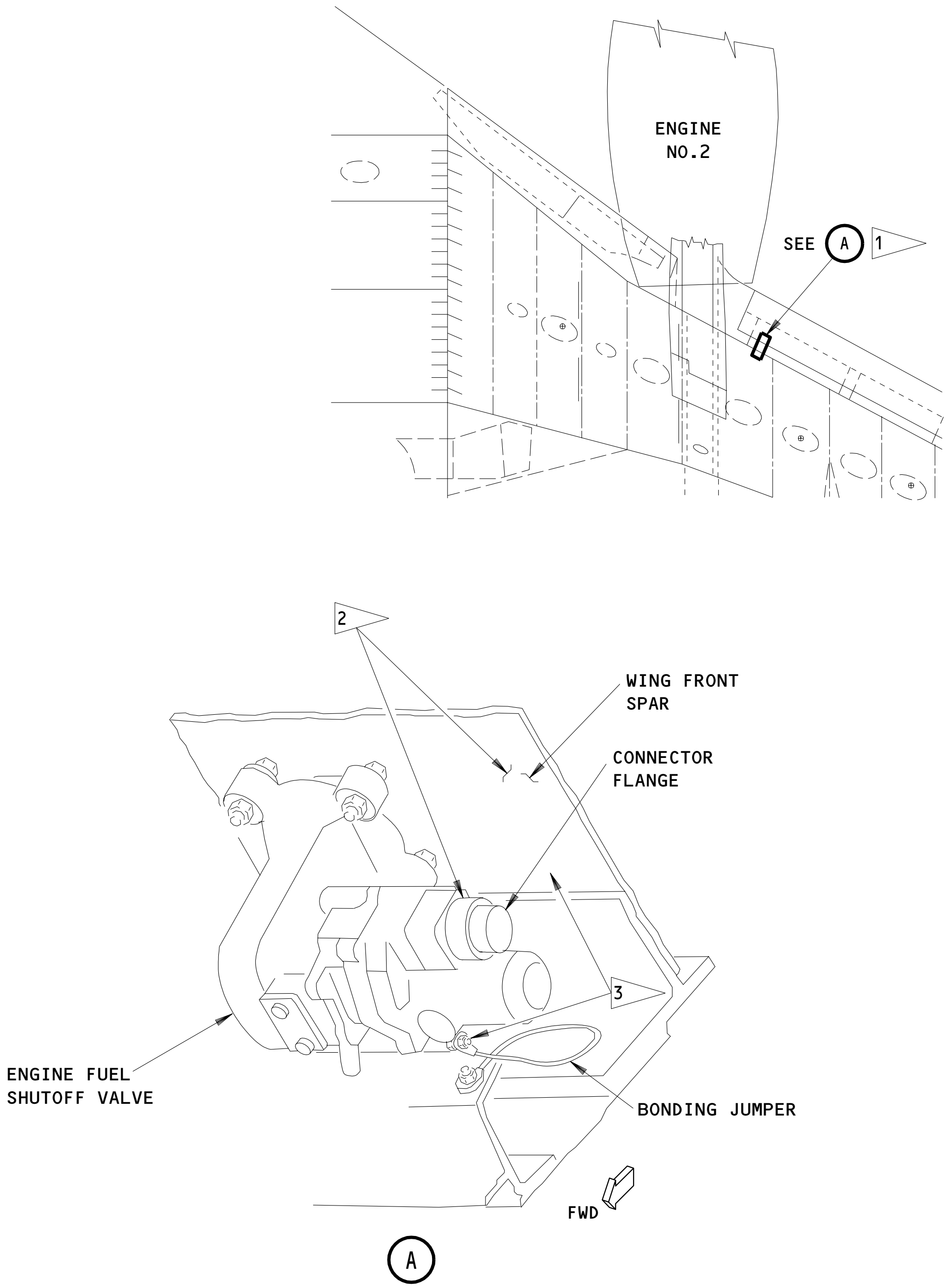
      (2) Access Panels

6212	Slat Access Panel (Left)
6512	Slat Access Panel (Right)

   D. Procedure
      (1) Open the applicable access door, 6212 or 6512, to the engine fuel shutoff valve.

         NOTE: These access doors are immediately outboard of the engine.

      (2) Disconnect the electrical connector from the shutoff valve.
      (3) Do a check of the bonding resistance between the engine fuel shutoff valve connector flange and the wing front spar (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.001 ohm (1.0 milliohm) or less.
      (4) Do a check of the bonding resistance between the bonding jumper terminal and the wing front spar (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.0025 ohm (2.5 milliohms) or less.
      (5) Reconnect the electrical connector to the shutoff valve.
      (6) Close the access door, 6212 or 6512, for the engine fuel shutoff valve.



1 NO. 2 ENGINE FUEL SHUTOFF VALVE IS SHOWN, NO. 1 ENGINE FUEL SHUTOFF VALVE IS OPPOSITE.

2 THE RESISTANCE FROM THE CONNECTOR FLANGE TO THE WING FRONT SPAR IS 0.001 OHM OR LESS.

3 THE RESISTANCE FROM THE BONDING JUMPER TERMINAL TO THE WING FRONT SPAR IS 0.0025 OHMS OR LESS.

Engine Fuel Shutoff Valve Resistance Check
Figure 601

FUEL CROSSFEED VALVE - REMOVAL/INSTALLATION

1. General
   A. The fuel crossfeed valve is mounted on the left wing front spar. The fuel crossfeed valve is composed of three major assemblies: actuator assembly, gate assembly, and port adapter assembly. The actuator assembly is bolted to the gate assembly and may be replaced separately or with the gate assembly as an assembled unit. Replacement of the port adapter assembly requires removal of the actuator and gate assemblies and complete defueling of the No. 1 fuel tank.
2. Removal/Installation of Crossfeed Valve Actuator Assembly
   A. Equipment and Materials
      (1) Bonding meter (AMM 20-22-01/601)
      (2) Grease, Aircraft, High Temperature - MIL-G-3545
      (3) Insulation Tape - MIL-I-23594B (AMM 20-30-51/201)
   B. Prepare for Crossfeed Valve Actuator Assembly Removal
      (1) Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

         WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS MOVE QUICKLY AND CAN CAUSE INJURY TO PERSONS.

      (2) Open crossfeed valve circuit breaker on aft overhead panel (P6).
   C. Remove Crossfeed Valve Actuator Assembly
      (1) Disconnect electrical plug from valve (Fig. 401).
      (2) Disconnect bonding jumper from valve.
      (3) Support actuator assembly and remove mounting bolts.

         CAUTION: IF ACTUATOR ASSEMBLY IS NOT SUPPORTED WHEN REMOVING BOLTS THE SPLINED SHAFTS MAY BE DAMAGED.

      (4) Carefully slide actuator assembly away from gate assembly until output shaft is clear of mating part; lift actuator assembly clear.
   D. Install Crossfeed Valve Actuator Assembly
      (1) Lightly coat splines of output shaft with grease.
      (2) Align actuator assembly output shaft with gate assembly input shaft, rotate output shaft until index spline lines up with spline in input shaft.

(3) Insert end of output shaft into input shaft, then carefully slide output shaft into input shaft until actuator mounting flange contacts gate assembly.

CAUTION: TO AVOID DAMAGE TO SPLINED SHAFTS, ACTUATOR ASSEMBLY MUST BE SUPPORTED SO THAT WEIGHT IS NOT ON SHAFT.

(4) If actuator assembly mounting holes do not line up with mating holes, carefully rotate actuator assembly until holes are aligned.
(5) Install actuator assembly mounting bolts.
(6) Connect bonding jumper to actuator assembly.
(7) Connect electrical plug to actuator assembly. Make sure any slack in wire bundle is used in a drip loop between plug and nearest clamp and not between clamps. If necessary, loosen last three clamps and reposition slack.

CAUTION: MAKE SURE WIRE BUNDLE HAS BEEN PROTECTED FROM CHAFING BY AN OVERWRAP OF TAPE FROM CONNECTOR PLUG TO JUST BEYOND THIRD CLAMP.

NOTE: Tape used for overwrap is applied with 50% overlap.

(8) Do a check of the electrical bond between the actuator assembly and the airplane structure (AMM 20-22-01/601).
(a) Make sure the resistance is 0.0025 ohm (2.5 milliohms) or less.

E. Restore Airplane to Normal Configuration
(1) Remove the leading edge flap locks and retract the flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(2) Close crossfeed valve circuit breaker on panel P6.

3. Removal/Installation of Crossfeed Valve Gate Assembly
A. Equipment and Materials
(1) Aliphatic Naphtha - TT-N-95 (AMM 20-30-31/201)

(2) G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
(3) Lock Assembly, Fuel Boost Pump Bypass Valve - ME-65-16713 (two each)
(4) Bonding meter (AMM 20-22-01/601)
(5) Insulation Tape - MIL-I-23594B (AMM 20-30-51/201)

B. Prepare for Crossfeed Valve Gate Assembly Removal
(1) Remove fuel boost pump bypass valve access plugs, for tank No. 1 and 2, and install lock assembly to close bypass valve.
(2) Extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

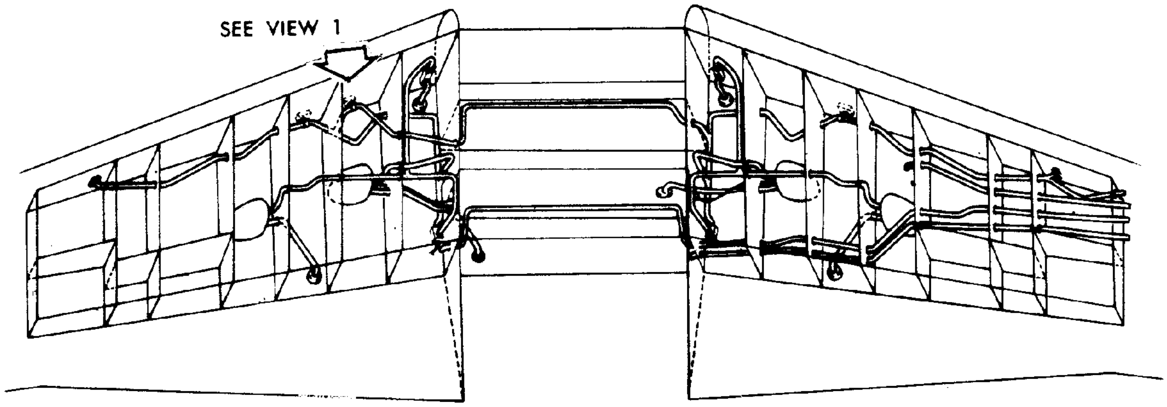
WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. THE FLAPS MOVE QUICKLY AND CAN CAUSE INJURY TO PERSONS.

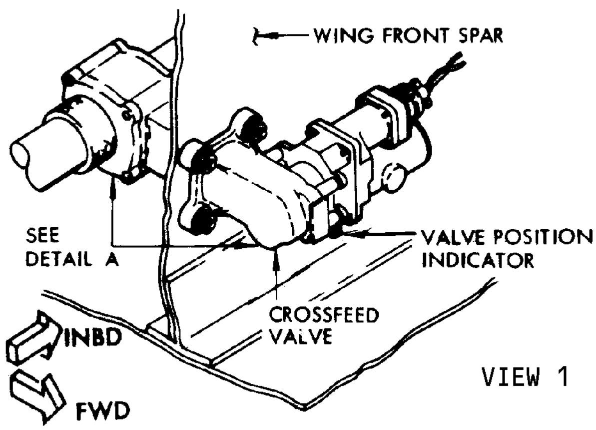
(3) Open crossfeed valve circuit breaker on panel P6.

C. Remove Crossfeed Valve Gate Assembly
(1) Disconnect electrical plug from valve (Fig. 401).
(2) Disconnect bonding jumper from valve.
(3) Place suitable container under valve to catch fuel.
(4) Remove gate assembly attaching nuts and washers.
(5) Carefully withdraw gate assembly from opening in front spar and lift clear.

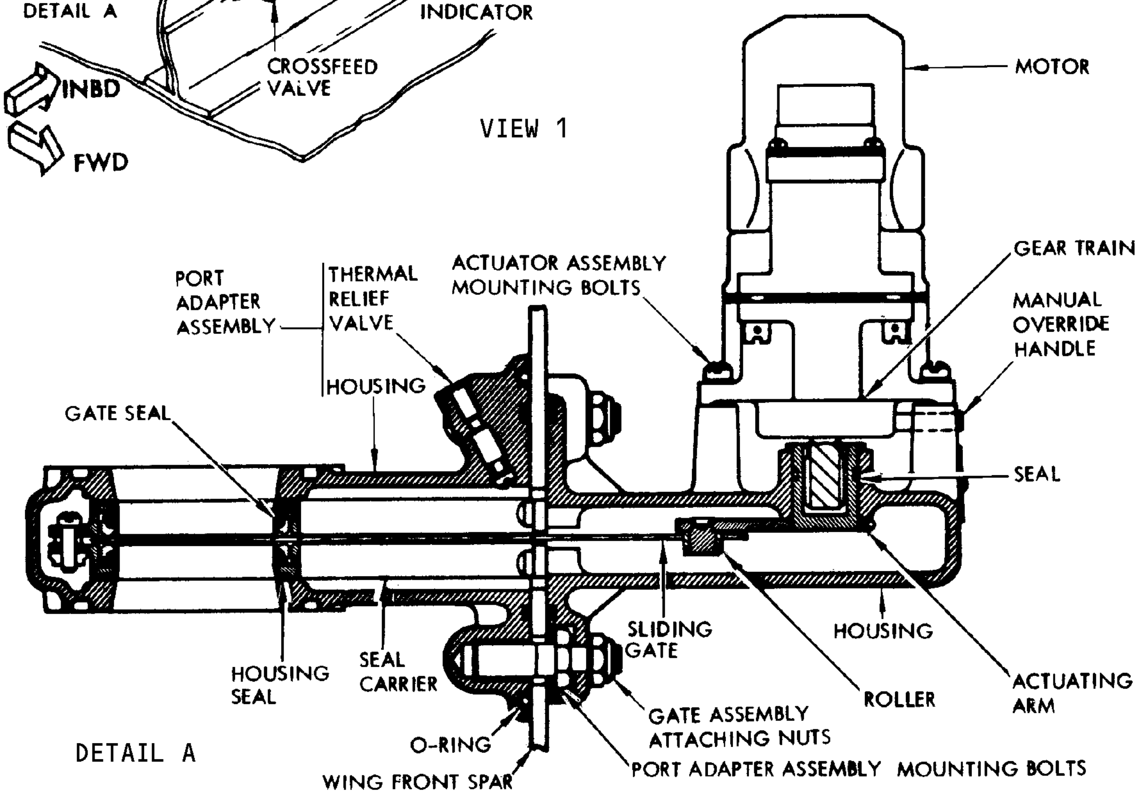
NOTE: If port adapter assembly is not being removed, check that its mounting bolts were not loosened during removal of gate assembly attaching nuts.

D. Install Crossfeed Valve Gate Assembly
(1) Clean O-ring groove in gate assembly housing and machined surface of front spar with naphtha, wipe dry with cotton wipers (BMS15-5).
(2) Install new O-ring, lightly lubricated with fuel, into groove on gate assembly housing.
(3) Carefully insert gate assembly into port adapter, through opening in front spar.
(4) Install gate assembly attaching nuts and washers. Torque 50-70 pound-inches.





VIEW 1



DETAIL A

Crossfeed Valve Installation
Figure 401

(5) Connect electrical plug to actuator assembly. Make sure that any slack in wire bundle is utilized in a drip loop between plug and nearest clamp and not between clamps. If necessary, loosen last three clamps and reposition slack.

CAUTION: MAKE SURE THAT WIRE BUNDLE HAS BEEN PROTECTED FROM CHAFING BY AN OVERWRAP OF TAPE FROM CONNECTOR PLUG TO JUST BEYOND THIRD CLAMP.

NOTE: Tape used for overwrap is applied with 50% overlap.

(6) Connect bonding jumper to actuator assembly.
(7) Check electrical bond between actuator assembly and airplane structure per 20-22-01. Resistance shall not exceed 0.0025 ohm.

E. Restore Airplane to Normal Configuration
(1) Remove lock assemblies to open fuel boost pump bypass valves and install access plugs.
(2) Do a leak-check and a check of the functional operation of crossfeed valve (AMM 28-22-0/501).
(3) Remove the leading edge flap locks and retract the flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

(4) Close crossfeed valve circuit breaker on panel P6.

4. Removal/Installation of Crossfeed Valve Port Adapter Assembly

A. Equipment and Materials
(1) Aliphatic Naphtha - TT-N-95 (AMM 20-30-31/201)
(2) G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
(3) Lock Assembly - Fuel Boost Pump Bypass Valve - ME-65-16713 (two each)

B. Prepare for Crossfeed Valve Port Adapter Removal
(1) Defuel and purge the fuel tank No. 1 (AMM 28-23-0/201, AMM 28-10-0/201).
(2) Remove fuel boost pump bypass valve access plugs, for tanks No. 1 and 2, and install lock assemblies to close bypass valves.
(3) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. THE FLAPS MOVE QUICKLY AND CAN CAUSE SERIOUS INJURY TO PERSONS.

(4) Remove the fuel tank No. 1 access panel No. 1 to get access to the rear of the wing front spar (AMM 28-11-11/401).

C. Remove Crossfeed Valve Port Adapter Assembly
(1) Perform steps 3.C.(1) thru 3.C.(5) to remove gate assembly.

(2) Gain access to valve through access panel No. 1 and rib access opening No. 2. Remove bolts attaching fuel line flanges to port adapter assembly.
(3) With one man inside fuel tank, supporting port adapter assembly, second man, outside fuel tank, remove port adapter assembly mounting bolts and washer (Fig. 401).

CAUTION: DO NOT ALLOW ADAPTER ASSEMBLY TO FALL, DAMAGE TO WING SKIN OR FUEL TANK SEALING MAY RESULT.

(4) Slide port adapter assembly from between fuel line flanges and lift clear.

D. Install Crossfeed Valve Port Adapter Assembly
(1) Clean O-ring grooves and machined surfaces of port adapter, fuel line flanges, and front spar with naphtha and wipe dry with cotton wipers (BMS15-5).
(2) Install new O-rings, lightly lubricated with fuel into grooves on port adapter assembly.
(3) Carefully slide port adapter assembly into position between fuel line flanges.

CAUTION: DO NOT DISLODGE OR PINCH. O-RING WHEN INSERTING PORT ADAPTER ASSEMBLY.

(4) Install bolts attaching fuel line flanges to adapter assembly.
(5) From outside fuel tank, install port adapter assembly mounting bolts and washers and torque 100 to 140 pound-inches.
(6) Perform steps 3.D.(1) thru 3.D.(7) to install gate assembly.

E. Restore Airplane to Normal Configuration
(1) Install the fuel tank access panel (AMM 28-11-11/401).
(2) Perform steps 3.E.(1) thru 3.E.(4).

FUEL CROSSFEED VALVE - INSPECTION/CHECK

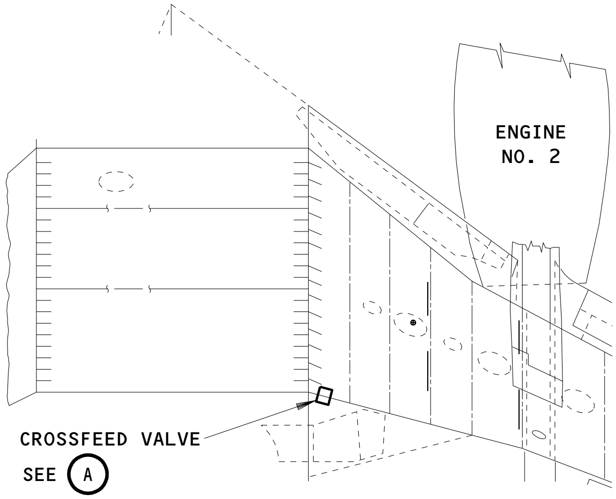
1. General
   A. This procedure contains instructions to do a bonding resistance check for the fuel crossfeed valve.
2. Fuel Crossfeed Valve - Bonding Resistance Check (Fig. 601)
   A. References
      (1) AMM 27-81-0/201, Leading Edge Flaps and Slats
      (2) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zone
          405 Right Fuel Tank

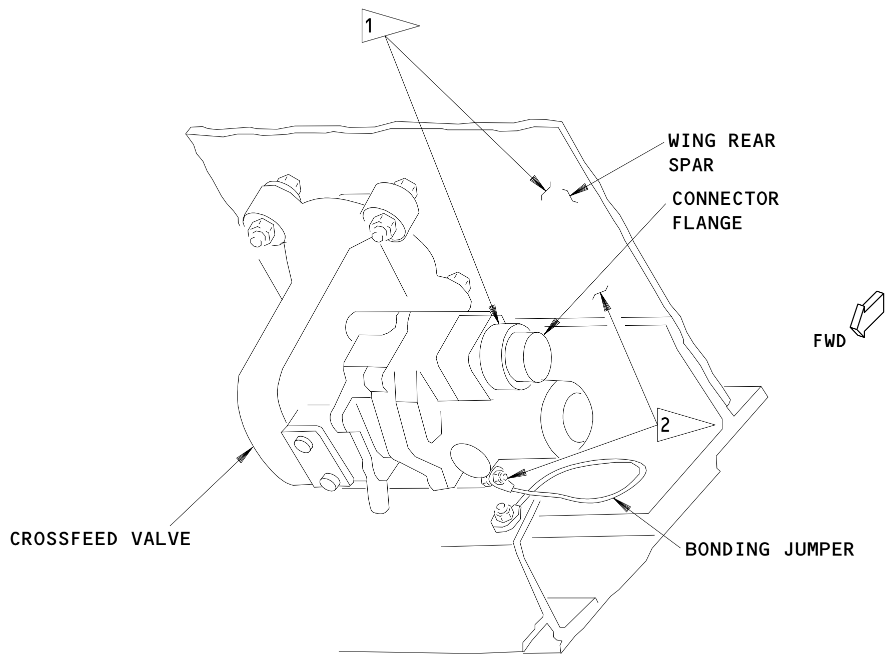
   D. Procedure
      (1) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

      WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

      (2) Disconnect the electrical connector from the fuel crossfeed valve.
      (3) Do a check of the bonding resistance between the fuel crossfeed valve connector flange and the wing rear spar (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.001 ohm (1.0 milliohm) or less.
      (4) Do a check of the bonding resistance between the bonding jumper terminal and the wing rear spar (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.0025 ohm (2.5 milliohms) or less.
      (5) Reconnect the electrical connector to the shutoff valve.
      (6) Remove leading edge flap locks (AMM 27-81-0/201).

      WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.





CROSSFEED VALVE

A

1 THE RESISTANCE FROM THE CONNECTOR FLANGE TO THE WING REAR SPAR IS 0.001 OHM OR LESS.THE

2 RESISTANCE FROM THE BONDING JUMPER TERMINAL TO THE WING REAR SPAR IS 0.0025 OHMS OR LESS.

Crossfeed Valve Resistance Check
Figure 601

APU FUEL VALVE - REMOVAL/INSTALLATION

1. General
   A. The APU fuel valve is mounted on the left wing rear spar in the wheel well. The APU fuel valve is composed of two major assemblies: actuator assembly and valve body assembly. The actuator assembly is bolted to a mounting adapter and may be replaced separately. Replacement of the valve body assembly requires removal of the actuator assembly and mounting adapter and complete defueling of the No. 1 fuel tank.
2. Removal/Installation of APU Fuel Valve Actuator Assembly
   A. Equipment and Materials
      (1) Grease, MIL-G-3545
      (2) Bonding meter (Ref 20-22-01 I/C)
   B. Remove APU Fuel Valve Actuator Assembly
      (1) Open APU CONT circuit breaker on P6 panel.
      (2) Disconnect electrical plug from valve (Fig. 401).
      (3) Disconnect bonding jumper from valve.
      (4) Support actuator assembly and remove mounting screw.

      CAUTION: IF ACTUATOR ASSEMBLY IS NOT SUPPORTED WHEN REMOVING SCREW THE KEYED SHAFT MAY BE DAMAGED.

      (5) Carefully slide actuator assembly away from mounting adapter until output shaft is clear of mating part; lift actuator assembly clear.
   C. Install APU Valve Actuator Assembly
      (1) Lightly coat keyway of output shaft with grease.
      (2) Align actuator assembly output shaft keyway with valve body assembly input shaft key. Rotate output shaft until keyway lines up with key in input shaft, then carefully slide output shaft into input shaft until actuator mounting lugs contact mounting adapter.

      CAUTION: TO AVOID DAMAGE TO SHAFTS, ACTUATOR ASSEMBLY MUST BE SUPPORTED SO THAT WEIGHT IS NOT ON SHAFT.

      (3) If actuator assembly mounting holes do not line up with mating holes, carefully rotate actuator assembly until holes are aligned.
      (4) Install actuator assembly mounting screws.
      (5) Connect bonding jumper to actuator assembly.
      (6) Connect electrical plug to actuator assembly.
      (7) Check electrical bond between actuator assembly and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.0025 ohm.
      (8) Close APU CONT circuit breaker on P6 panel.
      (9) Position battery switch to ON.
      (10) Place APU master switch in ON position. Verify that valve override handle moves to OPEN position.

(11) Place APU master switch in OFF position. Verify that valve override handle moves to CLOSE position.

(12) Position battery switch to OFF.

3. Removal/Installation of APU Valve Body Assembly

A. Equipment and Materials

(1) Aliphatic Naphtha TT-N-95 (Ref 20-30-31)

(2) G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5

B. Prepare for APU Valve Body Assembly Removal

(1) Defuel and purge fuel tank No. 1 (Ref 28-23-0 MP and 28-10-0 MP).

(2) Remove fuel tank No. 1 access panel No. 1 to provide access to front of wing rear spar (Ref 28-11-11 R/I).

C. Remove APU Valve Body Assembly

(1) Remove actuator assembly (Ref par. 2).

(2) Gain access to valve through access panel No. 1 and rib access opening No. 1 and 2.

(3) Place suitable container under valve to catch fuel and disconnect APU fuel line. Remove unions and retain for installation.

(4) With one man inside fuel tank, supporting valve body assembly, second man, outside fuel tank, support adapter and remove body assembly mounting screws (Fig. 401).

CAUTION: DO NOT ALLOW VALVE BODY ASSEMBLY TO FALL. DAMAGE TO WING SKIN OR FUEL TANK SEALING MAY RESULT.

D. Install APU Valve Body Assembly

(1) Clean O-ring groove of valve body assembly and machined surface of valve body assembly and rear spar with naphtha and wipe dry with cotton wipers (BMS15-5).

(2) Install new O-rings, lightly lubricated with fuel, on unions and install unions in valve body assembly.

(3) Install new O-ring, lightly lubricated with fuel into groove on valve body assembly.

(4) Carefully place valve body assembly into position between APU fuel line fittings.

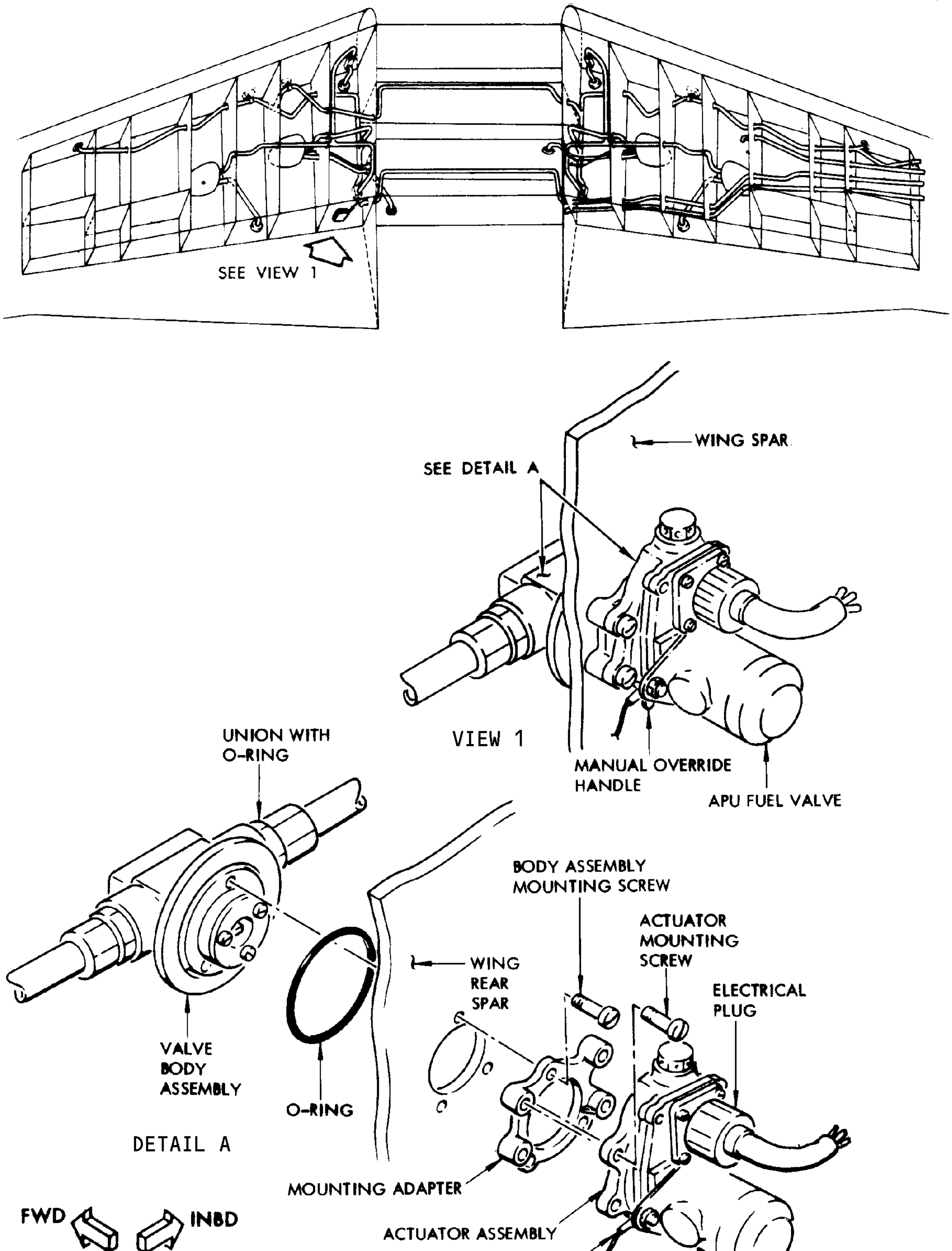
CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN INSERTING VALVE BODY ASSEMBLY.

(5) With one man inside fuel tank, to position body assembly, second man, outside fuel tank, install adapter and body assembly mounting screws.

(6) Attach APU fuel line to valve body assembly.

(7) Install actuator (Ref par. 2).

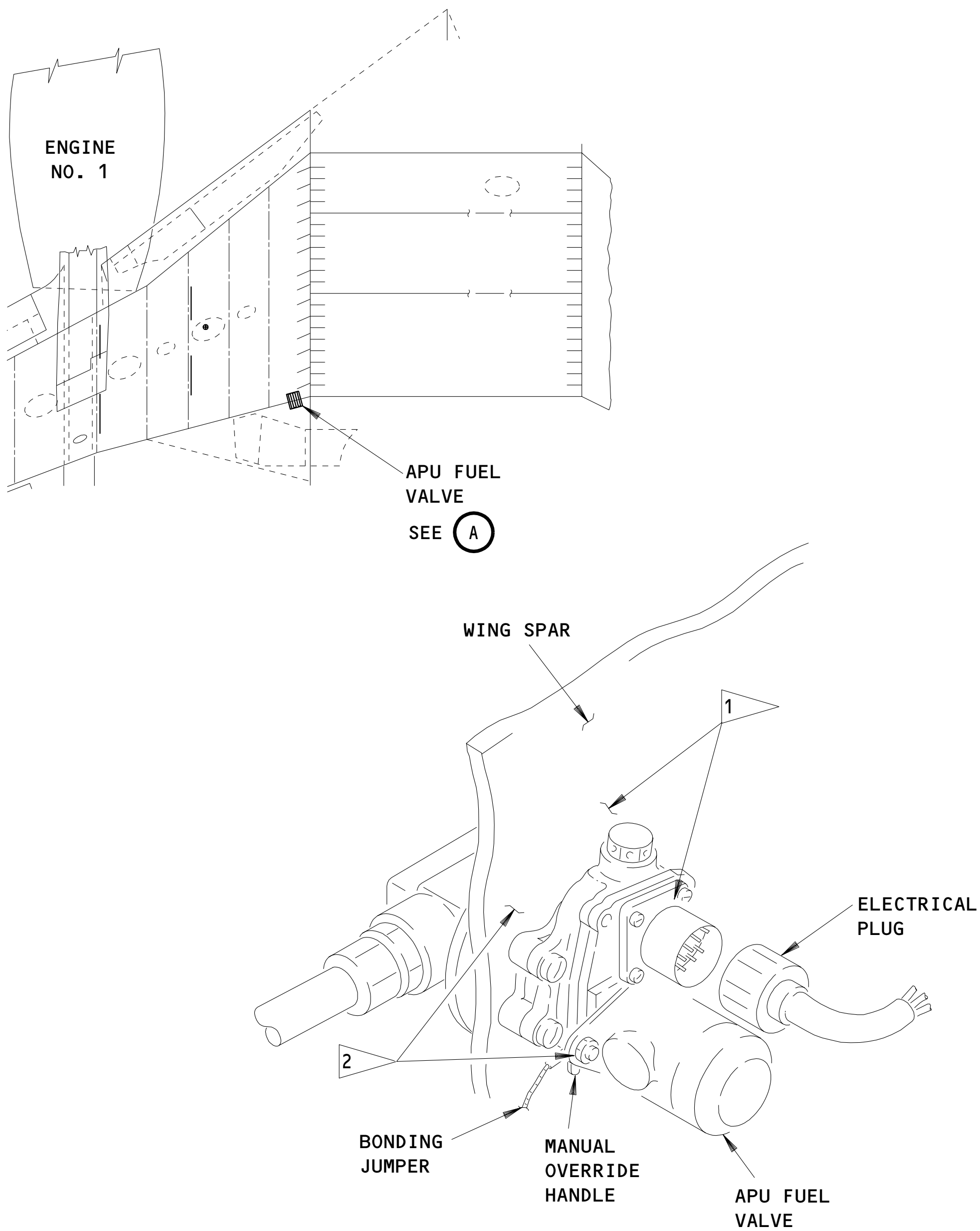
(8) Install fuel tank access panel. Refer to 28-11-11, Fuel Tank Access Panel - R/I.



APU Fuel Valve Installation
Figure 401

APU FUEL VALVE - INSPECTION/CHECK

1. General
   A. The APU fuel shutoff valve is installed on the left wing rear spar in the wheel well. It has two primary assemblies: the actuator assembly and valve body assembly.
2. APU Fuel Shutoff Valve - Bonding Resistance Check (Fig. 601)
   A. References
      (1) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zone
          310 Left Wing Wheel Well
   D. Procedure
      (1) Get access to the APU fuel shutoff valve on the rear spar in the left wheel well.
      (2) Disconnect the electrical connector from the APU fuel shutoff valve.
      (3) Measure the bonding resistance between the connector flange and the spar web (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.001 ohm (1.0 milliohm) or less.
      (4) Measure the bonding resistance between the bonding jumper terminal and the spar web (SWPM 20-20-00).
         (a) Make sure the bonding resistance is 0.0025 ohm (2.5 milliohms) or less.
      (5) Reconnect the electrical connector to the APU fuel shutoff valve.



APU FUEL VALVE

A

1 THE RESISTANCE FROM THE CONNECTOR FLANGE TO THE WING REAR SPAR IS 0.001 OHM OR LESS.THE

2 RESISTANCE FROM THE BONDING JUMPER TERMINAL TO THE WING REAR SPAR IS 0.0025 OHMS OR LESS.

APU Fuel Shutoff Valve Resistance Check
Figure 601

FUEL BOOST PUMP - REMOVAL/INSTALLATION

1. General
   A. Removal/installation procedures for all boost pumps are the same. There are two boost pumps in the inboard lower surface of each wing and one boost pump on the inboard front spar of each wing. Access to any pump is through its respective fuel boost pump access panel or, for FWD boost pumps on some airplanes, extending the leading edge flaps (observe warning below).
2. Equipment and Materials
   A. Aliphatic Naphtha Cleaning Solvent - TT-N-95 (Ref 20-30-31)
   B. G00034 Cotton Wiper, Process Cleaning Absorbant Wiper (cheesecloth, gauze) BMS15-5
   C. Bonding Meter (Ref 20-22-01 I/C)
   D. Bottle, Boost Pump Priming - F80203-1
   E. Leading Edge Flap Actuator Locks - F80048
3. Prepare for Fuel Boost Pump Removal
   A. Provide electrical power (Ref 24-22-0 MP).
   B. Check that all fuel boost pump switches, on pilot's overhead panel, are in OFF position and fuel crossfeed valve and engine fuel shutoff valves are closed.
   C. Open applicable fuel boost pump circuit breaker, fuel crossfeed valve circuit breaker, and both engine fuel shutoff valve circuit breakers on P6 panel. Attach DO-NOT-CLOSE identifier to opened circuit breakers.
   D. Gain access to boost pump by removing applicable access panel as follows:
      (1) Tank No. 1
         (a) Remove panel No. 6303, on wing leading edge lower surface, for FWD pump on airplanes not having leading edge flaps covering pump.
         (b) Extend leading edge flaps and install actuator locks (Ref 27-81-0 MP) for FWD pump on airplanes having leading edge flaps covering pump. Remove small clearance panel from wing lower skin, below pump removal valve handle.

            WARNING: REFER TO 27-81-0 MP FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

            CAUTION: CLEARANCE PANEL MUST BE REMOVED OR DAMAGE TO REMOVAL VALVE WARNING SIGNAL MAY RESULT WHEN VALVE CLOSING IS ATTEMPTED.

         (c) Remove panel No. 7203, on wing lower surface, for AFT pump.
      (2) Tank No. 2
         (a) Remove panel No. 6403, on wing leading edge lower surface, for FWD pump on airplanes not having leading edge flaps covering pump.

(b) Same as step A.(1)(b) for FWD pump on airplanes having leading edge flaps covering pump.
(c) Remove panel No. 7403, on wing lower surface for AFT pump.
(3) Center Tank
(a) Remove panel No. 7201, on wing lower surface, for LH pump.
(b) Remove panel No. 7401, on wing lower surface, for RH pump.
E. Remove electrical power (AMM 24-22-0/201).

4. Remove Fuel Boost Pump
A. Manually close fuel boost pump removal valve (Fig. 401).
(1) On airplanes with center tank boost pump vapor discharge lines routed to pressure refuel line, *[1] when removing a center wing tank boost pump, also close removal valve for opposite center wing tank boost pump.
B. Disconnect electrical plug from fuel boost pump.
C. With suitable container under fuel boost pump drain valve, open drain cock and drain fuel from fuel boost pump.
D. Support fuel boost pump and remove lower bolt from each mounting clamp.
E. Slide mounting clamps down and swing them out, as necessary to clear boost pump flange.

NOTE: If clamps stick, apply additional manual pressure. It is normally unnecessary to loosen or remove shoulder bolt in clamp upper end elongated slot.

*[1] AR ALL EXCEPT LV-JMW thru LV-JMY
EF ALL EXCEPT B-2601, B-2603, B-2607
ND C-GNDL, CF-NAP, CF-NAW, plus airplanes POST-SB 28-1018
NH ALL EXCEPT JA8403, JA8406 thru JA8408
PW ALL EXECTP 733

F. Pull fuel boost pump straight back from mounting face until free. Lower pump through access opening.

NOTE: O-rings on fuel boost pump ports form sliding seals in the mating fittings, making it necessary to exert extra pressure when pulling pump free.

5. Prepare for Fuel Boost Pump Installation
A. Clean all machined surfaces on fuel boost pump mounting flange and mating surfaces (AMM 20-10-181/701). Remove all oxidation deposits and other foreign material, and then wipe dry with cotton wipers (BMS15-5).

B. Prepare the mating surfaces of the fuel boost pump for an electrical faying surface bond (SWPM 20-20-00).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

C. Install boost pump mounting clamps, if removed.
   (1) Place mounting clamps in position and install shoulder bolt in elongated slot of each bracket. Do not install lower mounting bolts.
   (2) Tighten shoulder bolts to a torque range of 25 to 30 pound-inches.
   (3) Check that mounting clamps slide freely under shoulder bolts.

   NOTE: Binding may be result of using incorrect bolt, addition of washer, or a damaged clamp. Replace parts as necessary and ensure no washer is used under shoulder bolthead.

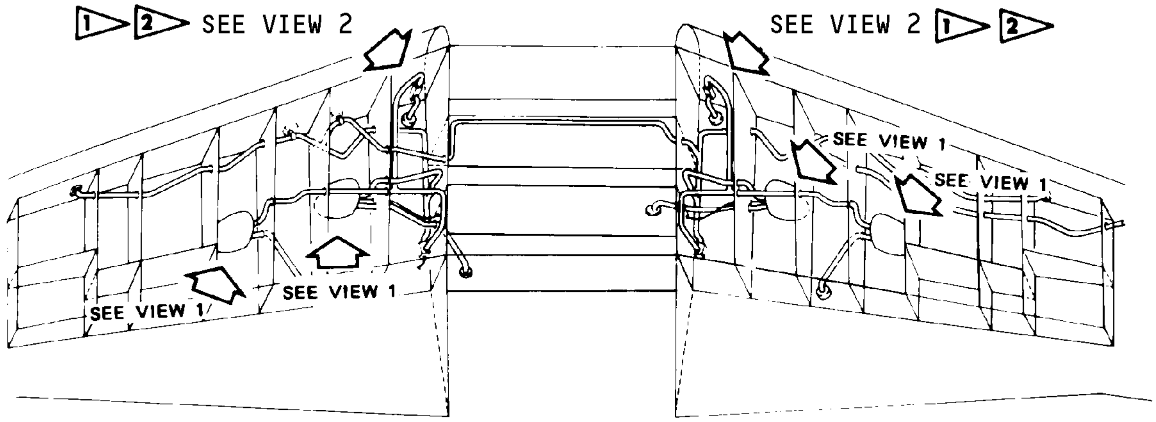
D. Do a check of the vent port to make sure the fuel pump flame arrestor (breather plug) is installed (Fig 402).

WARNING: MAKE SURE YOU DO THE INSPECTION FOR THE FUEL PUMP FLAME ARRESTOR. DO NOT INSTALL THE BOOST PUMP WITHOUT THE FLAME ARRESTOR. A FIRE OR EXPLOSION CAN OCCUR IF THE FLAME ARRESTOR IS NOT INSTALLED.

   (1) If the fuel pump flame arrestor is not installed, do not install this pump. Install a pump that has the flame arrestor installed correctly.

E. Install new O-rings, lightly lubricated with fuel, into grooves on boost pump inlet, outlet, and vent ports.
F. Prime fuel boost pump.
   (1) Check that fuel boost pump drain valve is closed.
   (2) Support fuel boost pump with inlet port up and pour approximately 1/2 pint of fuel into pump.
   (3) Carefully rotate fuel boost pump to installed position, allowing excess fuel to run out of pump.

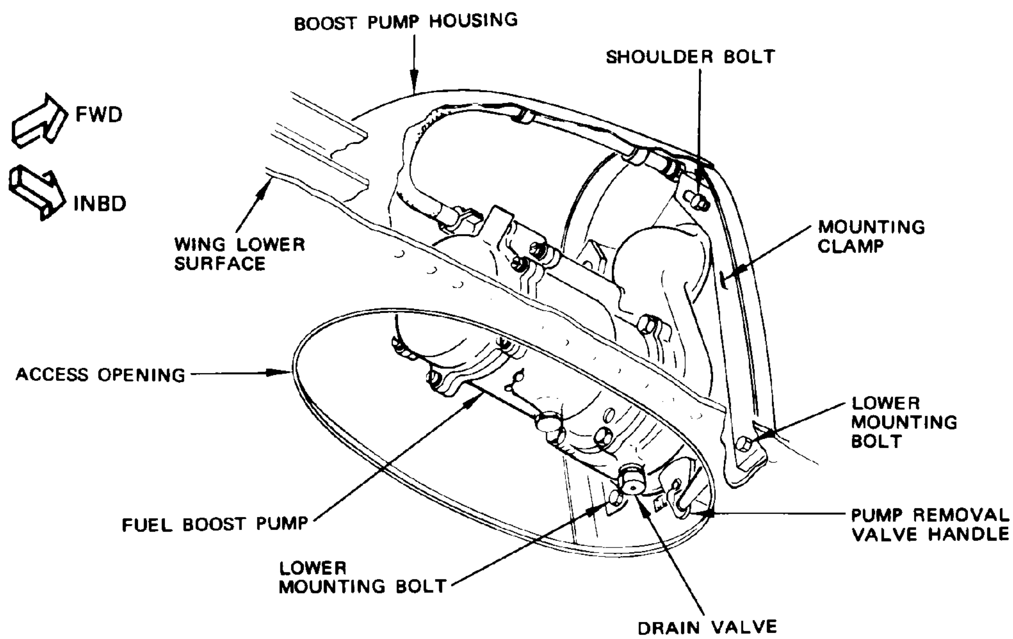
6. Install Fuel Boost Pump
   A. Lift fuel boost pump into dry bay through access opening, or onto front spar, whichever is applicable, inserting end of fuel boost pump ports into their mating fittings. Swing out mounting clamps as necessary to clear pump flange and push pump straight in until pump flange is against mating surface.
   B. Push up the mounting clamps and install mounting bolts.
   C. Connect electrical connector to fuel boost pump.



1 AIRPLANES NOT HAVING LEADING EDGE FLAPS COVERING FWD BOOST PUMPS

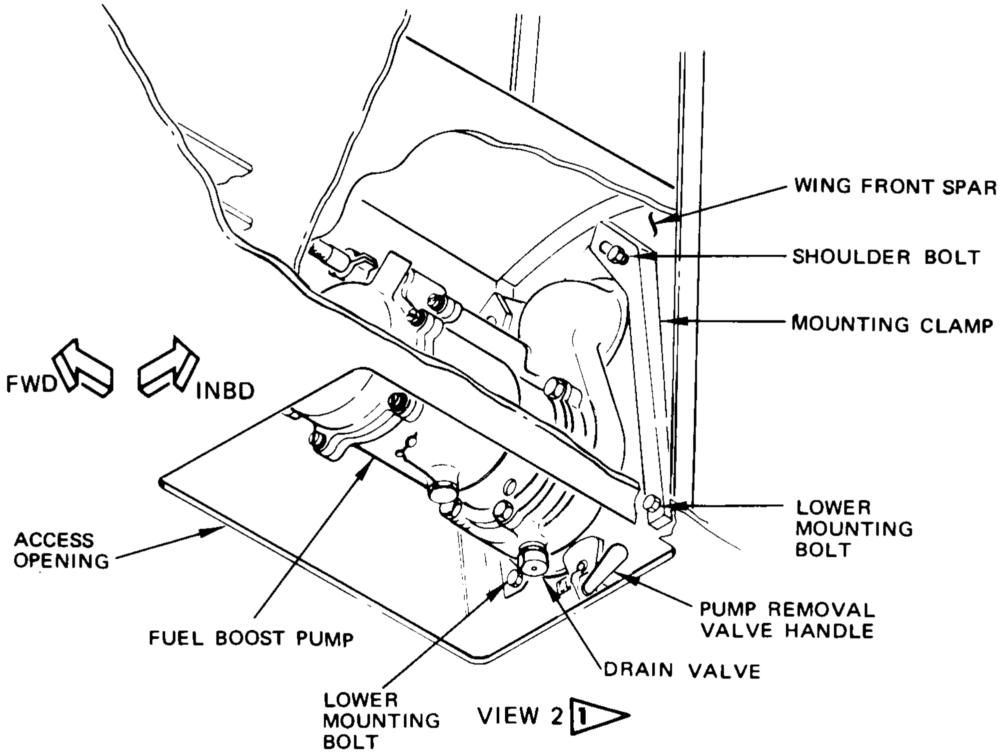
AR	LV-JMW THRU LV-JMZ, LV-JND, LV-JNE
AQ	N21SW THRU N23SW
IC	VT-EAG THRU VT-EAM
TZ	CF-TAN, CF-TAO
BU	ALL EXCEPT LN-SUA, LN-SUG, LN-SUP, LN-SUS

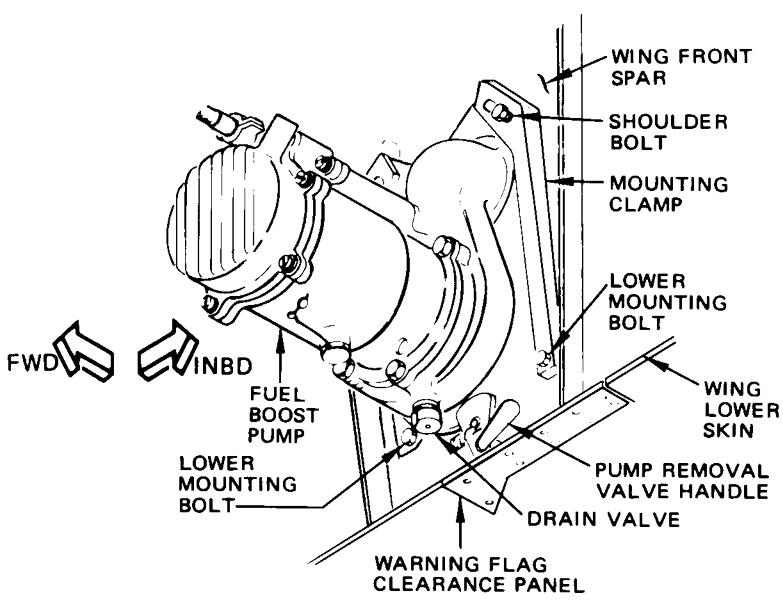
2 AIRPLANES HAVING LEADING EDGE FLAPS COVERING FWD BOOST PUMPS ALL EXCEPT 1



VIEW 1

Fuel Boost Pump Installation
Figure 401 (Sheet 1)





Fuel Boost Pump Installation
Figure 401 (Sheet 2)

D. Do a check of the electrical bond between the boost pump and the airplane structure (SWPM 20-20-00).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(1) Make sure the resistance is 0.0002 ohm or less.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

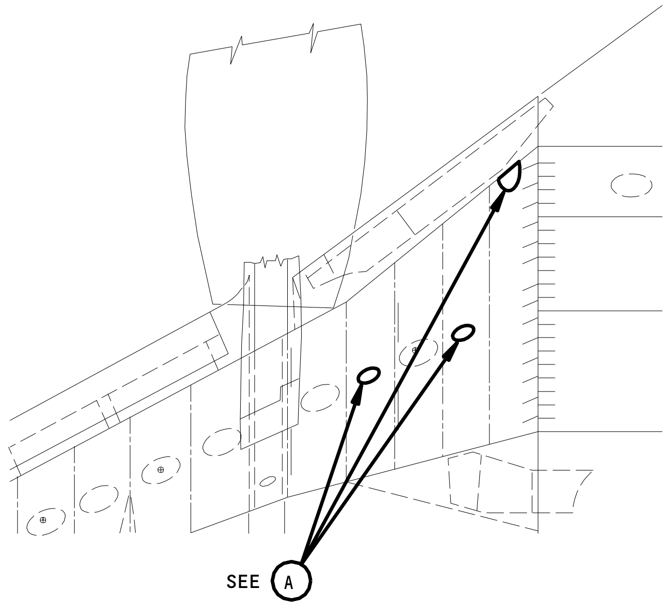
E. Manually open the boost pump removal valve.
(1) On airplanes noted in step 4.A.(1), after installation of center wing tank boost pump, also open removal valve for opposite center wing tank boost pump.

F. Verify that fuel boost pump is primed.
(1) Check that fuel tank has a minimum of 700 pounds (350 kilograms) of fuel.
(2) Make sure the manual defueling valve is closed.
(3) Close the fuel system indicator lights circuit breakers on aft overhead panel (P6).
(4) Remove DO-NOT-CLOSE identifier and close applicable boost pump circuit breaker on P6 panel. If boost pump is for tank No. 1 or 2, make sure the LOW PRESSURE indicating light on P5 panel is on.
(5) If boost pump is for the center or auxiliary tank, close master DIM AND TEST circuit breaker on P6 panel and press-to-test applicable boost pump LOW PRESSURE indicating lights on forward overhead panel (P5). Make sure the bulb comes on.
(6) Put the applicable boost pump switch on P5 panel to ON position.
(a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

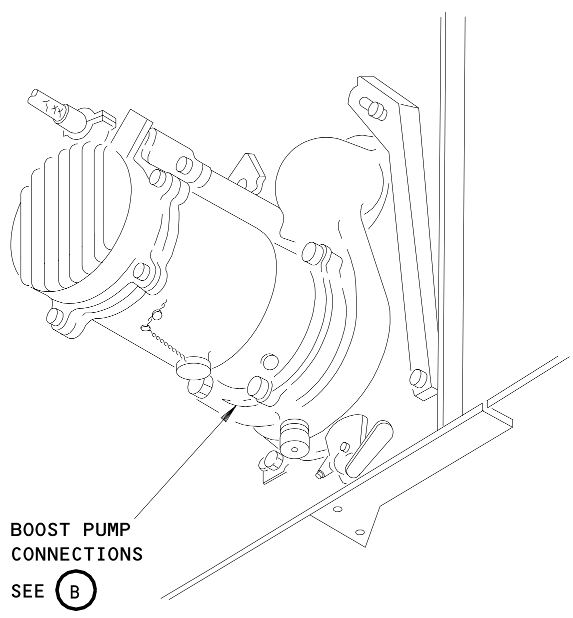
WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

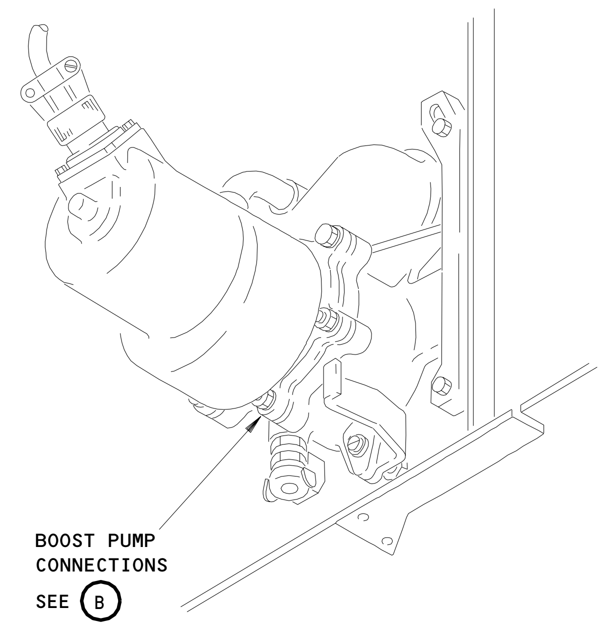


LEFT WING BOOST PUMPS SHOWN
RIGHT WING BOOST PUMPS OPPOSITE



BOOST PUMP TYPE I

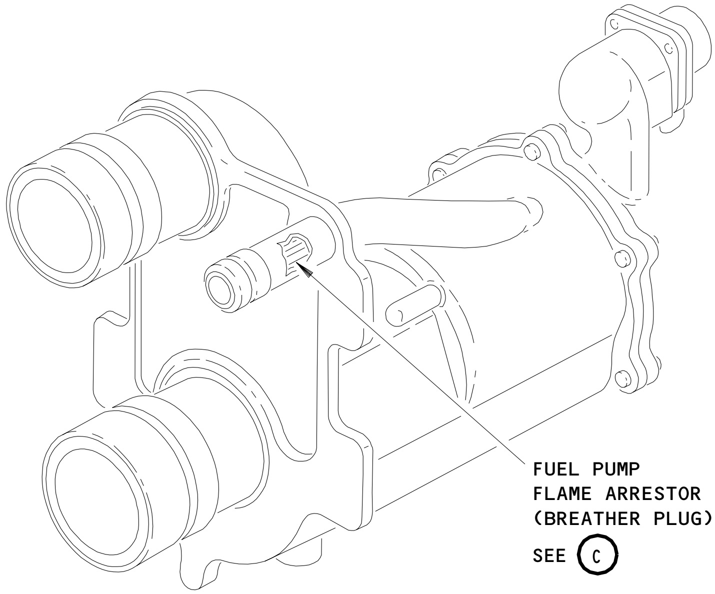
A



BOOST PUMP TYPE II

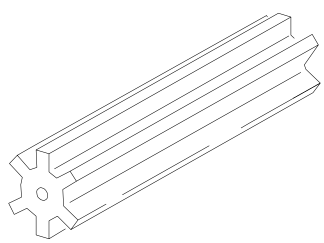
A

Fuel Pump Flame Arrestor Inspection
Figure 402 (Sheet 1)



BOOST PUMP CONNECTIONS
(PUMP REMOVED FROM AIRPLANE)

B



FUEL PUMP FLAME ARRESTOR
(BREATHER PLUG)

C

Fuel Pump Flame Arrestor Inspection
Figure 402 (Sheet 2)

(7) If boost pump is for tank No. 1 or 2, make sure the applicable LOW PRESSURE indicating light on P5 panel goes off when pressure builds up.
(8) If boost pump is for center tank, check that LOW PRESSURE indicating light on P5 panel illuminates briefly after pump switch is turned on and extinguishes after pump builds up fuel pressure.
(9) If indicator light response was satisfactory in step (9) or (10), proceed to step (15). If indicator light did not go off, proceed to step (12).
(10) Return boost pump switch on P5 panel to OFF and open boost pump and indicator light circuit breakers on P6 panel.
(11) Reprime pump as follows:
 (a) Open drain valve in bottom of pump casing (Fig. 401) until fuel runs out, then close drain. If fuel does not appear, perform step (b).
 (b) If fuel does not appear at drain in step (a), use the following priming method:
  1) Manually close the fuel boost pump removal valve.
  2) Inject fuel into pump drain valve using boost pump priming bottle (Fig. 403). Use at least three fourths of a full bottle of fuel.
  3) Open the fuel boost pump removal valve and immediately continue with the pump prime check.
(12) Repeat steps 6.E.(4) thru 6.E.(11).
(13) Return boost pump switch on P5 panel to OFF.

7. Return Airplane to Normal
 A. Close all fuel system circuit breakers on P6 panel. Remove DO-NOT-CLOSE identifiers.
 B. Install boost pump access panel if removed (Ref 57-30-11 R/I).

 NOTE: Make sure that boost pump removal valve is open before installing boost pump access panel.

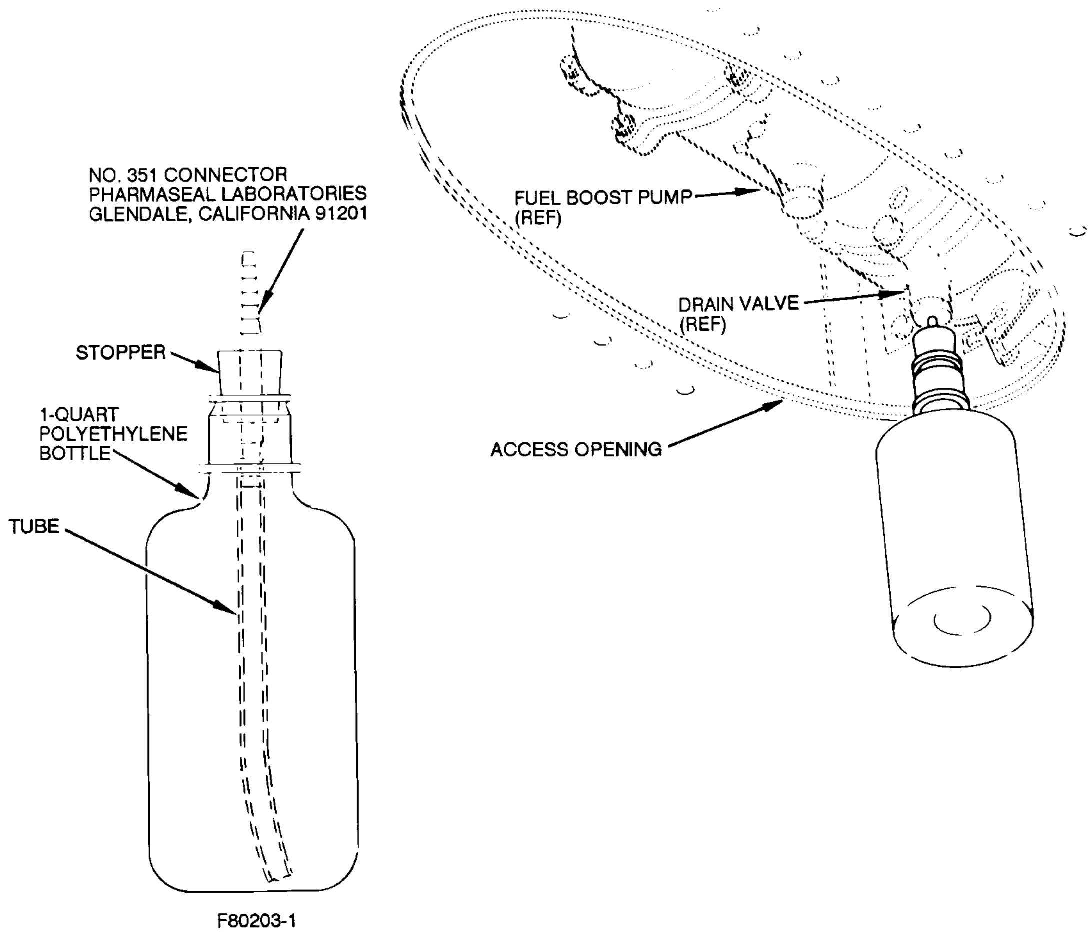
 C. If forward boost pump was installed on airplanes having leading edge flap covering boost pump, install small clearance panel on lower skin below pump removal valve handle. Make sure that retaining chain is not pinched between panel and stringers before tightening screws.

 CAUTION: CHECK LE FLAP NOSE TO FUEL BOOST PUMP CLEARANCE (REF 27-81-0 A/T). DAMAGE TO FLAPS OR BOOST PUMP MAY RESULT FROM INADEQUATE CLEARANCE.

 D. Remove actuator locks and retract leading edge flaps (Ref 27-81-0 MP).

 WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

 E. Remove external electrical power if no longer required.



Boost Pump Priming Bottle
Figure 403

FUEL BOOST PUMP - INSPECTION/CHECK

1. General
   A. This procedure contains these tasks:
      (1) Fuel Boost Pump Bonding Resistance Check
      (2) Fuel Boost Pump Wiring Inspection
      (3) Electrical Conduit Leak Test
   B. The Teflon sleeve is not repairable. When the wiring in the conduit or the conduit is removed, new Teflon sleeve or sleeves must be installed.

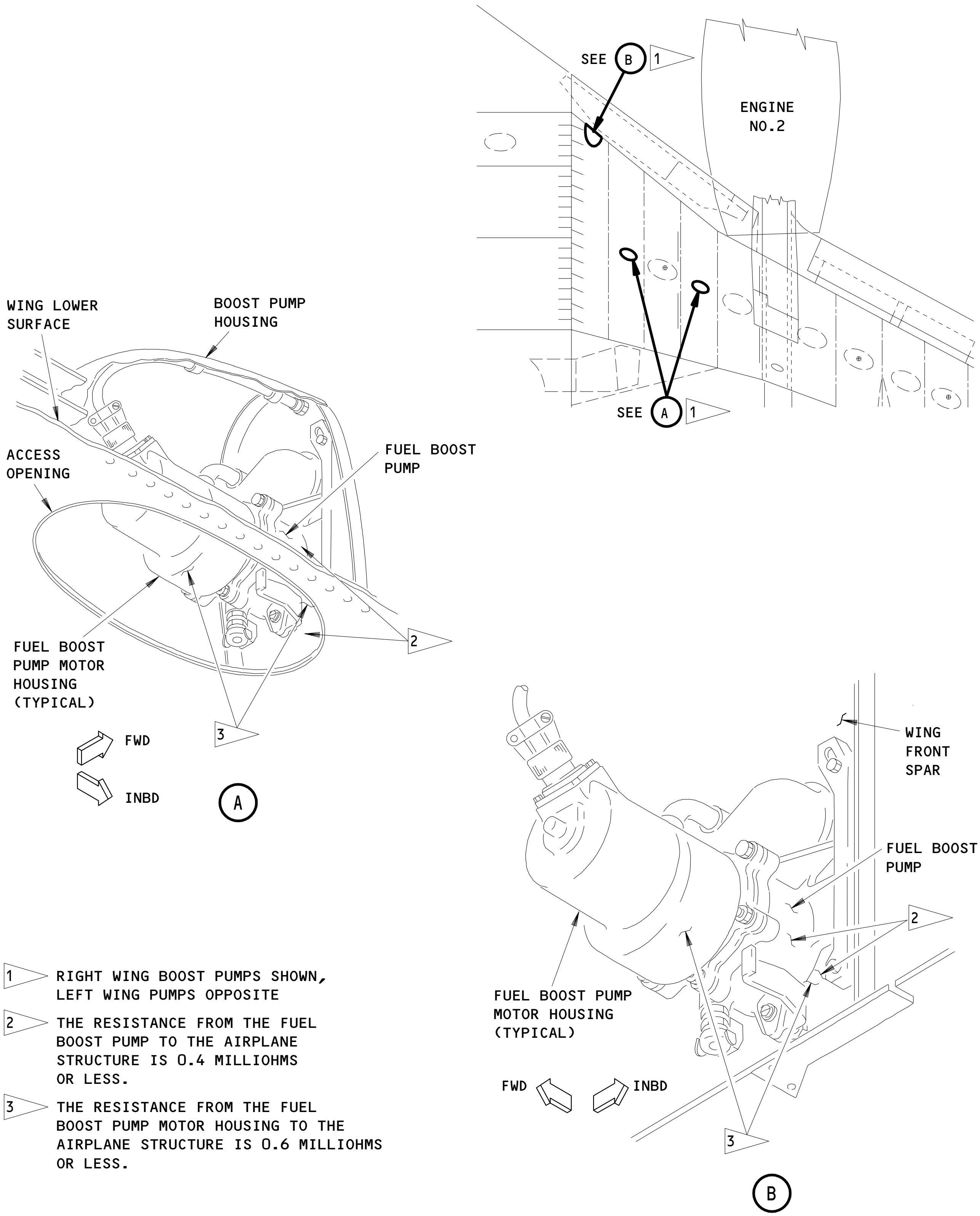
      NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

   C. Make sure one of the following conditions exist:

      NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

      (1) Jacketed wiring and a Teflon sleeve
      (2) Nonjacketed wiring and double Teflon sleeves
2. Fuel Boost Pump - Bonding Resistance Check (Fig. 601)
   A. Access
      (1) AMM 27-81-0/201, Leading Edge Flaps and Slats
      (2) AMM 57-30-11/401, Boost Pump Access Door
      (3) SWPM 20-20-00, Electrical Bonds and Grounds
   B. Equipment
      (1) Bonding Meter - Use one of these:
         (a) Bonding Meter - Model T477W
             Avtron Manufacturing Inc.
             Cleveland OH
         (b) Bonding Meter - Model M1
             (Serial Number A0000112 and subsequent)
             BCD Electronics Ltd.
             Vancouver Canada
   C. Access
      (1) Location Zones

221	Center Section Fuel Tank
303	Left Wing Inboard Leading Edge
305	Left Fuel Tank
403	Right Wing Inboard Leading Edge
405	Right Fuel Tank



Fuel Boost Pump Resistance Check
Figure 601

(2) Access Panels

7201	Boost Pump Access Panel
7203	Boost Pump Access Panel
7401	Boost Pump Access Panel
7403	Boost Pump Access Panel

D. Procedure

(1) To get access to the forward (FWD) fuel boost pump in the No. 1 or No. 2 tank, extend the leading edge flaps (AMM 27-81-0/201).

<u>WARNING</u>: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE FLAPS. THE LEADING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(a) Install the flap locks on the leading edge flaps (AMM 27-81-0/201).

<u>WARNING</u>: YOU MUST CAREFULLY DO THE STEPS IN THE ABOVE TASK TO INSTALL THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT INSTALL THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) Remove the small clearance panel from the bottom wing skin below the removal handle.

(2) To get access to the aft fuel boost pump in the No. 1 tank, remove the access panel, 7203, in the bottom wing skin (AMM 57-30-11/401).

(3) To get access to the aft fuel boost pump in the No. 2 tank, remove the access panel, 7403, in the bottom wing skin (AMM 57-30-11/401).

(4) To get access to the left (LH) fuel boost pump in the center tank, remove the access panel, 7201, in the bottom wing skin (AMM 57-30-11/401).

(5) To get access to the right (RH) fuel boost pump in the center tank, remove the access panel, 7401, in the bottom wing skin (AMM 57-30-11/401).

(6) Do a check of the bonding resistance between the fuel boost pump and the airplane structure (SWPM 20-20-00).

(a) Make sure the bonding resistance is 0.0004 ohm (0.4 milliohm) or less.

(7) Do a check of the bonding resistance between the fuel boost pump motor housing and the airplane structure (SWPM 20-20-00).

(a) Make sure the bonding resistance is 0.0006 ohm (0.6 milliohm) or less.

(8) Install the access panel that you removed to get access to the fuel boost pump.

CAUTION: MAKE SURE THERE IS SUFFICIENT SPACE BETWEEN THE FUEL BOOST PUMP AND THE LEADING EDGE FLAP. DAMAGE TO THE FLAP OR THE FUEL BOOST PUMP CAN EASILY OCCUR IF THERE IS NOT SUFFICIENT SPACE.

(a) Make sure the removal valve for the fuel boost pump is open.
(b) Install the access panel for the fuel boost pump.
(c) If the fuel boost pump is on the front spar, install the small clearance panel below the removal valve handle.
1) Make sure the chain that attaches the small clearance panel is not between the panel and the stringers.
2) Tighten the screws that attach the small clearance panel.

(9) Remove the flap locks from the leading edge flaps, if you installed them (AMM 27-81-0/201).

WARNING: YOU MUST CAREFULLY DO THE STEPS IN THE TASK BELOW TO REMOVE THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF YOU DO NOT REMOVE THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(10) Retract the leading edge flaps if they are extended (AMM 27-81-0/201).

WARNING: MAKE SURE THAT PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND FLAP DRIVE MECHANISMS. THE LEADING EDGE EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(a) Make sure there is sufficient space between the leading edge flap and the forward fuel boost pump while you retract the flaps.

3. Fuel Boost Pump Wiring Inspection (Fig. 602)

A. References

(1) AMM 24-22-0/201, Manual Control

(2) AMM 27-81-0/201, Leading Edge Flaps and Slats
(3) AMM 57-30-11/401, Boost Pump Access Door

B. Wiring Removal Procedure

(1) Set the switches for the fuel boost pumps (on the pilot's overhead panel) to the OFF position.

(2) Open the following circuit breakers and attach DO-NOT-CLOSE tags on the P6 main power distribution panel:
(a) BOOST PUMP TANK 1 FWD
(b) BOOST PUMP TANK 2 FWD
(c) BOOST PUMP TANK 1 AFT
(d) BOOST PUMP TANK 2 AFT
(e) BOOST PUMP CTR TANK LEFT
(f) BOOST PUMP CTR TANK RIGHT

(3) To get access to the fuel boost pump, do these steps:
(a) For the forward fuel boost pumps for the No. 1 and 2 tanks on airplanes with leading edge flaps covering the fuel boost pumps, extend the leading edge flaps (AMM 27-81-0/201).

<u>WARNING</u>: MAKE SURE PERSONS AND EQUIPMENT ARE CLEAR OF THE LE AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

1) Install the flap locks on the leading edge flaps (AMM 27-81-0/201).

<u>WARNING</u>: FOLLOW THE STEPS CAREFULLY IN THE TASK ABOVE INSTALLING THE LE FLAP SAFETY LOCKS. THE LE FLAPS CAN MOVE QUICKLY IF THE SAFETY LOCK IS NOT CORRECTLY INSTALLED. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) Remove the following access panel to get access to the applicable the fuel boost pump (AMM 57-30-11/401):
1) Panel 7203 (Tank No. 1, aft pump)

2) Panel 7201 (Center tank, left pump)
3) Panel 7401 (Center tank, right pump)
4) Panel 7403 (Tank No. 2, aft pump)
5) Panel 6303 (Tank No. 1, forward pump - airplanes without leading edge flaps covering the forward fuel boost pumps)
6) Panel 6403 (Tank No. 2, forward pump - airplanes without leading edge flaps covering the forward fuel boost pumps)

(4) Do the following steps at each of the four applicable fuel boost pumps:

NOTE: The forward boost pumps in the No. 1 and No. 2 tank do not have wiring in conduits. Thus, this inspection is not applicable to these pumps.

NOTE: To improve access to the wiring, remove the fuel boost pump. (AMM 28-22-41/401). This will require additional time to reinstall. A special bonding resistance meter is necessary to install the pump (SWPM 20-20-00, Test Procedures for Electrical Bonds, Conditions for Bond Tests in an Explosion Hazard Area).

(a) Disconnect the electrical connector from the fuel boost pump.
(b) Disconnect the wire clamps from the wiring.
(c) Remove the wires, with the socket contacts attached, from the electrical connector (SWPM 20-61-11). Keep the electrical connector if undamaged.
(d) Tie a string (lacing tape or equivalent) to the wire end.
(e) Apply tape as necessary on the end of wires and socket contacts to ensure smooth movement through conduit.

NOTE: Use a string approximately 15 feet long. Attach the end of the string (end not attached to wiring) to the pump or the airplane to avoid accidentally pulling wire thru conduit.

NOTE: If the airplane has a single ground wire in addition to the three conductor cable, the pull the ground wire out of the conduit before pulling the three conductor cable out.

(5) Complete the following steps at the front spar:
(a) Hold the large hex nut on the conduit at the front spar with a wrench.
(b) Disconnect the elbow from the front spar of the wing.

NOTE: It is recommended the nut and grommet not be removed from the elbow to avoid possible elbow breakage.

(c) Carefully pull the wiring out of the conduit.

C. Wiring Inspection Procedure
(1) If the Teflon sleeve is installed on the wiring (SB 28A1120, Revision 3), look carefully to make sure that there are no holes in the Teflon sleeve.
(2) If there are no holes in the Teflon sleeve, the inspection is complete.
(a) Do this task: Wiring Installation Procedure.
(3) If there are holes in the Teflon sleeve, then remove the Teflon sleeve (SB 28A1120), to do an inspection of the wire cable jacket or inner Teflon sleeve.
(4) Discard the Teflon sleeve.
(5) If there are no holes in the wire cable jacket or inner Teflon sleeve, the inspection is complete.
(6) Do this task: Wiring Installation Procedure.
(7) If there are holes in the wire cable jacket or inner Teflon sleeve, then remove the wire cable jacket or inner Teflon sleeve to do an inspection of the wiring.
(8) Discard the wire cable jacket or inner Teflon sleeve.
(9) Look carefully at the part of the electrical cable installed in the conduit.
(a) If the red, yellow, blue, and/or green wire can be seen through the outer jacket of the electrical cable, then the cable must be replaced. Do not make repairs to the part of the electrical cable housed in the conduit.

NOTE: There are two options on where the new cable is spliced to the cable.

Splice it where it joins the main wire bundle on the front spar.

Splice it where the electrical cable is now spliced in the fuselage.

Do not put a splice in a resulting location inside the conduit or in an elbow. Make sure splices and all wiring are a minimum of 2 inches from the control cables. Make the splices (including staggering them) as shown in SWPM 20-30-12. If wires are spliced at the front spar, then the procedure for a moistureproof splice in a fuel vapor area must be used. Also, the splice must be after (away from the direction of the boost pump) the first wire clamp on the front spar. This will permit the Teflon sleeve (installed below) to go through the wire clamp. If the electrical cable is spliced in the fuselage, then use a general purpose slice. Install the cable as shown in SWPM 20-10-11.

Refer to SB 28-1120 for acceptable wiring substitutions.

(b) If there is any indication of electrical arching or exposed copper wire on the electrical cable, one of the following two options must be done.

NOTE: Arcing can show as very small blackened holes in the insulation, or as deformation or pitting of the copper wire. Worn areas with a black material around the edge is not a sign of arching. The black material is aluminum oxide.

1) Option 1
a) Before the next flight, replace the section of the electrical conduit where the arching occurred.
2) Option 2
a) Perform an electrical conduit leak test.

(10) If fuel is seen and/or smelled on the electrical cable, then the leak must be located and repaired.
(a) If the leak is due to damage to the conduit, then replace the damaged conduit.
(11) If the electrical cable does not have any damage, install it again.

D. Wiring Installation Procedure
(1) Use compressed air (30 psi maximum) to blow dirt out of the conduit.
(2) Disconnect the string from the wiring.
(3) Remove loose dirt from the electrical cable with a clean cotton wiper (BMS15-5).
(4) Install a new Teflon sleeve over the electrical cable.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

NOTE: The sleeve must cover the part of the electrical cable inside the conduit. Make the sleeve sufficiently long to go through one wire clamp after each end of the conduit.

(5) On airplanes with a single case ground wire, do not put the case ground wire in the sleeve.
(6) If installing a non-jacketed electrical cable, then install two new Teflon sleeves on it. Do the following steps to install two sleeves:

CAUTION: DO NOT SHRINK THE TEFLON SLEEVE WITH HEAT. HEAT CAN CAUSE DAMAGE TO THE INSULATION ON THE WIRE.

(a) Use the electrical cable to push the lacing tape through the larger Teflon sleeve.
(b) Remove the electrical cable from the larger Teflon sleeve (keep the lacing tape in the sleeve).
(c) Put the electrical cable through the smaller, new Teflon sleeve.

(d) Make a crease (about one foot or 30 cm long) at the end of the smaller Teflon sleeve down to a smaller diameter (where the crease was made) so it will fit easily in the larger Teflon sleeve.

(e) Tie one end of the lacing tape to the creased end of the smaller Teflon sleeve.

1) For knots, refer to SWPM 20-10-11.

(f) Tie the other end of the lacing tape to a stationary object.

(g) Pull and push the larger, new Teflon sleeve over the smaller Teflon sleeve.

1) Regularly smooth the larger Teflon sleeve down the length of the smaller Teflon sleeve to prevent bunching.

(7) Replace the elbow and grommet if they have damage.

NOTE: Refer to SB 737-28-1120 for part substitution data.

(8) Connect the string back to the wiring and the sleeve.

(a) Put tape (as necessary) on the end of the wiring and socket contacts so the wiring will move smoothly through the conduit.

NOTE: If installing a case ground wire in addition to the three conductor cable, then pull the three conductor cable into the conduit before you pull the ground wire in the conduit.

(9) Put the tape on the entrance of the conduit at the front spar.

(a) This will protect the wiring from the sharp edge of the electrical conduit.

(10) Carefully pull the wiring and sleeve through the conduit with the string.

NOTE: The only lubricants permitted for Teflon sleeving are the following: talcum powder, Cetyl Alcohol (Boelube), and TFE Release Agent Dry Lubricant. No other substances are permitted on the wiring or the sleeving.

(11) Install the socket contacts in the electrical connector (at the fuel boost pump end of the wires).

(12) Attach the elbow to the fitting on the front spar.

NOTE: If using a MS 27557-3 or a MS 27559-3 fitting, then tighten its set screw to hold the fitting in the correct position.

(13) Install the wiring in the wire clamps.

(a) Make sure the Teflon sleeve is in the first clamp after each end of the conduit.

(14) If the fuel boost pump was removed to get access then reinstall it.

(15) Connect the electrical connector to the fuel boost pump.

E. Fuel Boost Pump Test
   (1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 main power distribution panel:
      (a) BOOST PUMP TANK 1 FWD
      (b) BOOST PUMP TANK 2 FWD
      (c) BOOST PUMP TANK 1 AFT
      (d) BOOST PUMP TANK 2 AFT
      (e) BOOST PUMP CTR TANK LEFT
      (f) BOOST PUMP CTR TANK RIGHT
   (2) Supply the electrical power (AMM 24-22-0/201)
   (3) Do the following steps for each boost pump.

      NOTE: Do this test for only one pump at a time. This will make sure the correct wires are connected to each pump.

      (a) Set the switch for the fuel boost pump to ON.
      (b) Make sure the applicable low pressure light goes off.

         NOTE: The low pressure lights for the center fuel boost pumps do not come on when the switches of these pumps are in the OFF position. For the center pumps, make sure the low pressure light comes on for a short period and then goes off (when the switch is set in the ON position).

      (c) the switch for the fuel boost pump back to OFF.
   (4) Remove electrical power, if it is not necessary (AMM 24-22-0/201).
F. Put the Airplane Back to Its Usual Condition
   (1) Install the access panels for the boost pumps (AMM 57-30-11/401).
   (2) For the forward fuel boost pumps for the No. 1 and 2 tank on airplanes with leading edge flaps covering the fuel boost pump, do these steps:
      (a) Remove the flap locks from the leading edge flaps (AMM 27-81-0/201).

         WARNING: CAREFULLY FOLLOW THE STEPS IN THE TASK ABOVE TO REMOVE THE LE FLAP SAFETY LOCKS CORRECTLY. IMPROPER REMOVAL CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

      (b) Retract the leading edge flaps if extended.

         WARNING: ENSURE PERSON AND EQUIPMENT ARE CLEAR OF THE LE FLAP AND TE FLAPS AND FLAP DRIVE MECHANISMS. THE LEADING EDGE AND THE TRAILING EDGE CONTROL SURFACES CAN EXTEND AND RETRACT QUICKLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

4. Electrical Conduit Leak Test
   A. Procedure
      (1) Do the necessary steps to remove the wiring from the conduit in the task, FUEL BOOST PUMP WIRING INSPECTION.
      (2) Do one of the following three tests to find if a leak exists in the electrical conduit:
         (a) Test 1
            1) Fill the applicable fuel tank with fuel.
            2) Pull a clean cotton wiper (BMS15-5) through the electrical conduit with the string.

               NOTE: Tie a second string to the cotton wiper (BMS15-5) so a string is available to pull the wire through the conduit for the wire insulation.

            3) Make sure there is no fuel on the cotton wiper (BMS15-5).
            4) After 5 minutes, make sure there is no sign of fuel leakage at the ends of thee electrical conduit.
            5) Examine the end of the electrical conduit at the front spar and the end near the fuel boost pump for indications of fuel leakage.
         (b) Test 2
            1) Fill the applicable fuel tank with fuel.
            2) Pull a clean cotton wiper (BMS15-5) through the electrical conduit with the string.

               NOTE: Tie a second string to the cotton wiper (BMS15-5) so a string is available to pull the wire through the conduit for the wire insulation.

            3) Make sure there is no fuel on the cotton wiper (BMS15-5).
         (c) Test 3
            1) Use the necessary fittings to plug one end of the electrical conduit and to connect a pressure gage and air supply to the other end of the electrical conduit.
            2) Pressurize the electrical conduit to 20 psi and shut off the air supply.
            3) After 5 minutes with no supply of air, make sure the pressure shown on the pressure gage do not decrease.

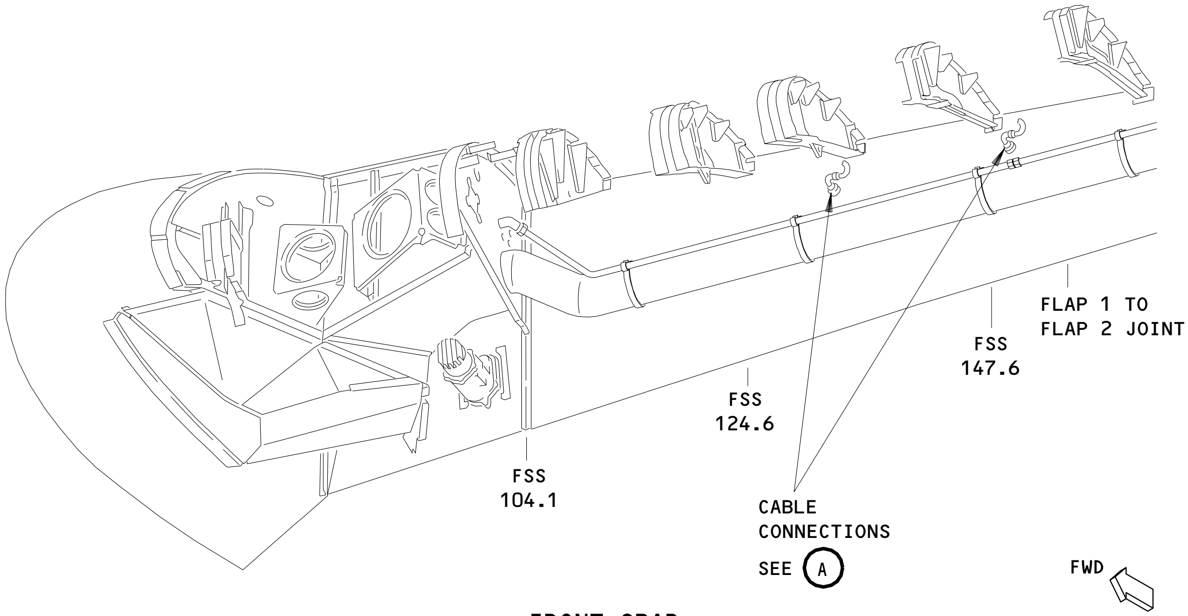
               NOTE: A pressure gage must be connected so it reads the pressure in the conduit when the air supply is shut off.

               NOTE: This test can be done with any quantity of fuel in the tank.

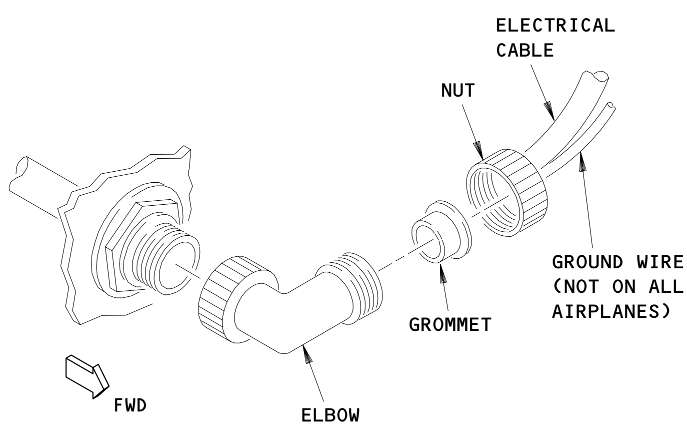
      (3) If a leak is not found (using one of the above tests), then it is not necessary to replace the electrical conduit immediately, but referral to SB 737-28-1120 provides inspection requirements.

(4) If a leak is found (using one of the above tests), then replacement of the leaking section of conduit is required before the next flight.

(5) Do the necessary steps to replace or reinstall the wiring in the task, Fuel Boost Pump Wiring Inspection.



FRONT SPAR
VIEW 3



CABLE CONNECTION
(EXAMPLE)
A

Fuel Boost Pump Wiring Inspection
Figure 602

FUEL BOOST PUMP REMOVAL VALVE - REMOVAL/INSTALLATION

1. General
   A. Removal/installation procedure for all the fuel boost pump removal valves is basically the same, the only differences being location and access. Tanks No. 1 and 2 each contain three valves. As the valves are located inside the tanks it is necessary to defuel the applicable fuel tank to gain access to any valve. It is also necessary to remove boost pump access panel or extend leading edge flaps to gain access to removal valve actuating handle.
2. Equipment and Materials
   A. Cleaning Solvent - Aliphatic Naphtha TT-N-95 (AMM 20-30-31)
   B. Leading Edge Flap Actuator Locks - F80048-36
   C. Bonding meter (AMM 20-22-01/601)
   D. G00034 Cotton Wiper - Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
3. Prepare Fuel Boost Pump Removal Valve for Removal
   A. Remove applicable boost pump access panel 6303L, 7201L, 7203L, 6403R, 7401R, or 7403R (AMM 12-31-61, AMM 57-30-11/401).

      NOTE: Access panels 6303L and 6403R are not used on airplanes having leading edge flaps covering fwd boost pumps.

   B. For fwd boost pump on airplanes having leading edge flaps covering pump, extend flaps and install actuator locks (AMM 27-81-0/201). Remove small clearance panel on wing lower skin below removal valve actuator handle.

      WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

      CAUTION: CLEARANCE PANEL MUST BE REMOVED OR DAMAGE TO REMOVAL VALVE WARNING SIGNAL MAY RESULT WHEN VALVE CLOSING IS ATTEMPTED.

   C. Defuel and purge applicable fuel tank (AMM 28-10-0/201, AMM 28-23-0/201).

      WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

   D. Gain access to valve to be removed through access panel and rib access openings listed below (AMM 28-11-11/401).

FUEL BOOST PUMP REMOVAL VALVE	FUEL TANK ACCESS PANEL AMM 28-11-0	RIB ACCESS OPENING AMM 28-11-0
FWD	No. 1	No. 2 and 1
AFT	No. 1	No. 3
CENTER	No. 1	No. 2

4. Remove Fuel Boost Pump Removal Valve
   A. Remove bonding jumper from removal valve.
   B. Remove fuel pump inlet line clamp attaching bolt (Fig. 401).
   C. Remove valve mounting bolts.

      CAUTION: VALVE MUST BE SUPPORTED WHEN LAST BOLT IS REMOVED. IF VALVE IS ALLOWED TO FALL, DAMAGE TO VALVE OPERATING SHAFT OR WING SKIN MAY BE CAUSED.

   D. Pull fuel pump inlet line clear of valve far enough to allow valve to be removed.
   E. Pull valve straight out until tongue and slot of operating shaft are clear of each other. Lift valve clear.
5. Install Fuel Boost Pump Removal Valve
   A. Clean O-ring groove and machined surfaces of valve and mating surfaces with solvent. Wipe dry with a cotton wiper (BMS15-5).
   B. Install new O-ring, lightly lubricated with fuel, into grooves on valve.
   C. Hold inlet line to prevent interference and position valve with tongue and slot of operating shaft engaged.
   D. Position pump inlet line flange against valve (Fig. 401).
   E. Install valve mounting bolts. Do not tighten.
   F. Operate valve handle and position valve for easiest operation, then tighten valve mounting bolts.

      NOTE: After valve mounting bolts are tightened, check operation of valve. Maximum operating torque on valve handle is 30 pound-inches.

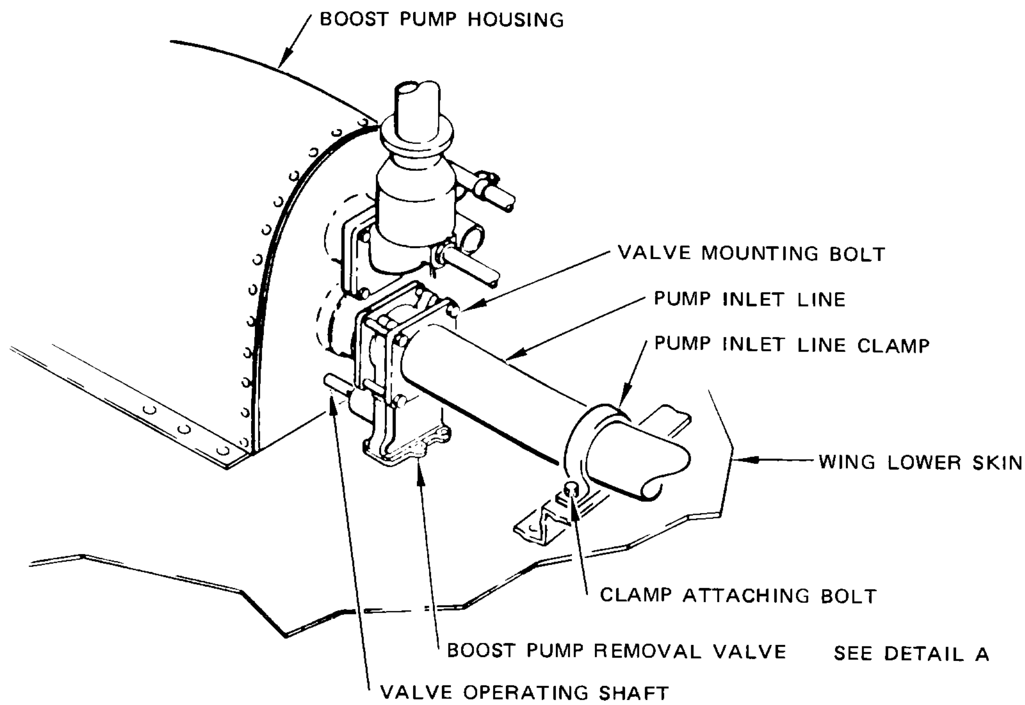
   G. Install fuel pump inlet line clamp attaching bolt.
   H. Attach bonding jumper to removal valve.
   I. Check electrical bond between removal valve and airplane structure per AMM 20-22-01/601. Resistance shall not exceed 0.010 ohm.
   J. Install fuel tank access panel (AMM 28-11-11/401).
   K. If removed, install boost pump access panel (AMM 57-30-11/401).

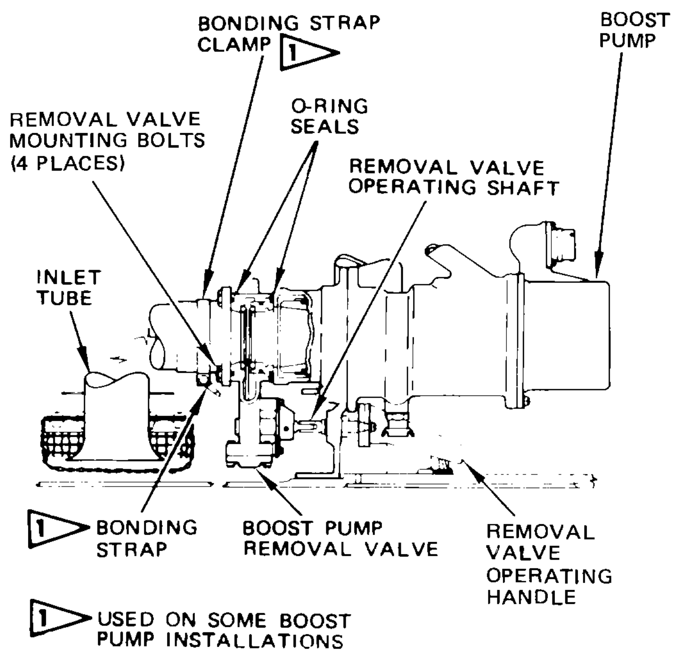
      NOTE: Make sure that boost pump removal valve is open before installing boost pump access panel.

L. If FWD boost pump removal valve was installed, on airplane having leading edge flap covering boost pump, install small clearance panel on wing lower skin below removal valve actuating handle. Make sure that panel retaining chain is not pinched between panel and stringers before tightening screws.

(1) Remove actuator locks and retract leading edge flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.





DETAIL A

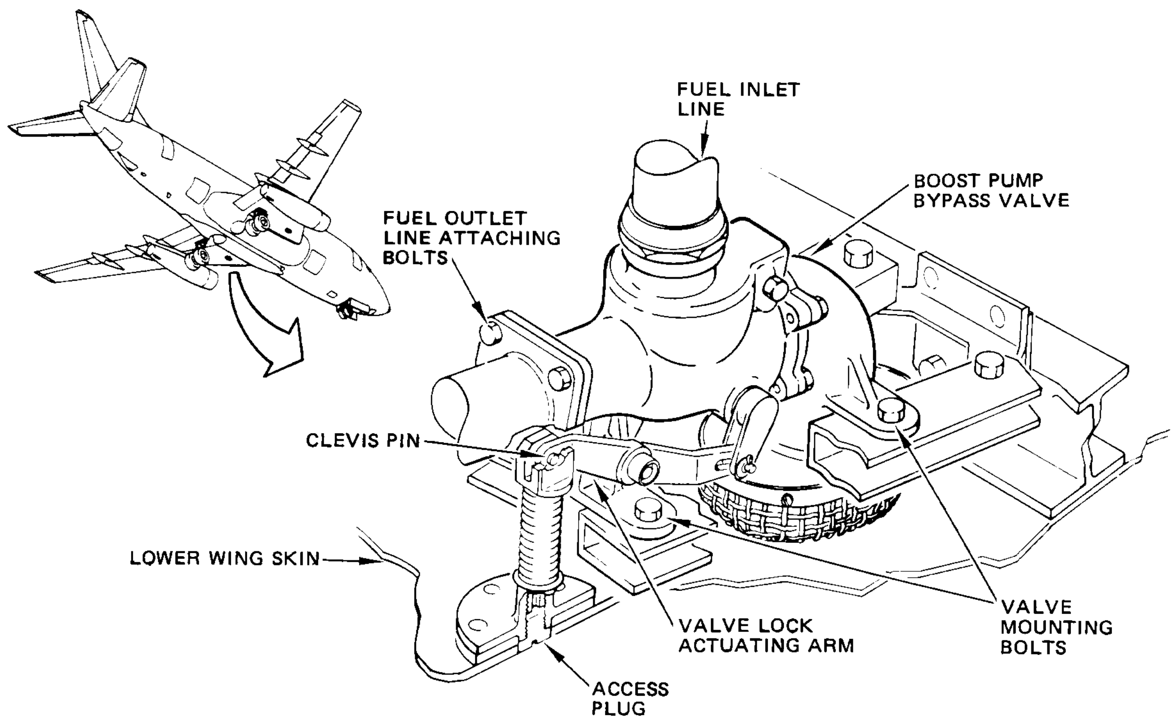
Fuel Boost Pump Removal Valve Installation
Figure 401

FUEL BOOST PUMP BYPASS VALVE - REMOVAL/INSTALLATION

1. General
   A. Removal/installation procedure for both fuel boost pump bypass valves is basically the same, the only difference being location and access. There is one bypass valve in each tank and since the valve is mounted inside the tank it is necessary to defuel the applicable tank to gain access to the valve.
2. Equipment and Materials
   A. Aliphatic Naphtha - TT-N-95 (Ref 20-30-31)
   B. Bonding meter (AMM 20-22-01/601)
   C. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
3. Prepare Fuel Boost Pump Bypass Valve for Removal
   A. Check that crossfeed valve is closed.

   WARNING: EXPLOSIVE AND TOXIC DANGERS OF VAPORS IN VICINITY OF BOTH WET AND DRY FUEL TANKS ARE OF SUCH POTENCY THAT SEVERAL PRECAUTIONS MUST BE ACCOMPLISHED BEFORE TANKS ARE DRAINED AND ENTERED.

   B. Gain access to valve through access panel No. 1 and rib access openings No. 2 and 1 (AMM 28-11-0, AMM 28-11-11/401).
4. Remove Fuel Boost Pump Bypass Valve
   A. Remove fuel outlet line attaching bolts (Fig. 401).
   B. Remove cotter pin from clevis pin of lock mechanism, remove washer and clevis pin.
   C. Disconnect fuel inlet line from bypass valve.
   D. Detach bonding strap and disconnect fuel inlet line at other end.
   E. Remove clamp from fuel inlet line and lift fuel line clear of valve.
   F. Remove valve mounting bolts and lift valve free.
5. Install Fuel Boost Pump Bypass Valve
   A. Clean O-ring groove in machined surfaces of valve and fuel outlet line flange with naphtha and wipe dry with a cotton wiper (BMS15-5).
   B. Install new O-ring, lightly lubricated with fuel, in groove.
   C. Position bypass valve on supports and install valve mounting bolts.
   D. Install fuel outlet line attaching bolts.
   E. Position fuel inlet line and install clamp, do not tighten clamp.
   F. Connect fuel inlet line to bypass valve.
   G. Connect other end of fuel inlet line. Attach bonding strap using care to ensure positive electrical bonding to structure.
   H. Check electrical bond between fuel inlet line and airplane structure per AMM 20-22-01/601. Resistance shall not exceed 0.010 ohm.
   I. Tighten fuel inlet line clamp.
   J. Install clevis pin in lock mechanism, install washer and cotter pin.
   K. Install fuel tank access panel (AMM 28-11-11/401).



Boost Pump Bypass Valve Installation (Typical)
Figure 401

FUEL BOOST PUMP CHECK VALVE - REMOVAL/INSTALLATION

1. General
   A. Removal/installation procedure for all of the fuel boost pump check valves is basically the same, the only differences being location and access. Tanks 1 and 2 each contain three valves. As the valves are located inside the tanks it is necessary to defuel the applicable fuel tank to gain access to any valve.
2. Equipment and Materials
   A. Aliphatic Naphtha (Ref 20-30-31)
   B. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
WA 3. Prepare Fuel Boost Pump Check Valve for Removal
   A. Defuel and purge applicable fuel tank (Ref 28-23-0, 28-10-0 MP).

      WARNING: DO NOT COMPROMISE THE SAFETY PRECAUTIONS GIVEN FOR PURGING AND FUEL TANK ENTRY.

   B. Gain access to valve to be removed through access panel No. 1 (AMM 28-11-11/401) and applicable rib access openings.
4. Remove Fuel Boost Pump Check Valve
   A. Disconnect low pressure sensing line (Fig. 401)
   B. Remove fuel line mounting bolts and nuts.
   C. Remove fuel boost pump check valve mounting bolts.

      CAUTION: CHECK VALVE MUST NOT BE ALLOWED TO FALL BECAUSE DAMAGE TO WING SKIN MAY RESULT.

   D. Remove check valve and remove O-rings from check valve flanges.
5. Install Fuel Boost Pump Check Valve
   A. Clean O-ring groove and machined surfaces of valve and mating surfaces with naphtha. Wipe dry with a cotton wiper (BMS15-5).
   B. Install new O-rings, lightly lubricated with fuel, in check valve flanges.
   C. Position check valve in place and install mounting bolts and nuts.
   D. Install fuel line mounting bolts and nuts.
   E. Connect low pressure sensing line.
6. Return Airplane to Normal
   A. Install access door(s) in rib openings, if previously removed.
   B. Install access panel (AMM 28-11-11/401).
   C. Fill tank with fuel (AMM 12-11-0/301) and do a check of the access panel for leaks.

APU FUEL FEED LINE - REMOVAL/INSTALLATION

1. General
   A. The APU fuel feed line carries fuel from the engine fuel line or APU fuel line bypass to the APU. To simplify removal/installation, the APU fuel feed line is divided into four segments. The segment from the engine fuel feed line and APU fuel line bypass to the 70.85 rib web is contained within the No. 1 fuel tank and will be identified as the APU fuel feed line (No. 1 fuel tank). The segment from the 70.85 rib web to the center wing box upper skin is contained within the wing center section and will be identified as the APU fuel feed line (wing center section). The segment from the center wing box upper skin to the APU compartment is a flexible line, enclosed in a shroud and will be identified as the APU fuel feed line (flexible). The segment in the APU compartment, connecting the flexible line to the APU fuel filter installation, is enclosed in a shroud and will be identified as the APU fuel feed line (APU compartment).
2. Removal/Installation APU Fuel Feed Line (No. 1 Fuel Tank)
   A. Equipment and Materials
      (1) Air pressure source - 40 psi maximum
      (2) Bonding meter (Ref 20-22-01 I/C)
   B. Prepare for APU Fuel Feed Line (No. 1 Fuel Tank) Removal
      (1) Connect external electrical power to airplane (Ref Chapter 24, Electrical Power).
      (2) Make sure that all fuel system circuit breakers, on aft overhead panel (P6), are closed.
      (3) Defuel fuel tank No. 1 (Ref 28-23-0 MP).
      (4) Place crossfeed valve switch, on forward overhead panel (P5), in the CLOSED position.
      (5) On airplanes with engine start lever control of engine fuel shutoff valves, ensure that ignition circuit breakers on P6 panel are open and that engine No. 1 start lever on aisle stand is in IDLE position.
      (6) Check that engine No. 1 fuel shutoff valve is open. Fire switch, on aft electronic panel (P8), in and locked.
      (7) Remove external electrical power from airplane.

(8) Remove LH center tank fuel boost pump access panel (7201L) and close fuel boost pump removal valve.
(9) Remove fuel tank No. 1 access panel No. 1, to provide access to APU fuel feed line (Ref 28-11-0, 28-11-11 R/I).
(10) Purge fuel tank No. 1 (Ref 28-10-0 MP).

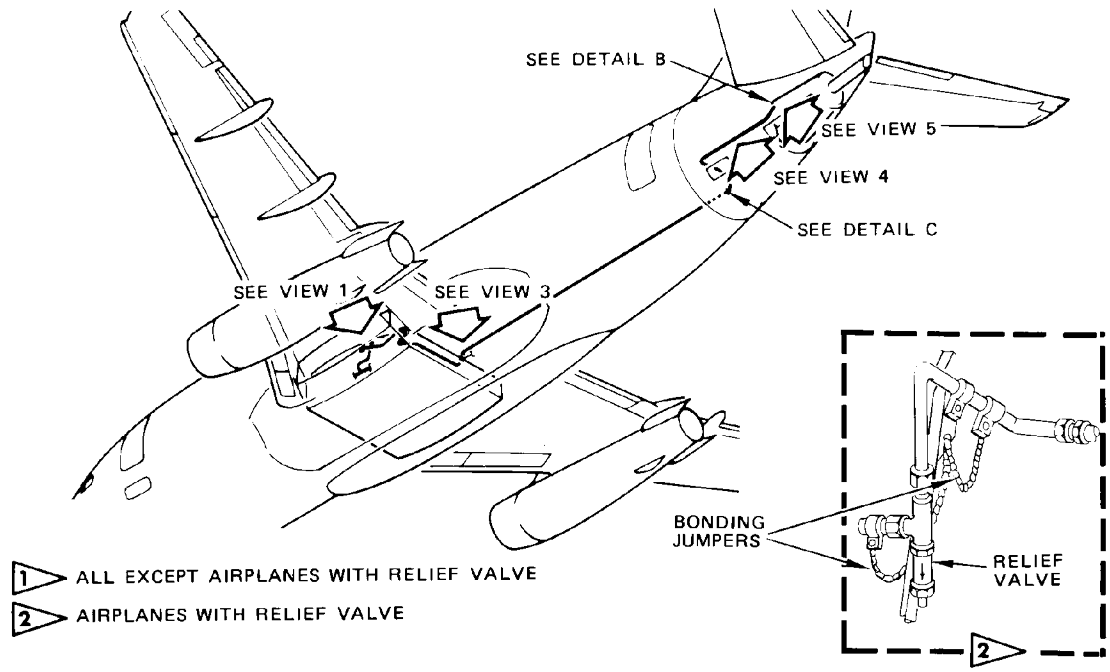
C. Remove APU Fuel Feed Line (No. 1 Fuel Tank)
(1) Disconnect one end of APU fuel line bonding jumper (View 1, Fig. 401).
(2) Remove bolt attaching APU fuel line support clamp.
(3) Remove bolts attaching APU fuel line bypass to bracket.
(4) Disconnect APU fuel line coupling nut at engine fuel feed line and tee connection. Remove line.

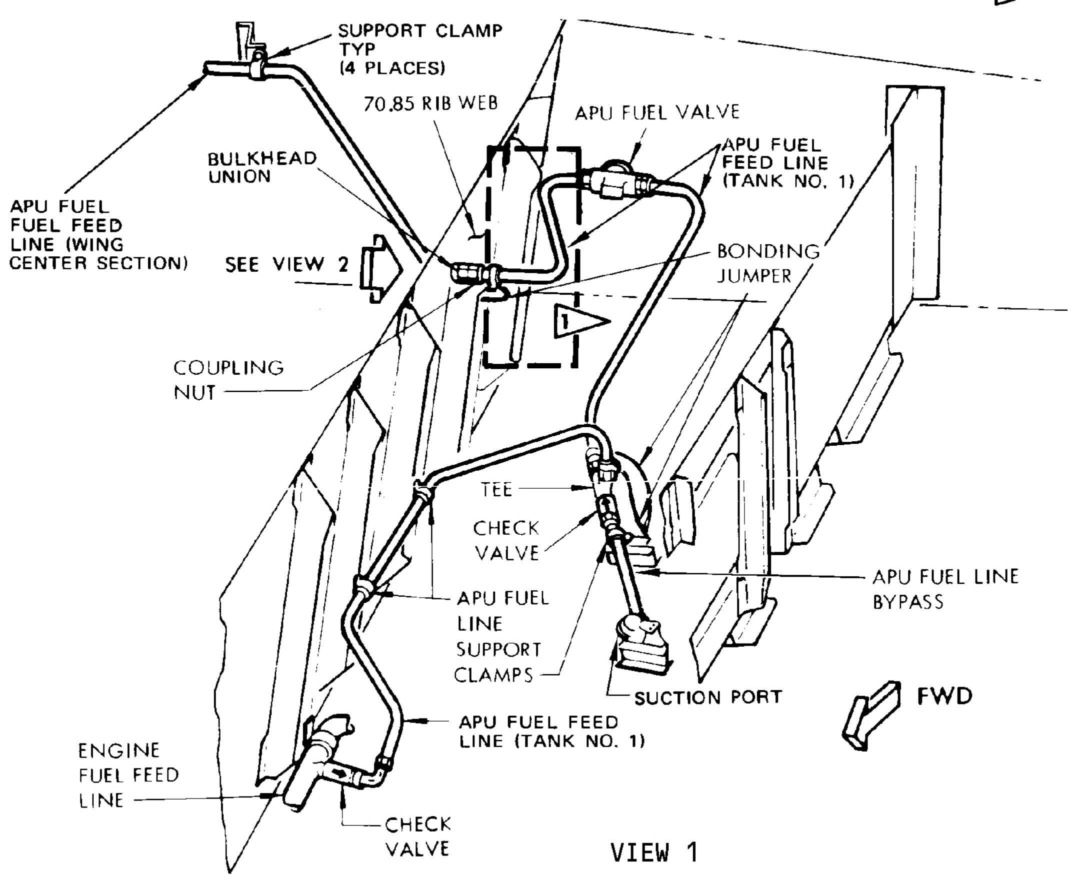
<u>WARNING</u>: DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL FEED LINES ARE DISCONNECTED. REFER TO 28-10-0, MAINTENANCE PRACTIVES, FOR SAFETY PRECAUTIONS.

(5) Disconnect APU fuel line coupling nut at APU fuel valve.
(6) Place suitable container under connections and disconnect APU fuel line coupling nut at APU fuel valve and APU fuel feed fitting at the 70.85 rib web. Remove line.

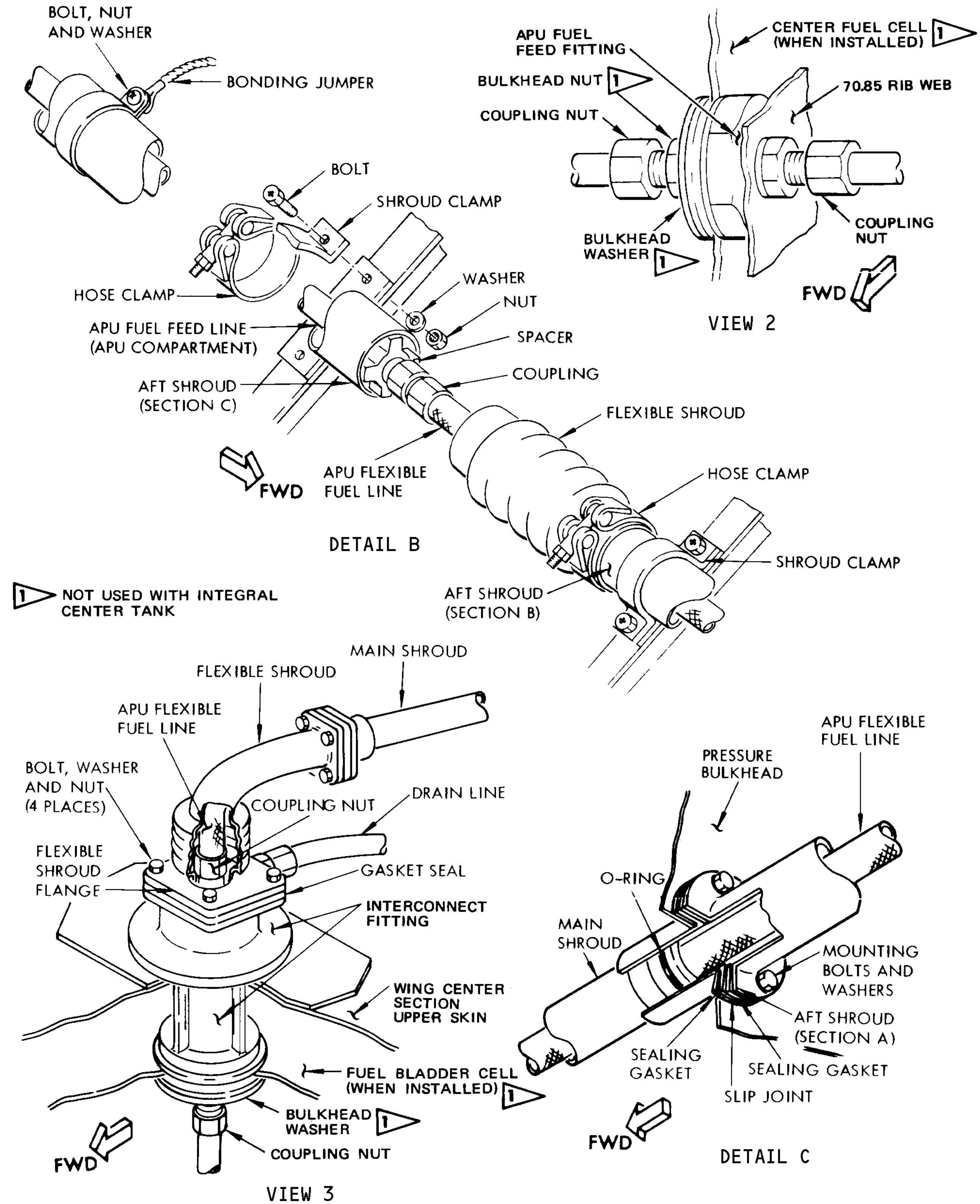
D. Install APU Fuel Feed Line (No. 1 Fuel Tank)
(1) Insert the three APU fuel line segments through access panel opening No. 1 and applicable rib access openings.
(2) Connect APU fuel line coupling nut to the APU fuel valve and APU fuel feed fitting at the 70.85 rib web.
(3) Connect APU fuel line, tee, and bypass pickup assembly coupling nut to the APU fuel valve.
(4) Connect APU fuel line coupling nut to the engine fuel feed line and tee connection.
(5) Position APU bypass on bracket and install mounting bolts.
(6) Position support clamps and install attaching bolts.
(7) Connect APU fuel line bonding jumpers.
(8) Check electrical bond between APU fuel line and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.010 ohm.
(9) Pressurize APU fuel feed line and check for leaks (air method).
(a) Temporarily detach suction port fuel line from connecting fitting and attach air pressure source and gage to fitting.
(b) If open, manually close APU fuel shutoff valve.
(c) Apply 40-psi maximum air pressure and hold for a minimum of 5 minutes.
(d) Check all fuel line connections and fittings for evidence of external leakage (no leakage allowed).
(e) Release pressure, remove air source and pressure gage, and reconnect suction port fuel line. Check tube nuts for tightness.

E. Return Airplane to Normal
(1) Remove all tools and equipment from tank cavities.
(2) Install fuel tank access panel (Ref 28-11-11 R/I).

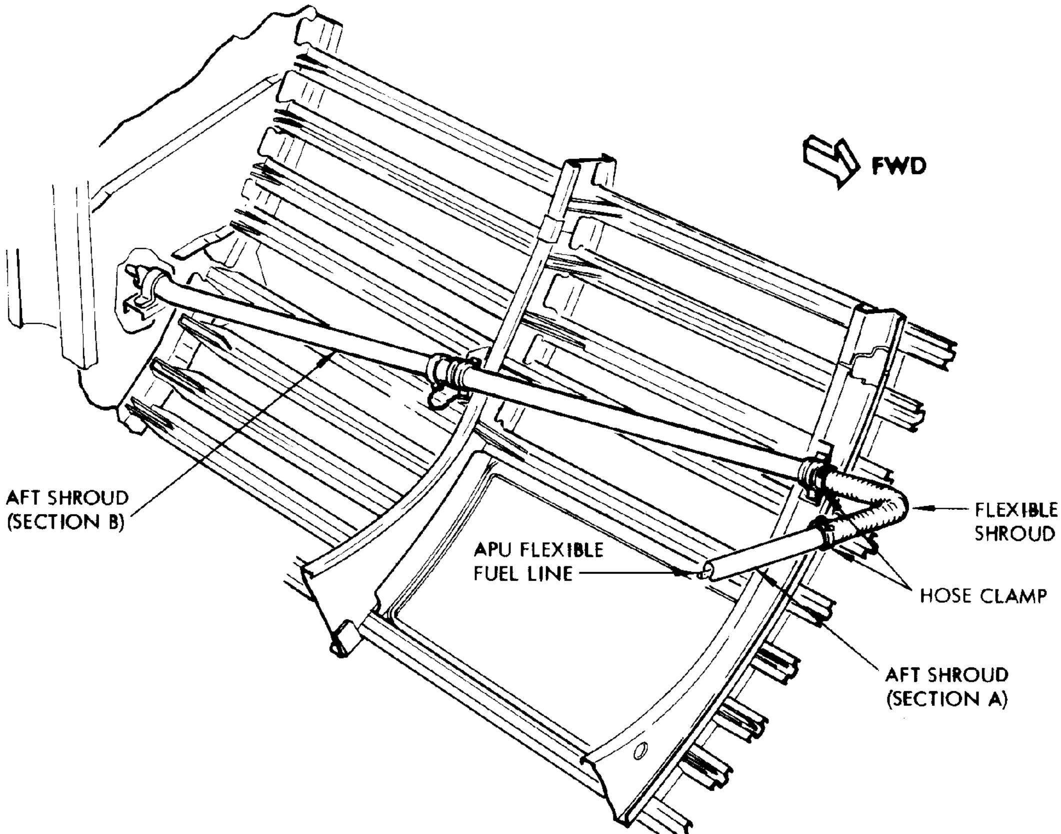




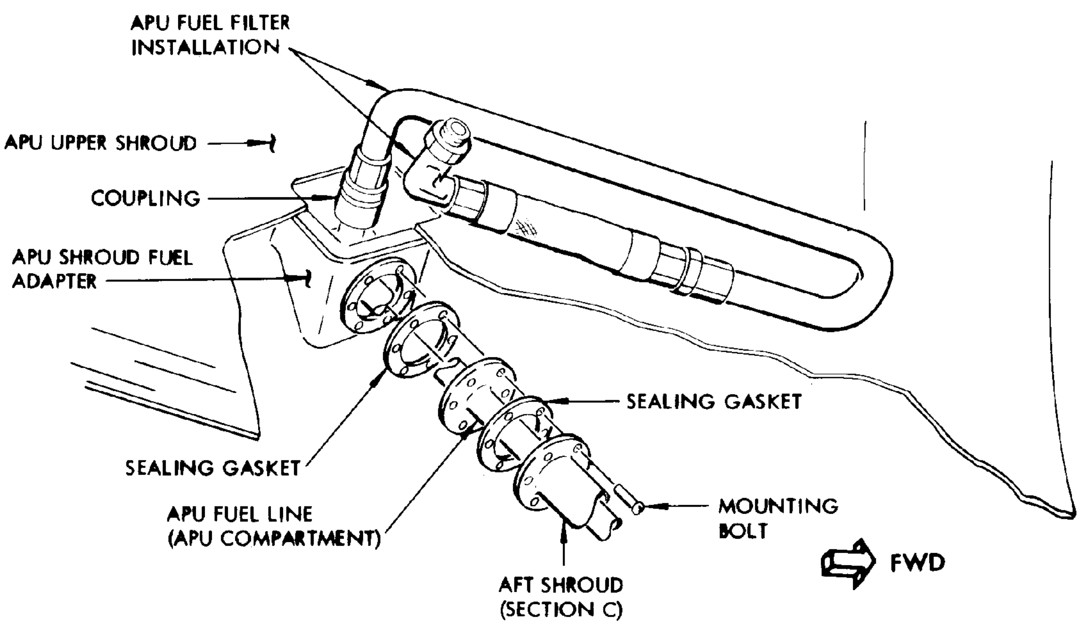
APU Fuel Feed Line Installation
Figure 401 (Sheet 1)



APU Fuel Feed Line Installation
Figure 401 (Sheet 2)



VIEW 4



VIEW 5

APU Fuel Feed Line Installation
Figure 401 (Sheet 3)

(3) Open LH center tank fuel boost pump removal valve and install access panel (7201L).

NOTE: Make sure that boost pump removal valve is open before installing boost pump access panel.

(4) Close and latch the engine No. 1 cowling (Ref Chapter 71, Power Plant).

3. Removal/Installation of APU Fuel Feed Line (Wing Center Section)

A. Equipment and Materials
(1) Air pressure source - 40 psi maximum

B. Prepare for Removal
(1) Connect external electrical power to airplane (Ref 24-22-0 MP).
(2) Check that all fuel system circuit breakers on P6 panel are closed.
(3) Defuel tank No. 1 and center tank (Ref 28-23-0 MP).
(4) Remove external electrical power from airplane (Ref 24-22-0 MP).
(5) Purge tank No. 1 and center tank (Ref 28-10-0 MP).

WARNING: DO NOT COMPROMISE SAFETY PRECAUTIONS GIVEN FOR PURGING AND ENTERING FUEL TANK.

C. Remove APU Feed Line (Wing Center Section)
(1) Remove bolt and washer attaching APU fuel line support clamp (4 places) (View 1, Fig. 401).
(2) Place suitable container under connection and disconnect APU fuel line coupling nut at bulkhead union (view 2).

WARNING: TO REDUCE POSSIBLE EXPLOSION HAZARD, DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL LINES ARE OPEN (REF 28-10-0, MP).

(3) Disconnect APU fuel line coupling nut at upper interconnect fitting (view 3). Remove line from center fuel tank cavity or cell.

CAUTION: USE CARE IN MANEUVERING LENGTHS OF TUBING OUT OF CENTER TANK CAVITIES TO AVOID DAMAGE TO TUBING AND SURROUNDINGS.

D. Install APU Fuel Feed Line (Wing Center Section)
(1) Insert APU fuel line through center tank access panel opening and center tank access openings in spanwise beams.
(2) Connect APU fuel line coupling nuts (finger-tight). Position line and install support clamps (4 places). Tighten coupling nuts.
(3) Pressurize APU fuel line and check for leaks (air method)
(a) Enter tank No. 1 and remove relief valve from tee at 70.85 rib web. Plug port in tee.
(b) Close APU fuel shutoff valve.
(c) Enter APU compartment and disconnect fuel feed line at APU fuel filter. Attach air pressure source and gage to fitting.
(d) Apply 40-psi maximum air pressure and hold for a minimum of 5 minutes.

(e) Check all fuel line connections and fittings for evidence of external leakage (no leakage allowed).
(f) Release pressure, remove air source and pressure gage, and reconnect fuel feed line at APU fuel filter inlet. Check tube nuts for tightness.
(g) Enter tank No. 1 and remove plug from tee at 70.85 rib web. Reinstall APU pressure relief valve in tee.

E. Return Airplane to Normal
(1) Remove all tools and equipment from tank cavities.
(2) On airplanes with removable bladder cells, install center tank intercell access panel, if used (Ref 28-12-41 R/I).
(3) Install fuel cell and center tank access panel, as applicable (Ref 28-12-21 R/I and 28-12-31 R/I on airplanes with removable bladder cells, or 28-11-31 R/I on all other airplanes).
(4) Install No. 1 tank access panel (Ref 28-11-11 R/I).

4. Removal/Installation of APU Fuel Feed Line (Flexible)

A. Equipment and Materials
(1) Air pressure source - 10 psi maximum
(2) Bonding meter (Ref 20-22-01 I/C)

B. Prepare for Removal
(1) Remove aisle carpets and floor panel at STA 660 for access to center tank interconnect fitting (Ref Chapter 25, Equipment/Furnishing).
(2) Remove external electrical power from airplane (Ref 24-22-0 MP).
(3) Open APU CONT circuit breaker on P6 panel.

C. Remove APU Fuel Feed Line (Flexible)
(1) Remove bolts attaching flexible shroud to interconnect fitting (View 3, Fig. 401).
(2) Pull flexible shroud away from center tank interconnect fitting and disconnect flexible fuel line coupling nut.

WARNING: DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL LINES ARE DISCONNECTED (REF 28-10-0, MAINTENANCE PRACTICES).

NOTE: When the flexible fuel line is opened, a small amount of fuel will drain from the center cavity/APU shroud drain mast. A suitable container should be placed under the drain mast.

(3) Obtain access to APU fuel line aft shroud in APU compartment (Detail B) through APU compartment access door (Ref Chapter 49).
(4) Loosen hose clamp and slide flexible shroud off aft shroud "section B" to expose flexible fuel line coupling. Disconnect APU fuel lines.
(5) Obtain access to APU fuel line aft shroud (View 4) in tail cone through stabilizer trim access door (Ref Chapter 12, Access Doors and Panels).

(6) Loosen hose clamp attaching flexible shroud to aft shroud "section B" and slide flexible shroud forward to expose fuel line.
(7) Withdraw aft portion of flexible fuel line from aft shroud "section B," lowering line through access door opening.
(8) Remove "section A" segment of aft shroud.
  (a) Remove bolt securing bonding jumper to aft shroud.
  (b) Remove bolts (Detail C) attaching aft shroud to pressure bulkhead.
  (c) Remove bolts attaching aft shroud support clamps to pressure bulkhead (2 places).
  (d) Rotate aft shroud and remove through access door by sliding shroud off flexible fuel line.
(9) Withdraw forward portion of flexible fuel line from the main shroud by pulling the line aft, at the pressure bulkhead, passing line through access door.

D. Install APU Fuel Feed Line (Flexible)
(1) Insert flexible fuel line through stabilizer trim access door and insert into aft end of main shroud (Detail C, Fig. 401).
(2) Continue to insert fue1 line into main shroud until line contacts center tank interconnect fitting (View 3).
(3) Pull flexible shroud away from center tank interconnect fitting and connect fuel line.

NOTE: Do not attach flexible shroud until fuel line leak check has been performed.

(4) Install "section A" segment of APU fuel line aft shroud (View 4, Detail C).
  (a) Slide sealing gasket and shroud over fuel line, through the stabilizer access door, and position against pressure bulkhead.
  (b) Install shroud support clamps (two places). Loosely attach clamps to pressure bulkhead.
  (c) Align slip joint, sealing gasket, and shroud. Install mounting bolts and washers.
  (d) Tighten shroud support bolts and install bolt securing bonding jumper to aft shroud. Check electrical bond between aft shroud and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
(5) Insert aft end of flexible fuel line in aft shroud "section B" and slide fuel feed line aft until line contacts the APU fuel line (APU compartment) Connect fuel line (View 4, Detail B).

NOTE: Do not attach flexible shroud to aft shroud "section B" until fuel line leak check has been performed.

(6) Slide flexible shroud over aft shroud "section B' and install hose clamp (view 4).
(7) Pressurize APU fuel feed line and check for leaks (fuel method).
  (a) Connect external electrical power to airplane (Ref 24-22-0 MP).
  (b) Close fuel system circuit breakers on P6 panel: FWD BOOST PUMP TANK 2, SHUTOFF VALVE ENG 1, SHUTOFF VALVE ENG 2, APU CONT, and MANIF VALVE.
  (c) Close INDICATOR LTS circuit breaker on P6 panel.
  (d) Pull engine fire switches on P8 panel to FIRE position to close both engine fuel shutoff valves.
  (e) Place crossfeed valve switch on P5 panel in OPEN position.
  (f) Open the APU fuel valve.
    1) Put the BATTERY switch to ON.
    2) Put the APU master switch to ON.
  (g) Put the tank No. 2 FWD boost pump switch in ON position.
    1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

       WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

       a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

          NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

  (h) After fuel low pressure indicating light goes off, check all APU fuel line connections for leaks.
  (i) Put the boost pump switch in OFF position.
  (j) Put the APU master switch to OFF.
  (k) Put the BATTERY SWITCH to OFF.
(8) Slide flexible shroud over aft shroud "section B" (Detail B) and install hose clamp.
(9) Install the bolts that attach the flexible shroud (view 3) to center
(10) Pressurize the APU fuel line shroud with air and check for leaks.
  (a) Disconnect the shroud drain line at interconnect fitting (view 3).

(b) Apply 10 psi to shroud drain connection at interconnect fitting for 5 minutes. There shall be no loss of pressure.
(c) Connect the shroud drain interconnect fitting.

E. Return Airplane to Normal Configuration
(1) Push the engine fire switches on P8 panel to NORMAL position.
(2) Put the crossfeed valve switch on P5 panel in closed position.
(3) Install the floor panel and aisle carpets at STA 660 (AMM Chapter 25, Equipment/Furnishings).
(4) Open all fuel system and indicator light circuit breakers on P6 panel.
(5) Remove external electrical power, if no longer required.

5. Removal/Installation APU Fuel Feed Line (APU Compartment)

A. Equipment and Materials
(1) Air pressure source - 10 psi maximum
(2) Bonding meter (Ref 20-22-01 I/C)

B. Remove APU Fuel Feed Line (APU Compartment)
(1) Remove external electrical power from airplane.
(2) Open APU CONT circuit breaker on P6 panel.
(3) Obtain access to APU fuel feed line aft shroud in APU compartment through APU compartment access door (Ref Chapter 49).
(4) Loosen hose clamp and slide flexible shroud off aft shroud "section C" to expose fuel line (Detail B, Fig. 401).
(5) Tape flexible APU fuel line to shroud "section B" and disconnect fuel line coupling.

WARNING: DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL LINES ARE OPEN (REF 28-10-0 MP).

(6) Disconnect APU fuel feed line coupling from the APU fuel filter installation (view 5).
(7) Remove bolt securing bonding jumper (Detail B) to aft shroud "section C."
(8) Remove bolts attaching aft shroud "section C" support clamp to APU compartment.
(9) Remove bolts attaching aft shroud to APU shroud fuel adapter (view 5).
(10) Rotate fuel feed line, with aft shroud "section C" attached, and remove fuel feed line and shroud.
(a) Slide aft shroud and sealing gaskets off fuel feed line.

C. Install APU Fuel Feed Line (APU Compartment)
(1) Slide sealing gaskets and aft shroud "section C" on APU fuel line.
(2) Rotate fuel feed line and shroud and insert fuel feed line in APU shroud fuel adapter.
(3) Align sealing gaskets and fuel feed line flange with APU shroud fuel adapter and install mounting bolts.

(4) Install bolts attaching aft shroud support clamp (Detail B) to APU compartment.
(5) Install bolt attaching bonding jumper to aft shroud.
(6) Check electrical bond between aft shroud and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.010 ohm.
(7) Connect fuel feed line coupling (View 5) to APU fuel filter installation.
(8) Connect fuel feed line coupling (detail B) to flexible fuel feed line. Remove tape used to secure flexible fuel feed line.

NOTE: Do not attach flexible shroud until fuel line leak check has been performed.

(9) Pressurize APU fuel feed line and check for leaks (fuel method) per step 4.D.(7).
(10) Slide flexible shroud over aft shroud "section C" and install hose clamp.
(11) Pressurize APU fuel line shroud with air and check for leaks.
(a) Perform step 4.D.(10) to leak check shroud.

D. Return Airplane to Normal Configuration
(1) Push the engine fire switches on P8 panel to NORMAL position.
(2) Put the crossfeed valve switch on P5 panel in closed position.
(3) Open all fuel system and indicator light circuit breakers on P6 panel.
(4) Remove external electrical power, if no longer required.

APU FUEL FEED LINE - INSPECTION/CHECK

1. General
   A. This procedure has one task:
      (1) Do a check of the APU fuel feed line for leakage.
   B. If the leakage rate from the APU fuel feed line is more than the limits, the APU fuel feed line must be replaced or the APU fuel feed line must be drained and the APU must be deactivated as inoperative until the APU fuel feed line can be replaced.
   C. The APU fuel feed line shroud is referred to as the APU shroud.
2. APU Fuel Feed Line Leakage Check
   A. Equipment
      (1) Container - applicable for fuel
      (2) Collar - Circuit Breaker
   B. APU Fuel Feed Line Leakage
      (1) Put a container under the drain mast to catch the fuel from the APU shroud.

         NOTE: The drain mast is located outboard and aft of the left main gear wheel well.

      (2) Do a check of the drain leakage rate at the drain mast.
         (a) Measure the fuel leakage rate at the drain mast for 5 minutes.
         (b) If the fuel leakage rate is not more than 1 drop per minute, the fuel leakage rate is OK.
         (c) If the fuel leakage rate is more than 1 drop per minute, do the In-Service Operational Check.
   C. In-Service Operational Check
      (1) Pressurize the APU fuel line to do a check for leakage.
         (a) Put a container under the drain mast to catch all the fuel from the APU shroud.
         (b) Connect the external electrical power to the airplane (AMM 28-22-00/201).
         (c) Make sure these circuit breakers are closed:
            1) On the main power distribution panel, P6:
               a) BOOST PUMP FWD TANK 2
               b) SHUTOFF VALVE ENG 1
               c) SHUTOFF VALVE ENG 2
               d) APU CONT
               e) CROSSFEED VALVE
               f) IND LT
         (d) Make sure the engine start levers on the engine control stand are at the CUTOFF position to close the two engine shutoff valves.
         (e) Set the fuel crossfeed valve switch on the P5 overhead panel to the OPEN position.

(f) Open the APU fuel valve.
  1) Set the BATTERY switch on the P5 overhead panel to ON.
  2) Set the APU master switch on the P5 overhead panel to ON.
(g) Set the No. 2 tank, FWD boost pump switch, on the P5 overhead panel, to the ON position.
  1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

  <u>WARNING</u>: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

    a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

    <u>NOTE</u>: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(h) Keep the pressure on the APU fuel feed line for 30 minutes.
(i) Set the No. 2 tank FWD boost pump switch to the OFF position.
(j) Close the APU fuel valve.
  1) Set the APU master switch to OFF.
  2) Set the BATTERY switch to OFF.

(2) Measure the quantity of fuel in the container: this is the fuel leakage from the drain mast collected over 30 minutes.
(3) If the quantity of fuel is not more than 60 drops (3 milliliters) in 30 minutes, do these steps:
  (a) Continue to operate the APU.
  (b) Do the In-Service Operational Check daily until you can repair the leak or replace the APU fuel feed line (AMM 28-22-81/401).
(4) If the quantity of fuel is more than 60 drops (3 milliliters) in 30 minutes, do the applicable steps:
  (a) Replace the APU fuel feed line (AMM 28-22-81/401) or
  (b) Do these steps to deactivate the APU and fully drain the APU fuel feed line:
    1) Make sure the APU master switch is at the OFF position and install a APU INOPERATIVE tag.

2) Open and collar this circuit breaker on the P6 Main Power Distribution Panel, to deactivate the APU fuel shutoff valve in the closed position:
   a) APU CONT
3) Get access to the APU fuel shutoff valve on the aft side of the No. 2 main fuel tank, rear wing spar, left wing wheel well.
4) Do a check that the manual override lever on the APU fuel shutoff valve actuator has moved to the closed position.
   a) If not, manually put the lever to the closed position.
5) Fully drain the APU fuel feed line until you can repair the leak or replace the APU fuel feed line (AMM 28-22-81/401).

APU FUEL FEED LINE SHROUD - REMOVAL/INSTALLATION

1. General
   A. The APU fuel feed line shroud runs from the fuel feed line exit point on the center wing box upper skin to the APU shroud fuel adapter. To simplify removal/installation, the APU fuel feed line shroud is divided into two segments. The segment from the center wing box upper skin to the forward side of the pressure bulkhead will be identified as the main shroud. The segment from the aft side of the pressure bulkhead to the APU shroud fuel adapter will be identified as the aft shroud.
2. Removal/Installation APU Fuel Feed Line Shroud (Main)
   A. Equipment and Materials
      (1) Air pressure source - 10 psi maximum
      (2) Bonding meter (Ref 20-22-01 I/C)
   B. Prepare for APU Fuel Feed Line Shroud (Main) Removal
      (1) Remove aisle carpets and floor panels, between station 616 and station 1016, for access to main shroud interconnect fittings and shroud clamps (Ref Chapter 25, Equipment/Furnishings).

      NOTE: Access to the five shroud clamps, between station 947 and station 1016, may be obtained through the aft wall access panels of the aft cargo compartment.

      (2) Remove electrical power from airplane.
   C. Remove APU Fuel Feed Line Shroud (Main)
      (1) Remove main shroud portion of flexible fuel feed line.

      NOTE: If the flexible fuel feed line is to be completely removed, refer to 28-22-81, Remove APU Fuel Feed Line (Flexible).

         (a) Remove bolts attaching flexible shroud to center tank interconnect fitting (Fig. 401).
         (b) (b) Pull flexible shroud away from the center tank interconnect fitting and disconnect flexible feed line coupling nut.

         WARNING: DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL LINES ARE DISCONNECTED. REFER TO 28-10-0, FUEL STORAGE SYSTEM - MAINTENANCE PRACTICES, FOR SAFETY PRECAUTIONS.

         NOTE: When the flexible fuel line is opened, a small amount of fuel will drain from the center cavity/APU shroud drain mast. A suitable container should be placed under the drain mast.

(c) Obtain access to APU fuel line aft shroud (view 2) in tail cone through stabilizer trim access door. Refer to Access Doors and Panels, Chapter 12.
(d) Remove bolt securing bonding jumper to aft shroud "section A".
(e) Remove bolts (detail B) attaching "section A" shroud to pressure bulkhead.
(f) Remove bolts attaching aft shroud support clamps to pressure bulkhead (two places) and pull "section A" shroud away from pressure bulkhead.
(g) Withdraw forward portion of flexible fuel line from the main shroud by pulling the line aft, coiling flexible line in tail cone area.

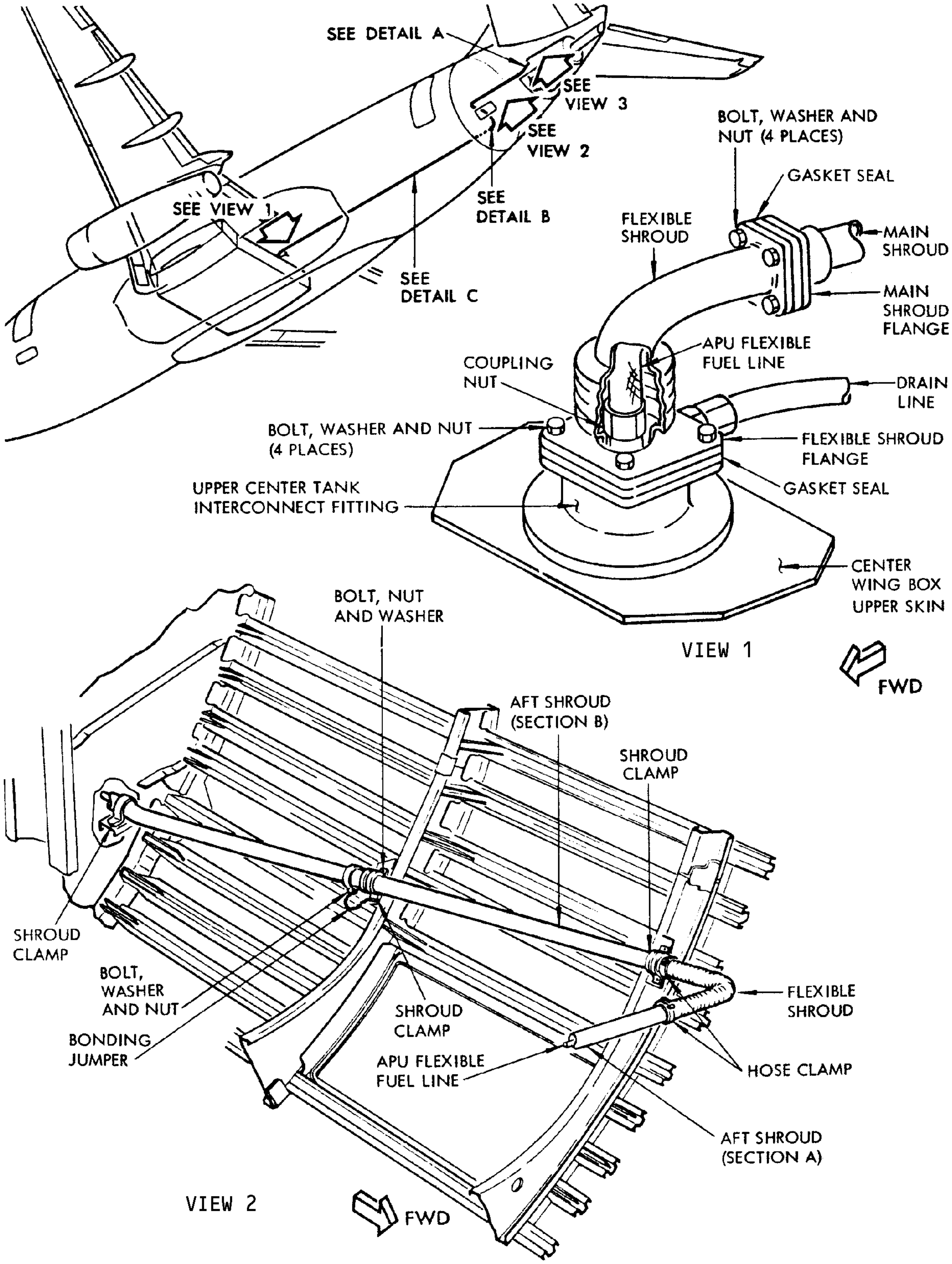
(2) Remove bolts attaching flexible shroud (view 1) to main shroud.
(3) Remove shroud support clamps (21 places). (See detail C.)
(4) Remove main shroud from floor beams by pulling shroud forward, rotating shroud to clear control cables and lifting shroud sufficiently to clear floor panels.
(5) Remove shroud from airplane through aft door.

D. Install APU Fuel Feed Line Shroud (Main)

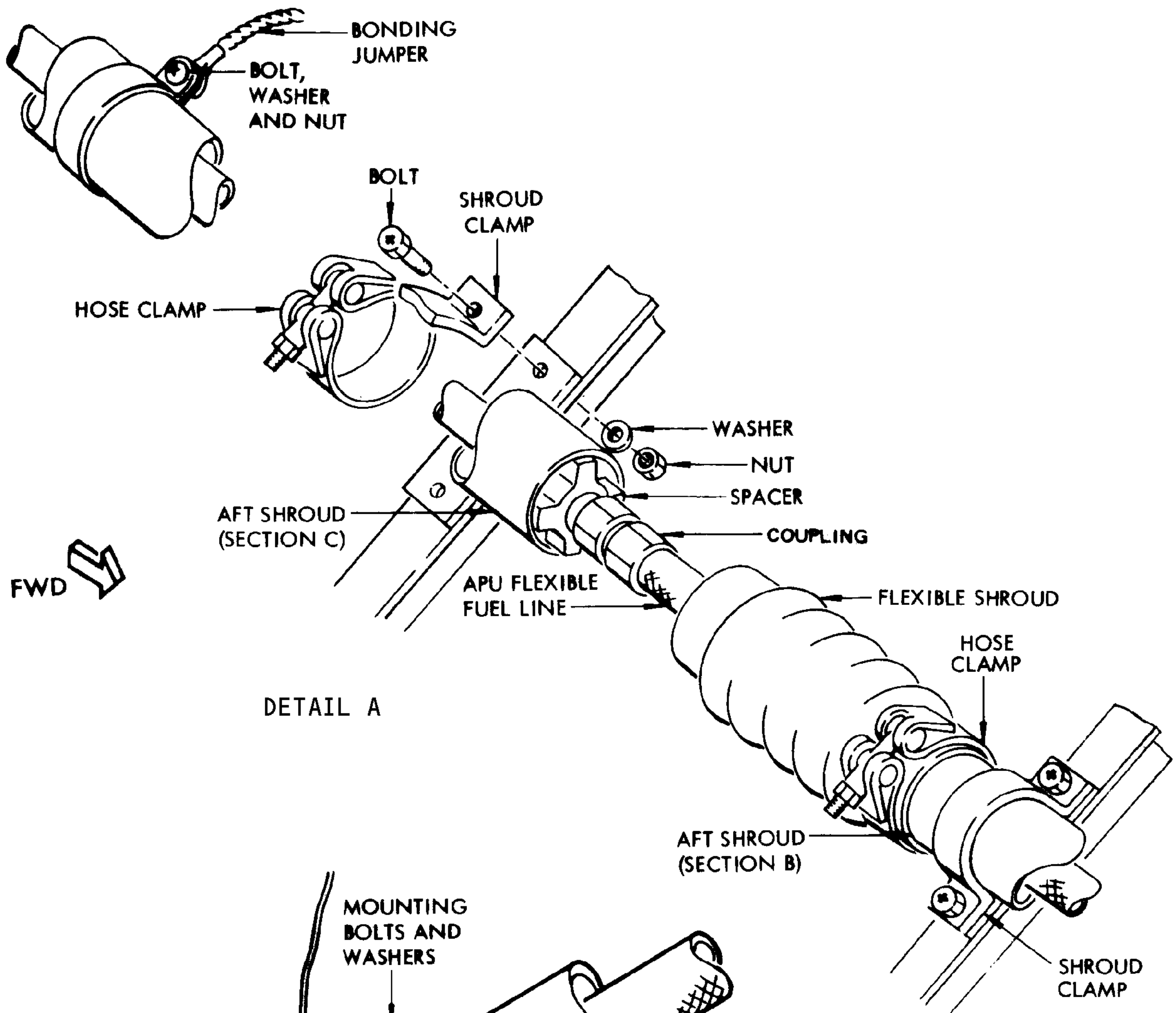
(1) Insert main shroud through the aft door and place in position by feeding shroud aft through the floor beams, rotating the forward portion of shroud to clear control cables.
(2) Install new O-ring on main shroud aft end fitting and insert main shroud into pressure bulkhead slip joint (Fig. 401, Detail B).
(3) Attach flexible shroud (view 1) to main shroud. Torque attaching bolts to 180 pound-inches.
(4) Rotate main shroud until flexible shroud is aligned with the upper center tanks interconnect fitting. Center main shroud locating rings at clamp location (first shroud clamp aft of flexible shroud) and install clamp.
(5) Install remaining shroud support clamps (20 places) (detail C).
(6) Insert flexible fuel line through pressure bulkhead and feed line forward until upper center tank interconnect fitting is contacted. Connect flexible fuel line coupling nut.

<u>NOTE</u>: Do not attach flexible shroud until fuel leak check has been performed.

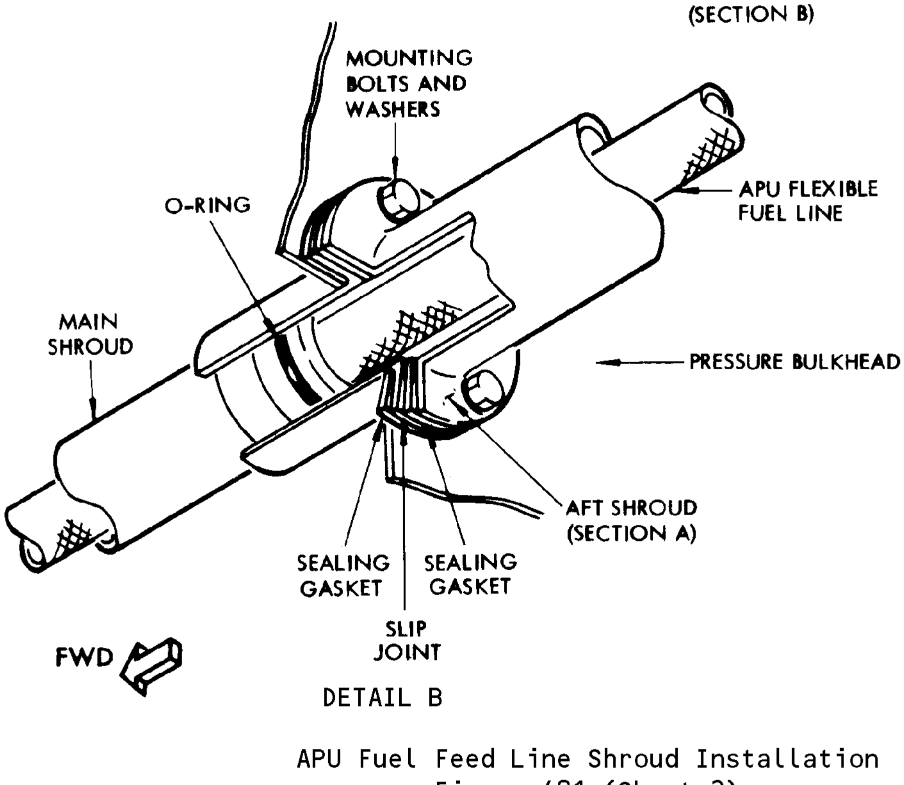
(7) Install "section A" segment of APU fuel line aft shroud (view 2, detail B).
(a) Slide sealing gasket and shroud into position against pressure bulkhead.
(b) Install shroud support clamps (two places). Loosely attach clamps to pressure bulkhead.
(c) Align slip joint, sealing gasket, and shroud. Install mounting bolts and washers.



APU Fuel Feed Line Shroud Installation
Figure 401 (Sheet 1)

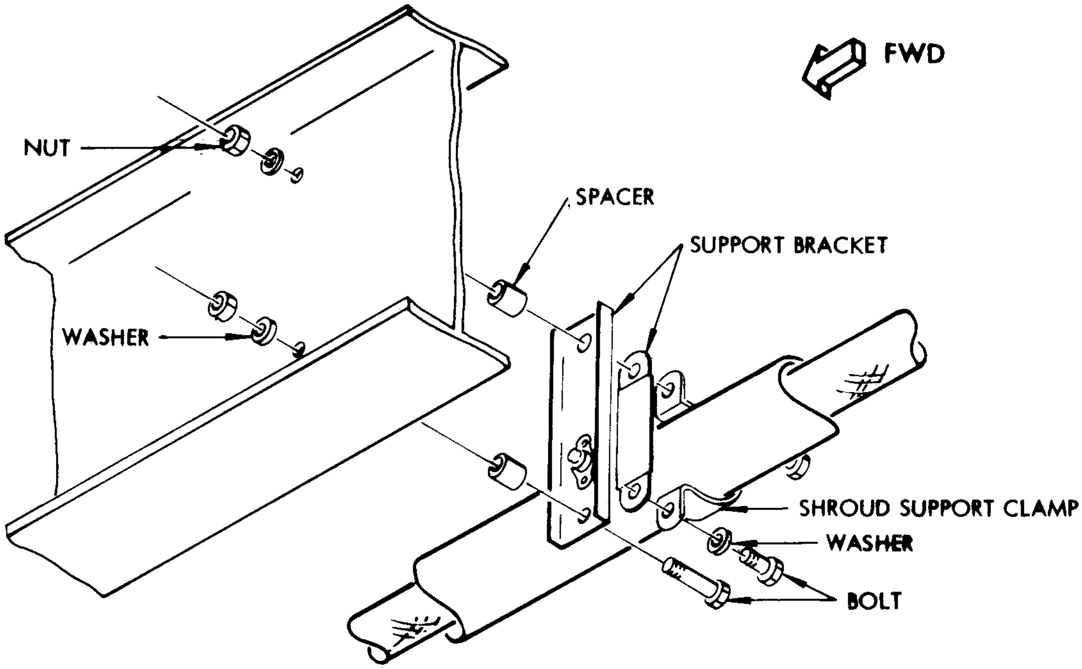


DETAIL A

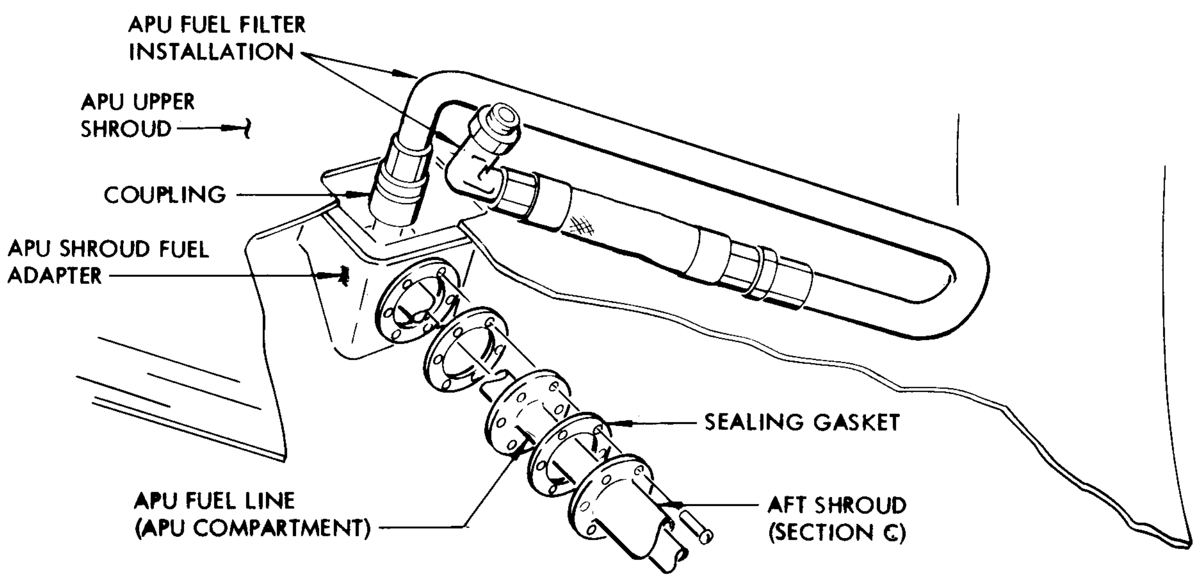


DETAIL B

APU Fuel Feed Line Shroud Installation
Figure 401 (Sheet 2)



DETAIL C
(TYPICAL)



VIEW 3

APU Fuel Feed Line Shroud Installation
Figure 401 (Sheet 3)

(d) Tighten shroud support bolts and install bolt securing bonding jumper to aft shroud.
(e) Check electrical bond between aft shroud and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.010 ohm.

(8) Pressurize the APU fuel feed line and check for leaks.
(a) Connect electrical power to airplane.
(b) Open the APU fuel valve.
1) Check that APU CONT circuit breaker on panel P6 is closed.
2) Put the BATTERY SWITCH to ON.
3) Put the APU master switch to ON.
(c) Put the tank No. 1 FWD boost pump switch in ON position.
1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(d) After fuel low pressure indicating light goes off, put the boost pump switch in OFF position.
(e) Put the APU master switch to OFF.
(f) Put the BATTERY SWITCH to OFF.
(g) Check APU fuel line connection for leaks.

(9) Install the bolts that attach the flexible shroud (view 1) to center tank interconnect fitting.

(10) Pressurize the APU fuel line shroud and do a check for leaks.
(a) Disconnect the shroud drain line located behind the "A" hydraulic reservoir on the wheel well forward wall.
(b) Apply 10 psi to shroud drain for five minutes. There shall be no loss of pressure.
(c) Connect the shroud drain.

E. Return Airplane to Normal Configuration
   (1) Install the floor panels and aisle carpets (AMM Chapter 25, Equipment Furnishings).
   (2) Determine if there is any further need for electrical power on airplane; if not, remove electrical power.

3. <u>Removal/Installation APU Fuel Feed Line Shroud (Aft)</u>

A. Equipment and Materials
   (1) Air Pressure Source - 10 psi maximum
   (2) Bonding meter (Ref 20-22-01 I/C)

B. Remove APU Fuel Feed Line Shroud (Aft)
   (1) Remove electrical power from airplane.
   (2) Obtain access to APU fuel line aft shroud in APU compartment (Fig. 401 Detail A), through APU compartment access door (Ref Chapter 49, APU).
   (3) Loosen hose clamp and slide flexible shroud off aft shroud "section C" to expose flexible fuel line coupling. Disconnect APU fuel line.

   WARNING: DO NOT CONNECT ELECTRICAL POWER TO AIRPLANE WHEN FUEL LINES ARE DISCONNECTED. REFER TO 28-10-0, FUEL STORAGE SYSTEM - MAINTENANCE PRACTICES, FOR SAFETY PRECAUTIONS.

   (4) Remove "section C" segment of aft shroud.
      (a) Disconnect APU fuel feed line coupling (view 3) from the APU fuel filter installation.
      (b) Remove bolt securing bonding jumper (detail A) to aft shroud.
      (c) Remove bolts attaching aft shroud support clamp to APU compartment.
      (d) Remove bolts attaching aft shroud to APU shroud fuel adapter (view 3).
      (e) Rotate fuel feed line and aft shroud and remove from APU shroud.
      (f) Slide aft shroud and sealing gaskets off fuel feed line.
   (5) Remove "section B" segment of aft shroud.
      (a) Obtain access to aft shroud (view 2) in tail cone through stabilizer trim access door (Ref Chapter 12, Access Doors and Panels).
      (b) Loosen hose clamp attaching flexible shroud to aft shroud "section B" and slide flexible shroud forward to expose fuel line.
      (c) Withdraw aft portion of flexible fuel line from aft shroud, lowering line through access door opening.
      (d) Remove bolt securing bonding jumper to aft shroud.
      (e) Remove bolts securing aft shroud support clamps (two places).
      (f) Obtain access to aft shroud in APU compartment (detail A) and remove bolts securing aft shroud support clamp.
      (g) Remove aft shroud by pulling shroud through APU compartment.

(6) Remove "section A" segment of aft shroud.
  (a) Remove bolt securing bonding jumper to aft shroud.
  (b) Remove bolts (detail B) attaching aft shroud to pressure bulkhead.
  (c) Remove bolts attaching aft shroud support clamps to pressure bulkhead (two places).
  (d) Rotate aft shroud and remove through access door while sliding shroud off flexible fuel line.

C. Install APU Fuel Feed Line Shroud (Aft)
(1) Install "section A" segment of aft shroud.
  (a) Slide sealing gasket and shroud (view 2, detail B) over fuel line, through the stabilizer access door, and position against pressure bulkhead.
  (b) Install shroud support clamps (two places). Loosely attach clamps to pressure bulkhead.
  (c) Align slip joint (detail B), sealing gasket, and shroud. Install mounting bolts and washers.
  (d) Tighten shroud support bolts and install bolt securing bonding jumper to aft shroud.
  (e) Check electrical bond between aft shroud and airplane structure per 20-22-01 I/C. Resistance shall not exceed 0.010 ohm.
(2) Install "section B" segment of aft shroud.
  (a) Slide aft shroud through hole in APU compartment wall into tail cone (view 2) while feeding the flexible fuel line into the aft shroud.
  (b) Loosely secure aft shroud support clamps (three places).
  (c) Slide flexible shroud over aft shroud and install hose clamp.
  (d) Install bolt securing bonding jumper to aft shroud.
  (e) Check electrical bond between aft shroud and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.010 ohm.
  (f) Position aft shroud and tighten shroud support bolts.
(3) Install "section C" segment of aft shroud.
  (a) Slide sealing gaskets and aft shroud (view 3) on APU fuel line.
  (b) Rotate fuel feed line and shroud and insert fuel feed line into APU shroud adapter and install mounting bolts.
  (c) Align sealing gaskets and fuel feed line flange with APU shroud fuel adapter and install mounting bolts.
  (d) Install bolts attaching aft shroud support clamp (detail A) to APU compartment.
  (e) Install bolt attaching bonding jumper to aft shroud.
  (f) Check electrical bond between aft shroud and airplane structure per 20-22-01, I/C. Resistance shall not exceed 0.010j ohm.
  (g) Connect fuel feed line coupling (view 3) to APU fuel filter installation.

(h) Connect fuel feed line coupling to flexible fuel feed line.

NOTE: Do not attach flexible shroud until fuel line leak check has been performed.

(4) Pressurize APU fuel feed line and check for leaks.
  (a) Perform steps 2.D.(8)(a) through 2.D.(8)(g).
(5) Slide flexible shroud over aft shroud "section C" and install hose clamp.
(6) Pressurize APU fuel line shroud and check for leaks.
  (a) Perform steps 2.D.(10)(a) through 2.D.(10)(c) to leak check shroud.

D. Return Airplane to Normal Configuration
  (1) Determine if there is any further need for electrical power on airplane; if not, remove electrical power.

ENGINE FUEL SHUTOFF VALVE SWITCH - REMOVAL/INSTALLATION

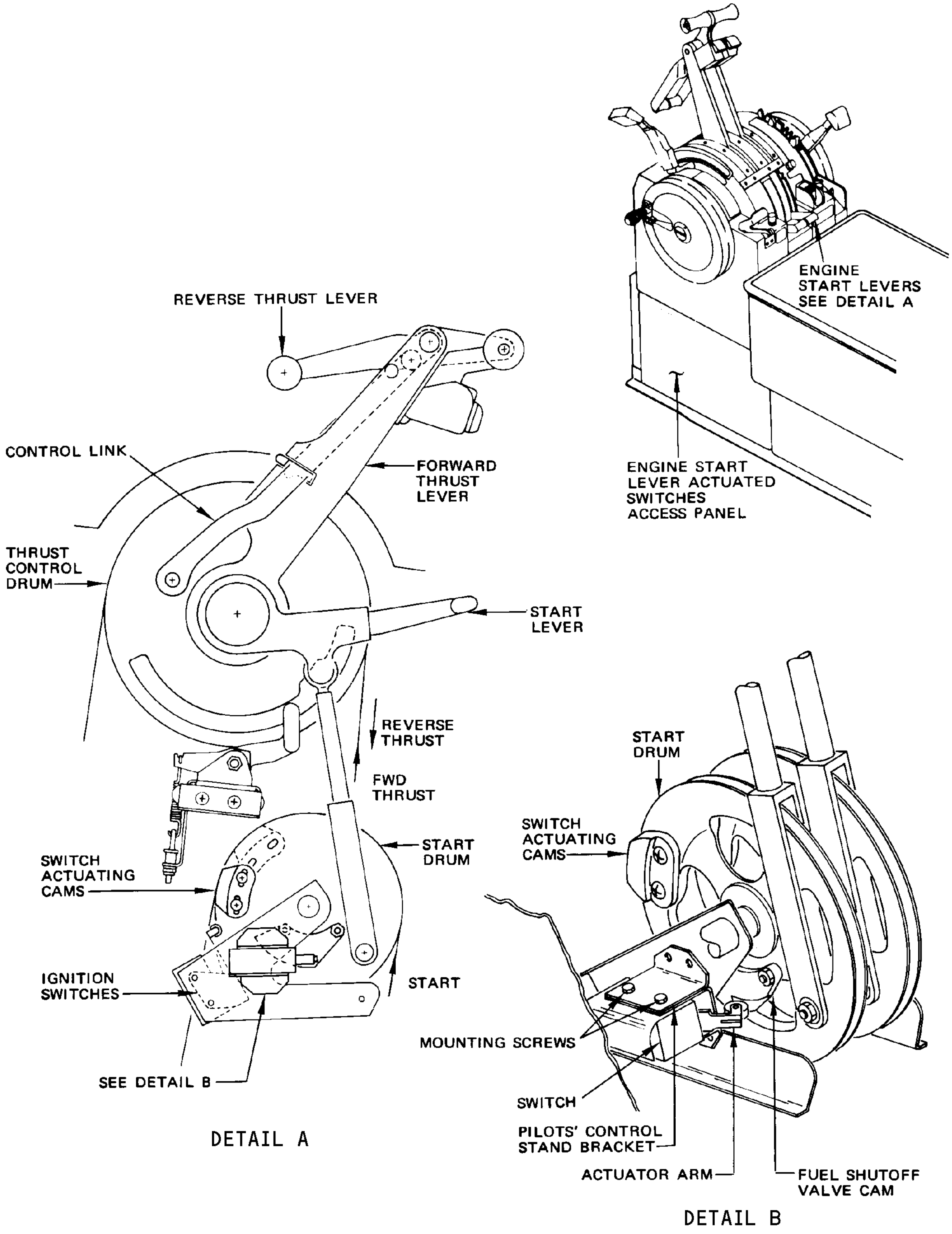
1. Prepare to Remove Engine Fuel Shutoff Valve Switch
   A. Open fuel shutoff and fuel shutoff fire shutdown breakers for both engines on P6-2 circuit breaker panel.
   B. Position start levers in CUTOFF detent.
   C. Remove lower forward panels (both sides) from pilots' control stand.

      NOTE: Fuel shutoff valve switches are mounted on brackets in pilots' control stand. There are two switches, one for each start lever. No. 1 start lever switch is accessible from the LEFT side of the pilots' control stand. No. 2 start lever fuel shutoff valve switches accessibility is from the RIGHT side of the pilots' control stand.

2. Remove Engine Fuel Shutoff Valve Switch (Fig. 401)
   A. Disconnect electrical leads from all switches. Identify leads to facilitate reassembly.
   B. Remove two mounting screws per switch. The switch actuator should be retained for reinstallation if serviceable.

      NOTE: For some airplanes remove mylar and retain if serviceable, also include in installation.

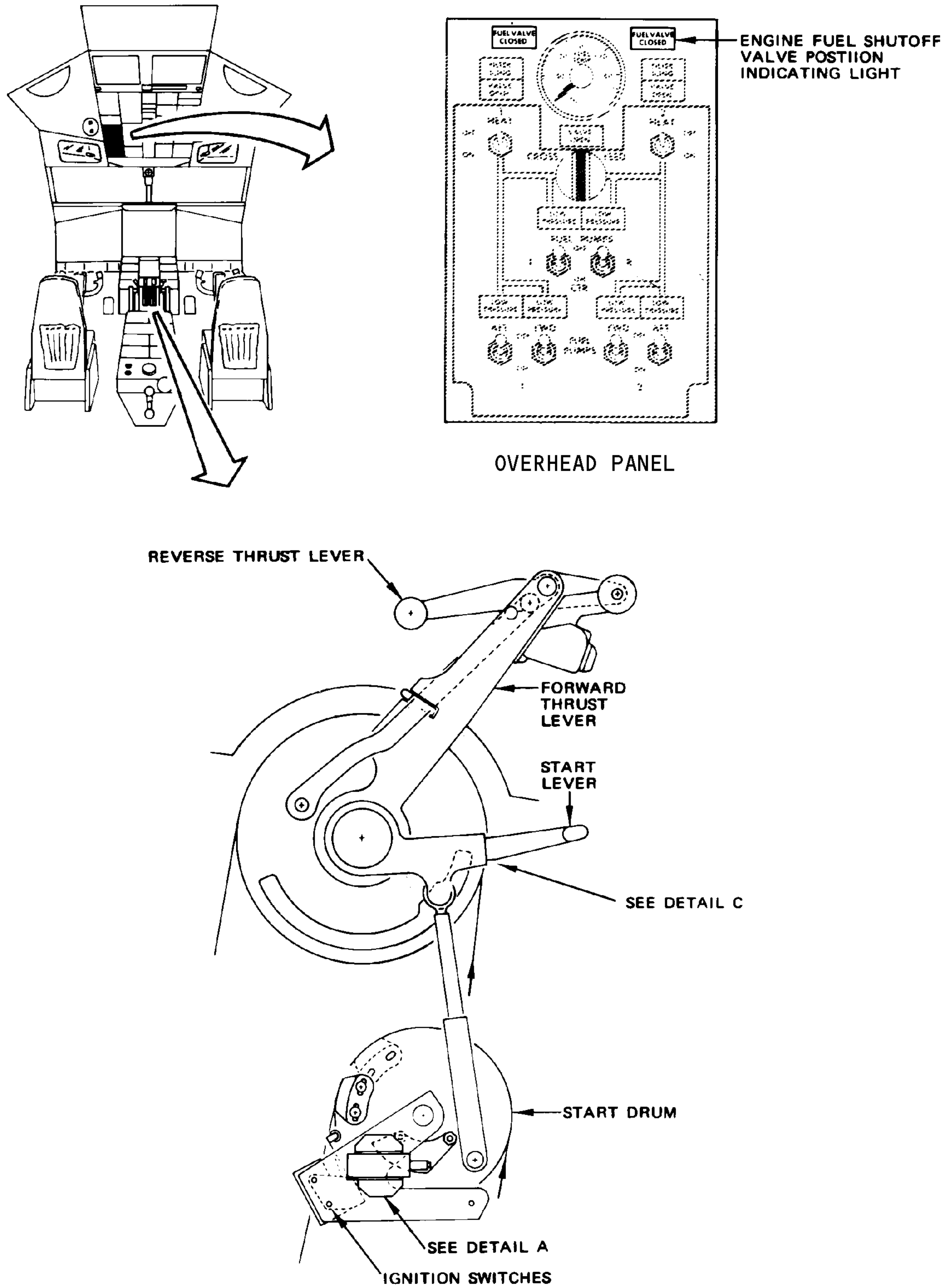
3. Install Engine Fuel Shutoff Valve Switch (Fig. 401)
   A. Position switch, switch actuator in appropriate pilots' control stand.
   B. Secure with mounting screws.
   C. Connect electrical leads to switch. Refer to Wiring Diagram Manual if necessary.
   D. Adjust (if applicable) and test fuel shutoff valve switches (Ref 28-22-111 A/T or 28-22-112 A/T).
4. Return Airplane to Normal Configuration
   A. Install lower forward panel (both sides) on pilots' control stand.



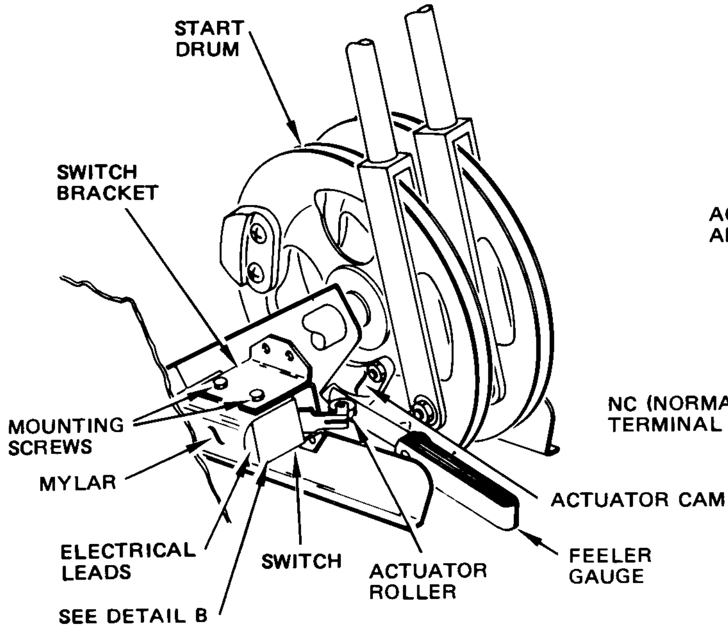
Engine Fuel Shutoff Valve Switch Installation
Figure 401

ENGINE FUEL SHUTOFF VALVE SWITCH - ADJUSTMENT/TEST

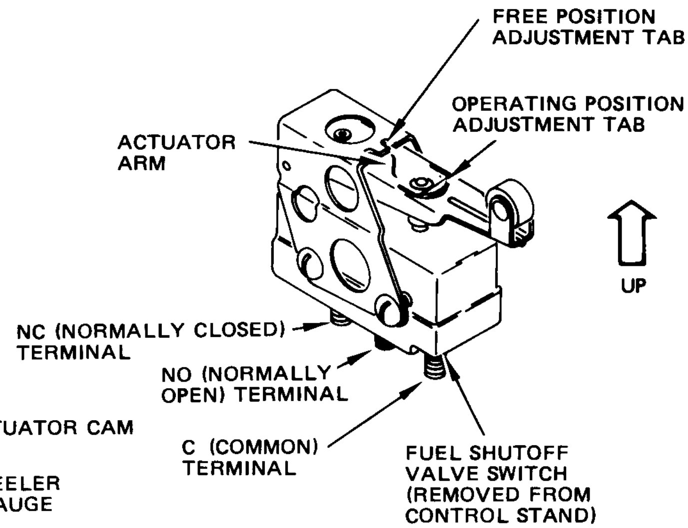
1. Fuel Shutoff Valve Switch Adjustment/Test
   A. General
      (1) The engine start levers must be properly rigged prior to switch adjustment to ensure synchronization of fuel and ignition system operation. Refer to Chapter 76 for engine start lever cable rigging procedures and to Chapter 74 for ignition switches adjustments.
      (2) The fuel shutoff valve switch is mounted on brackets in pilot's control stand. There is one switch for each start lever. The engine No. 1 start lever fuel shutoff valve switch is accessible from the left side of the pilot's control stand. The engine No. 2 start lever fuel shutoff valve switch is accessible from the right side of the pilot's control stand.
      (3) The fuel shutoff valve switch adjustment is performed in the "power off - static mode" and test is performed in "power on - dynamic mode".
         (a) The "power off" adjustment is performed with the engine start levers in the IDLE DETENT and with appropriate spacers or feeler gages inserted to simulate fuel shutoff valve open position 1, fuel shutoff valve open position 2 and fuel shutoff valve closed position 2. These positions are verified, with the use of an ohmmeter or continuity tester, by using the continuity or no continuity test.
         (b) The "power on" test is performed with the engine start levers manually positioned appropriately in the fuel shutoff valve open position 1, fuel shutoff valve open position 2 and fuel shutoff valve closed position 2. These positions are verified using the engine fuel shutoff valve position indicating light.
   B. Equipment and Materials
      (1) Spacer (or feeler gage) - 0.005 to 0.015 inch thick
      (2) Spacer (or feeler gage) - 0.032 to 0.035 inch thick
      (3) Spacer (or feeler gage) - 0.165 to 0.170 inch thick
      (4) Tape
      (5) Ohmmeter or Continuity Tester
   C. Prepare for Fuel Shutoff Valve Switch Adjustment/Test (Fig. 501)
      (1) Apply electrical power (Ref 24-22-0)
      (2) Open ENGINE IGNITION circuit breakers located on P6 panel.
      (3) Set engines No. 1 and/or 2 start levers (as applicable) in CUTOFF detent.
      (4) Open FUEL SYSTEMS circuit breaker and ENG 1-and/or 2 (as applicable) SHUTOFF VALVE on P6 panel.
      (5) Ensure fire switch for engine No. 1 and/or 2 (as applicable) on P8 panel are in NORMAL position.



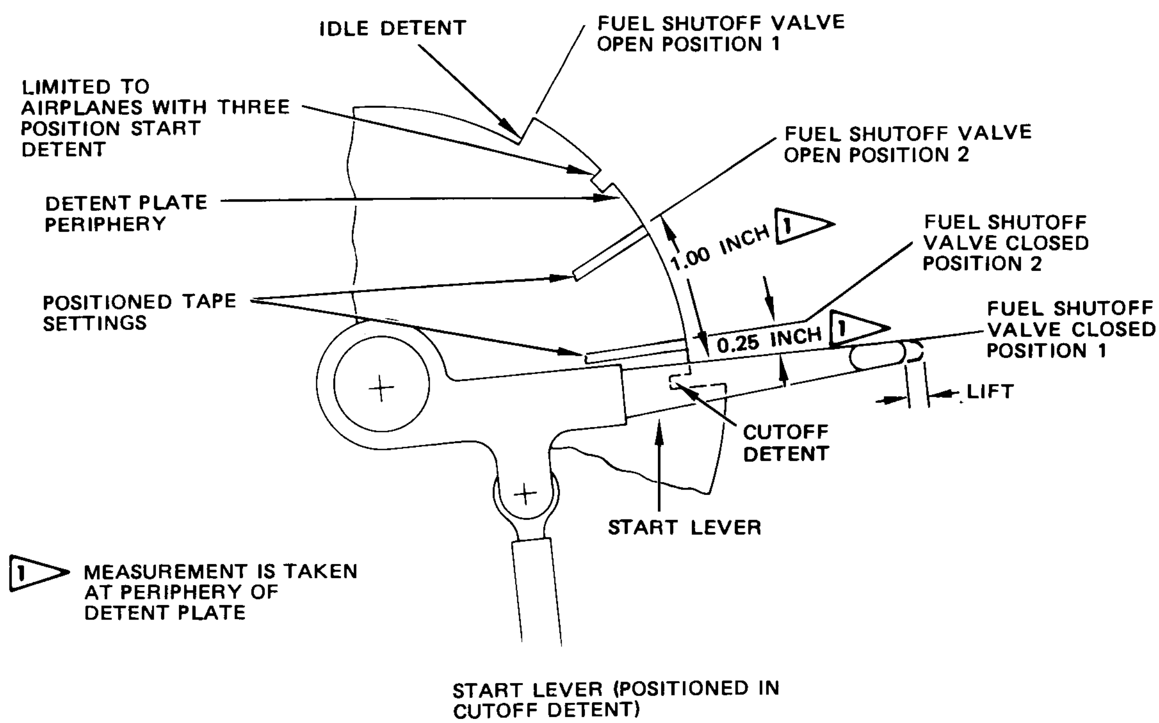
Engine Fuel Shutoff Valve Switch Adjustment
Figure 501 (Sheet 1)



DETAIL A



DETAIL B



DETAIL C

Engine Fuel Shutoff Valve Switch Adjustment
Figure 501 (Sheet 2)

(6) Place tape on periphery of start lever detent plate at fuel shutoff valve open position 2 (1.00 inch from start lever when in cutoff detent) and at fuel shutoff valve closed position 2 (0.25 inch from start lever when in cutoff detent) for engine No. 1 and/or 2 start levers (as applicable) (Fig. 501, Detail C).

D. Adjust Fuel Shutoff Valve Switch (Power off - static mode)

(1) Position engine No. 1 and/or 2 start levers (as applicable) at IDLE DETENT (Idle detent position).

(2) Simulate fuel shutoff valve open position 1 by inserting 0.005 to 0.015 inch thick spacer or feeler gage between switch actuator roller and cam. If gap of 0.005 to 0.015 inch had not been obtained, adjust as follows:

(a) Remove switch (as applicable) from control stand and carefully bend free position adjustment tab to obtain required gap (Fig. 501, Detail B). Reinstall switch.

(b) A gap of 0.005 to 0.015 inch between roller and cam shall establish discontinuity between the C (common) and NO (normally open) terminals on switch. Verify discontinuity using ohmmeter or continuity tester.

(3) Simulate fuel shutoff valve open position 2 by inserting 0.032 to 0.035 inch thick spacer or feeler gage between switch actuator roller and cam. A gap of 0.032 to 0.035 inch between roller and cam shall establish discontinuity between the C (common) and NO (normally open) terminals on switch. Verify discontinuity using ohmmeter or continuity tester.

(a) If continuity exists, remove switch and carefully bend operating position adjustment tab up. Reinstall switch.

(b) Repeat step 1.D.(3) as required to obtain discontinuity.

(4) Simulate fuel shutoff valve closed position 2 by inserting 0.165 to 0.170 inch thick spacer or feeler gage between switch actuator roller and cam. A gap of 0.165 to 0.170 inch between roller and cam shall establish continuity between switch terminals C and NO. Verify continuity with ohmmeter or continuity tester.

(a) If discontinuity exists, remove switch and carefully bend operating position adjustment tab down. Reinstall switch.

(b) Repeat step 1.D.(4) as required to obtain continuity.

E. Test fuel shutoff valve switch (Power on - dynamic mode)

(1) Position engine No. 1 and/or No. 2 start lever(s) at fuel shutoff valve closed position 1 (CUTOFF DETENT).

(2) Close FUEL SYSTEMS circuit breakers, ENG 1 and/or 2 (as applicable) SHUTOFF VALVE, on P6 panel.

(3) Position engine start lever(s) at fuel shutoff valve open position 1 (IDLE detent) and verify that fuel shutoff valve position indicating lights illuminate bright (valves in transit) and then extinguish (valves fully open).

(4) Position engine start lever(s) at fuel shutoff valve open position 2. Verify that fuel shutoff valve position indicating lights remain extinguished.

NOTE: On airplanes with three-position detent plate, the start detent is not used for this test.

(5) Position engine start lever(s) at fuel shutoff valve closed position 2. Verify that engine fuel shutoff valve position indicating lights illuminate bright (valves in transit) and then dim (valves fully closed).

F. Return airplane to normal configuration.

(1) Position engine start levers at fuel shutoff valve closed position 1 (CUTOFF detent).

(2) Remove tape inserted along periphery of start detent plate.

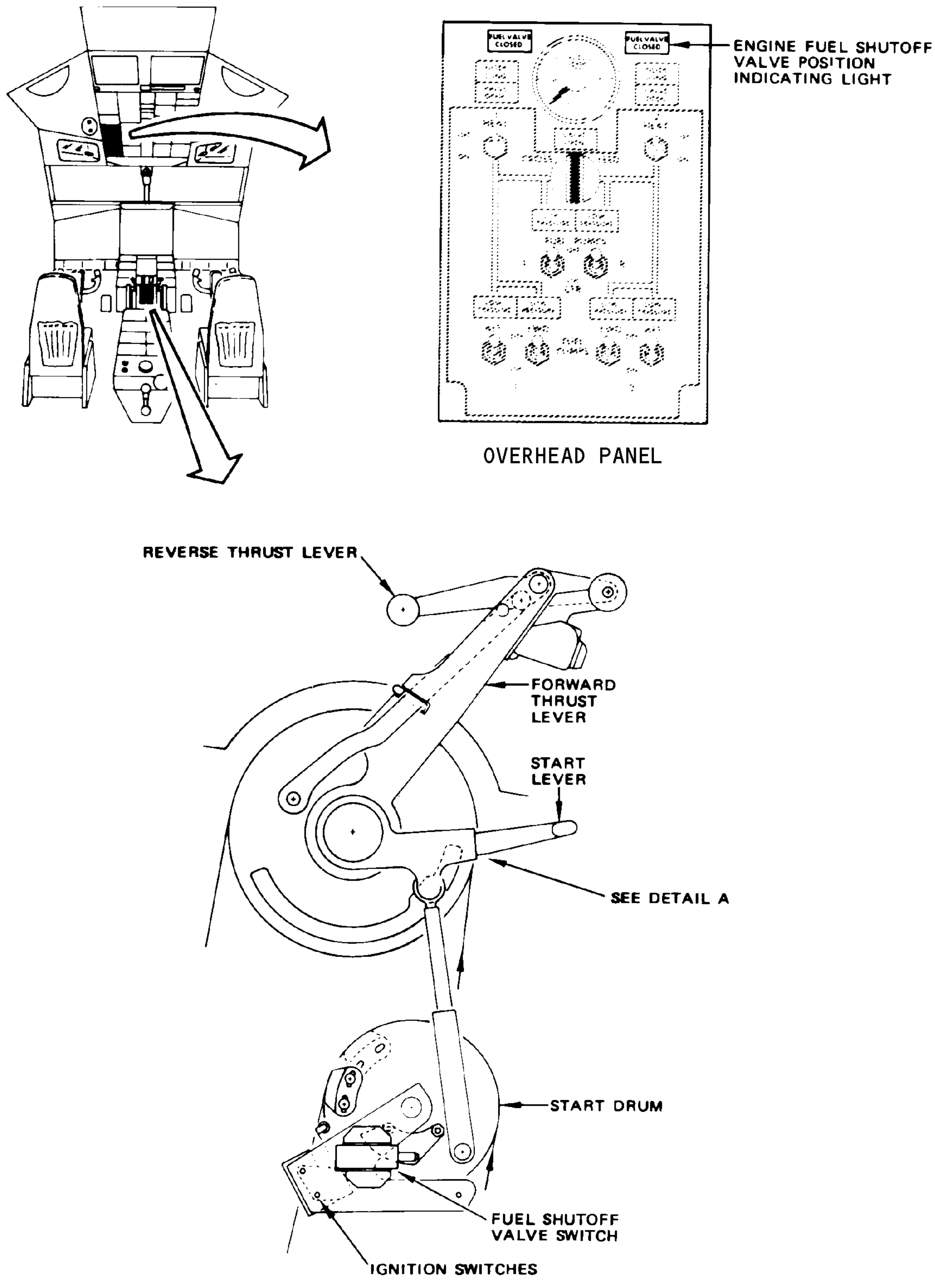
ENGINE FUEL SHUTOFF VALVE SWITCH - REMOVAL/INSTALLATION

1. Refer to Section 28-22-111 for Engine Fuel Shutoff Valve Switch - R/I.

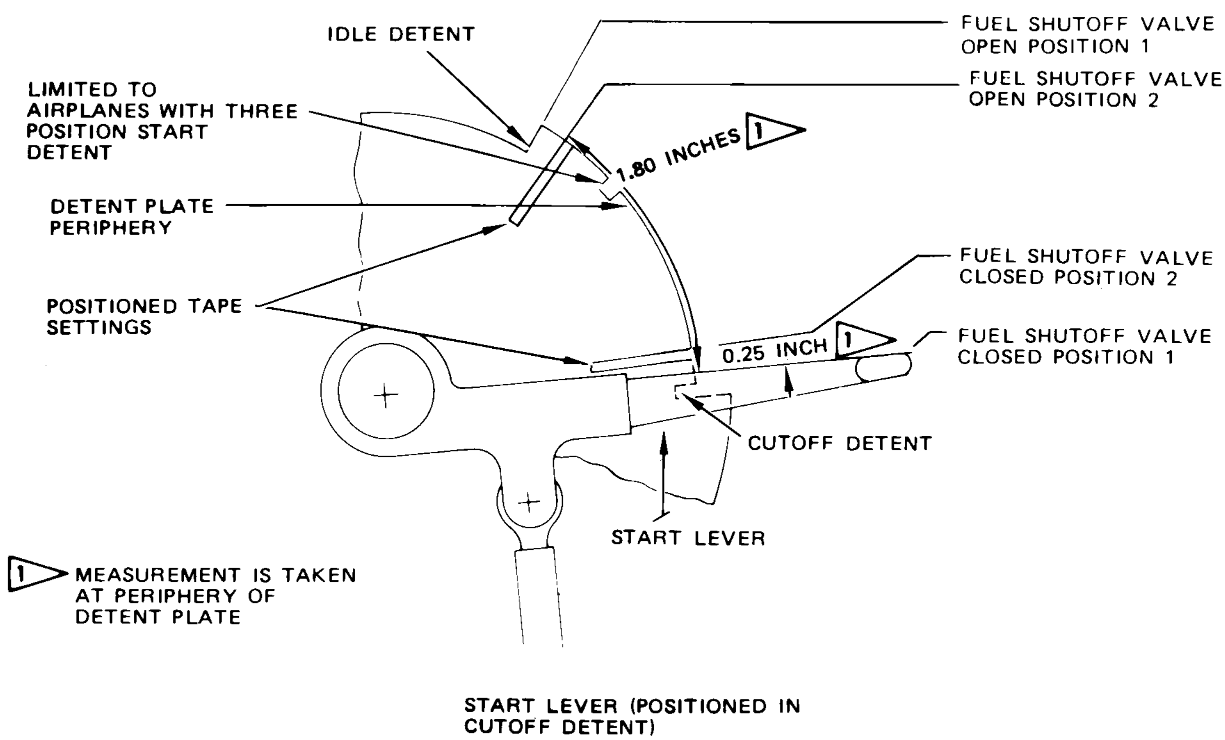
ENGINE FUEL SHUTOFF VALVE SWITCH - ADJUSTMENT/TEST

1. General
   A. The engine start levers must be properly rigged prior to switch test to ensure synchronization of fuel and ignition system operation. Refer to Chapter 76 for engine start lever cable rigging procedures and to Chapter 74 for ignition switches adjustments.
   B. This section provides an operational test for the engine fuel shutoff valve switch. This switch is not adjustable. There are two fuel shutoff valve switches mounted on brackets in the pilot's control stand. The engine No. 1 start lever fuel shutoff valve switch is accessible from the left side of the pilot's control stand. The engine No. 2 start lever fuel shutoff valve switch is accessible from the right side of the pilot's control stand.
   C. The fuel shutoff valve switch test is performed in "power on - dynamic mode". The test consists of positioning the engine start lever successively in fuel shutoff valve open position 1, fuel shutoff valve open position 2, and fuel shutoff valve closed position 2. These positions are verified using the engine fuel shutoff valve position indicating light.
2. Equipment and Materials
   A. Tape
3. Prepare for Fuel Shutoff Valve Switch Test (Fig. 501)
   A. Apply electrical power (Ref 24-22-0 MP).
   B. Verify engine start switches on overhead panel are positioned to OFF.
   C. Position engine start lever in CUTOFF detent.
   D. Open FUEL SYSTEMS, ENG 1/ENG 2 SHUTOFF VALVE circuit breakers (P6).
   E. Ensure engine fire switch (P8) panel is in NORMAL position.
   F. Place tape on periphery of start lever detent plate at fuel shutoff valve open position 2 (1.80 inch from start lever when in cutoff detent - fuel shutoff valve closed position 1) and at fuel shutoff valve closed position 2 (0.25 inch from start lever when in cutoff detent) for engine start levers (as applicable) (Fig. 501, Detail A).
4. Test Engine Fuel Shutoff Valve Switch
   A. Close FUEL SYSTEMS, ENG 1/ENG 2 SHUTOFF VALVE circuit breakers (P6).
   B. Position engine start lever(s) at fuel shutoff valve open position 1 (IDLE DETENT). Verify that fuel shutoff valve position indicating lights illuminate bright (valves in transit) and then extinguish (valves fully open).
   C. Position engine start lever(s) at fuel shutoff valve open position 2. Verify that fuel shutoff valve position indicating lights remain extinguished.

      NOTE: On airplanes with three position start detent, the start detent is not used for this test.



Engine Fuel Shutoff Valve Switch Adjustment
Figure 501 (Sheet 1)



DETAIL A

Engine Fuel Shutoff Valve Switch Adjustment
Figure 501 (Sheet 2)

D. Position engine start lever(s) at fuel shutoff valve closed position 2. Verify that engine fuel shutoff valve position indicating lights illuminate bright (valves in transit) and then dim (valves fully closed).

5. Return Airplane To Normal Configuration

A. Position engine start levers in fuel shutoff valve closed position 1 (CUTOFF DETENT).

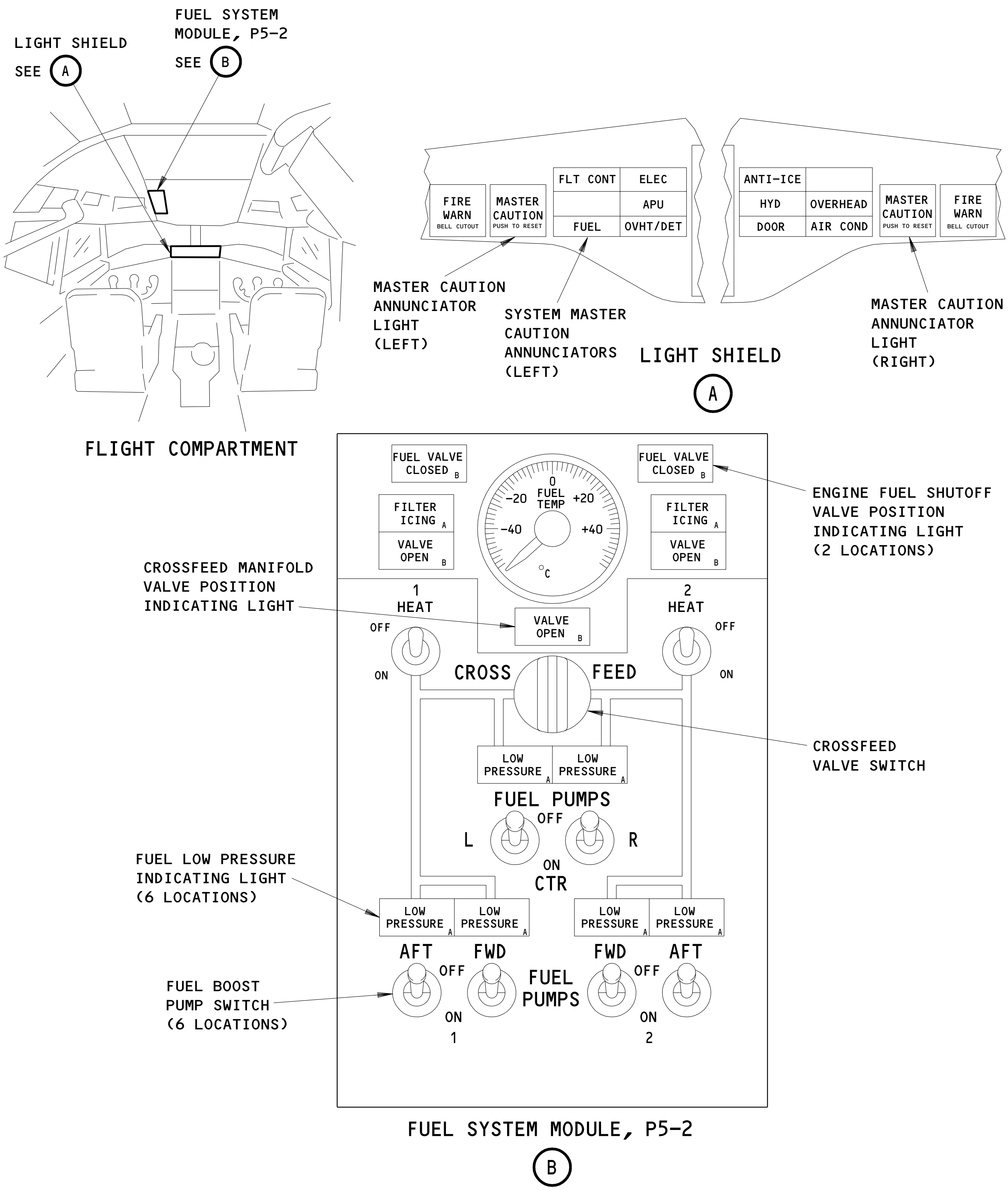
B. Remove tape inserted along periphery of start detent plate.

C. Remove electrical power if no longer required (Ref 24-22-0 MP).

FUEL SYSTEM MODULE, P5-2 - REMOVAL/INSTALLATION

1. General
    A. This procedure contains these tasks:
        (1) Removal of the Fuel System Module, P5-2
        (2) Installation of the Fuel System Module, P5-2
        (3) AIRPLANES WITH P5-2 FUEL SYSTEM MODULE P/N 69-37335-300 AND SUBSEQUENT (POST-SB 28A1210);
            Master Caution Timing Test
        (4) Operational Test of the Fuel System Module, P5-2.
2. Removal of the Fuel System Module, P5-2
    A. Access
        (1) Location Zones
            101 Control Cabin Left
            102 Control Cabin Right

    B. Procedure
        (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
            (a) P6 Main Power Distribution Panel
                1) SHUTOFF VALVE - ENG 1
                2) SHUTOFF VALVE - ENG 2
                3) FUEL TEMPERATURE IND
                4) FUEL MANIFOLD VALVE
                5) MASTER DIM SECTION 1
                6) MASTER DIM SECTION 6
                7) TANK-1 FWD BOOST PUMP
                8) TANK-2 FORWARD BOOST PUMP
                9) TANK-1 AFT BOOST PUMP
                10) TANK-2 AFT BOOST PUMP
                11) CENTER TANK BOOST PUMP LEFT
                12) CENTER TANK BOOST PUMP RIGHT
                13) FUEL CONT-1 AFT-2 FORWARD CTR LEFT
                14) FUEL CONT-1 FWD-2 AFT CTR RIGHT
        (2) Loosen the six quick-release fasteners on the baseplate of the P5-2 module.
        (3) Disconnect the connectors D626, D628, and D616 from the rear of the P5-2 module.
        (4) Remove the P5-2 module from the P5 panel.
        (5) Remove the fuel temperature indicator from the P5-2 fuel system module.
3. Installation of the Fuel System Module, P5-2
    A. Reference
        (1) AMM 28-42-0/501, Fuel Feed Low Pressure Indicating System



Fuel System Module, P5-2
Figure 401

B. Access
  (1) Location Zones
    101 Control Cabin Left
    102 Control Cabin Right

C. Procedure
  (1) Re-install the fuel temperature indicator in the P5-2 fuel system module.
  (2) Move the P5-2 module close to its position in the P5 panel.
  (3) Connect the connectors D616, D626, and D628 to the rear of the P5-2 module.
  (4) Install the P5-2 module in its position with the six quick-release fasteners on the baseplate.
  (5) AIRPLANES WITH P5-2 FUEL SYSTEM MODULE P/N 69-37335-300 AND SUBSEQUENT (POST-SB 28A1210);
      Do this task: Master Caution Timing Test.
  (6) Do this task: Operational Test of the Fuel System Module, P5-2.
  (7) AIRPLANES WITH P5-2 FUEL SYSTEM MODULE P/N 69-37335-300 AND SUBSEQUENT (POST-SB 28A1210);
      Do this task: Fuel Feed Low Pressure Indicating Test (AMM 28-42-0/501).

4. AIRPLANES WITH P5-2 FUEL SYSTEM MODULE P/N 69-37335-300 AND SUBSEQUENT (POST-SB 28A1210);
   Master Caution Timing Test

A. References
  (1) AMM 24-22-0/201, Manual Control
  (2) AMM 27-81-0/201, Leading Edge Flaps and Slats
  (3) AMM 28-42-0/001, Fuel Feed Low Pressure Indicating System

B. Access
  (1) Location Zones
    101 Control Cabin Left
    102 Control Cabin Right
    303 Left Wing Inboard Leading Edge
    403 Right Wing Inboard Leading Edge

C. Procedure
  (1) Supply external power to the airplane if power is not supplied (AMM 24-22-0/201).
  (2) Extend the leading edge flaps and install the leading edge flap locks (AMM 27-81-0/201).

      WARNING: INSTALL THE LEADING EDGE FLAP LOCKS TO PREVENT INADVERTANT OPERATION OF THE FLAPS. THE FLAPS CAN MOVE QUICKLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

  (3) Remove electrical power from the airplane (AMM 24-22-0/201).

(4) Get access to the fuel pump pressure switches for the No. 1 and 2 tanks on the leading edge ribs or front spar (AMM 28-42-0/001).
(5) Disconnect the electrical connectors from the low pressure switches for the boost pumps (forward and aft) for the No. 1 and No. 2 tanks.
(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
  (a) P6 Main Power Distribution Panel
    1) SHUTOFF VALVE - ENG 1
    2) SHUTOFF VALVE - ENG 2
    3) FUEL TEMPERATURE IND
    4) FUEL MANIFOLD VALVE
    5) MASTER DIM SECTION 1
    6) MASTER DIM SECTION 6
    7) FUEL CONT-1 AFT-2 FORWARD CTR LEFT
    8) FUEL CONT-1 FWD-2 AFT CTR RIGHT
(7) Make sure these circuit breakers are open and have DO-NOT-CLOSE tags:
  (a) P6 Main Power Distribution Panel
    1) CENTER TANK BOOST PUMP LEFT
    2) CENTER TANK BOOST PUMP RIGHT
    3) TANK-1 FWD BOOST PUMP
    4) TANK-2 FWD BOOST PUMP
    5) TANK-1 AFT BOOST PUMP
    6) TANK-2 AFT BOOST PUMP
(8) Supply electrical power (AMM 24-22-0/201).
(9) On the P5-2 fuel system module, move the CTR L fuel boost pump switch to the ON position and do these steps in less than 10 seconds:
  (a) Make sure the LOW PRESSURE light for the CTR L fuel boost pump comes on.
  (b) Move the CTR L fuel boost pump switch to the OFF position.
(10) At the P7 light shield, make sure that the FUEL light on the system master caution annuciators (left) is off.
(11) At the P5-2 fuel system module, move the CTR R fuel boost pump switch to the ON position.
(12) Make sure the LOW PRESSURE light for the CTR R fuel boost pump comes on.
(13) Wait for ten seconds.
(14) At the P7 light shield, make sure that the FUEL light on the system master caution annunciators (left) comes on.
(15) Make sure the MASTER CAUTION annunciator light is on.
(16) Push the MASTER CAUTION annunciator light.
(17) Make sure the FUEL light on the system master caution annunciators (left) goes off.
(18) Push the FUEL light on the system master caution annunciators (left).

(19) Make sure the FUEL light on the system master caution annunciators (left) goes off.
(20) At the P5-2 fuel system module, move the CTR R fuel boost pump switch to the OFF position.
(21) Remove electrical power from the airplane (AMM 24-22-0/201).
(22) Connect the electrical connectors to the low pressure switches for the boost pumps (forward and aft) for the No. 1 and No. 2 tanks.
(23) Remove the leading edge flap locks and retract the leading edge flaps (AMM 27-81-0/201).

WARNING: BE CAREFUL WHEN YOU REMOVE THE LEADING EDGE FLAP LOCKS. THE FLAPS CAN MOVE QUICKLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

5. Operational Test of the Fuel System Module, P5-2
A. References
(1) AMM 24-22-0/201, Manual Control
B. Access
(1) Location Zones
101 Control Cabin Left
102 Control Cabin Right

C. Procedure
(1) Supply external power to the airplane if power is not supplied (AMM 24-22-0/201).
(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
(a) P6 Main Power Distribution Panel
1) SHUTOFF VALVE - ENG 1
2) SHUTOFF VALVE - ENG 2
3) FUEL TEMPERATURE IND
4) FUEL MANIFOLD VALVE
5) MASTER DIM SECTION 1
6) MASTER DIM SECTION 6
7) TANK-1 FWD BOOST PUMP
8) TANK-2 FWD BOOST PUMP
9) TANK-1 AFT BOOST PUMP
10) TANK-2 AFT BOOST PUMP
11) FUEL CONT-1 AFT-2 FORWARD CTR LEFT
12) FUEL CONT-1 FWD-2 AFT CTR RIGHT
(3) Make sure these circuit breakers are open and have DO-NOT-CLOSE tags:
(a) P6 Main Power Distribution Panel
1) CENTER TANK BOOST PUMP LEFT
2) CENTER TANK BOOST PUMP RIGHT
(4) On the P5-2 module, make sure the FUEL VALVE CLOSED light for engine No. 1 is dimly on.

(5) At the P9 control stand, move the No. 1 engine start lever to the IDLE position and do these steps in less than six seconds:
   (a) At the P5-2 fuel system module, make sure the FUEL VALVE CLOSED light for the No. 1 engine comes on bright while the valve goes from the closed to the open position.
   (b) Make sure the FUEL VALVE CLOSED light for the No. 1 engine goes off.
(6) At the P9 control stand, move the No. 1 engine start lever to the CUTOFF position.
(7) At the P5-2 fuel system module, make sure the FUEL VALVE CLOSED light for the No. 2 engine is dimly on.
(8) At the P9 control stand, move the No. 2 engine start lever to the IDLE position and do these steps in less than 6 seconds:
   (a) At the P5-2 fuel system module, make sure the FUEL VALVE CLOSED light for the No. 2 engine comes on bright while the valve goes from the closed to the open position.
   (b) Make sure the FUEL VALVE CLOSED light for the No. 2 engine goes off.
(9) At the P9 control stand, move the No. 2 engine start lever to the CUTOFF position.
(10) On the P5-2 fuel system module, make sure the fuel temperature needle is not against the lower stop (less than -40 degrees Celsius) or the upper stop (more than +40 degrees Celsius).
(11) Make sure that the VALVE OPEN position indicating light for the crossfeed valve is off.
(12) Turn the crossfeed valve switch to the open position and do these steps in less than six seconds:
   (a) Make sure the VALVE OPEN position indicating light for the crossfeed valve is on bright while the valve goes from the closed position to the open position.
   (b) Make sure the VALVE OPEN position indicating light becomes dim.
(13) Turn the crossfeed valve switch to the closed position.
(14) Make sure the LOW PRESSURE lights for each of these fuel boost pumps are on:
   (a) TANK 1 - AFT
   (b) TANK 1 - FWD
   (c) TANK 2 - AFT
   (d) TANK 2 - FWD
(15) Move the switches for these fuel boost pumps to ON:
   (a) CTR L
   (b) CTR R
(16) Make sure the LOW PRESSURE lights for these fuel boost pumps come on:
   (a) CTR L
   (b) CTR R

(17) Move the switches for these fuel boost pumps to OFF:
(a) CTR L
(b) CTR R
(18) On the P7 light shield, make sure the FUEL light on the system master caution annunciators (left) is on.
(19) Make sure the MASTER CAUTION annunciator light is on.
(20) Push the MASTER CAUTION annuciator light on the P7 light shield.
(21) Make sure the FUEL light on the system master caution annunciators (left) goes off.
(22) Push the FUEL light on the system master caution annunciators (left).
(23) Make sure the FUEL light on the system master caution annunciators (left) comes on.
(24) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
(a) P6 Main Power Distribution Panel
1) CENTER TANK BOOST PUMP LEFT
2) CENTER TANK BOOST PUMP RIGHT
(25) Remove external power from the airplane if it is not necessary for other tasks (AMM 24-22-0/201).

FUEL LINE AND COUPLINGS - INSPECTION/CHECK

1. General
   A. This procedure has one task, an inspection for damage in the fuel system tubing and couplings.
2. Fuel Line and Couplings - Inspection/Check
   A. References
      (1) 28-22-141/401, Fuel Lines and Couplings
      (2) 28-22-141/801, Fuel Line and Couplings
   B. Procedure
      (1) Visually examine all the fuel tubing to make sure that it is tightly and correctly attached.
      (2) Adjust the installation of the tubes which are not correctly attached (AMM 28-22-141/401).
      (3) Visually examine all the fuel tubing for these types of damage and make sure the damage is permitted:
         (a) Make an inspection for cracks.
            1) No cracks are permitted.
         (b) Make an inspection for dents (areas that are pushed into the tubing). Acceptable dents (damage that is permitted) are as follows:
            1) All dents must have an area that is large compared to the depth of the dent.
            2) No single dent in the tubing shall decrease the diameter of the tubing by more than 2.5%. If there are multiple dents, the total dent depth (individual depths added together) in any section five times the tube diameter long, shall be no more than 10% of the tube diameter.
            3) The dents in the tubing must be farther than one diameter of the tube from the end of the tube.
            4) The dents in the tubing must not have an area of more than 0.125 square inch (0.81 square centimeter).
            5) If the dent is on the outer part of a bend in the tube, the dent must not have a depth of more than 0.015 inch.

            NOTE: If any one of the above limitations is not met, the damage is not permitted and the part must be repaired or replaced.

         (c) Do an inspection for nicks.
            1) The nicks in the tubing must have a rounded bottom.
            2) The nicks in the tubing must not have a depth of more than 0.004 inch.
            3) You must remove all the burrs from the nick if there are some burrs.

(d) Do an inspection for fretting.
  1) Fretting must not have a depth of more than 0.004 inch.
(e) Do an inspection for scoring.
  1) If you find some small scoring, you can make is smooth again, but obey these conditions:
    a) The scoring must not be on the outer part of a bend.
    b) You must not remove more than 0.004 inch of metal.
(f) Do an inspection for tubes with a cross section that is not fully circular (tubes with ovality).
  1) Calculate the percent ovality with this formula:
     percent ovality = OD Max - OD Min X 100%
     OD Nominal
    a) OD Max is the maximum outer diameter of the tube.
    b) OD Min is the minimum outer diameter of the tube.
    c) OD Nominal is the outer diameter of the tube at a position where the tube is circular or almost circular.
  2) The percent ovality must not be more than 10%.
  3) The percent ovality must not be more than 5% for tubes with a diameter of more than 2 inches.
(g) Wrinkles
  1) The height of a wrinkle is the distance between a straight line that touches the high point of a wrinkle and a straight line that touches the low point of a wrinkle.
  2) Wrinkles must not have a height larger than the applicable maximum wrinkle height:

Tube Diameter (inches)	Maximum Wrinkle Height (inches)
less than 1	0.020
1 to 1.99	0.030
2 to 2.99	0.040
3 or more	0.050

(4) Repair or replace all the tubes which have damage that is not permitted (AMM 28-22-141/801, AMM 28-22-141/401).

(5) Visually examine all the couplings for external indications of these types of damage and make sure that the damage is permitted:
   (a) Do an inspection for cracks.
      1) No cracks are permitted.
   (b) Do an inspection for scratches.
      1) The scratches in the couplings must not have a depth of more than 0.004 inch.
   (c) Do an inspection for nicks.
      1) The nicks in the tubing must have a rounded bottom.
      2) The nicks in the tubing must not have a depth of more than 0.004 inch.
      3) You must remove all the burrs around the nick.
   (d) Do an inspection for worn areas (galling).
      1) Worn areas must not have a depth of more than 0.010 inch.
      2) No worn areas in the surfaces that have an O-ring seal are permitted.

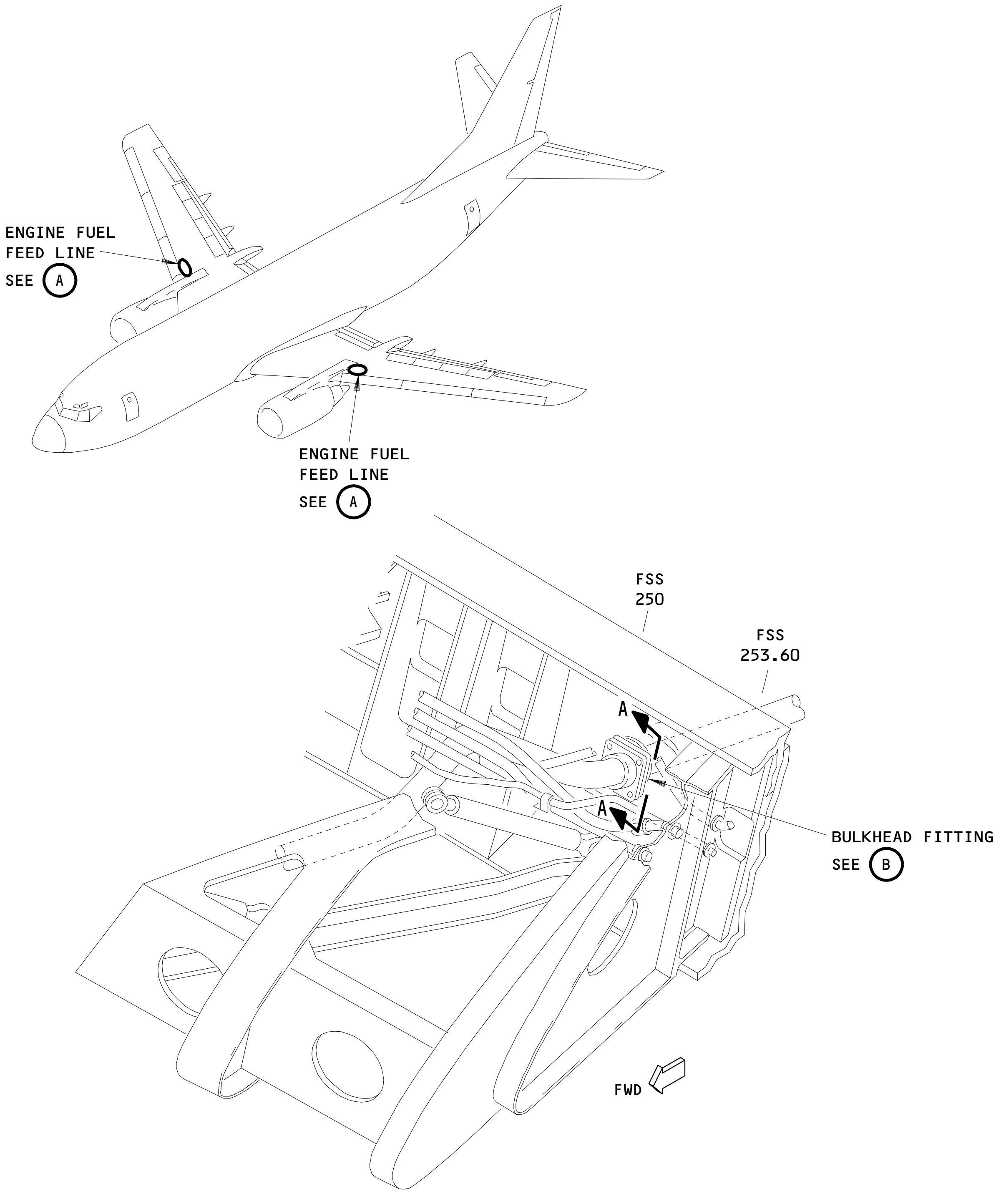
(6) Repair or replace all the couplings which have damage that is not permitted (AMM 28-22-141/801, AMM 28-22-141/401).

ENGINE FUEL FEED LINE BULKHEAD FITTING - REMOVAL/INSTALLATION

1. General
   A. This procedure has tasks to remove and install the bulkhead fitting for each engine fuel feed line at the front spar.
   B. It is recommended that two people do this procedure - one person in the tank and one person out of the tank.
2. Remove the Bulkhead Fitting (Fig. 402)
   A. Procedure
      (1) Remove electrical power from the airplane (AMM 28-22-0/201).
      (2) Defuel all the fuel tanks (AMM 28-23-0/201).
      (3) Purge and prepare to go into the applicable tank (AMM 28-10-0/201).

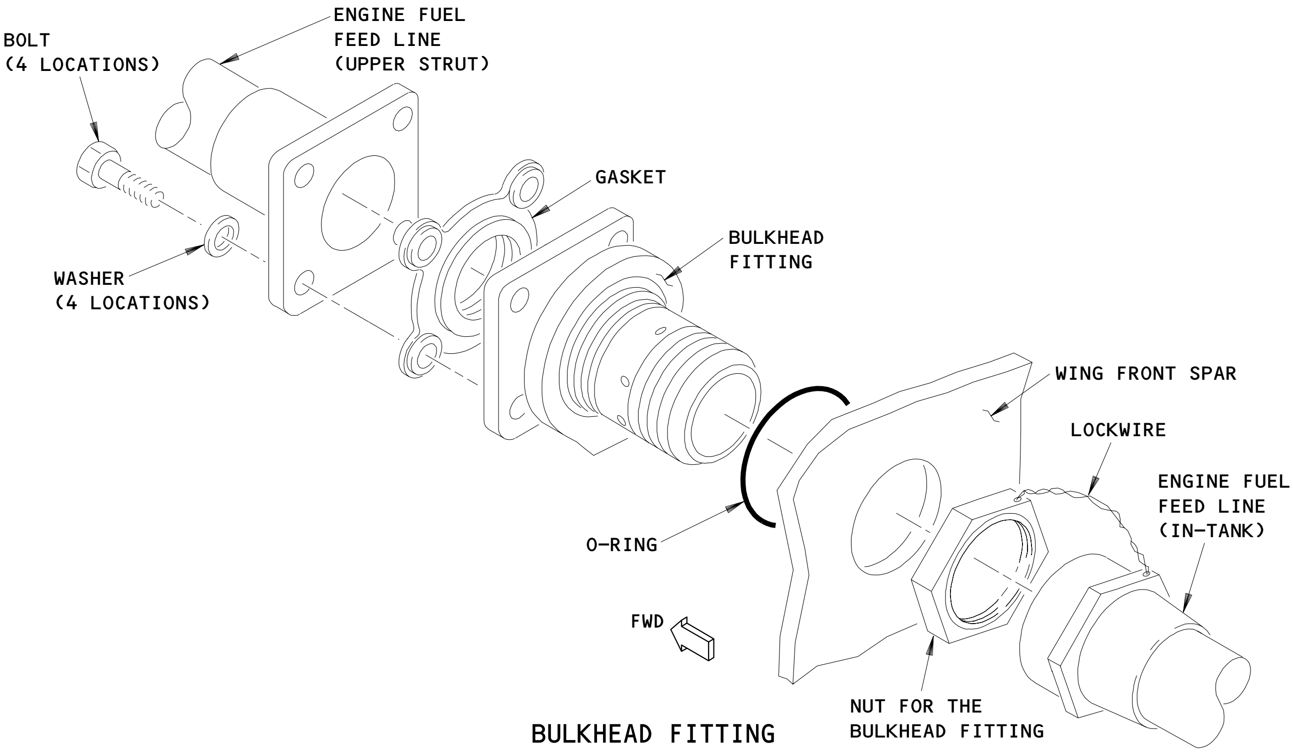
      WARNING: OBEY THE PURGING AND FUEL TANK ENTRY PRECAUTIONS. INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR IF YOU DO NOT OBEY THE FUEL TANK ENTRY PRECAUTIONS.

      (4) Get access to the bulkhead fitting.
         (a) In the fuel tank, remove the left (right) fuel tank access panel 7205 (7405) (access door No. 3) (AMM 12-31-61/201, AMM 28-11-11/401).
         (b) Out of the fuel tank, remove the left (right) panels 6212, 6301, 6241 (6512, 6401, 6541) (AMM 12-31-61/201, AMM 12-31-71/201).
      (5) From out of the fuel tank, do these steps:
         (a) Remove the sealant (if applied) from around the bulkhead fitting.
         (b) Remove the four bolts and washers and the gasket that attach the upper strut engine fuel feed line to the bulkhead fitting on the wing front spar.
      (6) From in the tank, do these steps:
         (a) Remove sealant (if applied) from around the bulkhead fitting.
         (b) Remove the lockwire (if installed) from between the nut of the bulkhead fitting and the engine fuel feed line.
         (c) Disconnect the engine fuel feed line from the bulkhead fitting at the wing front spar.
         (d) Remove the nut for the bulkhead fitting.
      (7) From out of the tank, remove the bulkhead fitting.
         (a) Discard the O-rings.



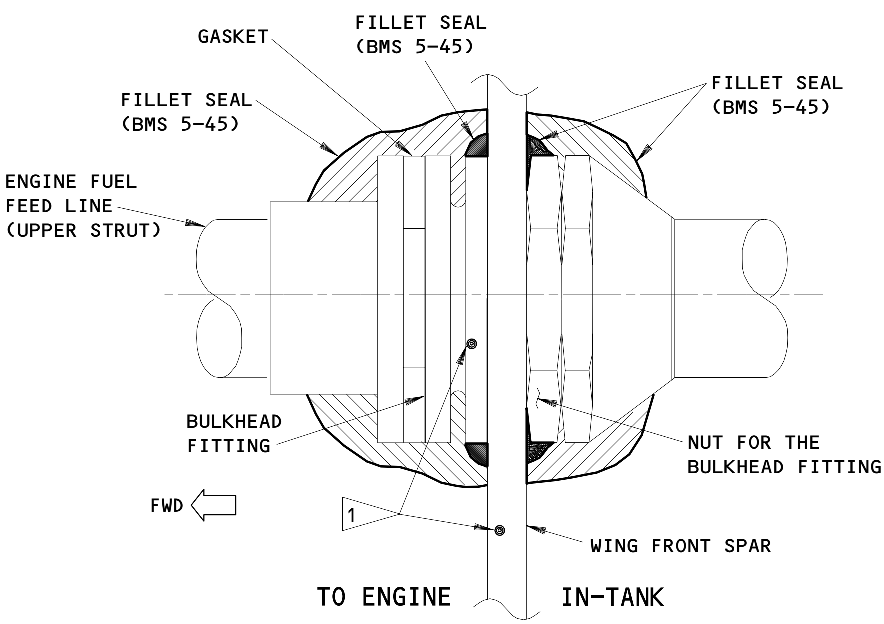
ENGINE FUEL FEED LINE
(LEFT SIDE IS SHOWN, RIGHT SIDE IS OPPOSITE)
A

Engine Fuel Feed Line Bulkhead Fitting Installation
Figure 401 (Sheet 1)



BULKHEAD FITTING

B



A-A

1 RESISTANCE FROM BULKHEAD FITTING TO SPAR NOT TO EXCEED 0.0005 OHM (0.5 MILLI-OHM)

Engine Fuel Feed Line Bulkhead Fitting Installation
Figure 401 (Sheet 2)

3. Install the Bulkhead Fitting (Fig. 402)

A. General

(1) This procedure installs the bulkhead fitting for the engine fuel feed line. It gives steps to prepare the surfaces of the front spar and the bulkhead fitting. These steps are necessary to satisfy the electrical bonding requirement on the bulkhead fitting for lightning protection. Service Bulletin SB 28A1174 also does these steps. If SB 28A1174 was completed for this airplane, it is not necessary to do these steps again.

B. Equipment

(1) Bonding Meter - Explosion-safe (SWPM 20-20-00)

(2) Brush - to apply coating

C. Consumable Materials

(1) Coating Alodine 600, Type II, Class D

(2) Sealant BMS 5-45, Class B

(3) Primer BMS 10-20, Type II

(4) Enamel Finish BMS 10-60, Type I or Type II

(5) Abrasive, 320 grit or finer

D. Prepare to Install the Bulkhead Fitting (PRE-SB 28A1174)

(1) Clean the threads and surfaces of the bulkhead fitting to supply good adhesion for the sealant (SWPM 2020-00).

(2) If the flange of the bulkhead fitting has an anodic surface finish, polish the flange of the bulkhead fitting with 320 or finer abrasive to make a clean and flat bare metal surface all the way around the mating surface flange (SWPM 20-20-00).

NOTE: Remove the minimum quantity of material.

(3) Clean the area on the wing front spar (in and out of the fuel tank) where the bulkhead fitting will be installed (SWPM 20-20-00).

(4) If necessary, polish the fay surface area of the front spar at the mating surface of the flange on the bulkhead fitting (SWPM 20-20-00):

CAUTION: KEEP THE BARE METAL SURFACES EXPOSURE TIME TO LESS THAN FOUR HOURS. RUB THE BARE METAL SURFACE AREA AGAIN BEFORE YOU APPLY THE CONVERSION COATING IF EXPOSURE TIME IS MORE THAN FOUR HOURS. THE CONVERSION COATING WILL NOT ADHERE CORRECTLY TO A BARE METAL SURFACE THAT IS NOT CLEAN.

(a) Use 320 grit or finer abrasive to remove the remaining anodic surface finish to make a clean and flat bare metal surface all the way around the hole for the bulkhead fitting (in and out of the tank).

NOTE: Remove the minimum quantity of material.

(b) Make sure the anodic surface finish is less that 0.0001 inch (0.025 mm).
(c) Polish and clean to a minimum of 0.0625 inch (1.59 mm) diameter more than the bulkhead fitting out of the tank on the front spar.
(d) Polish and clean to a minimum of 0.0625 inch (1.59 mm) diameter more than the nut in the tank on the front spar.

(5) Apply a conversion coating (Alodine 600, Type II, Class D) to the bare metal surfaces on the inner and outer surfaces of the wing front spar with a small, clean brush.

NOTE: Alodine 600 gives a good electrical conductive coating. Some types of Alodine are not electrically conductive. Some types of Alodine create a powdery coating if they are used on the fuel tank paint finishes.

E. Install the Bulkhead Fitting

(1) Install a new O-ring on the bulkhead fitting.
(2) Align the bulkhead fitting with the hole in the front spar for the engine fuel feed line.
(3) Install the nut on the bulkhead fitting.
(4) Tighten the nut to a torque of 855-945 inch-pounds (96.6-106.8 Nm).
(5) Measure the bonding resistance between the bulkhead fitting and the front spar (SWPM 20-20-00).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

WARNING: MAKE SURE YOU USE A EXPLOSION-SAFE BONDING METER TO DO A CHECK OF THE ELECTRICAL RESISTANCE (SWPM 20-20-00). AN OPEN FUEL TANK IS AN EXPLOSIVE VAPOR AREA.

(a) Make sure the electrical resistance is less than 0.0005 ohm.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(6) From out of the fuel tank, install the gasket and four bolts and washers to attach the engine fuel feed line to the bulkhead fitting.
(7) From in the fuel tank, connect the engine fuel feed line to the bulkhead fitting.
(8) Do a test of the engine fuel feed system for leaks (AMM 28-22-0/201).

NOTE: Refer to the Engine Fuel Feed Lines/Fittings Vacuum Test.

(9) Apply a fillet seal of BMS 5-45, Class B sealant to these areas:
(a) Seal the joint between the outside diameter of the bulkhead fitting and the wing front spar.
1) Seal to a minimum 0.1875 inch (4.76 mm) diameter more than the nut in the fuel tank on the other side of the front spar.
(b) In the fuel tank, seal the threads on the engine fuel feed line and the nut threads.
1) The sealant must extend to the flat dimension of the nut and at least two threads of the bulkhead fitting.
(c) Apply sealant to the joint between the outside diameter of the flange on the bulkhead fitting and the wing front spar, in and out of the fuel tank, the joints between the engine fuel feed lines and the bulkhead fittings and the surrounding areas.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

1) Seal to a minimum 0.1875 inch (4.76 mm) diameter more than the bulkhead fitting on the front spar.

S 424-002

(10) Install a bonding jumper between the structure and the first tube mating with the bulkhead fitting inside the tank.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

S 764-001

(11) Measure the bonding resistance from the structure to the first tube mating with the bulkhead fitting (SWPM 20-20-00).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(a) Make sure the resistance is less than 0.010 ohm (10 milliohms).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(12) Clean the wing front spar area of all particles and dust caused by the fay surfacing process.

(13) Apply BMS 10-20, Type II primer, as necessary, on the alodined bare metal at the forward and aft front spar surfaces.

(14) Apply BMS 10-60, Type I or Type II enamel finish where it is necessary, on the primer on the front spar surfaces.

(15) Do these steps to close the applicable fuel tank:

(a) Remove all tools, all equipment and all unwanted material from the fuel tank.

(b) Install the applicable left (right) fuel tank access panel 7205 (7405) you removed to get into the fuel tank (AMM 12-31-61/201, AMM 28-11-11/401).

(16) Do these steps to do a final check for fuel leakage:

(a) Refuel the applicable fuel tank until it is 75% full (AMM 12-11-01/301).

(b) Wait for one hour.

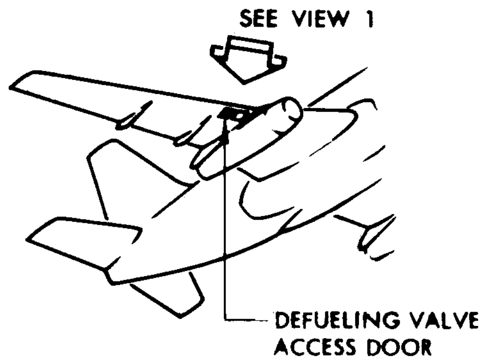
(c) Examine and make sure there is no fuel leakage at the front spar where you installed the bulkhead fitting for the engine fuel feed line.

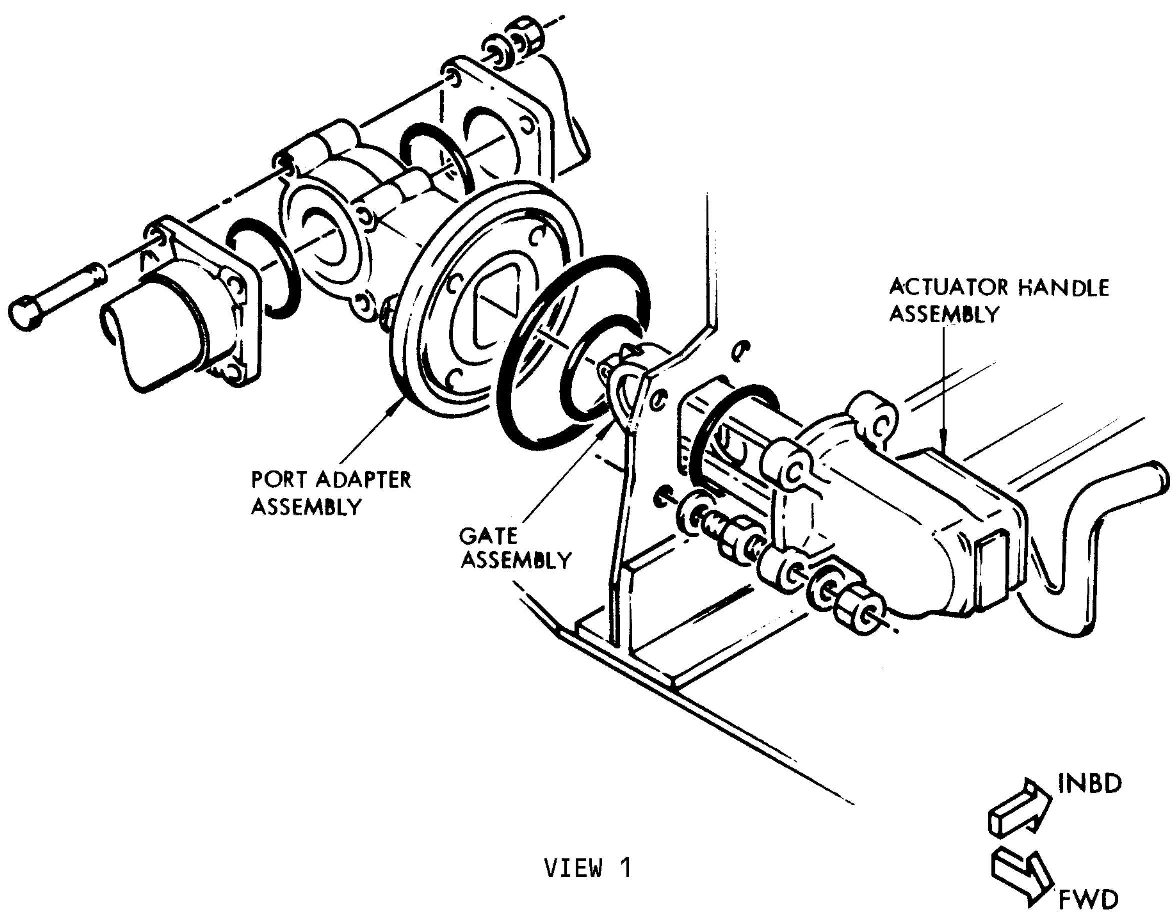
(d) Examine and make sure there is no fuel leakage at the access panel you opened to get access.

(17) Install the left (right) access panels 6212, 6301, 6241 (6512, 6401, 6541) you opened to get access to the dry side of the bulkhead fitting (AMM 12-31-61/201, AMM 12-31-71/201).

DEFUELING - DESCRIPTION AND OPERATION

1. General
   A. The fuel system is designed to permit complete or partial defueling of any or all tanks, or to allow fuel transfer to one or both other tanks while the airplane is on the ground. To accomplish defueling or fuel transfer, portions of the pressure fueling, engine fuel feed, and defueling systems are used in combination.
   B. Most rapid defueling of one or more tanks is accomplished by attaching a fuel truck hose nozzle to the fueling station (right wing) receptacle, positioning appropriate fuel system valves, and operating the fuel truck defueling pumps and the respective airplane fuel tank boost pumps. Fuel remaining in the tanks (unusable, trapped) after the pumps cease drawing fuel, is drained into containers by opening the sump drain valves (Ref 12-11-0, Fuel Servicing).
2. Defueling Valve
   A. The defueling valve (Fig. 1) is a manually operated, semisubmerged, slide-type shutoff valve which controls fuel flow from the engine fuel feed line to the pressure fueling receptacle. It is mounted on the wing front spar of the right wing. The actuating handle of the defueling valve is such that its access door cannot be closed while the valve is in the open position. As with other valves in the fuel system, the defueling valve mechanism can be removed without defueling a tank.
   B. The defueling valve consist of the following major assemblies; actuator handle assembly, gate assembly, and the port adapter assembly.
      (1) Actuator handle assembly.
         (a) The actuator handle assembly consists of an actuating handle, two spring-loaded balls, and a splined output shaft. The splined output shaft provides a means for the actuating handle to actuate the gate assembly. The two spring-loaded balls drop into detents and lock the actuating handle in the ful1 open or closed position. The actuating handle assembly is bolted to the gate assembly and can be replaced as an independent unit.
      (2) Gate Assembly
         (a) The gate assembly consists of a housing, a splined input shaft, a valve actuating arm, a sliding gate, and gate seals. One end of the valve actuating arm is attached to the splined input shaft. The other end of the arm carries a roller which engages in a slot in the end of the sliding gate. Spring-loaded seals, held in carriers attached to the housing, provide fuel line seals on both sides of the sliding gate: Other seals, at the housing mounting flange and the splined input shaft, seal the unit against external fuel leaks. The gate assembly is attached to the airplane by nuts installed on double ended bolts attaching the port adapter assembly to the airplane. Removing the nuts allows the gate assembly to be removed without disturbing the port adapter assembly or fuel lines (Fig. 1).





VIEW 1

Defueling Valve
Figure 1

(3) Port Adapter Assembly

(a) The port adapter assembly consists of a housing and a thermal relief valve. The assembly, which is mounted inside the fuel tank, provides the mounting surfaces for the fuel lines and a fuel tight enclosure for the gate assembly. A thermal relief valve vents excessive pressure inside the valve body back into the fuel tank.

DEFUELING - MAINTENANCE PRACTICES

1. General
    A. The following paragraphs cover the steps necessary to defuel the fuel tanks, transfer fuel from tank to tank and the precautions which must be observed during defueling. Standard precautions in effect at the airport, or as required by the airline, must be observed during all defueling operations to avoid fire and accidents.

    CAUTION: DO NOT OPERATE HYDRAULIC SYSTEM A OR B IF DEFUELING TANK NO. 1 OR 2, RESPECTIVELY, BELOW APPROXIMATELY 1675 POUNDS (250 U.S. GALLONS) OR 762 KILOGRAMS (950 LITRES) OF FUEL. HYDRAULIC SYSTEM OVERHEATING WILL RESULT IF HEAT EXCHANGER IS NOT SUBMERGED IN FUEL.

    B. All tanks may be defueled separately or simultaneously. If selective defueling is performed (single tank only), consideration should be given to the possibility of fuel or fuel vapor carryover into the defueled tank from tank(s) still containing fuel.
2. Fuel Tank Defueling
    A. General
        (1) Defueling is done in one of three ways - under pressure from the tank boost pumps in the tank to be defueled, by suction from fuel truck defueling pump, or both. With pressure defueling, a tank can be defueled to sump drain valve level through the crossfeed valve, engine shutoff valve, and defueling valve. The most rapid means of defueling is through the three valves simultaneously with the airplane boost pumps and fuel truck defueling (suction) pump operating.
        (2) Normal defueling is done with the airplane in normal attitude (0 degree roll - 1 degree nose down).
        (3) A11 valves may be opened or closed manually if desired.
    B. Equipment and Materials
        (1) Fuel Truck or equivalent fuel servicing facility (must be equipped with suction pump if suction defueling is used)
        (2) Fuel truck, or equivalent fuel servicing facility (must be equipped with suction pump if suction defueling is used)
        (3) Sump Fuel Drain Hose Adapter (Fig. 204) - B28002-1 (preferred); SE28-1105 (alternate)
        (4) Fuel drain hose to fit hose adapter (Fig. 204)
        (5) Center wing tank sump drain tool (Fig. 205)
        (6) Fuel Dripstick Operating Tool - F72949
    C. Defuel through Pressure Fueling Receptacle Using Airplane Boost Pumps and Fueling Truck Defueling (Suction) Pump

    NOTE: Boost pumps must be operating.

(1) Make sure the airplane is grounded (AMM 20-40-11/201, Static Grounding).

WARNING: MAKE SURE THE AIRPLANE AND THE FUELING TRUCK ARE ELECTRICALLY BONDED BEFORE FUELING OR DEFUELING. MAKE SURE THE AIRPLANE AND ALL WORK STANDS IN USE ARE GROUNDED AND BONDED BEFORE DOING FUEL TANK OR FUEL SYSTEM MAINTENANCE. REFER TO THE PARAGRAPH ON STATIC GROUNDING PROCEDURE. CORRECT ELECTROSTATIC GROUNDING AND BONDING PREVENTS STATIC ELECTRICITY DISCHARGES AND POSSIBLE FIRE OR EXPLOSION.

(a) Connect a grounding cable from the fueling vehicle and other fuel equipment being used for tank maintenance to an approved and identified static ground.
(b) Connect a bonding cable from the fueling vehicle to an approved electrical grounding or bonding connection on the airplane.

NOTE: If the fueling vehicle has a permanently attached V or Y grounding cable, connect one part of the V or Y to an approved, identified ground. Then connect the other part of the V or Y cable to an approved electrical bonding or grounding point on the airplane.

(2) Connect electrical power to airplane.

NOTE: APU may be used except for total defueling of tank No. 1. Check for minimum fuel and other operational requirements prior to starting APU (AMM 49-11-0/201, Operating Limits).

(3) On circuit breaker panel P6, make sure all fuel system circuit breakers are closed.
(4) Open fueling station access door (Fig. 201) and remove fueling nozzle receptacle cap.
(5) Connect defueling hose nozzle grounding jacks to grounding receptacles on wing.
(6) Connect defueling hose nozzle to fueling nozzle receptacle. Open nozzle fuel flow shutoff handle.

CAUTION: BEFORE DEFUEL OPERATIONS, MAKE SURE THE HOSE NOZZLE AND HOSE-END CONTROL VALVE (IF USED) ARE CONFIGURED PER THE SUPPLIER'S MAINTENANCE MANUAL. FAILURE TO DO SO COULD CAUSE DAMAGE TO THE AIRPLANE.

(7) Make sure the fueling valve switches on the fueling control panel P15 are in the CLOSED position. VALVE POSITION LIGHTS should be extinguished.

(8) Record fuel quantity for tank(s) to be defueled. Momentarily hold test switch on P15 panel on TEST GAGES & FUELING PRECHECK position on airplanes with VTO, or on TEST GAGES position on non-VTO airplanes. Indicator should move downscale. Release switch and indicator should return to its original position ± 50 pounds or ± 25 kilograms.

(9) Open defueling valve access door (Fig. 202) and place defueling valve to OPEN position.

(10) Make sure engine No. 2 fuel shutoff valve is open. The shutoff valve is normally closed on the ground; open to do the defueling procedure (valve blue position light on forward overhead P5 panel extinguished). If not:

(a) Open engine ignition circuit breakers on P6 panel.

(b) Make sure fire switches are pushed in.

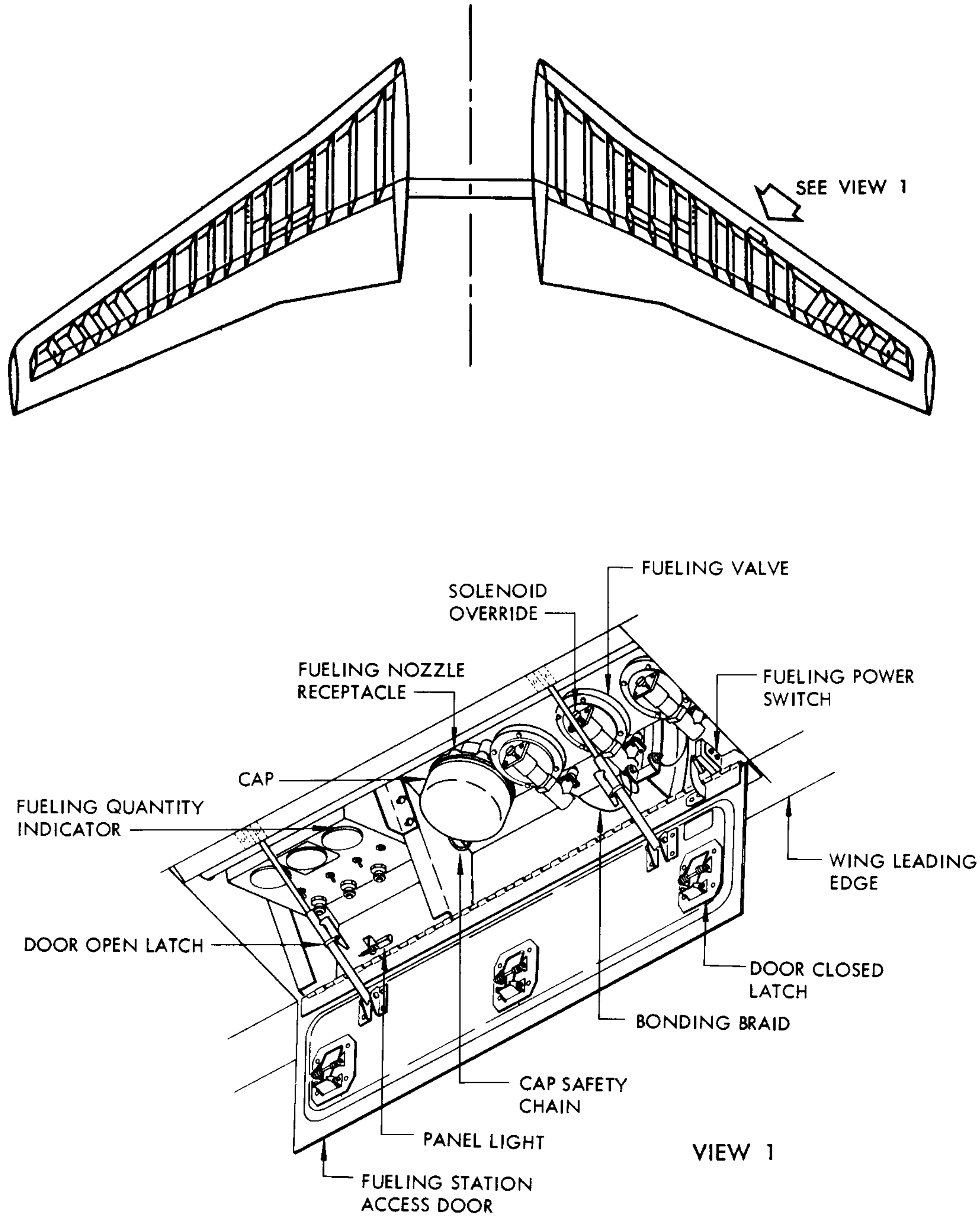
(c) On airplanes with engine start lever control of engine fuel shutoff valves (AR LV-JTO and on; EF ALL EXCEPT B-2601, B-2603, B-2607; IN ALL EXCEPT EI-ASA thru EI-ASH; MD ALL EXCEPT 5R-MFA; ND CF-NAW, C-GNDC, C-GNDL and on, plus airplane PV ALL EXCEPT CF-EPL, CF-EPO, CF-EPR; PW ALL EXCEPT CF-PWC thru CF-PWE, CF-PWM), place engine No. 2 start lever on aisle stand in IDLE position.

(11) Position crossfeed valve control on P5 panel to open crossfeed valve. Make sure valve position light is dim (blue).

NOTE: If defueling tank number two (right side) crossfeed valve may be open or closed.

(12) Put the fuel boost pump switches, found on the forward overhead panel, as shown in table below for applicable tank.

SWITCH POSITION FOR DEFUELING			
FUEL PUMP SWITCH	TANK NO. 1	TANK NO. 2	CENTER TANK
AFT 1	ON	OFF	OFF
FWD 1	ON	OFF	OFF
AFT 2	OFF	ON	OFF
FWD 2	OFF	ON	OFF
L CTR	OFF	OFF	ON
R CTR	OFF	OFF	ON



Fueling Station Access Door Location
Figure 201

(a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

(13) Start the fuel truck defueling pump.
(14) Continue defueling until the fuel quantity indicator shows desired quantity of fuel remaining in tank, or until corresponding fuel low pressure warning light comes on; then put the applicable boost pump switches to OFF.
(15) Put the crossfeed valve on P5 panel to CLOSE. Make sure the position light shows bright while valve is in transit and goes off when the valve is closed.
(16) If engine No. 2 start lever was placed in IDLE position, return start lever to CUTOFF and close the engine ignition circuit breaker on P6 panel.
(17) Stop the fuel truck defueling pump.
(18) Close the defueling valve and close the defueling valve access door.
(19) Close the nozzle fuel flow shutoff handle. Disconnect the defueling hose nozzle and disconnect the nozzle grounding jack.
(20) Install the fueling receptacle cap and close the fueling station access door.

(21) Remove electrical power if it is not necessary.
(22) Drain sump fuel from defueled tank.

NOTE: Optimum attitude for sump draining of fuel is 1 degree nose down pitch/0 degree roll.

(a) Remove fuel sump drain valve for integral tank (Fig. 203) (AMM 28-11-21/401, Fuel Sump Drain Valve).
(b) Install sump fuel drain adapter (Fig. 204).
(c) Electrically ground container or any associated equipment to basic airplane structure, but not in immediate vicinity of drainage (Ref Chapter 20).
(d) Drain sump fuel from defueled tank through sump drain valve fitting, using sump fuel drain adapter.

WARNING: DRAIN SUMP FUEL IN PROPERLY MARKED AND APPROVED CONTAINERS.

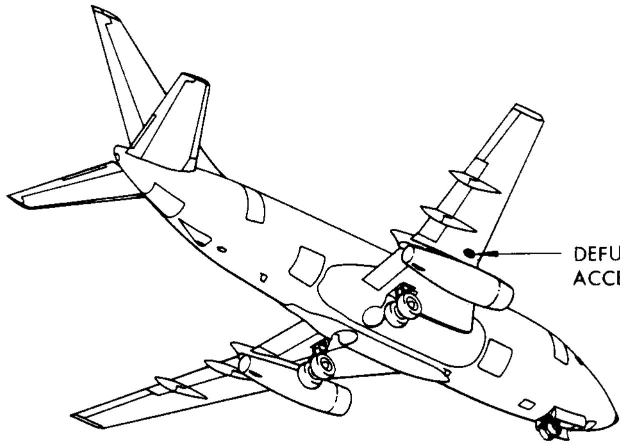
(e) Remove drain adapter and install drain valve.

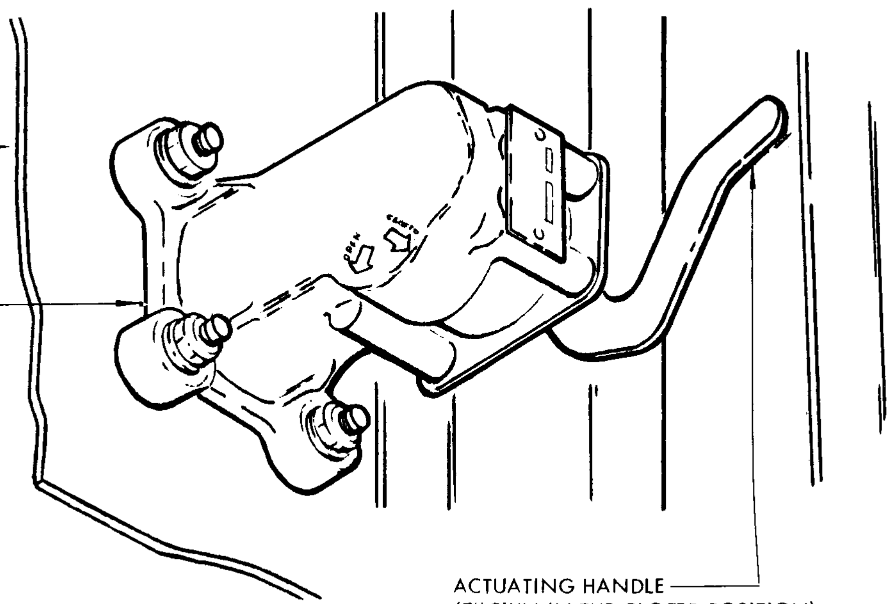
(23) Drain sump fuel from defueled center tank.
(a) On airplanes with integral center tank, adjust airplane attitude to 1/4 degree nose up and 0 degree roll for maximum sump drainage.
(b) Open sump valve access door for center tank (Fig. 203).
(c) Electrically ground metal container or any associated equipment to basic airplane structure, but not in immediate vicinity of drainage (Ref Chapter 20).
(d) Open sump drain by turning clockwise and pushing up. Drain will have to be held in this position until all fuel flow has stopped. A tool may be fabricated locally to aid in draining fuel (Fig. 205).

WARNING: DRAIN SUMP FUEL IN A PROPERLY MARKED AND APPROVED CONTAINER.

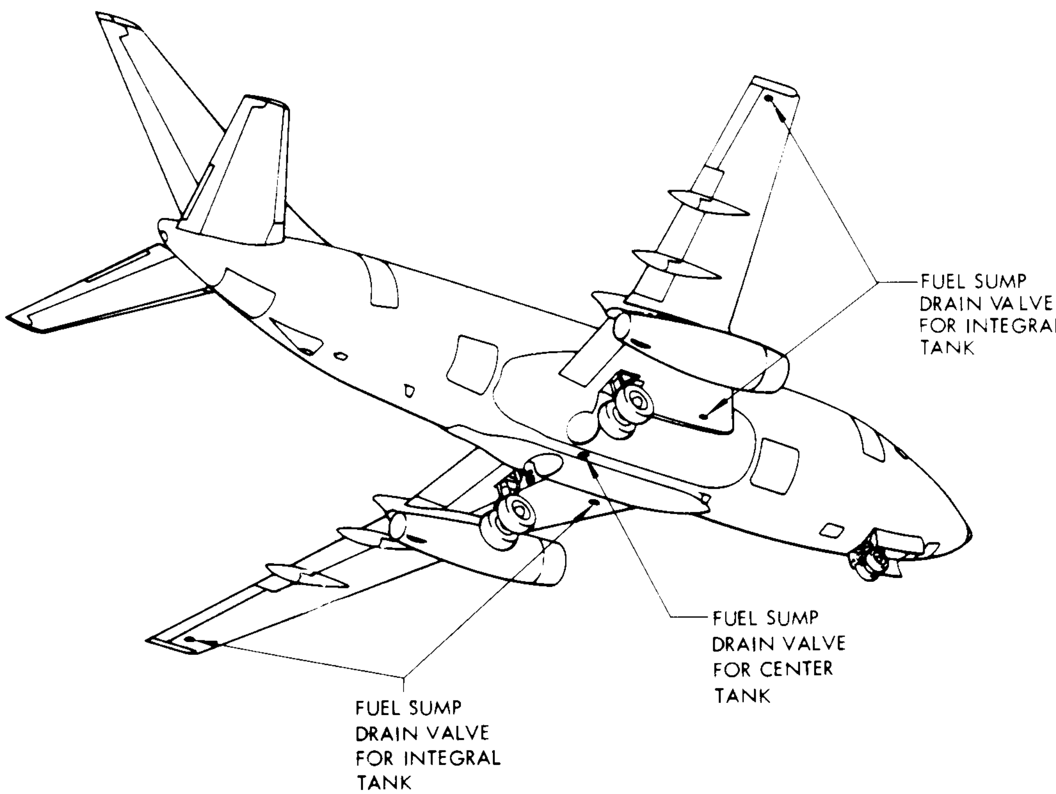
(e) Close sump drain by releasing and turning counterclockwise.

(24) Open boost pump drain cocks, and drain fuel from pumps.

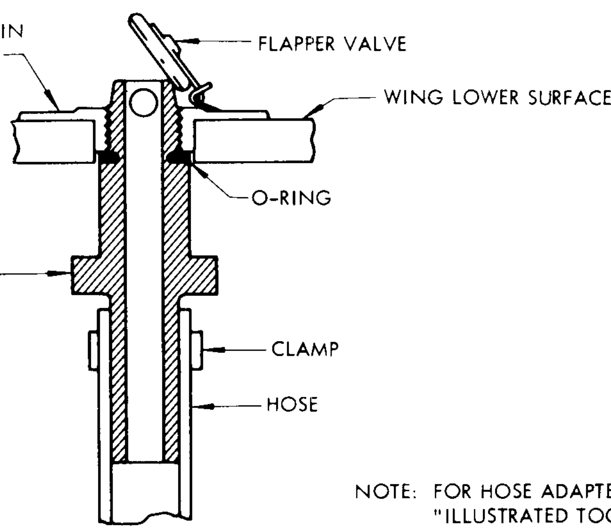




Defueling Valve
Figure 202



Location of Fuel Sump Drain Valve
Figure 203



NOTE: FOR HOSE ADAPTER INFORMATION SEE "ILLUSTRATED TOOL AND EQUIPMENT LIST," PART NUMBER SE28-1105.

Sump Fuel Drain Hose Adapter
Figure 204

(25) Close boost pump drain cocks.
(26) If entry is to be made into defueled tank, tank must be purged (AMM 28-10-0/201).

WARNING: ON AIRPLANES WITH INTEGRAL CENTER TANK, ENSURE THAT SUMP DRAINAGE WAS COMPLETED WITH AIRPLANE ATTITUDE AS NOTED IN PAR. 2.C.(22)(a) BEFORE CENTER TANK ENTRY IS ATTEMPTED OR SPILLAGE OF TRAPPED FUEL WILL OCCUR WHEN ACCESS PANEL IS LOOSENED.

D. Defuel Through Pressure Fueling Receptacle Using Airplane Boost Pump Only

NOTE: Defueling nozzle should be equipped with a filter screen.

(1) Ground airplane and fuel truck (AMM 20-41-11/201).
(2) Perform steps 2.C.(2) thru 2.C.(12), 2.C.(14) and 2.C.(15), and 2.C.(17) thru 2.C.(25).

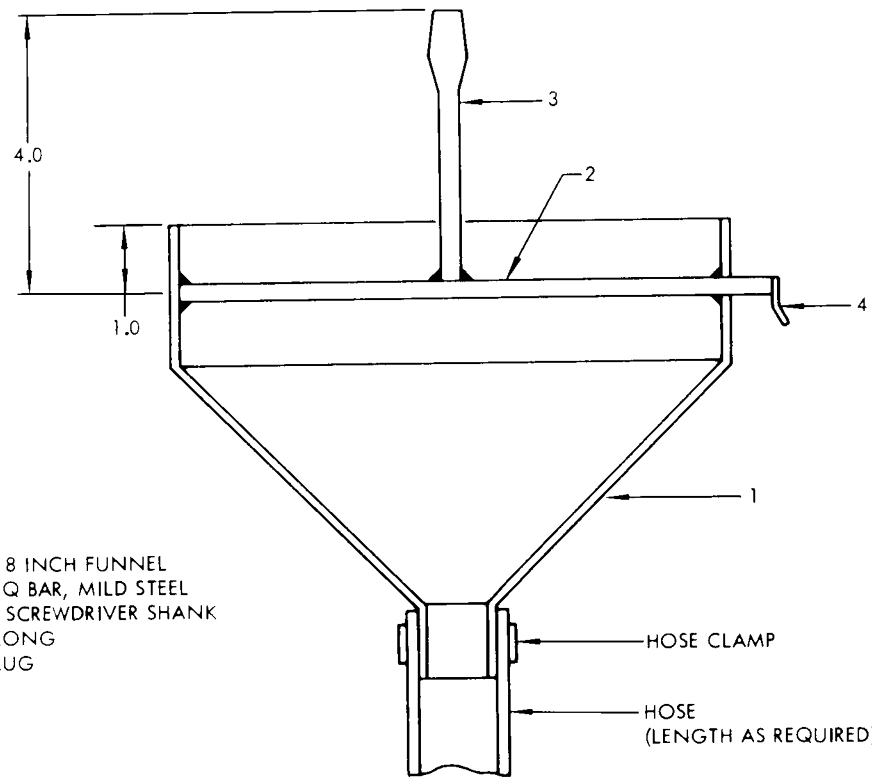
E. Defuel Through Pressure Fueling Receptacles Using Fuel Truck Defueling (Suction) Pump Only

NOTE: This method of defueling is extremely slow and should only be used when electrical power cannot be applied to airplane. Defueling nozzle should be equipped with a filter screen.

(1) Ground airplane and fuel truck (AMM 20-41-11/201).
(2) When defueling tank No. 1 open crossfeed valve and manually close boost pump bypass valve for tank No. 2.
(3) When defueling center tank open crossfeed valve and manually close boost pump bypass valves for tanks No. 1 and 2.
(4) When defueling tank No. 2 the crossfeed valve can be either open or closed.
(5) Perform steps 2.C.(4) thru 2.C.(6).
(6) Make sure fueling valve switches on the fueling control panel P15 are in the closed position.
(7) Perform steps 2.C.(9), 2.C.(10), and 2.C.(13).

NOTE: If it is difficult to get fuel to flow from airplane, use the fuel truck to pump the airplane lines full of fuel (pressure-prime) then start fuel truck defueling pumps.

(8) Defuel until dripsticks show desired quantity of fuel remaining in tanks No. 1 and/or 2 or until fuel truck flowmeter ceases to show fuel flow.
(9) Perform steps 2.C.(15) thru 2.C.(25).



1. STANDARD 8 INCH FUNNEL
2. 1/4 X 1/2 SQ BAR, MILD STEEL
3. STANDARD SCREWDRIVER SHANK 4 INCHES LONG
4. GROUND LUG

Center Wing Sump Drain Funnel Assembly
Figure 205

(10) Open fuel boost pump bypass valve or valves if tank No. 1 or center tank have been defueled.

3. <u>Transfer Fuel from Tank to Tank</u>

A. General

(1) When only one tank requires defueling, as for leak repair, the fuel can be transferred from one tank into another. The procedure is similar to a tank defueling with the boost pumps operating.

<u>NOTE</u>: Observe fuel quantity limits for each tank when transferring fuel from one tank to another.

B. Transfer Fuel

(1) Connect electrical power to airplane (AMM 24-22-0/201).

<u>NOTE</u>: APU may be used except for total defueling of tank No. 1. Check for minimum fuel and other operational requirements prior to starting APU (Ref 49-11-0 MP).

(2) On circuit breaker panel P6 ensure all fuel system circuit breakers are closed.

(3) If fuel is to be transferred from tank No. 1 or center tank, place crossfeed valve switch to OPEN position. If defueling tank No. 2 only place switch in CLOSE position.

(4) Make sure the No. 2 engine fuel shutoff valve is open (normal position). Fire switch should be in and locked.

(5) Open the fueling station access door (Fig. 201).

(6) Place fueling valve switches to OPEN position to check VALVE POSITION LIGHTS.

(7) Put the fueling valve switch for tank(s) receiving fuel to OPEN position. Make sure other fueling valve switches are in CLOSE position.

(8) Open the defueling valve access door and put the defueling valve handle to OPEN position.

(9) Do step 2.C.(12).

(a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

<u>WARNING</u>: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

NOTE: When defueling or transferring fuel with minimum backpressure to the pumps, it is possible for the low pressure light(s) to be on. In this case, monitor the tank quantity and put the pump switch(es) to OFF if the tank quantity is not changing.

a) Continue fuel transfer until fuel quantity indicator shows desired quantity of fuel remaining in tank, or until corresponding fuel low pressure warning light comes on. Position respective boost pump switches to OFF.

(10) Close the defueling valve, and close the defueling valve access door. Put the crossfeed valve control to closed position.
(11) Put the fueling valve switches to CLOSE position on fueling control panel and close the fueling station access door.
(12) Determine whether there is any further need for electrical power on airplane; if not, disconnect power.
(13) If draining the sump fuel, repeat steps 2.C.(21) thru 2.C.(25).

DEFUELING VALVE - REMOVAL/INSTALLATION

1. General
   A. The defueling valve is composed of three major assemblies; the actuator handle assembly, gate assembly, and the port adapter assembly. The actuator handle assembly and the gate assembly are bolted together. The gate assembly and actuator handle assembly may be removed or installed as an assembled unit. When removing the assembled unit, it is not necessary to defuel the fuel tank. The actuator handle assembly can be removed from the gate assembly and replaced as an independent unit.
   B. The defueling valve may be isolated by closing the No. 2 engine fuel shutoff valve. Replacing the port adapter assembly requires removal of the actuator handle and gate assemblies and complete defueling of No. 2 fuel tank.
2. Removal/Installation of Defueling Valve Actuator Handle Assembly
   A. Equipment and Materials
      (1) Grease - MIL-G-3545
   B. Prepare for Defueling Valve Actuator Handle Assembly Removal
      (1) Open defueling valve access panel located forward of the front spar and outboard of the right engine.
      (2) Check that No. 2 engine fuel shutoff valve is closed.
         (a) Fire switch shall be in FIRE position, or, on airplanes with engine start lever control of engine fuel shutoff valves, start lever shall be in cutoff.
   C. Remove Defueling Valve Actuator Handle Assembly (Fig. 401)
      (1) Support actuator handle assembly and remove mounting bolts.
      (2) Carefully slide actuator handle assembly away from gate assembly until handle assembly is clear of mating part.
   D. Install Defueling Valve Actuator Handle Assembly (Fig. 401)
      (1) Lightly coat splines of output shaft with grease.
      (2) Align actuator assembly output shaft with gate assembly input shaft, rotate output shaft until index spline lines up with index spline in input shaft.
      (3) Insert end of output shaft into input shaft.
      (4) Carefully slide output shaft into input shaft until actuator mounting flange contacts gate assembly.
      (5) Install mounting bolts and lockwire.
3. Removal/Installation of Defueling Valve Gate Assembly
   A. Equipment and Materials
      (1) Aliphatic Naphtha - TT-T-95

(2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
(3) Suitable container to hold residual fuel from fuel manifold

B. Prepare for Defueling Valve Gate Assembly Removal
(1) Make sure that No. 2 engine fuel shutoff valve is closed.
(a) Fire switch shall be in FIRE position, or, on airplanes with engine start lever control of engine fuel shutoff valves, start lever shall be in cutoff.
(2) Place container under valve to catch fuel.

C. Remove Defueling Valve Gate Assembly (Fig. 401)
(1) Remove gate assembly attaching nuts and washers.
(2) Carefully withdraw gate assembly from opening in front spar and lift clear.

<u>NOTE</u>: If port adapter assembly is not being removed, ensure mounting bolts were not loosened during removal of gate assembly attaching nuts.

D. Install Defueling Valve Gate Assembly (Fig. 401)
(1) Clean O-ring groove in gate assembly housing and machined surface of front spar with solvent. Wipe dry with a clean cotton wiper (BMS15-5).
(2) Clean O-ring groove in gate assembly housing and machined surface of front spar with naphtha, wipe dry with a clean cotton wiper (BMS15-5).
(3) Install new O-ring, lightly lubricated with fuel, into groove on gate assembly housing.
(4) Carefully insert gate assembly into port adapter, through opening in front spar.
(5) Install gate assembly attaching nuts and washer. Torque 50 to 70 pound-inches.

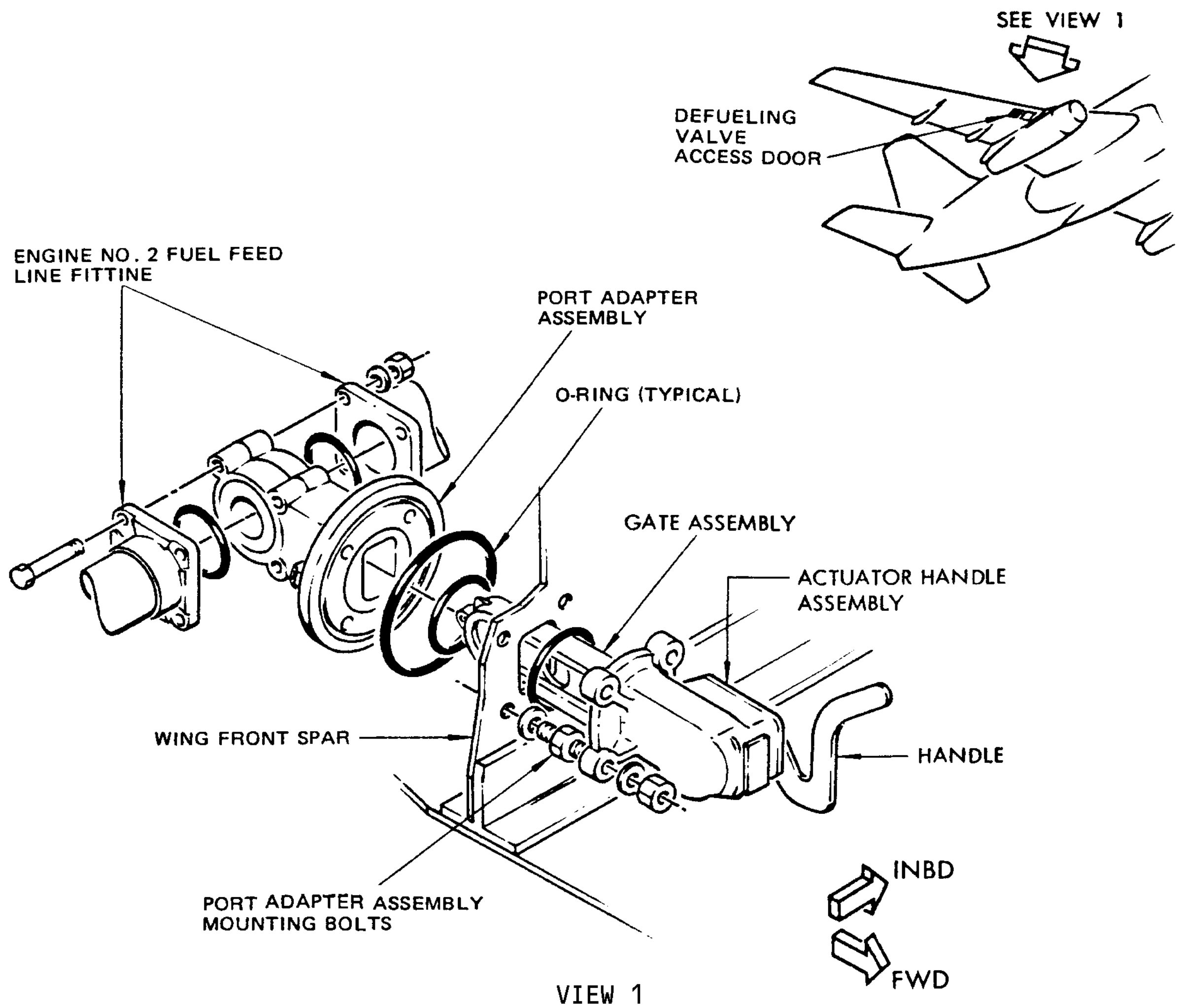
4. <u>Removal/Installation of Defueling Valve Port Adapter Assembly</u>

A. Equipment and Materials
(1) Aliphatic Naphtha
(2) G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5

B. Prepare for Defueling Valve Port Adapter Assembly Removal
(1) Defuel and purge No. 2 fuel tank. Refer to 28-23-0, Defueling and 28-10-0, Fuel Storage System - Maintenance Practices.
(2) Remove second fuel tank access panel outboard of the right engine to gain access to the aft side of wing front spar.

<u>WARNING</u>: COMPLY WITH ALL TANK ENTRY PRECAUTIONS AS GIVEN IN 28-10-0, FUEL STORAGE SYSTEM - MAINTENANCE PRACTICES.

C. Remove Defueling Valve Port Adapter Assembly (Fig. 401)
(1) Perform steps 3.C.(1) and 3.C.(2) to remove gate assembly.
(2) Gain access to valve through fuel tank access opening and remove bolts attaching fuel line flanges to port adapter assembly.



Defueling Valve Installation
Figure 401

(3) With one man inside fuel tank supporting port adapter assembly, second man, outside fuel tank, remove port adapter assembly mounting bolts and washers (Fig. 401).

CAUTION: DO NOT ALLOW ADAPTER ASSEMBLY TO FALL, DAMAGE TO WING SKIN OR FUEL TANK SEALING MAY RESULT.

(4) Slide port adapter assembly from between fuel line flanges and lift clear.

D. Install Defueling Valve Port Adapter Assembly (Fig. 401)

(1) Clean O-ring grooves and machined surfaces of port adapter, fuel line flanges, and front spar with naphtha and wipe dry with a clean cotton wiper (BMS15-5).

(2) Install new O-rings, lightly lubricated with fuel into grooves on port adapter assembly.

(3) Carefully slide port adapter assembly into position between fuel line flanges.

CAUTION: DO NOT DISLODGE OR PINCH O-RING WHEN INSERTING PORT ADAPTER ASSEMBLY.

(4) Install bolts attaching fuel line flanges to adapter assembly.

(5) From outside fuel tank, install port adapter assembly mounting bolts and washers and torque 100 to 140 pound-inches.

(6) Perform steps 3.D.(1) thru 3.D.(4) to install gate assembly.

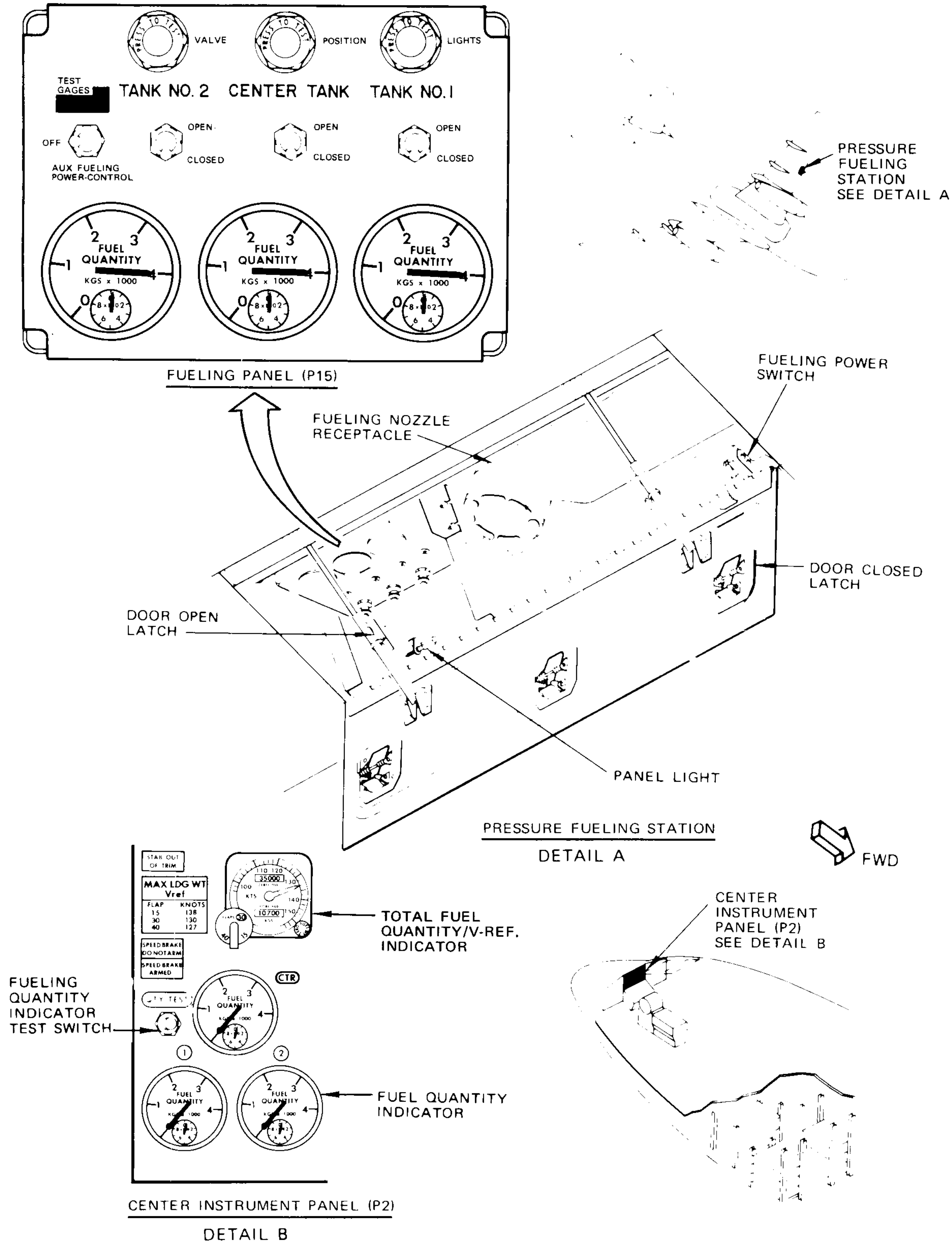
E. Restore Airplane to Normal Configuration

(1) Install fuel tank access panel (Ref 28-11-11 R/I).

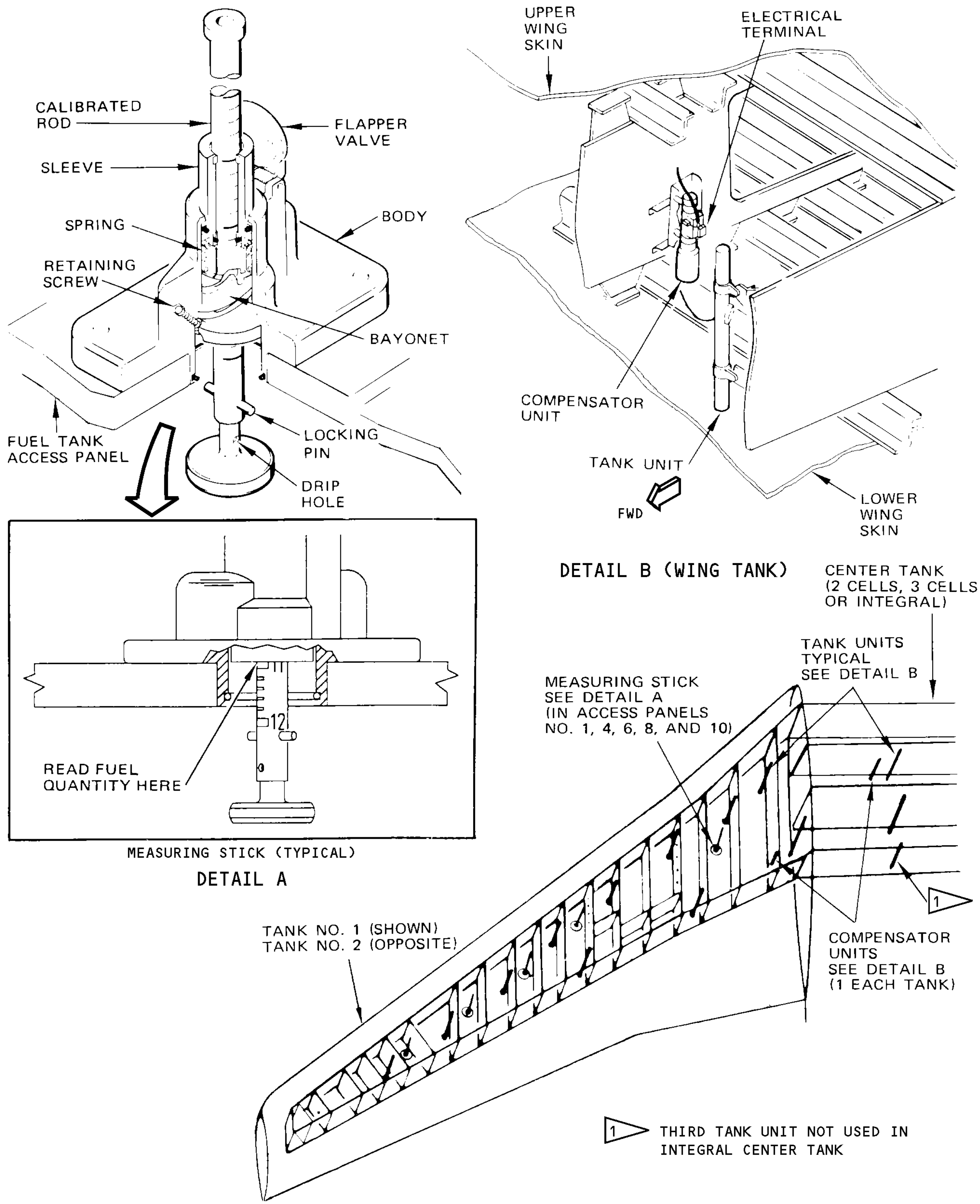
(2) Close defueling valve access panel.

FUEL QUANTITY INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The fuel quantity indicating system measures the weight of usable fuel in the fuel tanks. Three fuel quantity indicators and one total fuel quantity indicator on the pilots' center instrument panel (P2) and three indicators at the fueling station provide visual indication of the fuel weight in each of the three tanks or, for the total quantity indicator, the sum total in all the tanks. In each of fuel tanks No. 1 and 2, five fuel measuring sticks are provided to determine fuel quantity of the respective tank by mechanical means.
   B. System components are located in the control cabin, in the fuel tanks, and at the fueling station (Fig. 1). Control cabin components consist of three fuel quantity indicators, one total fuel quantity indicator, and a fuel quantity indicators press-to-test switch. Fuel tank components consist of tank units, compensator units and fuel measuring sticks. Three fueling quantity indicators and a fueling quantity indicators test switch are located at the fueling station. The fueling quantity indicators are interchangeable with the corresponding fuel quantity indicators located on pilots' center instrument panel (P2) provided they are recalibrated to their new location.
   C. The overall system is composed of three subsystems, one for each tank. Each subsystem consist of a fuel quantity indicator, a fueling indicator, a compensator unit and a number of tank units. The tank units in each tank are connected in parallel and positioned so that only usable fuel is measured. Fuel is the variable dielectric. Capacitance values of the tank units in each tank are added to give a single capacitance value, which is transmitted to each fuel quantity indicator. The fuel quantity indicator shows continuously the weight of fuel remaining in the tank. The fueling quantity indicators on the fueling control panel repeat the fuel quantity shown by the fuel quantity indicators in the control cabin. The fueling quantity indicators operate only when fueling station door is open.
2. Tank Units
   A. The tank units are cylindrical capacitors mounted throughout each fuel tank to sense fuel level variations and, as a result of capacitance change, transmit electrical signals to the fuel quantity indicators (Fig. 1). The tank units consist of two coaxial cylinders rigidly spaced at intervals throughout their length by insulating centering spacers. The inner electrode is a variable diameter tube of electroformed nickel alloy and is connected to the amplifier input. The outer electrode is an aluminum alloy tube of constant diameter and is connected to the 400 -Hz excitation voltage lead. The diameter of the inner electrode is profiled to provide an output signal linear with respect to the volume of fuel in the tank. Openings at the ends of tank units allow fuel to assume the same level between the two cylinders as that in the fuel tank. Tank units are located in the fuel tanks so that errors due to airplane attitude are kept to a minimum.



Fuel Quantity Indicating System Component Location
Figure 1 (Sheet 1)



Fuel Quantity Indicating System Component Location
Figure 1 (Sheet 2)

B. Tank units are mounted to main tank wing ribs and to center tank spanwise beams. Access to the tank units is obtained through fuel tank access openings. Electrical connections to tank units are made at the tank unit terminals (Fig. 1). Tank unit leads, within a given tank, form a harness which terminates at a receptacle (Fig. 2). The receptacles for tanks No.1 and 2 are located in the respective wing front spar, and for the center tank in the main landing gear wheel well forward bulkhead on the left side. Mating with each receptacle is a bussing plug assembly. The plug assembly connects the tank units in parallel.

3. Compensator Units

A. The compensator unit in each tank acts as a sensing element to maintain a linear relationship between fuel dielectric properties and fuel density. Each compensator unit consists of a low impedance plate and two high impedance plates, both protected by a mechanical shield. The compensators are mounted to the same wing structure as tank units and are located so that they are completely submerged in fuel at all times. Access to the compensator units is obtained through the fuel tank access openings. Leads from the compensator units are contained in the same harness used for the tank units.

4. Fuel Quantity Indicators

A. Three fuel quantity indicators, located on the center instrument panel (P2), show the weight of fuel in the three tanks. Each indicator consists of the reference side of a self-balancing capacitance bridge, a power transformer, an amplifier, a reversible two phase induction motor, gear trains, pointers, a main dial, and a vernier dial. All indicators are hermetically sealed. Electrical connection, and full and empty adjustment screws are at the rear of each indicator.

B. The fuel quantity indicators use 115-volt ac power for the bridge circuit through the transformer and for one phase of the induction motor (the other motor phase is energized by amplifier output). Indicator pointers are driven by the same shaft as the potentiometer wiper of the self-balancing bridge circuit and rotate with the wiper to provide continuous indication of the fuel quantity.

5. Total Fuel Quantity/V-Reference Indicator

A. The V-Reference indicator, located on the center instrument panel (P2), is a dual function instrument calculating and displaying V-Reference (landing reference speed), as a function of flap position and gross weight. The totalizer function is standard summing the outputs of the individual fuel quantity indicators and displaying the total fuel weight on a counter. This total quantity is then added to a manually inserted zero fuel weight to provide gross aircraft weight modified by a manually inserted flap position signal, and displayed on the V-Reference pointer scale, calibrated in knots. There are two knobs on the bezel permittng manual insertion of the zero fuel weight and the flap position.

B. At the rear of the indicator are three FULL controls and, on airplanes with removable bladder cells in center tank, one EMPTY adjustment control. The three full controls are for the fuel tanks and are labeled FULL 1, FULL 2 and FULL CENTER.

6. Fueling Quantity Indicators

A. Three fueling quantity indicators, located on the fueling control panel, show the weight of fuel in the fuel tanks (Fig. 1). The fueling quantity indicators function as repeaters of the fuel quantity indicators located in the control cabin and aid the ground crew in fueling or defueling operations. The fueling quantity indicators are interchangeable with the fuel quantity indicators provided they are recalibrated to their new location. The fueling quantity indicators are operative only when the fueling station door is open. When the door is closed, power to the fueling quantity indicators is interrupted by a proximity switch (Fig. 2).

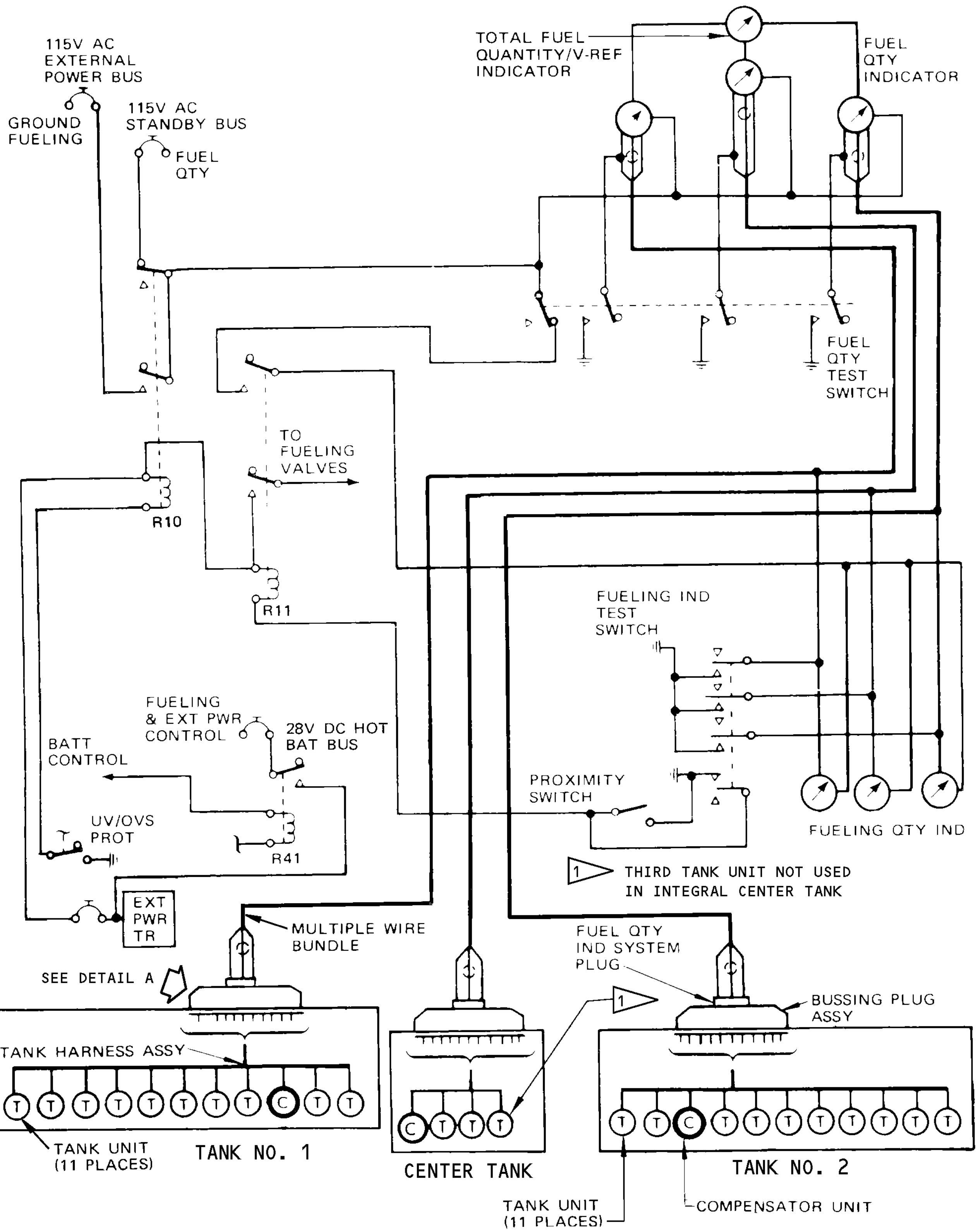
7. Measuring Sticks

A. The measuring sticks are used to measure the fuel quantity in tanks No. 1 and 2 by mechanical means. Each main tank has five measuring sticks, calibrated in inches or kilograms, located in wing fuel tank access panels No. 1, 4, 6, 8, and 10. The measuring stick unit of calibration is marked on each stick approximately one inch from end of stick.

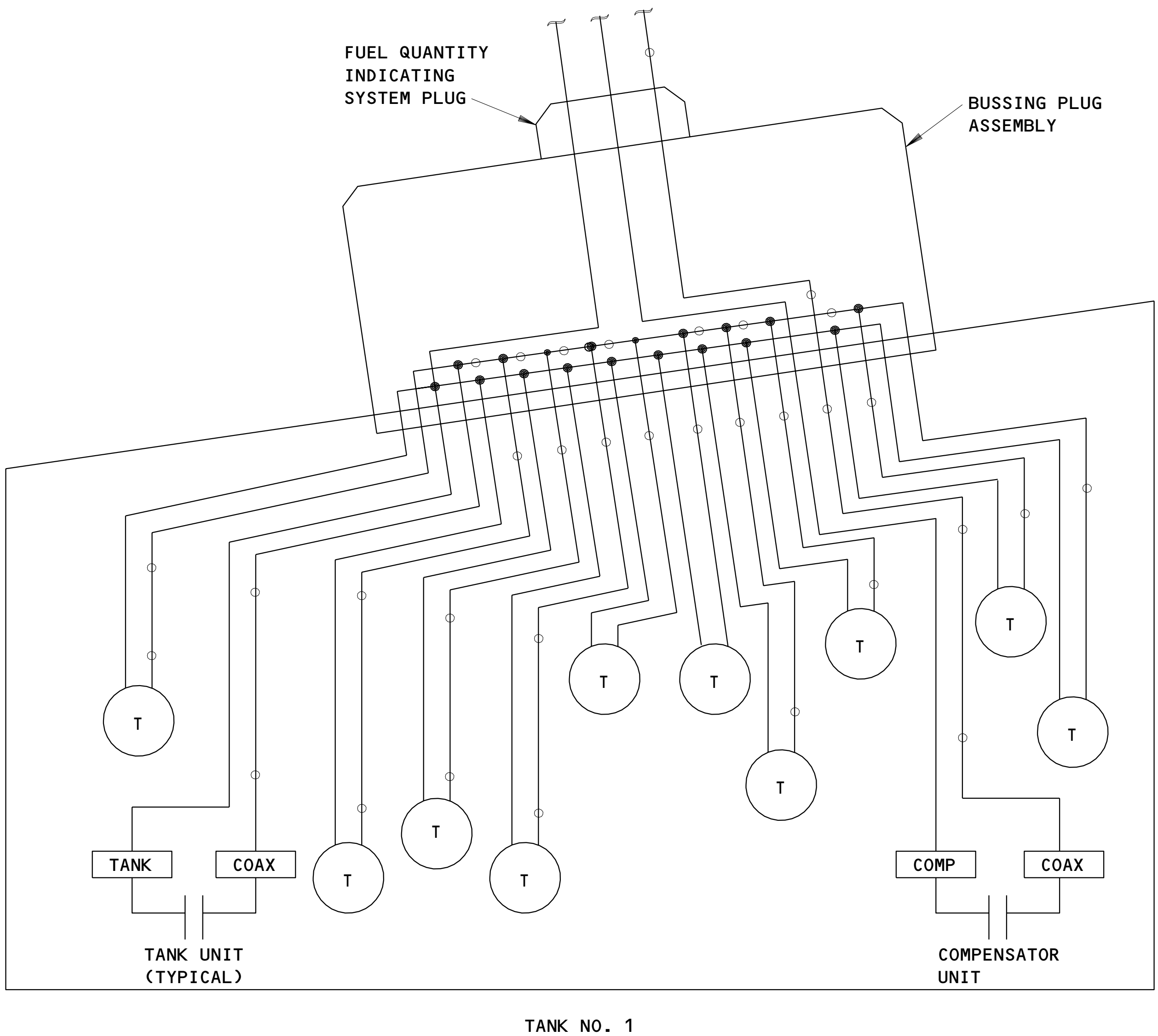
B. The measuring stick reading and measuring stick conversion document (D6-32628, inches to imperial gallons; D6-32037, inches to U.S. gallons, D6-32616, inches to kilograms; D6-32039, kilograms to U.S. gallons; or D6-32146, kilograms to kilograms) assist the ground crew in fueling operations when electrical power for fuel quantity indicators is not available. The measuring sticks are also used to verify fuel quantity indicator operation by comparing the fuel weight indicated by the indicators to the reading obtained by the measuring sticks.

8. Operation

A. The fuel quantity indicating system operates on 115-volt ac power obtained from the standby bus with one or both engines or the APU running. To energize the system without operating the engines or APU, power is obtained from ground cart through external power bus (Fig. 2), or from dc/ac inverter supplied by battery powering standby bus.



Fuel Quantity Indicating System Schematic
Figure 2 (Sheet 1)



DETAIL A

Fuel Quantity Indicating System Schematic
Figure 2 (Sheet 2)

B. The tank units function as variable capacitors, their capacitance value being determined by fuel level in the tank. The tank units are connected into a capacitance bridge so that current through the tank unit side of the bridge is compared to the current of the opposite phase in the balancing side of the bridge. A change in the fuel level alters capacitance value of the tank units and causes unbalance in the bridge circuit which is detected by phase sensitive amplifier. The amplifier controls an induction motor which moves a rebalance potentiometer wiper on the reference side of the bridge until a null point is again established in the system. The indicator dial pointer is connected to the potentiometer wiper and shows a fuel quantity reading corresponding to the null balance point.

C. Operation of the indicators can be tested by either of the two test switches. Actuation of the test switch on the engine instrument panel grounds the tank unit portion of the indicator circuit. This unbalances the indicator circuit and causes the fuel quantity indicator pointers to move downscale. The fueling quantity indicator pointers do not move. Upon releasing the test switch, the fuel quantity indicator pointers return to their original position. When the test switch is actuated on the fueling control panel, the fueling quantity indicator pointers move downscale and the fuel quantity indicator pointers move up scale. Upon releasing the test switch, all indicator pointers return to their original position.

NOTE: Keying of an HF system transmitter may cause a shifting or fluctuation of the fuel quantity indicator readings when the airplane is on the ground with entry door(s) open, and with service interphone cords and grounding straps connected.

FUEL QUANTITY INDICATING SYSTEM - TROUBLESHOOTING

1. General
   A. The following troubleshooting procedures are based on performance of system operational test and are presented in tree-type format. Test steps (heavy-line boxes) are connected by shaded arrows to show OK condition path. When all steps in OK condition path check out, system is operable.
   B. When a test step does not check out, follow the NOT OK line to box containing trouble symptom. Turn to procedure indicated and continue to follow a single line by analyzing results of each test step until required corrective action is determined. Perform specified corrective action, then repeat step at which failure was encountered.
   C. To reduce time required to troubleshoot fuel quantity indicating system problems, try the following shortcuts and check for proper response of fuel quantity indicating system. It is suggested that the longer troubleshooting procedures be used if the steps below do not resolve the problem.
      (1) Try switching same tank quantity indicators between P2 center panel and P15 fueling panel as it is unlikely that both fuel (primary) and fueling (repeater) indicators will fail simultaneously.
      (2) Make sure that fuel tank sump drains have been recently opened (at least 45 minutes after airplane has come to rest or after completion of fueling) and any water accumulation drained off. Sump drainage of approximately 5 gallons or 19 liters per tank every 24 hours is recommended in severe operating conditions such as in warm, humid climates.

         NOTE: No fuel quantity indicator is exactly interchangeable without having to make a final check and adjustment (AMM 28-41-0/501) to calibrate it to a specific subsystem. However, switching like indicators for the purpose of troubleshooting is sufficiently accurate to serve the purpose.

      (3) Inspect wing spar mounted volumetric top-off unit or bussing plug seals for evidence of leakage of fuel or water possibly causing electrical leakage paths between connector pins.
      (4) Perform press-to-test operation of fuel quantity indicators. If none of the indicators respond, a power supply to the indicator problem exists. If one indicator does not respond but the others do, the trouble is usually in the inoperative indicator.

D. Malfunctions within the fuel quantity (primary) indicator, VTO unit (if installed), associated tank units and compensator unit(s), interconnecting wiring, or operating with contaminated fuel result in the indicator either failing to respond to test switch, operating sluggishly or erratically, running against empty or full stop, or providing a high or low indication of fuel quantity. Also, since fuel quantity indicator or pilots center instrument panel P2 provides signals to total fuel quantity/V-reference indicator on P2 panel and fueling quantity indicator (repeater) on fueling station P15 panel, malfunctions in primary indicating circuits affect the other indicators as well.

E. Malfunctions in fueling quantity (repeater) indicator and associated wiring result in indicator either not operating or failing to provide a second indication of fuel quantity displayed by the associated fuel quantity (primary) indicator within maximum tolerance of ± 50 pounds (± 25 kilogams) for full tank, ± 100 pounds (± 50 kilograms) for empty tank, and ± 130 pounds (±65 kilograms) for empty integral center tank (if applicable).

F. Malfunctions in total fuel quantity/V-reference indicator or associated wiring result in an inoperative or inaccurate indicator. The total fuel quantity indicator should read within ± 3% of the full scale range of the primary indicators.

G. Erratic fuel quantity indicator readings can be experienced more often than other fuel quantity indicating system malfunctions. The following are some of the more common erratic readings:
   (1) Accumulation of excessive amounts of water in fuel tanks causing shorting of tank units and compensator units.
   (2) Clogged drain holes in wing tank spanwise stringers which could prevent water from draining to sumps.
   (3) Microbial growth and contamination in fuel tank internal structure and on tank units and compensator units.
   (4) Fuel tank unit grounding due to contact with structure, tubing, or bonding straps inside fuel tank.
   (5) Fuel tank unit electrical signal output being open or intermittent due to missing terminal screw, undertorquing of terminal screw, an improper terminal screw installed, or internal probe damage due to overtorquing terminal screw. Refer to AMM 28-41-21/401 for torque requirements.
   (6) Short circuit between compensator Hi-Z and Lo-Z elements which may be caused by compensator units not incorporating Simmonds SB 1060.
   (7) Broken wires in fuel tank electrical harness which are intermittently open-circuited.

(8) Improper O-ring seal installation at fuel bulkhead spar receptacle or bussing plug which allows fuel to leak from tank onto face of connector and/or moisture to enter onto face of connector. Either condition can create a leakage path between connector pins and vary system capacitance characteristics.

(9) Fuel penetration through fuel tank wire harness to face of fuel bulkhead spar receptacle which could cause variations in system capacitance.

(10) Indicators showing erratic readings due to indicator internal sticking from lack of, or improper, lubrication.

H. This table gives a summary of the most usual fault indications and their causes:

FAULT INDICATION	CAUSE OF THE FAULT
1. The indicator in the flight compartment goes to the high end of the scale. The refuel indicator follows.	Short Hi-Z to Lo-Z
2. The indicator in the flight compartment goes to the high end of the scale. The refuel indicator follows.	Short Hi-Z to Ground
3. The indicator in the flight compartment goes to the low end of the scale. The refuel indicator reads the same as the flight compartment indicator.	Short Lo-Z to Ground (probe hitting frame or plumbing in tank)
4. The indicator in the flight compartment reads HIGH or pegs at the top stop. The refuel indicator reads LOW or pegs at the bottom stop.	Short compensator Lo-Z to ground
5. The indicator in the flight compartment reads LOW. Probably at the bottom stop. Depends on resistance in short. Unstable if water is present.	Short compensator Lo-Z to Hi-Z (water in compensator)
6. The indicator in the flight compartment goes to the low end of the scale. The refuel indicator follows.	Open Hi-Z
7. The indicator in the flight compartment goes to the low end of the scale. The refuel indicator follows.	Open Lo-Z
8. The indicator in the flight compartment reads HIGH. The refuel indicator reads LOW.	Open Comp Lo-Z
9. The indicator in the flight compartment reads HIGH. The refuel indicator follows the flight compartment indicator (normal).	Open shield
10. The indicator in the flight compartment is sometimes erratic and undependable. Probably reads HIGH.	Grounded shield (other than at indicator). Causes ground loop, induces error in Hi-Z to indicator.

FAULT INDICATION	CAUSE OF THE FAULT
11. The indicator in the flight compartment is sluggish, travel time is high, poor repeatability of readings. The refuel indicator follows the flight compartment indicator (normal).	Low insulation resistance between: -Hi-Z and Lo-Z -Hi-Z and Ground -Lo-Z and Ground

2. Prepare for Troubleshooting
   A. Supply external electrical power (AMM Chapter 24).
   B. If fuel tank does not contain a known quantity of fuel, find the correct tank quantity (AMM 12-11-0/301).
      (1) If trouble is in tank No. 1 or 2, use dripstick to measure fuel quantity in tank.
      (2) If trouble is in center tank, transfer fuel in and out of tanks No. 1 and 2 measuring fuel quantity in the process.
   C. Make sure that GROUND EP REFUELING, FUEL QTY, and CAPTAINS AND CTR PANEL AND INSTR LIGHT circuit breakers on P6 panel are closed.

Prepare system for trouble shooting as described in par. 2. Check that fuel quantity (primary) indicator readings on P2 center instrument panel are within ± 1% of indicator full scale reading, and that total fuel quantity indicator counter reading is equal to sum of all fuel quantity readings within ± 1%. IF -

- NOT OK — FUEL QUANTITY (PRIMARY) INDICATOR INOPERATIVE - PROCEDURE 1
- NOT OK — TOTAL FUEL QUANTITY/V-REF INDICATOR INOPERATIVE - PROCEDURE 2
- NOT OK — TOTAL FUEL QUANTITY/V-REF INDICATOR INACCURATE - PROCEDURE 3
- NOT OK — FUEL QUANTITY (PRIMARY) INDICATOR READS LOW - PROCEDURE 4
- NOT OK — FUEL QUANTITY (PRIMARY) INDICATOR READS HIGH - PROCEDURE 5

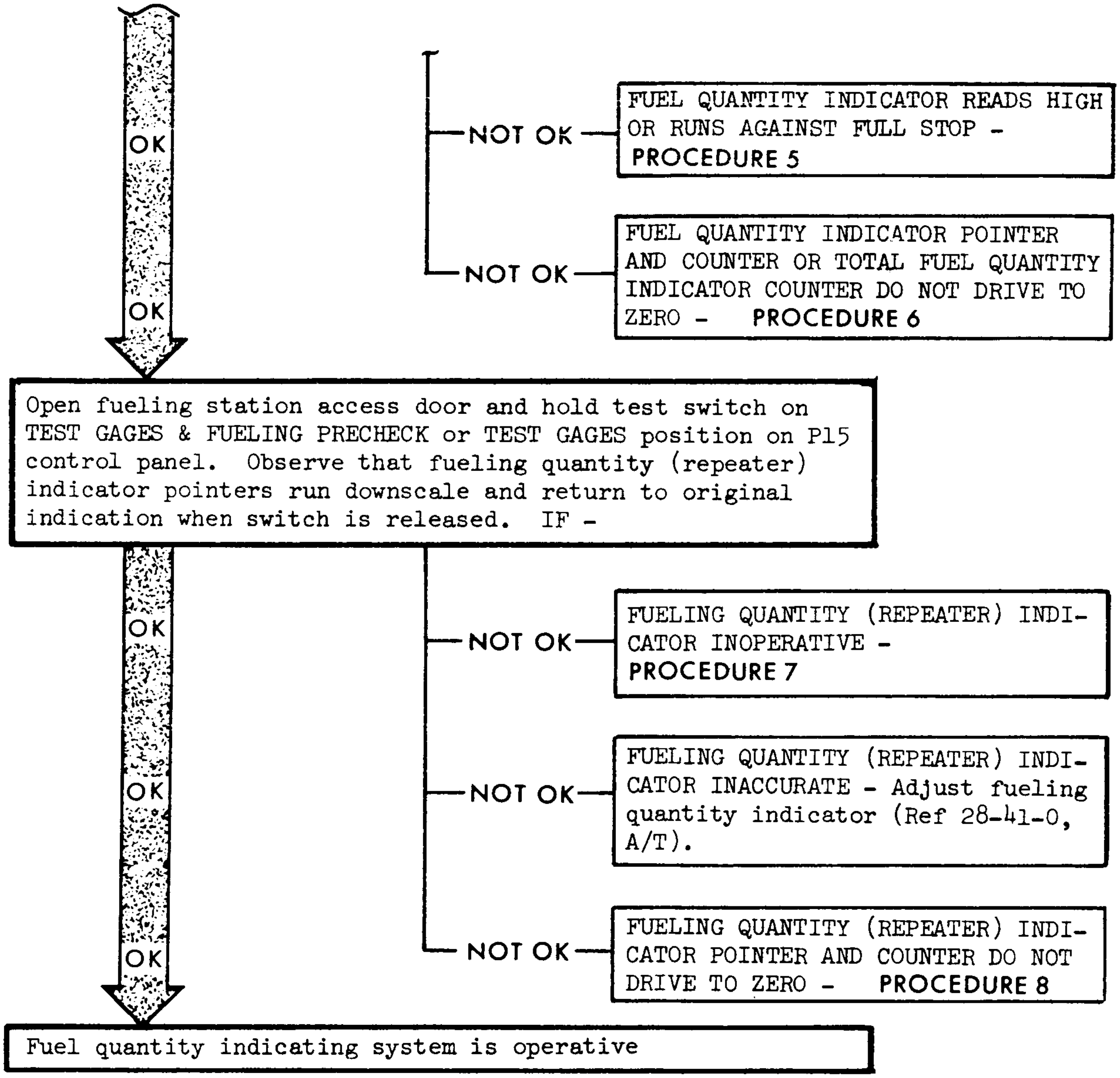
OK

With fueling station access door closed, press fuel quantity indicator QTY TEST button on P2 panel. Observe that fuel quantity indicator pointers run downscale and total fuel quantity indicator counter runs towards midscale and return to original indication when switch is released. IF -

- NOT OK — FUEL QUANTITY INDICATOR READS LOW, RUNS AGAINST EMPTY STOP, OR IS SLUGGISH IN OPERATION - PROCEDURE 4

OK

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 1)



Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 2)

PROCEDURE 1

FUEL QUANTITY (primary) INDICATOR INOPERATIVE - Remove indicator, disconnect electrical plug, and check for 115-volt ac power between pin 7 and 8 of plug. IF -

- OK - Replace fuel quantity indicator (Ref 28-41-51, R/I).
- NOT OK - Check if other fuel quantity indicators are operative. IF -
  - OK - Repair or replace indicator power cable or splice within P2-1 module in center instrument panel.
  - NOT OK - Check electrical continuity of indicator power cable between splice inside P2-1 module in center instrument panel, E3 electrical shelf and P6 load control center (Ref 28-41-01, Wiring Diagram). Repair or replace indicator power cable or replace R10 refueling power select relay.

PROCEDURE 2

TOTAL FUEL QUANTITY/V-REF INDICATOR INOPERATIVE - Remove indicator, disconnect electrical plug, and check for 115-volt ac power between pin 7 and 4 of plug. IF -

- OK - Replace total fuel quantity/V-Ref indicator and check and adjust as necessary (Ref 28-41-71, R/I; 28-41-0, A/T).
- NOT OK - Check for break in indicator power cable between splice inside P2-1 module in center instrument panel and indicator connector plug. Repair or replace cable.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 3)

PROCEDURE 3

TOTAL FUEL QUANTITY INDICATOR INACCURATE - Check individual indicator fuel quantity indication. IF -

FUEL QUANTITY INDICATORS PROVIDE ACCURATE INDICATION - Adjust or replace total fuel quantity indicator (Ref 28-41-0, Adjustment/Test)(Ref 28-41-71, Removal/Installation).

FUEL QUANTITY INDICATORS DO NOT PROVIDE ACCURATE INDICATION - Adjust applicable fuel quantity indicator (28-41-0, Adjustment/Test).

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 4)

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OK - Measure resistance between HI-Z (COAX) and COMP terminals. Check that resistance is not less than 2000 meg-ohms. IF -

NOT OK - Check wiring and connectors for insulation damage or short circuits between fuel quantity indicator and bussing plug for compensator. Repair or replace wire or connectors as necessary.

NOT OK - Check wiring and connectors for insulation damage or short circuits between fuel quantity indicator and bussing plug for tank unit circuit. Repair or replace wire or connectors as necessary.

CONTINUED FROM PRECEDING PAGE

OK - Check that tank unit is not in contact with fuel, in particular, the -11 tank unit located near inboard ends of tank No. 1, 2. IF -

NOT OK - Replace the tank unit or compensator unit which has the low resistance (Ref 28-41-21, R/I).

OK - Check for contamination between HI-Z and LO-Z tubes or damage to LO-Z tube as indicated by dents on external surface. IF -

NOT OK - Complete tank drainage thru sump. If necessary, gain access to tank and mop up fuel puddles that contact unit.

OK - Check wiring and connectors for insulation damage or short circuits between tank units and compensator unit wiring connectors and plug receptacle on wing spar. Repair or replace wire or connectors as necessary.

NOT OK - Clean or replace tank unit and recheck resistance reading.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 5)

PROCEDURE 5

FUEL QUANTITY INDICATOR READS HIGH OR RUNS AGAINST FULL STOP - Open sump drain valve and drain to ensure all water has been drained. If indicator still reads high or runs against full stop, switch quantity indicators, for same tank, between P2 center panel and P15 fueling panel. IF -

OK - Replace indicator (Ref 28-41-51, R/I).

NOT OK - Check resistance of shield to ground for wiring between fuel quantity indicator and tank units and compensator unit. Resistance should be zero (indicator connected) or minimum of 10 megohms (indicator disconnected). IF -

OK - Defuel tank (Ref 28-23-0, M/P), insert test harness between fuel quantity indicator connector on wing spar VTO unit or bussing plug and airplane cable connector plug to indicator (Ref 28-41-0, A/T). Measure applicable subsystem fuel quantity tank unit and compensator capacitance value. IF -

NOT OK - Check integrity of single point ground for fuel quantity indicator in P2 module. IF -

OK - Repair or replace wiring cable so that shield registers zero resistance with ground (indicator connected) or minimum of 10 megohms (indicator disconnected) throughout complete span of cable and connectors.

NOT OK - Repair or re-establish single point ground in P2 module.

COMPENSATOR CAPACITANCE IS LOW OR ZERO - Check fuel quantity compensator wire insulation resistance between wing spar connector and indicator. IF -

TANK UNIT CAPACITANCE IS HIGH - Check tank unit individual dry capacitance and insulation resistance (Ref 28-41-21, A/T). IF -

OK - Disconnect tank wire connections to fuel quantity compensator and measure compensator insulation resistance. IF -

NOT OK - Repair or replace signal cable and check and adjust as necessary (Ref 28-41-0, A/T).

CONTINUED ON FOLLOWING PAGE

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

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Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 6)

PROCEDURE 5 (CONT)

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OK - Repair or replace tank mounted cable and bulkhead plug and check and adjust system as necessary (Ref 28-41-0, A/T).

NOT OK - Replace fuel quantity compensator (Ref 28-41-21, R/I).

OK - Check fuel quantity signal cable continuity and insulation resistance between wing spar connector and indicator. Repair and/or replace signal cable and connectors as required and check and adjust system as necessary (Ref 28-41-0, A/T).

NOT OK - Check individual tank unit signal cable continuity and insulation resistance. IF -

OK - Replace applicable tank unit (Ref 28-41-21, R/I).

NOT OK - Repair and/or replace individual tank unit signal cable as required.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 7)

PROCEDURE 6

FUEL QUANTITY INDICATOR POINTER AND COUNTER OR TOTAL FUEL QUANTITY/V-REF INDICATOR COUNTER DO NOT DRIVE TO ZERO - Remove indicator, disconnect electrical plug, and check for 115-volt ac power at pin 7 of plug. IF -

OK - Check for electrical continuity across applicable terminals of press-to-test switch on P2 center instrument panel while pressing switch down. IF -

NOT OK - Check if other fuel quantity indicators are operative. IF -

OK - Repair or replace indicator power cable or splice within P2-1 module in center instrument panel.

NOT OK - Check electrical continuity of indicator power cable between splice inside P2-1 module in center instrument panel, E3 electrical shelf and P6 load control center (Ref 28-41-01, WDM). Repair or replace indicator power cable or replace R10 refueling power select relay.

OK - Check for open circuit in press-to-test switch ground wire. IF -

NOT OK - Replace press-to-test switch.

OK - Replace indicator (Ref 28-41-51, R/I).

NOT OK - Repair ground connection in P2 module.

NOTE; Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 8)

PROCEDURE 7

FUELING QUANTITY (REPEATER) INDICATOR INOPERATIVE - Remove indicator, disconnect electrical plug and check for 115-volt ac power between pins 7 and 8 of plug. IF -

OK - Replace fueling quantity indicator (Ref 28-41-61, R/I).

NOT OK - Check if other fueling quantity indicators on P15 panel are inoperative. IF -

OK - Repair or replace power or ground cable or their respective splices at P15 panel.

NOT OK - (All fueling quantity indicators inoperative). Check electrical continuity of power cable from P15 panel back to B2 pin of R11 relay connector on either E3-3 electrical shelf or P6 load control center. IF -

OK - Check electrical continuity from pin B1 to pin B2 on R11 relay connector socket. IF -

NOT OK - Repair or replace power cable or splices from P15 panel thru right wing to E3-3 shelf or P6 load control center in airplane body.

OK - Check for electrical continuity across applicable normally closed terminals of P2 panel press-to-test switch. IF -

NOT OK - Replace R11 relay.

OK - Repair or replace power cable or splice from press-to-test switch to SM33 splice.

NOT OK - Replace press-to-test switch.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 9)

PROCEDURE 8

FUELING QUANTITY (REPEATER) INDICATOR POINTER AND COUNTER DO NOT DRIVE TO ZERO - Remove indicator, disconnect electrical plug, and check for 115-volt ac power at pin 8 of plug. IF -

OK - Check for electrical continuity across applicable terminals of P15 panel test switch while holding switch in TEST GAGES position. IF -

NOT OK - Check if other fueling quantity indicators on P15 panel are operative. IF -

OK - Check for open circuit in test switch ground wire or ground wire terminal. IF -

NOT OK - Replace test switch.

OK - Replace indicator (Ref 28-41-61, R/I).

NOT OK - Repair ground connection.

OK - Repair or replace power cable, splice or connector between fueling indicator and splice at P15 panel.

NOT OK - Check electrical continuity of power cable from P15 panel back to B2 pin of R11 relay connector on either E3-3 electrical shelf or P6 load control center. IF -

OK - Check electrical continuity from pin B1 to pin B2 on R11 relay connector socket. IF -

NOT OK - Repair or replace power cable or splices from P15 panel thru right wing to E3-3 shelf or P6 load control center in airplane body.

CONTINUED ON FOLLOWING PAGE

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 10)

PROCEDURE 8 (CONT)

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OK - Check for electrical continuity across applicable normally closed terminals of P2 panel press-to-test switch. IF -

NOT OK - Replace R11 relay.

OK - Repair or replace power cable or splice from press-to-test switch to SM33 splice.

NOT OK - Replace press-to-test switch.

NOTE: Refer to Wiring Diagram Manual (WDM) for wiring details.

Fuel Quantity Indicating System - Troubleshooting
Figure 101 (Sheet 11)

NAM

FUEL QUANTITY INDICATING SYSTEM - ADJUSTMENT/TEST

1. General
   A. System adjustment consists of adjusting quantity indicators to EMPTY amd/or FULL values by means of adjustment screws on indicators. Indicators on center instrument panel P2 are referred to as FUEL quantity indicators. Repeater indicators on fueling panel P15 (Fig. 501) are referred to as FUELING quantity indicators.
   B. There are two methods of fuel quantity indicating system adjustment:
      (1) The empty tank method (preferred) is accomplished without fuel in tanks or sumps. It is an accurate method as the indicator zero reading is set to an actual empty tank condition which assures integrity of indicator lower range. A capacitance value, applied to system by a precision tester, is substituted for the equivalent quantity of fuel in tank and the indicator is adjusted to read this high range fuel quantity by means of a FULL adjusting screw. This method is most accurate because it provides a means of measuring stray capacitance so that it can be accounted for in the indicator adjustment.
      (2) Wet tank method (alternate) is accomplished with fuel in tanks. Some accuracy is sacrificed by necessity of disconnecting immersed tank and compensator units from system in order to "zero" indicators plus inability to account for stray capacitance. Inability to measure and compensate for stray capacitance may cause an adjustment error equivalent of up to 15 gallons, or 101 pounds (46 kgs), of fuel per tank.

         NOTE: Alternate method should only be used as an interim procedure. For optimum accuracy, empty tank method should be performed as soon as possible.

   C. Whenever a fuel/fueling quantity indicator is replaced, subsequent to system adjustment, replacement indicator may be bench adjusted to proper settings by use of data affixed to indicator being replaced.
   D. Use care, when inserting test equipment into fuel quantity indicating system, to turn off electrical power or to make circuit interruption as brief as possible.

      CAUTION: DO NOT LEAVE CONNECTORS DISCONNECTED WITH ELECTRICAL POWER ON. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

E. If erratic fuel quantity indicator readings are observed, check for presence of water in fuel tanks before performing system adjustment. Drain off water at sump drains and, if necessary, clean and unplug drain holes in wing tank spanwise stringers to permit water accumulation to drain to sumps.

F. Several components of fuel quantity indicating system's equipment are interrelated with various components in their respective calibration adjustments. The following table shows which adjustments must be accomplished when one of interrelated components have to be changed.

UNIT CHANGED	REQUIRED ADJUSTMENT	ADDITIONAL ADJUSMENT REQUIRED	
		RELATED UNIT	ADJUSTMENT
Fuel Quantity Indicator *[1]	EMPTY, FULL	Fueling Quantity Indicator	FULL
		Total Fuel Quantity/V-ref Indicator	FULL (on channel for changed unit)
Fueling Quantity Indicator *[1]	FULL	None	None
Total Fuel Quantity/V-ref Indicator	EMPTY *[2] FULL (F1, F2, FC)	None	None
Tank Unit	None	Fuel Quantity Indicator	FULL, EMPTY
or Compensator Unit	None	Fuel Quantity Indicator	FULL

*[1] When a fuel quantity indicator is moved from a center instrument panel (P2) to the fueling panel (P15) or vice-versa, it must be readjusted for the position in which it is installed.

*[2] EMPTY adjustment limited to airplanes without integral center tank.

2. Adjustment of Fuel Quantity Indicating System - Empty Tank Method (Preferred)

A. General

(1) In this adjustment method, the fuel tanks must be defueled and sump fuel drained. Indicators are first adjusted to read zero, the zero adjustment is checked, and then full adjustment is made by capacitance substitution. For proper adjustment of the fuel quantity indicating system, no part of the adjustment should be omitted.

(2) During adjustment, additional (stray) capacitance is present in the system because of test equipment. To minimize error, make sure that stray capacitance values are recorded and accounted for per adjustment procedure.

(3) If system adjustment values are not met, do the tank unit and compensator unit adjustment/test (AMM 28-41-21/501) or troubleshoot the system (AMM 28-41-0/101).

B. Equipment and Materials
 (1) System Tester
  (a) Model GTF-2, P/N 361-012-001, Gull Airborne Instruments Inc., 55 Engineers Road, Smithtown, New York 11787
  (b) P/N 472090-007, 472090-009, or PSD40-1, Simmonds Precision Products Inc., Panton Road, Vergennes, Vermont 05491
  (c) Model 8000, Barfield Instrument Corp., Miami, Florida 33142
 (2) Test Harnesses

NOTE: Quality of test cabling must be controlled, especially in regard to stray capacitance. Stray capacitance for test cables shall be less than 0.1 pf.

  (a) F72731-82
  (b) Gull Airborne 467-177-007, -008
  (c) P/N 464534, Simmonds Precision Products Inc.
  (d) PSD 40-502 and PSD 40-503, Simmonds Precision Products Inc.
  (e) P/N 101-00542, Barfield Instrument Corp.
 (3) Leading Edge Flap Actuator Locks - F80048-36

C. Prepare Fuel Quantity Indicating System for Adjustment
 (1) Provide electrical power (AMM 24-22-0/201).
 (2) Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

 (3) Defuel airplane for adjustment of entire system, or defuel applicable fuel tank, and drain sump fuel (AMM 28-23-0/201).

WARNING: TO PREVENT POSSIBILITY OF EXPLOSION, DO NOT REMOVE ANY FUEL TANK ACCESS PANELS WHILE ELECTRICAL POWER IS BEING USED.

 (4) Open FUELING & EXT PWR CONTROL circuit breaker on panel P6.
 (5) Check that GRD FUELING and BUS PROTECTION PANEL circuit breakers on panel P6 are closed.
 (6) On center instrument panel, loosen the total fuel quantity indicator clamp screw and remove indicator from center instrument panel far enough to obtain access to rear cover locking screws.
 (7) On center instrument panel, loosen fuel quantity indicator clamp screw and remove indicator from panel far enough to obtain access to rear cover locking screws.
 (8) Remove lockwire and loosen screws.
 (9) Obtain access to indicator adjustment screws by holding indicator and turning rear cover clockwise.

(10) Replace indicator into center instrument panel, but do not tighten clamp screw.
(11) Repeat steps (7) thru (10) for other fuel quantity indicators.
(12) Repeat steps (7) thru (10) for fueling quantity indicators on fueling control panel P15.
(13) Close fueling station access door.

D. Adjust Fuel Quantity Indicating System
(1) Adjust system to read zero.
(a) Close FUELING & EXT PWR CONTROL circuit breaker on circuit breaker panel P6.
(b) Warm up system for 5 minutes.
(c) On center instrument panel, adjust each fuel quantity indicator to read 0 ±25 lbs or 0 ±25 kgs and then adjust the total fuel quantity indicator to read 0 ±220 lbs or 0 ±100 kgs by means of empty adjustment screw at rear of indicator. If total fuel quantity indicator has no empty adjusting screw, make sure that total quantity indicator reads zero 0 ±220 lbs or 0 ±100 kgs and replace indicator, if necessary.

NOTE: Due to gear train backlash, adjust to zero in an increasing quantity direction.

Total fuel quantity indicators without empty adjustment are preset at vendor or overhaul facility and cannot be zero adjusted. Replace, if out of tolerance.

(d) Press-to-test indicator test button. Indicator pointer shall move downscale. Release test button. Indicator pointer shall return to adjusted zero position ± 25 lbs or kgs.
(e) If any indicator pointer does not return to adjusted zero position after press-to-test operation, repeat steps (c) and (d).
(f) Record fuel quantity indicator actual fuel weight readings.

NOTE: Because of indicator construction, it is usually impossible to adjust indicators to read zero exactly, but only within tolerances specified. To perform adjustment/test to greatest accuracy possible, it is necessary to record the actual fuel weight readings for determination of empty and full capacitance values.

(g) Open fueling station access door.
(h) Corresponding fueling quantity indicators on fueling control panel should read as shown in Table 1.

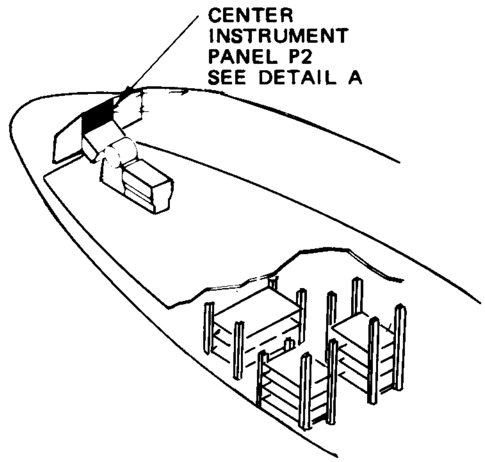
TABLE 1	
INDICATOR	READING
FUEL TANK NO. 1 & 2	ZERO ±100 LB OR ±50 KG
CENTER TANK (2 OR 3 CELL)	ZERO ±100 LB OR ±50 KG
CENTER TANK (INTEG)	ZERO ±130 LB OR ±65 KG

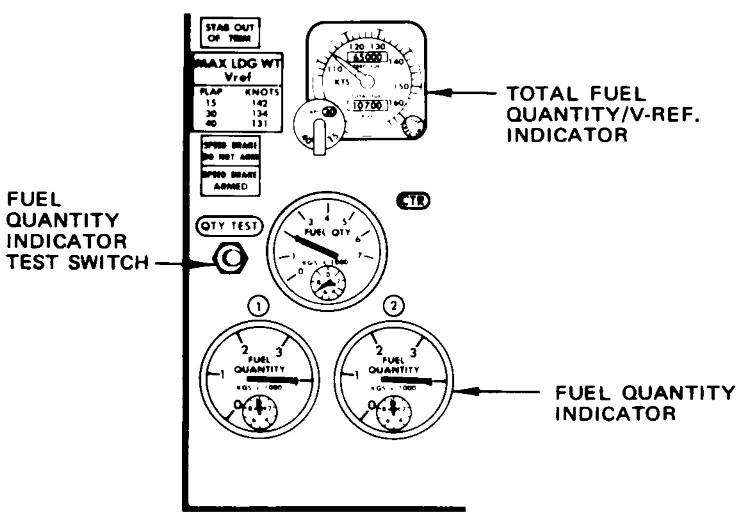
NOTE: The fueling quantity indicators on fueling control panel cannot be "empty" adjusted due to their use as repeaters.

(i) Record fueling quantity indicator actual weight readings.

(2) Check system adjustment.
(a) Hold fueling quantity indicator test switch, on P15 panel, on TEST GAGES position and make sure indicators respond as follows:
1) Fueling quantity indicator pointers shall move downscale.
2) Fuel quantity indicator pointers may or may not move when original reading is zero. Movement, if any, may be upscale or downscale.
(b) Release test switch and make sure indicators respond as follows:
1) Fuel and fueling indicator pointers return to original position ±50 lbs or ±25 kgs.
2) Total fuel quantity indicator pointer returns to original position ±220 lbs or ±100 kgs.
(c) Open GRD FUELING and FUEL QTY circuit breakers on circuit breaker panel P6.

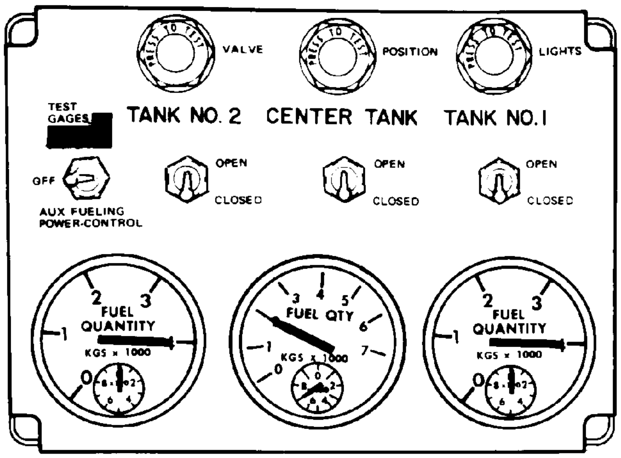
(3) Determine stray capacitance introduced by test harness:
(a) Disconnect fuel quantity indicator connector on tank and compensator bussing plug at front wing spar (tank 1 or 2) or rear wing spar (center wing tank) (Fig. 501).
(b) Connect test harness into (subsystem) circuit (Fig. 502).
(c) Close GRD FUELING and FUEL QTY circuit breakers on P6 panel.
(d) Record actual fuel weight readings on fuel quantity indicators and, when installed, total fuel quantity indicator.
(e) Subtract corresponding indicator actual zero adjustment reading of step D.(1)(f) from reading of step D.(3)(d). Record this difference as test set stray value for fuel quantity indicator.
(f) Record fueling quantity indicator fuel weight reading.



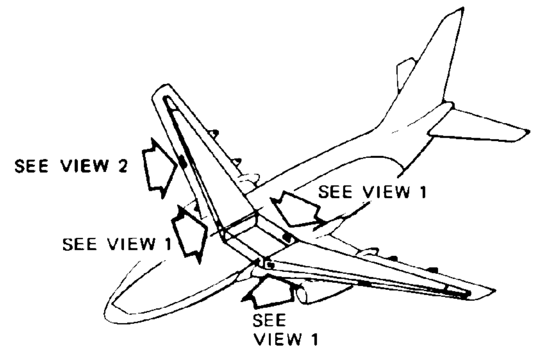


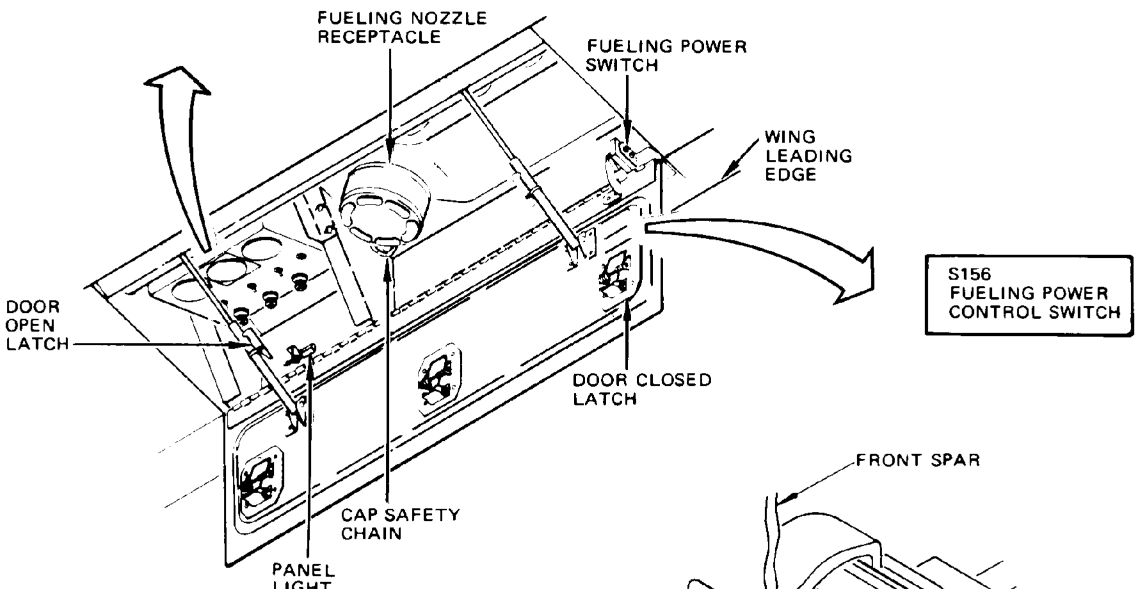
CENTER INSTRUMENT PANEL P2
DETAIL A

Fuel Quantity Indicating System Component Location
Figure 501 (Sheet 1)

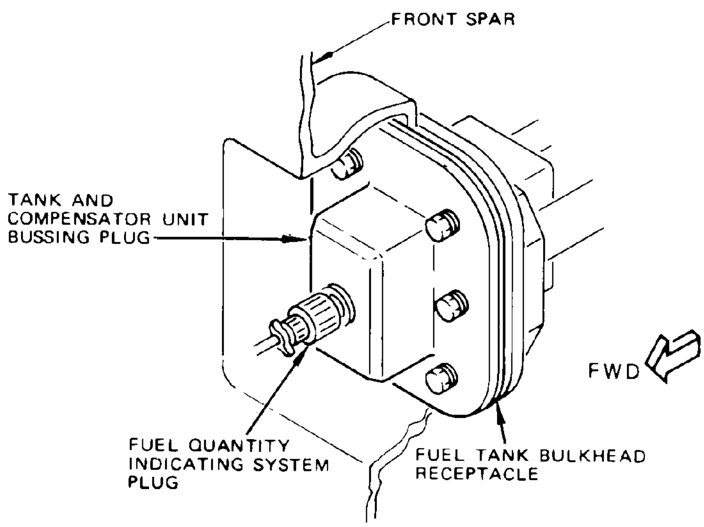


FUELING PANEL (P15)



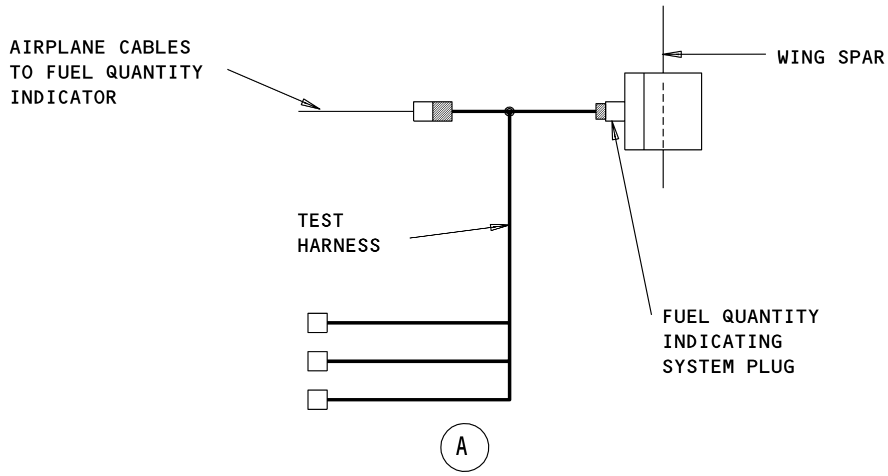


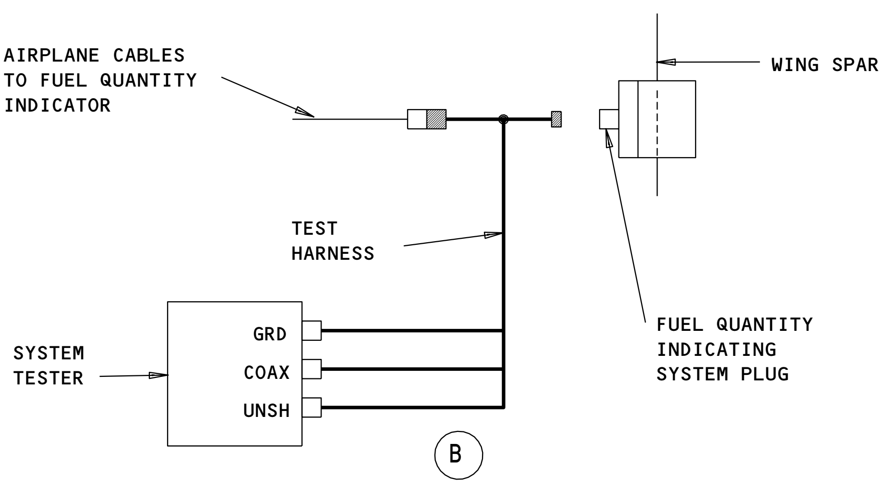
PRESSURE FUELING STATION
VIEW 2



FRONT SPAR INSTALLATION SHOWN.
SIMILAR FOR REAR SPAR INSTALLATION
VIEW 1

Fuel Quantity Indicating System Component Location
Figure 501 (Sheet 2)





Fuel Quantity Indicating System Test Connections
Figure 502

(g) Subtract corresponding fueling quantity indicator actual zero adjustment reading of step D.(1)(i) from reading of step D.(3)(f). Record this difference as test set stray value for fueling quantity indicator.

(h) Open GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(4) Determine subsystem empty capacitance adjustment.

(a) Disconnect test set harness plug from tank and compensator bussing plug receptacle (Fig. 502).

(b) Connect system tester to test set harness.

(c) Close GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(d) Adjust system tester compensator unit variable capacitor (COMP) to 39.0 pf.

(e) Adjust system tester tank unit variable capacitor (PROB) until reading of step D.(3)(d) (zero + test harness stray value) is obtained on indicator. The pf value should be as shown in Table 2.

TABLE 2

FUEL TANK	EMPTY CAPACITANCE *[1]	EMPTY CAPACITANCE *[2]
No. 1 & 2	458.2 ±16.0 pf	458.2 ±8.0 pf
CENTER TANK (2 CELL) *[3]	188.5 ±4.0 pf	188.5 ±3.0 pf
CENTER TANK (3 CELL) *[3]	203.4 ±4.0 pf	203.4 ±4.0 pf
CENTER TANK (INTEGRAL) *[3]	164.2 ±4.0 pf	164.2 ±4.0 pf

*[1] Indicators calibrated in pounds
*[2] Indicators calibrated in kilograms
*[3] For center tank configuration and effectivity, refer to AMM 28-10-0/0.

(f) Record actual pf value as subsystem's empty capacitance.
(g) Open GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(5) Adjust subsystem to read full.
(a) Connect test set harness plug to tank and compensator bussing plug receptacle (Fig. 502).
(b) Close GRD FUELING and FUEL QTY circuit breakers on P6 panel.
(c) Adjust system tester compensator unit variable capacitor (COMP) to 41.4 pf.
(d) Adjust system tester tank unit variable capacitor (PROB) to added capacitance shown in Table 3.

FUEL TANK	ADDED CAPACITANCE	
	INDICATORS IN KILOGRAMS	INDICATORS IN POUNDS
No. 1 or No. 2	524.3 pf	517.0 pf
CENTER (1 CELL) *[1]	146.7 pf	151.3 pf
CENTER (2 CELL) *[1]	211.8 pf	216.3 pf
CENTER (3 CELL) *[1]	240.2 pf	242.2 pf
CENTER (INTEGRAL) *[1]	190.5 pf	191.0 pf

TABLE 3

(e) Adjust fuel quantity indicator to value given in Table 4, plus test set stray value recorded in step D.(3)(e) by means of full adjustment screw at rear of indicator.

(f) Adjust total fuel quantity indicator to value given in Table 4 or 5 plus test set stray value recorded in step D.(3)(e) by means of TANK 1, TANK 2, and CENTER full adjustment screws at rear of indicator.

*[1] For center tank configurations and effectivity, refer to 28-10-0, Description and Operation.

(g) Following the full tank adjustment of V-ref and total fuel quantity indicator for tank No. 1 or No. 2 set "zero fuel weight" to 70,000 pounds/31,700 kilograms (gross weight 80,000 pounds/ 36,287 kilograms) and flap selector to each of the three positions. The V-ref reading in knots shall be as given in Table 4 or Table 5. These adjustments are accomplished on front face of the indicator.

FUEL TANK	FUEL & FUELING INDICATORS ADJUSTMENT READING	V-REF & TOTAL FUEL INDICATOR ADJUSTMENT READING	FLAP SELECTOR	V-REF READING KNOTS
No. 1 & 2	4,600 ±25 KG	4,600 ±100 KG		
No. 1 & 2	10,000 ±25 LB	10,000 ±100 LB	25°	127.5 ±2
CENTER (2 CELL)	10,000 ±25 LB	10,000 ±100 LB	30°	119.5 ±2
CENTER (2 CELL)	4,400 ±25 KG	4,400 ±100 KG	40°	115.5 ±2
CENTER (3 CELL)	14,000 ±25 LB	14,000 ±100 LB		
CENTER (3 CELL)	6,300 ±25 KG	6,300 ±100 KG		

TABLE 4 *[1]

FUEL TANK	FUEL & FUELING INDICATORS ADJUSTMENT READING	V-REF & TOTAL FUEL INDICATOR ADJUSTMENT READING	FLAP SELECTOR	V-REF READING KNOTS
No. 1 & 2	4,600 ±25 KG	4,600 ±100 KG	15°	123.5 ±2
No. 1 & 2	10,000 ±25 LB	7,600 ±100 LB	30°	116.0 ±2
CENTER (2 CELL)	4,400 ±25 KG	4,400 ±100 KG	40°	113.0 ±2
CENTER (2 CELL)	10,000 ±25 LB	10,000 ±100 LB		
CENTER (INTEGRAL)	7,600 ±25 KG	7,600 ±100 KG		
CENTER (INTEGRAL)	16,800 ±25 LB	16,800 ±100 LB		

TABLE 5 *[2]
*[1] AR LV-JMW thru LV-JMZ, LV-JND, LV-JNE
*[2] AR ALL EXCEPT *[1]

(h) Press to test fuel quantity indicator test button; indicator pointer shall move down scale. Release test button; indicator pointer shall return to adjusted full position reading.
(i) If fuel quantity or total fuel quantity indicator pointers do not return to adjusted full position after press-to-test switch operation, repeat steps (e) thru (h).
(j) Record fuel quantity indicator actual fuel weight reading.
(k) Adjust fueling quantity indicator on fueling control panel to value given in Table 4 or 5, as applicable, plus test set stray value recorded in step D.(3)(g) by means of full adjustment screw at rear of indicator.
(l) Hold fueling indicator test switch on TEST GAGES position.
    1) On P15 panel, fueling quantity indicator pointers shall move downscale.
    2) On P2 panel, fuel quantity indicator pointers shall move upscale.

3) On P2 panel, total fuel quantity/V-Ref indicator pointer shall move downscale.

(m) Release test switch.

1) On P15 panel, fueling quantity indicator pointers shall return to original position ±25 kgs or ±50 lbs.
2) On P2 panel, fuel quantity indicator pointers shall return to original position ±25 kgs or ±50 lbs.
3) On P2 panel, total fuel quantity/V-Ref indicator pointer shall return to original position ±100 kgs or ±220 lbs.

(n) If fueling quantity indicator pointer s do not return to adjusted full position, repeat steps (k) thru (m).

(o) Open GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(p) Disconnect system tester from test set harness.

(q) Disconnect test set harness from subsystem circuit.

(r) Reconnect fuel quantity indicator connector plug to tank and compensator unit bussing plug receptacle.

(s) Repeat steps D.(3)(a) thru D.(5)(r) for remaining fuel tanks.

(6) Check system empty adjustment.

(a) Close GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(b) Record fuel quantity and total fuel quantity indicator fuel weight readings. Compare these readings with corresponding indicator actual zero adjustment readings of step D.(1)(f). Both sets of readings should agree ± 25 kgs or ± 50 lbs.

(c) Record fueling quantity indicator actual fuel weight readings. Compare these readings with corresponding indicator readings of step D.(1)(j). Both sets of readings should agree ± 25 kgs or ± 50 lbs.

(d) If fuel weight readings in steps D.(6)(b) and D.(6)(c) do not agree, repeat steps D.(1)(c) thru D.(6)(c).

(e) Open GRD FUELING and FUEL QTY circuit breakers on P6 panel.

(7) Record empty and full capacitance adjustment on indicators.

(a) Remove fuel quantity indicator from center instrument panel and disconnect plug.

(b) Remove previous capacitance data on indicator.

(c) Record EMPTY and FULL capacitance on indicator in space provided.

1) Use EMPTY capacitance data for corresponding indicator recorded for step D.(4)(f).
2) Obtain FULL capacitance data by summation of empty capacitance in step 1) above, and added capacitance shown in Table 3.

(d) Mark data using rubber stamp and Cado pencil or Speedry Type A ink.

(e) Hold indicator and turn rear cover of indicator counterclockwise.

(f) Tighten two cover locking screws.

(g) Lockwire screws and seal lockwire with sealing wax.
(h) Connect electrical plug to indicator.
(i) Replace indicator into panel and tighten indicator clamp screw.
(j) Repeat steps (a) thru (i) for other indicators.
(k) Remove fueling quantity indicator from fueling control panel (P15), remove electrical plug, and repeat steps (e) thru (i).
(l) Repeat step (k) for other fueling quantity indicators.

(8) On airplanes with volumetric top-off (VTO) (Fig. 501), adjust the VTO system.
(a) Adjust center tank VTO for one-, two-, or three-cell configuration, as applicable (Ref 28-09-101, 28-09-102, 28-09-103, A/T).
(b) Adjust tank No. 1 and 2 VTO (Ref 28-09-100, A/T).

E. Restore System To Normal
(1) Close FUELING AND EXT PWR CONTROL circuit breaker on panel P6.
(2) Remove leading edge flap locks (Ref 27-81-0, MP).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL

(3) Remove electrical power if no longer required (Ref 24-22-0).

3. Adjustment of Fuel Quantity Indicating System - Wet Tank Method (Alternate)

A. General
(1) In this adjustment method (wet tank), empty capacitance substitution values are set into tester, after tank and compensator units are disconnected from indicator/tester circuit, and indicators are zero adjusted and rechecked. Tester is then reset to substitute capacitance values equivalent to indicator nominal full readings, corresponding weight readings are read on indicators, indicators are full adjusted as necessary and rechecked. It is preferable to use actual EMPTY and FULL capacitance substitution data if recorded on space provided on back of quantity indicator but if this data is missing, use nominal values provided on following pages.
(2) This method requires that fuel quantity system equipment installed inside tank (tank units(s), compensator units(s), wiring bundle, etc.) be disconnected in order to zero and full adjust indicators and therefore constitutes a possible error. Also, additional (stray) capacitance imposed by test equipment cannot be determined and accounted for, thus increasing chance of error. To ensure system integrity, use this method only when unable to use empty tank method (par. 2).

B. Equipment and Materials
(1) System Tester
(Use one of these):
(a) Model GTF-2, P/N 361-012-001, Gull Airborne Instruments, Inc., 55 Engineers Road, Smithtown, New York 11787

(b) P/N 472090-007, P/N 472090-009, or PSD40-1, Simmonds Precision Products Inc., Panton Road, Vergennes, Vermont 05491
(c) Model 8000, Barfield Instrument Corp., Miami, Florida 33142

(2) Test Harnesses

NOTE: Quality of test cabling must be controlled, especially in regard to stray capacitance. Stray capacitance for test cables shall be less than 0.1 pf.

(a) F72731-82 or Gull Airborne 467-177-007, -008
(b) P/N 464534, Simmonds Precision Products Inc.
(c) P/N 101-00542, Barfield Instrument Corp.

(3) Five gallon container
(4) Leading Edge Flap Actuator Locks - F80048-36

C. Prepare Fuel Quantity Indicating System for Adjustment
(1) Connect electrical power to airplane (Ref Chapter 24).
(2) Gain access to auxilliary tank equipment bay (Ref 28-14-11) or extend flaps and install leading edge flap locks (Ref 27-81-0 MP).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

D. Adjust Fuel Quantity Indicating System
(1) Adjust indicators to read zero.
(a) Open GRD FUELING an d FUEL QTY circuit breakers on circuit breaker panel P6.
(b) Disconnect tank an d compensator unit bussing plug for applicable tank (Fig. 501).
(c) Connect test harness into airplane circuit (Fig 502, Detail B).

NOTE: Test harness wire connections are identified as follows: WM - No. 1 and 2 main tanks WC - Center tank WA - Auxiliary tank

(d) Connect system tester to test harness.
(e) Close GRD FUELING and FUEL QTY circuit breakers on circuit breaker panel P6.
(f) Warm up system for five minutes.
(g) Adjust system tester compensator unit variable capacitor (COMP) and tank unit variable capacitor (PROB) to the respective EMPTY capacitance values stamped or imprinted on nameplate at rear of indicator.
1) If EMPTY capacitance values do not appear on nameplate or are considered obsolete, use nominal values as shown in Table 1.

FUEL TANK	NOMINAL EMPTY CAPACITANCE VALUES	
	TESTER SETTING TANK UNIT (PROBE)	TESTER SETTING COMPENSATOR UNIT (COMP)
No. 1, 2	458.2 pf	39.0 pf
Center (1-Cell) *[1]	129.1 pf	39.0 pf
Center (2-Cell) *[1]	188.5 pf	39.0 pf
Center (3-Cell) *[1]	203.4 pf	39.0 pf
Center (Integral) *[1]	164.2 pf	39.0 pf
*[1]	For center tank configuration and effectivity, refer to 28-10-0, Description and Operation.	
TABLE 1		

(h) On center instrument P2, adjust applicable fuel quantity indicator to read zero ±50 pounds or ±25 kilograms by means of empty adjustment screw at rear of indicator. Check that total fuel quantity/V-Ref indicator reads zero ±220 pounds or ±100 kilograms.

NOTE: Due to gear train backlash, adjust to zero in an increasing quantity direction. Total fuel quantity indicator(s) without EMPTY adjustment are preset at vendor or overhaul facility and cannot be zero adjusted. Replace, if out of tolerance.

(i) Press to test indicator test button; indicator pointer or dial should move down scale. Release test button; indicator pointer or dial should return to adjusted zero position ±50 pounds or ± 25 kilograms.

(j) If any indicator pointer or dial does not return to adjusted zero position after press-to-test operation, repeat steps (h) and (i).

NOTE: Because of indicator construction, it is usually impossible to adjust indicators to read zero exactly, but only within tolerances specified.

(k) Open fueling station access door.
(l) Corresponding fueling quantity indicators on fueling control panel P15 should read as shown in Table 2.

FUELING QUANTITY INDICATOR - P15 PANEL		
FUEL TANK	READING - LB UNITS	READING - KG UNITS
No. 1, 2	Zero ± 100	Zero ± 50
Center (1-Cell) *[1]	Zero ± 50	Zero ± 50
Center (2-Cell) *[1]	Zero ± 100	Zero ± 50
Center (3-Cell) *[1]	Zero ± 100	Zero ± 50
Center (Integral) *[1]	Zero ± 130	Zero ± 65

*[1] For center tank configuration and effectivity, refer to 28-10-0, Description and Operation.

TABLE 2

NOTE: The fueling quantity indicators on fueling control panel cannot be "empty" adjusted due to their use as repeaters.

(2) Check indicator adjustment
   (a) Place fueling quantity indicator test switch to TEST GAGE position and check that indicators respond as follows:
      1) Fueling quantity indicator pointers should move downscale.
      2) Fuel quantity indicator pointers may or may not move when original reading is zero. Movement, if any, may be upscale or downscale.
   (b) Release test switch and check that indicators respond as follows:
      1) Fuel and fueling indicator pointers return to original position ±50 pounds or ±25 kilograms.
      2) V-Ref/Total fuel quantity indicator pointer returns to original position ±220 pounds or ±100 kilograms.
(3) Adjust indicators to read full.
   (a) Adjust system tester compensator unit variable capacitor (COMP) and tank unit variable capacitor (PROB) to the respective full capacitance values as shown in Table 3.

SYSTEM TESTER NOMINAL FULL SUBSTITUTION VALUES			
FUEL TANK	TESTER VARIABLE CAPACITOR SETTING		
	TANK UNIT (PROBE)		OCOMPENSATOR UNIT (COMP) Lb or Kg
	Pound	Kilogram	
No. 1, 2	975.2 pf	982.5 pf	81.6 pf
Center (1-Cell)*[1]	280.4 pf	275.8 pf	81.6 pf
Center (2-Cell)*[1]	404.8 pf	400.3 pf	81.6 pf
Center (3-Cell)*[1]	445.6 pf	443.6 pf	81.6 pf
Center (Integral)*[1]	355.2 pf	354.7 pf	81.6 pf

TABLE 3

(b) Open GRD FUELING and FUEL QTY circuit breakers on circuit breaker panel P6.

(c) Disconnect electrical plug connector at each fuel quantity indicator except the one indicator being calibrated plus the V-Ref/Total fuel quantity indicator.

(d) Close GRD FUELING and FUEL QTY circuit breakers on circuit breaker panel P6.

(e) Adjust fuel quantity indicator to respective full value given in Table 4 by means of full adjustment screw at rear of indicator.

(f) Check V-Ref/Total fuel quantity indicator for reading of same value as for fuel quantity indicator adjusted in step (e).

1) Adjust as necessary to obtain same value by means of respective TANK, 1, 2, CENTER full adjustment screw at rear of indicator.

INDICATOR FULL ADJUSTMENT READINGS				
FUEL TANK	FUEL & FUELING QUANTITY INDICATOR		TOTAL FUEL QUANTITY/V-REF	
	Pound Units	Kilogram Units	Pound Units	Kilogram Units

INDICATOR FULL ADJUSTMENT READINGS				
No. 1, 2	10,000 ±25	4,600 ±25	10,000 ±100	4,600 ±100
Center (1-Cell)*[1]	5,000 ±25	2,200 ±25	5,000 ±100	2,200 ±100
Center (2-Cell)*[1]	10,000 ±25	4,400 ±25	10,000 ±100	4,400 ±100
Center (3-Cell)*[1]	14,000 ±25	6,300 ±25	14,000 ±100	6,300 ±100
Center (Integral)*[1]	16,800 ±25	7,600 ±25	16,800 ±100	7,600 ±100

TABLE 4

*[1] For tank configuration and effectivity, refer to 28-10-0, Description and Operation.

(g) Following full tank adjustment of V-Ref/Total fuel quantity indicator for tank No. 1 or 2, set ZERO FUEL WEIGHT to 70,000 pounds/ 31,700 kilograms (gross weight 80,000 pounds/36,300 kilograms) and flap selector to each of three positions listed in Table 5. Corresponding V-ref reading in knots should be as given in Table 5.

*[2] AIRPLANES		*[1] AIRPLANES	
FLAP SELECTOR	V-REF READING	FLAP SELECTOR	V-REF READING
DEGREES	KNOTS	DEGREES	KNOTS
15	123.5 ±2	25	127.5
30	116.0 ±2	30	119.5
40	113.0 ±2	40	115.5

TABLE 5
*[1], *[2] For effectivities, refer to par. 2.D.(5)(g).

(h) Press to test fuel quantity indicator test button; indicator pointer or dial should move downscale. Release test button; indicator should return to adjusted full position reading.

(i) If fuel quantity or total fuel quantity indicator pointer or dial do not return to adjusted full position after press-to-test switch operation, repeat step (e) thru (h).

(j) Adjust fueling quantity indicator on fueling control panel P15 to value given in Table 4 by means of full adjustment screw at rear of indicator.

(k) Press fueling indicator test switch to TEST GAGE position.

NOTE: If auxiliary tank is being checked, use separate test switch on P15 panel for auxiliary tank only.

1) On P15 panel, fueling quantity indicator pointer should move downscale.
2) On P2 panel, fuel quantity indicator pointer should move upscale.
3) On P2 panel, V-Ref/Total fuel quantity dial should move downscale.

(l) Release test switch.

1) On P15 panel, fueling quantity indicator pointer should return to original position ± 50 pounds or ± 25 kilograms.
2) On P2 panel, fuel quantity indicator pointer should return to original position ± 50 pounds or ± 25 kilograms.
3) On P2 panel, V-Ref/Total fuel quantity indicator dial should return to original position ± 220 pounds or ± 100 kilograms.

(m) If fueling quantity indicator pointers do not return to adjusted position, repeat steps (j) thru (1).

(4) Check system empty adjustment.

NOTE: A recheck of calibration procedures are advisable as there may be electrical interactions between empty and full adjustments.

(a) Repeat steps 3.D.(1)(g) thru 3.D.(2).

(5) Perform comparison check of Fuel Quantity Indicating System (FQIS) using the fuel measuring sticks.
   (a) Open fueling station door.
   (b) Calculate the fuel quantity for each tank using the fuel measuring sticks (AMM 12-11-0/301).
   (c) Verify that the calculated fuel quantity (using fuel measuring sticks) for each tank is within the following value of the fuel quantity shown on the fuel quantity indicator is within ± 400 pounds or ± 200 kilograms.
   (d) Close fueling station door.

E. Return Airplane to Normal
   (1) Open GRD FUELING and FUEL QTY circuit breakers on panel P6.
   (2) Disconnect system tester from test set harness.
   (3) Disconnect test set harness from airplane wiring bussing plug.
   (4) Reconnect tank and compensator unit bussing plug to fuel tank bulkhead receptacle on wing spar or auxiliary tank equipment bay.
   (5) Remove leading edge flap locks (Ref 27-81-0, MP).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

MEASURING STICK - REMOVAL/INSTALLATION

1. Remove Measuring Stick

NOTE: Removal of the measuring stick does not require tank defueling.

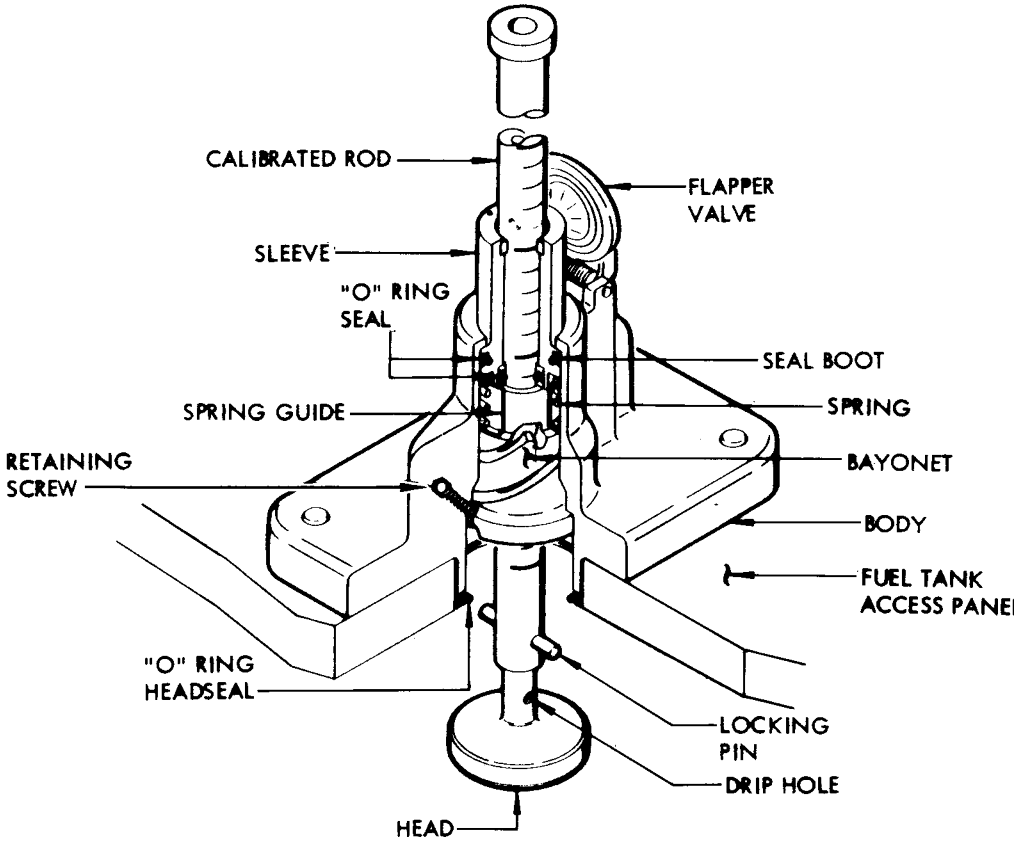
A. Push and turn measuring stick head and extend measuring stick until drip hole is visible. (See figure 401.)
B. Plug drip hole in cap.
C. Extend measuring stick until it bottoms.
D. Loosen bayonet base retaining screws.
E. Remove one screw.
F. Holding bayonet base against spring pressure, remove other screw.

NOTE: Spring exerts a force of approximately 5 pounds.

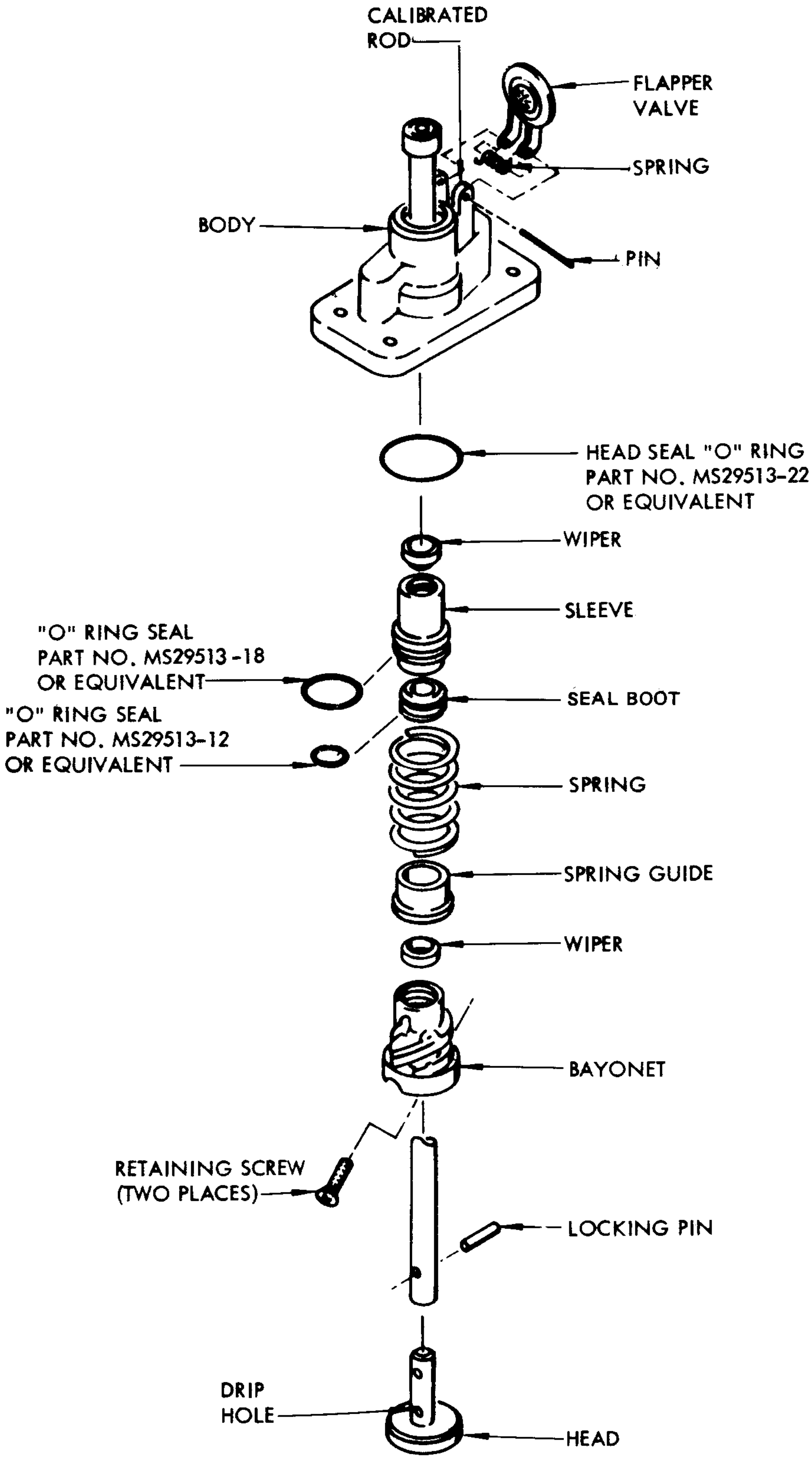
G. Pull measuring stick and bayonet base free of wing lower surface.
H. Remove locking pin from measuring stick.
I. Slip bayonet base free of measuring stick.

2. Install Measuring Stick

A. Install new headseal and new O-ring seals. (See figure 402.)
B. Assemble measuring stick parts (seal boot with O-ring seal, sleeve, spring, spring retainer, bayonet and calibrated rod) and attach measuring stick head with locking pin.
C. Plug drip hole in head.
D. Insert bayonet assembly into wing lower surface with stick fully extended all the time.
E. Install two bayonet retaining screws.
F. Remove plug from drip hole.
G. Push up measuring stick, turn and lock measuring stick head.



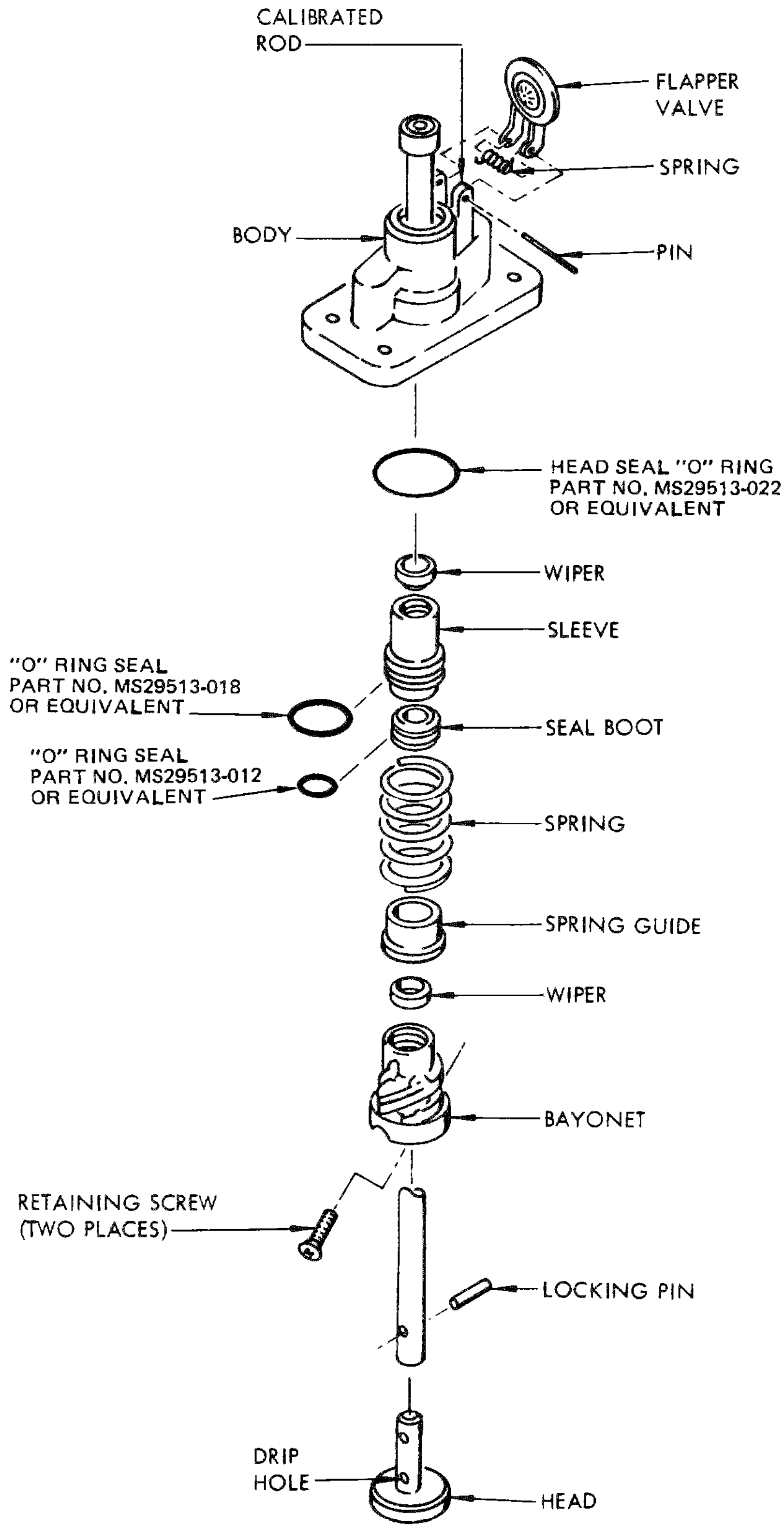
Measuring Stick Installation
Figure 401



Measuring Stick Assembly
Figure 402

MEASURING STICK - APPROVED REPAIRS

1. Repair External Fuel Leak at Measuring Stick Head
   A. Turn measuring stick head counterclockwise and withdraw measuring stick far enough to remove head seal O-ring. Plug drip hole in measuring stick head if fuel starts dripping.
   B. Replace head seal with new O-ring. (See figure 801.)
   C. If drip hole was plugged, step (1), push measuring stick part way up and remove plug.
   D. Push up measuring stick, turn and lock measuring stick head.
2. Repair Fuel Leak Around Bayonet Base when Measuring Stick is Withdrawn
   A. Remove measuring stick from fuel tank. See removal/installation.
   B. Replace O-ring seal on sleeve.
   C. Install measuring stick in fuel tank.
3. Repair Fuel Leak Around Measuring Stick
   A. Remove measuring stick from fuel tank. See removal/installation.
   B. Replace O-ring seal on seal boot.
   C. Replace measuring stick if damaged.
   D. Install measuring stick in fuel tank.



Measuring Stick Assembly
Figure 801

TANK UNITS AND COMPENSATOR UNITS - REMOVAL/INSTALLATION

1. General
   A. The removal/installation of the tank units and compensator units are basically the same; the differences are in locations and access openings, shown in Fig. 401.
2. Remove Tank Unit or Compensator Unit (Fig. 401)
   A. Defuel and purge applicable fuel tank (AMM 28-23-0, 28-10-0/201).
   B. Open GRD FUELING and FUEL QTY circuit breakers on P6 panel.
   C. Obtain access to tank or compensator unit through applicable fuel tank access panel opening and rib access openings (AMM 28-11-11, 28-11-31, 28-12-21, 28-12-31).
   D. Disconnect leads and loosen wire clamp on unit.
   E. Remove unit mounting screws and remove unit.

      CAUTION: HANDLE UNITS WITH CARE. DROPPING CAN DAMAGE CAPACITANCE CHARACTERISTICS OF UNIT.

3. Install Tank Unit or Compensator Unit (Fig. 401)
   A. Position tank or compensator unit and install mounting screws.
   B. Connect leads and tighten clamp on unit. Tighten screws/nut to following torque ranges:
      (1) HI Z (COAX) 15-16 pound-inches
      (2) LOW Z (TANK) 19-23 pound-inches
      (3) Wire Clamp 7-9 pound-inches
   C. After installation, check each terminal to make sure that the screw firmly holds the terminal from turning.

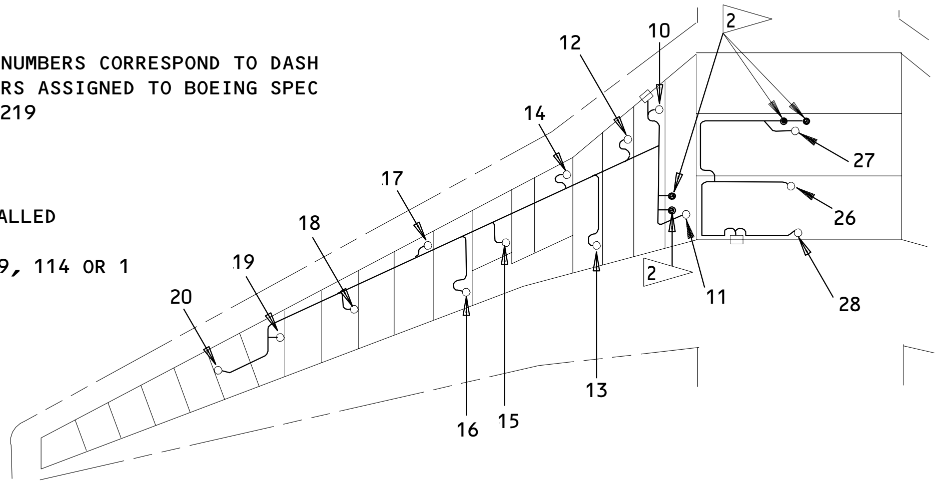
      NOTE: It is necessary for unit leads to have a drip loop as shown in illustration. Water droplets tend to accumulate on lead and run down on unit terminals. Drip loop is used to prevent this.

   D. Install fuel tank access panel (AMM 28-11-11, 28-11-31, 28-12-21, 28-12-31).
   E. Do the adjustments of related components (AMM 28-41-0/501).

NOTE: UNIT NUMBERS CORRESPOND TO DASH NUMBERS ASSIGNED TO BOEING SPEC 10-61219

1 IF INSTALLED

2 121, 119, 114 OR 1

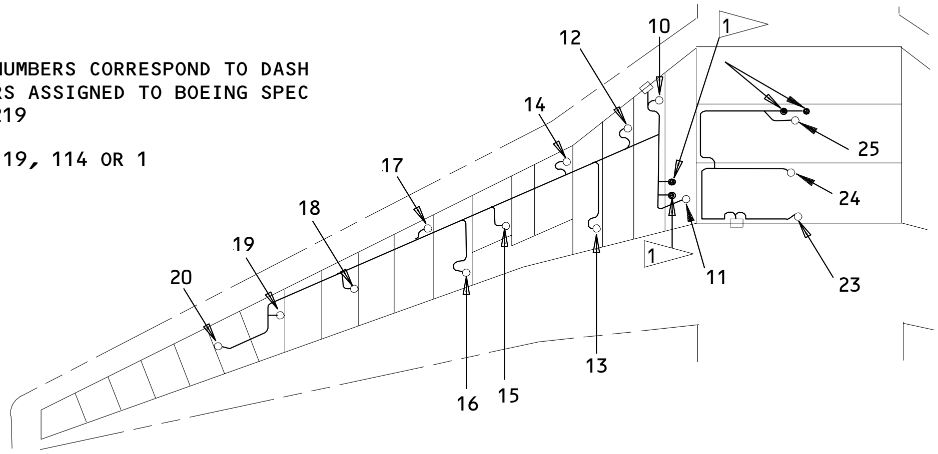


COMPONENT	FUEL TANK ACCESS PANEL	RIB ACCESS OPENING
FUEL TANK NO.1 OR 2	(REF 28-11-0)	(REF 28-11-0)
TANK COMP UNIT NO. 2	1	2 & 1
VTO COMP UNIT NO. 1	1	2 & 1
TANK UNIT NO.10 2	1	2
TANK UNIT NO.11	1	2 & 1
TANK UNIT NO.12	1	—
TANK UNIT NO.13	1	3
TANK UNIT NO.14	2	—
TANK UNIT NO.15	3	—
TANK UNIT NO.16	4	—
TANK UNIT NO.17	5	—
TANK UNIT NO.18	7	—
TANK UNIT NO.19	9	—
TANK UNIT NO.20	10	—
CENTER TANK	CENTER TANK	CENTER TANK BLADDER CELL - (REF. 28-12-0)
TANK COMP UNIT NO. 2		
VTO COMP UNIT NO. 1		
TANK UNIT NO.26 2		
TANK UNIT NO.27		
TANK UNIT NO.28		

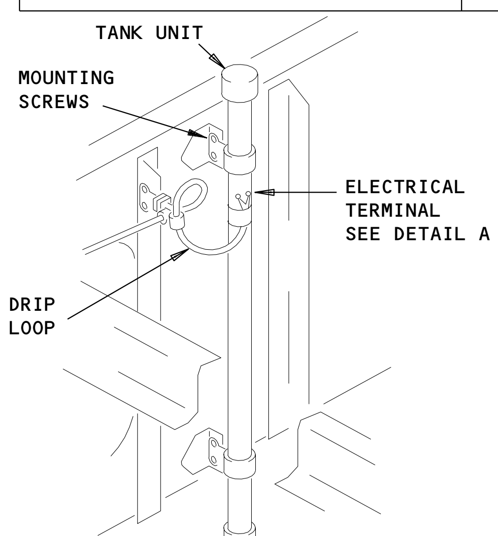
Tank Unit and Compensator Unit Installation
Figure 401 (Sheet 1)

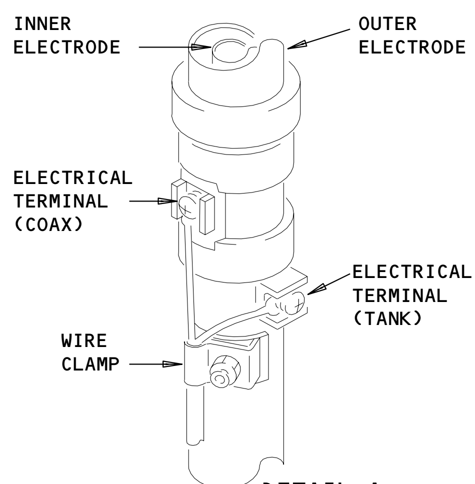
NOTE: UNIT NUMBERS CORRESPOND TO DASH NUMBERS ASSIGNED TO BOEING SPEC 10-61219

1 121, 119, 114 OR 1



COMPONENT	FUEL TANK ACCESS PANEL	RIB OR CELL ACCESS OPENING
FUEL TANK NO.1 OR 2	(REF 28-11-0, 28-11-11)	(REF 28-11-0)
TANK COMP UNIT NO. 1		
VOL TOPOFF COMP UNIT NO. 1	1	2 & 1
TANK UNIT NO.10	1	2
TANK UNIT NO.11	1	2 & 1
TANK UNIT NO.12	1	—
TANK UNIT NO.13	1	3
TANK UNIT NO.14	2	—
TANK UNIT NO.15	3	—
TANK UNIT NO.16	4	—
TANK UNIT NO.17	5	—
TANK UNIT NO.18	7	—
TANK UNIT NO.19	9	—
TANK UNIT NO.20	10	—
CENTER TANK (2-CELLS)	(REF 28-12-0, 28-12-21) CENTER TANK ACCESS PANEL	(REF 28-12-0, 28-12-31) FUEL TANK ACCESS PANEL
TANK COMP UNIT NO. 1		
VOL TOPOFF COMP UNIT NO. 1		
TANK UNIT NO.23		
TANK UNIT NO.24		
TANK UNIT NO.25		



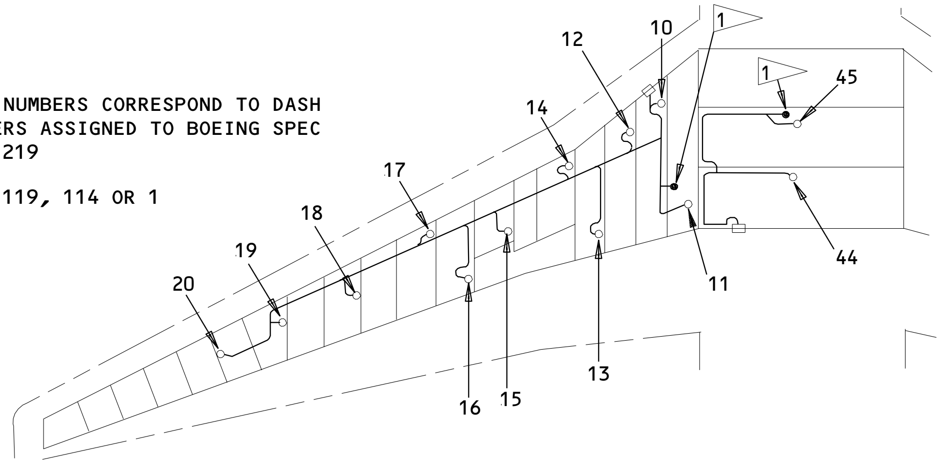


DETAIL A

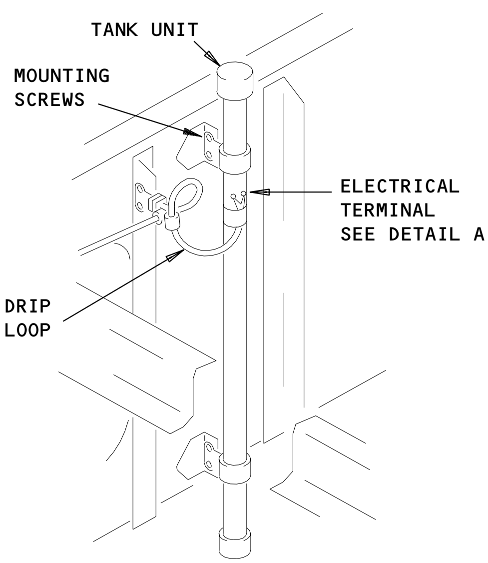
Tank Unit and Compensator Unit Installation
Figure 401 (Sheet 2)

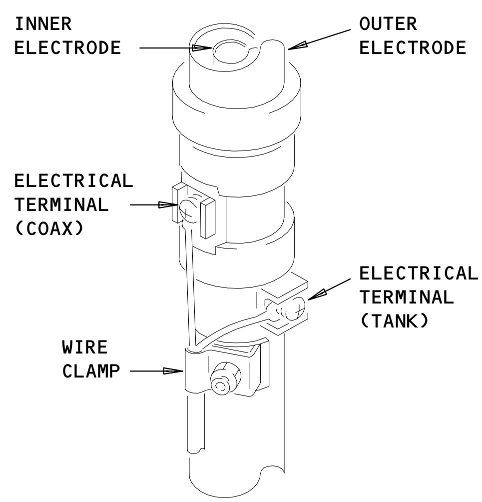
NOTE: UNIT NUMBERS CORRESPOND TO DASH NUMBERS ASSIGNED TO BOEING SPEC 10-61219

1 ▷ 121, 119, 114 OR 1



COMPONENT	FUEL TANK ACCESS PANEL	RIB OR SPANWISE BEAM ACCESS OPENING
FUEL TANK NO.1 OR 2	(REF 28-11-0, 28-11-11)	(REF 28-11-0)
TANK COMP UNIT NO. 1 ▷	1	2 & 1
TANK UNIT NO.10	1	2
TANK UNIT NO.11	1	2 & 1
TANK UNIT NO.12	1	—
TANK UNIT NO.13	1	3
TANK UNIT NO.14	2	—
TANK UNIT NO.15	3	—
TANK UNIT NO.16	4	—
TANK UNIT NO.17	5	—
TANK UNIT NO.18	7	—
TANK UNIT NO.19	9	—
TANK UNIT NO.20	10	—
CENTER TANK (INTEGRAL)	(REF 28-11-0, 28-11-31)	(USE SPANWISE BEAM ACCESS OPENING)
TANK COMP UNIT NO. 1 ▷		
TANK UNIT NO.44	CENTER TANK ACCESS PANEL	
TANK UNIT NO.45		





DETAIL A

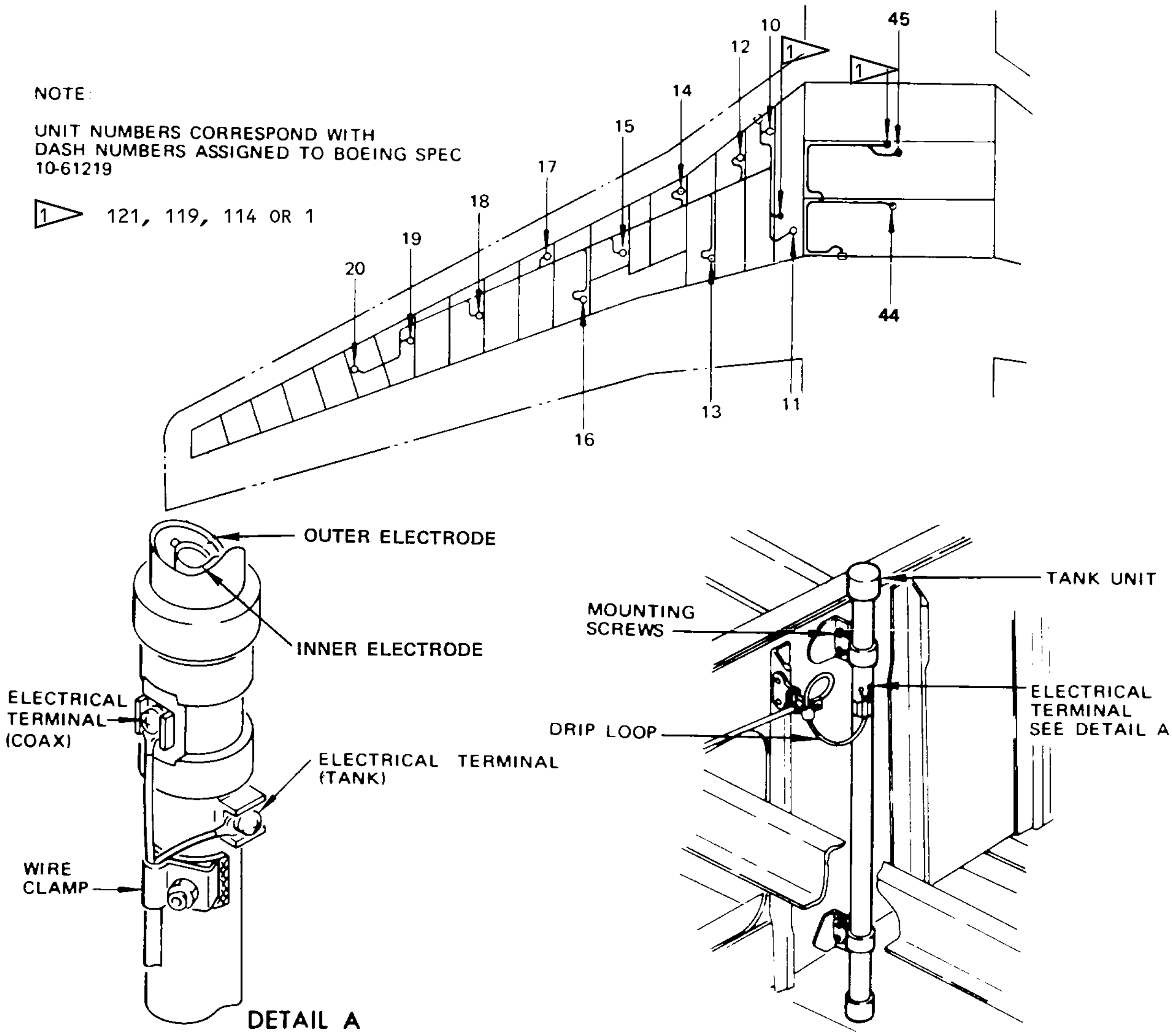
Tank Unit and Compensator Unit Installation
Figure 401 (Sheet 3)

COMPONENT	FUEL TANK ACCESS PANEL	RIB OR SPANWISE ACCESS OPENING BEAM
FUEL TANK NO. 1 OR NO. 2	(REF. 28-11-0, 28-11-11)	(REF. 28-11-0)
TANK COMP UNIT NO. [1]	1	2 & 1
TANK UNIT NO. 10	1	2
TANK UNIT NO. 11	1	2 & 1
TANK UNIT NO. 12	1	–
TANK UNIT NO. 13	1	3
TANK UNIT NO. 14	2	–
TANK UNIT NO. 15	3	–
TANK UNIT NO. 16	4	–
TANK UNIT NO. 17	5	–
TANK UNIT NO. 18	7	–
TANK UNIT NO. 19	9	–
TANK UNIT NO. 20	10	–
CENTER TANK (INTEGRAL)	(REF 28-11-0, 28-11-31)	(USE SPANWISE BEAM ACCESS OPENING)
TANK COMP UNIT NO. [1]	CENTER TANK ACCESS PANEL	
TANK UNIT NO. 44		
TANK UNIT NO. 45		

NOTE:

UNIT NUMBERS CORRESPOND WITH DASH NUMBERS ASSIGNED TO BOEING SPEC 10-61219

[1] 121, 119, 114 OR 1



Tank Unit and Compensator Unit Installation
Figure 401 (Sheet 4)

472956

TANK UNIT AND COMPENSATOR UNIT - ADJUSTMENT/TEST

1. Tank Unit and Compensator Unit Test
   A. Equipment and Materials
      (1) System Tester
         (a) Model GTF-2, P/N 361-012-001, Gull Airborne Instruments, Inc., 55 Engineers Road, Smithtown, New York, 11787
         (b) P/N 472090-007, 472090-009, or PSD 40-1, Simmonds Precision Products Inc., Panton Road, Vergennes, Vermont, 05491
         (c) Model 8000, Barfield Instrument Corp., Miami, Florida 33142
      (2) Test Harness (To connect system tester to fuel tank spar bulkhead receptacle)
         (a) F72731-81
      (3) Leading Edge Flap Actuator Locks - F80048-89 (Preferred), F80048-90 (Preferred), F80048-84 (Alternate), and F80048-36 (Alternate)
   B. Test Tank Unit and Compensator Unit Resistance and Capacitance
      (1) Defuel the airplane or defuel the applicable fuel tank only, and drain the sump fuel (AMM 28-23-0/201).
      (2) For testing tank No. 1 or 2 units, extend the flaps and install the leading edge flap locks (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

      (3) Open EP GRD FUELING and fuel QTY circuit breakers on aft overhead panel (P6) and maintain open position for duration of test.

CAUTION: DO NOT APPLY ELECTRICAL POWER WITH OPEN CIRCUIT BETWEEN TANK UNITS AND FUEL QUANTITY INDICATORS. OPEN CIRCUITED TANK UNITS DRIVE QUANTITY INDICATOR POINTERS AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

      (4) At wing front spar or rear of center tank, remove applicable tank bussing plug from bulkhead receptacle (AMM 28-41-41/401).

CAUTION: BE EXTREMELY CAREFUL WITH CONNECTOR PINS AND/OR SOCKETS. CONNECTOR RECEPTACLE IS PART OF TANK WIRING HARNESS. DAMAGE TO RECEPTACLE WILL NECESSITATE REMOVAL OF COMPLETE ASSEMBLY.

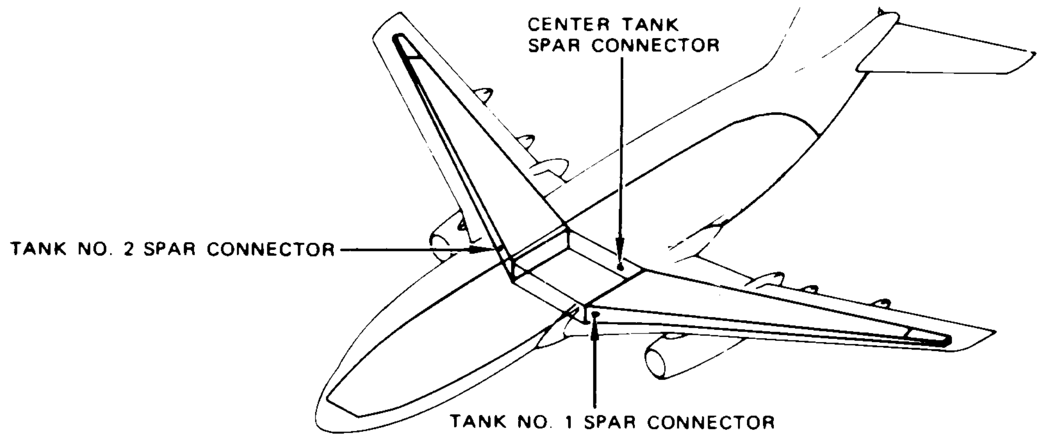
      (5) Connect kit test harness adapter plug to tank and compensator unit receptacle and secure plug with two bolts (Fig. 501).
      (6) Connect system tester to test harness (Fig. 501).

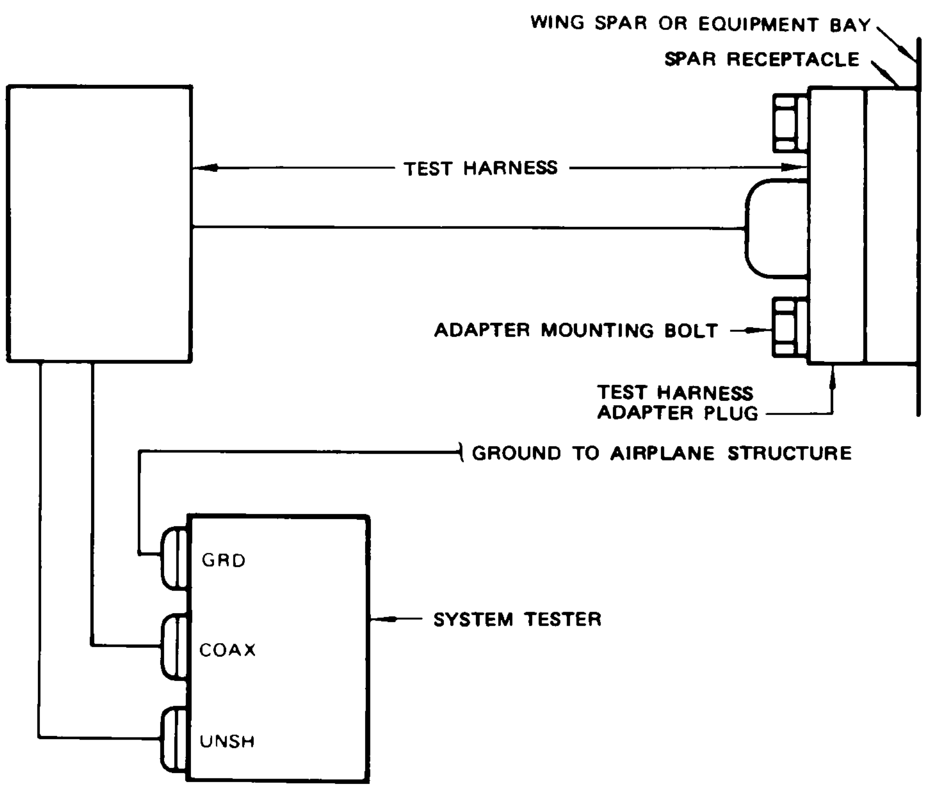
(7) Measure insulation resistance of each tank unit and compensator unit. Resistance shall not be less than shown in Fig. 502, Table A.
(8) Measure capacitance of each tank unit and compensator unit. Capacitance should be as shown in Fig. 502, Table B.
(9) Remove test harness adapter plug bolts and remove plug.

CAUTION: BE EXTREMELY CAREFUL WITH CONNECTOR PINS AND/OR SOCKETS. CONNECTOR RECEPTACLE IS PART OF TANK WIRING HARNESS. DAMAGE TO RECEPTACLE WILL NECESSITATE REMOVAL OF COMPLETE ASSEMBLY.

(10) Reconnect bussing plug to receptacle (AMM 28-41-41/401).
(11) Repeat steps (3) thru (10) for other fuel tanks.
(12) If extended, remove the leading edge flap locks and retract the leading edge flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.





Tank Unit and Compensator Unit Test Connections
Figure 501

472971

TABLE A (NON-VTO)						
				INSULATION RESISTANCE - MEGOHMS		
COMPONENT	PIN NO.			A TO B	A TO GRD	B TO GRD
FUEL TANK NO. 1 OR 2						
COMP UNIT NO. *[3]	11S	AND	C	500	1	1
TANK UNIT NO. 10	1S	AND	1	500	1	1
TANK UNIT NO. 11	2S	AND	2	500	1	1
TANK UNIT NO. 12	3S	AND	3	500	1	1
TANK UNIT NO. 13	4S	AND	4	500	1	1
TANK UNIT NO. 14	5S	AND	5	500	1	1
TANK UNIT NO. 15	6S	AND	6	500	1	1
TANK UNIT NO. 16	7S	AND	7	500	1	1
TANK UNIT NO. 17	8S	AND	8	500	1	1
TANK UNIT NO. 18	9S	AND	9	500	1	1
TANK UNIT NO. 19	10S	AND	10	500	1	1
TANK UNIT NO. 20	12S	AND	12	500	1	1
CENTER TANK (2 CELL) *[1]						
COMP UNIT NO. *[3]	11S	AND	C	500	1	1
TANK UNIT NO. 23	10S	AND	10	500	1	1
TANK UNIT NO. 24	9S	AND	9	500	1	1
TANK UNIT NO. 25	8S	AND	8	500	1	1

TABLE A (NON-VTO)						
COMPONENT	PIN NO.			INSULATION RESISTANCE - MEGOHMS		
				A TO B	A TO GRD	B TO GRD
CENTER TANK (3 CELL) *[2]						
COMP UNIT NO. *[3]	11S	AND	C	500	1	1
TANK UNIT NO. 26	9S	AND	9	500	1	1
TANK UNIT NO. 27	8S	AND	8	500	1	1
TANK UNIT NO. 28	10S	AND	10	500	1	1

NOTE: Pin numbers correspond to numbers on test harness and pin numbers on airplane connector receptacle. A to B, A to GRD, and B to GRD correspond to system capacitance tester switch positions.
A to B = COAX to TANK or COMP
A to GRD = COAX to SHIELD
B to GRD = TANK or COMP to SHIELD

*[1] AR LV-JMW THRU LV-JMZ, LV-JTD, LV-JTO, LV-LEB TM CR-BAA, CR-BAB, CR-BAD
*[2] AR 737-287C
TM CR-BAC
*[3] 121, 119, 114, OR 1

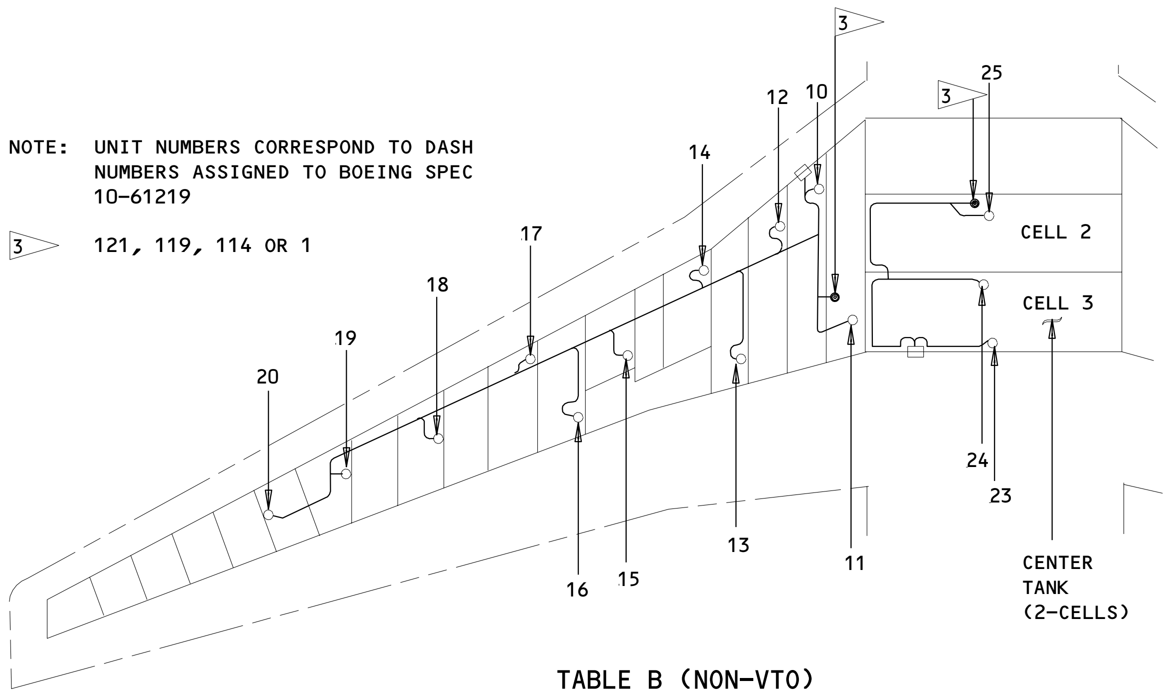


TABLE B (NON-VTO)

COMPONENT	PIN NO.	EMPTY CAPACITANCE pf
<u>FUEL TANK NO. 1 OR NO. 2</u>		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 10	1S AND 1	71.2 ±1.2
TANK UNIT NO. 11	2S AND 2	72.5 ±1.2
TANK UNIT NO. 12	3S AND 3	64.4 ±1.2
TANK UNIT NO. 13	4S AND 4	41.8 ±1.2
TANK UNIT NO. 14	5S AND 5	23.0 ±1.2
TANK UNIT NO. 15	6S AND 6	33.8 ±1.2
TANK UNIT NO. 16	7S AND 7	29.7 ±1.2
TANK UNIT NO. 17	8S AND 8	30.0 ±1.2
TANK UNIT NO. 18	9S AND 9	34.8 ±1.2
TANK UNIT NO. 19	10S AND 10	26.0 ±1.2
TANK UNIT NO. 20	12S and 12	31.1 ±1.2
<u>CENTER TANK</u> (2 CELL)		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 23	10S AND 10	40.5 ±1.2
TANK UNIT NO. 24	9S AND 9	71.2 ±1.2
TANK UNIT NO. 25	8S AND 8	76.8 ±1.2

<u>NOTE</u>: Pin numbers correspond to numbers on test harness and pin numbers on airplane connector receptacle.

Tank and Compensator Unit Capacitance and Resistance Values
Figure 502 (Sheet 1)

NOTE: UNIT NUMBERS CORRESPOND TO DASH NUMBERS ASSIGNED TO BOEING SPEC 10-61219

3 121, 119, 114 OR 1

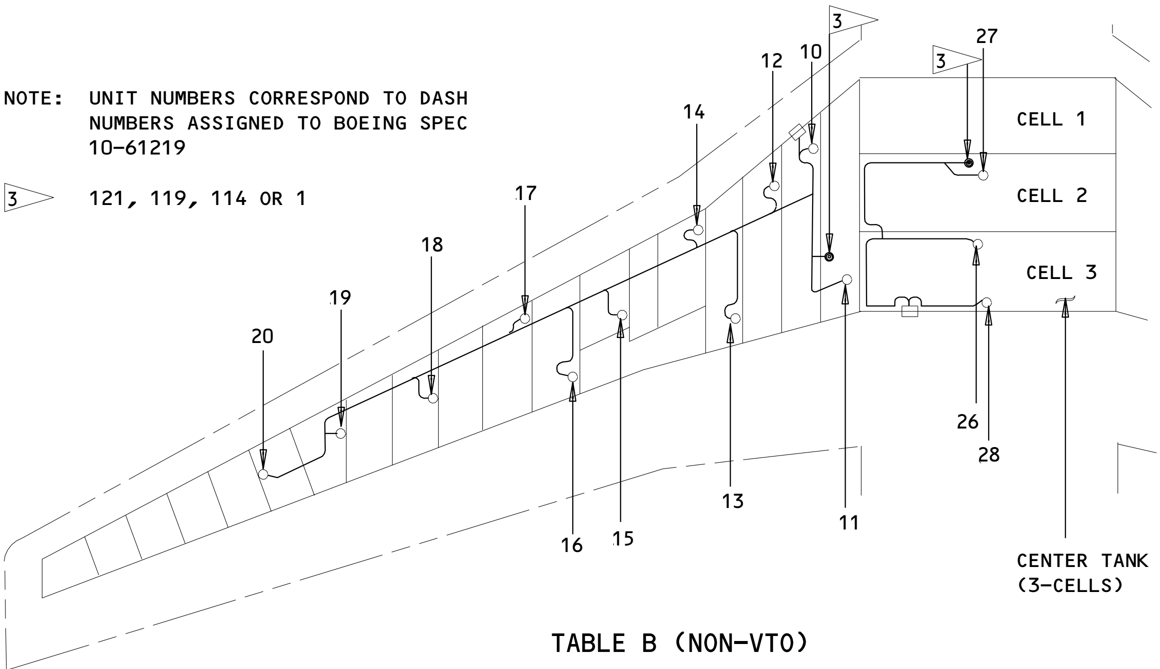


TABLE B (NON-VTO)

COMPONENT	PIN NO.	EMPTY CAPACITANCE pf
FUEL TANK NO. 1 OR NO. 2		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 10	1S AND 1	71.2 ±1.2
TANK UNIT NO. 11	2S AND 2	72.5 ±1.2
TANK UNIT NO. 12	3S AND 3	64.4 ±1.2
TANK UNIT NO. 13	4S AND 4	41.8 ±1.2
TANK UNIT NO. 14	5S AND 5	23.0 ±1.2
TANK UNIT NO. 15	6S AND 6	33.8 ±1.2
TANK UNIT NO. 16	7S AND 7	29.7 ±1.2
TANK UNIT NO. 17	8S AND 8	30.0 ±1.2
TANK UNIT NO. 18	9S AND 9	34.8 ±1.2
TANK UNIT NO. 19	10S AND 10	26.0 ±1.2
TANK UNIT NO. 20	12S and 12	31.1 ±1.2
CENTER TANK (3 CELLS)		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 26	9S AND 9	55.3 ±1.2
TANK UNIT NO. 27	8S AND 8	112.1 ±1.2
TANK UNIT NO. 28	10S AND 10	36.0 ±1.2

NOTE: Pin numbers correspond to numbers on test harness and pin numbers on airplane connector receptacle.

Tank and Compensator Unit Capacitance and Resistance Values
Figure 502 (Sheet 2)

TABLE A (NON-VTO)

COMPONENT	PIN NO.	INSULATION RESISTANCE - MEGOHMS		
		A to B	A to GRD	B to GRD
FUEL TANK NO. 1 OR NO. 2				
COMP UNIT NO. 3	11S AND C	500	1	1
TANK UNIT NO. 10	1S AND 1	500	1	1
TANK UNIT NO. 11	2S AND 2	500	1	1
TANK UNIT NO. 12	3S AND 3	500	1	1
TANK UNIT NO. 13	4S AND 4	500	1	1
TANK UNIT NO. 14	5S AND 5	500	1	1
TANK UNIT NO. 15	6S AND 6	500	1	1
TANK UNIT NO. 16	7S AND 7	500	1	1
TANK UNIT NO. 17	8S AND 8	500	1	1
TANK UNIT NO. 18	9S AND 9	500	1	1
TANK UNIT NO. 19	10S AND 10	500	1	1
TANK UNIT NO. 20	12S AND 12	500	1	1
CENTER TANK (INTEGRAL)				
COMP UNIT NO. 3	11S AND C	500	1	1
TANK UNIT NO. 44	9S AND 9	500	1	1
TANK UNIT NO. 45	8S AND 8	500	1	1

NOTE: Pin numbers correspond to numbers on test harness and pin numbers on airplane connector receptacle. A to B, A to GRD, and B to GRD correspond to system tester switch positions.

A to B = COAX to TANK or COMP
A to GRD = COAX to SHIELD
B to GRD = TANK or COMP to SHIELD

3 121, 119, 114 OR 1

Tank and Compensator Unit Capacitance and Resistance Values
Figure 502 (Sheet 3)

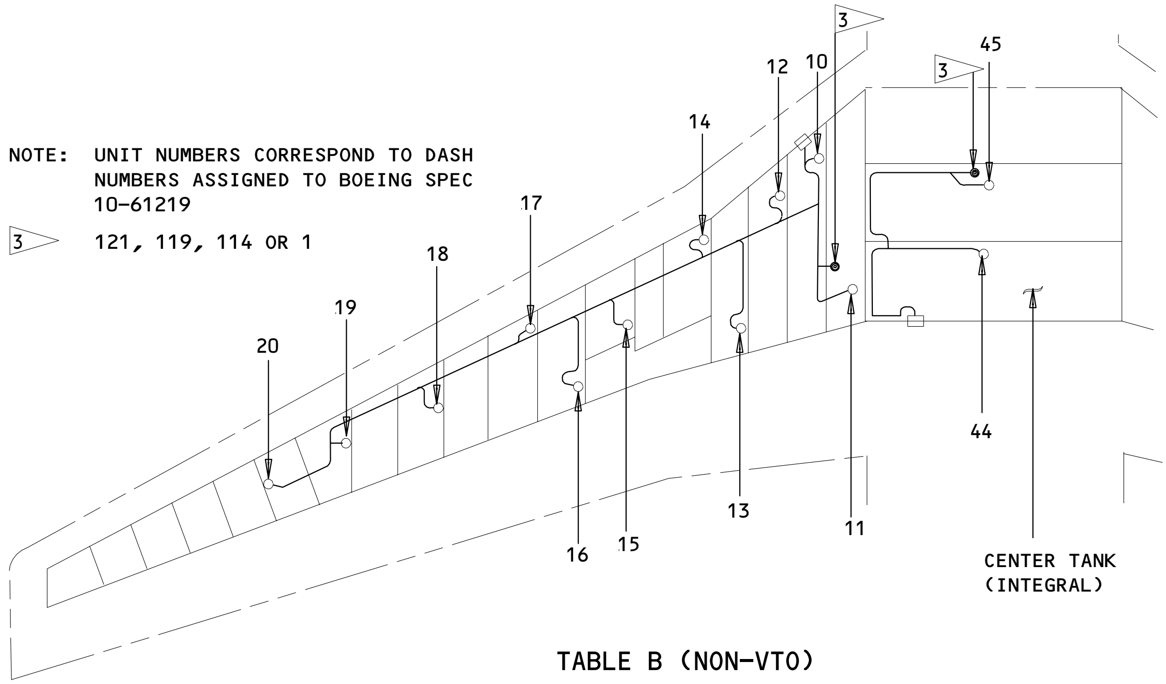


TABLE B (NON-VTO)

COMPONENT	PIN NO.	EMPTY CAPACITANCE pf
FUEL TANK NO. 1 OR NO. 2		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 10	1S AND 1	71.2 ±1.2
TANK UNIT NO. 11	2S AND 2	72.5 ±1.2
TANK UNIT NO. 12	3S AND 3	64.4 ±1.2
TANK UNIT NO. 13	4S AND 4	41.8 ±1.2
TANK UNIT NO. 14	5S AND 5	23.0 ±1.2
TANK UNIT NO. 15	6S AND 6	33.8 ±1.2
TANK UNIT NO. 16	7S AND 7	29.7 ±1.2
TANK UNIT NO. 17	8S AND 8	30.0 ±1.2
TANK UNIT NO. 18	9S AND 9	34.8 ±1.2
TANK UNIT NO. 19	10S AND 10	26.0 ±1.2
TANK UNIT NO. 20	12S and 12	31.1 ±1.2
CENTER TANK (INTEGRAL)		
COMP UNIT NO. 3	11S AND C	39.0 ±1.2
TANK UNIT NO. 44	9S AND 9	78.6 ±1.2
TANK UNIT NO. 45	8S AND 8	85.6 ±1.2

NOTE: Pin numbers correspond to numbers on test harness and pin numbers on airplane connector receptacle.

Tank and Compensator Unit Capacitance and Resistance Values
Figure 502 (Sheet 4)

TANK UNITS AND COMPENSATOR UNITS - CLEANING/PAINTING

1. General
   A. This procedure is for cleaning microbial contamination from fuel quantity tank units.
2. Equipment and Materials
   A. Alcohol
   B. Container with depth suitable for cleaning tank units
   C. Nylon bristle brushes
   D. Bottle-type brush having a bristle outside diameter of 1/4 to 3/8 inch with an extension rod attached and the entire handle and extension covered with plastic or heat shrinkage tubing.
3. Clean Tank Unit
   A. Remove tank unit (Ref 28-41-21, Removal/Installation).
   B. Thoroughly scrub all surfaces of the tank unit using alcohol only (never water or water and cleaner) and nylon bristle brushes. Use care to prevent scratching tank unit. Ensure that all microbial growth is removed.

      WARNING: USE ALCOHOL IN A WELL-VENTILATED AREA. DO NOT INHALE VAPORS OR USE NEAR AN OPEN FLAME.

      CAUTION: BE CAREFUL WHEN SCRUBBING INNER ELECTRODE NOT TO MOVE OR DISLODGE SPACERS AS CAPACITANCE MEASUREMENT WILL CHANGE.

   C. Thoroughly rinse tank unit with clean alcohol.
   D. Thoroughly wipe dry with clean lint free absorbent material.
   E. Install tank unit (Ref 28-41-21, Removal/Installation).

FUEL QUANTITY INDICATING SYSTEM WIRE HARNESS - APPROVED REPAIRS

1. General
   A. This section contains a procedure for recrimping the in-tank wire harness terminal lugs. Recrimping may be required to provide a tighter lug connection to the wire to assure electrical continuity within the fuel quantity indicating system.
2. Equipment and Materials
   A. AMP hand-crimping tool - P/N 59250 or 59170
3. Recrimp Fuel Tank Wire Harness Terminal Lug
   A. Defuel airplane or defuel applicable fuel tank only, and drain sump fuel (AMM 28-23-0/201).
   B. Remove fuel tank access panels.
      (1) For the wing tank remove underwing access panels 1, 2, 3, 4, 5, 7, 9, and 10 (AMM 28-11-11/401I).
      (2) For the center tank, remove the center tank access panel (Ref 28-11-31 R/I).
   C. Purge applicable fuel tank (Ref 28-10-0 MP).
   D. Enter applicable tank to gain access to fuel compensator.
   E. Disconnect harness terminal leads from compensator.
   F. Loosen or remove harness clamps as necessary to provide length of slack wire.
   G. Remove the captive screw and lockwasher from terminal tongue on the HI-Z wire lead. Retain for installation.
   H. Recrimp the wire harness terminal lug using the AMP hand tool and crimping dies. Verify that end of terminal lug barrel has been deformed by the tool.
   I. Install the captive screw and lockwasher on the terminal tongue.
   J. Repeat steps G. thru I. for recrimping for LO-Z wire lead.
   K. Connect leads and tighten clamp on unit. Tighten screws/nut to following torque ranges:
      HI-Z lead (COAX) 15-16 pound-inches
      LO-Z lead (TANK) 19-23 pound-inches
      Strain relief clamp 7-9 pound-inches
   L. Install and/or tighten any wire harness clamps removed or loosened.
   M. Repeat steps E. thru L. for each tank unit.
   N. Install fuel tank access panels as applicable (Ref 28-11-11 R/I, 28-11-31 R/I).
   O. Perform fuel quantity indicating system adjustment/test (Ref 28-41-0 A/T).

TANK AND COMPENSATOR UNIT BUSSING PLUG - REMOVAL/INSTALLATION

1. General
   A. There are three tank and compensator unit bussing plugs, one for each fuel tank. The removal/installation procedures are the same, only the physical location is different. Two plugs are installed on the front spar and one on the rear spar in the wheel well area (Fig. 401).
2. Equipment and Materials
   A. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Petrolatum - VV-P-236 (AMM 20-30-21/201)
   C. Aliphatic Naphtha (cleaning solvent) - TT-N-95 (AMM 20-30-31/201)
   D. Leading Edge Flap Actuator Locks - F80048-89 (Preferred), F80048-90 (Preferred), F80048-84 (Alternate), and F80048-36 (Alternate)
3. Remove the Bussing Plug (Fig. 401)
   A. For front spar plug, extend flaps and install leading edge flap locks (AMM 27-81-0/201).

      WARNING: REFER TO 27-81-0, MP FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   B. Open GRD FUELING and FUEL QTY circuit breakers on aft overhead panel P6.
   C. Disconnect electrical connector from face of plug. Ensure that circuit breakers opened in step 3.B. remain open as long as plug is open circuited.

      CAUTION: DO NOT LEAVE ELECTRICAL POWER ON WITH CONNECTOR DISCONNECTED. OPEN CIRCUITED FUEL QUANTITY UNITS DRIVE QUANTITY INDICATOR POINTER AGAINST STOP, AND CONTINUED RUNNING WILL DAMAGE INDICATOR CLUTCH.

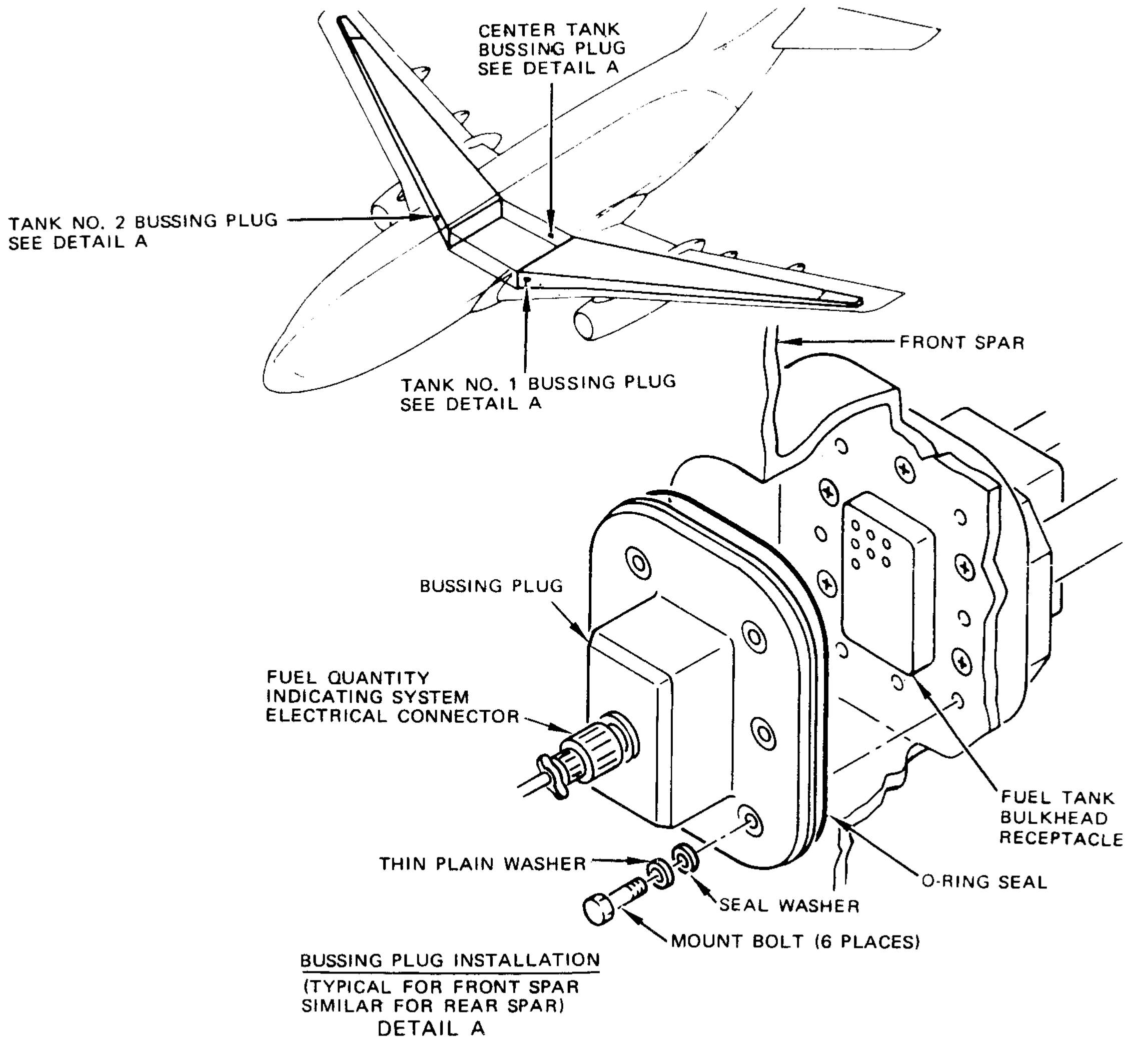
   D. Remove six mounting bolts attaching plug to receptacle, discard seal washers, and, while exercising care, remove plug from receptacle.

      CAUTION: BE EXTREMELY CAREFUL WITH RECEPTACLE PINS AND/OR SOCKETS. THE RECEPTACLE IS A PART OF THE FUEL TANK WIRING HARNESS ASSEMBLY. DAMAGE TO THE RECEPTACLE WILL RESULT IN THE REMOVAL OF THE COMPLETE HARNESS ASSEMBLY.

4. Install the Bussing Plug
   A. Clean machined surface on back of plug and seal contacting surface around receptacle with cleaning solvent. Wipe dry with a clean, cotton wiper (BMS15-5).
   B. Fit a new O-ring seal in machine groove and carefully engage contact pins of plug with pin sockets in bulkhead receptacle. Observe caution of step 3.D.
   C. Coat new seal washers and threads of mounting bolts with petrolatum.
   D. Install plug mounting bolts, using one each thin washer and seal washer under each bolt head (Fig. 401). Tighten bolts evenly to a torque range of 40 to 50 pound-inches.
   E. Connect electrical connector to bussing plug. For front spar plug, remove leading edge flap locks and retract leading edge flaps (Ref 27-81-0, MP).

      WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   F. Check operation of fuel quantity indicating system and adjust if necessary (Ref 28-41-0, A/T).
   G. Close GRD FUELING and FUEL QTY circuit breakers on aft overhead panel P6.



Tank Unit and Compensator Unit Bussing Plug Installation
Figure 401

FUEL QUANTITY INDICATOR - REMOVAL/INSTALLATION

1. Remove the Fuel Quantity Indicator
   A. Procedure
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
         (a) On the overhead circuit breaker panel, P6:
            1) QTY
            2) EP GRD FUELING
      (2) Loosen the clamp screw of the applicable fuel quantity indicator.
      (3) Remove the fuel quantity indicator from the panel.

      WARNING: MAKE SURE EACH ELECTRICAL CONNECTOR HAS A TAG TO IDENTIFY THE CORRECT ELECTRICAL CONNECTOR INSTALLATION LOCATION TO THE INDICATOR BEING REMOVED. CROSS-CONNECTION OF THE ELECTRICAL CONNECTORS CAN CAUSE THE AIRPLANE SYSTEM TO MALFUNCTION AND THE LOSS OF SAFE FLIGHT.

      (4) Disconnect electrical connector at indicator and attach a tag to identify the correct electrical connector installation location to the indicator being removed.
2. Install the Fuel Quantity Indicator
   A. Check side of indicator to be installed for presence of inked stamp adjustment setting values.
      (1) If adjustment setting values are on indicator, compare with these on indicator which was removed. They should be identical.
      (2) If inked stamp data is missing or adjustment values are not the same, indicator must be either bench adjusted to the removed indicator settings or the indicator must be adjusted after installation on the airplane.
   B. Remove the tag and reconnect the electrical connector to the correct installation location as identified by the tag, of the indicator being removed.
   C. Install indicator in panel and tighten clamp screw. Leave clamp screw loose if indicator must be adjusted.
   D. Adjust fuel quantity indicator if necessary (Ref 28-41-0, Adjustment/Test).

3. Check Fuel Quantity Connectors

A. The following steps must be performed to assure the fuel quantity connectors are connected to the correct indicator.

(1) Disconnect the connector D884 or D901 at the bussing plug for the No. 1 main tank on the front spar.

(2) Make sure the indicator for the No. 1 tank shows zero fuel quantity.

(3) Reconnect connector D884 or D902.

(4) Disconnect the connector D888 or D906 at the bussing plug for the No. 2 main tank on the front spar.

(5) Make sure the indicator for the No. 2 tank shows zero fuel quantity.

(6) Reconnect connector D888 or D906.

(7) A check of the center tank indicator is not necessary, as the indicator cannot be cross-connected with tank No. 1 or tank No. 2 indicators.

FUELING QUANTITY INDICATOR - REMOVAL/INSTALLATION

1. Remove the Fueling Quantity Indicator
   A. Procedure
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
         (a) On the circuit breaker panel, P6:
            1) QTY
            2) EP GND FUELING
      (2) Open the access door for the refueling control panel (P15).
      (3) Loosen the clamp screw of the applicable fueling quantity indicator.
      (4) Remove the indicator from the panel.
      (5) Disconnect the electrical connector at the indicator and attach a tag to identify the correct electrical connector installation location to the indicator being in removed.

      WARNING: MAKE SURE EACH ELECTRICAL CONNECTOR HAS A TAG TO IDENTIFY THE CORRECT ELECTRICAL CONNECTOR INSTALLATION LOCATION TO THE INDICATOR BEING REMOVED. CROSS CONNECTION OF THE ELECTRICAL CONNECTORS CAN CAUSE THE AIRPLANE SYSTEM TO MALFUNCTION AND THE LOSS OF SAFE FLIGHT.

2. Install the Fueling Quantity Indicator
   A. Inspection (Per SB 28-1193)
      (1) Open the access door for the fueling control panel (P15) if it is not open.
         (a) Remove the pins that attach the linkage assemblies to the access door.
      (2) Remove the screws that attach the fueling control panel to the wing structure.
      (3) Disconnect the bonding jumpers from the fueling control panel.
      (4) Remove the fueling control panel.

      NOTE: You can also attach the panel to the support member for the leading edge to keep it safe during this procedure.

      (5) Visually examine the wires in the wire bundle to the connector plug on the back of the fueling control panel.
         (a) Look for indications of these types of problems:
            1) Chafed wires
            2) Damaged wires
            3) Arcing
            4) Loose wires with too much wire slack
            5) Damage to the contact pins on the panel connector plug or to the sockets on the mating connector.

(6) Behind the fueling control panel and inside the wing structure, do a check for any marks or indications where wire chafing occurred.
   (a) Examine these types of surfaces:
      1) Flat edges on the back of the fueling control panel.
      2) Round edges on the backshells of the fueling quantity indicators.
      3) Any sharp edges or objects inside the wing structure behind the fueling control panel.
(7) If you find wires with problems or damage, then repair or replace those wires:
   (a) If there is any damage to the contact pins in the connector plug or to the sockets in the mating connector, replace those pins and sockets (SWPM 20-10-13).
   (b) Move loose and untied wires away from sharp edges and objects behind the fueling control panel and inside the wing structure (SWPM 28-10-11).
      1) Tie these wires to the main wire bundle.
      2) Make sure the wire bundle service loops have sufficient length and slack to permit the fueling control panel to be pulled out and lowered from the wing structure for servicing of the fueling quantity indicators without complete removal of the panel.
   (c) Make sure there is wire clearance and protection from chafing against the edges of the backshell connectors and screws on the backs of the fueling quantity indicators.
      1) If it is necessary, loosen and turn the backshell connectors to give clearance from the wires, and then tighten them.
   (d) Install protective sleeves around wires where the wires are routed close to sharp edges and objects on the back of the fueling control panel (SWPM 20-10-18).

      CAUTION: DO NOT SHRINK THE SLEEVES WITH HEAT. THE TEFLON WRAPPING SLEEVE USED IN THIS APPLICATION IS A NON-SHRINKABLE TYPE. HEAT CAN DAMAGE THE WIRE INSULATION UNDER THE SLEEVE.

      1) Where it is necessary, replace the Teflon wrapping sleeve and add a new sleeve to protect the wires from chafing.
      2) For more protection, wires that are routed near sharp edges can be wrapped with one more layer of Teflon sleeve.
(8) Re-install the fueling control panel.
   (a) Put the fueling control panel in position between the support members for the leading edge.
   (b) Install the screws in the fueling control panel to attach it.
(9) Install the bonding jumpers to the fueling control panel.

(10) Do a check of the electrical bond between the fueling control panel and the airplane structure (SWPM 20-20-00).
  (a) Make sure the resistance is 0.001 ohm or less.
(11) Install the pins and washers that attach the linkages to the access door.

B. Install the Fueling Quantity Indicator
(1) Remove the tag and connect the electrical connector to the correct installation location as identified by the tag, of the indicator being installed.
(2) Remove the DO-NOT CLOSE tags and close these circuit breakers:
  (a) On the circuit breaker panel, P6:
    1) QTY
    2) EP GND FUELING
(3) Do the fueling quantity indicator FULL adjustment (AMM 28-41-0/501).
(4) Install the fueling quantity indicator in the P15 panel.
(5) Tighten the clamp screw on the fueling quantity indicator.
(6) Close the access door for the refueling control panel (P15).

TOTAL FUEL QUANTITY INDICATOR - REMOVAL/INSTALLATION

1. Remove Total Fuel Quantity Indicator
   A. References
      (1) AMM 20-41-12/201, Electrostatic Discharge Sensitive Devices
      (2) Do the "Metal Encased ESDS LRU Removal" task to remove the total fuel quantity indicator (AMM 20-40-12/201).

      WARNING: WHEN YOU REMOVE AN ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) UNIT, MAKE SURE YOU PUT COVERS ON THE ELECTRICAL CONNECTORS. USE ELECTROSTATIC DISCHARGE (ESD) SAFE DUST CAPS. IF THE CONNECTORS DO NOT HAVE COVERS ON THEM, INJURY TO PERSONS AND DAMAGE TO THE CONNECTOR CAN OCCUR.

      CAUTION: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO REMOVE THE TOTAL FUEL QUANTITY INDICATOR. A FAILURE TO DO THE STEPS CORRECTLY CAN CAUSE DAMAGE TO THE EQUIPMENT.

   B. Open QTY and EP GRD FUELING circuit breakers on circuit breaker panel P6.
   C. Loosen clamp screw and withdraw indicator from panel.

   WARNING: MAKE SURE EACH ELECTRICAL CONNECTOR HAS A TAG TO IDENTIFY THE CORRECT ELECTRICAL CONNECTOR INSTALLATION LOCATION TO THE INDICATOR BEING REMOVED. CROSS-CONNECTION OF THE ELECTRICAL CONNECTORS CAN CAUSE THE AIRPLANE SYSTEM TO MALFUNCTION AND THE LOSS OF SAFE FLIGHT.

   D. Disconnect electrical connector at indicator and attach a tag to identify the correct electrical connector installation location to the indicator being removed.
2. Install Total Fuel Quantity Indicator
   A. Do the "Metal Encased ESDS LRU Installation" task to install the total fuel quantity indicator (AMM 20-40-12/201).

   WARNING: WHEN YOU INSTALL AN ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) UNIT, MAKE SURE THE COMPONENT AND MOUNT RACK TOUCH EACH OTHER. THEN REMOVE THE ELECTROSTATIC DISCHARGE (ESD) DUST CAPS. THIS LETS THE UNIT RELEASE THE ELECTROSTATIC DISCHARGE. THIS WILL PREVENT INJURY TO PERSONS AND DAMAGE TO THE UNIT ELECTRICAL CONNECTORS.

   CAUTION: YOU MUST CAREFULLY DO THE STEPS IN THE TASK ABOVE TO INSTALL THE TOTAL FUEL QUANTITY INDICATOR. A FAILURE TO DO THE STEPS CORRECTLY CAN CAUSE DAMAGE TO THE EQUIPMENT.

B. Remove the tag and reconnect the electrical connector to the correct installation location as identified by the tag, of the indicator being installed.

C. Adjust the indicator (AMM 28-41-71/501).

D. Install indicator in panel and tighten clamp screw.

FUEL TANK BULKHEAD (SPAR) RECEPTACLE WIRE HARNESS - REMOVAL/INSTALLATION

1. General
   A. Be careful when you do maintenance as damage to the receptacle requires replacement of the wire harness assembly.
   B. Repair and overhaul of the wire harness must be per SWPM 20-14-12.

      NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

2. Consumable Materials
   A. G00034 Cotton Wiper, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   B. Aliphatic Naphtha (cleaning solvent) - TT-N-95 (AMM 20-30-31/201)
   C. BMS 5-45 sealant
3. Prepare for Removal
   A. Open GRD FUELING and FUEL QTY circuit breakers on aft overhead panel P6.
   B. For tank 1 or 2 bulkhead (spar) receptacle wire harness, extend flaps and install leading edge flap locks.

      WARNING: REFER TO AMM 27-81-0/201 FOR THE LOCK INSTALLATION PROCEDURE. THE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

   C. Defuel and purge the applicable fuel tank (AMM 28-23-0/201, AMM 28-10-0/201).
   D. Remove the tank and compensator unit bussing plug (AMM 28-41-41/401).
4. Remove/Install Fuel Tank Bulkhead (Spar) Receptacle Wire Harness (Fig. 401)
   A. Go into the applicable fuel tank with the replacement wire harness.
   B. While the receptacle is being supported from inside tank, from outside tank, remove the receptacle mounting screws, and pull the receptacle free inside the tank.
   C. Make sure the mounting area is free of paint or primer.

      NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

      (1) With a clean cotton wiper moistened with naphtha, clean the receptacle mounting area on the bulkhead (spar) or auxiliary tank equipment bay, replacement receptacle face and replacement receptacle O-ring groove.

D. Install a new O-ring.

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

E. Position receptacle in bulkhead (spar) so that pin numbers are right side up.

F. While you support the receptacle from inside the tank, from outside the tank, install and tighten the receptacle mounting screws to 65-90 inch-pounds (7.3-10 Nm).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

G. Progressively remove existing wire harness and install replacement wire harness.

NOTE: As existing wire harness is being removed, install replacement wire harness to ensure proper clamping and routing.

(1) Make sure the wire slack clearance between the wires and structure are more than 0.125 inches (0.32 cm).

NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

H. At tank units and compensator units, install replacement harness connectors and tighten to 8 ±1 pound-inches.

NOTE: Drip loop must be left in wire after installing connector on tank or compensator unit.

I. Thoroughly clean the area around the internal tank wire harness connector and spar interface using Aliphatic Naphtha.

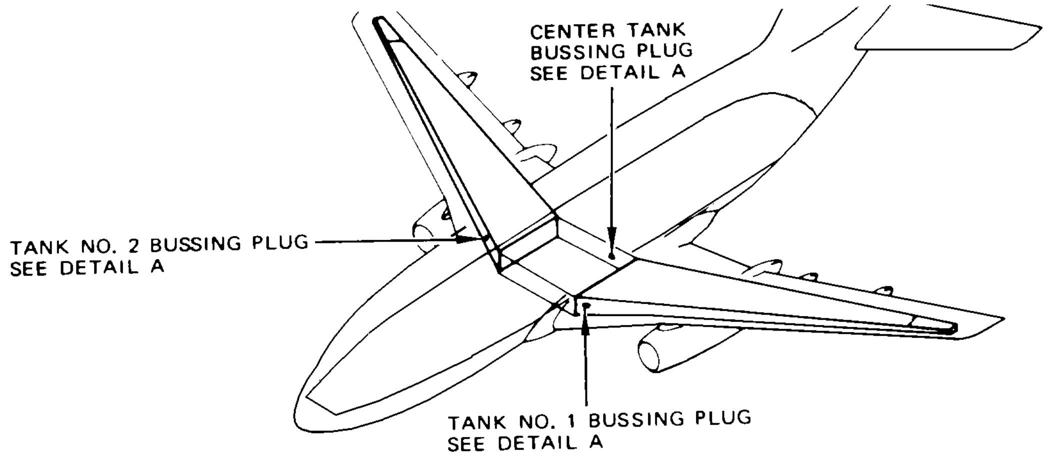
J. Apply a continuous fillet bead of BMS 5-45 sealant around the entire perimeter of the internal tank harness connector at the spar interface (AMM 28-11-0/801).

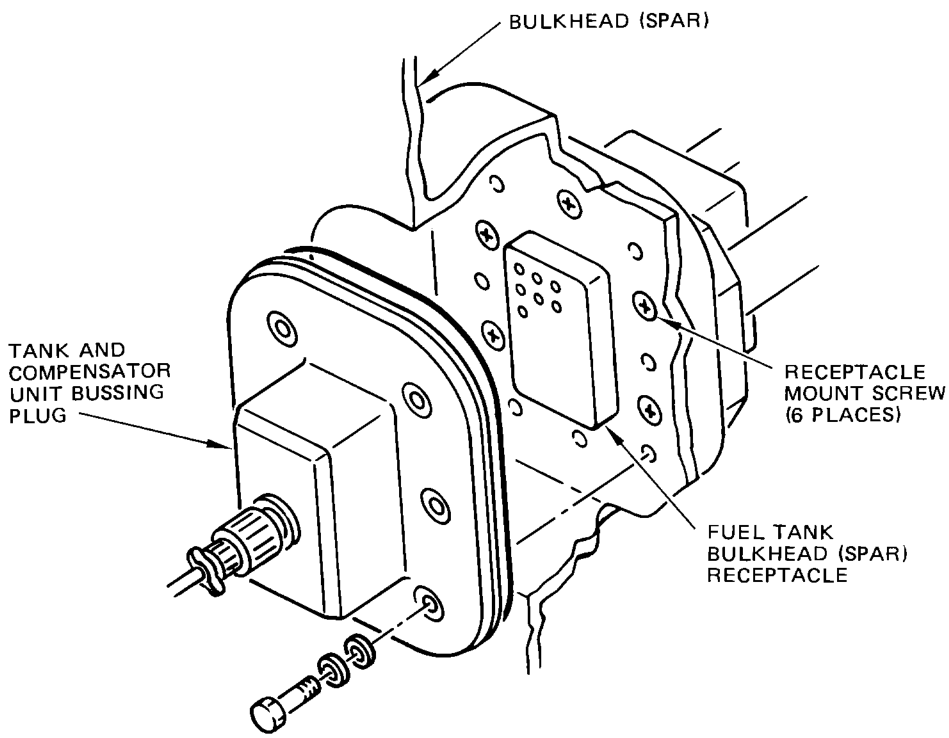
NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 28-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

K. Allow sealant to cure.

5. Restore Airplane to Normal

A. Install the tank and compensator unit bussing plug (AMM 28-41-41/401).





(TYPICAL FOR FRONT SPAR
SIMILAR FOR REAR SPAR)
DETAIL A

Fuel Tank Bulkhead (SPAR) Receptacle Wire Harness
Figure 401

B. If tank 1 or 2 bulkhead (spar) receptacle wire harness was replaced, remove the leading edge flap locks and retract the leading edge flaps (AMM 27-81-0/201).

WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. THE FLAPS FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

C. Close GRD FUELING and FUEL QTY circuit breakers on aft overhead panel P6.
D. Adjust the fuel quantity indicating system (AMM 28-41-0/501).

FUEL TANK BULKHEAD (SPAR) RECEPTACLE WIRE HARNESS - INSPECTION/CHECK

1. General
   A. This procedure has tasks to inspect the Fuel Quantity Indicating System (FQIS) wiring and components in the fuel tanks.
2. FQIS Wiring and Component Visual Inspection
   A. Procedure
      (1) Examine the wiring in the fuel tank for these problems:
         (a) Insulation that is abraded, cracked or over-stressed
         (b) Conductors or shields that are broken or exposed
         (c) Clearance from the structure that is not sufficient
         (d) Wiring that is routed incorrectly.
         (e) Missing clamps, corrosion, and loose or bent connections.
      (2) Examine the compensators and tank units for these problems:
         (a) Wiring that is not correctly attached to the terminals
         (b) Wiring to the terminals that is damaged or not correctly routed
         (c) Terminals that are bent.
         (d) Electrical connectors and seals that are damaged, worn, or show signs of fuel leakage.
         (e) An end cap that is missing
         (f) Clearance from the structure that is not sufficient.
         (g) Mounting brackets and hardware that are loose.
3. FQIS, No. 1 Tank - Inspection
   A. References
      (1) AMM 28-10-0/201, Fuel Tanks
      (2) AMM 28-11-11/401, Wing Fuel Tank Access Panels
   B. Procedure
      (1) For the area in the No. 1 fuel tank between rib No. 1 (side-of-body rib at WBL 71.24) and rib No. 5 (rib at WBL 157.00), do these steps:
         (a) Remove access panel No. 1 on the left wing (AMM 28-11-11/401).
         (b) Go into the opening for access panel No. 1 (AMM 28-10-0/201).
         (c) Do this task for all FQIS wiring and components between rib No. 1 and rib No. 5: FQIS Wiring and Component Visual Inspection.
         (d) If access is not necessary for subsequent tasks, install access panel No. 1 (AMM 28-11-11/401).
      (2) For the area in the No. 1 fuel tank between rib No. 5 (rib at WBL 157.00) and rib No. 7 (rib at WBL 198.60), do these steps:
         (a) Remove access panel No. 2 on the left wing (AMM 28-11-11/401).
         (b) Go into the opening for access panel No. 2 (AMM 28-10-0/201).
         (c) Do this task for all FQIS wiring and components between rib No. 5 and rib No. 7: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 2 (AMM 28-11-11/401).

(3) For the area in the No. 1 fuel tank between rib No. 7 (rib at WBL 198.60) and rib No. 8 (rib at WBL 227.00), do these steps:
(a) Remove access panel No. 3 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 3 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 7 and rib No. 8: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 3 (AMM 28-11-11/401).

(4) For the area in the No. 1 fuel tank between rib No. 8 (rib at WBL 227.00) and rib No. 9 (rib at WBL 254.00), do these steps:
(a) Remove access panel No. 4 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 4 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 8 and rib No. 9: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 4 (AMM 28-11-11/401).

(5) For the area in the No. 1 fuel tank between rib No. 9 (rib at WBL 254.00) and rib No. 10 (rib at WBL 279.25), do these steps:
(a) Remove access panel No. 5 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 5 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 9 and rib No. 10: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 5 (AMM 28-11-11/401).

(6) For the area in the No. 1 fuel tank between rib No. 10 (rib at WBL 279.25) and rib No. 11 (rib at WBL 304.5, do these steps:
(a) Remove access panel No. 6 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 6 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 10 and rib No. 11: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 6 (AMM 28-11-11/401).

(7) For the area in the No. 1 fuel tank between rib No. 11 (rib at WBL 304.50) and rib No. 12 (rib at WBL 329.75), do these steps:
(a) Remove access panel No. 7 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 7 (AMM 28-10-0/201).

(c) Do this task for all FQIS wiring and components between rib No. 11 and rib No. 12: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 7 (AMM 28-11-11/401).

(8) For the area in the No. 1 fuel tank between rib No. 12 (rib at WBL 329.75) and rib No. 13 (rib at WBL 355.00), do these steps:
(a) Remove access panel No. 8 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 8 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 12 and rib No. 13: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 8 (AMM 28-11-11/401).

(9) For the area in the No. 1 fuel tank between rib No. 13 (rib at WBL 355.00) and rib No. 14 (rib at WS 453.00), do these steps:
(a) Remove access panel No. 9 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 9 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 13 and rib No. 14: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 9 (AMM 28-11-11/401).

(10) For the area in the No. 1 fuel tank between rib No. 14 (rib at WS 453.00) and rib No. 15 (rib at WS 479.00), do these steps:
(a) Remove access panel No. 10 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 10 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 14 and rib No. 15: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 10 (AMM 28-11-11/401).

(11) For the area in the No. 1 fuel tank between rib No. 15 (rib at WS 479.00) and rib No. 16 (rib at WS 505.00), do these steps:
(a) Remove access panel No. 11 on the left wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 11 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 15 and rib No. 16: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 11 (AMM 28-11-11/401).

(12) For the area in the No. 1 fuel tank between rib No. 16 (rib at WS 505.00) and rib No. 17 (rib at WS 531.00), do these steps:
   (a) Remove access panel No. 12 on the left wing (AMM 28-11-11/401).
   (b) Go into the opening for access panel No. 12 (AMM 28-10-0/201).
   (c) Do this task for all FQIS wiring and components between rib No. 16 and rib No. 17: FQIS Wiring and Component Visual Inspection.
   (d) If access is not necessary for subsequent tasks, install access panel No. 12 (AMM 28-11-11/401).

4. FQIS, No. 2 Tank - Inspection

A. References
   (1) AMM 28-10-0/201, Fuel Tanks
   (2) AMM 28-11-11/401, Wing Fuel Tank Access Panels

B. Procedure
   (1) For the area in the No. 2 fuel tank between rib No. 1 (side-of-body rib at WBL 71.24) and rib No. 5 (rib at WBL 157.00), do these steps:
      (a) Remove access panel No. 1 on the right wing (AMM 28-11-11/401).
      (b) Go into the opening for access panel No. 1 (AMM 28-10-0/201).
      (c) Do this task for all FQIS wiring and components between rib No. 1 and rib No. 5: FQIS Wiring and Component Visual Inspection.
      (d) If access is not necessary for subsequent tasks, install access panel No. 1 (AMM 28-11-11/401).
   (2) For the area in the No. 2 fuel tank between rib No. 5 (rib at WBL 157.00) and rib No. 7 (rib at WBL 198.60), do these steps:
      (a) Remove access panel No. 2 on the right wing (AMM 28-11-11/401).
      (b) Go into the opening for access panel No. 2 (AMM 28-10-0/201).
      (c) Do this task for all FQIS wiring and components between rib No. 5 and rib No. 7: FQIS Wiring and Component Visual Inspection.
      (d) If access is not necessary for subsequent tasks, install access panel No. 2 (AMM 28-11-11/401).
   (3) For the area in the No. 2 fuel tank between rib No. 7 (rib at WBL 198.60) and rib No. 8 (rib at WBL 227.00), do these steps:
      (a) Remove access panel No. 3 on the right wing (AMM 28-11-11/401).
      (b) Go into the opening for access panel No. 3 (AMM 28-10-0/201).
      (c) Do this task for all FQIS wiring and components between rib No. 7 and rib No. 8: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 3 (AMM 28-11-11/401).

(4) For the area in the No. 2 fuel tank between rib No. 8 (rib at WBL 227.00) and rib No. 9 (rib at WBL 254.00), do these steps:

(a) Remove access panel No. 4 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 4 (AMM 28-10-0/201).

(c) Do this task for all FQIS wiring and components between rib No. 8 and rib No. 9: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 4 (AMM 28-11-11/401).

(5) For the area in the No. 2 fuel tank between rib No. 9 (rib at WBL 254.00) and rib No. 10 (rib at WBL 279.25), do these steps:

(a) Remove access panel No. 5 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 5 (AMM 28-10-0/201).

(c) Do this task for all FQIS wiring and components between rib No. 9 and rib No. 10: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 5 (AMM 28-11-11/401).

(6) For the area in the No. 2 fuel tank between rib No. 10 (rib at WBL 279.25) and rib No. 11 (rib at WBL 304.5, do these steps:

(a) Remove access panel No. 6 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 6 (AMM 28-10-0/201).

(c) Do this task for all FQIS wiring and components between rib No. 10 and rib No. 11: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 6 (AMM 28-11-11/401).

(7) For the area in the No. 2 fuel tank between rib No. 11 (rib at WBL 304.50) and rib No. 12 (rib at WBL 329.75), do these steps:

(a) Remove access panel No. 7 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 7 (AMM 28-10-0/201).

(c) Do this task for all FQIS wiring and components between rib No. 11 and rib No. 12: FQIS Wiring and Component Visual Inspection.

(d) If access is not necessary for subsequent tasks, install access panel No. 7 (AMM 28-11-11/401).

(8) For the area in the No. 2 fuel tank between rib No. 12 (rib at WBL 329.75) and rib No. 13 (rib at WBL 355.00), do these steps:

(a) Remove access panel No. 8 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 8 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 12 and rib No. 13: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 8 (AMM 28-11-11/401).

(9) For the area in the No. 2 fuel tank between rib No. 13 (rib at WBL 355.00) and rib No. 14 (rib at WS 453.00), do these steps:
(a) Remove access panel No. 9 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 9 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 13 and rib No. 14: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 9 (AMM 28-11-11/401).

(10) For the area in the No. 2 fuel tank between rib No. 14 (rib at WS 453.00) and rib No. 15 (rib at WS 479.00), do these steps:
(a) Remove access panel No. 10 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 10 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 14 and rib No. 15: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 10 (AMM 28-11-11/401).

(11) For the area in the No. 2 fuel tank between rib No. 15 (rib at WS 479.00) and rib No. 16 (rib at WS 505.00), do these steps:
(a) Remove access panel No. 11 on the right wing (AMM 28-11-11/401).
(b) Go into the opening for access panel No. 11 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 15 and rib No. 16: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 11 (AMM 28-11-11/401).

(12) For the area in the No. 2 fuel tank between rib No. 16 (rib at WS 505.00) and rib No. 17 (rib at WS 531.00), do these steps:
(a) Remove access panel No. 12 on the right wing (AMM 28-11-11/401).

(b) Go into the opening for access panel No. 12 (AMM 28-10-0/201).
(c) Do this task for all FQIS wiring and components between rib No. 16 and rib No. 17: FQIS Wiring and Component Visual Inspection.
(d) If access is not necessary for subsequent tasks, install access panel No. 12 (AMM 28-11-11/401).

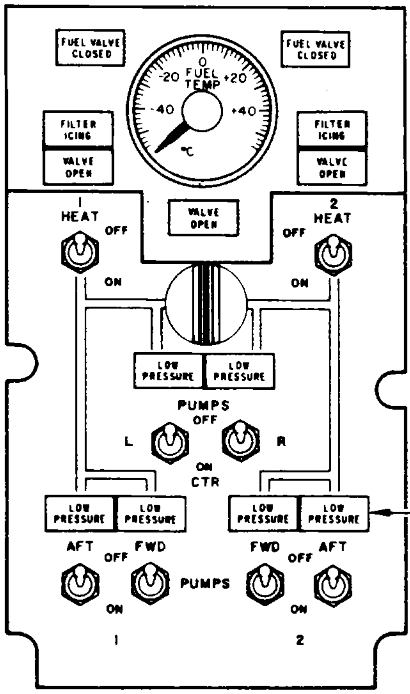
5. FQIS, Center Tank - Inspection
   A. References
      (1) AMM 28-10-0/201, Fuel Tanks
      (2) AMM 28-11-31/401, Integral Center Tank Access Panel
      (3) AMM 28-12-21/401, Center Tank Access Panel
   B. Procedure
      (1) For the center fuel tank, do these steps:
         (a) Remove the access panel for the center tank (AMM 28-11-31/401 or AMM 28-12-21/401).
         (b) Go into the center tank (AMM 28-10-0/201).
         (c) Do this task for all FQIS wiring and components in the center tank: FQIS Wiring and Component Visual Inspection.
         (d) If access is not necessary for subsequent tasks, install the access panel for the center tank (AMM 28-11-31/401 or AMM 28-12-21/401).

FUEL TANK BULKHEAD (SPAR) RECEPTACLE WIRE HARNESS - APPROVED REPAIRS

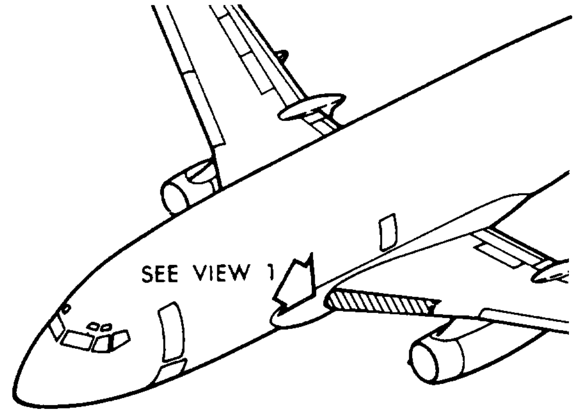
1. General
   A. This section contains a procedure for recrimping the in-tank wire harness terminal lugs. Recrimping may be required to provide a tighter lug connection to the wire to assure electrical continuity within the fuel quantity indicating system.
2. Equipment and Materials
   A. AMP hand-crimping tool - P/N 59250 or 59170
3. Recrimp Fuel Tank Wire Harness Terminal Lug
   A. Defuel airplane or defuel applicable fuel tank only, and drain sump fuel (Ref 28-23-0 MP).
   B. Remove fuel tank access panels.
      (1) For the wing tank remove underwing access panels 1, 2, 3, 4, 5, 7, 9, and 10 (Ref 28-11-11 R/I).
      (2) For the center tank, remove the center tank access panel (Ref 28-11-31 R/I).
   C. Purge applicable fuel tank (Ref 28-10-0 MP).
   D. Enter applicable tank to gain access to fuel compensator.
   E. Disconnect harness terminal leads from compensator.
   F. Loosen or remove harness clamps as necessary to provide length of slack wire.
   G. Remove the captive screw and lockwasher from terminal tongue on the HI-Z wire lead. Retain for installation.
   H. Recrimp the wire harness terminal lug using the AMP hand tool and crimping dies. Verify that end of terminal lug barrel has been deformed by the tool.
   I. Install the captive screw and lockwasher on the terminal tongue.
   J. Repeat steps G. thru I. for recrimping for LO-Z wire lead.
   K. Connect leads and tighten clamp on unit. Tighten screws/nut to following torque ranges:
      HI-Z lead (COAX) 15-16 pound-inches
      LO-Z lead (TANK) 19-23 pound-inches
      Strain relief clamp 7-9 pound-inches
   L. Install and/or tighten any wire harness clamps removed or loosened.
   M. Repeat steps E. thru L. for each tank unit.
   N. Install fuel tank access panels as applicable (Ref 28-11-11 R/I, 28-11-31 R/I).
   O. Perform fuel quantity indicating system adjustment/test (Ref 28-41-0 A/T).

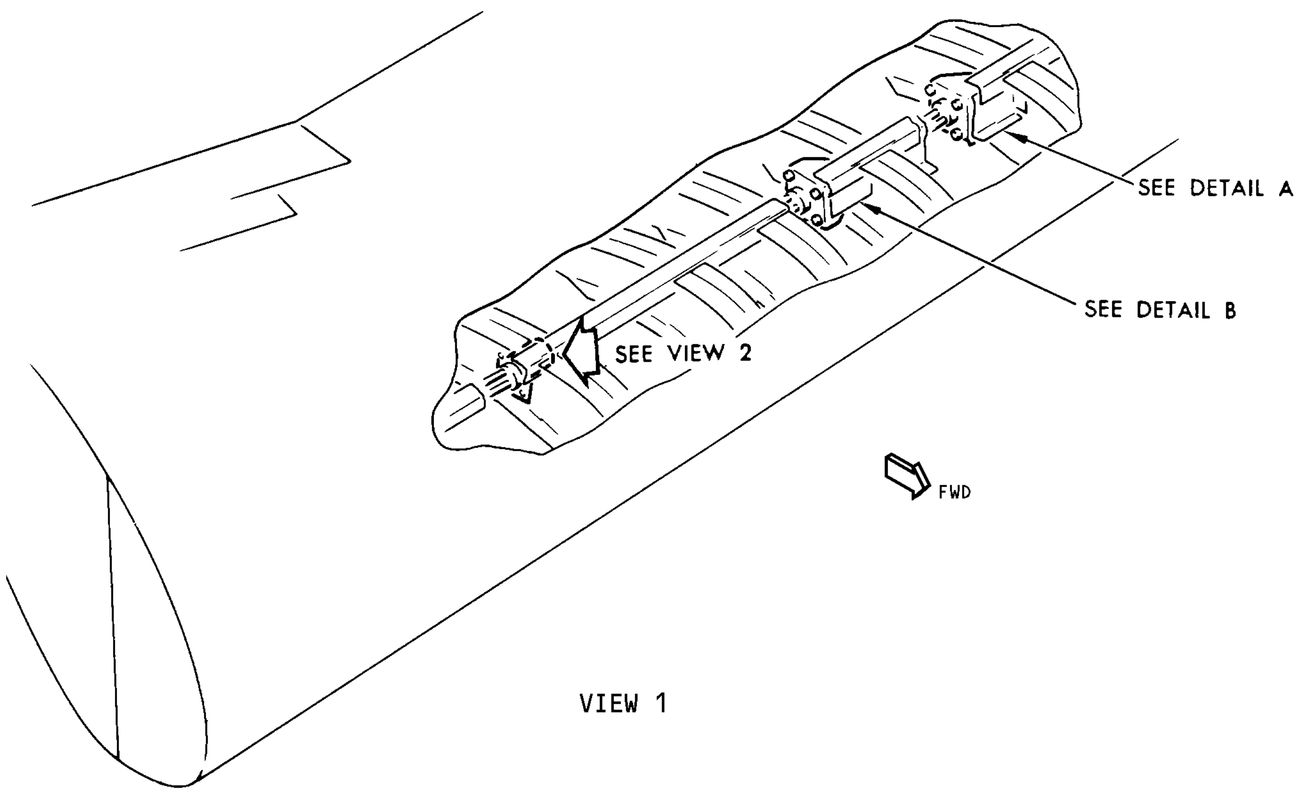
FUEL FEED LOW PRESSURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The fuel feed low pressure indicating system provides an indication when the output pressure of any fuel boost pump falls below a preset value. The system consists of six pressure actuated switches and six indicator lights, one for each fuel boost pump, together with connecting fuel lines. If the outlet fuel pressure of a fuel boost pump falls to the preset value its fuel low pressure switch will be actuated; this will illuminate the appropriate indicator light on the overhead panel.
2. Fuel Low Pressure Switches
   A. Fuel feed low pressure switches control the fuel low pressure indicating lights on the overhead panel. Each switch assembly consists of a cylindrical housing containing a diaphragm and a switch. The housing has two ports, one for inlet pressure and one for venting. The pressure inlet port is connected to a sensing line coming from a fuel boost pump check valve. The vent port is connected to a line leading overboard. The fuel feed low pressure switches are located on wing leading edge beams (Fig. 1).
   B. Low Pressure Switch
      (1) Used on all tank No. 1 and No. 2 boost pumps:
         (a) When pump output pressure drops to 5.0 psig, the switch closes to complete the circuit to energize the fuel low pressure indicating light.
         (b) When pump output pressure is increased to 7.0 psig, the switch opens and the indicating light is extinguished.
   C. Low Pressure Switch
      (1) Used on center wing tank boost pumps:
         (a) When pump output pressure drops to 14 ±1 psig, the switch closes to complete the circuit to energize the fuel low pressure indicating light.
         (b) When pump output pressure is increased to 16 psig, the switch opens and the indicating light is extinguished.
3. Operation
   A. The low pressure indicating light switches are actuated by direct pressure from the applicable boost pumps (Fig. 2).
   B. Low pressure fuel from any boost pump in any of the tanks will turn on an applicable low pressure light (Fig. 3). Low pressure from both fuel boost pumps in the same tank will turn on the applicable low pressure lights and, in addition, the fuel annunciator light and the master caution light will illuminate. When the master caution light is pressed in, the circuit is rearmed and the master caution and fuel annunciator lights are extinguished. Pressing the fuel annunciator light will reilluminate the master caution and fuel annunciator lights provided the low pressure condition remains (Ref Chapter 33, Master Warning and Caution Lights).



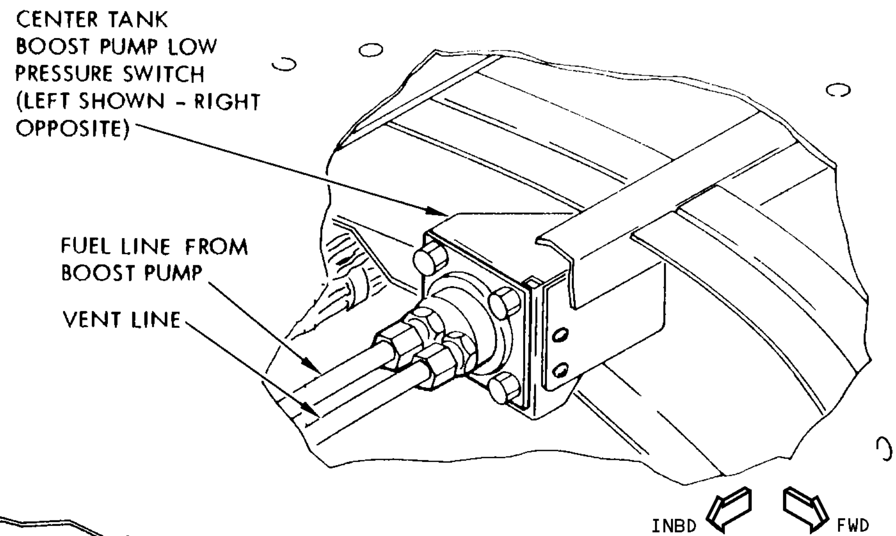
OVERHEAD PANEL



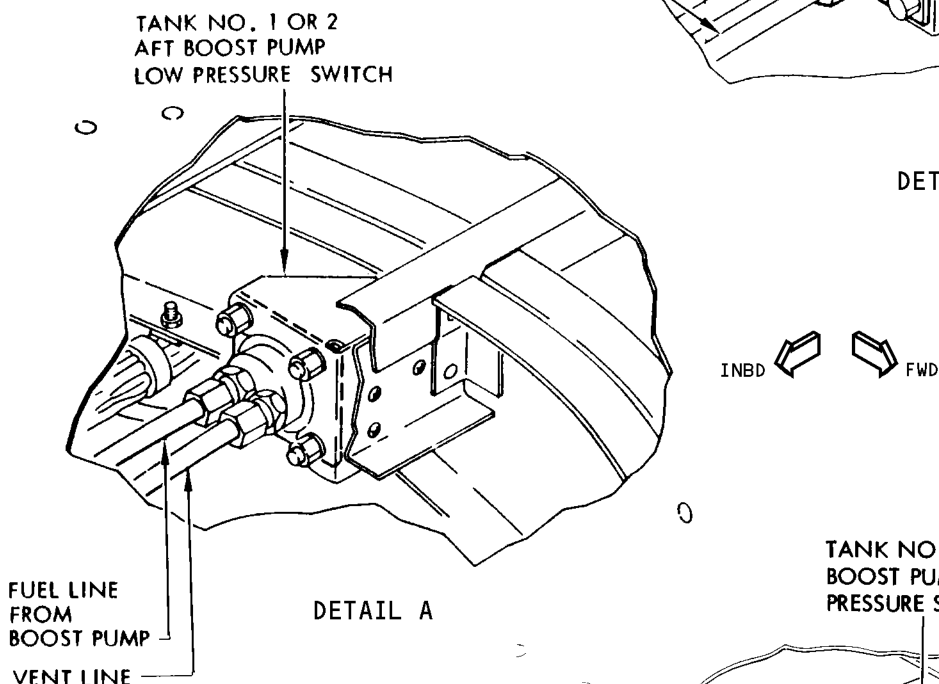


VIEW 1

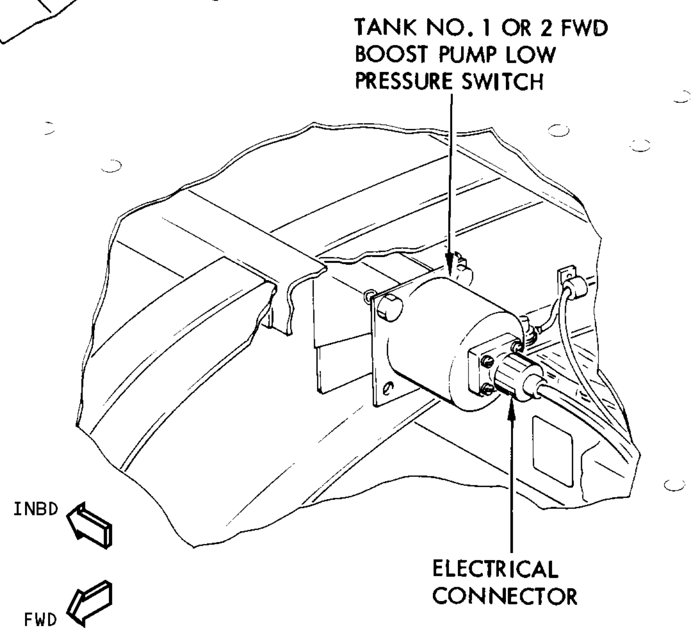
Fuel Feed Low Pressure Indicating System Component Location
Figure 1 (Sheet 1)



DETAIL B

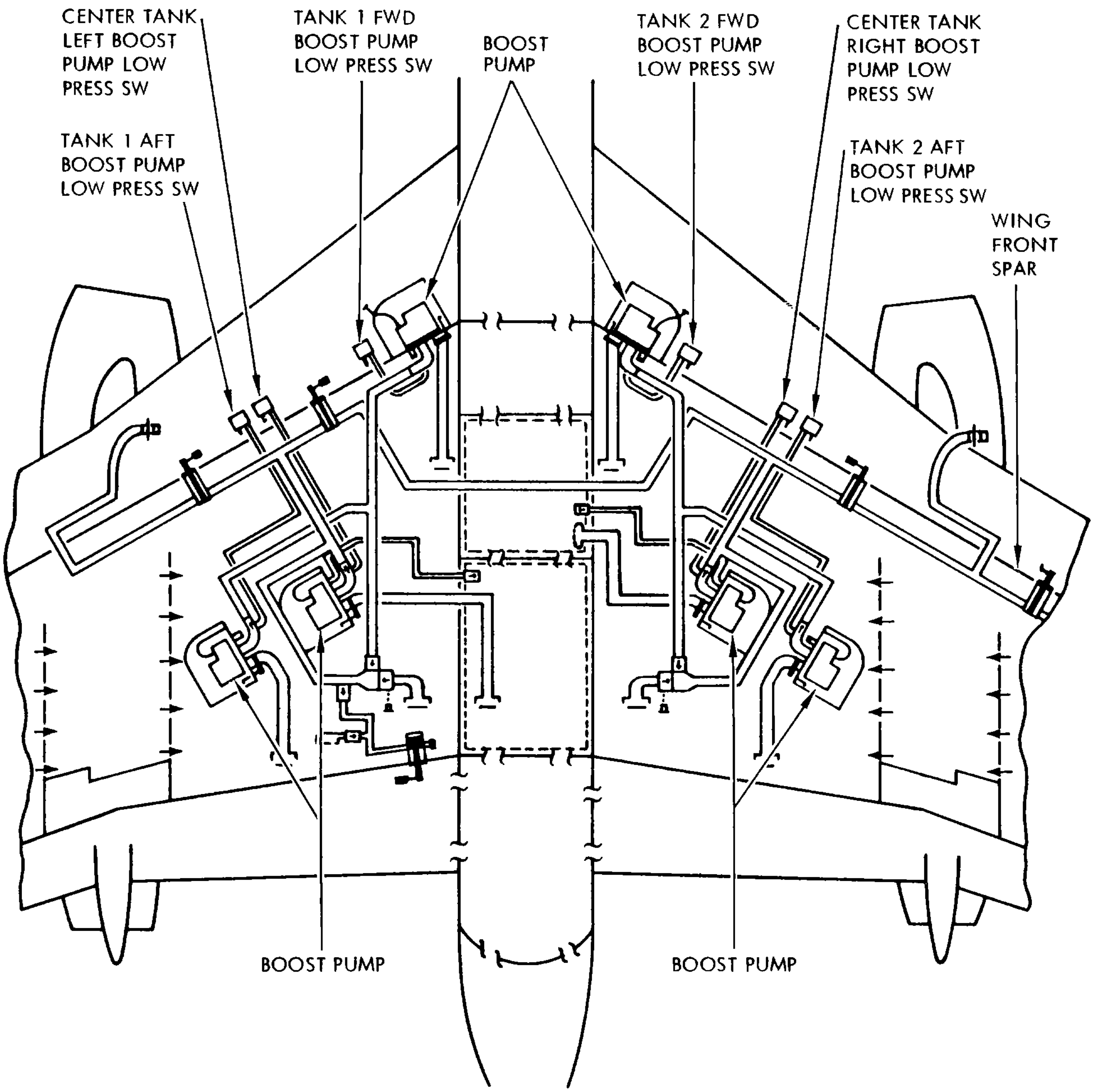


DETAIL A



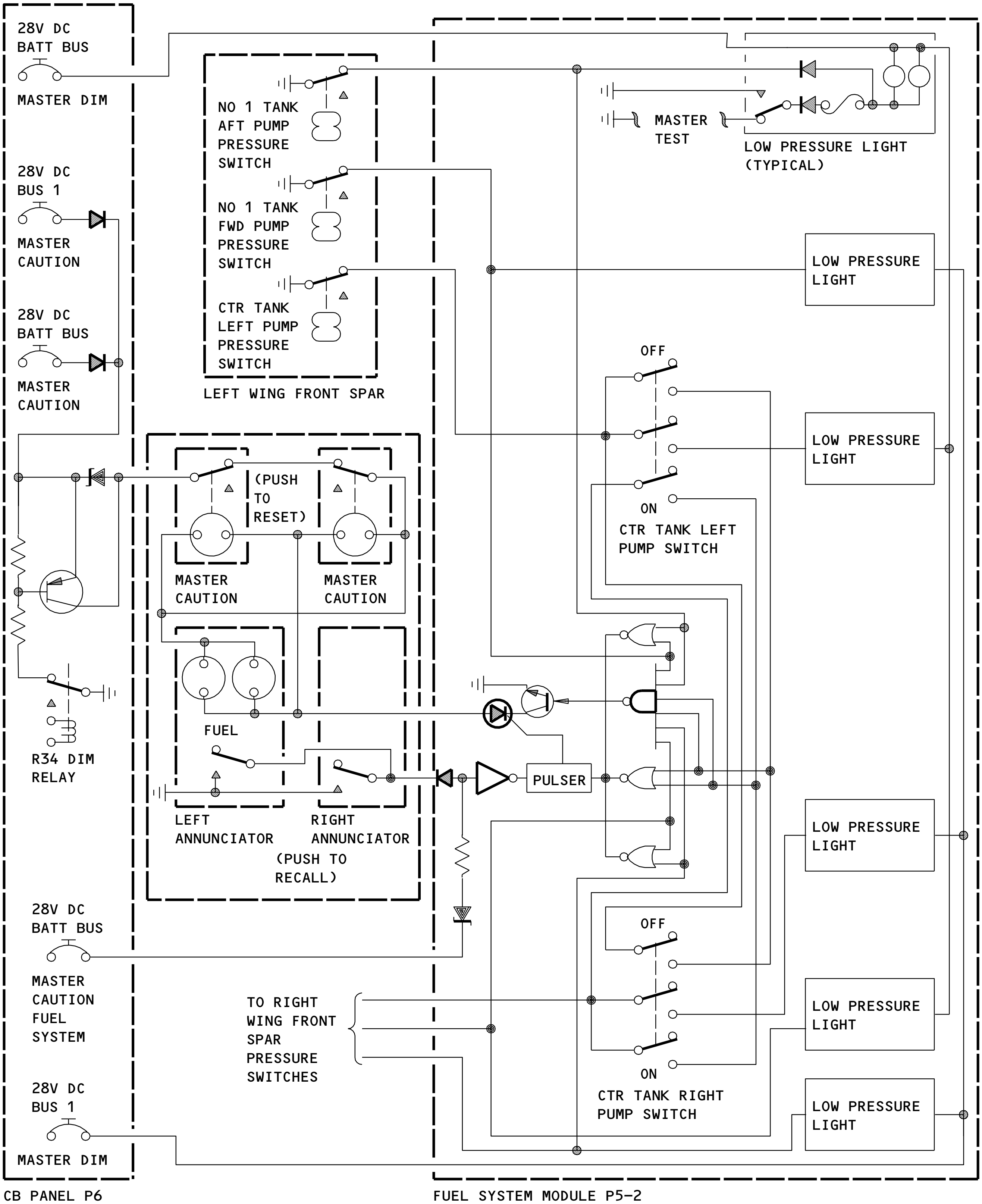
VIEW 2

Fuel Feed Low Pressure Indicating System Component Location
Figure 1 (Sheet 2)



Fuel Feed Low Pressure Indicating System Diagram
Figure 2

C. When the fuel in the center tank is depleted, the center tank boost pump low pressure lights are illuminated. The low pressure lights for the center tank boost pumps are extinguished when the boost pumps are turned off. The low pressure lights for the No. 1 or 2 tank boost pumps are illuminated when low fuel pressure exists or when the boost pumps are turned off.



Boost Pump Low Pressure Indicating Light Circuit
Figure 3

FUEL FEED LOW PRESSURE INDICATING SYSTEM - TROUBLE SHOOTING

1. General
   A. Trouble shooting the fuel feed low pressure indicating system consists of the isolation of any circuit faults to determine which component should be replaced or which wire should be repaired.
   B. The low pressure light can come on for two reasons; low fuel quantity and low pressure. During normal operation, when the fuel level decreases below the inlet for the pump, the pump will start to ingest air and the pressure will drop causing the low pressure light to come on. The low pressure light can also come on if the impeller on the pump is degraded to the point where the output pressure is less than the low pressure switch actuation pressure.
      AIRPLANES POST-SB 28A1114;
      The pressure setting for the low pressure switch is 18-22 psi.
      AIRPLANES PRE-SB 28A1114;
      The pressure setting for the low pressure switch is 4-7 psi.
   C. An intermittent fuel pump low pressure indication can occur after takeoff and remain on the airplane nose-up attitude is reduced. If this occurs, no troubleshooting is ncecessary.
2. Fuel Feed Low Pressure Indicating System Trouble Shooting Chart
   A. Make sure there is a minimum of 2000 pounds (900 kilograms) of fuel in each tank.

With fuel in all tanks, APU master switch OFF, engine shutoff valves CLOSED, manual defueling valve CLOSED, and with fuel boost pump and pump low pressure indicator light circuit breakers CLOSED.

Make sure, with fuel boost pump switches OFF, that tank No. 1 and 2 fuel low pressure indicator lights are on, center tank fuel low presure lights are OFF. IF -

Put the fuel boost pump switches to ON position. *[1] Make sure the LOW PRESSURE lights stay OFF after pressure builds up in the fuel system. IF -

Continued on page 103

TANK NO. 1 AND 2 LOW PRESSURE INDICATOR LIGHT(S) ARE OFF - Actuate indicator light press-to-test switch. IF -

CENTER TANK LOW PRESSURE INDICATOR LIGHT(S) ARE ON - Do a check for short to ground between P5 module plug and the master test switch or the applicable low pressure switch. IF -

OK - Check for open circuit breakers between P5 module plug and applicable low pressure switch. IF -

NOT OK - Replace the bulb.

OK - Replace the P5 module.

NOT OK - Replace the fuel low pressure switch or repair grounded circuit.

OK - Check for 28 volts dc for indicator light(s) at P5 plug.

NOT OK - Replace the fuel low pressure switch or repair the open circuit.

OK - Replace the P5 module.

NOT OK - Repair the circuit between P5 module and fuel low pressure light ciruit breaker.

*[1] To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

Fuel Feed Low Pressure Indicating System
Figure 101 (Sheet 1)

FUEL LOW PRESSURE INDICATOR LIGHT(S) STAY ON - Immediately put the applicable fuel boost switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

Do a check for a short to ground between P5 module plug and applicable fuel low pressure switch. IF -

OK - Check for short to ground between the P5 module plug and master test switch. IF -

NOT OK - Replace the fuel low pressure switch or repair the grounded circuit.

OK - Replace the P5 module.

NOT OK - Repair grounded circuit between P5 module and master test switch.

Fuel Feed Low Pressure Indicating System
Figure 101 (Sheet 2)

FUEL FEED LOW PRESSURE INDICATING SYSTEM - ADJUSTMENT/TEST

1. Fuel Feed Low Pressure Indicating System Test
   A. General
      (1) Testing the fuel feed low pressure indicating system requires that each fuel tank contain fuel. The low pressure indicating system test is a portion of the engine fuel feed system test; if the fuel feed system test is being done, it is not necessary to do a separate test of the low pressure indicating system.
   B. Test of the Fuel Feed Low Pressure Indicating System
      (1) Make sure that all fuel boost pump switches on the overhead panel are in the OFF position.
         (a) Make sure each tank has a minimum of 2000 pounds (900 kilograms) of fuel.
      (2) Connect electrical power to the airplane.
      (3) Make sure that all boost pump and pump low pressure circuit breakers, on the P6-3 panel, are closed.
      (4) Make sure the tank No. 1 and 2 boost pump low pressure indicating lights, on the forward overhead panel, are on.
      (5) Press-to-test the center tank boost pump low pressure indicating lights.
         (a) Make sure the bulbs come on.
      (6) Pull the engine fire switches, on aft electronic panel (P8-1), to FIRE position to close the engine fuel shutoff valves.
      (7) Make sure the APU master switch, on forward overhead panel, is in OFF position.
      (8) Make sure the crossfeed valve switch, on forward overhead panel, is in CLOSED position.
      (9) Make sure the manual defueling valve is closed.
      (10) Put the tank No. 1 forward boost pump switch in ON position.
         (a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

(11) When the fuel pressure has built up, make sure the pump low pressure indicating light goes off.
(12) Make sure there is no fuel leakage at the pressure switch.
(13) Put the tank No. 1 forward boost pump switch to the off position.
(14) Repeat steps (10) through (13) for the three remaining tank No. 1 and 2 fuel boost pumps.
(15) Open the RH center tank fuel boost pump circuit breaker, on P6-3 panel.
(16) Put the R CTR tank fuel boost pump switch in the ON position.
(17) Make sure the pump low pressure indicating light comes on.
(18) Close the RH center tank fuel boost pump circuit breaker.
(19) When the fuel pressure has built up, make sure the pump low pressure indicating light goes off.
(a) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

(20) Make sure there is no fuel leakage at the pressure switch.
(21) Put the R CTR tank boost pump switch to the off position.
(22) Repeat steps (15) through (21) for the L CTR tank fuel boost pump.
(23) Push in the engine fire switches.
(24) Determine if there is further need for electrical power on airplane; if not, remove electrical power.

2. Fuel Boost Pump Output Pressure Test

NOTE: This test is not necessary if SB 28A1114, Part II is completed.

A. General
   (1) This procedure does a check of the output pressure of each boost pump in the No. 1 and No. 2 fuel tanks. The output pressure is measured at the fuel filter drain of one of the engines. If a pump does not supply a minimum output pressure, a problem may exist.
   (2) This inspection has two alternatives. In alternative 1, you measure the output pressure of the pumps at one of the engines. Alternative 2 lets you measure the pressure for each pump at its low pressure switch. Alternative 2 may be easier if you want to replace the low pressure switches (AMM 28-42-11/401) at the same time that you do this inspection. It is only necessary to do one of the two alternatives.
   (3) This inspection is NOT applicable to airplanes (737-100 and 737-200) having only TRW fuel boost pumps for the two main fuel tanks. This test is optional for the TRW pumps.

B. Equipment
   (1) Gage-Fuel Pressure
      (a) Range 0-50 psig
      (b) Accurate to +/- 1 psig
   (2) Hose
      (a) Bleed valve and fitting with 05625-18UNF thread
   (3) Container
      (a) Five gallon or larger capacity
   (4) Ground Power Availability

C. References
   (1) Fuel Boost Pump (AMM 28-22-41/401)
   (2) Power Plant (AMM 71-00/201)
   (3) Fuel Filter Cartridge (Ref Pratt & Whitney Engine Manufacturing Maintenance Manual)

D. Test Preparation (Alternative 1)
   (1) Set the APU in the off position.
   (2) No. 1 and No. 2 fuel tanks must have a minimum of 2,000 pounds (900 kilograms) of fuel in each tank.
   (3) Set engine start switches and levers in the OFF position.
   (4) Set all six FUEL PUMP switches in the OFF position.

      NOTE: Although only four fuel boost for the main fuel tanks will be tested, all six fuel pump switches must be set in the OFF position. If they are not all off, pressurized fuel may come out when the fuel filter plug is removed. Also, if a center boost pump is on during the test, pressure indications will be inaccurate.

(5) Make sure the engine start levers are in the CUTOFF position.

E. Test Procedure (Alternative 1)

(1) Open the right removable fan cowl on the No. 1 or No. 2 engine (all four pumps can be tested from one engine).

(2) Put a five gallon container below the fuel pump on the engine.

(3) Remove the plug from the fuel purge port at the bottom of the fuel pump (Fig. 501) and discard the O-ring.

NOTE: Fuel will drain from the opening. Make sure the pressure gage hose fitting is prepared for installation to minimize fuel leakage.

(4) Attach the pressure gage hose fitting (Fig. 502) to the fuel purge port.

NOTE: Use a 0.5625-18UNJF or 0.5625-18UNF fitting.

(5) Open the airplane fuel crossfeed valve.

(6) Move the engine start lever for the engine with pressure gage attached to the RUN position.

(7) Do the following steps for each of the fuel boost pumps in the No. 1 tank and the No. 2 tank (test not necessary for center fuel tank):

(a) Make sure only one boost pump is turned on each time these steps are done.

NOTE: Do not try to test more than one boost pump at a time.

(b) Open the bleed valve on the pressure gage hose until fuel comes out of the drain hose and the pressure becomes stable.

(c) Close the bleed valve.

(d) Record the pressure shown on the pressure gage as the "Pump Off" pressure.

(e) Push the boost pump switch to the ON.

1) To operate any of the fuel boost pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication in the fuel tank.

WARNING: DO NOT OPERATE ANY FUEL BOOST PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

a) Immediately put the applicable fuel boost pump switch(es) to OFF if the LOW PRESSURE light comes on and stays on.

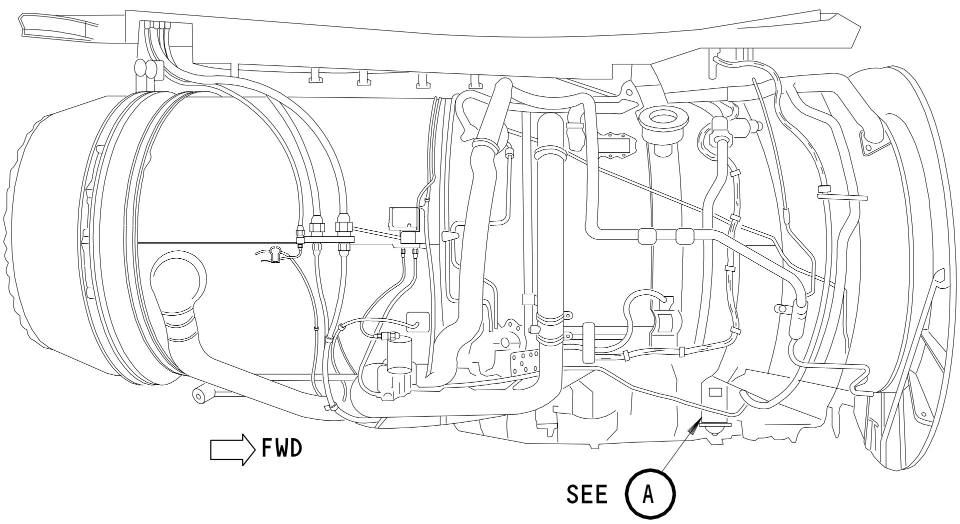
(f) Open the bleed valve on the pressure gage hose and drain approximately 0.25 gallon (1 liter) of fuel.
(g) Close the bleed valve.
(h) Read the pressure gage 5 to 10 seconds after closing the bleed valve.
(i) Record the pressure shown on the pressure gage as the "Pump On" pressure.
(j) Push the boost pump switch to the OFF position.
(k) Open the bleed valve on the pressure gage hose to release the pressure in the fuel line.

F. Boost Pump Output Pressure Calculation (Alternate 1)
(1) To find the output pressure for one of the boost pumps, subtract the "Pump Off" pressure from the "Pump On" pressure. This gives the input pressure at the engine. If the input pressure at the engine is less than 23 psi, then replace the pump (AMM 28-22-41/401).

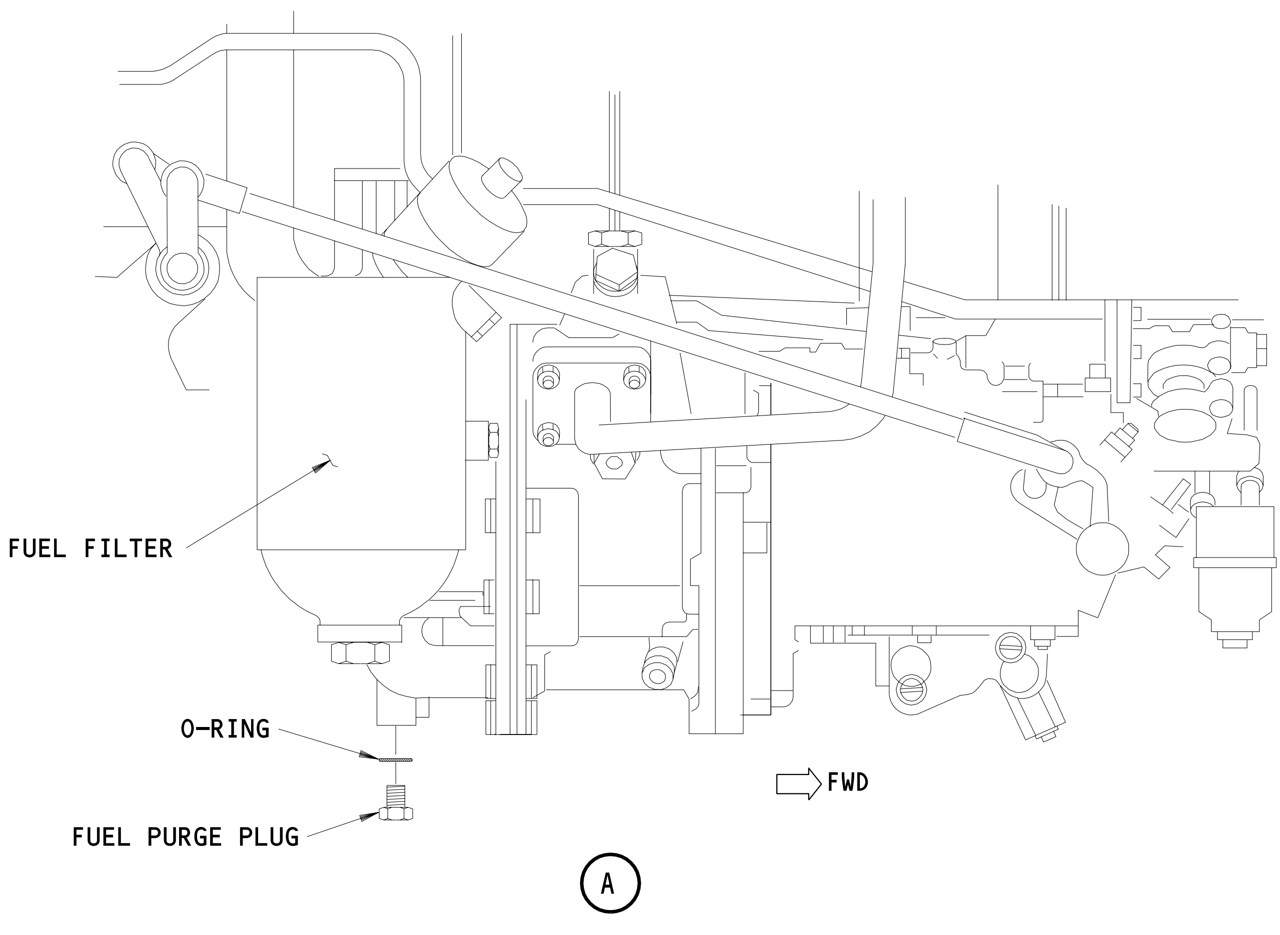
NOTE: An input pressure at the engine of 23 psi is equal to an output pressure of 36 psi at the pump. This is because a check valve between the pump and the engine opens at 13 psi. This reduces the pressure at the engine 13 psi from the output pressure of the pump.

G. Return Airplane to Normal (Alternate 1)
(1) After testing the four fuel boost pumps, do the following:
(a) Set all six FUEL PUMP switches to the OFF position.

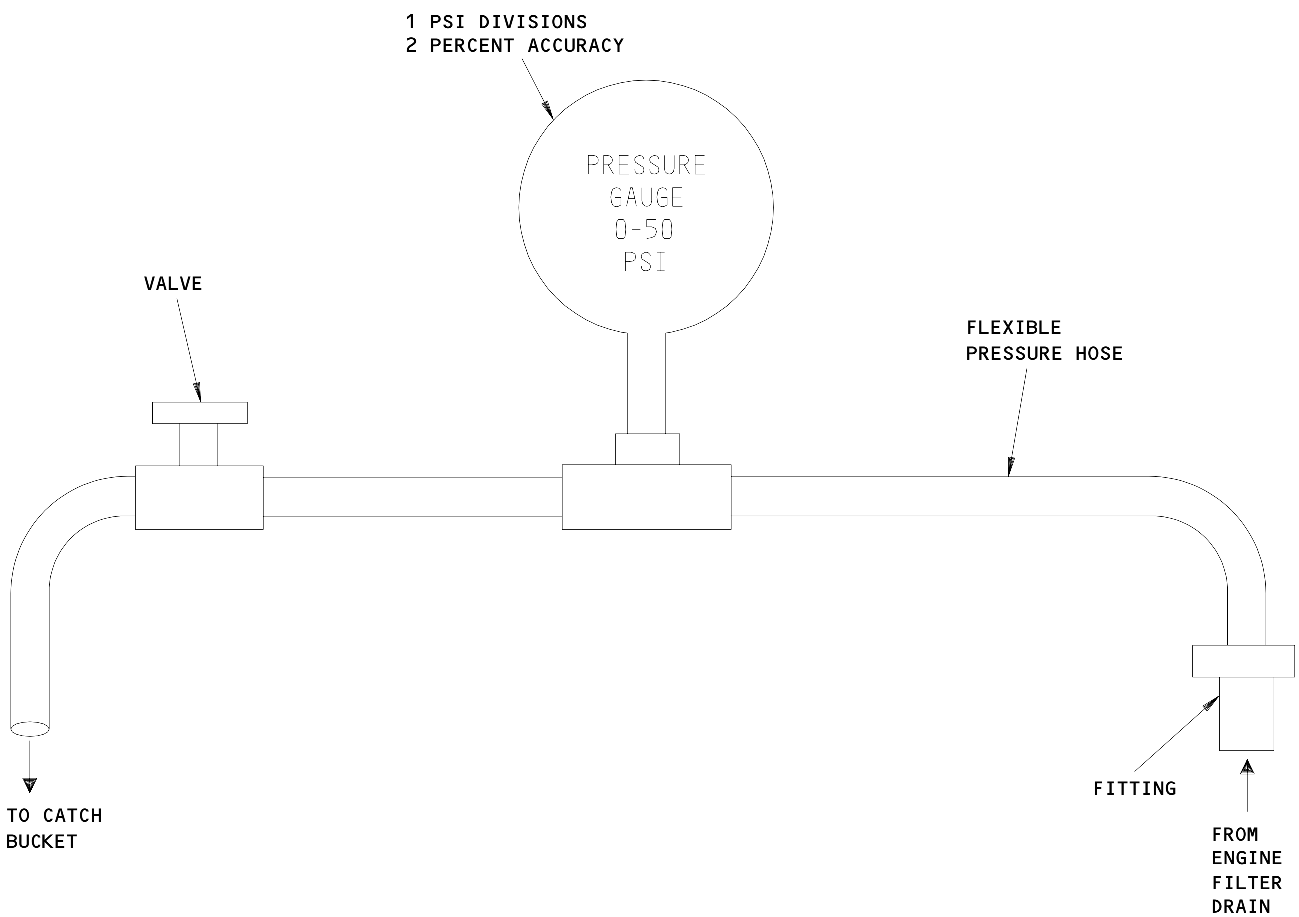
NOTE: Although only four fuel boost pumps were tested all six fuel pumps switches must be set to the OFF position. If they are not all off, pressurize fuel can come out when you disconnect the pressure gage hose from the fuel filter.



FUEL FILTER



Fuel Feed Low Pressure Indicating System
Figure 501



Fuel Boost Pump Inspection - Required Equipment
Figure 502

(b) Put the engine start lever back to the CUTOFF position.
(c) Close the airplane fuel crossfeed valve.
(d) Open the bleed valve on the pressure gage to release the pressure in the fuel line.
(e) Disconnect the pressure gage from the port.

NOTE: Fuel will drain from the opening. Preparing the drain plug for installation will minimize fuel leakage.

(f) Install the plug with a new O-ring in the port of the engine fuel pump. Tighten the drain plug to 50-75 inch-pounds (5.6 - 8.5 Newton meters).
(g) Do the "Test A - Ground Check at Idle" (AMM 71-00/501).
(h) Close engine cowl panels.

H. Test Preparation (Alternative 2)

NOTE: This alternative is recommended only if replacing the pressure switches at the same time of this inspection.

(1) Do the following inspection at each of the four low pressure switches for the main fuel tanks.

NOTE: This test is not needed for the two fuel boost pumps for the center tank.

NOTE: This inspection is NOT applicable to airplanes with only TRW fuel boost pumps for the two main fuel tanks. On airplanes with some GEC/PLESSEY and some TRW boost pumps for the two main fuel tanks, the test is necessary for GEC/PLESSEY fuel boost pumps and optional for TRW fuel boost pumps.

(2) Make sure there a minimum of 2000 pounds (900 kilograms) of fuel in each main tank.
(3) Set the engine start switches in the OFF position.
(4) Set the fuel pump switches in the OFF position.
(5) Set engine start levers in the CUTOFF position.

(6) Shut off the APU.

I. Test Procedure (Alternative 2)

(1) Do the following steps to connect the pressure gage hose:

NOTE: It is recommended only one low pressure switch be disconnected at a time. This will prevent a fuel spill if the wrong boost pump is operated.

(a) Remove the low pressure switch (AMM 28-42-11/401).
(b) Make sure fuel boost pump removal valve is closed to keep fuel leakage to a minimum.
(c) Connect the pressure gage hose to the fuel line (P/N 10-3067-3 pressure switch).

NOTE: Use a flareless nut sleeve fitting with a 0.5625-18 UNJF-3B thread on the pressure gage hose.

(d) Connect the pressure gage hose to the fitting you removed the low pressure switch from (P/N 60B92400-3 pressure switch).

NOTE: Use a 0.4375-20 UNJF fitting on the pressure gage hose.

(2) Open the removal valve for the boost pump.
(3) Set the FUEL PUMP switch (on the overhead panel) to the ON position and wait approximately one minute for the pump to warm up.
(a) To operate any of the fuel pumps, you must be in the flight compartment to continuously monitor the fuel quantity and the low pressure indication.

WARNING: DO NOT OPERATE ANY FUEL PUMP IF THE LOW PRESSURE LIGHT COMES ON AND STAYS ON. FUEL VAPORS IN THE TANK MAY IGNITE AND CAUSE A FIRE OR EXPLOSION.

1) Immediately set the applicable fuel pump switch to OFF if the LOW PRESSURE light comes on and stays on.

(4) Open the bleed valve on the pressure gage hose and drain approximately 0.25 gallon (1 liter) of fuel.

NOTE: Use a two gallon container to catch the fuel.

(5) Close the bleed valve. Read the pressure gage 5 to 10 seconds after you close the bleed valve. Record this pressure as the "Pump ON" pressure.
(6) Set the FUEL PUMP switch to the OFF position.
(7) Open the bleed valve on the pressure gage hose until the remaining pressure from the pump is gone.

NOTE: The fuel may continue to flow slowly or may stop flowing from the bleed valve after the remaining pressure is gone. This depends on the level of fuel in the tank and the height of the bleed valve.

(8) Close the bleed valve.
(9) Record the pressure on the pressure gage as the "Pump OFF" pressure.
(10) Subtract the "Pump OFF" pressure from the "Pump ON" pressure.

NOTE: This gives you the output pressure of the pump.

(a) If the output pressure of the pump is less than 36 psi, then replace the pump (AMM 28-22-41/401).
(11) Close the removal valve for the applicable boost pump.
J. Put the Airplane Back to Its Usual Condition (Alternative 2)
(1) Disconnect the pressure gage hose.
(2) Install the low pressure switch (AMM 28-42-11/401) with a new O-ring.

NOTE: Open the removal valve and do tests indicated.

(3) Do the "Fuel Feed Low Pressure Indicating System Test" (AMM 28-42-0/501).

FUEL LOW PRESSURE SWITCH - REMOVAL/INSTALLATION

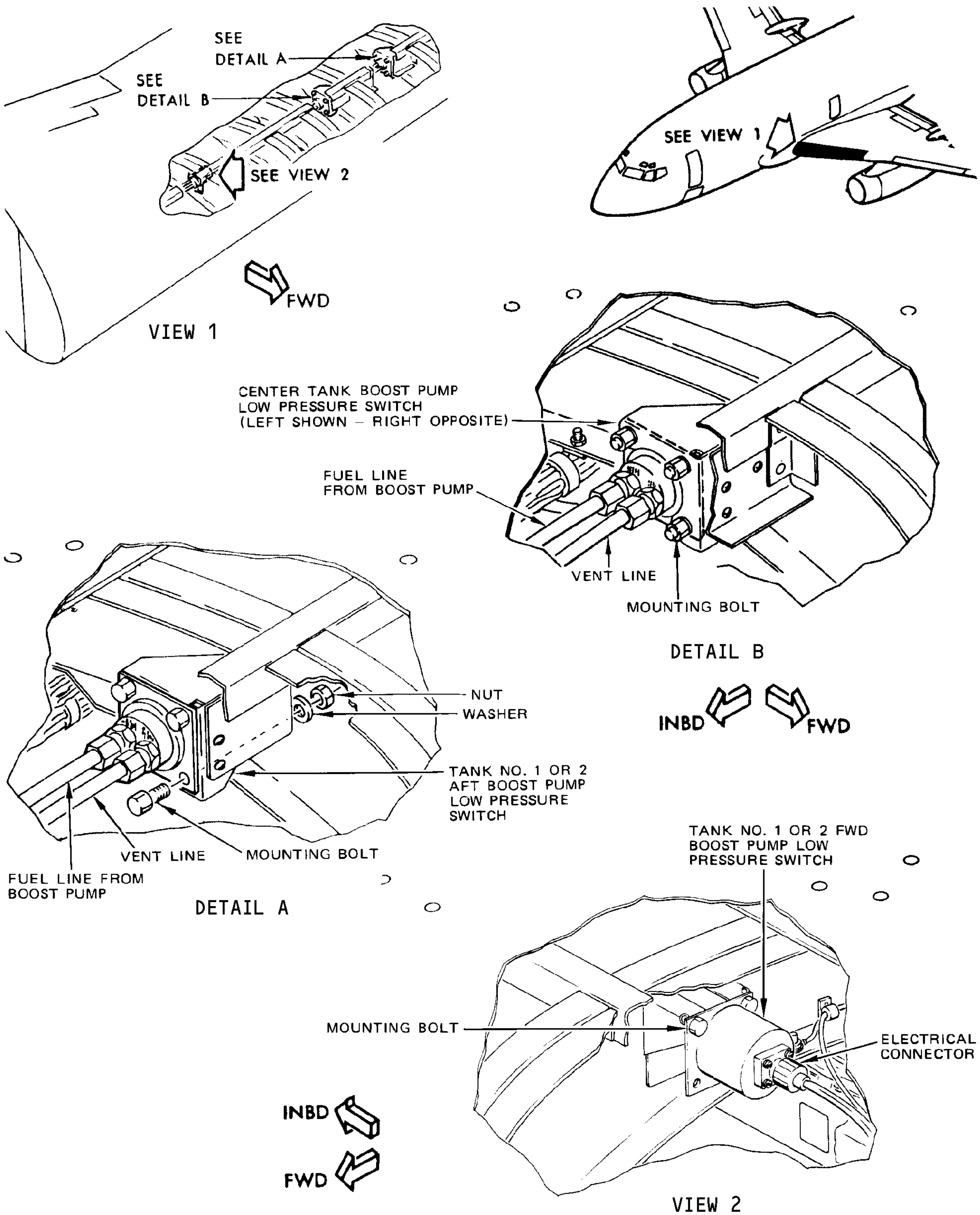
1. General
   A. Removal/installation is basically the same for all fuel low pressure switches; the only difference is location. The switches for tank No. 1 boost pumps and center tank (left side) boost pump are on the left wing leading edge ribs; the switches for tank No. 2 boost pumps and center tank (right side) boost pump are on the right wing leading edge ribs. The switches for the auxiliary tank boost pumps are in the equipment bay of the auxiliary tank (if installed).
2. Equipment and Materials
   A. Leading Edge Flap Actuator Locks - F80048-36
3. Prepare for Fuel Low Pressure Switch Removal
   A. Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

      WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

   B. Open boost pump and pump low pressure circuit breakers on P6 panel.
   C. Check that crossfeed valve switch, on forward overhead panel, is in CLOSED position.
   D. Check quantity of fuel in applicable tank. If fuel quantity does not exceed the quantity shown in Table I, steps E and F may be omitted.

TABLE I

FUEL TANK	FUEL QUANTITY	
	POUNDS	KILOGRAMS
NO. 1 OR 2	3100	1400
ONE CELL CENTER	3100	1400
TWO CELL CENTER	5100	2300
THREE CELL CENTER	7200	3260
INTEGRAL CENTER	7600	3450



Fuel Low Pressure Switch Installation
Figure 401

E. Remove the fuel boost pump access panels for the applicable fuel tank.
F. Close the applicable fuel boost pump removal valves.

WARNING: IF BOOST PUMP REMOVAL VALVES FOR APPLICABLE TANK ARE NOT CLOSED, SIPHONING OF FUEL CAN OCCUR WHEN THE FUEL LOW PRESSURE SWITCH IS REMOVED.

4. Remove the Fuel Low Pressure Switch
   A. Disconnect the electrical connector from the low pressure switch (Fig. 401).
   B. Put a small container under the low pressure switch to catch the fuel drips.
   C. Disconnect the fuel line from the low pressure switch.
   D. Disconnect the vent line from the low pressure switch.
   E. Remove the mounting bolt, washer and nut (4 locations).
   F. Remove the low pressure switch.
      (1) Remove the two unions and O-rings from the low pressure switch.
      (2) Discard the O-rings.
5. Install the Fuel Low Pressure Switch
   A. Put the low pressure switch in position on the bracket or leading edge rib, with the vent port forward of the fuel line port.
      (1) Install new O-rings on the switch ends of the unions.
      (2) Install the two unions in the low pressure switch.
   B. Install the mounting bolt, washer and nut (4 locations) (Fig. 401).
   C. Connect the fuel line to the low pressure switch.
   D. Connect the vent line to the low pressure switch.
   E. Connect the electrical connector to the low pressure switch.

   NOTE: If the electrical connectors do not mate, check low pressure switch for the correct part number.

   F. If steps 3.E. and 3.F. were accomplished previously, open the applicable fuel boost pump removal valves and install the boost pump access panels.

   NOTE: Make sure that the boost pump removal valve is open before you install the boost pump access panel.

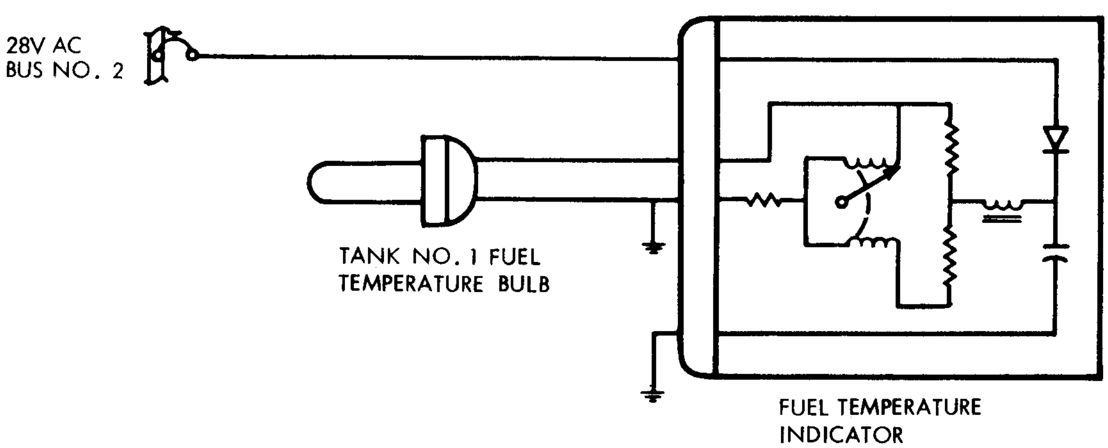
G. Do the test of the low pressure switch (AMM 28-42-0/501).

H. If the main tank or center tank low pressure switch was replaced, remove the leading edge flaps locks and retract flaps (AMM 17-81-0/201).

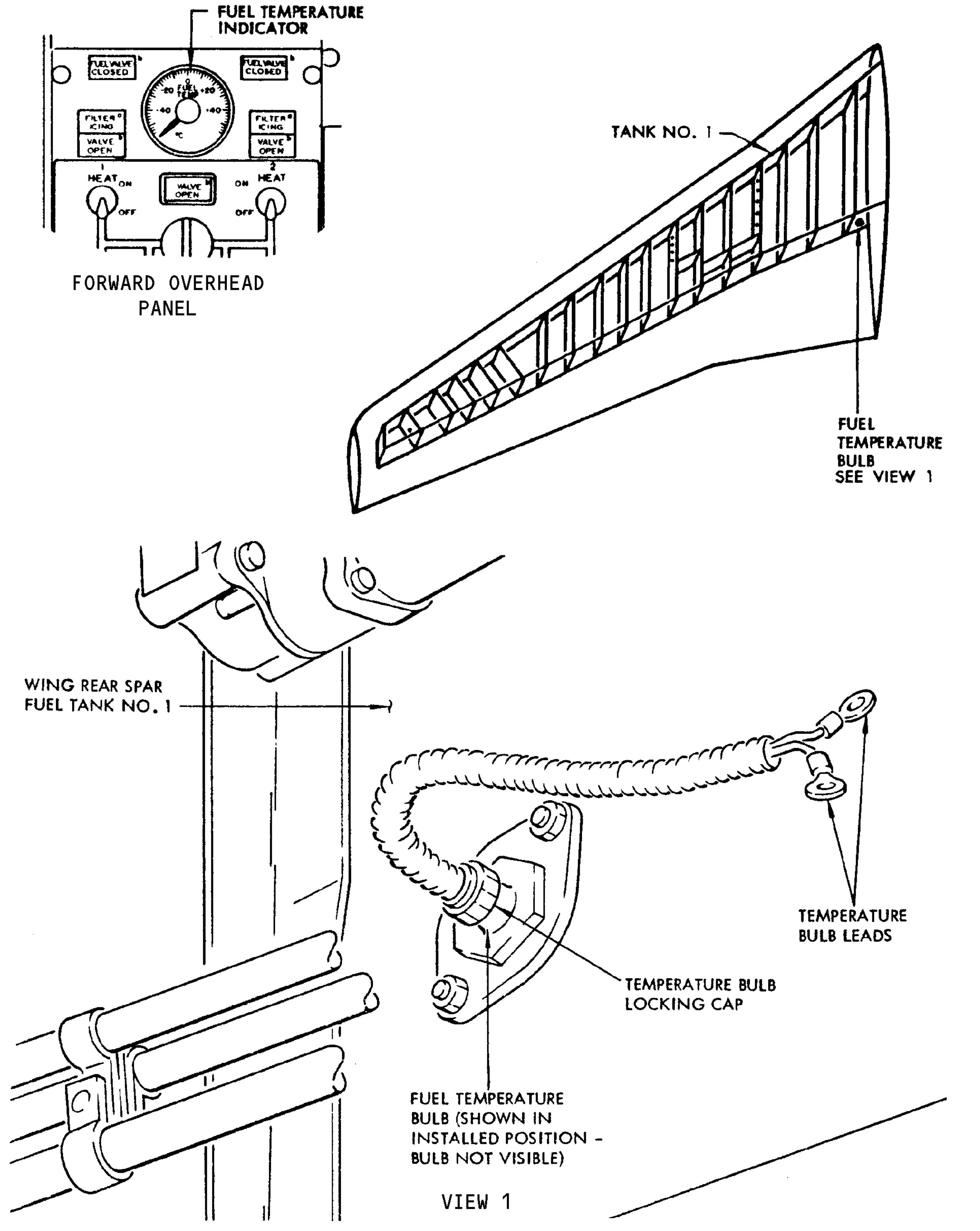
<u>WARNING</u>: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONS.

FUEL TEMPERATURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The fuel temperature indicating system allows the fuel temperature in tank No. 1 to be read on an indicator located on the forward overhead panel. A temperature sensing bulb is located in fuel tank No. 1. (See figure 2.)
   B. The temperature bulb contains a resistance element whose resistance varies in proportion to changes in temperature. This element controls the current passing through the meter movement of the fuel temperature indicator. Power is supplied to the system through 28 volt ac bus No. 2 in the load control center (P6-2). (See figure 1.)
2. Fuel Temperature Bulb
   A. The temperature bulb is an armored, bayonet locking, type bulb. It has a temperature range of -
      50 to +300°C. The resistance at 0°C is 90.38 ohms. The bulb is contained in a housing which projects into tank No. 1 through the rear spar. (See figure 2.) The housing is integral with the tank wall, and allows the bulb to be removed without draining the tank.
3. Fuel Temperature Indicator
   A. The fuel temperature indicator, located on the forward overhead panel in the control cab, is a resistance ratiometer instrument. The indicator is operated by the ratio of the currents through two coils in the meter movement. One of these currents is determined by the resistance o f the temperature bulb. The indicator dial is calibrated in degrees centigrade and reads from -56 to +56°C. (See figure 2.) With power off, the pointer remains off scale at the low temperature end. Electrical connections are made to the indicator through a disconnect plug.

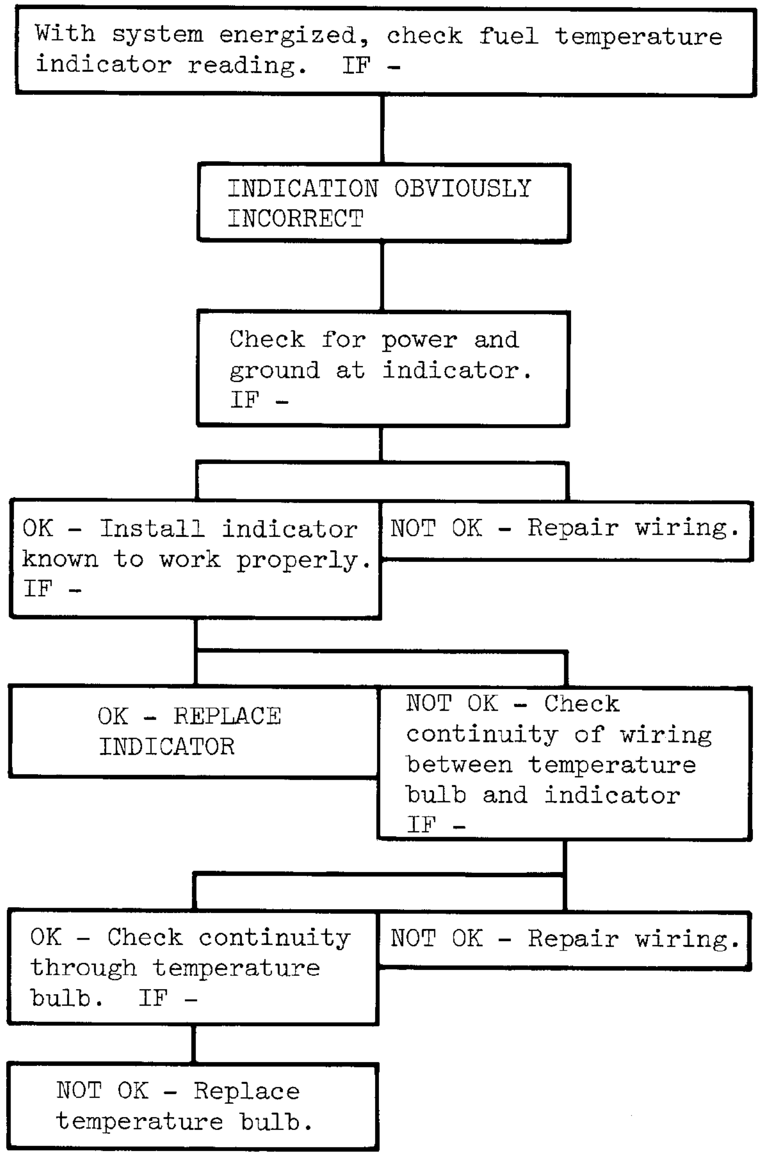


Fuel Temperature Indicating System Circuit
Figure 1



Fuel Temperature Indicating System Equipment Location
Figure 2

FUEL TEMPERATURE INDICATING SYSTEM - TROUBLE SHOOTING



Fuel Temperature Indicating System
Figure 101

FUEL TEMPERATURE INDICATING SYSTEM - ADJUSTMENT/TEST

1. Fuel Temperature Indicating System Test
   A. General
      (1) Testing the fuel temperature indicating system consists of two parts: testing the fuel temperature bulb and testing the fuel temperature indicator. This is done for the bulb by establishing a temperature at the fuel temperature bulb, measuring the temperature with a master thermometer and comparing the reading of the fuel temperature indicator with the master thermometer and for the indicator by comparing the reading of the airplane temperature indicator with a spare indicator.
   B. Equipment and Materials
      (1) Master Thermometer - Mercury Type, calibrated in degrees centigrade
      (2) Spare Temperature Indicator
      (3) Oil or water bath if conditions require tests beyond ambient temperature
   C. Prepare Fuel Temperature Indicating System for Test
      (1) Connect external power to airplane (Ref Chapter 24, 49).
      (2) Close TEMP IND circuit breaker on aft overhead panel (P6). Allow 10 minutes for system to stabilize.
   D. Test Fuel Temperature Bulb
      (1) Record indication of airplane indicator on forward overhead panel.
      (2) Rotate temperature bulb locking cap to free bulb from pin and pul1 bulb out of housing.

         NOTE: The fuel temperature bulb is located on the aft side of the aft spar, outboard of the left main landing gear, and directly below the APU fuel shutoff valve.

      (3) Place master thermometer in bulb housing and allow temperature to stabilize. Record temperature reading.
      (4) Compare readings of master thermometer and fuel temperature indicator. They should agree within + 4°C.
      (5) Replace fuel temperature bulb.
   E. Test Fuel Temperature Indicator
      (1) Read indication on airplane indicator on third crewman's lower instrument panel.
      (2) Open IND-TEMP circuit breaker and observe indicator reading. Indicator needle should return to normal down scale position.
      (3) Remove electrical connector from airplane indicator and connect it to spare indicator. Temperature readings of airplane indicator and spare indicator should correspond within + 5°C.
      (4) Remove electrical connector from spare indicator and install on airplane indicator.

F. Restore Airplane to Normal

(1) Close IND-TEMP circuit breaker.

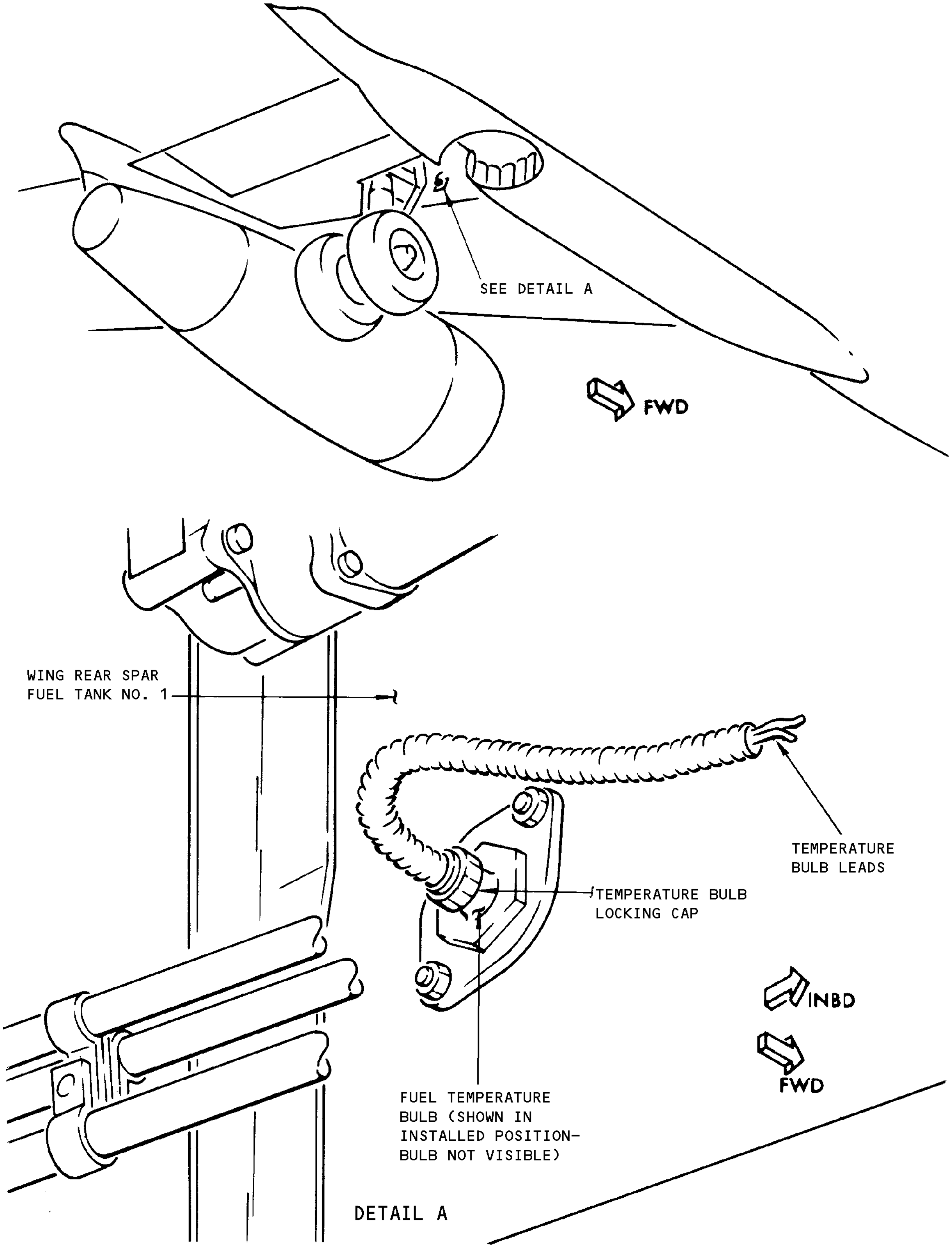
(2) If no further requirement exists for external power, disconnect external power from airplane.

FUEL TEMPERATURE BULB - REMOVAL/INSTALLATION

1. Prepare Fuel Temperature Bulb for Removal
   A. Open IND-TEMP circuit breaker on panel P6-3.
   B. Cut fuel temperature bulb leads.

      NOTE: The fuel temperature bulb is located on the aft side of the aft spar, outboard of the left main landing gear, and directly below the APU shutoff valve.

2. Equipment and Materials
   A. Silicone Grease - No. 4 (Dow Corning)
3. Remove Fuel Temperature Bulb (Fig. 401)
   A. Rotate temperature bulb locking cap to free bulb from pin.
   B. Hold locking cap and pull bulb out of bulb housing.
4. Install Fuel Temperature Bulb (Fig. 401)
   A. Apply a coat of Dow Corning No. 4 silicone grease to the external probe surfaces.
   B. Grasp temperature bulb by locking cap and insert into bulb housing.
   C. Push bulb in until stopped by pin.
   D. Rotate locking cap to lock around pin.
   E. Splice temperature bulb leads to wiring.
   F. Close IND-TEMP circuit breaker on panel P6-3.
   G. Provide electrical power (Ref 24-22-0 MP) and observe fuel temperature on indicator.
   H. Remove electrical power (Ref 24-22-0 MP), if no longer required.



Fuel Temperature Bulb Installation
Figure 401