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OIL - DESCRIPTION AND OPERATION

1. General
   A. The engine oil system is comprised of an oil storage and an oil distribution system together with the necessary indicating systems which provide measurements of oil quantity, oil pressure, and oil temperature. A low oil pressure warning system and filter bypass warning system are also provided.
   B. Each engine is provided with an independent oil system which provides cooling and lubrication of engine gears and bearings. An oil storage tank, mounted on the lower left side of the engine, furnishes a continuous supply of oil to the engine driven oil pressure pump in the accessory drive gearbox housing. An external line carries oil from the pump to a full flow type fuel/oil cooler. Cooled oil is then delivered to the engine bearings through a distribution manifold and galleries formed in the engine structure.
   C. An oil filter is provided downstream of the oil pump. The filter housing is made integral with the accessory drive gearbox casing. A removable cover is located on the outside of the gearbox to allow replacement or cleaning of the filter core. A bypass valve is arranged between the inlet and outlet of the filter. If the filter becomes clogged, this valve will open and allow a flow of unfiltered oil to circulate in the engine.
   D. Oil is scavenged from the engine bearing cavities by pumps and returned to the accessory drive gearbox. From there it is pumped back into the engine oil tank.

OIL - SERVICING

1. General
   A. Servicing of the engine oil system is accomplished by either changing or replenishing the oil supply. This procedure outlines the steps required to change the engine oil supply. Refer to Chapter 12, Servicing for engine oil tank replenishment procedures.
2. Equipment and Materials
   A. Engine oil conforming to PWA Specification 521B. (See PWA Service Bulletin No. 238.)

      CAUTION: SOME OILS ARE NOT COMPATIBLE WHEN MIXED. UNLESS COMPATIBILITY IS ASSURED, DO NOT MIX NAME BRAND OILS.

   B. Six gallon container
   C. One gallon container

      CAUTION: ENSURE THAT SERVICING CONTAINERS AND OPENING ACCESSORIES ARE CLEAN. DISPOSE OF UNUSED OIL REMAINING IN CONTAINERS.

3. Change Engine Oil
   A. Open left side cowl panel.
   B. Position containers to catch oil. Open oil tank drain on bottom of tank and remove main oil drain plug from bottom of accessory drives gearbox housing.

      NOTE: To facilitate draining oil from gearbox, remove plug and connector to drain oil from standpipe cavity.

   C. Remove nuts and washers securing main oil strainer cover to accessory drives gearbox. Remove cover and main oil strainer element, discard two packings.

      CAUTION: HOLD OIL STRAINER COVER TO KEEP IT FROM FLYING OFF UNDER SPRING PRESSURE.

D. Wash element in petroleum solvent and inspect for metal particles. Refer to P&WA Chapter 72, Engine.

CAUTION: WHEN A SMALL AMOUNT OF CONTAMINANT CONSISTING OF METAL SHAVINGS, BURRS, HAIR-LIKE PIECES, OR SLUDGE IS FOUND IN AN OIL STRAINER OR FILTER (WHERE NO DIFFERENTIAL PRESSURE (DELTA P) LIGHT CAME ON), CLEAN OR REPLACE THE STRAINER (40 MICRON TYPE) OR REPLACE THE FILTER (15/40 MICRON TYPE) AND DO AN ENGINE GROUND RUN AT PART POWER FOR SEVERAL MINUTES. ENGINE SHOULD BE ACCELERATED FROM IDLE TO PART POWER SEVERAL TIMES DURING THE RUN. RECHECK THE STRAINER OR FILTER AND, IF CLEAN, ENGINE IS READY FOR SERVICE. CHECK STRAINER FOR FILTER AFTER APPROXIMATELY 50 HOURS OF OPERATION. IF STRAINER OR FILTER IS NOT CLEAN, CLEAN OR REPLACE AND REPEAT GROUND RUN AGAIN, THEN REINSPECT. IF IT IS STILL NOT CLEAN, REMOVE ENGINE FOR DETAILED INSPECTION. DETERMINE CAUSE OF CONTAMINATION AND CORRECT AS REQUIRED. WHEN A LARGE AMOUNT OF CONTAMINANT, OR CHIPS, OR FLAKES, IS FOUND IN AN OIL STRAINER OR FILTER (WHERE NO DIFFERENTIAL PRESSURE (DELTA P) LIGHT CAME ON), DO THE TROUBLESHOOTING FOR OIL FILTER/STRAINER DIFFERENTIAL PRESSURE (DELTA P) LIGHT ON.

E. Allow engine oil to drain to slow drip for approximately 1/2 hour. Install main oil drain plug and standpipe cavity drain plug and connector in bottom of accessory drives gearbox housing. Lockwire plugs.
F. Close oil tank drain valve on bottom of tank.
G. Install main oil strainer element in strainer port of accessory drives gearbox. Install strainer cover and secure with washers and locknuts. Refer to P&WA Chapter 72, Engine.

CAUTION: BE SURE STRAINER ELEMENT IS INSTALLED RIGHT SIDE UP. WHEN CORRECTLY INSTALLED, THE STRAINER BYPASS VALVE WILL BE AT THE COVER END OF THE ELEMENT.

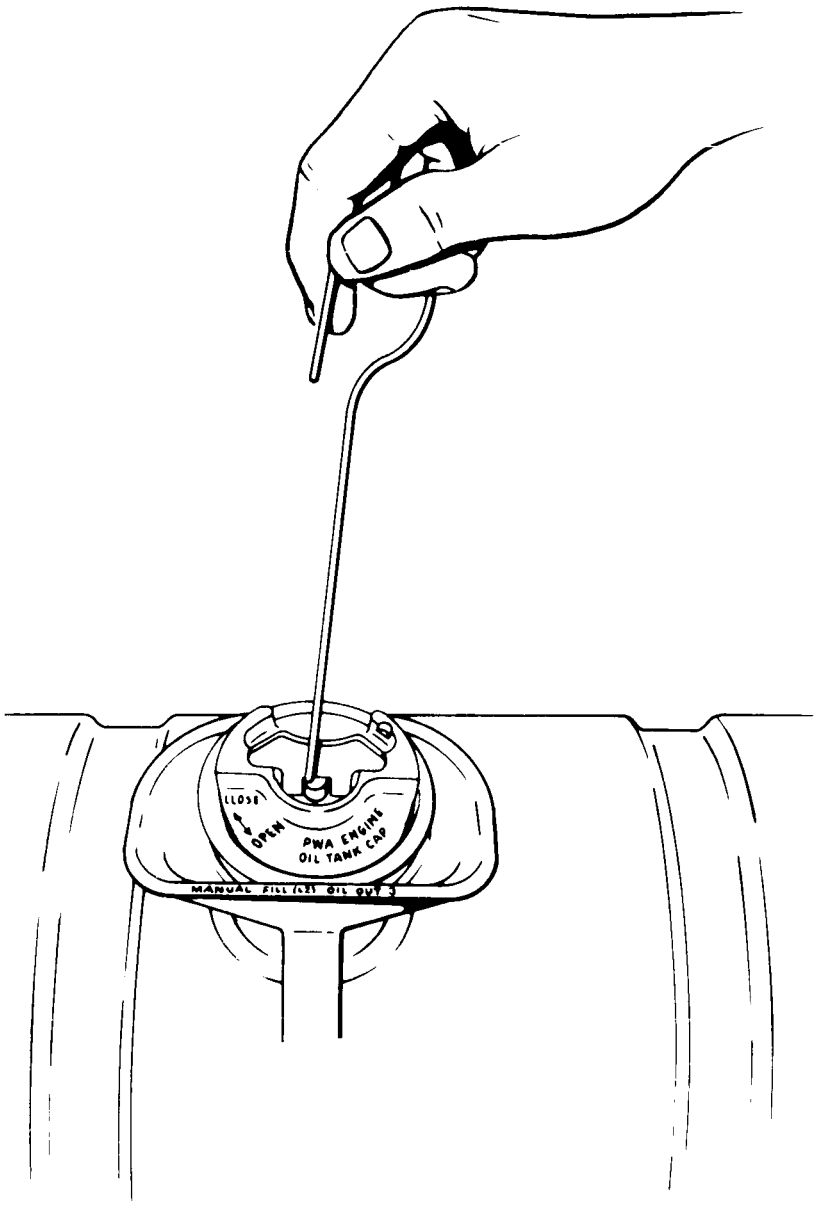
H. Remove self-locking filler cap from port in sump cavity and fill oil tank to center of upper sight gage with new oil. Replace oil tank filler cap and install, or close, cowl panels.

CAUTION: INSECURE INSTALLATION OF THE OIL TANK FILLER CAP MAY OCCUR IF INTERNAL STOPS ARE WORN PERMITTING INCORRECT LOCK ROTATION.

CHECK FOR PROPER LUG ENGAGEMENT AFTER CAP IS INSTALLED AND LOCK HANDLE IS TURNED TO "CLOSE" BY ATTEMPTING TO REMOVE CAP. (PULL STRAIGHT OUT ON HANDLE BY HAND OR WITH A WIRE HOOK AS SHOWN IN FIGURE 301.) WHEN STOWING LOCK HANDLE, CHECK THAT MACHINED SURFACE OF HANDLE IS TURNED UP AND AS-CAST SURFACE IS DOWN TOWARD CAP. PROPERLY LOCKED AND STOWED, THE LOCK HANDLE PRESENTS A SMOOTH FLAT SURFACE THAT IS FLUSH WITH THE CAP.

NOTE: If the engine oil supply was changed from one type of oil to another, operate engine at idle rpm for at least 1 minute. After engine shutdown, drain and service the system per steps A, B, D, E, and G.

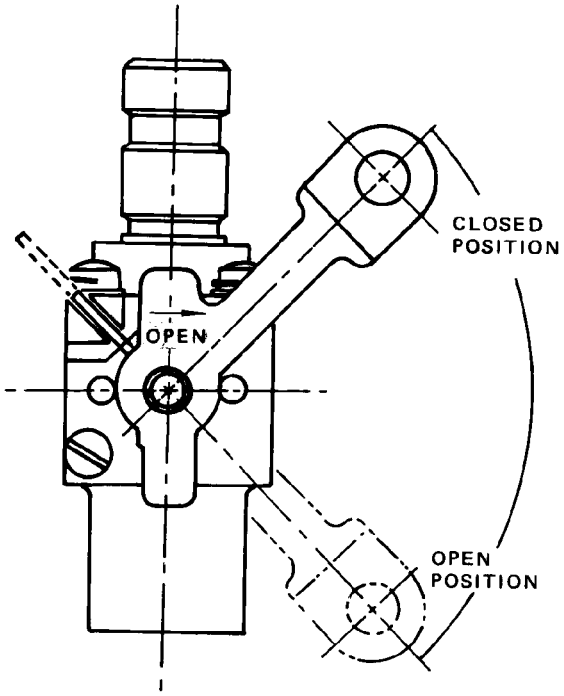
When the engine is operated for the first time after an oil change, check the oil supply tank level after engine shutdown and replenish as required. Refer to Chapter 12, Servicing.



Checking Oil Tank Filler Cap Installation
Figure 301

ENGINE OIL STORAGE - DESCRIPTION AND OPERATION

1. General
   A. Each engine is provided with a cylindrically shaped oil tank which mounts on the left front face of the accessory drive gearbox and is secured at the front by a strap. With the engines installed on the airplane, the tank holds approximately five U.S. gallons. The remaining tank volume accommodates foaming and expansion of the oil.
2. Engine Oil Tank
   A. The tank is constructed of stainless steel and is capable of withstanding without permanent deformation, the stresses imposed by pressure, vibration, and shock loads such as can occur during landing, rough flight conditions, etc. A baffle serves to minimize sloshing of the oil in the tank. A deaerator in the tank separates most of the air from the returning oil, thus minimizing foaming.
   B. Servicing of the oil tank is accomplished through a filler port, located in a sump cavity. When servicing through the filler port, any oil that is spilled in the sump cavity is drained through tubing to drain holes in the cowl panels.
   C. For ground check of oil quantity, a dipstick is attached to the self-locking filler cap. A capacitance sensing probe in the tank transmits an electrical signal for remote indication of oil quantity during flight.
   D. The tank is equipped with an inlet strainer at the filler port. An outlet strainer is located at the drain valve on the underside of the tank.
3. Oil Tank Drain Valve
   A. The oil tank drain valve is located at the bottom of the oil tank. The handle is spring-loaded to the valve closed position. Manually rotating the handle 90 degrees in a clockwise direction opens the valve allowing the oil to drain from the tank. The handle is locked in the valve open position by a ball detent arrangement. Counterclockwise movement of the handle unseats the balls form the detents and allows the spring tension to return the handle to the valve closed position (Fig. 1).



Oil Tank Drain Valve
Figure 1

ENGINE OIL TANK - REMOVAL/INSTALLATION

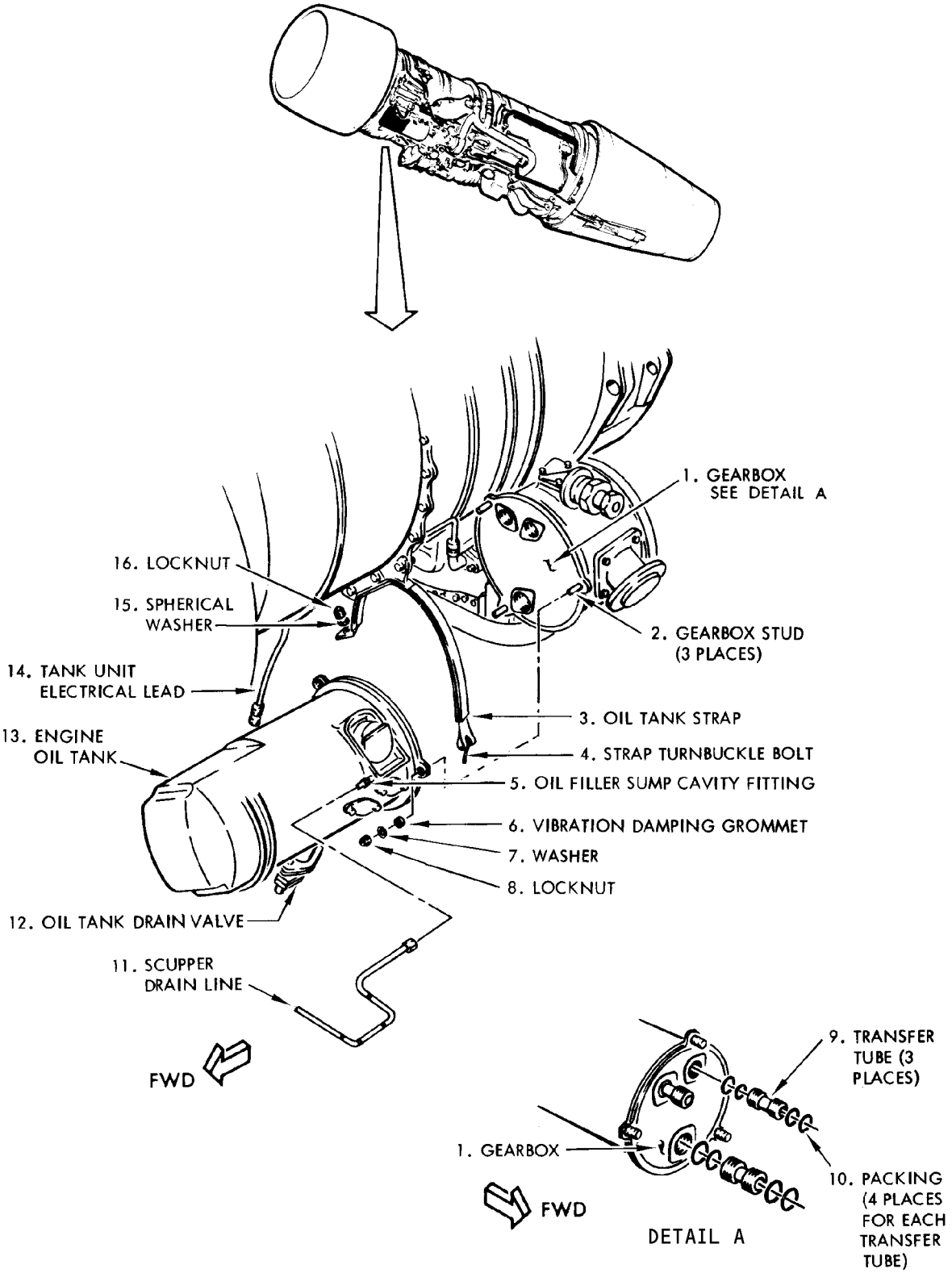
1. Prepare to Remove Engine Oil Tank
   A. Open left side removable cowl panel.
   B. Drain oil from tank prior to removal by opening drain valve on bottom of tank. Close valve after draining.
2. Remove Engine Oil Tank
   A. Disconnect electrical connector from oil quantity tank unit on underside of oil tank. Remove two clamps retaining tank unit electrical lead to tank unit mounting flange.
   B. Remove bolt and disconnect electrical bonding jumper from tank.
   C. Disconnect scupper drain line (11, figure 401) at oil filler sump cavity fitting (5).
   D. Remove three locknuts (8) and washers (7) holding tank (13) to gearbox (1).
   E. Support tank and remove locknut (16) and washer (15), if installed from tank strap turnbuckle bolt (4) and open strap (3).
   F. Pull tank straight forward off gearbox studs (2) and remove from engine.

      CAUTION: USE CARE TO AVOID DAMAGE TO TRANSFER TUBES BETWEEN TANK AND GEARBOX.

   G. Remove three transfer tubes (9) and cover openings.
3. Install Engine Oil Tank
   A. Install vibration damping grommet and bushing (6, figure 401) in each of three oil tank lugs.
   B. Install four new packings (10) on each of three straight transfer tubes (9). Coat packings lightly with petrolatum.
   C. Install three transfer tubes (9) in their openings in front of gearbox (1).
   D. Position tank (13), drain valve (12) down, in front of gearbox (1). Move tank aft into position, engaging bushings over gearbox studs (2) and mating transfer tubes (9) with openings in rear of oil tank.

      CAUTION: USE EXTREME CARE TO AVOID DAMAGING OR DISRUPTING TUBES AND/OR PACKINGS.

   E. Install three washers (7) and locknuts (8) on gearbox studs (2).
   F. Wrap oil tank strap (3) around oil tank (13).



Engine Oil Tank Installation
Figure 401

G. Install spherical washer (15) and locknut (16) on strap turnbuckle bolt (4). Tighten locknut until just before it begins to tension oil tank strap (3). Check torque, then continue tightening until 3 to 5 pound-inches above the checked torque is reached. Strap turnbuckle bolt (4) threads must be flush or protrude above locknut (16).

NOTE: For engines incorporating the two piece construction strap, the spherical washer is not required.

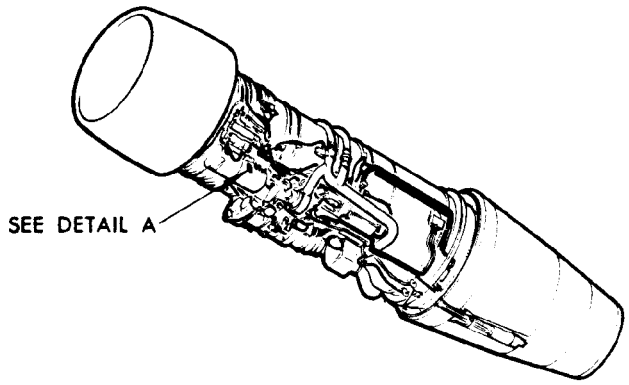
H. Connect scupper drain line (11) to oil filler sump cavity fitting (5).
I. Connect the electrical bonding jumper to oil tank using bolt.
J. Install two clamps retaining tank unit electrical lead (14) to tank unit mounting flange.
K. Connect electrical connector to oil quantity tank unit on underside of oil tank.

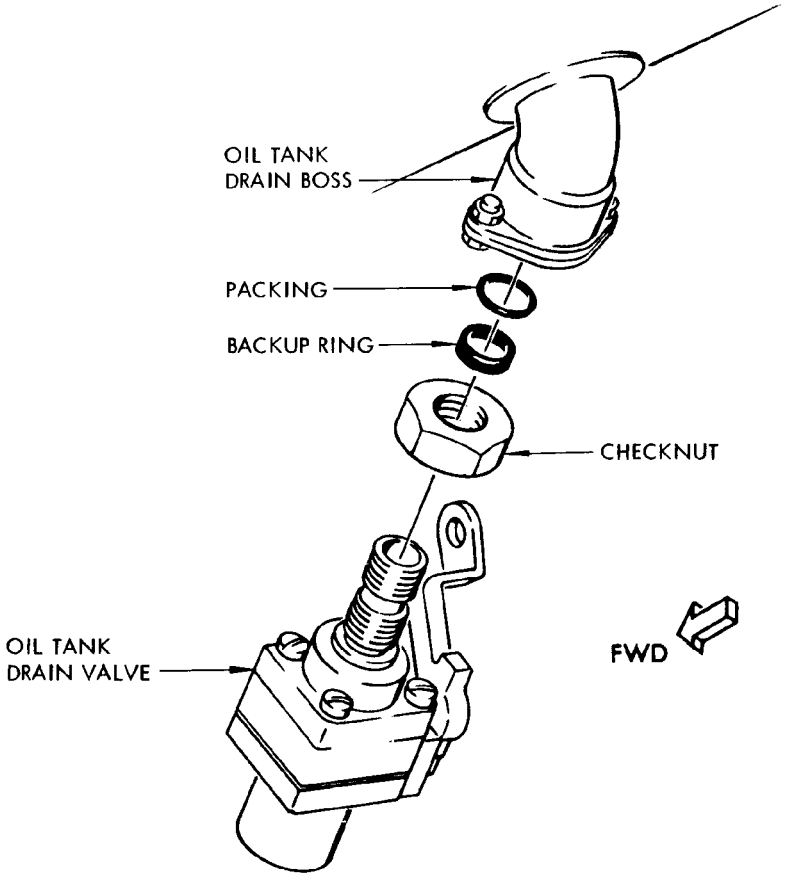
CAUTION: IF THE GEARBOX IS NOT DRAINED BEFORE SERVICING THE OIL TANK THE OIL SYSTEM COULD BE OVER SERVICED. THIS COULD RESULT IN A BUILDUP OF SUFFICIENT PRESSURE TO RUPTURE THE OIL TANK.

L. Drain the gearbox by removing the gearbox drain plug.
M. Install the drain plug with a new seal into the gearbox, tighten to the recommended torque and lockwire.
N. Service oil tank to operational level. Refer to Chapter 12, Engine Oil Tank Servicing.
O. Close left side removable cowl panel.
P. Test engine in accordance with Power Plant Repair Reference Table, Test A and allow oil temperature to reach 40°C during test. Refer to Chapter 71, Power Plant.
Q. Service oil tank to operational level. Refer to Chapter 12, Engine Oil Tank Servicing.

OIL TANK DRAIN VALVE - REMOVAL/INSTALLATION

1. Prepare to Remove Oil Tank Drain Valve
   A. Open left side cowl panel.
   B. Open tank drain valve and drain oil from engine oil tank. Close drain valve after draining.
2. Remove Oil Tank Drain Valve (See figure 401.)
   A. Loosen checknut on drain valve.
   B. Remove drain valve from oil tank drain boss insert on bottom of tank.
3. Install Oil Tank Drain Valve (See figure 401.)
   A. Install checknut on drain valve, counterbored face of nut away from body of valve.
   B. Install a new backup ring into counterbored face of checknut, then install a new packing against backup ring. Adjust position of packing, backup ring, and checknut.
   C. Insert drain valve into drain boss insert on bottom of tank and turn valve until O-ring packing comes in contact with drain boss.
   D. Adjust position of valve, then tighten checknut to recommended torque. (Refer to Chapter 72 - Engine.) Lockwire checknut.
   E. Service oil tank to operational level (AMM 12-13-11/201).
   F. Close left side cowl panel.



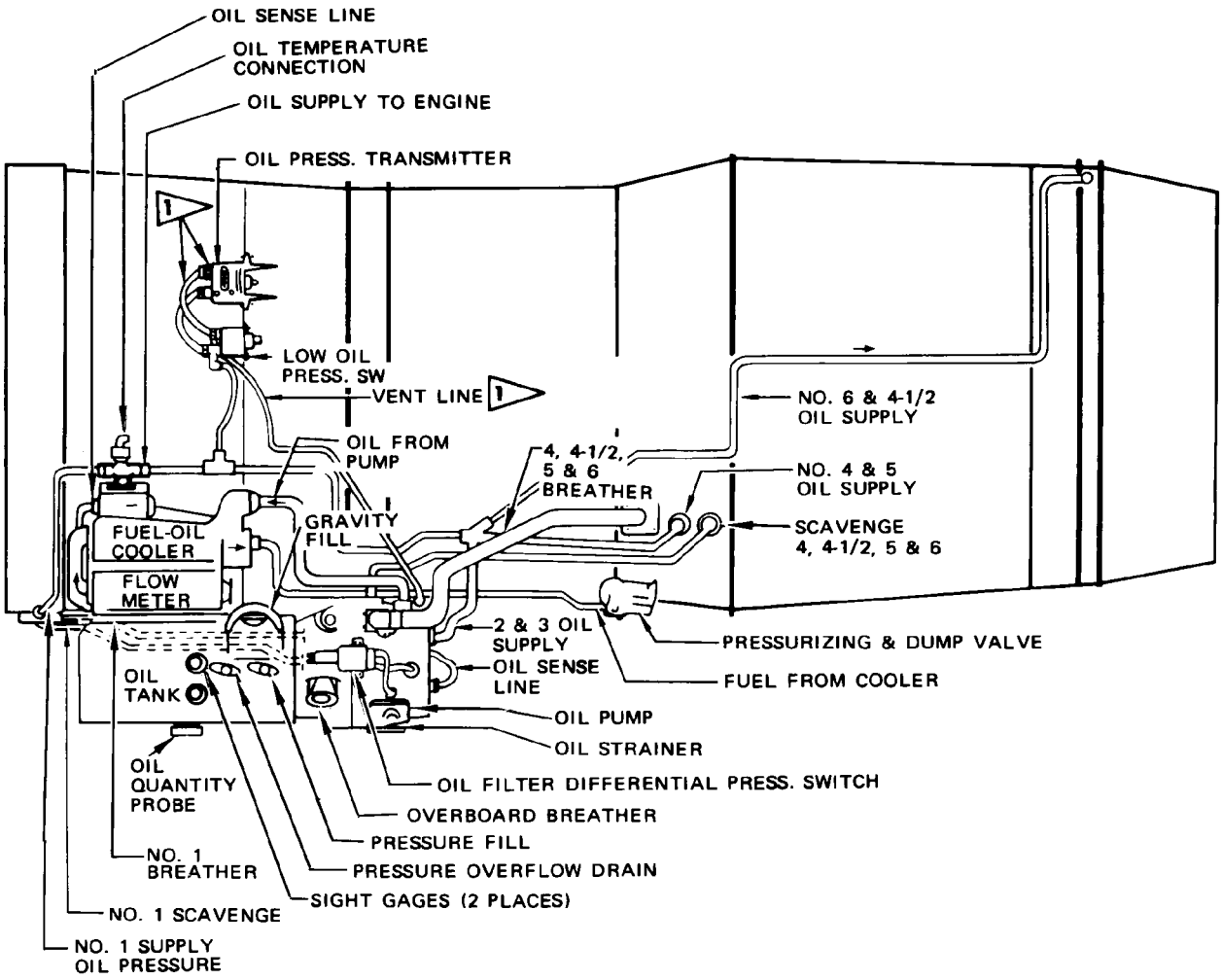


DETAIL A

Oil Tank Drain Valve Installation
Figure 401

ENGINE OIL DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The engine oil distribution system is a self-contained high pressure design consisting of a pressure system which supplies lubrication to the main engine bearings and to the accessory drives, and a scavenge system by which oil is withdrawn from the bearing compartments, and from the accessories, and then returned to the oil tank. A breather system connecting the individual bearing compartments, the accessory drive gearbox, and the oil tank completes the oil distribution system. (See figure 1.) For a complete description of the internal engine oil system refer to chapter 72-00 "ENGINE - DESCRIPTION."
2. Oil Pressure System
   A. Oil flows by gravity from the oil tank to the engine driven pump, located inside the accessory drive gearbox housing. Pressure oil from the pump flows through an oil filter to a fuel cooled oil cooler. From this unit it passes to the various engine bearings. Bypass valves are provided in the filter and in the oil cooler. These valves open and allow oil to continue flowing through the system in the event that either unit becomes clogged. An adjustable pressure regulating valve, installed in the accessory drive gearbox on the pressure side of the pump, maintains system pressure and flow by bypassing oil back to the pump inlet.
3. Scavenge Oil System
   A. Four scavenge pumps return oil from the bearing cavities to a sump in the accessory drive gearbox. The scavenge stage of the engine driven pump then returns the oil to the tank. A deaerator in the tank separates the air from the returning oil, thus minimizing foaming.
4. Oil Breather System
   A. An oil breather system connects the engine bearing cavities, the accessory drive gearbox, and the oil storage tank. This system controls the pressures in the accessory drive gearbox and main bearing cavities, thereby ensuring adequate oil flow and preventing scavenge pump cavitation during engine operation.
   B. Oil droplets and vapor are removed from the breather airstream by a centrifugal separator located in the accessory drive gearbox. After passing through the separator unit the breather air is exhausted overboard through a vent pipe.
5. Fuel Coolant Oil Cooler
   A. The fuel-oil cooler is of the full flow type with a pressure bypass feature. The cooler is mounted on the lower left side of the front compressor case. It consists of a housing containing a removable core composed of more than 200 soda straw-like tubes through which fuel passes; a series of baffles within the core which direct the flow of oil around the tubes; and a bypass valve which permits oil flow to the main bearing compartments in the event of core clogging.



1 VENT HOSE AND LINE NOT INSTALLED AND VENT PLUG INSTALLED IN PLACE OF UNIONS ON ENGINES WITH TRANSMITTER VENTED TO AMBIENT

Engine External Oil Distribution
Figure 1

B. The oil leaves the oil pressure pump in the gearbox and flows to the fuel oil cooler. The oil flows through the cooler directed by baffles to flow around the tubes through which fuel flows. Heat from the oil is transferred through the tube walls to the fuel. If the cooler becomes clogged, the oil bypass valve opens to permit the continuous flow of oil. Oil leaves the cooler and flows through the oil pressure tubing to the main bearing compartments.

ENGINE OIL DISTRIBUTION - MAINTENANCE PRACTICES

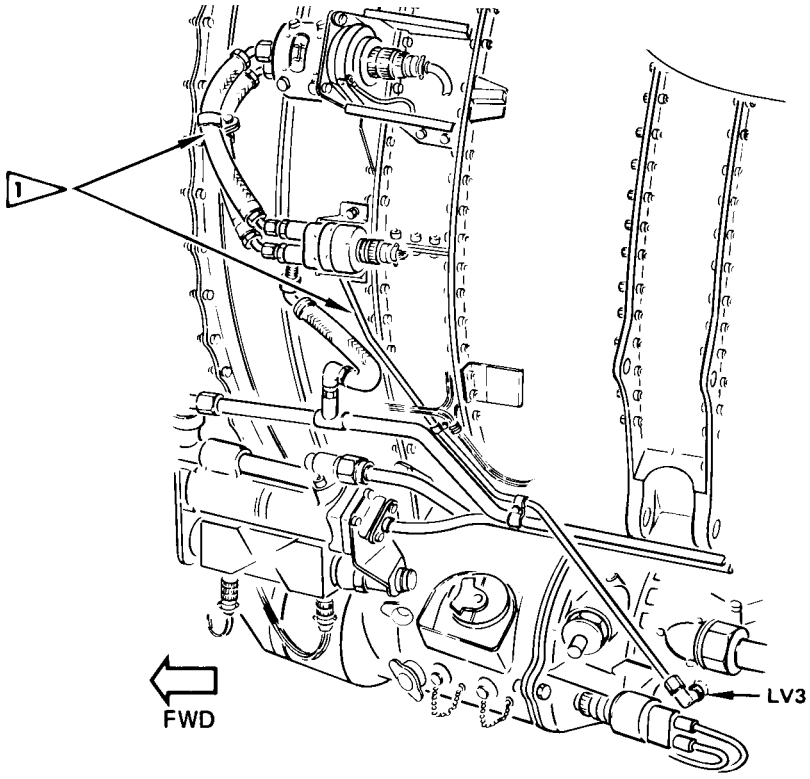
1. General
   A. This section provides instructions for performing the oil breather pressure test.
   B. The oil breather pressure test is performed with cowl panels and breather duct removed to make sure that engine oil breather pressure is within acceptable limits.
2. Equipment and Materials
   A. Oil Breather Pressure Test Equipment - F72903-24
3. Test Oil Breather Pressure
   A. Remove engine cowl panels (AMM 71-11-11).
   B. Remove gearbox breather duct from engine.
   C. On engines with oil pressure transmitter vented to gearbox, disconnect vent tube at LV3 gearbox location (Fig. 201) and remove elbow from LV3 port. On engines with oil pressure transmitter vented to ambient, remove P&WA installed LV3 gearbox fitting.
   D. Connect oil breather test gage to LV3 port.
   E. Determine takeoff EPR for existing ambient temperature and true local barometric pressure using applicable trim table section (AMM 71-09-200, Trim Procedure).
   F. Start engine and operate at idle for 5 minutes (AMM 71-09-100/201).
   G. Advance thrust lever to no bleed takeoff EPR setting determined in step E.

      CAUTION: THERE IS NO THRUST LEVER STOP AT TAKEOFF POWER RATING. DURING ENGINE OPERATION AT TAKEOFF RATING, EXHAUST GAS TEMPERATURE, N1 AND N2 RPM MUST BE CLOSELY MONITORED TO ENSURE THAT OPERATING LIMITATIONS ARE NOT EXCEEDED. MONITOR "GEN DRIVE OIL IN TEMP" INDICATOR. OIL TEMPERATURE SHOULD NOT EXCEED 125°C.

   H. Allow engine to remain at takeoff power (minimum of 2 minutes at takeoff), record gearbox breather pressure as follows:

      WARNING: WHEN NECESSARY TO APPROACH AN OPERATING ENGINE, EAR PROTECTIVE DEVICES MUST BE WORN AND EXTREME CARE MUST BE EXERCISED TO REMAIN CLEAR OF ENGINE HAZARD AREAS DEFINED IN AMM 71-00/201. RECORD PRESSURE WHILE ENGINE IS AT IDLE.

      (1) Retard thrust lever to idle, then record maximum indicated gearbox breather pressure.



1 VENT HOSE AND TRANSMITTER—TO—GEAR BOX VENT LINE NOT INSTALLED ON SOME ENGINES

Oil Breather Pressure Test
Figure 201

I. Compare recorded gearbox breather pressure with maximum allowable pressure of 8.0 inches Hg (3.9 psig). 7.1 inches Hg (3.5 psig) for engines with No. 4 bearing carbon seal (incorporated by original build or by P&WA SB 5250).

NOTE: Engines with breather pressure tests conducted using continuous permanent recording equipment may be continued in service if the steady-state limit of 7.1 in.Hg. (3.5 psi) is exceeded for no more than 30 seconds and the pressure level does not exceed 10.2 in.Hg. (5.0 psi). An engine accepted to this additional limit must be put on watch and a repeat test conducted every 50 cycles thereafter. Total breather pressure must not exceed 13 in.Hg., that is, back pressure produced by any ducting attached to breather vent must not exceed difference between engine breather pressure and 13 in.Hg.

J. Shut down engine.

K. If gearbox breather pressure is not within acceptable limits (P&WA 72-00, Engine - Troubleshooting).

L. Remove test equipment, and install elbow in LV3 port and connect vent tube to gearbox, or reinstall P&WA LV3 gearbox fitting, as applicable.

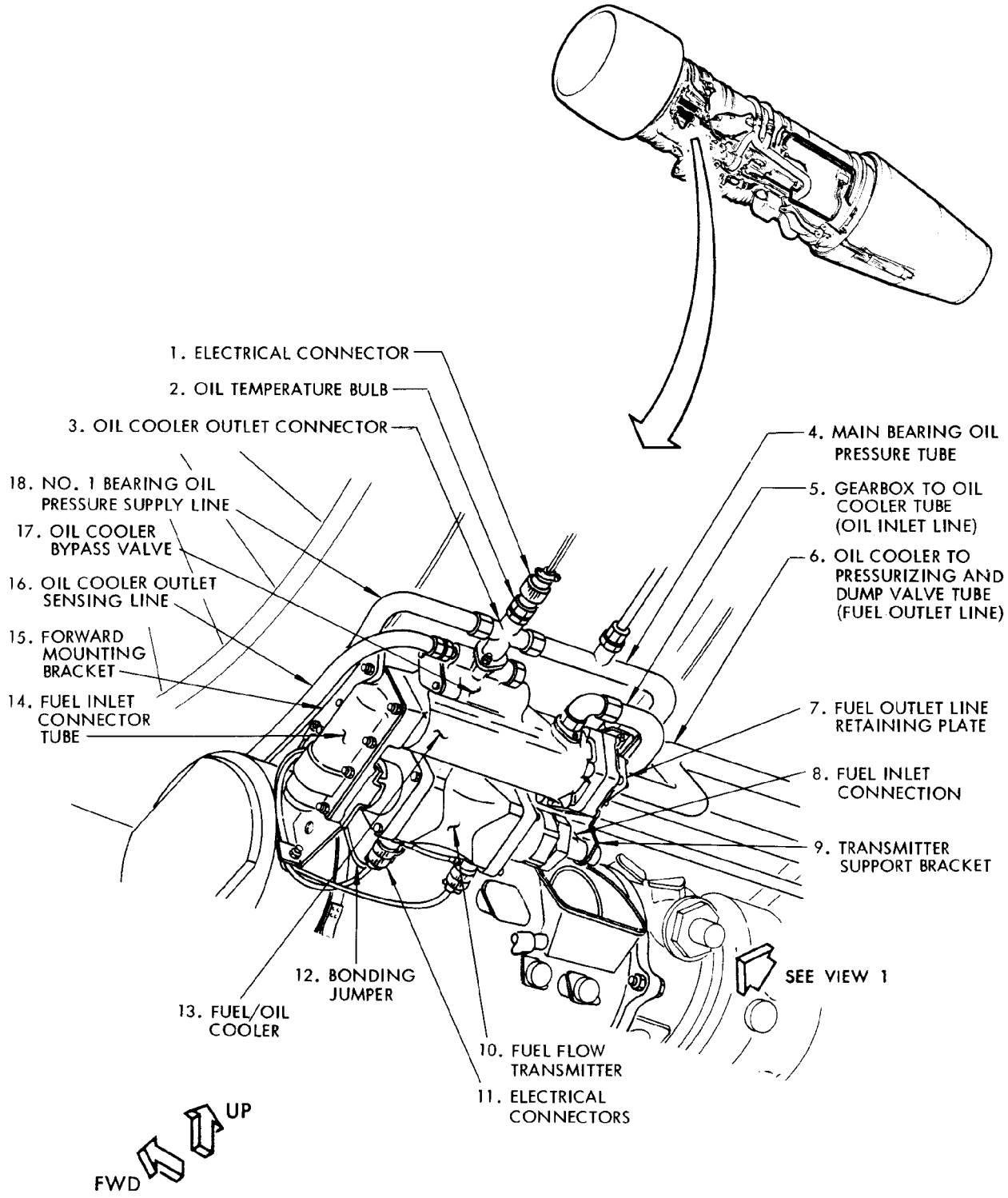
M. Install engine cowl panels (AMM 71-11-11).

FUEL/OIL COOLER - REMOVAL/INSTALLATION

1. General
   A. The fuel/oil cooler, located on the engine left side at about the 8 o'clock position, is paired with the fuel flow transmitter in a common assembly. To facilitate removal of the fuel/oil cooler, the unit is removed with the fuel flow transmitter. The two components can then be separated.
2. Prepare to Remove Fuel/Oil Cooler
   A. Open applicable Oil Temperature and Pressure circuit breaker on panel P6.

      CAUTION: FAILURE TO OPEN CIRCUIT BREAKER BEFORE REMOVING OIL TEMPERATURE BULB ELECTRICAL CONNECTOR MAY RESULT IN DAMAGE TO OIL TEMPERATURE INDICATOR.

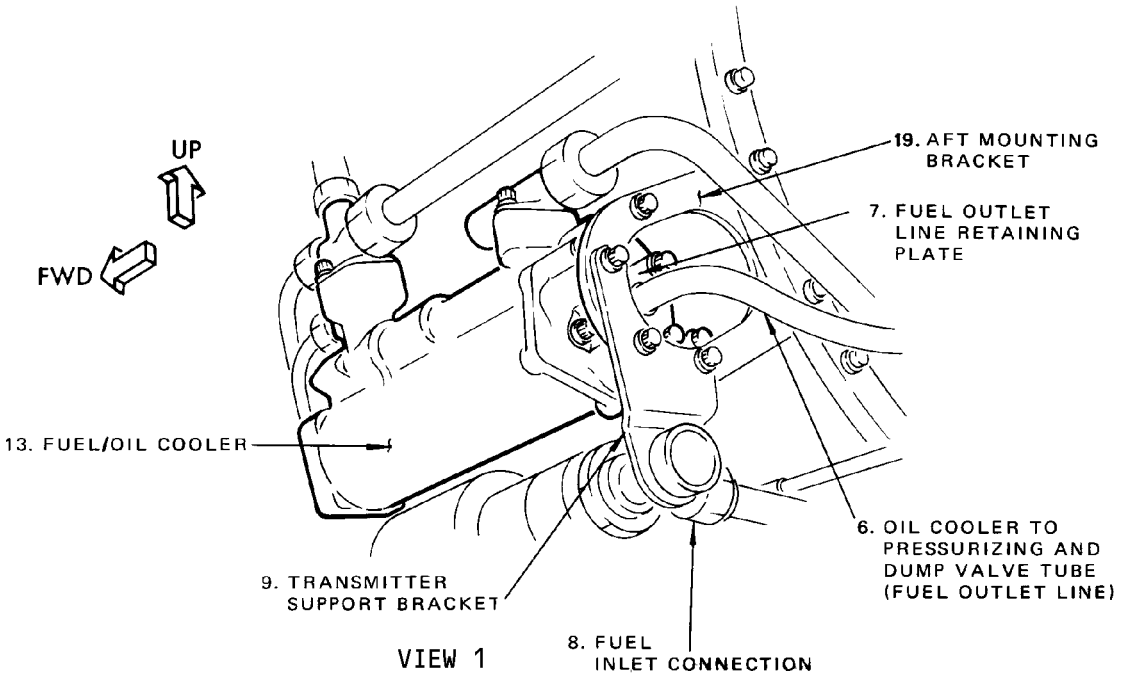
   B. Open applicable Fuel Flow circuit breaker on panel P6 to prevent fuel flow transmitter damage resulting from dry operation.
   C. Open left side cowl panel.
   D. Place suitable container under fuel/oil cooler and fuel flow transmitter to catch fuel and oil spillage.
   E. Remove drain plug at bottom of fuel inlet connector tube (14, figure 401) and drain fuel into container.
3. Remove Fuel/Oil Cooler
   A. Disconnect electrical connector (1, figure 401) from oil temperature bulb (2).
   B. Disconnect two electrical connectors (11) from fuel flow transmitter (10).
   C. Disconnect bonding jumper (12) at forward electrical connector on fuel flow transmitter.
   D. Disconnect fuel flow transmitter fuel inlet line by backing off coupling nut at fuel inlet connection (8). Remove seal washer.
   E. Disconnect oil cooler outlet sensing line (16) at connection on forward end of oil cooler bypass valve (17). Remove packing and retainer.
   F. Disconnect main bearing oil pressure tube (4) at aft end of oil cooler outlet connector (3). Remove packing and retainer.
   G. Disconnect No. 1 bearing oil pressure supply line (18) at forward end of oil cooler outlet connector (3). Remove packing and retainer.
   H. Disconnect gearbox-to-oil cooler tube (5) at elbow on top rear of oil cooler. Remove packing and retainers.
   I. Unfasten nuts holding fuel outlet line retaining plate (7) at rear of oil cooler and slide plate aft.
   J. At upper right side of fuel inlet connector tube (14), remove three bolts securing fuel/oil cooler to forward mounting bracket (15).
   K. At rear end of fuel/oil cooler, remove three bolts securing transmitter support bracket (9) to oil cooler. Remove bracket.



Fuel/Oil Cooler Installation
Figure 401 (Sheet 1)

L. Hold oil cooler and remove remaining bolt securing oil cooler to aft mounting bracket (19).
M. Carefully remove fuel/oil cooler and fuel flow transmitter by easing assembly outward and then forward off from oil cooler to pressurizing and dump valve tube (fuel outlet line) (6).
N. Separate fuel/oil cooler from fuel flow transmitter by removing remaining nuts securing fuel inlet connector tube (14).

4. Install Fuel/Oil Cooler
A. If not joined, assemble fuel/oil cooler and fuel flow transmitter by inserting aft end of fuel flow transmitter in transmitter support bracket (9, figure 401). Secure transmitter to fuel/oil cooler by installing fuel inlet connector tube (14) with bolts, nuts and washers. (Omit three forward mounting bolts, nuts and washers.) Use new packing on forward end of transmitter.
B. Position a new seal on oil cooler-to-pressurizing and dump valve tube (6). Position oil cooler and fuel flow transmitter assembly on engine and carefully move assembly aft to join oil cooler-to-pressurizing and dump valve tube (6).
C. Secure fuel inlet connector tube (14) to forward mounting bracket (15) using three mounting bolts and washers.
D. Secure rear end of fuel/oil cooler to aft mounting bracket (19) using one bolt, nut, and washer through the uppermost bolt hole.
E. Slide fuel outlet line retaining plate (7) forward and fasten to rear of fuel/oil cooler using three nuts.
F. Position transmitter support bracket (9) at fuel inlet connection (8) and aft mounting bracket (19). Secure bracket to oil cooler using three bolts, nuts and washers. Lockwire.
G. Install drain plug at bottom of fuel inlet connector tube (14) using new packing. Lockwire.
H. Connect fuel flow transmitter fuel inlet line at fuel inlet connection (8) using new seal washer.
I. Using new packing and retainers, connect gearbox to oil cooler line (5) at elbow on top rear of oil cooler. Lockwire.
J. Using new packing and retainer, connect No. 1 bearing oil pressure supply line (18) at forward end of oil cooler outlet connector (3). Lockwire.
K. Using new packing and retainer, connect main bearing oil pressure tube (4) at aft end of oil cooler outlet connector (3). Tighten nut to recommended torque and lockwire (Ref P&WA JT8D Maintenance Manual, 72-00 R/I).
L. Using new packing and retainer, connect oil cooler outlet sensing line (16) at connection on forward end of oil cooler bypass valve (17). Lockwire.
M. Connect two electrical connectors (11) to fuel flow transmitter (10).
N. Connect bonding jumper (12) at forward electrical connector on fuel flow transmitter.
O. Connect electrical connector (1) to oil temperature bulb (2).

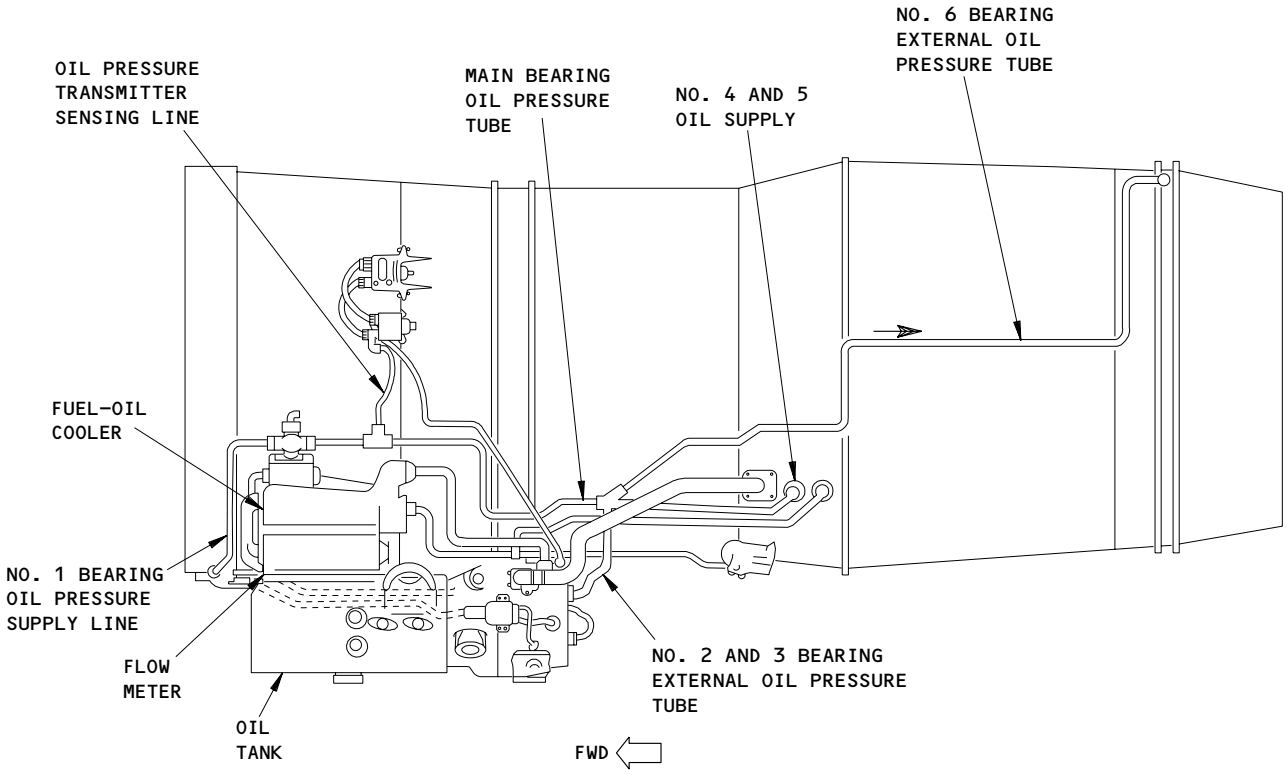


Fuel/Oil Cooler Installation
Figure 401 (Sheet 2)

P. Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
Q. Close applicable Fuel Flow circuit breaker on panel P6.
R. Test engine in accordance with Power Plant Repair Reference Table, Test C. Refer to Chapter 71, Power Plant.
S. Close left side cowl panel.

PRESSURE OIL EXTERNAL TUBES - REMOVAL/INSTALLATION

1. Remove Pressure Oil External Tubes
   A. Open left side cowl panel.
   B. Mark location of supporting clips and brackets to facilitate proper installation. (See figure 401.)
   C. Remove support clips, then disconnect and remove No. 6 bearing external oil pressure tube from rear left side of engine.
   D. Disconnect and remove No. 2 and 3 bearings external oil pressure tube from between main bearing oil pressure tube and gearbox upper rear elbow.
   E. Disconnect oil pressure transmitter sensing line from main bearing tube.
   F. Disconnect and remove main bearing oil pressure tube from left side of engine.
   G. Disconnect and remove No. 1 bearing oil pressure supply line from between oil cooler outlet connector and adapter at bottom of inlet case.
2. Install Pressure Oil External Tubes
   A. Using new packings, retainers, ferrules and backup rings as indicated, install following pressure oil external tubes:
      (1) No. 1 bearing oil pressure supply line between oil cooler outlet connector and inlet case tubes adapter, bottom of inlet case (retainer and packing at each end).
      (2) Main bearing oil pressure line, left side of engine (packing and retainer at oil cooler outlet connector, packing and retainer at diffuser outer duct center elbow). Connect oil pressure transmitter sensing line to main bearing tube.
      (3) No. 2 and 3 bearings external oil pressure tube between main bearing and the gearbox upper rear elbow (nut, packing, and retainer at brazed ferrule end; nut, ferrule, packing, and retainer at other end).
      (4) No. 6 bearing external oil pressure tubes, rear left side of engine (retainer and packing at each end).
   B. Tighten all tube nuts to recommended torque. (Refer to Chapter 72, Engine.) Lockwire nuts.
   C. Reinstall clips and brackets. Secure with screws.
   D. Close left side cowl panel.
   E. Test engine in accordance with Power Plant Repair Reference Table, Test A and allow oil temperature to reach 40°C during test. Refer to Chapter 71, Power Plant.



Pressure Oil External Tubes Installation
Figure 401

SCAVENGE OIL EXTERNAL TUBES - REMOVAL/INSTALLATION

1. Remove Scavenge Oil External Tubes
   A. Open left side cowl panel.
   B. Remove following scavenge oil tubes from engine.
      (1) No. 1 bearing oil scavenge tube from lower side of engine. (See figure 401.)
      (2) No. 4 bearing oil scavenge tube from between gearbox and lower left side of engine.
2. Install Scavenge Oil External Tubes
   A. Using new retainers, packing and ferrules as indicated, install the following scavenge oil tubes.
      (1) No. 1 bearing oil scavenge tube using two retainers and two packings. Tighten nuts to required torque and then lockwire.

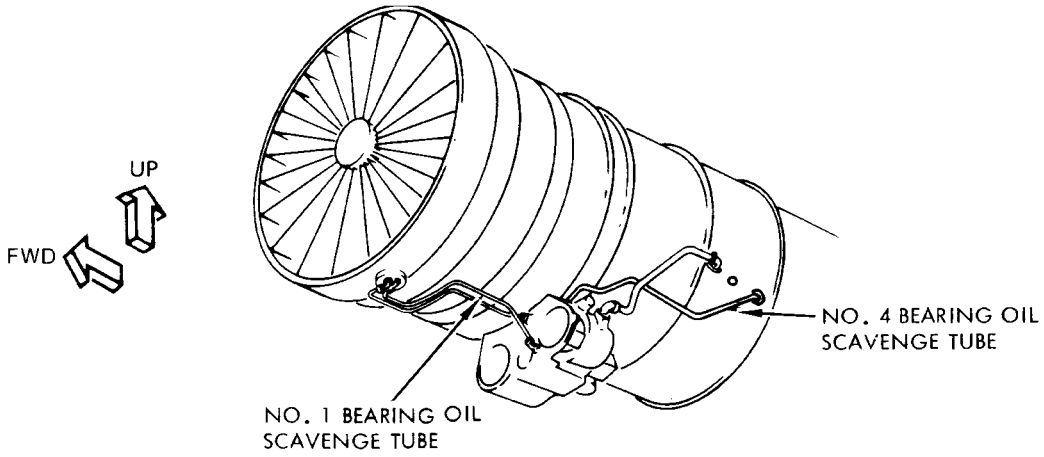
          NOTE: Install packing and plug for engines not equipped with chip detector, but having a T-fitting on gearbox end and lockwire plug.

      (2) No. 4 bearing oil scavenge tube using a ferrule, packing and retainer. Tighten nut to required torque. (Refer to Chapter 72, Engine.) Lockwire nut.

          NOTE: Install packing and plug for engines not equipped with chip detector, but having a T-fitting at diffuser outer duct end and lockwire plug.

          NOTE: Make sure there are two temperature indicators attached correctly. It must be possible to see the indicators when the tube is installed on the engine. Do the inspection procedures in P&W S/B 5944 or 6101, as applicable.

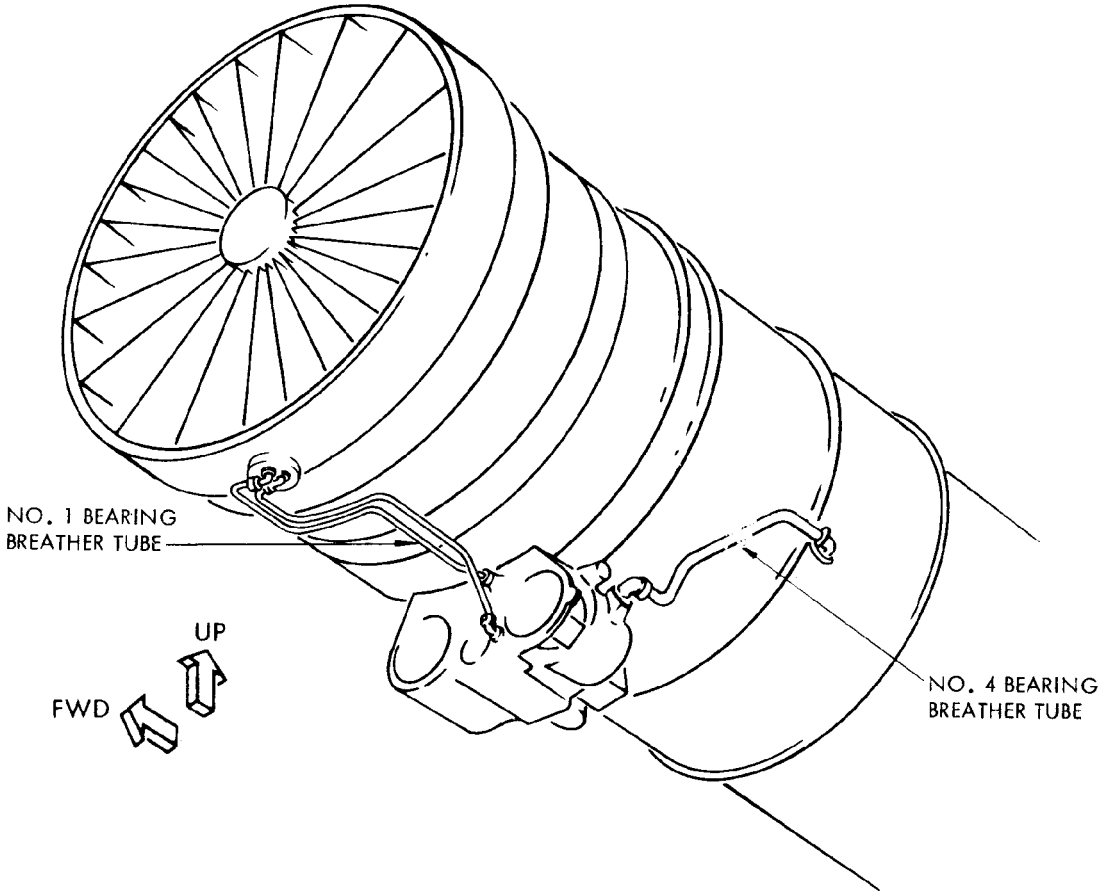
   B. Close left side cowl panel.
   C. Test engine in accordance with Power Plant Repair Reference Table, Test A and allow oil temperature to reach 40°C during test. Refer to Chapter 71, Power Plant.



Scavenge Oil External Tubes Installation
Figure 401

OIL BREATHER EXTERNAL TUBES - REMOVAL/INSTALLATION

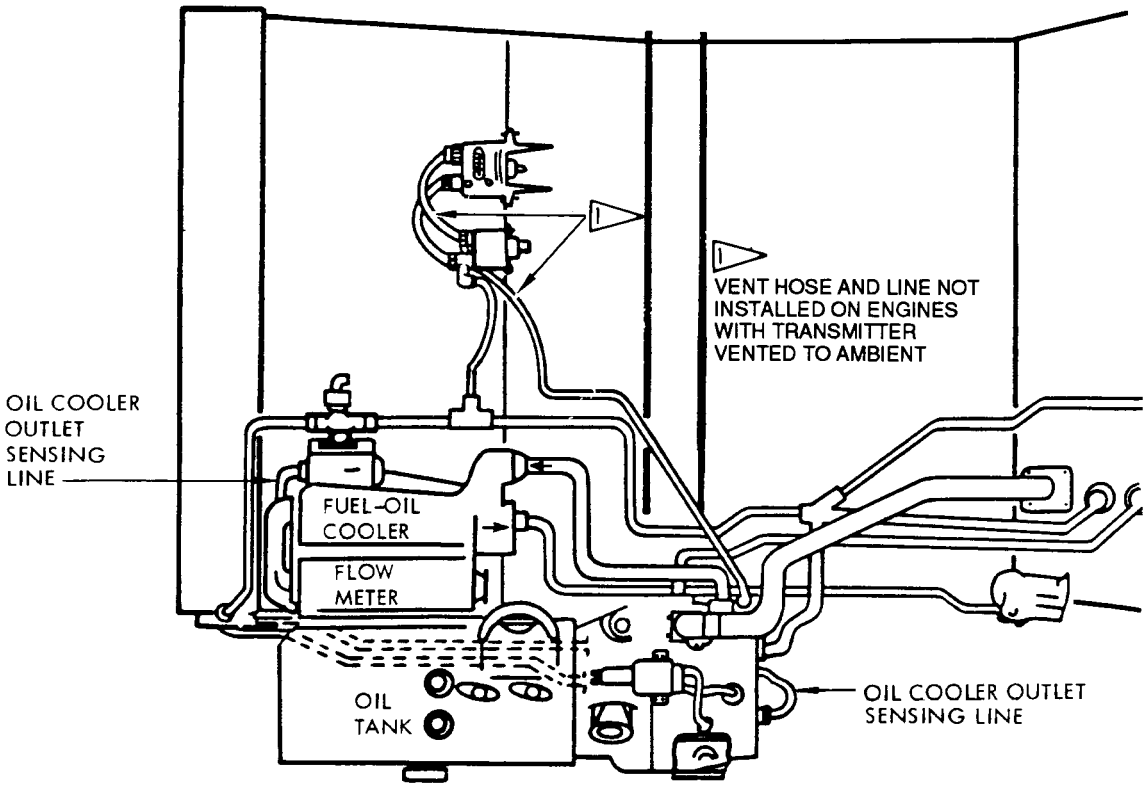
1. Remove Oil Breather External Tubes
   A. Open left side cowl panel.
   B. Remove all clips and/or brackets securing No. 1 and No. 4 bearing breather tubes.
   C. Remove No. 1 bearing breather tube (lower left side of engine). See figure 401.
   D. Remove No. 4 bearing breather tube (left side, gearbox to diffuser case outer duct).
2. Install Oil Breather External Tubes
   A. Using new packings and retainers as indicated, install the following breather tubes:
      (1) Fasten No. 1 bearing breather tube at six o'clock position on front compressor inlet case using a packing and retainer. Fasten other end at gearbox using a packing and retainer, then tighten nut to required torque and lockwire.
      (2) Connect No. 4 bearing breather tube on diffuser outer duct using a new packing, a plate, two washers, two bolts and nuts. Tighten nuts to recommended torque. (Refer to Chapter 72, Engine.) Lockwire nuts.
      (3) Fasten other end of No. 4 bearing breather tube to gearbox using a ferrule, packing, retainer and nut. Tighten nut to recommended torque (Refer to 72-00, Removal/Installation, P&WA JT8D Maintenance Manual), and lockwire.
   B. Secure all clips and brackets to breather tube assemblies with screws.
   C. Close left side cowl panel.
   D. Test engine in accordance with Power Plant Repair Reference Table, Test C and allow oil temperature to reach 40°C during test. Refer to Chapter 71, Power Plant.



Oil Breather External Tubes Installation
Figure 401

OIL COOLER TO OIL PRESSURE RELIEF VALVE TUBE (OIL COOLER OUTLET SENSING LINE) - REMOVAL/INSTALLATION

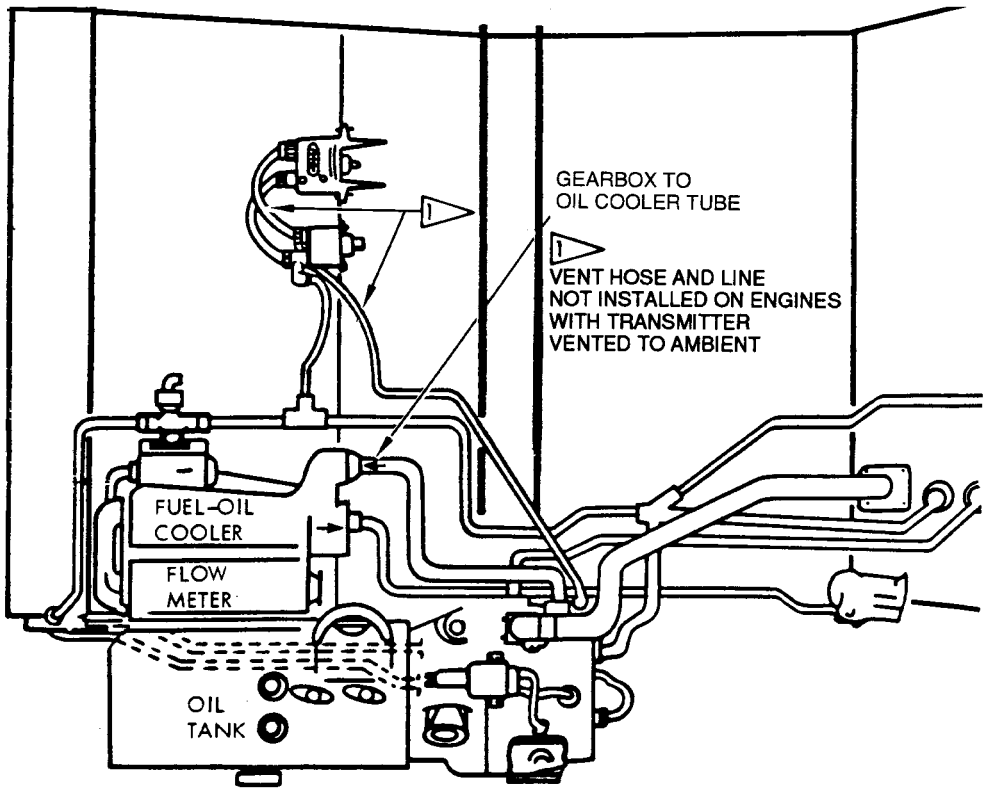
1. Remove Oil Cooler Outlet Sensing Line
   A. Open left side cowl panel.
   B. Disconnect tube at forward end of oil cooler bypass valve strainer and at tube connection on rear side of gearbox.
2. Install Oil Cooler Outlet Sensing Line
   A. Using new packing, and retainer, install oil cooler outlet sensing line at forward end of oil cooler bypass valve strainer.
   B. Secure other end to elbow at rear of gearbox at pressure relief valve using a new packing and retainer.
   C. Tighten to recommended torque (Ref Chapter 72, Engine). Lockwire connections.
   D. Close left side cowl panel.
   E. Test engine in accordance with Power Plant Repair Reference Table, Test A and allow oil temperature to reach 40°C during test (Ref Chapter 71, Power Plant).



Oil Cooler Outlet Sensing Line
Figure 401

GEARBOX TO OIL COOLER TUBE - REMOVAL INSTALLATION

1. Remove Gearbox to Oil Cooler Tube
   A. Open left side cowl panel.
   B. Remove all clips and brackets securing tube to engine.
   C. Disconnect oil cooler tube at gearbox end and at oil cooler end.
2. Install Gearbox to Oil Cooler Tube
   A. Install oil cooler tube at oil cooler using a ferrule, a new packing and retainer and nut.
   B. Tighten nut to recommended torque (Ref Chapter 72, Engine). Lockwire nut.
   C. Install oil cooler tube at gearbox end using a new packing and two bolts.
   D. Tighten bolts to recommended torque (Ref Chapter 72, Engine). Lockwire bolts.
   E. Close left side cowl panel.
   F. Test engine in accordance with Power Plant Repair Reference Table, Test A, and allow oil temperature to reach 40°C during test (Ref Chapter 71, Power Plant).



Gearbox to Oil Cooler Tube Installation
Figure 401

OIL COOLER BYPASS VALVE - REMOVAL/INSTALLATION

1. Remove Fuel/Oil Cooler Bypass Valve
   A. Remove locknuts and washers and remove bypass valve cover.
   B. Remove bypass valve assembly from valve cavity in oil cooler housing.
   C. Remove retaining ring and separate spring seat, spring, and valve from bypass valve seat.
2. Install Fuel/Oil Cooler Bypass Valve
   A. Assemble valve, spring, and spring seat inside bypass valve seat and secure with retaining ring.
   B. Install new packing on bypass valve assembly and install valve assembly in oil cooler housing.
   C. Install cover, with new packing, on valve cavity and secure with washers and nuts.

OIL COOLER BYPASS VALVE - INSPECTION/CHECK

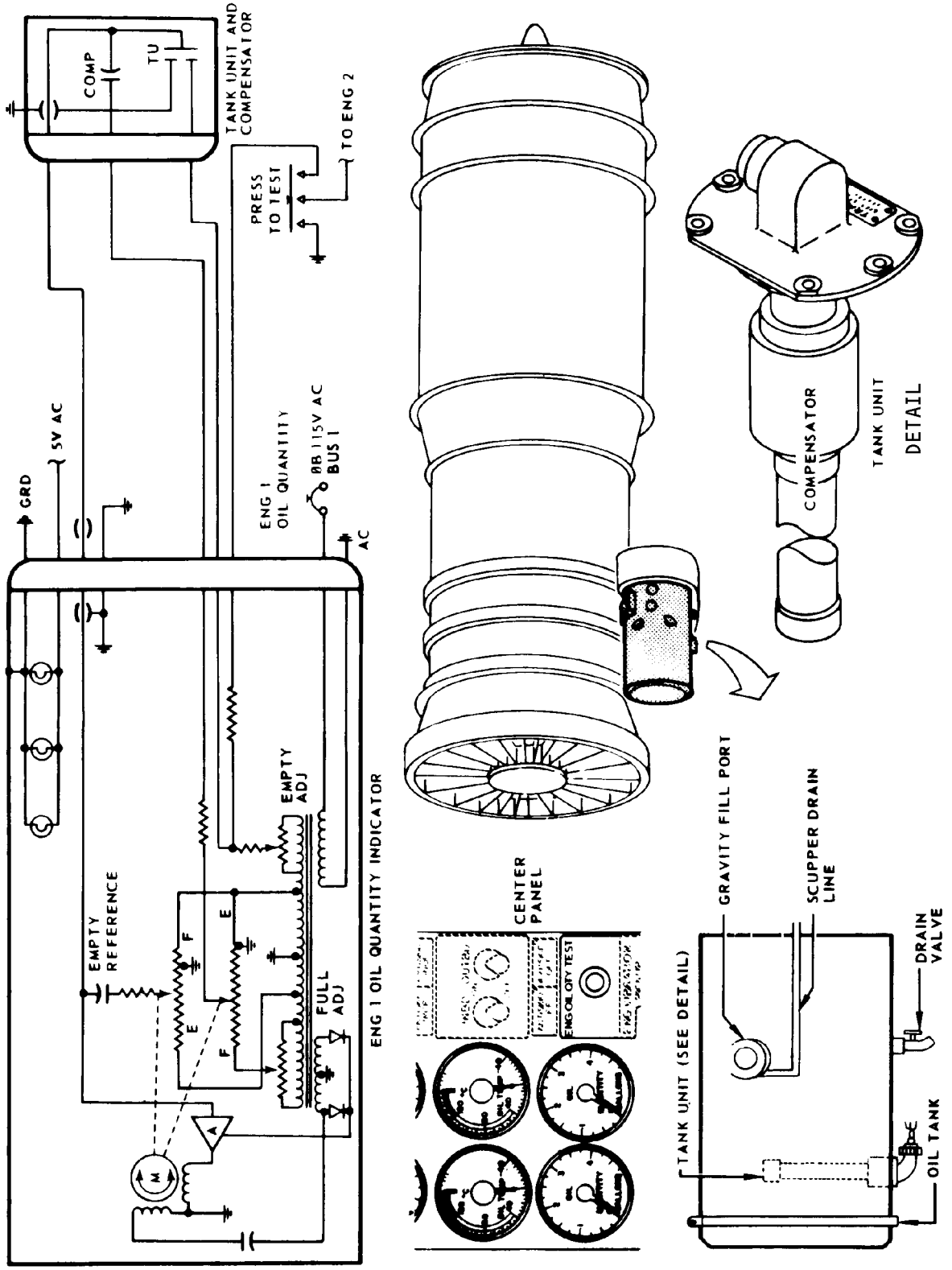
1. Inspection
   A. Check seating and sealing surfaces of bypass valve, valve seat, and spring seat which could impair function or sealing.

OIL COOLER BYPASS VALVE - CLEANING/PAINTING

1. Cleaning
   A. Clean all bypass valve parts in petroleum solvent (Varsol or equivalent) and dry with compressed air.

OIL QUANTITY INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. Engine oil quantity may be measured by use of a dipstick, attached to the engine oil tank manual filler cap, or by an electrically operated remote quantity indicating system.
   B. The remote oil quantity indicating system, for each engine, consists of a variable capacitance tank unit probe electrically connected to an indicator, on the center instrument panel, to form a self-balancing capacitance bridge circuit. (See figure 1.) A change in oil level alters the tank unit capacitance, creating an unbalanced condition in the bridge circuit. The resulting flow of current is amplified and used to actuate a servo motor which positions a potentiometer wiper in the indicator to rebalance the circuit. The indicator dial pointer is connected to the potentiometer wiper in the indicator to rebalance the circuit. The indicator dial pointer is connected to the potentiometer wiper and moves with the wiper to provide the oil quantity indication.
   C. A single PUSH-TO-TEST switch is used to check the operation of both remote quantity indicating systems simultaneously.
2. Oil Quantity Tank Unit
   A. The oil quantity tank unit is an assembly that contains an electrical plug, a flange and probe. The probe is the capacitance part of the tank unit. It is also comprised of two separate capacitors. One is a quantity (depth) measuring capacitor, the other is a compensator unit which minimizes the effect of change in oil dielectric due to temperature or variations in composition.
   B. The upper section of the tank unit consists of two concentric electrodes insulated from each other by plastic centering spacers. The inner electrode is a plastic tube with two separate metallic areas printed on its surface. One area is active and is connected to the amplifier input of the quantity indicator. The other area borders against the active pattern and is grounded to prevent an electrostatic fringe forming around the active area. The outer electrode is an aluminum tube with an insulating finish on its outer surface.
   C. The lower, or compensator, section of the tank unit consists of two short tubular members separated by an air gap and insulated from each other. Since the compensator is at the lower end of the tank unit it will remain submerged to the lowest usable level of oil.
   D. The lower end of the tank unit is open and permits oil to flow between the electrodes to the same level as that in the tank. The oil between the electrodes provides the variable dielectric which is the controlling factor of the system.
   E. The oil quantity tank units are mounted in fittings on the bottom of each engine oil tank (Fig. 1).



Oil Quantity Indicating System
Figure 1

3. Oil Quantity Indicator
   A. The oil quantity indicator is housed in a hermetically sealed cylindrical case and contains a motor driven self-balancing capacitance bridge circuit. The essential parts of the circuit are a reversible motor which drives the rebalance potentiometer, a dial pointer assembly, a capacitance bridge network and a four-stage transistorized amplifier. A rectifier provides dc power for the transistors. "Full" and "Empty" adjustment screws are accessible through holes in the rear cover.
   B. The oil quantity indicators, one for each engine, are located on the center instrument panel. The indicators are secured to the panel by a standard clamp mounting and have an electrical plug in back.
4. Operation
   A. Electrical power for the oil quantity indicating system is 115 volt, 400 cycle ac, supplied through circuit breaker panel P6. The system is operative whenever electrical power is supplied to the airplane and the applicable circuit breakers are closed.
   B. The oil level in the engine oil tank determines the capacitance of the tank unit sensing probe, thus the capacitance of the probe varies proportionally to the oil level in the tank. Whenever the oil level in the tank changes, the resulting change in capacitance of the probe unbalances the bridge network. The error signal (unbalance) is detected by the amplifier in the indicator, and causes the reversible motor in the indicator to drive a balancing potentiometer and indicator pointer. The motor drives the balancing potentiometer until the bridge network is again in balance. The indicator then displays the usable quantity of oil in the tank in U.S. gallons.
   C. Operating the PUSH-TO-TEST switch simultaneously connects the active areas of the tank sensing probes to ground, thus simulating a "tank empty" signal. As a result, both indicators, if working properly, will drive toward a tank empty indication. The indicators will return to the correct quantity indication when the test switch is released.
   D. Deleted

OIL QUANTITY INDICATING SYSTEM - TROUBLESHOOTING

1. General
   A. To determine and correct the cause of oil quantity indicating system malfunctions, the symptoms should be studied carefully. Each possible cause should be checked, beginning with the most probable, until the exact cause of the malfunction is determined. The following chart lists troubles likely to occur in operation of the system.
2. Equipment and Materials
   A. Any of the following capacitance testers may be used:
      (1) Field Calibration Unit - Part No. 387016-1 or 387991-003, Simmonds Precision Products, Inc., Tarrytown, New York
      (2) Variable Capacitance Tester - Type 1429-A or MD-1, with current calibration chart, General Radio Co., West Concord, Massachusetts
      (3) Variable Capacitance Tester - Type HT-109, Honeywell Inc., Annapolis Operation, Annapolis, Maryland (two required)
      (4) Capacitance - Type Liquid Quantity System Test Set, Model TF-20, Consolidated Airborne Systems Inc., Carle Place, Long Island, New York
   B. Ohmmeter - For continuity checking
   C. Cleaning Solvent - Acetone
   D. Stoddard Solvent, or equivalent

TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY

TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
Indicator reads low	Indicator out of adjustment	Perform adjustment procedure	
	Compensator capacitance high	Remove tank unit and immerse portion of tank unit below flange assembly in acetone for a maximum of 20 twenty minutes. Agitate unit in the solvent to remove foreign material. Rinse in clean Stoddard solvent and allow to air dry. Measure compensator capacitance between center of pins 1 and 3 while grounding pin 2 to flange. Capacitance should be 27.50 MMF. If not, adjust outer compen-sator tube assembly by loosening cap screw and adjusting assembly until capacitance is exactly 27.50 MMF. If desired capacitance cannot be obtained, compensator tubes are defective.	Replace tank unit
	Defective indicator		Replace indicator AMM 31-00-11/401

TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
Indicator reads high	Indicator out of adjustment	Perform adjustment procedure.	
	Compensator capacitance low	Remove tank unit and adjust compensator capacitance to 27.50 MMF (tank unit must be dry). If desired capacitance cannot be obtained, compensator tubes are defective.	
	Open compensator circuit	Continuity check system wiring and check tank unit capacitance.	Repair defective wiring or replace tank unit
	Defective indicator		Replace indicator AMM 31-00-11/401
Indicator pointer remains at top of scale	Short in tank unit		Replace tank unit
	Open compensator circuit	Continuity check system wiring and tank unit	Repair defective wiring or replace
	Defective indicator		Replace indicator AMM 31-00-11/401

TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
Indicator remains at zero or below	No power at indicator	Check that circuit breaker is closed and continuity check wiring between tank and indicator and between test switch and indicator.	Close circuit breaker or repair defective wiring
	Open tank unit circuit	Check wiring and tank unit with pin 3 grounded to flange. Measure capacitance between center of pins 1 and 2. Capacitance should be 22.30 ±0.30 MMF (tank unit must be dry).	Repair defective wiring or replace tank unit
	Short in compensator circuit	Check wiring and tank unit.	Repair defective wiring or replace tank unit
	Defective indicator		Replace indicator AMM 31-00-11/401
Both indicators read zero	Defective test switch		Replace test switch
Oil quantity indication changes rapidly by 3 or 4 gallons or drops to zero as engine is run up	Defective system wiring	Continuity check system wiring. Check wire splices and shielding on lead to tank probe.	Repair defective wiring
	Defective indicator		Replace indicator AMM 31-00-11/401
	Oil quantity low	Check quantity.	Service oil tank
	Defective tank probe		Replace tank unit

OIL QUANTITY INDICATING SYSTEM - ADJUSTMENT/TEST

1. General
   A. Effectivity
      (1) Use this procedure if you have one of the following capacitance testers:
         (a) SIMMONDS PRECISION 387016-1 OR 387991-003
         (b) GENERAL RADIO CO. TYPE 1429A OR MD-1
         (c) HONEYWELL TYPE HT-109
         (d) CONSOLIDATED AIRBORNE SYSTEMS MODEL TF-20
      (2) Use the procedure in AMM 79-31-02/501 if you have one of the following testers:
         (a) SIMMONDS PRECISION CAPACITANCE TESTER PSD60-1
         (b) BARFIELD 8000 PART NUMBER 101-00542
      (3) Use the procedure in AMM 79-31-02/501 if you do not have a capacitance tester.
   B. The oil quantity indicating system adjustment/test is performed to ensure operational integrity of the tank unit, oil quantity indicator, and system wiring. Bench adjustment of the tank unit and indicator is not sufficient to ensure proper component operation after installation on the airplane.
   C. System adjustment should be checked at every oil change, when a tank unit or indicator is changed, and whenever an engine is changed.
   D. Four adjustment procedures are provided for the oil quantity indicating system. These procedures provide instructions for adjusting wet oil tanks with oil above 38°C, wet oil tanks with oil under 38°C, dry oil tanks in which no oil is added during the adjustment and an alternate wet tank procedure.
   E. Two tests are provided. One tests the system after a dry tank adjustment by adding a measured quantity of oil and checking the indicator reading. The other tests the system insulation, a factor which may affect the stray capacitance in the system.
   F. If adjustment of the oil quantity indicating system is performed more than 30 minutes after engine shutdown, make sure that an accurate indication of engine oil quantity is obtained. This is necessary because oil will drain from the oil tank into the engine sump after engine shutdown causing the possibility of inaccurate oil quantity indications or overservicing of the oil tank during the adjustment or test procedure. If the oil quantity indicating system cannot be adjusted within 30 minutes of engine shutdown, all oil can be drained by opening the oil tank drain valve and removing the main oil drain plug from the bottom of the accessory drive gearbox housing.
   G. When calibrated per the following procedures, the oil quantity indicator will show the usable quantity of oil in the tank. Approximately 1.3 gallons of nonusable oil in the tank bottom which will not be available to the engine or reflected on the oil quantity indicator.

2. Oil Quantity Indicating System Adjustment

A. Oil Quantity Indicating System Adjustment (Wet Oil Tank Calibration with Dry Tank Unit Probe or Oil in Tank Above 38°C (100°F))

(1) Equipment and Materials

(a) Any of the following capacitance testers may be used:

1) Field Calibration Unit - Part No. 387016-1 or 387991-003, Simmonds Precision Products, Inc., Tarrytown, New York

2) Variable Capacitance Tester - Type 1429-A or MD-1, with current calibration chart, General Radio Co., West Concord, Massachusetts

3) Variable Capacitance Tester - Type HT-109, Honeywell Inc., Annapolis Operation, Annapolis, Maryland (two required)

4) Capacitance - Type Liquid Quantity System Test Set, Model TF-20, Consolidated Airborne Systems Inc., Carle Place, Long Island, New York

(b) Adapter Harness Test Set - Boeing F72731

(c) Approved engine oil

(2) Prepare Oil Quantity Indicating System for Adjustment

(a) Open left side cowl panel of applicable engine.

(b) Open oil tank drain valve and allow oil to drain for 5 minutes. Close drain valve.

NOTE: If engine has been shut down for more than 30 minutes, open engine gearbox drain plugs to assure complete drainage. Replace plugs and lockwire after draining.

If a new tank unit has been installed, it is not necessary to wet the probe in oil before adjusting system.

(c) Connect electrical power to airplane.

(d) Close applicable oil quantity circuit breaker on panel P6.

(3) Adjust Oil Quantity Indicating System

NOTE: Do not adjust the oil quantity indicating system during keying of an HF system transmitter. Keying of an HF system transmitter when the airplane is on the ground with entry doors open, and with service interphone cords and grounding straps connected may cause a shifting or fluctuation of the oil quantity indicator readings.

(a) Adjust potentiometer screw marked E on back of oil quantity indicator, until indicator pointer reads zero.

NOTE: Push TEST SWITCH after each small increment of adjustment is made. Make sure that indicator pointer moves in a downward direction and returns to adjusted reading when switch is released.

(b) Disconnect tank unit and connect variable capacitance tester and harness into oil quantity indicator circuit per Fig. 501.

(c) Adjust variable capacitor in tester until oil quantity indicator pointer reads zero.

NOTE: This setting should not be altered until system adjustment is completed.

(d) Remove adapter harness and tester and reconnect tank unit electrical plug.
(e) Remove filler cap and add 4.3 U.S. gallons of oil to tank.
(f) Adjust potentiometer screw marked F on back of oil quantity indicator, until indicator dial pointer reads 3.0 U.S. gallons. Push TEST SWITCH several times while making adjustment.

NOTE: When adjusted in this manner, the oil quantity indicator displays the usable quantity of oil in the tank. The remaining 1.30 U.S. gallons in the bottom of the tank is not available to the engine.

(g) Disconnect tank unit and reconnect variable capacitance tester and harness into oil quantity indicator circuit per Fig. 501.

NOTE: Tester reading must not be changed from the settings established in step A.(3)(c) above.

(h) Make sure that indicator dial pointer reads zero. Readjust indicator E screw if necessary to obtain this indication.
(i) Disconnect tester and harness, reconnect tank unit. Make sure that indicator reads 3.0 U.S. gallons. Readjust F screw, if necessary, to obtain this indication.

NOTE: Since there is interaction between the E and F adjustment screws, it is necessary to repeat the adjustments of each screw until their effect on each other is at a minimum.

(j) Complete servicing of engine oil tank. Refer to AMM Chapter 12, Engine Oil Tank Servicing.
(k) Close left side cowl panel.
(l) If no longer required, remove electrical power.

B. Oil Quantity Indicating System Adjustment (Wet Oil Tank Calibration with Tank Oil Under 38°C (100°F))
(1) Equipment and Materials
(a) Any of the following capacitance testers may be used:
1) Field Calibration Unit - Part No. 387016-1 or 387991-003, Simmonds Precision Products, Inc., Tarrytown, New York

2) Variable Capacitance Tester - Type 1429-A or MD-1, with current calibration chart, General Radio Co., West Concord, Massachusetts
3) Variable Capacitance Tester - Type HT-109, Honeywell Inc., Annapolis Operation, Annapolis, Maryland (two required)
4) Capacitance Type Liquid Quantity System Test Set - Model TF-20, Consolidated Airborne Systems Inc., Carle Place, Long Island, New York

(b) Adapter Harness Test Set - Boeing F72731, or equivalent
(c) Approved engine oil

(2) Prepare Oil Quantity Indicating System for Adjustment
(a) Open left side cowl panel.
(b) Open oil tank drain valve and allow oil to drain for 30 minutes. Close drain valve.

NOTE: If engine has been shut down for more than 30 minutes, open engine gearbox drain plugs to assure complete drainage. Replace plugs and lockwire after draining. When temperature of oil drained from oil tank is under 38°C (100°F), the quantity indicator may not read zero due to capacitance effect of film of cold oil on the tank unit.

(c) Connect electrical power to airplane.
(d) Close applicable oil quantity circuit breaker on panel P6.

(3) Adjust Oil Quantity Indicating System

NOTE: Do not adjust the oil quantity indicating system during keying of an HF system transmitter. Keying of an HF system transmitter when the airplane is on the ground with entry doors open, and with service interphone cords and grounding straps connected may cause a shifting or fluctuation of the oil quantity indicator readings.

(a) Disconnect tank unit and connect variable capacitance tester and harness into oil quantity indicator circuit per Fig. 501.
(b) Adjust tank unit section of tester to 22.30 MMF. Adjust the tester compensator section to 108.80 MMF.

NOTE: These settings must not be altered until system adjustment is completed.

(c) Adjust potentiometer screw marked E on back of oil quantity indicator until indicator pointer reads zero.

NOTE: Push TEST SWITCH after each small increment of adjustment is made. Make sure that indicator pointer moves in a downward direction and returns to adjusted reading when switch is released.

(d) Remove adapter harness and tester and reconnect tank unit electrical plug.
(e) Add 4.3 U.S. gallons of oil to tank.
(f) Adjust potentiometer screw marked F on back of oil quantity indicator, until indicator dial pointer reads 3.0 U.S. gallons. Push TEST SWITCH several times while making adjustment.

NOTE: When adjusted in this manner, the oil quantity indicator displays the usable quantity of oil in the tank. The remaining 1.3 U.S. gallons in the bottom of the tank is not available to the engine.

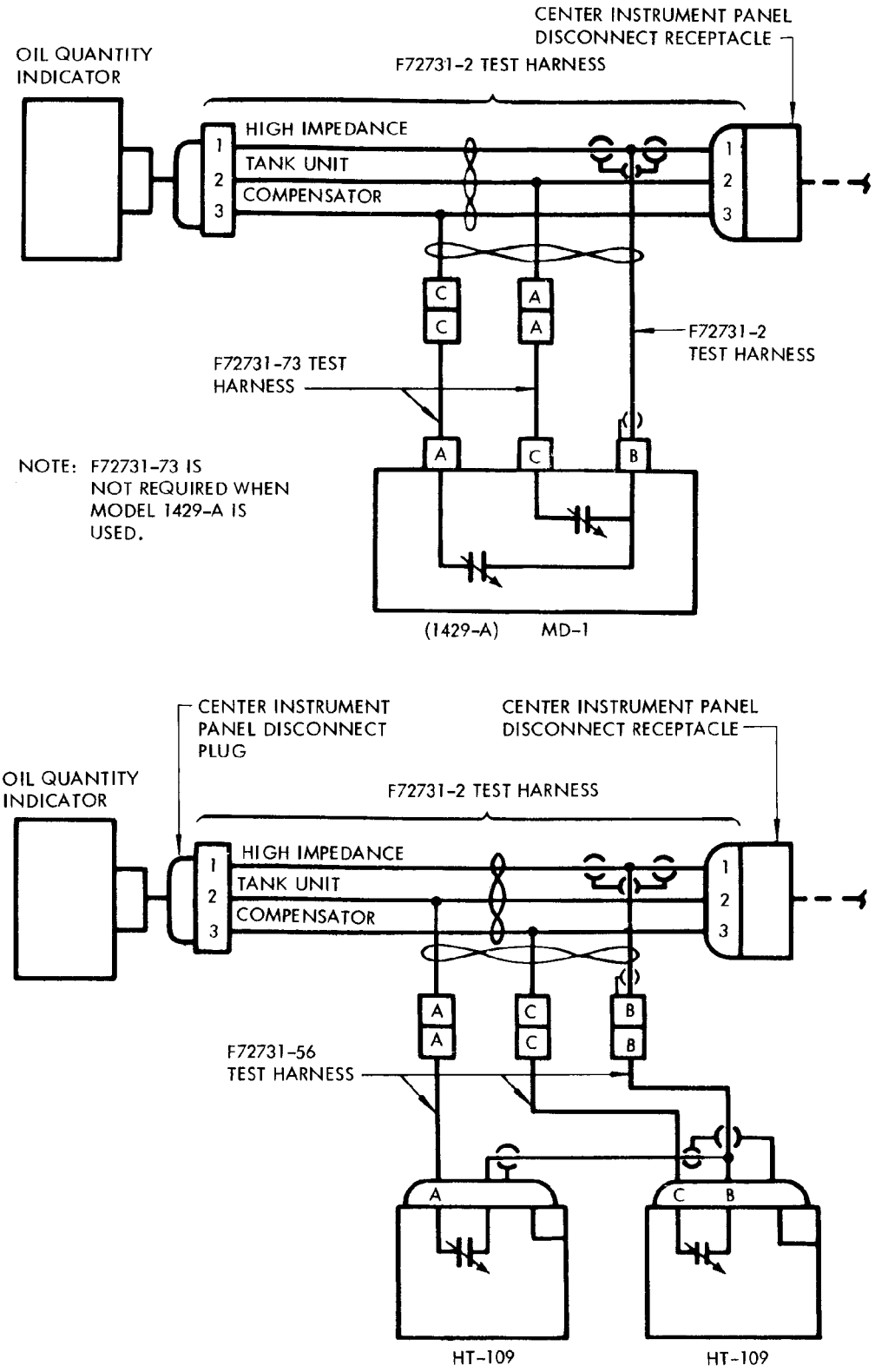
(g) Disconnect tank unit and reconnect variable capacitance tester and harness into the oil quantity indicator circuit per Fig. 501.

NOTE: Tester reading must not be changed from the settings established in step B.(3)(b) above.

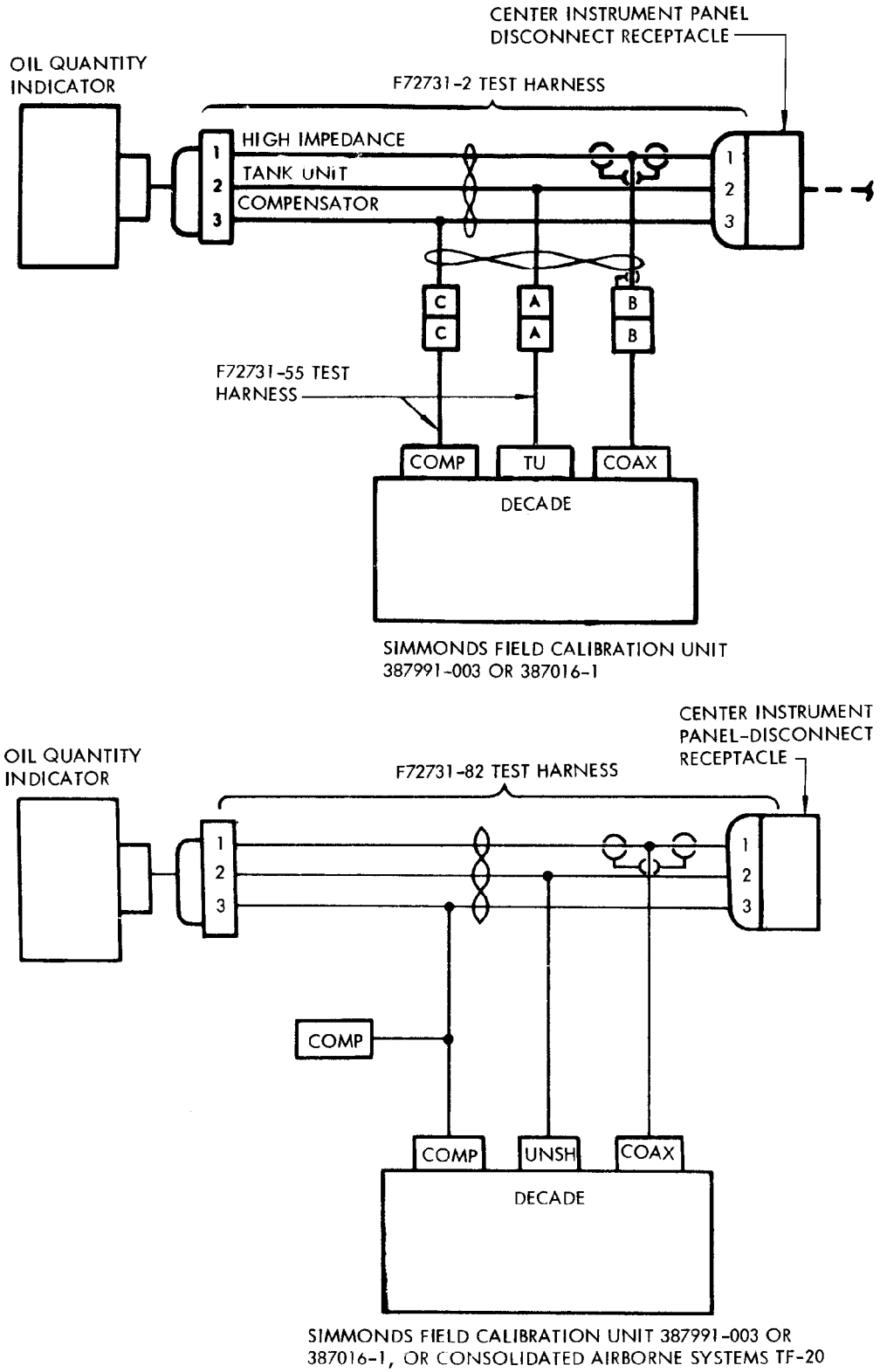
(h) Check that indicator dial pointer reads zero. Readjust indicator E screw if necessary to obtain this indication.
(i) Disconnect tester and harness, reconnect tank unit. Make sure that indicator reads 3.0 U.S. gallons. Readjust F screw if necessary to obtain this indication.

NOTE: Since there is interaction between the E and F adjustment screws, it is necessary to repeat the adjustments of each screw until their effect on each other is at a minimum.

(j) Complete servicing of engine oil tank (AMM Chapter 12, Engine Oil Tank Servicing).
(k) Close left side cowl panel.
(l) If no longer required, remove electrical power.



Oil Quantity Indicating System Test Circuits
Figure 501 (Sheet 1)



Oil Quantity Indicating System Test Circuits
Figure 501 (Sheet 2)

C. Oil Quantity Indicating System Adjustment (Dry Oil Tank Method)

NOTE: This procedure may be used when it is desired to adjust the oil quantity indicating system without adding oil to an empty oil tank. Subsequent to performing a dry tank adjustment, a test should be made when servicing the tank to confirm accurate operation.

(1) Equipment and Materials
  (a) Any of the following capacitance testers may be used:
    1) Field Calibration Unit - Part No. 387016-1 or 387991-003, Simmonds Precision Products, Inc., Tarrytown, New York
    2) Variable Capacitance Tester - Type 1429-A or MD-1, with current calibration chart, General Radio Co., West Concord, Massachusetts
    3) Variable Capacitance Tester - Type HT-109, Honeywell Inc., Annapolis Operation, Annapolis, Maryland (two required)
    4) Capacitance Type Liquid Quantity System Test Set - Model TF-20, Consolidated Airborne Systems Inc., Carle Place, Long Island, New York
  (b) Adapter Harness Test Set - Boeing F72731, or equivalent
(2) Prepare Oil Quantity Indicating System for Adjustment
  (a) Open left side cowl panel.
  (b) Connect electrical power to airplane.
  (c) Close applicable oil quantity circuit breaker on panel P6.
(3) Adjust Oil Quantity Indicating System

NOTE: Do not adjust the oil quantity indicating system during keying of an HF system transmitter. Keying of an HF system transmitter when the airplane is on the ground with entry doors open, and with service interphone cords and grounding straps connected may cause a shifting or fluctuation of the oil quantity indicator readings.

  (a) Disconnect tank unit and connect variable capacitance tester and harness into oil quantity indicator circuit per Fig. 501.
  (b) Adjust tank unit section of tester to 22.30 MMF. Adjust compensator section to 108.80 MMF.
  (c) Adjust potentiometer screw marked E at back of oil quantity indicator, until indicator pointer reads exactly zero.

NOTE: Push test switch after each small increment of adjustment is made. Make sure that indicator pointer moves in a downward direction and returns to the adjusted reading when switch is released.

(d) Adjust tank unit section of tester to 87.70 MMF. Compensator section shall be left on 108.80 MMF.
(e) Adjust potentiometer screw marked F on back of oil quantity indicator, until indicator pointer reads 4.75 U.S. gallons.
(f) Readjust tank unit section of tester to 22.30 MMF. Compensator section shall be left on 108.80 MMF.
(g) Make sure that indicator pointer shall read zero. If necessary, readjust E screw on back of indicator.
(h) If E screw was adjusted in step (g), readjust tank unit section of tester to 87.70 MMF. Compensator section shall be left at 108.80 MMF.
(i) Make sure that indicator reads 4.75 U.S. gallons. If necessary, adjust F screw on back of indicator.

NOTE: Since there is interaction between the E and F adjustment screws, it is necessary to repeat the adjustments of each screw until their effect on each other is at a minimum.

(j) Perform oil quantity indicating system test in 3.A.

D. Oil Quantity Indicating System Adjustment (Alternate Wet Oil Tank Calibration)
(1) Equipment and Materials
(a) Any of the following capacitance testers may be used:
1) Field Calibration Unit - Part No. 387016-1 or 387991-003, Simmonds Precision Products, Inc., Tarrytown, New York
2) Variable Capacitance Tester - Type 1429-A or MD-1, with current calibration chart, General Radio Co., West Concord, Massachusetts
3) Variable Capacitance Tester - Type HT-109, Honeywell Inc., Annapolis, Maryland (two required)
4) Capacitance Type Liquid Quantity System Test Set - Model TF-20, Consolidated Airborne Systems Inc., Carle Place, Long Island, New York
(b) Adapter Harness Test Set - Boeing F72731
(2) Prepare Oil Quantity Indicating System for Adjustment
(a) Open left side cowl panel.
(b) Connect external electrical power.
(c) Close applicable oil quantity circuit breaker on panel P6.
(3) Adjust Oil Quantity Indicating System
(a) Disconnect tank unit and connect variable capacitance tester and harness into oil quantity indicator circuit per Fig. 501.

(b) On the tester, adjust tank unit section to 22.3 MMF and compensator section to 108.8 MMF.

NOTE: Compensator section setting must not be altered until test is complete.

(c) Adjust the potentiometer screw marked E located at the back of the oil quantity indicator on the center instrument panel (P2-2), until the indicator pointer shows zero.

NOTE: Push the "test switch" after each adjustment. The indicator needle shall move downscale and shall return to normal reading when the test switch is released.

(d) On the tester, adjust tank unit section to 87.70 MMF.

(e) Adjust the potentiometer screw marked F located at the back of the oil quantity indicator until the indicator pointer shows 4.75 U.S. gallons or 3.96 imperial gallons.

(f) Reset the tester to the settings of par. D.(3)(b) and recheck the reading to be "Zero". If necessary, readjust the E screw on the back of the indicator to show "Zero" on the dial.

(g) If the F adjustment was reset under par. D.(3)(f) above, reset the tester to the settings of par. D.(3)(d) and recheck the indicator reading to be 4.75 U.S. gallons or 3.96 imperial gallons. If necessary, readjust the F screw to show 4.75 U.S. gallons or 3.96 imperial gallons.

(h) On the tester, adjust the tank unit section to 63.6 MMF and check to see that the indicator reads 3.0 U.S. gallons ± 1 pint. For indicators reading imperial gallons, set tank unit section to 70.83 MMF and make sure that the indicator reads 3.0 imperial gallons ± 0.83 pints.

(i) Disconnect the tester and test harness and connect the tank unit to the indicator.

(4) Calibration Check

(a) Remove the engine oil tank dipstick (attached to tank filler cap) and determine the amount of oil remaining in the tank. Make sure that the indicator reading agrees with the dipstick determined value with ± 1 U.S. quart.

(b) Return system to normal.

3. Oil Quantity Indicating System Test

A. Oil Quantity Indicating System Test (After Dry Oil Tank Adjustment)

(1) Equipment and Materials

(a) Approved engine oil

(2) Test Oil Quantity Indicating System

(a) Open oil tank gravity fill port and add measured 1.3 +0.0/-0.1 U.S. gallons of approved engine oil to oil tank.

(b) Make sure that quantity indicator on engine instrument panel reads 0 ±1 pint (one-half indicator dial division).
(c) Add 3.0 U.S. gallons of oil to oil tank. Indicator should read 3.0 gallons ± 1 pint.
(d) Complete servicing of engine oil tank (AMM Chapter 12, Engine Oil Tank Servicing).
(e) Close left side cowl panel.
(f) If no longer required, remove electrical power.

B. Oil Quantity Indicating System Insulation Test
(1) Equipment and Materials
(a) Ohmmeter
(2) Test Oil Quantity Indicating System Insulation
(a) Open applicable oil quantity circuit breaker on panel P6.
(b) Remove applicable oil quantity indicator from engine instrument panel and disconnect electrical plug.
(c) Using ohmmeter, measure resistances at plug locations noted in Table 1. Resistances shall not be less than those specified.

NOTE: Tank unit probe shall be dry and tank drained for this test.

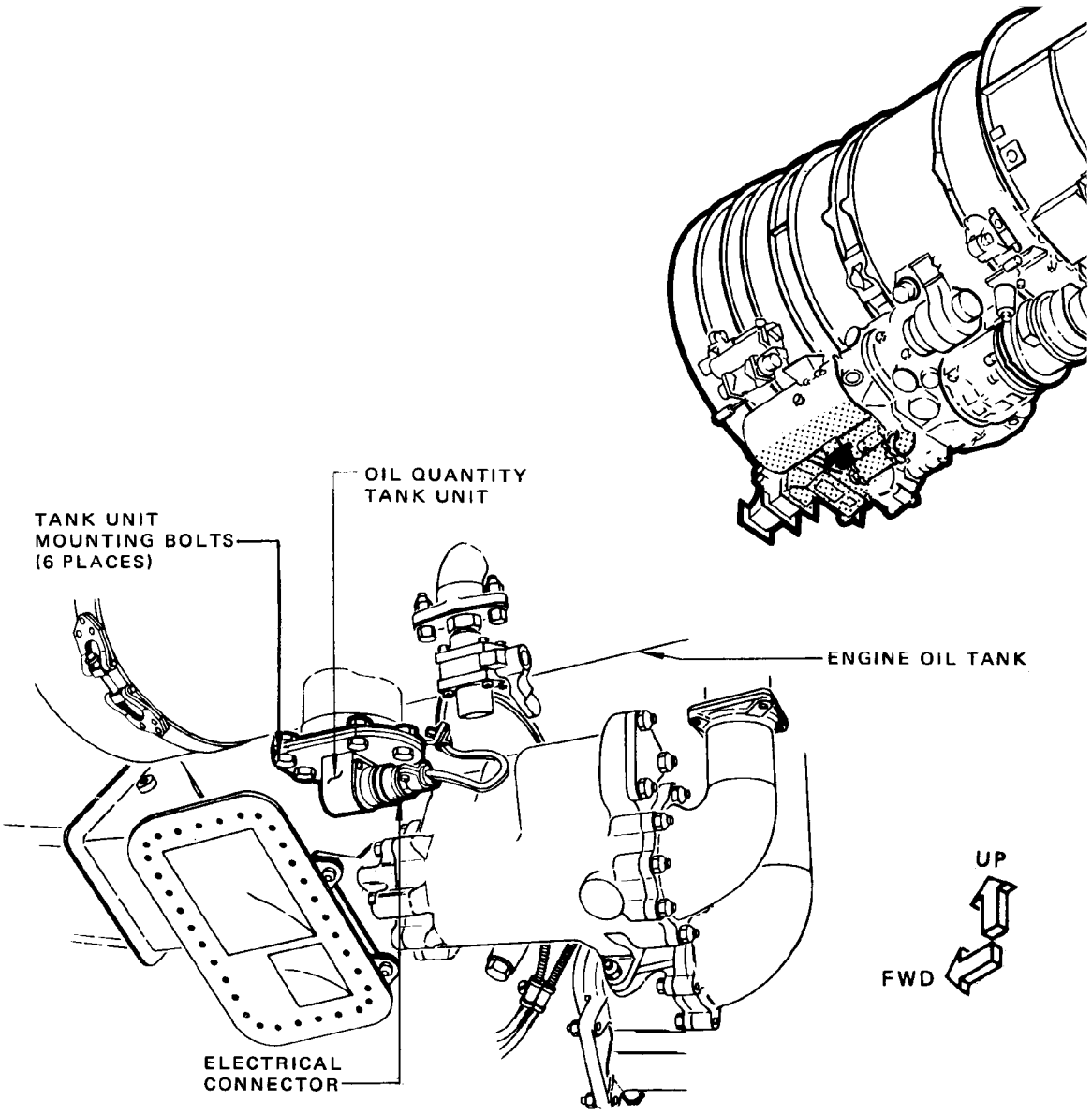
TABLE 1

PLUG PIN(S)	MINIMUM INSULATION RESISTANCE - MEGOHMS
Pin 1 to Ground	1
Pin 2 to Ground	1
Pin 3 to Ground	1
Pin 1 to Pin 2	3500
Pin 1 to Pin 3	3000
Pin 2 to Pin 3	10

(d) Connect electrical plug to oil quantity indicator and install indicator in instrument panel.
(e) Close oil quantity circuit breaker on panel P6.

OIL QUANTITY TANK UNIT - REMOVAL/INSTALLATION

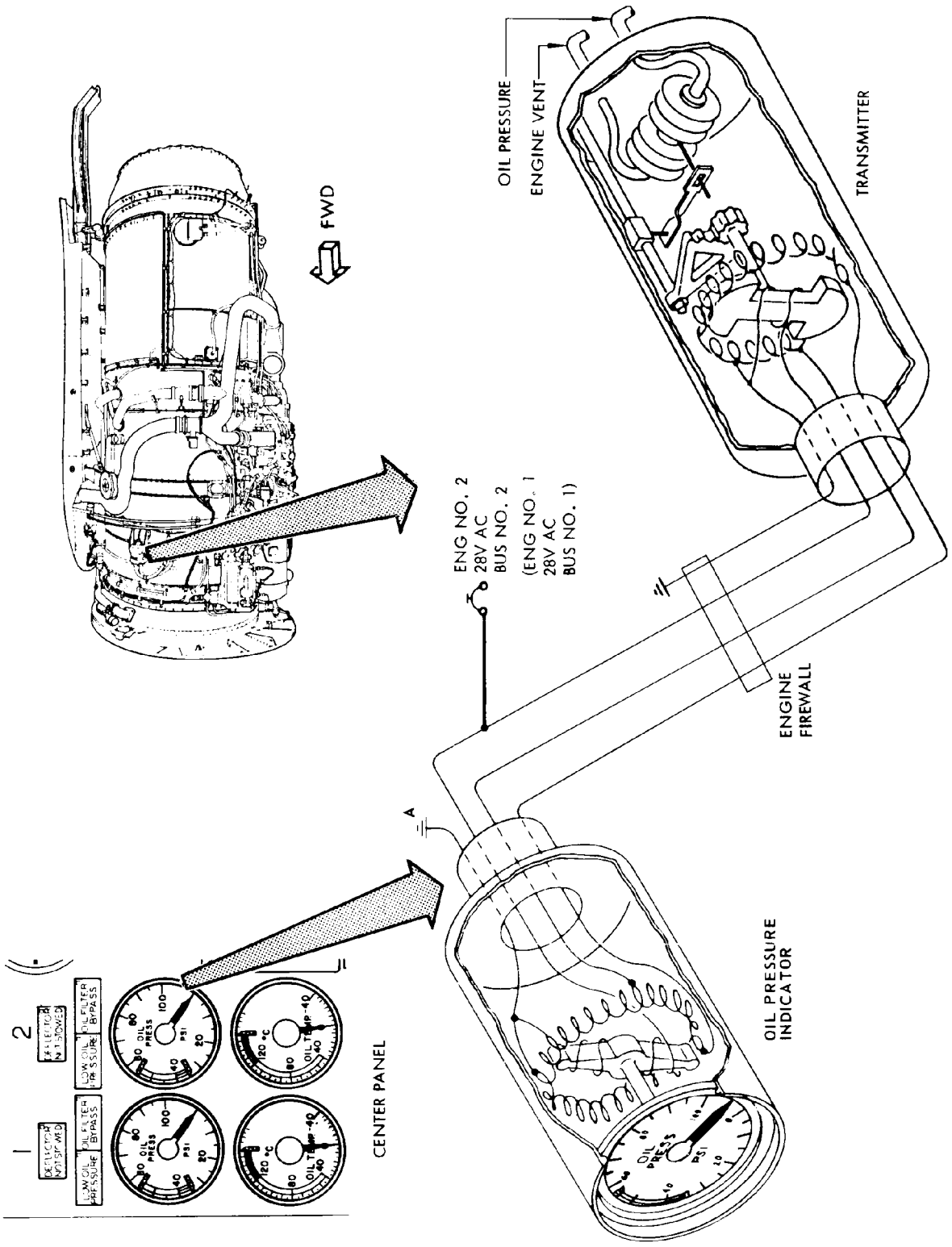
1. Remove Oil Quantity Tank Unit
   A. Open left side cowl panel.
   B. Open applicable oil quantity circuit breaker, on circuit breaker panel P6.
   C. Drain engine oil tank. (See 79-11-21.)
   D. Remove electrical connector from tank unit electrical receptacle. (See figure 401.)
   E. Support tank unit and remove six bolts, nuts, and washers retaining tank unit to oil tank flange.
   F. Remove tank unit and O-ring.
2. Install Oil Quantity Tank Unit
   A. With a new O-ring inserted on tank unit, locate unit on oil tank flange with electrical connector facing aft.
   B. Install three shortest bolts, light washers and nuts retaining tank unit to oil tank at two outboard and forward center bolt hole locations.
   C. Position a standard washer in spot face at forward inboard bolt hole location on tank unit. Install bolt, light washer and nut securing bonding jumper and tank unit to oil tank flange.
   D. Insert bolts through two bolt holes at aft end of flange. Position electrical wiring bracket over protruding ends of bolts and install light washers and nuts.
   E. Connect electrical connector to tank unit electrical receptacle.
   F. Calibrate oil quantity indicating system. (See 79-31-0).



Oil Quantity Tank Unit Installation
Figure 401

OIL PRESSURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The oil pressure indicating system shows the engine oil pressure on indicators in the control cabin. The components of the system for each engine are an oil pressure transmitter and an indicator (Fig. 1).
   B. The oil pressure transmitter senses oil pressure in the external pressure oil manifold and also senses accessory drive gearbox vent pressure (or ambient cowl pressure depending on configuration). The difference between these two pressures is measured and converted into an electrical signal which actuates the oil pressure indicator.
   C. A union orifice (restrictor) is installed in the external pressure oil manifold for surge protection and to reduce indicator fluctuation.
2. Oil Pressure Transmitter
   A. The oil pressure transmitter contains a diaphragm connected to a synchro transmitter. One side of the diaphragm senses oil pump output pressure in the bearing oil line. The other senses vent pressure in the accessory drive gearcase (or ambient cowl pressure depending on configuration). The difference between the two pressures positions the diaphragm and, in turn, the rotor of the synchro transmitter. The movement of the synchro transmitter rotor induces electrical signals in the transmitter stator. These signals are transmitted to the oil pressure indicator.
   B. The oil pressure transmitter is shock mounted at approximately the 10 o'clock position on the left side of each engine (Fig. 1).
3. Oil Pressure Indicator
   A. The oil pressure indicator contains a synchro receiver, a gear train, and a pointer to indicate oil pressure. The electrical signals received from the oil pressure synchro transmitter are induced on the stator of the synchro receiver. This causes the receiver rotor to assume a position corresponding to the position of the synchro transmitter rotor. The receiver rotor drives the indicator pointer through the gear train.
4. Operation
   A. Engine oil manifold pressure and gearcase vent pressure (or ambient cowl pressure depending on configuration) are applied to opposite sides of the diaphragm in the oil pressure transmitter. The pressure differential positions the diaphragm, and in turn, the rotor position of a synchro transmitter. The rotor of the oil pressure indicator's synchro receiver assumes a position corresponding to the transmitter rotor, since the stators of both are connected in parallel. The synchro receiver rotor drives the oil pressure indicator pointer, through a gear train, to indicate oil pressure.
   B. If power is interrupted, the indicator will remain at the pressure recorded at the moment of interruption. Electrical power for the system is 28 volts, 400-Hz ac through circuit breaker panel P6.



Oil Pressure Indicating System
Figure 1

With external power connected and all applicable circuit breakers closed, observe operation of oil pressure indicator while starting, operating, and shutting down engine. IF –

INDICATOR INACCURATE.

INDICATOR FLUCTUATES.

Disconnect low oil pressure line at LP3 port (Fig. 101). Check that diameter of union orifice is 0.027–0.029 inch. IF –

OK – Reconnect pressure line to LP3 port. Proceed to next step.

NOT OK – Replace union orifice and O–ring. Reconnect pressure line to LP3 port.

Interchange indicator with one that is known to operate. IF –

NOT OK – Check for power and ground at indicator. IF –

OK – Replace indicator.

OK – Check for power and ground at transmitter. IF –

NOT OK – Repair wiring to ground or from circuit breaker panel.

OK – Check oil pressure lines for leaks or restrictions and check vent line or vent plug for restriction. IF –

NOT OK – Repair wiring to ground or from circuit breaker panel.

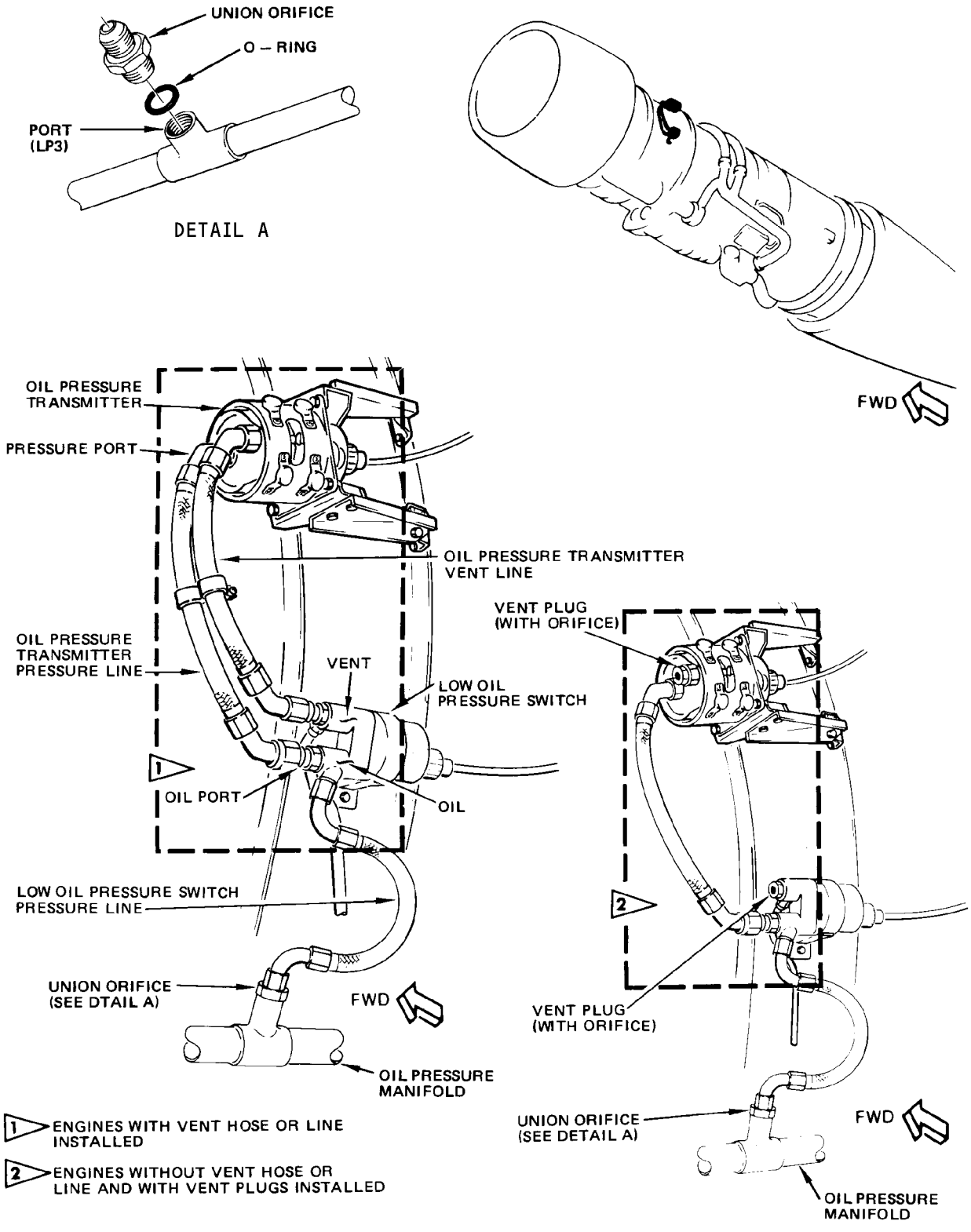
OK – Check continuity of wiring between indicator and transmitter. IF –

NOT OK – Repair oil pressure line and/or vent lines (or plug).

OK – Replace transmitter.

NOT OK – Repair wiring between indicator

Oil Pressure Indicating System Troubleshooting
Figure 101 (Sheet 1)

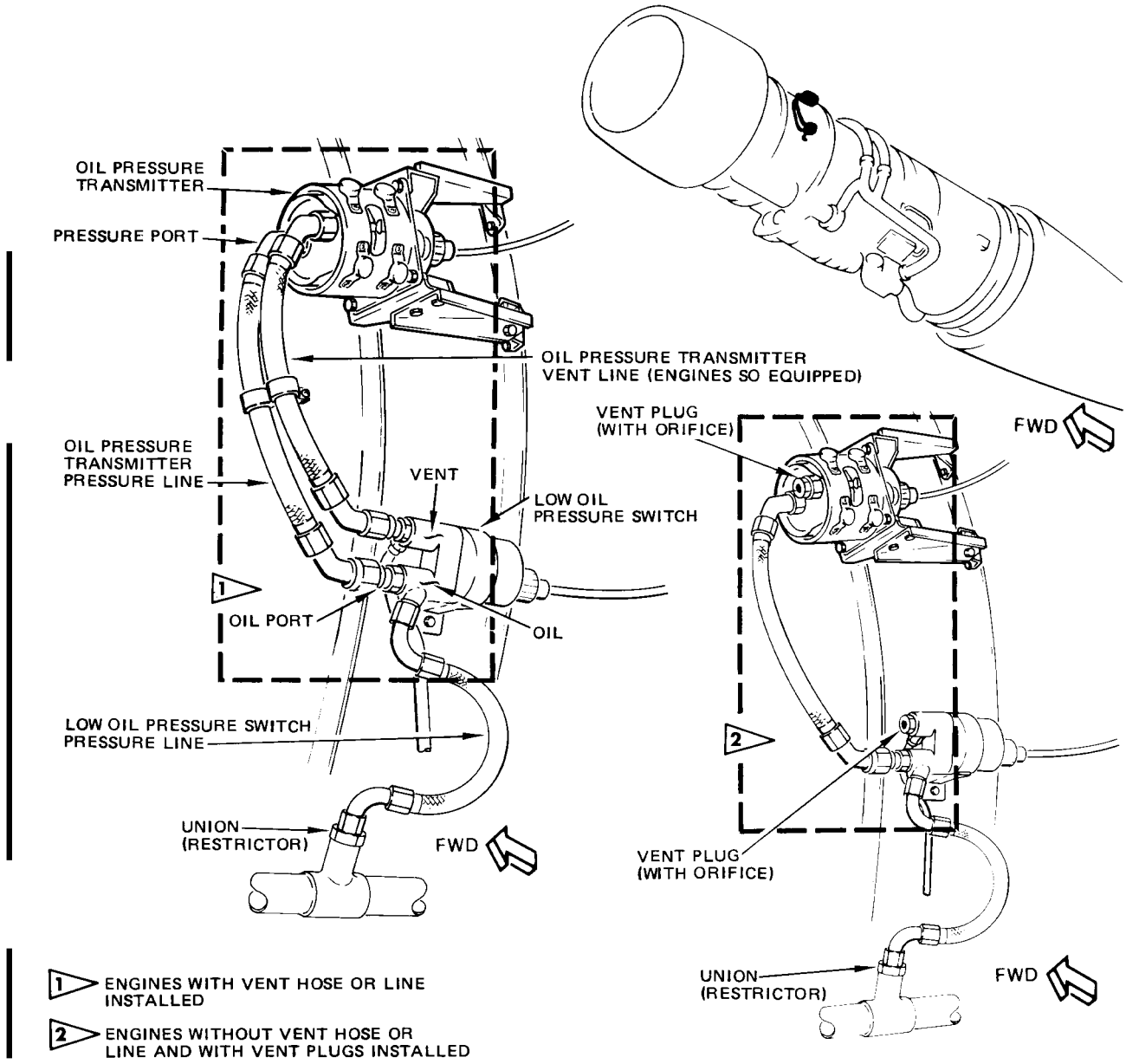


Oil Pressure Indicating System Troubleshooting
Figure 101 (Sheet 2)

OIL PRESSURE INDICATING SYSTEM - ADJUSTMENT/TEST

1. Oil Pressure Indicating System Test
   A. General
      (1) The oil pressure indicating system test is performed to ensure operational integrity of the oil pressure transmitter, electrical wiring, and the oil pressure indicator.
      (2) The system test is accomplished by connecting a variable air pressure source to the pressure side of the oil pressure transmitter and checking that the applied pressure is correctly indicated on the oil pressure indicator.
   B. Equipment and Materials
      (1) Variable Dry Air Pressure Source - 0 to 100 psi
   C. Prepare to Test Oil Pressure Indicating System
      (1) Open applicable left side cowl panel.
      (2) Connect electrical power to airplane.
      (3) Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
   D. Test Oil Pressure Indicating System
      (1) Disconnect oil pressure transmitter pressure line at low oil pressure switch (lower end.) (See figure 501.)
      (2) Connect air pressure source to disconnected line.
      (3) Cap or cover switch opening to prevent entry of foreign matter into system.
      (4) Apply 80 psig air pressure. Check that oil pressure indicator on engine instrument panel reads 80 (±3) psig.
      (5) Hold pressure for 3 minutes. Check that there is no leakage.
      (6) Open applicable Oil Temperature and Pressure circuit breaker on panel P6. Check that oil pressure indicator reading does not change. Close circuit breaker.
      (7) Reduce air pressure to 45 psig. Check that oil pressure indicator reads 45 (±3) psig.
      (8) Reduce pressure to zero psig and observe indicator reading. Check that indicator pointer returns to zero (±3) psig.
      (9) Disconnect air pressure source from oil pressure transmitter pressure line. Remove cap or cover from switch opening and connect pressure line to fitting in oil port of low oil pressure switch (Fig. 501).
      (10) Close left side cowl panel.
      (11) If no longer required, remove electrical power.

      NOTE: The first time that engine is operated after performing this test, check to ensure that no leakage occurs at transmitter pressure line connection on low oil pressure switch.



Oil Pressure Indicating System Test
Figure 501

OIL PRESSURE TRANSMITTER - REMOVAL/INSTALLATION

1. Remove Oil Pressure Transmitter
   A. Open applicable left side cowl panel.
   B. Open applicable oil temperature and pressure circuit breaker on panel P6.
   C. Disconnect oil pressure transmitter electrical connector (Fig. 401).
   D. Disconnect bonding jumper from oil pressure transmitter.
   E. Disconnect oil pressure transmitter pressure line from reducer union at transmitter pressure port.
   F. On engines with vent lines, disconnect oil pressure transmitter vent line from union at transmitter vent port.
   G. Remove transmitter from shock mount by loosening shock mount clamp screw.

      NOTE: Shock mount may be left on engine during oil pressure transmitter removal.

   H. If a new transmitter is to be installed, remove unions and O-rings from transmitter pressure port, and union or vent plug and O-rings from vent port.
2. Install Oil Pressure Transmitter
   A. If a new transmitter is being installed;
      (1) Install reducer union in oil pressure transmitter pressure port using new O-ring.
      (2) Install union or vent plug in oil pressure transmitter vent port using new O-ring.

         NOTE: Lubricate O-rings with engine oil before installation.

   B. With transmitter vent and pressure ports facing forward, position transmitter in shock mount. Transmitter vent port should be outboard of pressure port (with respect to the engine) (Fig. 401).

      NOTE: Disregard orientation instructions, if any, on oil pressure transmitter.

   C. Connect oil pressure transmitter pressure line (and vent line when installed) to union fittings in transmitter vent and pressure ports. Tighten pressure port fitting. Ensure that hoses, hose end fittings and transmitter are arranged so that transmitter is free in all directions and tighten screw on shock mount clamp (Fig. 401).

      NOTE: To minimize vibrations transmitted to the transmitter, each hose and its end fittings should lie in a single plane as viewed from front of engine.

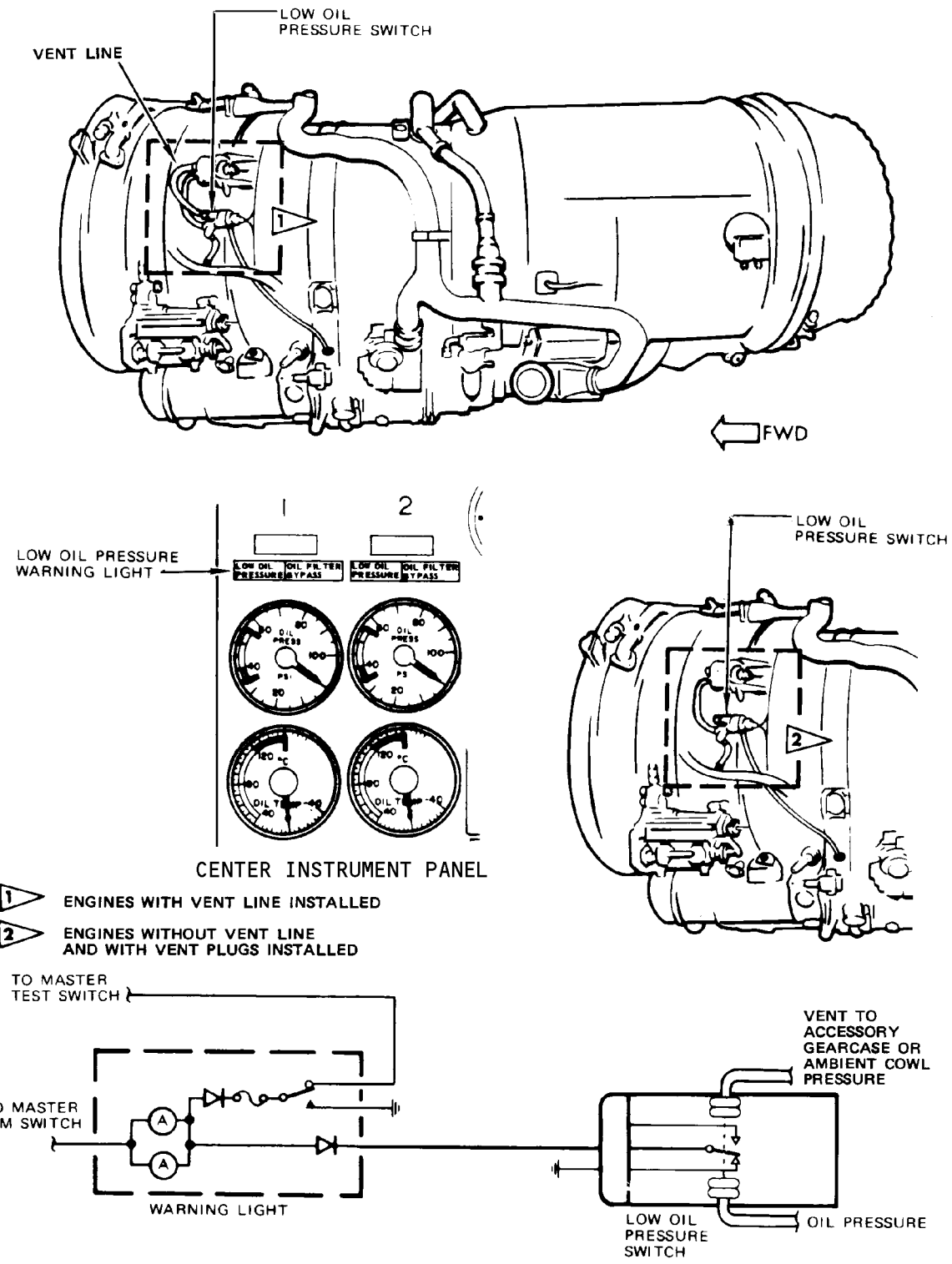
D. Connect electrical connector to receptacle on aft side of oil pressure transmitter.
E. Connect bonding jumper to tapped hole on oil pressure transmitter.
F. Close OIL TEMP & PRESS circuit breaker on circuit breaker panel P6.
G. Check oil pressure transmitter operation per AMM 71-00/501, Test A.

NOTE: With the two engines in operation at the same power, make sure the oil pressure indication is approximately the same for the two engines.

H. Close engine left cowl panel.

LOW OIL PRESSURE WARNING SYSTEM - DESCRIPTION AND OPERATION

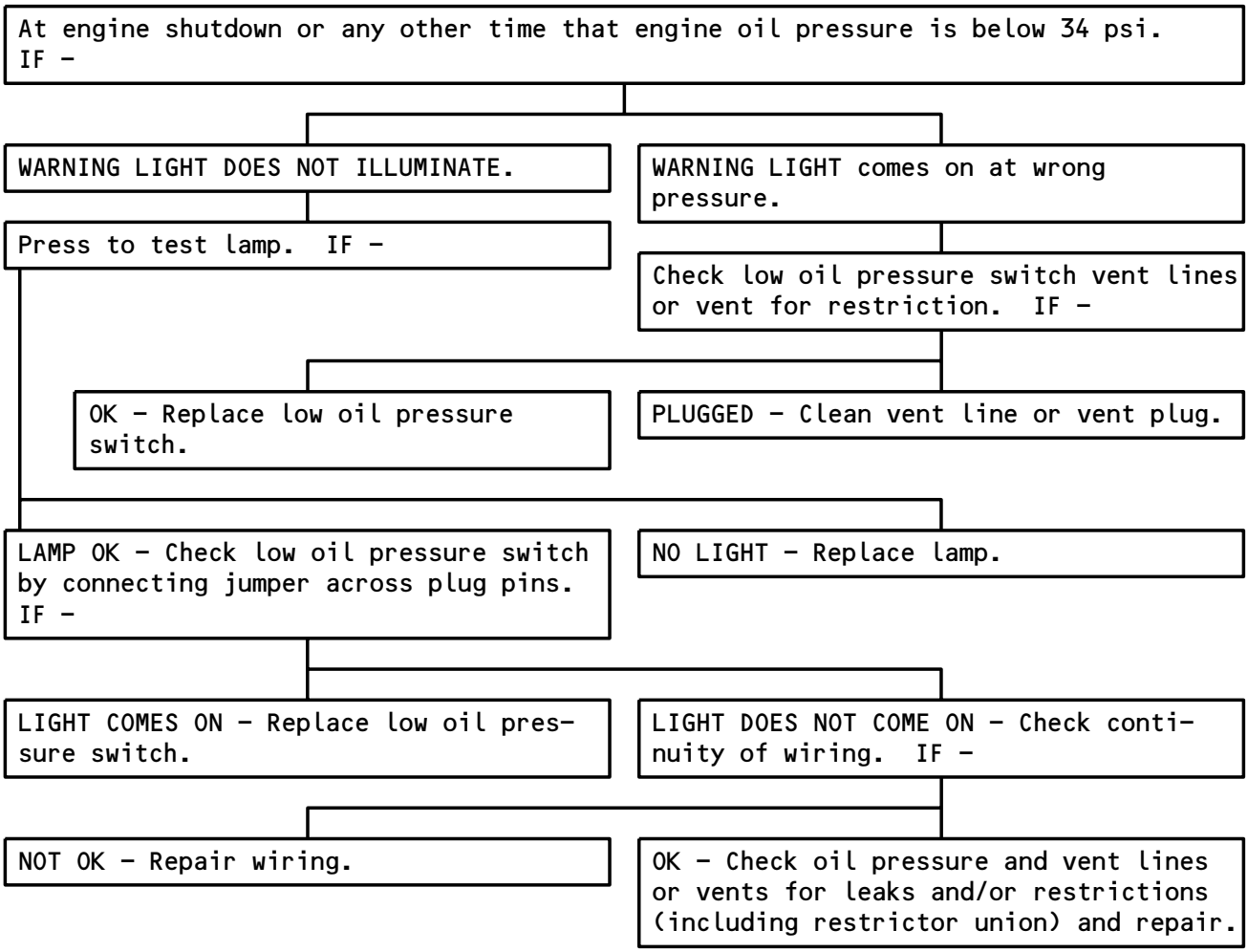
1. General
   A. The low oil pressure warning system provides indication in the control cabin of low engine oil pressure. The system consists of two amber lights on the center instrument panel and a low oil pressure switch mounted on each engine (Fig. 1).
   B. The low oil pressure switch senses the pressure differential between the oil pressure supply line and the accessory drive gearcase vent or ambient cowl pressure depending on configuration. When the pressure falls, the switch closes and completes a 28-volt dc circuit to illuminate the amber low oil pressure light on the center instrument panel.
2. Low Oil Pressure Switch
   A. The low oil pressure switch senses oil supply pressure. High pressure in the supply line opens the switch contacts, breaks the circuit, and extinguishes the warning lights. Low pressure permits the switch to close, completing the circuit and illuminating the low oil pressure warning light. The switch operates at a differential pressure of 34 to 38 psi (Fig. 1).
   B. The low oil pressure switch is mounted on the left side of the engine at approximately the 9 o'clock position slightly below the oil pressure transmitter (Fig. 1).
3. Low Oil Pressure Warning Light
   A. The low oil pressure warning light is a press-to-test light that is connected to the airplane master test and master dim switches. The light for each engine is located on the upper right portion of the center instrument panel.
4. Operation
   A. With electrical power applied and the engines inoperative, the low oil pressure switch will be closed energizing the warning lights. The lights will remain energized until the engines are started and the oil pressure in each engine is built up to approximately 38 psi. If a system malfunction causes an oil pressure drop in one engine, the switch will close before or at 34 psi, turning on the light.



Low Oil Pressure Warning System
Figure 1

LOW OIL PRESSURE WARNING SYSTEM - TROUBLESHOOTING

1. General
   A. Troubleshooting the low oil pressure warning system is a comparatively simple operation since few malfunctions can occur. Symptoms of system defects will be indicated by noting the operation of the indicating light and are limited to the following.
      (1) Illumination of the light at oil pressures above 38 psi
      (2) Illumination of the light at the wrong pressures
      (3) Failure of the light to illuminate.
   B. The following charts cover the troubleshooting procedures.
2. Troubleshooting Charts



Low Oil Pressure Warning System – Troubleshooting
Figure 101

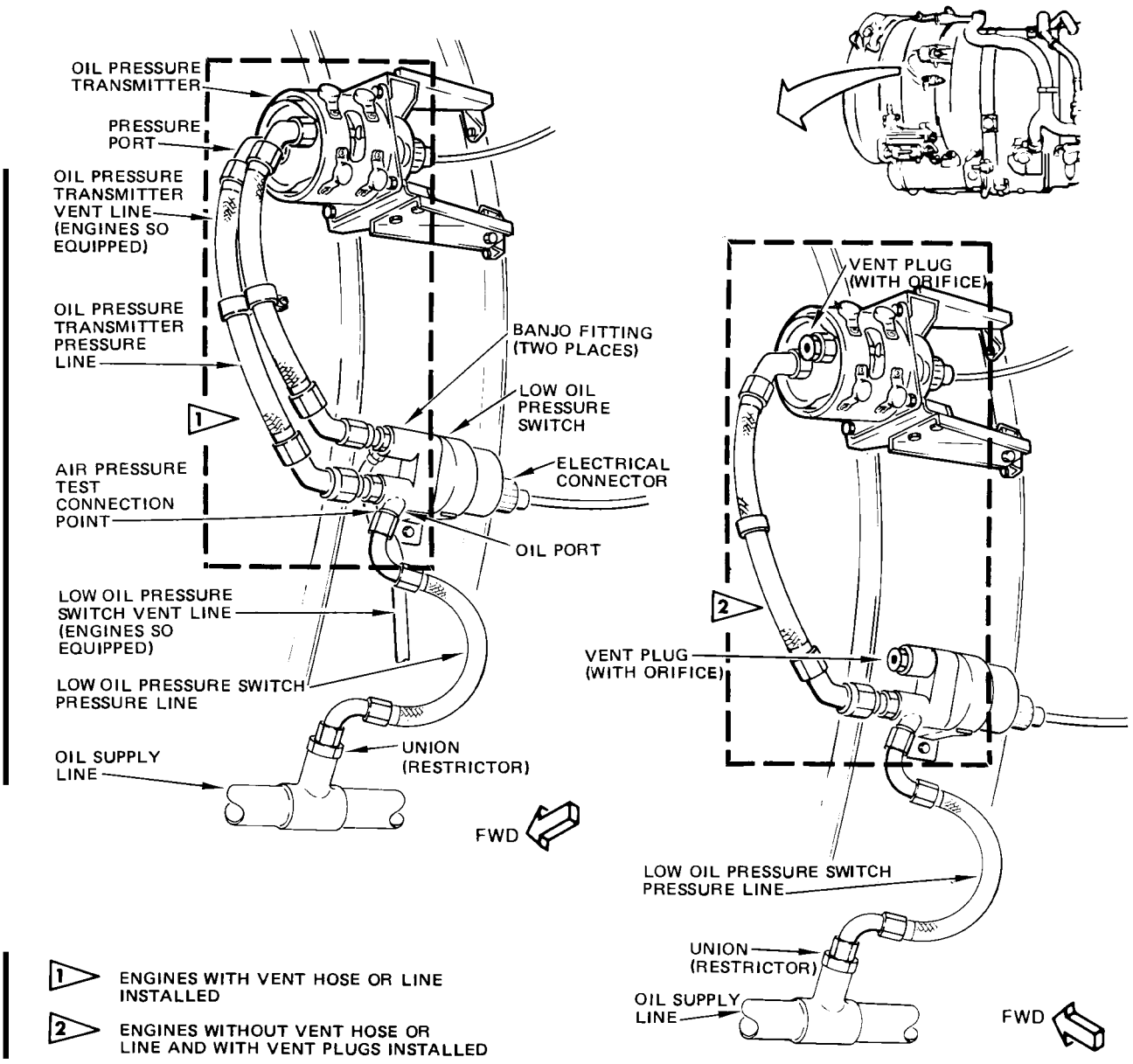
LOW OIL PRESSURE WARNING SYSTEM - ADJUSTMENT/TEST

1. Low Oil Pressure Warning System Test
   A. General
      (1) The low oil pressure warning system can be tested by two different methods. When an engine is started or shut down, the warning light and low oil pressure switch operation may be checked against the oil pressure indicator on the engine instrument panel. The system may also be tested with the engine inoperative by applying an air pressure source to the low oil pressure switch and observing the warning light operation.
   B. Equipment and Materials
      (1) Variable air pressure source - 38 psi minimum pressure
   C. Test Low Oil Pressure Warning System During Engine Start and Shutdown
      (1) With Sec 2 and Sec 5 circuit breakers on panel P6 closed, determine that warning light is illuminated before starting engine.
      (2) During engine start, note pressure at which warning light goes out. Light should go out with increasing pressure before or at 38 psi.
      (3) When engine is shut down, note pressure at which warning light illuminates. Light should come on with decreasing pressure before or when 34 psi is reached.
   D. Test Low Oil Pressure Warning System Using Air Pressure Source
      (1) Open left cowl panel to expose left side of engine.
      (2) With external power applied to airplane and Sec 2 and Sec 5 circuit breakers on circuit breaker panel P6 closed, determine that warning light is illuminated before connecting air source.
      (3) Disconnect low oil pressure switch pressure line at banjo fitting in low oil pressure switch OIL port and connect air pressure source to banjo fitting. (See figure 501.)
      (4) Gradually apply air pressure to low oil pressure switch. Warning light should go out with increasing pressure before or at 38 psi.

          CAUTION: DO NOT OVERPRESSURIZE LOW OIL PRESSURE SWITCH OR DAMAGE TO UNIT MAY OCCUR.

      (5) Gradually reduce pressure until pressure warning light illuminates. Light should come on with decreasing pressure before or when 34 psi is reached.
      (6) Open Sec 2 and Sec 5 circuit breakers. Light should go out. Close circuit breakers.
      (7) Reduce air pressure to zero psig and remove air pressure source.
      (8) Connect low oil pressure switch pressure line to low oil pressure switch banjo fitting. Do not tighten connection.
      (9) Motor or operate engine until oil leakage is observed of switch pressure line connection. Tighten fitting and install lockwire.
      (10) Close cowl panels.

(11) If no longer required, disconnect external electrical power (Refer to Chap 24).



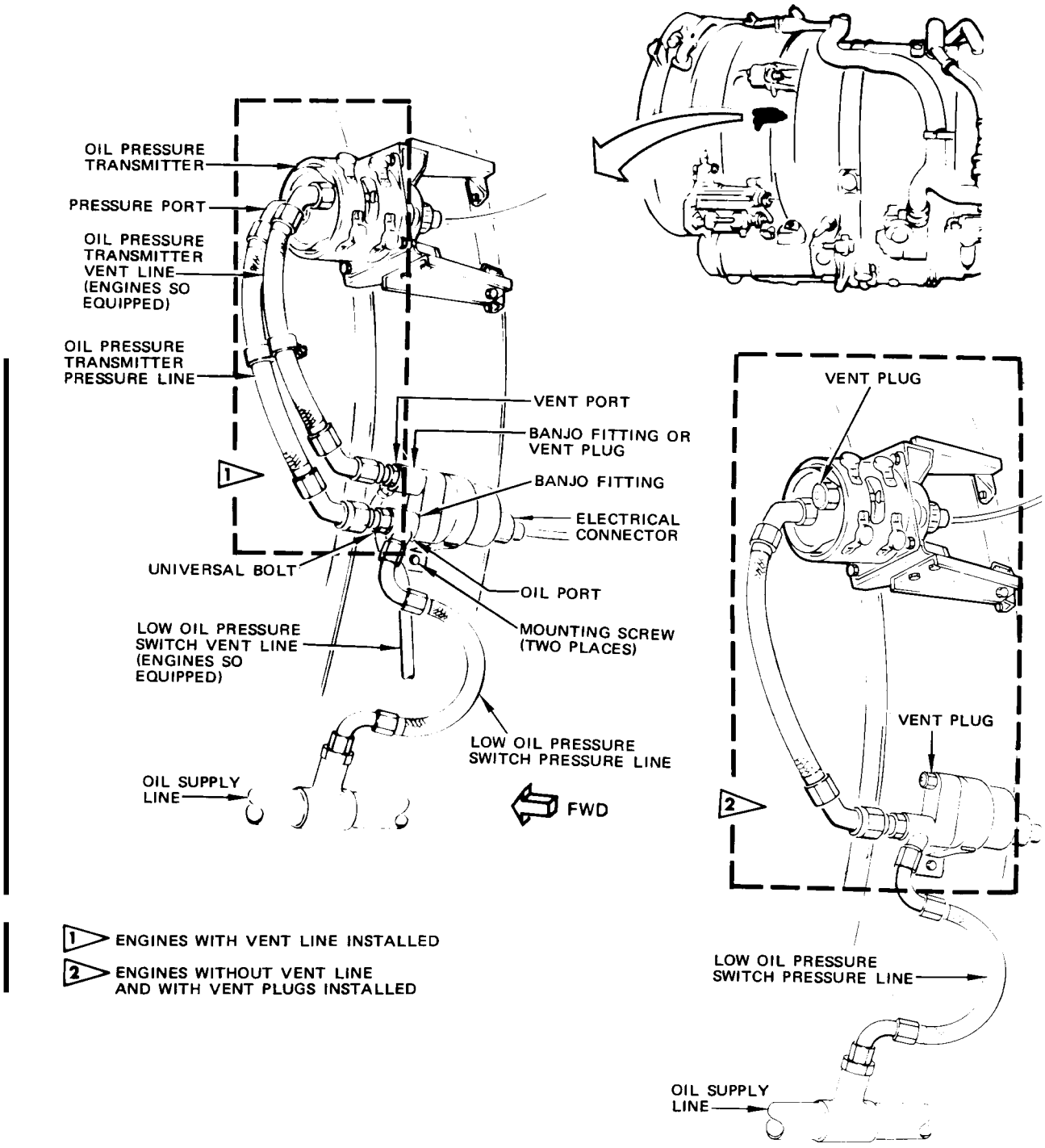
Low Oil Pressure Indicating System Test
Figure 501

LOW OIL PRESSURE SWITCH - REMOVAL/INSTALLATION

1. Prepare to Remove Low Oil Pressure Switch
   A. Open applicable left cowl panel.
   B. Open Sec 2 and Sec 5 circuit breakers on circuit breaker panel P6.
2. Remove Low Oil Pressure Switch
   A. Remove electrical connector from low oil pressure switch (Fig. 401).
   B. Disconnect low oil pressure switch vent line and oil pressure transmitter vent line (if installed) at banjo (universal) fitting in switch VENT port.
   C. Disconnect low oil pressure switch pressure line and oil pressure transmitter pressure line at banjo fitting in switch OIL port.
   D. Remove two bracket mounting screws and remove bracket and switch assembly.
   E. If switch is to be replaced with a new unit remove universal bolts and banjo fittings.
3. Install Low Oil Pressure Switch
   A. If a new switch is being installed, position banjo fittings in switch OIL and VENT (if installed) ports. Install universal bolts thru banjo fittings using new O-rings, (two for each bolt).

      NOTE: Lubricate O-rings with engine oil before installation.

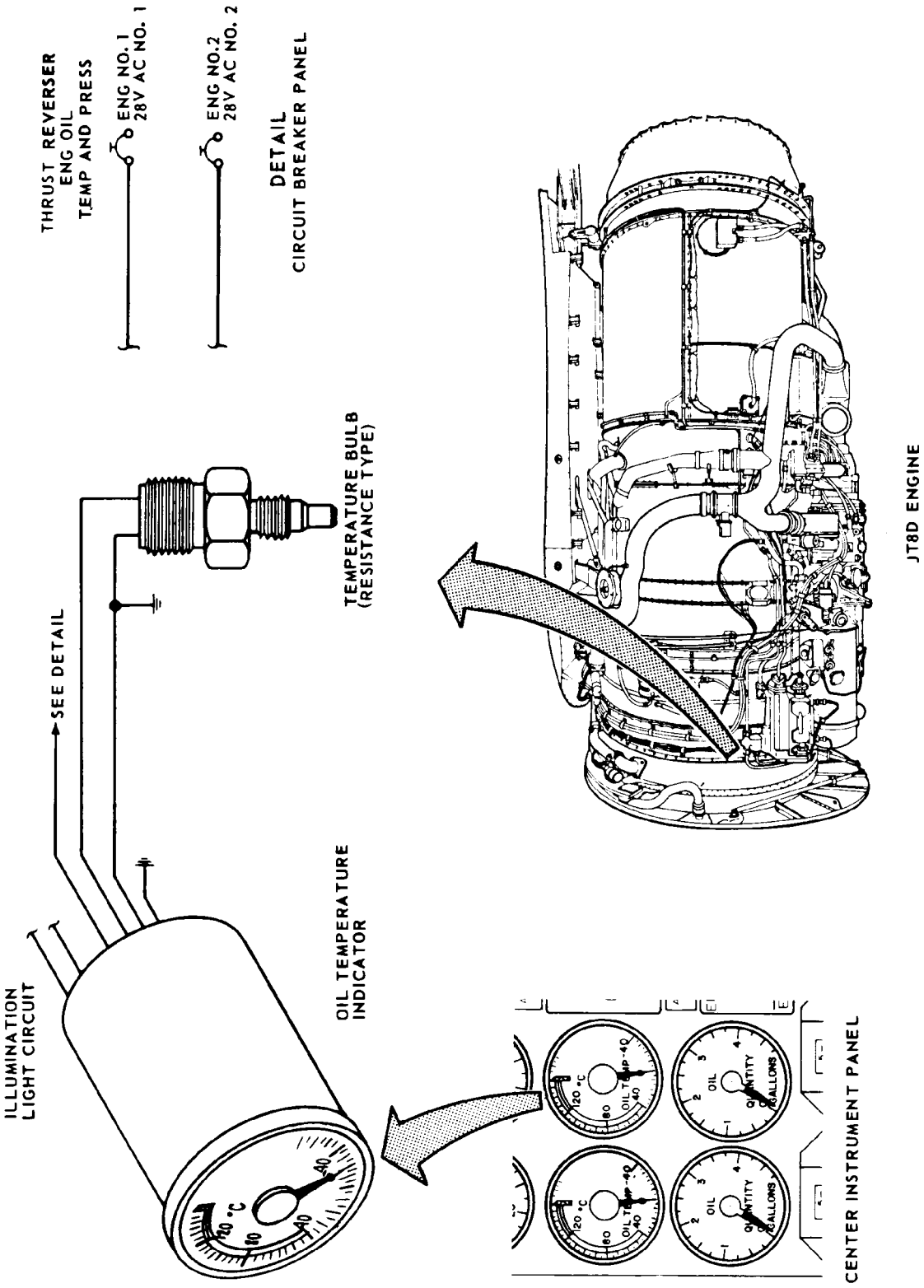
   B. To provide adequate electrical bonding, ensure that faying surface between switch mounting base and bracket on engine flange E is clean. Secure switch to bracket using two screws, washers and nuts (Fig. 401).
   C. Connect oil pressure transmitter vent line (if installed) to universal bolt at switch VENT port. Connect low oil pressure switch vent line to banjo fitting at switch VENT port.
   D. Connect oil pressure transmitter pressure line to universal bolt at switch OIL port. Connect low oil pressure switch pressure line to banjo fitting at switch OIL port. Do not tighten connection.
   E. Motor or operate engine until oil leakage is observed at low oil pressure transmitter line connection and low oil pressure switch pressure line connection at banjo fitting. Tighten connections.
   F. Lockwire universal bolts.
   G. Connect electrical connector at receptacle on aft end of switch.
   H. During next engine operation, check that switch operates normally.
4. Restore Airplane to Normal Configuration
   A. Close Sec 2 and Sec 5 circuit breakers on panel P6.
   B. Close engine left cowl panel.



Low Oil Pressure Switch Installation
Figure 401

OIL TEMPERATURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The oil temperature indicating system provides an indication in the control cabin of the oil temperature in each engine. The overall system consists of two oil temperature indicators and two oil temperature sensing bulbs. (See figure 1.)
   B. Each oil temperature bulb contains a resistance element which varies its resistance proportionally to changes in temperature. This resistance element controls the current passing through the meter movement in the oil temperature indicator. Electrical power for system operation is 28 volt, 400-cycle ac.
2. Oil Temperature Bulb
   A. The oil temperature bulb comprises an enclosed resistance unit whose value changes from approximately 68 ohms at -70°C to 242 ohms at +300°C. The bulb screws into a fitting at the outlet of the fuel/oil cooler. The temperature sensing part of the bulb is in direct contact with the oil flow leaving the cooler.
3. Oil Temperature Indicator
   A. The oil temperature indicator is a resistance ratiometer type unit. The indicator is operated by the ratio of currents through two coils in the meter movement. The indicator dial is calibrated in degrees centigrade and reads from -70°C to +150°C. With power off, the dial pointer remains off scale at the low temperature end. Electrical connections are made to the indicator through a quick disconnect plug.
4. Operation
   A. The oil temperature indicator and the temperature sensing bulb are electrically connected to form the temperature indicating circuit. The temperature sensing bulb is electrically connected to a deflection coil in the indicator. Since the temperature bulb contacts the engine oil, it will assume the same temperature as the oil, and thus the resistance of the bulb is proportional to oil temperature. Resistance of the bulb controls the current flowing through the indicator deflection coil, and therefore controls the angular position of the pointer.



Oil Temperature Indicating System
Figure 1

OIL TEMPERATURE INDICATING SYSTEM - TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
Indicator reads low	Indicator out of tolerance	Perform Oil Temperature Indicator Test, AMM 79-34-11 (Substitution of test indicator)	Replace indicator
	Defective temperature sensing bulb		Replace bulb
Indicator reads high	Indicator out of tolerance	Perform Oil Temperature Indicator Test, AMM 79-34-11 (Substitution of test indicator)	Replace indicator
	Defective Temperature Sensing bulb		Replace bulb
Indicator pointer remains at top of scale	Open circuit in temperature bulb		Replace temperature bulb
	Short circuit in indicator		Replace indicator
Indicator pointer remains at bottom of scale	No power supplied to system	Check that engine oil temperature and pressure indicator circuit breaker on P6 panel is closed and external power is connected	Close circuit breaker and connect external power
	Short circuit in temperature bulb		Replace temperature bulb
	Open circuit in indicator		Replace indicator
	No power supplied to indicator	Check continuity of wiring between indicator, temperature bulb and power supply	Repair defective wiring

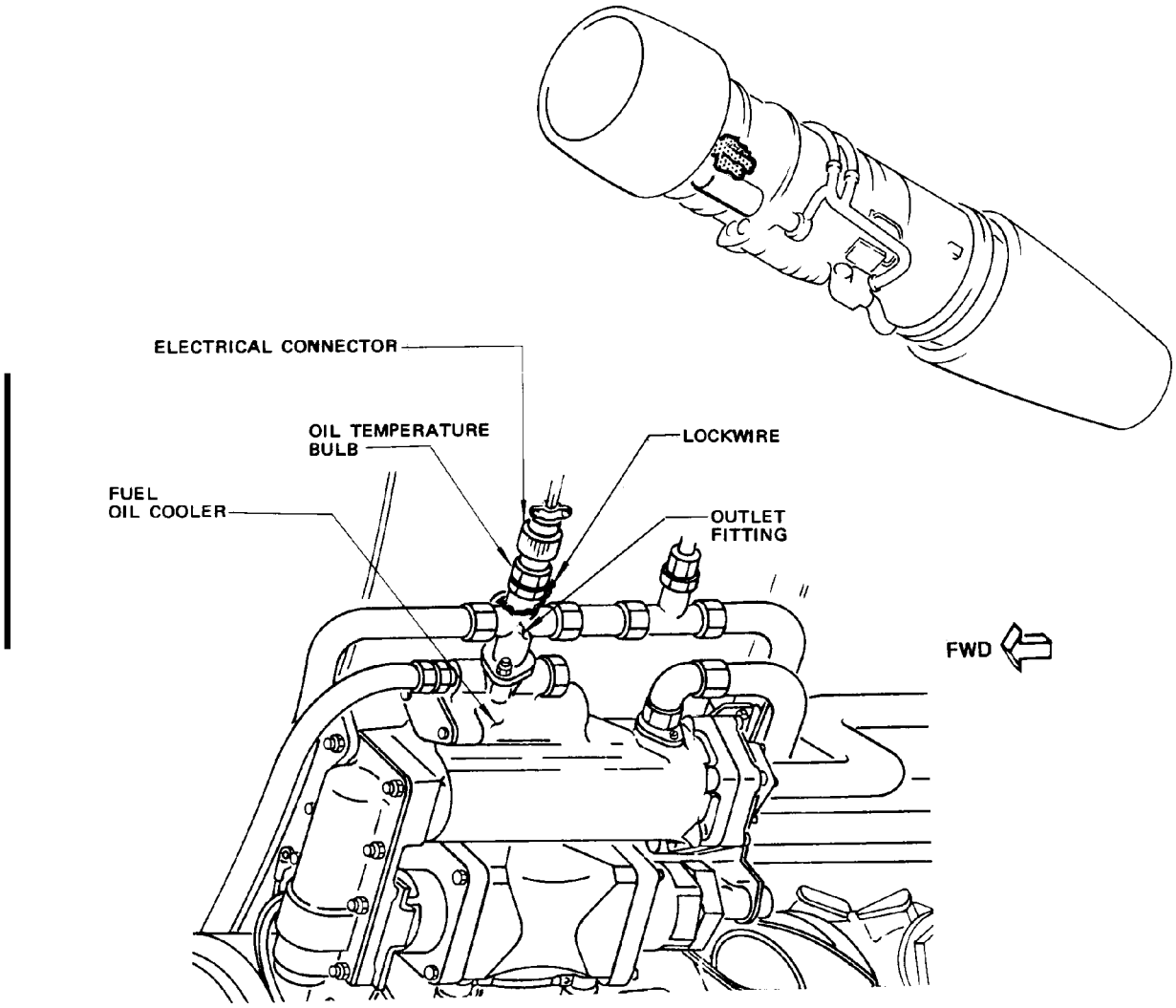
TROUBLE	PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
Indicator fluctuates or is erratic	Engine ground stud self-locking nut improperly tightened	Check self-locking nut for proper tigbhtness	Tighten self-locking nut
	Defective engine ground	Check resistance of indicating system electrical ground on engine. Ground resistance should not exceed .001 ohm.	Clean ground stud, terminal lug and bond area

OIL TEMPERATURE INDICATING SYSTEM - ADJUSTMENT/TEST

1. Oil Temperature Indicating System Test
   A. General
      (1) The oil temperature indicating system test is performed to ensure operational integrity of the oil temperature bulb, electrical wiring, and the oil temperature indicator.
      (2) The system test is accomplished by applying simulated engine oil temperatures to the oil temperature bulb, taking the temperature readings with a master thermometer, and comparing these with the temperatures observed on the oil temperature indicator.
      (3) An additional test of the oil temperature indicator may be performed by substituting a test indicator for the airplane indicator and comparing the temperature readings of the two indicators. See 79-34-11, Oil Temperature Indicator - Adjustment/Test.
   B. Equipment and Materials
      (1) Unbreakable Master Thermometer - calibrated in degrees centigrade
      (2) Variable Temperature Oil Bath
   C. Prepare to Test Oil Temperature Indicating System
      (1) Connect electrical power to airplane.
      (2) Open applicable Oil Temperature and Pressure circuit breaker on main load control panel (P6).

          CAUTION: FAILURE TO OPEN CIRCUIT BREAKER BEFORE REMOVING OIL TEMPERATURE BULB ELECTRICAL CONNECTOR MAY RESULT IN DAMAGE TO OIL TEMPERATURE INDICATOR.

      (3) Open left side cowl panel.
   D. Test Oil Temperature Indicating System
      (1) Remove lockwire from oil temperature bulb electrical connector on fuel oil cooler and remove connector from bulb. (See figure 501.)
      (2) Remove oil temperature bulb from fuel oil cooler outlet fitting.
      (3) Cap fuel oil cooler outlet fitting to prevent entry of foreign matter into system.
      (4) Connect electrical connector to oil temperature bulb.
      (5) Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
      (6) Immerse sensing element portion of master thermometer and oil temperature bulb to top of attaching threads in hot oil bath.
      (7) Regulate oil bath to several different temperatures and observe readings on master thermometer and oil temperature indicator. Check that readings agree within ± 5°C.
      (8) Open applicable Oil Temperature and Pressure circuit breaker on panel P6.
      (9) Remove oil temperature bulb from oil bath.



Oil Temperature Indicating System Test
Figure 501

(10) Disconnect electrical connector from oil temperature bulb. Remove cap from fuel oil cooler outlet fitting and install temperature bulb in fitting. (See figure 501.)
(11) Install electrical connector on oil temperature bulb and lockwire to boss on fuel oil cooler fitting.
(12) Close left side cowl panel.
(13) Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
(14) If no longer required, remove electrical power.

NOTE: The first time that engine is operated after performing this test, check to ensure oil temperature indications are normal and no leakage occurs around oil temperature bulb fitting on fuel oil cooler.

OIL TEMPERATURE INDICATOR – ADJUSTMENT/TEST

1. Oil Temperature Indicator Test
   A. General
      (1) Testing of the oil temperature indicator may be performed by replacing the airplane indicator with a test indicator. The readings of the two indicators with external power applied to the system may then be compared.
   B. Equipment and Materials
      (1) Temperature Test Indicator – temperature scale in centigrade from –70°C to +150°C. (Lewis Engineering Company, Naugatuck, Connecticut, Model 162C7 or equivalent.)
   C. Test Oil Temperature Indicator
      (1) Connect external electrical power to airplane (or use APU electrical power).
      (2) Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
      (3) Read oil temperature on airplane indicator.
      (4) Open Oil Temperature and Pressure circuit breaker on panel P6 and observe indicator reading. Indicator needle should return to normal no-power (down scale) position. Close circuit breaker.
      (5) Remove oil temperature indicator from engine instrument panel and disconnect electrical connector.
      (6) Connect electrical connector to test indicator. Temperature reading of test indicator should correspond with temperature reading obtained from airplane indicator in step (3) within ± 5°C.
      (7) Remove electrical connector from test indicator, connect to airplane indicator and install airplane indicator in engine instrument panel.
      (8) If no longer required, remove external electrical power.

OIL TEMPERATURE BULB - REMOVAL/INSTALLATION

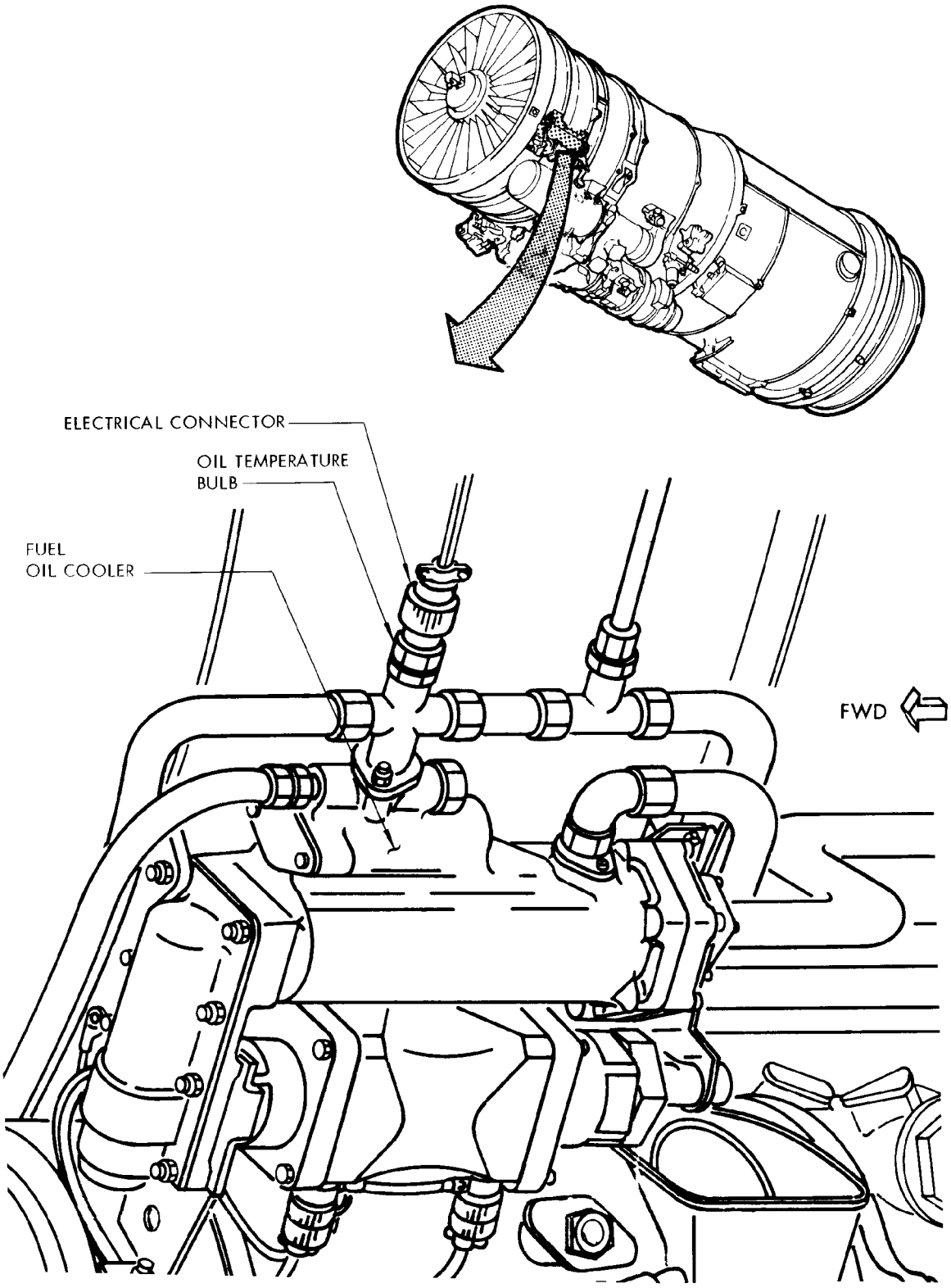
1. Remove Oil Temperature Bulb (Fig. 401)
   A. Open left side removable cowl panel.
   B. Open applicable Oil Temperature and Pressure circuit breaker on panel P6.

      CAUTION: FAILURE TO OPEN CIRCUIT BREAKER BEFORE REMOVING OIL TEMPERATURE BULB ELECTRICAL CONNECTOR MAY RESULT IN DAMAGE TO OIL TEMPERATURE INDICATOR.

   C. Disconnect electrical connector from oil temperature bulb located in oil outlet fitting on fuel oil cooler.
   D. Remove oil temperature bulb by unscrewing bulb from fitting.
2. Install Oil Temperature Bulb

   NOTE: Make electrical bond between oil temperature bulb and fuel oil cooler faying surfaces. Maximum resistance across faying surfaces is 0.0025 ohms (2.5 milliohms).

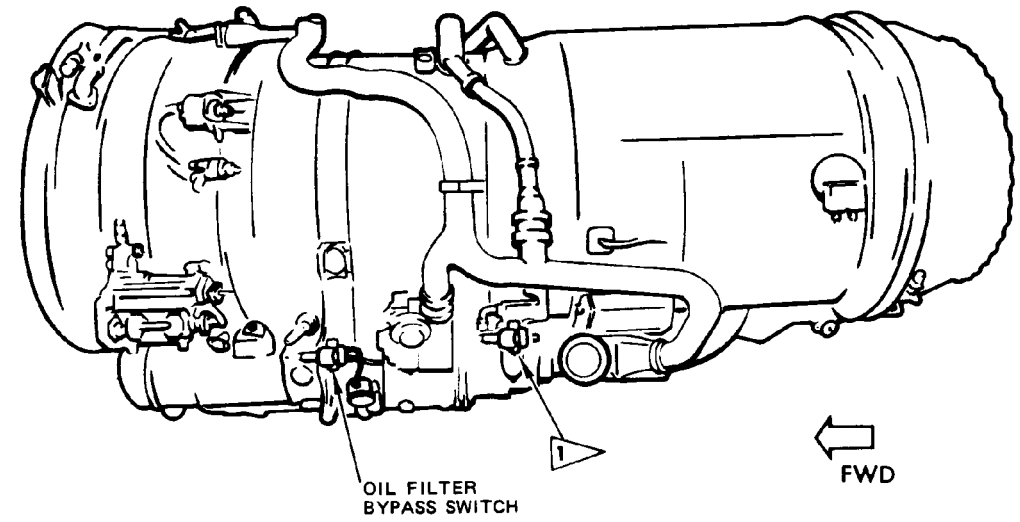
   A. Install oil temperature bulb in oil outlet fitting on fuel oil cooler and lockwire.
   B. Install electrical connector on oil temperature bulb and lockwire to boss on fuel oil cooler fitting.
   C. Close left side cowl panel.
   D. Close applicable Oil Temperature and Pressure circuit breaker on panel P6.
   E. Operate engine (Ref 71-09-100, MP). Check that oil temperature bulb indications are normal.



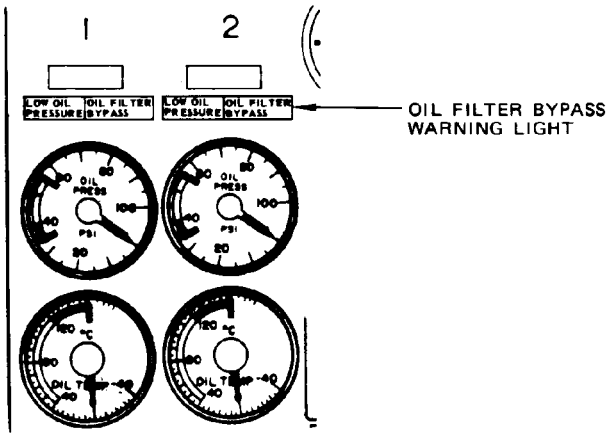
Oil Temperature Bulb Installation
Figure 401

OIL FILTER BYPASS WARNING SYSTEM - DESCRIPTION AND OPERATION

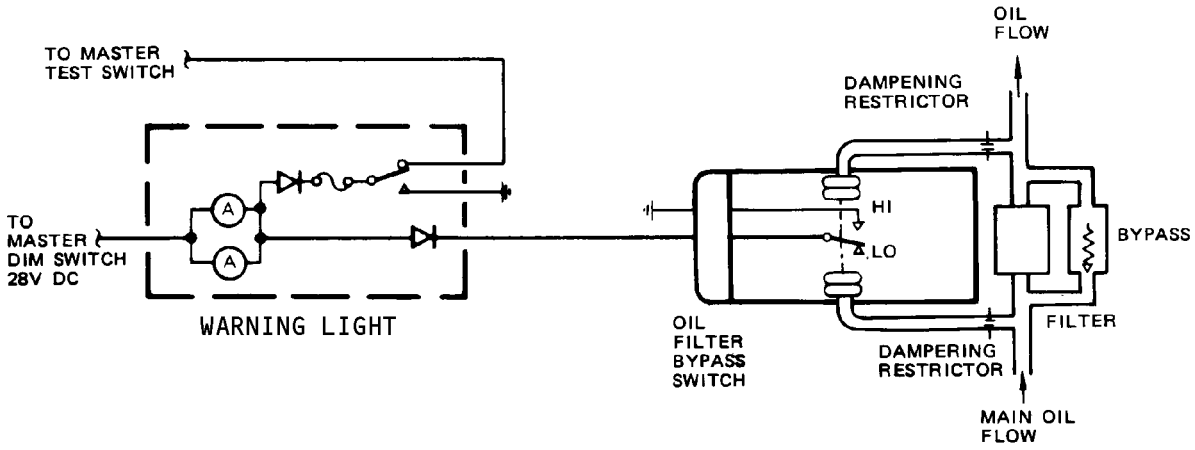
1. General
   A. The oil filter bypass warning system provides indication in the control cabin of an engine oil filter bypass valve about to bypass oil around a clogged filter. The system consists of two amber lights on the center instrument panel and an oil filter bypass switch mounted on each engine Fig. 1).
   B. The oil filter bypass switch senses the oil pressure on each side of the engine main oil filter. An increase in pressure difference across the filter closes the switch and completes a 28 volt dc circuit to illuminate the amber filter bypass light on the center instrument panel.
2. Oil Filter Bypass Switch
   A. The oil filter bypass switch is a pressure operated switch which senses the oil pressure drop across the engine oil filter. The switch is designed to operate at a differential pressure of 34 to 38 psi.
   B. The oil filter bypass switch is mounted on a bracket attached to the accessory drive gearcase at approximately the 7 o'clock position just above the gearcase overboard breather. On some engines the oil filter bypass switch is mounted on a bracket attached to the constant speed drive oil filter on the left side of the engine (Fig. 1).
3. Oil Filter Bypass Warning Light
   A. The oil filter bypass warning light is a press-to-test type light that is connected to the airplane master test and master dim switches. The light for each engine is located on the upper right portion of the center instrument panel.
4. Operation
   A. During engine operation the main oil filter may become clogged. If the filter becomes sufficiently contaminated to impede the supply of oil to the bearings, a bypass valve in the filter will open diverting the oil past the filter and providing an uninterrupted oil supply to the bearings. At an oil pressure differential of approximately 34 to 38 psi between the inlet and outlet of the filter, the switch will close illuminating the warning light. Illumination of the warning light is designed to precede actual bypass of the oil filter.



1 OIL FILTER BYPASS SWITCH POSITION ON SOME ENGINES



CENTER INSTRUMENT PANEL



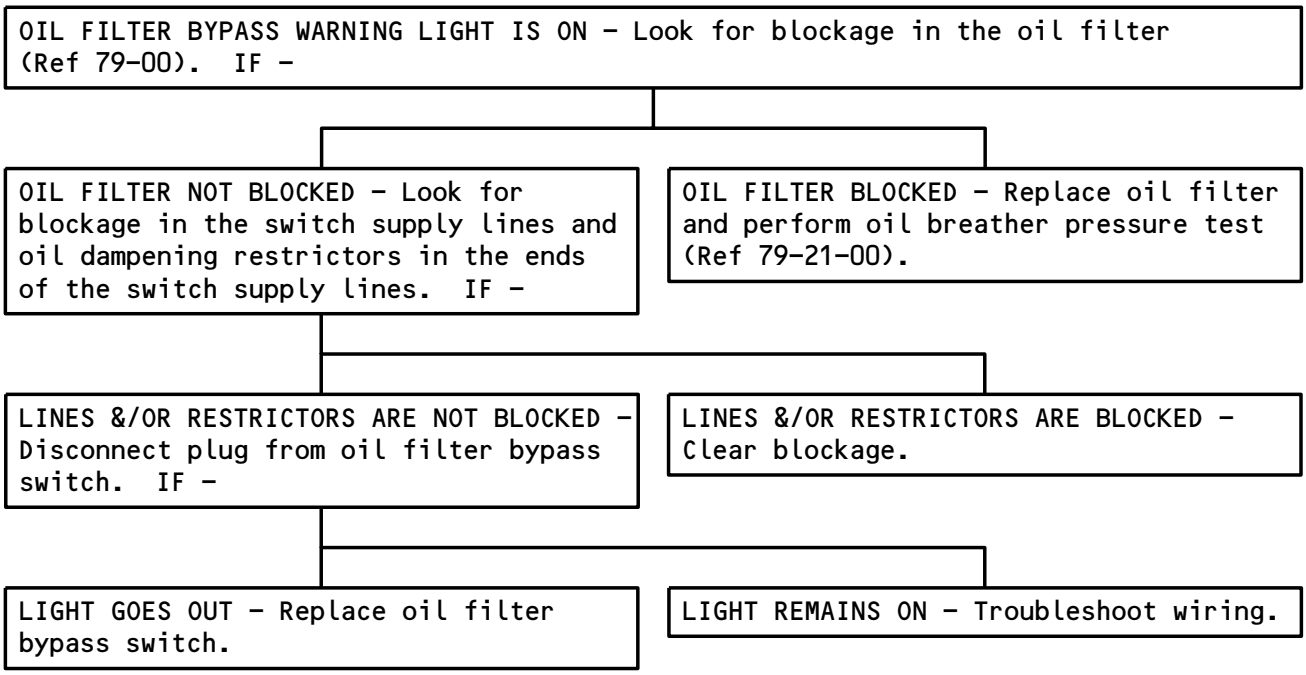
Oil filter Bypass Warning System
Figure 1

OIL FILTER BYPASS WARNING SYSTEM - TROUBLESHOOTING

1. General

A. Troubleshooting the oil filter bypass warning system is a comparatively simple operation since few malfunctions can occur. Symptoms of system defects will be indicated by noting the operation of the warning light are limited to the following: illumination of the light at differential pressures below 38 psi, illumination of the light at the wrong pressures, and the failure of the light to illuminate. The following chart cover the troubleshooting procedures.

NOTE: For starting and ground operation of JT8D engines incorporating the 15 or 40 microns main oil filter: Illumination of the differential oil pressure warning light may be caused by contaminant material in the filter, by cold, viscous oil, or by a combination of the two. In general, when oil temperature is above 25°C (77°F) at idle, illumination of the warning light indicates the presence of contaminants alone and the filter should be serviced immediately. If oil temperature is 25°C or below, the warning light may remain on after start, but should go out as the oil warms. Normally the oil will warm sufficiently within 5 minutes to extinguish the warning light.



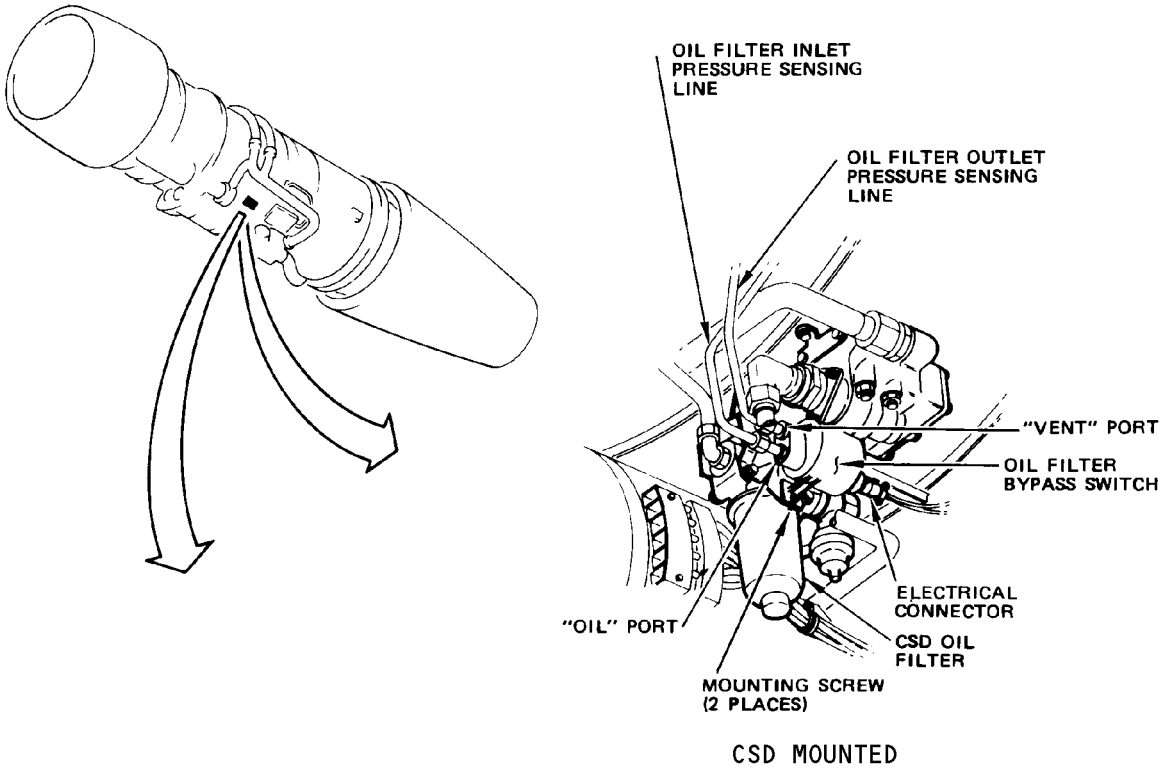
Oil Filter Bypass Warning System – Troubleshooting
Figure 101

OIL FILTER BYPASS WARNING SYSTEM - ADJUSTMENT/TEST

1. Oil Filter Bypass Warning System Test
   A. General
      (1) Since the oil filter bypass switch actuates only when the oil filter is clogged, it is only practical to test this switch using an external air pressure source.
   B. Equipment and Materials
      (1) Variable air pressure source - 38 psig minimum pressure
      (2) Engine oil
   C. Prepare to Test Oil Filter Bypass Warning System
      (1) Open left cowl panel.
      (2) Connect external electrical power to airplane.
   D. Test Oil Filter Bypass Warning System
      (1) Close Sec 2 and Sec 5 circuit breakers on P6 panel.
      (2) Observe oil filter bypass warning light on engine instrument panel. Light should be out.
      (3) Disconnect oil filter inlet pressure sensing line at oil filter bypass switch OIL port and connect air pressure source to switch. (See figure 501.)
      (4) Gradually apply air pressure to oil filter bypass switch. Filter bypass warning light should illuminate when pressure reaches 34-38 psig.

          CAUTION: DO NOT OVERPRESSURIZE OIL FILTER BYPASS SWITCH OR DAMAGE TO UNIT MAY OCCUR.

      (5) Hold pressure and open Sec 2 and Sec 5 circuit breakers. Light should go out.
      (6) Gradually reduce pressure to zero psig.
      (7) Close, and then open Sec 2 and Sec 5 circuit breakers on panel P6. Light should remain out.
      (8) Remove air pressure source from oil filter bypass switch.
      (9) Loosely connect oil filter inlet sensing line to oil filter bypass switch pressure port. Motor or operate engine until oil leakage is observed at fitting. Tighten fitting and lockwire.
   E. Restore Airplane to Normal Configuration
      (1) Close engine cowl panel.
      (2) Close Sec 2 and Sec 5 circuit breakers on panel P6.
      (3) If no longer required, remove external electrical power.



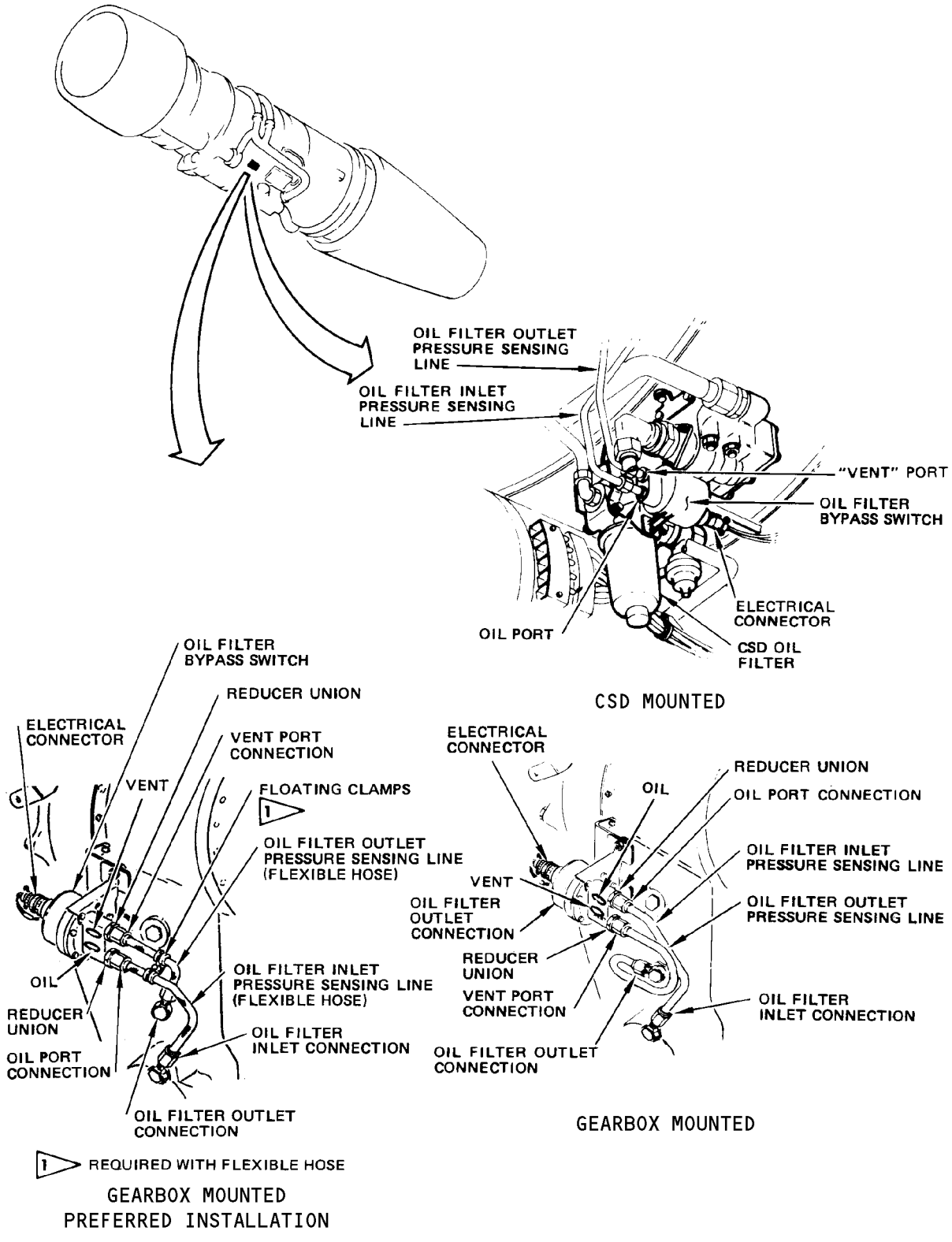
Oil Filter Bypass Warning System Test
Figure 501

OIL FILTER BYPASS SWITCH - REMOVAL/INSTALLATION

1. Prepare to Remove Oil Filter Bypass Switch
   A. Open left cowl panel.
   B. Open Sec 2 and 5 circuit breakers on circuit breaker panel P6.
2. Remove Oil Filter Bypass Switch (Fig. 401)
   A. Remove electrical connector from oil filter bypass switch.
   B. Disconnect tubing between filter inlet port and switch at reducer union in switch OIL port. On some engines a flexible hose is installed.
   C. Disconnect tubing between filter outlet port and switch at reducer union in switch VENT port. On some engines a flexible hose is installed.
   D. Remove two screws attaching switch and bracket assembly to bracket on engine gearbox. On some engines, remove two screws attaching switch and bracket assembly to bracket on constant speed drive (CSD) oil filter.
   E. If switch is to be replaced with a new unit, remove reducer unions and O-rings.
3. Install Oil Filter Bypass Switch (Fig. 401)
   A. If a new switch is being installed, install reducer unions in switch using new O-rings.

      NOTE: Lightly coat O-rings with engine oil before installation.

   B. To provide adequate electrical bonding, ensure that faying surface between switch mounting base and bracket on engine gearbox is clean. Secure switch to bracket using two screws. On some engines, ensure that faying surface between switch mounting base and bracket on CSD oil filter is clean. Secure switch to bracket using two screws.
   C. Connect oil filter outlet pressure sensing line to reducer union in switch VENT port. Do not tighten VENT port connection.
   D. If oil filter inlet and outlet thru bolts have been loosened or removed, re-install and tighten to 133-147 inch-pounds.
   E. Install electrical connector at oil filter bypass switch electrical receptacle.
   F. Perform oil filter bypass system test (Ref 79-35-0/501).
   G. Motor or operate engine until oil leakage is observed at vent port connection, then tighten that fitting.
4. Restore Airplane to Normal Configuration
   A. Close Sec 2 and 5 circuit breakers on circuit breaker panel P6-3.
   B. Close engine cowl panel.



Oil Filter Bypass Switch Installation
Figure 401