CHAPTER

79

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BOEING 707 Intercontinental

MAINTENANCE MANUAL

CHAPTER 79

OIL

TABLE OF CONTENTS

ENGINE OIL SYSTEM - DESCRIPTION AND OPERATION

1. General

A The engine oil system consists of an oil storage and an oil distribution system, which together with the indicating systems, provide measurements of oil quantity, oil pressure, and oil temperature. A low oil pressure and filter bypass indicating system is also provided.

B Each engine is provided with an integral pressure oil system The system supplies oil under pressure for lubrication of gears and bearings in the engine and returns scavenged oil to the oil supply tank The engine oil system consists of an oil supply tank, pressure oil pump, oil system strainer, strainer bypass valve, pressure relief valve, scavenge pumps, fuel-oil cooler, and the necessary tubing to provide lubrication and venting for all bearings in the engine.

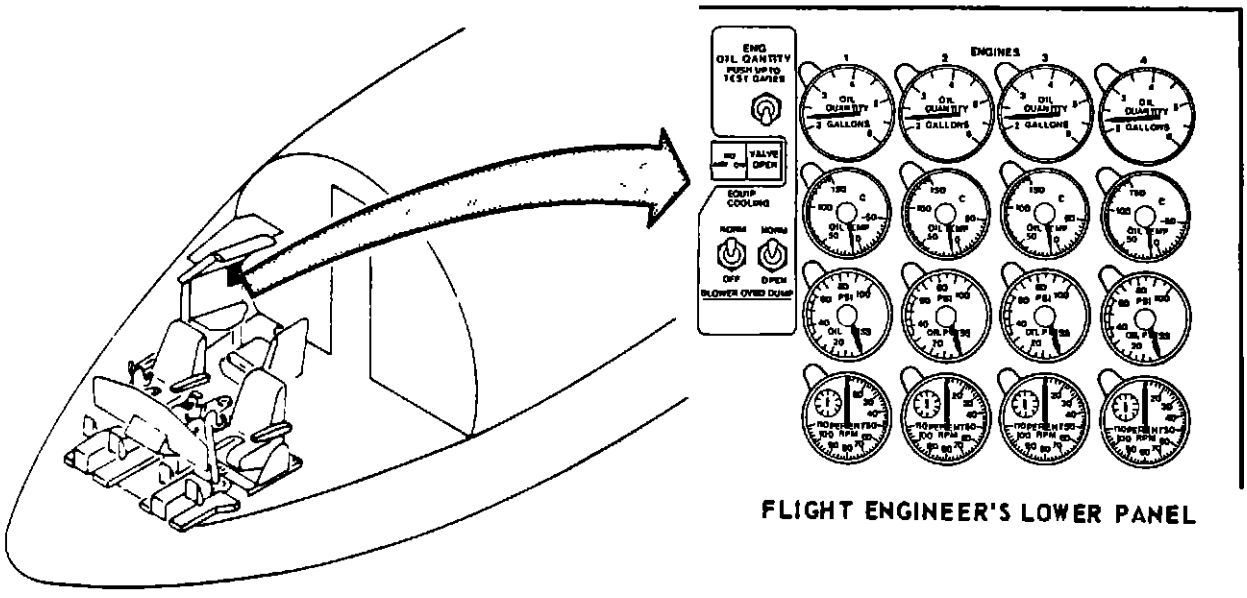
NOTE. This section, 79-6-0, covers only the engine oil tank, fuel-oil cooler, and oil system operation and servicing procedures. Refer to Chapter 71, Power Plant - General, for oil pressure adjustment procedures and to Chapter 72, Engine, for detailed coverage of the oil tank, fuel-oil cooler, and other engine manufacturer supplied components.

2 Engine Oil Tank

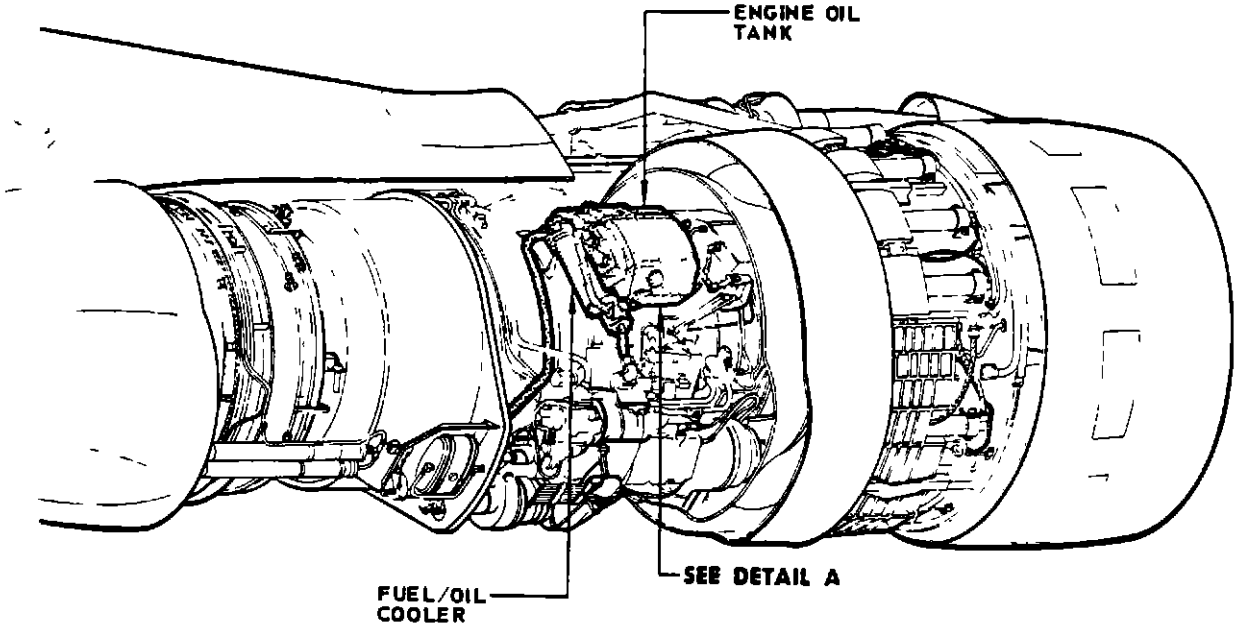
A Each engine is equipped with an independent oil supply tank mounted on the right side of the compressor intermediate case (See figure 1.) Each tank has a total enclosed volume of 8.3 U S. gallons including expansion space. Approximately 0.7 U.S gallon of oil is retained in the oil tank outlet pipe and 2 U.S. gallons will fill the bearing compartments the first time the engine is operated. During engine operation, only the oil indicated (flight engineer's indicators) in the tank may be considered as usable (burnable) oil when calculating the maximum duration of an engine mission.

B 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 may occur during landing, rough flight conditions, etc. A de-aerator in the tank separates most of the air from the returning oil, thus minimizing foaming.

C. Servicing of the oil tank is accomplished through a filler port in the sump cavity. A scupper drain collects and drains overboard any oil spilled or overfilled during servicing. A drain valve at the bottom of the tank allows complete draining of the tank



FLIGHT ENGINEER'S LOWER PANEL



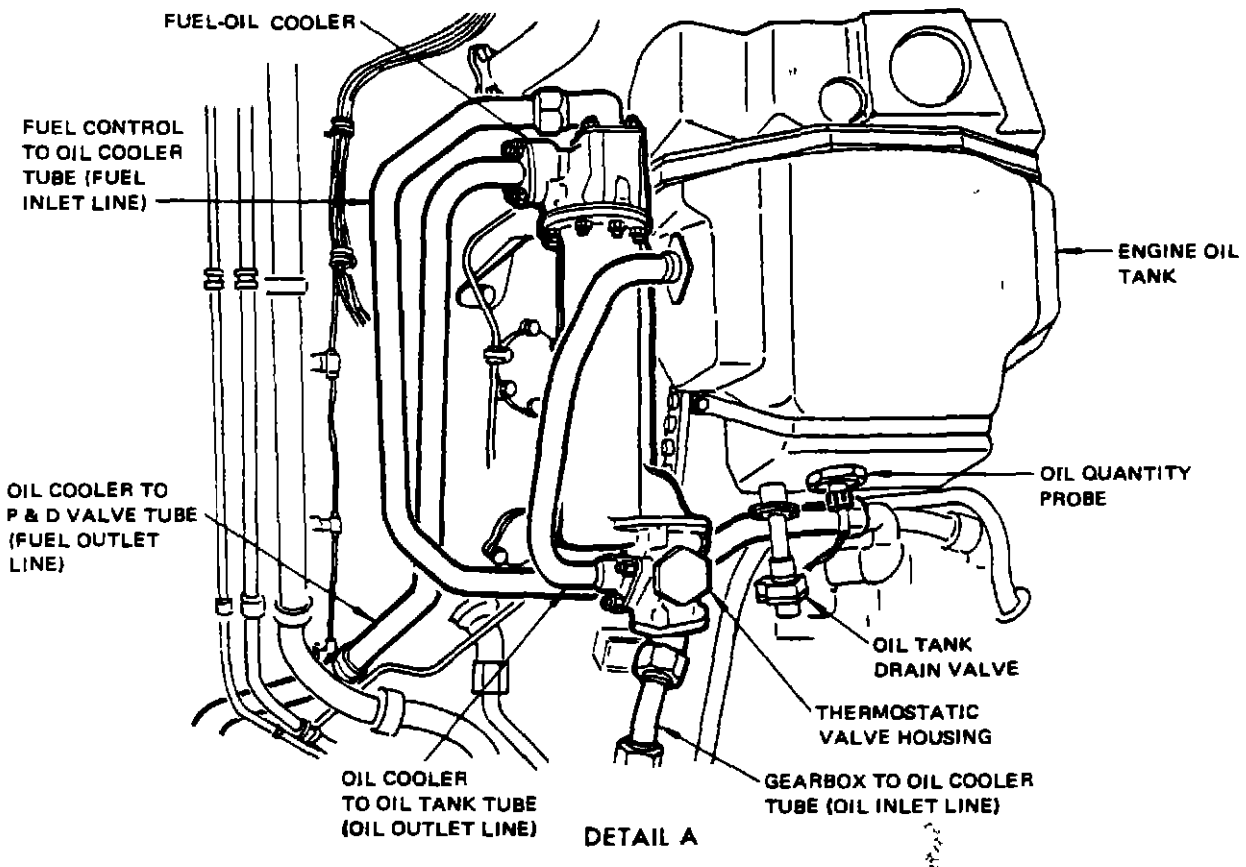
Engine Oil System Equipment Location
Figure 1 (Sheet 1 of 2)

D 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

3 Fuel-Oil Cooler

A The fuel-oil cooler is a cylindrical unit mounted on the lower left side of the intermediate case just aft of the engine oil tank (See figure 1) The cooler consists of a housing containing a removable core composed of small soda straw-like tubes, a series of baffles within the core, and a thermostatic valve

B Oil from the pressure pump in the accessory drive gearbox is directed to the oil inlet port of the fuel-oil cooler The oil flows through the cooler and is 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 Engine oil which has not been heated sufficiently by engine operation to require cooling is prevented from entering the cooler by a thermostatic valve located in the oil inlet port of the cooler Operation of the thermostatic valve is controlled by the oil-out-of-cooler temperature which determines whether the oil bypasses the cooler or goes through it The low limit on the fuel-oil cooler is designed to minimize the amount of cooling done by the fuel so that proper fuel temperatures are maintained. Oil leaves the cooler and flows through the cooler outlet line to the engine oil tank



Engine Oil System Equipment Location
Figure 1 (Sheet 2)

4 Operation

A Oil flows by gravity from the engine oil tank to the engine-driven pump, located in the accessory drive gearbox housing Pressure oil from the pump flows through an oil filter and on to the various engine bearings. A bypass valve provided in the filter, will open and allow oil to continue flowing through the system in the event the filter becomes clogged. An adjustable pressure relief 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 passage.

B Scavenge pumps in the bearing cavities return the oil to a sump in the accessory drive gearbox where another scavenge pump picks up the oil and returns it through the fuel-oil cooler to the engine oil tank A de-aerator in the tank minimizes foaming by separating most of the air from the returning oil.

C An oil breather system interconnects the individual 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. Oil droplets and vapor are removed from the breather airstream by a centrifugal air-oil separator located in the accessory drive gearbox. After passing through the separator unit, the relatively oil-free air is conducted overboard through a vent pipe.

ENGINE OIL SYSTEM - MAINTENANCE PRACTICES

EFFECTIVITY

Turbofan

1. General

A. The maintenance practices included in this section (201-299 page block) are general maintenance instructions that do not definitely fall within a specific category. Any maintenance practices that fall within a specific category will be provided in the applicable page blocks.

2. Engine Oil System - Flushing

A. General

(1) When the engine oil system requires flushing due to suspected or actual contamination, the following procedure shall be used.

B. Equipment and Materials

(1) 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.

(2) Ten gallon container.

(3) Two gallon container.

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

C. Flush Engine Oil System

(1) For access to engine, open left and right side cowl panels.

(2) Position containers to catch oil. Open oil tank drain on bottom of tank.

NOTE: Oil drained in steps (3), (4), and (5) shall be drained through a strainer lined with material capable of retaining any contamination in the oil. Check strainer for contamination. Refer to P&WA Chapter 72, Engine.

(3) Remove main oil drain plug and oil pump drain plug from bottom of accessory drives gearbox housing, and disconnect inlet pressure sensing line from oil strainer.

(4) If contamination is suspected in CSD system, drain cavity by removing CSD cavity drain plug. Refer to Chapter 24, Electrical Power.

(5) Remove nuts and washers securing main oil strainer cover to main oil strainer housing. Remove cover and main oil strainer element. Disassemble and check element for metal particles and contamination. Refer to P&WA Chapter 72, Engine.

D. Prepare Engine for Runup.

(1) Close engine oil tank drain valve on bottom of tank.

(2) Install main oil drain plug and oil pump drain plug in bottom of accessory drive gearbox housing.

(3) Install new or overhauled main oil strainer element in main oil strainer housing. Install strainer cover and secure with washers and nuts. Tighten nuts to recommended torque. Refer to P&WA Chapter 72, Engine.

(4) Connect inlet pressure sensing line to oil strainer.

(5) If constant speed drive input spline cavity was drained. Install CSD drain plug and service with recommended oil. Refer to Chapter 12, Servicing, and Chapter 24, Electrical Power.

(6) Remove self-locking filler cap from port in sump cavity and fill oil tank to lip of filler port with new oil. Replace oil tank filler cap

(7) Close engine cowling as necessary.

E. Engine Runup

(1) Start engine and operate at idle rpm for at least 5 minutes. Refer to Chapter 71, Power Plant.

F. After Engine Runup

(1) Repeat steps C(1) through (5).

(2) Repeat steps D(1) through (7).

(3) Lockwire, main oil drain plug, oil pump drain plug, and CSD spline cavity drain plug.

(4) Start and operate engine at idle rpm and check for oil leaks.

(5) Check the oil supply tank level after engine shutdown and replenish as required. Refer to Chapter 12, Servicing.

(6) Close and secure cowl panels.

ENGINE OIL SYSTEM - SERVICING

EFFECTIVITY

Turbofan

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 Ten gallon container

C Two gallon container.

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

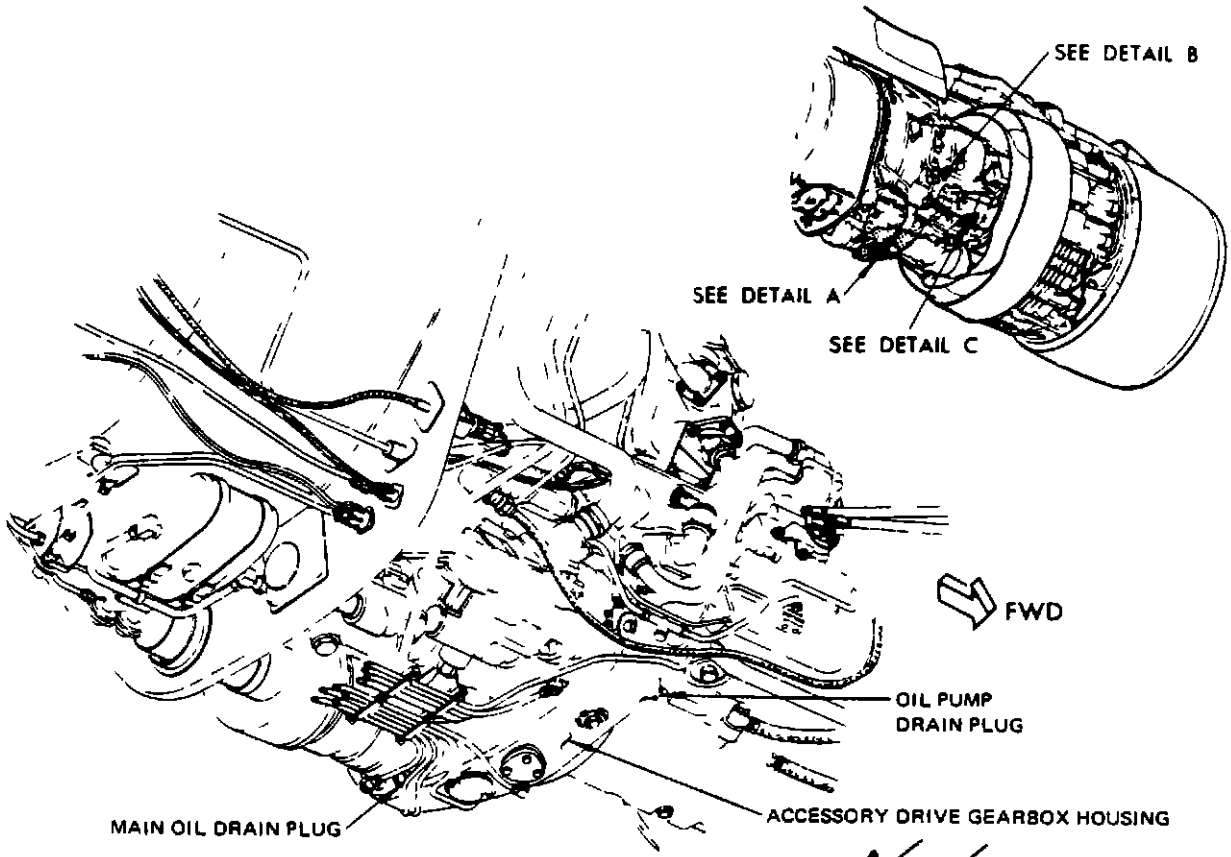
3. Change Engine Oil

A For access to engine, open left and right side cowl panels.

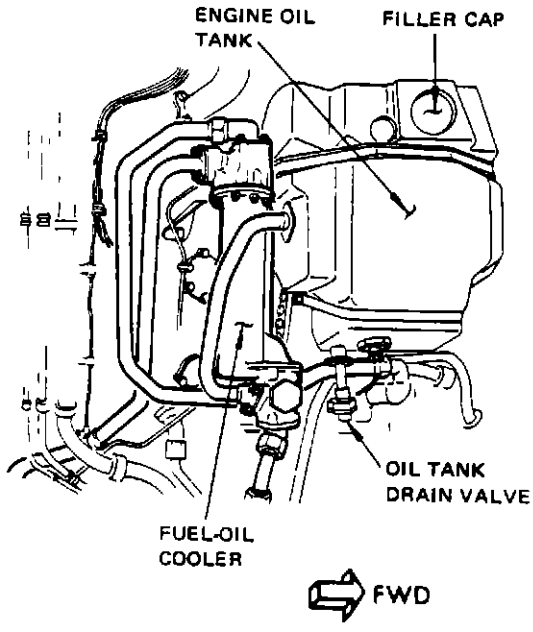
B Position containers to catch oil. Open oil tank drain valve on bottom of tank. (See detail B, figure 301.)

C Remove main oil drain plug and oil pump drain plug from bottom of accessory drive gearbox housing (detail A, figure 301), and disconnect inlet pressure sensing line (detail C) from oil strainer.

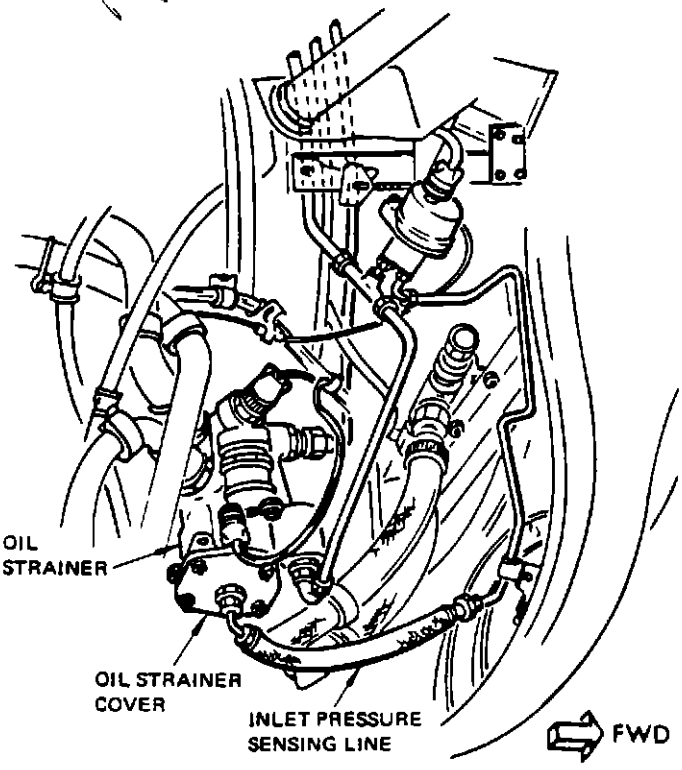
D Remove nuts and washers securing main oil strainer cover to main oil strainer housing. Remove cover and main oil strainer element. Wash element in petroleum solvent and inspect for metal particles. Refer to P&WA Chapter 72, Engine.



DETAIL A



DETAIL B



DETAIL C

Engine Oil System Drains
Figure 301

E Allow engine oil to drain to slow drip for approximately 1/2 hour Install main oil drain plug and oil pump drain plug in bottom of accessory drive gearbox housing. Lockwire plugs

F Close oil tank drain valve on bottom of tank

G Install main oil strainer element in main oil strainer housing Install strainer cover and secure with washers and nuts. Tighten nuts to recommended torque. Refer to P&WA Chapter 72, Engine

H Connect inlet pressure sensing line to oil strainer

I Remove self-locking filler cap from port in sump cavity and fill oil tank to lip of filler port with new oil. Replace oil tank filler cap and install, or close, cowl panels

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, C, E, F, H, and I

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

OIL QUANTITY INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The oil quantity indicating system provides indication in the control cabin of actual oil quantity (gallons) in each engine oil tank. The system consists of one circuit for each engine. Each circuit contains an oil quantity tank unit located in the engine oil tank, and an oil quantity indicator on the flight engineer's lower panel. A "PUSH TO TEST GAGES" switch located close to the gages is common to each circuit. (See figures 1 and 2.) Electrical power for the oil quantity indicating system is 115-volt, 400-cycle ac.

B. The system uses electrical capacitance probes as tank units, each probe controls a self-balancing bridge circuit contained in the respective indicator. Oil level and oil dielectric constant determine the capacitance of the tank units. The oil quantity indicator pointer is connected to the balance mechanism and provides continuous indication of oil quantity on the dial face.

2. Oil Quantity Tank Unit

A. The oil quantity tank unit probe is composed of two separate capacitors. A quantity measuring capacitor and a compensator unit to minimize the effects of oil dielectric changes due to temperature or variations in composition.

B. The upper section of the tank unit is an electrostatic capacitor consisting 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 in the system circuit. The other area is grounded to prevent fringing of 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 probe is a group of concentric aluminum tubes spaced and insulated from each other. Since the compensator is at the lower end of the tank unit it will remain submerged at the lowest usable level of oil in the tank.

D. The lower end of the tank unit is open to permit oil to flow between the electrodes to the same level as that in the tank. The oil between the electrodes provides the dielectric which is the variable factor of the capacitor.

E. The oil quantity tank units are mounted in fittings welded into the bottom of each engine oil tank. (See figure 1.)

3. Oil Quantity Indicator

A. The oil quantity indicator contains a motor driven self-balancing capacitance bridge indicator unit. The unit consists of a reversible motor driving a rebalance potentiometer and dial pointer assembly through a gear train. Other items included are a capacitance bridge network, a three stage transistorized amplifier, a rectifier to provide d-c power for the transistors, and various transformers. (See figure 2.) The complete indicator assembly is hermetically sealed.

B. The oil quantity indicators, one for each engine, are located in a horizontal row on the right-hand portion of the flight engineer's lower panel. (See figure 1.) The indicators are secured to the panel by a standard clamp mounting and have an electrical disconnect plug on their rear face.

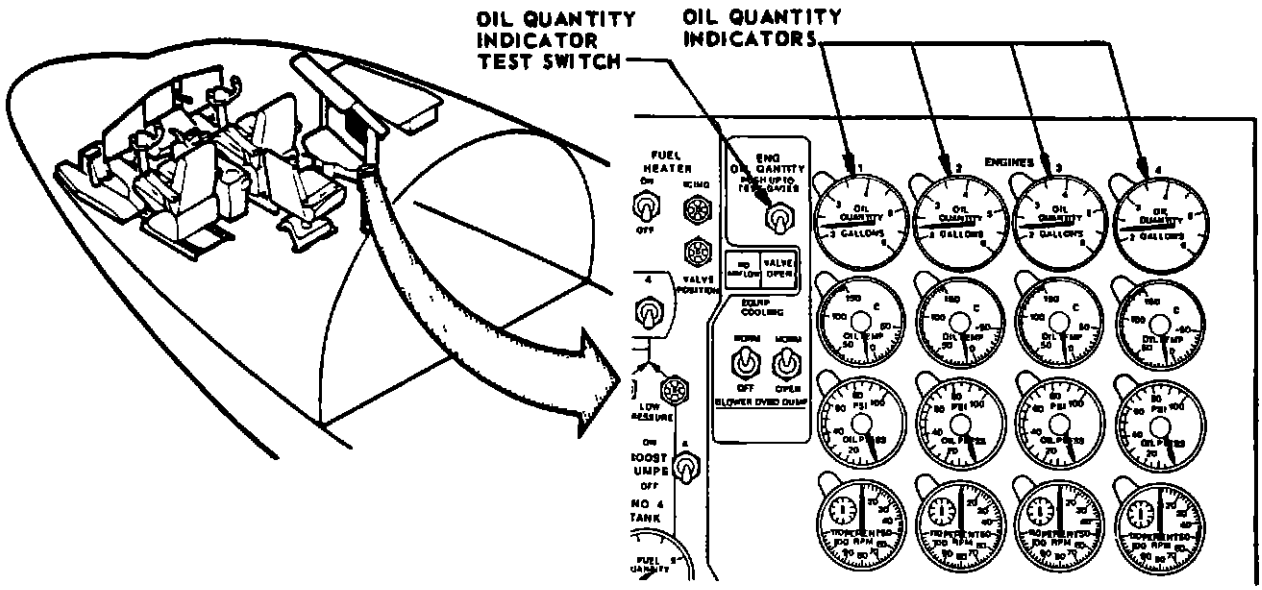
4. Operation

A. The oil level in the engine oil tank determines the capacitance of the oil quantity tank unit. This capacitance is a part of the self-balancing capacitance bridge network in the indicator. When in a balanced state this bridge network shows the actual gallons of oil in the tank on the indicator dial. (See figure 2.)

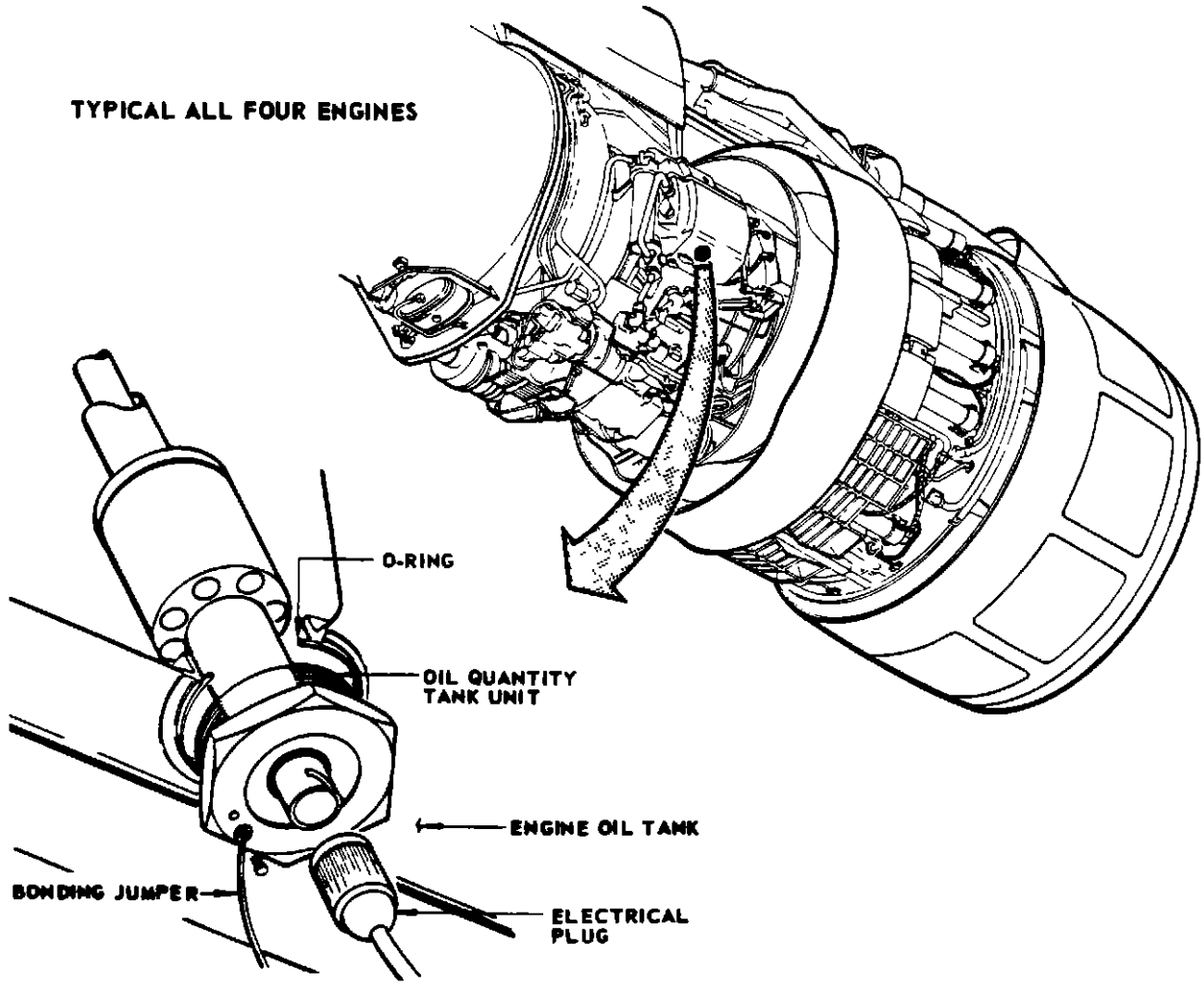
B. The "PUSH TO TEST GAGES" switch is common to all four oil quantity indicating circuits. Closing the switch grounds the current on the tank unit side of the bridge. (See figure 2.) As a result, all the indicators drive toward the empty end of the dial. If the system is functioning properly, the indicators will return to their original position when the test switch is released.

C. Electrical power for the oil quantity indicating system is 115-volt, 400-cycle ac through the following circuit breaker panels:

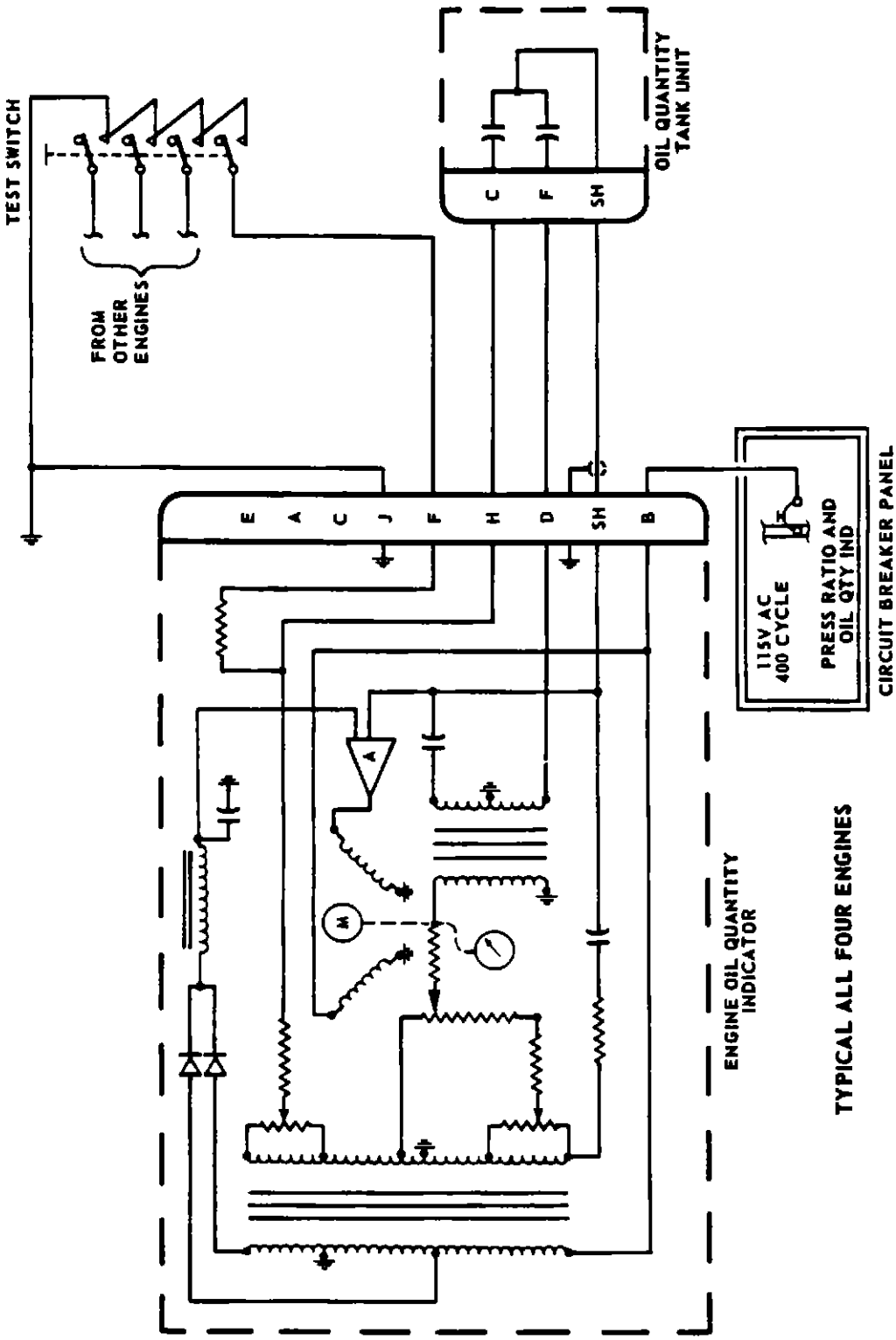
Engine No. 1 - A-C Bus No. 1 Circuit Breaker Panel (P1)
Engine No. 2 - A-C Bus No. 2 Circuit Breaker Panel (P2)
Engine No. 3 - A-C Bus No. 3 Circuit Breaker Panel (P3)
Engine No. 4 - A-C Bus No. 4 Circuit Breaker Panel (P4)



FIGHT ENGINEER'S LOWER PANEL

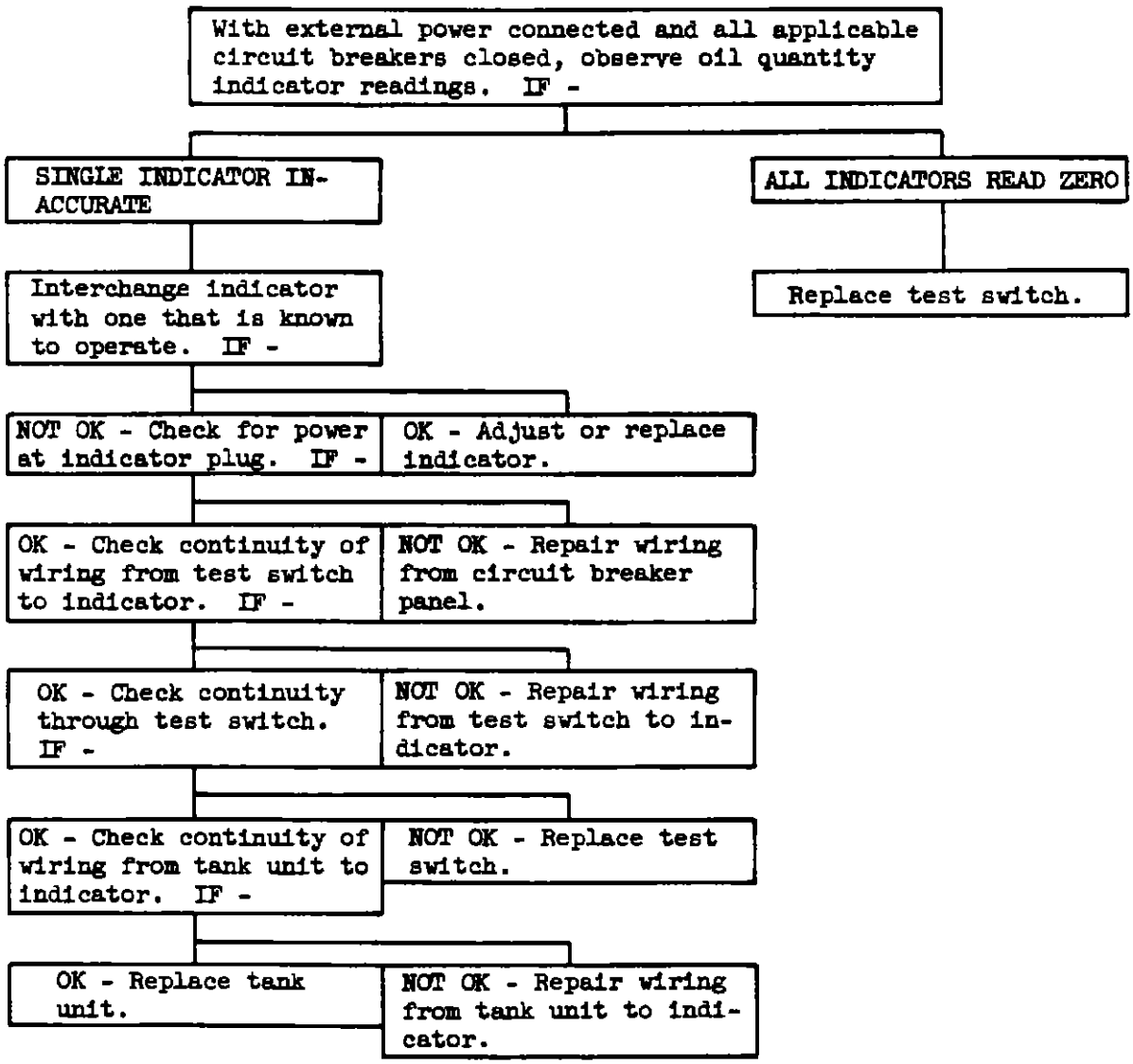


Oil Quantity Indicating System Equipment Location
Figure 1



Oil Quantity Indicating System Circuit
Figure 2

OIL QUANTITY INDICATING SYSTEM - TROUBLE SHOOTING



OIL QUANTITY INDICATING SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test Oil Quantity Indicating System

A. General

(1) Since tank unit capacitance varies from one unit to another, and stray capacitance in airplane wiring has a significant effect on system calibration, it is essential that the system, as a whole, be calibrated as installed on the airplane. Bench calibration of individual components is not sufficient since no nominal capacitance value can be used for all probes or systems.

(2) System calibration should be checked at every oil change or when a tank unit or indicator is changed. This necessitates checking the system at every engine change.

NOTE: Any reading other than zero when the oil tank is drained indicates that calibration is required.

B. Deleted

C. Adjust Oil Quantity Indicating System

NOTE: Before adjusting the oil quantity indicating system fill the oil tank, let stand for at least 5 minutes and then push "PRESS-TO-TEST" switch. Sluggish indicator response indicates contamination of the oil system. If the system is contaminated, drain the oil and remove and wash the tank unit in water and detergent. (Refer to 79-6-0, "Servicing Engine Oil System," for location of oil system drains and 79-7-11, "Removal/Installation Oil Quantity Tank Unit.")

(1) Open right side cowl panel and drain engine oil tank. Allow tank to drain for five minutes if temperature of oil is 100°F or above. Allow 30 minute drainage period if oil temperature is below 100°F

(2) Connect external power and determine that the respective oil quantity indicating system circuit breaker on a-c bus circuit breaker panel P1, P2, P3, or P4 is closed.

(3) Insert a measured 1.25 U.S. gallons of oil in tank. At the back of the oil quantity indicator, located on flight engineer's lower panel, adjust "EMPTY" screw until the indicator pointer shows at small sight hole on lower end of dial scale.

NOTE: Push the "TEST SWITCH" after each small increment of adjustment is made.

(4) Add 4.25 U.S. gallons of oil to make a total of 5.5 gallons in the tank.

(5) Set the "FULL" adjusting screw on the back of the oil quantity indicator until gage reads 5.5 U.S. gallons. Push "PRESS-TO-TEST" switch several times while making adjustment.

(6) through (13) deleted

OIL QUANTITY TANK UNIT - MAINTENANCE PRACTICES

1. Removal/Installation Oil Quantity Tank Unit

   A. Remove Oil Quantity Tank Unit

      (1) Open right side cowl panel.

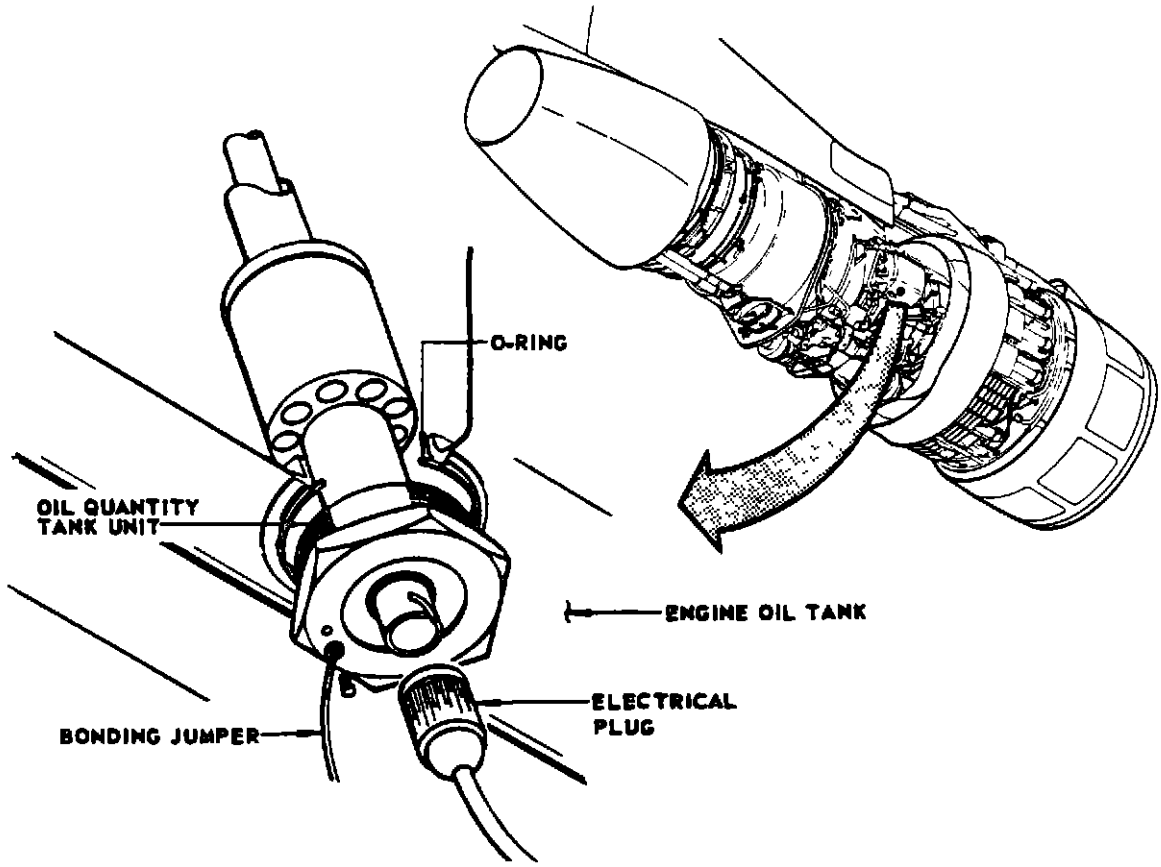
      (2) Drain engine oil tank.

      (3) Open respective oil quantity circuit breaker on a-c bus circuit breaker panel P1, P2, P3 or P4.

      (4) Remove electrical plug. (See figure 201.)

      (5) Remove bonding jumper.

      (6) Unscrew oil quantity tank unit and remove tank unit and O-ring from engine oil tank.



Oil Quantity Tank Unit Installation
Figure 201

B. Install Oil Quantity Tank Unit (See figure 201.)

(1) With a new O-ring in place, install oil quantity tank unit and torque to 700 to 900 pound-inches.

(2) Install safety wire.

(3) Install bonding jumper.

(4) Connect electrical plug.

(5) Close right side cowl panel.

(6) Adjust oil quantity indicating system. See 79-7-0.

OIL TEMPERATURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The oil temperature indicating system provides visual indication of oil temperature in each engine. The system consists of four oil temperature indicators on the flight engineer's lower panel and four temperature bulbs, one at each engine. (See figure 1.)

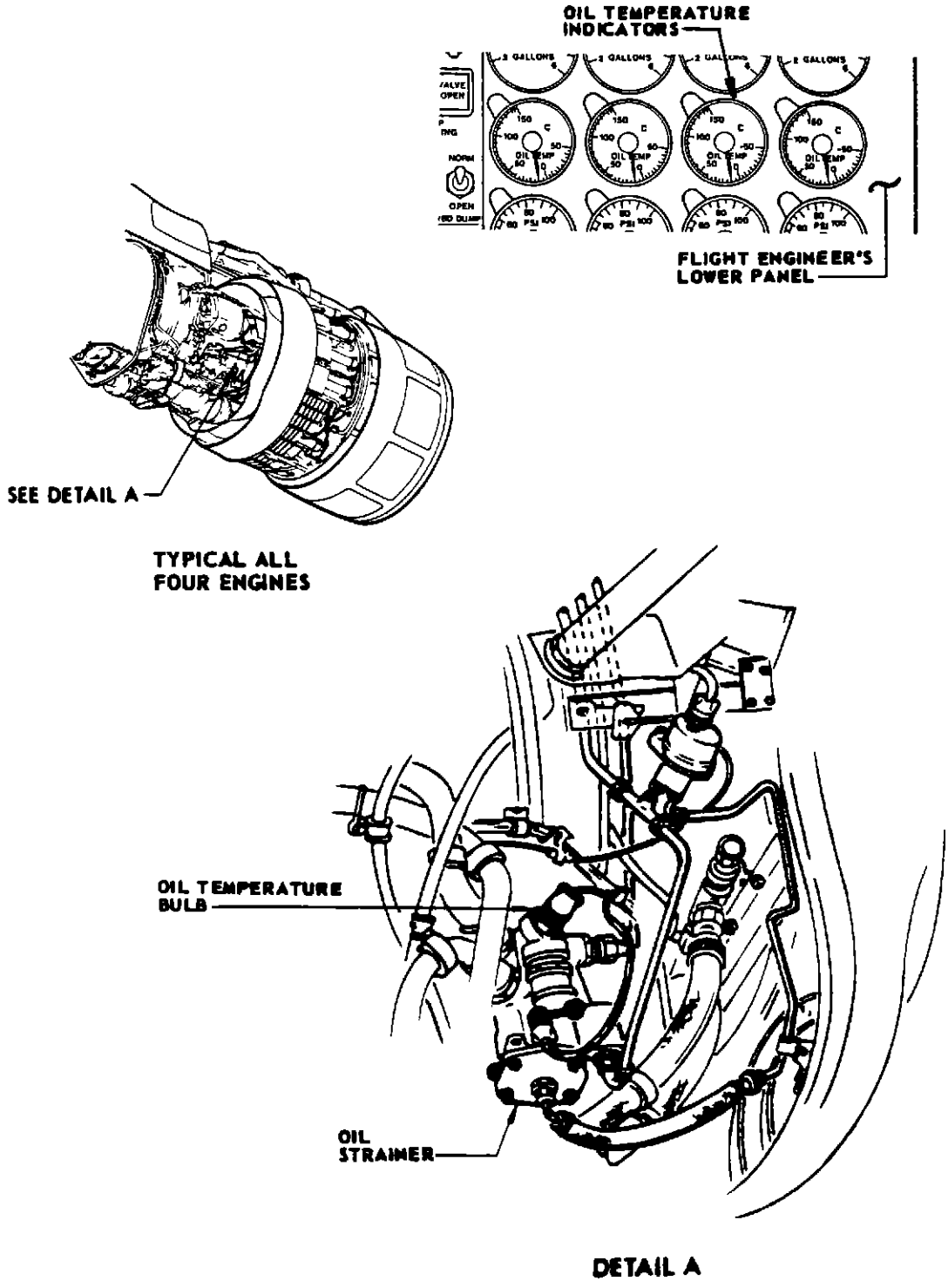
B. Each temperature bulb contains a resistance element which changes resistance with changes in temperature. This resistance element controls the current passing through the meter movement of the oil temperature indicator. Power is supplied to the system through 28-volt a-c circuit breakers. (See figure 2.)

2. Oil Temperature Bulb

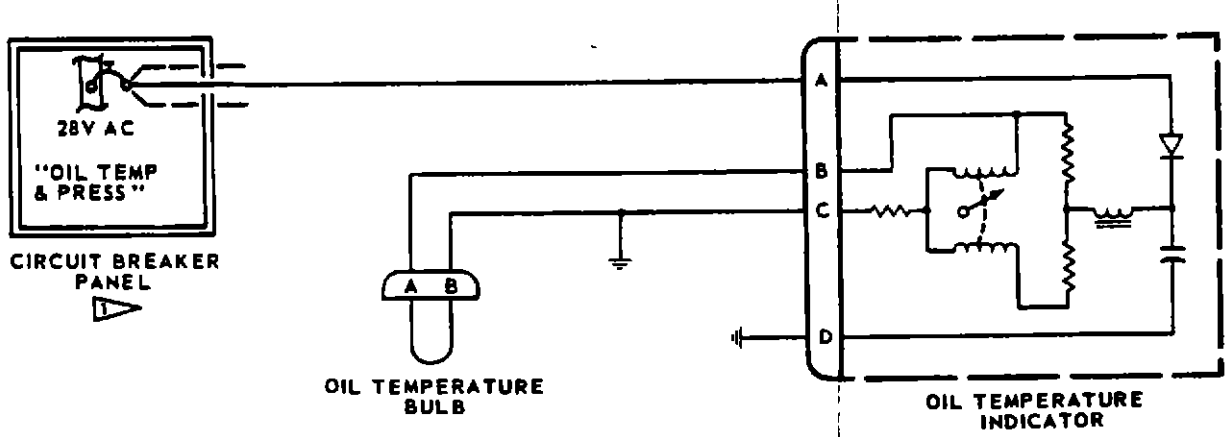
A. The oil temperature bulb has an operating range of -70° to +300°C. The resistance at 0°C is 90.38 ohms. The temperature bulb has an armoured envelope which screws into a housing on the outlet side of the oil strainer. (See figure 1.) The temperature bulb is in direct contact with the oil and when removed will cause draining of the oil pressure delivery lines.

3. Oil Temperature Indicator

A. The oil temperature indicator is a resistance ratiometer type instrument. It is located on the flight engineer's lower panel. The indicator operates on the ratio of the currents through two coils in the meter movement. The ratio of these currents is determined by the resistance of the temperature bulb. The indicator dial is calibrated in degrees centigrade and reads from -70° to +150°C. (See figure 1.) With power off, the pointer remains off scale at the low temperature end. Electrical connections are made to the indicator through a disconnect plug.



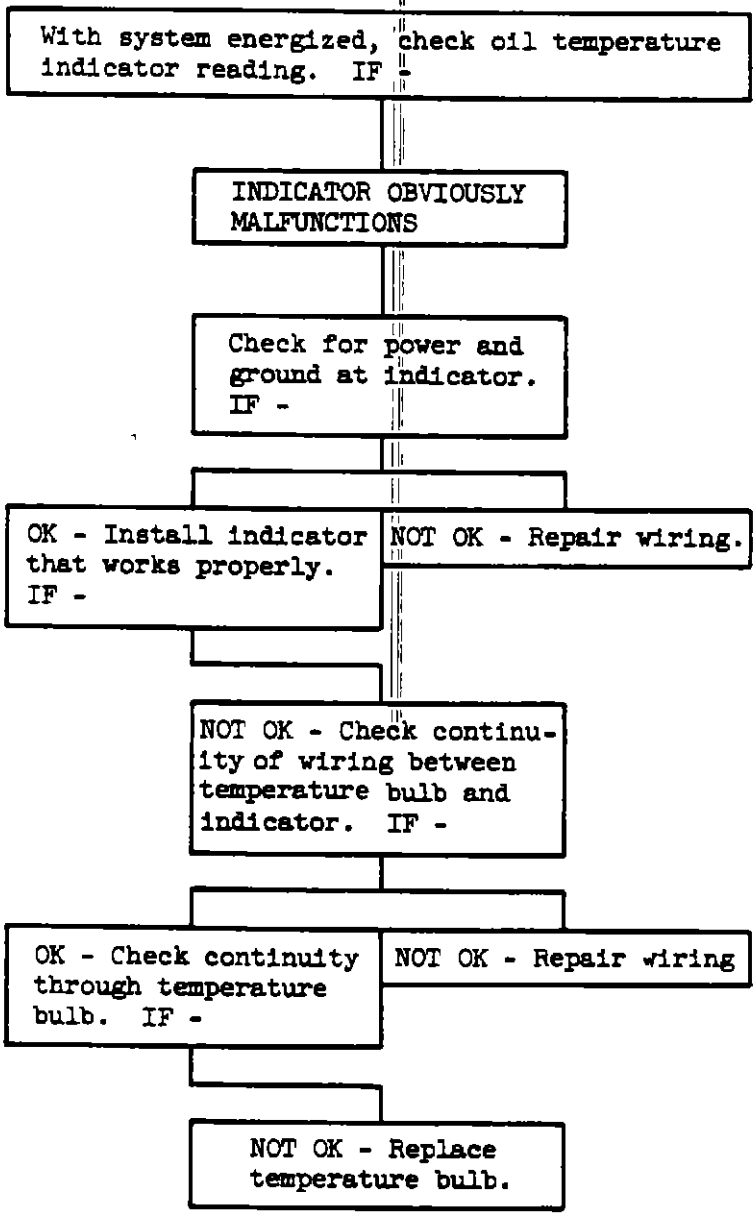
Oil Temperature Indicating System Component Location
Figure 1



1 Engine No. 1 - A-C Bus No. 1 Circuit Breaker Panel (P1)
Engine No. 2 - 28 Volt A-C Circuit Breaker Panel (P7)
Engine No. 3 - A-C Bus No. 3 Circuit Breaker Panel (P3)
Engine No. 4 - A-C Bus No. 4 Circuit Breaker Panel (P4)

Oil Temperature Indicating System Circuit
Figure 2

OIL TEMPERATURE INDICATING SYSTEM - TROUBLE SHOOTING



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

B Equipment and Materials

(1) Unbreakable Master Thermometer - calibrated in °C or °F (See 79-9-1, figure 202, for conversion)

(2) Variable Temperature Oil Bath

C Prepare to Test Oil Temperature Indicating System

(1) Connect external electrical power to airplane

(2) Open applicable OIL TEMP & 'PRESS circuit breaker

CAUTION. THE OIL TEMP & PRESS CIRCUIT BREAKER SHALL BE OPEN BEFORE OIL TEMPERATURE BULB IS REMOVED FAILURE TO OPEN BREAKER COULD RESULT IN DAMAGE TO AIRPLANE INDICATOR

(3) Open right side cowl panel

D Test Oil Temperature Indicating System

(1) Remove lockwire from oil temperature bulb electrical connector on engine oil strainer and remove connector from bulb

(2) Remove oil temperature bulb from oil strainer fitting.

(3) Cover oil strainer fitting to prevent entry of foreign matter into system

(4) Connect electrical connector to oil temperature bulb.

(5) Close applicable OIL TEMP & PRESS circuit breaker

(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 TEMP & PRESS circuit breaker

(9) Remove oil temperature bulb from oil bath.

(10) Disconnect electrical connector from oil temperature bulb Remove cover from oil strainer fitting and install temperature bulb in fitting.

(11) Install electrical connector on oil temperature bulb and lockwire

(12) Close cowl panel.

(13) Close applicable OIL TEMP & PRESS circuit breaker.

(14) Determine whether there is any further need for electrical power on airplane If not, remove external 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 oil strainer.

OIL TEMPERATURE BULB - MAINTENANCE PRACTICES

1. Removal/Installation Oil Temperature Bulb

A. Remove Oil Temperature Bulb

(1) Open applicable "OIL TEMP & PRESS" circuit breaker. (See 79-9-0, figure 2.)

(2) Open right side cowl panel.

(3) Locate bulb on oil strainer and remove electrical connector. (See figure 201.)

(4) Remove oil temperature bulb.

NOTE: When the oil temperature bulb is removed, oil will drain from the oil pressure delivery line.

B. Install Oil Temperature Bulb (See figure 201.)

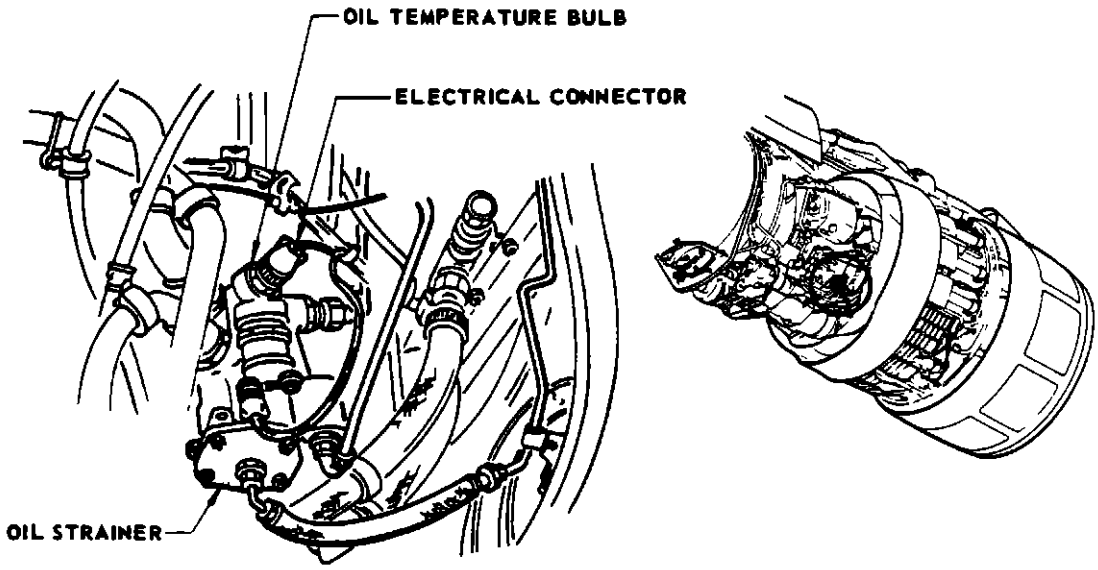
(1) Install temperature bulb in threaded socket on oil strainer using a new copper-asbestos fluid seal.

(2) Connect electrical plug.

(3) Close right side cowl panel.

NOTE. Before closing cowl panel check that oil in engine oil tank has not been drained below a safe level.

(4) Close "OIL TEMP & PRESS" circuit breaker on applicable panel.



Oil Temperature Bulb Installation
Figure 201

2. Adjustment/Test Engine Oil Temperature Bulb

A. General

(1) The oil temperature bulb has no provisions for adjustment and only a test for accuracy can be performed on it. To test the bulb, the resistance across the bulb connections is measured and compared with values found on the chart of temperature resistance values. (See figure 202.) The bulb temperature may be measured by allowing the bulb and a master thermometer to come to a common temperature. If an extended temperature range test is required, the temperature bulb and a master thermometer should be immersed in a variable temperature water or oil bath.

B. Equipment and Materials

(1) A precision ohmmeter or bridge tester.

(2) A master thermometer, mercury type, calibrated in degrees centigrade.

(3) Water or oil bath if conditons require.

C. Test Oil Temperature Bulb

(1) Open OIL TEMP IND circuit breaker on applicable a-c circuit breaker panel. (See 77-9-0, figure 2.)

(2) Obtain access to oil temperature bulb (See figure 201.) by opening right side cowl panel on applicable engine.

(3) Disconnect electrical plug and remove temperature bulb.

(4) Allow temperature bulb and master thermometer to reach ambient temperature, or place sensing portions of temperature bulb and thermometer in oil or water bath until a steady temperature is reached. Record temperature shown on master thermometer.

(5) Measure resistance of temperature bulb by connecting leads of ohmmeter to its A (+) and B (-) terminals. Compare resistance value from chart with resistance value measured across bulb connections. They should agree within the limits shown. If they do not agree, replace with a serviceable temperature bulb.

TEMPERATURE		RESISTANCE (OHMS)	TEMPERATURE		RESISTANCE (OHMS)
°C	°F		°C	°F	
-20	-4	83.77±.40	+70	+158	116.27±.50
-10	+14	87.04±.40	+80	+176	120 36±.50
0	+32	90.38±.40	+90	+194	124 55+.50
+10	+50	93.80±.40	+100	+212	128.85+ 50
+20	+68	97 31±.40	+110	+230	133.26±.50
+30	+86	100.91±.40	+120	+240	137.78±.60
+40	+104	104 60±.40	+130	+266	142.40±.60
+50	+122	108.39±.40	+140	+284	147.11±.60
+60	+140	112.28± 50			

CONVERSION·

°C TO °F °F = 9/5 °C + 32

°F TO °C °C = 5/9 (°F - 32)

Oil Temperature Bulb - Temperature Resistance Values
Figure 202

OIL PRESSURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1 General

A. The oil pressure indicating system provides a visual presentation of the oil pressure (psi) in each engine on indicators located on the flight engineers lower panel. The components of the system for each engine are an oil pressure transmitter and an indicator. (See figure 1).

B. The oil pressure transmitter senses the engine oil pressure at the oil strainer outlet. The pressure is electrically transmitted to the indicator where it is displayed as a reading on the dial face.

2. Oil Pressure Transmitter

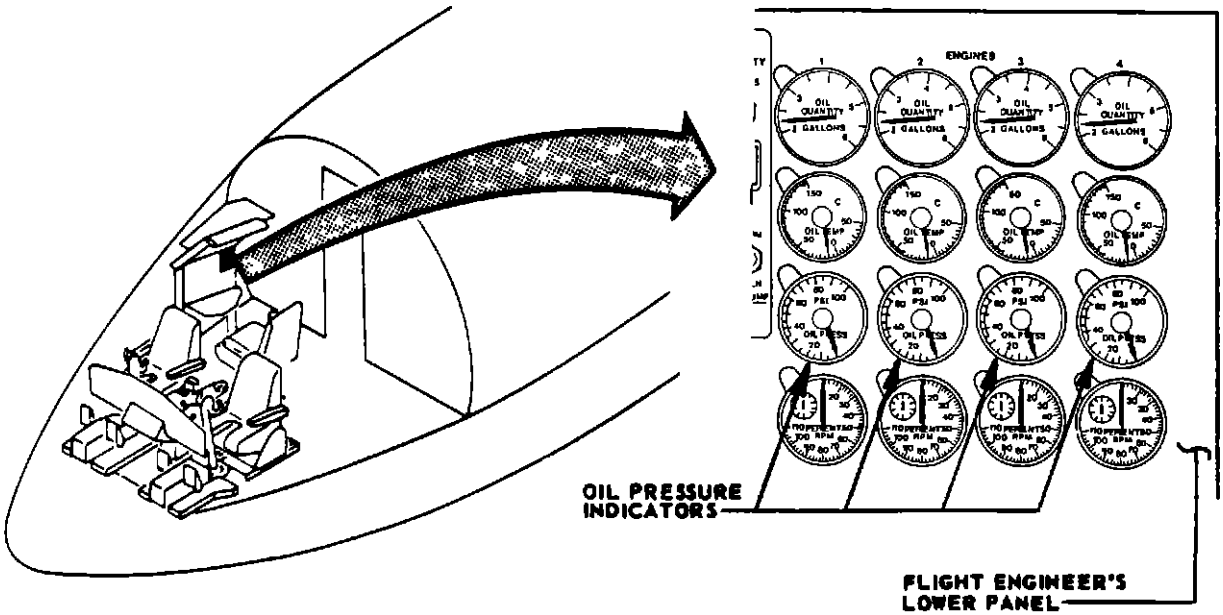
A. The oil pressure transmitter consists of an armature which is attached to a diaphragm and is centrally located in the field of two concentrically wound induction coils. One side of the diaphragm senses oil pump output pressure, the other senses ambient pressure. The difference between the two pressures, positions the diaphragm and armature axially, changing the relative inductance of the coils and producing a signal to actuate the indicator on the flight engineer's panel. (See figure 3.)

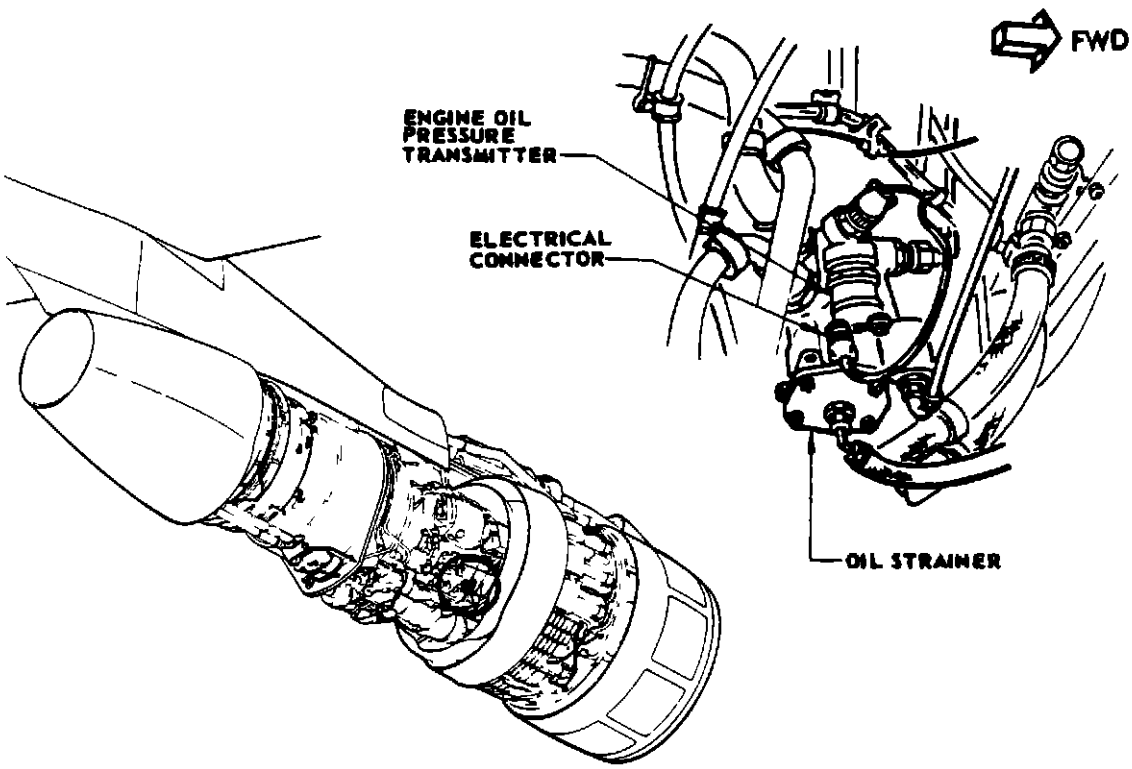
B. The oil pressure transmitter is mounted to the oil pressure sensing outlet of the engine oil strainer on the right side of the engine. The pressure port is integral with the threaded mounting boss at the top of the transmitter; the vent port is connected to a drain port which senses ambient pressure.

3. Oil Pressure Indicator

A. The oil pressure indicator is a hermetically sealed voltage ratio type unit operating a pointer which continuously indicates the measured pressure on a dial face. The indicator contains a moving coil suspended in the field of an induction coil. The dial pointer is attached to the moving coil, thus motion of the coil produces a pressure reading on the dial face. (See figure 4.)

B. Four indicators, one for each engine, are mounted in a horizontal row in the top right corner of the flight engineer's lower instrument panel.



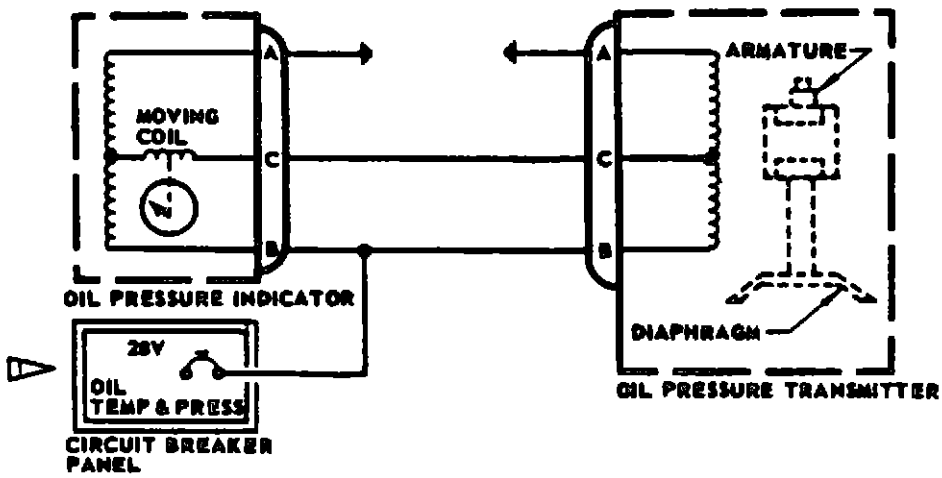


Oil Pressure Indicating System Component Location
Figure 1

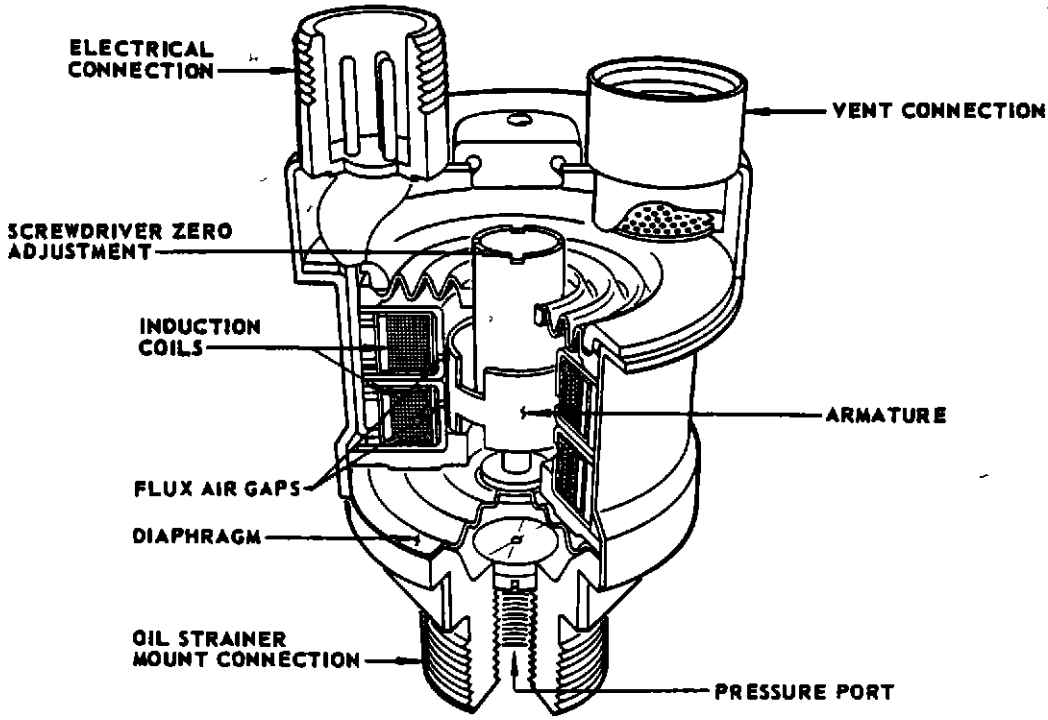
4. Operation

A. The fixed coils of the transmitter and indicator are connected to form an a-c bridge while the moving coil in the indicator serves as the galvanometer leg. Pressure entering through the pressure port deflects the armature relative to the air gaps in the induction coils. This action changes the inductance values of the transmitter coils causing a change in voltage at the center tap and an unbalanced circuit. The moving coil rebalances the circuit by moving to a new angular position so that the net torque in the coil is zero. The pointer, which is attached to the moving coil, moves with the coil to present the oil pressure indication.

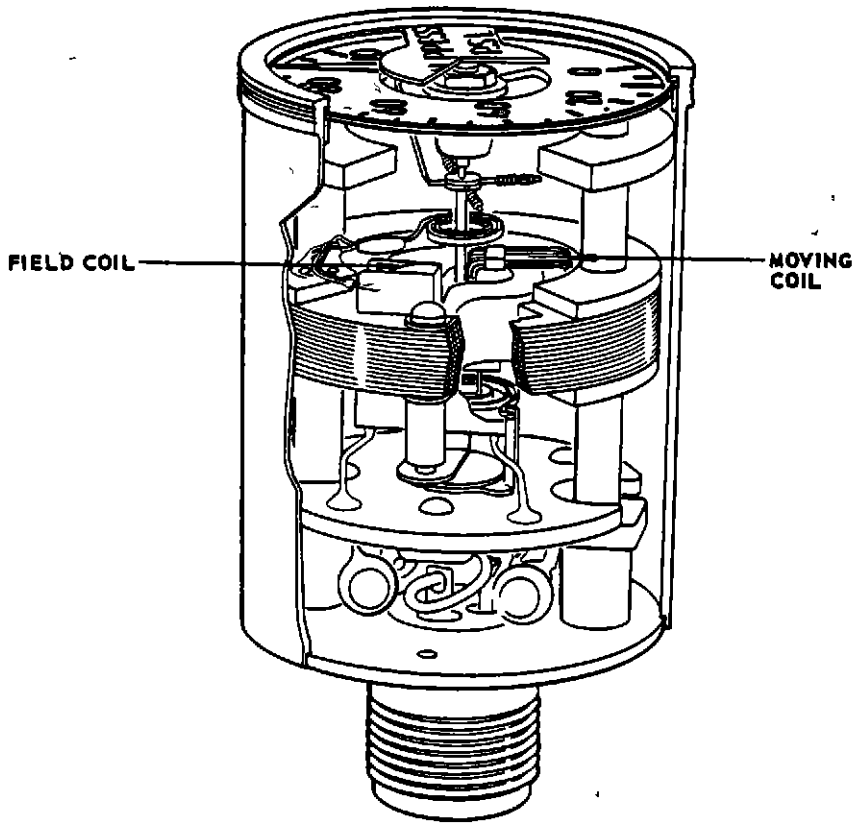
B. Electrical power for the system is 28 volts, 400 cycle ac. Circuit breakers for each engine are as shown in figure 2. If power is interrupted the oil pressure indicator will indicate a pressure below zero.



Engine No. 1	A-C Bus No. 1 Circuit Breaker Panel (P1)
Engine No. 2	28 Volt A-C Circuit Breaker Panel (P7)
Engine No 3	A-C Bus No. 3 Circuit Breaker Panel (P3)
Engine No. 4	A-C Bus No. 4 Circuit Breaker Panel (P4)

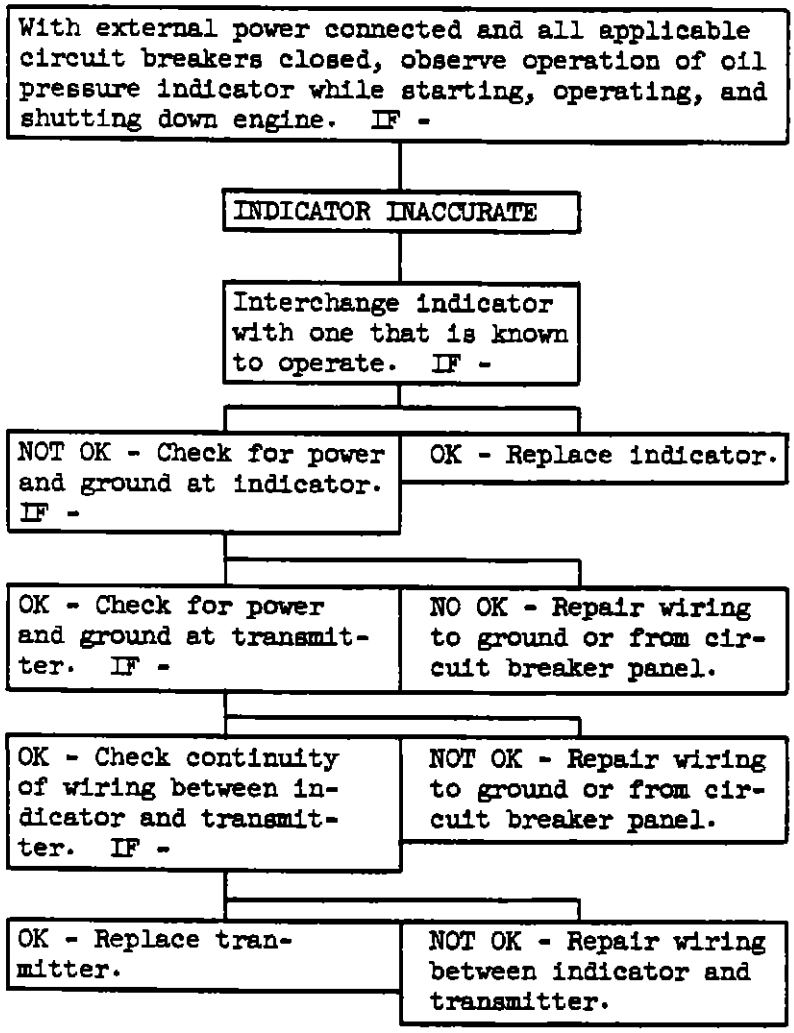


Oil Pressure Transmitter
Figure 3



Oil Pressure Indicator
Figure 4

OIL PRESSURE INDICATING SYSTEM - TROUBLE SHOOTING



OIL PRESSURE INDICATING SYSTEM - ADJUSTMENT/TEST

EFFECTIVITY

TURBOFAN

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 prssure 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 right side cowl panel.

(2) Provide electrical power.

(3) Check that the applicable oil pressure indicating system circuit breaker is closed.

D. Test Oil Pressure Indicating System

(1) Disconnect electrical connector from oil pressure transmitter. (See figure 501.)

(2) Remove oil pressure transmitter from fitting on oil strainer.

(3) Connect adjustable air pressure source to transmitter pressure inlet.

(4) Connect electrical connector to oil pressure transmitter.

(5) Apply 100 psig air pressure. Check that oil pressure indicator on engine instrument panel reads 100 (± 2) psig.

(6) Hold pressure for three minutes. Check that there is no leakage.

(7) Reduce air pressure to 50 psig. Check that oil pressure indicator reads 50 (± 2) psig.

(8) Reduce air pressure to zero psig and observe oil pressure indicator reading. Check that indicator pointer returns to zero (± 2) psig.

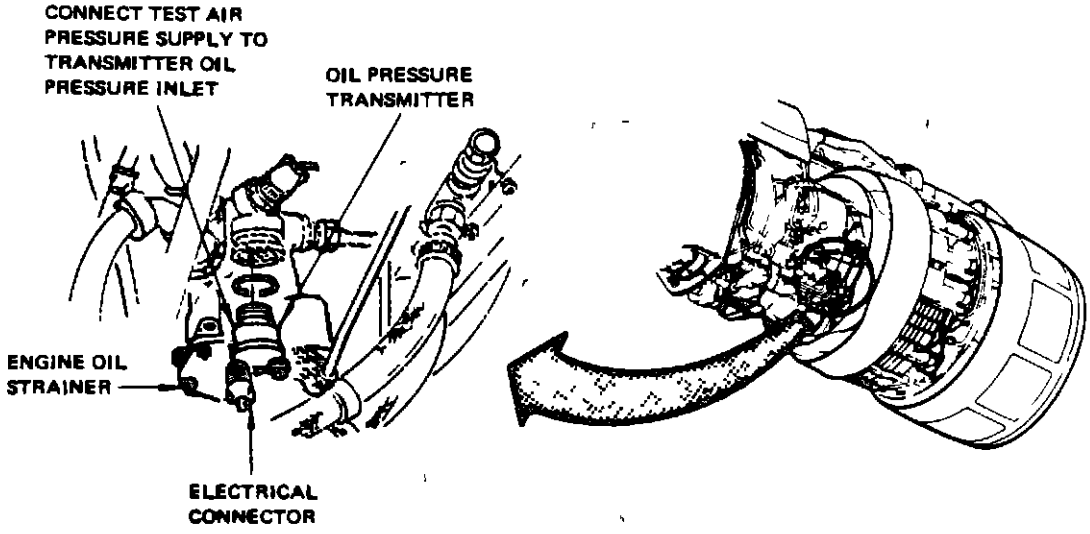
(9) Disconnect air pressure source from oil pressure transmitter pressure inlet.

(10) Disconnect electrical connector from transmitter and connect transmitter to oil strainer.

(11) Connect electrical connector to transmitter, lockwire connector, and close right side cowl panel.

(12) If no longer required, remove electrical power from airplane.

NOTE: The first time that engine is operated after performing this test, check to ensure that no leakage occurs around transmitter fitting on oil strainer.



Oil Pressure Indicating System Test Connections
Figure 501

OIL PRESSURE TRANSMITTER - MAINTENANCE PRACTICES

1. Removal/Installation Oil Pressure Transmitter

A. Remove Oil Pressure Transmitter

(1) Open applicable oil pressure indicating system circuit breaker.

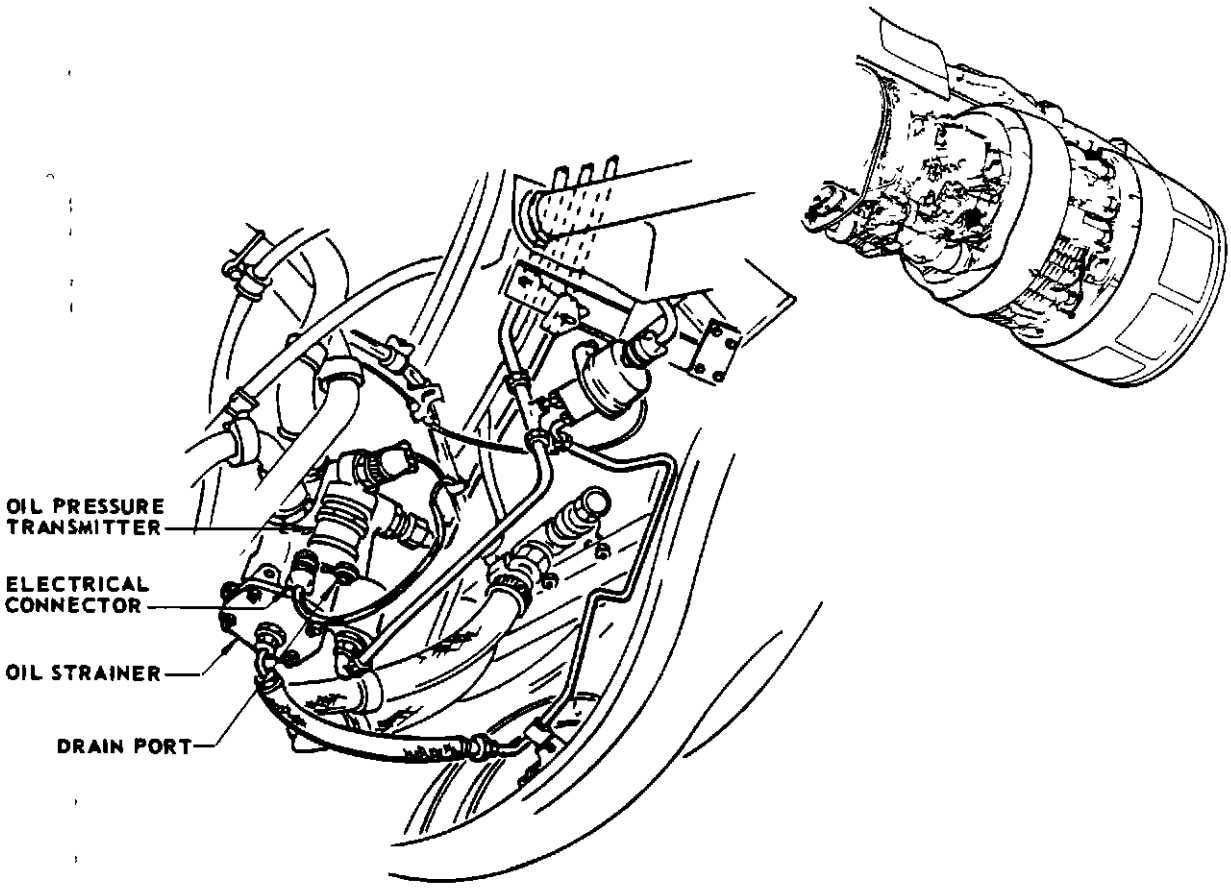
(2) Open right side cowl panel.

(3) Disconnect electrical plug. (See figure 201.)

(4) Disconnect transmitter from fitting on oil strainer.

CAUTION THE OIL STRAINER ADAPTER MUST BE HELD WITH A WRENCH TO PREVENT ROTATION WHEN THE OIL PRESSURE TRANSMITTER IS BEING REMOVED OR INSTALLED.

(5) If transmitter is to be replaced with a new unit remove drain port and O-ring.



Oil Pressure Transmitter Installation
Figure 201

B. Install Oil Pressure Transmitter

(1) If a new oil pressure transmitter is being installed, install drain port in transmitter vent port using a new O-ring.

(2) Install transmitter on oil strainer pressure fitting. Tighten to torque of 300 to 500 pound-inches.

CAUTION: THE OIL STRAINER ADAPTER FITTING MUST BE HELD WITH A WRENCH TO PREVENT ROTATION WHEN THE OIL PRESSURE TRANSMITTER IS BEING REMOVED OR INSTALLED.

(3) Connect electrical plug.

(4) Close right side cowl panel.

(5) Close applicable oil pressure indicating system circuit breaker.

OIL PRESSURE WARNING SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The oil pressure warning system provides the pilot with warning of low engine oil pressure. The system also indicates when the engine oil strainer is about to bypass contaminated oil. The system consists of four amber warning lights on the engine instrument panel, an oil pressure switch on each engine and an oil strainer bypass switch on each engine. (See figure 1.)

B. When the oil pressure switch senses a differential oil pressure below approximately 30 psi the switch closes illuminating the oil pressure warning light on the engine instrument panel. The oil strainer bypass switch also illuminates the oil pressure warning light when it closes at a differential pressure of approximately 50 psi. To determine which switch has actuated the light the applicable oil pressure indicator on the flight engineer's panel must be observed. A normal oil pressure indicates that the oil strainer is clogged and is bypassing oil.

C. Electrical power for the oil pressure warning system is 28 volt dc through the radio and T-R circuit breaker panel (P5.)

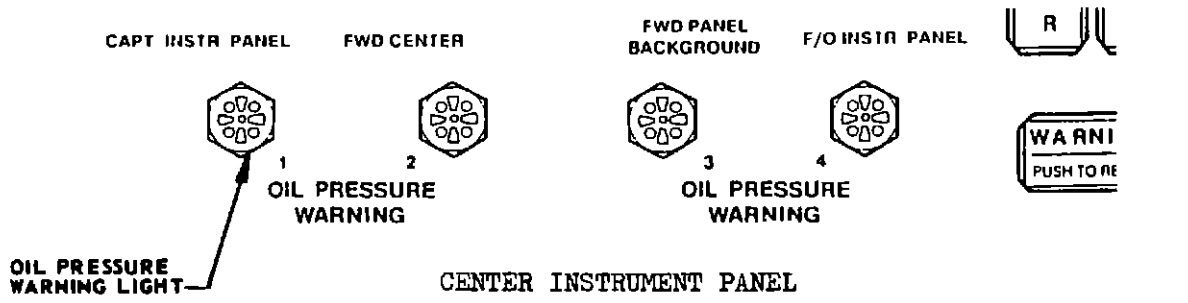
2. Oil Pressure Switch

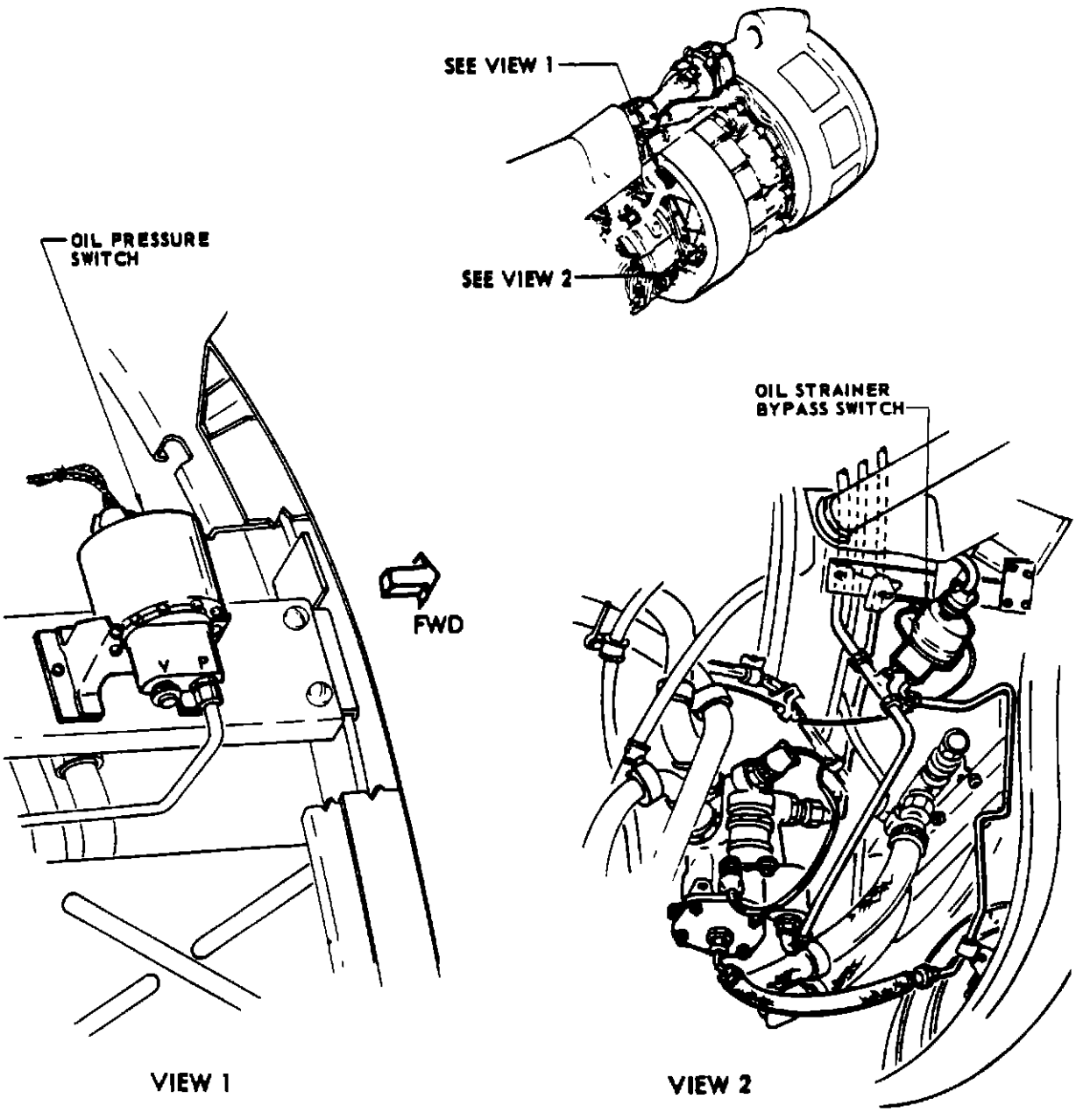
A. The oil pressure switch senses the differential between engine oil pressure and engine ambient pressure. The switch opens at a maximum differential pressure of 36 psi and the warning light goes out. (See figure 2.)

B. The oil pressure switch is mounted on a bracket at the 2 o'clock position on the right side of the engine just aft of the fan air exhaust case. (See figure 1.)

3. Oil Strainer Bypass Switch

A. The oil strainer bypass switch senses the pressure differential between the inlet and outlet fittings on the engine oil strainer. The switch provides a warning when the oil strainer is clogged and bypassing contaminated oil.



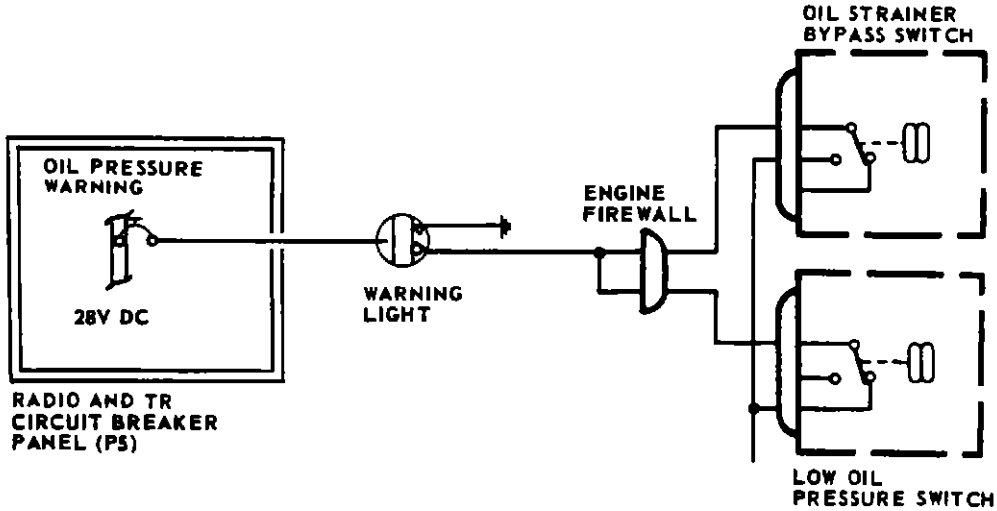


Oil Pressure Warning System Equipment Location
Figure 1

B. The oil strainer bypass switch is mounted on a support bracket, which is attached to the throttle control support structure on the right side of the engine.

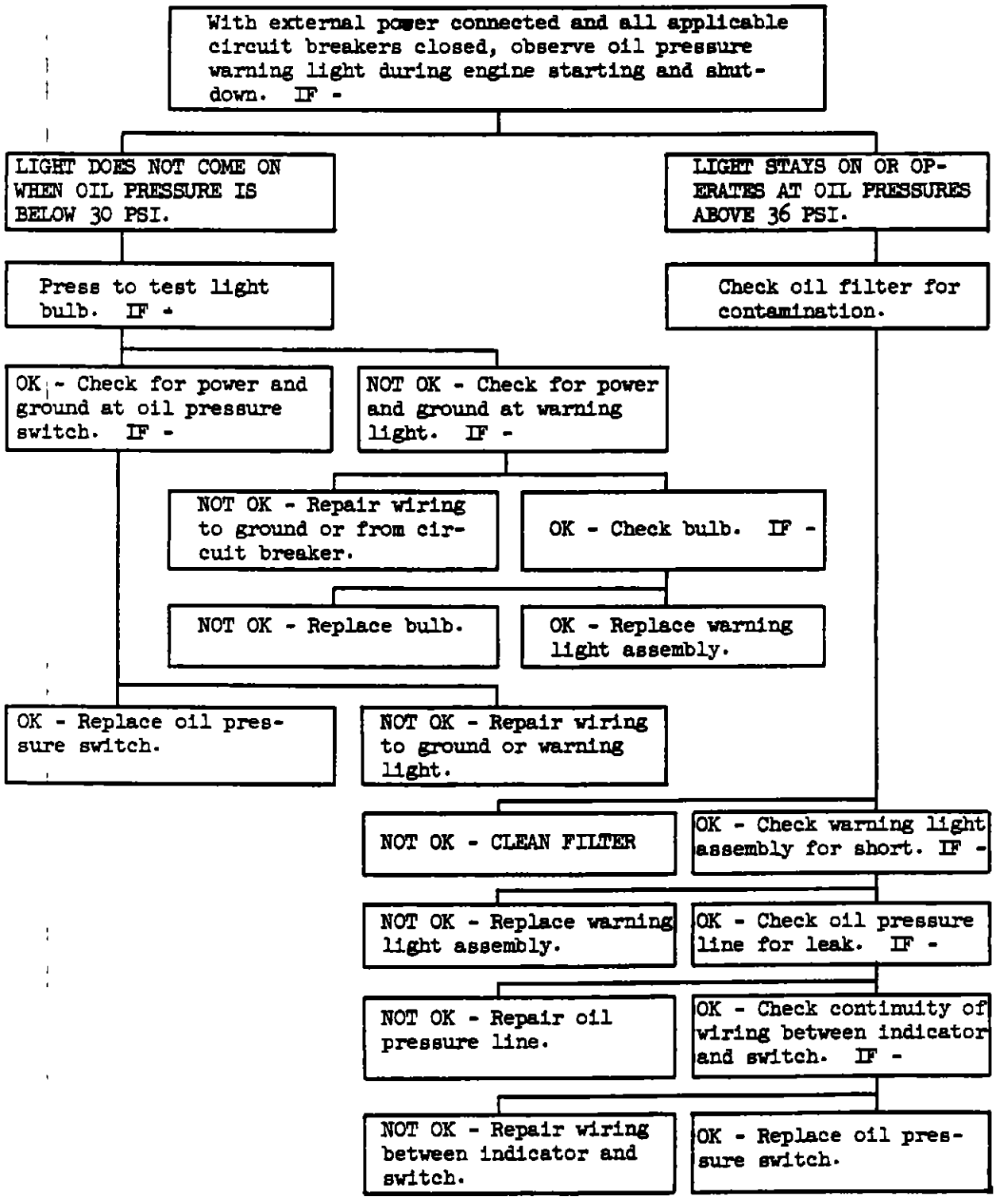
4. Oil Pressure Warning Light

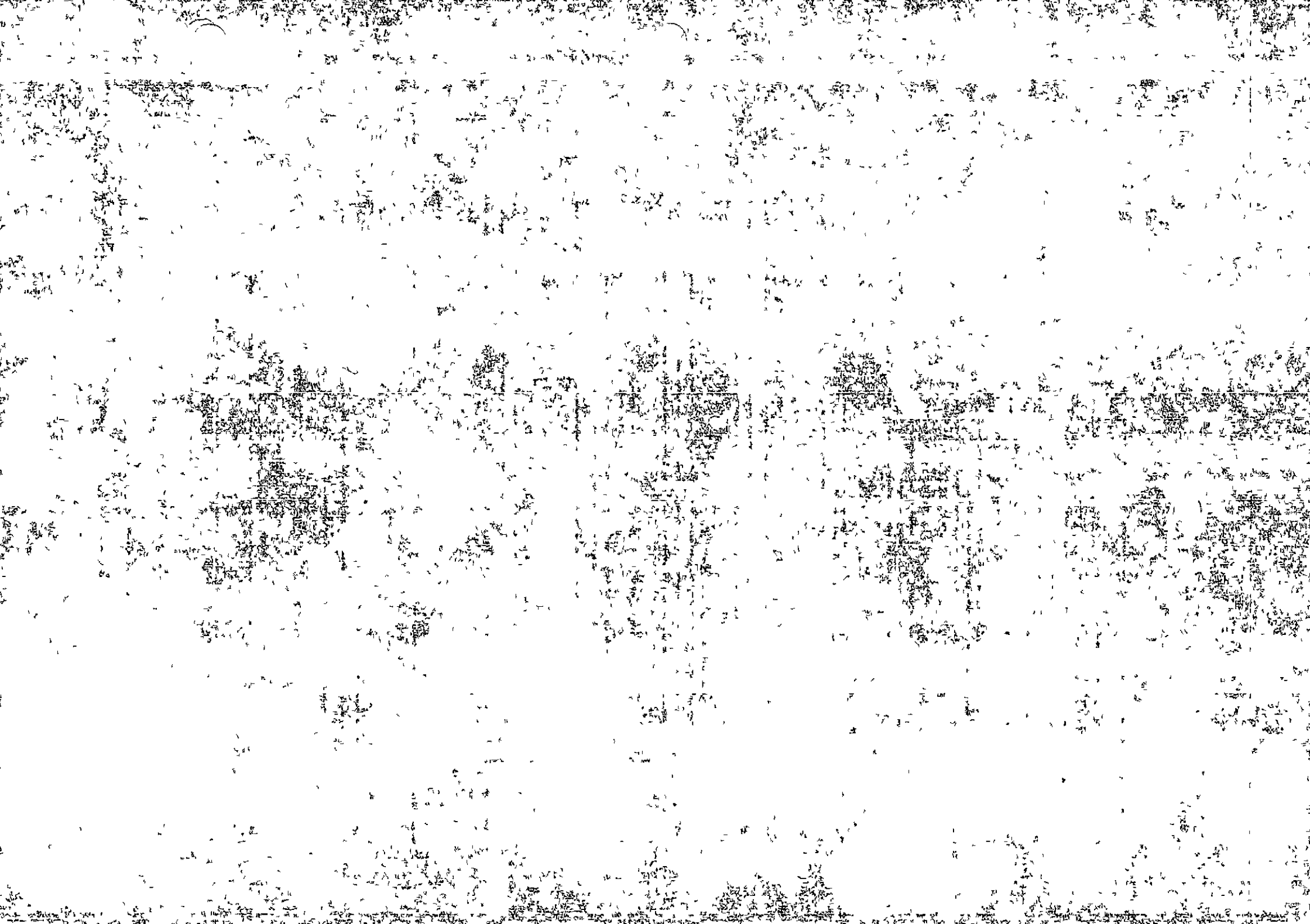
A The oil pressure warning light is a press-to-test indicator light with an integral dimmer feature (See figure 2.) The warning lights are located at the upper half of the Center Instrument Panel. (See figure 1)



Oil Pressure Warning System Circuit
Figure 2

OIL PRESSURE WARNING SYSTEM - TROUBLE SHOOTING





OIL PRESSURE WARNING SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test Oil Pressure Warning System

A. General

(1) The oil pressure warning system can be tested in two different ways. The test may be performed during the normal starting and run-up of an engine or by attaching an air source to the oil pressure sensing line.

(2) When an engine is started or shut-down, the warning light operation can be checked against the oil pressure indicator on the flight engineer's lower panel.

B. Equipment and Materials

(1) Variable Air Pressure Source - 36 psig minimum pressure

C. Test Oil Pressure Warning System

(1) During Engine Run-up

(a) With system energized, determine that warning light is on before starting engine.

(b) During engine start, note pressure at which warning light goes out. Light should go out with increasing pressure before or at 36 psig.

(c) When engine is shut down, note pressure at which pressure warning light comes on. Light should come on as pressure decreases to 28 psig.

(2) Using Air Pressure Source

(a) Open right side cowl panel.

(b) With system energized, determine that warning light is on before connecting air source.

(c) Disconnect oil pressure sensing line from oil strainer and gradually apply air pressure to oil pressure switch. Pressure warning light should go out with increasing pressure before or at 36 psig.

CAUTION: DO NOT OVER-PRESSURIZE OIL PRESSURE SWITCH OR DAMAGE TO UNIT WILL OCCUR.

(d) Gradually reduce pressure until pressure warning light comes on. Light should come on with decreasing pressure before or when 28 psig is reached.

(e) Remove electrical connectors from oil pressure switch and oil strainer bypass switch. Short pins A and B on oil strainer bypass switch connector. Light should come on.

(f) Disengage applicable circuit breaker. Light should go out.

(g) Remove pressure source and reconnect pressure sensing line at oil strainer.

(h) Loosen union at switch "PRESS" port and motor or operate engine until oil leakage is observed at the switch union, then tighten union.

NOTE: Air trapped in the pressure line to the oil pressure switch may extend the duration of oil pressure warning light illumination after the engine is started.

(i) Close right side cowl panel.

OIL PRESSURE SWITCH - MAINTENANCE PRACTICES

1. Removal/Installation Oil Pressure Switch

NOTE: The switch and its attached mounting bracket comprise a single replaceable spares assembly. Do not dismantle bracket from switch body when removing unit from engine.

A. Remove Oil Pressure Switch

(1) Open respective oil pressure warning circuit breaker.

(2) Remove electrical plug from oil pressure switch. (See figure 201.)

(3) Disconnect oil pressure sensing line at reducer union.

(4) Remove two bracket mounting screws and remove bracket and switch assembly.

(5) If the oil pressure switch is to be replaced with a new unit remove the reducer union, drain port, and O-rings.

B. Install Oil Pressure Switch

(1) If a new unit is being installed, install the reducer union at the switch "P" port using a new O-ring. Do not tighten union to final torque. Install drain port at switch "V" port using new O-ring.

(2) Locate bracket and switch assembly in mounting position and secure to mounting bracket with two screws.

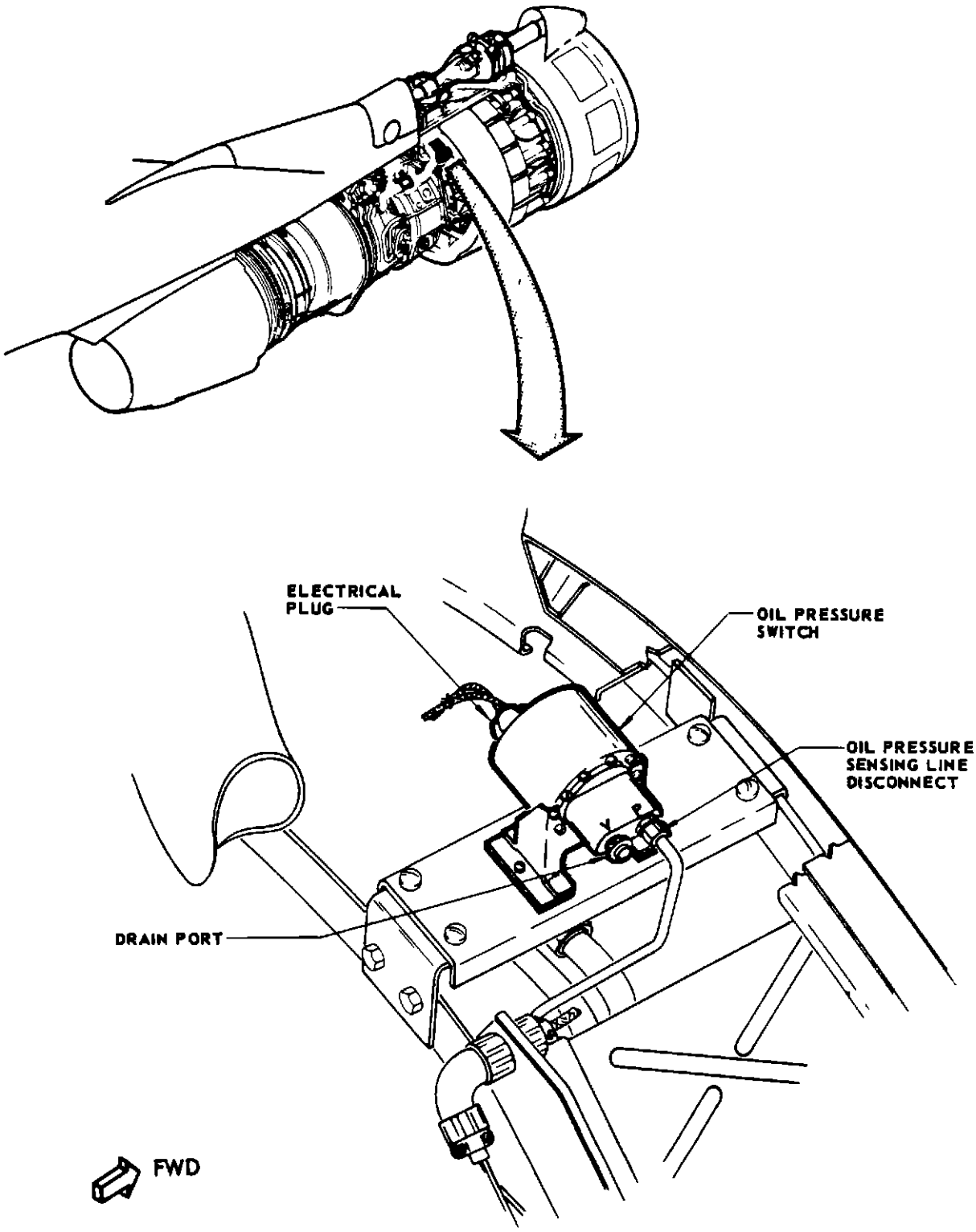
(3) Connect oil pressure sensing line at reducer union.

(4) Bleed air from the oil pressure sensing line by motoring or operating the engine until oil leakage is observed at the union, then tighten union.

NOTE: It is necessary to bleed air from pressure line to pressure switch because air trapped in the line may extend the duration of oil pressure warning light illumination after the engine is started.

(5) Connect electrical plug.

(6) Close respective oil pressure warning circuit breaker.



Oil Pressure Switch Installation
Figure 201

OIL STRAINER BYPASS SWITCH - MAINTENANCE PRACTICES

1. Removal/Installation Oil Strainer Bypass Switch

NOTE: The switch and its attached bracket comprise a single replaceable spares assembly. Do not dismantle bracket from switch body when removing unit from engine.

A. Remove Oil Strainer Bypass Switch

(1) Open respective oil pressure warning circuit breaker.

(2) Open right side cowl panel.

(3) Remove electrical plug from oil strainer bypass switch. (See figure 201.)

(4) Disconnect tubing between inlet side of strainer and switch "P" port at elbow

(5) Disconnect tubing between bypass side of strainer and switch "V" port at T-fitting.

(6) Remove two bracket mounting screws and remove bracket and switch assembly.

(7) If switch is to be replaced with a new unit, remove elbow, T-fitting, backup rings and O-rings

B. Install Oil Strainer Bypass Switch

(1) If a new switch is being installed, install T-fitting in switch "V" port and elbow in switch "P" port using new O-rings and backup rings. Do not tighten T-fitting locknut to final torque until switch tubing has been installed.

(2) Locate bracket and switch in mounting position and secure to mounting bracket using two screws.

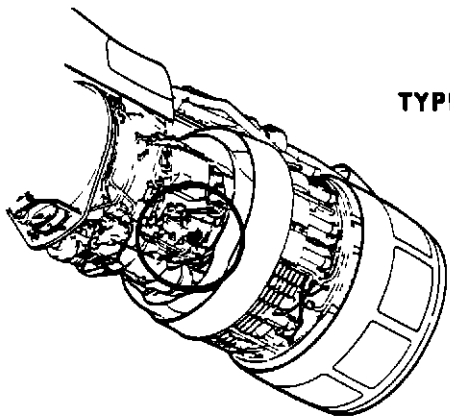
(3) Connect inlet pressure line to elbow at switch "P" port.

(4) Connect bypass pressure line to T-fitting at switch "V" port and tighten T-fitting locknut to final torque.

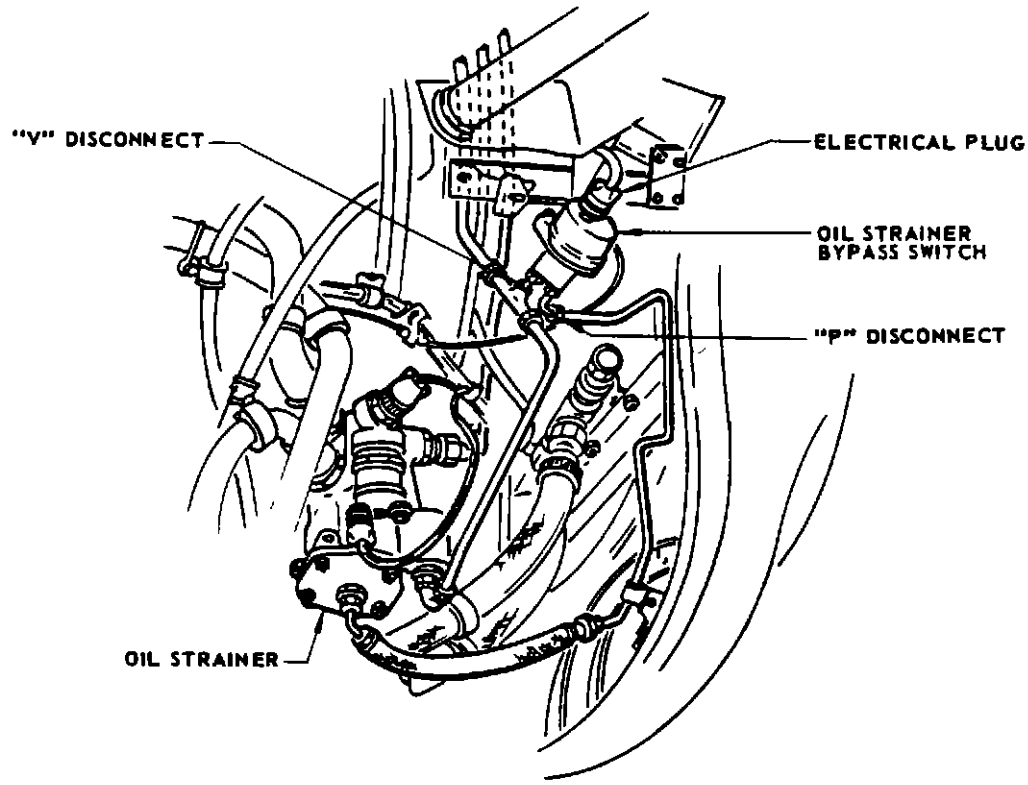
(5) Connect electrical plug to switch connector.

(6) Close respective oil pressure warning circuit breaker.

(7) Close right side cowl panel.



TYPICAL ALL FOUR ENGINES



Engine Oil Strainer Bypass Switch Installation
Figure 201