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6	AUG 01/06	ARG
R 7	AUG 01/07	ARG.1
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R 102	AUG 01/07	04.1
103	AUG 01/06	03
R 104	AUG 01/07	01.1
R 105	AUG 01/07	01.1
R 106	AUG 01/07	01.1
R 107	AUG 01/07	01.1
R 108	AUG 01/07	01.1
R 109	AUG 01/07	01.1
R 110	AUG 01/07	05.1
R 111	AUG 01/07	01.101
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R 159	AUG 01/07	03.101
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R 609	AUG 01/07	04.1
R 610	AUG 01/07	04.1
R 611	AUG 01/07	04.1
R 612	AUG 01/07	04.1
R 613	AUG 01/07	04.1
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615	AUG 01/05	04
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403	DEC 01/04	04
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404	AUG 01/05	02
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R 504	AUG 01/07	09.101
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506	DEC 01/04	06
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R 508	AUG 01/07	13.101
R 509	AUG 01/07	12.101
R 510	AUG 01/07	13.1
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R 515	AUG 01/07	14.101
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R 504	AUG 01/07	02.101
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602	DEC 01/04	01

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602	DEC 01/04	01

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403	DEC 01/04	03
404	BLANK	
49-94-21		
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404	DEC 01/04	02

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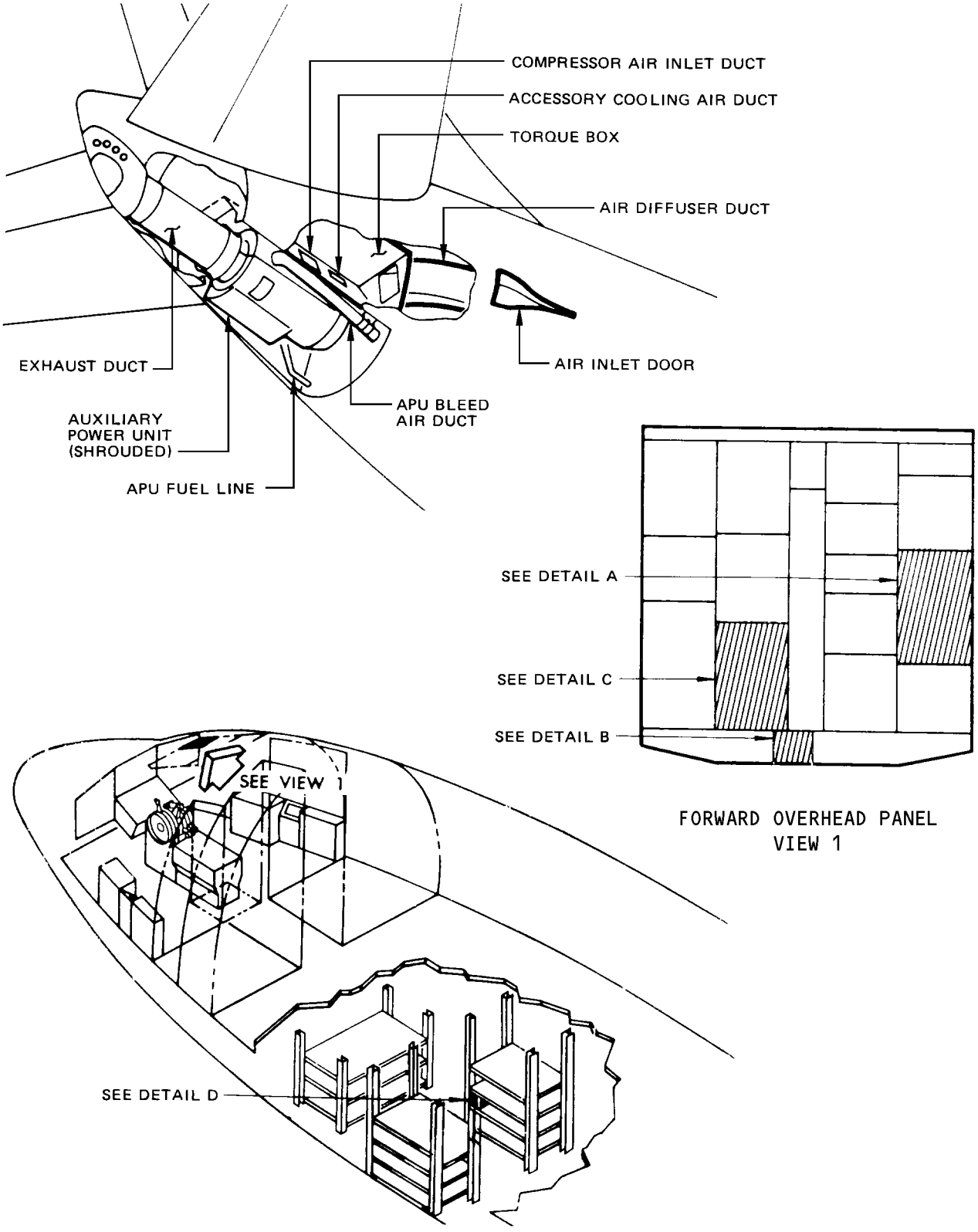
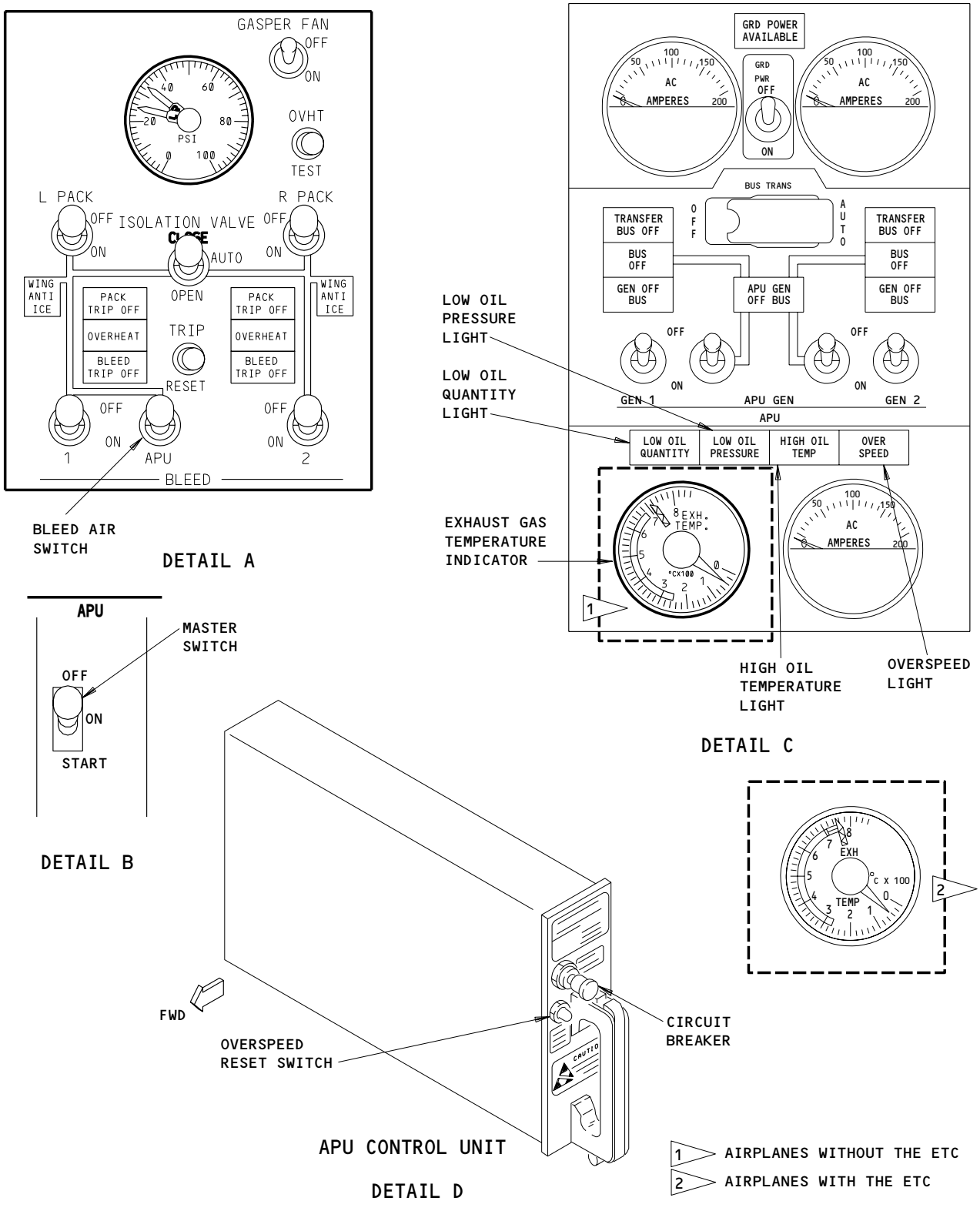
AIRBORNE AUXILIARY POWER - DESCRIPTION AND OPERATION

1. General
   A. The airborne auxiliary power is obtained from a gas turbine auxiliary power unit (APU). The APU is a compact, self-contained unit that provides compressed air for engine starting on the ground. The unit provides compressed air for air conditioning while the airplane is on the ground and at limited altitude in flight. The unit also provides electrical power for use on the ground or in flight.
   B. The APU consists of a gas turbine engine, an ac electrical generator driven by a turbine through an accessory drive, and controls for safe and continuous operation. An engine compressor bleed system is connected to the airplane pneumatic system. Refer to Chapter 36, Pneumatic System. The generator provides electrical power for airplane electrical system. Refer to Chapter 24, AC Generation System. Fire detection, warning and extinguishing systems are also provided for the APU. Refer to Chapter 26, Fire Protection.
   C. The APU is located in a compartment in the tail section of the airplane (Fig. 1). Access to the APU is obtained through a latched access door in the fuselage directly below the APU.
   D. Fuel for the operation of the APU is obtained from fuel tank No. 1 (Fig. 2). Electrical power for starting the APU is obtained from airplane battery. Positioning the master switch to START initiates automatically controlled operations to start the APU. The APU fuel valve and air inlet door opens. Acceleration, ignition, and starter motor cutout are controlled to allow the engine to reach service speed quickly and safely. As soon as the APU attains the service speed, pneumatic or electrical power is obtained by properly positioning the controls. If large amounts of pneumatic power are required, such as for airplane engine starting, the electrical load must be reduced.
   E. The APU is stopped by positioning the master switch to OFF. The APU shuts down automatically in event of engine overspeed, low oil pressure, high oil temperature, or if there is a fire in the APU compartment. Fire extinguisher discharge, in event of a fire in the APU, is controlled manually. Refer to Chapter 26, Fire Protection.
2. Airplanes with Later Configuration APU
   A. Some of the airplanes have a later configuration APU. This APU has an electronic temperature control (ETC) and a timed acceleration control unit (TAFCU). To do maintenance of the APU, you must correctly identify the APU. In the maintenance manual, the procedures that are not common between the APU's have an effectivity of AIRPLANES WITH THE ETC and AIRPLANES WITHOUT THE ETC, or AIRPLANES WITH THE TAFCU and AIRPLANES WITHOUT THE TAFCU.
   B. To identify the airplanes with the ETC, look in the aft cargo compartment. The ETC is found on the ceiling in the right side of the aft cargo compartment (Fig. 3).



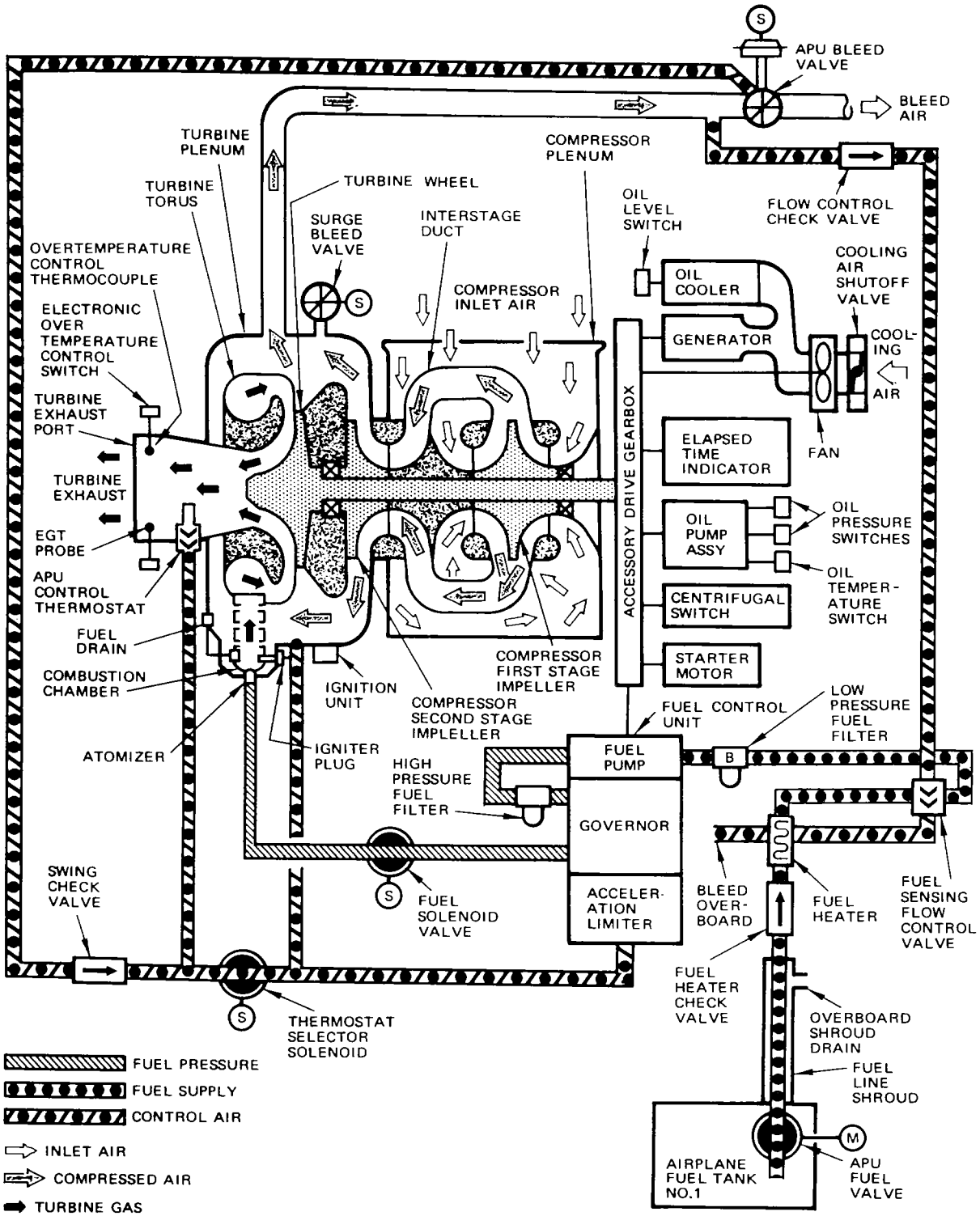
Auxiliary Power Unit Component Location
Figure 1 (Sheet 1)



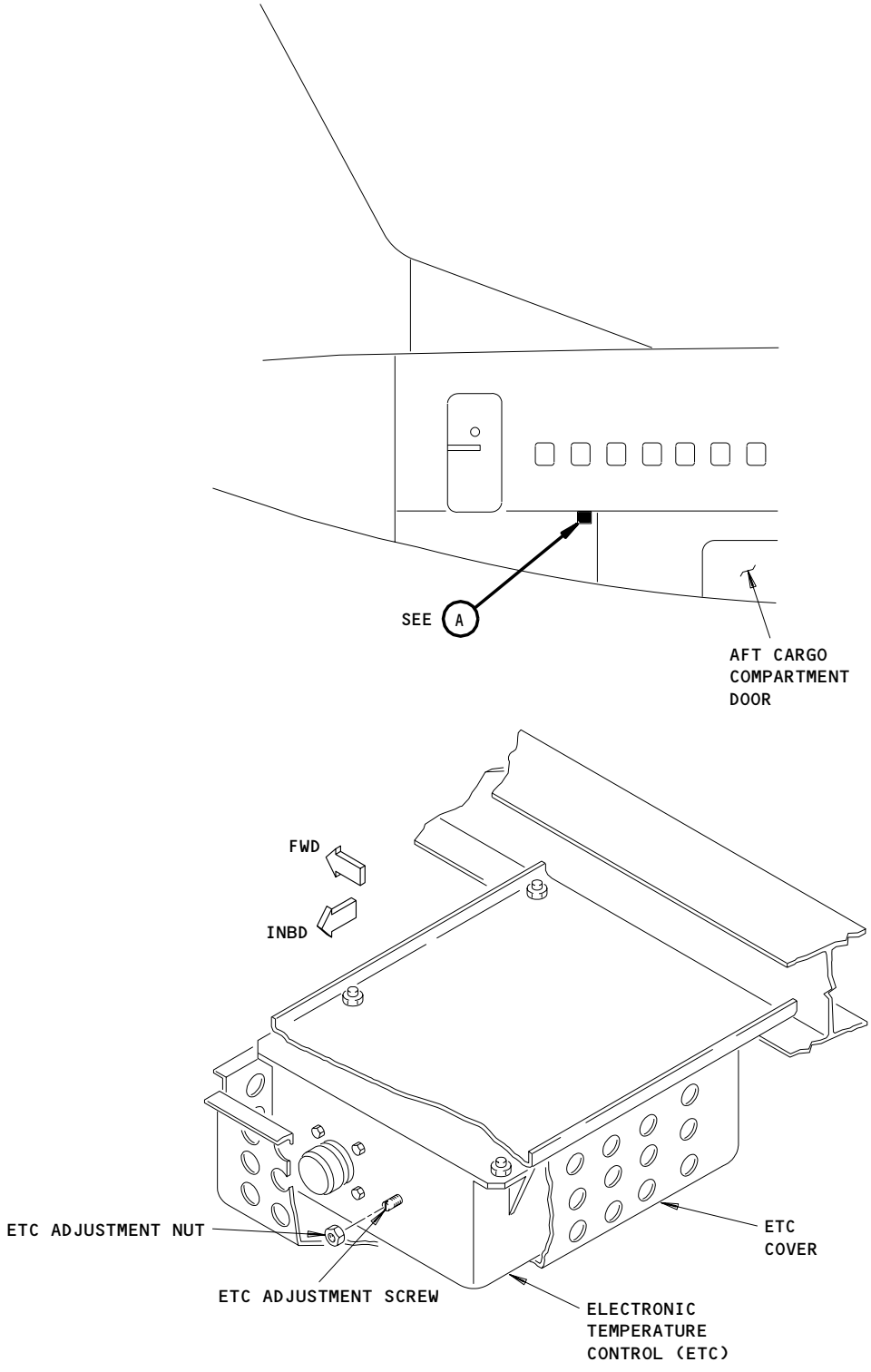
Auxiliary Power Unit Component Location
Figure 1 (Sheet 2)

C. To identify the airplanes with the TAFCU, look at the fuel control unit on the APU. The fuel control unit is located on the gearbox end of the APU (Fig. 4).

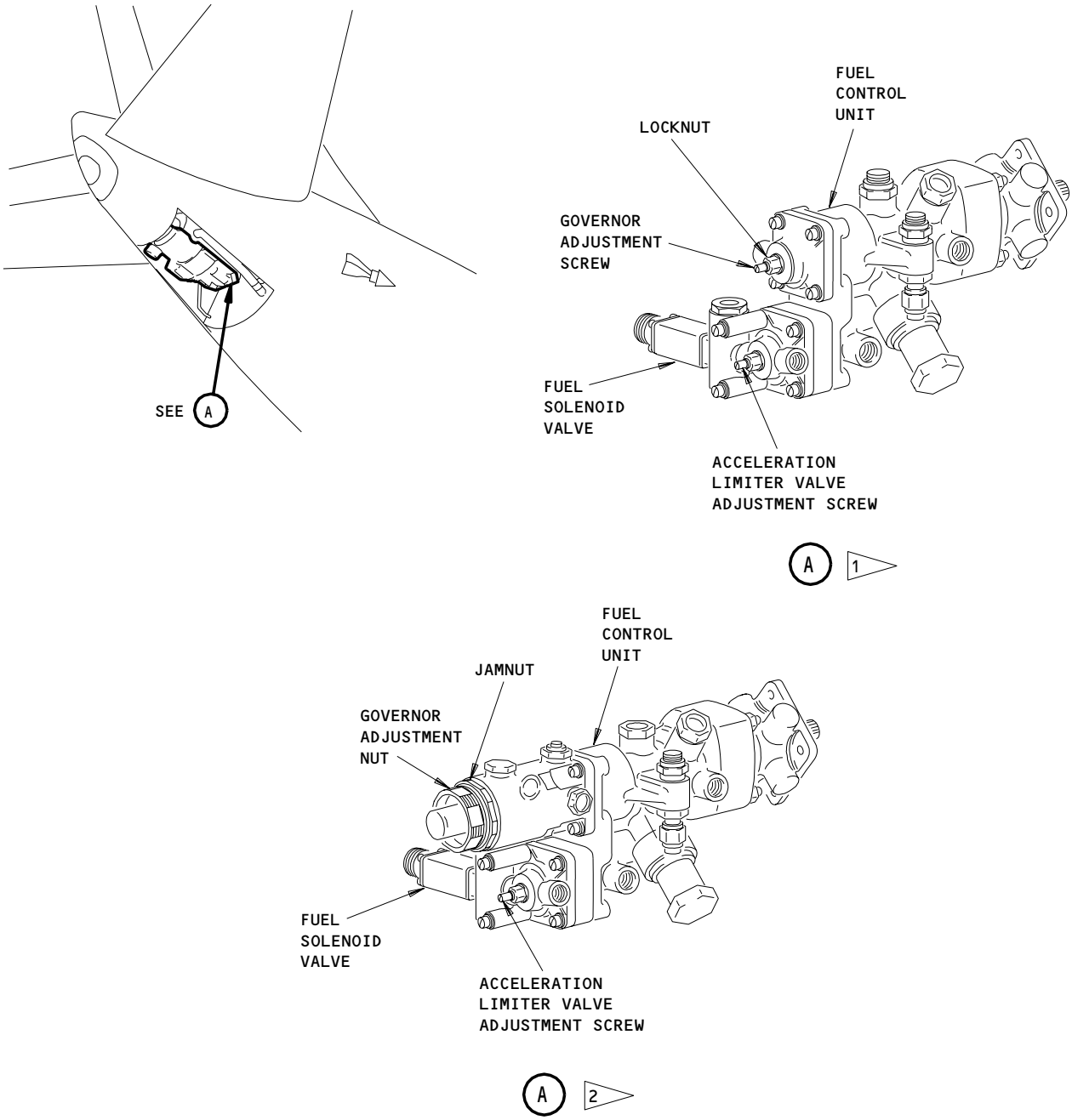
3. APU Power Plant
   A. The APU power plant consists of the APU engine assembly as installed on the airplane (Fig. 1). The APU engine assembly contains the APU engine, ac electrical generator, and the engine mount brackets.
4. APU Shroud
   A. The APU engine and its accessories are enclosed in a fireproof and sound reducing shroud (Fig. 1). The shroud consists of the upper shroud and the lower shroud.
5. APU Mounts
   A. The APU mounts consist of the ring mounts, shroud rings, and engine mounts. The shroud rings provide support for the engine mounts and for the upper shroud. The shroud rings are attached to the airplane structure with ring mount struts and brackets.
6. APU Air Inlet
   A. The APU air inlet provides the compressor inlet air and cooling air to the APU engine. The air inlet consists of the air diffuser duct, compressor air inlet duct, accessory cooling air duct, and the air inlet door (Fig. 1).
7. APU Engine
   A. The APU engine is a gas turbine consisting of a two-stage centrifugal compressor directly coupled to a single-stage inward flow turbine (Fig. 2). The turbine shaft is geared to the accessory drive section and provides power for driving the engine accessories and the generator.
8. APU Fuel System
   A. The APU engine fuel system delivers fuel from the airplane tank No. 1 to the APU engine where it is metered and delivered to the combustion chamber (Fig. 2). The fuel system regulates the fuel flow to maintain a constant turbine speed under varying load conditions and to maintain turbine temperatures within the safe zone.
9. APU Ignition and Starting
   A. The APU ignition and starting system provides the means of cranking the engine and igniting the fuel-air mixture in the combustion chamber (Fig. 2). Automatic controls de-energize the starter motor and ignition circuits when the engine is rotating at approximately 35 and 95% service speed respectively.
10. APU Air
    A. The APU air system consists of pneumatic and mechanical components, which function automatically, to regulate the rate and maximum amount of bleed air that can be drawn from the APU for use in the airplane pneumatic systems (Fig. 2).
    B. A fan driven by the accessory drive section circulates the cooling air to the ac electrical generator, lubricating oil cooler, and engine accessories (Fig. 2).



Auxiliary Power Unit Block Diagram
Figure 2



Electronic Temperature Control
Figure 3



1 AIRPLANES WITHOUT THE TAFCU

2 AIRPLANES WITH THE TAFCU

Airborne Auxiliary Power
Figure 4

11. APU Engine Controls
    A. The APU engine controls consist of manually and automatically operated switches to control the starting, stopping and normal running of the APU engine. The APU control components are located on the APU engine, in the APU control unit, and on the forward overhead panel (Fig. 1 and 2).
12. APU Engine Indicating
    A. The APU engine indicating consists of an exhaust gas temperature indicating system, an elapsed time indicator mounted on the APU for recording the number of hours the APU has been operated, and an overspeed light on the forward overhead panel (Fig. 1).
13. APU Exhaust
    A. The APU exhaust is a sound reducing system that directs the APU exhaust gases overboard through an air-cooled exhaust duct (Fig. 1).
14. APU Lubrication
    A. The APU lubrication system is a self-contained system that provides pressurized and spray lubrication for all gears and bearings within the unit. It consists of an oil pump, oil tank and various oil lines (Fig. 2).
15. APU Oil Indicating
    A. The APU oil indicating system provides means of monitoring the high oil temperature, low oil pressure, and low oil quantity with indicating lights, which are located on the forward overhead panel (Fig. 1).

AUXILIARY POWER UNIT - TROUBLESHOOTING

1. General
   A. This section provides troubleshooting tips, indications, and symptoms for detecting and isolating malfunctions of the auxiliary power unit (APU).
      (1) To find and correct APU problems, first study the symptoms carefully. Then check each possible cause, beginning with the most probable, until the exact cause of the problem is determined.
      (2) The charts list problems in the sequence most likely to occur before starting, during starting, after starting, and during shutdown.
      (3) The charts do not list all possible short circuits like wire breaks, or loose connections because normal maintenance and inspection procedures eliminate most of these problems.
   B. In the event of an electrical failure, consult WDM 49.
   C. Obey these precautions:

      WARNING: DO NOT TOUCH THE IGNITION UNIT UNTIL YOU MAKE IT SAFE. REMOVE POWER FROM THE SYSTEM. STAY AWAY FROM THE IGNITION UNIT FOR A MINIMUM OF 4 MINUTES BEFORE YOU DISCONNECT CONNECTIONS. ELECTRICAL POWER CAN KILL YOU, OR CAUSE INJURIES.

      WARNING: AFTER YOU DISCONNECT THE HIGH-TENSION LEAD, IMMEDIATELY GROUND THE IGNITION UNIT TERMINAL TO MAKE SURE THAT THE CAPACITORS ARE FULLY DISCHARGED. ELECTRICAL POWER CAN KILL YOU, OR CAUSE INJURIES.

      WARNING: DO NOT OPERATE THE IGNITION SYSTEM UNLESS THE IGNITION PLUG IS CORRECTLY GROUNDED. THE CURRENT AND VOLTAGE IN THE IGNITION SYSTEM ARE DANGEROUS. ELECTRICAL POWER CAN KILL YOU, OR CAUSE INJURIES.

      CAUTION: TO PREVENT DAMAGE TO THE APU, OBEY THE LIMITS (AMM 49-11-0/201) KEEP THE STARTER IN THE CYCLE LIMITS WHILE YOU LOOK FOR APU PROBLEMS. HIGH-ENERGY STARTERS BECOME TOO HOT QUICKLY. IF YOU DO NOT OBEY THE LIMITS, DAMAGE TO THE STARTER WILL OCCUR.

      CAUTION: DO NOT OPERATE APU UNLESS THERE IS FUEL AT THE FUEL CONTROL UNIT. WITHOUT LUBRICATION, DAMAGE TO THE APU WILL OCCUR.

      CAUTION: DO NOT OPERATE APU UNLESS THE OIL LEVEL IS CORRECT. WITHOUT LUBRICATION, DAMAGE TO THE APU WILL OCCUR.

   D. For equipment location, refer to Description and Operation (APU component location).

E. APU troubleshooting is divided into four parts:
(1) Malfunctions before start
(2) Malfunctions during start
(3) Malfunctions after start
(4) Malfunctions related to APU shutdown

2. Equipment and Materials
A. Multimeter - Simpson 260
B. Pressure Gage - 0 to 100 PSIG
C. Pressure Gage - 0 to 200 PSIG
D. RPM Indicator and Tachometer - Generator Test Set
(1) F72891-1

3. Troubleshooting Tips
A. General Conditions
(1) Many external signs of problems may be evident during APU operation. An observer can be used in troubleshooting to aid the APU operator. Some conditions to watch for are:
(a) Smoke in the ventilation system.
(b) Unusual noises in the APU compartment.
(c) Fire or smoke in the exhaust ducting.
(d) No air pressure in APU drain system while APU is operating.
(e) Fluids draining from airplane APU drain system.
(2) The APU must reach governed speed during a normal starting operation (AMM 49-00-00/201).
(3) The APU engine shuts down automatically in event of low oil pressure, high oil temperature, turbine overspeed and automatic fire detection (AMM Chapter 26).
B. Indications and/or Symptoms
(1) APU Battery DC Voltmeter (AMM Chapter 24):
(a) On a normal start, (initial starter engagement) battery voltage will drop 8-10 volts and slowly rise 3 to 5 volts during first 10 seconds.
(b) Excessive battery voltage drop (in excess of 12 volts) indicates battery is weak and should be replaced.
(c) Excessive battery voltage drop followed by steady state could indicate sufficient voltage but failure of APU to rotate.
(d) A small battery voltage drop of 1-2 volts could be caused by starter rotation without engagement.

CAUTION: STARTER WILL OVERSPEED AND DESTRUCT.

(e) Voltage rises suddenly to normal (24-28 volts) at 35% to indicate release of start relay (R5) and starter assembly drop out.
(2) DC Ammeter (AMM 24-31-0/001)
(a) Reads current of source selected by the DC selector for TR1, 2, 3, and BAT.
(3) Frequency Meter (AMM 24-21-0/001)
(a) The frequency meter will indicate the frequency of the APU generator, if the APU generator is selected. Under normal conditions, no-load, and an elevation of sea level, the APU frequency meter should read 405-410 Hz.

(4) Duct Pressure Indicator (AMM 36-21-0/001)
  (a) With the bleed valve switch to the OPEN position, duct pressure should stabilize. Duct pressure (nominal) should read 45 ±5 psig at sea level with no pneumatic load.
(5) Fuel Quantity Indicator (AMM 28-41-0/001)
  (a) Fuel tank No. 1 must contain a specified amount of fuel for APU operation (AMM 49-11-0/201).
  (b) The APU fuel inlet line must be filled with fuel before attempting to start the APU. During start, the fuel is fed to the fuel control unit by one of these modes:
    1) ac boost pump if ac power is available
    2) suction feed only - no boost pump available
(6) APU Controls and Indicators
  (a) The APU control panel on forward overhead panel P5 provides the controls and indicators required to operate the APU.
  (b) The APU control unit (M280 module), located in the lower 43 section on the E3-3 electrical and electronic equipment rack has one board in it containing micro circuits that may be damaged by electrostatic discharges. A decal attached to the module indicates that special handling of the unit is required.

    CAUTION: STATIC SENSITIVE. DO NOT HANDLE BEFORE READING PROCEDURE FOR HANDLING ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-40-12/201). CONTAINS DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

CONTROL/INDICATOR	FUNCTION
Battery Switch	Provides power to APU control system.
Master Switch ON	Provides dc power to open fuel shutoff valve and air inlet door.
Master Switch START (Momentary Position)	1. Initiates starter sequence (start relay R5). 2. Center spring-loaded return position to ON. 3. Opens fuel shutoff valve and air inlet door.
STOP	Actuates pneumatic solenoid valve to pneumatically open 110% contact of the centrifugal switch.
Bus Tie Breaker Switches	Connects APU generator to the airplane electrical system (AMM Chapter 24).
FIRE SWITCH	When pulled will shut down an operating APU and energize fire-extinguishing circuit (AMM Chapter 26).
APU Bleed Valve Switch	Operates the APU bleed air valve (AMM Chapter 36).
FIRE WARN Indicator	Indicates fire condition in APU compartment (AMM Chapter 26).
APU Generator Ammeter	Indicates APU generator load current (AMM Chapter 24).
EGT	Indicates APU exhaust gas temperature.
LOW OIL PRESSURE LIGHT (amber) NORMAL	Illuminates when master switch placed in ON position. Extinguishes when the oil pressure reaches 55 psig.
ABNORMAL	Illuminated when oil pressure decrease to 45 ±3 psi. Automatic shutdown in 10 ±2 seconds. Master caution light and APU annunciator illuminates.

CONTROL/INDICATOR	FUNCTION
LOW OIL QUANTITY LIGHT (blue)	Illuminates when APU oil quantity is low (1.5 ±0.5 qt)
HIGH OIL TEMP LIGHT (amber)	Illuminates when APU oil temperature exceeds high oil temperature switch set point (250° ±10°F or 285° ±0°F).
	MASTER CAUTION light and APU annunciator illuminate.
APU GEN OFF BUS LIGHT (blue)	Illuminates when APU is not supplying a generator bus and APU turbine speed reaches 95% RPM.

CONTROL/INDICATOR	FUNCTION
OVERSPEED LIGHT (amber)	Illuminates under the following conditions: 1. When the APU MASTER switch is turned to OFF following an unsuccessful APU start. 2. When the APU is shut down by turning the MASTER switch to OFF (normal shutdown) if there is a malfunction. 3. When the APU automatically shuts down due to overspeed during APU operation either on the ground or in the air. NOTE: It is important that conditions under which the OVERSPEED light is illuminated be determined and that correct maintenance procedures be used to avoid damage to the APU. The most common occurrence of OVERSPEED light operation is the OVERSPEED light coming on when the APU master switch is turned OFF following an unsuccessful APU start.

CONTROL/INDICATOR	FUNCTION
OVERSPEED LIGHT Starting	Depending on the point reached in the start cycle during the attempted start, the light will come on either immediately after the APU is switched to OFF or within 5 seconds after switching the APU to OFF. Before attempting another start, 2 minutes should elapse with the APU switch in the OFF position to allow for the time delay system in the APU start system to recycle.
	The OVERSPEED light will remain on with the switch in OFF position, during the waiting period. In these circumstances the light cannot be eliminated by pushing the overspeed reset button. But the overspeed light should go out during the subsequent start cycle.
	When operation of the OVERSPEED light occurs as a result of an unsuccessful APU start, a time limit of 2 minutes should elapse before attempting another start. The OVERSPEED light should go out during the subsequent start cycle.
OVERSPEED LIGHT Master switch set to OFF (Normal Shutdown)	If the OVERSPEED light comes on when the APU is shut down by turning the master switch OFF (Normal shutdown), this indicates a possible malfunction of the overspeed automatic protection system. The pneumatic solenoid or three-speed switch should be checked as a possible cause of this malfunction. Thus, the operation of the OVERSPEED light in these circumstances would require maintenance investigation and rectification.

CONTROL/INDICATOR	FUNCTION
OVERSPEED LIGHT APU automatic Shutdown	If the APU automatically shuts down during operation either on the ground or in the air and the OVERSPEED light comes on, it should be understood that in these circumstances definite maintenance investigation is required in order to avoid possible APU damage. To extinguish the OVERSPEED light, reset the overspeed in the E & E compartment.
	Overspeed shutdowns can be caused by erratic governor operation in the APU Fu el Control Unit or by a defective three-speed switch. Further operation of the APU with a defective speed control system could result in serious damage to the APU.
	If the OVERSPEED light comes on after an automatic shutdown, the APU should be checked for vibration or unusual noise after the subsequent restart. It is not satisfactory to simply reset the M280 module to extinguish the OVERSPEED light. Further operation of the APU could cause severe damage if the APU overspeed was caused by mechanical damage to the APU.
OVERSPEED LIGHT Reports of APU automatic shutdown	Do these steps: (a) Select APU master switch to OFF. (b) Push the overspeed reset switch on the M280 module (in the E & E compartment) to make the OVERSPEED light go off. (c) Start the APU. If the APU starts and overspeeds, replace the fuel control unit or three-speed switch. If the APU vibrates excessively or has unusual noise, shut down the APU immediately and replace the APU. If there is no indication of vibration or overspeed on subsequent starts, the APU can continue in service without further investigation.
OVERSPEED LIGHT Self-Initiated APU Shutdowns:	If a self-initiated shutdown of an APU occurs in service, inspect the APU and its auxiliary equipment for any obvious cause of malfunction (broken electrical lead, broken air line, etc.). NOTE: The seemingly obvious reason is not always the cause of the self-initiated shutdown of the APU. For example, the cause could be vibration due to a bearing failure.

CONTROL/INDICATOR	FUNCTION
OVERSPEED LIGHT Internal Engine Failure Check	Do these checks to make sure that it is not an internal engine failure that caused the problem: (a) Inspect the oil for discoloration and metal particles. (b) Inspect for presence of excessive metal particles within the oil filter or housing. (c) Check for high oil consumption. An APU requiring the addition of a quart of oil at a time other than at its normal oil level inspection period is an indication of internal failure. (d) Check for signs of oil in the exhaust section due to damaged turbine oil seal. (e) If any of the above defects are found in the APU, remove the APU and do a further investigation. (f) If you find no problems, start the APU. If the APU vibrated excessively or has unusual noise, shut down the APU immediately and replace the APU. If the APU starts and overspeeds, the speed control system may be the problem. The most likely components to cause this problem are the fuel control unit, or three-soeed switch.
OVERSPEED LIGHT APU On-ground Use	If a self-initiated shutdown of an APU occurs in service and there is insufficient time available to check the APU oil system for possible bearing failure the APU must must be placarded to the effect that the APU may be used on the ground only provided that there is compliance with the following requirements: (a) Start the APU. (b) Check for excessive vibration or unusual noise. (c) Check the APU annunciator lights are functioning normally. (d) APU operation must be monitored continuously.
	The APU can be used for in-flight use when the requirements specified herein have been successfully accomplished.
RPM Indicator *[1] *[1] (Not on some airplanes)	Indicates percent APU turbine speed (expect certain actions at specific RPM). 1. 7% speed - fuel solenoid opens, igniter fires, EGT rises from ambient indication.

CONTROL/INDICATOR	FUNCTION
RPM Indicator *[1] *[1] (Not on some airplanes)	Indicates percent APU turbine speed (expect certain actions at specific RPM). 1. 7% speed - fuel solenoid opens, igniter fires, EGT rises from ambient indication. 2. AIRPLANES WITHOUT THE ETC; When the APU engine speed gets to 35%, power is removed from the start relay R5. The dc voltmeter shows approximately 24-28 V. This shows that the starter has disengaged. AIRPLANES WITH THE ETC; When the APU engine speed gets to 50%, power is removed from the start relay R5. The dc voltmeter shows approximately 24-28 V. This shows that the starter has disengaged. 3. 95% speed - APU bleed air valve ready to accept pneumatic load. The APU generator system is armed. Igniter is deactivated. The time totalizer meter is activated.
APU FIRE CONTROL HANDLE	When pulled, arms the APU bottle discharge switch (on this panel only), closes the APU fuel shutoff, bleed air valves, and APU inlet door. Also, the generator control relay and generator breaker trip.

SEE THE TABLE OF CONTENTS TO FIND THE APPLICABLE FIGURE.
THESE ARE THE CATEGORIES IN THIS TROUBLESHOOTING.

MALFUNCTIONS BEFORE START

MALFUNCTIONS DURING START

MALFUNCTIONS AFTER START
APU AT 100% RPM.

MALFUNCTIONS RELATED TO
APU SHUTDOWN

Auxiliary Power Unit – Troubleshooting
Figure 101

"OVERSPEED" LIGHT ON WITH MASTER SWITCH OFF.

Turn master switch ON. IF –

OVERSPEED LIGHT DOES NOT GO OUT – Return master switch to OFF, momentarily press the OVERSPEED RESET button *[1] on the M280 control module to turn the light out. IF –

IF OVERSPEED LIGHT GOES OUT – Return master switch to OFF, and continue system check; or start the engine and shut it down. If the OVERSPEED light comes ON when the engine is shut down, go to Fig. 35.

OVERSPEED LIGHT GOES OUT – Start APU. IF –

OVERSPEED LIGHT REMAINS ON – Replace M280 module.

APU STARTS AND OVERSPEEDS – Replace fuel control.

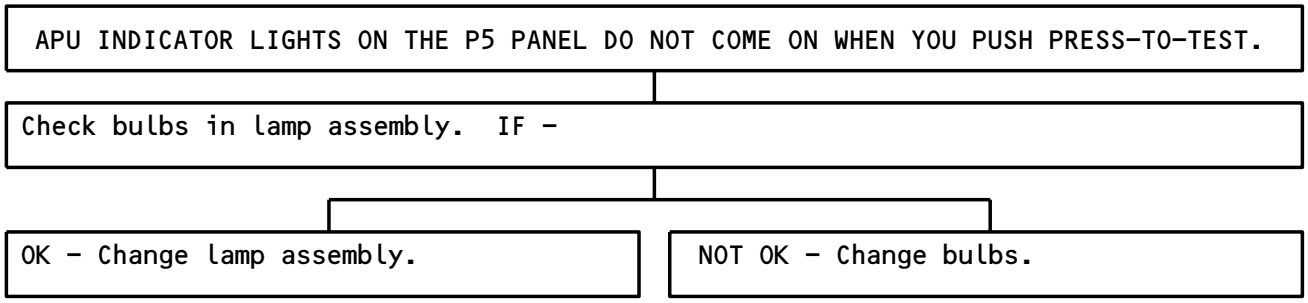
EXCESSIVE ENGINE VIBRATION OR ENGINE NOISE – Change engine (internal engine damage).

RESTART APU. IF –

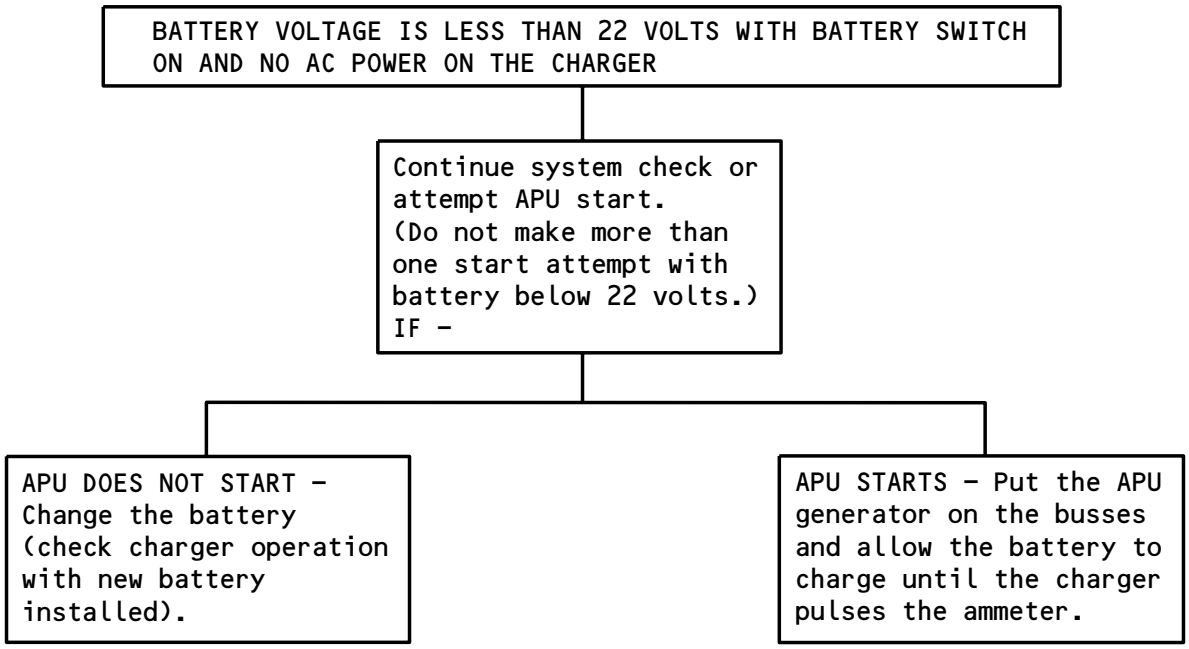
NOT OK – Replace 3-speed switch.

*[1] The OVERSPEED RESET button will extinguish the overspeed light only if an actual overspeed conditionhas occurred. Any other illumination of overspeed light will require the APU master switch be positioned to OFF, allow 2 minutes for all relays to react, and then position switch to START.

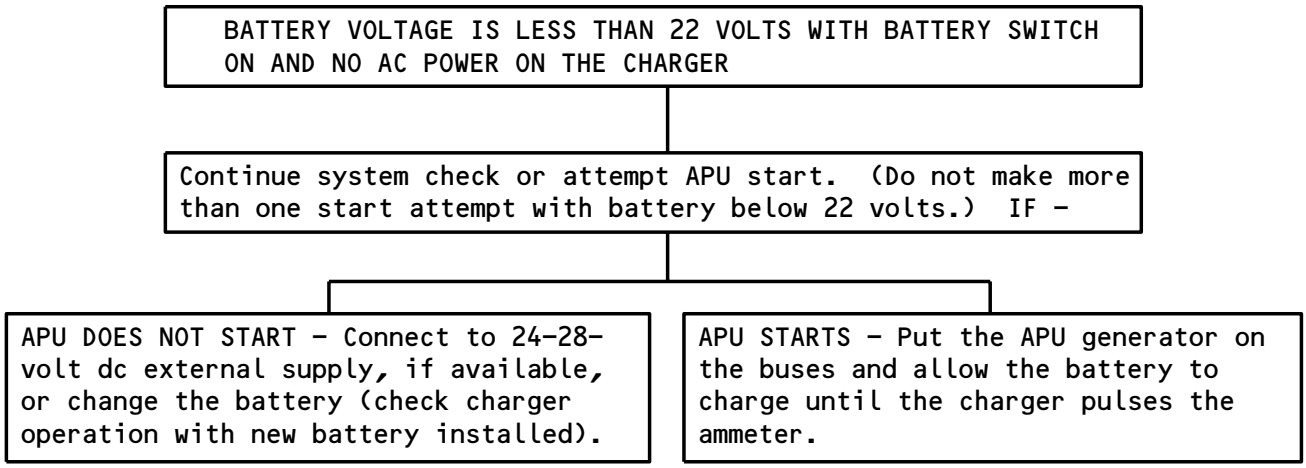
OVERSPEED Light On with Master Switch Off
Figure 102



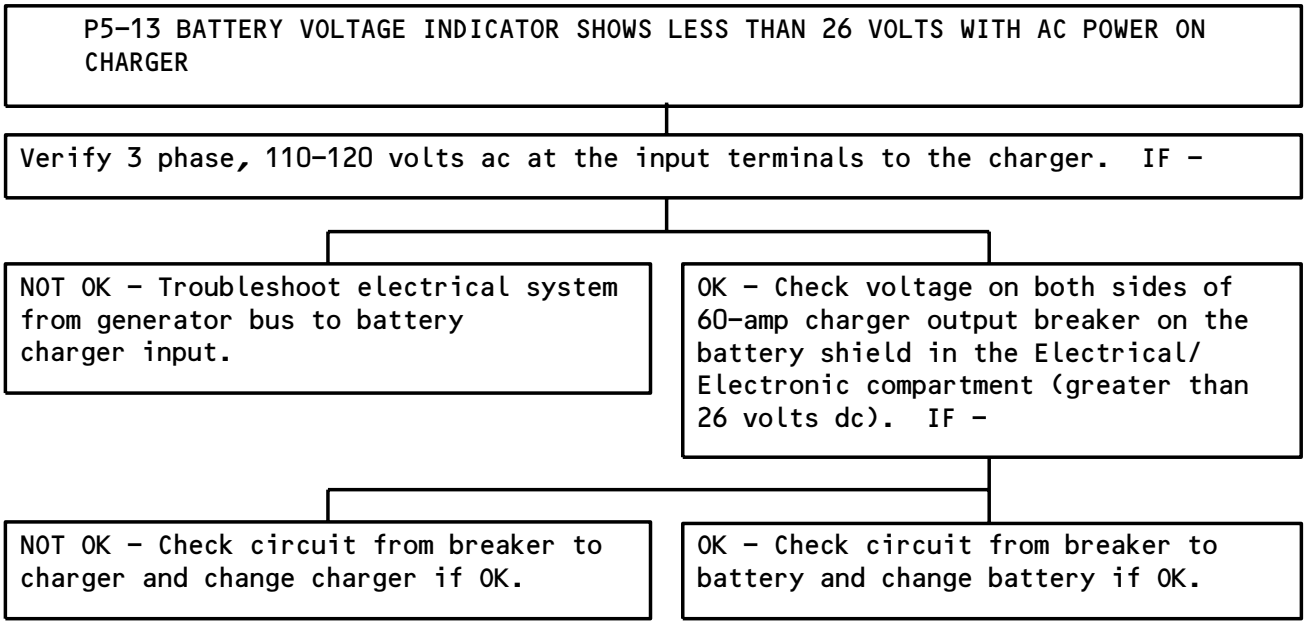
APU Indicator Lights on the P5 Panel Do Not Come On when You Push Press-To-Test.
Figure 103



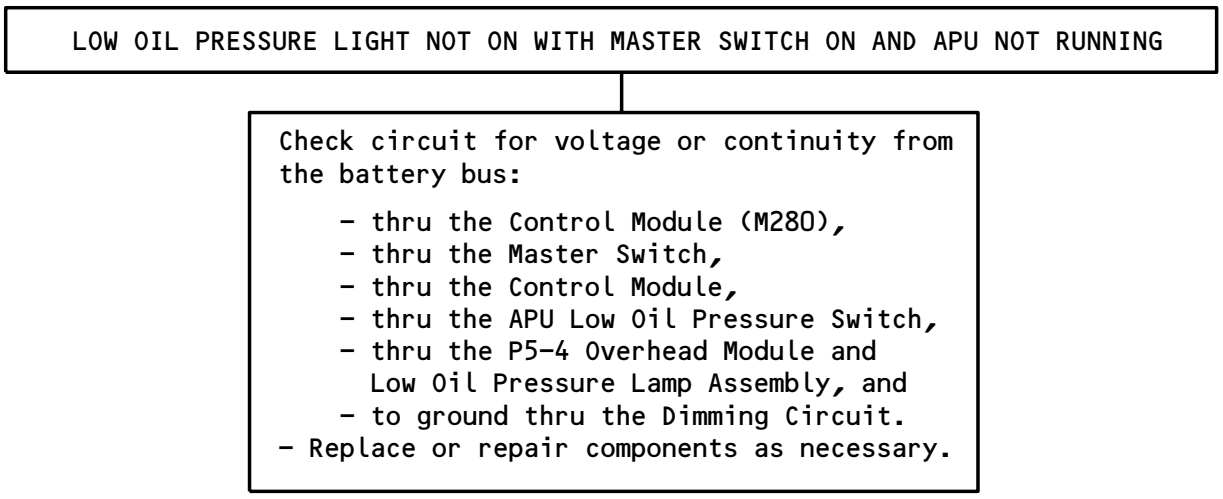
Battery Voltage is Less Than 22 Volts with Battery Switch On
and No ac Power On the Charger
Figure 104 (Sheet 1)



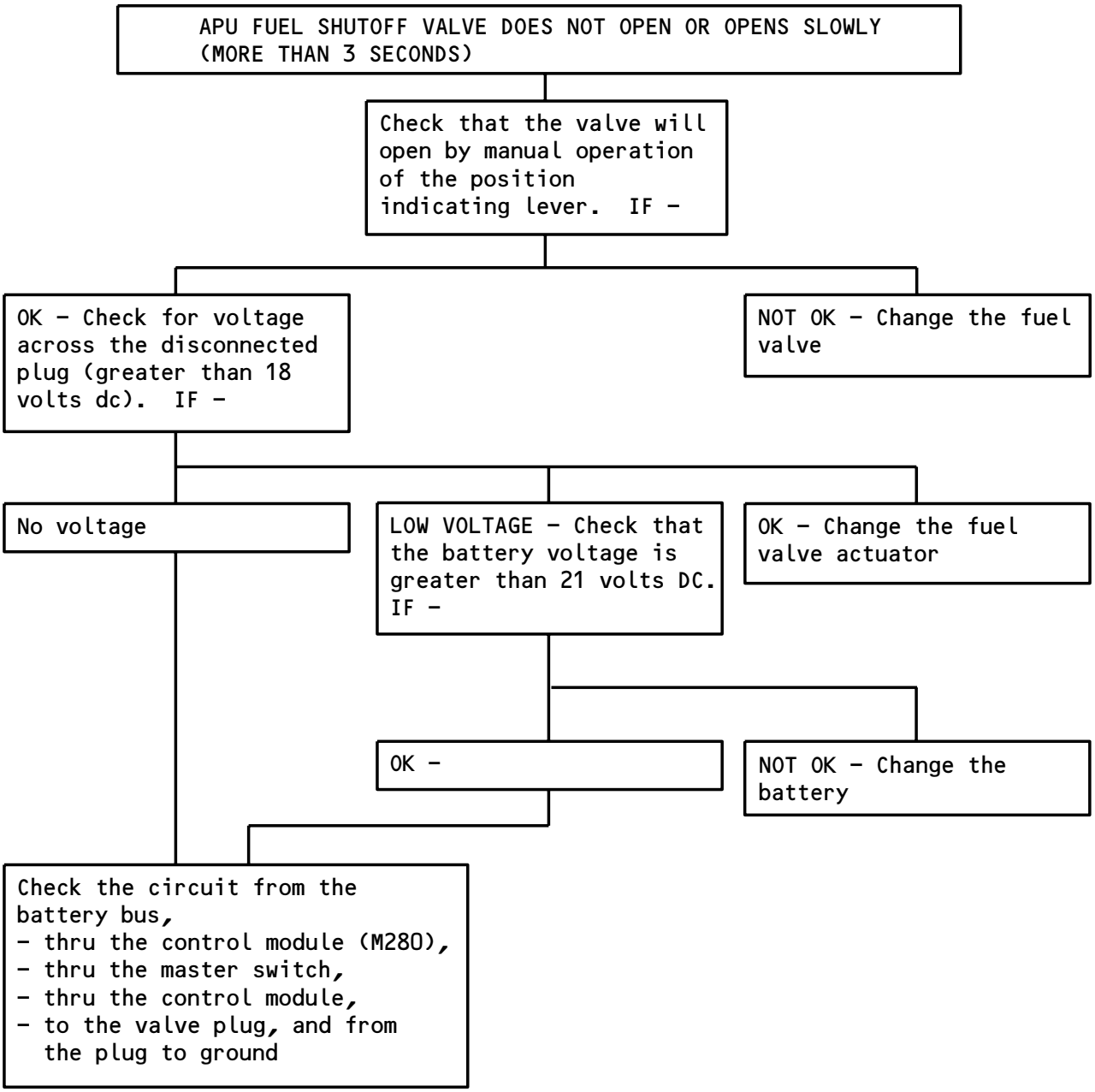
Battery Voltage is Less Than 22 Volts with Battery Switch On
and No ac Power On the Charger
Figure 104 (Sheet 2)



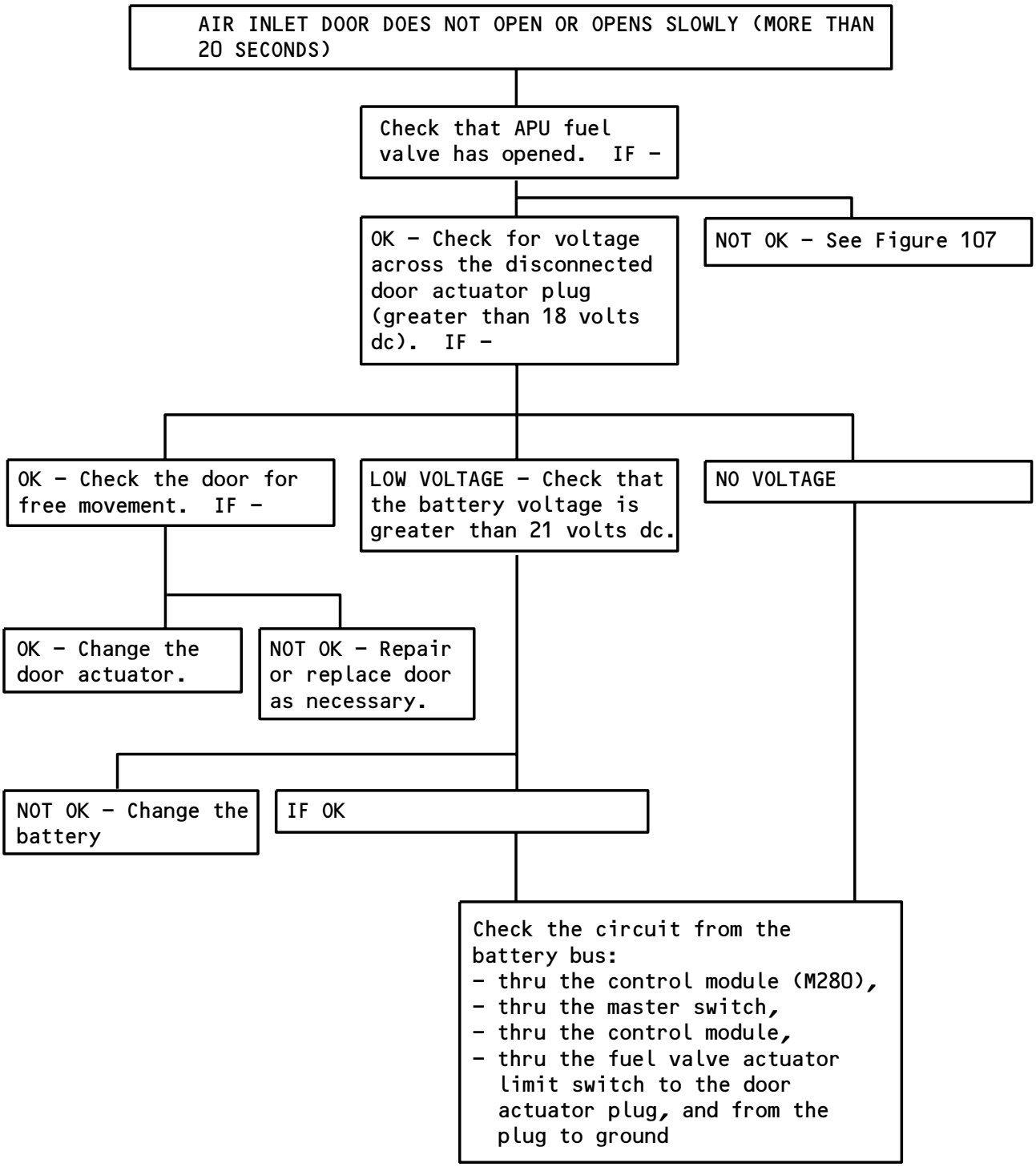
P5-13 Battery Voltage Indicator Shows Less Than 26 Volts
with ac Power On the Charger
Figure 105



Low Oil Pressure Light Not On with Master Switch On and APU Not Running
Figure 106



The APU Fuel Shutoff Valve Does Not Open or Opens Slowly
(more than 3 Seconds)
Figure 107



The APU Inlet Door Does Not Open or Opens Slowly
(more than 20 Seconds)
Figure 108

MODULE (M280) CIRCUIT BREAKER OPENS. IF –

DURING START – This is a short circuit problem. The point in the start sequence at which the breaker opens is an indication as to which component has shorted.

There will be a delay between application of fault and circuit breaker opening. The heavier the fault current, the shorter the delay. IF –

BREAKER OPENS AFTER STARTER MOTOR ENGAGES – Check for short to ground in:
(a) 35% switch
(b) 95% switch
(c) 110% switch
(d) Sequencing oil pressure switch
(e) Fuel solenoid
(f) Ignition unit
(g) Igniter lead.
IF –

ALL OK – Check APU wiring harness for abraded wires or short circuits to ground. IF –

NOT OK – Replace faulty component.

OK – Replace M280 control module.

NOT OK – Repair wiring harness.

WITH ENGINE RUNNING – Check for short circuit in:
(a) 95% switch
(b) 110% switch
(c) Sequencing oil pressure switch
(d) Fuel solenoid
(e) Hourmeter
(f) Surge bleed valve solenoid
(g) Overtemperature control switch
(h) Circuitry downstream of immersion thermocouple
(i) APU wire bundle
IF –

IF ALL OK – Replace M280 module.

NOT OK – Replace faulty component.

BREAKER OPENS BEFORE STARTER ENGAGEMENT – Check for short circuit in:
(a) Inlet door actuator
(b) Fuel shutoff valve actuator
(c) Starter lead
IF –

NOT OK – Replace faulty component.

OK – Replace M280 module. IF –

PROBLEM PERSISTS – Check engine for free rotation. (AMM 49-21-00/201) IF –

NOT OK – Replace APU.

OK – Replace starter.

Module (M280) Circuit Breaker Opens
Figure 109

STARTER MOTOR DOES NOT TURN.

If the APU start motor, or APU electrical wiring harness has just been changed, check the polarity of the start motor terminals. IF –

OK – Check that the air inlet door has opened. IF –

NOT OK – Turn master switch and battery to OFF. Correct start motor leads polarity.

OK – Check that the door has actuated the door position switch (S284). IF –

NOT OK – See Fig. 108.

1 OK – Check for voltage at the starter motor and confirm that ground connection is secure. IF –

NOT OK – Adjust or repair switch as necessary.

OK – Change the starter motor.

1 NOT OK – Check for voltage across the coil of the start relay (greater than 20 volts). IF –

OK – Change the start relay.

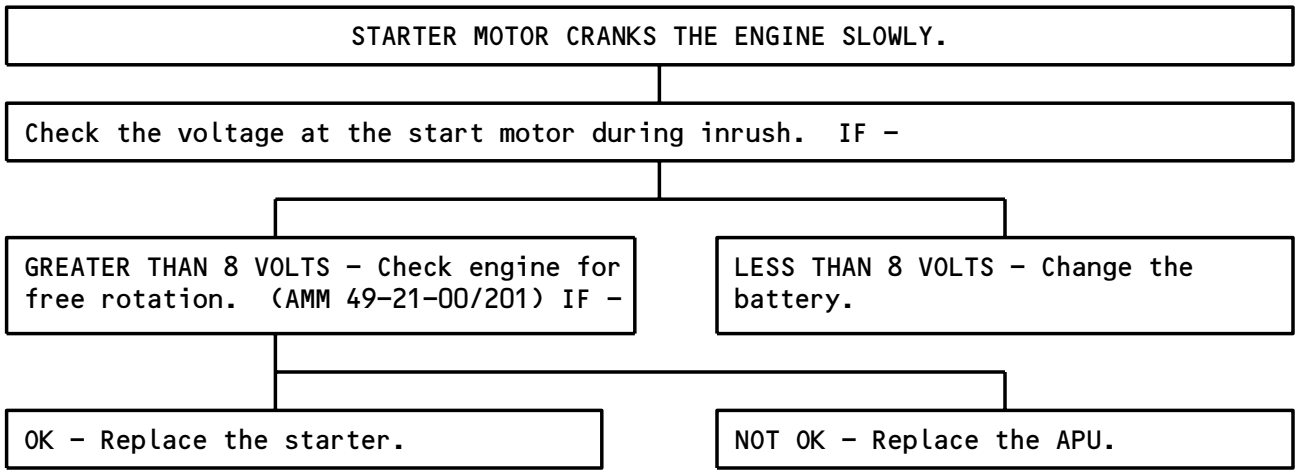
NOT OK – Check the start relay control circuitry
- from the control module to the master switch and through the ON and START positions to the module,
- from the control module thru the APU centrifugal speed switch,
- from the control module thru the start relay coil circuit,
- and from the control module thru the start relay normally closed contacts. IF –

OK – Change the control module (M280).

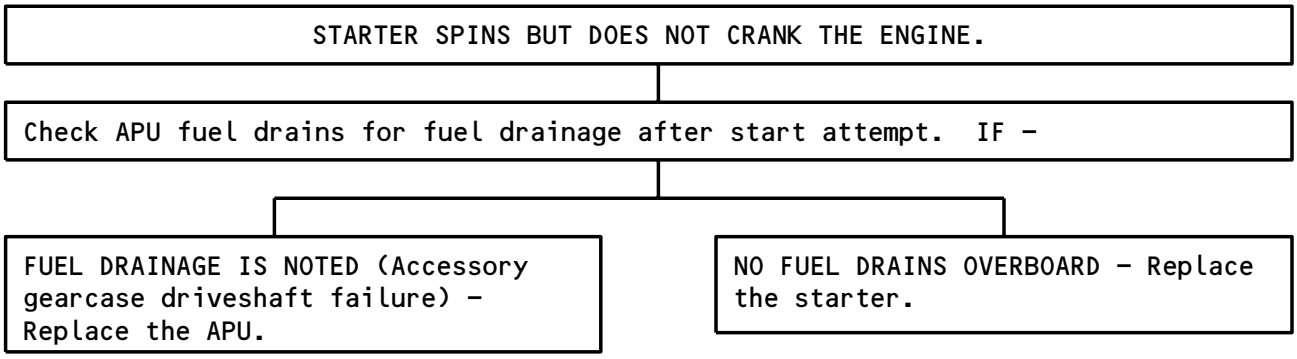
NOT OK – Replace faulty component or repair wiring.

1 Make these checks within 60 seconds (90 seconds on some airplanes) after the air inlet door fully opens after start initiation.

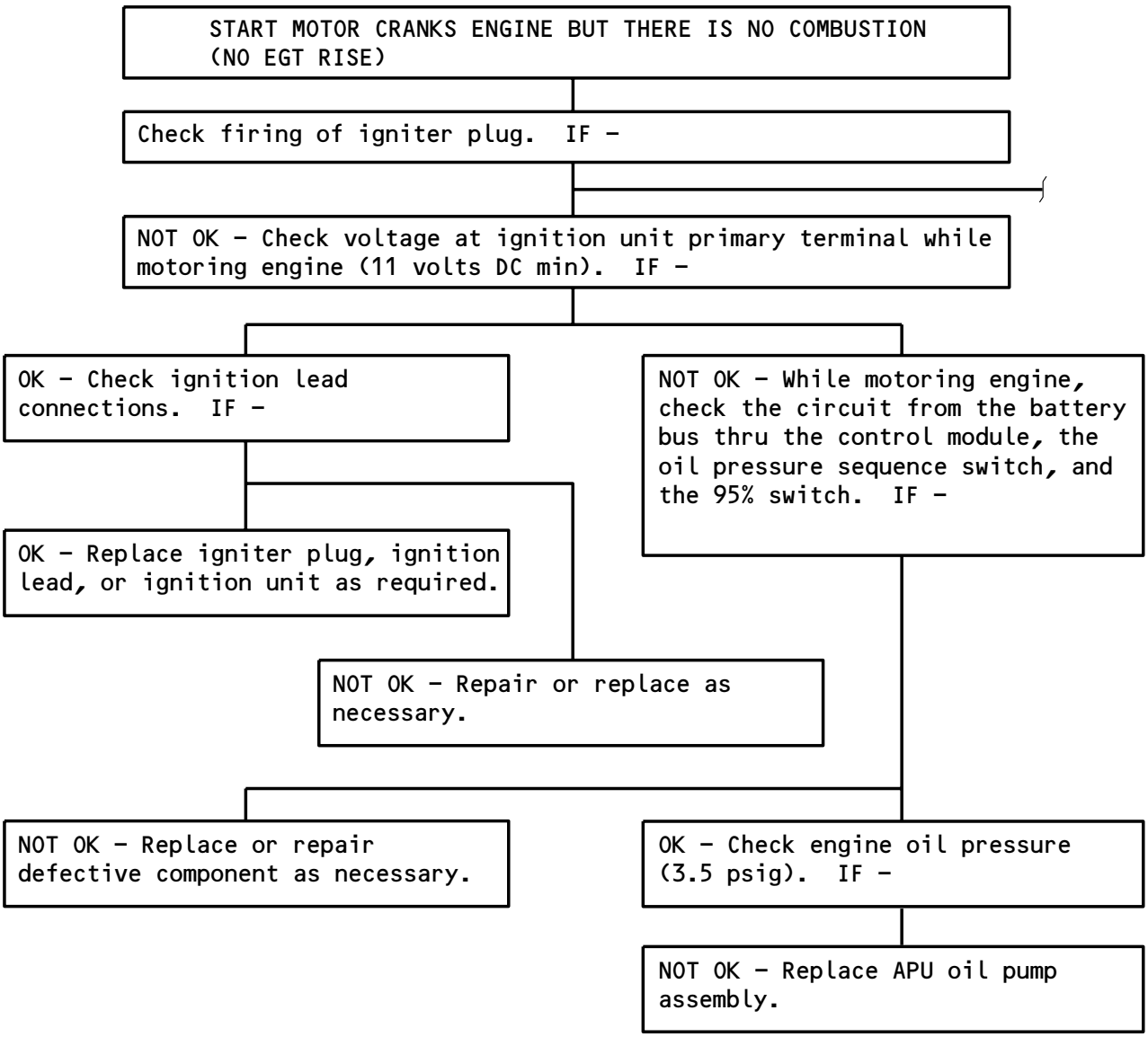
Starter Does Not Turn
Figure 110



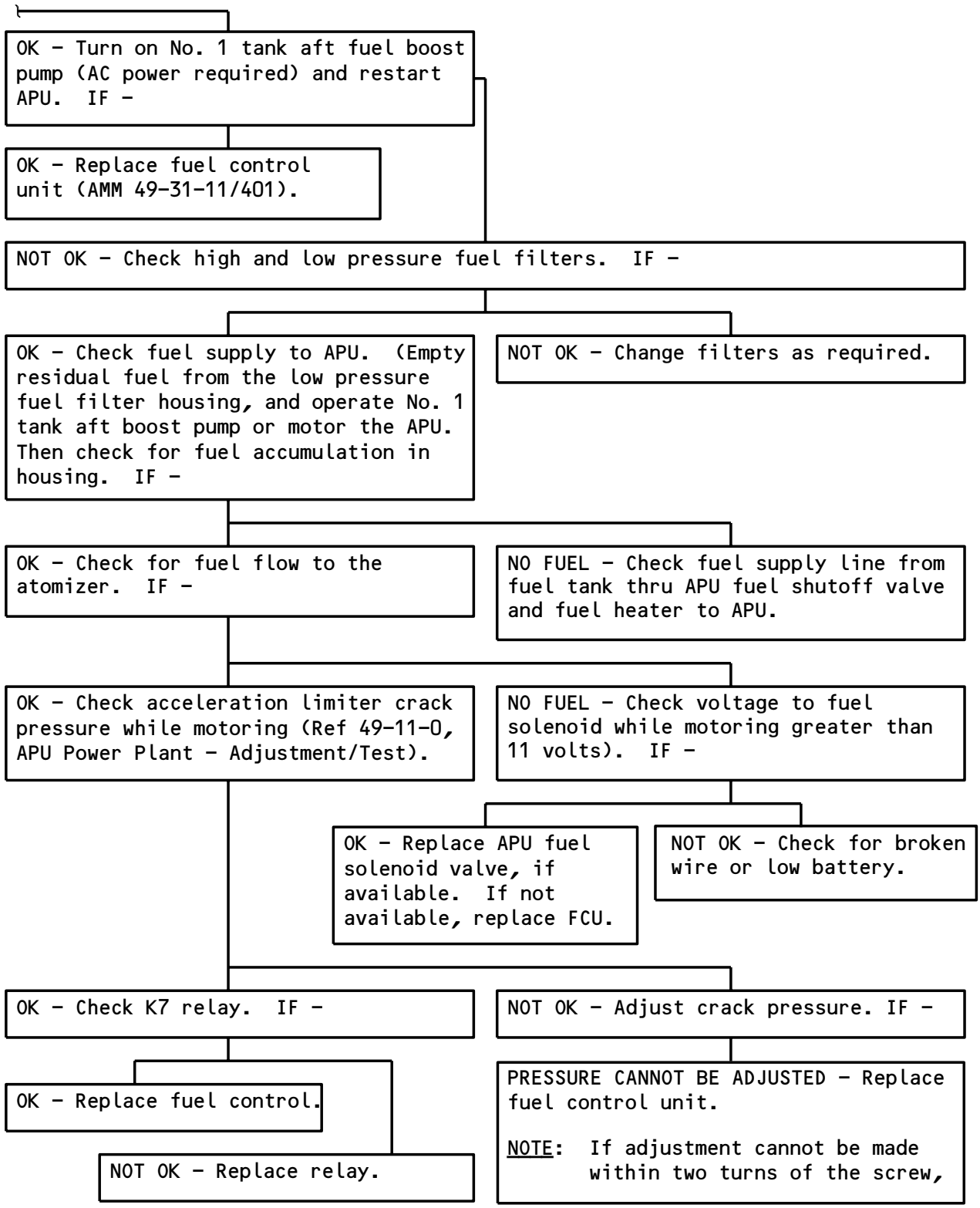
Starter Motor Cranks The Engine Slowly
Figure 111



Starter Spins But Does Not Crank The Engine
Figure 112



Start Motor Cranks Engine But There is no Combustion (NO EGT RISE)
Figure 113 (Sheet 1)



Start Motor Cranks Engine But There is no Combustion (NO EGT RISE)
Figure 113 (Sheet 2)

STARTER MOTOR REMAINS ENGAGED ABOVE 35/50% SPEED. STARTING TIME DELAY RELAYS SHUTS DOWN APU AFTER APPROPRIATE CRANKING TIME.

NOTE: Starter cutout can be monitored by watching battery current drain during start cycle. DC ammeter rises to 0 from negative indication with normal starter cutout.

Remove starter brush cover. Visually check starter motor for damage due to overspeed. IF –

NO DAMAGE – Check for continuity between contact A1 of start relay R5 and ground. IF –

DAMAGED – Remove and replace starter (AMM 49-41-11/401).

NOTE: (1) If starter drive gear (jaw ratchet) appears damaged, replace APU (49-11-0/401).

(2) As a precautionary measure, replace centrifugal switch or electronic speed switch at same time starter is replaced.

NO CONTINUITY – Start relay R5 OK. Connect voltmeter to contact X1 of start relay R5. Start APU. Check for 28V dropout as 35/50% switch is actuated. IF –

CONTINUITY – Contact A1 shorted. Replace start relay R5.

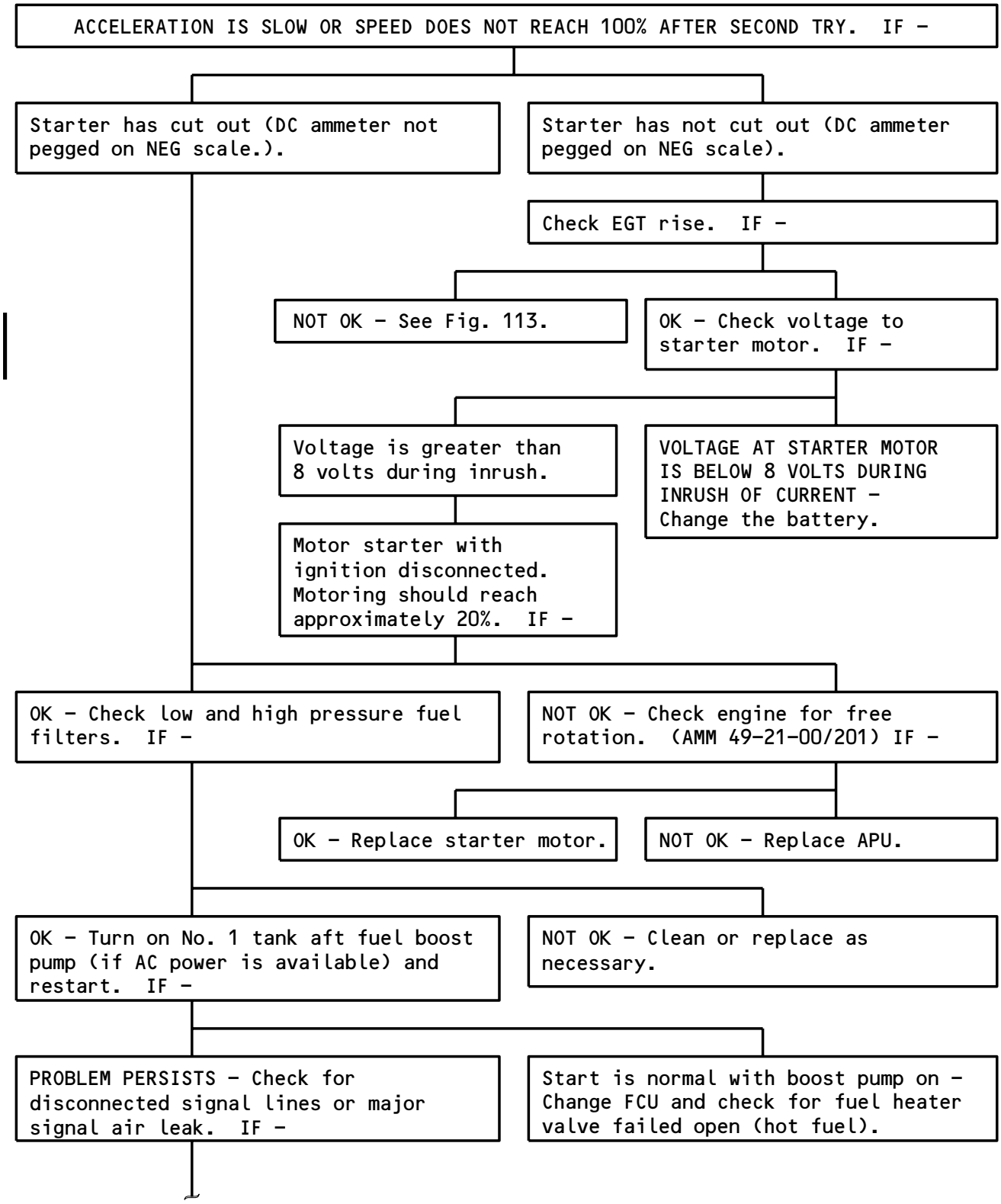
CAUTION: 28V DC IS CONSTANTLY AVAILABLE AT CONTACT A1. BATTERY MUST BE DISCONNECTED PRIOR TO REMOVING R5 RELAY.

STARTER DROPS OUT AT 35/50% RPM – Centrifugal switch appears to be good.

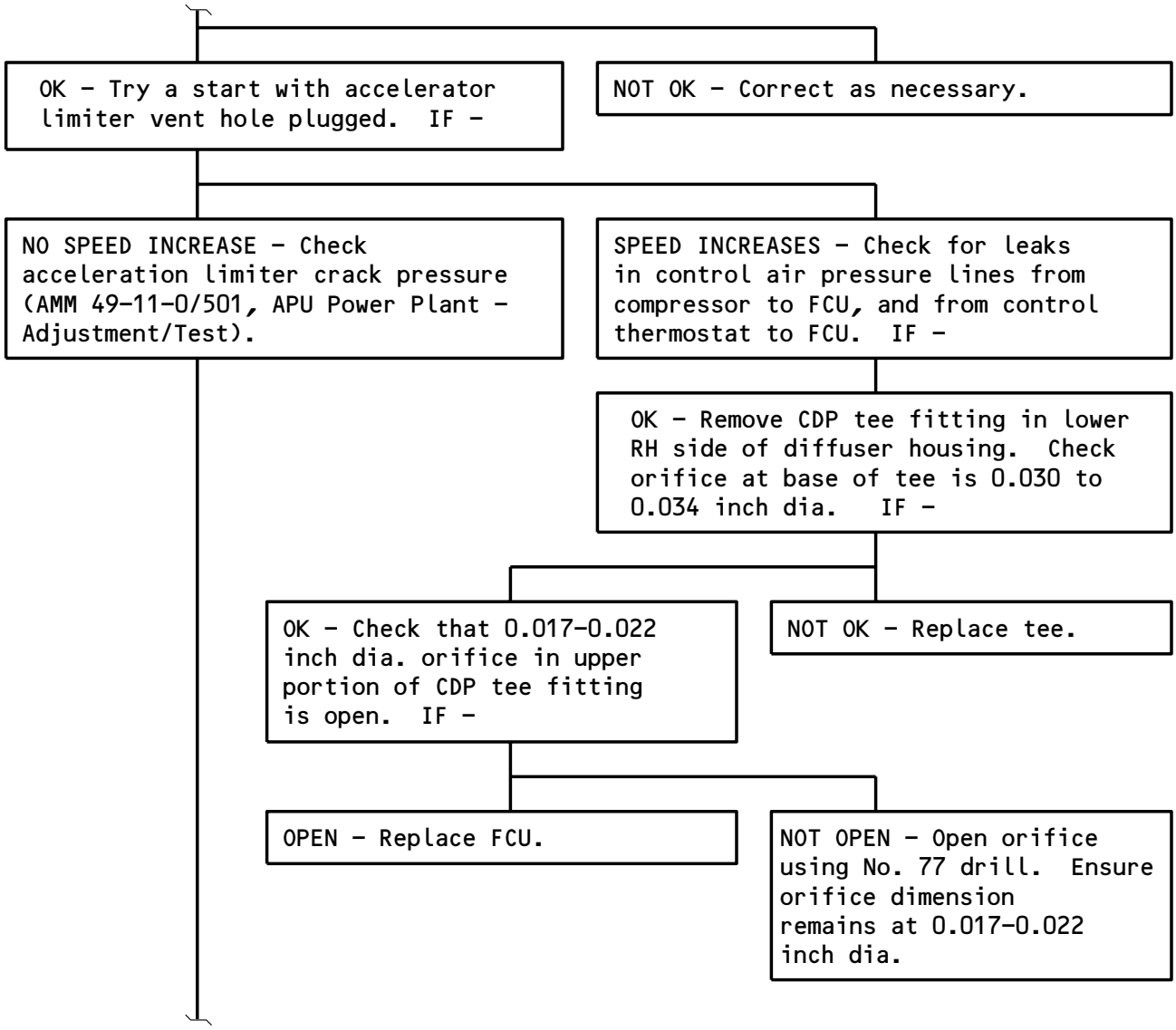
NOTE: It is possible for switch to have intermittent sticking problem. As a precaution, replace centrifugal switch (AMM 49-61-21/401) or electronic speed switch (AMM 49-61-22/401).

STARTER FAILS TO DROP OUT AT 35/50% RPM – Replace centrifugal switch (AMM 49-61-21/401).

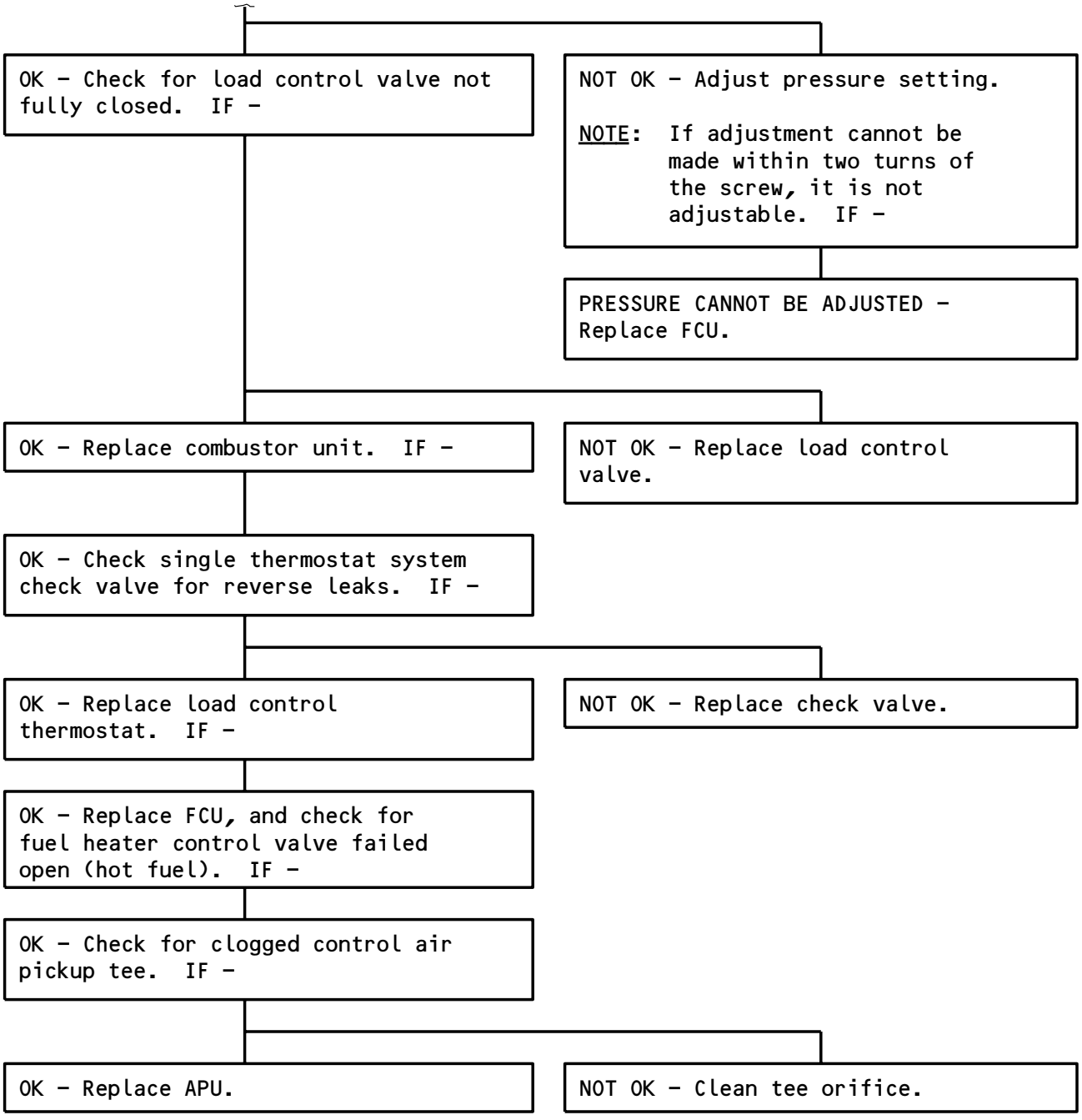
Starter Motor Remains Engage Above 50% Speed.
Figure 114



Acceleration is Slow or Speed Does Not Reach 100% After Second Try
Figure 115 (Sheet 1)



Acceleration is Slow or Speed Does Not Reach 100% After Second Try
Figure 115 (Sheet 2)



Accelereation is Slow or Speed Does Not Reach 100% After Second Try
Figure 115 (Sheet 3)

EXPLOSIVE PUFF, BANG, OR FLAMES OUT OF TAIL PIPE AT START – Check oil screen for metal particles. IF –

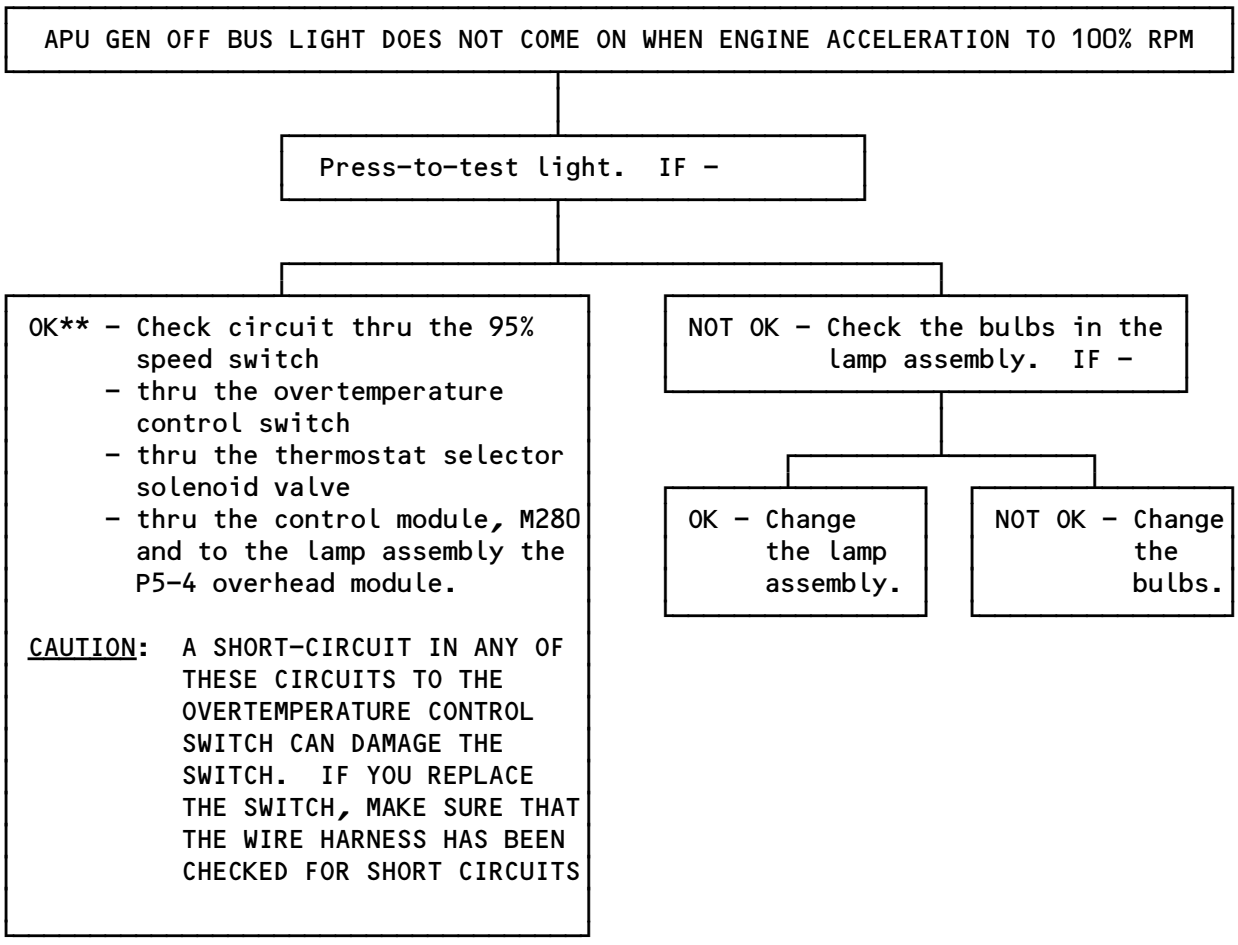
- METAL IN SCREEN – Change oil filter. Start APU and run for 1 minute. Recheck oil filter. IF –
  - METAL IN SCREEN – Replace APU.
  - OK – Remove combustor unit, and check for excessive carbon. IF –
    - EXCESSIVE CARBON – Clean or replace combustor unit.
    - PROBLEM PERSISTS – Check acceleration limiter valve crack pressure setting (AMM 49-11-0/501, APU Power Plant – Adjustment/Test). IF –
      - NOT OK – Adjust pressure setting.

        NOTE: If pressure cannot be set within two turns of the screw, it is not adjustable.
      - OK – Check for clogging of:
        (a) Combustor fuel drain line
        (b) Turbine plenum fuel drain
        (c) Drain from APU lower shroud to drain mast. IF –
        - NOT OK – Clean as required.
        - OK – Check fuel solenoid valve for leakage. (Remove electrical connector from valve, and disconnect fuel line from atomizer assembly. Then motor the engine.) IF –
          - NOT OK – (Fuel flows from fuel line) Replace fuel solenoid if available. If not available separately, replace fuel control.
          - OK – (No flow from fuel line) Check sequencing oil pressure switch for actuation at oil pressure of 3 to 5 psi. IF –
            - NOT OK – Replace sequencing oil pressure switch.
            - OK – Check ignition unit for intermittent operation. IF –
              - NOT OK – Replace ignition unit.
              - OK – Replace APU.

Explosive Puff, Bang, or Flames Out of Tail Pipe at Start
Figure 116

SEE THE NEXT PAGE

APU at 100% RPM with APU Gen Off, Bus Light Does Not Come On When Engine Reaches 100% RPM
Figure 117

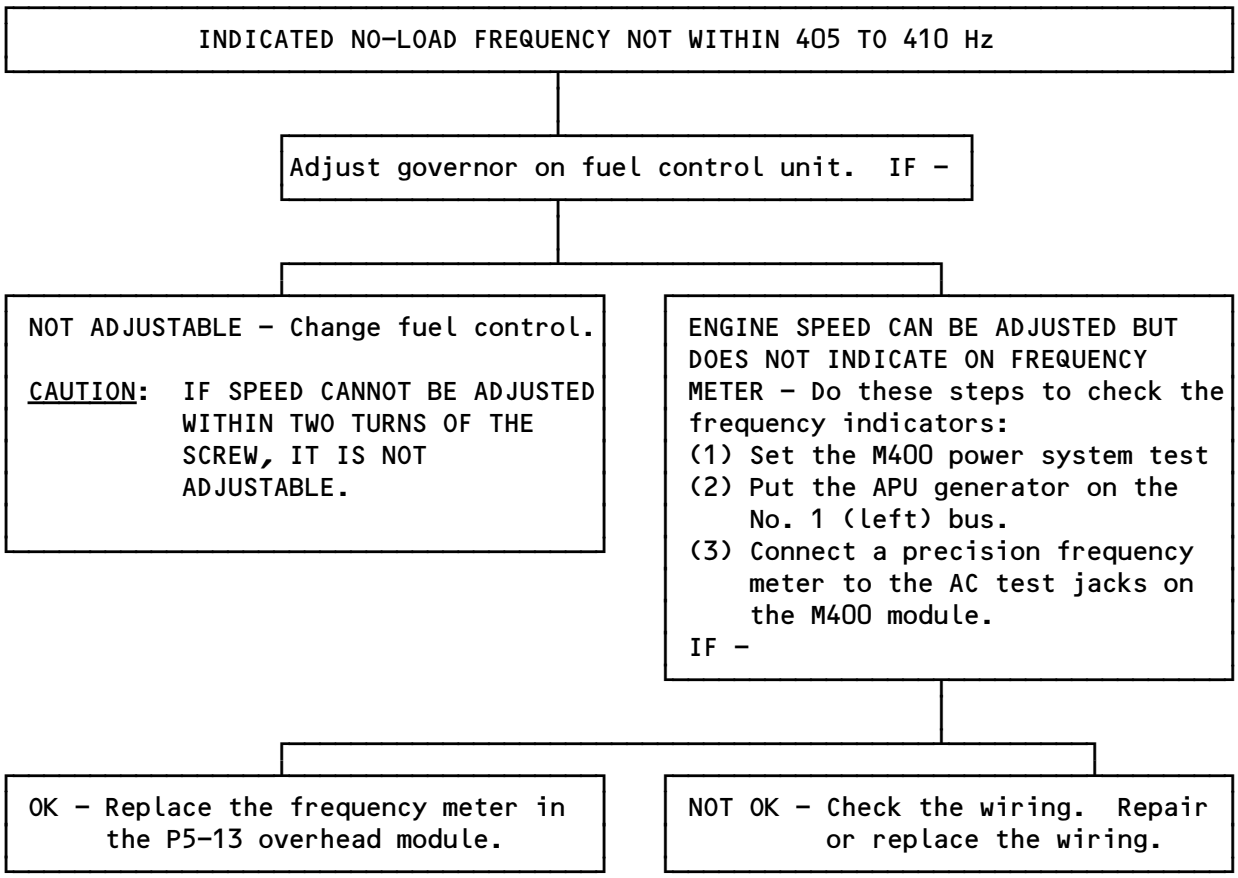


** With APU running, turn APU bleed switch ON and check for opening of load control valve (monitor A/C manifold pressure). If LCV opens, check circuit from overtemperature control switch to cockpit lamp. If LCV does not open, check for open circuit through 95% switch (normally open contacts) and overtemperaturecontrol switch.

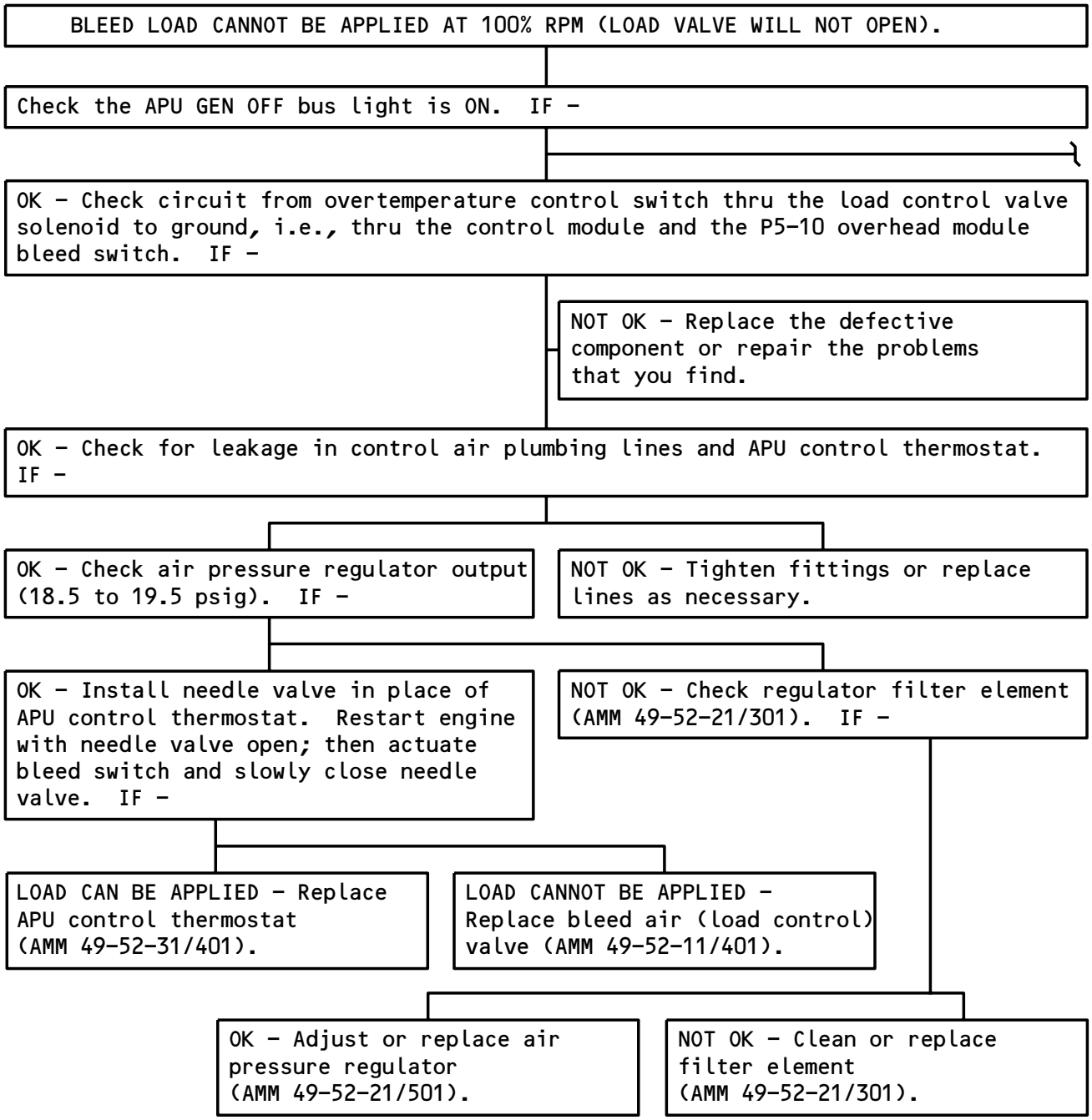
APU at 100% RPM With APU Gen Off, Bus Light Does Not Come On When Engine Reaches 100% rpm
Fig. 117 (Sheet 2)

SEE THE NEXT PAGE

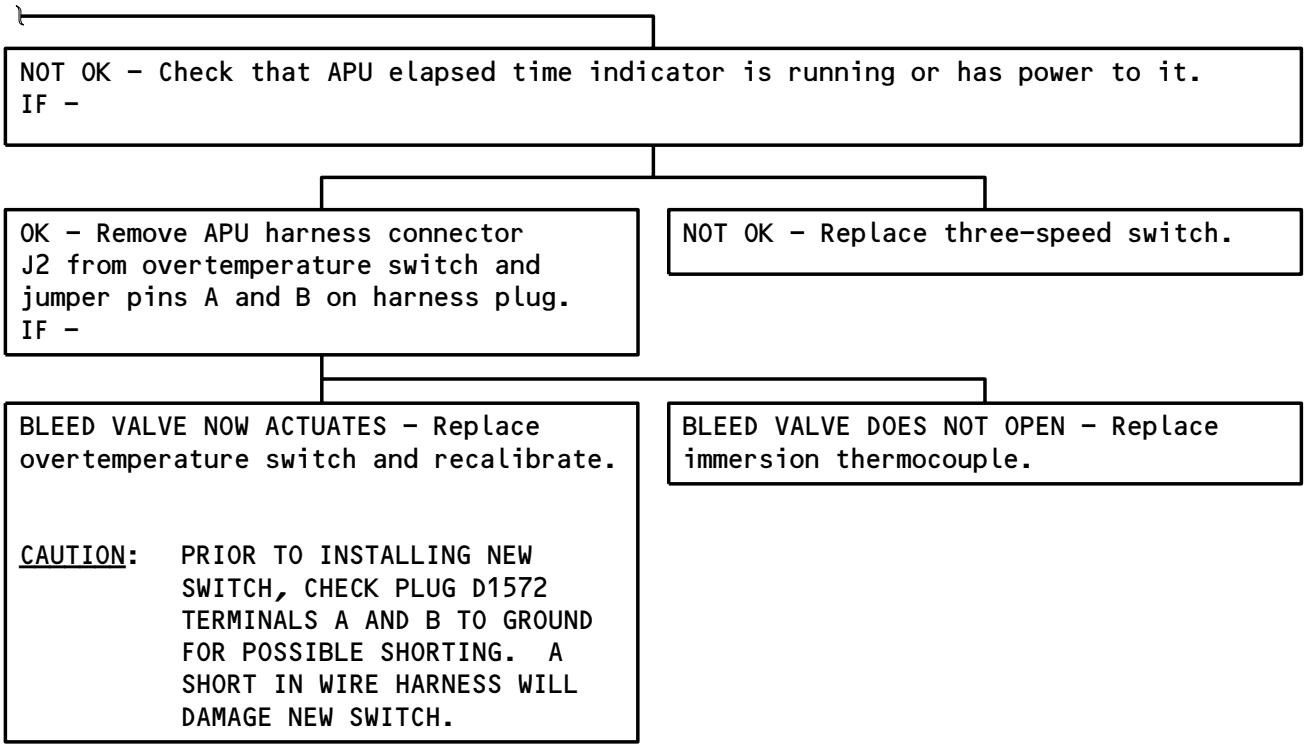
Indicated No-Load Frequency Not within 405-410 Hz
Figure 118



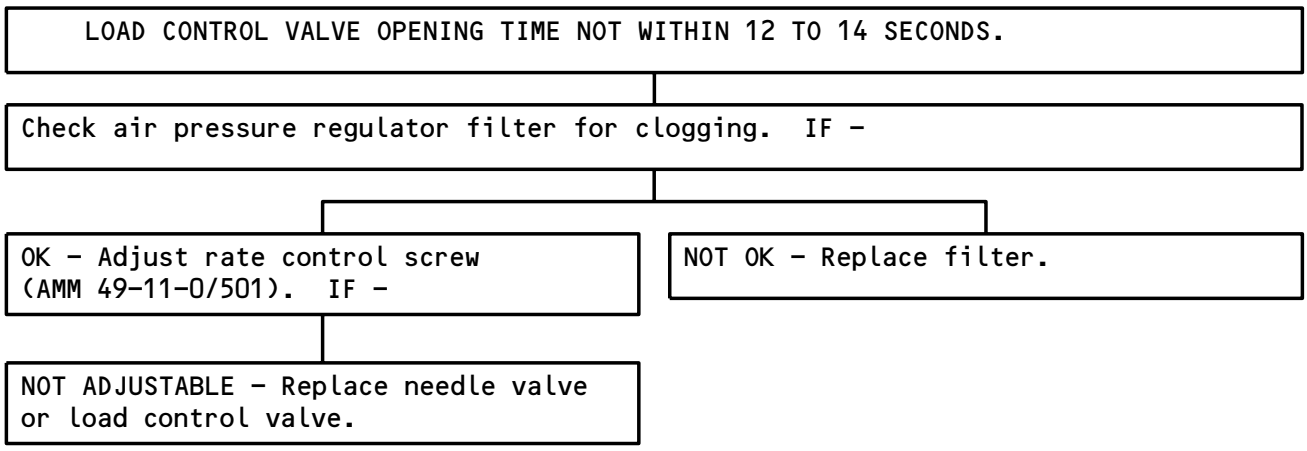
Indicated No-Load Frequency Not within 405-410 Hz
Fig. 118 (Sheet 2)



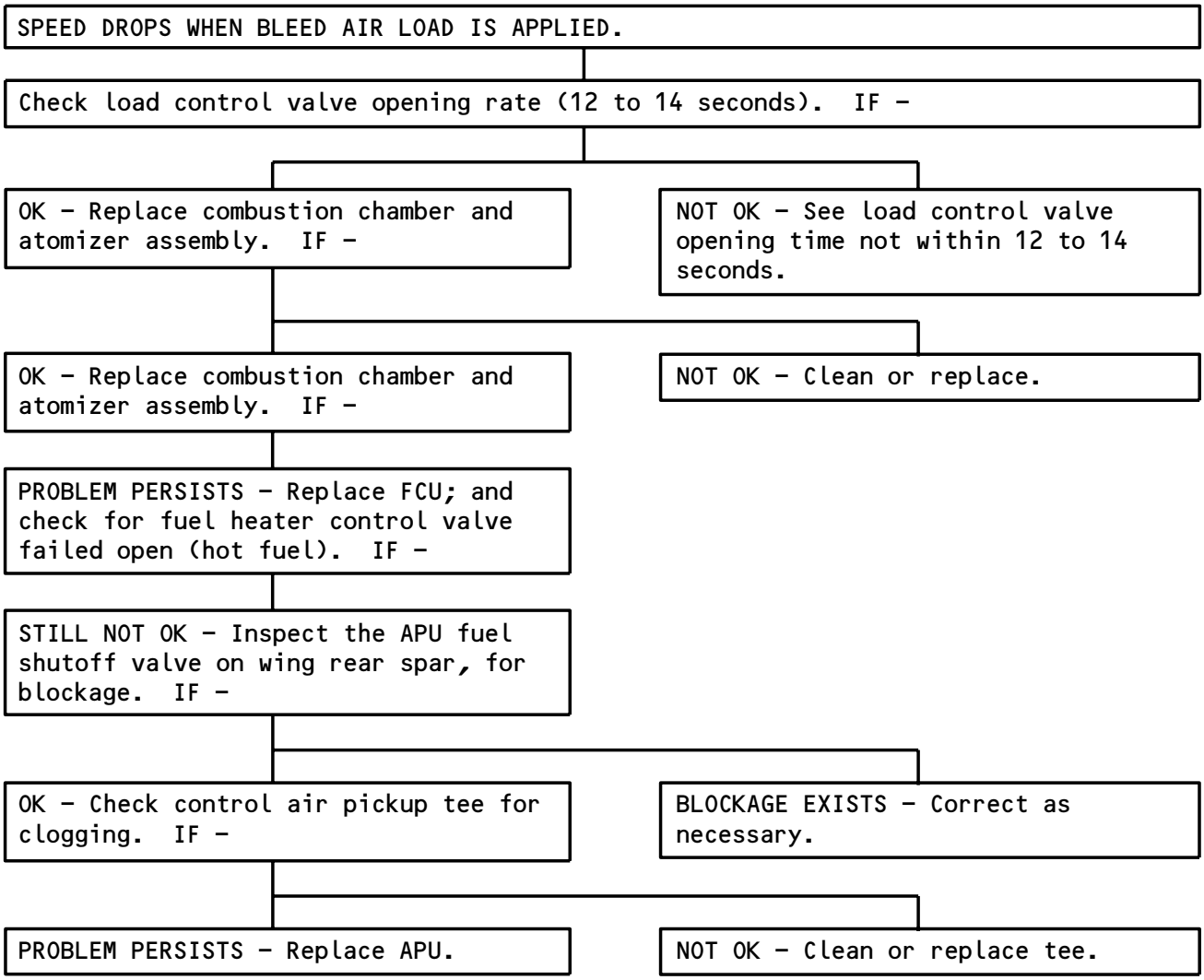
Bleed Load Cannot Be Applied at 100% RPM (LOAD VALVE WILL NOT OPEN)
Figure 119 (Sheet 1)



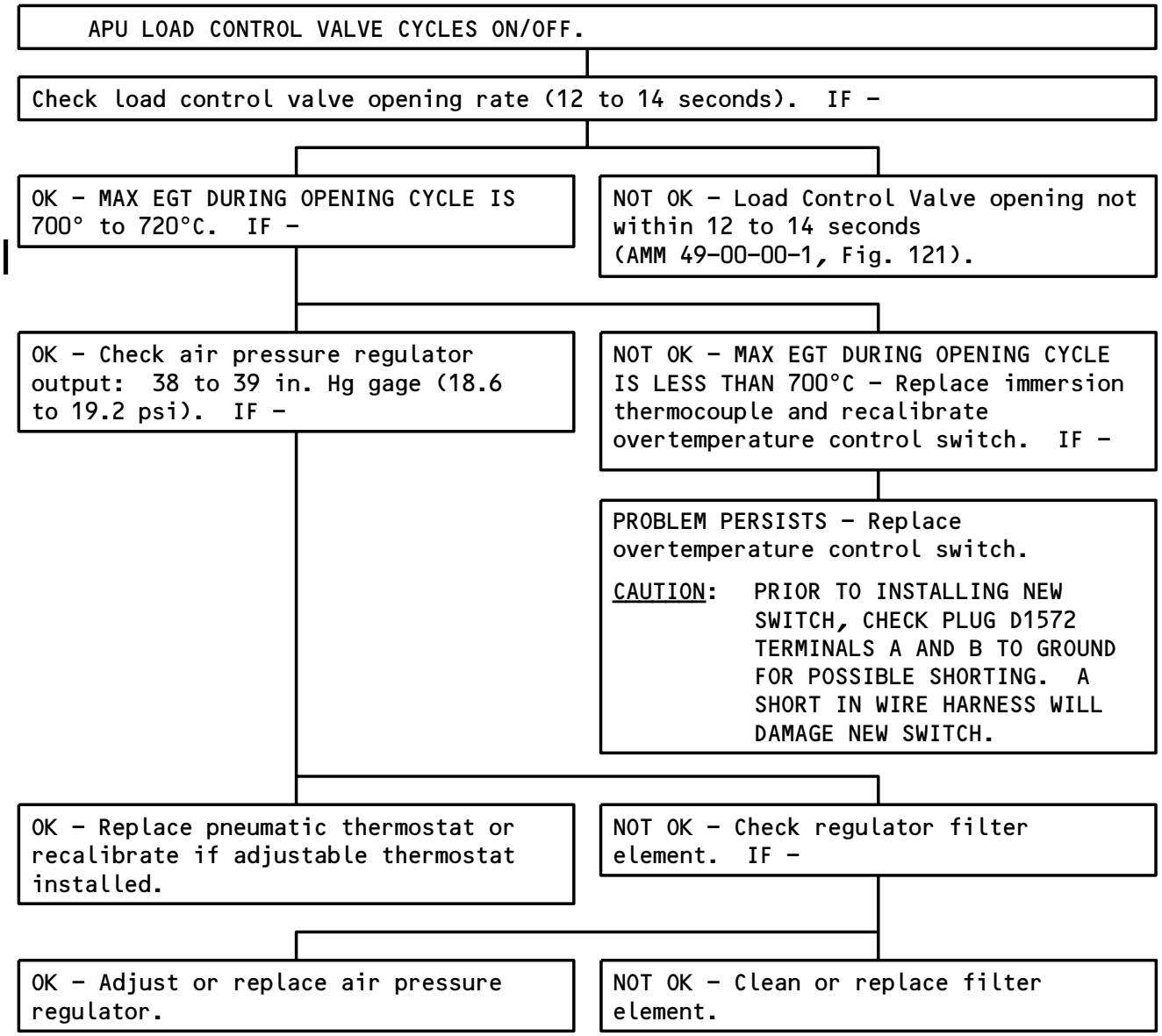
Bleed Load Canot Be Applied at 100% RPM (LOAD VALVE WILL NOT OPEN)
Figure 119 (Sheet 2)



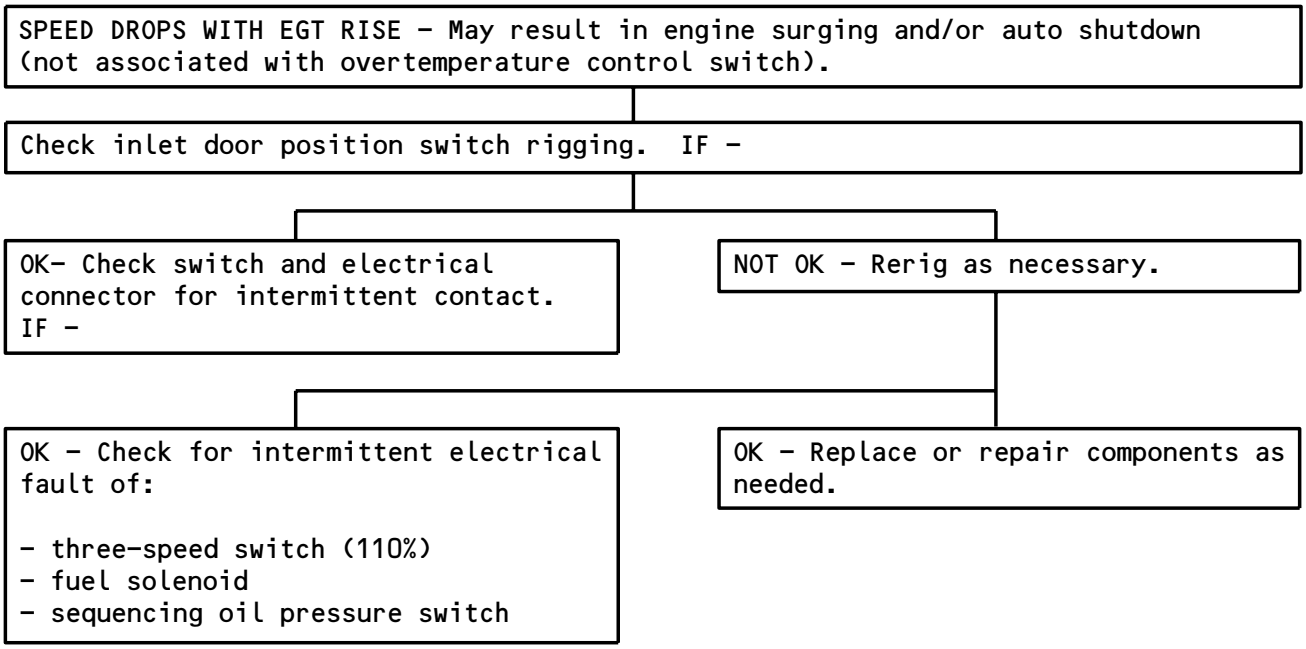
Load Control Valve Opening Time Not within 12 to 14 Seconds
Figure 120



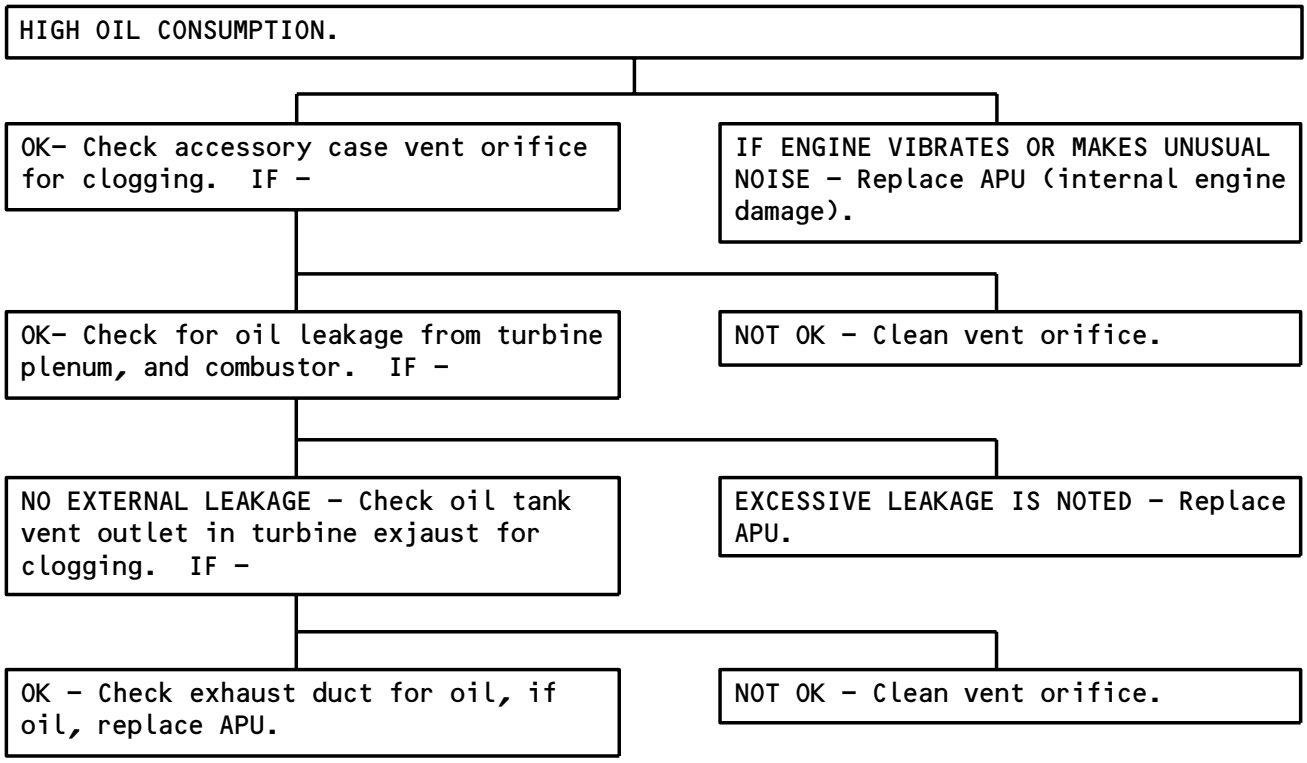
Speed Drops Excessive when Bleed Air Load is Applied
Figure 121



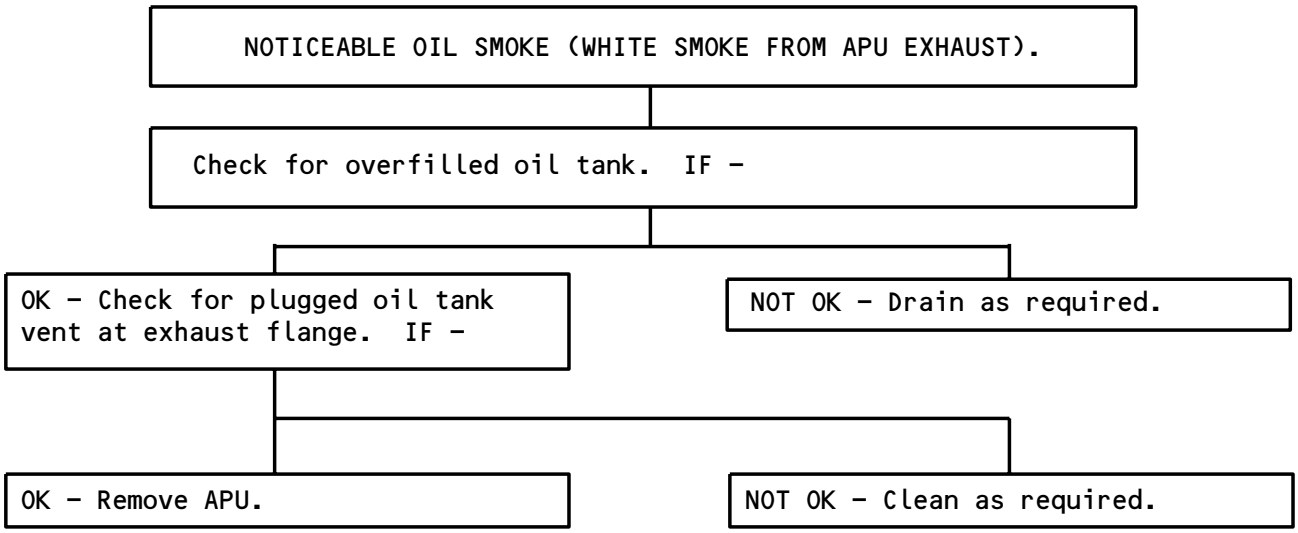
APU Load Control Valve Cycles On/Off
Figure 122



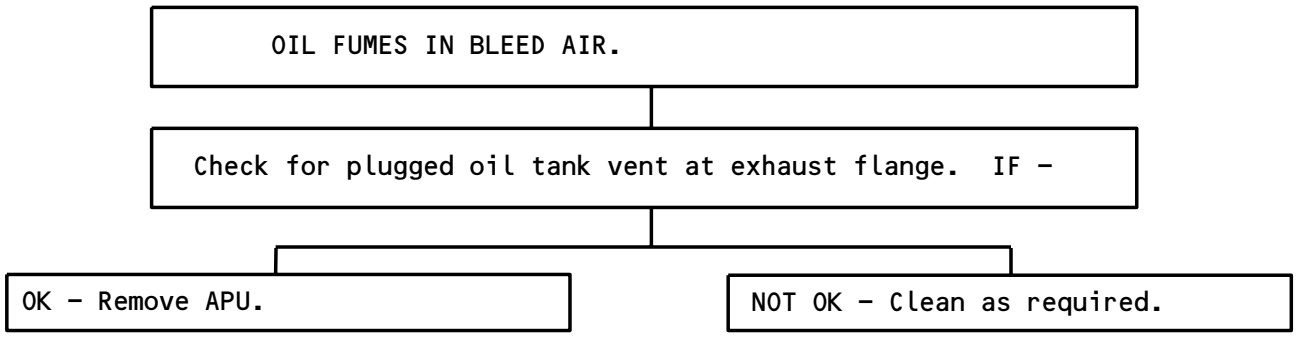
Speed Drops with EGT Rise
Figure 123



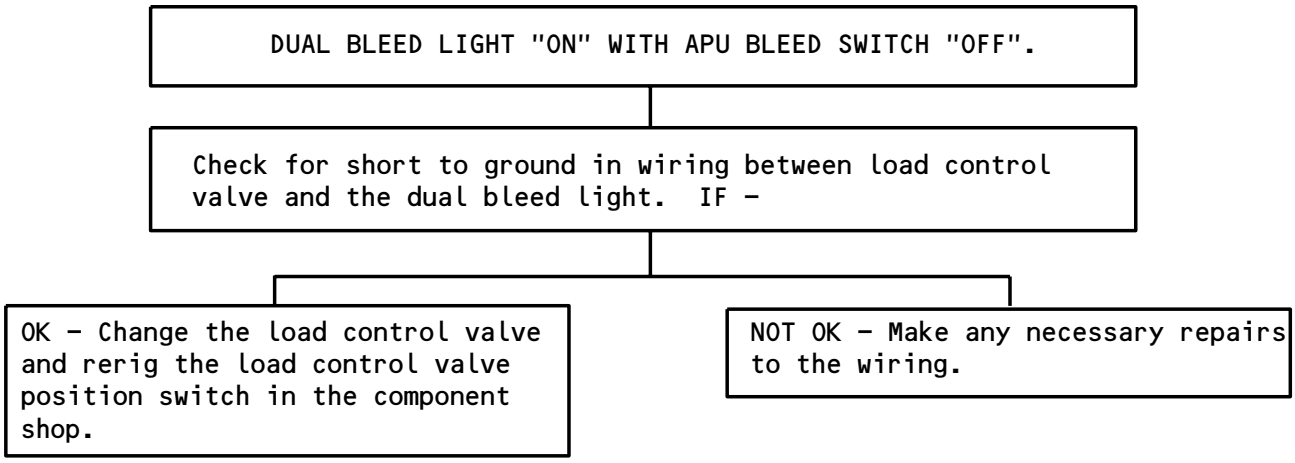
High Oil Consumption
Figure 124



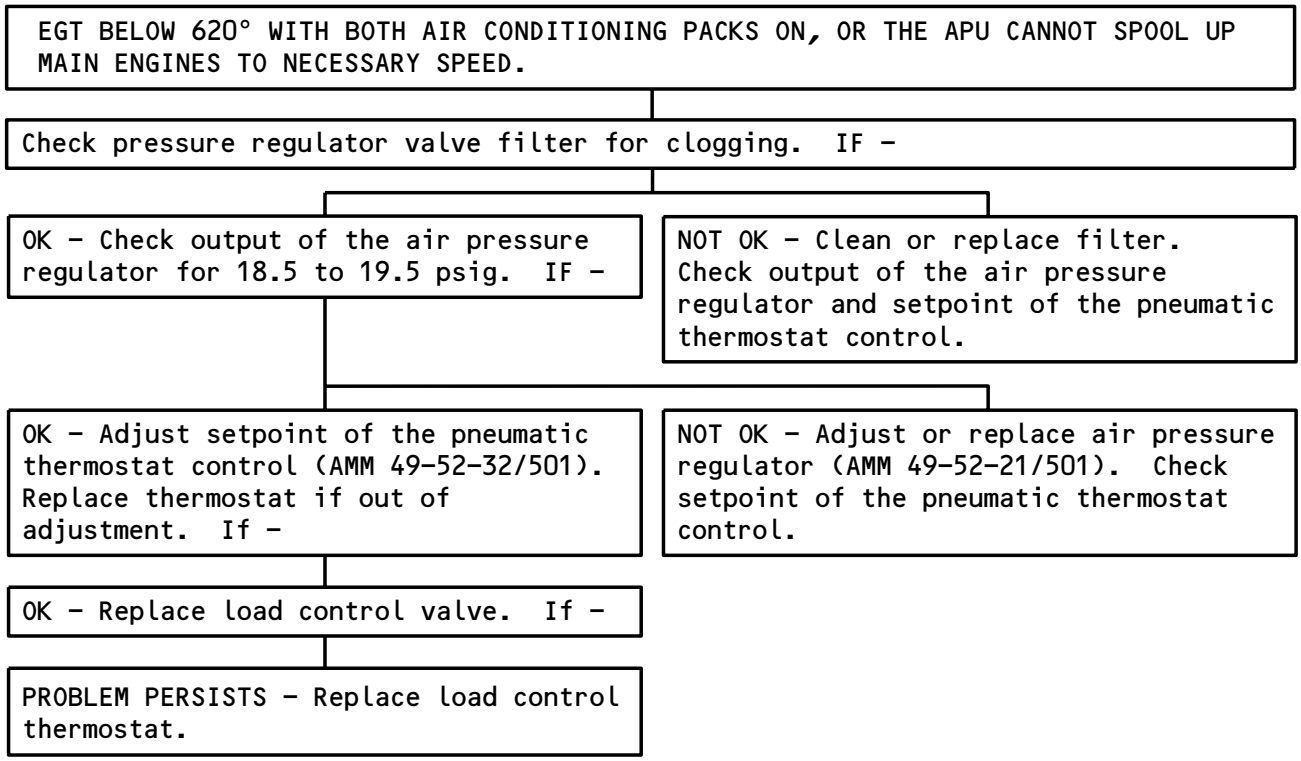
Noticeable Oil Smoke (White Smoke From APU Exhaust)
Figure 125



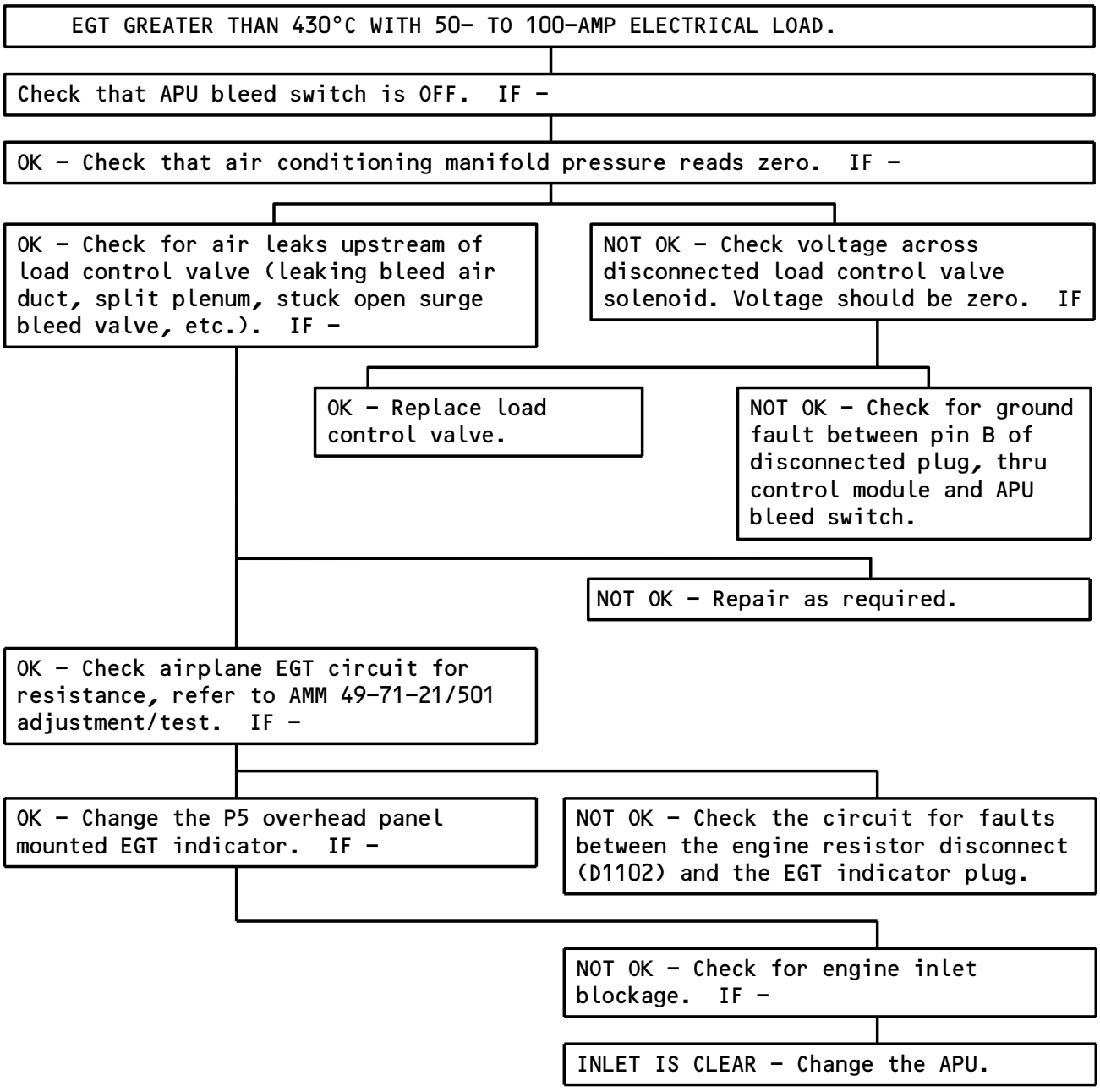
Oil Fumes in Bleed Air
Figure 126



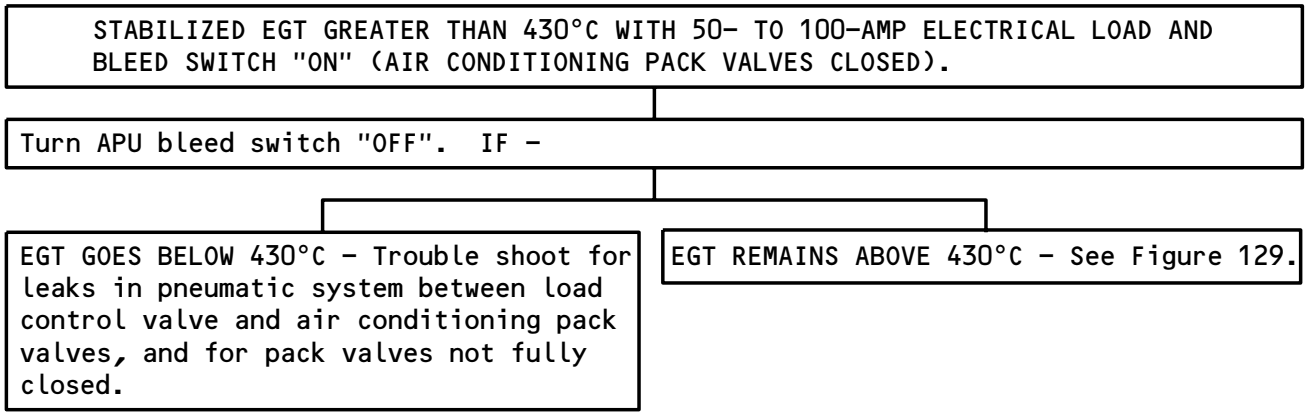
Dual Bleed Light "ON" with APU Bleed Switch "OFF"
Figure 127



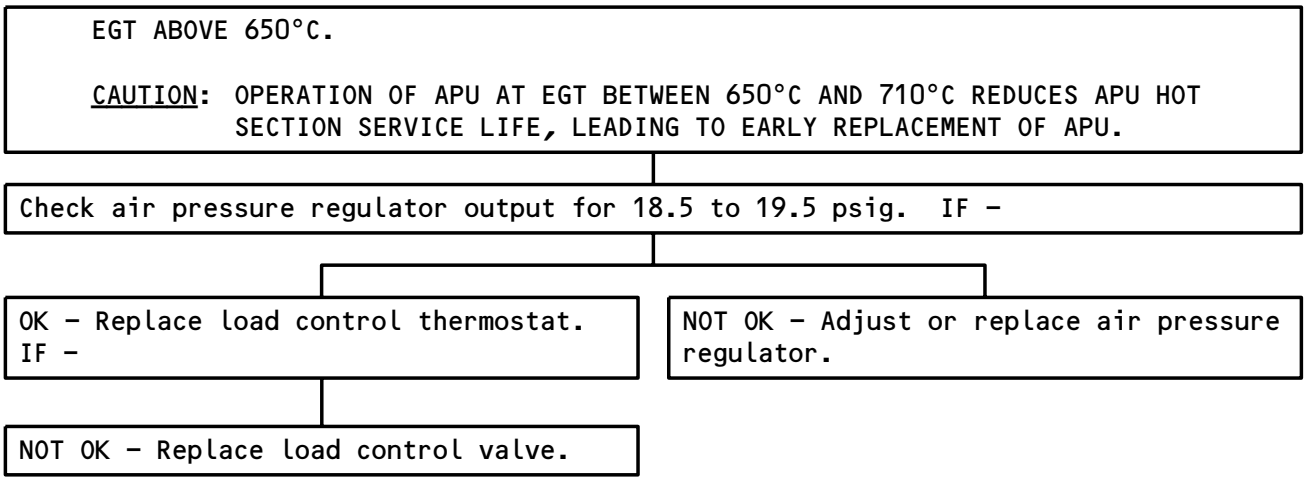
EGT Below 620 Degree with Both Air Conditioning Packs on, or The APU Cannot Spool Up Main Engines to Necessary Speed
Figure 128



EGT Greater Than 430 Degree Celsius with 50- to 100-AMP Electrical Load
Figure 129



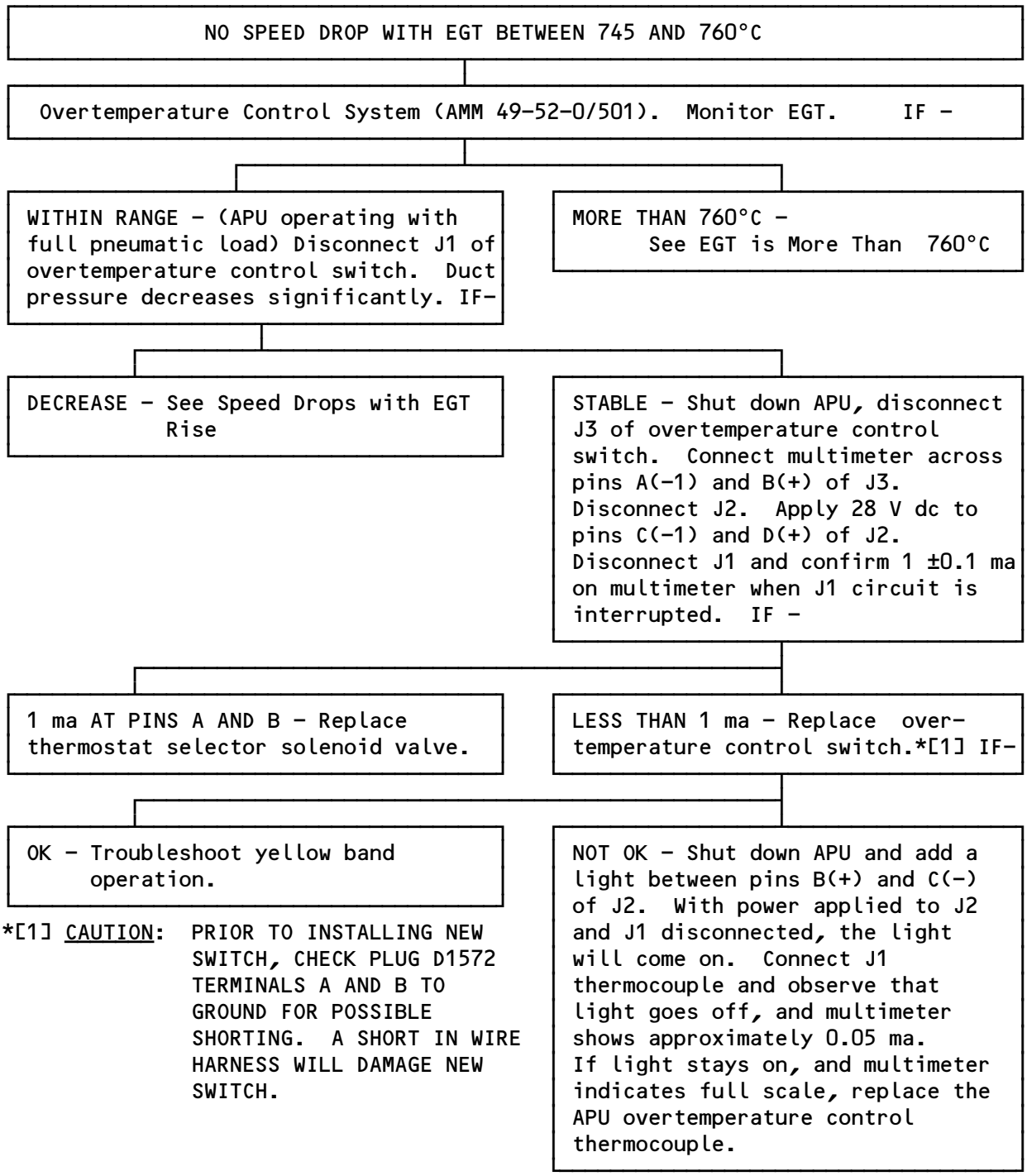
Stabilized EGT Greater Than 430 Degree Celsius with 50- to 100-AMP Electrical Load and Bleed Switch "ON" (Air Conditioning Pack Valves Closed)
Figure 130



EGT Above 650 Degree Celsius
Figure 131

SEE THE NEXT PAGE

No Speed Drop with EGT between 745_ bC and 760_bC
Figure 132

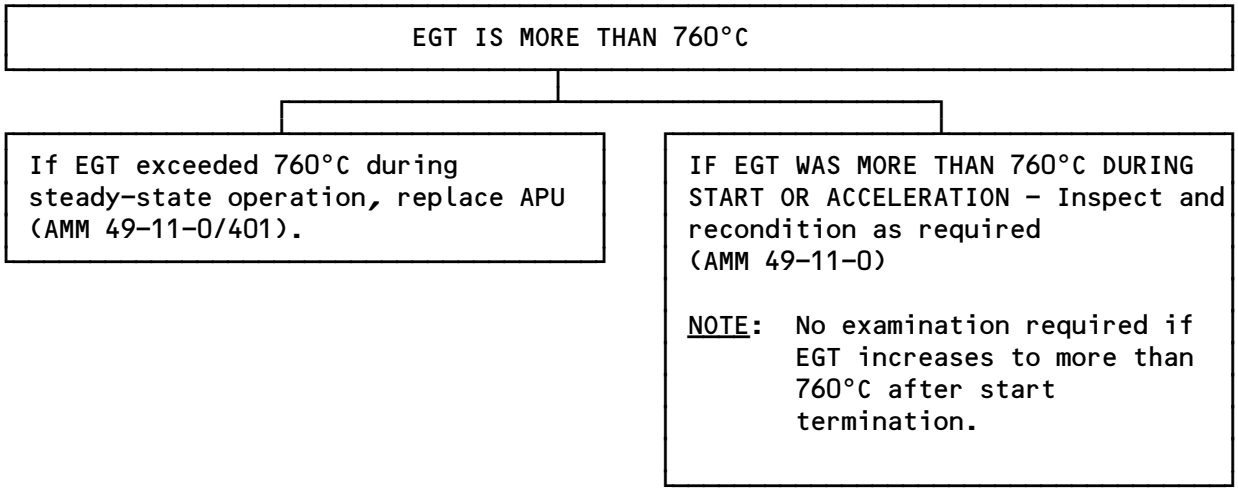


*[1] CAUTION: PRIOR TO INSTALLING NEW SWITCH, CHECK PLUG D1572 TERMINALS A AND B TO GROUND FOR POSSIBLE SHORTING. A SHORT IN WIRE HARNESS WILL DAMAGE NEW SWITCH.

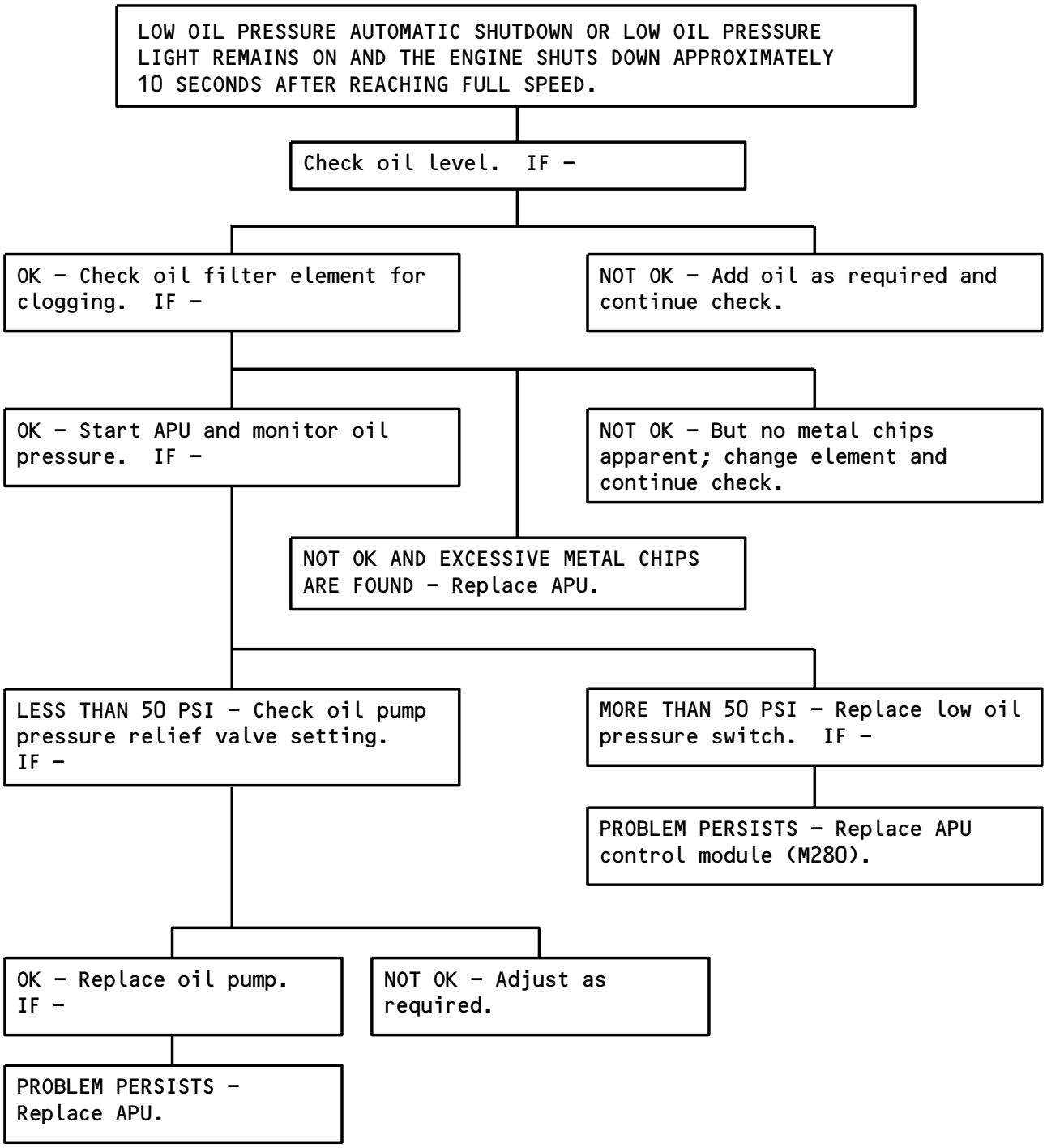
No Speed Drop with EGT between 745 and 760°C
Figure 132 (Sheet 2)

SEE THE NEXT PAGE

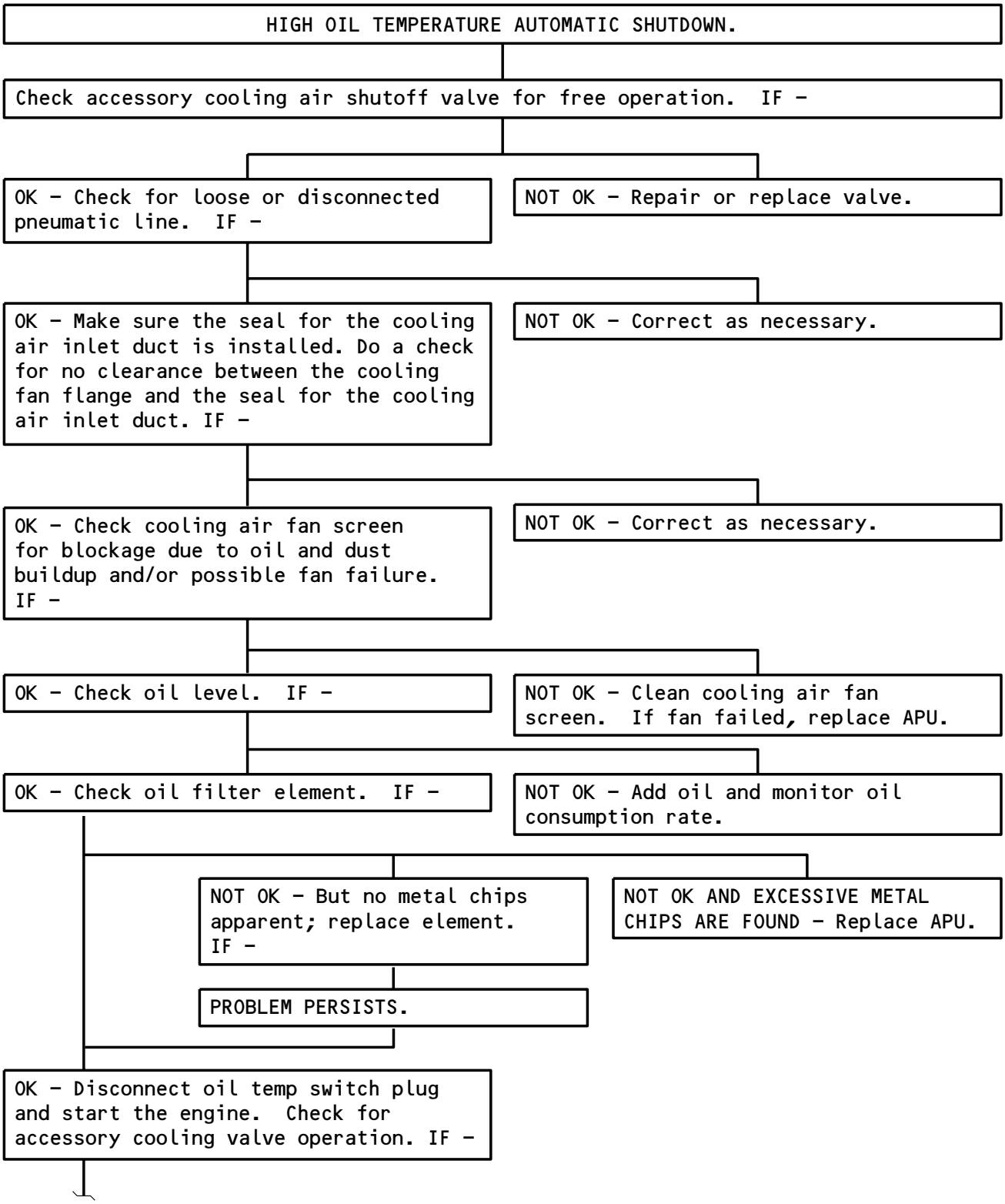
EGT is More Than 760_ bC
Figure 133



EGT IS MORE THAN 760°C
Figure 133 (Sheet 2)



Low Oil Pressure Automatic Shutdown or Low Oil Pressure Light Remains "ON" and The Engine Shuts Down Approximately 10 Seconds after Full Speed
Figure 134



High Oil Temperature Automatic Shutdown
Figure 135 (Sheet 1)

ENGINE WILL NOT RESTART AND HIGH OIL TEMP LIGHT IS "ON" AFTER RECYCLING THE MASTER SWITCH – Change the P5-4 overhead module.

NOT OK – Trouble shoot valve actuator pneumatic sense line and filter for clogging.

OK – APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096;
Check for airflow from oil cooler. IF –

WARNING

DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF THREE FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

– APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096;
If you know that air does not flow from the oil cooler, replace the oil cooler (AMM 49-91-41/401). IF –

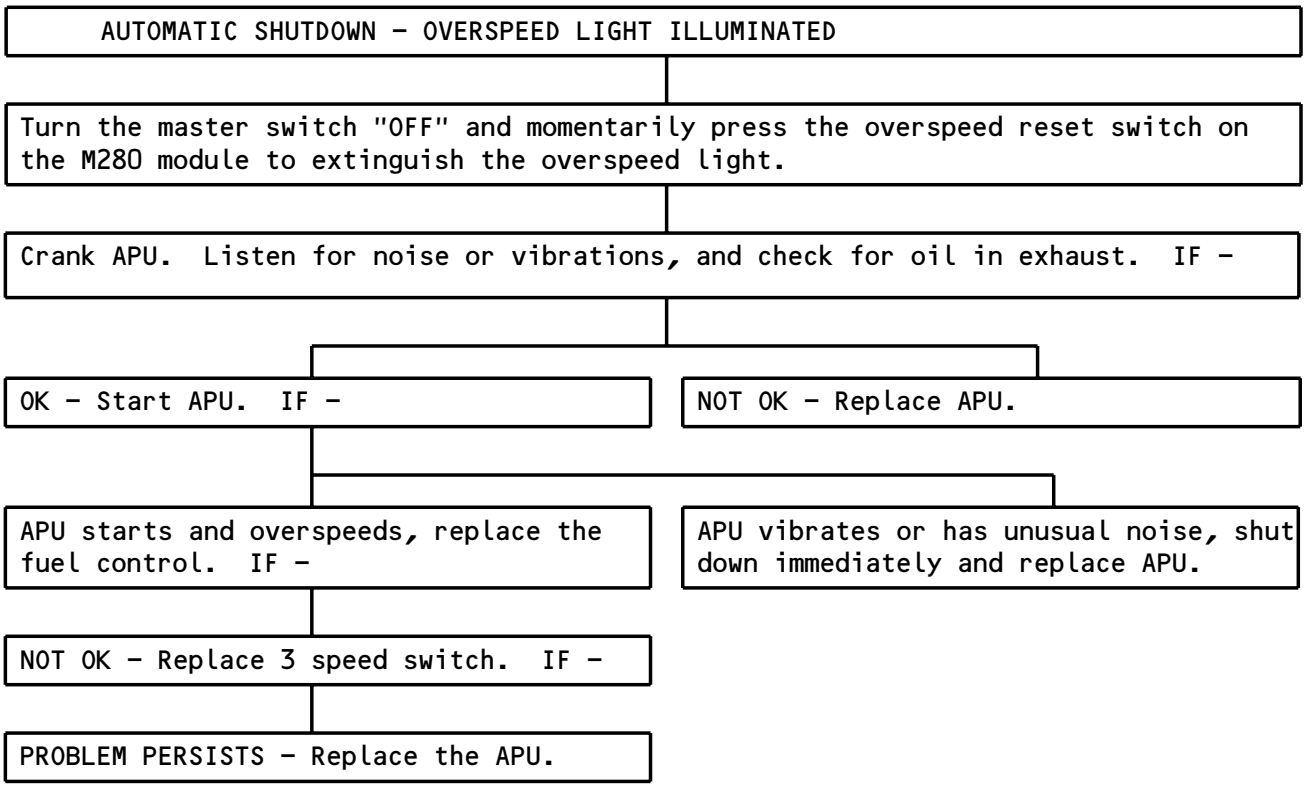
APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096;
If you know that air flows from the oil cooler, replace the oil temperature switch (AMM 49-94-21/401). If the problem continues, replace the APU (AMM 49-11-00/401).

OK – Replace oil temperature switch (AMM 49-94-21/401). IF –

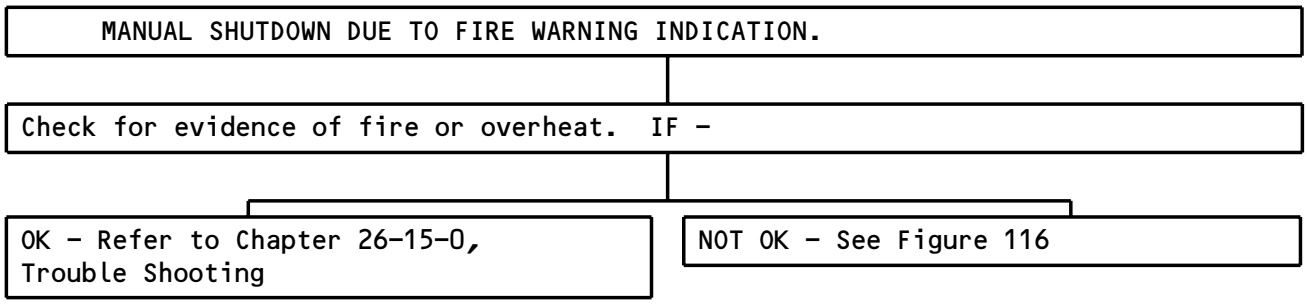
PROBLEM PERSISTS – Replace the APU (AMM 49-11-0/401).

NOT OK – Check for:
(a) Damaged cooling fan
(b) Clogged oil cooler
(c) Clogged cooling air ducts

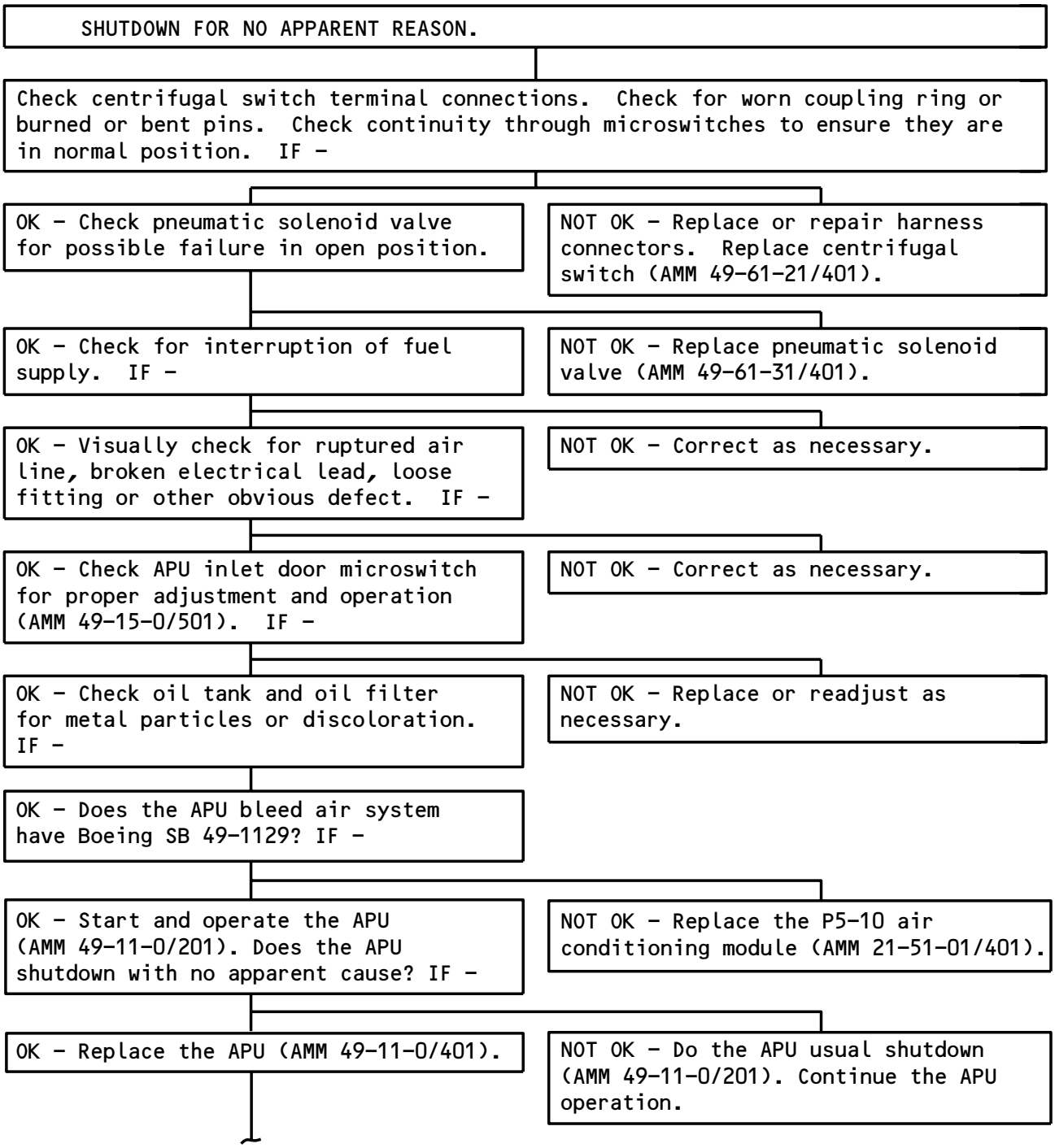
High Oil Temperature Automatic Shutdown
Figure 135 (Sheet 2)



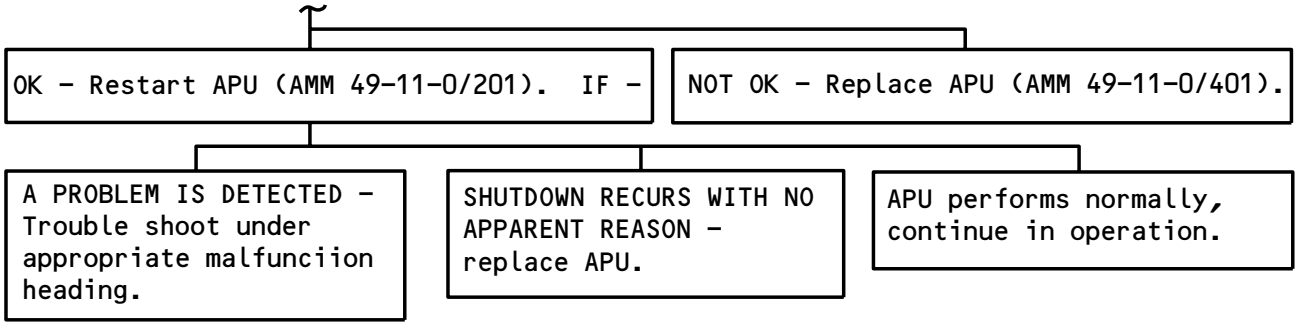
Automatic Shutdown – Overspeed Light Illuminated
Figure 136



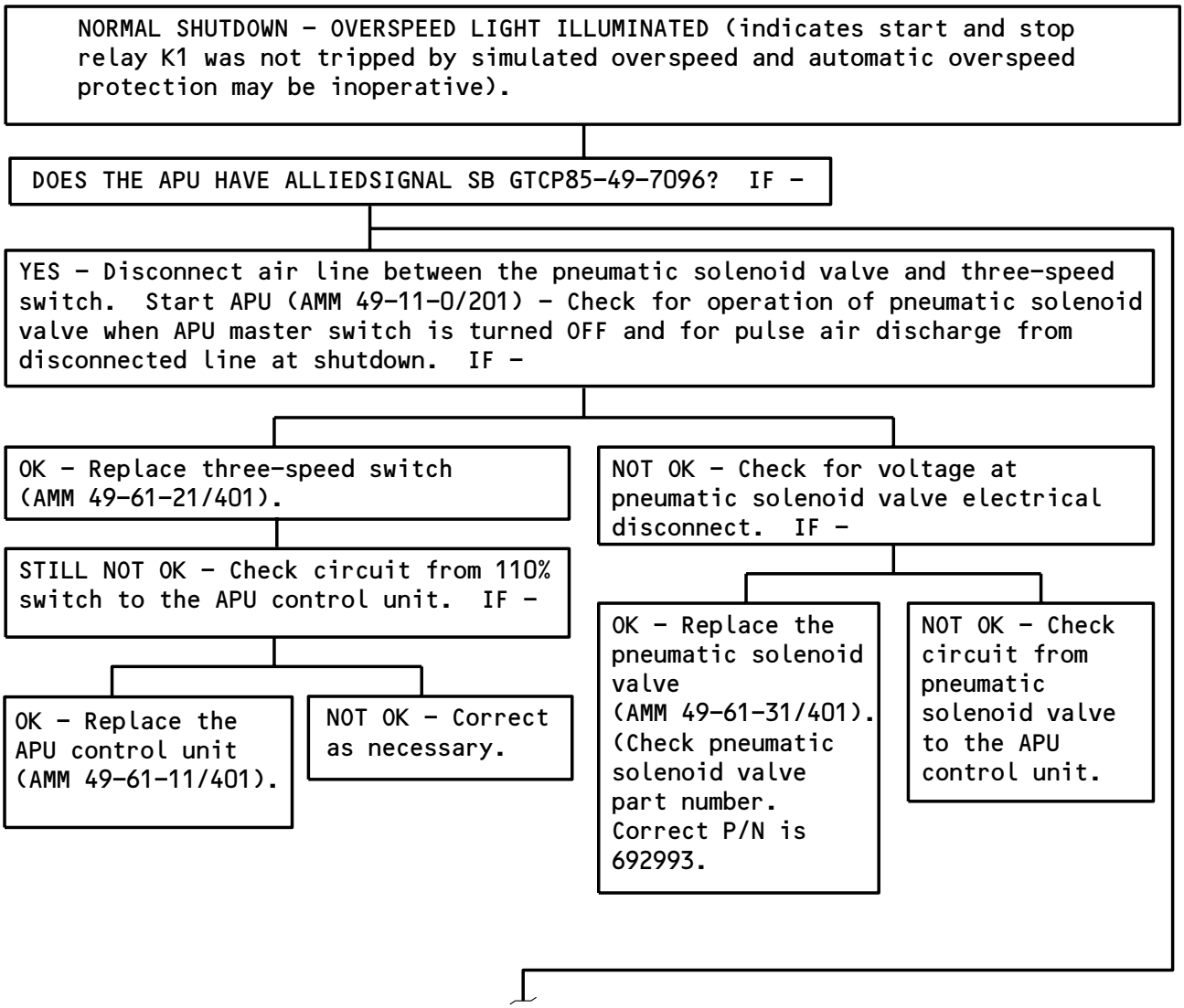
Manual Shutdown Due to Fire Warning Indication
Figure 137



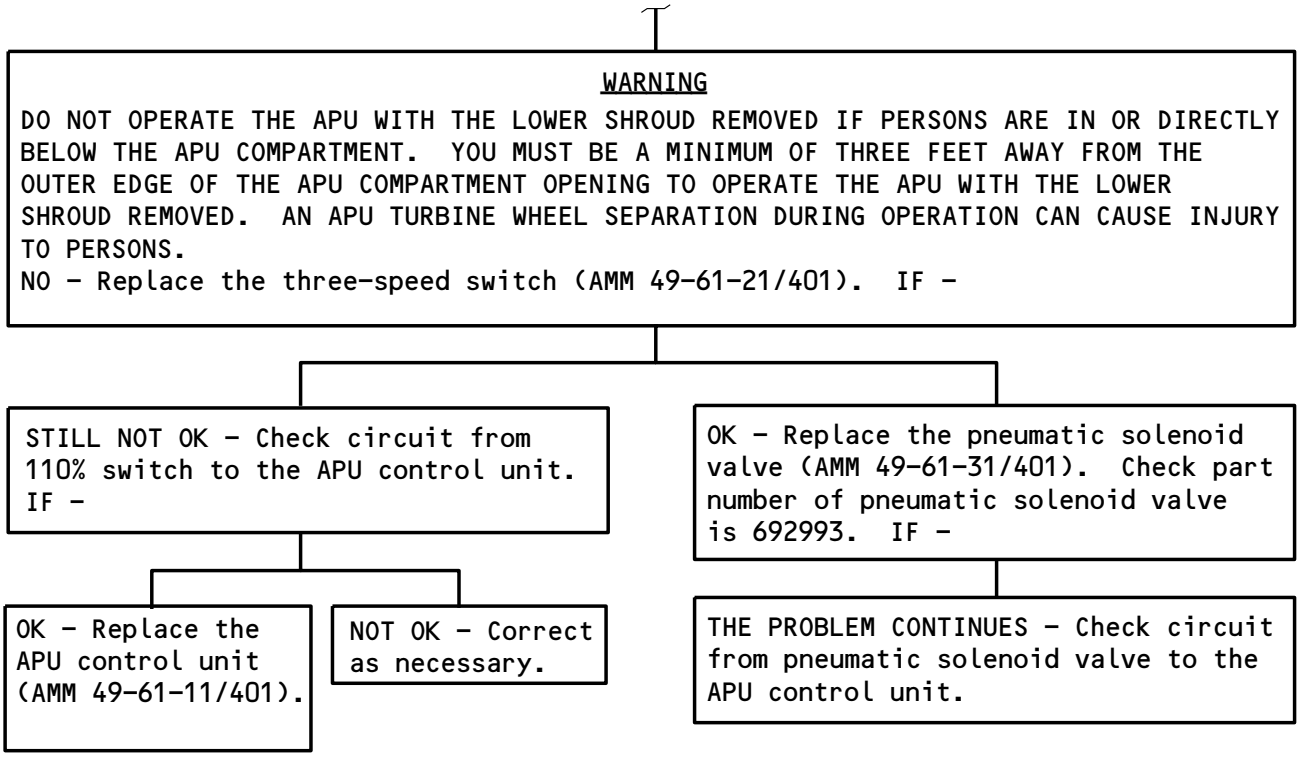
Shutdown for No Apparent Reason
Figure 138 (Sheet 1)



Shutdown for No Apparent Reason
Figure 138 (Sheet 2)



Normal Shutdown – Overspeed Light Illuminated
Figure 139 (Sheet 1)



Normal Shutdown - Overspeed Light Illuminated
Figure 139 (Sheet 2)

APU POWER PLANT - DESCRIPTION AND OPERATION

1. General
   A. The APU power plant is located in a compartment in the tail section of the airplane. The power plant consists of the engine assembly as installed on the airplane. The APU engine is covered in section 49-21-0. This section provides general information of the power plant and the operation of the APU system.
   B. The power plant is enclosed in a sound reducing, fireproof shroud. The shroud consists of two parts: the lower shroud and the upper shroud. The shroud is covered in Section 49-12-0. The upper shroud is mounted in the APU compartment to the shroud rings. The APU engine is also attached to the shroud rings with engine mounts. The ring mounts, shroud rings, and engine mounts constitute the APU mounts, and are covered in Section 49-13-0. Air supply to the APU is provided through the air inlet door and ducts as described in Section 49-15-0.
   C. Maintenance of the power plant does not require removal of the unit from the airplane. For the engine maintenance, it is required to open the APU access door in the fuselage and to remove the lower shroud. This provides access to the ac electrical generator, engine accessories, accessory cooling system components, turbine exhaust port, combustion chamber, ignition system, oil tank, and oil lines. AC electrical generator removal is, however, simplified when the power plant is lowered on an aero stand. The lubricating oil can be replenished by opening the APU access door. This provides access to the oil tank filler port and cap.
   D. The APU power plant is designed for quick removal and installation. To remove the power plant, it is required to open the APU access door and remove the lower shroud. The unit is removed vertically downward using a special tool.
2. Operation
   A. Power for the APU control circuit is 28 volts dc, obtained from the hot battery bus or from the APU generator control unit transformer-rectifier. During the APU start only hot battery bus power is available. The transformer-rectifier power is used as a backup in event the battery bus power is lost while the APU is operating. The APU starter motor obtains 28-volt dc power directly from the airplane battery (Fig. 1). On airplanes with an external dc power receptacle a dc power supply can be used to provide power to both the starter and the hot battery bus in the event of a discharged battery. The external dc power supply receptacle is located together with the external power and battery charger circuit breakers inside the forward body equipment door on the J9 battery shield.
      (1) To connect external power:
         (a) Open battery charger and external power dc circuit breakers.
         (b) Connect 24- to 28-volt dc external power supply cart.
         (c) Close external power dc circuit breakers.

(2) To disconnect external power:
(a) Open external power dc circuit breaker.
(b) Close battery charger circuit breaker.
(c) Disconnect external dc power supply.

B. APU start is initiated when the master switch is moved through ON to START position and released. After being released, the master switch assumes the ON position. The starter lockout relay K6 locks in the start signal from the airplane master switch until the air inlet door has fully opened, and locks out the R5 start relay until a start is called for. The K6 relay closes through the normally closed contacts of the start relay R5 (Fig. 1). The starter lockout relay K6 then locks in through its own contacts. The start and stop relay K1 CLOSE coil is energized if the fire shutdown relay K4 is de-energized, the overspeed relay K2 is in RESET position, and the air inlet door switch is in the NOT FULLY OPEN position. The high oil temperature light and the low oil quantity light circuits are armed and the low oil pressure light illuminates. The high oil temperature automatic shutdown becomes operable. The APU fuel valve opens. After the APU fuel valve opens, power is transferred from the fuel valve to the air inlet door actuator, and the door opens.

NOTE: If the master switch is positioned initially to ON and the air inlet door fully opens before the master switch is moved to START, the CLOSE coil of the start and stop relay K1 will not be energized and the APU will not start.

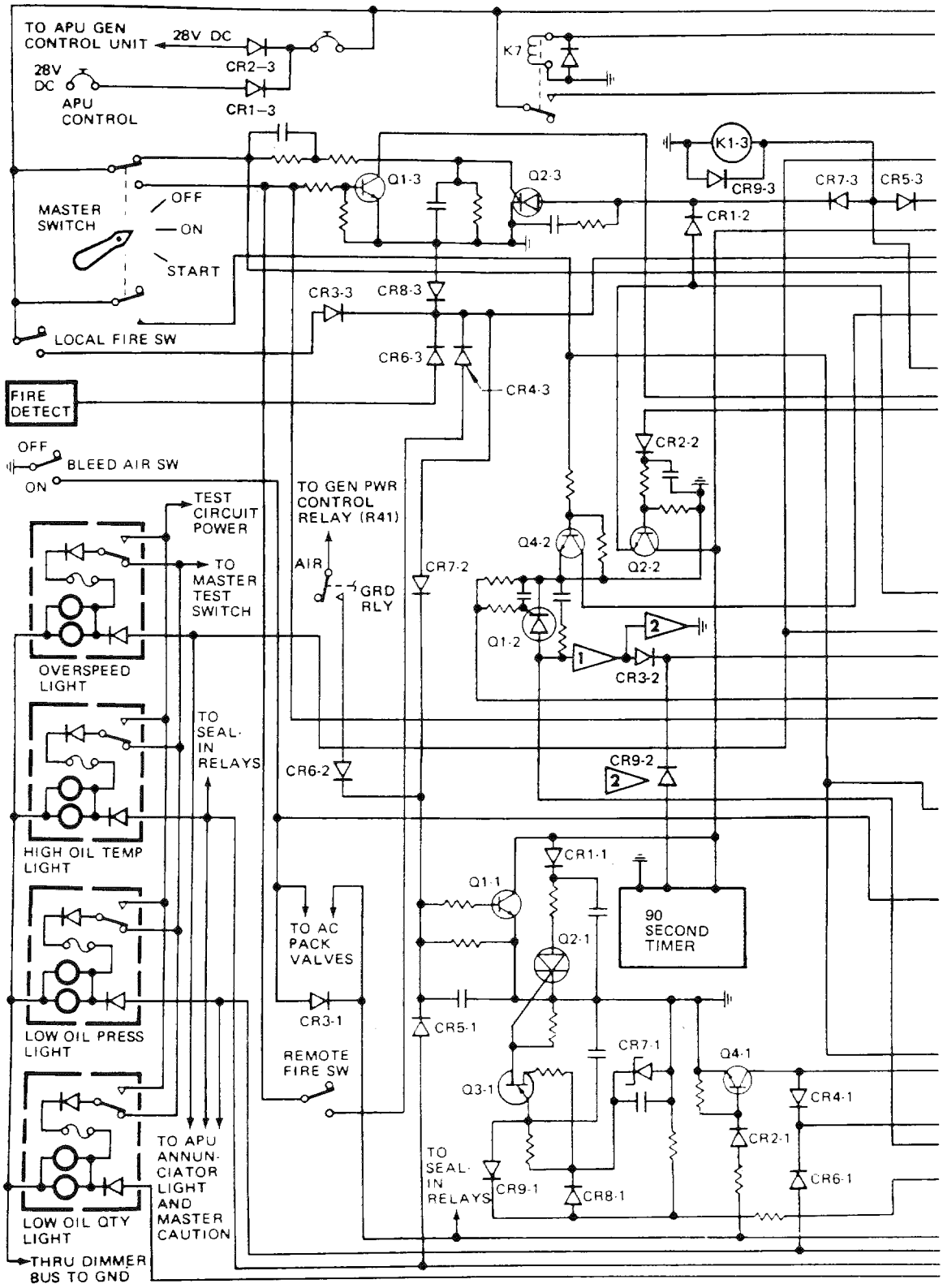
C. When the air inlet door switch is in the FULLY OPEN position, power is supplied to the sequencing oil pressure switch and to the 90-second timer to start the timing operation (Fig. 1). The start relay R5 closes. This trips the starter lockout relay K6 and completes the starter motor circuit. The starter motor begins cranking the engine.

D. As the engine rotates, the oil pressure rises. When the oil pressure reaches approximately 4.5 psig, the sequencing oil pressure switch closes and completes the circuit to the fuel solenoid valve and to the ignition unit (Fig. 1). The fuel solenoid valve opens and permits fuel flow to the combustion chamber. The ignition unit causes the igniter plug to fire. The engine lights up and begins to accelerate to service speed. IRPLANES WITHOUT THE ETC: When the APU engine speed gets to approximately 14,500 to 16,500 rpm, the 35% contact in the centrifugal speed switch opens. AIRPLANES WITH THE ETC: When the APU engine speed gets to approximately 19,000 to 21,000 rpm, the 50% contact in the centrifugal speed switch opens. This de-energizes the 90-second time delay device and the start relay R5. With the start relay R5 de-energized, the starter motor circuit is broken. The starter motor disengages, slows and stops. When the engine oil pressure reaches 55 psig, the low oil pressure switch opens and the low oil pressure light is extinguished. The engine continues to accelerate. When the engine speed reaches approximately 37,300 to 38,900 rpm, the 95% switch actuates. This de-energizes the ignition unit, arms the bleed air valve solenoid circuit, arms the pneumatic solenoid valve circuit, and energizes the APU GEN OFF BUS light. The APU low oil pressure automatic shutdown becomes operable at this speed.

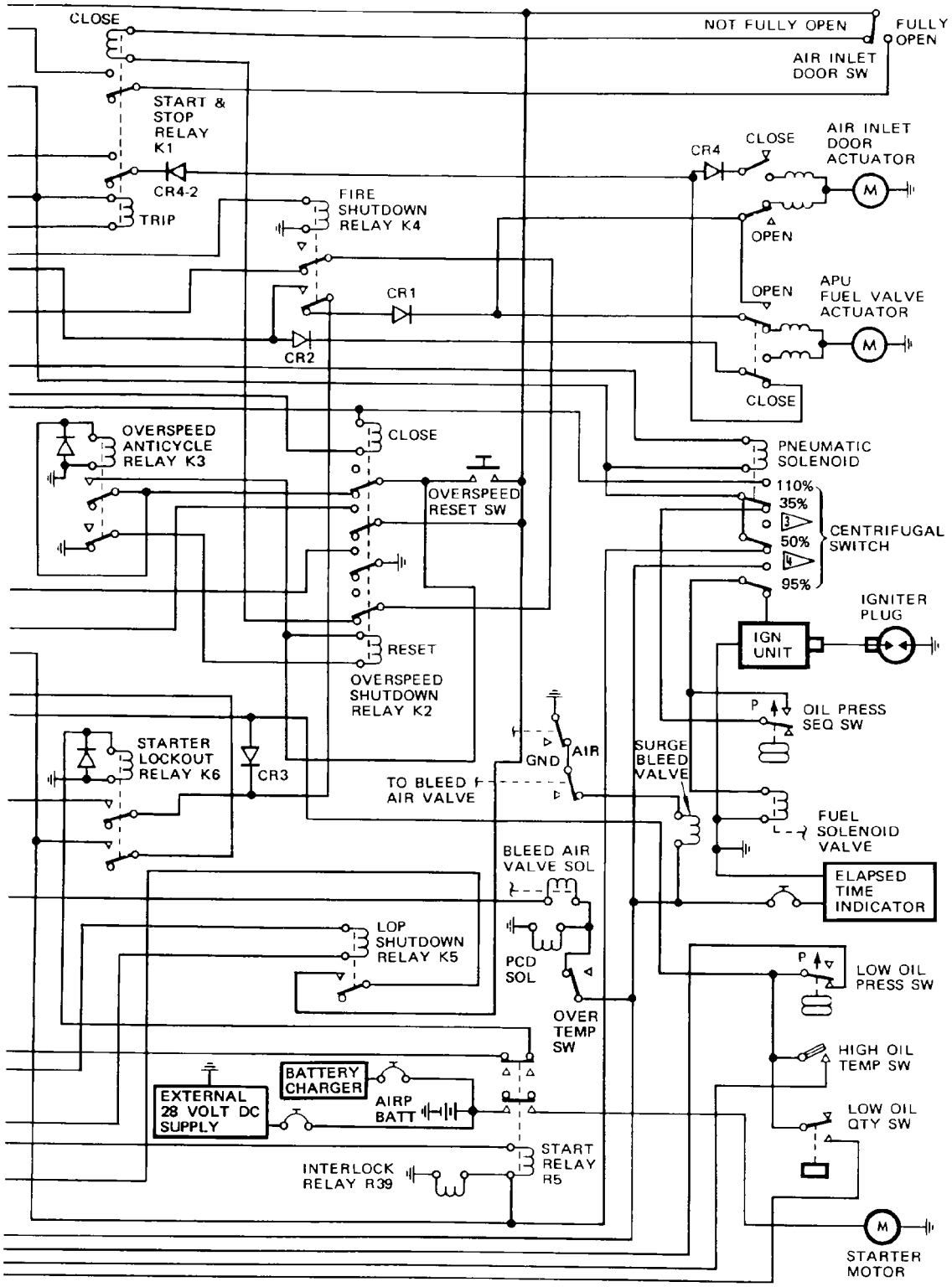
E. AIRPLANES WITHOUT THE ETC:
If the APU engine speed does not get to 35%, the APU engine will not start and the timer remains energized. AIRPLANES WITH THE ETC:
If the APU engine speed does not get to 50%, the APU engine will not start and the timer remains energized. After 90 seconds have elapsed, the timer completes TRIP coil circuit of start and stop relay K1, and the relay trips (Fig. 1). This de-energizes relay K7. The power is removed from the start relay R5, ignition unit, timer, and the fuel solenoid valve. The starter motor and ignition unit cease operation and the fuel flow ceases to the combustion chamber.

F. The APU is stopped by positioning the master switch to OFF. Power is supplied to the gate of the silicon controlled rectifier Q2-3 to energize the pneumatic solenoid valve (Fig. 1). The pneumatic solenoid valve permits compressed airflow to the 110% switch of the centrifugal switch to simulate an engine overspeed. The normally closed 110% switch contact opens. This breaks the fuel solenoid valve circuit. The normally open 110% switch contact energizes the TRIP coil of the start and stop relay K1. With K1 tripped, the pneumatic solenoid valve is de-energized allowing the 110% switch to reclose, and relay K7 is de-energized to completely isolate the fuel solenoid valve which was initially de-energized when the 110% switch was opened. As soon as the fuel solenoid valve closes, fuel ceases to flow to the combustion chamber, and the engine slows and stops. Simultaneously with the pneumatic solenoid valve operation, power is supplied to the APU fuel valve and the valve closes. When the valve is fully closed, power is transferred to the air inlet door actuator, and the door closes.

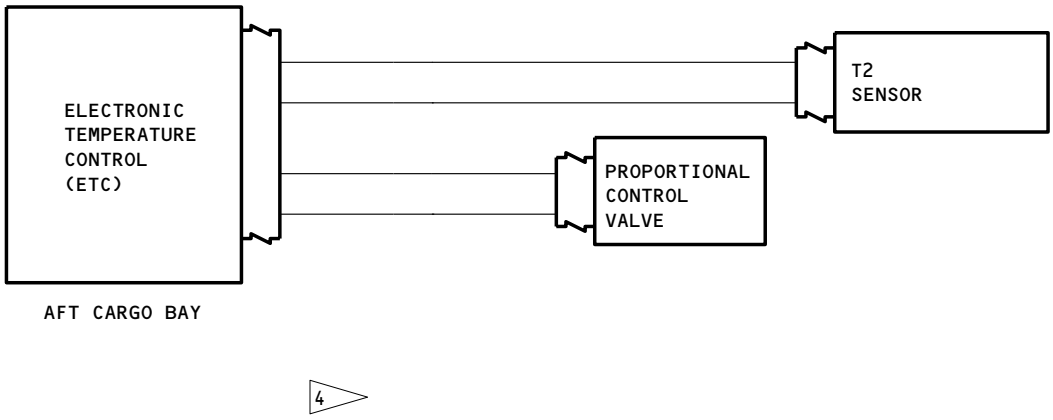
G. If start and stop relay K1 does not trip as described above, the overspeed light will illuminate to indicate this.



APU Circuit
Figure 1 (Sheet 1)



APU Circuit
Figure 1 (Sheet 2)



1 LV-JMW THRU LV-JMZ
LV-JTD, LV-JTO
LV-JND, LV-JNE

2 LV-LEB
LV-LIV THRU LV-LIW

3 AIRPLANES WITHOUT THE ETC

4 AIRPLANES WITH THE ETC

APU Circuit
Figure 1 (Sheet 3)

APU POWER PLANT - MAINTENANCE PRACTICES

1. General
   A. The maintenance procedures included in this section provide instructions necessary for APU power plant operation and general maintenance. Included in this section are the following paragraphs, listed in order of most common usage.
      (1) Operate APU

          CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (FIG. 202).

      (2) Motor APU
      (3) Depreserve APU
      (4) Purge APU fuel system
      (5) APU fuel system leak check
      (6) APU control air pressure line leak check
      (7) Procedure following overtemperature during start
      (8) Procedure to remove and install tachometer-generator assemblies
2. Operate APU
   A. General
      (1) This procedure provides the instructions necessary for operating the engine under normal conditions. Emergency shutdown modes are also included. This procedure may be used for checking operation of the engine or related systems when engine operation is required.

          CAUTION: WHEN ICING CONDITIONS EXIST, ATTEMPTS TO START APU WITH ICE FORMED AROUND INLET DOOR VORTEX GENERATOR HINGED FLAP COULD RESULT IN OVERHEAT DAMAGE TO THE INLET DOOR ACTUATOR MOTOR AND SLIP CLUTCH (AMM 12-50-0, DEICING PROCEDURE).

      (2) Recommended engine operating conditions, limitations and fuel requirements are outlined in Fig. 202. When an overtemperature condition has occurred, the engine should be shut down. The engine should not be restarted until the cause of the overtemperature is corrected.

(3) The No. 1 tank must contain a minimum of 350 pounds (159 kilograms) of fuel to start the APU. Schedule an additional 350 pounds (159 kilograms) for each hour of APU operation. It is possible that more fuel will be necessary in the No. 1 tank for other airplane systems or operations.

(4) High temperatures will be found up to 30 feet from the exhaust nozzle depending on wind conditions. Occasionally when the APU is started, excess fuel that has accumulated in the tailpipe ignites and long flames are blown out of the exhaust nozzle. Starts must not be attempted within range of flammable material or fumes.

(5) The APU engine is shut down in three different ways: using the master switch, using the fire switch in control cabin or in the main landing gear wheel well on the right side, and engine automatic shutdown. The engine shuts down automatically in event of engine low oil pressure, high oil temperature, overspeed, and high temperatures sensed by the fire detection system.

B. Prepare to Operate APU

(1) Make sure that the following circuit breakers on circuit breaker panel P6 are closed:

(a) LANDING GEAR, ANTISKID, LIGHTS

(b) LANDING GEAR, ANTISKID, TEST

(c) FIRE PROTECTION, DETECTION, APU

CONDITION	INDICATIONS	RANGE	LIMIT
FUEL QUANTITY REQUIREMENT FOR STARTING AND CONTINUOUS OPERATION	MAIN FUEL TANK INDICATOR NO. 1	FOR CONTINUOUS OPERATION, ADD 350 POUNDS (159 KILOGRAMS) TO MINIMUM LIMIT FOR EACH HOUR OF PLANNED OPERATION	MINIMUM FOR STARTING AIRPLANE PARKED: 350 POUNDS (159 KILOGRAMS) AIRPLANE TAXIING: 3500 POUNDS (1590 KILOGRAMS)
OIL CONSUMPTION	INDICATING LIGHT ON THE P5 FORWARD OVERHEAD PANEL		120 CC EACH HOUR (0.127 QUART EACH HOUR)
USEABLE OIL QUANTITY	INDICATING LIGHT ON THE P5 FORWARD OVERHEAD PANEL	6 QUARTS	
BATTERY (PRIOR TO STARTING APU)	DC VOLTMETER	22-28V DC WITHOUT AC POWER 26-28V DC WITH AC POWER	22V DC (MIN) WITHOUT AC POWER 26V DC (MIN) WITH AC POWER
APU STARTING	DC AMMETER PEGGED ON NEGATIVE SCALE	SEE SHEET 2 FOR THE DUTY CYCLE LIMITS OF THE STARTER MOTOR.	
STABILIZED OPERATION "NO LOAD" BLEED VALVE SWITCH "CLOSED" BLEED VALVE SWITCH "OPEN"	RPM *[3] AC FREQUENCY METER BLEED DUCT PRESSURE BLEED DUCT PRESSURE	101.3% TO 102.5% 405-410 Hz 0 45 ±5 PSIG AT SEA LEVEL (IN 12 TO 14 SECONDS) *[4]	102.5% 410 Hz MAX (SEA LEVEL) 420 Hz MAX (35,000 FT) 0 30 PSIG MIN
CONTINUOUS OPERATION "LOADED" *[6] PNEUMATICALLY (2 A/C PACKS) AND ELECTRICALLY (60 AMPS)	EGT RPM *[3] AC FREQUENCY METER BLEED DUCT PRESSURE	620 TO 650°C *[1] 104.3% to 99.3% 397-417 Hz *[5] 20 TO 5 PSIG *[5]	710°C MAX *[2] 99.3% MIN 397 Hz MIN 5 PSIG MIN

*[1] FOR EXTENDED APU SERVICE LIFE, CORRECTIVE MAINTENANCE ACTION IS NECESSARY IF CONTINUOUS OPERATION ABOVE 650°C IS EXPERIENCED.

*[2] CAUTION: IF EGT IS IN YELLOW BAND (710-760°C) DURING NORMAL CONTINUOUS OPERATION, SHUT DOWN APU AND TAKE CORRECTIVE ACTION. IF DURING START/ACCELERATION CYCLE, EGT EXCEEDS RED LINE (760°C), SHUT DOWN APU AND DO THE PROCEDURE FOLLOWING OVERTEMPERATURE DURING START (AMM 49-11-0/201). THIS PROCEDURE IS NOT NECESSARY IF EGT EXCEEDS 760°C DURING HEAT SOAK-BACK AFTER START TERMINATION. IF DURING ANY STEADY-STATE OPERATION, EGT EXCEEDS RED LINE (760°C), SHUT DOWN APU IMMEDIATELY AND REPLACE IT.

*[3] WITH RPM INDICATOR AND TACHOMETER-GENERATOR INSTALLED.

*[4] SUBTRACT 1/2 PSIG FOR EVERY 1000 FT ELEVATION.

*[5] A SMALL FLUCTUATION IN GENERATOR FREQUENCY (2-4 Hz) AND DUCT PRESSURE (1-2 PSIG) IS PERMITTED AT FULL LOAD CONDITION.

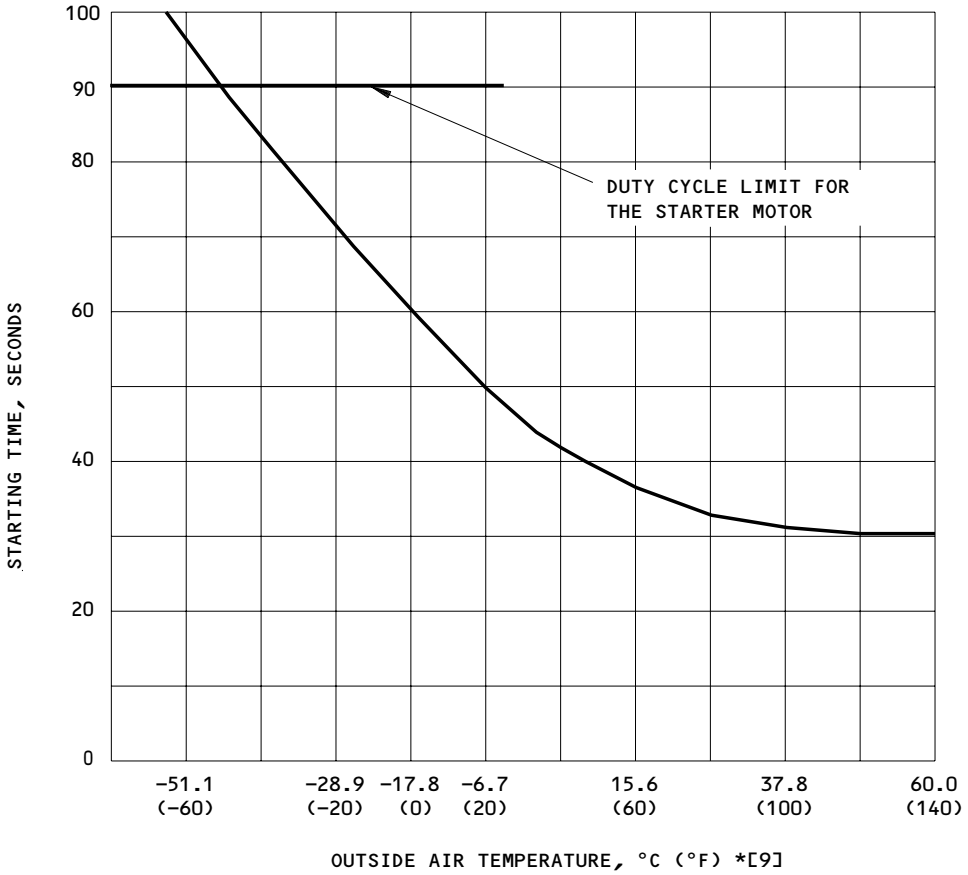
*[6] FULL LOAD EGT MUST ONLY BE CHECKED WITH SPECIFIED LOAD CONDITION (2 A/C PACKS PLUS 60 AMPS). ANY VARIATION IN LOAD CONDITIONS OTHER THAN THAT SPECIFIED WILL GIVE AN ERRONEOUS EGT INDICATION.

*[7] DELETED

Operating Limits
Figure 201 (Sheet 1)

STARTS OR TRIES TO START IN ONE HOUR	OPERATION (STARTER "ON" TIME)	COOL DOWN (BEFORE YOU TRY TO START AGAIN)
1	0-90 SEC (MAX) (AUTO ABORT)	0 MINUTES
2	0-90 SEC (MAX) (AUTO ABORT)	5 MINUTES (MIN)
3 *[8]	0-90 SEC (MAX) (AUTO ABORT)	60 MINUTES (MIN)

*[8] VISUALLY EXAMINE THE BRUSH ASSEMBLIES FOR DISCOLORATION IN THE STARTER MOTOR AFTER YOU TRY TO START THE APU A THIRD TIME.



MAXIMUM TIME TO START

*[9] THE OUTSIDE AIR TEMPERATURE MUST BE THE SAME AS THE APU OIL TEMPERATURE. PERMIT SUFFICIENT TIME FOR THE TEMPERATURE OF THE APU OIL TO BECOME THE SAME AS THE OUTSIDE AIR.

Operating Limits
Figure 201 (Sheet 2)

AIRPLANES WITHOUT THE ETC:

Operating Limits

CONDITIONS	INDICATIONS	RANGE	LIMIT
FUEL QUANTITY REQUIREMENT FOR STARTING AND CONTINUOUS OPERATION	MAIN FUEL TANK INDICATOR NO. 1	FOR CONTINUOUS OPERATION, ADD 350 POUNDS (159 KILOGRAMS) TO MINIMUM LIMIT FOR EACH HOUR OF PLANNED OPERATION	FOR AN APU START WHEN THE AIRPLANE IS PARKED 350 POUNDS (159 KILOGRAMS)
OIL CONSUMPTION	INDICATING LIGHT ON THE P5 FWD OVERHEAD PANEL		120 CC EACH HOUR (0.127 QUART EACH HOUR)
USABLE OIL QUANTITY	INDICATING LIGHT ON THE P5 FWD OVERHEAD PANEL	6 QUARTS	
BATTERY (PRIOR TO STARTING APU)	DC VOLTMETER	22-28V DC WITHOUT AC POWER 26-28V DC WITH AC POWER	22V DC (MIN) WITHOUT AC POWER 26V DC (MIN) WITH AC POWER
APU START	DC AMMETER TO THE MAXIMUM ON THE NEGATIVE SCALE	SEE SHEET 2 FOR THE DUTY CYCLE LIMITS OF THE STARTER MOTOR	
STABILIZED OPERATION "NO LOAD"	EGT RPM *[3] AC FREQUENCY METER	LESS THAN 350°C 101.3% TO 102.5% 405-410 Hz	102.5% 410 Hz MAX (SEA LEVEL) 420 Hz MAX (35,000 FT)
BLEED VALVE SWITCH "CLOSED"	BLEED DUCT PRESSURE	0	0
BLEED VALVE SWITCH "OPEN"	BLEED DUCT PRESSURE	45 ±5 PSIG AT SEA LEVEL (IN 12 TO 14 SECONDS) *[4]	30 PSIG MIN

AIRPLANES WITHOUT THE ETC:

Operating Limits

CONDITIONS	INDICATIONS	RANGE	LIMIT
CONTINUOUS OPERATION "LOADED" *[6] PNEUMATICALLY (2 PACKS) AND ELECTRICALLY (60 AMPS)	EGT	620 TO 650°C *[1]	710°C MAX *[2]
	RPM *[3]	104.3% TO 99.3%	99.3% MIN
	AC FREQUENCY METER	397-417 Hz *[5]	397 Hz MIN
	BLEED DUCT PRESSURE	20 TO 5 PSIG *[5]	5 PSIG MIN

*[1] FOR EXTENDED APU SERVICE LIFE, CORRECTIVE MAINTENANCE ACTION IS NECESSARY IF CONTINUOUS OPERATION ABOVE 650 C IS EXPERIENCED.

*[2] CAUTION: IF EGT IS IN THE YELLOW BAND (710-760°C) DURING NORMAL CONTINUOUS OPERATION, DO THE APU USUAL SHUTDOWN AND DO THE CORRECTIVE ACTION. IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING THE APU START, DO THE APU USUAL SHUTDOWN AND DO THIS PROCEDURE: THE APU FOR AN OVERTEMPERATURE DURING START (AMM 49-11-0/201). THIS PROCEDURE IS NOT NECESSARY IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING A HEAT SOAK AFTER YOU TRY AN APU START. IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING ANY STEADY-STATE OPERATION, SHUT DOWN APU IMMEDIATELY AND REPLACE IT.

*[3] WITH THE RPM INDICATOR AND THE TACHOMETER-GENERATOR INSTALLED.

*[4] SUBTRACT 1/2 PSIG FOR EVERY 1000 FT OF ELEVATION

*[5] A SMALL CHANGE IN THE FREQUENCY OF THE APU ELECTRICAL GENERATOR (2-4 Hz) AND THE BLEED DUCT PRESSURE (1-2 PSIG) IS PERMITTED FOR THE FULLY LOADED CONDITION.

*[6] FOR THE FULLY LOADED CONDITION, THE EGT MUST ONLY BE MEASURED WITH SPECIFIED LOAD CONDITIONS (2 AC PACKS PLUS 60 AMPS) AND T2 SENSOR DISCONNECTED. ANY DIFFERENCE IN THE LOAD CONDITIONS WILL GIVE AN INCORRECT EGT INDICATION.

CONDITION	INDICATIONS	RANGE	LIMIT
FUEL QUANTITY REQUIREMENT FOR THE APU START AND OPERATION	INDICATOR FOR THE NO. 1 FUEL TANK	FOR CONTINUOUS OPERATION, ADD 350 POUNDS (159 KILOGRAMS) TO THE MINIMUM LIMIT FOR EACH HOUR OF SCHEDULED APU OPERATION	FOR AN APU START WHEN THE AIRPLANE IS PARKED: 350 POUNDS (159 KILOGRAMS).
OIL CONSUMPTION	INDICATING LIGHT ON THE P5 FORWARD OVERHEAD PANEL		120 CC EACH HOUR (0.127 QUART EACH HOUR)
USEABLE OIL QUANTITY	INDICATING LIGHT ON THE P5 FORWARD OVERHEAD PANEL	6 QUARTS	
BATTERY (FOR THE APU START)	DC VOLTMETER	22-28V DC WITHOUT AC POWER 26-28V DC WITH AC POWER	22V DC (MIN) WITHOUT AC POWER 26V DC (MIN) WITH AC POWER
APU START	DC AMMETER TO THE MAXIMUM ON THE NEGATIVE SCALE	SEE SHEET 4 FOR THE DUTY CYCLE LIMITS OF THE STARTER MOTOR.	
OPERATION THAT IS STABLE "NO LOAD"	EGT RPM [3] AC FREQUENCY METER	LESS THAN 350°C [7] 101.3% TO 102.5% 405-410 Hz	102.5% 410 Hz MAX (SEA LEVEL) 420 HZ MAX (35,000 FT)
BLEED VALVE SWITCH "CLOSED" BLEED VALVE SWITCH "OPEN"	BLEED DUCT PRESSURE BLEED DUCT PRESSURE	0 45 ±5 PSIG AT SEA LEVEL (IN 12 TO 14 SECONDS) [4]	0 30 PSIG MIN
CONTINUOUS OPERATION "LOADED" [6] PNEUMATICALLY (2 A/C PACKS) AND ELECTRICALLY (60 AMPS)	EGT RPM [3] AC FREQUENCY METER BLEED DUCT PRESSURE	566 TO 649°C [1] 104.3% TO 99.3% 397-417 Hz [5] 20 TO 5 PSIG [5]	710°C MAX [2] 99.3% MIN 397 Hz MIN 5 PSIG MIN

[1] FOR EXTENDED APU SERVICE LIFE, CORRECTIVE MAINTENANCE ACTION IS NECESSARY IF CONTINUOUS OPERATION ABOVE 649°C IS EXPERIENCED.

[2] CAUTION: IF THE EGT IS IN THE YELLOW BAND (710-760°C) DURING THE APU OPERATION, DO THE APU USUAL SHUTDOWN AND DO THE CORRECTIVE ACTION. IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING THE APU START, DO THE APU USUAL SHUTDOWN AND DO THIS PROCEDURE: THE APU FOR AN OVERTEMPERATURE DURING START (AMM 49-11-0/201). THIS PROCEDURE IS NOT NECESSARY IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING A HEAT SOAK AFTER YOU TRY AN APU START. IF THE EGT IS MORE THAN THE RED LINE (760°C) DURING ANY STEADY-STATE OPERATION, DO THE APU USUAL SHUTDOWN IMMEDIATELY AND REPLACE THE APU.

[3] WITH THE RPM INDICATOR AND THE TACHOMETER-GENERATOR INSTALLED.

[4] SUBTRACT 1/2 PSIG FOR EVERY 1000 FT OF ELEVATION.

[5] A SMALL CHANGE IN THE FREQUENCY OF THE APU ELECTRICAL GENERATOR (2-4 Hz) AND THE BLEED DUCT PRESSURE (1-2 PSIG) IS PERMITTED FOR THE FULLY LOADED CONDITION.

[6] FOR THE FULLY LOADED CONDITION, THE EGT MUST ONLY BE MEASURED WITH THE SPECIFIED LOAD CONDITIONS (2 A/C PACKS, PLUS 100 AMPS) AND T2 SENSOR DISCONNECTED. ANY DIFFERENCE IN THE LOAD CONDITIONS WILL GIVE AN INCORRECT EGT INDICATION.

[7] FOR EXTENDED APU SERVICE LIFE, CORRECTIVE MAINTENANCE ACTION IS NECESSARY IF CONTINUOUS "NO LOAD" OPERATION ABOVE 350°C IS EXPERIENCED. AN EGT INDICATION ABOVE 350°C MUST BE MONITORED FOR POSSIBLE DETERIORATION OF THE APU.

Operating Limits
Figure 201 (Sheet 3)

FULLY LOADED CONDITION [8]
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
0	-18	516 ±10
2	-17	519 ±10
4	-16	521 ±10
6	-14	524 ±10
8	-13	527 ±10
10	-12	529 ±10
12	-11	532 ±10
14	-10	534 ±10
16	-9	537 ±10
18	-8	540 ±10
20	-7	542 ±10
22	-6	545 ±10
24	-4	548 ±10
26	-3	550 ±10
28	-2	553 ±10
30	-1	556 ±10
32	0	558 ±10
34	1	561 ±10
36	2	563 ±10
38	3	566 ±10
40	4	569 ±10
42	6	571 ±10
44	7	574 ±10
46	8	577 ±10
48	9	579 ±10

TABLE 1

[8] EGT INDICATION WITH THE APU IN THE FULLY LOADED CONDITION (BOTH A/C PACKS ON HIGH AND A 100 AMP ELECTRICAL LOAD) WITH A T2 BIAS FROM THE ETC (EGT SET-POINT AT 621°C).

Operation Limits
Figure 202 (Sheet 1)

TABLE 1		
AIRPLANES WITH THE ETC		
FULLY LOADED CONDITION APU EGT VS OUTSIDE AIR TEMPERATURE		
		APU
OAT °F	OAT °C	EGT °C
50 52 54 56 58	10 11 12 13 14	580 ±10 584 ±10 588 ±10 590 ±10 592 ±10
60 62 64 66 68	16 17 18 19 20	595 ±10 598 ±10 600 ±10 603 ±10 606 ±10
70 72 74 76 78	21 22 23 24 26	608 ±10 611 ±10 613 ±10 616 ±10 619 ±10
80 82 84 86 88	27 28 29 30 31	621 ±10 621 ±10 621 ±10 621 ±10 621 ±10

TABLE 1		
AIRPLANES WITH THE ETC		
FULLY LOADED CONDITION APU EGT VS OUTSIDE AIR TEMPERATURE		
		APU
OAT °F	OAT °C	EGT °C
90	32	621 ±10
92	33	621 ±10
94	34	621 ±10
96	36	621 ±10
98	37	621 ±10
100	38	621 ±10
102	39	621 ±10
104	40	621 ±10
106	41	621 ±10
108	42	621 ±10

(d) FIRE PROTECTION, DETECTION, MASTER WARN & CONTR
(e) MASTER CAUTION BUS, BAT
(f) PANEL & INSTRUMENT, DIM & TEST
(g) Nine circuit breakers under INDICATOR LTS, MASTER DIM BUS
(h) APU GENERATOR CONTROL
(i) APU CONT
(j) HOT BAT, BAT BUS CONT
(k) HOT BAT, GEN CONT
(l) HOT BAT BUS

(2) Make sure that circuit breaker on generator control unit is closed (generator control unit is located in P6 panel area).
(3) Make sure that circuit breaker on face of APU control unit is closed (APU control unit is located in electrical & electronic bay).
(4) Position DC METERS selector switch to BATTERY.
(5) Position AC METERS selector switch to APU GEN.
(6) Position BATTERY switch to ON.
(7) Make sure that APU bleed valve switch is OFF.
(8) Momentarily position either APU generator switch to ON to close field relay.

CONDITION FOR A MAIN ENGINE START 9
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
0	−18	586 ±10
2	−17	588 ±10
4	−16	591 ±10
6	−14	594 ±10
8	−13	596 ±10
10	−12	599 ±10
12	−11	601 ±10
14	−10	604 ±10
16	−9	607 ±10
18	−8	609 ±10
20	−7	612 ±10
22	−6	615 ±10
24	−4	617 ±10
26	−3	620 ±10
28	−2	622±10
30	−1	625 ±10
32	0	628 ±10
34	1	630 ±10
36	2	633 ±10
38	3	636 ±10
40	4	639 ±10
42	6	641 ±10
44	7	643 ±10
46	8	646 ±10
48	9	649 ±10
50	10	651 ±10
52	11	654 ±10
54	12	657 ±10
56	13	659 ±10
58	14	662 ±10

TABLE 2

9 EGT INDICATION WITH THE ETC IN THE MODE FOR A MAIN ENGINE START WITH A T2 BIAS.

Operation Limits
Figure 202 (Sheet 2)

EFFECTIVITY
AIRPLANES WITH THE ETC

452521

CONDITION FOR A MAIN ENGINE START 11
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
60	16	664 ±10
62	17	667 ±10
64	18	670 ±10
66	19	672 ±10
68	20	675 ±10
70	21	678 ±10
72	22	680 ±10
74	23	683 ±10
76	24	685 ±10
78	26	688 ±10
80	27	690 ±10
82	28	690 ±10
84	29	690 ±10
86	30	690 ±10
88	31	690 ±10
90	32	690 ±10
92	33	690 ±10
94	34	690 ±10
96	36	690 ±10
98	37	690 ±10
100	38	690 ±10
102	39	690 ±10
104	40	690 ±10
106	41	690 ±10
108	42	690 ±10

TABLE 2 (CONT)

Operation Limits
Figure 202 (Sheet 3)

(9) Position No. 1 tank forward fuel boost pump selector switch to ON.

NOTE: If ac electrical power is on the airplane, select No. 1 generator bus. The No. 1 tank boost pump will then assist the APU engine-driven fuel pump during starting.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

C. Start APU

CAUTION: AN UNDETECTED FIRE COULD OCCUR IN THE APU COMPARTMENT WITH THE APU COWL DOOR OPEN AND THE LOWER SHROUD REMOVED. IF THIS HAPPENS, THE APU FIRE DETECTION SYSTEM MAY NOT SENSE A SMALL FIRE AND MOST OF THE FIRE EXTINGUISHING AGENT WILL BLOW OUT OF THE OPEN APU COWL DOOR. IF A FIRE DOES TAKE PLACE AND IS NOT QUICKLY EXTINGUISHED, DAMAGE TO THE APU AND THE AIRPLANE CAN OCCUR.

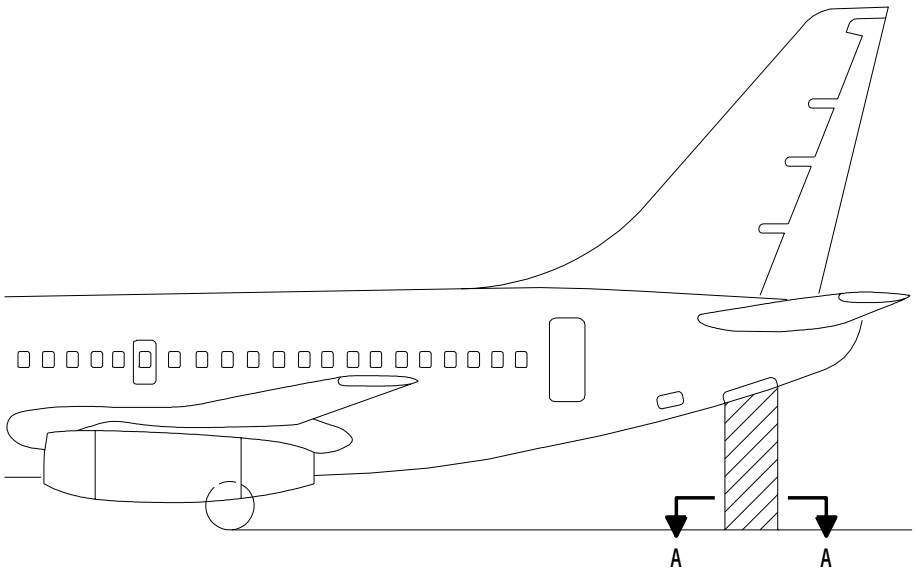
(1) Make sure that there is an observer located near the APU compartment to watch for fire if the APU cowl door is open and the lower shroud is removed during APU operation.

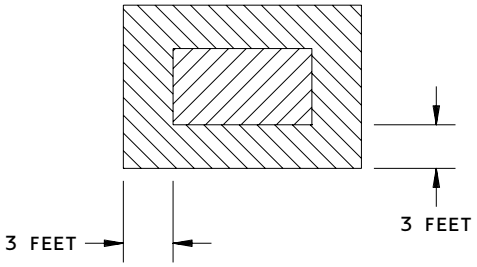
WARNING: DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF 3 FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

NOTE: The observer should be in voice contact with other personnel in order to provide a warning if a fire occurs. Airplane personnel can then do the APU shutdown procedure and other corrective actions (including the use of portable fire extinguishers).

(2) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096;
If you must operate the APU with the lower shroud removed, make sure all persons are not in the hazard area (Fig. 203).

NOTE: APUs with AlliedSignal SB GTCP85-49-7096 have an external shield around the turbine plenum and have no hazard area.





A–A

WARNING: DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF 3 FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

Hazard Area
Figure 203

(3) Position the APU MASTER SWITCH to START and release.

NOTE: If the APU MASTER SWITCH is positioned initially to ON and the air inlet door fully opens before the APU MASTER SWITCH is moved to START, CLOSE coil of start and stop relay K1 will not be energized and the APU will not start.

(4) Monitor EGT indicator, ac frequency meter, low oil pressure light, and dc ammeter.

CAUTION: TO AVOID DAMAGING APU, OBSERVE ALL OPERATING LIMITS (FIG. 202).

(a) Low oil pressure light shall come on.
(b) The APU fuel valve and air inlet door will open, in that order, in approximately 17 seconds.

NOTE: The APU fuel valve is located on the LH wing rear spar. Make sure that the valve is open by observing from the LH wheel well that the valve position indicator goes to OPEN.

(c) After the air inlet door is fully open, the starter motor will be energized, indicated by a negative reading of the dc ammeter, and engine rotation commences. Light-off should occur within 15 seconds, as indicated by EGT rise.
(d) Low oil pressure light shall go off.
(e) Engine should accelerate to 100% service speed within the maximum time specified in Fig. 202. 100% service speed is indicated when the ac frequency meter stabilizes just over 400 Hz only if the field relay is closed.
(f) If a satisfactory initial ground-start of the APU does not occur, any subsequent APU ground-start requires a qualified ground-observer. The qualified ground-observer must make sure that the airplane surfaces are not damaged by a fire from the APU exhaust. If the flames from an APU exhaust fire are blown onto the airplane surfaces, all damaged areas must be examined.

(g) If the engine does not accelerate to 100% service speed within 90 seconds, the APU will automatically shut down through the 90-second time delay relay of the starting circuit. Position the APU MASTER SWITCH to OFF. Observe the starter duty cycle, then repeat steps C.(3) thru C.(4)(g). If the engine does not accelerate to 100% service speed on second attempt, maintenance action is required.

CAUTION: TO AVOID DAMAGING APU, OBSERVE ALL OPERATING LIMITS (FIG. 202).

NOTE: If the APU MASTER SWITCH is turned OFF before 100% speed is reached, the overspeed light may come on. This is a normal condition and is caused by insufficient pneumatic pressure to operate the 110% speed switch. The overspeed light will extinguish following a normal restart of the APU.

(h) The APU GEN OFF BUS light should come on at 95% speed to indicate that the unit is ready to receive a load.

NOTE: Operate the APU in a unloaded condition for a minimum of 1 minute prior to application of a load to allow the temperature to stabilize.

D. Shut Down APU

(1) Normal Shutdown

(a) Disconnect all load except APU generator supplying No. 1 generator system (bus transfer switch OFF and No. 1 tank forward fuel boost pump ON). Allow the engine to operate at this condition for 1 minute.

NOTE: With ac electrical power available, shut down the APU with power on the No. 1 generator system and the No. 1 tank forward fuel boost pump ON.

(b) Position the APU MASTER SWITCH to OFF. APU fuel valve and air inlet door should close in approximately 20 seconds after shutdown initiation.
(c) Make sure that the cooling air shutoff valve is fully closed (actuator rod is retracted when valve is closed).
(d) Position the BATTERY switch to OFF.
(e) Position No. 1 tank forward boost pump switch to OFF.

(2) Shutdown Using Fire Switch
(a) Pull either fire switch.

NOTE: When either fire switch is used for APU shutdown, the fire extinguisher discharge button is armed in addition to APU normal shutdown functions. A check for the actual presence of fire should be made, if possible, before discharging the fire extinguisher bottle.

(b) Position the APU MASTER SWITCH to OFF.
(c) Position No. 1 tank forward boost pump switch to OFF.
(d) Reset the fire switch.

(3) Automatic Shutdown
(a) After automatic shutdown occurs, determine the cause of shutdown, then position the APU MASTER SWITCH and No. 1 tank forward boost pump switch to OFF.
(b) Correct malfunction, and restart per par. 2.C.

3. Motor APU
A. General
(1) Engine motoring is generally required for depreservation of a new engine and to purge air from the fuel lines after replacing fuel system components or checking the low pressure fuel filter. However, motoring of an engine may be performed for testing engine components.
(2) If motoring run is to be performed for maintenance other than fuel system purging or depreservation of engine, disconnect the electrical plug from the sequencing oil pressure switch.
(3) Fuel tank No. 1 must contain a specific amount of fuel for APU operation (Fig. 202). The APU fuel inlet line must be filled with fuel before attempting to start the APU. The fuel inlet line is filled and pressurized using the No. 1 tank forward boost pump. To turn on the No. 1 tank boost pump, external ac power is required.

B. Equipment and Materials

NOTE: The following equipment is required for fuel system purging and engine depreservation.

(1) Container - 2-gallon minimum capacity
(2) Fuel hose

NOTE: Fabricate a fuel hose to reach the container and to mate with the fitting on the end of the high pressure fuel line disconnected from the fuel atomizer.

C. Prepare for Engine Motoring
(1) Position the BATTERY switch to OFF and placard.
(2) Open the APU compartment access door latches and open door. Install door support rods.
(3) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(4) Disconnect electrical plug from sequencing oil pressure switch.

NOTE: Step (4) is not necessary if the high pressure fuel line has been disconnected from the fuel atomizer for fuel supply line purging or APU depreserving.

(5) Position the BATTERY switch to ON and remove placard.

NOTE: Do not position the BATTERY SWITCH to ON at this time if the unit is being preserved.

D. Motor Engine
(1) Provide airplane with external power.

NOTE: No. 1 tank boost pump requires ac power.

(2) Position No. 1 tank forward boost pump to ON.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(3) Position the APU MASTER SWITCH to START and release.

NOTE: The APU MASTER SWITCH will return to ON and engine motoring will begin after the APU fuel valve and the air inlet door have opened. After approximately 60/90 seconds of motoring, motoring is terminated by a time limiting device in the APU control unit.

(4) Position the APU MASTER SWITCH to OFF.
(5) Verify proper operation of APU fuel shutoff valve (located on LH rear wing spar in LH wheel well).
  (a) Observe that the fuel valve position indicator has returned to closed position.
(6) Repeat steps (3) and (4) as required.

CAUTION: TO AVOID DAMAGING APU, OBSERVE ALL OPERATING LIMITS (FIG. 202).

E. Restore Airplane to Normal Configuration
(1) Position No. 1 tank forward boost pump switch and the BATTERY SWITCH to OFF and placard.
(2) If motoring run was performed for maintenance other than fuel system purging or depreservation of engine, connect electrical plug to sequencing oil pressure switch.
(3) If fuel system purging or engine depreservation was performed, disconnect the fuel hose from the high-pressure fuel line and connect the fuel line to the fuel atomizer.

(4) Connect ignition unit power supply electrical plug to ignition unit.
(5) Position the lower shroud against the upper shroud and close the shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(6) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(7) Remove placard.

4. Depreserve APU
A. General
(1) Depreservation of an the engine consists of filling the engine oil tank with lubricating oil, purging the fuel control unit of preservative oil, operating the engine for a short period, then replacing the high and low pressure fuel filter elements and the oil filter element. Purging air from the APU fuel system is required when the fuel control unit or any other fuel system component is replaced on an existing engine or when the low pressure fuel filter is checked.
B. Equipment and Materials

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.

(1) Synthetic Gas Turbine Oil - MIL-L-7808, MIL-L-23699, or their commercial equivalents (Ref AiResearch Report GT-7800-R)
(2) Cleaning Solvent - Federal Specification P-D-680, or equivalent
C. Depreserve Engine
(1) Prepare for engine depreservation per par. 3.C.

(2) Remove the filler cap from the APU oil tank.
(3) Add oil until the level is at the FULL mark on dipstick.

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

(4) Install filler cap on APU oil tank.
(5) Manually open the APU fuel shutoff valve at left rear wing spar, accessible at left main wheel well area.
(6) Perform the following if unit has been preserved:
  (a) Reconnect fuel supply line to shroud fuel inlet port.
  (b) Install oil filter element in oil pump assembly.
  (c) Install fuel control unit high pressure fuel filter element.
  (d) Remove protective covering and masking tape from air inlet, exhaust outlet, and cooling air outlet in access door.
(7) Position the BATTERY switch to ON and remove placard.
(8) Position No. 1 tank forward boost pump to ON.

NOTE: No. 1 tank boost pump requires ac power. If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(9) Loosen the fuel line at the low pressure inlet of the APU fuel control unit just enough to allow trapped air to escape.
(10) Position the APU MASTER SWITCH to ON (do not go to START position). Operate fuel boost pump until air or preservation oil is forced from the line and the low pressure fuel filter. Catch dripping fuel in container. Tighten fuel line fitting and shutoff fuel boost pump (position the APU MASTER SWITCH to OFF).
(11) Manually close the APU fuel shutoff valve at left rear wing spar.
(12) Disconnect the high pressure fuel line from the atomizer, connect fuel hose to disconnected line, and place the open end of fuel hose into container.
(13) Motor the engine per par. 3.D., until fuel free from air bubbles and oil is discharged into container.

CAUTION: DO NOT EXCEED STARTER MOTOR DUTY CYCLE OF 1 MINUTE ON, 4 MINUTES OFF. HIGH ENERGY STARTER MOTORS ARE EASILY OVERHEATED AND CONSEQUENTLY DAMAGED.

NOTE: Clear fuel should normally appear within three motoring cycles.

(14) Restore the engine to operating condition per par. 3.E., but do not install lower shroud.
(15) Start the engine per par. 2.C.

(16) Allow the engine to accelerate to 100% service speed and operate at this speed for 3 to 5 minutes.
(17) Shut down the engine per par. 2.D.
(18) Position the BATTERY switch to OFF and placard.
(19) Check the engine oil lines and fuel lines and their connection points for evidence of oil and fuel leakage.
(20) Replace the low pressure fuel filter element (Fig. 204).
  (a) Unscrew filter cap from filter head. Catch dripping fuel in suitable container.
  (b) Remove and discard old filter element and packing.
  (c) Remove backup ring and packing from filter head. Discard packing.
  (d) Wash filter cap and backup ring in solvent and dry thoroughly with clean compressed air.

    WARNING: SOLVENT IS TOXIC. USE IN WELL-VENTILATED AREA. KEEP AWAY FROM FLAME.

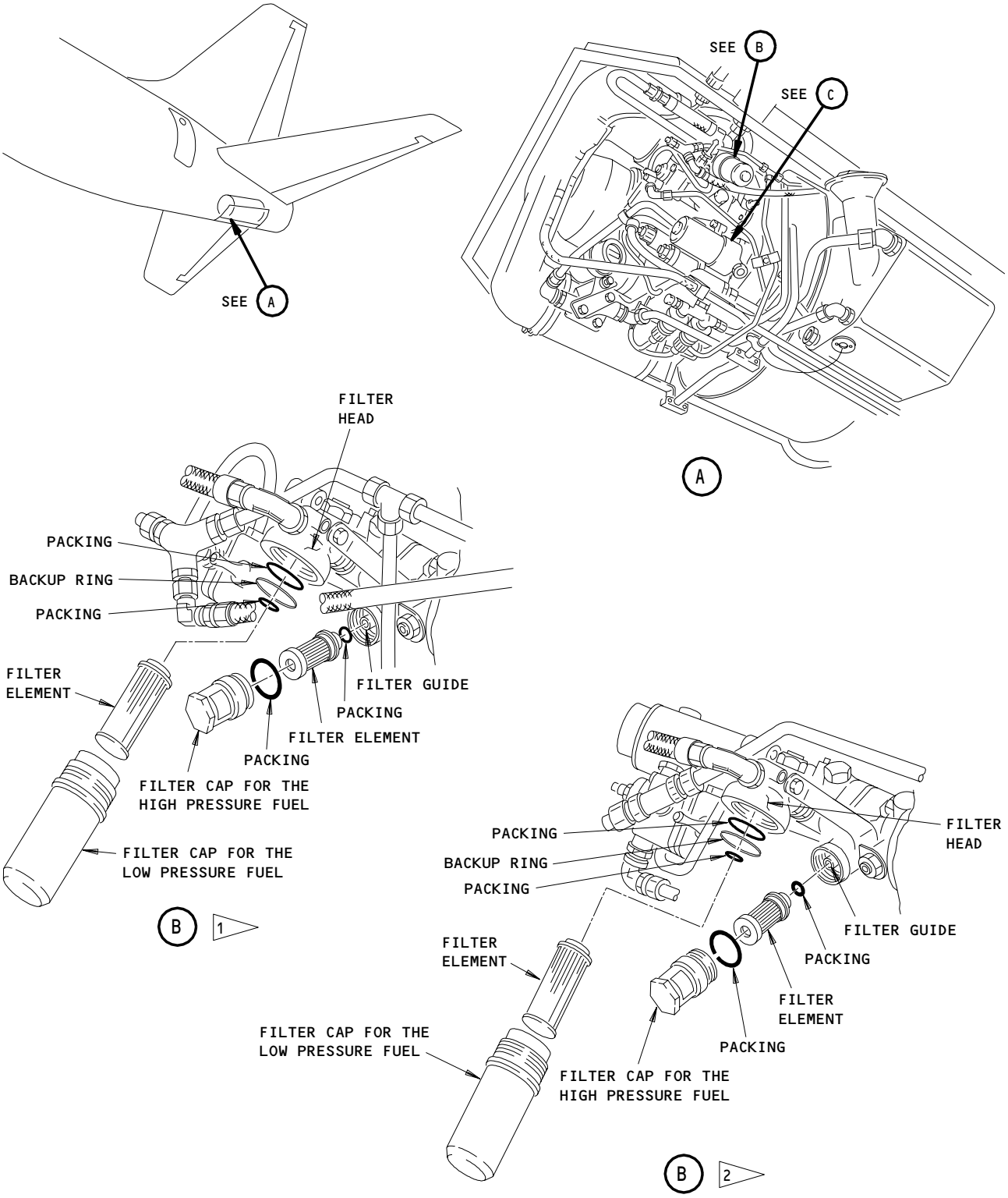
  (e) Install a new packing and backup ring in filter head.
  (f) Install a new packing on new filter element and install element in filter head.
  (g) Install filter cap in filter head and safety wire.
(21) Replace the high pressure fuel filter element (Fig. 204).
  (a) Unscrew filter cap from fuel control unit.
  (b) Remove the filter element, spring, and packing.

    CAUTION: EXERCISE EXTREME CARE TO PREVENT ANY DIRT FROM ENTERING FUEL CONTROL UNIT.

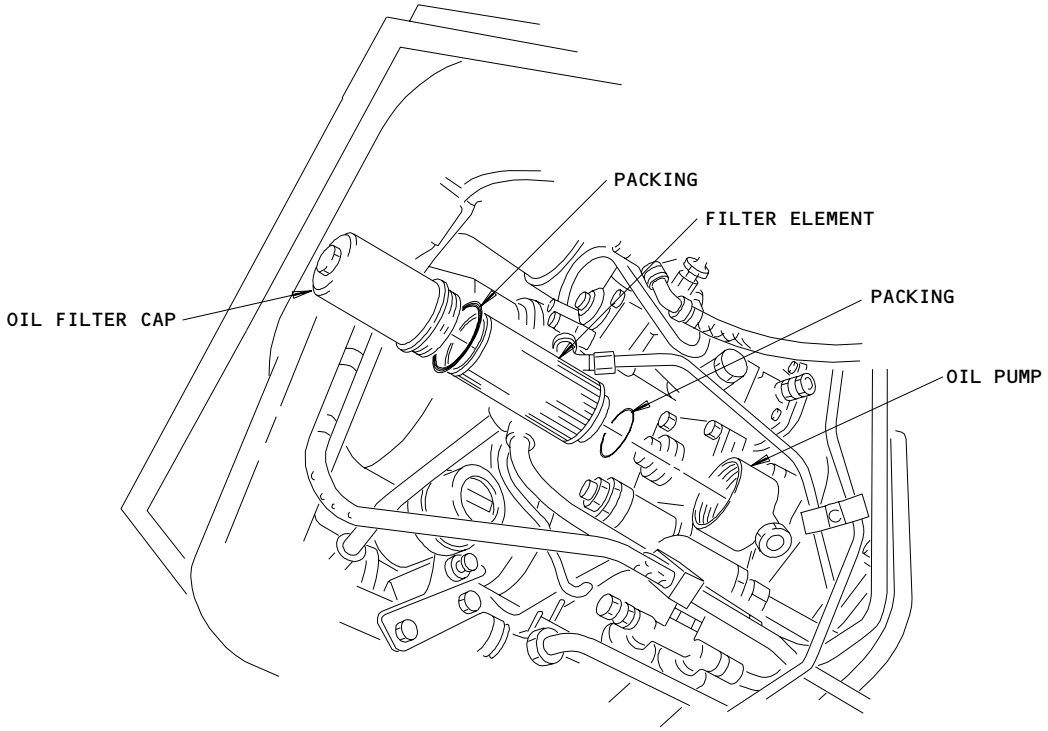
  (c) Clean filter cap and spring in solvent and dry thoroughly.

    WARNING: SOLVENT IS TOXIC. USE IN WELL VENTILATED AREA. KEEP AWAY FROM FLAME.

  (d) Install a new packing on filter guide.
  (e) Place a new filter element, spring, and new filter cap packing in place and install filter cap in fuel control unit.
  (f) Safety wire filter cap to fuel control unit housing.
(22) Replace the oil filter element (Fig. 204).
  (a) Remove filter cap, packing, and filter element. Catch dripping oil in suitable container. Discard filter element and packings.



Fuel and Oil Filter Installation
Figure 204 (Sheet 1)



C

1 AIRPLANES WITHOUT THE ETC
2 AIRPLANES WITH THE ETC

Fuel and Oil Filter Installation
Figure 204 (Sheet 2)

(b) Clean the cap in solvent and dry thoroughly with clean, compressed air.

WARNING: SOLVENT IS TOXIC. USE IN WELL-VENTILATED AREA. KEEP AWAY FROM FLAME.

(c) Lubricate and install a new O-ring packing in filter element.
(d) Lubricate and install a new O-ring packing on filter cap.
(e) Place filter element on centering boss of oil pump housing.
(f) Position filter cap over filter element and screw cap into oil pump housing. Tighten cap and lockwire.

CAUTION: DO NOT EXCEED TORQUE VALUE OF 25 POUND-INCHES WHEN TIGHTENING OIL FILTER CAP.

(23) Purge fuel system per par. 5.

5. Preserve APU

A. General

(1) This section contains instructions for preserving the APU to protect against corrosion during inactive periods. Preservation by periodic operation of the APU (every 7 days) is the recommended action. An optional method of preserving the APU for longer periods of time or when preservation by periodic operation is discontinued is also acceptable.

B. Equipment and Materials

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.

(1) Mineral Oil - MIL-L-6081, Grade 1010 or 1005
(2) Tape - 3M Company No. 481, Permacel P32, or equivalent
(3) Nonadherent covering - Mylar Polyethylene or Polyvinyl Chloride, or equivalent, per BAC5034 Type II, Class I, Grade A
(4) Alumifilm - Turco or Spraylat TR 5157-1

C. Preservation by Periodic Operation

(1) On day 1 and at 7-day intervals thereafter, operate APU at no-load governed speed for a minimum of 5 minutes.

D. Preservation by Optional Method (To be performed when preservation by periodic operation is discontinued)

(1) Start APU and operate at no-load governed speed for a minimum of 5 minutes, shut down APU and preserve while engine is hot.
(2) Open the following circuit breakers on panel P6:
(a) APU CONT

(3) Position BATTERY switch and APU START SWITCH to OFF and placard that APU maintenance is "in work".
(4) Open APU shutoff valve at left rear wing spar, accessible at left main wheel well area. Gain access to Tank No. 1 and disconnect fuel feed line at check valve. Drain fuel from APU and reconnect line.
(5) Open APU compartment access door latches and open door. Install door support rods.
(6) Support lower shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(7) Disconnect electrical harness from ignition unit.
(8) Disconnect engine fuel inlet hose from elbow on low pressure fuel filter and drain hose. Reconnect hose.
(9) Remove and discard low pressure filter in the fuel inlet line between the shroud and fuel control.
(10) Dip new fuel filter element in mineral oil and install with new packing.
(11) Disconnect high pressure fuel line from fuel atomizer and drain fuel into suitable container.
(12) Fabricate a fuel hose and connect one end to the high pressure line and place other end in 2-gallon container.
(13) Disconnect fuel supply line at shroud inlet port and connect to APU line a fabricated hose at least 2.5 feet long.
(14) Raise end of hose approximately 2 feet above shroud fuel inlet port and gravity feed mineral oil.
(15) Close the following circuit breaker on panel P6:
(a) APU CONT
(16) Place battery switch to ON position.
(17) Position APU master switch to START and release.

NOTE: APU master switch will return to ON. Engine motoring will begin after air inlet door and APU fuel valve have opened. After 90 seconds of motoring, motoring is automatically terminated.

(18) Position APU master switch to OFF.
(19) Repeat steps (17) and (18) until clear oil is seen from overboard drain line.

CAUTION: MAKE SURE YOU OBEY THE DUTY CYCLE LIMITS FOR THE STARTER MOTOR. DAMAGE TO THE STARTER MOTOR CAN OCCUR.

(20) Open following circuit breaker on panel P6:
(a) APU CONT

(21) Remove and discard fuel control unit high pressure fuel filter element. Re-install empty filter housing and tag to install new filter when depreserving unit.
(22) Remove drain hose from high pressure fuel line and reconnect line to fuel atomizer.
(23) Disconnect hose at shroud fuel inlet port and cap line with plug.
(24) Install cap on fuel supply line at shroud.
(25) Oil System Preservation (to be performed on or before day 61)
  (a) Remove oil tank drain plug and drain oil. Allow all oil to drain.
  (b) Remove and discard oil filter element and packing from oil pump assembly. Re-install empty filter housing and tag to install new filter when depreserving.
  (c) Replace oil tank drain plug using new packing.
(26) Unit Preservation (to be performed on or before day 61)

NOTE: The compressor air inlet must not be sprayed with preservative oil at any time.

  (a) Install and secure all APU access panels.
  (b) Apply protective coating of Turco Alumifilm or Spraylat TR 5157-1 on metal surfaces to be masked around air inlet, exhaust outlet and cooling air inlet in access door.
  (c) Mask off APU air inlet, exhaust outlet, and cooling air outlet in access door with approved polyethylene sheeting and masking tape No. 481 or equivalent.
  (d) Make sure that the APU master control switch and battery switch are in OFF position.
(27) Preservation Runs (to be performed on day 90 and at 30-day intervals for a maximum of 180 days)
  (a) Remove all masking on APU air inlet, exhaust outlet and cooling air outlet.
  (b) Fill oil tank to FULL mark on dipstick.
  (c) Close following circuit breakers on panel P6:
    1) APU CONT
  (d) Place APU master control switch and battery switch to ON position.
  (e) Position APU master control switch to START and release. Switch will return to ON and motoring will begin after air inlet door and APU fuel valve have opened. After 90 seconds, motoring is automatically terminated. Repeat cycle three times to achieve at least 3 minutes of motoring.
  (f) Drain oil from tank and replace drain plug.
  (g) Open APU control circuit breaker on panel P6.
  (h) Place APU master control switch and battery switch to OFF position.

(i) Install masking on air inlet, exhaust outlet, and cooling air outlet per par. 5.D.(26).

(28) On day 181, APU preservation may be renewed for an additional 180 days by performing steps 5.D.(1) thru 5.D.(27)(i).

(29) On day 361, APUs still inactive must be placed in service or removed from installation.

6. Purge APU Fuel System

A. General

(1) APU fuel system purging is divided into two groups, low pressure and high pressure purging. In either group, use of ac boost pump is required.

(a) Low pressure purging ensures fuel to be present at APU low pressure fuel filter.

(b) High pressure purging ensures fuel to be present at the atomizer. To ensure fuel being available at the atomizer, motoring APU is required.

B. Equipment and Materials

(1) Container - 2-gallon minimum capacity

(2) Fuel hose

NOTE: Fabricate fuel hose to reach container and mate with fitting on end of high pressure fuel line disconnected from fuel atomizer.

C. Low Pressure Fuel Line Purging

(1) Prepare to operate boost pump.

(a) Position BATTERY switch to OFF and placard.

(b) Make sure that all fuel system boost pump switches are OFF.

(c) Open APU compartment access door latches and open access door. Install door support rods.

(d) Support shroud, open shroud latches and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(e) Manually open APU fuel shutoff valve at left rear wing spar, accessible at left main wheel well area.

(2) Purge low pressure fuel line.

(a) Provide airplane with external power.

NOTE: No. 1 tank boost pump requires ac power.

(b) Position No. 1 tank forward boost pump switch to ON.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(c) Loosen fuel line at low pressure inlet (inlet side of low pressure fuel filter) just enough to allow trapped air to escape.
(d) Catch dripping fuel in container.
(e) Tighten fuel line fitting when all air has been expelled.
(f) Position APU master switch to OFF.
(g) Position No. 1 tank forward boost pump switch to OFF.
(h) Manually close APU fuel shutoff valve at left rear wing spar.
(i) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS, AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(j) Disengage APU compartment access door support rods and stow rods. Close and latch access door.

D. High Pressure Fuel Line Purging

(1) Prepare to motor APU.
(a) Provide airplane with external power.
(b) Position BATTERY switch to OFF and placard.
(c) Make sure that all fuel system boost pump switches are OFF.
(d) Open APU compartment access door latches and open access door. Install door support rods.
(e) Support shroud, open shroud latches and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(f) Disconnect ignition unit power supply electrical connector from ignition unit.
(g) Disconnect high pressure fuel line from fuel atomizer and connect fabricated hose. Place free end of hose into container.

(2) Purge high pressure fuel line.
(a) Position No. 1 tank forward boost pump to ON.

NOTE: No. 1 tank boost pump requires AC power. If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(b) Remove placard and position BATTERY switch to ON.
(c) Motor APU.
(d) Observe fuel flow into container. When fuel flow comes out in steady stream, free of air bubbles, position APU MASTER SWITCH to OFF.

CAUTION: PURGING HIGH PRESSURE FUEL LINES MAY REQUIRE MORE THAN ONE START CYCLE. TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (FIG. 202).

(e) Restore airplane to normal configuration.

7. APU Fuel System Leak Check (Fig. 205)
A. General
(1) Test of APU fuel supply system will check the integrity of the system for leaks which are causing pressure decay.
B. Equipment and Materials
(1) Pressure Gage - 0-100 psi
(2) Suitable hose
(3) Bulkhead tee fitting
C. Prepare for APU Fuel System Leak Check
(1) Position BATTERY switch to OFF and placard.
(2) Open APU compartment access door latches and open access door. Install door support rods.
(3) Support lower shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

D. Check APU Fuel System
(1) Disconnect fuel hose from inlet side of low pressure fuel filter assembly.
(2) Remove elbow fitting from inlet side of filter head. Remove and discard packing. Save fitting for installation on filter assembly.
(3) Install a bulkhead tee fitting in inlet port of filter head.
(4) Connect fuel hose to one side of the bulkhead tee fitting.

(5) Connect suitable hose and pressure gage to the other side of the bulkhead tee fitting.
(6) Remove placard and position BATTERY switch to ON.
(7) Open APU fuel valve by positioning APU MASTER SWITCH to ON.
(8) Connect external AC power to airplane.
(9) Position either the forward or aft No. 1 tank AC boost pump to ON.

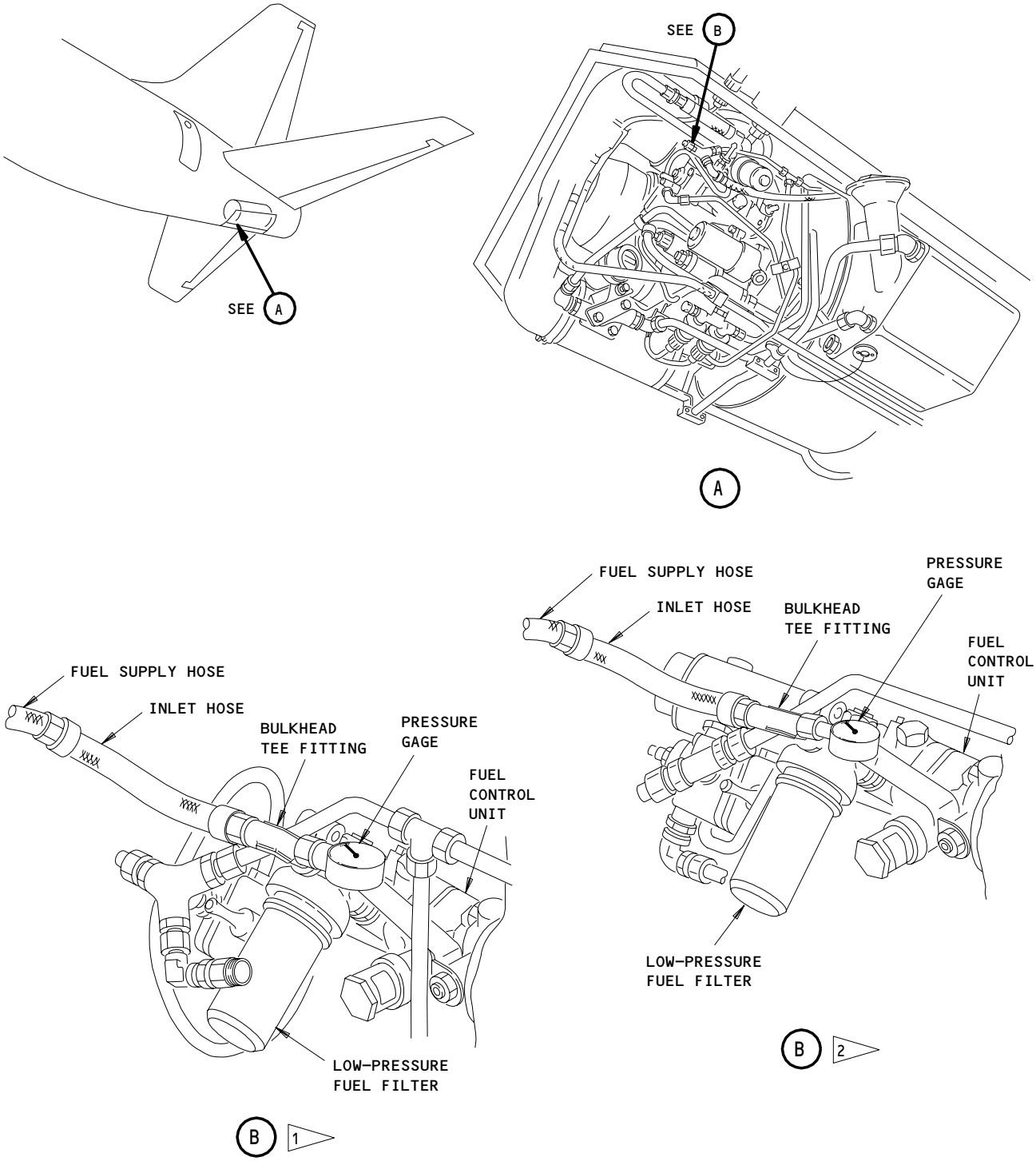
NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(10) Observe boost pressure (approximately 20 psig) on pressure gage.
(11) Close APU fuel valve by positioning APU MASTER SWITCH to OFF and placard.
(12) Position No. 1 tank AC boost pump switch to OFF.
(13) Observe fuel pressure at pressure gage:
(a) There should be no decay in pressure.
(b) Correct any leaks in the system which are causing pressure decay (APU fuel solenoid valve, check valve, etc.).
(14) Bleed off fuel pressure by loosening "B" nut at hose.
(15) Disconnect hose and pressure gage from bulkhead tee fitting.
(16) Disconnect fuel hose from other side of the bulkhead tee fittings.
(17) Remove bulkhead tee fitting from inlet port of filter head.
(18) Install elbow fitting with packing in inlet port of filter head.
(19) Connect fuel hose to inlet side of filter assembly.
(20) Restore airplane to normal configuration.
(a) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(b) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(c) Remove placard from BATTERY switch.

8. APU Control Air Pressure Line Leak Check (Fig. 206)
A. General
(1) The following procedure permits a quick economical means of checking for leak in control air pressure line.
B. Equipment and Materials
(1) Compressed air source
(2) Pressure Gage - 0-50 psig
(3) Standard tee fitting
(4) Air supply line



1 AIRPLANES WITHOUT THE ETC

2 AIRPLANES WITH THE ETC

Fuel Leakage Check
Figure 205

(5) Shutoff valve

C. Prepare for APU Control Pressure Air Line Leak Check

(1) Position BATTERY switch to OFF and placard.

(2) Open APU compartment access door latches and open access door. Install door support rods.

(3) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

D. Check APU Control Air Pressure Line Check

(1) Disconnect compressor discharge pressure line (control air pressure line) from compressor discharge orificed tee. Remove and save compressor discharge orificed tee for installation.

(2) Connect a standard tee fitting to control air pressure line.

(3) Connect a pressure gage, air supply line and shutoff valve to tee fitting.

(4) Plug acceleration limiter valve orificed vent (if installed) on the fuel control unit.

(5) Connect compressed air source to air supply line.

(6) Open shutoff valve and apply 40 psig pressure to control air pressure line.

(7) Close shutoff valve.

(8) Observe pressure gage.

(a) Pressure decay should not exceed 3 psi/minute.

(b) Correct any leaks in the control air pressure line.

(9) Disconnect compressor air source from air supply line.

(10) Remove plug from acceleration limiter valve orificed vent (if installed) on the fuel control unit.

(11) Disconnect a pressure gage, air supply line and shutoff valve from tee fitting.

(12) Disconnect a standard tee fitting from control air pressure line.

(13) Connect compressor discharge orificed tee to control air pressure line.

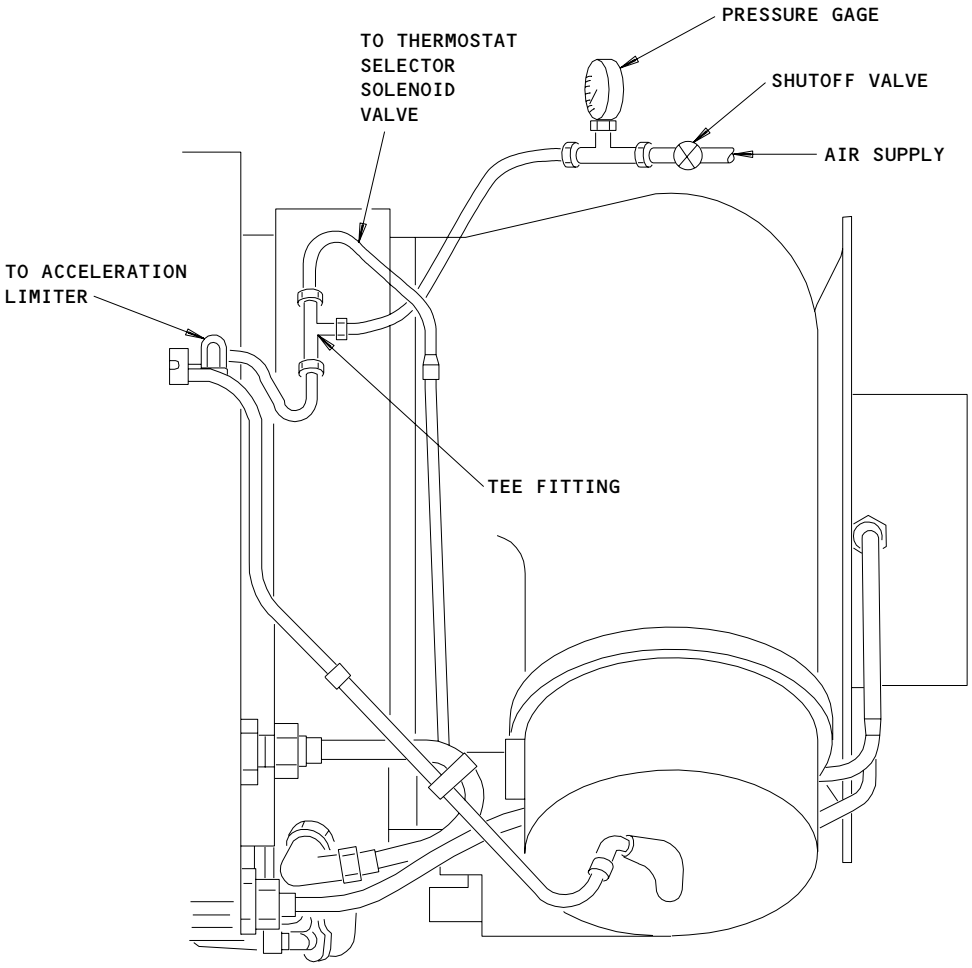
(14) Restore airplane to normal configuration.

(a) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(b) Disengage APU compartment access door support rods and stow rods. Close and latch access door.

(c) Remove placard from BATTERY switch.



APU Control Air Pressure Line Leak Check
Figure 206

9. Procedure Following Overtemperature During Start

A. General

(1) During start/acceleration cycle, if EGT exceeds Red Line (760°C), the following items must be accomplished to prevent reoccurrence.

B. Prepare for APU Examination

(1) Position BATTERY switch and APU start switch to OFF and placard that APU maintenance is "in work".

(2) Open circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.

(3) Open APU compartment access door latches and open access door. Install door support rods.

(4) Support lower shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(5) Remove combustor unit (AMM 49-31-42/401).

C. Examine APU

(1) Visually examine the hot section for evidence of distress.

(a) Turbine wheel tips for erosion/burning.

(b) Turbine wheel blades for erosion/rubbing.

(c) Nozzle guide vanes and torus for erosion.

(2) If examination indicates no evidence of distress, accomplish steps in par. D. and E. and return APU to service.

(3) If examination does indicated distress, the APU must be removed (AMM 49-11-0) for Hot Section Inspection (HSI) and necessary maintenance action.

NOTE: Instructions for performing HSI are outlined in Heavy Maintenance section of the APU Engine Overhaul Manual, AMM 49-20-31.

D. Recondition APU

(1) Replace combustor unit with a replacement unit (AMM 49-31-42/401).

(2) Replace fuel control unit (AMM 49-31-11/401).

(3) AIRPLANES WITHOUT THE ETC;
Replace the APU control thermostat (AMM 49-52-31/401).
(4) AIRPLANES WITH THE ETC;
Replace the proportional control valve (AMM 49-52-33/401).
(5) Check fuel drains for freedom from obstruction (AMM 49-12-0/701, AMM 49-31-71/601).
(6) Check airplane battery voltage (22 volts dc minimum).
(7) Close circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.
(8) Test APU (AMM 49-11-0/501).

E. Restore Airplane to Normal Configuration
(1) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(2) Disengage APU compartment access door support rods and stow rods. Close and latch access door.

10. Procedure to Remove and Install Tachometer Generator
A. General
(1) The tachometer generator should be installed on the APU whenever trouble shooting situations could be facilitated. The RPM indicator should be used in conjunction with EGT indicator, frequency meter and duct pressure indicator (Fig. 201).
B. Equipment and Materials
(1) RPM Indicator and Tachometer-Generator Test Set - F72891-1
C. Install test tachometer-generator on APU as follows:
(1) Position BATTERY switch to OFF and placard.
(2) Open APU compartment access door latches and open access door. Install door support rods.
(3) Support shroud, open shroud latches and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(4) Disconnect tachometer electrical connector from receptacle on coverplate.
(5) Remove nuts and washers attaching coverplate to APU and remove coverplate and gasket.
(6) Place tachometer-generator and new gasket on mounting pad, carefully aligning and mating drive shafts.
(7) Install tachometer generator mounting nuts and washers.
(8) Connect electrical connector to tachometer generator.
(9) Connect RPM indicator to tachometer generator.
(10) Remove placard from BATTERY switch.
D. Start APU per par. 2.B. and 2.C.
E. Observe RPM indicator.
F. Stop APU per par. 2.D.

G. Return airplane to normal configuration.
(1) Placard BATTERY switch.
(2) Disconnect indicator from tachometer generator.
(3) Disconnect electrical connector from tachometer generator.
(4) Remove tachometer generator and gasket.
(5) Install coverplate and new gasket using nuts and washers.
(6) Connect tachometer electrical connector to receptacle on coverplate.
(7) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

(8) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(9) Remove placard from BATTERY switch.

11. Bleeding The Timed Acceleration Fuel Control Unit (TAFCU)
A. General
(1) Some APUs use a TAFCU, when installing a new TAFCU the preservation oil needs to be bled from the unit.
B. Equipment and Materials
(1) Container - 2-gallon minimum capacity
C. Prepare to motor APU.
(1) Provide airplane with external power.
(2) Position BATTERY switch to OFF and placard.
(3) Open APU compartment access door latches and open access door. Install door support rods.
(4) Support shroud, open shroud latches and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(5) Disconnect ignition unit power supply electrical connector from ignition unit.
(6) Place container under the TAFCU.
(7) If TAFCU does not have priming valve, loosen the retaining plug one turn.

CAUTION: THERE IS A CHECK BALL AND SPRING BEHIND THE RETAINING PLUG. DO NOT COMPLETELY REMOVE THE SPRING RETAINING PLUG FOR THE PURGE PROCEDURE, ONLY LOOSEN IT ONE TURN. IF THE SPRING RETAINING PLUG IS COMPLETELY REMOVED FOR THE PURGE PROCEDURE, THE CHECK BALL AND SPRING WILL BE LOST. THE RESULT WILL BE HOT STARTS AND REDUCED APU HOT SECTION LIFE.

D. Purge TAFCU
(1) On TAFCU with priming valve, a second person will be required to push and hold the priming valve during the motoring procedure.

(2) Position No. 1 tank forward boost pump to ON.

NOTE: No. 1 tank boost pump requires ac power. If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

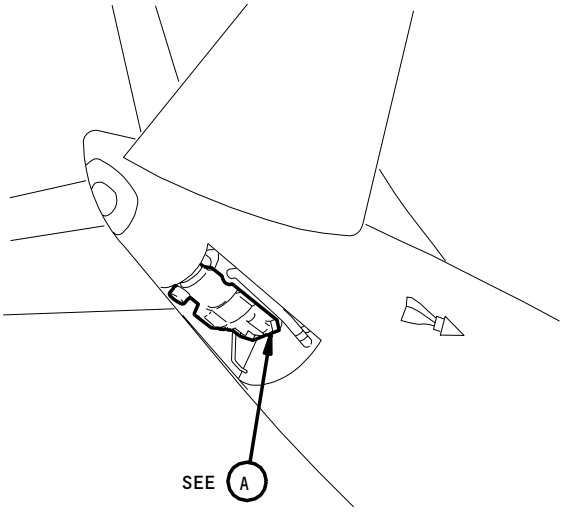
(3) Remove placard and position BATTERY switch power.
(4) Motor APU for 90 seconds.

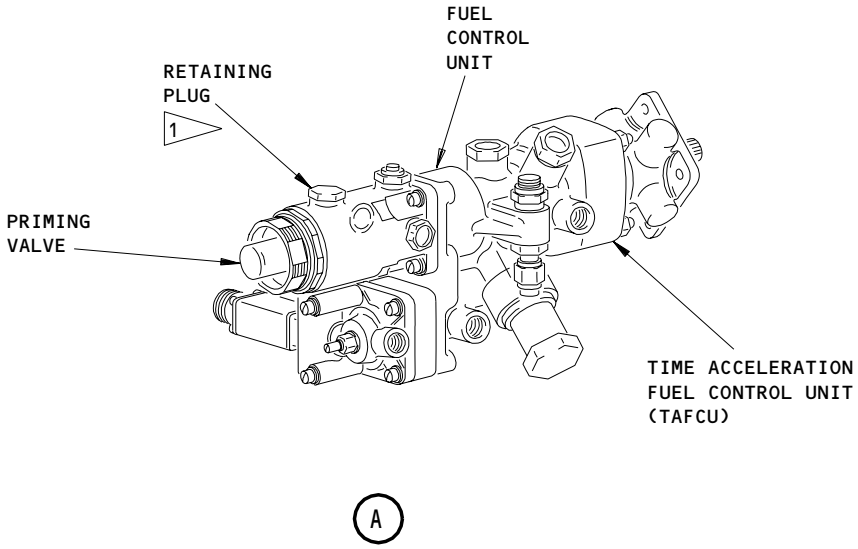
E. Restore Airplane to Normal Configuration

(1) Position No. 1 tank forward boost pump switch and BATTERY switch to OFF and placard.
(2) Connect ignition unit power supply electrical plug to ignition unit.
(3) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(4) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(5) Remove placard.





1 SOME FUEL CONTROLS USE A SPRING RETAINING PLUG ON THE ACCELERATION CONTROL ASSEMBLY

Fuel Control Unit Installation
Figure 207

APU POWER PLANT - REMOVAL/INSTALLATION

1. General
   A. This section covers removal/installation of the APU power plant, consisting of the APU engine, ac electrical generator, and engine mount brackets. The procedure given is for removal of the APU power plant and installation of a replacement unit. However, the same procedure can be used for maintenance of power plant. The unit may be lowered on an aero stand for replacement of the engine mount brackets or the ac electrical generator. Access to the ac electrical generator is gained simply by removing lower shroud, but due to the weight of the generator and space limitations, replacement of the generator is simplified if the APU power plant is lowered as described above.
2. Equipment and Materials
   A. Hoisting Cradle Assembly - F80002, or F80114-1 (preferred)
   B. Two Fishpole Hoist Assemblies - F80039-1, or PF51-003 (preferred, PF Industries 9320 15th South, Seattle, Washington 98108). Alternate Fishpole Hoist Assemblies, (10/3641 Hoist - Fishpole, Manual Powered (Quantity of 3) Didsbury Engineering Co. Ltd, Manor Road, Levenshulme, Manchester M19 3EJ).
   C. Transportation Dolly - F72950-2 superseded by F72950-127 or F72950-138 (for future procurement)
3. Prepare to Remove APU Power Plant
   A. Open the following circuit breakers on circuit breaker panel P6.
      (1) Fire DETECTION APU
      (2) APU GENERATOR CONTROL
      (3) APU CONT
      (4) HOT BAT, BAT BUS CONT
      (5) HOT BAT, GEN CONT
      (6) HOT BAT BUS
   B. Open the circuit breaker on M280 module - APU accessory unit on E3-3 electronic shelf.
   C. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   D. Open APU compartment access door latches and open door. Install door support rods.
   E. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

4. Remove APU Power Plant
   A. Install cradle base on APU power plant and secure in place with pins (Fig. 401).
   B. When using F80002 cradle, insert tubes in cradle base and secure in place with pins.

C. Install hoist assemblies to brackets in APU compartment with pins.

CAUTION: CHECK THAT HOIST CABLES ARE UNIFORMLY WRAPPED AROUND DRUMS BEFORE ATTEMPTING TO SUPPORT APU. CABLES THAT ARE NOT UNIFORMLY WRAPPED AROUND DRUMS CAN CAUSE A SHORT BUT SUDDEN DROP OF THE UNIT, IMPARTING A SHOCK LOAD TO THE HOIST AND FITTINGS.

D. Attach hoist cables to cradle assembly tubes with pins.
E. Pull hoist cables taut to remove load from APU engine mounts.
F. Disconnect APU harness, APU starter motor, and APU generator plugs from receptacles in upper shroud.
G. Disconnect APU generator control plug from receptacle in upper shroud.
H. Disconnect EGT indicating system plug from receptacle in upper shroud.
I. AIRPLANES WITH THE ETC; Disconnect the electronic temperature control (ETC) plug from receptacle in upper shroud.
J. Disconnect bleed load control air line from fitting in upper shroud.
K. Disconnect fuel hose from elbow on low pressure fuel filter (View 1, Fig. 401). Catch dripping fuel in a suitable container.
L. Disconnect fire detection sensor element plug from receptacle in upper shroud.
M. On airplanes with bonding jumpers, disconnect APU to upper shroud bonding jumper (Fig. 401, detail C).
N. Remove clamp attaching bleed air duct coupling to turbine plenum bleed air flange.
O. Push bleed air duct coupling outboard as far as it will go.
P. Move compressor air inlet duct lock handle outboard until heel of cam is free from spring arm. Rotate compressor plenum downward so that compressor air inlet opening in plenum no longer matches air inlet duct in upper shroud.
Q. Remove nuts, washers, and bolts fastening mount caps to engine mount brackets. Do not remove cap and mount bracket hinge bolts. Open mount caps.

NOTE: The weight of a dry APU is approximately 318-326 pounds (144-148 kilograms).

R. Lower power plant slowly. Guide unit to clear bleed air duct coupling, fuel line, and airplane structure.
S. After the unit is set on transportation dolly, slacken hoist cables.
T. Disconnect hoist cables from tubes by removing pins.
U. When using F80002 cradle, remove pins securing tubes to cradle base and remove tubes.

NOTE: If spare cradle bases are available, bases may be used for transportation and storage of APU power plants.

V. Inspect torque box, air inlet liner and aft bulkhead for cracks. If cracks are found refer to the structural repair manual for damage limits.

5. Install APU Power Plant
   A. Position APU power plant, installed on a cradle base, directly under APU compartment.
   B. When using F80002 cradle, insert tubes in cradle base and secure in place with pins (Fig. 401).
   C. Connect hoist cables to tubes with pins.
   D. Rotate compressor plenum air inlet opening down.
   E. Slowly raise APU power plant. Guide unit to clear airplane structure.

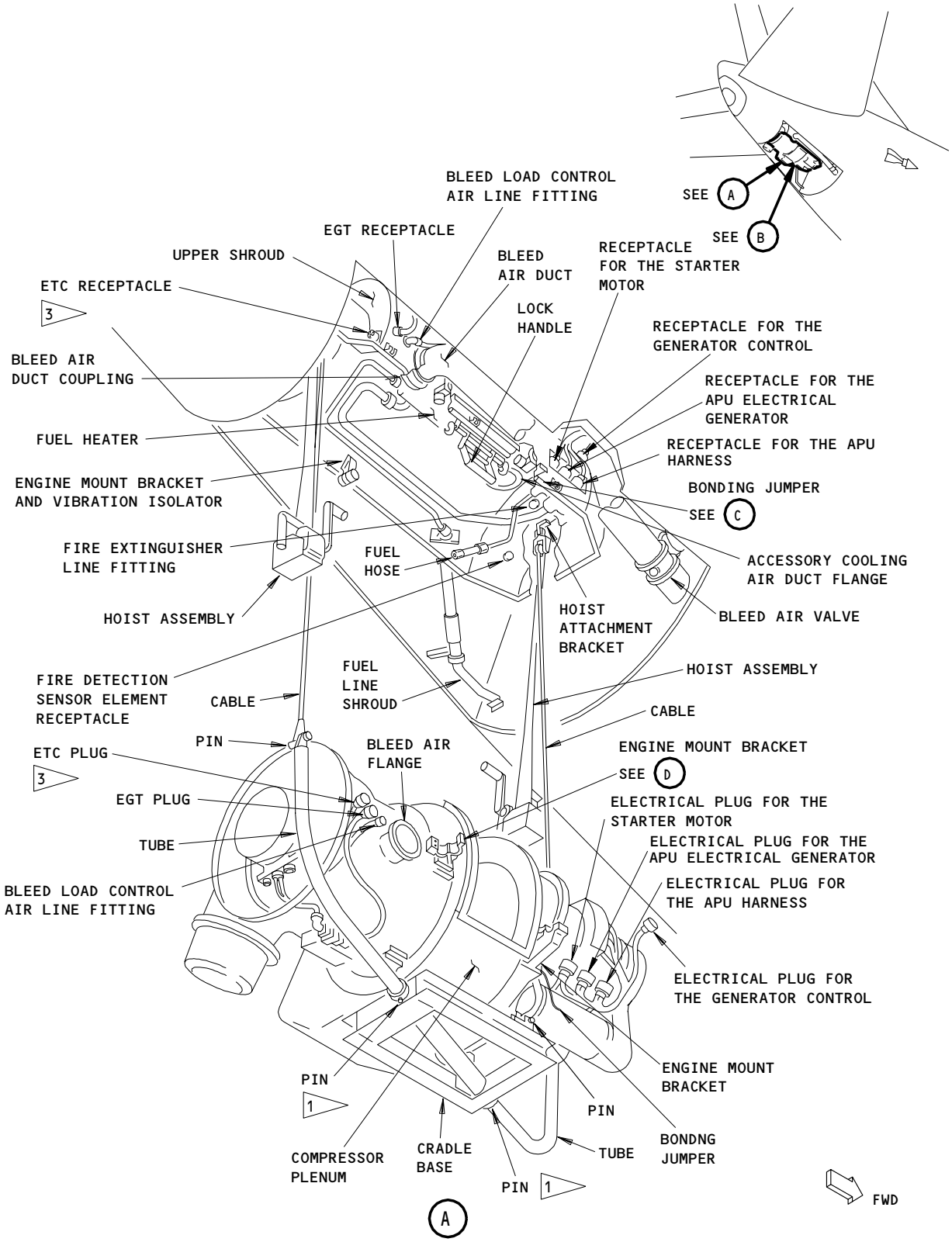
      NOTE: The weight of a dry APU is approximately 318-326 pounds (144-148 kilograms).

      CAUTION: WHILE RAISING APU, CHECK THAT CABLES WRAP UNIFORMLY AROUND DRUMS. IF CARE IS NOT TAKEN WHILE RAISING UNIT, CABLES MAY BECOME TANGLED ON DRUMS. THIS CAN CAUSE A SHORT BUT SUDDEN DROP OF THE UNIT, IMPARTING A SHOCK LOAD TO THE HOIST AND FITTINGS.

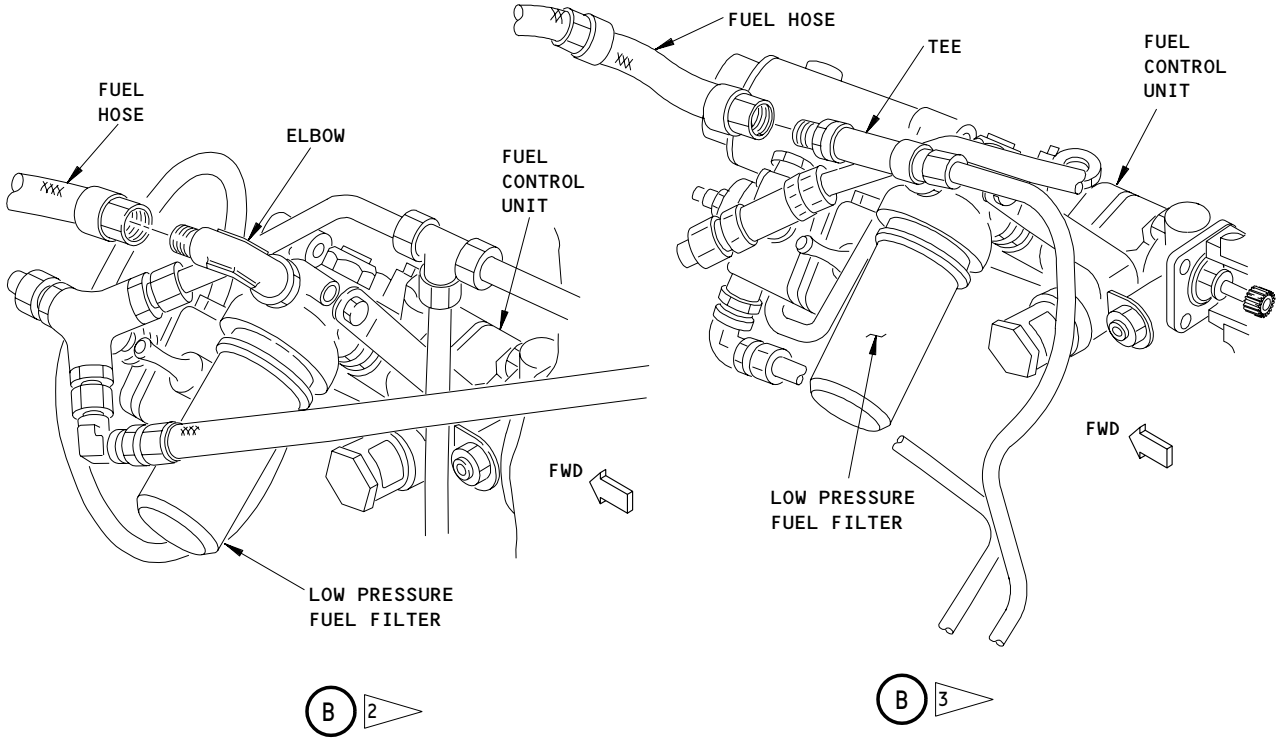
   F. When power plant is nearly in place, stop hoisting operation and make following checks:
      (1) Ensure that mount caps do not interfere with installation.
      (2) Check that cooling air inlet duct seal is properly aligned with cooling air fan flange.
      (3) Align compressor plenum air inlet flange with upper shroud air inlet duct and guide into place as APU is raised.
   G. Raise APU slowly into place.

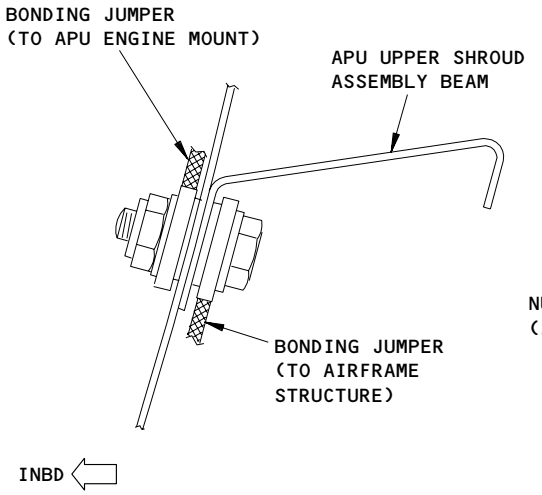
      CAUTION: AVOID ANY SIDEWAYS MOVEMENT OF THE APU OVER THE LAST ONE-INCH OF TRAVEL. THIS COULD CAUSE THE COOLING AIR INLET DUCT SEAT TO BE MISALIGNED WITH THE COOLING FAN FLANGE AND IMPAIR THE COOLING AIR SYSTEM.

   H. With the APU in place, make sure the seal of the cooling air inlet duct is touching the cooling fan flange:
      (1) APU's WITH A SEAL CLAMP; If the seal is not touching the cooling fan flange, adjust the seal:
         (a) Lower the APU.
         (b) Loosen the seal clamp and pull the seal down the necessary distance for the seal to touch the cooling fan flange.
         (c) Tighten the seal clamp.
         (d) Lift the APU into its position.



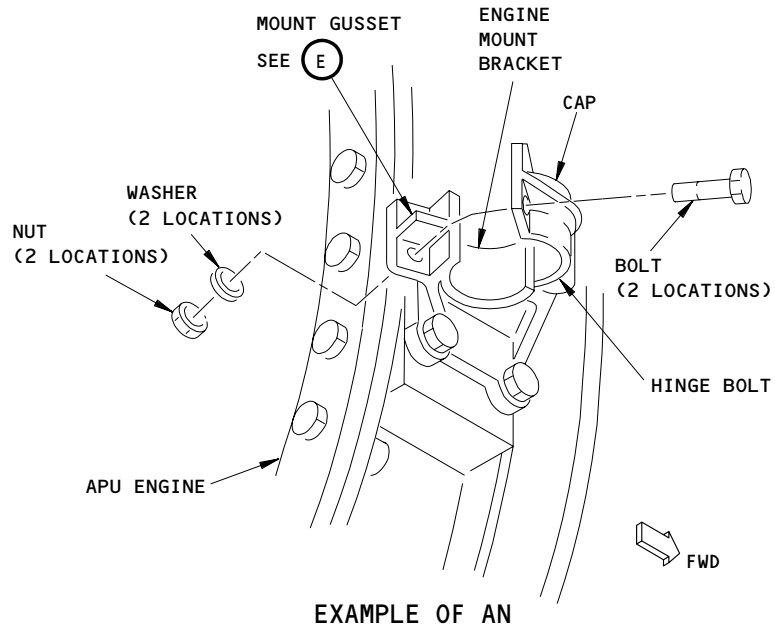
APU Power Plant Installation
Figure 401 (Sheet 1)





BONDING JUMPER INSTALLATION

C



EXAMPLE OF AN ENGINE MOUNT BRACKET

D 4

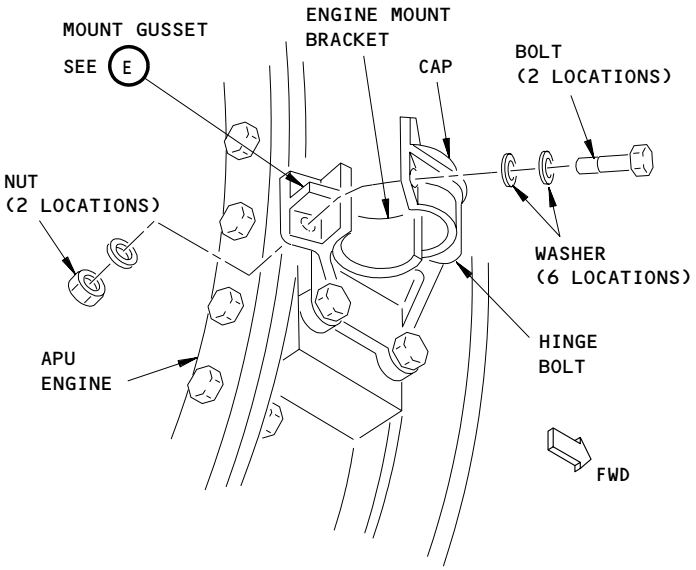
1 APPLICABLE TO F80002 CRADLE ASSEMBLY ONLY

2 AIRPLANES WITHOUT THE ETC

3 AIRPLANES WITH THE ETC

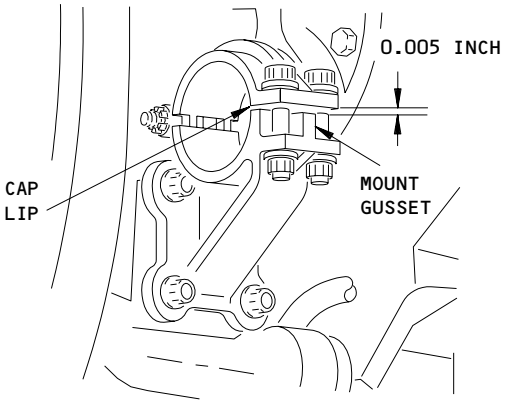
4 APUs WITHOUT TWO WASHERS BELOW THE BOLT HEAD (PRE-SB 49-1031)

APU Power Plant Installation
Figure 401 (Sheet 2)



EXAMPLE OF AN ENGINE MOUNT BRACKET

D 5



EXAMPLE OF A CAP AND
MOUNT GUSSET ADJUSTMENT

E

5 APUs WITH TWO WASHERS BELOW THE BOLT HEAD (POST-SB 49-1031)

APU Power Plant Installation
Figure 401 (Sheet 3)

(2) APU's WITHOUT A SEAL CLAMP
If there is a clearance between the cooling fan flange and the seal for the cooling air duct, close the clearance (Fig. 402):
(a) Lift or lower the APU by pulling or pushing the APU gearbox assembly until the seal is lightly compressed by the cooling fan flange.

NOTE: Lowering the right aft mount on the APU will lift the cooling fan flange and compress the seal. Lifting the right aft mount will lower the cooling fan flange and make the seal not compressed.

(b) Measure the distance from the bottom of the vibration isolator on the right aft mount to the bottom of the cap on the engine mount bracket.

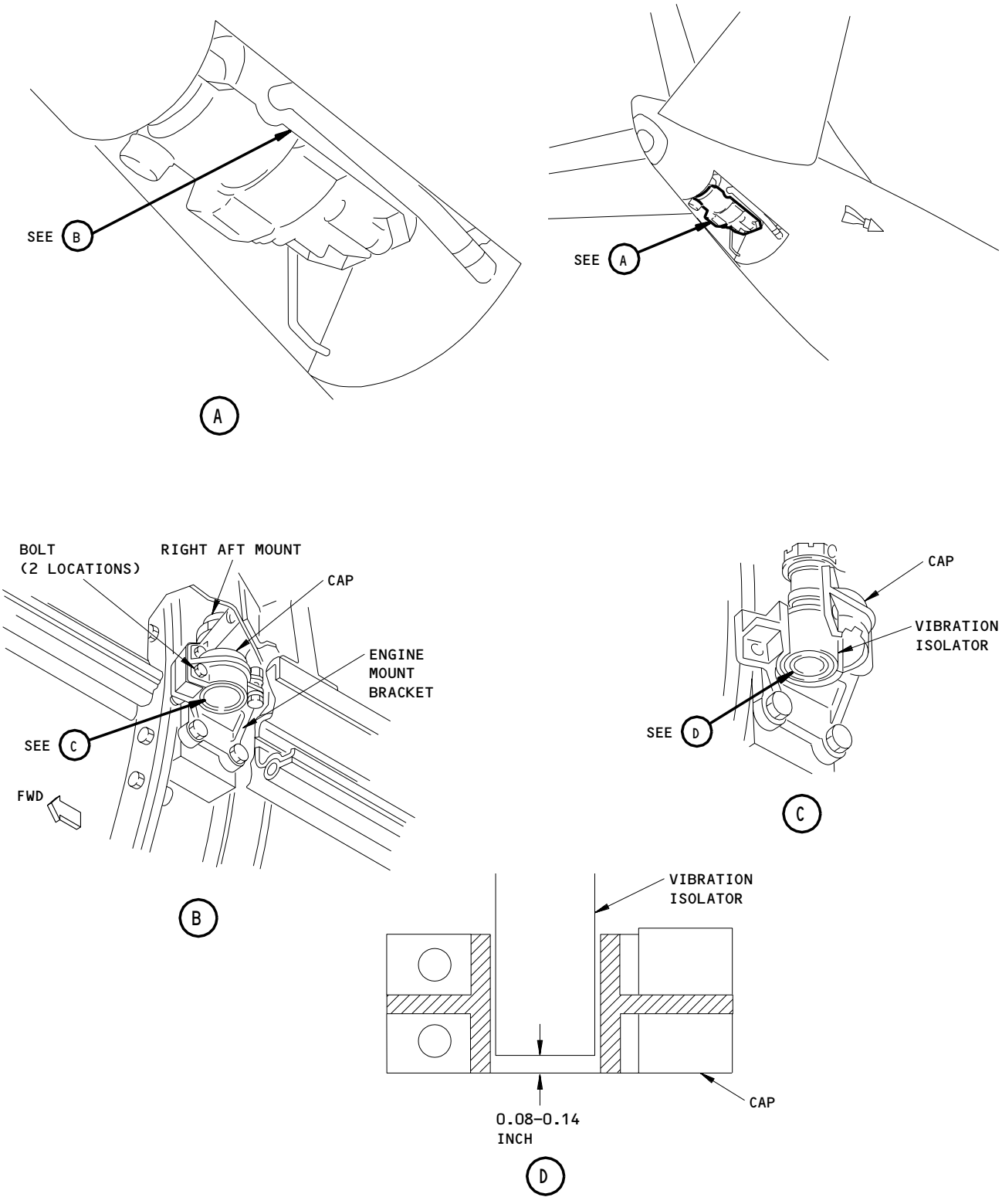
NOTE: The clearance between the vibration isolator and the cap must be 0.08-0.14 inches.

(c) Do the above adjustment steps again until the clearance between the vibration isolator and the cap is correct.

I. Close mount caps and install bolts, washers, and nuts. Tighten nuts to a torque range of 30 to 40 pound-inches.

NOTE: Ensure minimum gap of 0.005 inch between cap lip and mount gusset after torquing. This will ensure positive clamp-up on vibration isolator.

J. Rotate compressor plenum to match compressor air inlet opening in plenum with air inlet duct in upper shroud.
K. Move compressor air inlet duct lock handle inboard until heel of cam falls behind spring arm. Install locking screws and nuts (2) to secure locking handle.
L. Slide bleed air duct coupling inboard as far as it will go.
M. Install clamp attaching bleed air duct coupling to turbine plenum bleed air flange. Tighten clamp-coupling nut to a torque range of 45 to 55 pound-inches.
N. Connect fuel hose to elbow on low-pressure fuel filter (View 1, Fig. 401).
O. Connect fire detection sensor element plug to receptacle on upper shroud and safety wire.
P. Connect bleed load control air line to fitting in upper shroud.
Q. AIRPLANES WITH THE ETC; Connect the electronic temperature control (ETC) plug to receptacle upper shroud and safety wire.
R. Connect EGT indicating system plug to receptacle in upper shroud and safety wire.



Right Aft mount Adjustment
Figure 402

S. Connect APU generator control plug to receptacle in upper shroud and safety wire.
T. Connect APU harness, APU starter motor, and APU generator plugs to receptacles in upper shroud and safety wire connectors.
U. Slacken hoist cables and disconnect cables from tubes by removing pins.
V. When using F80002 cradle, remove pins securing tubes to cradle base and remove tubes.
W. Remove pins securing cradle base to APU power plant and remove base.
X. Remove pins securing hoist to brackets in APU compartment and remove hoists.
Y. On airplanes with bonding jumpers, connect APU to upper shroud bonding jumper (Fig. 401, Detail C).
Z. Depreserve or purge the fuel system by motoring (AMM 49-11-0/201).

6. Restore Airplane to Normal Configuration

A. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

B. Disengage APU compartment access door rods and stow rods. Close and latch access door.
C. Close the following circuit breakers on circuit breaker panel P6.
(1) FIRE PROTECTION, DETECTION APU
(2) APU GENERATOR CONTROL
(3) APU CONT

AUXILIARY POWER UNIT - ADJUSTMENT/TEST

1. General
   A. This section provides adjustment/test procedures using airplane instrumentation. For adjustment/test procedure using the AlliedSignal tester, refer to AMM 49-21-0/501.
   B. The APU is tested by accomplishing the following:

      CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201).

      (1) Operating the APU under a "loaded" condition and observing that APU operates within defined limits
      (2) A fuel control unit acceleration limiter valve cracking pressure (opening) test
      (3) A fuel control unit governor speed setting test under a NO LOAD condition
      (4) Bleed air valve opening rate test
   C. The APU does not require any adjustments other than those specified as an integral part of the APU operational test. Procedures for operating the APU are given in AMM 49-11-0/201. You must do the APU operation test - LOADED CONDITION after you replace the APU, fuel control unit or bleed air valve. It is not necessary to do the cracking pressure test for the acceleration limiter valve or governor speed setting test under a NO LOAD condition for the fuel control unit after you replace the APU, fuel control unit or bleed air valve. It is not necessary to do the opening rate test for the bleed air valve after you replace the APU, fuel control unit or bleed air valve. You can use these tests for troubleshooting or adjustments of the fuel control unit or bleed air valve.
   D. Design parameters and operating characteristics determine operating limits of the engine. If the limits listed in AMM 49-11-0/201 are exceeded, the engine must be shut down immediately and the malfunction corrected.
2. APU Operational Test
   A. Equipment and Materials
      (1) Pressure Gage and Case Set - 282645, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
      (2) RPM Indicator and Tachometer Generator Test Set - F72891-1
      (3) AIRPLANES WITHOUT THE TAFCU; Screwdriver and Wrench Assembly - 280353, AlliedSignal, Inc.
      (4) AIRPLANES WITH THE TAFCU; Jamnut Wrench - 833275-1, AlliedSignal, Inc.
      (5) AIRPLANES WITH THE TAFCU; Adjuster Wrench - 833274-1, AlliedSignal, Inc.
      (6) High-pressure hose - 1/4 inch inside diameter, commercially available

B. Test APU Operation - LOADED CONDITION
(1) Operate APU (AMM 49-11-0/201).

CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201).

(2) With "no load" applied, engine speed should stabilize at 405-410 CPS as indicated on generator frequency meter.
(3) Position air conditioning L PACK and R PACK valve switches to ON.
(4) Make sure the engines 1 and/or 2 BLEED switches on the P5 forward overhead panel are in the OFF position.
(5) Check that ISOLATION VALVE is in AUTO position.
(6) On forward overhead panel, position APU BLEED AIR valve switch to ON.
(7) Observe engine frequency on frequency meter at load application.
(8) Move air conditioning control cabin temperature selector to MANUAL COLD until air mix valves indicate COLD.
(9) Observe engine speed at full bleed load operation on frequency meter. Stabilized generator frequency under load should not be more than 10 CPS below that observed in (2).
(10) Incrementally add 60 amps additional electrical load to APU generator.
(11) Observe engine exhaust gas temperature on indicator at full bleed air load operation ("loaded" condition).
(12) AIRPLANES WITHOUT THE TAFCU; With a full load applied to the APU, the EGT must become stable between 620-650°C.
(a) If it is necessary to adjust the APU control thermostat to a higher EGT set-point, adjust the APU control thermostat (AMM 49-52-31/501).

NOTE: For extended APU service life, the EGT set-point is set at the lower EGT limit range. A lower EGT set-point may cause main engine start problems. A higher EGT set-point will correct the main engine start problems.

(13) AIRPLANES WITH THE TAFCU; With a full load applied to the APU, the EGT must agree with the operation limits (Fig. 502).
(a) If it is necessary to adjust the ETC to a higher EGT set-point, adjust the ETC (AMM 49-61-71/501).

NOTE: For extended APU service life, the EGT set-point for the ECS mode is set at the lower EGT limit range. The EGT limit range is 566 to 650°C. A higher EGT set-point causes better ECS performance.

(14) Remove electrical load (as required).

(15) Position air conditioning R PACK and L PACK valve switches to OFF.
(16) Position APU BLEED AIR valve switch to OFF.
(17) Allow engine to operate at "no load" governed frequency for one minute (minimum).
(18) Position APU master switch to OFF.

C. Fuel Control Unit Acceleration Limiter Valve Cracking Pressure (Opening) Test.

NOTE: It is not necessary to do the cracking pressure (opening) test for the acceleration limiter valve on the fuel control unit after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting or cracking pressure (opening) adjustment of the fuel control unit. Prior to performing fuel control unit acceleration limiter valve cracking pressure (opening) test, operate APU at "no-load" condition for approximately 5 minutes. This will ensure that fuel is available to the APU, and, if the fuel control unit was changed, will remove preservative oil from the fuel control unit.

(1) Prepare for fuel control unit acceleration limiter valve cracking pressure (opening) test (Fig. 501).
(a) Prepare to operate APU (AMM 49-11-0/201).
(b) Position BATTERY switch to OFF and placard.
(c) Open all fuel system boost pump circuit breakers on aft overhead panel P6-3.
(d) Open APU compartment access door latches and open door. Install door support rods.
(e) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(f) Remove cap from control air pressure port on fuel control unit.
(g) Disconnect high pressure fuel supply line at fuel atomizer assembly.
(h) Connect test pressure gage to high pressure fuel supply line.
(i) Close the fuel system boost pump circuit breakers.
(j) Position BATTERY switch to ON and remove placard.

(2) Test fuel control unit acceleration limiter valve cracking pressure (opening).

(a) Position APU master switch to START and release.

NOTE: APU master switch will return to ON. Engine motoring will begin after air inlet door and APU fuel valve have opened. Make sure the fuel boost pump is operating. After approximately 90 seconds of motoring, motoring is terminated by a time limiting device in APU control unit.

(b) While engine is motoring, loosen fuel line nut at pressure test gage, and bleed trapped air from line and tighten nut.

(c) AIRPLANES WITHOUT THE TAFCU;
As the APU engine rpm becomes stable, observe the cracking pressure for the acceleration limiter valve. The cracking pressure should be 60 +3 psig.

(d) AIRPLANES WITH THE TAFCU;
As the APU engine rpm becomes stable, observe the cracking pressure for the acceleration limiter valve. The cracking pressure should be 60 +5 psig (414 +34kPa).

(e) AIRPLANES WITHOUT THE TAFCU;
If the cracking pressure is to low, replace control unit. Do not adjust. If the cracking pressure is greater then 60 ±3 psig, adjust the acceleration limiter valve as follows:

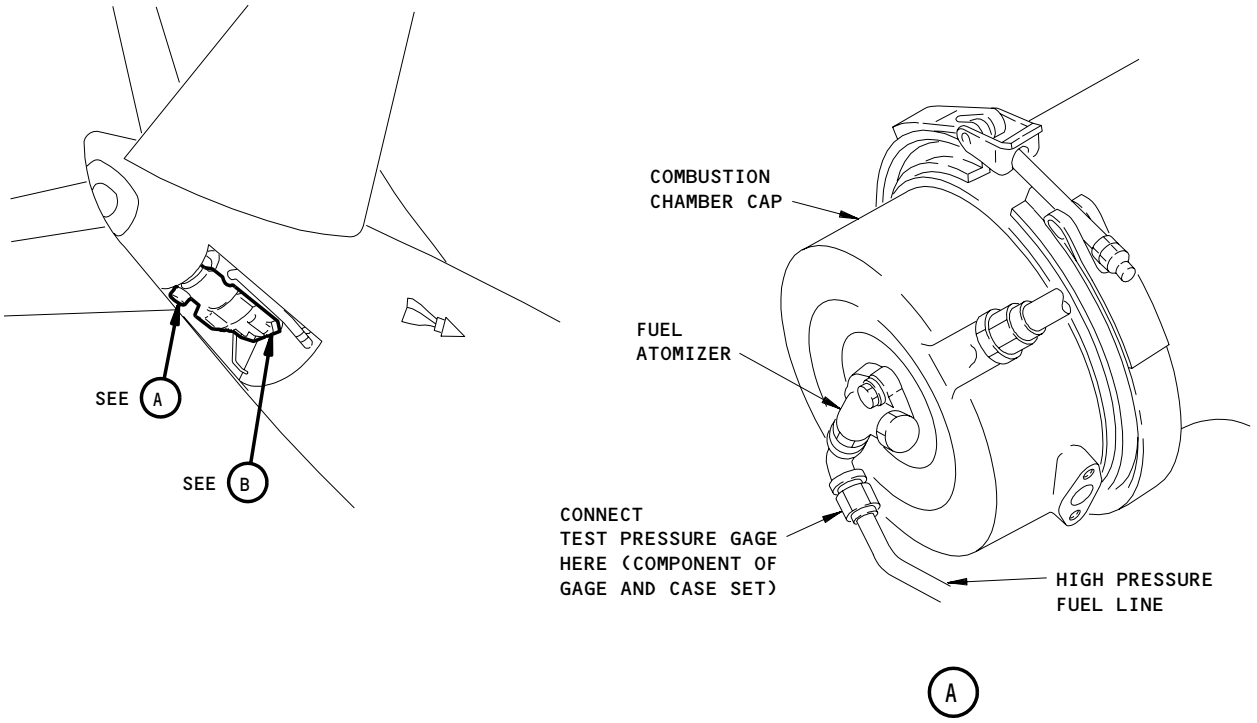
1) Remove the lockwire from the locknut for the valve adjustment screw.
2) Loosen the locknut on the valve adjustment screw.
3) If the cracking pressure is too high, turn the valve adjustment screw counterclockwise.

NOTE: A full turn of the adjustment screw is the same as approximately 8-10 psig change.

4) Tighten the locknut on the valve adjustment screw.
5) Install a lockwire on the locknut for the valve adjustment screw.

(f) AIRPLANES WITH THE TAFCU;
If the cracking pressure is more than 65 psig (448 kPa), or less than 55 psig (380 kPa), replace the timed acceleration fuel control unit (AMM 49-31-11/401).

(g) Position APU master switch to OFF.



1 AIRPLANES WITHOUT THE TAFCU
2 AIRPLANES WITH THE TAFCU

Fuel Control unit Adjustments
Figure 501

(h) After air inlet door has closed, repeat steps (a) and (c) thru (h) until fuel control acceleration limiter valve adjustment is satisfactory.

CAUTION: MAKE SURE YOU OBEY THE DUTY CYCLE FOR THE STARTER MOTOR (AMM 49-11-0/201). DAMAGE TO THE STARTER MOTOR CAN OCCUR.

(3) Restore airplane to normal configuration (Fig. 501).
(a) Position BATTERY switch to OFF and placard.
(b) Open the fuel boost pumps circuit breakers.
(c) Disconnect test pressure gage from high pressure fuel line.
(d) Connect high pressure fuel line at fuel atomizer assembly.
(e) Install cap on control air pressure port on fuel control unit.
(f) Remove placard from BATTERY switch.
(g) Activate fuel boost pumps as required.
(h) APU WITH ALLIEDSIGNAL SB GTCP85-49-7096;
Examine the atomizer fuel line for leakage:
1) Start and operate the APU (AMM 49-11-0/201).
2) During the APU operation, examine the atomizer fuel line for leakage.
3) Do the APU normal shutdown (AMM 49-11-0/201).
4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
5) If you found leakage, repair the cause of it.
(i) APU WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096;
Examine the atomizer fuel line for leakage:
1) Start and operate the APU (AMM 49-11-0/201).
2) Do the APU normal shutdown (AMM 49-11-0/201).
3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
4) Visually examine the atomizer fuel line for any signs of leakage.
a) If you found signs of leakage, repair the cause of it.
(j) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE P LUMBING, FIRE DETECTOR CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

(k) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(l) Remove the DO-NOT-OPERATE tag from the APU master switch on the P5 forward overhead panel.

D. Test Fuel Control Unit Governor Speed Setting - NO LOAD

NOTE: It is not necessary to do the governor speed setting test for the fuel control unit after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting and governor speed adjustment of the fuel control unit.

(1) Position BATTERY switch to OFF and placard.
(2) Open APU compartment access door latches and open door. Install door support rods.
(3) Support lower shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(4) Remove placard from BATTERY switch.
(5) Start APU (AMM 49-11-0/201).

CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201).

(6) With no load applied, APU frequency meter should stabilize at 405-410 Hz.
(7) If steady state "no-load" governed frequency is not within limits, install tachometer-generator (AMM 49-11-0/201).
(8) Start APU (AMM 49-11-0/201).
(9) Compare "no load" governed frequency in conjunction with the RPM indicator.

NOTE: If the speed is out of limits, adjust no more than 1/12 (half a flat of nut) of a turn. Any adjustment of the Governor greater than 1/12 of a turn requires a check of the fuel control crack pressure.

(10) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITHOUT THE ETC;
if the stable APU frequency is not between 405-410 Hz, adjust the governor for the fuel control unit:
(a) Do the APU normal shutdown (AMM 49-11-0/201).
(b) Use the screwdriver and wrench assembly to loosen the locknut on the governor adjustment screw.
(c) If the APU frequency is too low, turn the governor adjustment screw clockwise.
(d) If the APU frequency is too high, turn the governor adjustment screw counterclockwise.
(e) Tighten the locknut on the governor adjustment screw.

(11) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITHOUT THE ETC;
if the stable APU frequency is not between 405-410 Hz, adjust the governor for the fuel control unit:
(a) Use the screwdriver and wrench assembly to loosen the locknut on the governor adjustment screw.
(b) If the APU frequency is too low, turn the governor adjustment screw clockwise.
(c) If the APU frequency is too high, turn the governor adjustment screw counterclockwise.
(d) Tighten the locknut on the governor adjustment screw.

(12) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITH THE ETC;
if the stable APU frequency is not between 405-410 Hz, adjust the governor for the fuel control unit.
(a) Do the APU normal shutdown (AMM 49-11-0/201).
(b) Use the jamnut wrench to loosen the jamnut on the governor adjustment nut.
(c) If the APU frequency is too low, turn the governor adjustment nut clockwise with the adjuster wrench.
(d) If the APU frequency is too high, turn the governor adjustment nut counterclockwise with the adjuster wrench.
(e) Tighten the jamnut on the governor adjustment nut.

(13) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITH THE ETC;
if the stable APU frequency is not between 405-410 Hz, adjust the governor for the fuel control unit.
(a) Use the jamnut wrench to loosen the jamnut on the governor adjustment nut.
(b) If the APU frequency is too low, turn the governor adjustment nut clockwise with the adjuster wrench.
(c) If the APU frequency is too high, turn the governor adjustment nut counterclockwise with the adjuster wrench.
(d) Tighten the jamnut on the governor adjustment nut.

(14) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096;
do the APU normal shutdown (AMM 49-11-0/201).

(15) Do the above test steps again until the governor speed adjustment is correct.

(16) Placard BATTERY switch.

(17) Restore airplane to normal configuration.
(a) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

(b) Disengage APU compartment access door support rods and stow rods. Close and latch access door.

(18) Remove placard from BATTERY switch.

E. Bleed Air Valve Opening Rate Test

NOTE: It is not necessary to do the opening rate test for the bleed air valve after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting or adjustment of the bleed air valve.

(1) Check that APU BLEED AIR switch is closed.
(2) Perform steps 2.B.(1) thru 2.B.(9).
(3) Position APU BLEED AIR switch to CLOSE (allow duct pressure to stabilize at zero).
(4) Position APU BLEED AIR switch to OPEN.
(5) Measure time from actuation of APU BLEED VALVE switch to stabilize minimum frequency reading. This should occur within 12 to 14 seconds.

NOTE: APU bleed air (load control) valve opening should occur 12 to 14 seconds from time APU bleed air valve switch is actuated till time frequency meter indicates minimum frequency. In addition, the duct pressure indicator will show minimum duct pressure, indicating that the bleed air (load control) valve has reached full open position.

(6) Position air conditioning R PACK and L PACK valve switch to OFF.
(7) Position APU BLEED AIR switch to CLOSE.
(8) Allow engine to operate at "no load" governed frequency for one minute minimum.
(9) Position APU master switch to OFF.
(10) If time in step (5) was not met, adjust bleed air valve rate control adjustment screw as follows:

NOTE: There are two configurations of rate control adjustment screw. Each requires certain precautions when making adjustments.

FULLY LOADED CONDITION [1]
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
0	-18	516 ±10
2	-17	519 ±10
4	-16	521 ±10
6	-14	524 ±10
8	-13	527 ±10
10	-12	529 ±10
12	-11	532 ±10
14	-10	534 ±10
16	-9	537 ±10
18	-8	540 ±10
20	-7	542 ±10
22	-6	545 ±10
24	-4	548 ±10
26	-3	550 ±10
28	-2	553 ±10
30	-1	556 ±10
32	0	558 ±10
34	1	561 ±10
36	2	563 ±10
38	3	566 ±10
40	4	569 ±10
42	6	571 ±10
44	7	574 ±10
46	8	577 ±10
48	9	579 ±10

TABLE 1

[1] EGT INDICATION WITH THE APU IN THE FULLY LOADED CONDITION (BOTH A/C PACKS ON HIGH AND A 100 AMP ELECTRICAL LOAD) WITH A T2 BIAS FROM THE ETC (EGT SET-POINT AT 621°C).

Operation Limits
Figure 502 (Sheet 1)

FULLY LOADED CONDITION 1

APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
50	10	580 ±10
52	11	584 ±10
54	12	588 ±10
56	13	590 ±10
58	14	592 ±10
60	16	595 ±10
62	17	598 ±10
64	18	600 ±10
66	19	603 ±10
68	20	606 ±10
70	21	608 ±10
72	22	611 ±10
74	23	613 ±10
76	24	616 ±10
78	26	619 ±10
80	27	621 ±10
82	28	621 ±10
84	29	621 ±10
86	30	621 ±10
88	31	621 ±10
90	32	621 ±10
92	33	621 ±10
94	34	621 ±10
96	36	621 ±10
98	37	621 ±10
100	38	621 ±10
102	39	621 ±10
104	40	621 ±10
106	41	621 ±10
108	42	621 ±10

TABLE 1 (CONT)

Operation Limits
Figure 502 (Sheet 2)

452593

CONDITION FOR A MAIN ENGINE START [2]
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
0	−18	586 ±10
2	−17	588 ±10
4	−16	591 ±10
6	−14	594 ±10
8	−13	596 ±10
10	−12	599 ±10
12	−11	601 ±10
14	−10	604 ±10
16	−9	607 ±10
18	−8	609 ±10
20	−7	612 ±10
22	−6	615 ±10
24	−4	617 ±10
26	−3	620 ±10
28	−2	622±10
30	−1	625 ±10
32	0	628 ±10
34	1	630 ±10
36	2	633 ±10
38	3	636 ±10
40	4	639 ±10
42	6	641 ±10
44	7	643 ±10
46	8	646 ±10
48	9	649 ±10
50	10	651 ±10
52	11	654 ±10
54	12	657 ±10
56	13	659 ±10
58	14	662 ±10

TABLE 2

[2] EGT INDICATION WITH THE ETC IN THE MODE FOR A MAIN ENGINE START WITH A T2 BIAS.

Operation Limits
Figure 502 (Sheet 3)

CONDITION FOR A MAIN ENGINE START 2
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
60	16	664 ±10
62	17	667 ±10
64	18	670 ±10
66	19	672 ±10
68	20	675 ±10
70	21	678 ±10
72	22	680 ±10
74	23	683 ±10
76	24	685 ±10
78	26	688 ±10
80	27	690 ±10
82	28	690 ±10
84	29	690 ±10
86	30	690 ±10
88	31	690 ±10
90	32	690 ±10
92	33	690 ±10
94	34	690 ±10
96	36	690 ±10
98	37	690 ±10
100	38	690 ±10
102	39	690 ±10
104	40	690 ±10
106	41	690 ±10
108	42	690 ±10

TABLE 2 (CONT)

Operation Limits
Figure 502 (Sheet 4)

(a) Make sure BATTERY switch is OFF and placard.
(b) Open APU compartment access door latches and open access door. Install door support rods.
(c) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

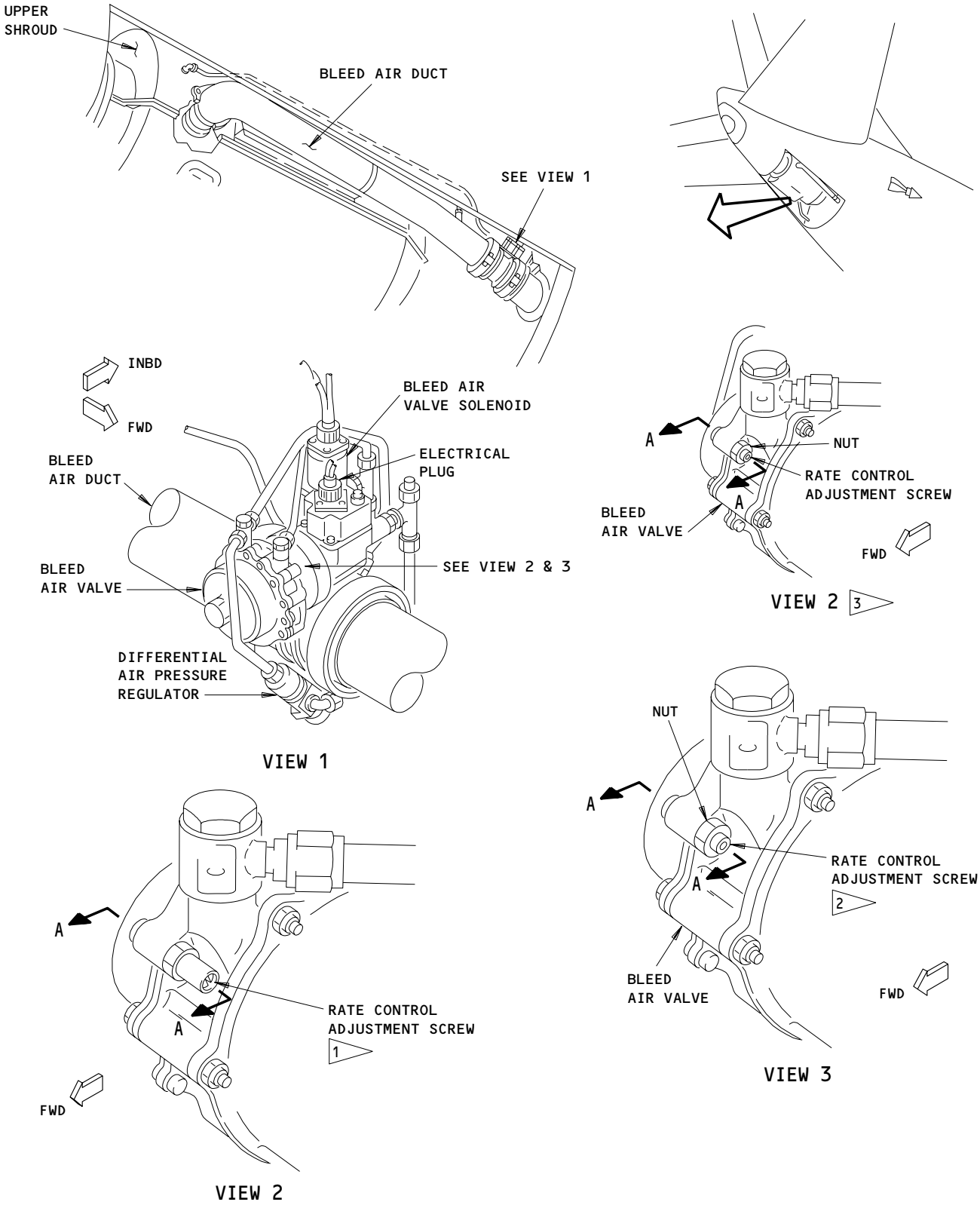
(d) On airplanes with configuration 1 rate adjusting screw (Fig. 503):
1) Loosen sleeved jamnut on rate control adjustment screw.
2) Turn adjustment screw clockwise to increase opening time; turn adjustment screw counterclockwise to decrease opening time.

NOTE: If adjustment is difficult to make, contamination of needle valve may be a problem. Remove needle valve wipe clean and reinstall.

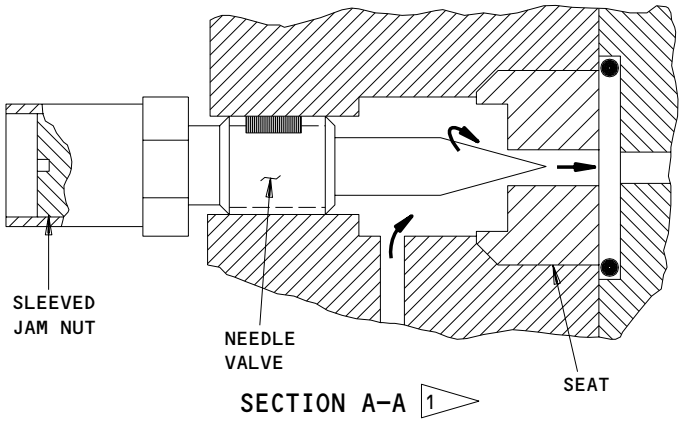
3) Tighten sleeved jamnut on adjustment screw.
4) Repeat steps (2) thru (9) and (10)(d)[1) thru 3)] until valve is adjusted correctly.

(e) On airplanes with configuration 2 rate adjusting screw (prior to incorporation of AiResearch SB 49-3646) (Fig. 503):
1) Loosen jamnut on rate control adjusting screw.
2) Turn adjustment screw clockwise to increase opening time.

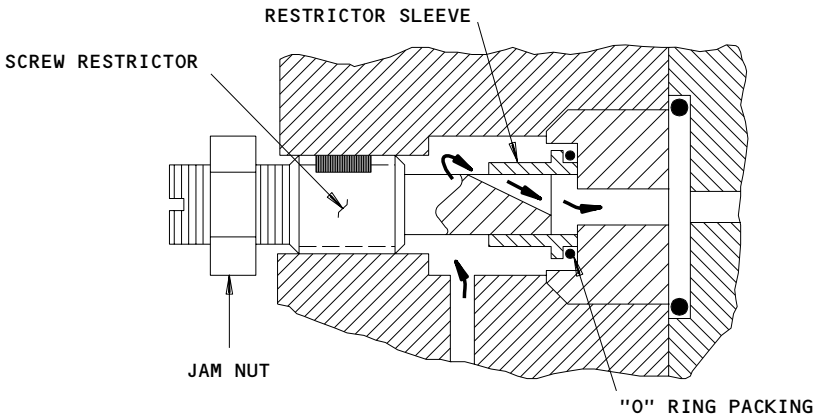
NOTE: Adjustment can only be made in a clockwise direction. If adjusting screw is turned in too far, it will be necessary to back adjustment screw all the way out. The sleeve will come out with it. Manually slide sleeve (interference fit) on screw restrictor so that more of the adjusting slot is visible. Install the screw and sleeve. Adjust again, turning screw clockwise.



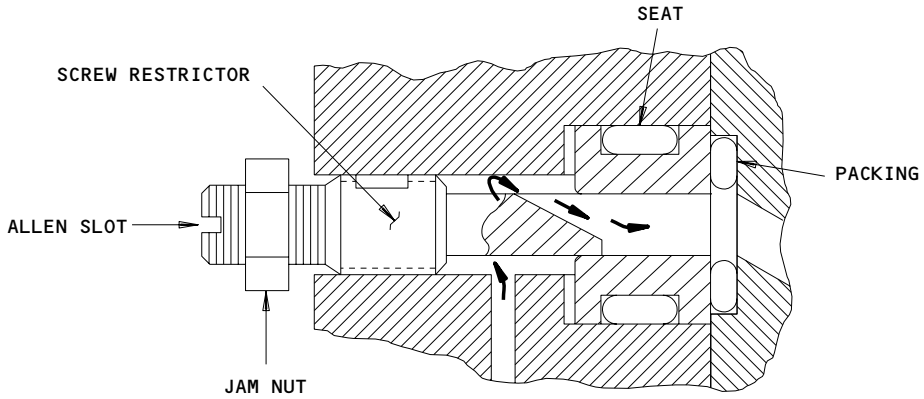
Bleed Air Valve Adjustments
Figure 503 (Sheet 1)



SECTION A-A 1



SECTION A-A 2



SECTION A-A 3

1 CONFIGURATION 1 RATE ADJUSTING SCREW

2 CONFIGURATION 2 RATE ADJUSTING SCREW (PRIOR TO INCORPORATION OF AIRESEARCH SB 49-3646)

3 CONFIGURATION 2 RATE ADJUSTING SCREW (AFTER INCORPORATION OF AIRESEARCH SB 49-3646)

Bleed Air Valve Adjustments
Figure 503 (Sheet 2)

3) Tighten jamnut on adjustment screw.
4) Repeat steps (2) thru (9) and (10)(e) [1) thru 3)] until valve is adjusted correctly.

(f) On airplanes with configuration 2 rate adjusting screw (after incorporation of AiResearch SB 49-3646) (Fig. 503):
1) Loosen jamnut on rate control adjusting screw.
2) Turn adjustment screw clockwise to increase opening time or, counterclockwise to decrease opening time.
3) Tighten jamnut on adjustment screw.
4) Repeat steps (2) thru (9) and (10)(f) [1) thru 3)] until valve is adjusted correctly.

(11) Restore airplane to normal configuration.

(a) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

(b) Disengage APU compartment access door support rods and stow rods. Close latch access door.

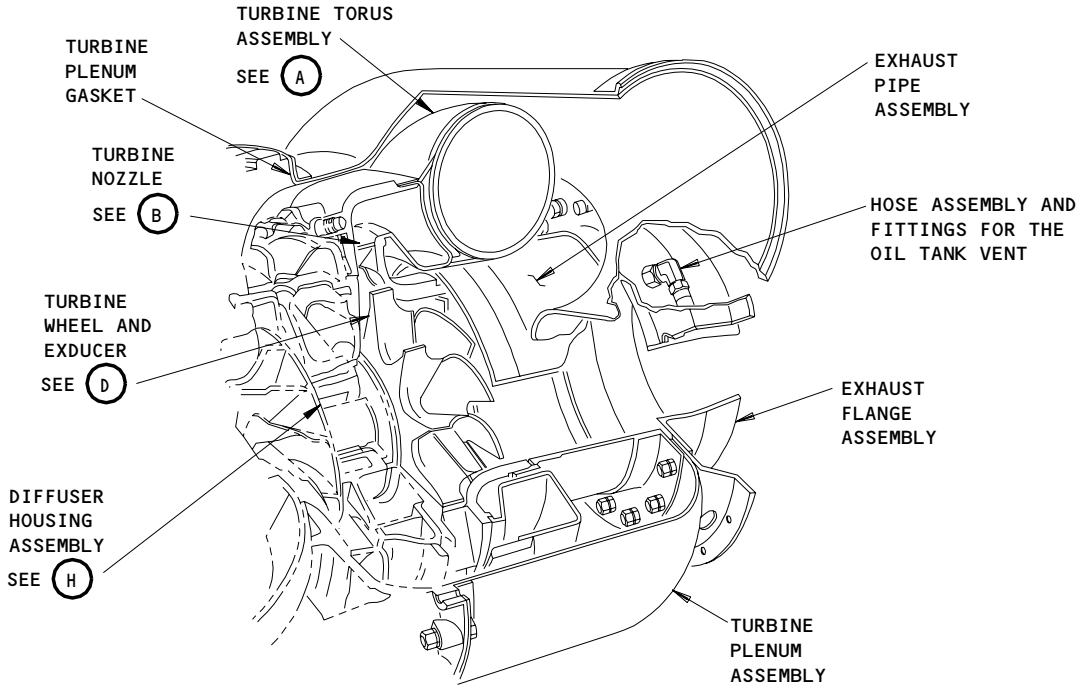
(c) Remove placard from BATTERY switch.

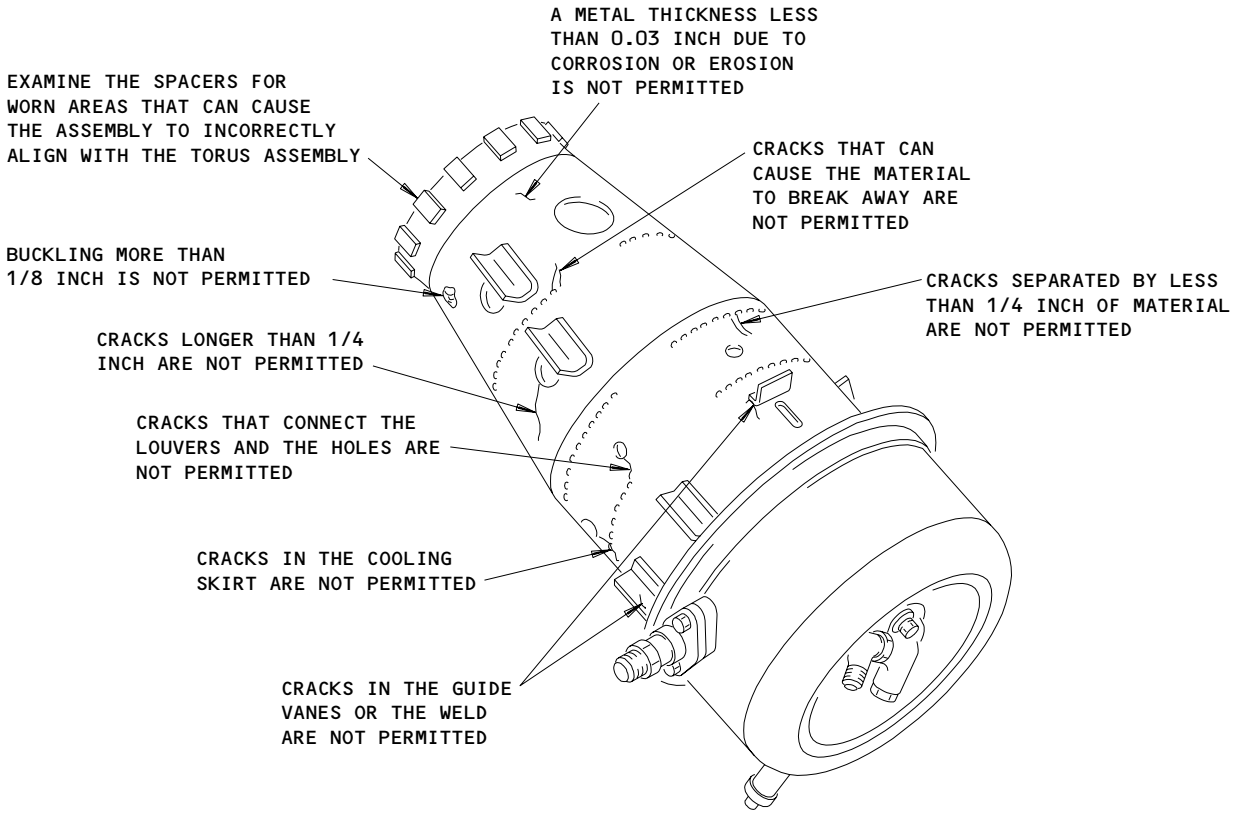
AUXILIARY POWER UNIT - INSPECTION/CHECK

1. General
   A. The APU inspection/check consists of checks of the APU as a whole, as well as examinations and checks of certain engine and engine system components. These components are accessible directly or with minimum parts removal such as removal of shroud doors or exhaust duct. If distress is found when performing checks 3.A.(2), and 3.A.(3) the distress may be indicative of critical engine condition, and detailed examination of APU should be considered.
   B. APU condition monitoring consists of a periodic check of those critical parameters of APU operation, which indicate the condition of the APU.
2. Materials and Equipment
   A. Fiber Optics (Borescope)
3. Examine Auxiliary Power Unit
   A. Check engine for the following:
      (1) Compressor air inlet for loose fasteners.
      (2) Combustion chamber liner assembly for damage. Remove combustor unit (AMM 49-31-42). Examine per Fig. 601.
      (3) Examine critical engine condition for damage as follows (Fig. 601):

          NOTE: If cracks, erosion, deformation or other obvious damage is greater than the limits given in Fig. 601, remove APU for hot section inspection. Instructions for performing HSI are outlined in Heavy Maintenance Section of the APU Engine Overhaul Manual, AMM 49-20-31.

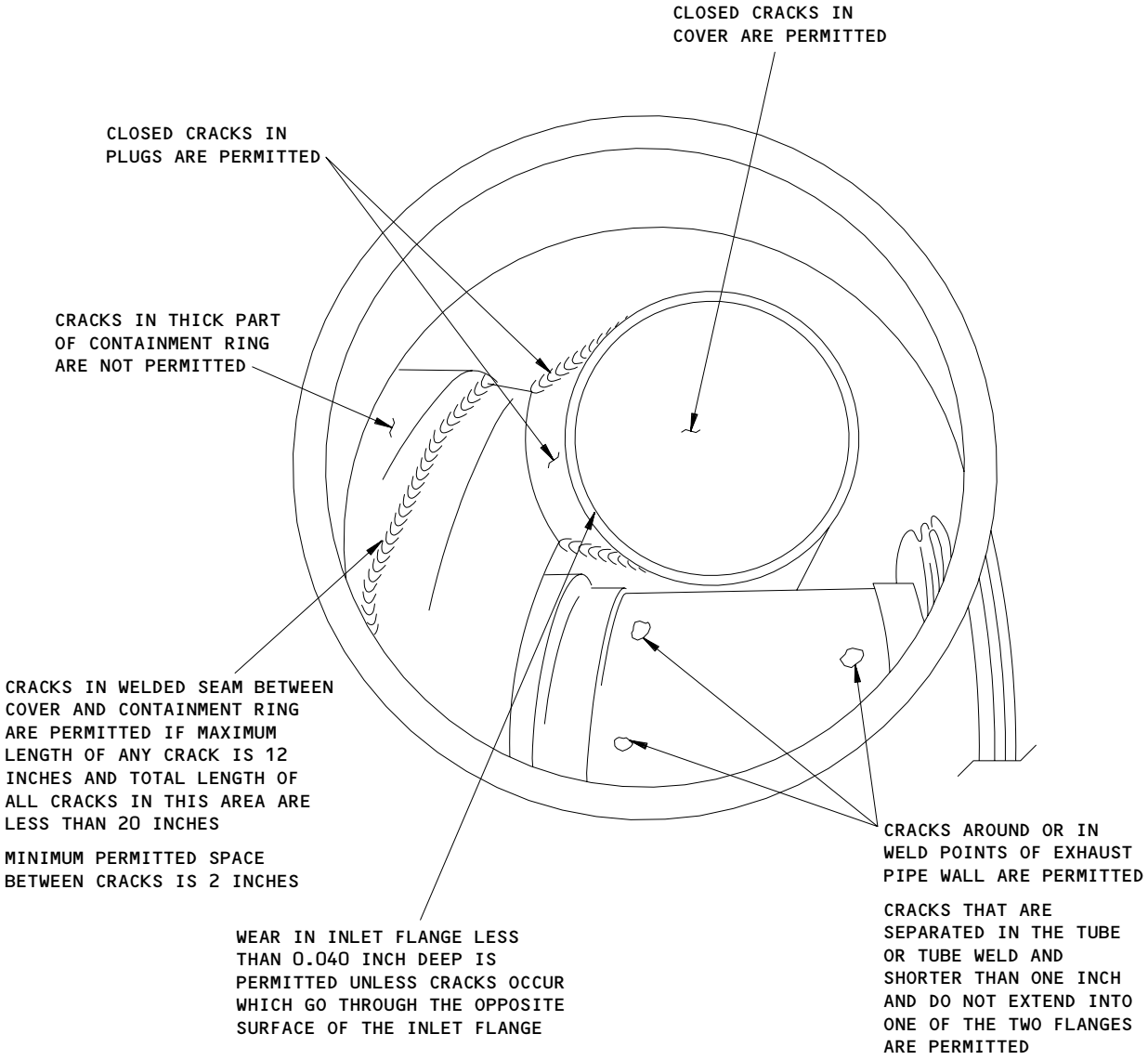
          (a) Remove exhaust duct muffler (AMM 49-80-11/401).
          (b) Visually make sure that oil tank vent hose ID and opening in fitting are not obstructed.
          (c) Visually examine exhaust flange assembly for cracks.
          (d) Visually examine turbine plenum assembly for cracks in welds and adjoining material.
          (e) Visually examine turbine wheel and exducer for cracks, rubbing, blade tip bending and thinning due to erosion.
          (f) Check turbine plenum gasket for evidence of deterioration and leakage.
          (g) Visually examine accessible portion of turbine nozzle for cracks, erosion or feathering type damage.





COMBUSTOR UNIT

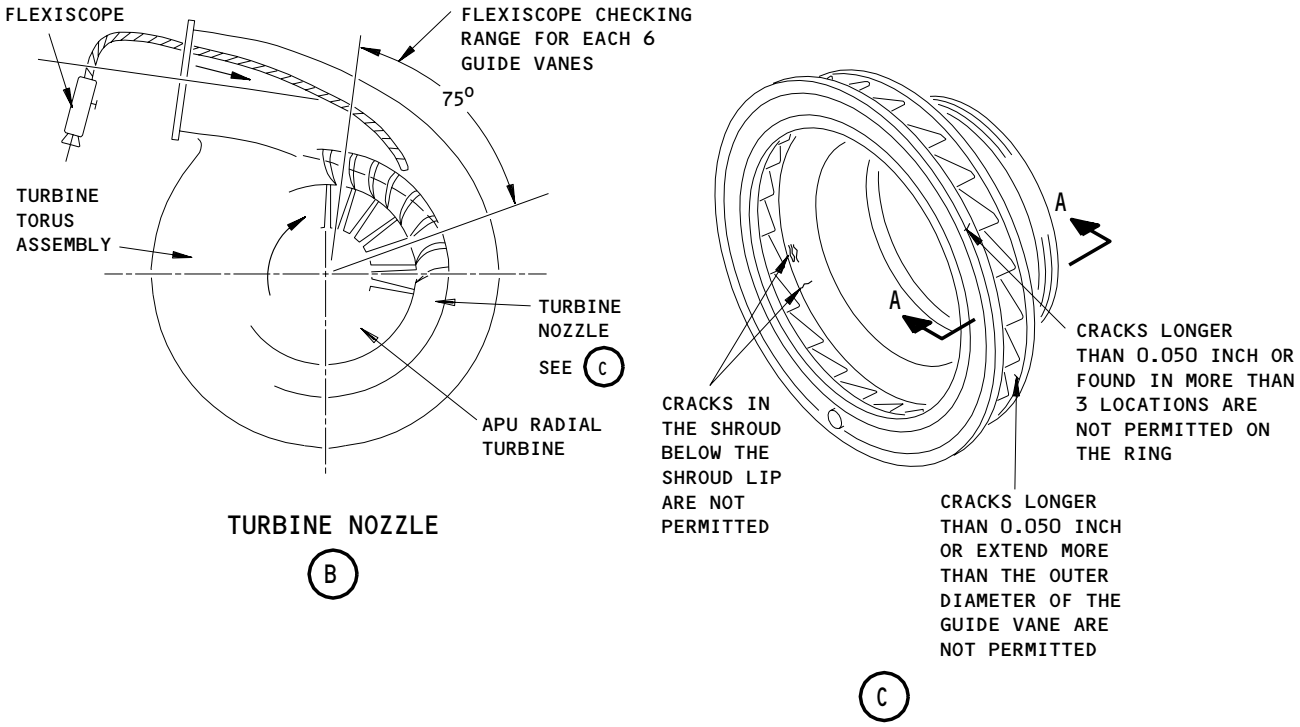
Hot Section and Combustor Unit Check
Figure 601 (Sheet 1)

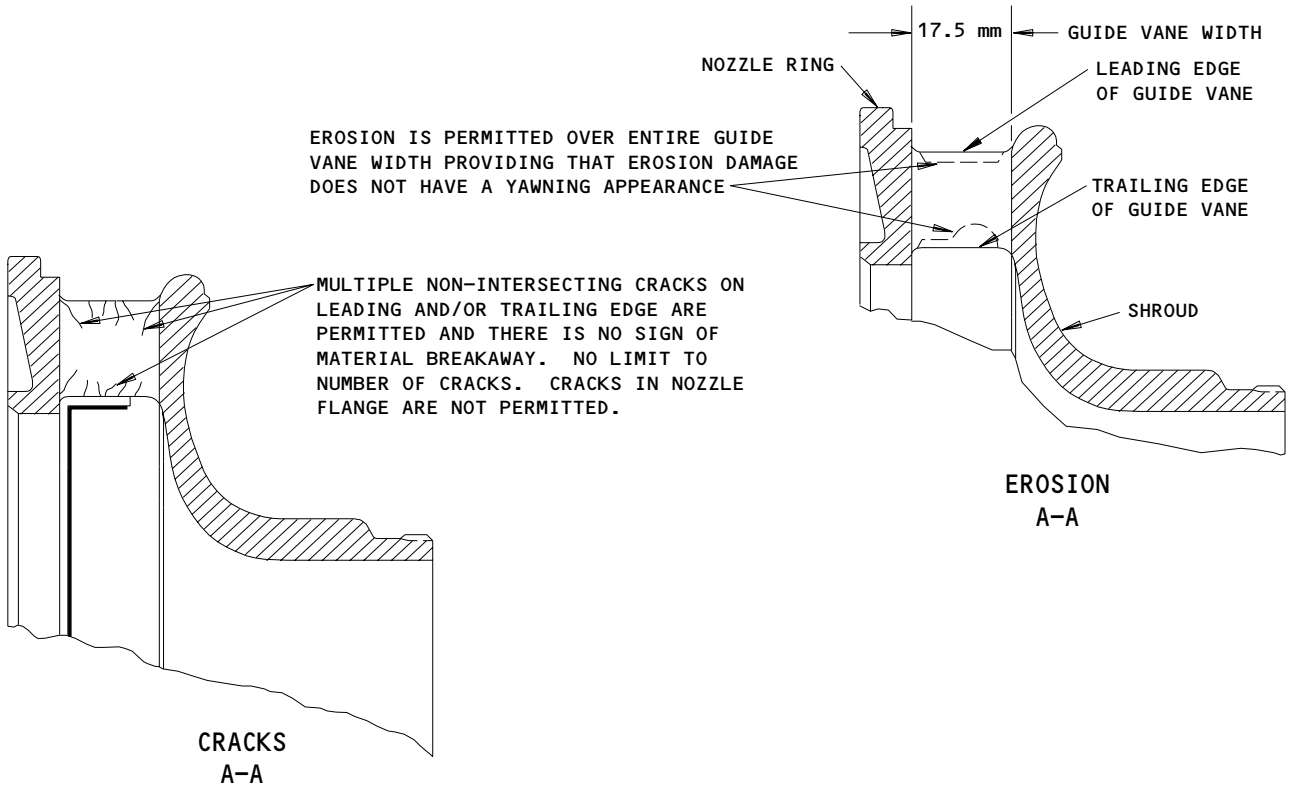


TURBINE TORUS ASSEMBLY

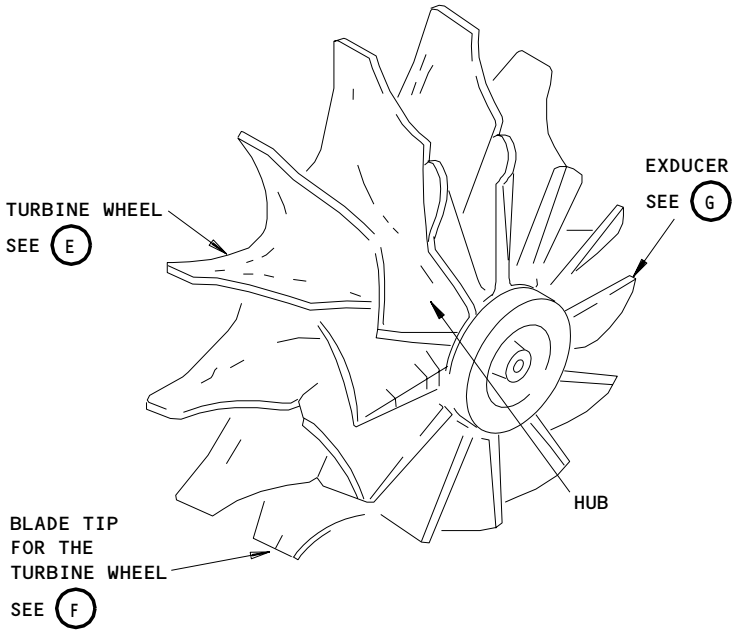
(A)

Hot Section and Combustor Unit Check
Figure 601 (Sheet 2)



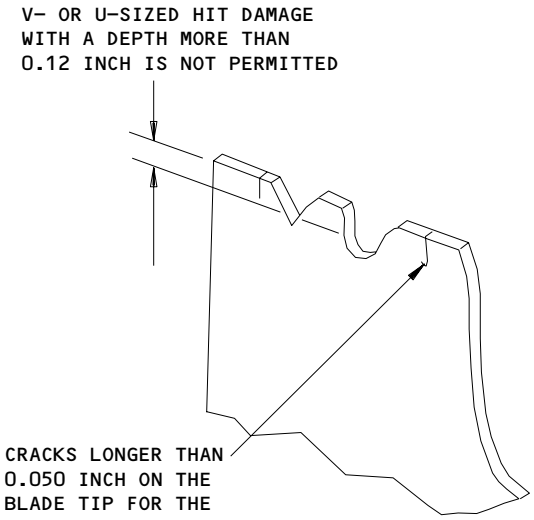


Hot Section and Combustor Unit Check
Figure 601 (Sheet 3)



TURBINE WHEEL AND EXDUCER

D



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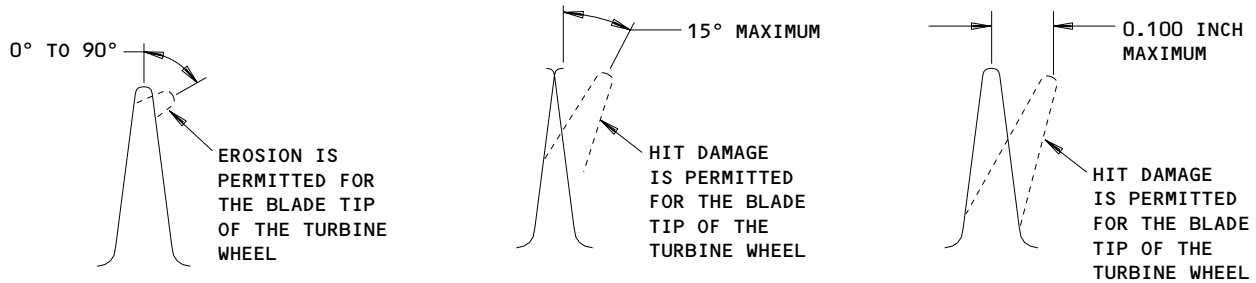
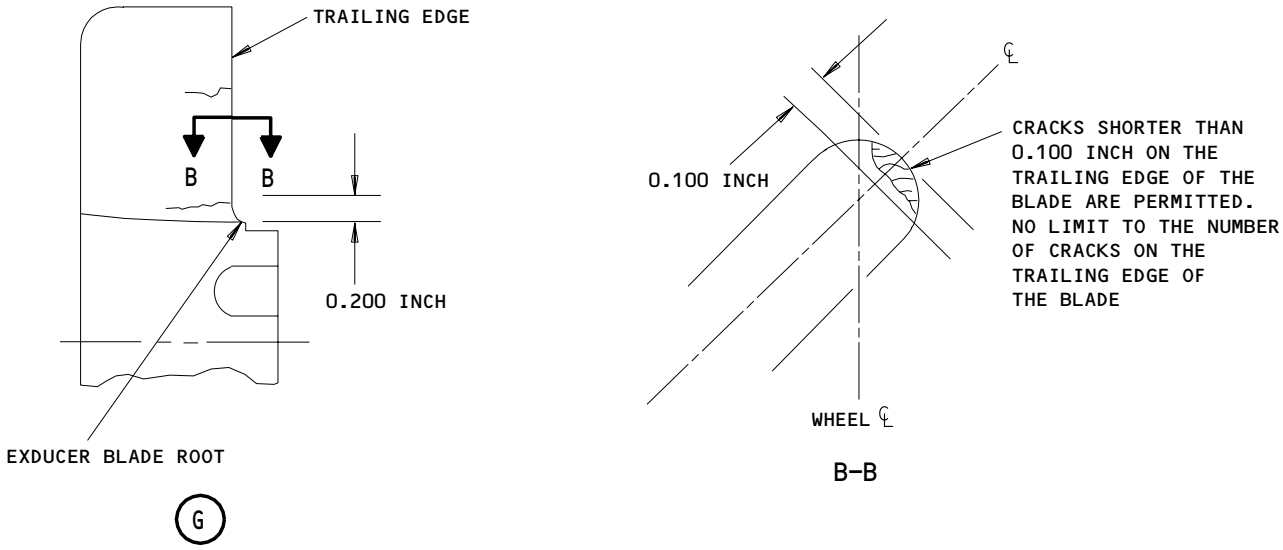


F

Hot Section and Combustor Unit Check
Figure 601 (Sheet 4)



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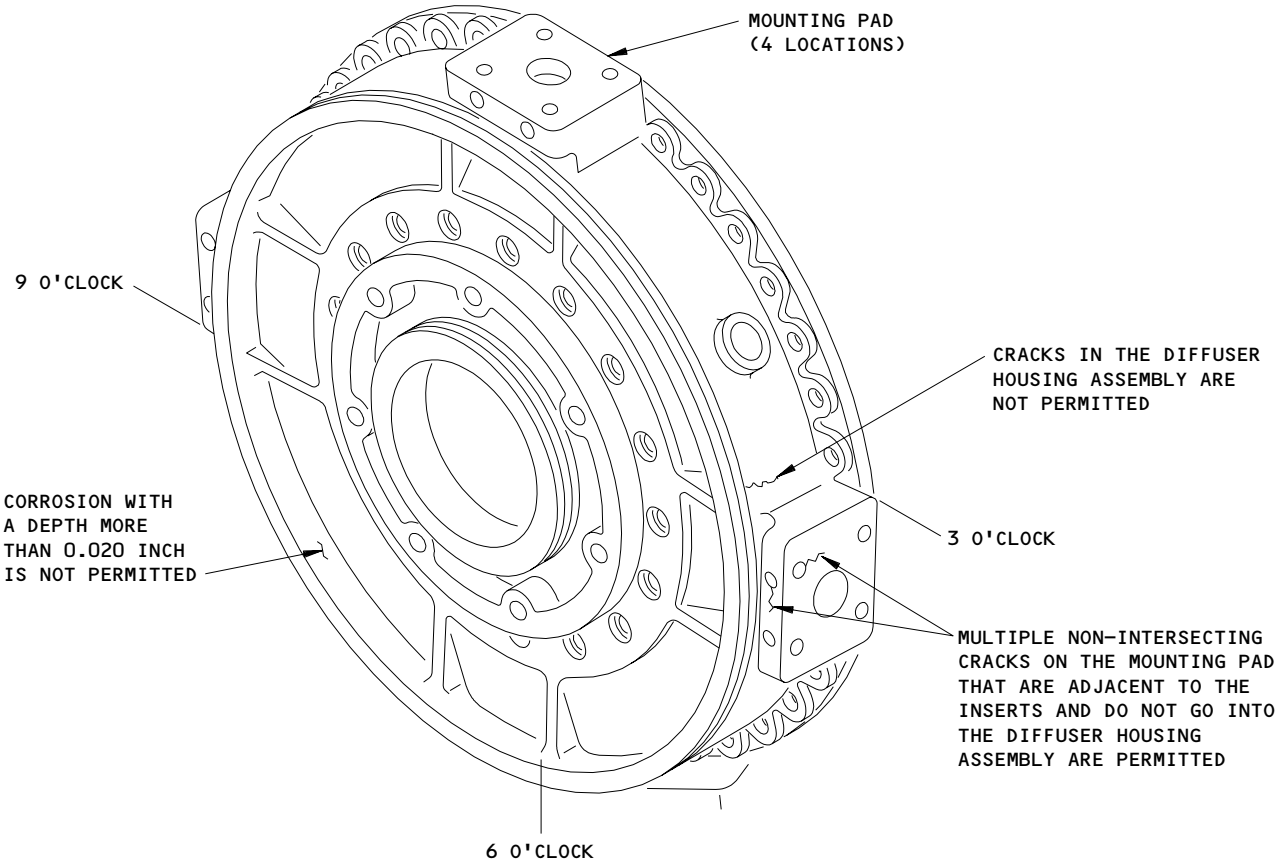


DIFFUSER HOUSING ASSEMBLY

H

Hot Section and Combustor Unit Check
Figure 601 (Sheet 5)

(h) Visually examine accessible portion of turbine torus assembly for cracks, erosion, deformation and wear.

NOTE: If supplemental containment ring has been installed, check that it is secure in both radial and axial directions. If not secure, remove APU for hot section inspection as outlined in Heavy Maintenance Section of APU Engine Overhaul Manual, AMM 49-20-31.

(i) Visually examine accessible portion of exhaust pipe assembly for cracks.

B. Check fuel system for the following:
   (1) Fuel filter element for cleanliness
   (2) Tubing for loose or broken clamps, loose or leaking connections, and flexible lines for chafing.
   (3) Fuel control unit gaskets for leakage or deterioration.
   (4) Loose electrical or pneumatic connections.

C. Check bleed air system for the following:
   (1) Ducts for loose connections, loose or broken clamps.
   (2) All control air tubing for loose connections.
   (3) Loose electrical connections.

D. Check exhaust system for the following:
   (1) Duct connections for loose or broken fasteners.
   (2) Duct for deformation or corrosion.

E. Check lubricating system for the following:
   (1) Oil filter element for cleanliness.
   (2) Oil tank for oil quantity, loose or broken mountings, and leakage.
   (3) Accessory cooling fan air inlet for cleanliness.
   (4) Tubing for loose or leaking connections.
   (5) Oil pump for leaking.
   (6) Oil pressure switches for leaks or loose electrical connector.
   (7) Oil cooler for leaks.
   (8) Oil low pressure switches for leaks or loose electrical connector.
   (9) Oil level switch for leaks or loose electrical connector.

F. Check starting system for the following:
   (1) Starter for loose mounting bolts or electrical connectors.
   (2) Ignition unit for loose mounting bolts or electrical connectors.
   (3) Igniter plug for carbon deposits.
   (4) Igniter plug lead for broken or frayed insulation or loose connectors.
   (5) Centrifugal switch or tachometer generator (if installed) for loose mounting bolts or electrical connectors.

G. Check air inlet system for the following:
   (1) Air inlet door for cleanliness and distortion.
   (2) Air inlet door actuator for loose or broken electrical or mechanical connections.

(3) Duct for deformation.
(4) Duct connections for loose or broken fasteners.
(5) Door switch for loose, chafed or broken electrical or mechanical connections.
(6) Door linkage for loose or broken fasteners.
(7) Check seal on door for deterioration or damage.

H. Check the following additional items:
(1) Fuel drain on outside of airplane for cleanliness.
(2) APU mounting bolts for looseness.
(3) APU mount structure for loose fasteners.
(4) Examine the rubber cushion of each vibration isolator on the shroud mounting brackets for cracks, separations and displacements.
(5) APU shroud for loose or broken fasteners.
(6) All external electrical or tubing connections for looseness.
(7) Open and close door in side of shroud. Door should open easily and close completely.
(8) APU shroud drains (AMM 49-12-0/701).

4. APU Condition Monitoring Check

A. This is a preventive maintenance check, which if performed at regular intervals, will identify a potential problem. Appropriate corrective action can then be taken before the problem results in flight delays, expensive part replacement, and/or APU failure.

(1) This table has an explanation for each item on the data sheet (Fig. 602). The reference values in parentheses are recommended based upon experience with this monitoring procedure:

Explanation for the APU Condition Monitoring Check
Item 1. RECORD OUTSIDE AIR TEMPERATURE (a) This reading will be used for heat exchanger effectiveness, for a comparison of prior no-load EGT recordings, and for a check of acceleration time during starting.
Item 2. CHECK BATTERY VOLTAGE (22 VOLTS MINIMUM) (a) Low batteries cause slow or hung starts. (b) Battery voltage should drop to approximately 16-18 volts and recover then to 20 volts during starter motor in-rush. If voltage does not drop, clutch slippage or corroded terminals may be the cause.
Item 3. CHECK THAT PACK VALVES ARE OFF, APU AND MAIN ENGINE BLEED VALVES ARE CLOSED AND THE ISOLATION VALVE IS CLOSED (a) No recording required.
Item 4. START APU - CHECK ACCELERATION - RECORD TIME FROM STARTER ENGAGED AS NOTED BY DC VOLTAGE DROP, TO APU GENERATOR "OFF" BUS LIGHT ON (20-40 SECONDS) (a) This is to evaluate condition of battery circuit, starter motor and clutch, fuel control, centrifugal switch and EGT control system. CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201). (b) Slow acceleration time may be due to: 1) Aircraft battery - low state. 2) APU starter electrical cables faulty. 3) Starter clutch slipping.

Explanation for the APU Condition Monitoring Check

4) Fuel control accelerator limiter diaphragm leaking.
5) Fuel control accelerator limiter valve leaking (half ball piston out of position or piston limiter O-ring extruded).
6) Fuel control accelerator limiter crack pressure setting low.
7) Fuel control accelerator limiter pneumatic control lines loose, or leaking.
8) Fuel control accelerator limiter air supply restricted (orifice clogged or line plugged with ice).
9) Swing check valve or 3-way solenoid valve leaking.
10) AIRPLANES WITHOUT THE ETC;
APU control thermostat set too low or stuck open.
11) AIRPLANES WITH THE ETC;
Proportional control valve failure.

CAUTION: Hung starts cause combustor and hot gas nozzle damage.

Item 5. RECORD NO-LOAD IDLE EGT - APU BLEED VALVE SWITCH CLOSED - MINIMUM ELECTRICAL LOAD (280-350° MAXIMUM)
(a) Low IDLE EGT can be faulty EGT indicating system.
(b) High idle EGT may be caused by:
1) Dirty compressor
2) Dirty crossover ducts
3) Damaged compressor wheels
4) Restricted inlet
5) Damaged diffuser section
6) Damaged or wrong combustor
7) Damaged torus
8) Damaged hot gas nozzle
9) Damaged turbine wheel
10) Leaking gasket between plenum and case assembly.
a) Bleed air duct leakage - clamp at APU bleed valve, clamp at APU turbine plenum or slip joint between APU and APU shroud.
b) Damaged generator bearing
c) Any bearing failure causing DRAG

Item 6. NO-LOAD GENERATOR FREQUENCY (405-410 Hz)
(a) Used as RPM indicator.
(b) Used to calculate droop under load.
1) Overspeed may cause APU shutdown.
2) Underspeed will cause 95% switch actuation dropping load.

Explanation for the APU Condition Monitoring Check

Item 7. SELECT NO. 1 TANK FUEL BOOST PUMP ON

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(a) Adds fuel pressure to the FCU supply. No recording required.

Item 8. RECORD INCREASE IN GENERATOR FREQUENCY (2 Hz MAXIMUM)

(a) If a 3 Hz or greater increase is observed, remove the FCU.

Item 9. OPEN APU BLEED VALVE AND ISOLATION VALVE WITH DOWNSTREAM PACK VALVES CLOSED

(a) No recording required.

Item 10. RECORD DUCT PRESSURE (38-50 PSIG)

(a) Indicates condition of APU and used as a reference for the ECS check.

Item 11. RECORD APU EGT (370°C MAXIMUM)

(a) Used to check duct leakage. The difference between EGT with the APU bleed valve closed (item 5) and EGT with the APU bleed and isolation valves open determines duct leakage (20°C maximum).

Item 12. CLOSE APU BLEED VALVE

(a) To establish a condition for the APU bleed valve opening rate check. No recording required.

Item 13. OPEN BOTH PACK VALVES, SELECT MANUAL FULL COLD WITH ISOLATION VALVE OPEN

(a) To establish a condition of minimum resistance to observe load control valve, regulator and thermostat performance. No recording required.

Item 14. OPEN APU BLEED VALVE

(a) No recording required. With both pack valves open or opening when the APU bleed valve is opened, a minimum flow resistance will exist in the pneumatic system allowing the APU bleed valve to seek its maximum rate of opening.

Item 15. RECORD "TIME" FROM APU BLEED VALVE SWITCH ACTUATION TO MINIMUM GENERATOR FREQUENCY (12-14 SECONDS) OR RECORD "TIME" FOR A 200°C EGT RISE (30 SECONDS MAXIMUM) FOR TREND ANALYSIS

(a) A slow opening APU bleed valve causes low duct pressure during main engine starts. A slow opening APU bleed valve may be due to:

Explanation for the APU Condition Monitoring Check

1) Dirty air supply filter in valve (if installed).
2) Dirty or contaminated rate needle or orifice.
3) Dirt under the rate chamber poppet valve.
4) Leaking diaphragm.
5) Leaking switcher ball valve.
6) Air pressure regulator set low.
7) Sticking regulator.
8) Regulator filter dirty.
9) Leaking pneumatic control lines or thermostat.
10) Incorrect rate valve setting.

(b) A fast opening APU bleed valve will cause excessive speed droop and load cycling. A fast opening APU bleed valve may be due to:
1) Faulty fuel control.
2) Incorrect rate valve setting.
3) Air pressure regulator set too high.

Item 16. RECORD MAXIMUM STABILIZED EGT (RECOMMENDED EGT operating range for extended APU service life is:
AIRPLANES WITHOUT THE ETC;
620-650°C
AIRPLANES WITH THE ETC;
566-649°C

CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201).

(a) Established power available for main engine start and/or air conditioning system.
(b) Low EGT will cause slow APU starts.
(c) Low EGT will cause a slow main engine start.

NOTE: Idle EGT (Item 11) subtracted from the maximum stabilized EGT is the available APU power (250°C minimum).

NOTE: Idle EGT with bleed valve open (pack valves closed) subtracted from the maximum stabilized EGT is the actual APU power available for main engine start and/or air conditioning. This takes into consideration duct leakage.

NOTE: The maximum stabilized EGT is the APU temperature control point for both air and electrical load. This is a function of the air pressure regulator, load control valve, thermostat, and fuel control.

Explanation for the APU Condition Monitoring Check

Item 17. RECORD GENERATOR FREQUENCY (395-405 Hz) The generator frequency meter is the APU RPM indicator above the APU 95% RPM range.
(a) Low frequency below 395 Hz is fuel control related.
1) Leaking pneumatic line to the FCU.
2) Acceleration limiter valve leaking.
3) FCU metering slide valve sticking or leaking.
4) Low governor setting.
5) Fuel pump deficiency.
6) Clogged fuel filter.
7) Fuel nozzle screen contaminated.
8) High frequency above 405 Hz.
a) Incorrect governor adjustment.

NOTE: If maximum load frequency is subtracted from idle frequency (Item 6) and the difference exceeds 10, the fuel control is suspect. If the difference or delta from maximum load HZ to idle HZ is increasing, the pump may be suspect. If the difference or delta is excessive but stable, a spring change in the governor is necessary.

Item 18. RECORD DUCT PRESSURE (6-12 PSIG)
(a) Used to determine full load capability of the APU. If a higher than normal pressure is recorded, the duct restriction may not allow the APU to be fully loaded.

Item 19. SELECT 60 AMP ELECTRICAL LOAD
(a) The addition of the 60 amp electrical load to the pneumatic load, should cause automatic temperature control correction by the thermostat to modulate the APU bleed valve and reduce bleed airflow maintaining the EGT is recorded.
(b) If the EGT continues to rise with additional shaft load, the automatic temperature control system is not functioning correctly.
1) Pneumatic control pressure faulty.
2) Low spring tension in the APU bleed valve return spring.
3) Incorrect load control thermostat set point.

Item 20. RECORD APU EGT

CAUTION: TO AVOID DAMAGING APU, OBSERVE OPERATING LIMITS (AMM 49-11-0/201).

(a) Used to observe sensitivity of the APU bleed valve as a trend data value.

Explanation for the APU Condition Monitoring Check
Item 21. REMOVE THE ELECTRICAL LOAD FROM THE APU (a) No steps are necessary. NOTE: Let the APU operate in the no-load condition for a minimum of 1 minute. Item 22. DO THE APU USUAL SHUTDOWN (a) No steps are necessary.

A/C_____

APU S/N_____ DATE_____

APU SYSTEM MONITOR CHECK

ITEM	OPERATION/OBSERVATION	DATA	INSP
1	RECORD OUTSIDE AIR TEMPERATURE		
2	CHECK BATTERY VOLTAGE (22 VOLTS MINIMUM)		
3	PACKS OFF, APU BLEED, ENGINE BLEED, ISOLATION VALVE CLOSED	-	
4	START APU - CHECK ACCELERATION TIME (SECONDS)		
5	RECORD NO-LOAD IDLE EGT		
6	RECORD NO-LOAD GENERATOR FREQUENCY (405-410 HZ)		
7	SELECT NO. 1 TANK FUEL BOOST PUMP ON	-	
8	RECORD INCREASE IN GENERATOR FREEQUENCY (2 HZ MAXIMUM)		
9	PACK VALVES CLOSED - APU BLEED VALVE OPEN	-	
10	RECORD DUCT PRESSURE (38-50 PSIG)		
11	RECORD APU EGT (370°C MAXIMUM)		
12	CLOSE APU BLEED VALVE	-	
13	OPEN BOTH PACK VALVES, SELECT MANUAL FULL COLD, ISOLATION VALVE OPEN	-	
14	OPEN APU BLEED VALVE	-	
15	RECORD IN SECONDS APU BLEED VALVE OPENING RATE		
16	RECORD MAXIMUM STABILIZED EGT		
17	RECORD GENERATOR FREQUENCY (395-405 HZ)		
18	RECORD DUCT PRESSURE (6-12 PSIG)		
19	SELECT 60 AMP ELECTRICAL LOAD	-	
20	RECORD APU EGT		
21	REMOVE THE ELECTRICAL LOAD FROM THE APU	-	
22	DO THE APU USUAL SHUTDOWN	-	

APU Condition Monitoring Check
Figure 602

5. Inspection After an APU Power Plant Fire

A. General

(1) In the event of an APU fire, a complete cleaning and inspection of the APU Power Plant, APU components and the surrounding structural area should be performed.

B. Equipment and Materials

NOTE: The following equipment and materials are required for an inspection after an APU Power Plant Fire.

(1) Vacuum - Source, 24-inch Hg minimum
(2) G00034 - Cloth, Process Cleaning Absorbent Wiper (Cheesecloth, Gauze), BMS 15-5
(3) G02439 - Brush, Nylon-Bristle
(4) G00110 - Sponge, Silcone Rubber, Closed-Cell, General Purpose, Non-Solvent Use, BMS 1-23
(5) G50140 - Gloves, Protective, Latex or Nitrile
(6) G02418 - Water, De-Ionized
(7) B01023 - Cleaner, Primary, Ardrox 6025

C. Prepare for the Inspection

(1) Set the switch and the circuit breaker:
  (a) Set the APU MASTER SWITCH on the P5 forward overhead control panel to the OFF position and attach a DO-NOT-OPERATE tag.
  (b) Open this circuit breaker and attach a DO-NO-CLOSE tag:
    1) E3-3 Electrical Self, APU Control Unit.

(2) Open the APU cowl door:
  (a) Open the latches for the APU cowl door.
  (b) Open the APU cowl door.
  (c) Connect the door support rods.

CAUTION: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

(3) Remove the lower shroud:
  (a) Hold the lower shroud and open the shroud latches.
  (b) Remove the lower shroud.

D. Procedure

(1) Visually examine the APU power plant for the cause of the APU fire, or an APU that became too hot.
  (a) If you find external damage to the APU, replace the APU (AMM 49-11-0/401).
  (b) If you do not find any external damage to the APU, refer to the Fault Isolation Manual for the APU fire detection system to find the cause of the high temperature indication.

(2) Do these steps to visually examine the APU compartment, upper and lower shrouds and its structural components for signs of fire damage:
  (a) Visually examine the APU compartment and its structural components for signs of fire damage.
  (b) Visually examine the three APU engine mounts for signs of fire damage.

(c) If any signs of fire damage are found in the APU compartment, and its structural components, contact BOEING SERVICE ENGINEERING for the disposition of the APU and the APU compartment structural components.

NOTE: An APU fire will affect the safety and structural integrity of the airplane. Boeing engineering and structural repair personnel will review airline/operator-supplied information and provide recommendations on a case-by-case basis.

(3) Do these steps to remove and/or clean the fire extinguishing agent, used for the APU power plant fire, from the external surfaces of the APU and the APU compartment:

(a) Do these steps if foam was used as the fire extinguishing agent.

CAUTION: DO NOT LET THE FOAM GO INTO THE HOLES OF THE APU. FOAM THAT STAYS IN THE APU CAN CAUSE CORROSION OF THE POWER PLANT INTERNAL COMPONENTS.

1) Clean the areas of the APU and the APU compartment where the foam was used with clean water, cleaning cloth, brush, sponge, gloves or other equivalent equipment.
2) Make sure that all signs of the foam are removed from the APU and the APU compartment.

(b) Do these steps if dry chemical power was used as the fire extinguishing agent:

CAUTION: DO NOT USE WATER TO REMOVE THE DRY POWDER FROM THE APU. THE DRY AGENTS IN THE CHEMICAL POWDER, WHEN MIXED WITH WATER, WILL MAKE A COMPOUND THAT CAN CAUSE CORROSION. DO NOT LET THE DRY CHEMICAL POWDER GO INTO THE HOLES OF THE APU. ANY DRY CHEMICAL POWDER THAT STAYS IN THE APU CAN CAUSE CORROSION OF THE POWER PLANT INTERNAL COMPONENTS.

1) Clean the areas of the APU and the APU compartment, where the dry chemical powder was used, by removing the powder with a brush and vacuum or equuivalent tool.
2) If the dry chemical powder was changed to a glaze-like formation due to high temperatures, clean the areas with the primary cleaner (Ardrox 6025), cleaning cloth, brush, sponge, gloves or other equivalent equipment.
3) Make sure that you remove all signs of the dry chemical powder from the APU and the APU compartment.

(c) Do these steps if halogen or halon was used as the fire extinguishing agent:
1) In-flight use of this fire extinguishing system is permitted with no special cleaning procedures required.

WARNING: DO NOT BREATHE THE GAS FROM THIS FIRE EXTINGUISHING AGENT IN THE APU COMPARTMENT AFTER IT IS USED. DO NOT LET THIS FIRE EXTINGUISHING AGENT TOUCH YOUR SKIN. YOU MUST HAVE A GOOD FLOW OF AIR AT THE LOCATION WHERE THE AGENT WAS USED. IF THESE PRECAUTIONS ARE NOT FOLLOWED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

2) Ground use of this fire extinguishing system is permitted but make sure that the APU cowl door is opened and the lower shroud is removed for a minimum of 30 minutes to remove all halogen or halon gases. No special cleaning procedures are required.
3) If necessary, clean the external surfaces of the APU from the power section (combustor and power turbine) to the turbine exhaust port with water, cleaning cloth, brush, sponge, gloves or other equivalent equipment.

E. Put the Airplane Back to its Usual Condition

CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCHES (5 mm) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS AND LOWER SHROUD. BE CARFUL WHEN YOU MOVE THE LOWER SHROULD. DAMAGE TO THE SHROULD DRAIN LINES CAN OCCUR.

(1) Install the lower shroud:
(a) Hold the lower shroud against the upper shroud.
(b) Close the shroud latches.
(2) Close the APU cowl door:
(a) Disconnect the door support rods.
(b) Put the door support rods in the clips on the APU cowl door.
(c) Close the APU door.
(d) Close the latches for the APU cowl door.
(3) Set the circuit breaker and the switch:
(a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit.
(b) Remove the DO-NOT-OPERATE tag from the APU MASTER SWITCH on the P5 forward overhead panel.

APU POWER PLANT - APPROVED REPAIRS

1. General
   A. After suitable preparation, the airplane can be dispatched with the APU removed. The APU compartment preparation includes securing pneumatic ducting, electrical bundles, and hoses. Protective covers are placed on the electrical and plumbing connections, exhaust duct and cooling air outlets. The air inlet door is deactivated. Electrical circuit breakers and the APU fuel valve are deactivated to complete airplane preparation. Both APU system deactivation and activation procedures are included.
2. Equipment and Materials
   A. C49001 Tool Kit - APU Deletion
   B. F80136 Tool Kit - APU Deletion (optional to the C49001 Tool Kit)
3. APU System Deactivation (Removal of Inoperative APU from Airplane)
   A. Remove APU (Ref 49-11-0 R/I).
   B. Remove hoist assemblies from brackets in APU compartment.
   C. Deactivate APU fuel shutoff valve located on left rear spar in wheel well (Fig. 801).
      (1) Disconnect electrical connector from valve.
      (2) FOR THE C49001 TOOL KIT; Install the cap assembly to the electrical connector and electrical receptacle for the APU fuel shutoff valve.
      (3) FOR THE F80136 TOOL KIT;
          Do these steps:
          (a) Install a cap on the electrical connector for the APU fuel shutoff valve.
          (b) Tie the electrical harness with the cap chain to the airplane structure with the braid.
          (c) Install a cap on the electrical receptacle of the APU fuel shutoff valve.
          (d) Attach the cap chain to the receptacle attachment screw.
   D. Deactivate air inlet door (Fig. 803).
      (1) FOR THE C49001 TOOL KIT; If the inlet door actuator does not operate correctly, do the deactivation of the air inlet door with the actuator removed:
          (a) Remove the inlet door actuator (Ref 49-15-31 R/I).
          (b) Install the cap for the electrical connector for the inlet door actuator.
          (c) Attach the electrical connector for the inlet door actuator to the airplane structure with the braid.
          (d) Install the door lock bracket:
              1) Install the door lock bracket on the mounting bracket for the inlet door actuator with the bolts, nuts and washers.

2) Install the spacers to the pushrods for the inlet door actuator.

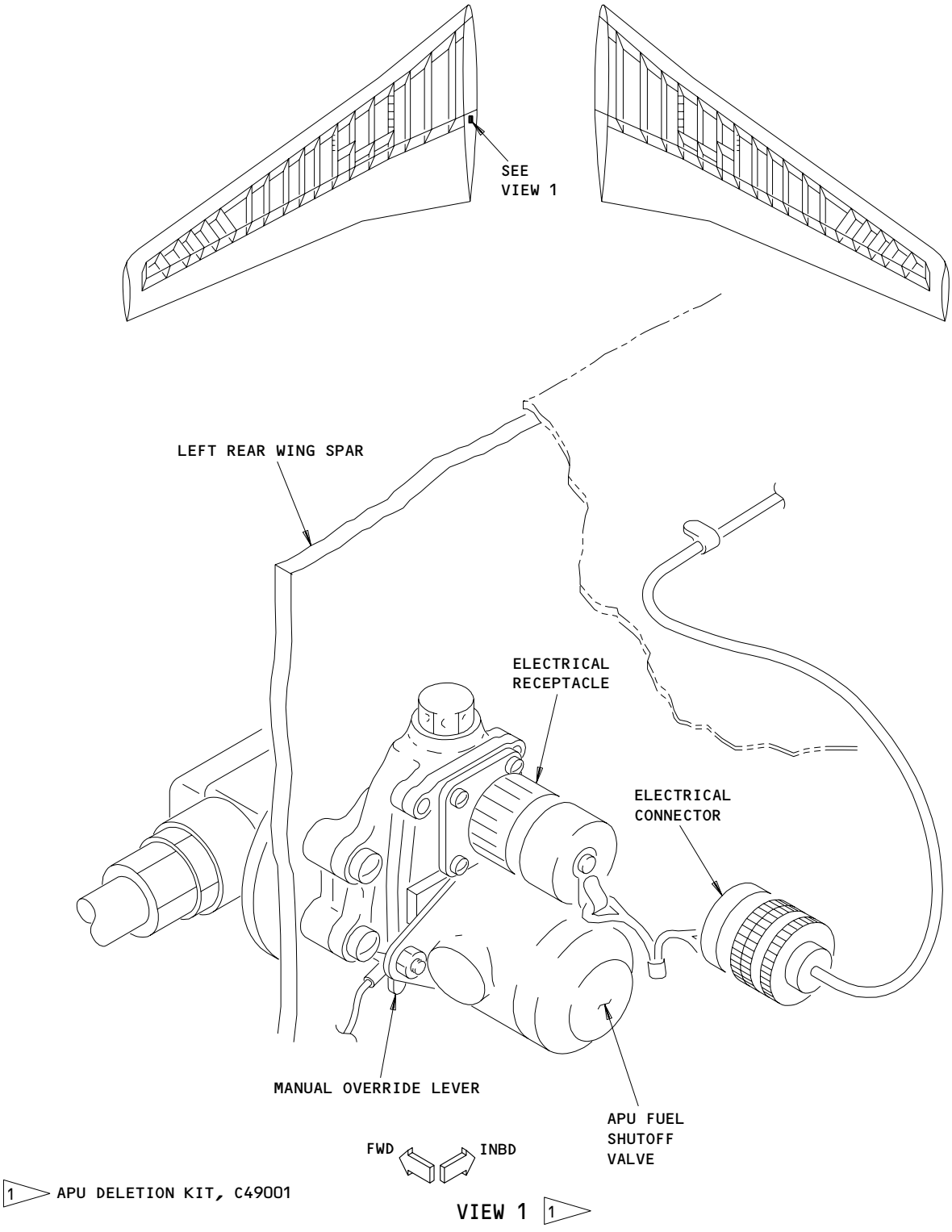
NOTE: You install the spacers to add length to the pushrods. This will hold the air inlet door in the closed position.

3) Connect the actuator arms to the pushrods with the bolts, nuts and washers.
4) Install the actuator arms to the door lock bracket with the bolts and washers.

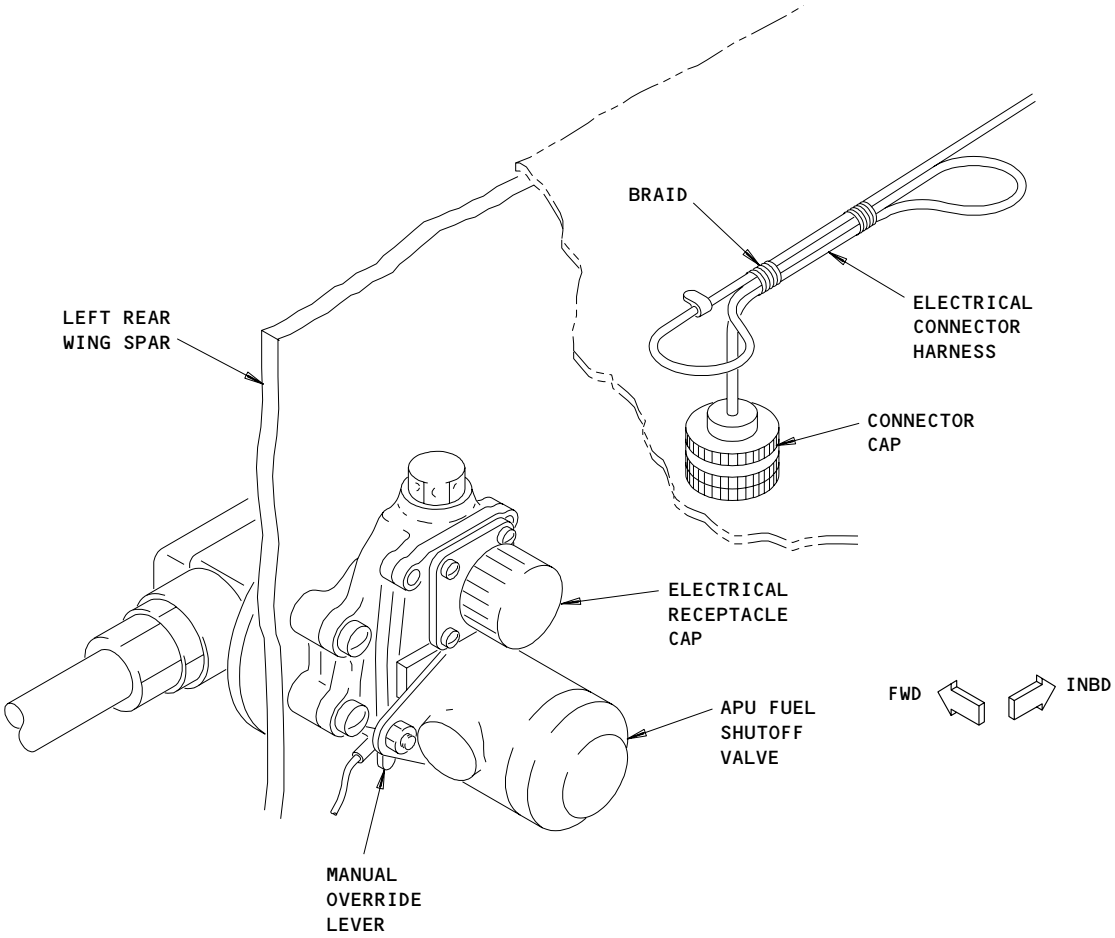
NOTE: Put the actuator arms on the door lock bracket so the air inlet door is in the closed position.

(2) If the inlet door actuator operates correctly;
Do the deactivation of the air inlet door with the actuator installed:
(a) Disconnect the electrical connector for the inlet door actuator.
(b) FOR THE C49001 TOOL KIT; Install the cap assembly to the electrical connector and electrical receptacle for the inlet door actuator.
(c) FOR THE F80136 TOOL KIT; Do these steps:
1) Install a cap on the electrical connector for the inlet door actuator.
2) Attach the electrical harness with the cap chain to the airplane structure with the braid.
3) Install a cap on the actuator electrical receptacle.
4) Attach the cap chain to the receptacle attachment screw.

E. Fully close inlet door.
(1) Disconnect both pushrods from actuator arms.
(2) FOR THE C49001 TOOL KIT;
Install the spacers to the pushrods for the inlet door actuator.
(3) Remove rod ends from both pushrods.
(4) Install extension studs in both pushrods together with locknuts on both ends of studs.
(5) Install female rod ends on both extension studs.
(6) Adjust pushrod assemblies to maintain door and body contours flush within 0.03 inch. Tighten both locknuts on each extension stud.
(7) Reconnect pushrod ends to actuator arms using existing fasteners if not worn.



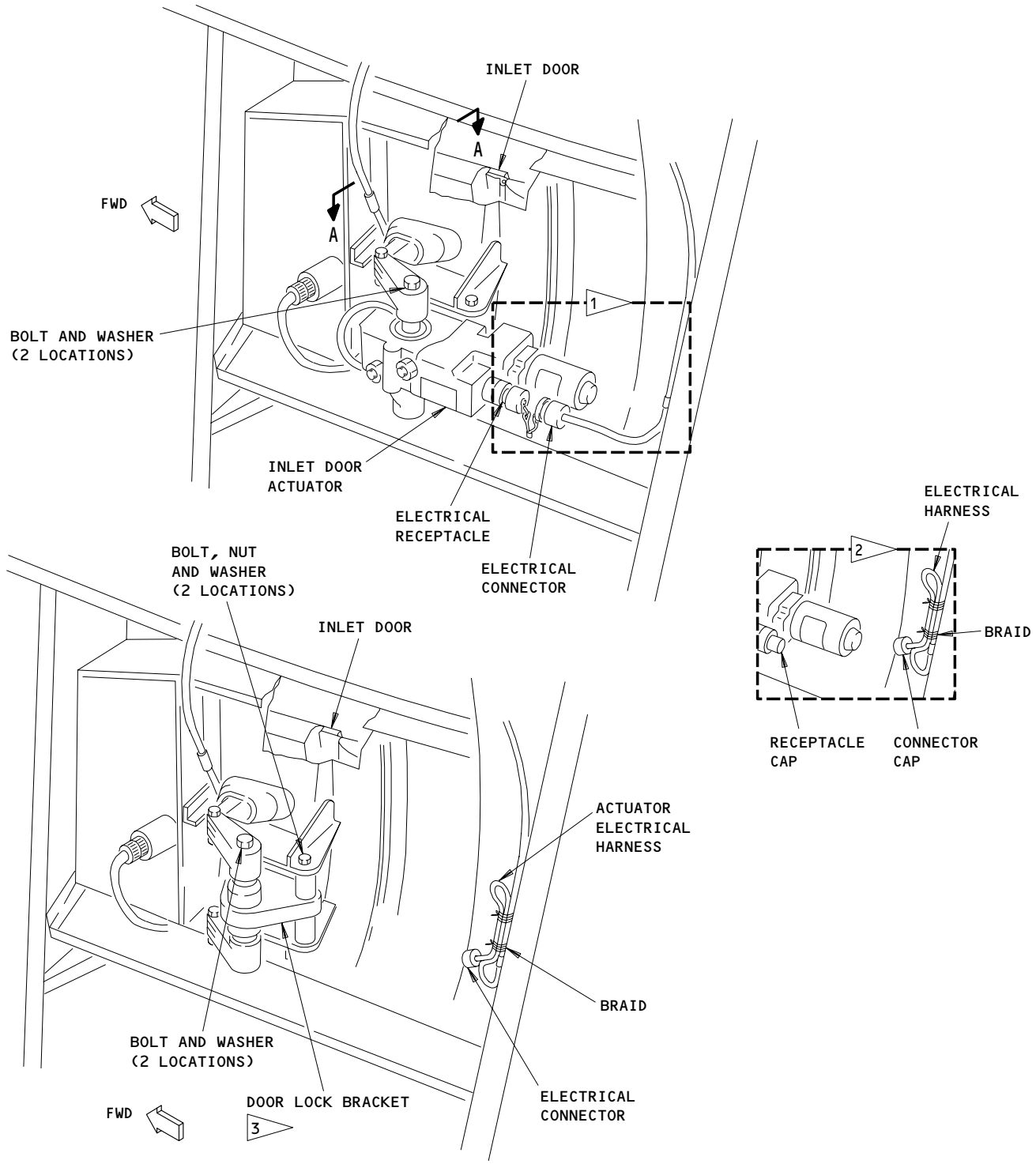
APU Fuel Shutoff Valve Deactivation
Figure 801



VIEW 1 [2]

[2] APU DELETION KIT, F80136

APU Shutoff Valve Detactivation
Figure 802

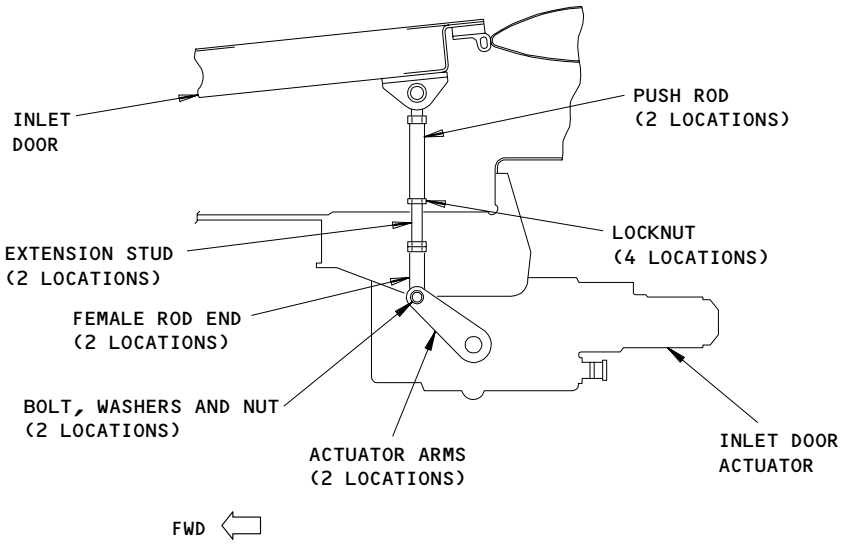


1 APU DELETION KIT, C49001

2 APU DELETION KIT, F80136

3 FOR INLET DOOR ACTUATORS THAT DO NOT OPERATE CORRECTLY. (APU DELETION KIT, C49001 ONLY)

APU Inlet Door Deactivation
Figure 803 (Sheet 1)



APU Inlet Door Deactivation
Figure 803 (Sheet 2)

F. Install exhaust muffler plug (Fig. 804).
   (1) Fit exhaust plug into exhaust fairing until it comes into contact with exhaust muffler. Handle of exhaust plug to face aft. If necessary, minimum material may be removed from four bumper blocks on plug to achieve an easy slide fit of plug into exhaust fairing.

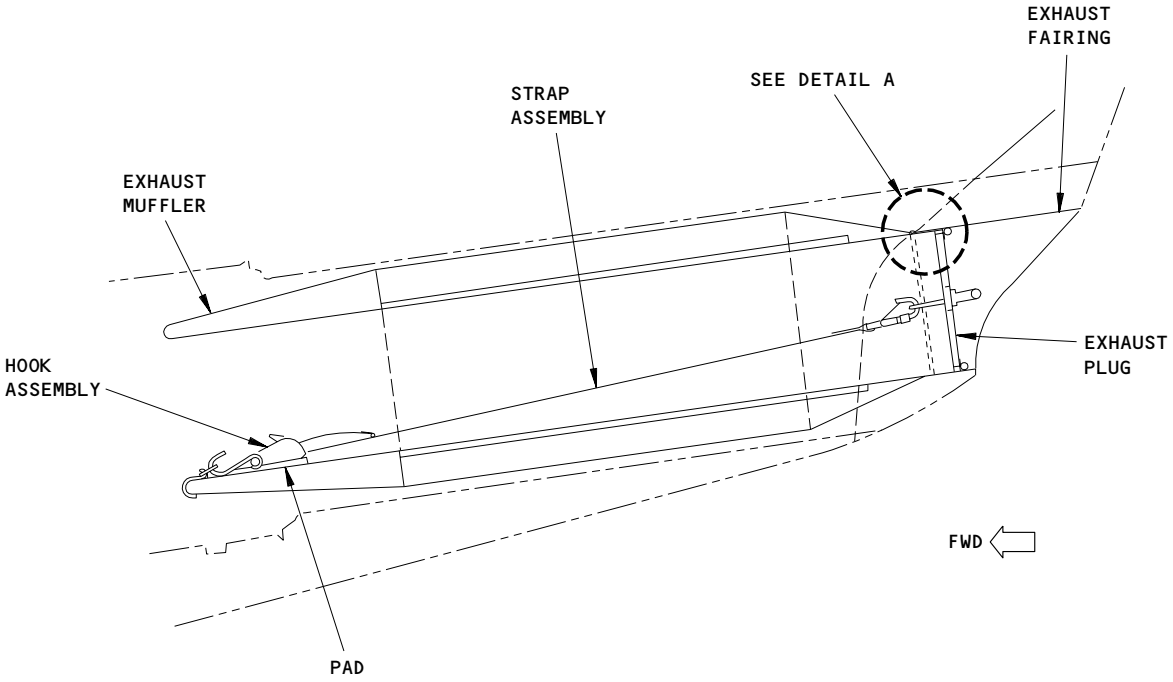
   NOTE: The four bumper blocks must have at least 0.06-inch interference contact with exhaust muffler.

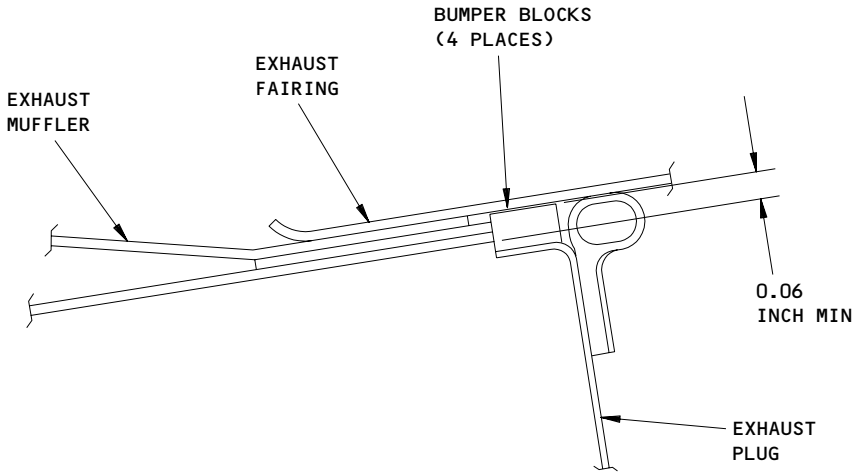
   (2) Attach hook assembly to forward end of exhaust muffler. Insert pad between buckle of hook assembly and exhaust muffler. Secure pad to buckle with nylon cord.
   (3) Secure exhaust plug to hook assembly with strap assembly adjusted to 50 to 100 pounds of tension.

G. Remove flexible connector, duct end, clamp and gasket from bleed air duct. Cap bleed air duct and secure with clamp. Discard gasket (Fig. 805).

   NOTE: Do not disconnect bleed air valve electrical connectors. This allows the valve butterfly position to be monitored via the dual bleed indication light.

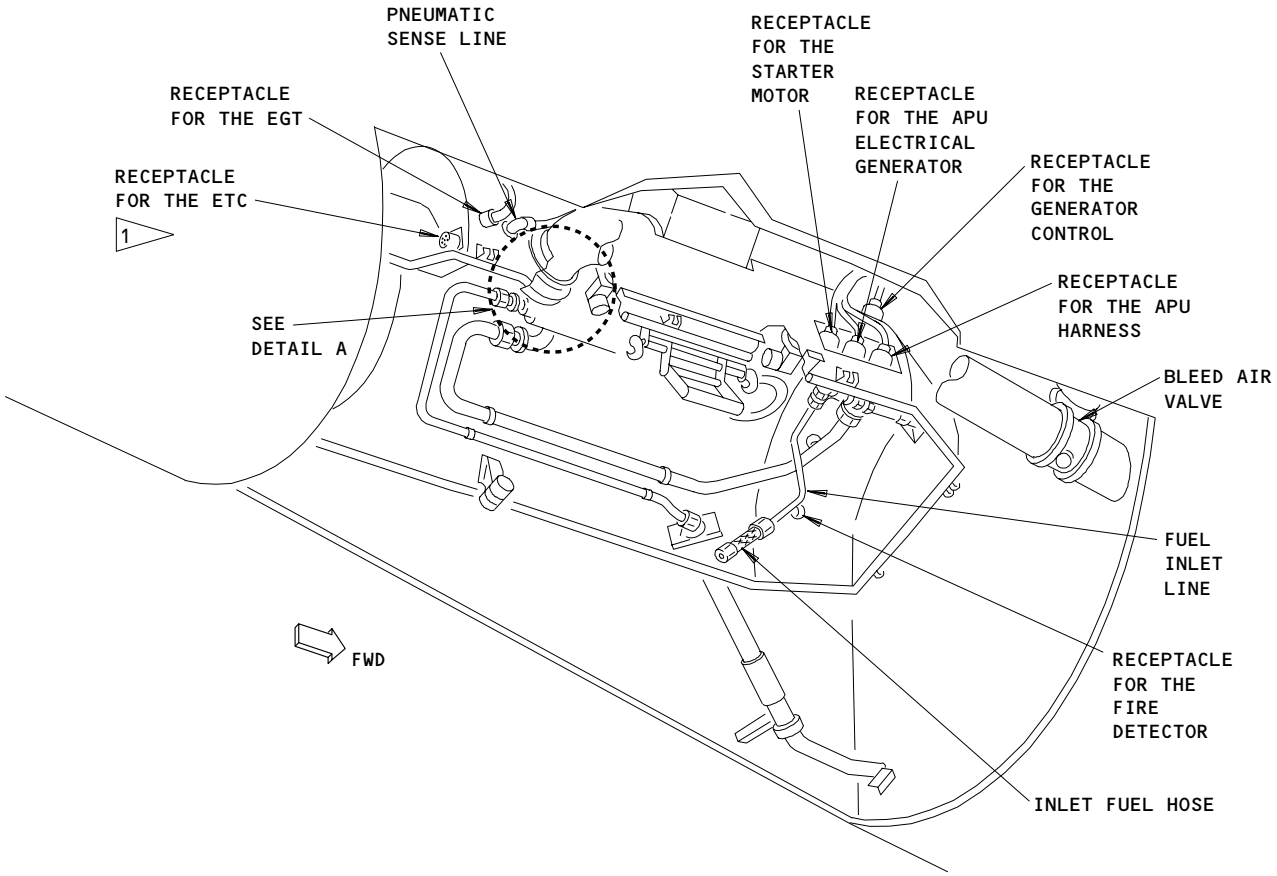
H. Remove fuel inlet hose from fuel inlet line, and cap line.
I. Cap pneumatic sensing line in upper shroud.
J. Cap the following electrical receptacles:
   (1) Starter motor
   (2) Generator
   (3) Generator control
   (4) EGT Indicating
   (5) Fire detection
   (6) APU control
   (7) AIRPLANES WITH THE ETC; Electronic temperature control (ETC)
K. Install dummy plug assembly to APU control receptacle on APU shroud.
L. Install coverplate at cooling air outlet (Fig. 806).
   (1) Clean faying surfaces with cleaning solvent.
   (2) Position cover over outlet duct.
   (3) Bond coverplate to outlet duct with tape.
M. Deactivate following circuit breakers by installing red collars:
   (1) FIRE DETECTION APU and APU CONT located on P6 panel.
   (2) Circuit breaker on M280 module, APU accessory unit on E3-3 electronic shelf.
N. Close following circuit breakers on P6 panel:
   (1) APU GENERATOR CONTROL
   (2) HOT BAT, BAT BUS CONT
   (3) HOT BAT BUS
   (4) HOT BAT, GEN CONT





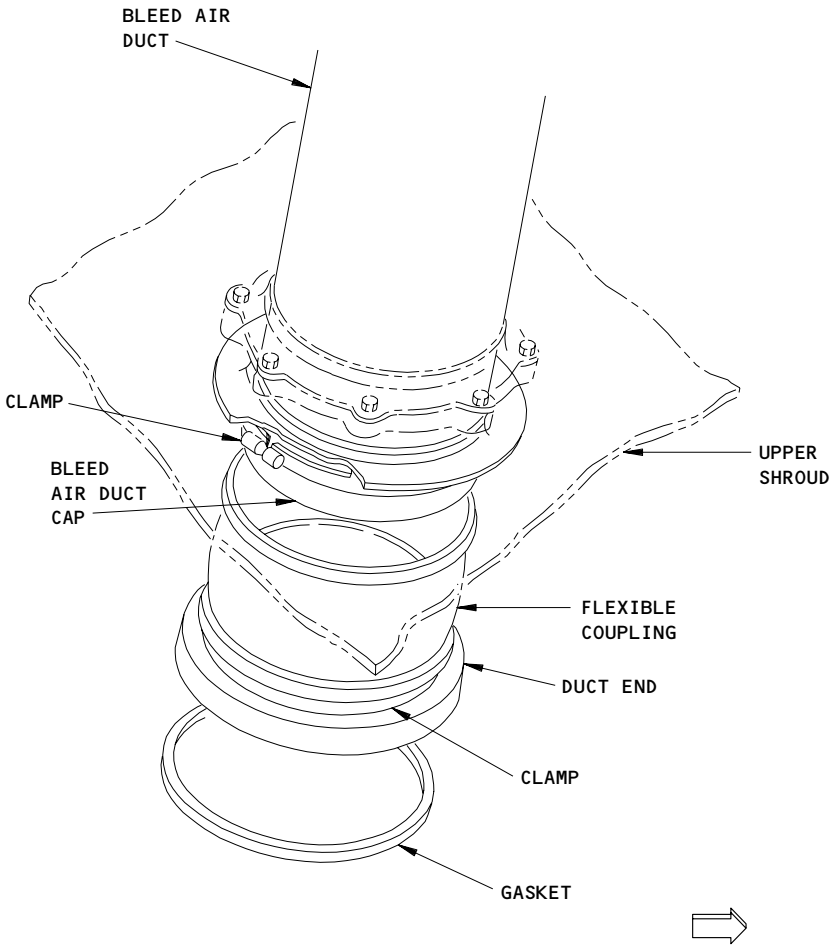
DETAIL A

Exhaust Duct Plug Installation
Figure 804



1 AIRPLANES WITH THE ETC

APU Compartment Deactivation
Figure 805 (Sheet 1)



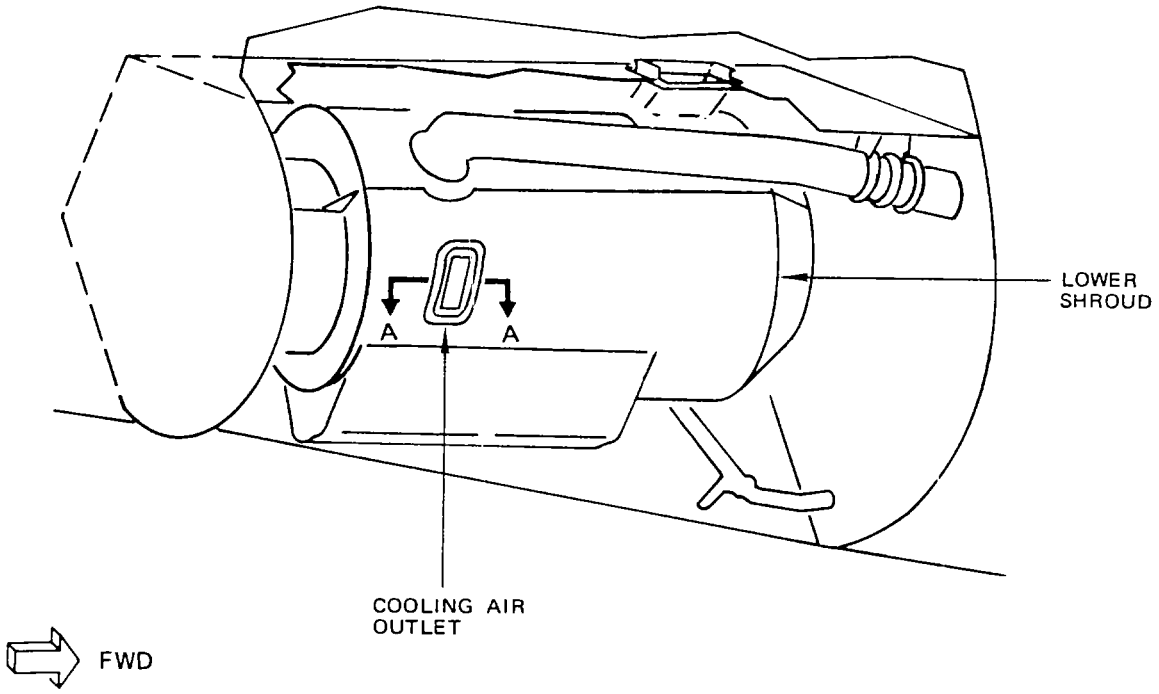
APU Compartment Deactivation
Figure 805 (Sheet 2)

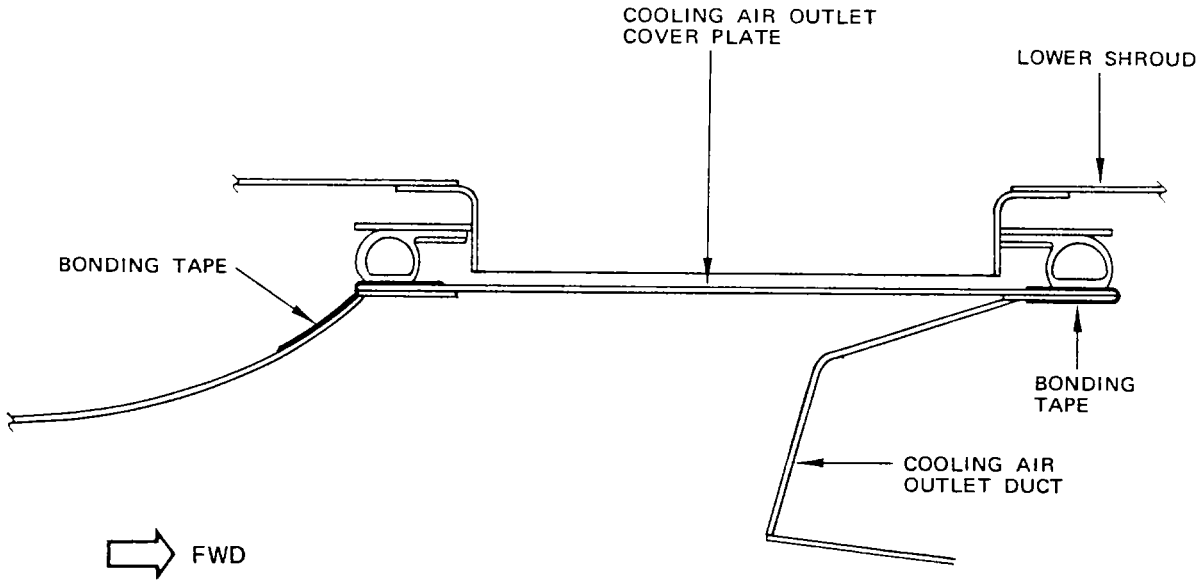
O. Fix placard above APU control switch stating INOPERATIVE-APU REMOVED.
P. Perform fuel line leak test.
(1) Open APU fuel shutoff valve using manual override lever (Fig. 802).
(2) Operate No. 1 tank forward fuel boost pump and check for leaks at capped fuel inlet line in upper shroud. Correct any leaks.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(3) Shut down No. 1 tank forward boost pump and close APU fuel shutoff valve using manual override lever.
Q. Using compressed air; check shroud drain systems for free flow.
R. Perform APU bleed valve closed check.
(1) With ac or dc electrical power available, open both engine bleed valves.
(2) Observe that amber dual bleed indication light located on P5 panel does not illuminate. This confirms that APU bleed valve is closed.

4. APU System Reactivation (Reinstallation of APU)
A. Open following circuit breakers on P6 panel:
(1) APU GENERATOR CONTROL
(2) HOT BAT, BAT BUS CONT
(3) HOT BAT BUS
(4) HOT BAT, GEN CONT
B. Remove coverplate at cooling air outlet (Fig. 806).
C. Remove bleed air duct clamp and cover. Connect flexible connector, duct end, clamp and gasket to bleed air duct (Fig. 805).
D. Remove exhaust muffler strap assembly, hook assembly and plug (Fig. 804).
E. Open inlet door (Fig. 803).
(1) Disconnect both pushrods from actuator arms.
(2) FOR THE C49001 TOOL KIT; Remove the spacers from the pushrods.
(3) Loosen locknuts and remove both rod ends and both extension studs.
(4) Install locknuts on male rod ends and install rod ends in both pushrods.
(5) Adjust inlet door open position (Ref 49-15-0 A/T).
F. Do the deactivation of the air inlet door (Fig. 803):
(1) FOR THE C49001 TOOL KIT; If the inlet door actuator was removed from the airplane and the door lock bracket installed, do these steps:
(a) Disconnect the pushrods from the actuator arms.
(b) Remove the spacers from the pushrods.
(c) Remove the bolts and washers from the actuator arms.
(d) Remove the actuator arms from the door lock bracket.
(e) Remove the bolts, nuts and washers that attach the door lock bracket to the mounting bracket for the inlet door actuator.





SECTION A-A

Cooling Air Duct Coverplate Installation
Figure 806

(f) Remove the door lock bracket.
(g) Remove the braid that holds the electrical connector for the inlet door actuator to the airplane structure.
(h) Install the inlet door actuator (Ref 49-15-31 R/I).

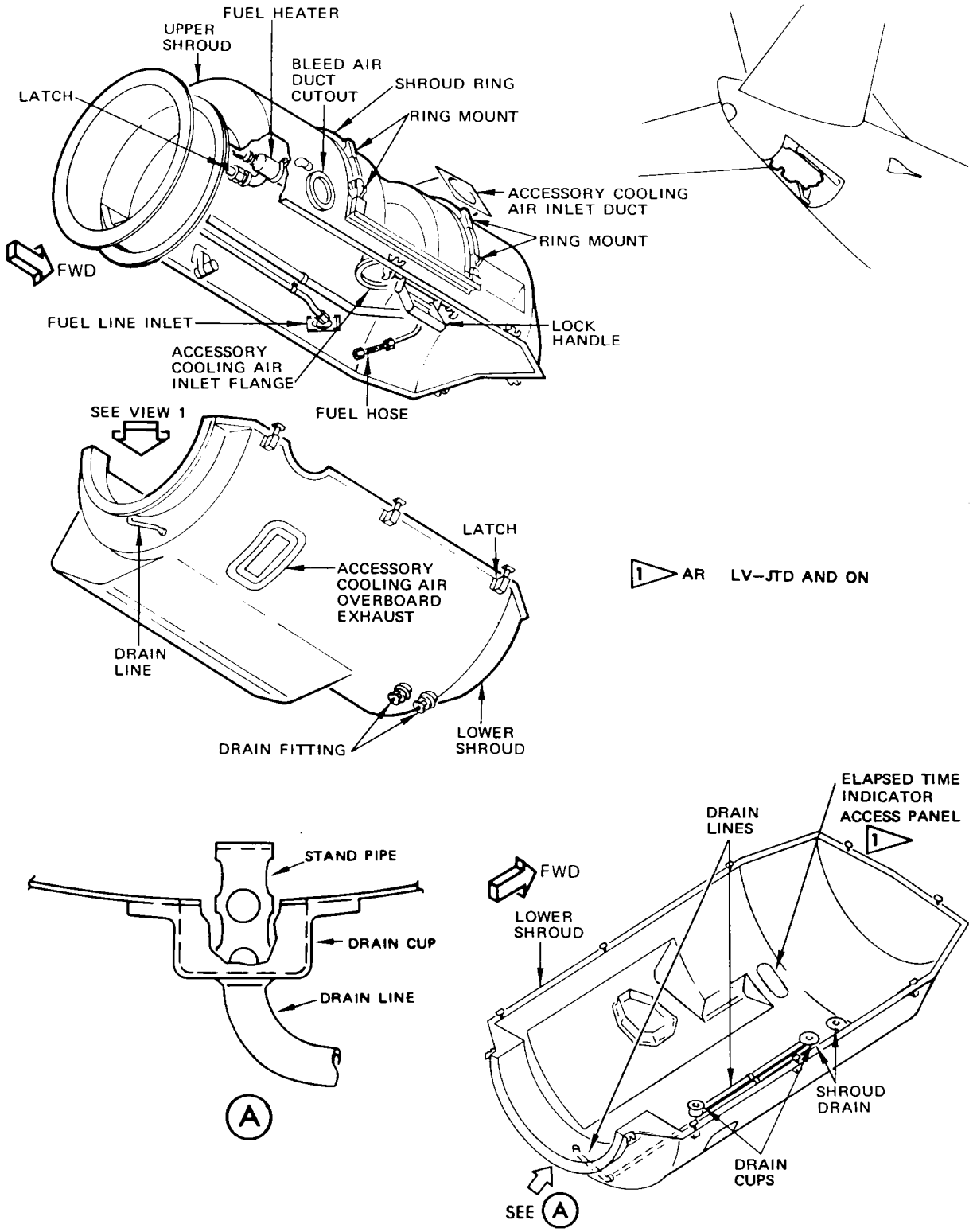
(2) If the inlet door actuator was not removed from the airplane; Do these steps:
(a) FOR THE C49001 TOOL KIT; Remove the cap assembly from the electrical connector and electrical receptacle for the inlet door actuator.
(b) FOR THE F80136 TOOL KIT; Do these steps:
1) Remove the cap chain from the receptacle attachment screw.
2) Remove the cap from the actuator electrical receptacle.
3) Remove the electrical harness with the cap chain from the airplane structure.
4) Remove the cap from the electrical connector for the inlet door actuator.

(3) Connect the electrical connector to the inlet door actuator.

G. Remove cap from fuel inlet line and connect fuel inlet hose (Fig. 805).
H. Remove cap from pneumatic sensing line in upper shroud.
I. Remove caps from following electrical receptacles:
(1) Starter motor
(2) Generator
(3) Generator control
(4) EGT Indicating
(5) Fire detection
(6) APU control
(7) AIRPLANES WITH THE ETC; Electronic temperature control (ETC)
J. Remove dummy plug assembly from APU control receptacle on APU shroud.
K. Do the activation of the APU fuel shutoff valve found on left rear spar in wheel well (Fig. 802):
(1) FOR THE C49001 TOOL KIT; Remove the cap assembly from the electrical connector and electrical receptacle for the APU fuel shutoff valve.
(2) FOR THE F80136 TOOL KIT; Do these steps:
(a) Remove the cap chain from the receptacle attachment screw.
(b) Remove the cap from the electrical receptacle of the APU fuel shutoff valve.
(c) Remove the electrical harness with the cap chain from the airplane structure.
(d) Remove the cap from the electrical connector for the APU fuel shutoff valve.
(3) Connect the electrical connector to the APU fuel shutoff valve.
L. Install APU (Ref 49-11-0 R/I).

APU SHROUD - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The APU power plant is completely enclosed in a titanium shroud to provide a fireproof and sound reducing enclosure for the unit. The shroud consists of the upper shroud and lower shroud. The upper shroud supports the forward (floating) end of the exhaust duct. Both shrouds mate with a seal on the turbine section aft flange. The seal separates the exhaust duct cooling system from the APU (accessory) cooling air system.
2. Upper Shroud (Fig. 1)
   A. The upper shroud encloses the upper half of the APU engine. The upper shroud is attached to the shroud rings; the shroud rings are attached to the APU compartment structure with eight ring mounts. The upper shroud remains on the airplane when the APU engine is removed. The upper shroud provides cutouts for the fuel line, the compressor air inlet duct, the accessory cooling air duct, and bleed air duct. The shroud is fitted with electrical and plumbing quick disconnects. Three mount brackets for the APU engine are attached to the shroud rings. A fuel heater is attached to the inside surface of the shroud.
3. Lower Shroud (Fig. 1)
   A. The lower shroud encloses the lower half of the engine, the combustion chamber, and the oil tank. The lower shroud is attached to the upper shroud with eight latches. The shroud provides cutouts for the oil tank filler port and the accessory cooling air overboard exhaust. Some shroud assemblies will have an access panel that may be removed for reading of the elapsed time indicator. When the shroud is removed, access is obtained to the APU control thermostat (Airplanes without the ETC) or the proportional control valve (Airplanes with the ETC), overtemperature control thermocouple, EGT probes, combustor unit, fuel line, igniter plug, ignition unit, oil tank, oil quantity transmitter, oil lines, APU electrical generator, cooling air fan, fuel control unit, centrifugal switch, starter motor, and the oil pump.
4. Drains (Fig. 1)
   A. The APU drains provide means for draining unburned fuel from the engine and for draining fuel and/or oil from the shroud in event of fuel or oil leakage inside the shroud. At the aft end of shroud, a drain cup with standpipe picks up unburned fuel discharged through the turbine exhaust port. Two fuel drain lines are manifolded into a fitting on engine. This fitting mates with a drain cup in the drain line. The drain line terminates at a fitting at the forward end of the shroud. Adjacent to the drain line terminal end fitting is another fitting. Through this fitting fuel or oil is drained from the shroud. Both fittings at the forward end of the shroud mate with drain cups in APU compartment access door. The drain cups in access door are connected to a drain mast. For description of the APU compartment access door, refer to Chapter 52.



VIEW 1

APU Shroud
Figure 1

APU SHROUD DRAINS - CLEANING/PAINTING

1. General
   A. The APU shroud drain system includes drain cups and plumbing of the lower shroud and the mating seal plates and drain mast of the APU access door.
   B. For additional information regarding drain fittings mating with the shroud drains, see 49-31-71, Fuel Drains - Inspection/Check.
2. Equipment and Materials
   A. Cleaning solvent - Federal specification P-D-680, or equivalent
   B. Compressed air source - 90 to 100 psi
3. Clean APU Shroud Drains (Fig. 701)
   A. Open circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   B. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU is "in work."
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Using air source, blow through exhaust duct drain tube, aft drain cup and forward drain cup. Ascertain that air flows from through-shroud fitting of forward drain cup.

      NOTE: Forward drain cup can be cleaned by removing cover, blowing cup out with compressed air and reinstalling cover.

   F. Check interior of drain cups for evidence of deterioration due to corrosion.
   G. Blow air through shroud drain fitting. Ensure fitting is clear.

      NOTE: If oil has accumulated in lower shroud, wipe down with solvent. Dry with compressed air.

   H. With APU access door open, blow air through seal plate fittings. Verify that air exits through APU drain mast.
   I. Blow air through two drain holes in forward end of door.

      NOTE: If oil has accumulated in door, wipe down with solvent. Dry with compressed air.

   J. Wipe drain mast and external surface of APU access door clean.

4. Restore Airplane to Normal Configuration

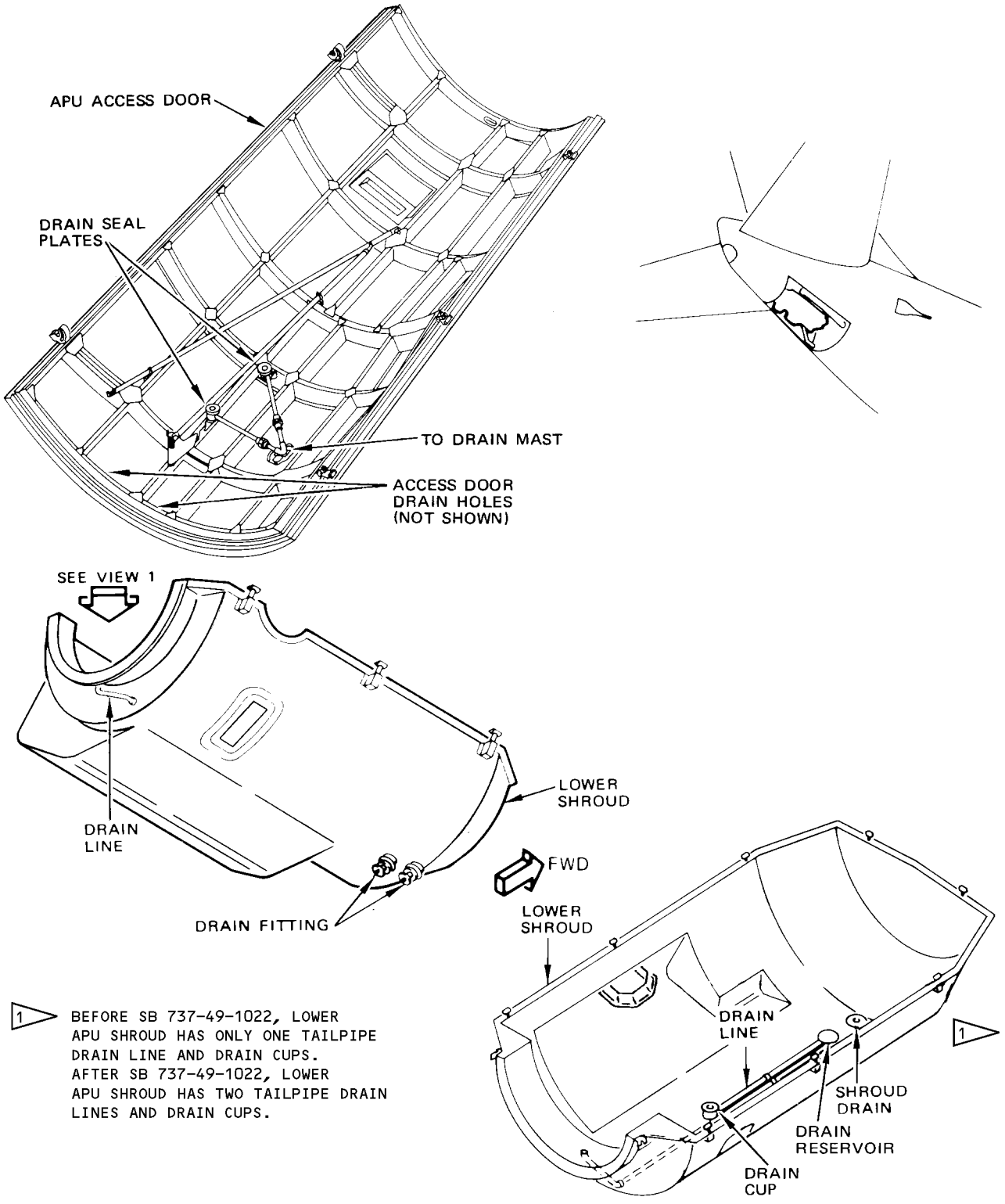
A. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

B. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

C. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.

D. Remove placard from BATTERY SWITCH and APU START SWITCH.



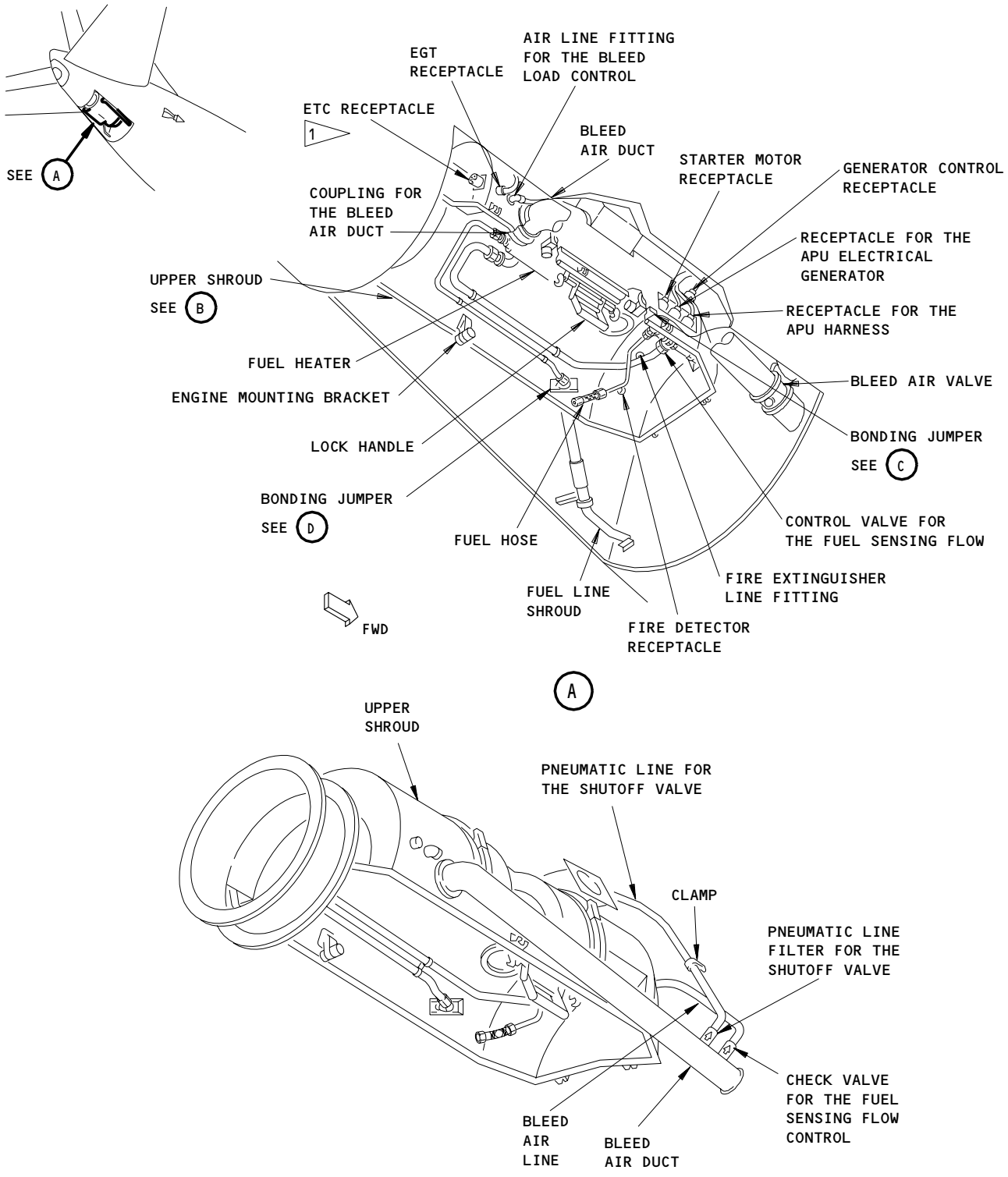
APU Shroud Drains
Figure 701

UPPER SHROUD - REMOVAL/INSTALLATION

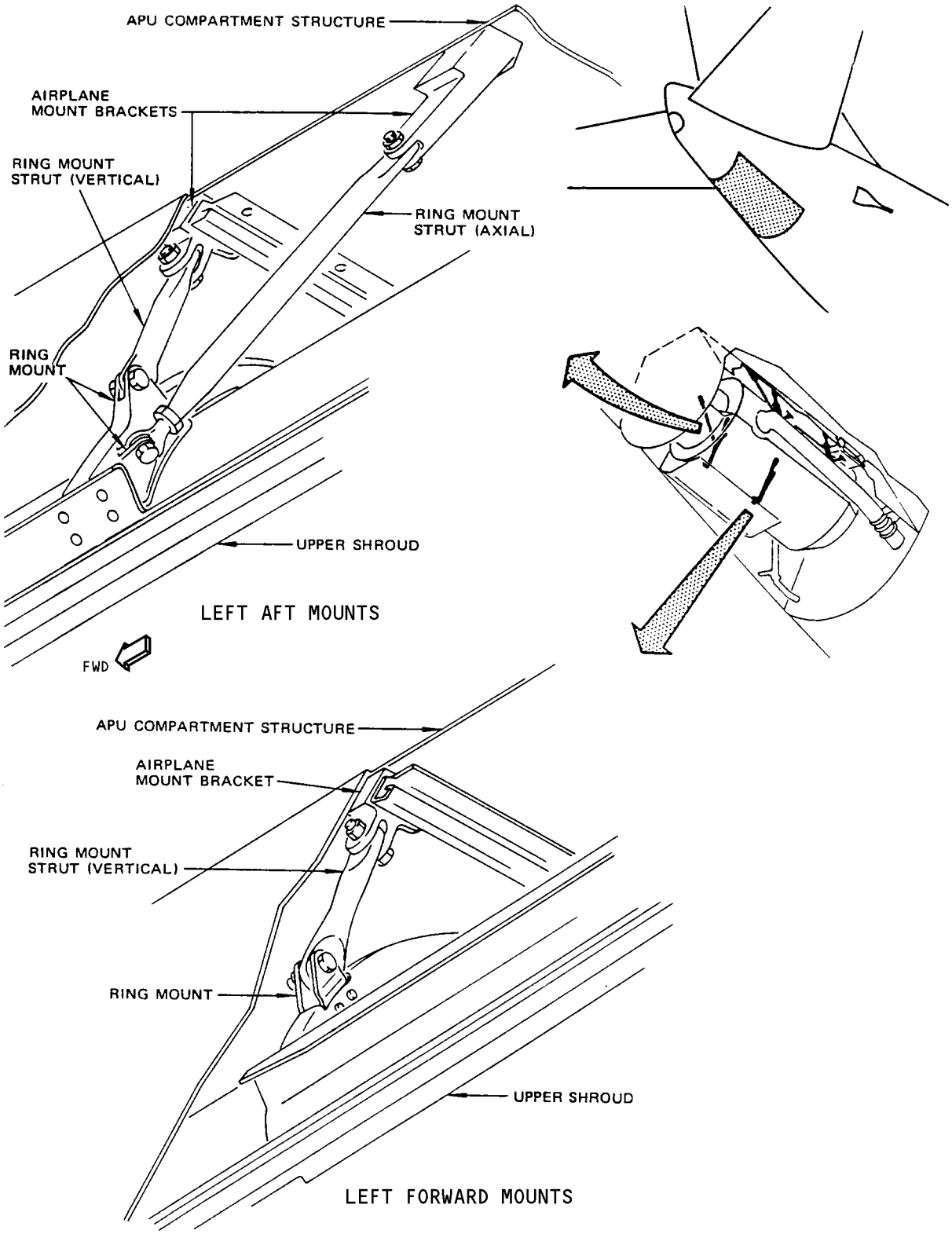
1. Prepare Upper Shroud for Removal
   A. Position stabilizer trim in full up position (airplane nose down).
   B. Open stabilizer trim control circuit breaker on P6 panel and placard that APU maintenance is "in work."
   C. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work."
   D. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   E. Open APU compartment access door latches and open door. Install door support rods.
   F. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

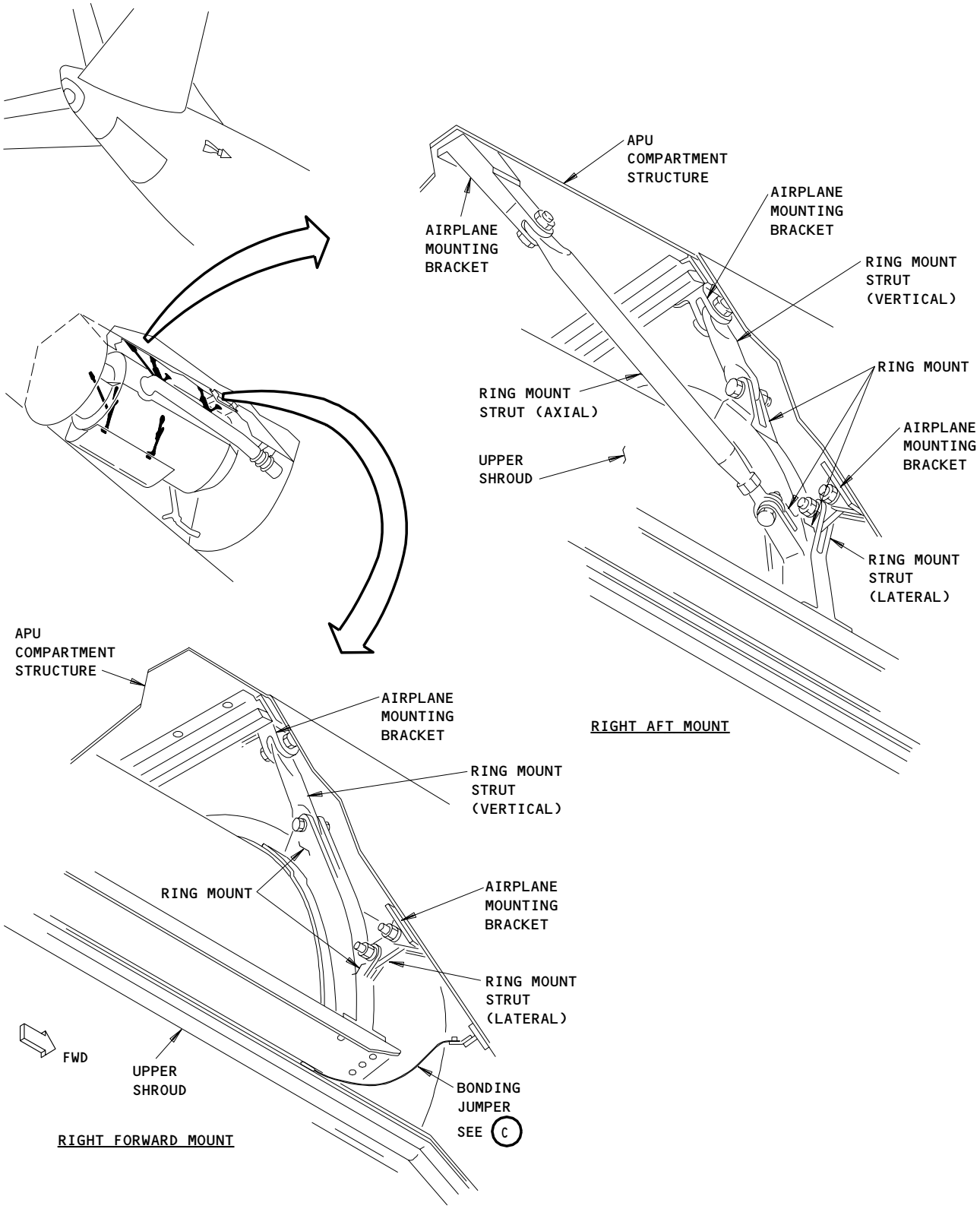
   G. Remove APU (AMM 49-11-0/401).
2. Remove Upper Shroud (Fig. 401)
   A. Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
   B. Reaching through opening in horizontal web, disconnect air pressure line from cooling air shutoff valve pneumatic actuator.
   C. In APU compartment, disconnect generator, starter motor, and APU harness receptacles from fittings in upper shroud.
   D. AIRPLANES WITH THE ETC; disconnect the ETC receptacle from the fitting in the upper shroud.
   E. Disconnect EGT receptacle from the fitting in the upper shroud.
   F. Disconnect generator control receptacle from fitting in upper shroud.
   G. Remove the six screws that attach the fuel line shroud to the upper shroud.
      (1) Remove the nut, two washers and screw that attach the clamp and bonding jumper to the upper shroud.
      (2) Remove the clamp
      (3) Disconnect the fuel line from the upper shroud.
   H. Disconnect bleed load control air line from bleed air valve. Cap and plug fittings.
   I. Disconnect fire detection sensor element receptacle from fitting in upper shroud.
   J. Disconnect fire extinguisher line from fitting in upper shroud.
   K. Disconnect upper shroud to airplane structure bonding jumper (Fig. 401, Sheet 3, Detail B).
   L. Disconnect the bleed air line from the fitting of the control valve for the fuel sensing flow in the upper shroud.
   M. Remove flexible connector, duct end and clamp from bleed air duct.



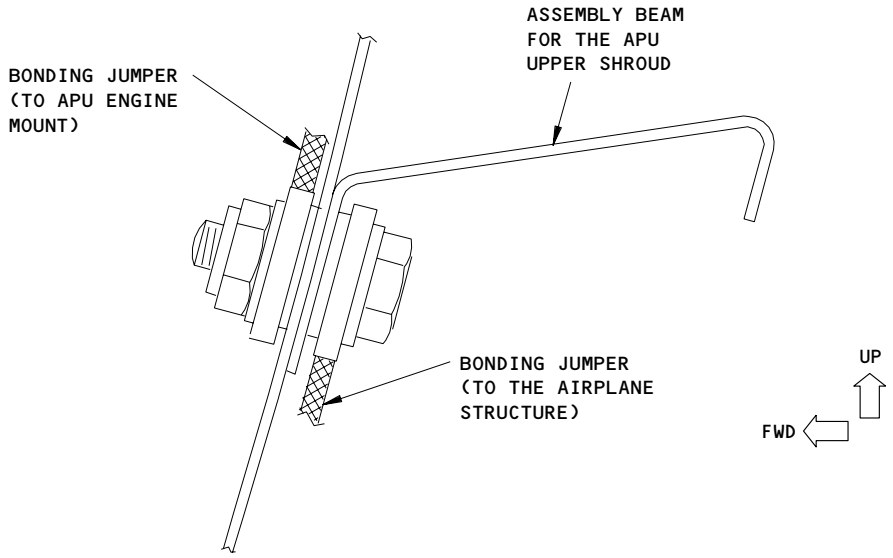
Upper Shroud Installation
Figure 401 (Sheet 1)



Upper Shroud Installation
Figure 401 (Sheet 2)

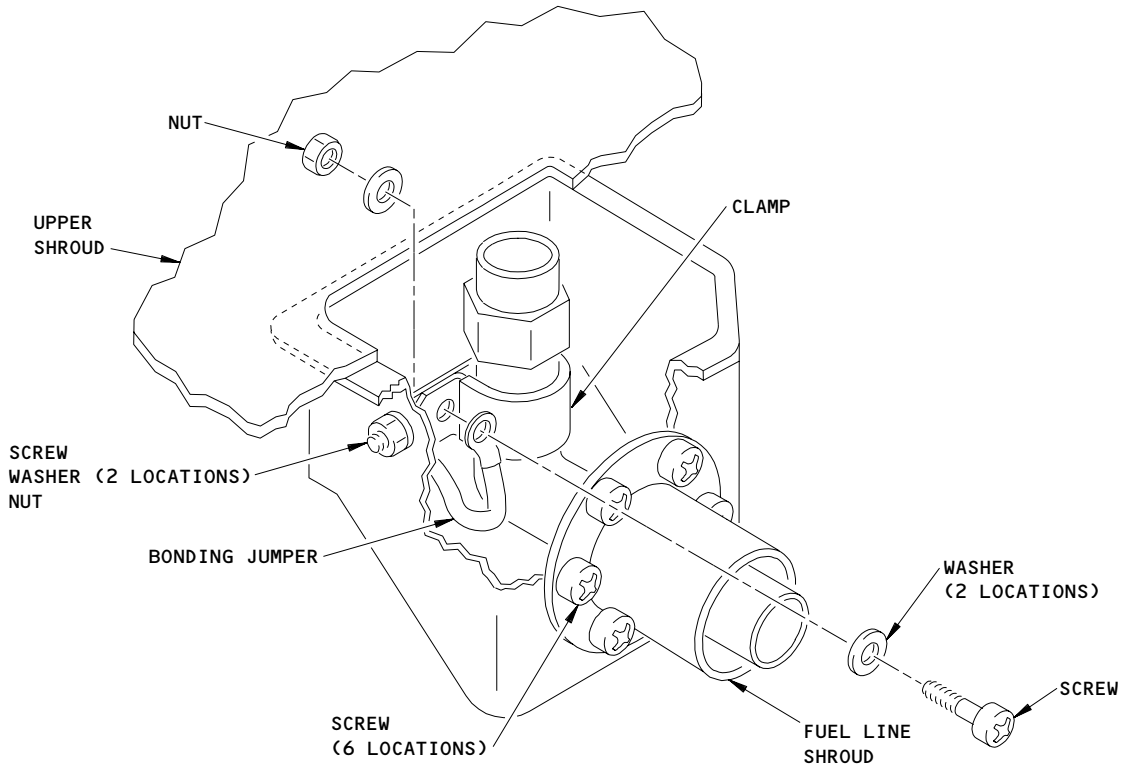


Upper Shroud Installation
Figure 401 (Sheet 3)



BONDING JUMPER INSTALLATION

C



BONDING JUMPER INSTALLATION

D

Upper Shroud Installation
Figure 401 (Sheet 4)

N. Remove screws securing bleed air duct to outer surface of shroud, move duct outboard to clear shroud and temporarily secure bleed air duct to the APU compartment.
O. Disconnect overheat detector from shroud where applicable.
P. Remove nuts, washers, and bolts attaching vertical and axial ring mount struts to left aft ring mount.

NOTE: Ring mount struts vary in length. Do not remove from airplane mount brackets unless necessary.

Q. Remove nut, washer, and bolt attaching ring mount strut to left forward ring mount.
R. Remove nuts, washers, and bolts, attaching axial, vertical, and lateral ring mount struts to right aft ring mount.
S. Remove nuts, washers, and bolts attaching vertical and lateral ring mount struts to right forward ring mount.
T. Carefully remove upper shroud from APU compartment.

CAUTION: BE CAREFUL WHEN YOU REMOVE THE UPPER SHROUD FROM THE APU COMPARTMENT. DAMAGE TO THE INSPECTION PORT FOR THE AIR INLET DUCT AND THE UPPER SHROUD CAN OCCUR.

U. If shroud is to be replaced, remove cooling air shutoff valve (AMM 49-51-21/401) and fuel heater (AMM 49-31-61/401) (where applicable) from shroud.

3. Install Upper Shroud (Fig. 401)
A. If cooling air shutoff valve and fuel heater were removed in 2.U., install valve (AMM 49-51-21/401) and fuel heater (AMM 49-31-61/401) on new shroud.
B. Make sure the bleed air duct is temporarily attached in the APU compartment before you install the upper shroud.
C. Carefully raise upper shroud into APU compartment, aligning compressor air inlet opening in shroud with compressor air inlet duct.

NOTE: Put the inspection port for the air inlet duct into the lightning hole of the horizontal web during upper shroud installation.

D. Attach vertical and lateral ring mount struts to right forward ring mount with bolts, washers, and nuts.
E. Attach axial, vertical, and lateral ring mount struts to right aft ring mount with bolts, washers, and nuts.
F. Attach ring mount strut to left forward ring mount with nut, washer, and bolt.
G. Attach vertical and axial ring mount struts to left aft ring mount with bolts, washers, and nuts.
H. Attach overheat detector to shroud where applicable.

I. Insert bleed air duct elbow into upper shroud and secure with screws.
J. Connect flexible connector, duct end and clamp to bleed air duct.
K. Connect fire detection sensor element receptacle to fitting in upper shroud.
L. Connect fire extinguisher line to fitting in upper shroud.
M. Connect bleed load control air line to bleed air valve.
N. Connect the fuel line to the upper shroud.
   (1) Install the clamp on the fuel line.
   (2) Install the bonding jumper to the clamp with a screw, two washers and nut (AMM 20-10-185/401).
      (a) You must have a resistance of 0.0025 ohm maximum (AMM 20-22-01/601).
   (3) Install the six screws that attach the fuel line shroud to the upper shroud.
O. Connect the bleed air line to the fitting of the control valve for the fuel sensing flow in the upper shroud.
P. Connect generator control receptacle to fitting in upper shroud.
Q. Connect EGT receptacle to fitting in upper shroud.
R. AIRPLANES WITH THE ETC; Connect the ETC receptacle to the fitting in the upper shroud.
S. Connect generator, starter motor, and APU harness receptacles to fittings in upper shroud.
T. AIRPLANES WITH BONDING JUMPERS; Connect upper shroud to airframe structure bonding jumper (Fig. 401, Sheet 3, Detail B).
U. Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
V. Reaching through opening in horizontal web, connect air pressure line to cooling air shutoff valve pneumatic actuator.

4. Restore Airplane to Normal Configuration
   A. Install APU power plant (AMM 49-11-0/401).
   B. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   C. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   D. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   E. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.

F. Close horizontal stabilizer trim control circuit breaker on P6 panel and remove placard.
G. Position BATTERY SWITCH to ON and rotate horizontal stabilizer trim to neutral position.
H. Remove placard from APU START SWITCH.
I. Position BATTERY SWITCH to OFF if power no longer required.

APU SHROUD LATCH - ADJUSTMENT/TEST

1. General
   A. This procedure applies to the latch bolts securing the lower shroud to the upper shroud. The latch bolts should have proper latching tension and both a lock nut and jam nut installed.
   B. This adjustment will be made with the lower shroud installed and all latches in secured position.
2. Adjust APU Shroud Latches
   A. Position APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Unlatch one shroud latch assembly.
   E. Check force required to move latch handle through over-center travel. Force should be 23-33 pounds.
   F. If latch requires adjustment, loosen jamnut and move lock nut as required to either increase or decrease tension. Tighten jam nut.

      NOTE: To prevent loss of jam nut from bolt, deform outer two threads of bolt.

   G. Repeat steps D through F for each of remaining latches.
3. Restore Airplane to Normal Configuration
   A. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   B. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

C. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
D. Remove placard from APU master switch.

UPPER SHROUD SEAL - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Air Source - Dry Compressed, 30 psig (206 kPa) maximum
   B. Adhesive - BAC 5010 Type 60
   C. Alcohol - Isopropyl, TT-I-735
   D. Cloth - Lintfree (commercially available)
   E. Sealant - Fire-Resistant, BMS 5-63
2. Prepare Upper Shroud Seal for Removal
   A. Position APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Upper Shroud Seal Removal (Fig. 401)
   A. Remove the upper shroud seal.

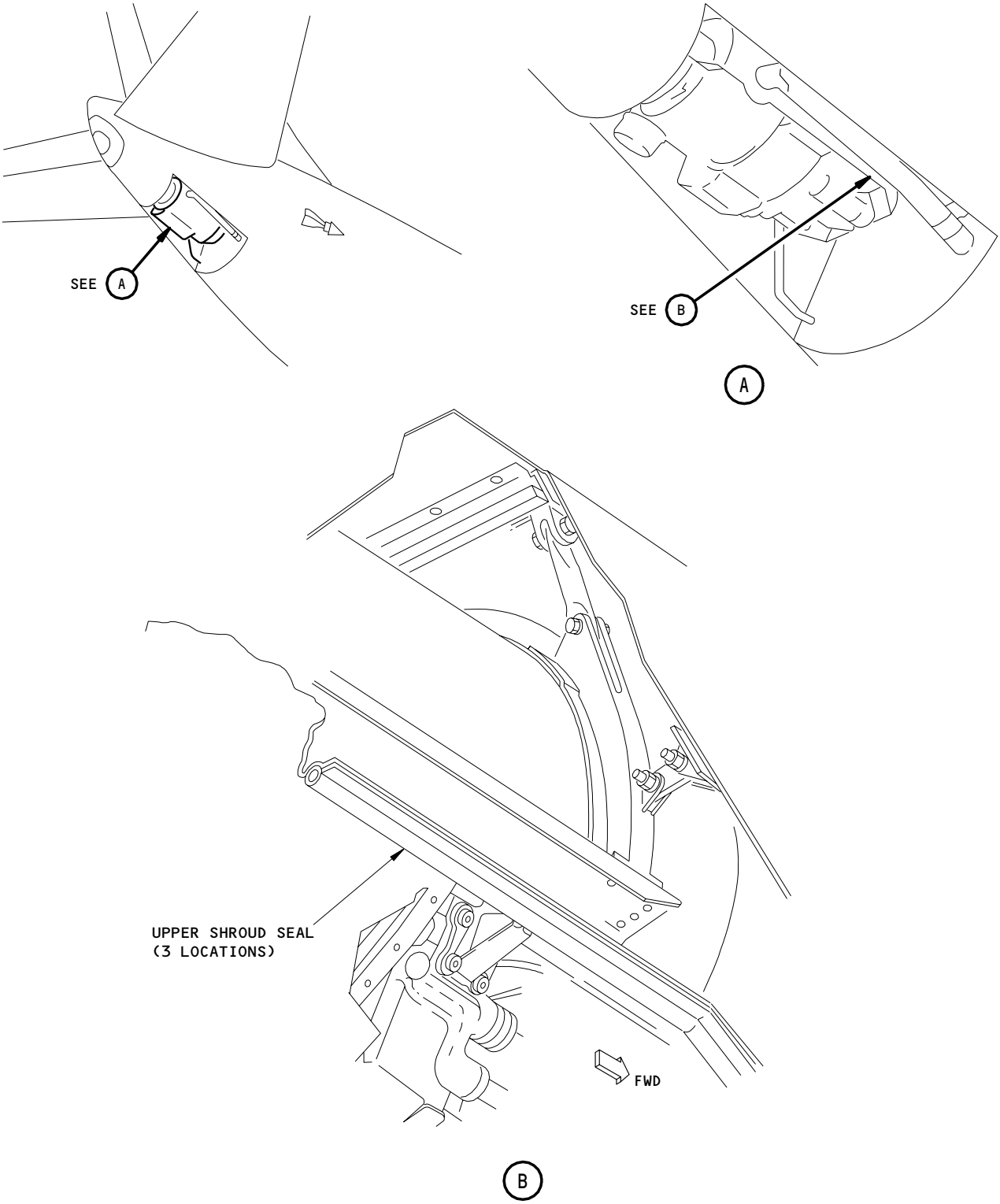
      NOTE: If a part of the seal is loose, missing or has a tear, you can repair the damaged part. Carefully use a knife to remove the damaged part and replace with a new part of the same length.

      NOTE: There are three seals installed around the bottom outer edge of the upper shroud.

   B. Clean the surfaces of the upper shroud:
      (1) Remove the remaining sealant and adhesive from the surfaces of the upper shroud (AMM 51-31-0/201).

          CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (2) Clean the surfaces of the upper shroud with isopropyl alcohol and a cloth.
      (3) Use an air source or a cloth to dry the surfaces of the upper shroud.
4. Upper Shroud Seal Installation (Fig. 401)
   A. Do these steps to install the upper shroud seal:
      (1) Apply the adhesive to the faying surfaces of the seal.



Upper Shroud Seal Installation
Figure 401

(2) Install the seal on the upper shroud.

NOTE: There are three seals installed around the bottom outer edge of the upper shroud.

(3) Apply sufficient pressure to the seal to make sure the seal is installed correctly.
(4) Make sure that the surfaces of the seal show no wrinkles, bubbles or inclusions.
(5) Remove the unwanted adhesive from the upper shroud and seal with a cloth.
(6) Use foam rubber pads, wood strips (ruler) and/or rubber-padded clamps to temporarily attach the seal to the upper shroud.
(7) Let the adhesive dry under contact pressure for a minimum of 24 hours at 65°F-100°F (18°C-38°C).

NOTE: You can use a heat lamp to decrease the time for the adhesive to dry. The time to dry with a heat lamp is four hours at 120°F (49°C).

(8) Remove the temporary materials that attach the seal to the upper shroud.
(9) Apply a sufficient amount of sealant in the space between the seal and the upper shroud and between each of the two adjacent seals (AMM 51-31-0/201).

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE STRUCTURE CAN OCCUR.

(10) Remove the unwanted sealant from the upper shroud and seal with a cloth.
(11) Let the sealant dry for a minimum of 48 hours at 72°F-82°F (22°C-28°C).

NOTE: You can use a heat lamp to decrease the time for the sealant to dry. The time to dry with a heat lamp is four hours at 120°F (49°C).

5. Restore Airplane to Normal Configuration

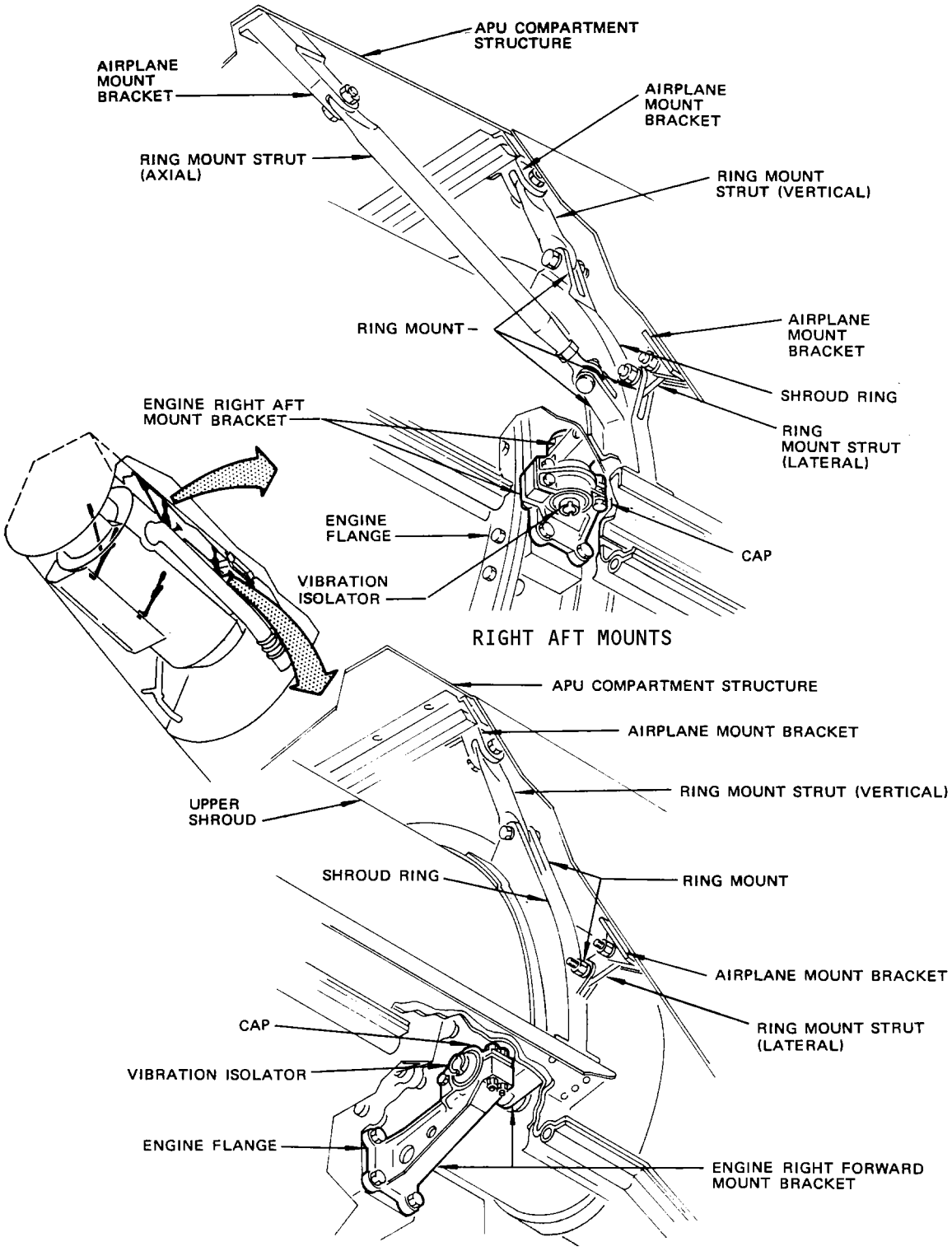
A. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

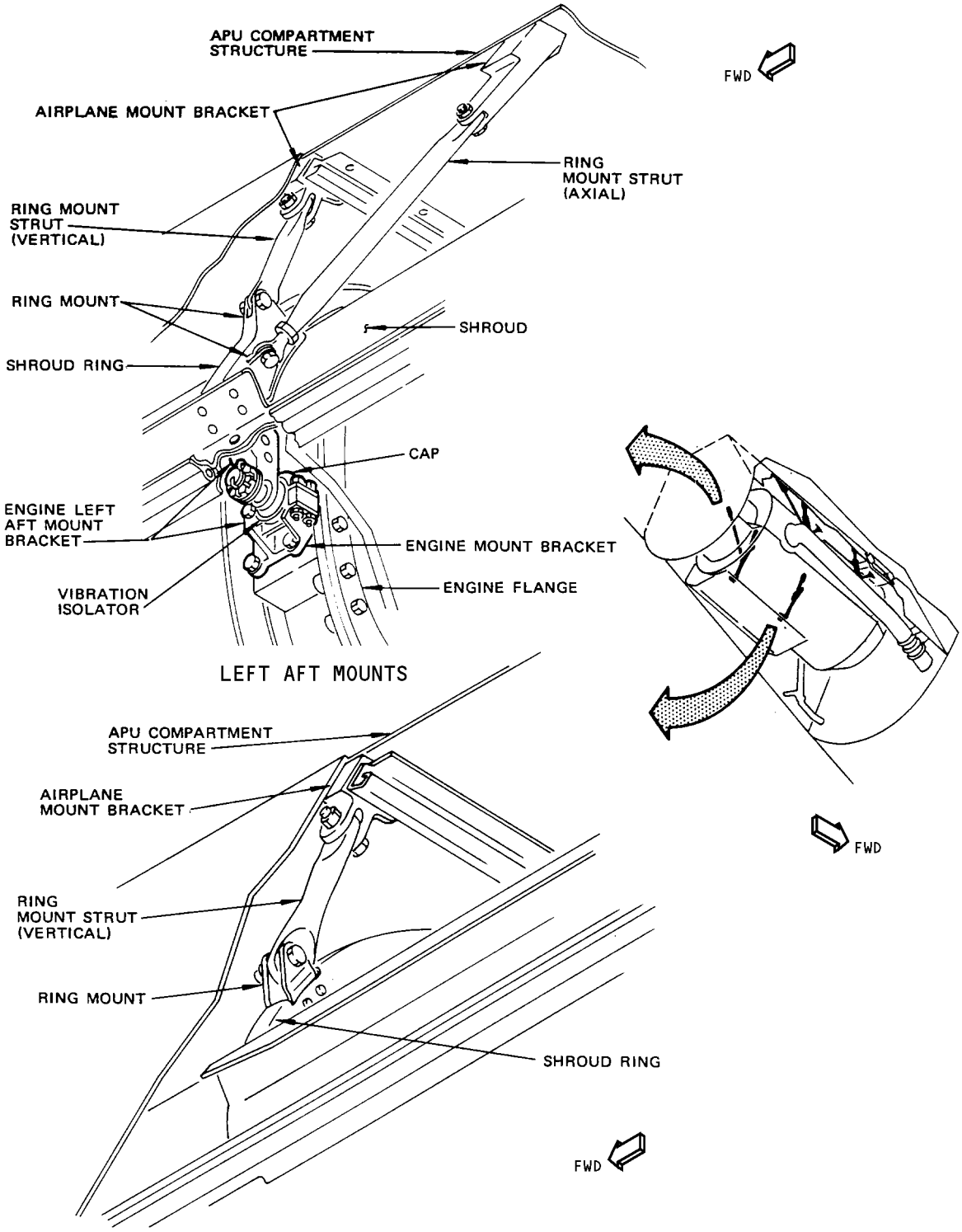
B. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
C. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
D. Remove placard from APU master switch.

APU MOUNTS - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The APU mounts support the APU installation and isolate the airplane from adverse vibrations of the APU engine. The APU mounts consist of the shroud mounts, shroud rings, and APU engine mounts. The shroud mounts attach the shroud rings to the airplane and the engine mounts attach the APU engine to the shroud rings. The shroud mounts, shroud rings, and the engine mounts constitute the APU mount system.
2. Shroud Mounts (Fig. 1)
   A. The shroud mounts attach the shroud rings to the airplane structure. The shroud mounts consist of airplane mount brackets, struts, and ring mounts. The ring mounts are integral with the shroud rings. Each shroud ring is supported vertically by two struts and laterally by one strut. In addition, the aft shroud ring is supported axially by two struts. The struts are fastened to the brackets with bolts and nuts.
3. Shroud Rings (Fig. 1)
   A. Two shroud rings provide the mounting base for the upper shroud and the APU engine mounts. For convenience of installation, the shroud rings are made integral with the upper shroud.
4. Engine Mounts (Fig. 1)
   A. Three engine mounts attach the APU engine to the shroud rings. Two mounts are located on the right side of the APU and one on the left side. The mounts are designed to give the engine maximum support in all directions. Each engine mount consists of two mount brackets, a vibration isolator, and a cap. The mount brackets attached to the shroud rings are fitted with the vibration isolators. The mount brackets attached to the APU engine flanges contain the caps. The caps are used to facilitate a quick removal and installation of the APU.
   B. The vibration isolators prevent the APU engine vibrations from being transmitted to the fuselage. A vibration isolator consists of resilient material bonded to a metal core and enclosed in a tubular metal case. The vibration isolator is between the mount bracket on the engine and the mount bracket on the shroud ring. As the engine vibrates, the resilient material slightly deforms and dampens the engine vibrations by absorbing them.



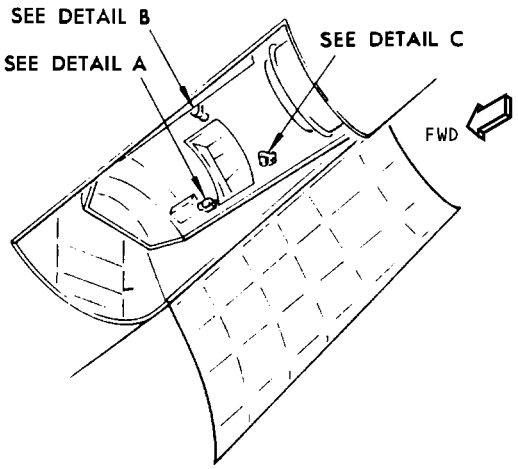
APU mounts
Figure 1 (Sheet 1)

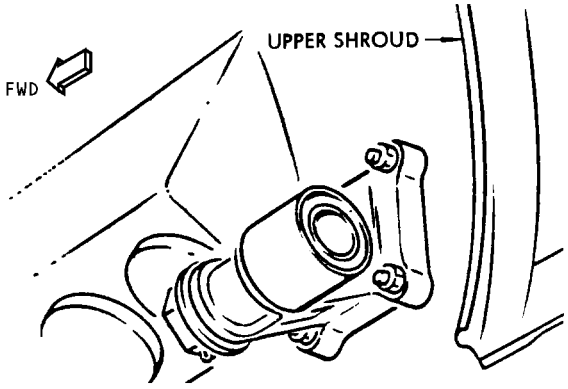


APU Mounts
Figure 1 (Sheet 2)

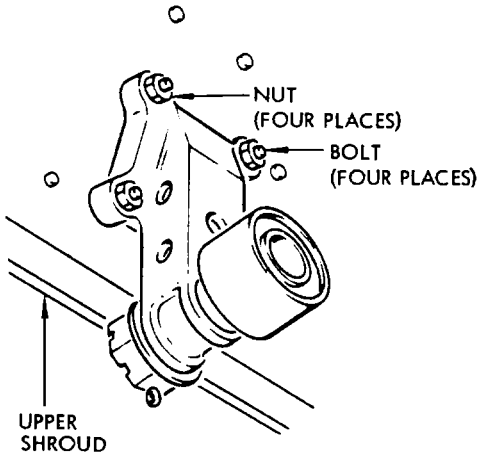
APU ENGINE MOUNTS - REMOVAL/INSTALLATION

1. General
   This section covers the removal/installation of the APU engine mounts, consisting of vibration isolators and engine mount brackets. To gain access to the engine mounts, the APU power plant must first be removed. If a vibration isolator alone is to be replaced, the power plant is removed and the isolator taken off. It is not necessary to remove the engine mount bracket in this case.
2. Removal/Installation APU Engine Mount Brackets From Shroud (Fig. 401)
   A. Remove APU Engine Mount Bracket From Shroud
      (1) Lower APU power plant onto aero stand (AMM 49-11-0/401).
      (2) Remove nuts, washers, and bolts attaching engine mount bracket to upper shroud, and remove bracket.
      (3) Look at the rubber cushion of the vibration isolator for these problems:
         (a) Separations more than 1/8 inch in depth or longer than 1/2 the distance around the vibration isolator are not permitted.
         (b) Cracks more than 1/8 inch in depth are not permitted.
         (c) Displacements more than 0.04 inch (radial) or 0.06 inch (axial) are not permitted.
      (4) If necessary to remove vibration isolator, remove cotter pin, nut, and washers and remove isolator.
   B. Install APU Engine Mount Bracket to Shroud
      (1) If vibration isolator was removed in paragraph A, install vibration isolator with washers and nut.
      (2) Tighten nut to torque value of 25 pound-feet. Install cotter pin.
      (3) Attach engine mount bracket to upper shroud with bolts, washers and nuts. Torque the nuts to 50-75 lb-ins for lubricated bolts and 65-100 lb-ins for dry bolts. Install safety wire.
      (4) Install APU power plant (AMM 49-11-0/401).
3. Removal/Installation APU Engine Mount Brackets From Engine (Fig. 401)
   A. Remove APU Engine Mount Bracket From Engine
      (1) Lower APU power plant onto aero stand (AMM 49-11-0/401).
      (2) Remove bolts attaching engine mount bracket to engine and remove bracket.
   B. Install APU Engine Mount Bracket to Engine
      (1) Attach engine mount bracket with bolts. Torque the bolts to 216-408 lb-ins. Safety wire to engine.
      (2) Install APU power plant (AMM 49-11-0/401).

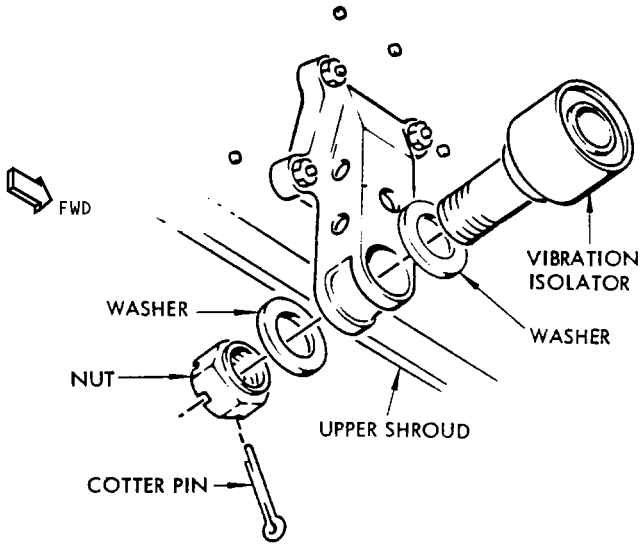




ENGINE RIGHT FWD MOUNT BRACKET
DETAIL A

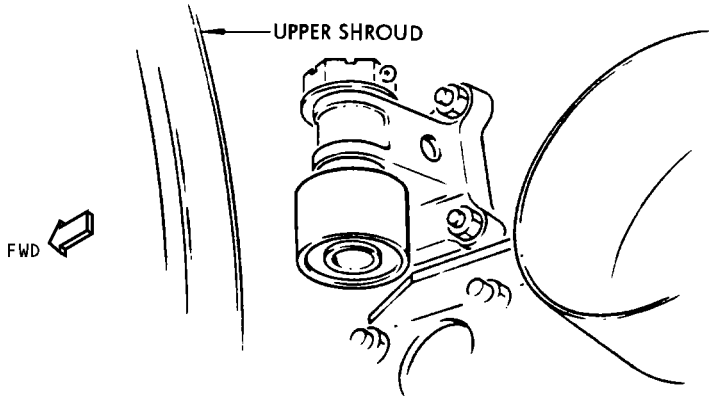


ENGINE LEFT AFT MOUNT BRACKET



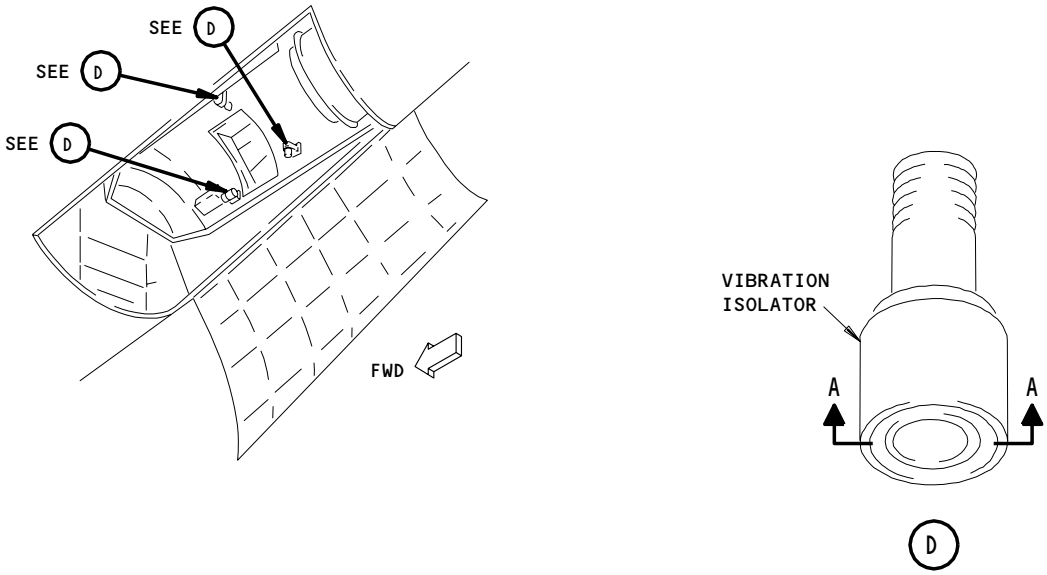
EXPLODED VIEW OF ISOLATOR

DETAIL B

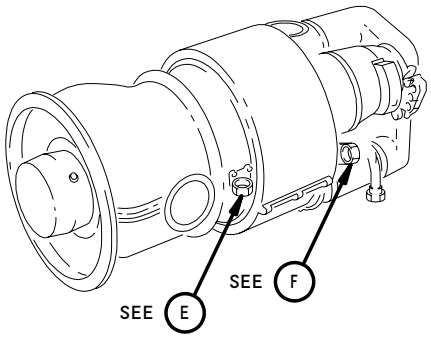


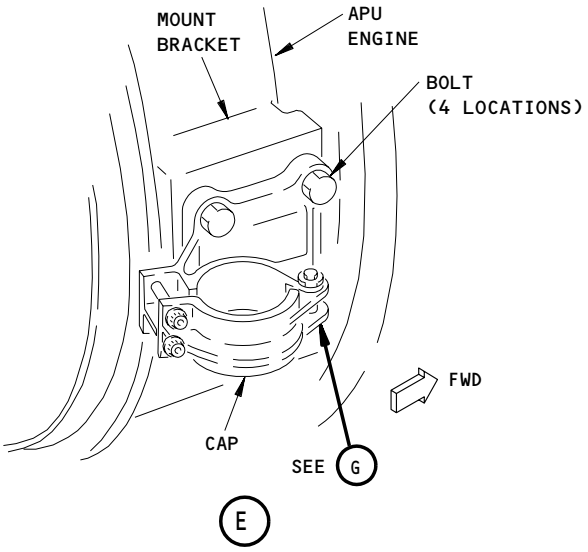
ENGINE RIGHT AFT MOUNT BRACKET
DETAIL C

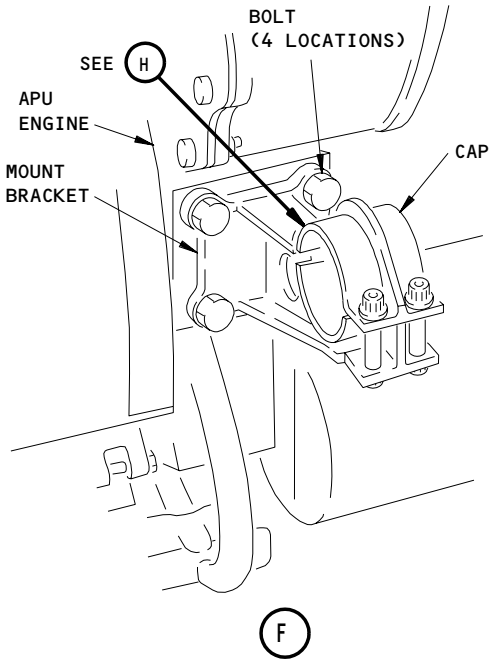
APU Engine Mounts Installation
Figure 401 (Sheet 1)



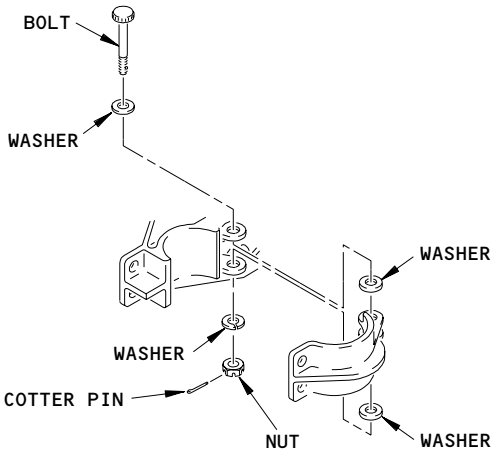
APU Engine Mounts Installation
Figure 401 (Sheet 2)



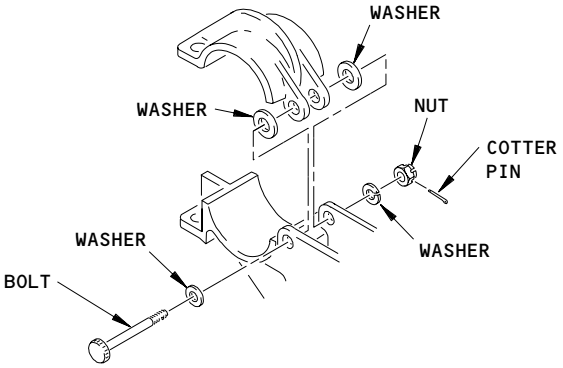




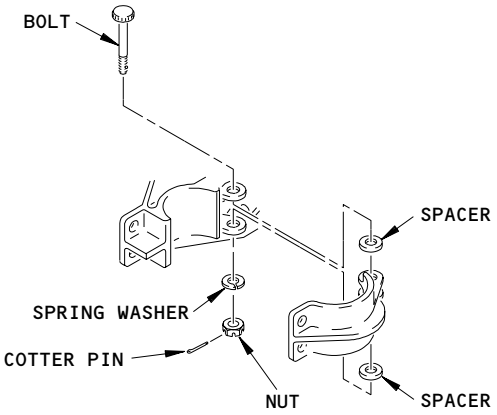
APU Engine Mounts Installation
Figure 401 (Sheet 3)



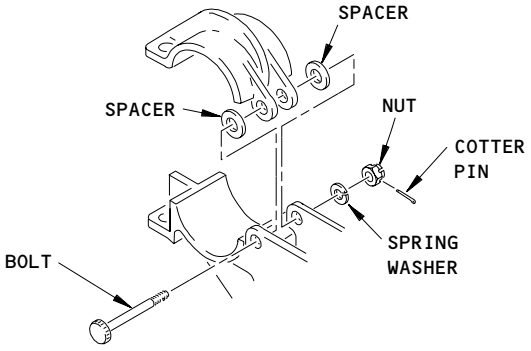
G 1



H 1



G 2

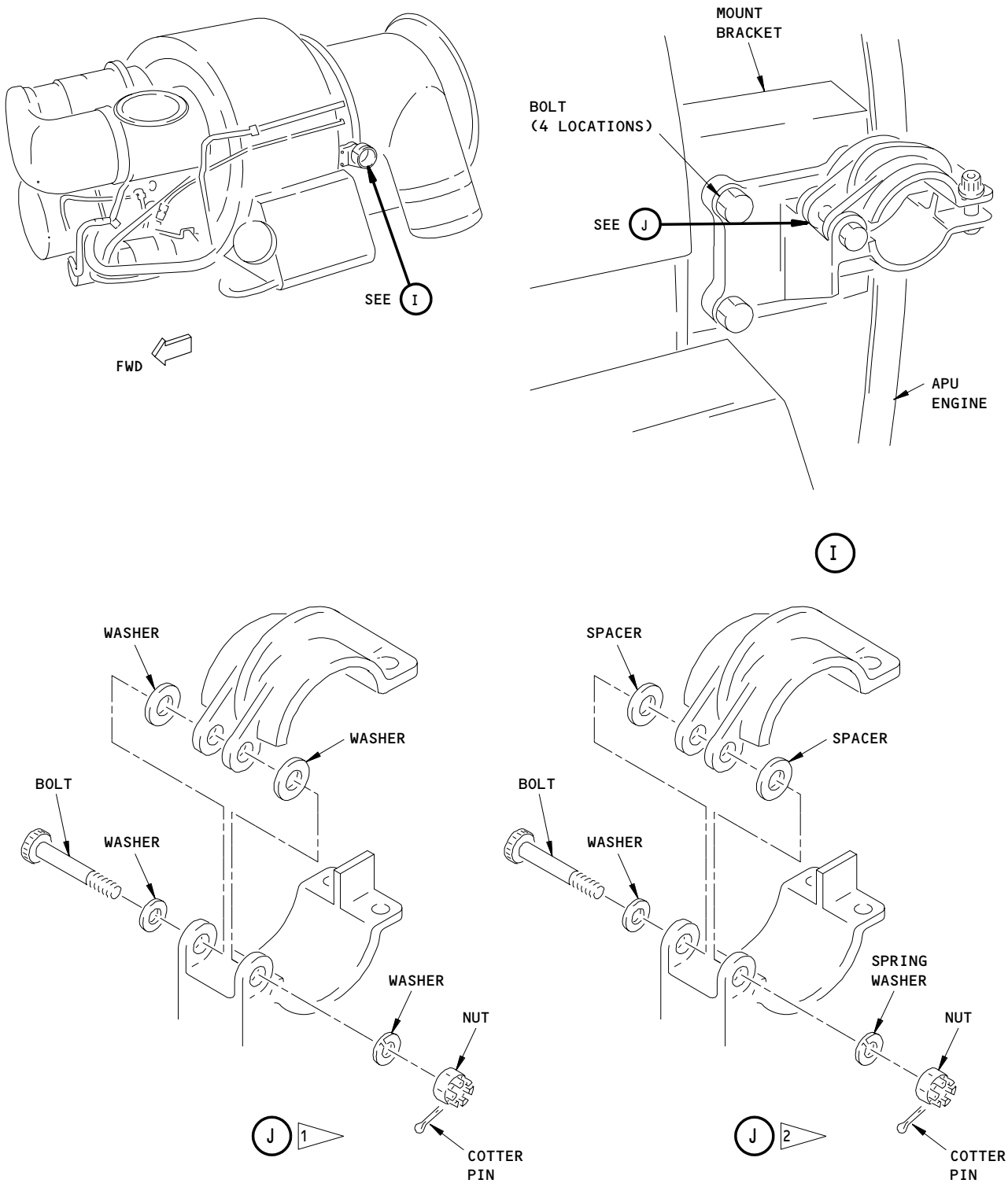


H 2

1 APU PRE-SB 49-1031

2 APU POST-SB 49-1031

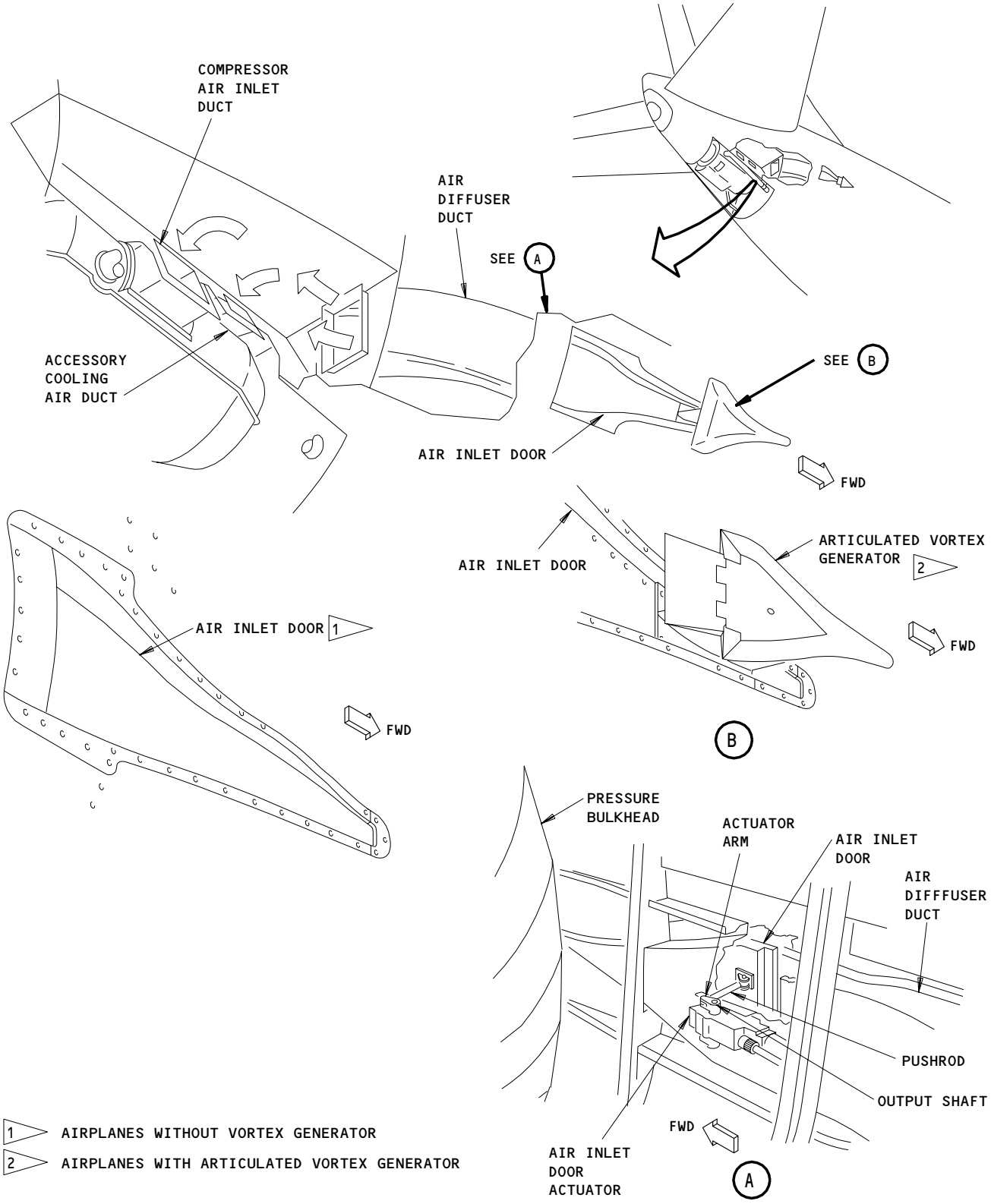
APU Engine Mounts Installation
Figure 401 (Sheet 4)



APU Engine Mounts Installation
Figure 401 (Sheet 5)

APU AIR INLET - DESCRIPTION AND OPERATION

1. General
   A. Air supply to the APU is provided through the air inlet door and ducts (Fig. 1). The air inlet door is located on the right side of the fuselage forward of the APU. The inlet air is ducted to the APU engine compressor plenum and to the accessory cooling air fan.
2. Air Inlet Ducts
   A. The air inlet ducts supply static air on the ground and ram air in flight.The ducts consist of the air diffuser duct, the compressor air inlet duct, and the accessory cooling air duct. The air diffuser duct is located inside the fuselage aft of the rear pressure bulkhead on the right side (Fig. 1). The forward end of the duct is attached to the fuselage where the APU air inlet door is located. The aft end of the duct is connected to the airplane right torque box. The torque box functions as an air collector. The air supply is routed into two ducts from the torque box, the compressor air inlet duct and the accessory cooling air duct. Both ducts are rigidly attached to the torque box and remain with the airplane at the time of the APU engine change. The compressor air inlet duct is rectangular in shape. It is attached to the flange of the APU compressor plenum with a quick action lock. For the description of the accessory cooling air duct, refer to 49-51-0, Accessory Cooling Air System.
3. Air Inlet Door
   A. The air inlet door controls the air supply to the APU. It is triangular in shape and is located at the right side of the fuselage forward of the right horizontal stabilizer. A vortex generator (if installed), located on outer surface of door, provides increased ram air flow to air inlet when APU is operated in flight (Fig. 1). The door is hinged at the forward end, opening inward, and is operated by two pushrods and an electrical actuator. The door does not fully close, thus allowing APU air inlet pressure to be greater than tail pipe pressure at all times.
4. Air Inlet Door Actuator
   A. The air inlet door actuator opens and closes the APU air inlet door. The actuator is of the rotary type. It consists of a gear train and a worm gear set, enclosed in a housing. Two output shafts are integral with the worm gear. Two actuator arms, which operate the air inlet door pushrods, are attached to the output shafts. Driving the actuator is a dc, split field, series wound motor. The motor is reversible and equipped with a magnetic brake. The motor operation is initiated by the APU master switch and terminated by either of the two limit switches in the actuator. One limit switch is for the opening cycle, the other for the closing cycle. The actuator is attached to the structure inside the fuselage aft of the rear pressure bulkhead (Fig. 1).



Air Inlet Duct and Door
Figure 1

APU AIR INLET - ADJUSTMENT/TEST

1. General
   A. The APU air inlet adjustment/test consists of adjusting the air inlet door pushrods for door alignment, the door switch plunger for travel distance and on some airplanes (See Fig. 501 for effectivity), the vortex generator flap for efficient ram air flow into inlet. The switch and vortex generator flap must be adjusted each time the door position is altered by either removal or realignment. A test is provided for the air inlet door alignment but no test can be performed for the door switch plunger travel distance because of the installation characteristics of the switch.
   B. Adjustment of the vortex generator flap requires that adjustments and checks be made both inside and outside of airplane.
2. Air Inlet Adjustment
   A. Air Inlet Door Alignment Adjustment
      (1) Prepare for Air Inlet Door Alignment Adjustment
         (a) Check that BATTERY SWITCH is ON.
         (b) Position APU master switch to ON.
         (c) After door is fully open, position BATTERY SWITCH to OFF and placard.

            WARNING: SERIOUS INJURY CAN RESULT WHILE MEASURING DOOR ALIGNMENT IF BATTERY SWITCH IS ON AND APU MASTER SWITCH IS INADVERTENTLY POSITIONED OFF.

         (d) Open stabilizer trim access door 3701 to gain access to air inlet door actuator.
      (2) Adjust Air Inlet Door Alignment
         (a) Measure door alignment when door is fully open. Refer to View 2, Fig. 501.
         (b) Remove nuts, washers and bolts connecting pushrods to actuator arms (Fig. 501).
         (c) Loosen one pushrod rod end bearing locknut.
         (d) On basis of approximately 0.02 inch travel per half revolution of rod end, rotate rod end until door alignment would be within limits as shown in View 2, Fig. 501.
         (e) Tighten pushrod rod end bearing locknut.
         (f) Perform steps (c) thru (e) for other pushrod rod end.
         (g) Position pushrods on actuator arms and install connecting bolts, nuts, and washers.
         (h) Position BATTERY SWITCH to ON and remove placard.
         (i) Position master switch to OFF.

(j) Measure door alignment when door is closed. Refer to View 2, Fig. 501.

CAUTION: ON AIRPLANES WITH DOOR LIMIT STOP, AIR INLET DOOR ACTUATOR CAN BE SERIOUSLY DAMAGED IF AIR INLET DOOR CONTACTS DOOR LIMIT STOP WHILE DOOR IS RETURNING TO THE CLOSED POSITION.

(k) If required, adjust rod ends until gap between door and inlet throat is as shown in view 2, Fig. 501.

NOTE: Do not adjust beyond limits shown for door open position.

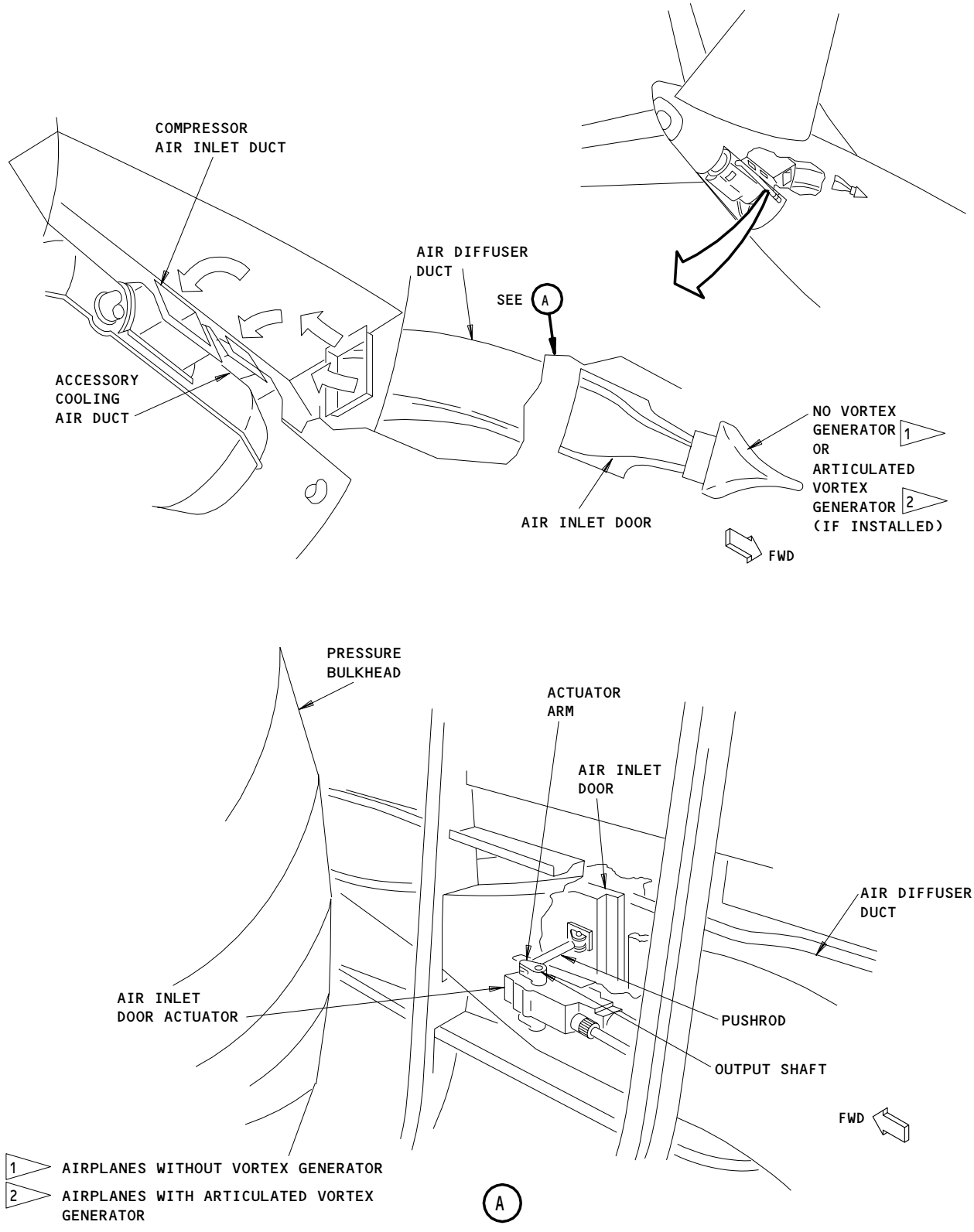
(l) Adjust air inlet door switch plunger travel length per par. B.

B. Air Inlet Door Switch Adjustment

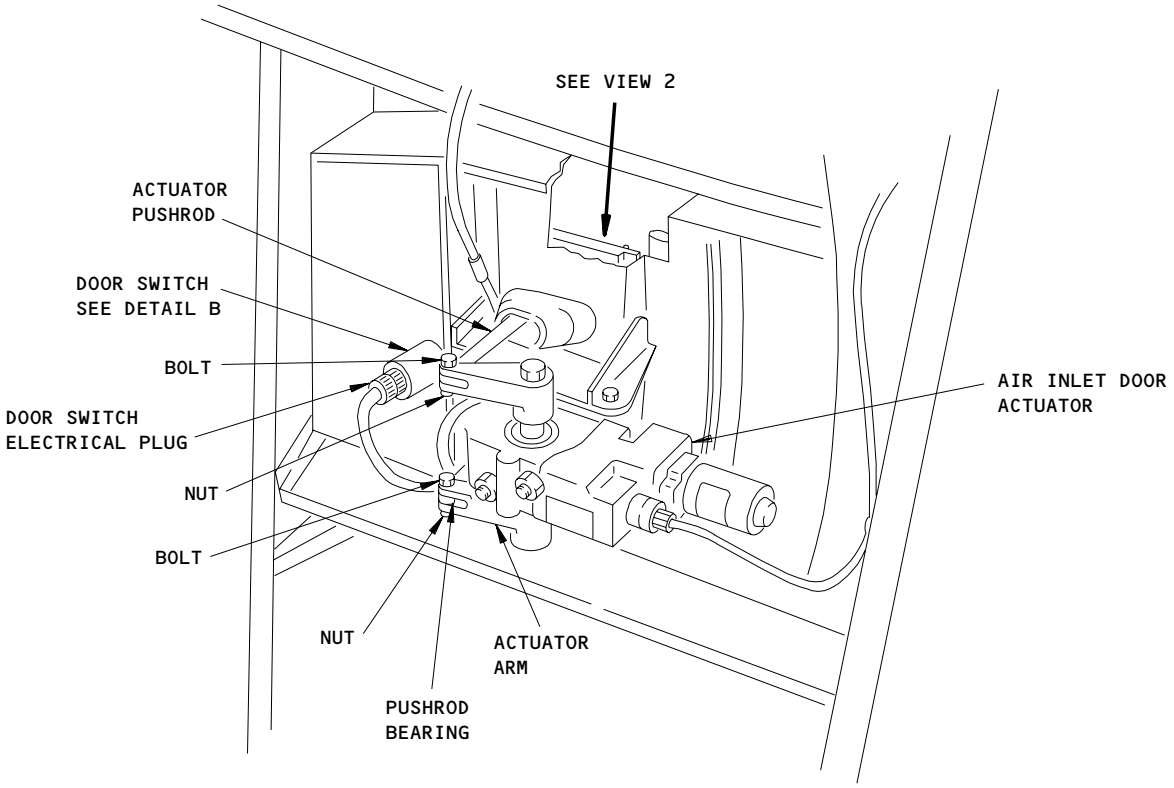
(1) Prepare for Air Inlet Door Switch Adjustment
- (a) Check that BATTERY SWITCH is ON.
- (b) Position APU master switch to ON.
- (c) After air inlet door is fully open, position BATTERY SWITCH to OFF and placard.
- (d) Open stabilizer trim access door 3701 to gain access to air in let door switch.

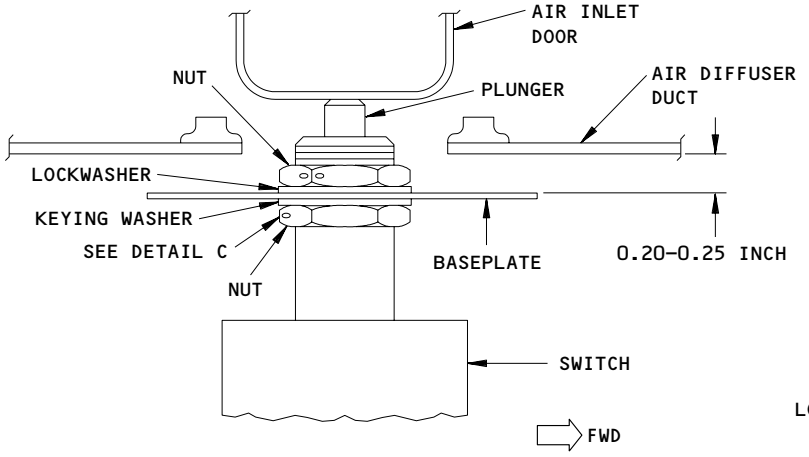
(2) Adjust Air Inlet Door Switch Plunger
- (a) Disconnect electrical plug from switch (Fig. 501).
- (b) Remove screws attaching switch baseplate to air diffuser duct and remove switch and plate.
- (c) Remove nut and lockwasher securing switch to baseplate and remove switch. If replacing switch, remove keying washer and nut.
- (d) Temporarily assemble switch to baseplate in following sequence: nut, keying washer, baseplate, lockwasher and nut.
- (e) Insert switch in duct so that plunger is just touching air inlet door. Do not compress plunger.
- (f) Rotating nuts on switch, adjust location of baseplate so that gap between baseplate and duct is 0.20 to 0.25 inch.
- (g) Position tab of keying washer in baseplate slot and tighten locknut to a torque value of 30-40 pound-inches.
- (h) Lockwire and seal (Fig. 501, Sheet 2, Detail C).
- (i) Position baseplate on air diffuser duct and install attaching screws.
- (j) Connect electrical plug to switch.

(3) Restore Airplane to Normal Configuration
- (a) Close stabilizer trim access door 3701.
- (b) Position BATTERY SWITCH to ON and remove placard.
- (c) Position APU master switch to OFF.

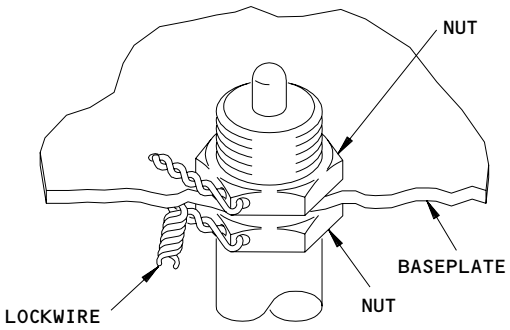


APU Air Inlet Adjustment
Figure 501 (Sheet 1)



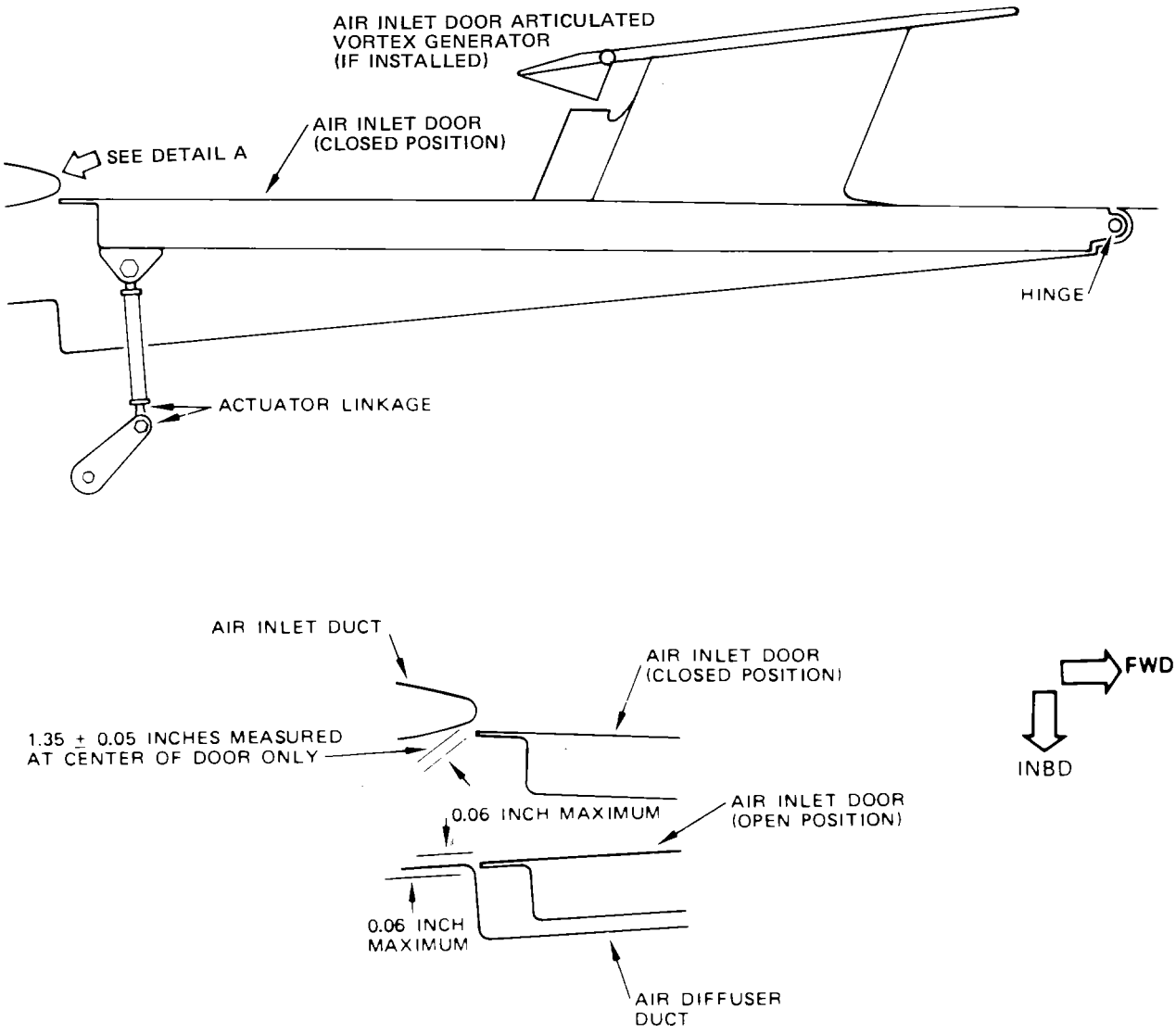


DETAIL B



DETAIL C

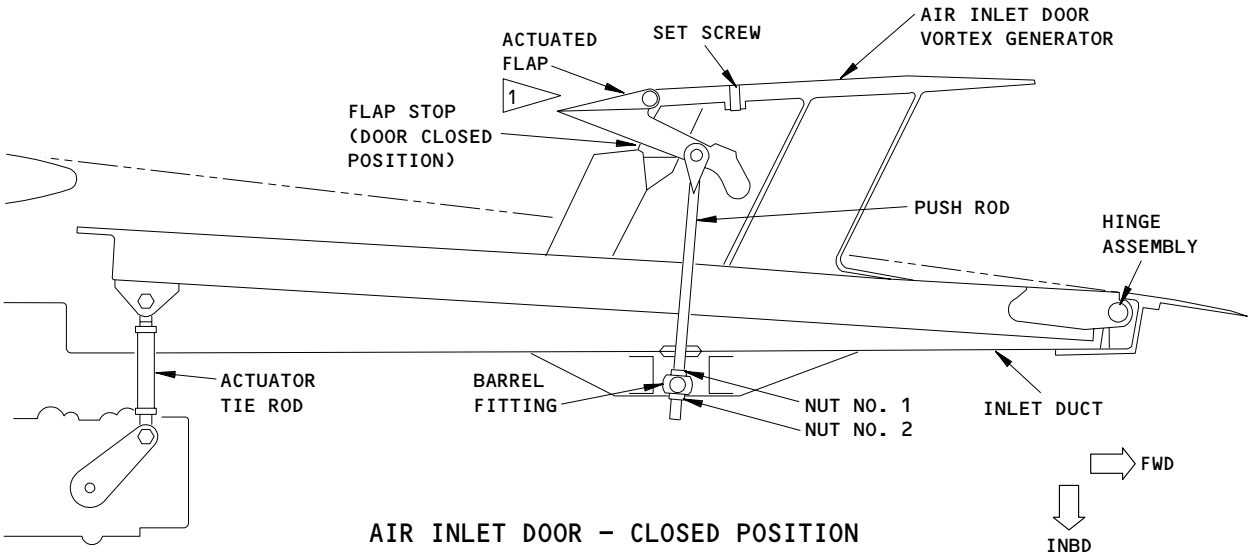
APU Air Inlet Adjustment
Figure 501 (Sheet 2)



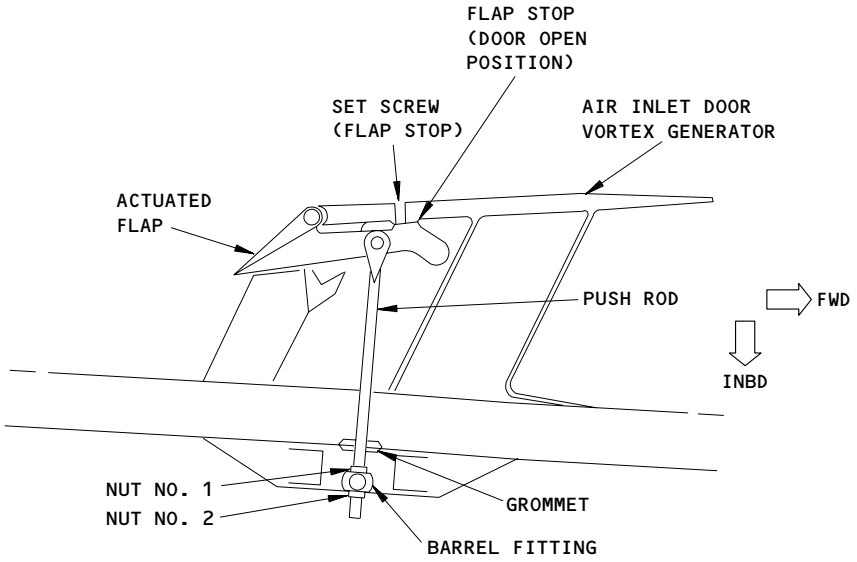
DETAIL A

VIEW 2

APU Air Inlet Adjustment
Figure 501 (Sheet 3)



AIR INLET DOOR – CLOSED POSITION



AIR INLET DOOR – OPEN POSITION

1 AIRPLANES WITH ARTICULATED VORTEX GENERATOR INSTALLED

APU Air Inlet Adjustment
Figure 501 (Sheet 4)

C. Air Inlet Door Vortex Generator Flap Adjustment (If Installed)

NOTE: Air inlet door and door switch adjustment must have been accomplished prior to adjustment of vortex generator flap.

(1) Prepare for air inlet door vortex generator flap adjustment.
  (a) Verify air inlet door in closed position.
  (b) Check that BATTERY SWITCH is OFF and placard that APU maintenance is "in work."
  (c) Open stabilizer trim access door 3701 to gain access to air inlet duct.
(2) Adjust air inlet door vortex generator flap.
  (a) Turn set screw out 3-4 turns
  (b) Loosen nuts No. 1 and 2 and back them off to clear barrel fitting .

    NOTE: Ensure that nut No. 1 is backed off to end of thread to prevent interference when checking door and flap position.

  (c) Pull outward on trailing edge to eliminate all looseness on door and flap and to ensure that flap is firmly seated against door closed position stop. Turn nut No. 2 finger-tight against barrel nut.
  (d) Tighten No. 2 nut an additional 1-1/2 turns.
  (e) Tighten No. 1 nut firmly against barrel fitting. Lockwire nuts 1 and 2 together.
  (f) Remove placard from BATTERY SWITCH and position switch to ON.
  (g) Position APU master switch to ON. Do not go to start.
  (h) After air inlet door is fully open, position BATTERY SWITCH to OFF and placard.
  (i) Rotate set screw inward until contact is made with flap lever, then turn in additional 1-1/2 turns.
  (j) Remove placard from BATTERY SWITCH and position switch to ON.
  (k) Cycle door to closed position and then open position. Check flap for smooth operation.
  (l) Recheck air inlet door alignment per par. 3.

3. APU Air Inlet Door Test
A. Air Inlet Door Alignment Test
(1) Test Air Inlet Door Alignment
  (a) Measure door alignment when door is closed. Refer to view 3, figure 501.
  (b) If door alignment is not within limits, adjust per paragraph 2.
  (c) Position BATTERY SWITCH to OFF and placard.

(d) Position APU master switch to ON.

WARNING: SERIOUS INJURY CAN RESULT WHILE MEASURING DOOR ALIGNMENT IF BATTERY SWITCH IS "ON" AND APU MASTER SWITCH IS INADVERTENTLY POSITIONED TO "OFF."

(e) Measure door alignment when door is fully open. Refer to view 2, figure 501.
(f) If door alignment is not within limits, adjust per paragraph 2.
(g) Cycle actuator to door open and closed position to check that there is no mechanical binding.
(h) Position BATTERY SWITCH to ON and remove placard.
(i) Position APU master switch to OFF.

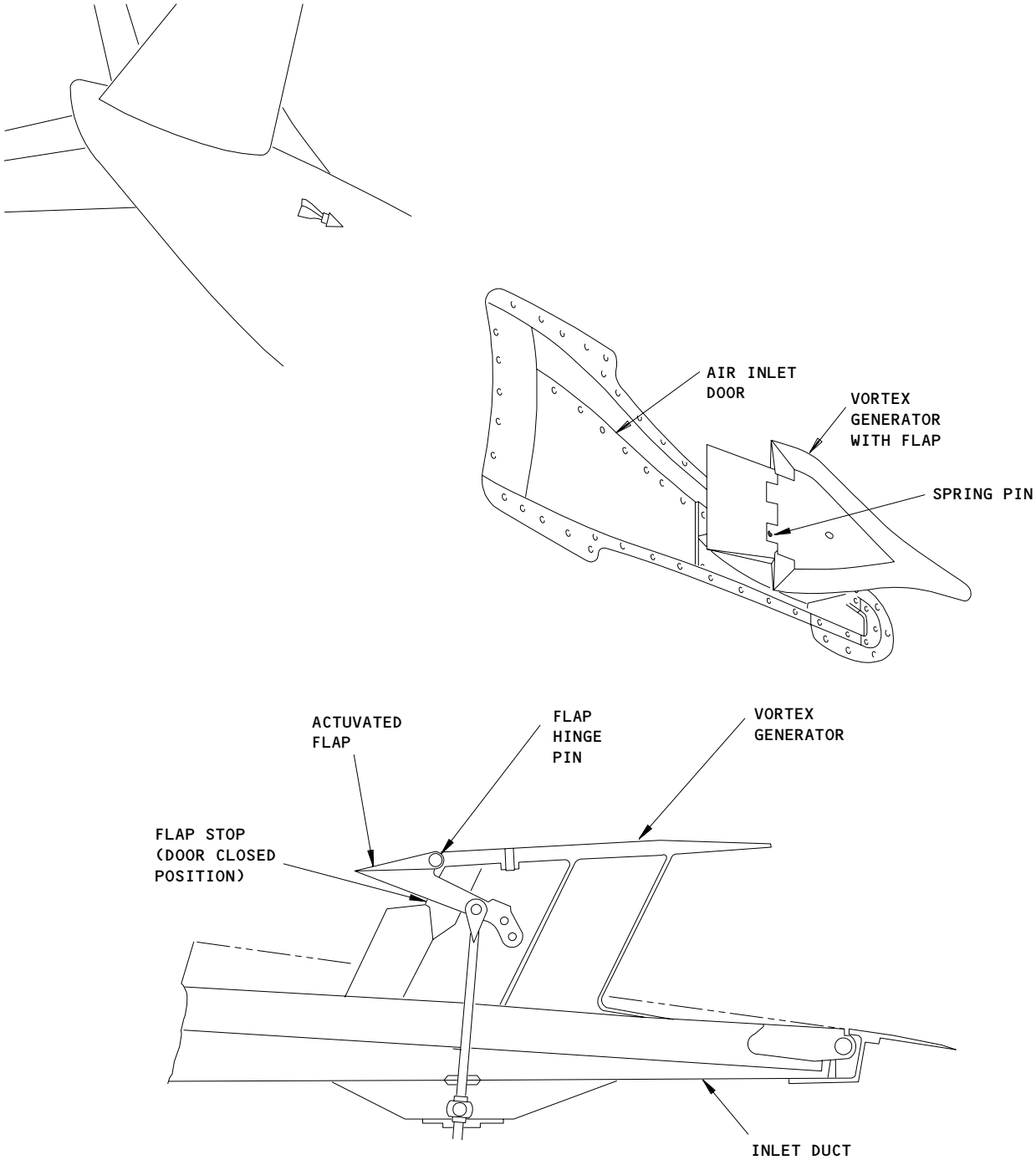
APU AIR INLET DOOR - SERVICING

1. General
   A. This section covers the removal and lubrication of the vortex generator flap assembly hinge pin. No other disassembly is required.
2. Equipment and Material
   A. Grease - BMS 3-24 (AMM 20-30-21)
   B. Spring Pin - MS16562-194
   C. Primer - BMS 10-11, Type I (AMM 20-30-02)
3. Prepare to Lubricate Vortex Generator Hinge Pin
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "IN WORK".
   B. Open the circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.
   C. Gain access to APU inlet door and vortex generator on aft RH side of airplane.
4. Lubricate Vortex Generator Hinge Pin (Fig. 301)
   A. Use a hammer, or rubber mallet, and a 1/16 inch diameter drift to carefully tap the spring pin from the hinge pin.
      (1) Remove the spring pin that holds the vortex generator and the hinge pin in their positions.
      (2) Discard the spring pin.
   B. Remove the hinge pin from vortex generator.
   C. Lubricate O.D. of hinge pin and I.D.of flap and vortex generator hinge bushings.
   D. Align flap and vortex generator hinge bushings and insert hinge pin.
   E. Align spring pin hole of hinge pin with spring pin hole in vortex generator hinge tab.
   F. Install a new spring pin.

      NOTE: Prior to installation of spring pin, apply primer to pin and pin hole.

5. Restore Airplane to Normal Configuration
   A. Close circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.

B. Remove placard from the APU BATTERY SWITCH and APU START SWITCH.



APU Air Inlet Door Installation
Figure 301

APU AIR INLET DOOR - REMOVAL/INSTALLATION

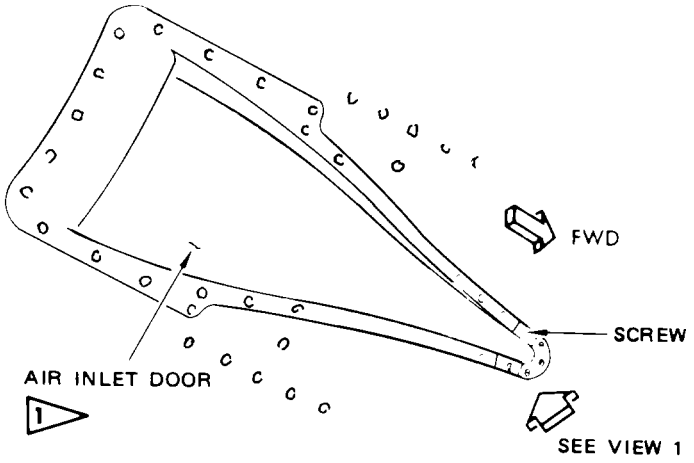
1. General
   A. This section covers the removal and installation of the APU air inlet door. The air inlet door and hinge assembly (forward part of the air diffuser duct) are removed as a unit. The hinge assembly can then be removed from the door.
2. Equipment and Material
   A. Grease - BMS 3-24 (Ref 20-30-21)
3. Prepare to Remove Air Inlet Door
   A. Position BATTERY switch to OFF and placard.
   B. Open stabilizer trim access door 3701 to gain access to air inlet door actuator.
4. Remove Air Inlet Door (Fig. 401)
   A. Remove nuts, washers and bolts connecting pushrod bearings to actuator arms.
   B. On airplanes with vortex generator installed remove nut from inboard end of vortex generator flap pushrod.
   C. Remove screws attaching hinge assembly to airplane structure. Access to screws is gained from outside of airplane.
   D. Carefully remove door and hinge assembly from airplane.

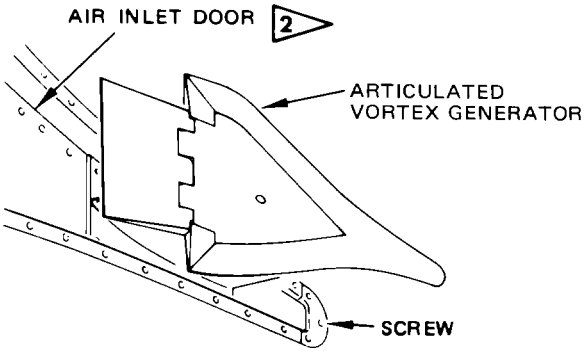
      NOTE: Removing inlet door and hinge assembly from airplane (outside) and nuts (between barrel fitting and grommet in duct) from pushrod inside airplane must be accomplished simultaneously. With nuts removed, inlet door is free to be removed.

   E. Remove hinge pin, washers and cotter pin attaching hinge assembly to door.
   F. Remove hinge assembly from door.
5. Install Air Inlet Door (Fig. 401)
   A. Apply grease to bushing and hinge pin.
   B. Attach hinge assembly to air inlet door with hinge pin, washers and cotter

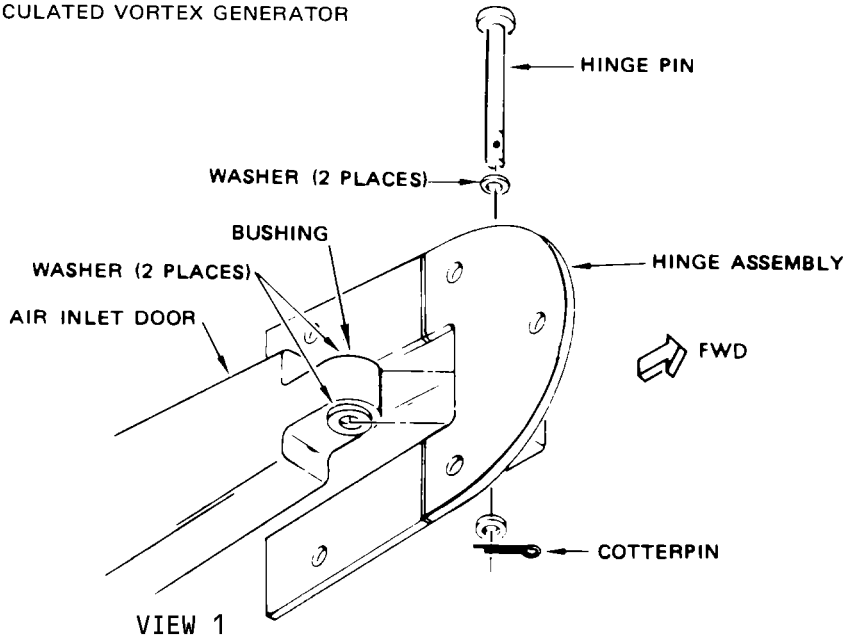
      NOTE: Hinge pin must be installed with head up.

   C. Carefully install door and hinge assembly on airplane with screws.
   D. On airplanes with hinged vortex generator, install door and hinge assembly as follows:
      (1) Check vortex generator flap for restricted movement. If flap does not move freely, refer to 49-15-22, Servicing.
      (2) Apply grease to pin of vortex generator flap pushrod.
      (3) Carefully insert vortex generator flap pushrod through grommet in duct.





1 APU INLET DOOR WITHOUT VORTEX GENERATOR
2 APU INLET DOOR WITH ARTICULATED VORTEX GENERATOR



APU Air Inlet Door Installation
Figure 401

(4) Prior to inserting pushrod through barrel fitting, start hex nut on threaded end.
(5) As nut is turned on, feed pushrod through barrel fitting. Run nut to upper end of threads.
(6) With all three pushrods properly positioned, secure door hinge assembly on airplane with screws.

E. Position pushrod bearings on actuator arms and install connecting bolts, nuts and washers.
F. Place nut on inboard end of vortex generator flap pushrod. Do not tighten at this time.
G. Check inlet door alignment and adjust vortex generator flap (Ref 49-15-00, A/T).

6. Restore Airplane to Normal Configuration
A. Close stabilizer trim access door 3701.
B. Remove placard from BATTERY switch.

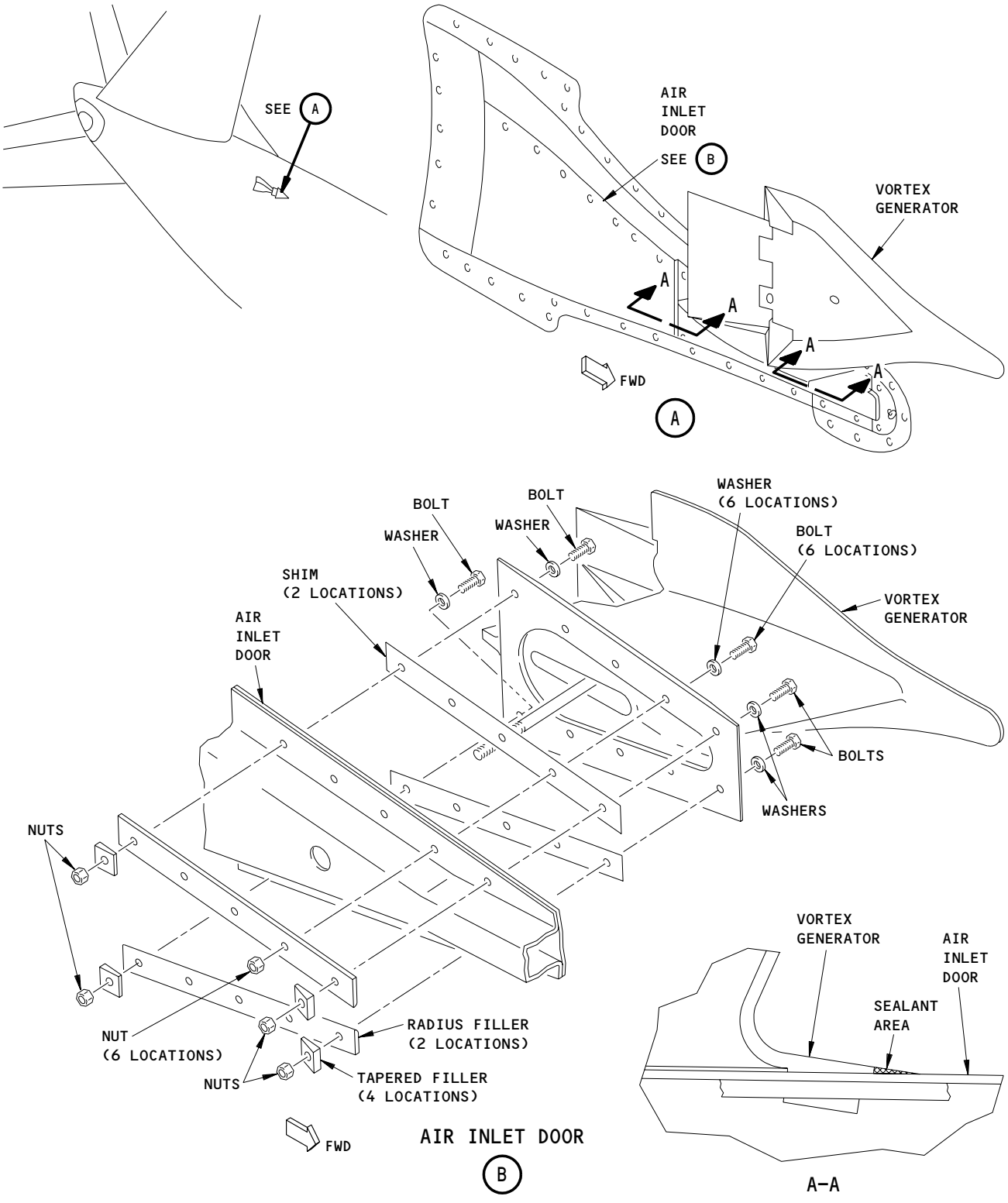
VORTEX GENERATOR - REMOVAL/INSTALLATION

1. General
   A. This procedure has these tasks:
      (1) A removal of the vortex generator
      (2) An installation of the vortex generator.
   B. The vortex generator is installed on the air inlet door. You must remove the air inlet door from the airplane for the removal of the vortex generator.
2. Equipment and Materials
   A. Air Source - Regulated, Dry Filtered, Compressed 60-105 psig (414-723.9 kPa) (22 SCFM) (commercially available)
   B. Tool - Fairing, Plastic or Metal (commercially available)
   C. Sealant, Pressure and Environmental - BMS5-95
   D. Adhesive - BMS5-126, Type 3, Class 1
   E. Alcohol, Isopropyl - TT-I-735
   F. Cloth, Process Cleaning Absorbent Wiper (Cheesecloth, Gauze) - BMS15-5
   G. Swab, Cotton - GG-A-616
3. Vortex Generator Removal (Fig. 401)
   A. Procedure
      (1) Do this task: Air Inlet Door Removal (AMM 49-15-22/401).

          NOTE: During the air inlet door removal, remove the two pushrod bearings from the two pushrods before you remove the nut from the inboard end of the vortex generator flap pushrod.

      (2) Do these steps to remove the vortex generator:
          (a) Remove the ten nuts, ten washers and ten bolts that attach the vortex generator to the air inlet door.
          (b) Remove the four tapered fillers, two radius fillers, two shims and vortex generator from the air inlet door.
          (c) Remove the sealant from the air inlet door (AMM 51-31-0/201).

              CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.



Vortex Generator Installation
Figure 401

4. Vortex Generator Installation (Fig. 401)
   A. Procedure
      (1) Do these steps to install the vortex generator:
         (a) If you see sealant and/or adhesive on the mating surfaces of the air inlet door, vortex generator and two shims, then do these steps:
            1) Remove the remaining sealant and/or adhesive from the mating surfaces of the air inlet door, vortex generator and two shims (AMM 51-31-0/201).

               CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

            2) Clean the surface with alcohol and a cloth.
            3) Use the air source to dry the surfaces of the air inlet door, vortex generator and two shims.

               NOTE: It is recommended that you use a pressure of 60-90 psig (414-620 kPa) of air or nitrogen to dry the surfaces.

         (b) Put the vortex generator without the two shims on the air inlet door.
         (c) If there is a clearance of more than 0.005 inch (0.13 mm) between the vortex generator and the air inlet door, then do these steps to install the two shims:
            1) Clean the mating surfaces of the vortex generator and two shims with alcohol and a cloth.
            2) Use the air source to dry the surfaces of the vortex generator and the two shims.

               NOTE: It is recommended that you use a pressure of 60-90 psig (414-620 kPa) of air or nitrogen to dry the surfaces of the vortex generator and two shims.

3) Mix the two-part adhesive per the manufacturer's instructions.

NOTE: The pot life of the mixed adhesive is approximately two hours at 68°F-80°F (20°C-26.7°C).

4) Apply a thin and continuous layer of mixed adhesive to the mating surfaces of the two shims.
5) Install the two shims on the vortex generator.
6) Remove the unwanted mixed adhesive from the two shims and vortex generator with a cloth or cotton swabs.
7) Use rubber-tipped clamps or wood strips or equivalent tools to hold the two shims tightly to the vortex generator during the cure time.

NOTE: The cure time for the mixed adhesive is approximately 15-24 hours at 68°F-80°F (20°C-26.7°C).

8) Remove the rubber-tipped clamps, wood strips or equivalent tools from the two shims and vortex generator.

(d) Apply a thin layer of sealant to the mating surface of the vortex generator (AMM 51-31-0/201).
(e) Put the vortex generator on the air inlet door.
(f) Install the two radius fillers, four tapered fillers, ten bolts, ten washers and ten nuts that attach the vortex generator to the air inlet door.
(g) Remove the unwanted sealant from the vortex generator and air inlet door with a cloth or cotton swabs.
(h) Use a fairing tool to apply a fillet seal between the forward and aft edges of the vortex generator and air inlet door (view A-A).

(2) Do this task: Air Inlet Door Installation (AMM 49-15-22/401).

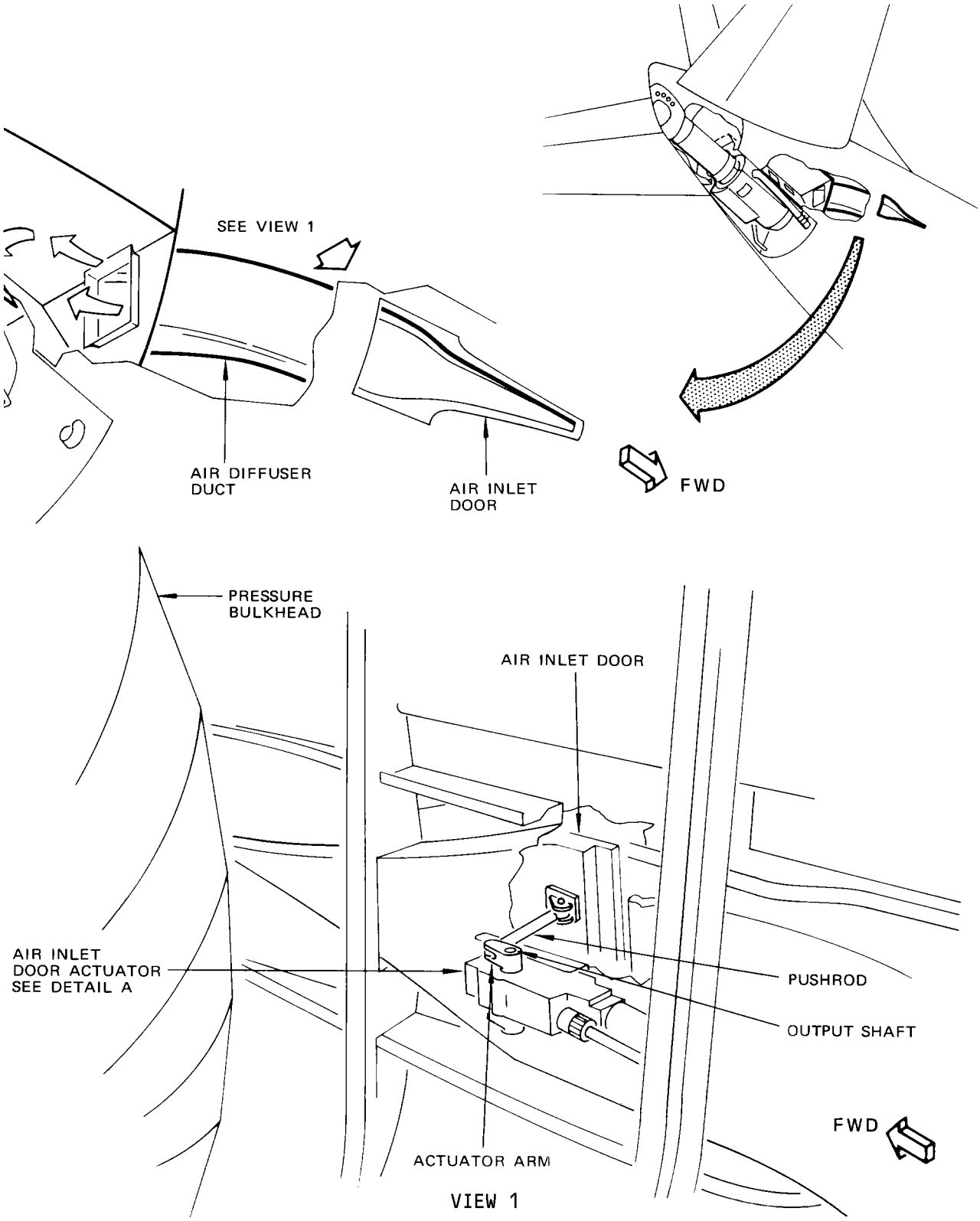
NOTE: During the air inlet door installation, install the two pushrod bearings on the two pushrods before you put the two pushrod bearings on the actuator arms.

APU AIR INLET DOOR ACTUATOR - REMOVAL/INSTALLATION/

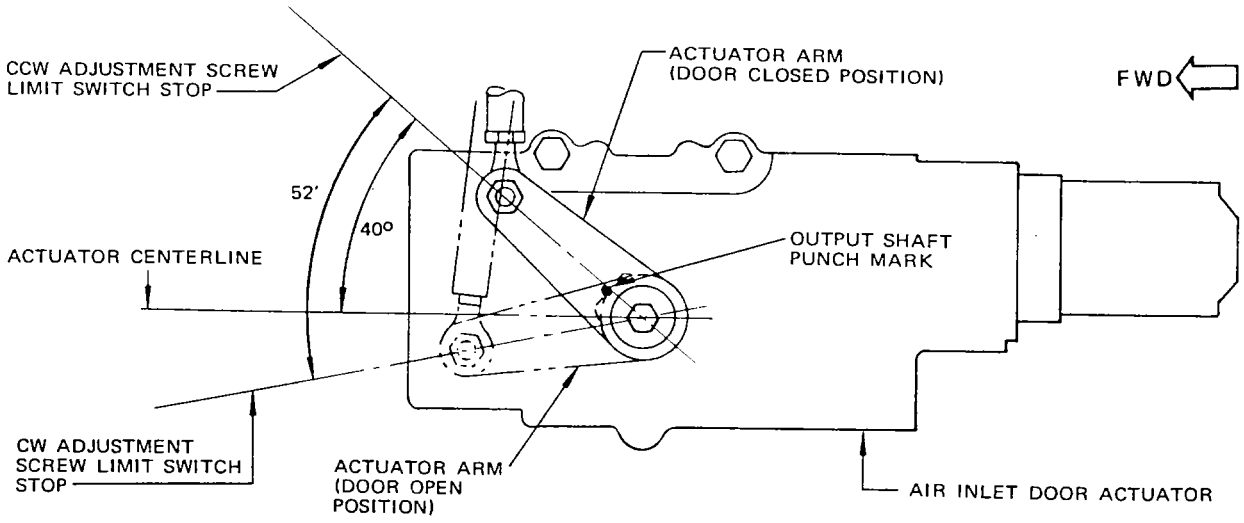
1. Prepare for Air Inlet Door Actuator Removal
   A. Check that BATTERY SWITCH is ON.
   B. Position master switch to ON.
   C. After APU air inlet door is open, position BATTERY SWITCH to OFF and placard.
   D. Open the stabilizer trim control circuit breaker on the P6 panel, and put a DO-NOT-CLOSE identifier on the circuit breaker.
   E. Install horizontal stabilizer trim wheel lock F71336-501 on horizontal trim wheel.
   F. Obtain access to actuator by removing stabilizer trim access panel 3701.
2. Remove Air Inlet Door Actuator
   A. Disconnect the electrical plug from the actuator (Fig. 402).
   B. Remove nuts, washers and bolts connecting pushrod bearings to actuator arms.
   C. Remove nuts, washers, and bolts attaching actuator to bracket. Remove actuator and shim if shim was used.
   D. Remove bolts and washers from actuator arms.
   E. Remove arms from actuator output shaft and save for installation.
3. Install Air Inlet Door Actuator
   A. Position actuator arms on output shaft , aligning punch mark on output shaft with centerline of actuator arm, and install bolts and washers (Fig. 402)
      (1) Tighten the bolts to 25 ±3 pound-inches.
   B. When installing a spare actuator P/N R62OOM3, check that limit stroke from door closed to door open position is 52 degrees.
      (1) If it is necessary to adjust the actuator, do these steps:
         (a) To adjust the door open position, turn CW screw clockwise to decrease stroke and counterclockwise to increase stroke.

            NOTE: Always power actuator to door closed position before turning CW screw, or power actuator to door open position before turning CCW screw. Approximately 7 revolutions rotation of adjustment screw required per degree rotation of actuator arm.

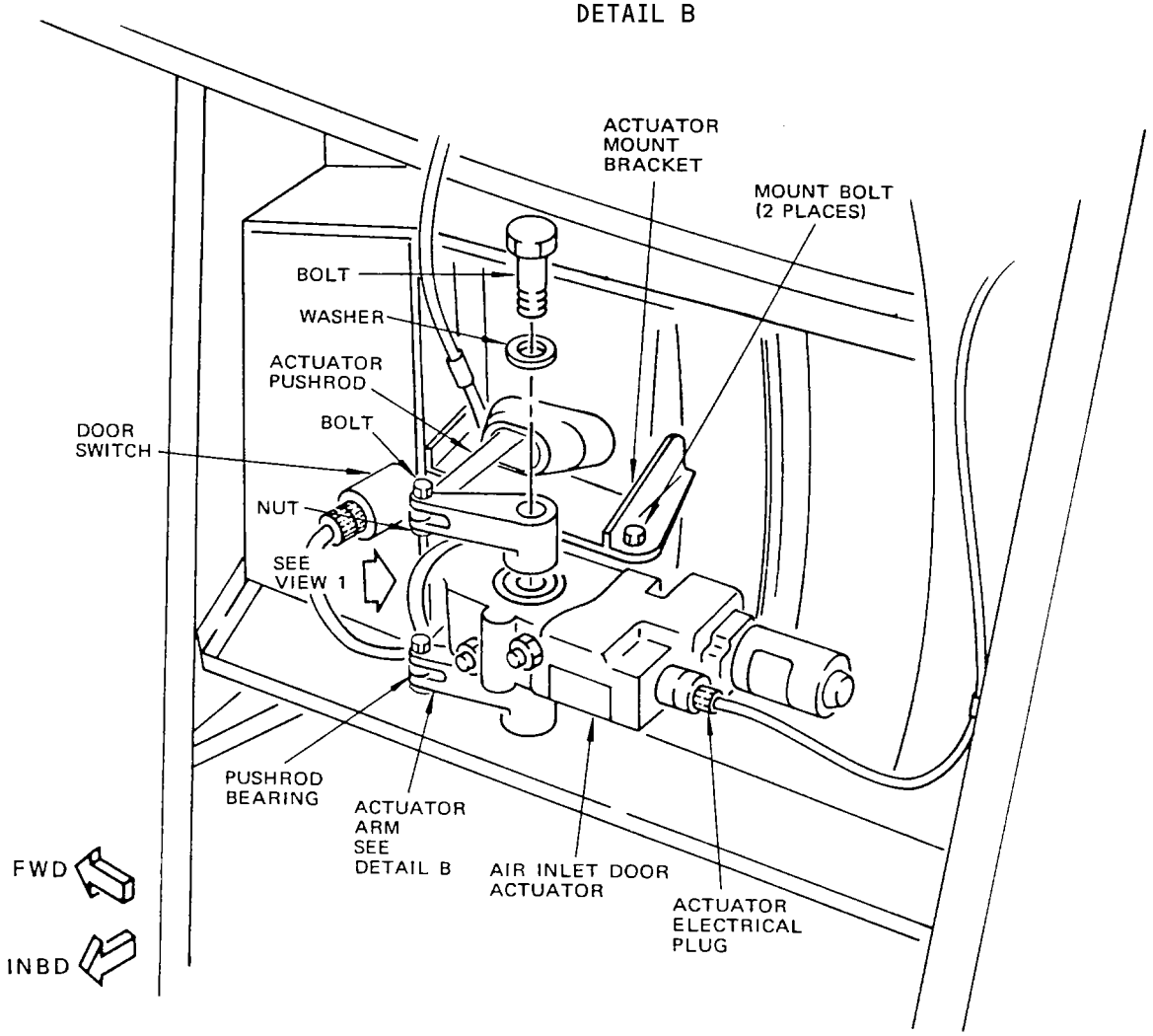
         (b) To adjust the door closed position, turn CCW screw counterclockwise to decrease stroke, and clockwise to increase stroke.
   C. Position actuator on bracket. Shim if required using 0.062 inch laminated shim.
   D. Install actuator attaching bolts, washers, and nuts.
   E. Position pushrod bearings on actuator arms and install connecting bolts, nuts, and washers.
   F. Connect electrical plug to actuator.
   G. Position BATTER SWITCH to ON and remove placard.
   H. Position master switch to OFF.
   I. Test and adjust APU air inlet (AMM 49-15-0/501).



APU Air Inlet Door Actuator Installation
Figure 401

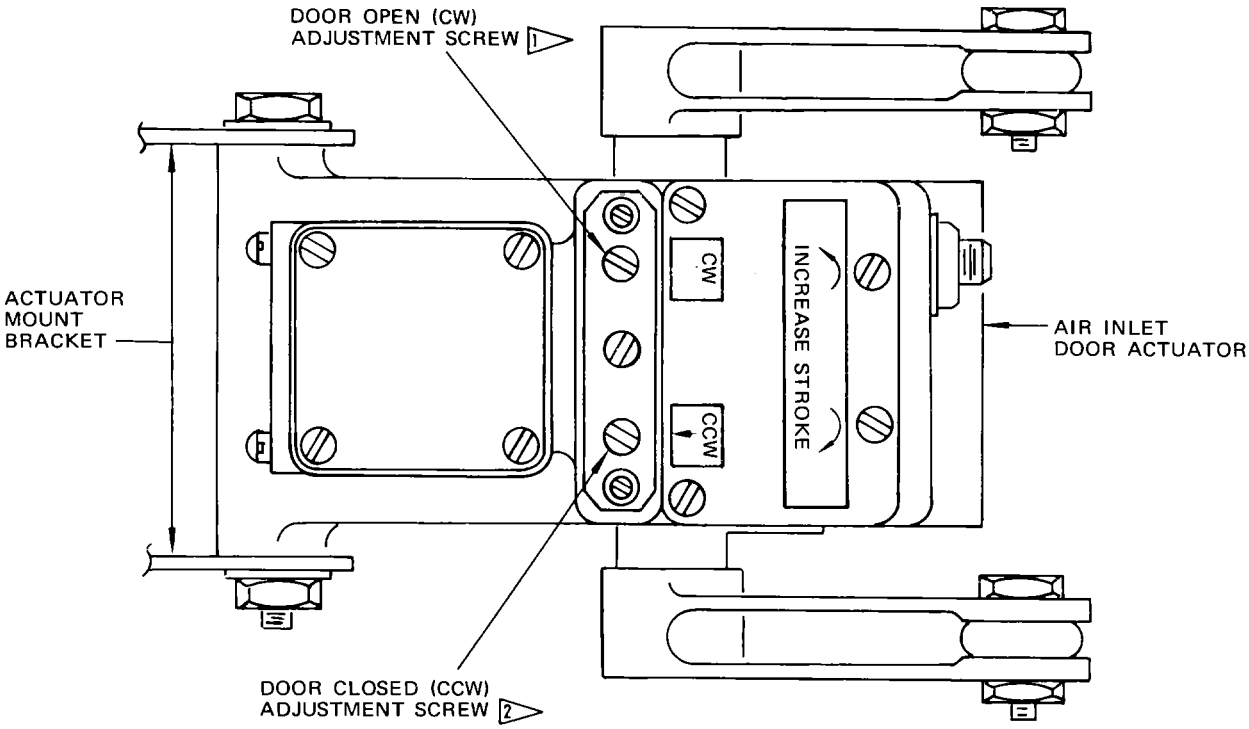


DETAIL B



Air Inlet Door Actuator Installation
Figure 402 (Sheet 1)

J. Close stabilizer trim control circuit breaker on P6 panel and remove placard.
K. Remove horizontal stabilizer trim wheel lock F71336-501 on horizontal stabilizer trim wheel.



VIEW 1

1 TURN SCREW COUNTERCLOCKWISE TO INCREASE STROKE; TURN SCREW CLOCKWISE TO DECREASE STROKE.

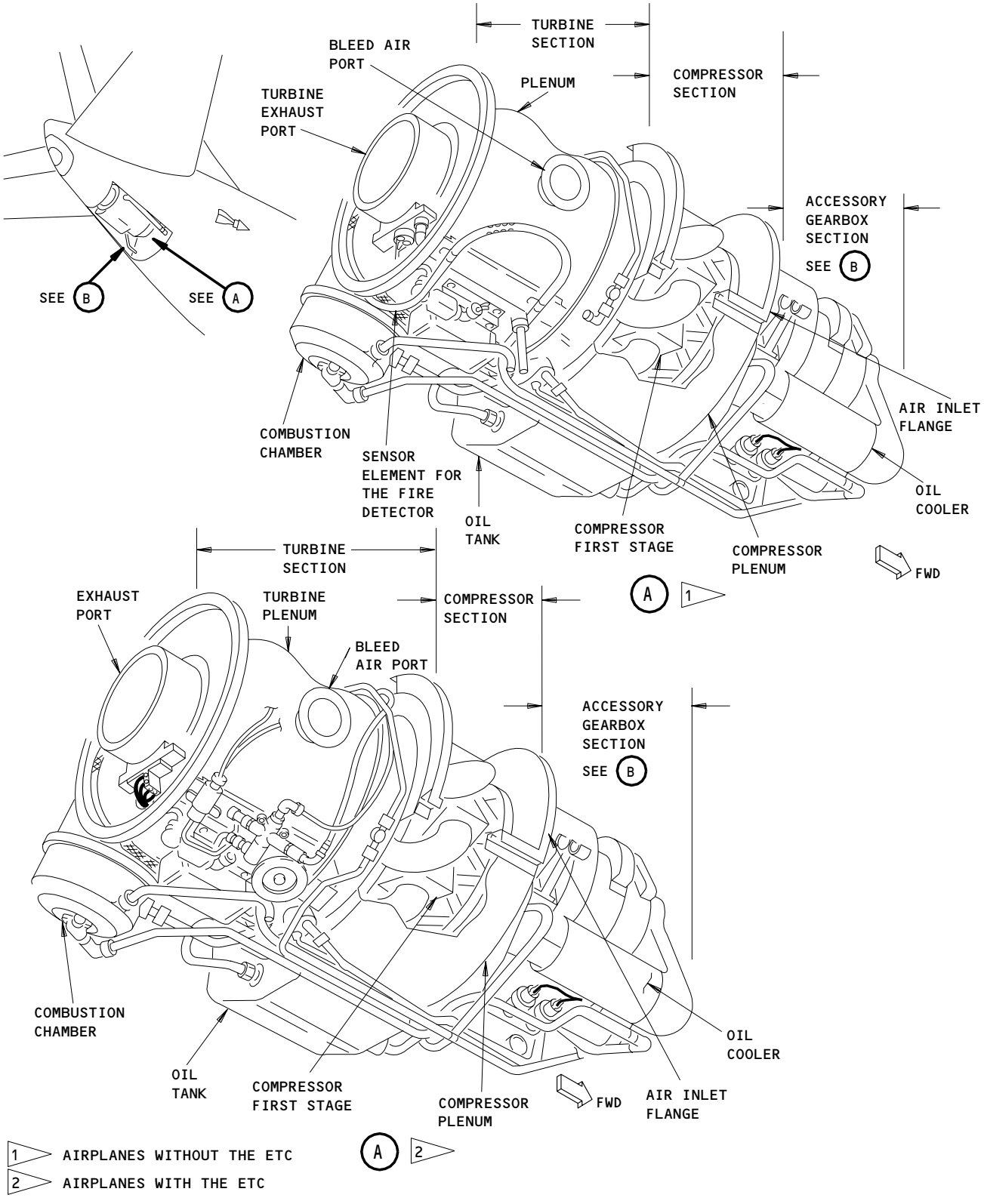
2 TURN SCREW CLOCKWISE TO INCREASE STROKE; TURN SCREW COUNTERCLOCKWISE TO DECREASE STROKE.

Air Inlet Door Actuator Installation
Figure 402 (Sheet 2)

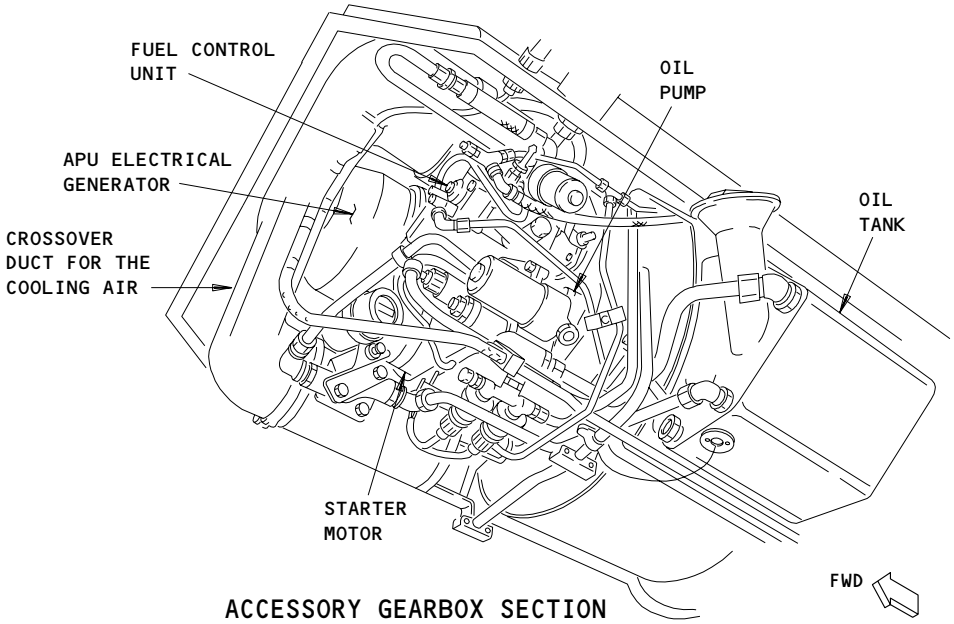
APU ENGINE - DESCRIPTION AND OPERATION

1. General
   A. The APU engine provides bleed air for the pneumatic power and shaft power for driving the engine accessories and the electrical generator. The engine is basically a gas turbine. It consists of a compressor section, a turbine section and an accessory drive section (Fig. 1).
   B. Static or ram air enters the compressor plenum. The air is compressed by a first stage impeller, by a second stage impeller, and discharged into the turbine plenum. From the turbine plenum, compressed air enters the combustion chamber where fuel is added, and the air-fuel mixture ignited. The gases of combustion then flow into the turbine where the gas energy is converted into useful mechanical power. The mechanical power is used to drive the engine compressor and the ac electrical generator. When required, the bleed air for pneumatic power is obtained from the turbine plenum.
2. Compressor Section
   A. The compressor section is the source of compressed air for the engine turbine. It consists of a two stage centrifugal type compressor and the compressor plenum. The two compressor stages are connected by crossover ducts. One impeller and one diffuser constitute a compressor stage. The first stage impeller is a double entry type (two similar impellers back-to-back); the second stage impeller is a single-entry type. Both impellers have a common shaft. The shaft is mounted in two pressure lubricated bearings. The accessory end of the shaft is splined to mate with the accessory drive section quill shaft. Seals are used to prevent excessive amounts of turbine gas from entering into the lubrication system.
3. Turbine Section
   A. The turbine section provides the means of burning the air-fuel mixture and extracting mechanical power from the gases of combustion. The turbine section consists of a turbine wheel, a torus assembly, a nozzle assembly, a turbine plenum assembly, and a combustion chamber. The turbine wheel is a radial inward-flow type. It is attached to the same shaft carrying the compressor impellers. The plenum chamber serves as a receiver for the compressor discharge air and as an enclosure and heat shield for the turbine end of the unit. The torus assembly mates with the discharge end of the combustion chamber and directs the combustion gases into a series of nozzles. The nozzles guide the combustion gases from the torus assembl y into the turbine wheel. The single combustion chamber is formed by integral portions of the plenum and torus assemblies and incorporates a combustion chamber liner and cap. The combustion chamber liner provides a combustion area. It is perforated to control the burning rate and the location of the flame. Mounting pads are provided on the cap for mounting the fuel atomizer and igniter plug.

4. Accessory Drive Section
   A. The accessory drive section reduces the high turbine speed to lower values to drive the components necessary for the engine operation and to drive the ac electrical generator. It is located at the compressor end of the engine. The accessory drive section consists of a gear train enclosed in a housing. The gear train receives its power from a quill shaft splined to the compressor impellers and turbine wheel shaft. The gears in the accessory drive section are spray lubricated. Refer to APU Lubrication System, 49-91-0.
   B. The accessory drive housing provides mounting pads for the fuel control unit, starter motor, cooling air fan, centrifugal switch, oil pump, and ac electrical generator. For description of the accessories, refer to APU Fuel System, 49-31-0; APU Ignition and Starting System, 49-41-0; APU Cooling Air System, 49-51-0; APU Engine Controls, 49-61-0; APU Lubrication System, 49-91-0; and AC Generation System, Chapter 24.
5. Operation
   A. Static or ram air is drawn in the first stage impeller from the compressor plenum. Following compression in the first stage impeller and diffuser, the air is guided to the compressor second stage through the crossover ducts. The air is further compressed by the second stage impeller and diffuser and collected in the turbine plenum. Part of the air flows to the combustion chamber; the remainder is available for the bleed air pneumatic power. Fuel is injected into the combustion chamber by a fuel atomizer. The air-fuel mixture is ignited by an igniter plug. No ignition is required for sustained combustion. From the combustion chamber, the hot combustion gases flow through the turbine torus where a series of nozzles direct them against the blades of the turbine wheel and rotate the wheel. Thus, the turbine wheel converts the energy of combustion gases into useful mechanical power. Part of this power is used to drive the compressor and the engine accessories; the remainder is available as shaft power to drive the ac electrical generator. The cooler, low pressure exhaust gases are discharged from the engine through the exhaust port.

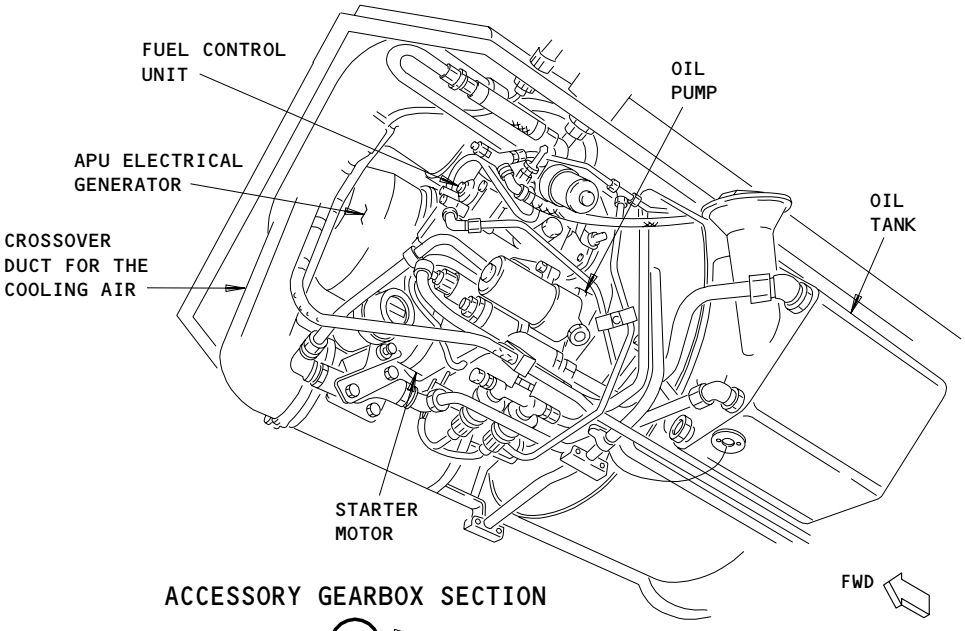


APU Engine Component Location
Figure 1 (Sheet 1)



ACCESSORY GEARBOX SECTION

B 1



ACCESSORY GEARBOX SECTION

C 2

1 AIRPLANES WITHOUT THE ETC

2 AIRPLANES WITH THE ETC

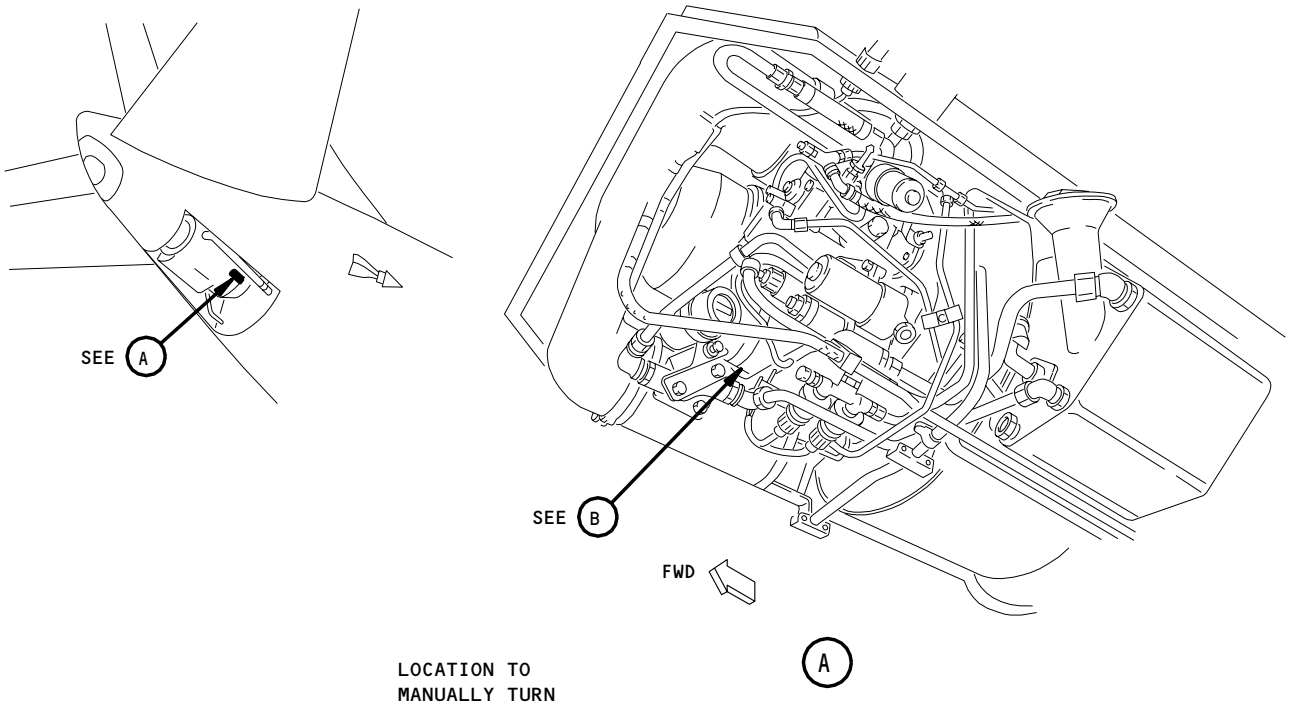
APU Engine Component Location
Figure 1 (Sheet 2)

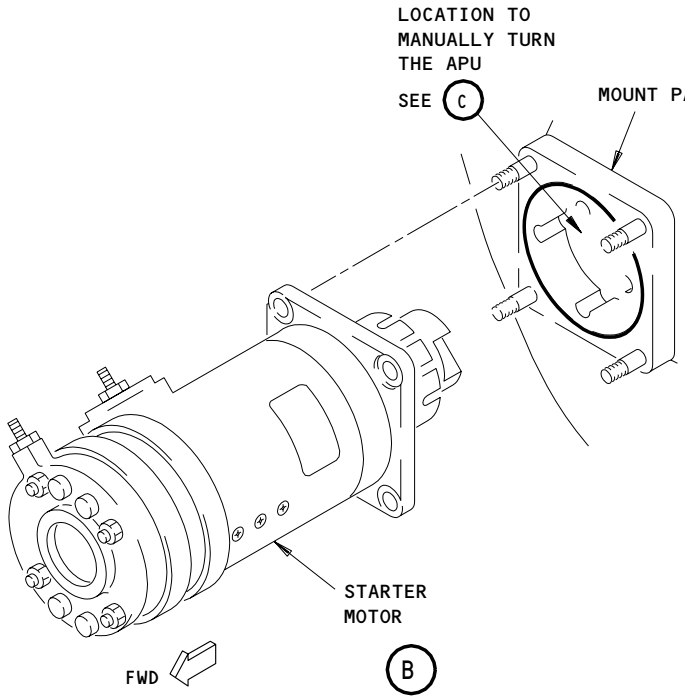
APU ENGINE - MAINTENANCE PRACTICES

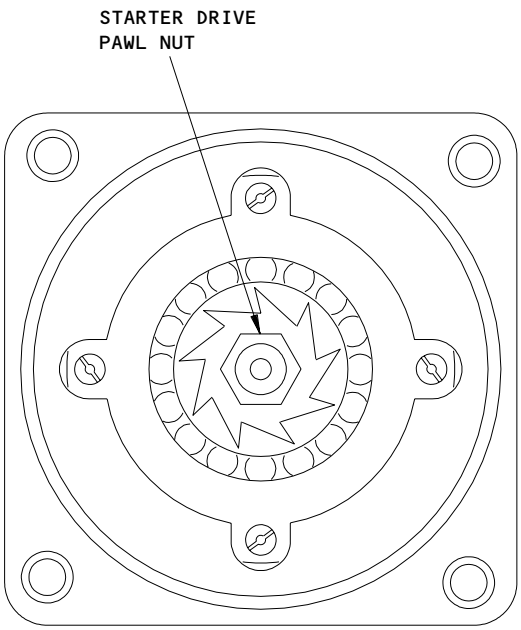
1. General
   A. This procedure gives the steps to manually turn the APU. To manually turn the APU you must remove the starter motor. You can then turn the APU by using a socket on the starter jaw pawl nut.
2. Manually Turn the APU (Fig. 201)
   A. References
      (1) AMM 49-41-11/401, Starter Motor
   B. Equipment
      (1) 3/8 inch socket on 1/4 inch drive wrench
   C. Procedure
      (1) Remove the starter motor (AMM 49-41-11/401)
         (a) Install 3/8 inch socket onto starter drive pawl nut. Turn socket clockwise with 1/4 inch drive wrench.

            NOTE: When you turn the shaft for the starter motor clockwise, the APU will turn.

      (2) Install the starter motor (AMM 49-41-11/401)







LOCATION TO MANUALLY TURN THE APU

C

Location to Manually Turn APU
Figure 201

APU ENGINE - ADJUSTMENT/TEST

1. General
   A. The APU power plant does not require specific adjustments. Any adjustments that may be required are performed during the power plant test. The test consists of four parts: engine start, acceleration, operation, and automatic controls test; fuel control unit governor speed setting test; fuel control unit acceleration limiter valve test; and APU bleed air valve test. Each test is independent from others and may be performed after an engine component replacement or when a certain component is suspected of malfunctioning, such as adjusting the governor when ac electrical generator frequency is not 400 Hz.
   B. It is not necessary to do the APU engine start, acceleration, operation, and automatic controls test after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting the oil pressure problems of the APU. In addition, this test may be used when any of the following components are replaced: centrifugal switch, sequencing oil pressure switch, low oil pressure switch, fuel solenoid valve, pneumatic solenoid valve, and oil pump. Replacement components such as starter motor, igniter plug, ignition unit, and combustion chamber and atomizer assembly may be tested during engine run-up as described in AMM 49-11-0/201.
   C. Operating Limits
      (1) Design parameters and operating characteristics determine operating limits of the engine. If the limits listed in AMM 49-11-0/201 are exceeded, the engine must be shut down immediately and the malfunction corrected.
   D. Engine Operating Precautionary Requirements
      (1) To preclude APU ingestion of foreign objects while airplane cabin area is being serviced and aft galley door is open, it is recommended that an optional air inlet screen be installed before starting APU. If there is an APU operation and there is no optional air inlet screen installation, it is recommended that the right aft galley door must be closed. If the right aft galley door is going to be opened for servicing, the APU must be shut down and the optional air inlet screen installed before the galley door is opened and APU restarted. Do not remove screen until APU operation is complete and aft galley door is closed.
      (2) Shut down engine at once and correct malfunction if any of the following conditions occur:
         (a) No oil pressure reading within 10 seconds.

            NOTE: With tester LOAD switch (27) OFF, low oil pressure automatic shutdown and GENERATOR OFF BUS indication circuits are disabled.

         (b) Ignition failure (flameout).
         (c) Engine oil pressure exceeds limit.

(d) Engine exhaust gas temperature exceeds limits (AMM 49-11-0/201).
(e) Engine speed exceeds operating limits (AMM 49-11-0/201).
(f) Failure of centrifugal 35% switch to actuate at approximately 35% indicated engine speed.

2. APU Power Plant Test

A. Engine Start, Acceleration, Operation, and Automatic Controls Test

NOTE: It is not necessary to do the APU engine start, acceleration, operation, and automatic controls test after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting the oil pressure problems of the APU.

(1) Equipment and Materials
(a) Gas Turbine Engine Tester - No. 290122-400, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
(b) Electrical Cable Assembly - No. 2024497-1, AlliedSignal, Inc.
(c) Test Cable Assembly - No. 290378-1-1, AlliedSignal, Inc. (this is an alternative to the 2024497-1 Electrical Cable Assembly)
(d) Tachometer Generator - MS25038-4
(e) AIRPLANES WITHOUT THE ETC; Wheatstone Bridge - Measurement range of 8 ohms (±0.05%), Model 1432U, General Radio Co., W. Concord, Mass
(f) AIRPLANES WITH THE ETC; Wheatstone Bridge - Measurement range of 8 ohms (±0.05%), No. 4289-2, Leeds and Northrup Co., Sumneytown Pike, North Wales, PA 19454
(g) Multimeter - measurement range of 8 ohms (±0.05%), Model 8012A-01, Fluke, P.O. Box 9090, Everett, WA 98206-9090 (this is an alternative to the wheatstone bridge)
(h) Grease - BMS 3-33 (Preferred)
(i) Grease - MIL-PRF-23827 (Supercedes MIL-G-23827) (Alternate)

(2) Prepare for Engine Start, Acceleration, Operation, and Automatic Controls Test
(a) Position BATTERY switch to OFF and placard.
(b) Open APU compartment access door latches and open access door. Install door support rods.
(c) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(3) Connect Gas Turbine Engine Tester to Engine
(a) Disconnect APU harness (11) electrical plug (D1252) from receptacle (D452) in upper shroud (Fig. 502).

(b) Disconnect APU harness (11) electrical plug (D1252) from receptacle (D452) in upper shroud (Fig. 501).
(c) Connect the electrical cable or test cable assembly (10) to the electrical plug (11) of the APU harness and to the receptacle in the upper shroud.

NOTE: The connectors on the electrical cable or test cable assembly are identified by aluminum markers.

(d) AIRPLANES WITHOUT THE ETC; Disconnect the leads of the thermocouple harness from the terminals of the EGT thermocouple probe.
(e) AIRPLANES WITH THE ETC; Disconnect the leads of the thermocouple harness from the studs of the ETC thermocouple probe.
(f) AIRPLANES WITHOUT THE ETC; Connect the leads of the electrical cable or test cable assembly (10) to the terminals of the EGT thermocouple probe.
(g) AIRPLANES WITH THE ETC; Connect the leads of the electrical cable or test cable assembly (10) to the studs of the ETC thermocouple probe.
(h) Connect the electrical cable or test cable assembly (10) to the tester receptacle (18).
(i) At initial use of tester, check tester exhaust gas temperature loop resistance as follows:
    1) Remove tester instrument panel attaching screws and lift panel to obtain access to temperature indicating circuit components.
    2) Tag and disconnect lead wires from exhaust gas temperature indicator terminals on rear of indicator case.
    3) Using decade resistance box, test total resistance of circuit between (and external to) indicator and thermocouple probe. Resistance shall be 8.000 ±0.035 ohms.
    4) If resistance is not within limits, adjust slide of variable resistor in tester to obtain correct resistance.
    5) Remove decade resistance box and connect lead wires to temperature indicator terminals.

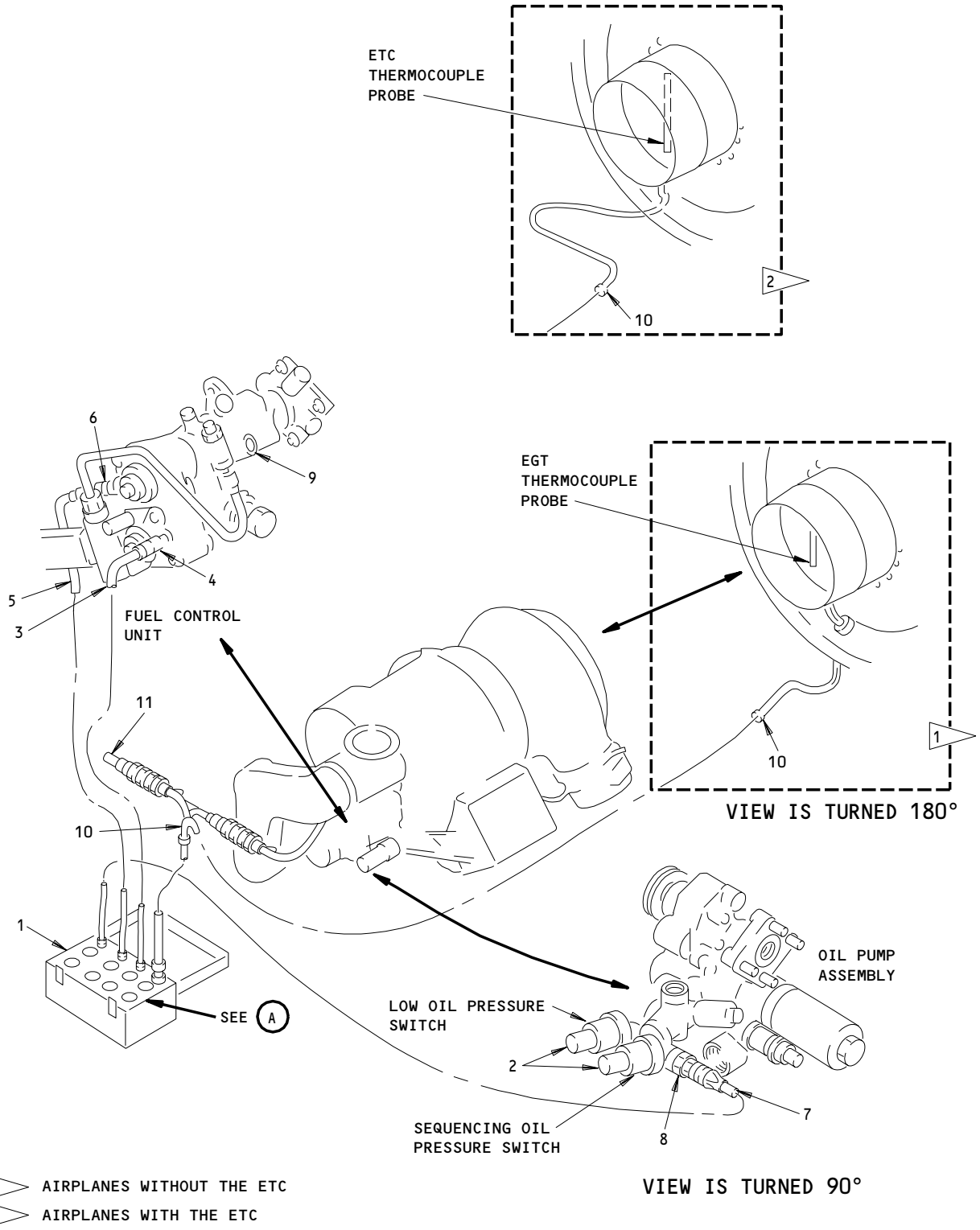
       CAUTION: BE SURE THAT WHITE (CHROMEL) WIRE IS CONNECTED TO "CR" TERMINAL AND THAT GREEN (ALUMEL) WIRE IS CONNECTED TO "AL" TERMINAL.

    6) Install tester instrument panel on tester with attaching screws.
(j) Install tachometer generator on engine as follows:
    1) Disconnect tachometer generator electrical plug from cover plate on engine.
    2) Remove nuts and washers attaching cover plate to tachometer generator mounting pad and remove cover plate.

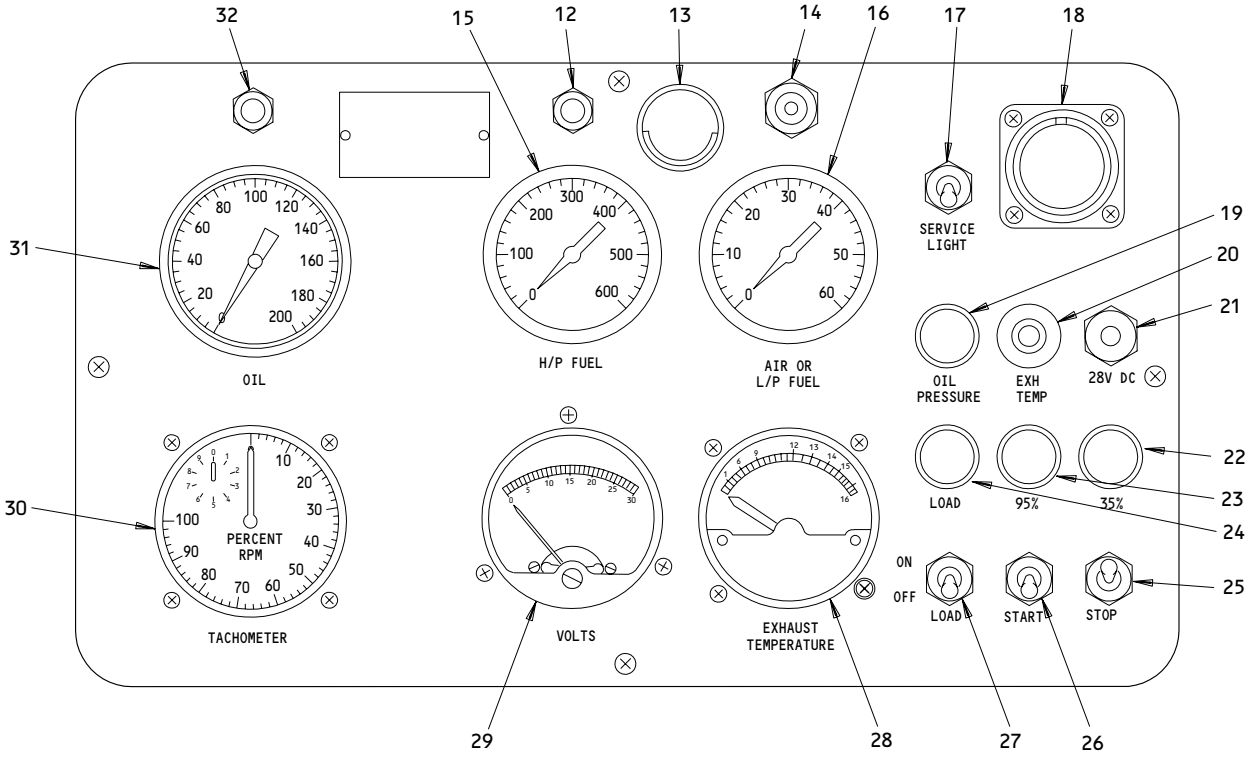
3) Lightly coat splines of tachometer generator with grease, place generator on mounting pad carefully aligning mating shafts.
4) Install tachometer generator mounting nuts and washers.
5) Connect electrical plug to generator.

(k) Remove cap from fuel pressure port (6) on fuel control unit.
(l) Install one end of fuel pressure hose assembly (5) on fuel pressure port (6); install other end of hose assembly (5) to tester fuel pressure coupling (12).
(m) Remove cap from control air pressure port (4) on fuel control unit.
(n) Install one end of control air pressure hose end assembly (3) on control air pressure port (4); install other end of hose assembly (3) to tester control air pressure coupling (14).
(o) Remove cap from oil pressure connection port (8) on oil pressure switch manifold.
(p) Install one end of oil pressure hose assembly (7) on oil pressure connection port (8); install other end of hose assembly (7) to tester oil pressure coupling (32).
(q) Disconnect the electrical connector from the tachometer generator.
(r) Connect the electrical cable or test cable assembly (10) to the tachometer generator and the generator electrical connector.

(4) Prestart Procedure
(a) Check that the following circuit breakers on circuit breaker panel P6 are closed.
1) LANDING GEAR, ANTISKID, LIGHTS.
2) LANDING GEAR, ANTISKID, TEST.
3) FIRE PROTECTION, DETECTION, APU.
4) FIRE PROTECTION, DETECTION, MASTER WARN & CONTR.
5) MASTER CAUTION BUS, BAT.
6) PANEL & INSTRUMENT, DIM & TEST.
7) Nine circuit breakers under INDICATOR LTS & MASTER DIM BUS.
8) APU GENERATOR CONTROL.
9) HOT BAT, BAT BUS CONT.
10) HOT BAT, GEN CONT.
11) HOT BAT BUS.
(b) Close APU CONT circuit breaker on circuit breaker panel P6.
(c) Check that circuit breaker on generator control unit is closed. (Generator control unit is located in P6 panel area).



Gas Turbine Engine Tester and Connections
Figure 501



1. GAS TURBINE ENGINE TESTER
2. SEQUENCING AND LOW OIL PRESSURE SWITCH RECEPTACLES
3. CONTROL–AIR PRESSURE HOSE ASSEMBLY
4. CONTROL–AIR PRESSURE CONNECTION PORT
5. FUEL PRESSURE HOSE ASSEMBLY
6. FUEL PRESSURE PORT
7. OIL PRESSURE HOSE ASSEMBLY
8. OIL PRESSURE CONNECTION PORT
9. FUEL CONTROL UNIT FUEL INLET PORT
10. ELECTRICAL CABLE ASSEMBLY P/N 2024497–1
10. TEST CABLE ASSEMBLY P/N 290378–1–1 (THIS IS AN ALTERNATIVE TO THE ELECTRICAL CABLE ASSEMBLY)
11. APU HARNESS ELECTRICAL PLUG
12. FUEL PRESSURE COUPLING
13. TESTER INSTRUMENT PANEL LIGHT
14. CONTROL AIR PRESSURE COUPLING
15. FUEL PRESSURE GAGE
16. CONTROL AIR PRESSURE GAGE
17. TESTER INSTRUMENT PANEL LIGHT SWITCH
18. TESTER RECEPTACLE
19. LOW OIL PRESSURE LIGHT (RED)
20. EXHAUST GAS TEMPERATURE SWITCH
21. 28V DC JACK
22. 35 PERCENT LIGHT
23. 95 PERCENT LIGHT
24. LOAD LIGHT (GREEN)
25. STOP SWITCH (INOPERATIVE FOR 737)
26. START SWITCH (INOPERATIVE FOR 737)
27. LOAD SWITCH
28. EXHAUST GAS TEMPERATURE INDICATOR
29. DC VOLTMETER
30. TACHOMETER INDICATOR
31. OIL PRESSURE GAGE
32. OIL PRESSURE COUPLING

Turbine Engine Tester and Connections
Figure 502

(d) Check that circuit breaker on face of APU control unit is closed. (APU control unit is located in electrical and electronic bay.)
(e) Position D-C METER'S selector switch to BAT BUS.
(f) Position A-C METER'S selector switch to APU GEN.
(g) Position BATTERY switch to ON.
(h) Check that APU BLEED valve switch is OFF.
(i) Momentarily position either APU generator switch to ON to close field relay.
(j) Position No. 1 tank forward boost pump switch to ON.

NOTE: No. 1 tank forward boost pump requires ac power. Provide airplane with external power.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(5) Test Engine Start, Acceleration, Operation, and Automatic Controls
(a) Observe engine operating precautionary requirements given in par. 1.D.
(b) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; if you must operate the APU with the lower shroud removed, make sure all persons are not in the hazard area (AMM 49-11-0/201).

WARNING: DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF THREE FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

NOTE: APUs with AlliedSignal SB GTCP85-49-7096 have an external shield around the turbine plenum and have no hazard area.

(c) On forward overhead panel, position APU master switch to START and release.

NOTE: If APU master switch is positioned initially to ON and air inlet door fully opens before APU master switch is moved to START, CLOSE coil of start and stop relay K1 will not be energized and engine will not start.

(d) Observe the following sequence of events:
1) Low oil pressure light (19) should come on immediately.
2) AIRPLANES WITHOUT THE ETC; The 35% switch light (22) should come on when the air inlet door is fully open and crank begins.
3) AIRPLANES WITH THE ETC; The 50% switch light (22) should come on when the air inlet door is fully open and crank begins.
4) Engine should start and accelerate smoothly as indicated by the following instruments:
a) Oil pressure at gage (31).
b) Engine speed at indicator (30).
c) Control air pressure at gage (16).
d) Fuel pressure at gage (15).
e) Exhaust gas temperature at indicator (28).
5) When oil pressure reaches 2.5 to 3.5 psi as indicated on gage (31), fuel solenoid valve should open, allowing fuel flow as indicated on gage (15). This also indicates satisfactory operation of engine sequencing oil pressure switch.
6) AIRPLANES WITHOUT THE ETC; The centrifugal 35% switch operates to stop the starter operation when the indicator (30) shows 35% engine speed.
a) The light (22) will go off when the centrifugal 35% switch operates.
7) AIRPLANES WITH THE ETC; The centrifugal 50% switch operates to stop the starter operation when the indicator (30) shows 50% engine speed.
a) The light (22) will go off when the centrifugal 50% switch operates.
8) When engine oil pressure reaches 45 to 55 psi as indicated on gage (31), oil pressure light (19) should go off, indicating satisfactory operation of engine low oil pressure switch.
9) When engine speed reaches approximately 75% as indicated on indicator (30), engine oil pressure should be 90 to 100 psi as indicated on gage (31), and should remain at this pressure for engine operation above 75% speed. Oil pressure should not fluctuate more than 3 psi during steady state operation.
10) When engine speed reaches 95% as indicated on indicator (30), centrifugal 95% switch should actuate to break ignition circuit and complete elapsed time indicator circuit as indicated by light (23) going on and engine elapsed time indicator starting to record time.
11) Engine should continue to accelerate, and fuel control unit governor should operate to control engine speed to 100% (maximum) as indicated on indicator (30).

(e) On forward overhead panel, position APU master switch to OFF.
1) When stop is initiated, pneumatic solenoid valve is energized to permit compressed air flow to centrifugal 110% switch. 110% switch actuates and the engine shuts down. No overspeed light indicates satisfactory operation of centrifugal 110% switch.
(f) Position BATTERY switch to OFF and placard.
(g) Position No. 1 forward boost pump switch to OFF.

(6) Disconnect Gas Turbine Engine Tester from Engine
(a) Check that BATTERY switch is OFF and placarded.
(b) Remove oil pressure hose assembly (7) from tester coupling (32) and from oil pressure connection port (8) on oil pressure switch manifold.
(c) Install cap on oil pressure connection port (8).
(d) Remove control air hose assembly (3) from tester coupling (14) and from control air pressure port (4) on fuel control unit.
(e) Install cap on control air pressure port (4).
(f) Remove fuel pressure hose assembly (5) from tester coupling (12) and from fuel pressure port (6) on fuel control unit.
(g) Install cap on fuel pressure port (6).
(h) Remove tachometer generator from engine.
1) Disconnect electrical plug from generator.
2) Remove generator mounting nuts and washers and remove generator.
3) Position coverplate on tachometer generator mounting pad and install washers and nuts.
4) Connect generator electrical plug to coverplate.
(i) Disconnect electrical cable or test cable assembly (10) from the tester and the engine.
(j) AIRPLANES WITHOUT THE ETC; Disconnect the leads of the electrical cable or test cable assembly (10) from the terminals of the EGT thermocouple probe.
(k) AIRPLANES WITH THE ETC; Disconnect the leads of the electrical cable or test cable assembly (10) from the studs of the ETC thermocouple probe.
(l) AIRPLANES WITHOUT THE ETC; Connect the leads of the thermocouple harness to the terminals of the EGT thermocouple probe.
(m) AIRPLANES WITH THE ETC; Connect the leads of the thermocouple harness to the studs of the ETC thermocouple probe.
(n) Connect the APU harness (11) electrical plug to the receptacle in the upper shroud.

(7) Restore airplane to normal configuration.
(a) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).

(b) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(c) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(d) Remove placard from BATTERY switch.

B. Fuel Control Unit Governor Speed Setting Test

NOTE: It is not necessary to do the governor speed setting test for the fuel control unit after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting and governor speed adjustment of the fuel control unit.

(1) Equipment and Materials
(a) Gas Turbine Engine Tester - 290122-400, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
(b) Electrical Cable Assembly - No. 2024497-1, AlliedSignal, Inc.
(c) Test Cable Assembly - No. 290378-1-1, AlliedSignal, Inc. (this is an alternative to the 2024497-1 Electrical Cable Assembly)
(d) Tachometer Generator - MS25038-4
(e) AIRPLANES WITHOUT THE ETC; Screwdriver and Wrench Assembly - 280353, AlliedSignal, Inc.
(f) AIRPLANES WITH THE ETC; Jamnut Wrench - 833275-1, AlliedSignal, Inc.
(g) AIRPLANES WITH THE ETC; Adjuster Wrench - 833274-1, AlliedSignal, Inc.
(h) RPM Test Set Indicator - F72891-1
(i) Grease - BMS 3-33 (Preferred)
(j) Grease - MIL-PRF-23827 (Supercedes MIL-G-23827) (Alternate)
(2) Prepare for fuel control unit governor speed setting test.
(a) Position BATTERY switch to OFF and placard.
(b) Open APU compartment access door latches and open door. Install door support rods.
(c) Support lower shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(3) Connect gas turbine engine tester to engine.
(a) Repeat steps A.(3)(a) thru A.(3)(i).

NOTE: Connecting the fuel pressure hose assembly (5), control air pressure hose assembly (3), and oil pressure hose assembly (7) are not necessary for this test.

(4) Test fuel control unit governor speed setting.
  (a) Perform prestart procedure per par. A.(4).
  (b) Observe engine operating precautionary requirements given in par. 1.D. while performing test.
  (c) On forward overhead panel, position APU master switch to START and release.

    NOTE: If APU master switch is positioned initially to ON and air inlet door fully opens before APU master switch is moved to START, CLOSE coil of start and stop relay K1 will not be energized and engine will not start.

  (d) Allow engine to accelerate to service speed.
  (e) With no load applied, engine speed should stabilize at 102.5 percent rpm (max) as indicated on indicator (3) (Fig. 501).
  (f) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITHOUT THE ETC; If the stable APU speed is not between 101.3-102.5% rpm, adjust the governor for the fuel control unit:
    1) Do the APU normal shutdown (AMM 49-11-0/201).
    2) Use the screwdriver and wrench assembly to loosen the locknut on the governor adjustment screw.
    3) If the APU speed is too low, turn the governor adjustment screw clockwise.
    4) If the APU speed is too high, turn the governor adjustment screw counterclockwise.
  (g) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITHOUT THE ETC; If the stable APU speed is not between 101.3-102.5% rpm, adjust the governor for the fuel control unit:
    1) Use the screwdriver and wrench assembly to loosen the locknut on the governor adjustment screw.
    2) If the APU speed is too low, turn the governor adjustment screw clockwise.
    3) If the APU speed is too high, turn the governor adjustment screw counterclockwise.
    4) Tighten the locknut on the governor adjustment screw.
  (h) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITH THE ETC; If the stable APU speed is not between 101.3-102.5% rpm, adjust the governor for the fuel control unit:
    1) Do the APU normal shutdown (AMM 49-11-0/201).
    2) Use the jamnut wrench to loosen the jamnut on the governor adjustment nut.
    3) If the APU speed is too low, turn the governor adjustment nut clockwise with the adjuster wrench.
    4) If the APU speed is too high, turn the governor adjustment nut counterclockwise with the adjuster wrench.
    5) Tighten the jamnut on the governor adjustment nut.

(i) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096 AND AIRPLANES WITH THE ETC; If the stable APU speed is not between 101.3-102.5% rpm, adjust the governor for the fuel control unit:
1) Use the jamnut wrench to loosen the jamnut on the governor adjustment nut.
2) If the APU speed is too low, turn the governor adjustment nut clockwise with the adjuster wrench.
3) If the APU speed is too high, turn the governor adjustment nut counterclockwise with the adjuster wrench.
4) Tighten the jamnut on the governor adjustment nut.

(j) On forward overhead panel, position APU master switch to OFF.

(5) Disconnect gas turbine engine tester from engine.
(a) Check that BATTERY switch is OFF and placard.
(b) Repeat steps A.(6)(h) thru A.(6)(n).

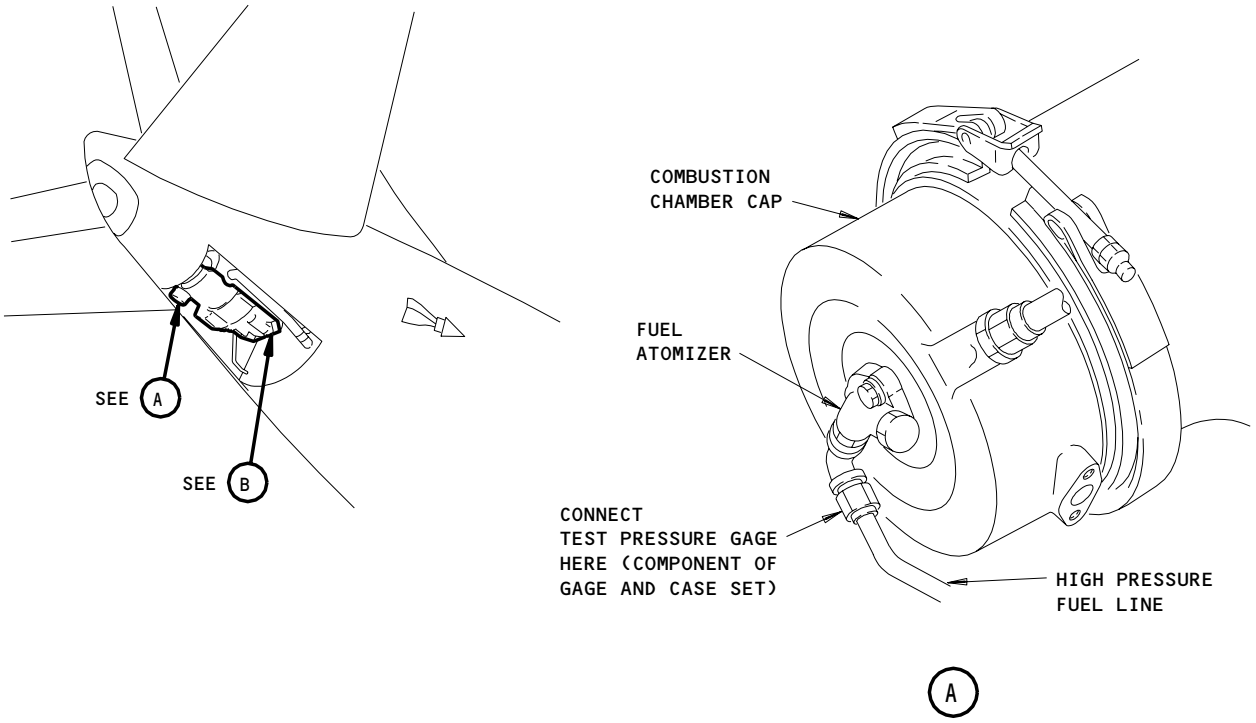
(6) Restore airplane to normal configuration.
(a) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
(b) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(c) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(d) Remove placard from BATTERY switch.

C. Fuel Control Unit Acceleration Limiter Valve Cracking Pressure (Opening) Test

NOTE: It is not necessary to do the cracking pressure (opening) test for the acceleration limiter valve on the fuel control unit after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting or cracking pressure (opening) adjustment of the fuel control unit. Prior to performing fuel control unit acceleration limiter valve cracking pressure test, operate APU at no-load condition for approximately 5 minutes. This will ensure that fuel is available to the APU, and, in the event the fuel control unit was changed, will remove preservative oil from the fuel control unit.



1 AIRPLANES WITHOUT THE TAFCU
2 AIRPLANES WITH THE TAFCU

Fuel Control Unit Adjustments
Figure 503

(1) Equipment and Materials
  (a) Pressure Gage and Case Set - 282645, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
(2) Prepare for fuel control unit acceleration limiter valve cracking pressure test (Fig. 503).
  (a) Position BATTERY switch to OFF and placard.
  (b) Open all fuel boost pump circuit breakers on aft overhead panel P6-3.
  (c) Open APU compartment access door latches and open door. Install door support rods.
  (d) Support lower shroud, open shroud latches, and remove shroud.

    CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

  (e) Disconnect ignition unit power supply electrical plug at ignition unit.

    WARNING: CURRENT INVOLVED IN IGNITION SYSTEM IS OF VERY HIGH VOLTAGE AND CAN BE FATAL. BE SURE THAT POWER IS REMOVED FROM IGNITION SYSTEM FOR A MINIMUM OF 3 MINUTES BEFORE ANY DISCONNECTIONS ARE MADE. AFTER DISCONNECTING HIGH VOLTAGE LEAD, ENSURE COMPLETE DISCHARGE OF CAPACITORS IN IGNITION UNIT BY IMMEDIATELY SHORTING HIGH VOLTAGE LEAD TERMINAL TO GROUND.

  (f) Remove cap from control air pressure port on fuel control unit.
  (g) Disconnect fuel supply line at fuel atomizer assembly.
  (h) Connect test pressure gage to fuel supply line.
  (i) Close the fuel system boost pump circuit breakers.
  (j) Position BATTERY switch to ON and remove placard.
(3) Test fuel control unit acceleration limiter valve cracking pressure.
  (a) Position APU master switch to START and release.

    NOTE: APU master switch will return to ON. Engine motoring will begin after air inlet door and APU fuel valve have opened. Make sure the fuel boost pump is operating. After approximately 60/90 seconds of motoring, motoring is terminated by a time limiting device in APU control unit.

  (b) While engine is motoring, loosen fuel line nut at pressure test gage and bleed trapped air from line and tighten nut.
  (c) AIRPLANES WITHOUT THE TAFCU; As the APU engine rpm becomes stable, observe the cracking pressure for the acceleration limiter valve. The cracking pressure should be 60 +3 psig.

(d) AIRPLANES WITH THE TAFCU; As the APU engine rpm becomes stable, observe the cracking pressure for the acceleration limiter valve. The cracking pressure should be 60 +3 psig (414 +20kPa).

(e) AIRPLANES WITHOUT THE TAFCU; If the cracking pressure is not in the limits, adjust the acceleration limiter valve as follows:
1) Remove the lockwire from the locknut for the valve adjustment screw.
2) Loosen the locknut on the valve adjustment screw.
3) If the cracking pressure is too low, turn the valve adjustment screw clockwise.
4) If the cracking pressure is too high, turn the valve adjustment screw counterclockwise.
5) Tighten the locknut on the valve adjustment screw.
6) Install a lockwire on the locknut for the valve adjustment screw.

(f) AIRPLANES WITH THE TAFCU: If the cracking pressure is more than 65 psig (448 kPa), or less than 55 psig (380 kPa), replace the timed acceleration fuel control unit (AMM 49-31-11/401).

(g) AIRPLANES WITH THE TAFCU: If the cracking pressure is between 55 psig (380 kPa) and 57 psig (396 kPa) or 63 psig (434 kPa) and 65 psig (448 kPa), adjust the adjustment screw on the acceleration limiter valve as follows:
1) Remove the lockwire from the locknut for the valve adjustment screw.
2) Loosen the locknut on the valve adjustment screw.
3) If the cracking pressure is too low, turn the valve adjustment screw clockwise.
4) If the cracking pressure is too high, turn the valve adjustment screw counterclockwise.

NOTE: A full turn of the adjustment screw is the same as approximately 8-10 psig.

5) Tighten the locknut on the valve adjustment screw.
6) Install a lockwire on the locknut for the valve adjustment screw.

(h) Position APU master switch to OFF.

(i) After the air inlet door closes, do the above test steps (a) and (c) thru (h) until the limiter valve adjustment is satisfactory.

CAUTION: DO NOT EXCEED STARTER MOTOR DUTY CYCLE (AMM 49-11-0/201).

(4) Restore airplane to normal configuration (Fig. 503)
(a) Position BATTERY switch to OFF and placard.
(b) Open the fuel boost pumps circuit breakers.
(c) Disconnect test pressure gage from high pressure fuel line.
(d) Connect high pressure fuel line at fuel atomizer assembly.
(e) Install cap on control air pressure port on fuel control unit.

(f) Connect ignition unit power supply connector plug to ignition unit.
(g) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
(h) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(i) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
(j) Remove placard from BATTERY switch.
(k) Activate fuel boost pumps as required.

D. Bleed Air Valve Opening Rate Test

(1) Test Bleed Air Valve Opening Rate (Using AlliedSignal Tester)

NOTE: It is not necessary to do the opening rate test for the bleed air valve after you replace the APU, fuel control unit or bleed air valve. You can use this test for troubleshooting or adjustment of the bleed air valve.

(a) Equipment and Materials
1) Gas Turbine Engine Tester - 290122-400, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
2) Electrical Cable Assembly - No. 2024497-1, AlliedSignal, Inc.
3) Test Cable Assembly - No. 290378-1-1, AlliedSignal, Inc. (this is an alternative to the 2024497-1 Electrical Cable Assembly)
4) Tachometer Generator - MS25038-4
5) Grease - BMS 3-33 (Preferred)

6) Grease - MIL-PRF-23827 (Supercedes MIL-G-23827) (Alternate)

(b) Prepare for Bleed Air Valve Operation Test
1) Position BATTERY switch to OFF and placard.
2) Open APU compartment access door latches and open access door. Install door support rods.
3) Support shroud, open shroud latches, and remove shroud.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(c) Connect Gas Turbine Engine Tester to Engine
1) Repeat steps A.(3)(a) thru A.(3)(k).

NOTE: Connecting of control air pressure hose assembly (3) and oil pressure hose assembly is not necessary for this test.

(d) Test Bleed Air Valve Opening Rate
1) Do the prestart procedure per par. A.(4).
2) Observe engine operating requirements given in par. 1.D while performing test.
3) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; If you must operate the APU with the lower shroud removed, make sure all persons are not in the hazard area (AMM 49-11-0/201).

WARNING: DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF THREE FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

NOTE: APUs with AlliedSignal SB GTCP85-49-7096 have an external shield around the turbine plenum and have no hazard area.

4) On forward overhead panel, position APU master switch to START and release.

NOTE: If APU master switch is initially positioned to ON and air inlet door fully opens before APU master switch is moved to START, start and stop relay K1 will not be energized and engine will not start.

5) Allow engine to accelerate to governed speed.
6) With no load applied, engine speed should stabilize at 101% rpm (max) as indicated on indicator (30) (Fig. 501).

NOTE: With tester LOAD switch (27) OFF, low oil pressure automatic shutdown and GENERATOR OFF BUS indication circuits are disabled.

7) On forward overhead panel, position APU BLEED valve switch to ON.
8) Position air conditioning R PACK and L PACK valve switches to ON. For complete operation of air conditioning system, Ref Chapter 21, Air Conditioning.
9) Position tester load switch (27) to ON.
10) Measure time from actuation of tester load switch until fuel pressure gage (15) shows first peak reading. This should occur within 12 to 14 seconds, indicating that valve has reached full load position.
11) Observe engine speed drop on indicator (30) at load application. Speed drop should not exceed 2% engine rpm.
12) Move air conditioning control cabin temperature selector switches to MANUAL COLD until air mix valves indicate COLD.
13) Observe engine speed at full bleed load operation on indicator (30). Speed should stabilize at 98% engine rpm.
14) Observe engine exhaust gas temperature on indicator (28) at full bleed air load operation. This temperature is load control thermostat controlling temperature and should not exceed 649°C (1200°F).
15) Position tester load switch to OFF.
16) Position air conditioning R PACK and L PACK valve switches to OFF.
17) Position APU BLEED valve switch to OFF.
18) Allow engine to operate at no load governed speed for one minute (minimum).
19) Position APU master switch to OFF.
20) If time limit in step 10) was not met, adjust bleed air valve rate control adjustment screw as follows:

NOTE: There are two configurations of rate control adjustment screw. Each requires certain precautions when making adjustments.

(e) On airplanes with configuration 1 rate adjustment screw (Fig. 504, View 2):
1) Loosen sleeved jamnut on rate control adjustment screw.
2) Turn adjustment screw clockwise to increase opening time; turn adjustment screw counterclockwise to decrease opening time.

NOTE: If adjustment is difficult to make, contamination of needle valve may be a problem - remove needle valve, wipe clean and reinstall.

3) Tighten sleeved jamnut on adjustment screw.

4) Repeat steps 4) thru 10) and 14) thru 20)a)3. until valve is adjusted correctly.

(f) On airplanes with configuration 2 rate adjustment screw (prior to incorporation of AiResearch SB 49-3646) (Fig. 504, View 3):

1) Loosen jamnut on rate control adjustment screw.
2) Turn adjustment screw clockwise to increase opening time.

NOTE: Adjustment can only be made in a clockwise direction. If adjustment screw is turned in too far, it will be necessary to back adjustment screw all the way out. The sleeve will come out with it. Manually slide sleeve (interference fit) on screw restrictor so that more of the adjusting slot is visible. Install the screw and sleeve. Adjust again, turning screw clockwise.

3) Tighten jamnut on adjustment screw.
4) Repeat steps 4) thru 10) and 14) thru 20)b)3. until valve is adjusted correctly.

(g) On airplanes with configuration 2 rate adjustment screw (after incorporation of AiResearch SB 49-3646) (Fig. 504, View 3):

1) Loosen jamnut on rate control adjustment screw.
2) Turn adjustment screw clockwise to increase opening time or counterclockwise to decrease opening time.
3) Tighten jamnut on adjustment screw.
4) Repeat steps 4) thru 10) and 14) thru 20)c)3. until valve is adjusted correctly.
5) AIRPLANES WITHOUT THE ETC; If the EGT temperature for the APU control thermostat was not in the specified limits, replace the APU control thermostat (AMM 49-52-31/401).
6) AIRPLANES WITH THE ETC; If the EGT temperature is not within the specified limits, adjust the ETC (AMM 49-61-71/501).

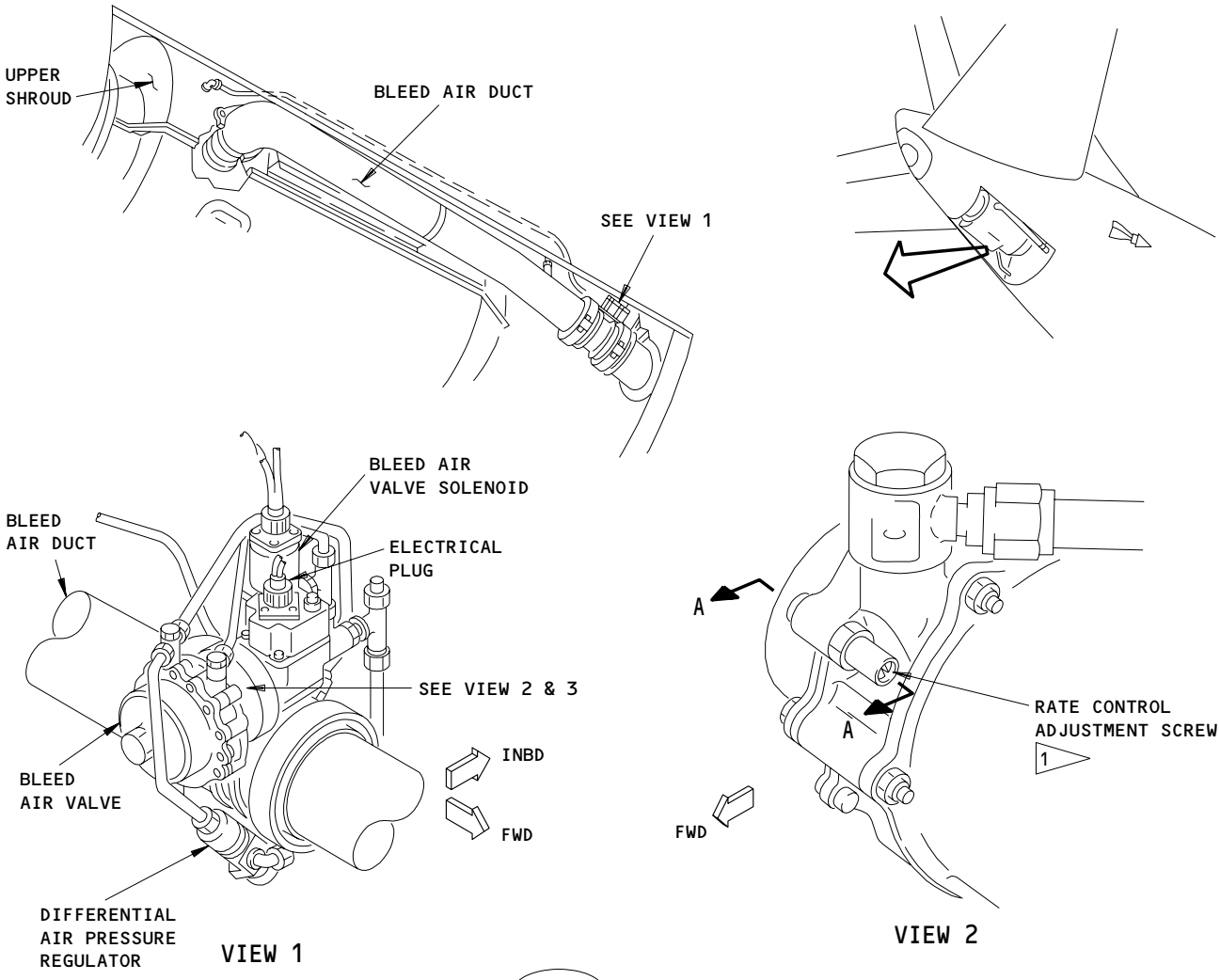
(h) Disconnect Gas Turbine Engine Tester from Engine

1) Check that BATTERY switch is OFF and placard.
2) Repeat steps A.(6)(f) thru A.(6)(n).

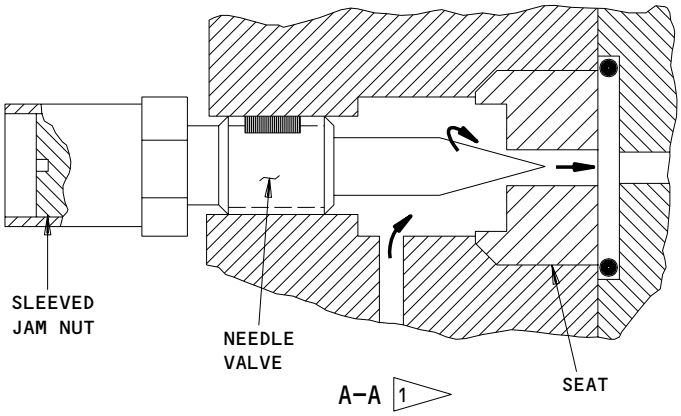
(i) Restore Airplane to Normal Configuration

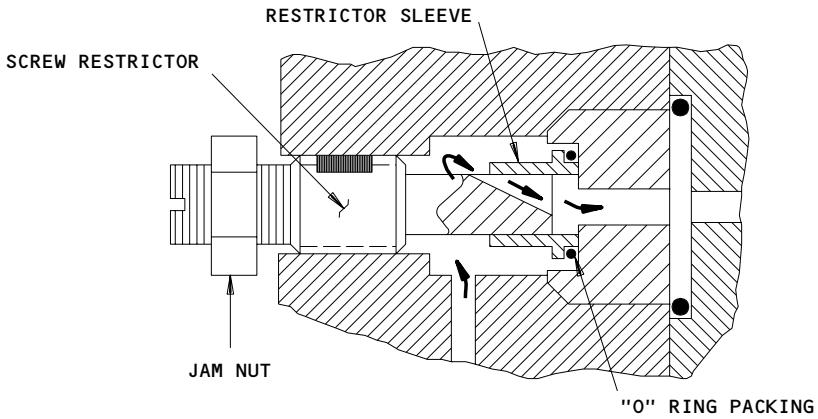
1) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
2) Install lower shroud.
   a) Position lower shroud against upper shroud and close shroud latches.

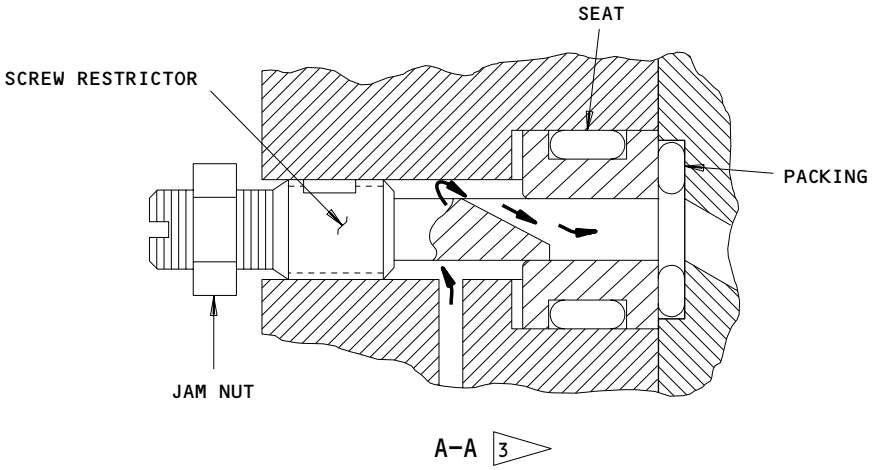
CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.



Bleed Air Valve Adjustments
Figure 504 (Sheet 1)







1 CONFIGURATION 1 RATE ADJUSTING SCREW

2 CONFIGURATION 2 RATE ADJUSTING SCREW (PRIOR TO INCORPORATION OF AIRESEARCH SB 49-3646)

3 CONFIGURATION 2 RATE ADJUSTING SCREW (AFTER INCORPORATION OF AIRESEARCH SB 49-3646)

Bleed Air Valve Adjustments
Figure 504 (Sheet 2)

3) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
4) Remove placard from BATTERY switch.

APU FUEL SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU fuel system supplies fuel from the airplane fuel system to the APU and automatically meters the flow rate to match speed and loading requirements. The system consists of a fuel control unit, a fuel solenoid valve, a fuel atomizer, an APU control thermostat (airplanes without the ETC), a low pressure fuel filter, a fuel heater and a fuel sensing flow control, and various lines connecting the components (Fig. 1).
   B. The fuel control unit supplies and regulates the fuel flow to the fuel atomizer. The regulated fuel flow controls the acceleration of the engine during the starting operation. When a load is applied to the APU, the fuel control unit meters the fuel flow to maintain a near constant speed and a safe operating temperature of the unit.
2. APU Fuel Valve
   A. The APU fuel valve connects the APU fuel system to the airplane fuel tank No. 1. The valve is located on the rear spar of the left wing and controlled through the APU master switch. For description and operation of the valve, refer to Chapter 28, Engine Fuel Feed System.
3. Low Pressure Fuel Filter
   A. The low pressure fuel filter protects the fuel control unit from contamination with dirt in fuel. The filter is a full-flow type with a replaceable filter element. A bypass valve in the filter allows unfiltered fuel to be delivered to the fuel control unit when the filter element becomes clogged. The bypass valve opens when the pressure differential across the filter is approximately 14 psi. The filter is installed on the fuel control unit (Fig. 1).
4. Fuel Control Unit
   A. The fuel control unit regulates the fuel flow to the combustion chamber. It consists of an engine-driven fuel pump, a fuel filter, an acceleration limiter valve, a flyweight governor, a sleeve-type fuel bypass valve, two relief valves, fuel inlet and outlet ports, drive shaft seal drain line, and a control air connection. The fuel control unit is mounted on the accessory drive section (Fig. 1). It is driven by the accessory drive gear train at approximately 10% engine rpm.
   B. The engine-driven fuel pump is a gear-type positive displacement high pressure pump. The pump housing contains a spring-loaded ball-type pressure relief valve which allows fuel to return to the pump inlet if excessive fuel pressure is built up in the fuel control unit. The high pressure fuel filter is a micronic fuel filter located downstream of the pump outlet port and filters all fuel passing from the pump to the governor.

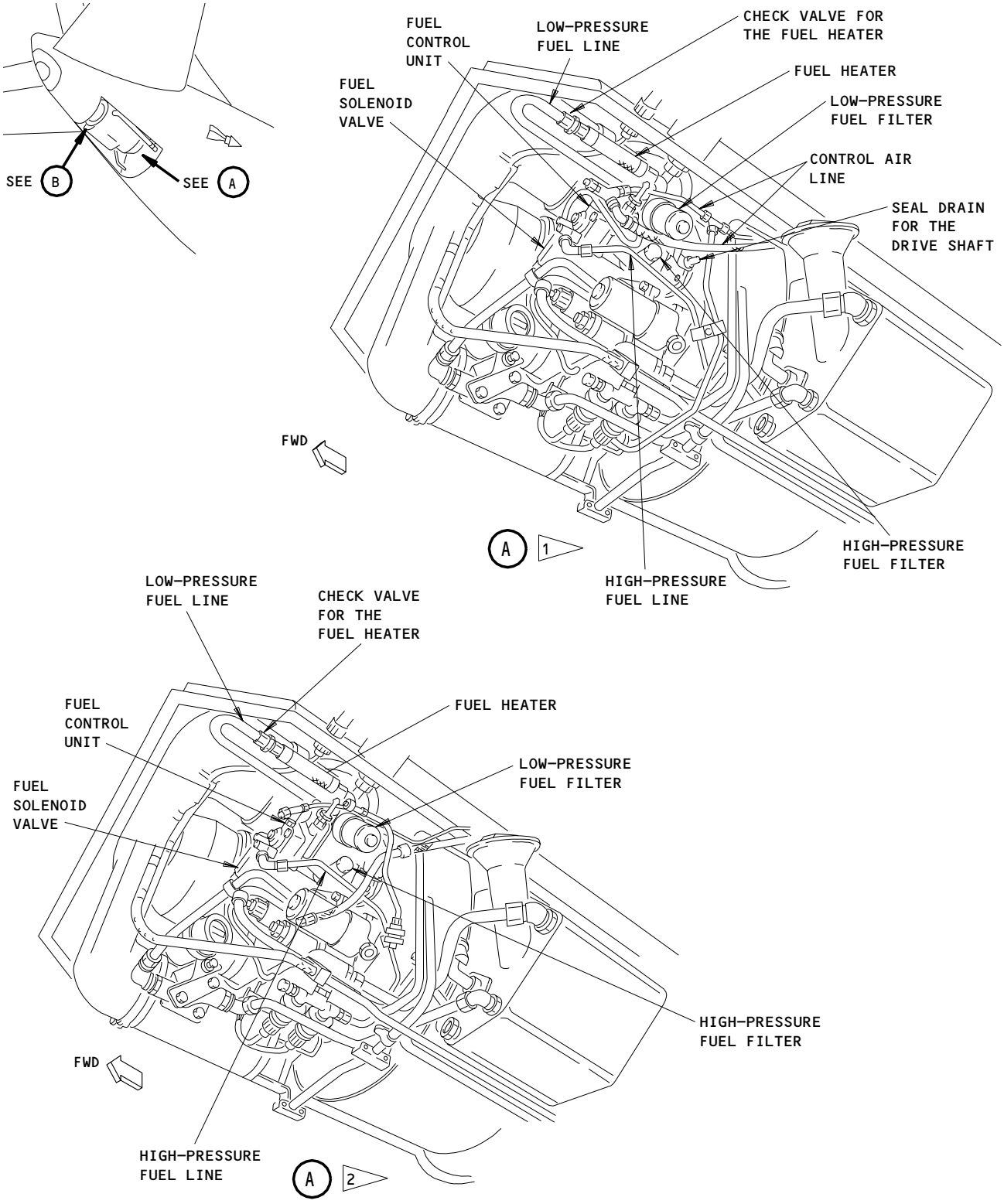
C. AIRPLANES WITHOUT THE ETC: The acceleration limiter valve consists of an air to air diaphragm assembly, a piston and guide assembly, a bypass valve, spring, adjustment screw, nut, and a bypass filter. The valve cover is provided with a connection for control air inlet and with a fixed vent orifice. This vent orifice vents control air to ambient in order to provide correct fuel scheduling during the acceleration cycle. On some airplanes, this vent has been plugged and another vent provided at the orifice tee fitting located just forward of the combustor unit and on upper LH side of the diffuser housing (Ref 49-52-91).

D. AIRPLANES WITH THE ETC: The acceleration limiter valve controls the quantity of fuel for acceleration when the APU speed is less than 20%. The acceleration limiter valve has a diaphragm, piston and guide assembly, bypass valve, spring, adjustment screw, nut, and bypass filter. Air supplied by the compressor controls the acceleration limiter valve. The air is supplied from an orificed tee. The orificed tee is found forward of the combustor unit on the lower right side of the diffuser housing. When the APU speed is more than 20%, the timed-accleration head on the fuel control unit supplies a specified quantity of fuel. The timed-acceleration head is made to supply a specified quantity of fuel for a specified APU speed during the acceleration.

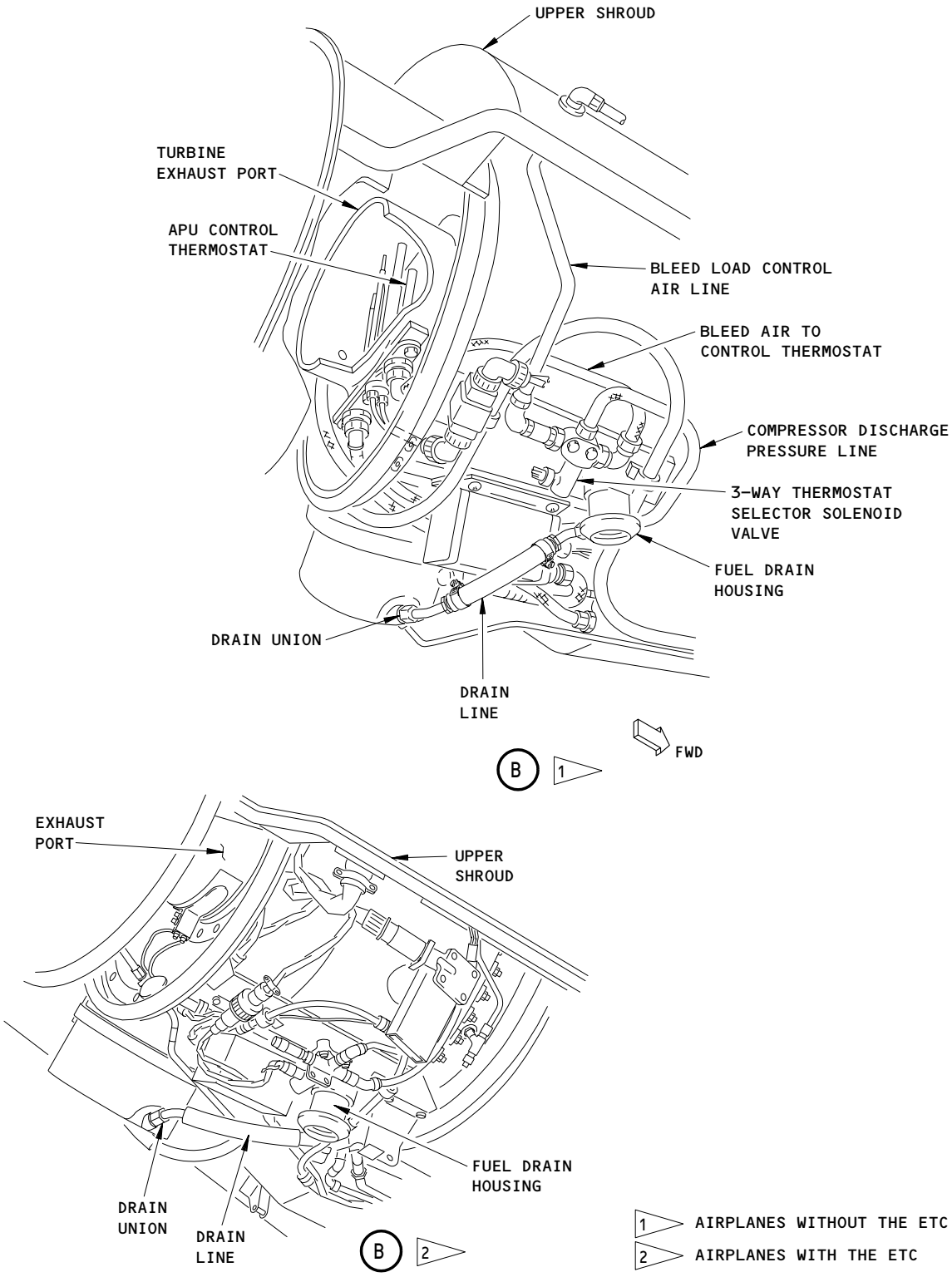
E. The governor controls the fuel flow to the fuel atomizer during the APU usual operation. The governor supplies the fuel to keep a constant APU speed during different load conditions. The governor has a shaft and sleeve assembly, governor cage, flyweights, spring, adjustment screw, and nut. High-pressure fuel is on all sides of the flyweights. The flyweights move the sleeve to cover the shaft ports for control of the bypass of the fuel. This will give the correct quantity of fuel to the fuel atomizer.

5. <u>APU Control Thermostat (Airplanes without the ETC)</u>

A. The APU control thermostat in the single thermostat control system acts both as an acceleration control thermostat and as a load control thermostat. The single thermostat control system consists of a thermostat, selector solenoid, check valve, immersion thermocouple and an overtemperature control switch. The thermostat projects into the turbine exhaust duct and is comprised of an alloy steel housing, spring-loaded ball valve, thermostatic core and connection for a pneumatic line. The thermostat is connected through the normally open selector solenoid to the acceleration limiter valve located in the fuel control unit. It functions in the acceleration control mode until 95% switch actuation. At 95% speed, the selector solenoid is energized closed, transferring the thermostat to the load control mode. At about 650°C (1200°F) the thermostat opens to bleed air from the bleed air valve to reduce the EGT.

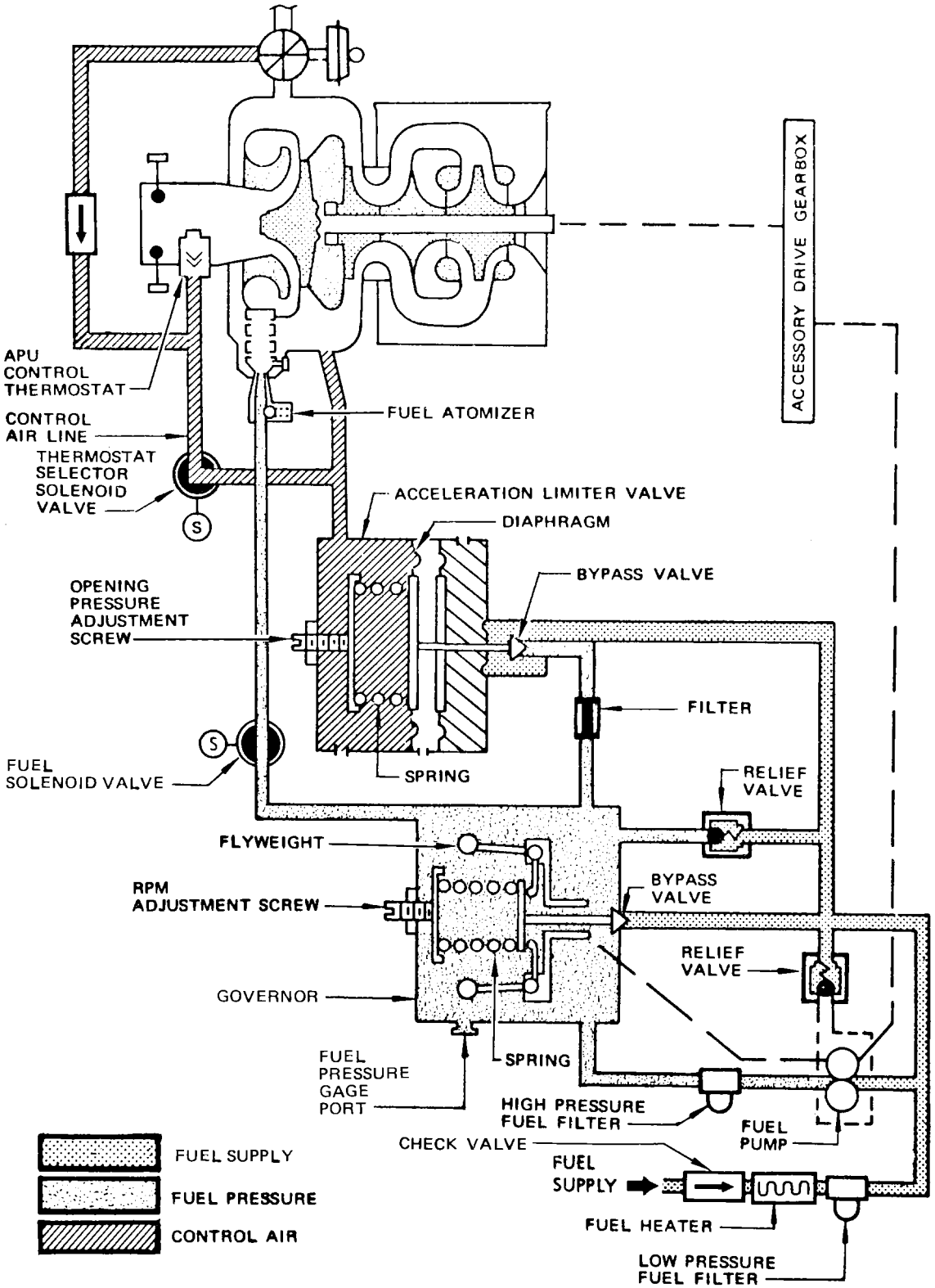


APU Fuel System Component Location
Figure 1 (Sheet 1)



APU Fuel System – Component Location
Figure 1 (Sheet 2)

6. Fuel Solenoid Valve
   A. The fuel solenoid valve is a normally closed electromagnetic shutoff valve. The valve is located in the high pressure fuel line between the fuel control unit and the fuel atomizer and it is attached to the fuel control unit housing (Fig. 1). The valve consists of two body assemblies, a coil, plunger and spring. The valve is energized to pass fuel to the fuel atomizer when the sequencing oil pressure switch closes during a starting operation.
7. Combustor Unit
   A. The atomizer, combustor cap and the combustion chamber liner comprise the combustor unit. The fuel atomizer is a dual-orifice type mounted on the combustion chamber cap (Fig. 1). The fuel atomizer consists of a screen, flow-divider valve, distributor head, and housing. The distributor head functions as a dividing passageway, with a core in the center leading to a small orifice plate, and an annulus leading to a large orifice plate located at the tip. The distributor head and orifice plates located within the housing are covered by an atomizer nut. Also located within the housing is the screen and flow-divider valve. The screen strains all fuel entering the fuel atomizer. The flow-divider valve functions to direct all fuel at lower pressures to the small orifice which provides proper atomization of fuel under these conditions. At higher fuel pressures, the valve actuates to permit combined flow to both orifices.
8. Fuel Drain
   A. The fuel drain permits the unburned fuel from the combustion chamber and turbine plenum to drain from the APU. The fuel drain has a fuel drain housing to increase the capacity of the fuel drain. The fuel drain housing has a drain seal, spring and screen. A warm airflow from the fuel drain shows that the fuel drain is not clogged.
9. Fuel Heater
   A. The fuel heater is attached to the inside surface of the upper shroud, and is located between the fuel inlet and low pressure fuel filter (Fig. 2). It is used to prevent fuel ice from blocking the fuel filter by regulating the temperature of the fuel entering the APU. A check valve is installed in the fuel line upstream of the fuel heater to retain fuel in the APU fuel pump. This ensures a positive prime for starting.
   B. Fuel sensing flow control valve is part of the APU fuel heating system which operates automatically by action of the fuel temperature sensing air regulator valve. When the temperature of the fuel passing through this valve drops to a predetermined value, the valve will modulate open allowing hot air from the APU bleed port to circulate through the finned shroud around the fuel line passing through the fuel heater. A fuel sensing flow control check valve is installed in the fuel heating system to prevent fuel from entering the bleed air duct.



APU Fuel System Schematic
Figure 2 (Sheet 1)

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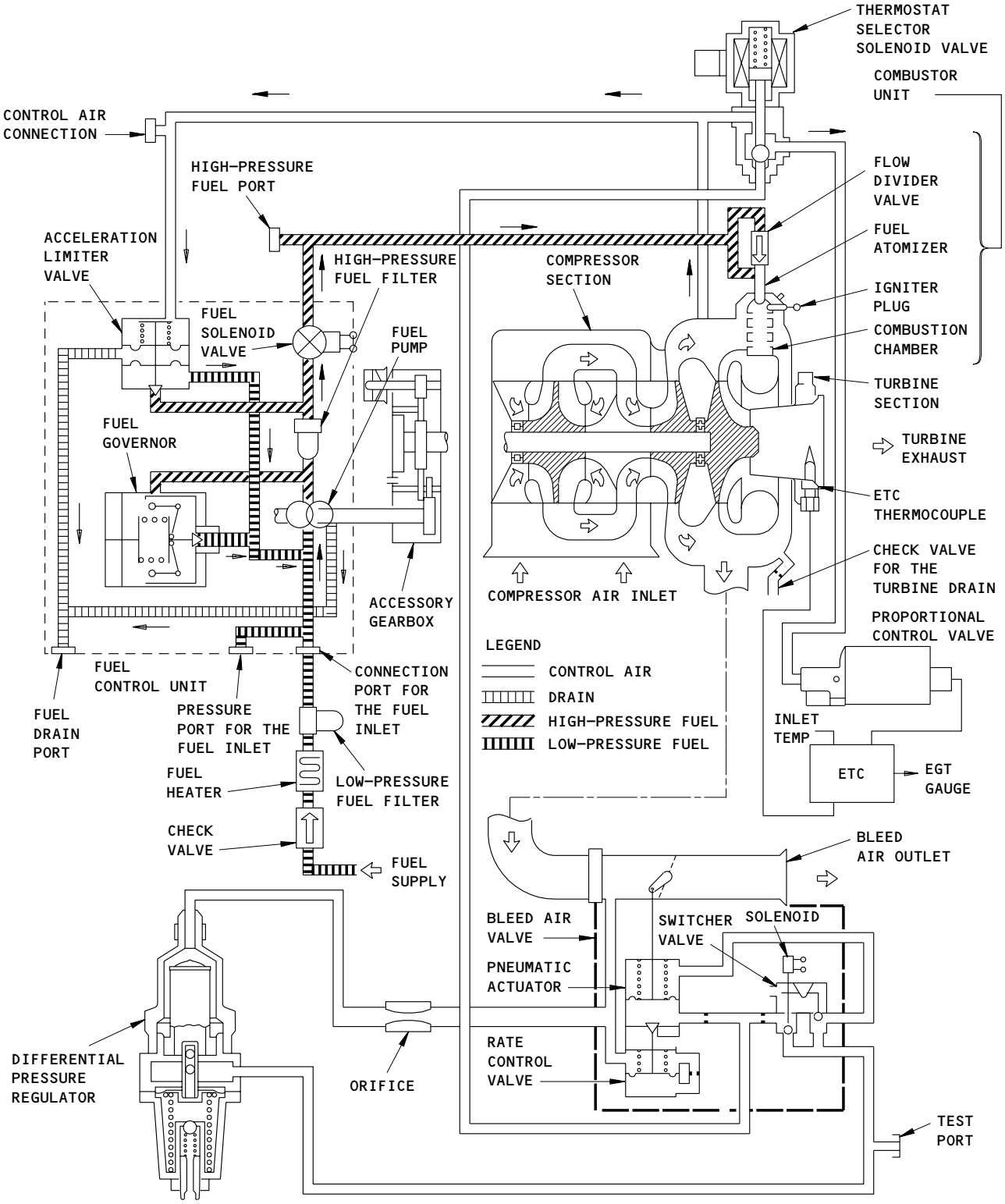


APU Fuel System Schematic
Figure 2 (Sheet 2)

10. Operation

A. All components of the APU fuel system are controlled automatically. Placing the APU master switch to the START position opens the APU fuel valve to deliver fuel to the fuel control unit. For fuel system component operation electrically, refer to 49-11-0. The fuel control unit is full of fuel at all times since it is not drained at APU shutdown. The fuel pump delivers high pressure fuel to the fuel solenoid valve whenever the turbine is rotating. The valve solenoid is energized when the sequencing oil pressure switch actuates. This occurs when the engine oil pressure rises to approximately 4.5 psig. When the fuel solenoid valve is opened, high pressure fuel is delivered to the fuel atomizer and injected into the combustion chamber (Fig. 2). Engine speed and exhaust gas temperature are automatically controlled within established limits by the fuel control unit.

B. The acceleration of the engine is controlled by the action of the acceleration limiter valve. The valve references the control air pressure (compressor air discharge pressure) to fuel pressure. The pressure-actuated diaphragm in the acceleration limiter valve operates a bypass valve to bypass more or less fuel to maintain the required ratio of fuel flow to control air pressure (Fig. 2). During start and first stages of acceleration, when the control air pressure is very low due to the low rpm of the compressor, the bypass valve is restrained from bypassing fuel by the spring force acting on the actuating diaphragm.

C. AIRPLANES WITH THE ETC; The exhaust gas temperature is controlled by the electronic temperature control (ETC). For a more detailed description of the ETC, refer to 49-61-0 D&O.

D. Turbine exhaust gas temperature (EGT) is controlled by a single thermostat having two functions as follows:

(1) The thermostat functions as an acceleration control thermostat when the APU is accelerating to, or is operating below, 95% service speed. When turbine exhaust temperature exceeds 620 to 649°C (1150 to 1200°F) during this mode of operation, the thermostat opens and bleeds some of the control air from the acceleration limiter valve (Fig. 2). This allows the fuel control unit bypass valve to bypass fuel and thereby reduces the turbine EGT. When the turbine EGT is reduced below the limits noted above, the thermostat closes and stops bleeding control air from the acceleration limiter valve. This results in the closing of the fuel bypass valve.

(2) When the APU is operating at or above 95% service speed, the 95% switch actuates and the thermostat selector solenoid is energized closed, to transfer the thermostat to the load control mode and causes it to function as an overload protection for the APU. Refer to 49-52-01 for additional information pertaining to thermostat operation in the load control mode.

E. The fuel atomizer injects atomized fuel into the combustion chamber in a uniform pattern. The pattern is unaffected by changes in the fuel pump delivery pressure. Fuel is directed to the primary (small) orifice plate to provide thorough atomization of fuel at low fuel pressure. As fuel pressure increases with increasing unit speed, the flow divider valve opens and allows fuel to flow to both the primary and secondary orifices for correct fuel atomization at high fuel pressures.

F. When the unit reaches service speed, the governor regulates the fuel flow to match power demands maintaining the engine speed nearly constant. When the engine exceeds the service speed, the governor flyweights move outward to open the sleeve-type bypass valve to bypass fuel and so decrease the engine speed (Fig. 2). When the engine speed drops as a load is applied, the governor flyweights move inward to close the bypass valve to permit greater fuel flow and so increase the engine speed.

G. When shutdown is initiated, power is supplied to the overspeed oscillator of the electronic speed switch. This in turn, excites the normally closed 110% switch, causing it to open, simulating an engine overspeed condition. The 110% switch actuates and breaks the fuel solenoid valve circuit. The valve closes. For fuel system component operation electrically, refer to 49-11-0.

FUEL CONTROL UNIT - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Lubricant - MIL-G-21164 (Ref 20-30-21)
2. Prepare for Fuel Control Unit Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

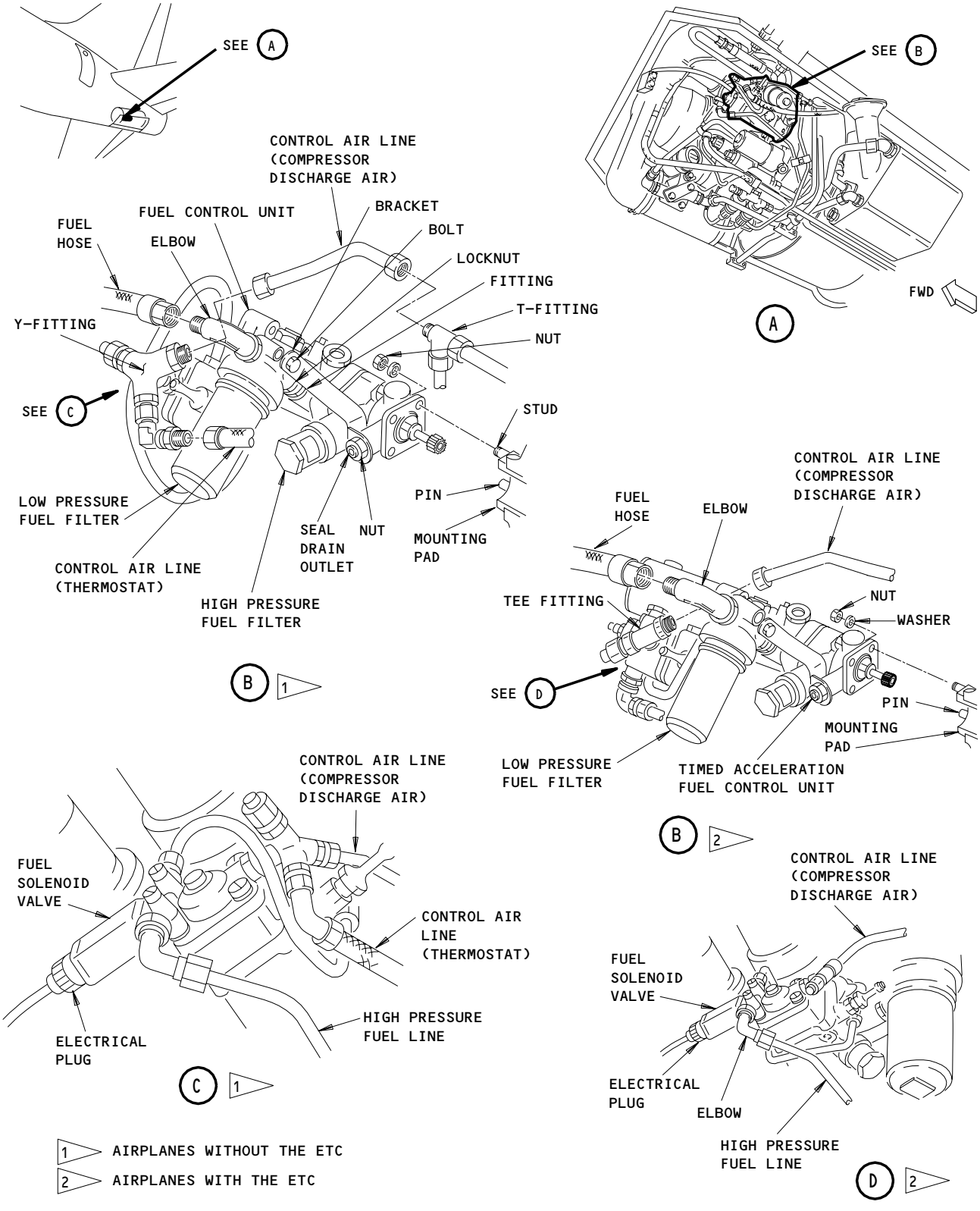
3. Remove the Fuel Control Unit (Airplanes with the ETC) (Fig. 401)
   A. Put the container below the elbow on the low pressure fuel filter.
   B. Disconnect the fuel hose from the elbow on the low pressure fuel filter.
      (1) Let the fuel drain into the container.
   C. Put the container below the elbow on the fuel solenoid valve.
   D. Disconnect the high pressure fuel line from the elbow on the fuel solenoid valve.
      (1) Let the fuel drain into the container.
   E. Disconnect the electrical plug from the fuel solenoid valve.
      (1) Install caps on the plug and the fuel solenoid valve to prevent damage and contamination.
   F. Disconnect the control air line (compressor discharge air) from the fitting on the fuel control unit.
   G. Remove the nuts and washers that attach the fuel control unit to the APU engine.
   H. Carefully remove the fuel control unit in a straight line to prevent damage to the drive shaft splines and the mounting studs.
   I. Install caps and plugs on all the disconnected lines and the ports to prevent contamination.
   J. If it is necessary, remove the fuel solenoid valve from the fuel control unit (Ref 49-31-31 R/I).
   K. If it is necessary, remove the low pressure fuel filter from the fuel control unit (Ref 49-31-21 R/I).
   L. If it is necessary, do the servicing for the high pressure fuel filter on the fuel control unit (Ref 49-31-81 SRV).
4. Remove Fuel Control Unit (Airplanes without the ETC) (Fig. 401)
   A. Disconnect fuel hose from elbow on low pressure fuel filter. Catch dripping fuel in suitable container.
   B. Disconnect high pressure fuel line from elbow on fuel solenoid valve. Catch dripping fuel in suitable container.

C. Disconnect electrical plug from fuel solenoid valve.
D. Disconnect control air line (thermostat) from Y fitting on fuel control unit.
E. Remove control air line (compressor discharge air) from Y fitting on fuel control unit and from T fitting located adjacent to fuel control unit base.
F. Remove fuel control unit mounting nuts and washers.
G. Carefully withdraw fuel control unit in a straight line to avoid damage to drive shaft splines and mounting studs.
H. If removal of fuel solenoid valve is required, remove fuel solenoid valve (AMM 49-31-31/401).
I. If removal of low pressure fuel filter is required, remove as follows:
(1) Remove nut, washer, and bolt attaching low pressure fuel filter to bracket.
(2) Remove nut attaching bracket to seal drain line fitting and remove bracket.
(3) Loosen locknut on fitting connecting filter to fuel control unit.
(4) Unscrew filter from fitting.
(5) Remove old packing from fitting and discard.

5. Install the Fuel Control Unit (Airplanes with the ETC) (Fig. 401)
A. If the high pressure fuel filter was removed from the fuel control unit, install the high pressure fuel filter (AMM 49-31-81/301).
B. If the fuel solenoid valve was removed from the fuel control unit, install the fuel soelenoid valve (AMM 49-31-31/401).
C. If the low pressure fuel filter was removed from the fuel control unit, install the low pressure fuel filter (AMM 49-31-21/401).
D. Remove the caps and the plugs from all the disconnected lines and the ports.
E. Apply a thin layer of grease to the flat areas of the square drive.
F. Apply a thin layer of grease to the teeth on the drive shaft for the fuel control unit.
G. Carefully put the fuel control unit in its position on the mounting studs.
(1) Make sure the drive shaft for the fuel control unit engages the gear shaft of the accessory drive.
H. Install the washers and nuts that attach the fuel control unit engages the APU engine.

NOTE: You do not have to install the nut at the 9 o'clock position. This will make the installation of the fuel control unit easier.

(1) Tighten the nuts to 70-90 pound-inches (7.9-10.2 newton-meters).
I. Connect the control air line (compressor discharge air) to the fitting on the fuel control unit.
J. Connect the electrical plug to the fuel solenoid valve.
(1) Install a lockwire to the electrical plug.



Fuel Control Unit Installation
Figure 401

K. Connect the high pressure fuel line to the elbow on the fuel solenoid valve.
L. Connect the fuel hose to the elbow on the low pressure fuel filter.

NOTE: On APU with timed acceleration fuel control unit (TAFCU), bleed preservation fluid from the fuel control unit (AMM 49-11-0/201).

M. APUs WITHOUT ALLIED SIGNAL SB GTCP85-49-7096; do the APU operation test - LOADED CONDITION (AMM 49-11-0/501):
(1) After the APU operation test, make sure the APU master switch, on the P5 forward overhead panel, is in the OFF position and attach a DO-NOT-OPERATE tag.
(2) Visually examine the fuel control unit for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

NOTE: A fuel leakage rate of 1 drop for each minute (2.5 cc for each hour) is permitted from the fuel control unit.

N. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; do the APU operation test - LOADED CONDITION (AMM 49-11-0/501):
(1) During the APU operation, examine the fuel control unit for leakage.
(2) If you found leakage, repair the cause of it.

NOTE: A fuel leakage rate of 1 drop for each minute (2.5 cc for each hour) is permitted from the fuel control unit.

6. Install Fuel Control Unit (Airplanes without the ETC) (Fig. 401)
A. If high pressure fuel filter element was removed from fuel control unit, service fuel control unit (AMM 49-31-81/301).
B. If fuel solenoid valve was removed, install fuel solenoid valve (AMM 49-31-31/401).
C. If low pressure fuel filter was removed from fuel control unit, install filter (AMM 49-31-21/401).
D. Carefully position fuel control unit on mounting studs. Make sure that fuel control unit drive shaft engages with accessory drive gear shaft.

NOTE: Apply light coat of lubricant to square drive flats and splined teeth of fuel control unit drive shaft.

E. Install fuel control unit mounting nuts and washers. Tighten nuts to torque range of 70 to 90 pound-inches.

NOTE: Nut at 9 o'clock position may be omitted to facilitate fuel control unit installation.

F. Install control air line (compressor discharge air) to Y-fitting on fuel control unit and to T-fitting located adjacent to fuel control unit base.
G. Connect control air line (thermostat) to Y-fitting on fuel control unit.
H. Connect electrical plug to fuel solenoid valve and safety wire.
I. Connect high pressure fuel line to elbow on fuel solenoid valve.
J. Connect fuel hose to elbow on low pressure fuel filter.

NOTE: On APU with timed acceleration fuel control unit (TAFCU), bleed preservation fluid from the fuel control unit (AMM 49-11-0/201).

K. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; do the APU operation test - LOADED CONDITION (AMM 49-11-0/501):
(1) After the APU operation test, make sure the APU master switch, on the P5 forward overhead panel, is in the OFF position and attach a DO-NOT-OPERATE tag.
(2) Visually examine the fuel control unit for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

NOTE: A fuel leakage rate of 1 drop for each minute (2.5 cc for each hour) is permitted from the fuel control unit.

L. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; do the APU operation test - LOADED CONDITION (AMM 49-11-0/501):
(1) During the APU operation, examine the fuel control unit for leakage.
(2) If you found leakage, repair the cause of it.

NOTE: A fuel leakage rate of 1 drop for each minute (2.5 cc for each hour) is permitted from the fuel control unit.

7. Restore Airplane to Normal Configuration
A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

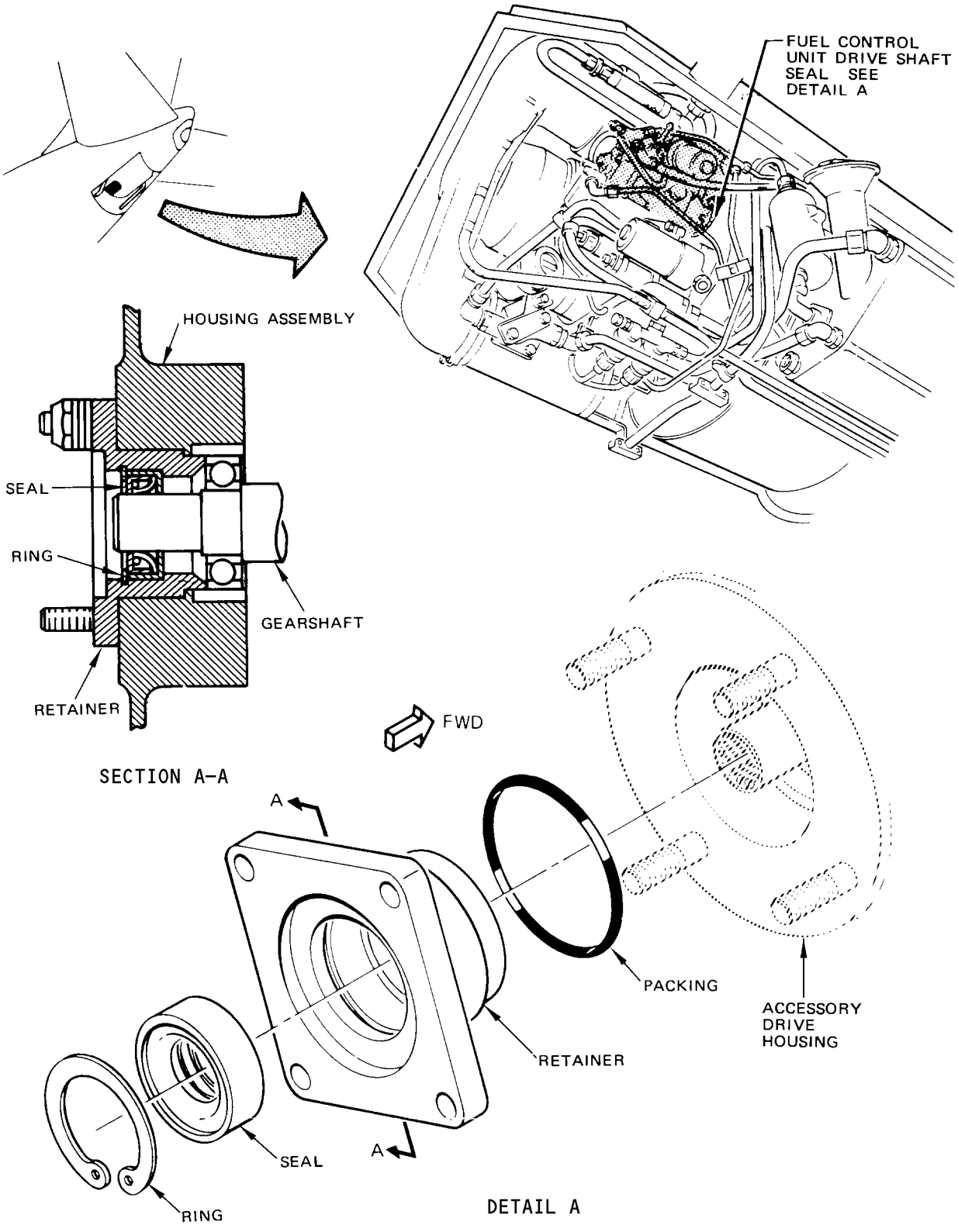
C. Disengage APU access door support rods and stow rods. Close and latch access door.
D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
E. Position BATTERY switch to ON and remove placard.

FUEL CONTROL UNIT DRIVE SHAFT SEAL - REMOVAL/INSTALLATION

1. Remove Fuel Control Unit Drive Shaft Seal
   A. Remove fuel control unit. Refer to 49-31-11, Fuel Control Unit - Removal/Installation.
   B. Remove retainer. Remove and discard packing. (See figure 401).
   C. Remove ring and seal from retainer. Discard seal.
2. Install Fuel Control Unit Drive Shaft Seal
   A. Install new seal in retainer. Secure with ring.
   B. Install new packing on retainer and install on accessory drive housing.

      NOTE: Use care when moving seal over drive shaft.

   C. Install fuel control unit. Refer to 49-31-11, Fuel Control Unit - Removal Installation.



Fuel Control Unit Drive Shaft Seal Installation
Figure 401

APU FUEL PUMP - ADJUSTMENT/TEST

1. General
   A. The purpose of the fuel pump test is to provide prompt identification of a worn or marginal fuel pump.
   B. The APU fuel pump is an integral part of the APU fuel control unit. If the fuel pump indicates a deteriorating condition, the fuel control unit must be replaced.
2. Check APU Fuel Pump
   A. Operate APU - Engine Start Procedure (Ref 49-11-0, Maintenance Practices).

      NOTE: Ensure that either an AC or DC boost pump is operating throughout this test.

   B. Allow APU to stabilize at no load condition.
   C. Observe APU generator frequency indication.
   D. Load APU (2 air conditioning packs).
   E. Observe APU generator frequency. Frequency indication must not drop more than 12 Hz from that observed in step C.

      NOTE: If AC generator frequency indicates drop of more than 12 Hz, the fuel control unit must be replaced (Ref 49-31-11).

   F. Shut down APU - Engine Shutdown Procedure (Ref 49-11-0, Maintenance Practices).

LOW PRESSURE FUEL FILTER - SERVICING

1. General
   A. The low pressure fuel filter element is a full-flow type replaceable type filter element, which protects the fuel control unit from contamination.
2. Equipment and Materials
   A. Cleaning Solvent - Federal Specification P-D-680
3. Prepare for Low Pressure Fuel Filter Servicing
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work".
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

4. Low Pressure Fuel Filter Servicing (Fig. 301)
   A. Unscrew filter bowl from filter head. Catch dripping fuel in suitable container.
   B. Remove and discard old filter element and packing.
   C. Remove backup ring and packing from filter head; discard packing.
   D. Wash filter bowl and backup ring in solvent and dry thoroughly with clean compressed air.

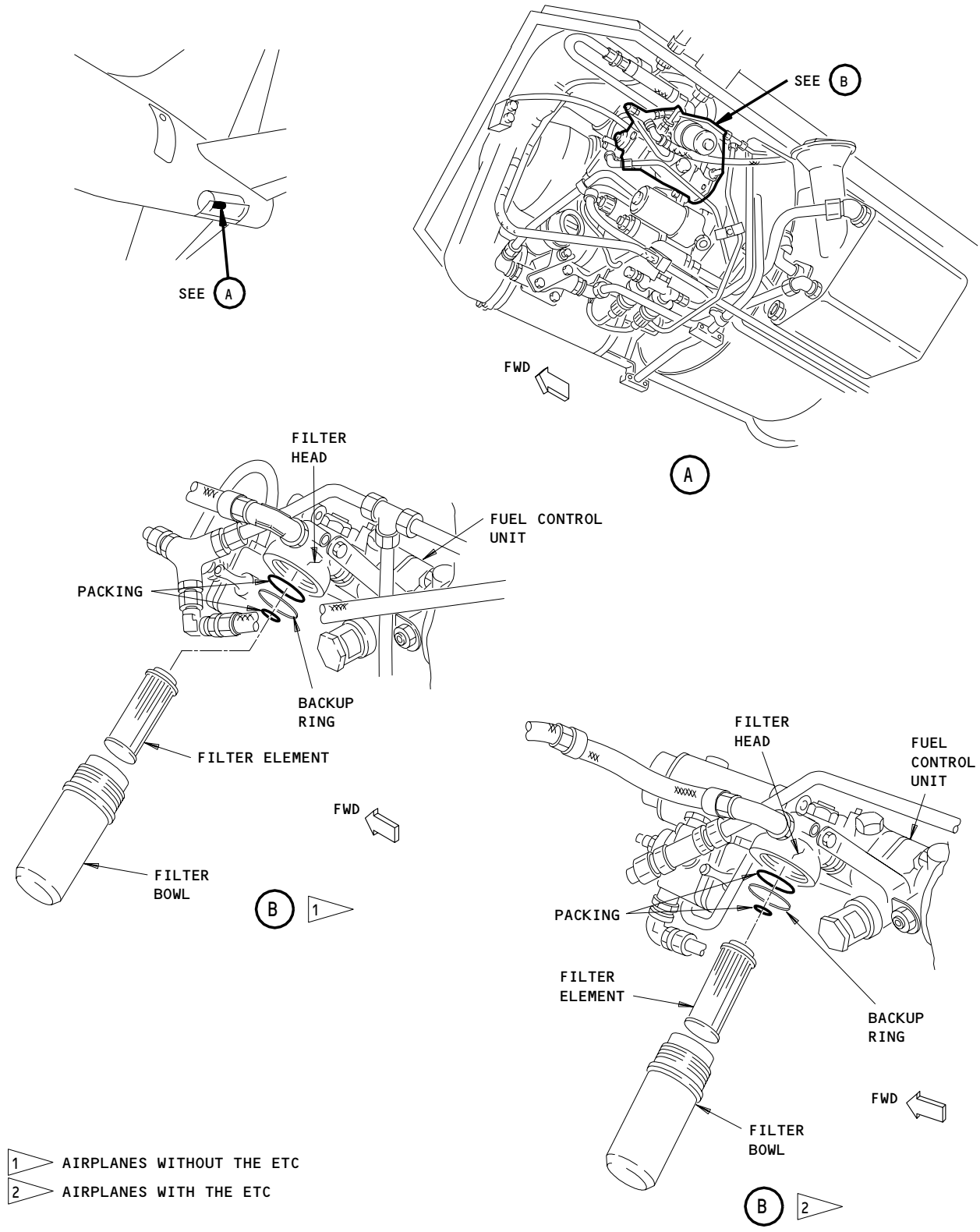
      WARNING: SOLVENT IS TOXIC. USE IN WELL VENTILATED AREA. KEEP AWAY FROM FLAME.

   E. Install new packing and backup ring in filter head.
   F. Install new packing on new filter element and install element in filter head.
   G. Install filter bowl in filter head, tighten to torque value of 65 to 75 pound-inches and lock wire.
      (1) APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; examine the fuel filter for leakage:
          (a) Start and operate the APU (AMM 49-11-0/201).
          (b) During the APU operation, examine the fuel filter for leakage.
          (c) Do the APU normal shutdown (AMM 49-11-0/201).
          (d) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
          (e) If you found leakage, repair the cause of it.
      (2) APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; examine the fuel filter for leakage:
          (a) Start and operate the APU (AMM 49-11-0/201).
          (b) Do the APU normal shutdown (AMM 49-11-0/201).
          (c) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
          (d) Visually examine the fuel filter for any signs of leakage:
              1) If you found signs of leakage, repair the cause of it.

5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



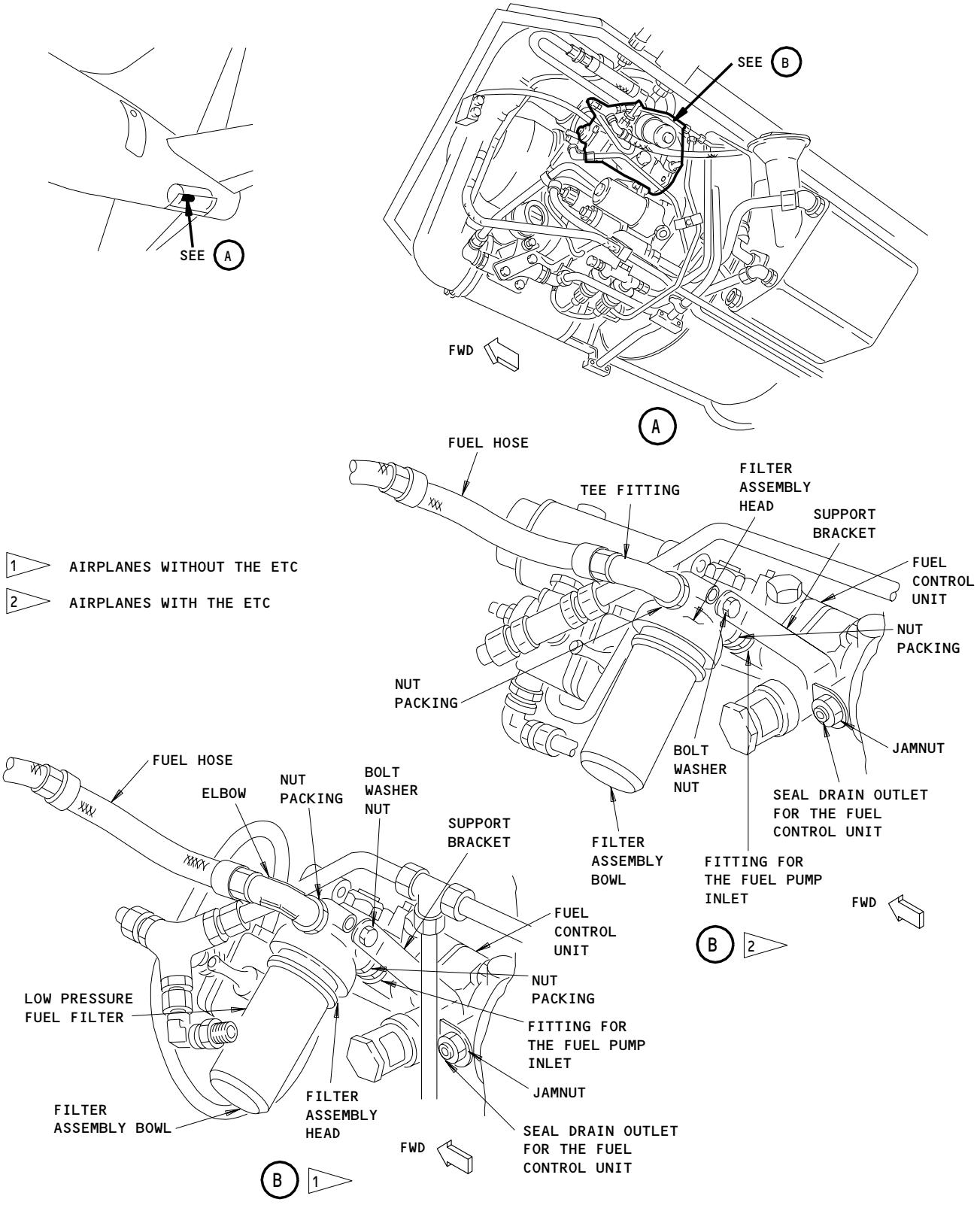
Low Pressure Fuel Filter Unit Servicing
Figure 301

LOW PRESSURE FUEL FILTER ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. The low pressure fuel filter assembly is attached to and is an integral part of the fuel control unit. A bypass valve in the filter assembly allows passage of unfiltered fuel to the fuel control unit if the filter element becomes clogged.
2. Prepare for Low Pressure Fuel Filter Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HAULING SHROUD.

3. Remove Low Pressure Fuel Filter Assembly (Fig. 401)
   A. Loosen jamnut on fitting securing filter assembly to fuel pump.
   B. Disconnect fuel hose from inlet side of filter assembly.
   C. Remove nut, washer and bolt securing filter assembly to support bracket.
   D. Loosen jamnut at fuel control unit seal drain port fitting and rotate support bracket out of way.
   E. Remove filter bowl and element from filter head.
   F. Unscrew filter head from fuel pump inlet fitting. Remove and discard packing.
   G. Remove fitting from inlet side of filter head. Remove and discard packing. Save fitting for installation on replacement filter assembly.
   H. Reassemble filter bowl to filter head.
4. Install Low Pressure Fuel Filter Assembly (Fig. 401)
   A. Disassemble filter bowl and element from filter head.
   B. Install elbow fitting with new packing in inlet port of filter head. Do not tighten jamnut at this time.
   C. Place new packing on fuel pump fitting and screw filter head onto fitting. Do not tighten jamnut at this time.
   D. Install filter element and bowl (Ref 49-31-21, Servicing)
   E. Rotate filter support bracket into position and install bolt, washer and nut. Tighten nut and jamnut on fuel control unit seal drain port to secure support bracket.
   F. Position filter assembly and tighten jamnut on fuel pump fitting.
   G. Connect fuel hose at filter assembly inlet fitting. Tighten hose nut and jamnut of elbow fitting.



Low Pressure Fuel Filter Installation
Figure 401

5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.

FUEL SOLENOID VALVE - REMOVAL/INSTALLATION

1. Prepare for Fuel Solenoid Valve Removal
   A. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Fuel Solenoid Valve
   A. Place suitable container under solenoid valve to catch dripping fuel.
   B. Disconnect electrical plug from solenoid valve (Fig. 401).
   C. Disconnect high pressure fuel line from fitting on fuel control unit and from fitting on solenoid valve and remove line.
   D. Disconnect high pressure fuel line from elbow on solenoid valve.
   E. Supporting solenoid valve, remove attaching screws and washers and remove valve.
3. Install Fuel Solenoid Valve
   A. Position solenoid valve on fuel control unit housing and install attaching screws with washers (Fig. 401).
   B. Connect high pressure fuel line to elbow on solenoid valve.
   C. Install high pressure fuel line to fitting on solenoid valve and to fitting on fuel control unit.
   D. Connect solenoid valve electrical plug and safety wire.
   E. Safety wire solenoid valve attaching screws.
   F. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; examine the fuel solenoid valve for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the fuel solenoid valve for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) Open the circuit breaker on M280 module - APU control unit on E3-3 electronic shelf.
      (6) If you found leakage, repair the cause of it.
   G. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; examine the fuel solenoid valve for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Do the APU normal shutdown (AMM 49-11-0/201).

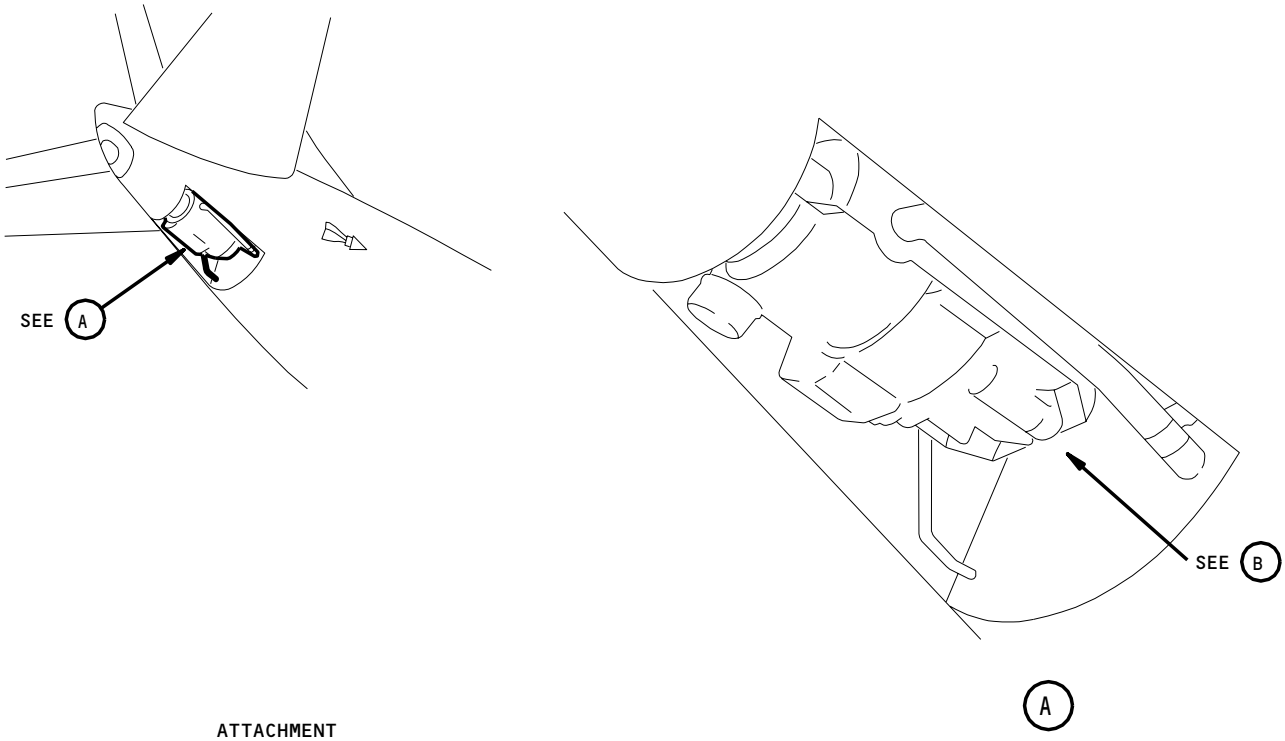
(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(4) Open the circuit breaker on M280 module - APU control unit on E3-3 electronic shelf.
(5) Visually examine the fuel solenoid valve for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

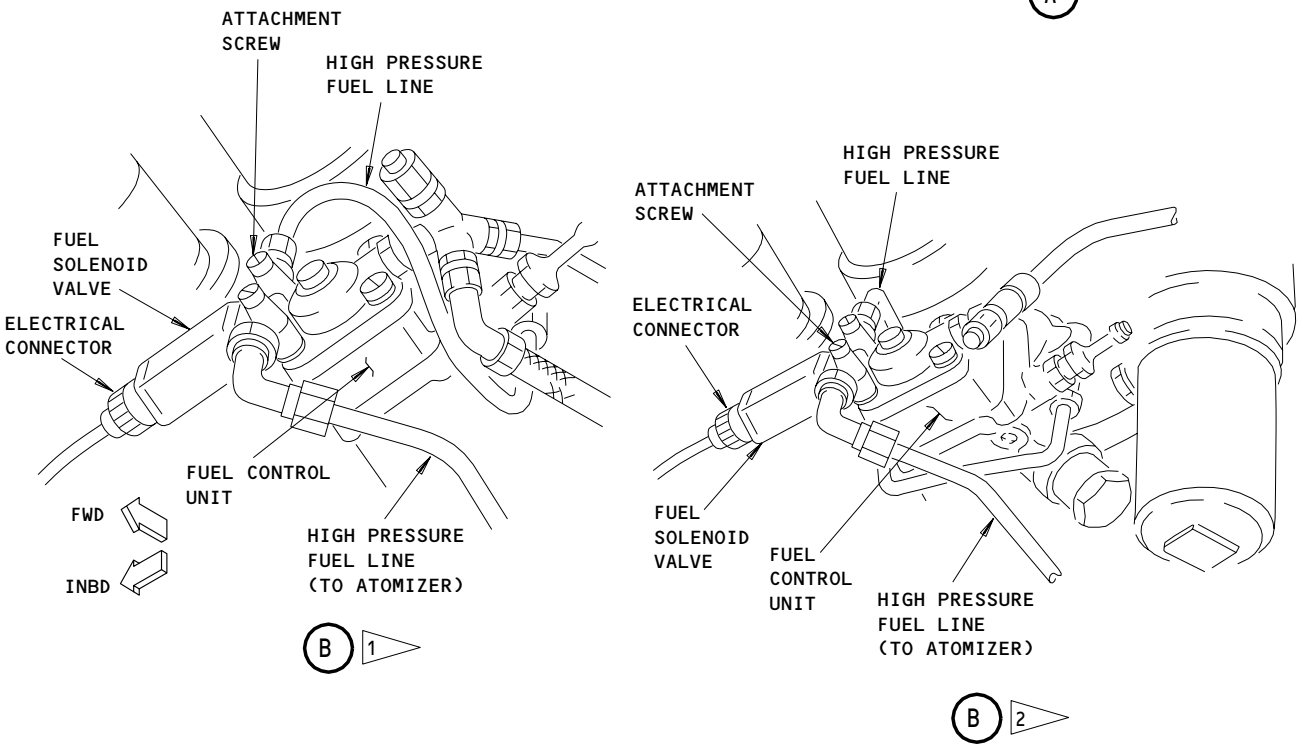
4. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods. Close and latch access door.
D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
E. Position BATTERY SWITCH to ON and remove placard.





1 AIRPLANES WITHOUT THE ETC

2 AIRPLANES WITH THE ETC

Fuel Solenoid Valve Installation
Figure 401

FUEL SOLENOID VALVE - ADJUSTMENT/TEST

1. Fuel Solenoid Valve Test
   A. General
      (1) The fuel solenoid valve test gives a fast indication that there is a problem with the fuel solenoid valve. The fuel solenoid valve is attached to the housing of the fuel control unit.
   B. Test the Fuel Solenoid Valve
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Let the APU operation become stable with no load applied.
      (3) Open the circuit breaker on the M280 module - APU control unit on the E3-3 electronic shelf.
      (4) If the APU will not shut down with the circuit breaker open, do the following:
         (a) Shut down the APU (AMM 49-11-00/201) and tag the APU master switch DO-NOT-OPERATE.
         (b) Replace the fuel solenoid valve (AMM 49-31-31/401).
         (c) Do the fuel solenoid valve test again.
      (5) If the APU does shut down with the circuit breaker open, do the following:
         (a) Position the APU master switch.
            1) APU's WITHOUT 60-SECOND SHUTDOWN DELAY;
               Position APU master switch to OFF.
            2) APU's WITH 60-SECOND SHUTDOWN DELAY;
               Position APU master switch to OFF DELAYED.
         (b) Position battery switch to OFF.
         (c) Close the circuit breaker on the M280 module - APU control unit on the E3-3 electronic shelf.

COMBUSTOR UNIT - REMOVAL/INSTALLATION

1. General
   A. The fuel atomizer, combustor cap and combustion chamber liner assemblies are removed, cleaned, examined and reinstalled as a unit.
2. Prepare for Combustor Unit Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Combustor Unit (Fig. 401)
   A. Disconnect high voltage lead from igniter plug.

      WARNING: CURRENT INVOLVED IN IGNITION SYSTEM IS OF VERY HIGH VOLTAGE AND CAN BE FATAL. BE SURE THAT POWER IS REMOVED FROM IGNITION SYSTEM FOR A MINIMUM OF 3 MINUTES BEFORE ANY DISCONNECTIONS ARE MADE. AFTER DISCONNECTING HIGH VOLTAGE LEAD, ENSURE COMPLETE DISCHARGE OF CAPACITORS IN IGNITION UNIT BY IMMEDIATELY SHORTING HIGH VOLTAGE LEAD TERMINAL TO GROUND.

   B. Disconnect high-pressure fuel line from fitting on fuel atomizer and loosen fitting on fuel solenoid valve. Release line to rotate. Catch dripping fuel in suitable container.
   C. Rotate high pressure fuel line away from combustor cap to clear cap.
   D. Disconnect fuel drain line from combustion chamber cap.

      NOTE: If engine identification plate is reusable, remove attaching screws and identification plate. Retain identification plate for installation on replacement combustor unit. If identification plate is damaged, carefully note all information for transfer to new identification plate. The identification plate on latest series engines has been relocated to a bracket located on the turbine plenum assembly.

   E. Remove clamp attaching combustor unit to turbine plenum.
      (1) If required, use a rubber mallet and tap lightly to loosen the clamp.
      (2) Discard the nut.

(3) Examine the T-bolt on the clamp for wear, galling, stripping, or crossed threads.
(a) If signs of damage are found, replace the clamp.

F. Remove combustor unit and discard packing.

NOTE: Examine hot section components for damage per 49-11-0, Inspection/Check, par. 3.A.(2) and 3.A.(3).

4. Install Combustor Unit (Fig. 401)
A. Using new packing, position combustor unit on plenum.
B. Do a close visual inspection of the clamp that attaches the combustor to the plenum. Look for cracks near the spot welds and around T-bolt. Replace the clamp if you find damage.
C. Install clamp with new nut but do not tighten clamp.
D. Connect high-pressure fuel line to fitting on atomizer and tighten fitting on fuel solenoid valve. Fasten line to engine.
E. Tighten clamp nut of clamp attaching combustor unit to turbine plenum to a torque range of 50 to 70 pound-inches.
(1) Tap clamp around circumference of the band with a non-metallic hammer to make sure clamp is seated correctly.
(2) Torque nut 50 to 70 pound-inches.

NOTE: Continue to alternately torque and tap until the torque remains between 50 and 70 pound-inches.

NOTE: If atomizer was removed for overhaul or line maintenance, check to ensure that atomizer bolts are torqued to 20 to 25 pound-inches and lockwired.

F. Connect high voltage lead to igniter plug.
G. Lockwire igniter plug mounting bolts and high voltage lead terminal.
H. Connect fuel drain line to combustion chamber cap.
I. Perform plenum drain check (AMM 49-31-71/601).

CAUTION: BEFORE CONNECTING FUEL DRAIN LINE TO COMBUSTION CAP, BE SURE TO PERFORM PLENUM DRAIN CHECK TO ENSURE DRAIN IS NOT BLOCKED BY FOREIGN OBJECTS.

J. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; examine the combustor unit for leakage:
(1) Start and operate the APU (AMM 49-11-0/201).
(2) During the APU operation, examine the combustor unit for air or fuel leakage.
(3) Do the APU normal shutdown (AMM 49-11-0/201).
(4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(5) If you found leakage, repair the cause of it.

K. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; examine the combustor unit for leakage:
(1) Start and operate the APU (AMM 49-11-0/201).
(2) Do the APU normal shutdown (AMM 49-11-0/201).
(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(4) Visually examine the combustor unit for any signs of air or fuel leakage:
(a) If you found signs of leakage, repair the cause of it.

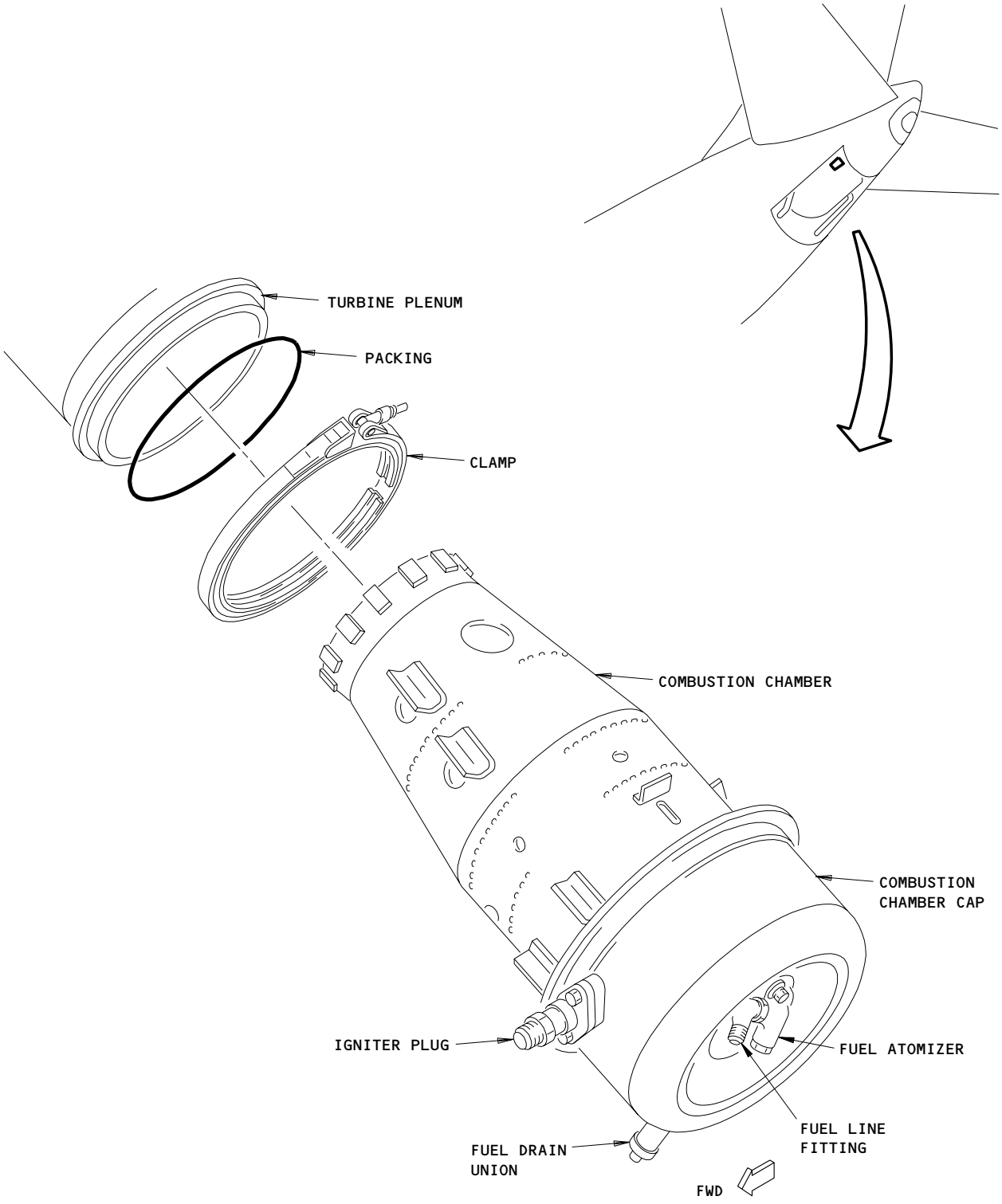
5. Restore Airplane to Normal Configuration
A. Clean APU shroud drains (AMM 49-12-0/701).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

CAUTION: BEFORE INSTALLING LOWER SHROUD, BE SURE TO CLEAN APU SHROUD DRAINS TO ENSURE DRAINS ARE NOT BLOCKED BY FOREIGN OBJECTS.

CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
D. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf and remove placards.



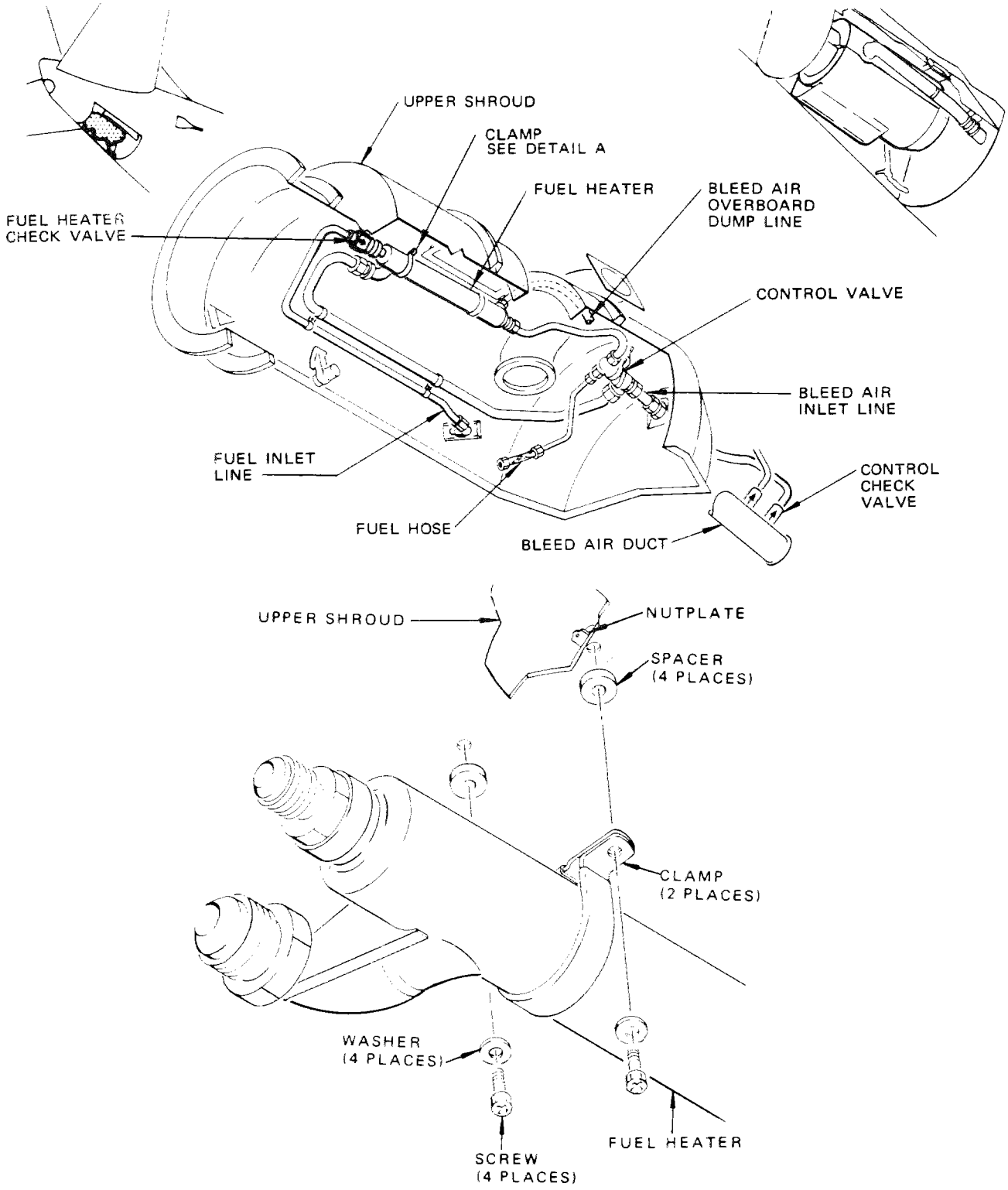
Combustor Unit Installation
Figure 401

FUEL HEATER - REMOVAL/INSTALLATION

1. Prepare to Remove Fuel Heater
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Remove APU power plant (Ref 49-11-0, Removal/Installation).
2. Remove Fuel Heater (Fig. 401)
   A. Disconnect all plumbing from fuel heater.
   B. Remove screws and washers securing clamps to shroud, and remove clamps, heater, and spacers.
   C. If required to remove fuel heater check valve, proceed as follows:
      (1) Disconnect plumbing from check valve if still installed in shroud.
      (2) Remove check valve from heater.
      (3) Remove and discard packing.
3. Install Fuel Heater (Fig. 401)
   A. If check valve was removed, insert new packing and install on plumbing with arrow directed at fuel heater.
   B. Position heater, spacers, and clamps on shroud, and attach loosely with screws and washers.
   C. Connect all plumbing to fuel heater and valves, and tighten all fittings.
   D. Tighten all support clamps securing heater and valves to shroud.
   E. Pressurize fuel system and check for leakage.
      (1) Plug fuel line at fuel control unit connector.
      (2) Bleed air from fuel line.
         (a) Manually open APU fuel shutoff valve at rear wing spar, accessible at left main wheel well area.



DETAIL A

Fuel Heater Installation
Figure 401

(b) Pressurize fuel line by operating fuel tank No. 1 forward boost pump.

NOTE: No. 1 tank boost pump requires ac power. Provide airplane with external power.

NOTE: If you must use the fuel boost pumps in the center tank, you must have a maintenance person or observer in the flight compartment to continuously monitor the LOW PRESSURE lights. Turn the applicable fuel boost pump to the OFF position if the LOW PRESSURE light for the center tank stays on.

(c) Loosen plug at fuel supply line (fuel control unit) just enough to allow trapped air to escape. Catch dripping fuel in appropriate container. Tighten plug.
(d) Check fuel heater, fuel heater check valve and fuel flow sensing control valve for fuel leaks. Correct as required.
(e) Shut off No. 1 tank forward boost pump.
(f) Manually close APU fuel shutoff valve.

4. Restore Airplane to Normal Configuration
A. Install APU (AMM 49-11-0/401).
B. Test fuel sensing flow control valve (AMM 49-31-92/501).
C. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
D. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

E. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
F. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
G. Remove placards.

FUEL DRAIN - INSPECTION/CHECK

1. General
   A. The fuel drain system has the turbine plenum boss, fuel drain housing, drain line and drain reducer on the combustion chamber cap. A check should be made to ensure continuous flow of fuel. For additional fuel drain information, refer to AMM 49-12-0/701.
2. Equipment and Materials
   A. Cleaning Solvent - Federal Specification P-D-680
   B. Air source - Compressed dry
   C. Vacuum cleaner - To clean
   D. Antiseize Compound - MIL-T-83483
3. Fuel Drain Inspection (Fig. 601)
   A. Set BATTERY switch and APU master switch to OFF.
      (1) Put a DO-NOT-CHANGE placard on the switch until the maintenance is completed.
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: BE CAREFUL WITH SHROUD DRAIN LINES WHEN YOU REMOVE THE SHOURD. YOU CAN CAUSE DAMAGE TO THE LINES.

   E. Remove the drain line:
      (1) Disconnect the drain line from the drain union on the fuel drain housing.
      (2) Disconnect the drain line from the drain reducer on the combustion chamber cap.
      (3) Remove the drain line from the APU.
   F. Remove the fuel drain housing from the turbine plenum:
      (1) Remove the drain seal from the lower drain housing.
      (2) Remove the clamp that holds the lower drain housing to the upper drain housing.
      (3) Remove the lower drain housing from the upper drain housing.
      (4) Remove the spring, screen, and packing from the lower drain housing.
         (a) Discard the packing.
      (5) Remove the upper drain housing from the turbine plenum boss.
      (6) Remove the packing from the upper drain housing.
         (a) Discard the packing.
   G. Do an inspection of the fuel drain:
      (1) Make sure the drain line has no carbon material or blockage.
      (2) Make sure the parts for the fuel drain housing have no carbon material.
      (3) Make sure the drain reducer on the combustion chamber cap has no carbon material or blockage.

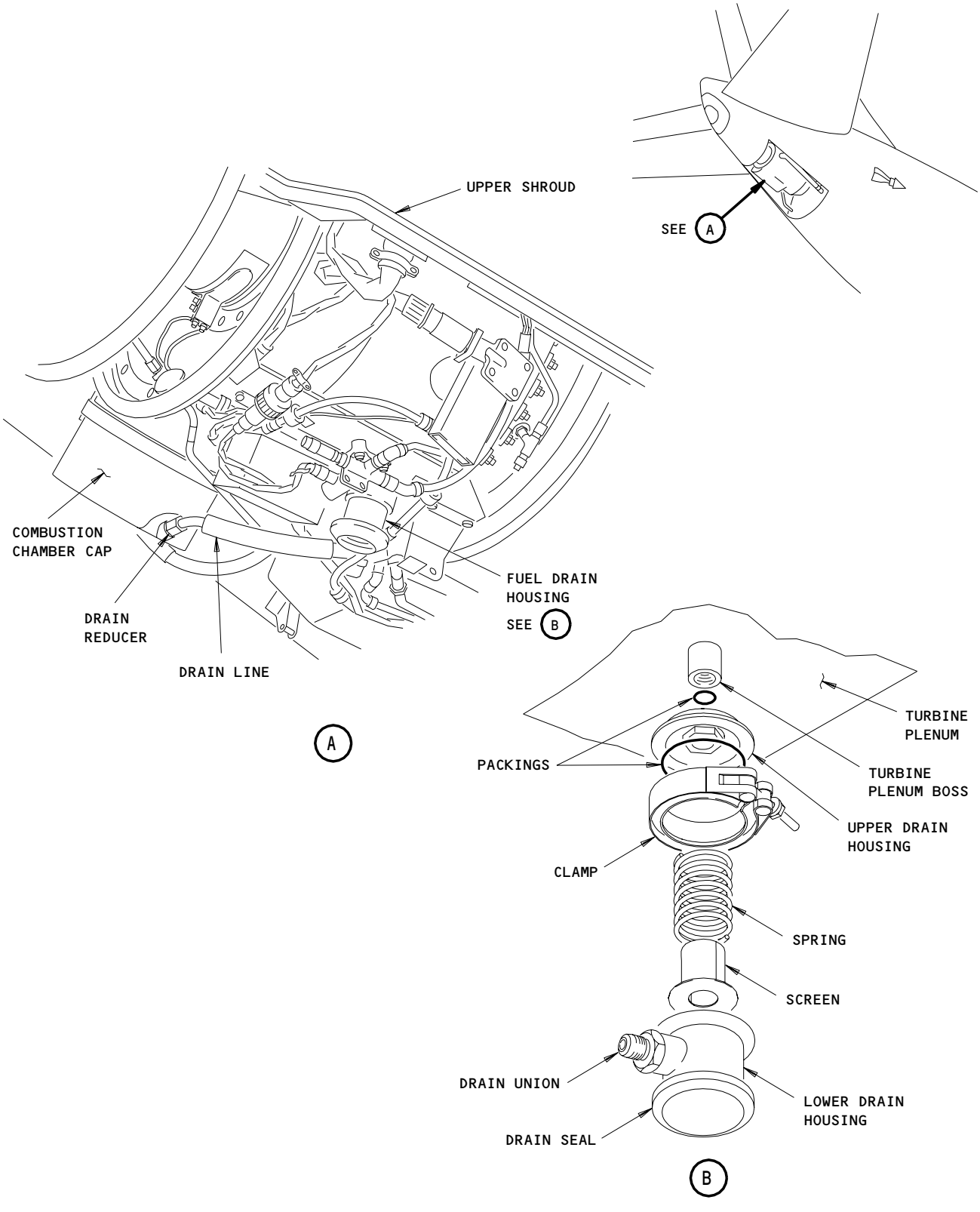
(4) Make sure the turbine plenum boss has no carbon material or blockage.

H. If there is carbon material or blockage in the fuel drain, clean the applicable parts:

CAUTION: DO NOT GET THE SOLVENT IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVE WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. THE SOLVENT IS A POISONOUS AND FLAMMABLE MATERIAL WHICH CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) If the drain line has blockage, remove the blockage with the compressed air.
(2) If the drain line has carbon material, clean the drain line with the solvent:
  (a) Clean the drain line with the solvent.
  (b) Dry the drain line with the compressed air.
(3) If the parts for the fuel drain housing have carbon material, clean the parts for the fuel drain housing:
  (a) Clean the upper drain housing, spring, screen and lower drain housing with solvent.
  (b) Dry the parts with compressed air.
(4) If there is blockage in the drain reducer on the combustion chamber cap or in the turbine plenum boss, remove the blockage:
  (a) Remove the combustor unit (AMM 49-31-42/401).
  (b) Use the vacuum cleaner to remove the blockage from the inside of the combustion chamber cap or the turbine plenum.
(5) If there is carbon material in the drain reducer on the combustion chamber cap or in the turbine plenum boss, clean the drain reducer or turbine plenum boss:
  (a) If it is not already done, remove the combustor unit (AMM 49-31-42/401).
  (b) Clean the drain reducer and turbine plenum boss with the solvent.
    1) If you must disassemble the combustor unit to remove the carbon material, install a new combustor unit (AMM 49-31-42/401).
(6) If the combustor unit was removed, install the combustor unit (AMM 49-31-42/401).

I. Install the fuel drain housing to the turbine plenum:
(1) Apply a layer of the antiseize compound to the threads of the upper drain housing.
(2) Install a new packing on the upper drain housing.
(3) Install the upper drain housing to the turbine plenum boss.
(4) Tighten the upper drain housing to 270 pound-inches (30.5 newton-meters).
(5) Put the screen and spring in the lower drain housing.
(6) Install a new packing on the lower drain housing.



Fuel Drain – Inspection/Check
Figure 601

(7) Install the lower drain housing to the upper drain housing with the clamp.

NOTE: Do not tighten the clamp at this time.

(8) Install the drain seal to the lower drain housing.

J. Install the drain line:
(1) Apply a layer of the antiseize compound to the threads of the drain reducer, drain union and drain line.
(2) Connect the drain line to the drain reducer on the combustion chamber cap.
(3) Connect the drain line to the drain union on the fuel drain housing.
(4) Tighten the drain reducer, drain union and drain line to 270 pound-inches (30.5 newton-meters).

K. Tighten the clamp on the fuel drain housing until the lower drain housing does not turn.

4. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).

B. Put the lower shroud against the upper shroud and close the latches.

CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS, AND THE INNER SURFACE OF THE LOWER SHROUD. BE CAREFUL WITH THE SHROUD DRAIN LINES WHEN YOU MOVE THE SHROUD. IF YOU ARE NOT CAREFUL, DAMAGE TO EQUIPMENT CAN OCCUR.

C. Disengage APU compartment access door support rods. Close and latch access door.

D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.

E. Set the BATTERY SWITCH to ON and remove the placard.

HIGH PRESSURE FUEL FILTER - SERVICING

1. General
   A. The high pressure fuel filter element is a micronic filter which filters fuel passing from the pump to the governor of the fuel control unit.
2. Equipment and Materials
   A. Cleaning Solvent - Federal Specification P-D-680
   B. Lubricating Oil - MIL-L-6081
3. Prepare for High Pressure Fuel Filter Servicing
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work".
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

4. High Pressure Fuel Filter Servicing (Fig. 301)
   A. Unscrew filter cap from fuel control unit.
   B. Remove filter element and packing.

      CAUTION: EXERCISE EXTREME CARE TO PREVENT ANY DIRT FROM ENTERING FUEL CONTROL UNIT.

   C. Clean filter cap in solvent and dry thoroughly.

      WARNING: SOLVENT IS TOXIC. USE IN WELL-VENTILATED AREA. KEEP AWAY FROM FLAME.

   D. Lubricate and install new packing in filter element.
   E. Install new filter element with packing over filter guide. Lubricate and install new packing on filter cap.
   F. Install filter cap in fuel control unit, tighten to torque value of 100 to 120 pound-inches.
   G. Safety wire filter cap to fuel control unit housing.
   H. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; examine the high pressure fuel filter for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the high-pressure fuel filter for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) If you found leakage, repair the cause of it.
   I. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; examine the high pressure fuel filter for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Do the APU normal shutdown (AMM 49-11-0/201).

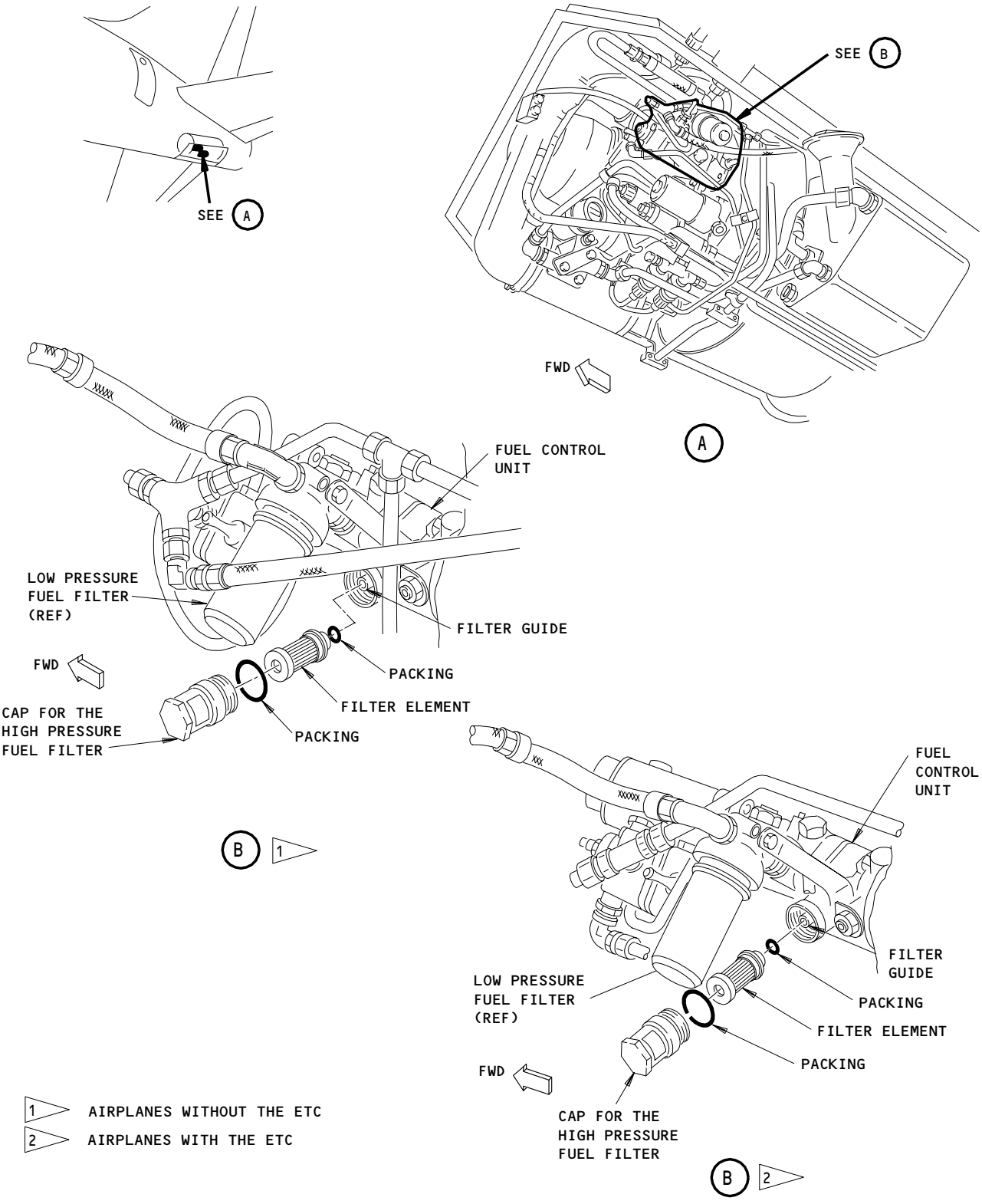
(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(4) Visually examine the high-pressure fuel filter for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

5. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
E. Position BATTERY SWITCH to ON and remove placards.



High Pressure Fuel Filter Servicing
Figure 301

FUEL HEATER CHECK VALVE - REMOVAL/INSTALLATION

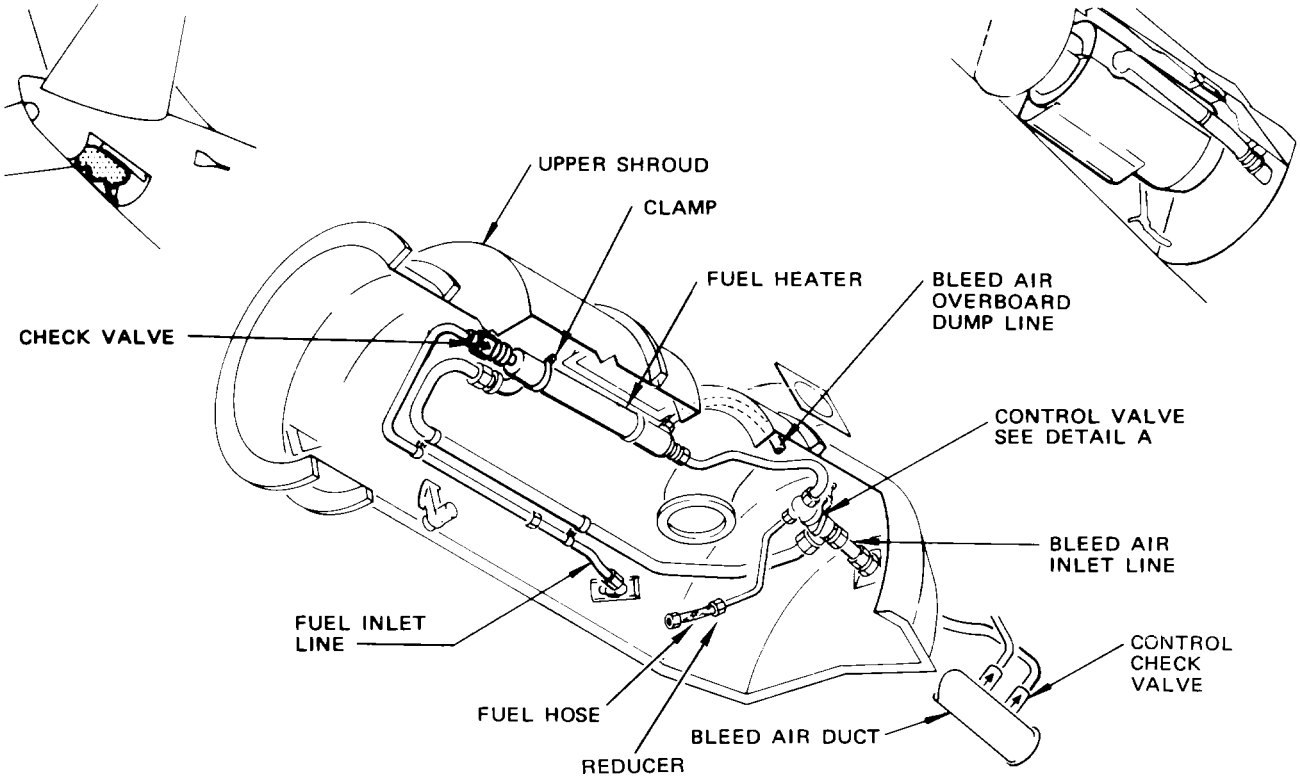
1. General
   A. The fuel heater check valve is used to isolate possible APU fuel feed system air leakage and to maintain a supply of fuel for priming the APU fuel pump for starting. To remove and install the fuel heater check valve, refer to the removal/installation of the fuel heater, 49-31-61.

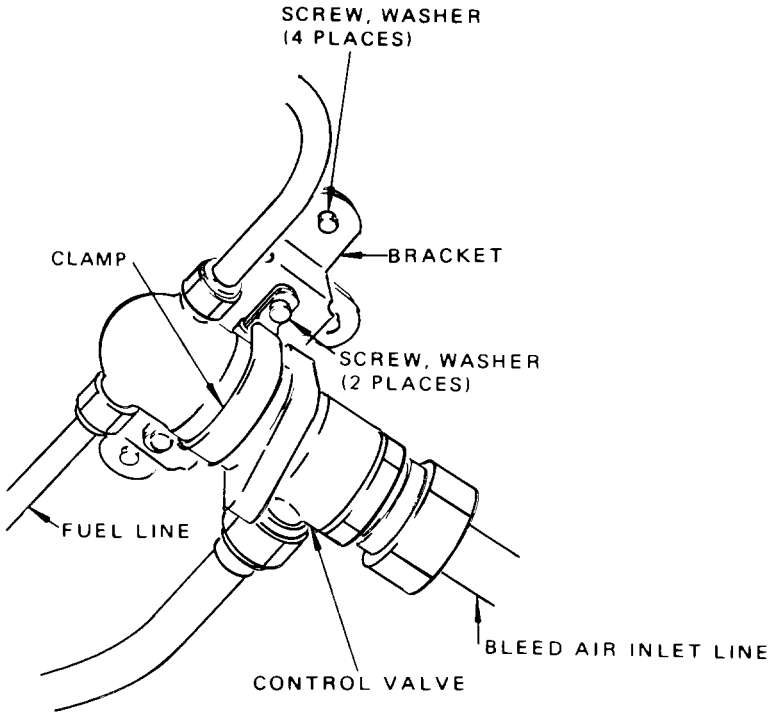
FUEL SENSING FLOW CONTROL VALVE - REMOVAL/INSTALLATION

1. General
   A. The fuel sensing flow control valve is part of the fuel heater system. When the temperature of the fuel passing through the valve drops to a predetermined value, the valve will modulate open.
2. Prepare to Remove Fuel Sensing Flow Control Valve
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Disconnect and remove fire detection element from APU.
   F. Remove overtemperature control switch (Ref. 49-52-81, Removal/Installation).
   G. Remove pneumatic solenoid valve (Ref 49-61-31, Removal/Installation).
   H. Remove clamps securing cooling air crossover duct at oil cooler and cooling air fan housing.
   I. Remove screw and washer securing cooling air crossover duct to generator.
   J. Remove and rotate duct to gain access to fuel sensing flow control valve.
3. Remove Fuel Sensing Flow Control Valve (Fig. 401)
   A. Disconnect all plumbing from valve.
   B. Remove screws and washers securing clamp to bracket.
   C. Remove clamp and fuel sensing flow control valve.
4. Install Fuel Sensing Flow Control Valve (Fig. 401)
   A. Loosely assemble all plumbing to fuel sensing flow control valve.
   B. Install clamp using screws and washer.
   C. Secure fuel sensing flow control valve and fittings.
5. Restore Airplane to Normal Configuration
   A. Position cooling air crossover duct so that ports are aligned with cooling fan housing, generator and oil cooler. Install screw and washer securing duct to generator.
   B. Install and tighten clamps securing duct to cooling air fan housing and oil cooler.
   C. Install pneumatic solenoid valve (Ref. 49-61-31, Removal/Installation).
   D. Install overtemperature control switch (Ref. 49-52-81, Removal/Installation).
   E. Install fire detection element on APU (Ref 26-15-11, Removal/Installation).
   F. Test fuel sensing flow control valve, refer to adjustment/test.





DETAIL A

Fuel Sensing Flow Control Valve Installation
Figure 401

FUEL SENSING FLOW CONTROL VALVE - ADJUSTMENT/TEST

1. General
   A. This test procedure applies to the fuel heater system. With APU operating and lower shroud removed, check airflow from heater bleed air over board dump line to check the valve for operation.
2. Test Fuel Sensing Flow Control Valve (Fig. 501)
   A. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work".
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. APU WITH ALLIEDSIGNAL SB GTCP85-49-7096;
      Examine the fuel temperature indicator and the airflow at the overboard dump line:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Write the value shown on the fuel temperature indicator on the P5 forward overhead panel.
      (3) Examine the airflow at the overboard dump line for the bleed air of the fuel heater.
      (4) Compare the data from the previous two steps with the data in table 501.

Fuel Temperature versus Overboard Airflow
Table 501

Fuel Temperature Indicator	Airflow at the Overboard Dump Line for the Bleed Air
Above 62°F (17°C)	Small Quantity or No Airflow
62°F (17°C) or Lower	Airflow

(5) Shut down the APU (AMM 49-11-0/201).
(6) If the data from the test and the table are different, the flow control valve does not operate correctly. Replace the flow control valve (AMM 49-31-92/401).

F. APU WITHOUT ALLEDSIGNAL SB GTCP 85-49-7096;
Examine the fuel temperature indicator and the airflow at the overboard dump line:
(1) Install one end of flexible tubing on the overboard dump line.

NOTE: The minimum length of flexible tubing must be a minimum of 3 feet (0.9 m).

(2) Put the other end of flexible tubing into a bucket of water that is away from the APU.
(3) If you must operate the APU with the lower shroud removed, make sure all persons are not in the hazard area (AMM 49-11-0/201).

WARNING: DO NOT OPERATE THE APU WITH THE LOWER SHROUD REMOVED IF PERSONS ARE IN OR DIRECTLY BELOW THE APU COMPARTMENT. YOU MUST BE A MINIMUM OF THREE FEET AWAY FROM THE OUTER EDGE OF THE APU COMPARTMENT OPENING TO OPERATE THE APU WITH THE LOWER SHROUD REMOVED. AN APU TURBINE WHEEL SEPARATION DURING OPERATION CAN CAUSE INJURY TO PERSONS.

NOTE: APU with AlliedSignal SB GTCP85-49-7096 have an external shield around the turbine plenum and have no hazard area.

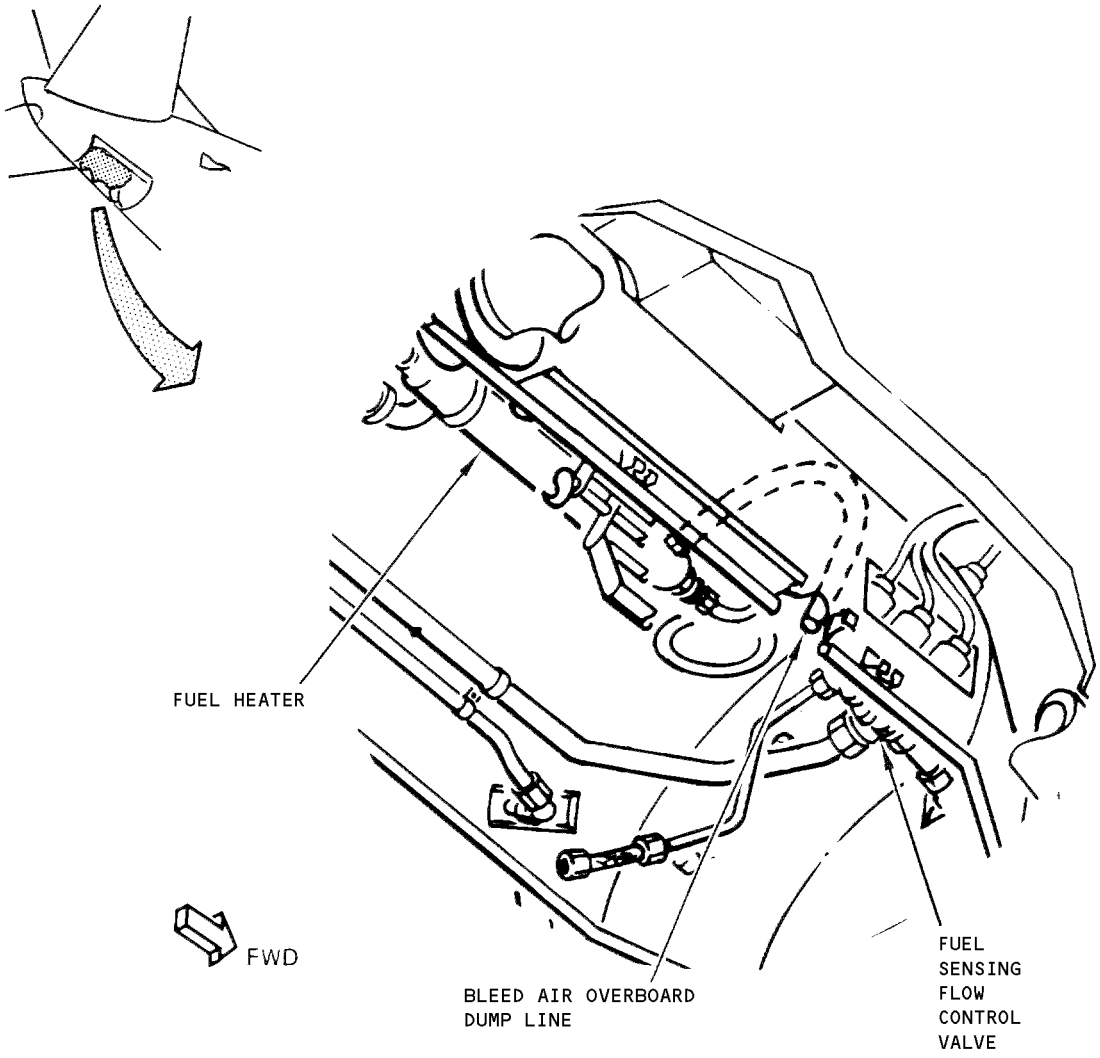
(4) Start and operate the APU (AMM 49-11-0/201).
(5) Write the value shown on the fuel temperature indicator on the forward overhead panel.
(6) Look for air bubbles from the flexible tubing in the bucket of water.
(7) If you see air bubbles from the flexible tubing in the bucket of water, the value on the fuel temperature indicator must be 62°F (17°C) or lower.
(8) If you see a small quantity or no air bubbles from the flexible tubing in the bucket of water, the value on the fuel temperature indicator must be above 62°F (17°C).
(9) Shut down the APU (AMM 49-11-0/201).

(10) Remove flexible tubing from the overboard dump line.
(11) If the airflow and the value on the fuel temperature indicator are different, replace the flow control valve (AMM 49-31-92/401).

3. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.



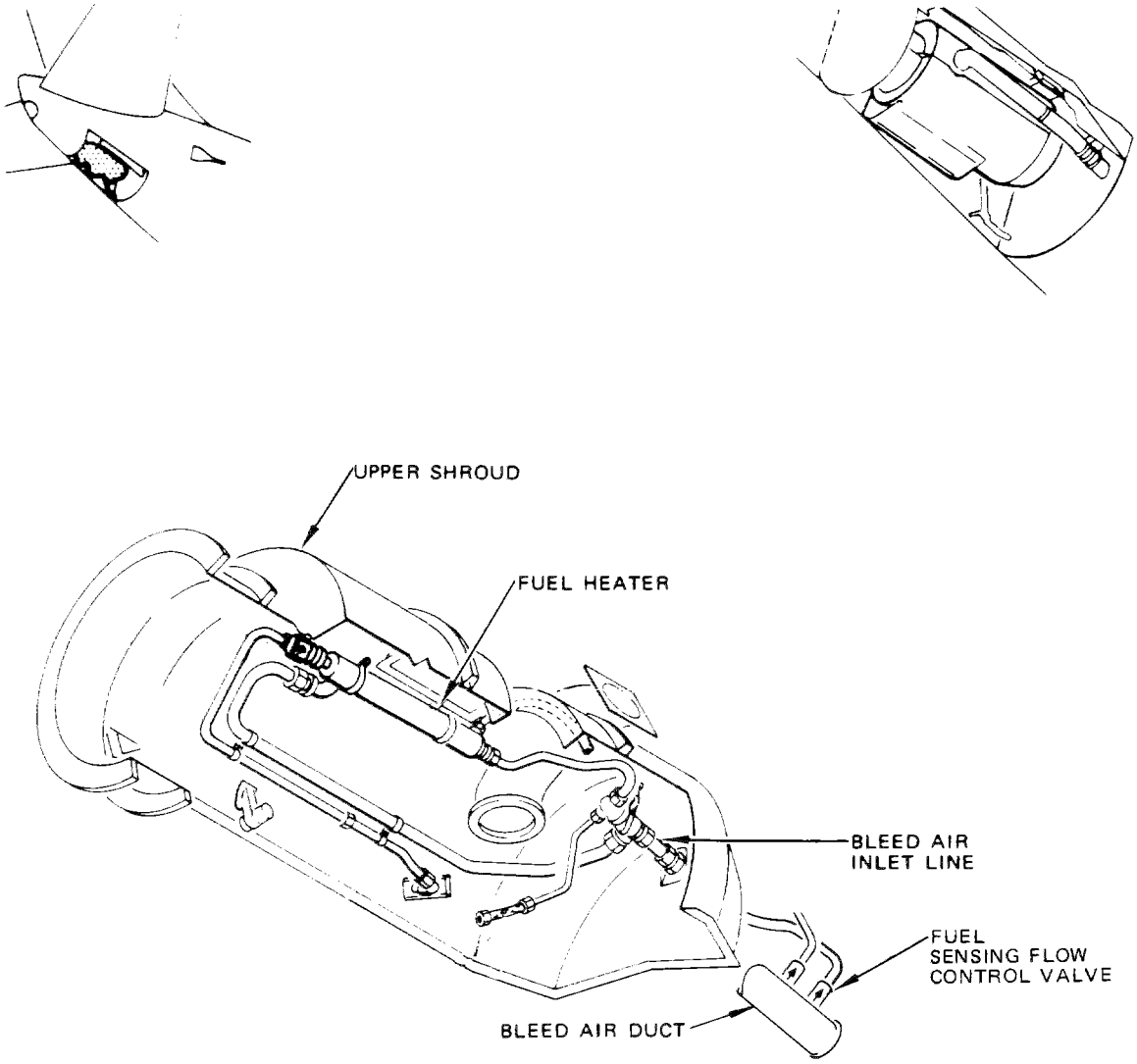
Fuel Heater Bleed Air Overboard Dump Line Location
Figure 501

FUEL SENSING FLOW CONTROL CHECK VALVE - REMOVAL/INSTALLATION

1. General
   A. The fuel sensing flow control check valve is installed on the bleed air duct to prevent fuel leakage from the fuel sensing flow control valve from entering the bleed air duct.
2. Remove Fuel Sensing Flow Control Check Valve (Fig. 401)
   A. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open circuit breaker on M280 module - APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Disconnect air line from check valve.
   E. Remove check valve and gasket from air duct boss.
3. Install Fuel Sensing Flow Control Check Valve (Fig. 401)
   A. Install check valve with new gasket in air duct boss.

      NOTE: When installing check valve, make certain that directional flow arrow points away from bleed air duct.

   B. Attach air line to check valve.
   C. Close circuit breaker on M280 module - APU control unit on E3-3 electronic shelf.
   D. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the check valve for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the check valve for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) If you found leakage, repair the cause of it.
   E. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the check valve for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Do the APU normal shutdown (AMM 49-11-0/201).
      (3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (4) Visually examine the check valve for any signs of leakage:
         (a) If you found signs of leakage, repair the cause of it.
   F. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   G. Remove placards.



Fuel Sensing Flow Control Check Valve Installation
Figure 401

ACCELERATION LIMITER VALVE ORIFICE - INSPECTION/CHECK

1. General
   A. The purpose of the acceleration limiter valve orifice check is to ensure that the orifice is clear of contaminants. Contaminants or moisture condensation blocking the orifice will cause hot starting and overtemperature conditions.
   B. For cold weather operations, some installations have been modified by plugging the acceleration limiter valve orifice and relocating the orifice at the compressor discharge pressure orificed tee located just forward of the combustor unit and on upper LH side of the diffuser housing (Ref 49-52-91).

      CAUTION: APU MUST HAVE ONLY ONE ORIFICE IN COMPRESSOR DISCHARGE PRESSURE LINE TO ACCELERATION LIMITER. MORE THAN ONE VENT WILL RESULT IN ENGINE DAMAGE DUE TO HUNG STARTS.

2. Equipment and Materials
   A. Drill - No. 77 (0.018-inch diameter)
3. Check Acceleration Limiter Valve Orifice (Fig. 601)
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open circuit breaker on M280 module - APU accessory unit on E3-E electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

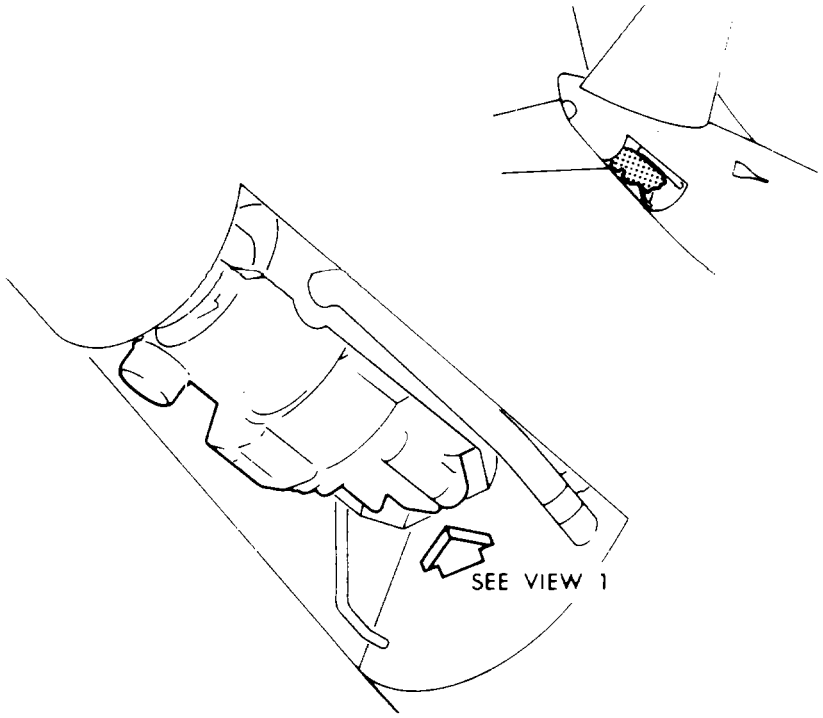
      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

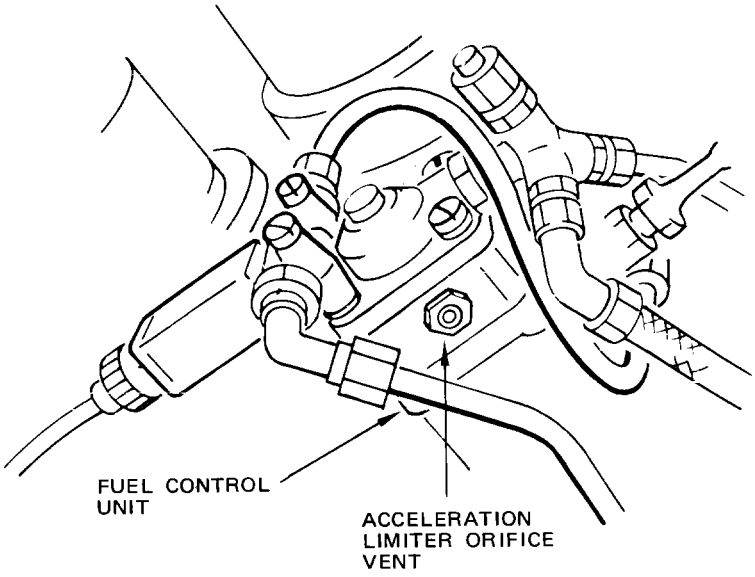
   E. Visually examine orifice vent for damage or plugged condition.

      NOTE: Orificed plug should be located at lowest possible point. If orifice is not properly oriented, fuel control unit should be replaced.

   F. Carefully insert drill to clear orifice of any contaminants.
   G. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.





VIEW 1

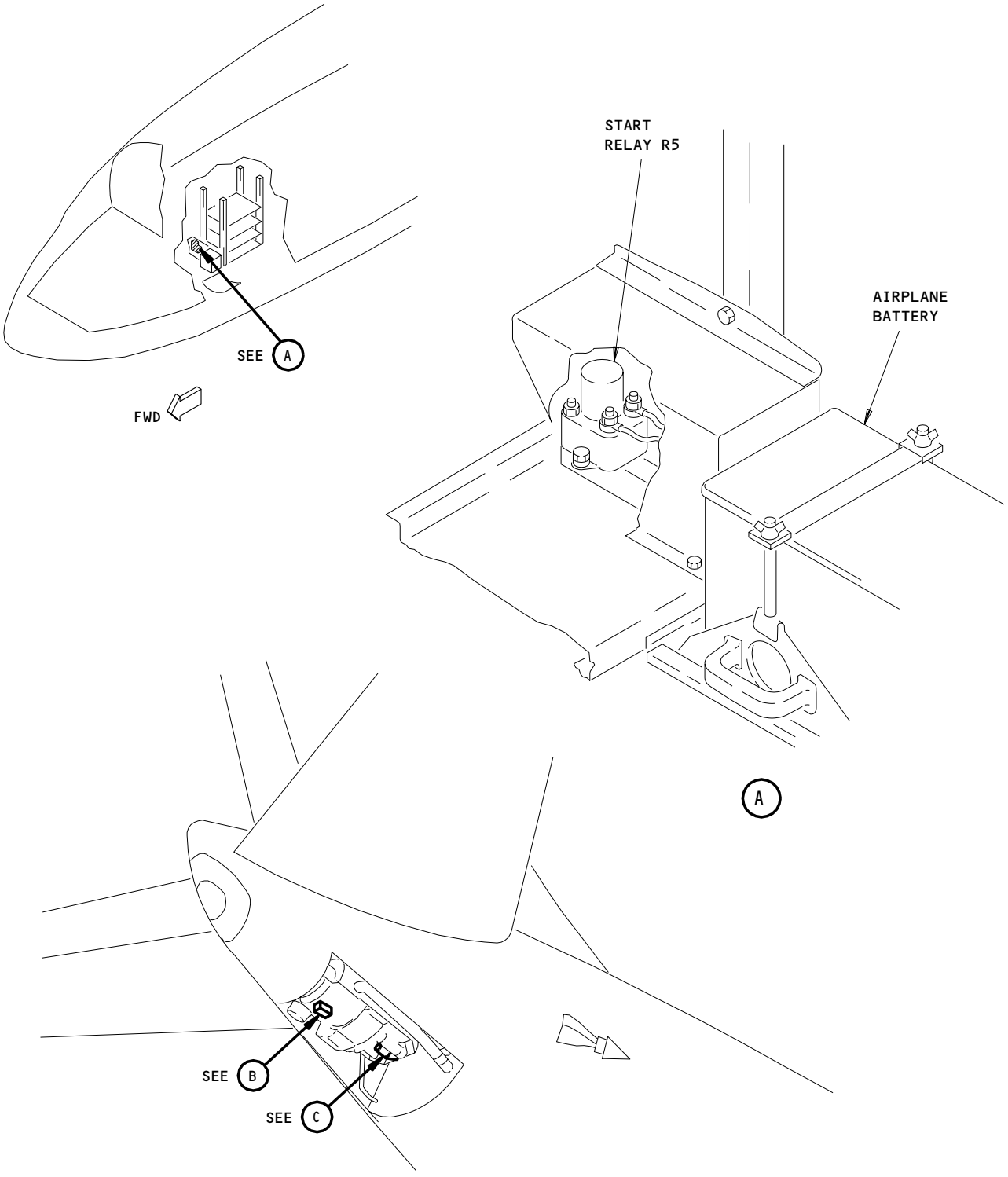
Acceleration Limiter Valve Orifice Check
Figure 601

H. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
I. Close circuit breaker on M280 module - APU accessory unit on E3-E electronic shelf.
J. Remove placard from APU control panel.

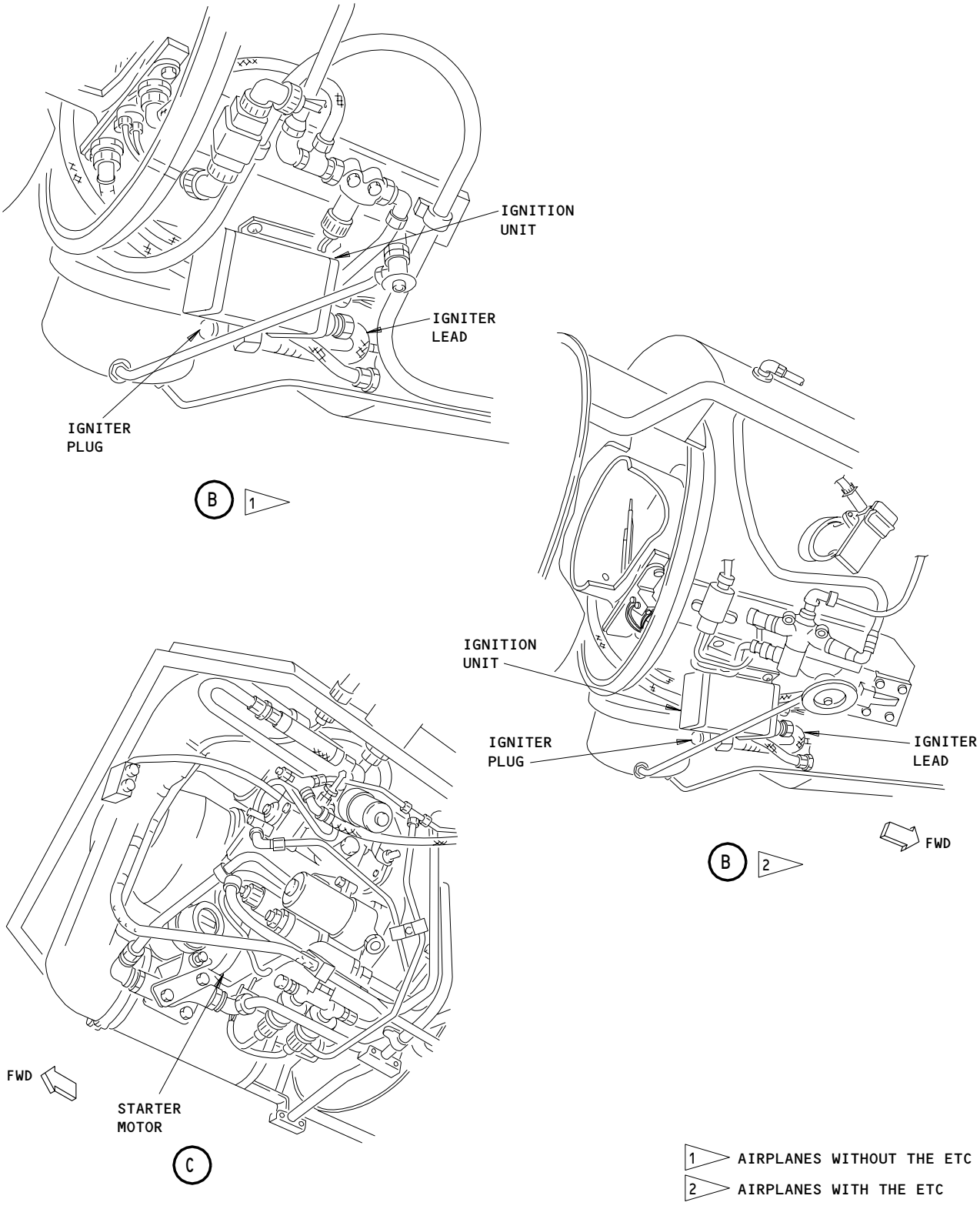
APU IGNITION AND STARTING SYSTEM - DESCRIPTION AND OPERATION

WARNING: THE CURRENT INVOLVED IN THE IGNITION UNIT IS OF A VERY HIGH VOLTAGE AND CAN BE FATAL. BE SURE THAT POWER IS REMOVED FROM THE SYSTEM FOR A MINIMUM OF 3 MINUTES BEFORE MAKING ANY DISCONNECTIONS. AFTER DISCONNECTING THE HIGH TENSION LEAD, ENSURE COMPLETE DISCHARGE OF CAPACITORS BY IMMEDIATELY SHORTING IGNITION UNIT TERMINAL TO GROUND.

1. General
   A. The APU ignition and starting system provides the means of rotating the APU engine to starting speed and for igniting the fuel-air mixture in the combustion chamber. The system consists of a starter motor, start relay, ignition unit, igniter plug and a high voltage lead. (See figure 1.)
   B. During an APU start, the starter motor cranks the APU engine. The ignition unit converts 28 volt dc power into a high voltage current which is conducted to the igniter plug by the high voltage lead. The resultant high energy spark starts combustion of the fuel-air mixture in the combustion chamber. Engagement and disengagement of the starter motor and the application of ignition are controlled automatically. (See figure l.)
2. Starter Motor
   A. The starter motor provides initial power for rotating the APU engine compressor, turbine, and engine-driven accessories to a speed high enough to obtain good airflow for combustion. The starter motor is mounted on the accessory drive section. (See figure 1.) The starter motor consists of a series-wound electric motor, a spring-loaded friction clutch, and a pawl-engagement mechanism. When the starter motor is energized and its speed increases, centrifugal force throws the pawls into engagement with the ratchet on the accessory drive shaft. The shock of initial engagement of the pawls is absorbed by the spring-loaded friction clutch. The friction clutch also limits the starting torque, which in turn limits the current drain on the battery during initial phase of the starting cycle. When the starter motor is de-energized, the engine speed will exceed starter motor speed. The ratchet on the accessory drive shaft will override the pawls until the starter motor speed slows to where the centrifugal force is small enough to allow the springs to retract the pawls.
3. Start Relay
   A. A heavy duty start relay R5 is provided to carry the heavy electrical load occurring during starter motor operation. The relay is located in the electrical and electronic compartment (Fig. 1).



APU Ignition and Starting System Component Location
Figure 1 (Sheet 1)



APU Ignition and Starting System Component Location
Figure 1 (Sheet 2)

4. Ignition Unit
   A. The ignition unit provides the high voltage current required to produce the spark at the igniter plug. The unit consists of a transformer, vibrator, rectifier, booster coil, and a series of capacitors, all enclosed in a hermetically-sealed metal container mounted on the turbine plenum at approximately 6 o'clock position (Fig. 1).
   B. When the ignition unit is energized, the vibrator is supplied with 28-volt dc power. The vibrator converts the input current to a pulsating output current. This pulsating output current is transmitted to the transformer, where the voltage is stepped up, then passed through the rectifier unit into the storage capacitors. When the storage capacitors are fully charged, the capacitor air gap will break down. This allows the capacitors to discharge a surge of high intensity current into primary winding of the booster coil. The secondary winding of the booster coil produces a surge current which is transmitted to the center electrode of the igniter plug by a high voltage lead.
5. Igniter Plug
   A. The igniter plug provides the high energy spark for igniting the fuel-air mixture in the combustion chamber. The igniter plug is installed on the forward side of the combustion chamber (Fig. 1). The principal parts of the igniter plug are the outer casing, center electrode, and a ceramic insulator. The spark, that bridges the nonadjustable annular gap between the center electrode and the outer casing, is sufficiently high to break down the igniter plug air gap and produce a high energy spark to ignite the fuel air mixture in the combustion chamber.
6. High Voltage Lead
   A. The high voltage lead conducts the output current of the ignition unit to the igniter plug (Fig. 1). The lead consists of an insulated electrical conductor encased in a braided metal conduit with insulated, threaded, connectors at each end. The lead and connectors are shielded to prevent radio interference.
7. Operation
   A. Once an APU start is initiated, operation of the ignition and starting system is automatically controlled to correctly sequence the energizing and de-energizing of the starter motor and the ignition unit. Positioning the master switch momentarily to START energizes the starter lockout relay K6. This energizes the start relay R5. When the start relay is energized, power is supplied to starter motor, and the starter motor begins cranking the engine. As the speed increases, the oil pressure rises. When the oil pressure rises to approximately 3.5 psig, the sequencing oil pressure switch closes and energizes the ignition unit and fuel solenoid valve.

B. When the engine has accelerated to approximately 14,500 to 16,500 rpm, the 50% centrifugal switch opens. The start relay R5 is de-energized, and the starter motor terminates its operation. The engine continues to accelerate. At approximately 37,300 to 38,900 rpm, the 95% centrifugal switch actuates and breaks the circuit to the ignition unit to terminate ignition. The engine continues to accelerate until service speed of approximately 41,000 rpm is attained. If the APU does not start within 90 seconds after the air inlet door opening, the unit will automatically shut down. This occurs because a time delay device in the APU control unit trips the start and stop relay K1. The time limit is adequate for normal start of the APU, it prevents overheating the starter motor and limits the drain on airplane battery should the APU fail to start and accelerate to service speed properly. For starting and ignition system operation electrically, refer to 49-11-0.

NOTE: During the initial phase of the APU start, if the master switch is positioned to ON and the air inlet door fully opens before the master switch is moved to START, the CLOSE coil of the start and stop relay K1 will not be energized and the APU will not start. The purpose of this sequence is to prev an APU restart after an automatic shutdown.

STARTER MOTOR - REMOVAL/INSTALLATION

1. Prepare for Starter Motor Removal
   A. Position BATTERY SWITCH and APU MASTER SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

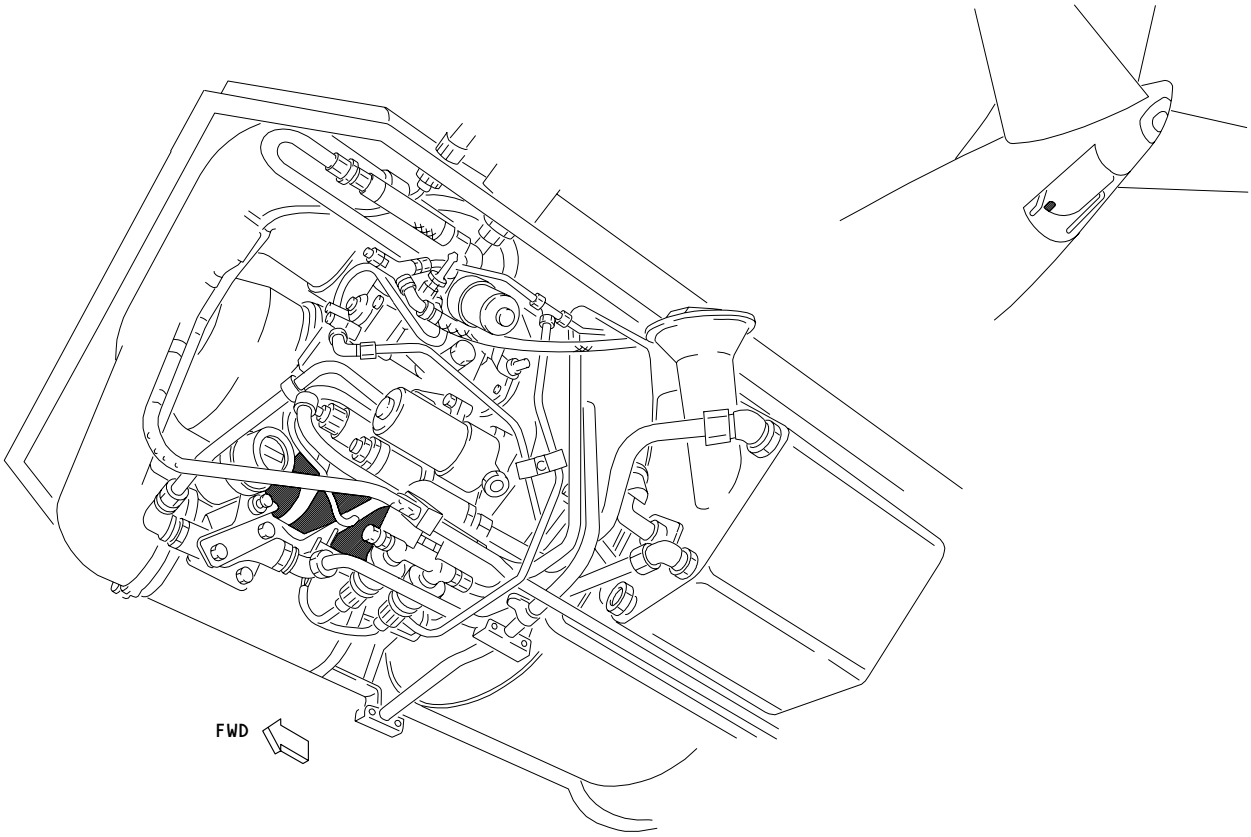
2. Remove Starter Motor (Fig. 401)

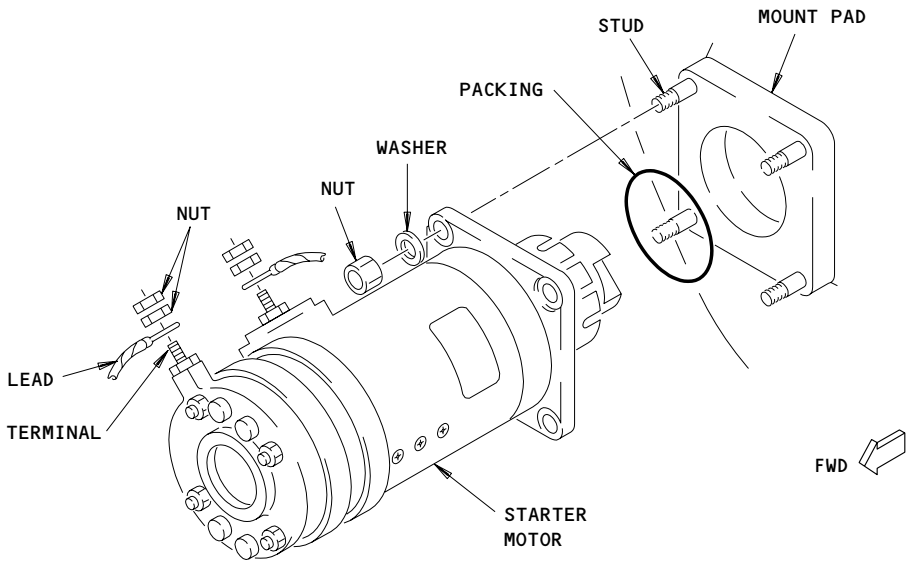
   CAUTION: IF STARTER MOTOR IS BEING REPLACED DUE TO A CLUTCH FAILURE, CHECK CLUTCH PORTION OF STARTER FOR MISSING PARTS. REMOVE VISIBLE CLUTCH PARTS FROM GEARBOX. IF ALL PARTS ARE NOT LOCATED, REPLACE APU. IF ALL PARTS ARE ACCOUNTED FOR, REPLACE BOTH STARTER MOTOR AND OIL PUMP ASSEMBLY.

   A. Tag and disconnect electrical leads from starter motor terminals.

      CAUTION: ELECTRICAL LEADS MUST BE IDENTIFIED WITH CORRESPONDING STARTER MOTOR TERMINALS TO PREVENT CROSSING WIRES. CROSSED WIRES MAY RESULT IN DAMAGE TO APU COMPONENTS WHEN APU START IS ATTEMPTED.

   B. Remove starter motor attaching nuts and washers.
   C. Carefully withdraw starter motor from mounting studs in a straight line.
   D. Remove and discard packing.
3. Install Starter Motor (Fig. 401)
   A. Install new packing on starter motor mount pad.
   B. Position starter motor on accessory drive, tilt slightly and rotate starter motor shaft until shaft pawls mesh with mating shaft in accessory drive.
   C. Carefully slide starter motor onto mounting studs.
   D. Install starter motor attaching washers and nuts. Tighten nuts to a torque range of 70 to 90 pound-inches.
   E. Connect the electrical leads to the applicable starter motor terminals:
      (1) Remove the tags from the starter motor terminals and the electrical leads.
      (2) Put the electrical leads on the applicable starter motor terminals.
      (3) Install the nuts on the starter motor terminals.





Starter Motor Installation
Figure 401

(4) Tighten the nuts on the starter motor terminals to 75 pound-inches (8.5 newton-meters).

CAUTION: DO NOT CROSS ELECTRICAL LEADS. LEADS MUST BE CONNECTED TO CORRESPONDING STARTER MOTOR TERMINALS TO PREVENT DAMAGE TO APU COMPONENTS WHEN APU START IS ATTEMPTED.

NOTE: If starter motor was replaced due to clutch failure, inspect oil filter element prior to oil pump replacement (AMM 49-91-11, oil Pump - Inspection/Check).

F. Close the circuit breaker on M280 module-APU accessory unit on E3-electronic shelf.
G. Position BATTERY SWITCH to ON and remove placards.
H. Test starter operation (AMM 49-11-0).

4. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

STARTER BRUSH - INSPECTION/CHECK

1. Prepare for Starter Brush Check
   A. Position BATTERY SWITCH and APU MASTER SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Check Starter Motor Brushes (Fig. 601)
   A. Remove attaching nuts and clamp from starter dust cover. Remove dust cover.
   B. Clean brush residue from brushes and brush leads.

      NOTE: If brush leads appear to be badly discolored or frayed, remove and replace starter motor (49-41-11).

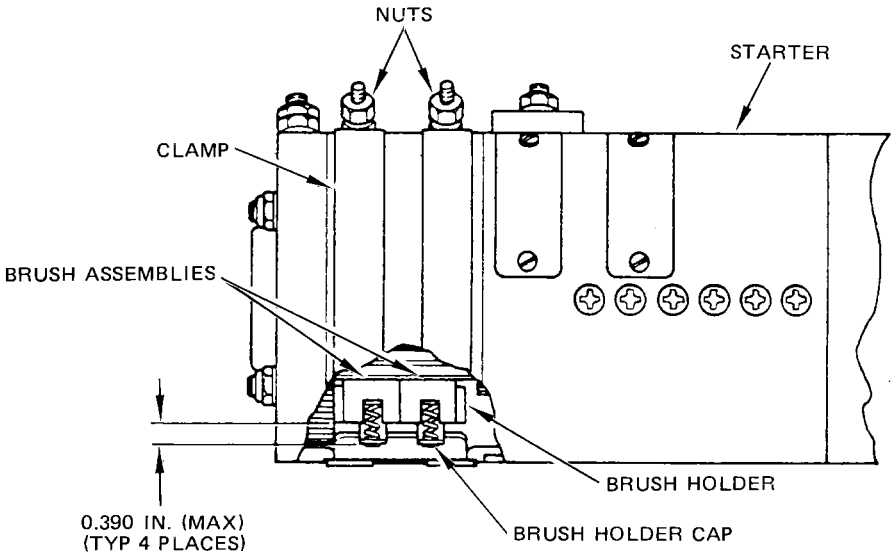
   C. Measure distance from top of brush holder cap to top of each brush. If distance exceeds 0.390 inch, remove and replace starter motor (49-41-11).

      NOTE: A 0.340 inch distance from top of brush holder cap to top of each brush assembly equates to approximately 400 APU operating hours remaining, i.e., a 0.290 inch distance equates to approximately 800 APU operating hours remaining.

   D. If brush dimensions are acceptable, wipe dust cover clean and install cover and clamp on starter motor. Tighten clamp.
3. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.
   E. Remove "APU in work" placard.
   F. Test starter operation (Refer to 49-11-0).



Starter Brush Check
Figure 601

IGNITION UNIT - REMOVAL/INSTALLATION

1. Prepare for Ignition Unit Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module - APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

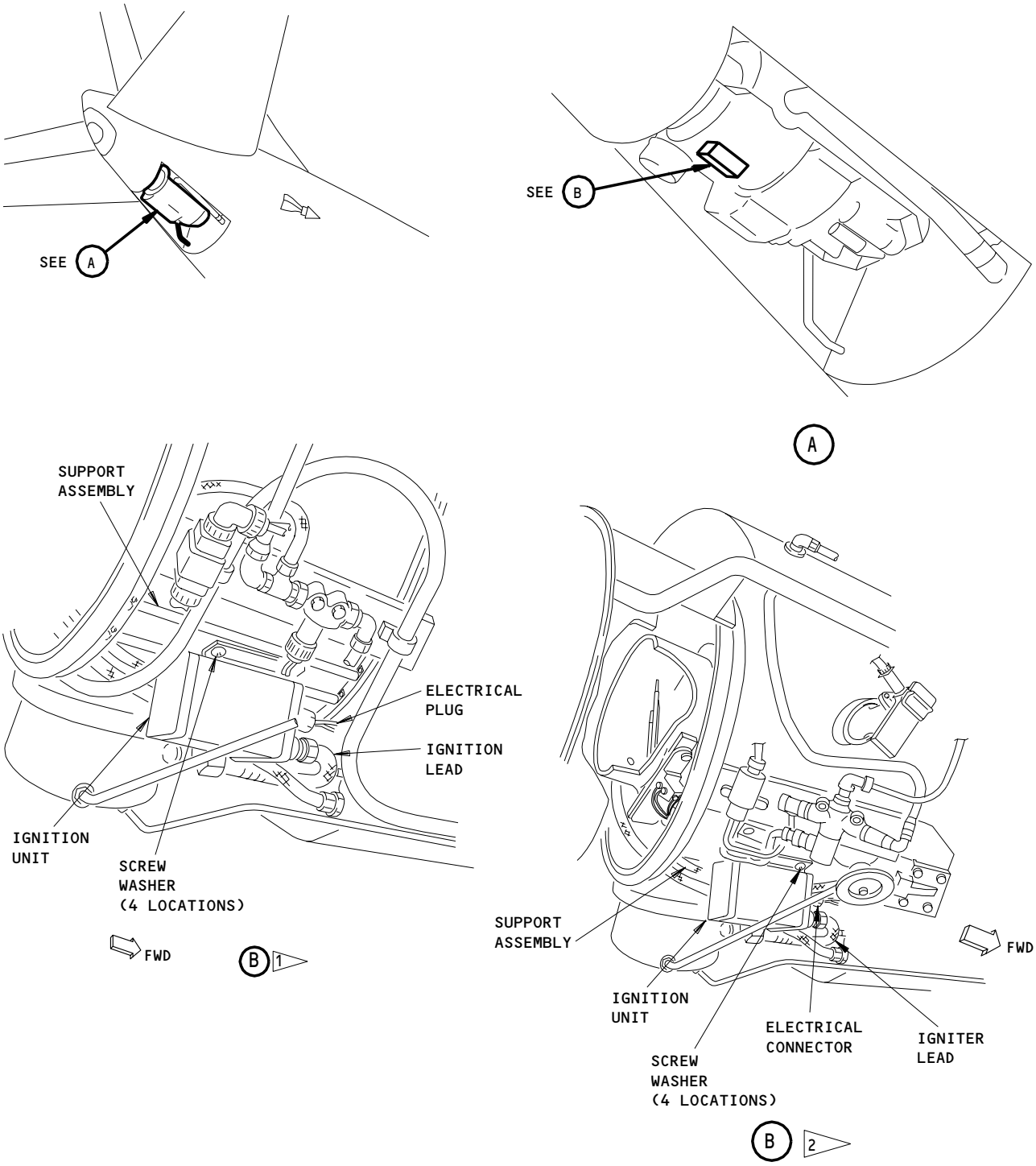
2. Remove Ignition Unit (See figure 401.)
   A. Disconnect electrical plug and shielded igniter lead from ignition unit.

      WARNING: CURRENT INVOLVED IN IGNITION SYSTEM IS OF VERY HIGH VOLTAGE AND CAN BE FATAL. BE SURE THAT POWER IS REMOVED FROM IGNITION SYSTEM FOR A MINIMUM OF THREE MINUTES BEFORE ANY DISCONNECTIONS ARE MADE. AFTER DISCONNECTING HIGH VOLTAGE LEAD, ENSURE COMPLETE DISCHARGE OF CAPACITORS IN IGNITION UNIT BY IMMEDIATELY SHORTING HIGH VOLTAGE LEAD TERMINAL TO GROUND.

   B. Remove ignition unit mounting screws and washers, and remove unit from support assembly on turbine plenum.
3. Install Ignition Unit (See figure 401.)
   A. Install ignition unit on rubber pad on support assembly and secure with screws and washers. Tighten bolts to a torque of 20 to 25 pound-inches.
   B. Connect and lockwire electrical plug and shielded igniter lead to ignition unit.
   C. Test APU operation (Refer to 49-11-0).
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close circuit breaker on M280 module APU accessory unit on E3-3 electronic shelf.
   E. Remove "APU in work" placard.



1 AIRPLANES WITHOUT THE ETC

2 AIRPLANES WITH THE ETC

Ignition Unit Installation
Figure 401

IGNITER PLUG - REMOVAL/INSTALLATION

1. Prepare for Igniter Plug Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module - APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Do these steps to remove the lower shroud:
      (1) Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Igniter Plug (Fig. 401)
   A. Disconnect high-voltage lead from igniter plug.

      WARNING: CURRENT INVOLVED IN IGNITION SYSTEM IS OF VERY HIGH VOLTAGE AND CAN BE FATAL. BE SURE THAT POWER IS REMOVED FROM IGNITION SYSTEM FOR A MINIMUM OF THREE MINUTES BEFORE ANY DISCONNECTIONS ARE MADE. AFTER DISCONNECTING HIGH VOLTAGE LEAD, ENSURE COMPLETE DISCHARGE OF CAPACITORS IN IGNITION UNIT BY IMMEDIATELY SHORTING HIGH VOLTAGE LEAD TERMINAL TO GROUND.

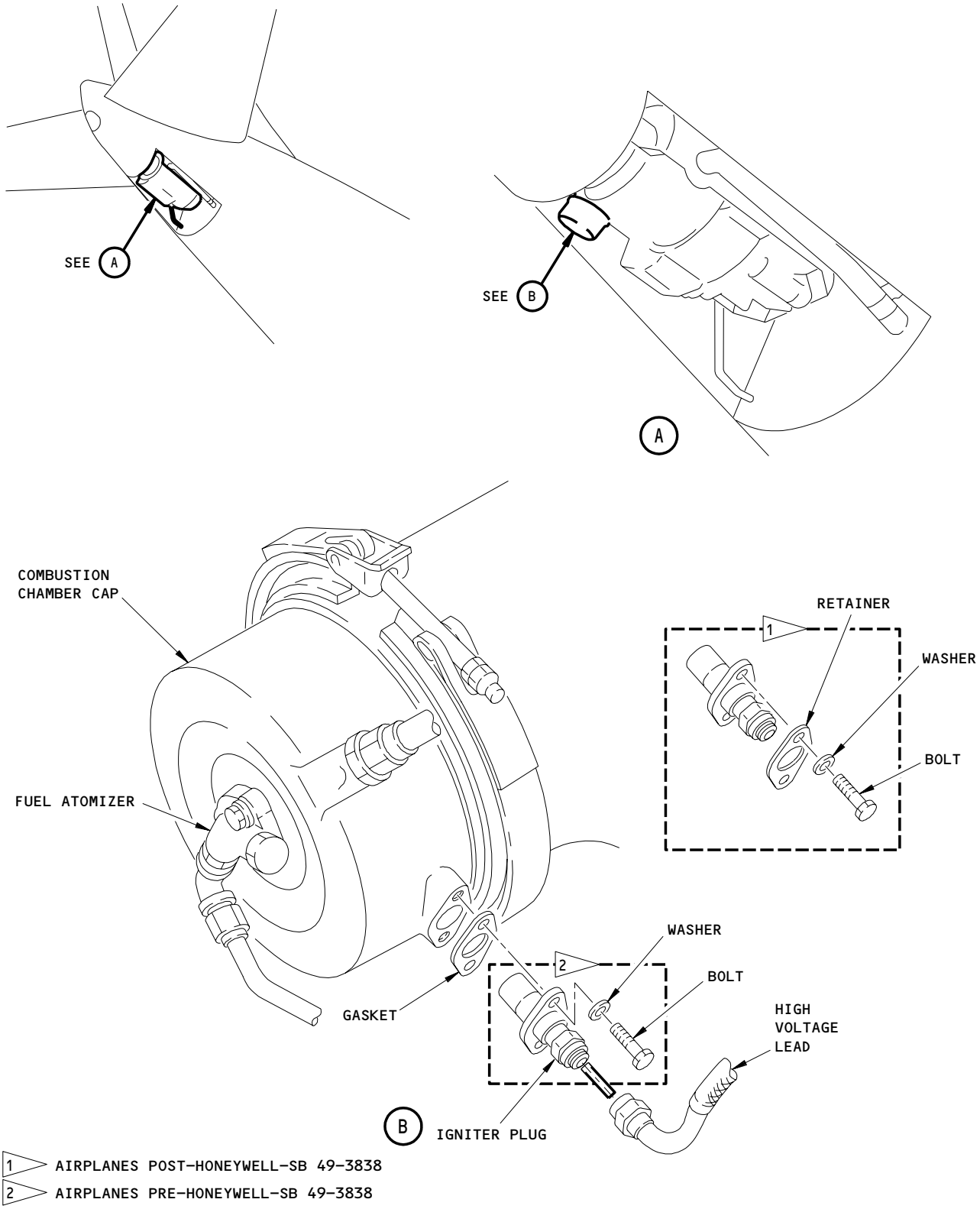
   B. APUs WITH HONEYWELL SB 49-3838;
      Remove igniter plug mounting bolts, washers, and retainer.
   C. APUs WITHOUT HONEYWELL SB 49-3838;
      Remove igniter plug mounting bolts and washers.
   D. Withdraw igniter plug from combustion chamber cap.
   E. Remove the gasket.
   F. Discard the gasket.
3. Install Igniter Plug (Fig. 401)
   A. Place new gasket on igniter plug.
   B. Insert igniter plug into combustion chamber cap.
   C. APUs WITHOUT HONEYWELL SB 49-3838;
      Install igniter plug mounting bolts with washers.

D. APUs WITH HONEYWELL SB 49-3838;
Install igniter plug mounting bolts with washers and retainer.
(1) Tighten nuts to a torque range of 50 to 70 pound-inches.
E. Connect high voltage lead to igniter plug.
F. Safety wire igniter plug mounting bolts and high voltage lead terminal.
G. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
H. Position BATTERY SWITCH to ON and remove placards.
I. Test igniter plug operation (AMM 49-11-0).

4. Restore Airplane to Normal Configuration
A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Do these steps to install the lower shroud:
(1) Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

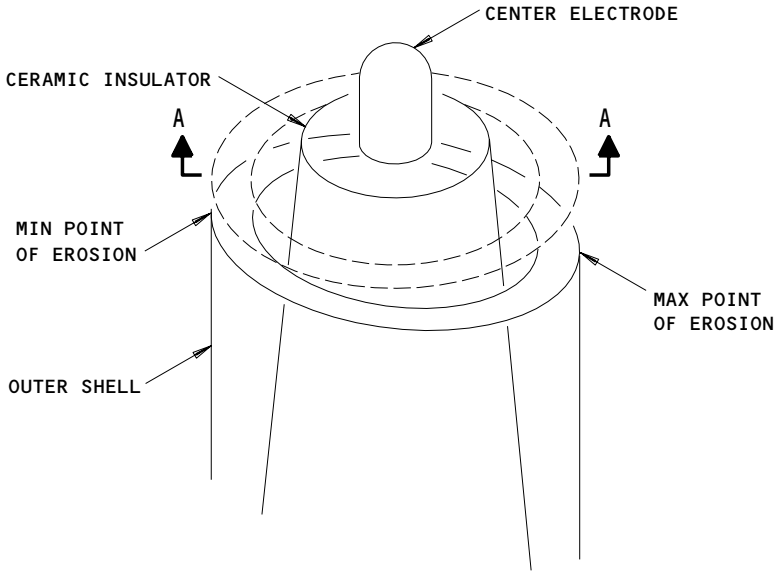
C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

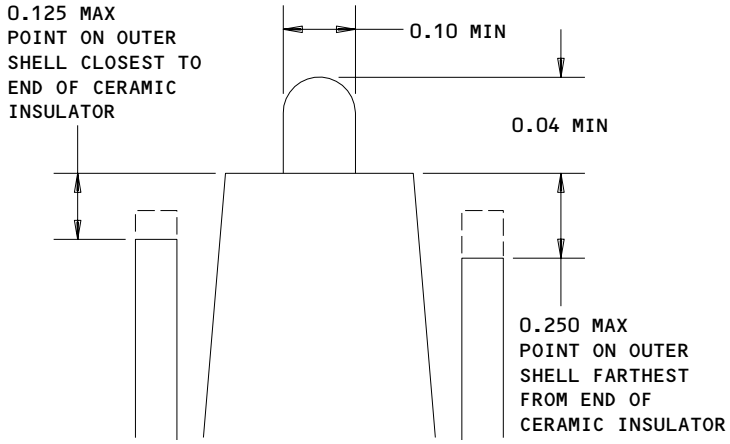


Igniter Plug Installation
Figure 401

IGNITER PLUG - INSPECTION/CHECK

1. Igniter Plug Inspection
   A. Examine Igniter Plug
      (1) Remove igniter plug from combustion chamber cap. Refer to Igniter Plug - Removal/Installation.
      (2) Examine ceramic parts of igniter plug for cracks or chipping.
      (3) Examine center electrode and outer shell for erosion. Igniter plug must be replaced if erosion is outside tolerances shown in figure 601.
      (4) Examine igniter plug barrel and threads for corrosion and damage.
      (5) Install igniter plug on combustion chamber cap. Refer to Igniter Plug - Removal/Installation.





SECTION A-A

Igniter Plug Erosion Limits
Figure 601

IGNITER PLUG - CLEANING/PAINTING

1. Igniter Plug Cleaning
   A. Equipment and Materials
      (1) Solvent - Federal Specification P-D-680, or equivalent
      (2) Soft grit blasting equipment or brass bristle brush

          NOTE: Suitable soft blasting materials are ground corn, apricot or peach pits, walnut shells, clover seeds, or cracked wheat.

   B. Clean Igniter Plug
      (1) Remove igniter plug from combustion chamber cap. Refer to Igniter Plug - Removal/Installation.
      (2) Clean igniter plug with solvent and blow dry with clean compressed air.
      (3) Clean all deposits from igniter plug by blasting or brushing.
      (4) Blow off all loosened material with clean, dry compressed air.

          CAUTION: DO NOT USE HARD GRIT BLASTING OR STEEL BRISTLE BRUSH AS THESE MATERIALS CAN SERIOUSLY DAMAGE IGNITER PLUG.

      (5) Install igniter plug on combustion chamber cap. Refer to Igniter Plug - Removal/Installation

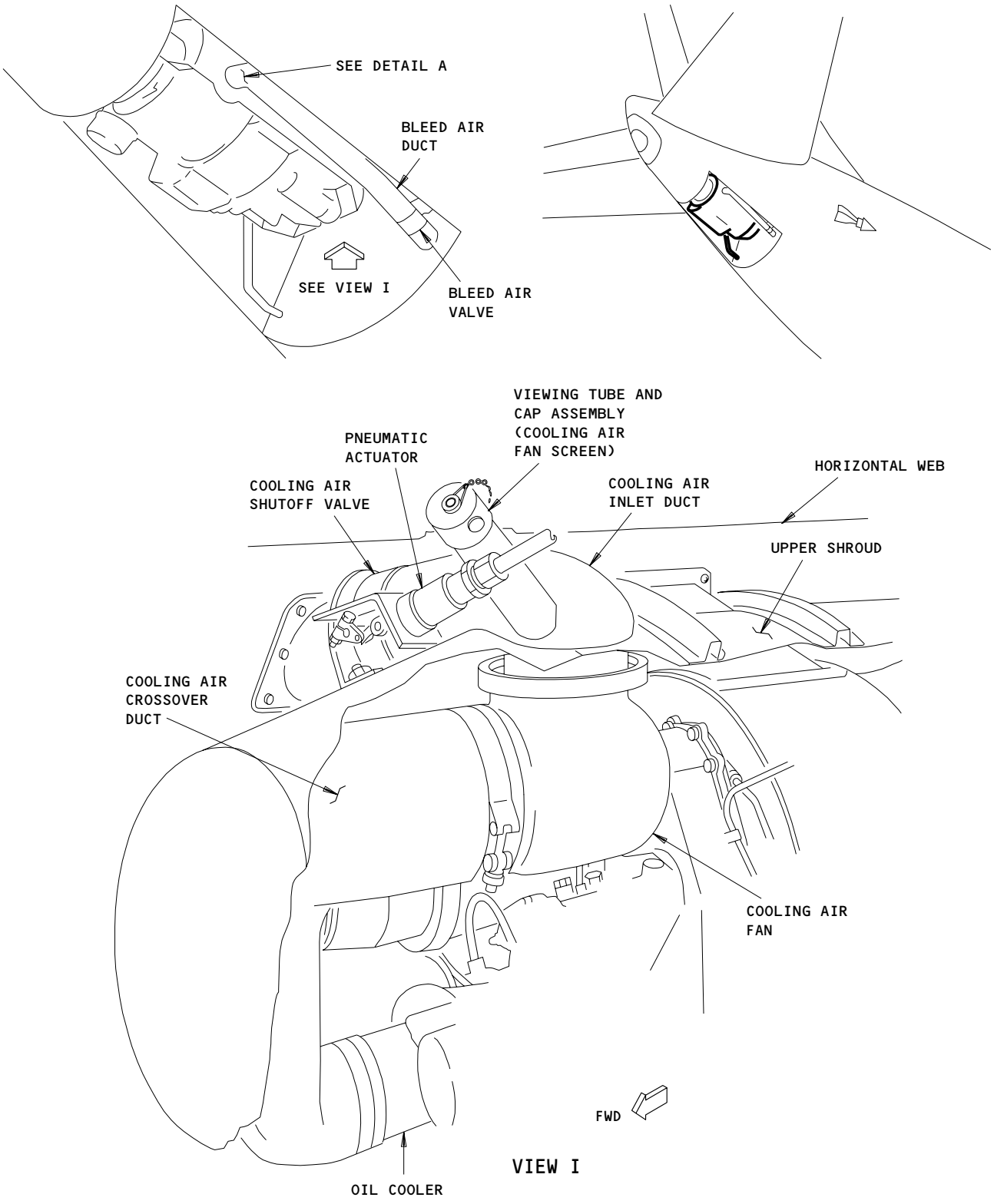
AIR - DESCRIPTION AND OPERATION

1. General
   A. The APU air system consists of two systems: APU cooling air system and APU bleed air system. The APU cooling air system provides cooling air for the ac electrical generator, APU lubrication system, APU engine accessories, and APU shroud. The APU bleed air system provides pneumatic power for the airplane air conditioning system and for starting the airplane engines. For detail description of the air systems, refer to 49-51-0, APU Cooling Air System, and 49-52-01, APU Bleed Air System.

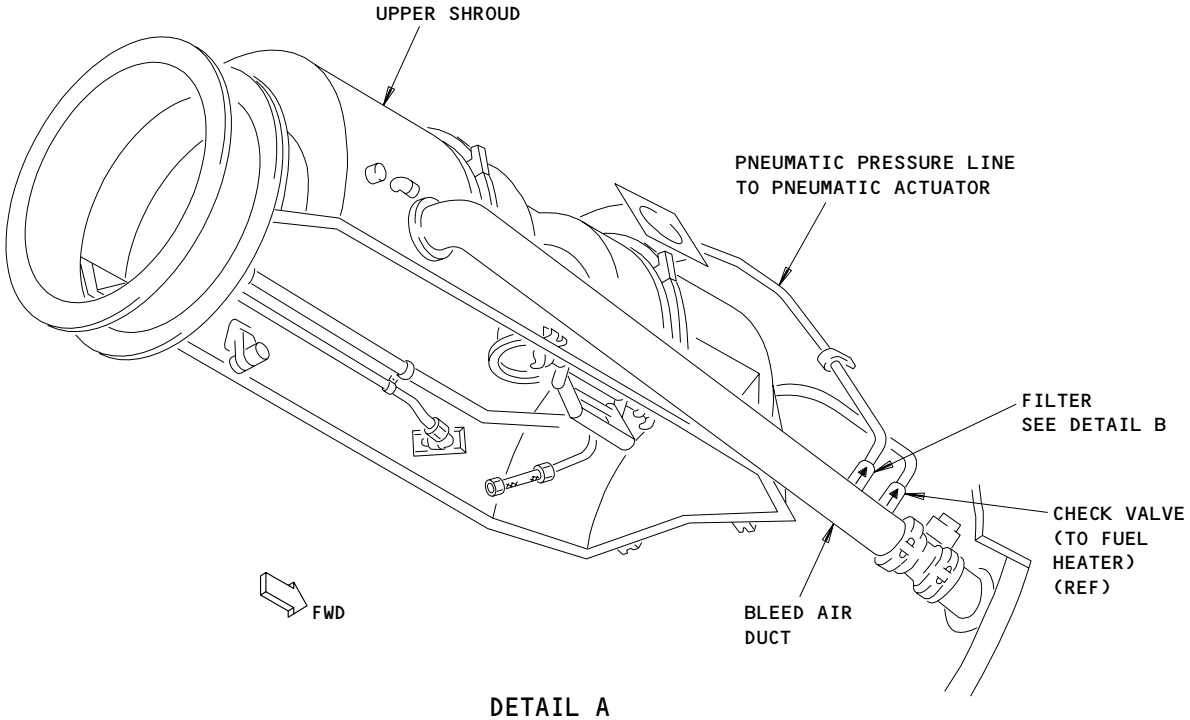
APU COOLING AIR SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU cooling air system provides forced air for cooling the ac electrical generator, APU lubricating oil, APU engine shroud, and engine accessories. The cooling air system consists of the accessory cooling air duct, cooling air fan, cooling air shutoff valve, pneumatic actuator, and cooling air crossover duct (Fig. 1). The cooling air is obtained from the torque box, passed through the ac electrical generator and the oil cooler to the inside of the engine shroud, and exhausted overboard.
2. Cooling Air Inlet Duct
   A. The cooling air inlet duct supplies the static air on ground, or ram air in flight, to the cooling air fan. The duct is located between the torque box and the cooling air fan inlet flange, and is riveted to the upper shroud (Fig. 1).
   B. An inlet air screen is attached to the cooling air fan housing. An inspection tube and cap assembly is attached to the inlet duct, providing visual access to the screen. The inspection tube protrudes through a lightening hole in the horizontal webbing above the upper shroud and is accessible from the compartment just aft of the aft pressure bulkhead.
3. Cooling Air Shutoff Valve
   A. The cooling air shutoff valve stops the airflow through the cooling air inlet duct when the APU is not operating. The valve serves as a flame stop in event of an APU fire. The valve consists of a shaft-mounted butterfly installed in the cooling air inlet duct (Fig. 1). The valve is controlled by the pneumatic actuator.
4. Pneumatic Actuator
   A. The pneumatic actuator controls the cooling air shutoff valve. It consists of a cylinder, piston and rod assembly, spring, and cap. The actuator is installed on the cooling air inlet duct flange (Fig. 1). The actuator piston is spring-loaded to the retracted position. The actuator rod extends when supplied with pneumatic pressure from bleed air duct to overcome the spring force. A filter in the pneumatic line protects the pneumatic actuator from contaminants. The filter may be either a disposable or cleanable type.
5. Cooling Air Fan
   A. The cooling air fan provides a positive cooling airflow through the oil cooler and the generator. The fan is an axial flow type mounted in a T-shaped housing (Fig. 1). It is driven by the accessory drive section. One arm of the housing provides the support for the fan bearings and the mounting flange that attaches the housing to the accessory drive casing. The other arm forms the air inlet duct to the fan and includes an air inlet screen. The leg of the T-shaped housing is the fan air outlet and provides the mounting for the cooling air crossover duct.

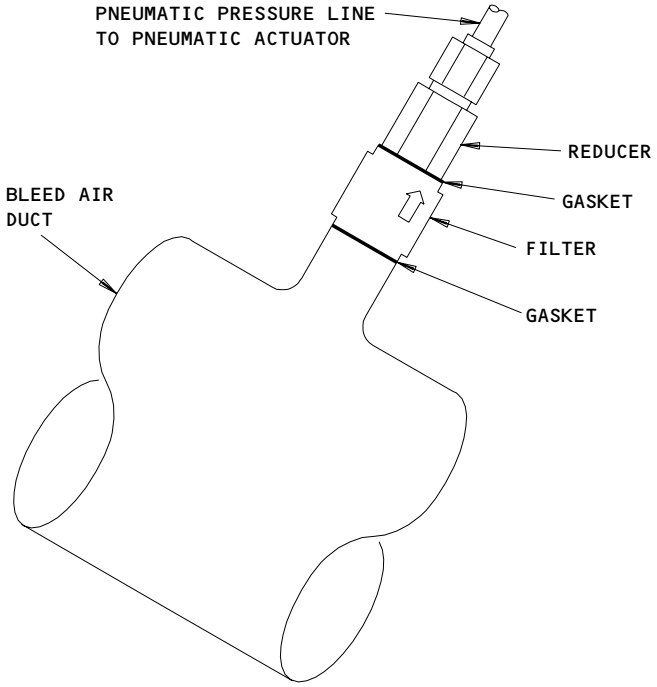
6. Cooling Air Crossover Duct
   A. The cooling air crossover duct provides airflow from the cooling air fan to the oil cooler and ac electrical generator. The duct is V-shaped (Fig. 1).
7. Operation
   A. When the APU is operating, cooling air is supplied by the cooling air fan. It is driven by accessory drive section gear train. The fan draws static air while on the ground, or is supplied by ram air in flight, from the torque box through the diffuser air duct. The cooling air shutoff valve is held open by the pneumatic actuator. The actuator obtains the pneumatic pressure from APU bleed duct upstream of the APU bleed valve. The cooling air from the fan is distributed to the ac electrical generator and the oil cooler through a cooling air crossover duct. From the manifold, the air is forced through the generator and oil cooler, and exhausted inside the APU shroud. The exhaust air is circulated inside the shroud to cool the APU engine and engine accessories, then exhausted overboard. When the APU is shut down, the cooling air shutoff valve is closed by the actuator. The valve serves as a flame stop in event of an APU fire, thus preventing the fire from spreading into the torque box in the fuselage.



APU Cooling Air System Component Location
Figure 1 (Sheet 1)



DETAIL A



DETAIL B

APU Cooling Air System Component Location
Figure 1 (Sheet 2)

APU COOLING AIR SYSTEM - MAINTENANCE PRACTICES

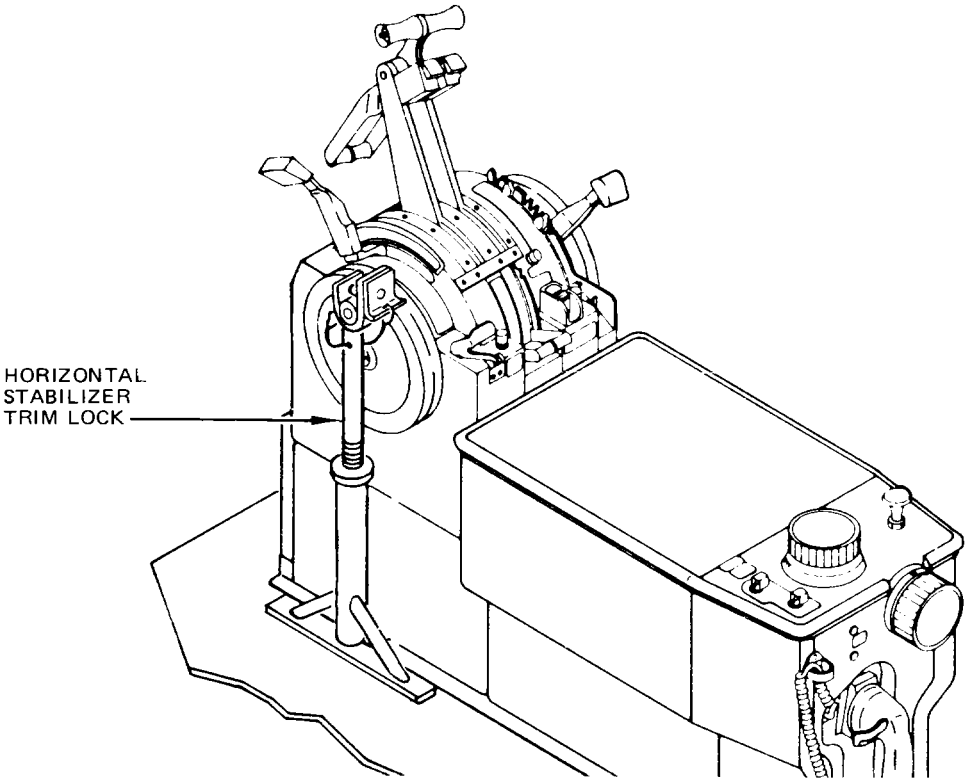
1. General
   A. The maintenance practices described herein deal specifically with the cleaning of the cooling air inlet screen attached at top of cooling air fan housing. The cooling air fan screen cannot be removed from the engine while installed in airplane. It can however, be checked and cleaned using a portable vacuum cleaner with a minimum diameter of 1.0 inch flexible nozzle. Access to the screen is through the inspection tube attached to the cooling air inlet duct.

      NOTE: Sufficient blockage of the screen will cause an automatic shutdown of APU due to high oil temperature.

2. Examine Cooling Air Fan Screen
   A. Position BATTERY SWITCH and APU MASTER SWITCH to OFF and placard that APU maintenance is ?IN WORK".
   B. Open stabilizer trim actuator and stabilizer trim control circuit breakers on panel P6.
   C. Open circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.
   D. Install the stabilizer trim lock assembly on the stabilizer trim wheel. (Fig 201)
      (1) Turn the trim wheel to put the handle at the top of the wheel.
      (2) Adjust the height of the trim lock to set the trim wheel handle tightly in the bottom of the yoke.
      (3) Install the pin through the yoke and install the safety pin.
   E. Gain access to compartment immediately aft of pressure bulkhead.
   F. Disconnect the electrical connectors from the stabilizer trim electric actuator, and the autopilot stabilizer trim servo.
   G. Remove cap assembly from viewing tube.
   H. Using a flashlight, inspect screen for accumulation of oil and lint or other debris.
3. Cooling Fan Inlet Screen Cleaning
   A. Standard Tools and Equipment.
      (1) Vacuum cleaner - movable, with a minimum diameter of 1.0 nch (25 mm) flexible nozzle.
      (2) Retriever, claw type
      (3) Pressure Washer (Commercially Available) - Low pressure water or steam - to supply the solvent to the screen.
      (4) Container - Oil and Solvent resistant
      (5) Gloves - Oil and Solvent resistant
      (6) Goggles, Safety
   B. Consumable Materials
      (1) B00722 Solvent - P-D-680

C. References
(1) AMM 49-11-0/401, APU Power Plant
(2) AMM 49-11-0/501, APU Power Plant

D. Procedure
(1) Make sure that the switch and the circuit breaker are set correctly:
(a) Make sure the APU MASTER SWITCH is in the OFF position with a DO-NOT-OPERATE tag attached.
(b) Make sure this circuit breaker is open with a DO-NOT-CLOSE tag attached:
1) E3-3 Electrical Shelf, M280 module - APU Accessory Unit
(2) Make sure the electrical connectors are disconnected:
(a) Make sure the electrical connector is disconnected from the stabilizer trim electric actuator.
(b) Make sure the electrical connector is disconnected from the autopilot stabilizer trim servo.
(3) Clean the fan inlet screen:
(a) Clean the fan inlet screen with the vacuum cleaner.
1) Put the nozzle of the vacuum cleaner in the inspection tube to remove all blockage.
2) If there are pieces too large or heavy for the vacuum cleaner, use a claw type retriever to remove them.
(b) With a flashlight, examine the fan inlet screen for any remaining blockage.
1) If you have found any blockage, do these steps to clean the fan inlet screen with solvent:
a) Remove the fire loop bracket from crossover duct.
b) Remove the two clamps from the crossover duct.
c) Remove the crossover duct and the two gaskets.
d) Put a cover on the cooling air inlet to the generator and the cooling air inlet to the oil cooler.
e) Put a container under the cooling fan housing.
f) Place the solvent into the pressure washer.
g) Place the nozzle of the washer into the inspection tube.
h) Wash the screen with the solvent.
i) Use the container to catch the solvent and dissolved blockage.
j) Rinse the inspection tube, the cooling fan and the APU with clean water.
k) Remove the cover from the cooling air inlet to the oil cooler.
l) Do the inspection of the oil cooler (Para. 4).
m) Remove the cover from the cooling air inlet to the generator.
n) Put the two gaskets in the crossover duct.



Horizontal Stabilizer Trim Lock Installation
Figure 201

o) Put the crossover duct on the cooling fan and the oil cooler.
p) Reinstall the two clamps on the crossover dust.
q) Reinstall the fire loop bracket on the crossover duct.

2) With a flashlight, examine the fan inlet screen for any remaining blockage.
a) If any blockage is found, remove the APU and clean or replace the fan inlet screen (AMM 49-11-0/401).

4. Inspect the oil cooler
A. Remove the cooling air crossover duct.
(1) Disconnect all components from cooling air crossover duct.
(2) Remove the upper and lower clamps from the cooling air crossover duct.
(3) Remove the cooling air crossover duct.
B. Examine the oil cooler for blockage.
(1) If the oil cooler inlet or outlet surfaces have blockages, remove the blockages.
(2) If the air flow tubes have any blockages, remove the blockages.
C. Install the cooling air crossover duct.
(1) Install the upper and lower clamps.
(2) Install all components to cooling air crossover duct.

5. Restore Airplane to Normal Configuration
A. Close access door to compartment aft of pressure bulkhead.
B. Close circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.
C. Remove "IN WORK" placard from BATTERY SWITCH.

APU COOLING FAN - REMOVAL/INSTALLATION

1. General
   A. This section covers the removal and installation of the cooling fan while the APU is installed on the aircraft. It is necessary to lower APU and remove cooling duct in order to gain access to cooling fan for removal and installation.
2. Prepare to Remove Cooling Fan (Figure 401)
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Lower APU enough to gain access for removal of cooling fan. Refer to 49-11-0, pages 401-403.
   F. Remove cooling duct (110) as follows:
      (1) Remove fire loop brackets from duct (110).
      (2) Remove nut (40) and washer (50).
      (3) Remove clamps (120, 130), gaskets (140, 150) and cooling duct (110).
3. Remove Cooling Fan (Figure 401)

   CAUTION: BACK FAN ASSEMBLY SLOWLY OUT OF GEARCASE ASSEMBLY IN A STRAIGHT LINE SO AS NOT TO DAMAGE EXTERNAL FAN ASSEMBLY SPLINES OR INTERNAL GEARCASE SPLINES.

   A. Loosen oil tube fitting at bottom of fan (280). Remove bolts (290), washers (300) and carefully back fan assembly (280) out of accessory drive gearcase assembly. Remove and discard packings (310).
4. Install Cooling Fan (Figure 401)

   CAUTION: PROTECT PACKINGS AS FAN ASSEMBLY IS INSERTED INTO GEARCASE ASSEMBLY.

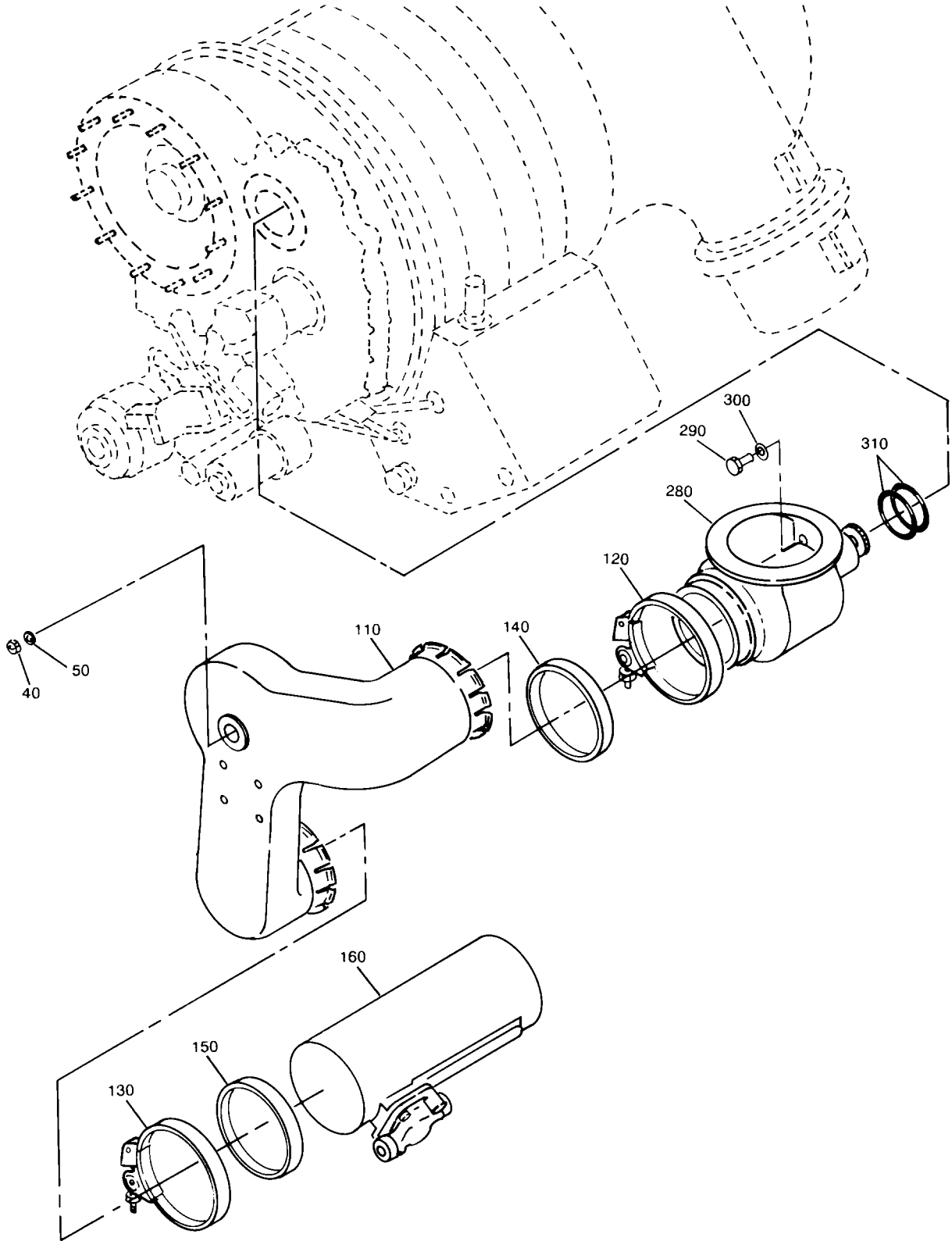
   A. Apply a thin film of engine oil to packings (310).
   B. Install new packings (310) on fan assembly (280), then install fan assembly by inserting into gearcase assembly in a straight line so that internal and external splines mesh properly and are not damaged.

C. Insert fan assembly (280) and attach loosely oil tube fitting to fan. Coat threads of bolts (290) with engine oil. Install washers (300) and bolts (290) and secure fan assembly (280) to gearcase assembly. Tighten bolts to a torque value of 50 to 70 inch-pounds. Tighten oil tube fitting.

5. Restore Airplane to Normal Configuration (Figure 401)
   A. Install cooling duct (110) as follows:
      (1) Position cooling duct (110) between fan assembly and oil cooler (160) and secure with gaskets (140, 150) and clamps (120, 130).
      (2) Install washer (50) and nut (40).
      (3) Install fire loop brackets to duct (110).
   B. Hoist APU in position according to 49-11-0, pages 403-408.
   C. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   D. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Disengage APU access door support rods and stow rods. Close and latch access door.
   F. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   G. Position BATTERY SWITCH to ON and remove placards.



APU Cooling Fan, Removal/Installation
Figure 401

COOLING AIR SHUTOFF VALVE - REMOVAL/INSTALLATION

1. General
   A. This section covers the removal and installation of the cooling air shutoff valve located on the APU upper shroud assembly. On airplanes with an access hole in the horizontal web above the APU upper shroud the valve can be removed with the APU and upper shroud installed. On airplanes without the access hole, the APU and the upper shroud must be removed.
2. Remove Cooling Air Shutoff Valve (Fig. 401)
   A. On airplanes not having access to the valve through the horizontal web above the APU upper shroud, remove valve as follows:
      (1) Remove APU power plant (Ref 49-11-0, APU Power Plant - Removal/Installation).
      (2) Remove APU upper shroud (Ref 49-12-31, Upper Shroud - Removal/Installation).
      (3) Remove bolts attaching cooling air shutoff valve to upper shroud.
      (4) Remove cooling air shutoff valve from cooling air inlet duct.
   B. On airplanes having access hole through horizontal web above upper shroud, remove cooling air shutoff valve as follows:
      (1) Position stabilizer trim in full up position (airplane nose down).
      (2) Open stabilizer trim control circuit breaker on P6 panel and placard that APU maintenance is "in-work".
      (3) Position BATTERY SWITCH and APU START switch to OFF and placard that APU maintenance is "in-work".
      (4) Open circuit breaker on M280 module-APU accessory unit on E3-3 electrical shelf.
      (5) Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
      (6) Disconnect pneumatic pressure line at valve actuator. Cap/plug fittings.
      (7) Remove nuts and washers securing valve to top of upper shroud.

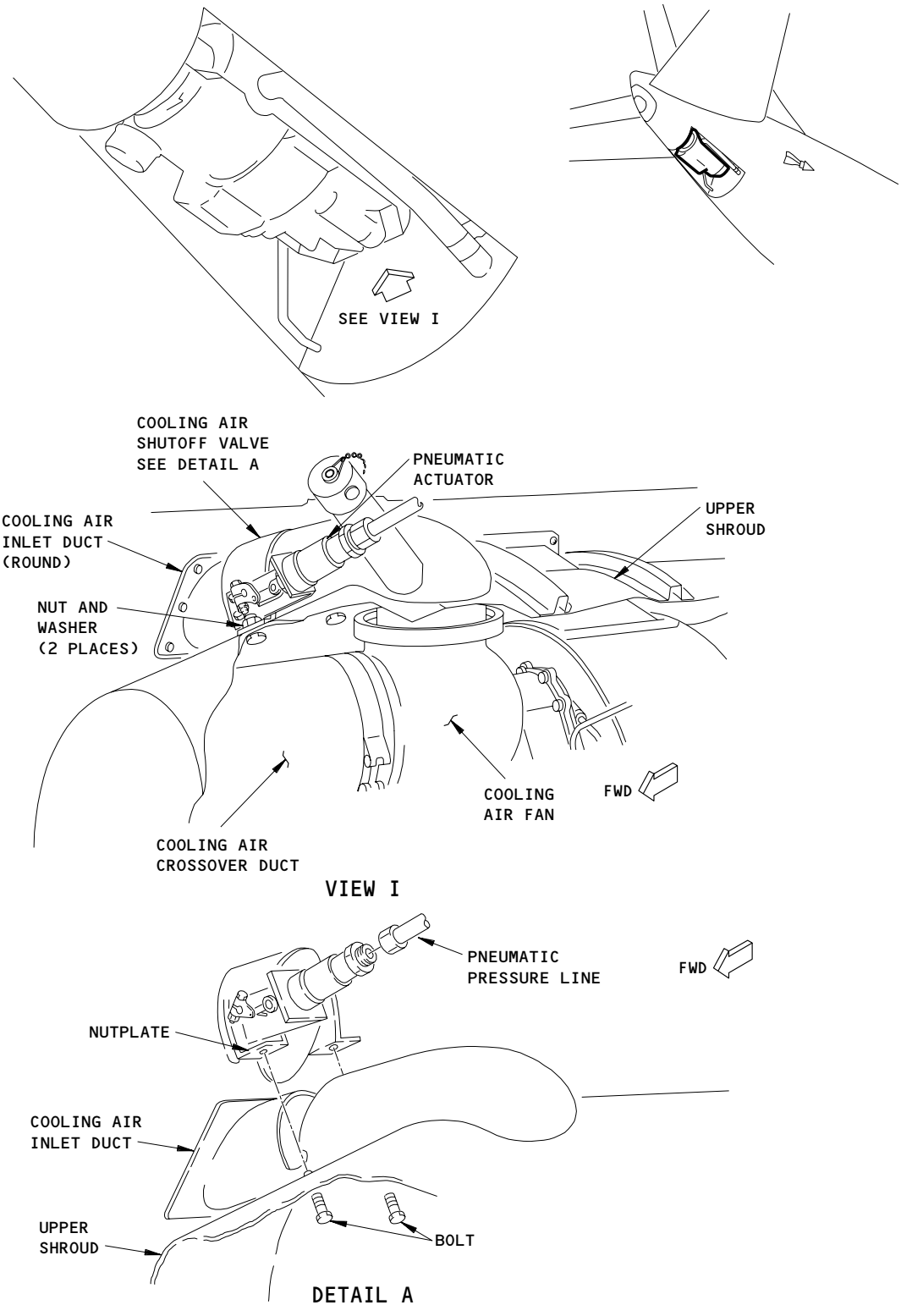
          NOTE: Bolts are secured to inner surface of upper shroud.

      (8) Lift valve through access hole in horizontal web.
3. Install Cooling Air Shutoff Valve (Fig. 401)
   A. On airplanes not having access to the valve through the horizontal web above the APU upper shroud, install valve as follows:
      (1) Position cooling air shutoff valve on cooling air inlet duct of upper shroud and secure with bolts.

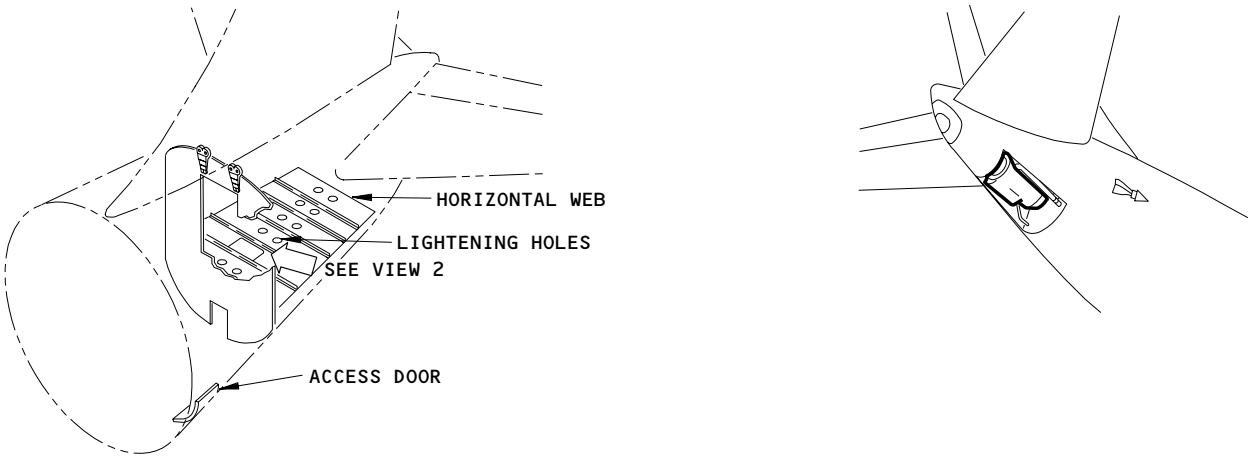
          NOTE: If required, place washers between valve body and shroud to ensure snug fit of saddle to curved surface of duct.

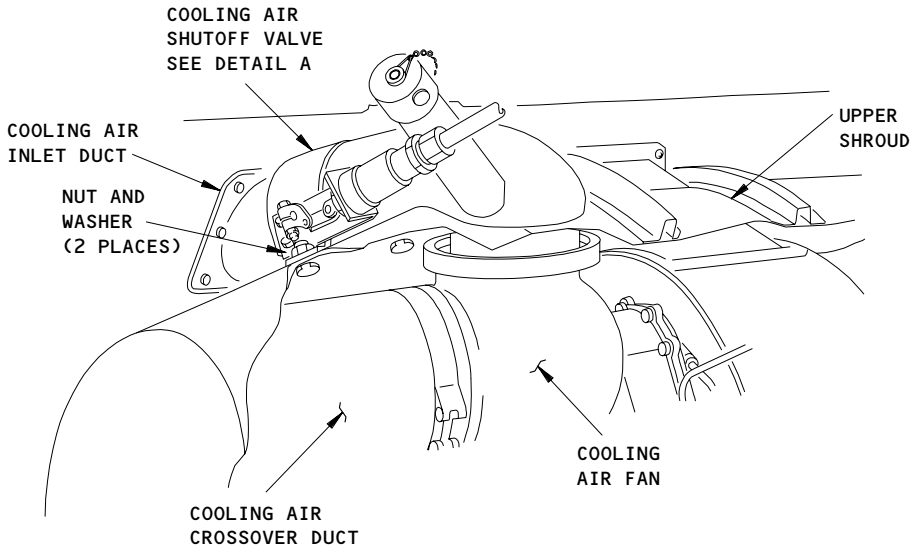
(2) Install APU upper shroud (Ref 49-12-31, Upper Shroud - Removal/Installation).
(3) Install APU power plant (Ref. 49-11-0, APU Power Plant - Removal/Installation).
(4) Check operation of valve (Ref. 49-51-21, Adjustment/Test).

B. On airplanes having access hole through horizontal web above upper shroud, install cooling air shutoff valve as follows:
(1) Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
(2) Insert valve through opening in web, aligning bracket holes with bolts protruding through upper shroud.
(3) Install nuts and washers. Make certain valve fits snugly over cooling air duct.
(4) Check operation of valve (Ref. 49-51-21, Adjustment/Test).
(5) Close access door to compartment aft of pressure bulkhead.
(6) Close circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.
(7) Close horizontal stabilizer trim control circuit breaker on P6 panel and remove placard.
(8) Position BATTERY SWITCH to ON and rotate horizontal stabilizer trim to neutral position.
(9) Remove placard from APU MASTER SWITCH.
(10) Position BATTERY SWITCH TO OFF if power no longer required.

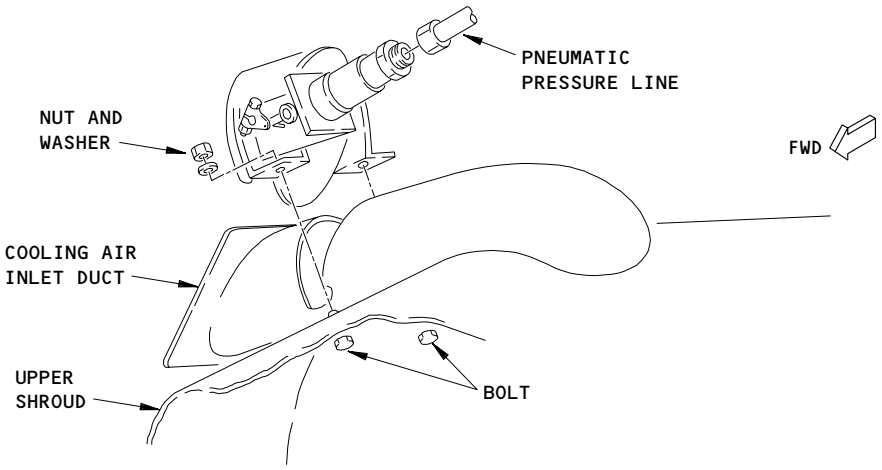


Cooling Air Shutoff Valve Installation
Figure 401 (Sheet 1)





VIEW 2

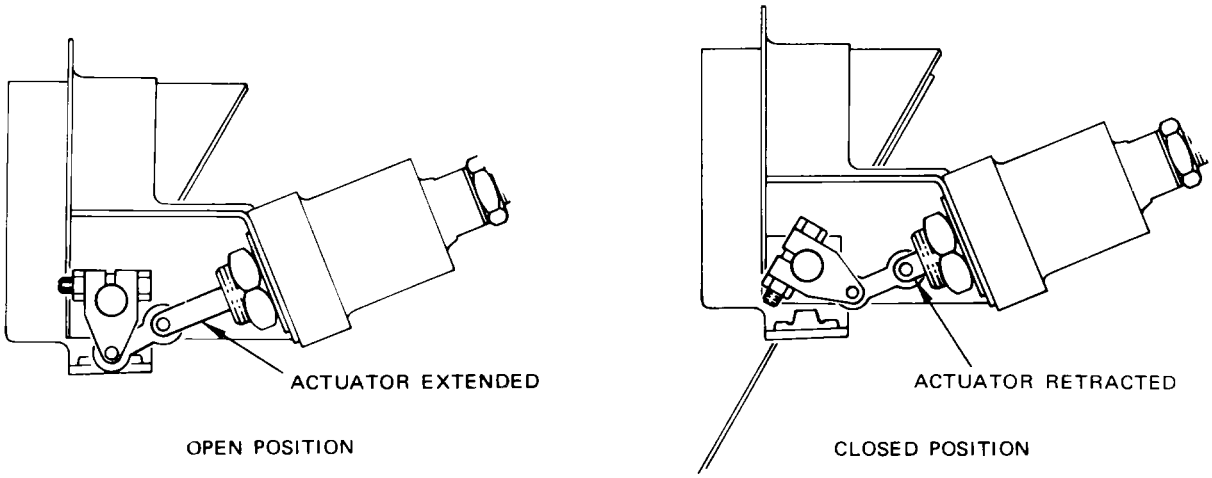


DETAIL A

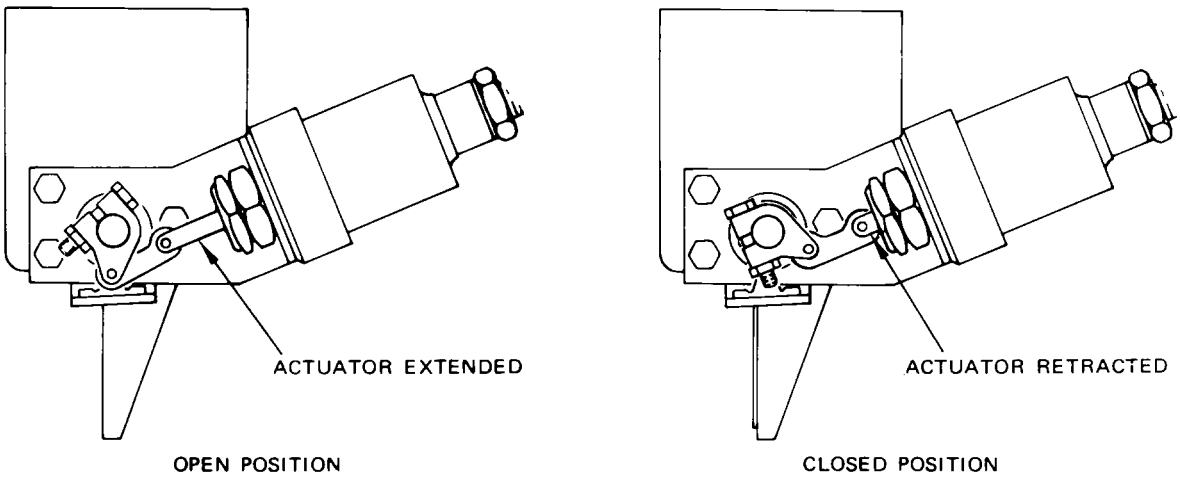
Cooling Air Shutoff Valve Installation
Figure 401 (Sheet 2)

COOLING AIR SHUTOFF VALVE - ADJUSTMENT/TEST

1. Cooling Air Shutoff Valve Test
   A. General
      (1) The APU cooling air shutoff valve test is performed to test the operation of the pneumatic actuator, and to check the valve for binding.
   B. Equipment and Materials
      (1) Pressurized air supply capable of supplying up to 7 psig
      (2) Pressure gages
   C. Prepare for Cooling Air Shutoff Valve Test
      (1) Position BATTERY SWITCH and APU MASTER SWITCH to OFF and placard that APU maintenance is "in work."
      (2) Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
      (3) Gain access to compartment immediately aft of pressure bulkhead.
      (4) The pneumatic actuator is accessible through the lightening holes in the horizontal web above the APU.
   D. Test Cooling Air Shutoff Valve (Fig. 501.)
      (1) If aircraft pneumatic pressure line is attached, disconnect and attach air line from portable air source.
      (2) Apply 7.0 ±0.5 psi air to pneumatic actuator air inlet port. Valve should open to fully open position without binding.
      (3) Remove air supply. Actuator spring should return valve to closed position without binding.
      (4) Disconnect portable air source pressure air line and reconnect aircraft pneumatic pressure line to pneumatic actuator fitting. Tighten coupling nut.
   E. Restore Airplane to Normal Configuration
      (1) Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
      (2) Remove placard from APU MASTER SWITCH.
      (3) Start APU (Ref 49-11-0, Maintenance Practices).
      (4) Visually check that cooling air valve and actuator function properly.
      (5) Shut down APU (Ref 49-11-0, Maintenance Practices).
      (6) Position BATTERY SWITCH to OFF if power no longer required.
      (7) Close access door to compartment aft of pressure bulkhead.



CONFIGURATION 1

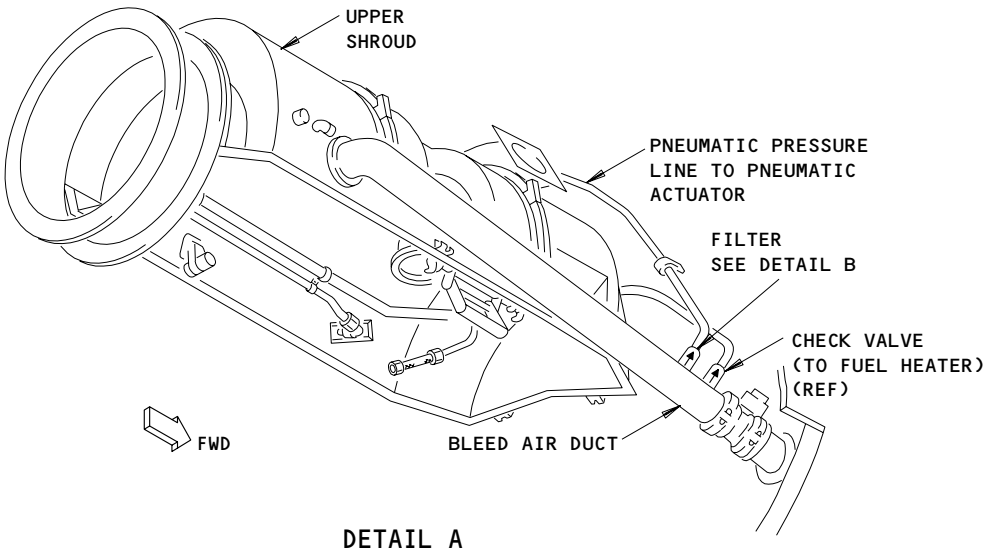


CONFIGURATION 2

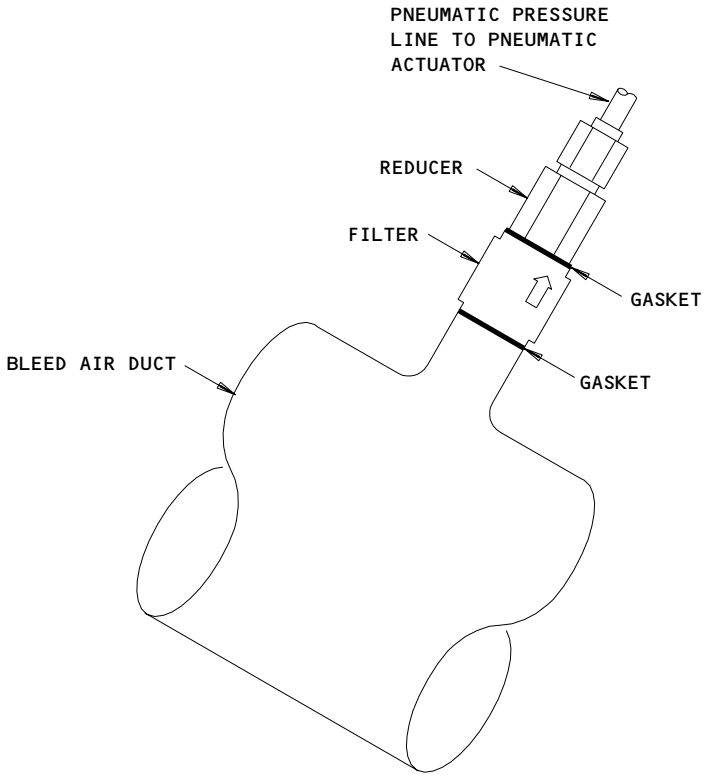
Cooling Air Shutoff Valve - Adjustment/Test
Figure 501

COOLING AIR SHUTOFF VALVE PNEUMATIC LINE FILTER - REMOVAL/INSTALLATION

1. Prepare for Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is in work.
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
2. Remove Pneumatic Line Filter (Fig. 401)
   A. Disconnect pneumatic pressure line from reducer and remove reducer from filter. Discard gasket.
   B. Remove filter from air bleed duct. Discard gasket.
3. Install Pneumatic Line Filter (Fig. 401)
   A. Install filter, with new gasket, in boss on air bleed duct.
   B. Install reducer, with new gasket, on filter.
   C. Connect pneumatic pressure line to reducer.
4. Restore Airplane to Normal Configuration
   A. Close and latch APU compartment access door.
   B. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Position BATTERY SWITCH to ON and remove placards.



DETAIL A



DETAIL B

Cooling Air Shutoff Valve Pneumatic Line Filter Installation
Figure 401

COOLING AIR SHUTOFF VALVE PNEUMATIC LINE FILTER - CLEANING/PAINTING

1. General
   A. The filter assembly can be one of two types: a disposable filter or a reusable filter assembly. The following cleaning procedure is for the reusable filter assembly only.
2. Equipment and Materials
   A. Solvent - B01000 - General Cleaning of Metals (Series 80) (Ref AMM/SOPM 20-30-80)
   B. Brush, Fiber-Bristle
   C. Lubricant-Petrolatum (Ref 20-30-21)
3. Clean Filter
   A. Remove filter assembly from bleed air duct (Ref Cooling Air Shutoff Valve Pneumatic Line Filter-Removal/Installation).
   B. Disassemble filter assembly. Remove O-ring and filter element. Discard O-ring.
   C. Place filter element in small container of solvent and soak for one hour.
   D. Clean external and internal surfaces of filter head and housing using brush and solvent. Blow dry with low pressure compressed air.
   E. Dry filter element with low pressure compressed air.
   F. Lubricate and install new O-ring on filter head portion of filter assembly.
   G. Insert filter element in filter head and install filter body.

      NOTE: Check that O-ring remains seated when screwing filter body onto filter head.

   H. Lockwire filter body and filter head together.
   I. Install filter assembly in bleed air duct (Ref Cooling Air Shutoff Valve Pneumatic Line Filter - Removal/Installation).

PNEUMATIC ACTUATOR - REMOVAL/INSTALLATION

1. General
   A. This section covers the removal and installation of the cooling air shutoff valve pneumatic actuator located on the APU upper shroud assembly. On airplanes with an access hole in the horizontal web above the APU upper shroud the actuator valve can be removed with the APU and upper shroud installed. On airplanes without the access hole, the APU and the upper shroud must be removed.
2. Remove Pneumatic Actuator (Fig. 401)
   A. On airplanes not having access to the valve through the horizontal web above the APU upper shroud, remove actuator as follows:
      (1) Remove APU power plant (Ref 49-11-0, APU Power Plant - Removal/Installation).
      (2) Remove APU upper shroud (Ref 49-12-31, Upper Shroud - Removal/Installation).
      (3) Remove cotter pin, washers and pin attaching link to actuator assembly.
      (4) Remove bushing retainer, teflon bushing, nut and washer attaching actuator assembly to bracket on cooling air valve body and remove actuator.

      NOTE: Teflon bushing may fit loosely in actuator. When removing retainer, use care not to drop bushing.

   B. On airplanes having access hole through horizontal web above upper shroud, remove pneumatic actuator as follows:
      (1) Position stabilizer trim in full up position (airplane nose down).
      (2) Open stabilizer trim control circuit breaker on P6 panel and placard that APU maintenance is "in-work".
      (3) Position BATTERY SWITCH and APU START switch to OFF and placard that APU maintenance is "in-work".
      (4) Open circuit breaker on M280 module-APU accessory unit on E3-3 electrical shelf.
      (5) Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
      (6) Disconnect pneumatic pressure line at pneumatic actuator. Cap/plug fittings.
      (7) Remove cotter pin, washers and pin attaching link to actuator assembly.

(8) Remove bushing retainer, teflon bushing, nut and washer attaching actuator assembly to bracket on cooling air valve body and remove actuator.

NOTE: Teflon bushing may fit loosely in actuator. When removing retainer, use care not to drop bushing.

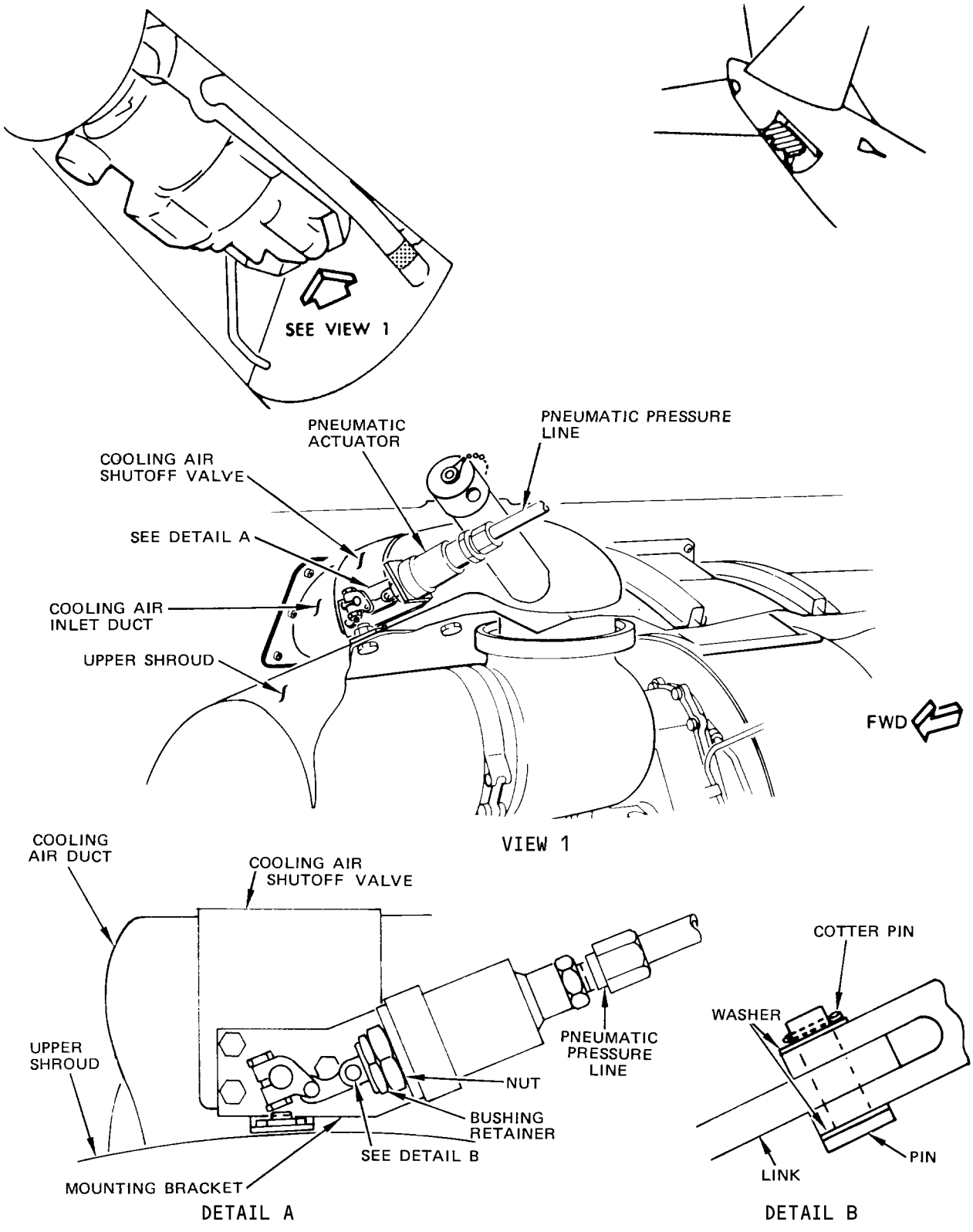
3. Install Pneumatic Actuator (Fig. 401)

A. On airplanes not having access to the valve through the horizontal web above the APU upper shroud, install pneumatic actuator as follows:

(1) Position pneumatic actuator on bracket of cooling air valve body and install washer, nut, teflon bushing retainer. Tighten nuts and lockwire.
(2) Attach link to actuator assembly with pin, washers and cotter pin.
(3) Check operation of valve (Ref. 49-51-21, Adjustment/Test).
(4) Install APU upper shroud (Ref. 49-12-31, Upper Shroud - Removal/Installation).
(5) Install APU power plant (Ref. 49-11-0, APU Power Plant - Removal/Installation).

B. On airplanes having access hole through horizontal web above upper shroud, install pneumatic actuator as follows:

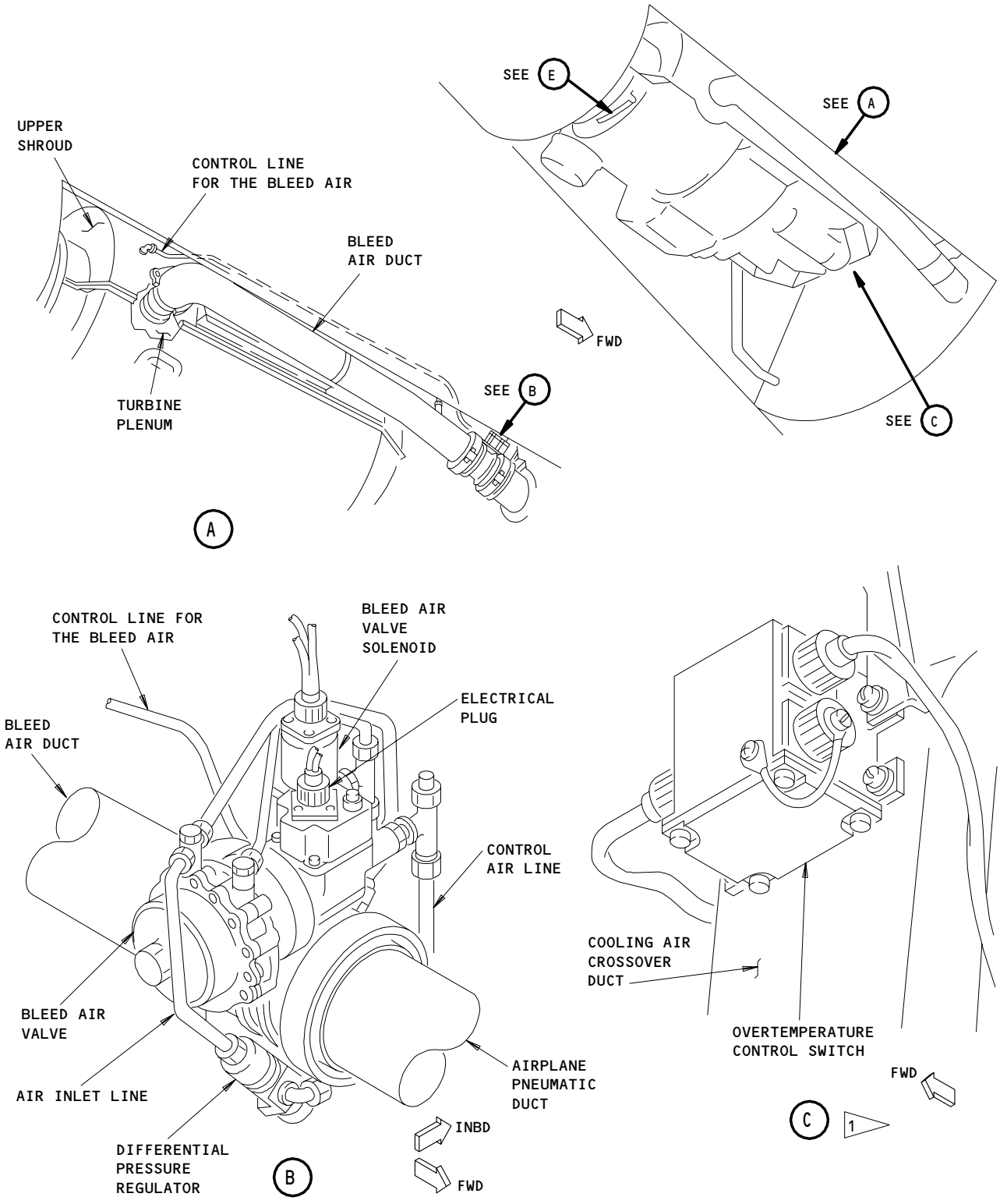
(1) Gain access to horizontal stabilizer jackscrew compartment just aft of pressurized bulkhead.
(2) Position pneumatic actuator on bracket of cooling air valve body and install washers, nut, teflon bushing, and bushing retainer. Tighten nuts and lockwire.
(3) Attach link to actuator assembly with pin, washers and cotter pin.
(4) Connect pneumatic pressure line to pneumatic actuator.
(5) Check operation of valve (Ref. 49-51-21, Adjustment/Test).
(6) Close access door to compartment aft of pressure bulkhead.
(7) Close circuit breaker on M280 module - APU accessory unit on E3-3 electrical shelf.
(8) Close horizontal stabilizer trim control circuit breaker on P6 panel and remove placard.
(9) Position BATTERY SWITCH to ON and rotate horizontal stabilizer trim to neutral position.
(10) Remove placard from APU START SWITCH.
(11) Position BATTERY SWITCH TO OFF if power no longer required.



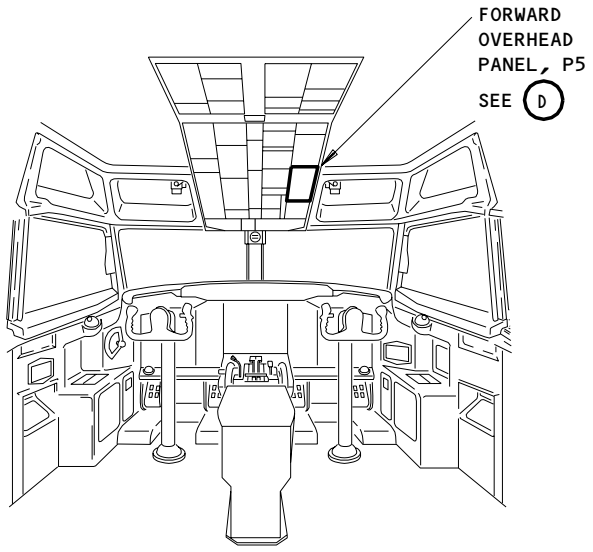
Pneumatic Actuator Installation
Figure 401

APU BLEED AIR SYSTEM - DESCRIPTION AND OPERATION

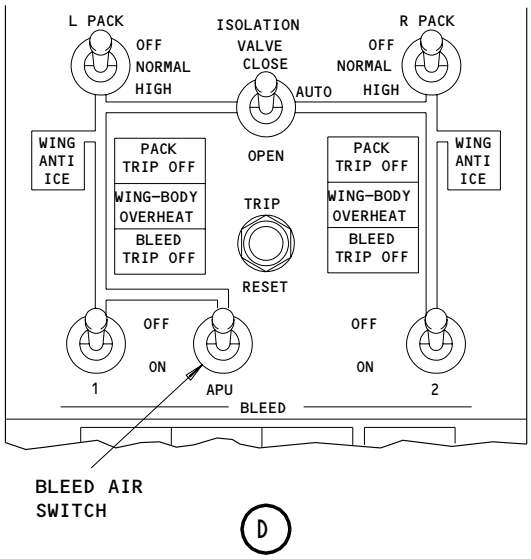
1. General
   A. The bleed air system for the APU supplies the compressed air for the air conditioning system, engine start system, and other pneumatic components of the airplane. The bleed air system also decreases compressor surge when the airplane is in flight and there is no bleed load. The bleed air duct is found in the APU compartment between the upper shroud and the bleed air valve. The bleed air duct is attached to the upper shroud and the bleed air valve with support clamps. The pneumatic line filter for the cooling air shutoff valve and the check valve for the fuel sensing flow control are installed on the bleed air duct. The bleed air system has these components:
      (1) The bleed air duct
      (2) The bleed air valve
      (3) AIRPLANES WITHOUT THE ETC; The APU control thermostat
      (4) AIRPLANES WITH THE ETC; The proportional control valve
      (5) The differential pressure regulator
      (6) The surge bleed valve
2. Bleed Air Valve
   A. The bleed air valve controls the bleed airflow from the APU turbine plenum to the airplane pneumatic ducts. The bleed air valve is installed on the bleed air duct at the front of the APU compartment. The bleed air valve has a main valve, actuator, rate control valve, and switcher valve. A housing contains the main valve. The main valve is a butterfly valve that is usually in the closed position. The housing for the main valve has a port for a control air connection that is upstream of the butterfly valve. The actuator has a spring-loaded diaphragm and a linkage that closes the switcher valve. The switcher valve is a two-ball selector valve that is operated by a solenoid. The switcher valve controls the airflow to the two sides of the actuator diaphragm. One ball of the switcher valve is a check valve for the control air pressure. The other ball is the check valve for the switcher. The rate control valve controls a poppet-valve that is contained in the housing.

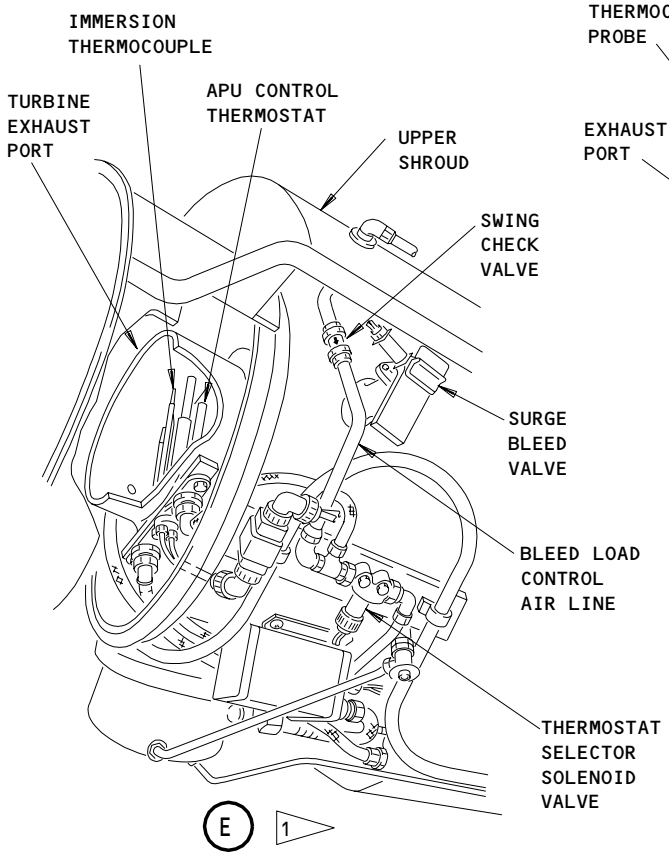


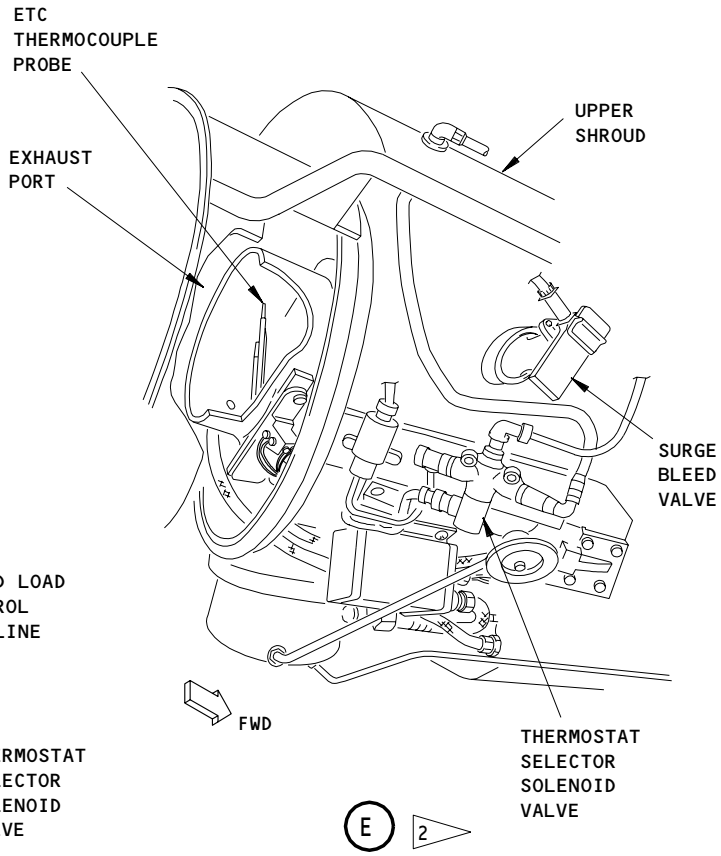
APU Bleed Air System Component Location
Figure 1 (Sheet 1)



FLIGHT COMPARTMENT







1 AIRPLANES WITHOUT THE ETC

2 AIRPLANES WITH THE ETC

APU Bleed Air System Component Location
Figure 1 (Sheet 2)

B. When the APU engine speed is more than 95%, the solenoid for the bleed air valve is energized. When the solenoid for the bleed air valve is not energized, the switcher valve moves the control air to the bottom of actuator diaphragm. This keeps the main valve closed. Control air from upstream of the main valve moves to the two sides of the diaphragm of the rate control valve. The pressure of the two sides of the diaphragm is the same. This keeps the poppet valve closed. When the BLEED AIR switch is moved to the ON position, the solenoid for the bleed air valve is energized. This opens the check valve and closes the switcher valve. Also, the control air from the bottom of the actuator diaphragm moves to the top of the actuator diaphragm and opens the main valve. When the main valve opens, the pressure at the rate control valve will decrease in proportion to the quantity of bleed air from the APU. Since the adjustable orifice keeps to a limit the bleed air from the top of the rate control diaphragm, the rate control diaphragm will move down and open the poppet valve. Control air will bleed from the actuator to control the rate that the main valve opens. Also, this controls how much the main valve opens to prevent an overload on the APU. While the pressure of the control air bleeds from the top of the rate control diaphragm, the poppet valve will close slowly. While the poppet valve closes, the pressure from the control air in the actuator will increase and open the main valve more. When the poppet valve is fully closed, the main valve is fully open. The adjustable orifice is usually set to make the main valve open in 12 to 14 seconds.

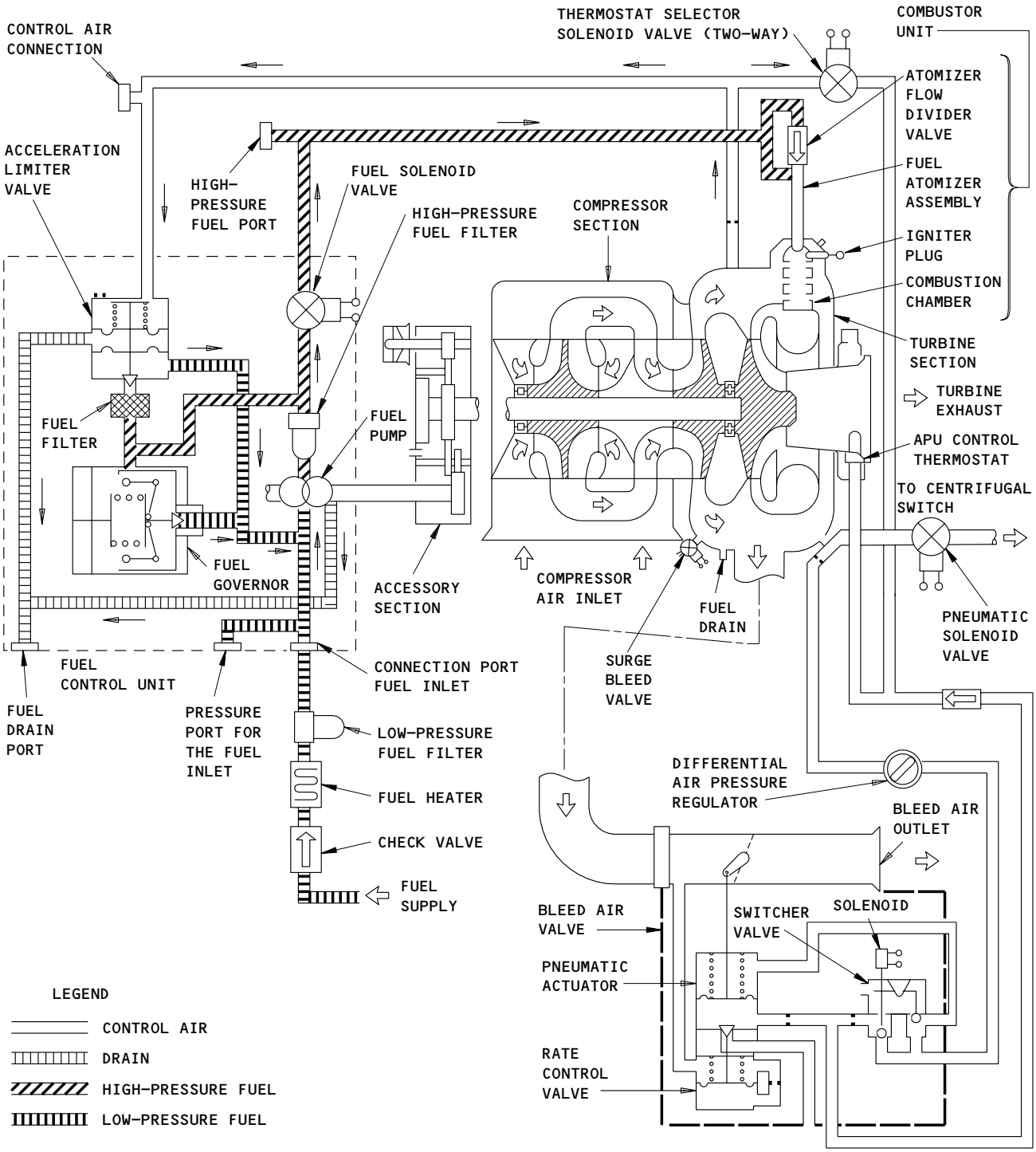
3. APU Control Thermostat (Airplanes without the ETC) (Fig. 1)

A. The APU control thermostat is installed in the turbine exhaust port. The APU control thermostat has a steel housing, spring-loaded ball valve, thermostatic core, and pneumatic line connection. The APU control thermostat is part of a single thermostat control system. The single thermostat control system also has an overtemperature control switch, thermocouple, swing check valve and thermostat selector solenoid valve. The APU control thermostat operates as an acceleration control thermostat and a load control thermostat.

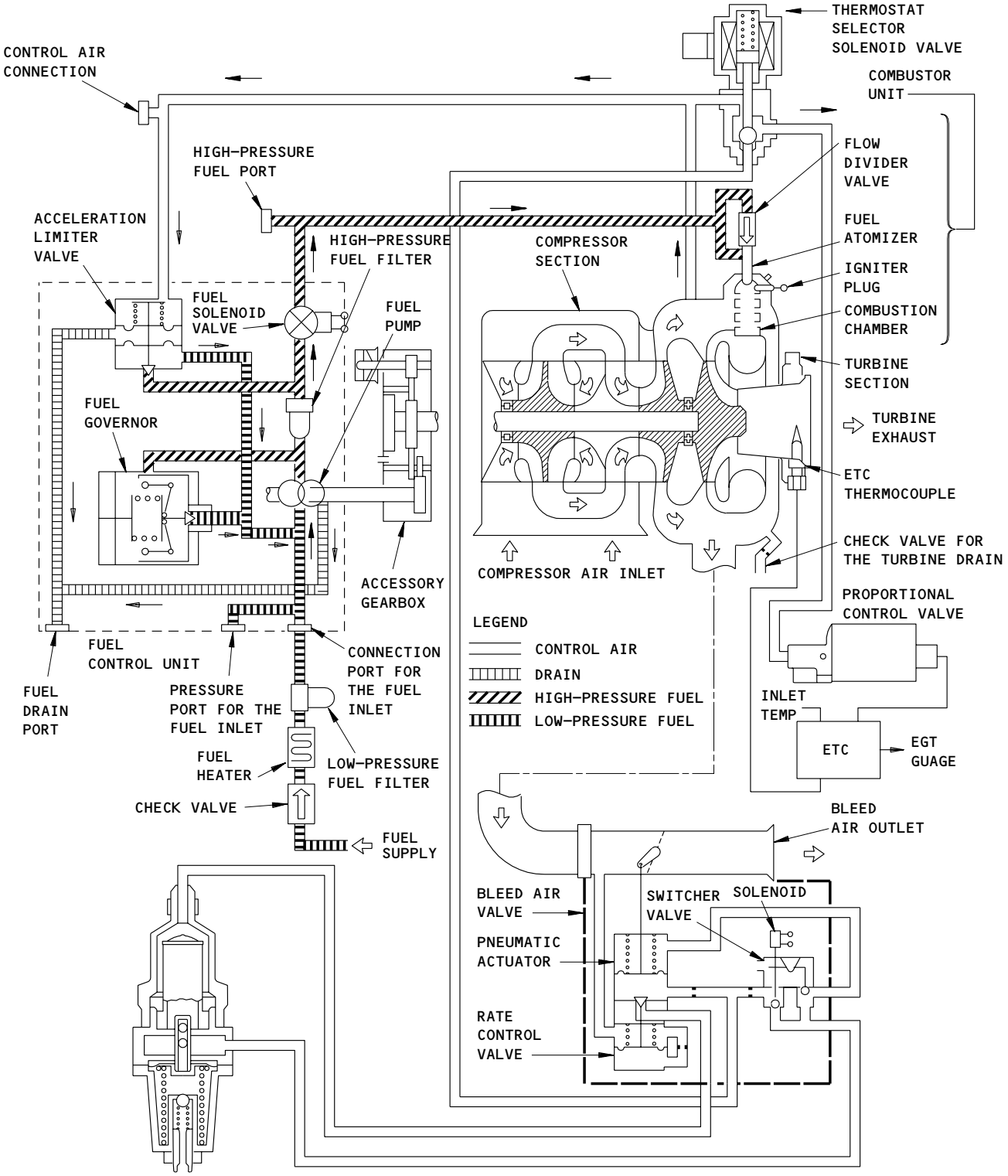
B. When the APU engine speed is less than 95%, the APU control thermostat is an acceleration control thermostat. With the 95% contact in the speed switch open, no electrical power is supplied to the bleed air valve or the thermostat selector solenoid valve. When the APU speed is more than 95%, the APU control thermostat is a load control thermostat. Electrical power is supplied through the overtemperature control switch to the thermostat selector solenoid valve. When the thermostat selector solenoid valve closes, the APU control thermostat operates in the load control mode. In this mode, the APU control thermostat is an overload protection for the APU.

C. The overtemperature control switch in conjunction with the thermocouple provides overtemperature protection for the APU in the load control mode. The thermocouple is mounted in the turbine exhaust port. It comprises four chromel-alumel thermocouples connected in parallel. The overtemperature control switch trip point is set at 704 to 718°C. In the event of an overtemperature (704 to 718°C), the sensing circuit in the overtemperature control switch will de-energize the thermostat selector solenoid and the bleed air valve solenoid. The bleed air valve closes, and the thermostat returns to the acceleration mode. Refer to 49-31-0 for additional information pertaining to thermostat operation in the acceleration mode. With the load removed, the overtemperature switch will reset itself when the EGT drops to a nominal 205°C below the switch trip point. This cycle will repeat until the bleed air switch is turned OFF.

4. Proportional Control Valve (Airplanes with the ETC) (Fig. 2)
   A. The proportional control valve is installed on the bottom of the APU near the turbine exhaust port. The proportional control valve is a part of the electronic temperature control system. The electronic temperature control uses the proportional control valve for overload protection of the APU. During an overload condition, the electronic temperature control sends a signal to the proportional control valve to move the bleed air valve to the closed position. This will remove the pneumatic load from the APU and permit the EGT to decrease. When the EGT decreases, the electronic temperature control sends a signal to the proportional control valve to open the surge bleed valve. For a more detailed description of the electronic temperature control, refer to 49-61-00 D&O.
5. Differential Air Pressure Regulator (Fig. 1)
   A. The differential pressure regulator supplies a constant air pressure to the bleed air valve. This permits the bleed air valve to operate independently of the ambient temperature and ambient pressure. The differential pressure regulator is installed on the bleed air valve. The differential pressure regulator has a cover with an inlet fitting and air filter. Also, the differential pressure regulator has a main housing with a spring-loaded diaphragm assembly, metering valve, and relief valve. The differential pressure regulator is set to approximately 19 psig (131 kPa).
6. Surge Bleed Valve (Fig. 1)
   A. The surge bleed valve is installed on the turbine plenum directly below the bleed air duct. The surge bleed valve operates when the APU engine speed is more than 95%, the airplane is in flight and the bleed air valve is closed. The surge bleed valve prevents a compressor surge at high altitudes.



APU Bleed Air System Schematic
Figure 2 (Sheet 1)



APU Bleed Air System Schematic
Figure 2 (Sheet 2)

7. Operation (Fig. 2)
   A. When the APU engine speed is more than 95%, electrical power is supplied to the circuit for the bleed air valve. With the BLEED AIR switch on the P5 forward overhead panel is in the ON position, the solenoid for the bleed air valve is energized. The bleed air valve will open. With the bleed air valve open, the airplane pneumatic system can use the bleed air from the APU.
   B. AIRPLANES WITH THE ETC: When the airplane pneumatic system uses the bleed air from the APU, the proportional control valve supplies the overload protection for the APU. In an overload condition, the EGT will increase. The proportional control valve will bleed the compressed air from the bleed air valve. The bleed air valve will close and the EGT will decrease.
   C. AIRPLANES WITHOUT THE ETC: When the airplane pneumatic system uses the bleed air from the APU, the APU control thermostat supplies the overload protection for the APU. In an overload condition, the EGT will increase. The APU control thermostat will bleed the compressed air from the bleed air valve. The bleed air valve will close and the EGT will decrease. When the EGT reaches the trip point of the overtemperature switch (704 to 718°C), the sensing circuit in the overtemperature switch will de-energize the thermostat selector solenoid and the bleed air valve solenoid. This causes the bleed air valve to close (removes the load) and switches the thermostat to the acceleration mode. When the EGT drops to nominal 205°C below the switch trip point, the overtemperature switch will reset itself.

BLEED AIR VALVE - REMOVAL/INSTALLATION

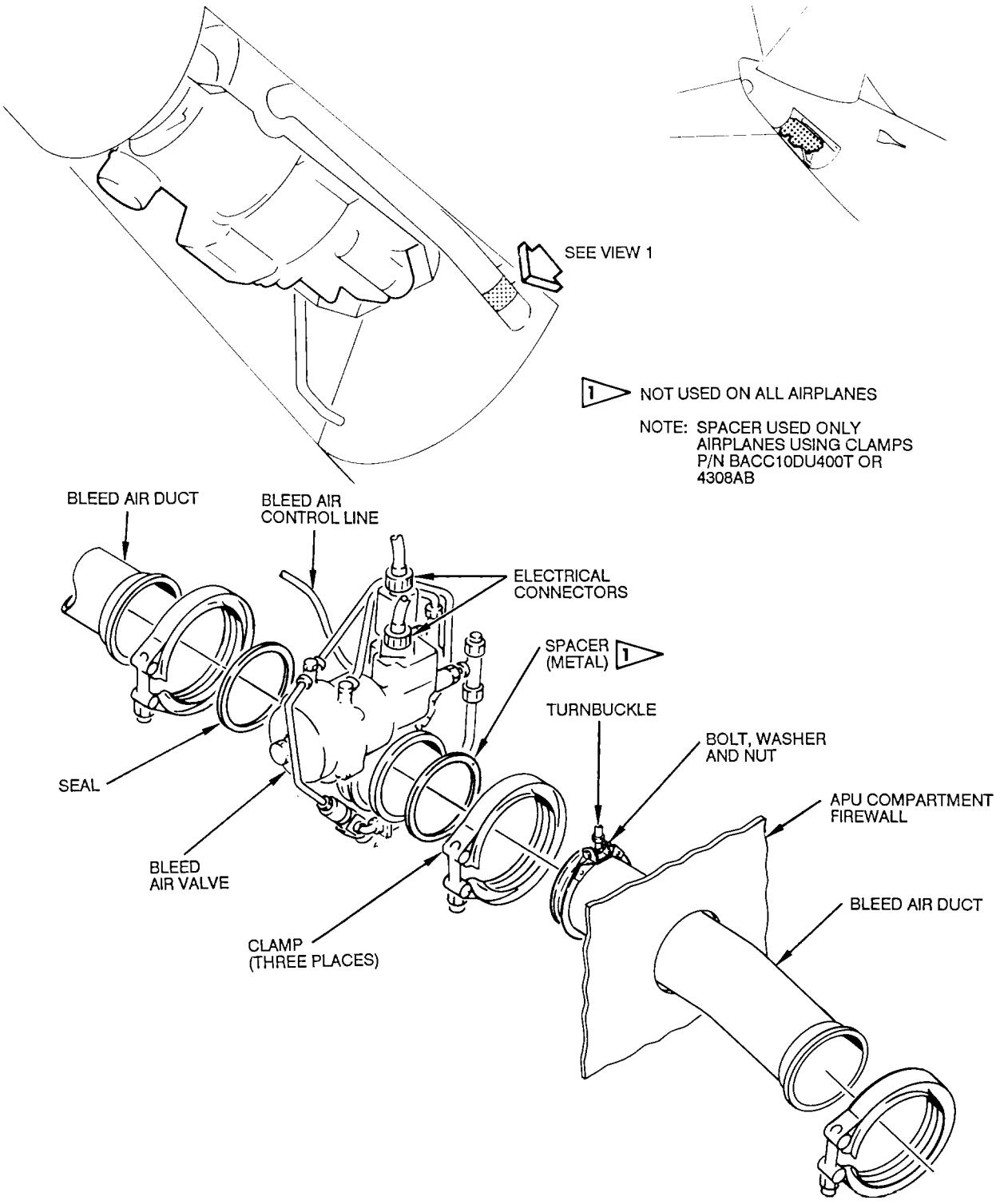
1. Equipment and Materials
   A. Antiseize Compound - Fel-Pro C-5A (AMM 20-30-21/201)
2. Prepare Bleed Air Valve for Removal
   A. Position BATTERY SWITCH and APU MASTER SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open stabilizer trim control circuit breaker on P6 panel and placard that APU maintenance is "in-work".
   D. Open access door 3701, just forward of APU compartment.
   E. Open APU compartment access door latches and open access door.
3. Remove Bleed Air Valve (Fig. 401)
   A. Enter horizontal stabilizer jackscrew compartment, and at station 1075 (approximately), remove clamp from APU bleed air duct.
   B. In APU compartment, on aft side of APU compartment firewall, remove bolt, washer, and nut securing turnbuckle to bleed air duct.
   C. Disconnect electrical connectors from bleed air valve.
   D. Disconnect bleed load control air line from valve.
   E. Disconnect and remove clamps securing bleed air valve to duct.
   F. Remove bleed air valve, seal, and spacer. Save seal and metal spacer for installation, par. 4.

      NOTE: If clamps removed are P/N 4308AG, only a seal is used, and is removed/installed on aft side of valve.

4. Install Bleed Air Valve (Fig. 401)
   A. Install seal in upstream flange of bleed air valve.
   B. Install bleed air valve and spacer between duct flanges.

      NOTE: If clamps installed are P/N 4308AG, no spacer is installed.

   C. Coat threads of clamp bolts with antiseize compound. Install clamps securing valve to flanges, but do not tighten.
   D. Connect bleed load control air line to valve. Rotate valve if necessary to facilitate connection.
   E. Position and secure turnbuckle to hanger clamp on APU bleed air duct with bolt, washer, and nut. Do not tighten at this time.
   F. Enter horizontal stabilizer jackscrew compartment and install clamp securing sections of APU bleed air duct. Torque clamp coupling nut to approximately 50 pound-inches.
   G. In APU compartment, tighten bleed air valve clamp coupling nuts and hanger clamp nut to approximately 50 pound-inches of torque.
   H. Connect electrical plugs to valve and safety wire.



Bleed Air Valve Installation
Figure 401

I. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf and remove placards.
J. Do the APU operation test - LOADED CONDITION (AMM 49-11-0/501).
(1) During the APU operation, examine the clamp joints for leakage.
(2) If you found leakage, repair the cause of it.

5. Restore Airplane to Normal Configuration
A. Close and latch APU compartment access door.
B. Close and latch access door 3701 just forward of APU compartment.
C. Open stabilizer trim circuit breaker on P6 panel and remove placard.
D. Remove placards and position BATTERY SWITCH to OFF if electrical power is no longer required.

BLEED AIR DUCT - REMOVAL/INSTALLATION

1. General
   A. The bleed air duct is found in the APU compartment between the upper shroud and the bleed air valve.
2. Bleed Air Duct Removal (Fig. 401)
   A. Remove the Bleed Air Duct
      (1) Remove the upper shroud (AMM 49-12-31/401).

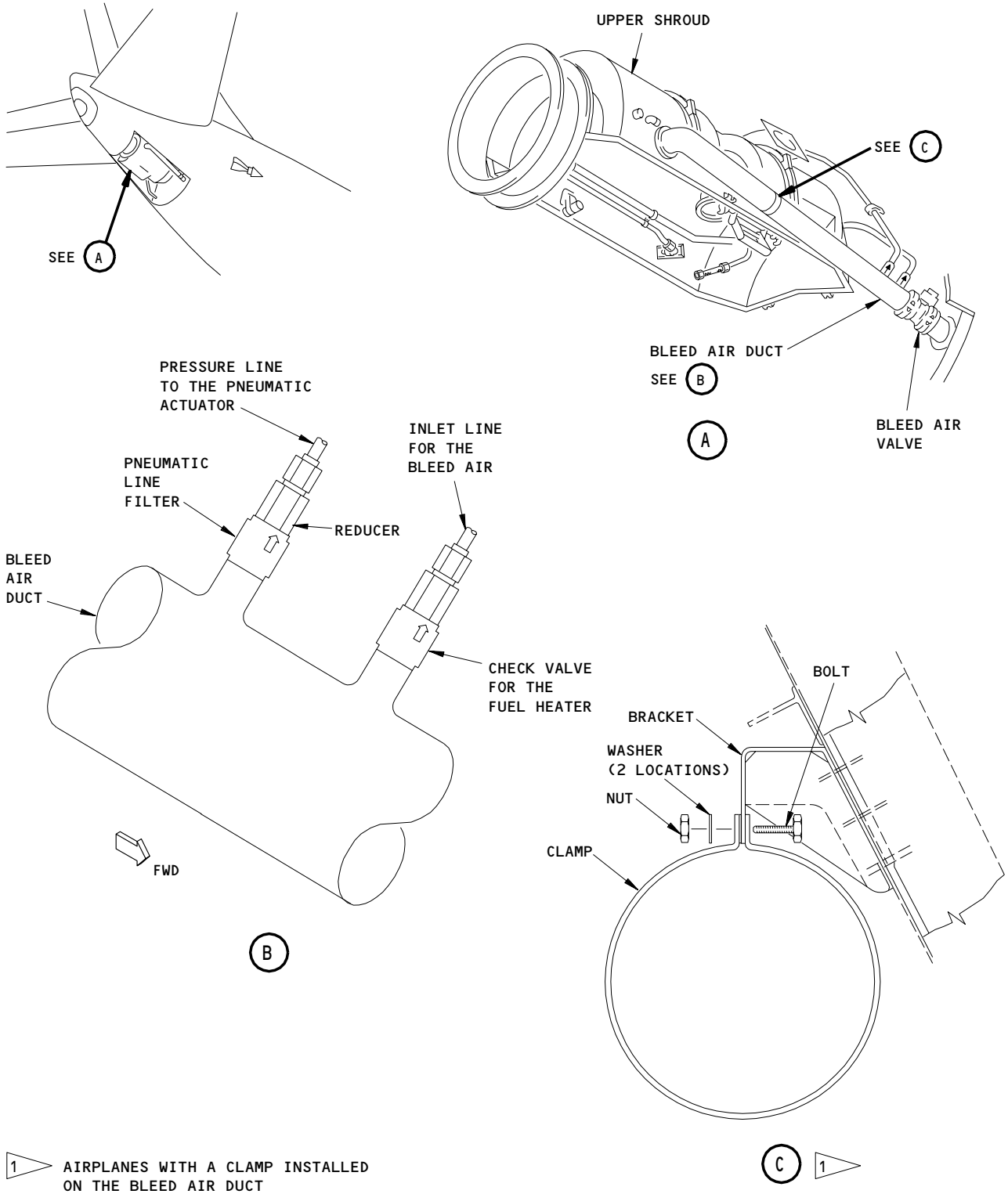
          NOTE: The bleed air duct is disconnected from the upper shroud and the bleed air valve during the upper shroud removal.

      (2) Disconnect the pressure line for the pneumatic actuator from the reducer.
      (3) Remove the bleed air line:
          (a) Disconnect the bleed air line from the check valve for the fuel sensing flow control.
          (b) Remove the bleed air line.
      (4) On airplanes with a clamp installed on the bleed air duct, remove the nut, washers and bolt that attach the clamp to the airplane support bracket.
      (5) Carefully remove the bleed air duct from the APU compartment.
      (6) If the bleed air duct will be replaced, remove these parts:
          (a) Remove the pneumatic line filter for the cooling air shutoff valve (AMM 49-51-22/401).
          (b) Remove the check valve for the fuel sensing flow control (AMM 49-31-93/401).
          (c) On airplanes with a clamp installed on the bleed air duct, remove the clamp.
3. Bleed Air Duct Installation (Fig. 401)
   A. Install the Bleed Air Duct
      (1) If a new bleed air duct will be installed, install these parts:
          (a) On airplanes with a clamp installed on the bleed air duct, put the clamp on the bleed air duct.
          (b) Install the check valve for the fuel sensing flow control (AMM 49-31-93/401).

              NOTE: Do not connect the bleed air line to the check valve at this time.

          (c) Install the pneumatic line filter for the cooling air shutoff valve (AMM 49-51-22/401).

              NOTE: Do not connect the pressure line for the pneumatic actuator to the reducer at this time.



Bleed Air Duct Installation
Figure 401

(2) Install the bleed air duct and temporarily secure bleed air duct to the APU compartment.
(3) On airplanes with a clamp installed on the bleed air duct, install the clamp to the airplane support bracket with the bolt, washers and nut.
(4) Connect the bleed air line to the check valve for the fuel sensing flow control.
(5) Connect the pressure line for the pneumatic actuator to the reducer.
(6) Install the upper shroud (AMM 49-12-31/401).

NOTE: The bleed air duct is connected to the upper shroud and the bleed air valve during the upper shroud installation.

DIFFERENTIAL AIR PRESSURE REGULATOR - UNIT SERVICING

1. Equipment and Materials
   A. Solvent - B00062 Acetone, Turco
   B. Grease - MIL-G-6032
   C. Grease - Sealube (473-001-9001)
2. Prepare for Differential Air Pressure Regulator Unit Servicing
   A. Position battery switch and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
3. Service Differential Air Pressure Regulator Filter (Fig. 301)
   A. Remove regulator air inlet line clamp.
   B. Remove regulator air inlet line from regulator and from bleed air valve.
   C. Remove cover from regulator housing and remove filter.
   D. Remove lock-o-seal (including retaining washer) and packing from regulator housing.

      WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

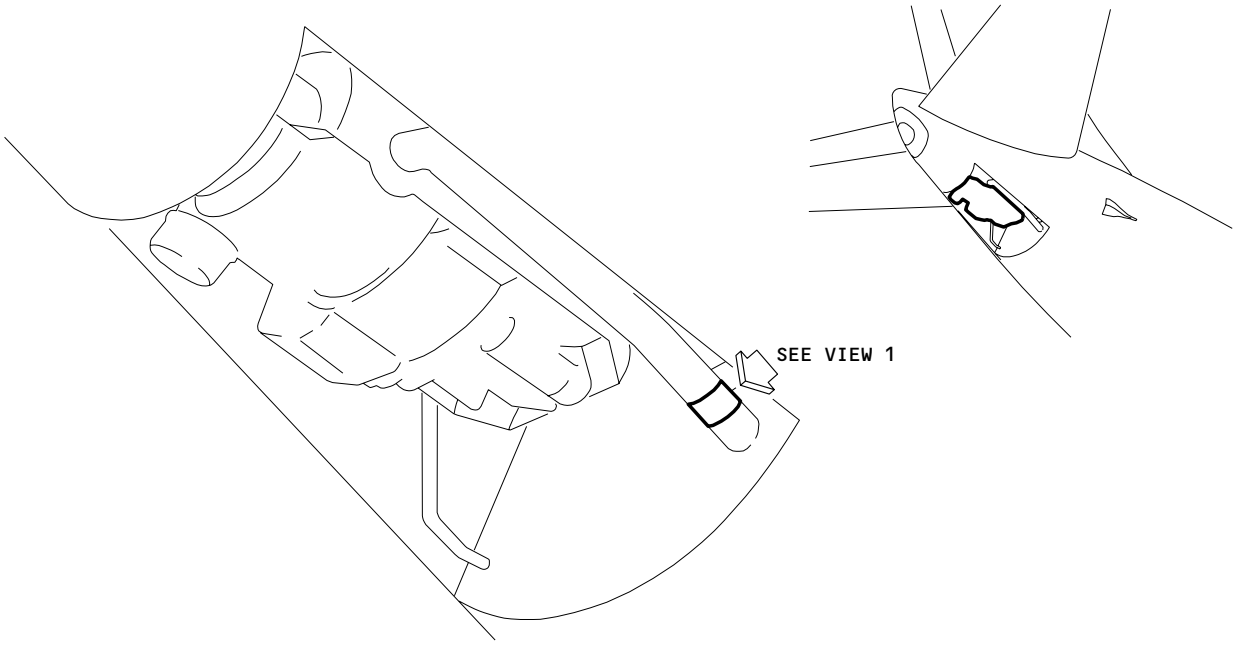
   E. Clean filter element using Turco Transpo. Wash filter in acetone and dry with clean compressed air.

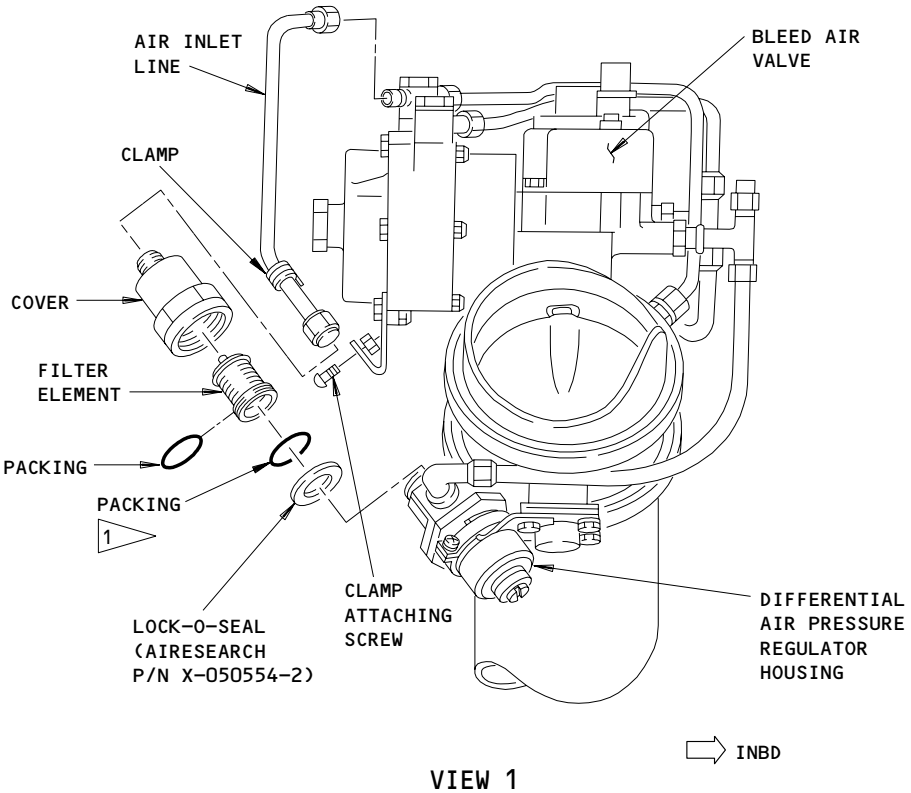
      NOTE: Older filter elements are threaded at the base; condition of threads for these elements is not significant as the threads are not used in this application.

   F. Coat external threads of air pressure regulator housing with grease.
   G. Install new lock-o-seal (including retaining washer) and new packing in regulator housing.

      CAUTION: ENSURE THAT THE CORRECT CONFIGURATION OF PACKING(S) IS USED OR DAMAGE TO FILTER ELEMENT COULD RESULT. DIFFERENTIAL AIR PRESSURE REGULATOR P/N 108032-3, USES TWO PACKINGS; P/N 108032-8 AND ON, USES ONE PACKING (FIG. 301).

   H. Position filter in cover with new packing(s); install cover on regulator housing and tighten to torque value of 75 to 85 pound-inches.





VIEW 1

1 LIMITED USEAGE

Differential Air Pressure Regulator Unit Servicing
Figure 301

I. Install regulator air inlet line to regulator and to bleed air valve.

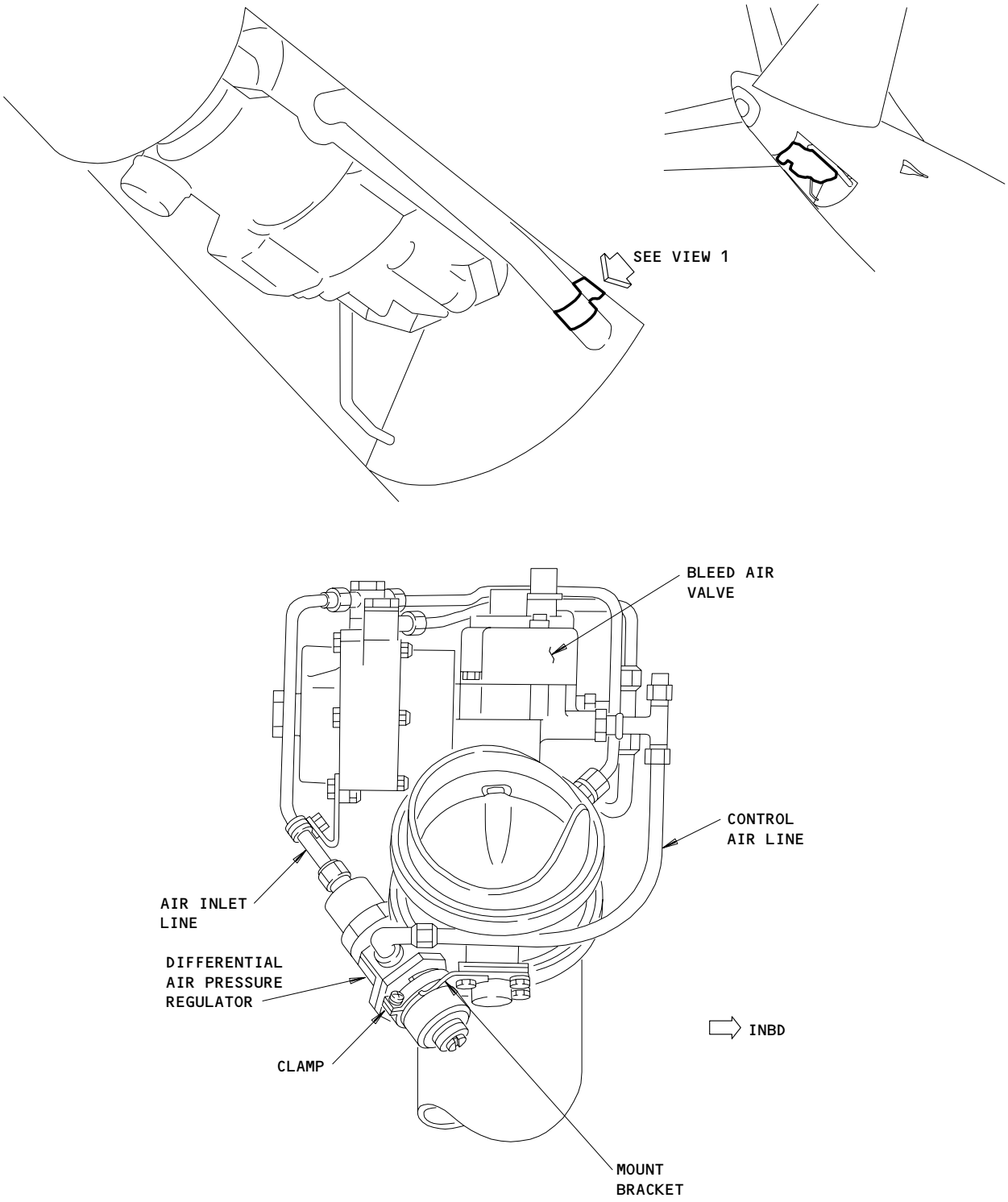
CAUTION: LIMIT TORQUE ON REGULATOR AIR INLET LINE TO 65 POUND-INCHES OR FITTING MAY SHEAR FROM FILTER COVER.

J. Install regulator air inlet line clamp.
K. Test Differential Air Pressure Regulator (Ref Adjustment/Test).

4. Restore Airplane to Normal Configuration
   A. Close and latch APU compartment access door.
   B. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Remove placard and position battery switch and APU master switch to ON.

DIFFERENTIAL AIR PRESSURE REGULATOR - REMOVAL/INSTALLATION

1. Prepare for Differential Air Pressure Regulator Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
2. Remove Differential Air Pressure Regulator (Fig. 401)
   A. Disconnect regulator air inlet line from regulator.
   B. Disconnect constant pressure control air line from regulator.
   C. Remove clamp attaching regulator to mount bracket on bleed air valve and remove regulator.
3. Install Differential Air Pressure Regulator (Fig. 401)
   A. Position regulator on mount bracket on bleed air valve and install attaching clamp.
   B. Connect air inlet line to regulator.
   C. Connect constant pressure control air line to regulator.
   D. Test differential air pressure regulator (Ref Adjustment/Test).
4. Restore Airplane to Normal Configuration
   A. Close and latch APU compartment access door.
   B. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Position BATTERY SWITCH to ON and remove placards.



VIEW 1

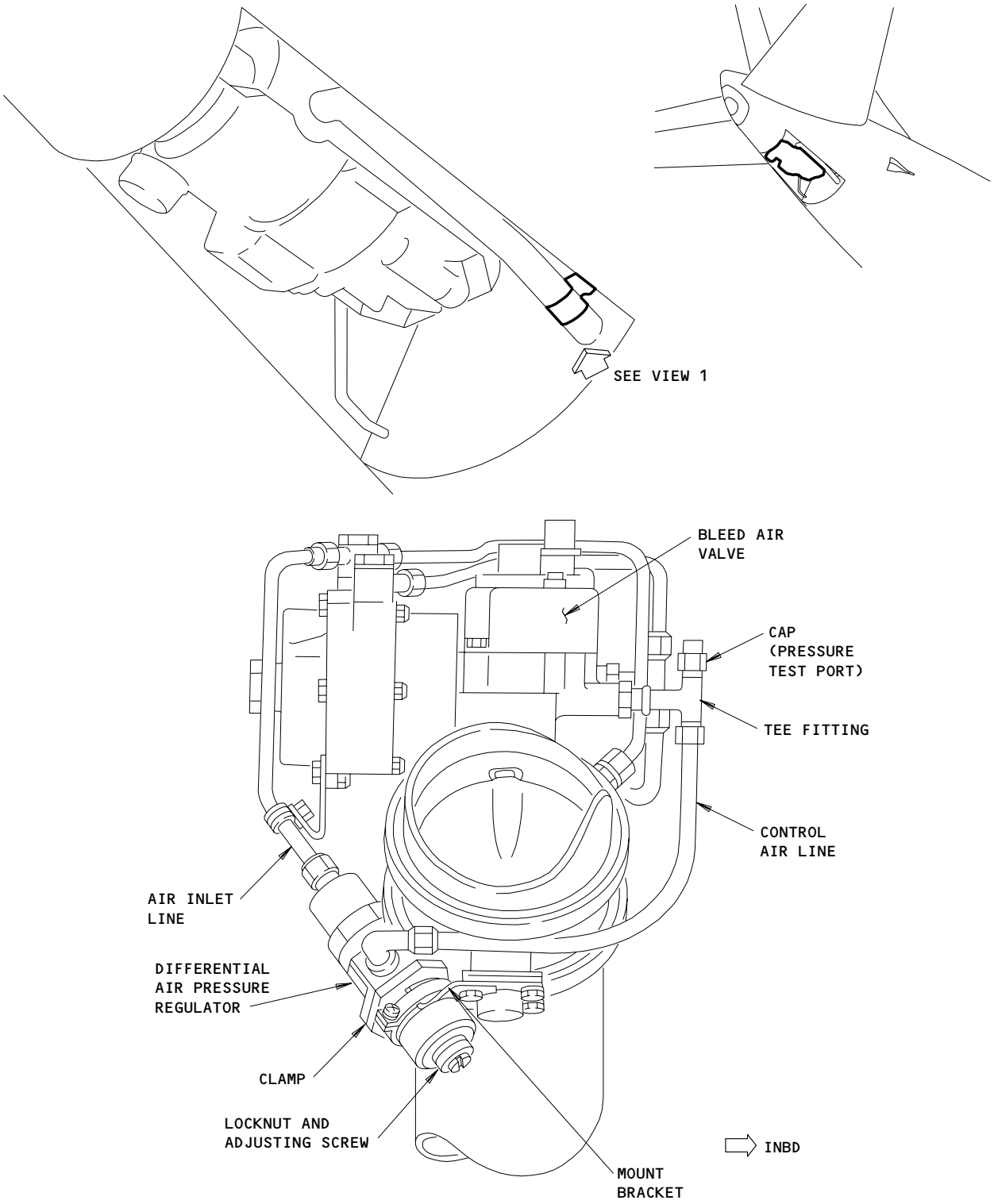
Differential Air Pressure Regulator Installation
Figure 401

DIFFERENTIAL AIR PRESSURE REGULATOR - ADJUSTMENT/TEST

1. General
   A. An operational check of the differential air pressure regulator should be made if any one of the following occurs: (1) the regulator was disassembled for cleaning; (2) the regulator was removed and replaced; or (3), the bleed air valve was removed and replaced.
2. Equipment and Materials
   A. Pressure gage - 60 or 100 psi
   B. Suitable length of flexible air hose and fittings
3. Test Differential Air Pressure Regulator
   A. Remove cap from tee fitting at bleed air valve (Fig. 501).
   B. Attach flexible air line with pressure gage to tee fitting.
   C. Operate APU (Ref 49-11-0, Engine Start Procedure).

      NOTE: Allow engine to accelerate to no-load steady state rpm.

   D. Observe pressure indicated on air pressure gage. Pressure should be 18.5 to 19.5 psi.
   E. If pressure is not within specified limits, shut down engine and adjust air pressure regulator as follows:
      (1) Loosen locknut and adjust.
         (a) Turn adjusting screw clockwise to increase outlet pressure.
         (b) Turn adjusting screw counterclockwise to decrease outlet pressure.
      (2) Tighten locknut and repeat steps C thru E.
   F. If pressure is within specified limits, shut down engine.
   G. Remove flexible air line with pressure gage from tee fitting and reinstall cap.



VIEW 1

Differential Air Pressure Regulator Installation
Figure 501

APU CONTROL THERMOSTAT - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Antiseize Compound - Fel-Pro C-5A, Felt Products Corp., Skokie, Illinois
2. Prepare for Thermostat Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Thermostat (Fig. 402)
   A. Disconnect control air line from thermostat.

      CAUTION: HOLD THERMOSTAT HEX FITTING WITH WRENCH WHEN REMOVING CONTROL AIR LINE.

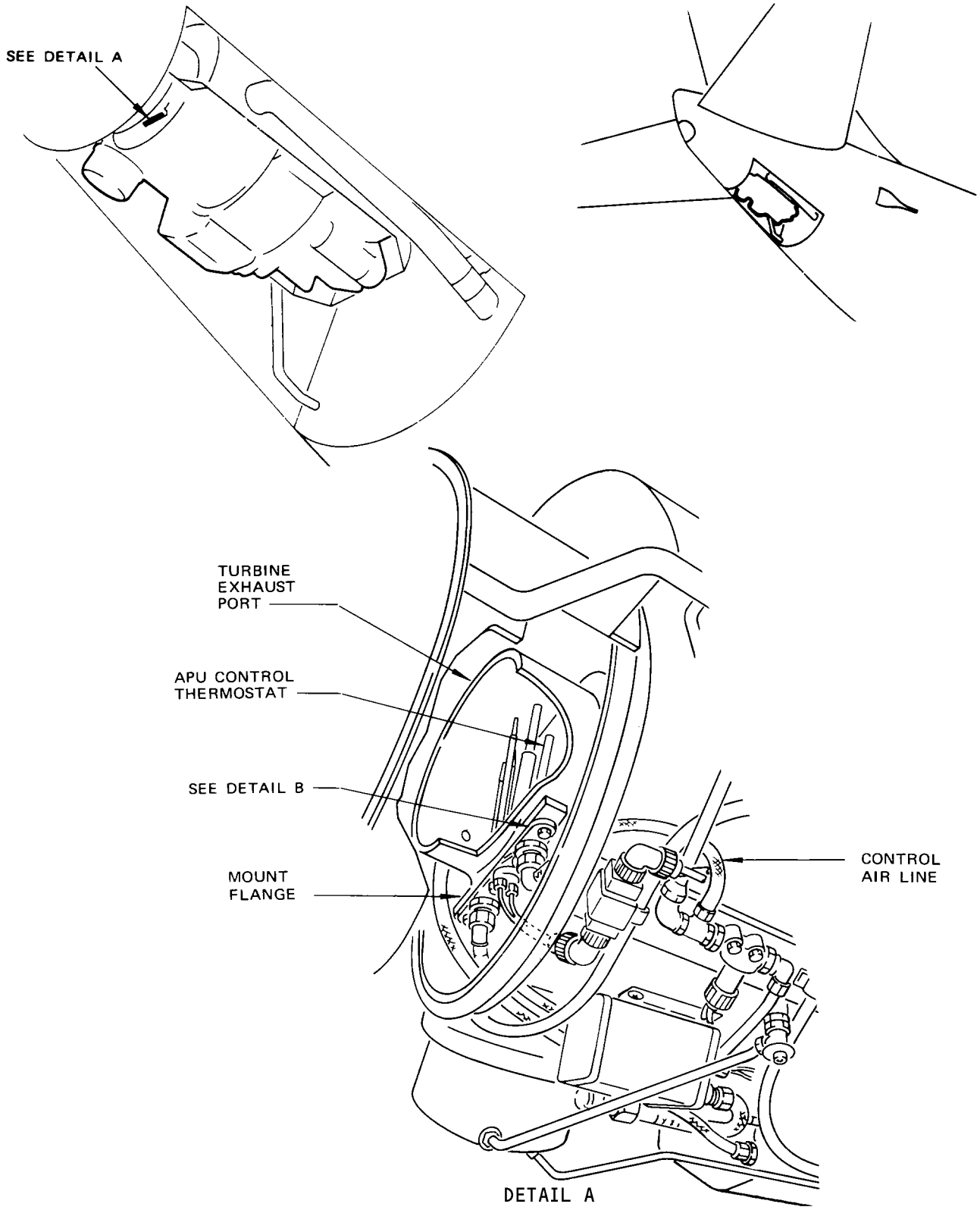
   B. Remove retainer attaching bolt, washer, and retainer.
   C. Remove thermostat in a straight line from mount flange.
   D. Remove shim washers.
4. Install Thermostat (Fig. 402)
   A. Install control thermostat in exhaust flange assembly with word AFT directed toward rear of engine. Install thickness of washers, as required, to obtain a 0.010- to 0.020-inch pinch fit between plate and boss on exhaust flange assembly.
   B. Position retainer with two washers on thermostat.
   C. Coat threads of retainer bolt with antiseize compound; install bolt with washer. Tighten bolt to torque range of 50 to 70 pound-inches.
   D. Connect control air line to thermostat.

      CAUTION: HOLD THERMOSTAT HEX FITTING WITH WRENCH WHEN INSTALLING CONTROL AIR LINE TO PREVENT SETTING CHANGE AND DAMAGE TO THERMOSTAT.

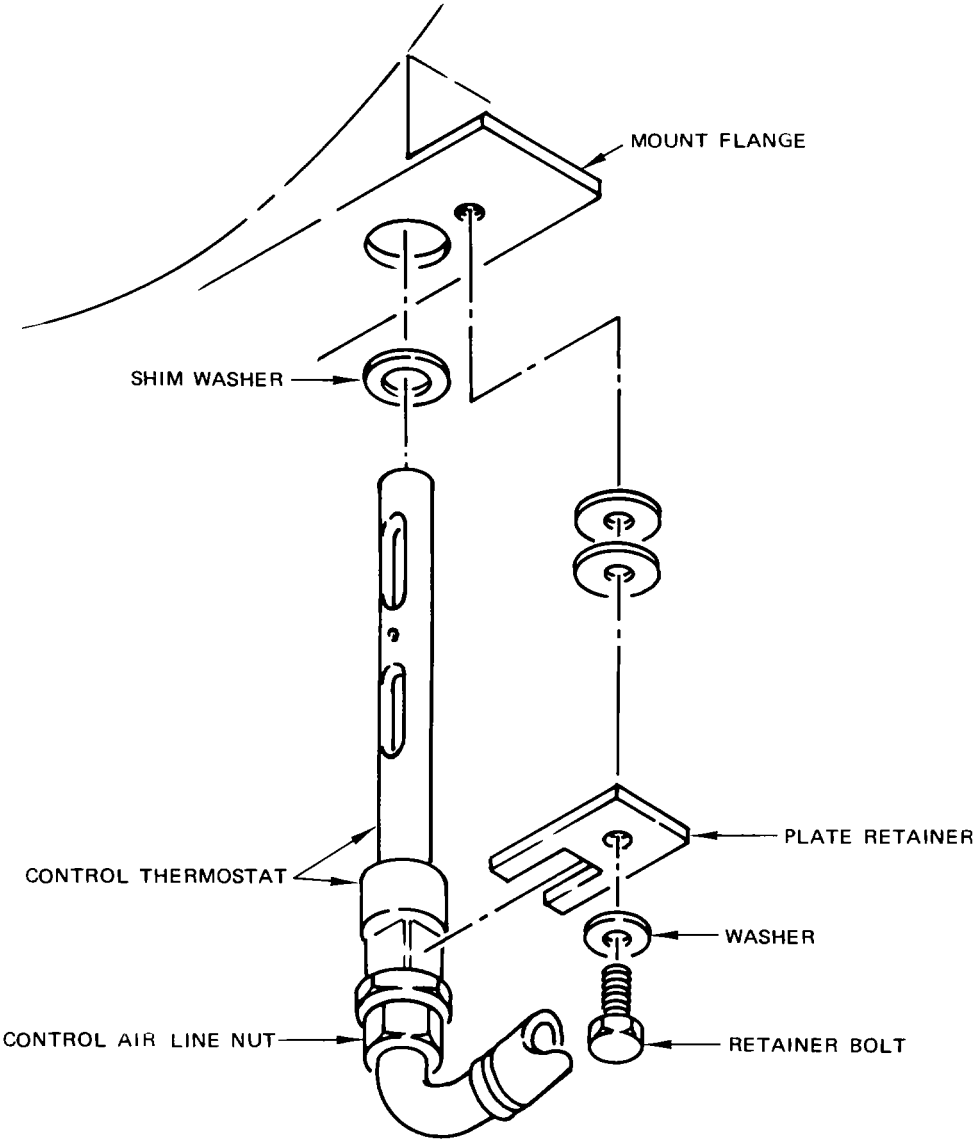
   E. Test thermostat (Ref Adjustment/Test).
5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
D. Position BATTERY SWITCH to ON and remove placard.



APU Control Thermostat Installation
Figure 401



DETAIL B

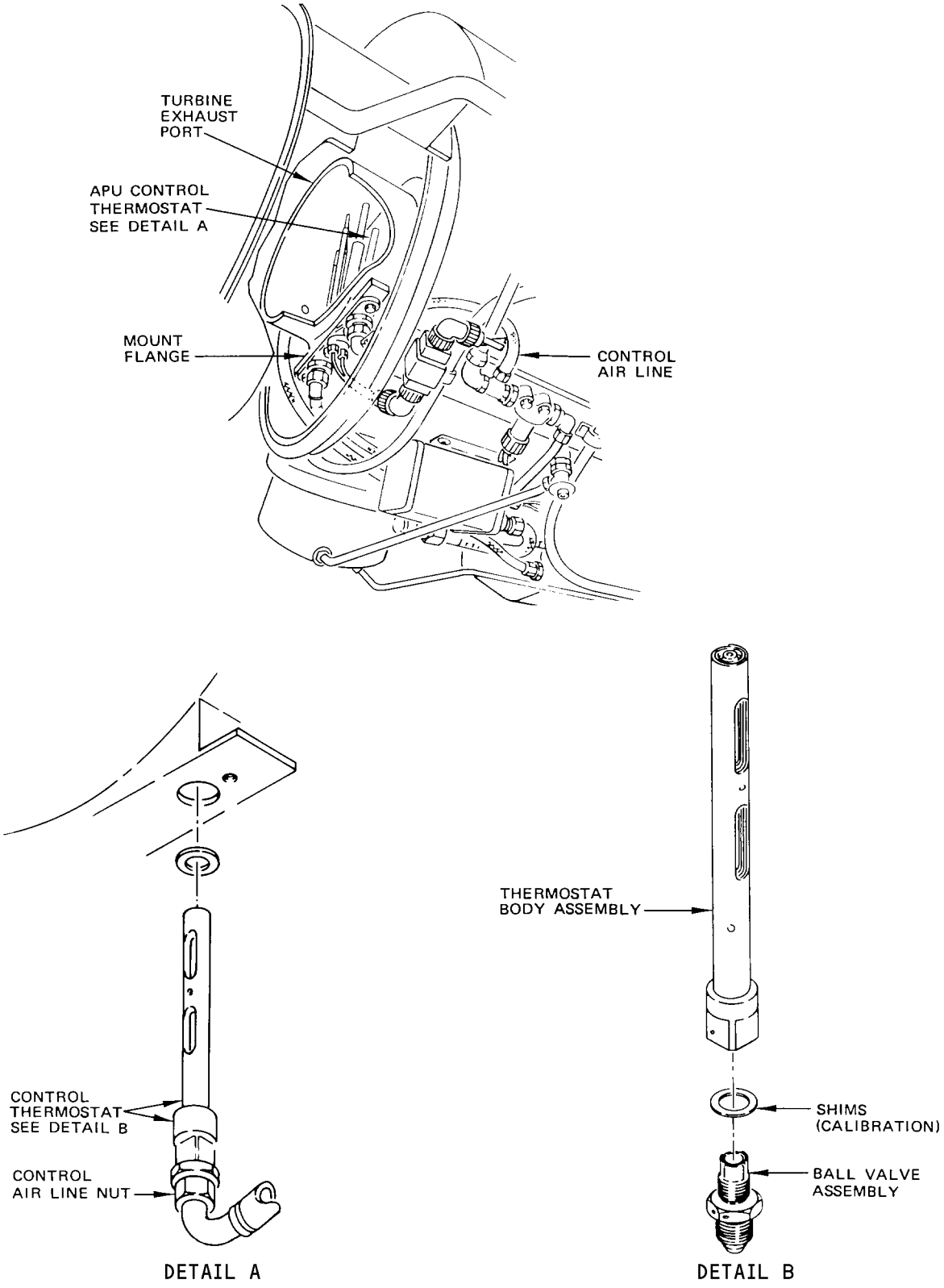
Bleed Load Control Thermostat Installation
Figure 402

APU CONTROL THERMOSTAT - ADJUSTMENT/TEST

1. General
   A. These test procedures apply to the APU control thermostat used in the single thermostat control system. After installation of a new control thermostat, operate APU, both air conditioning packs, and observe EGT and bleed duct pressure. If EGT is not within the range of 620°C (1148°F) and 650°C (1202°F), the thermostat should be adjusted.
   B. There are two adjustment/test procedures for the APU control thermostat. The first procedure uses the airplane instrumentation. The second procedure uses the thermostat calibration kit. You can use one of the two tests to adjust the APU control thermostat.
2. Equipment and Materials
   A. Shim - AlliedSignal, Inc. part numbers 99867-1 thru 99867-12 and 99867-82 thru 99867-91; shim as necessary
   B. Micrometer - 0-1 inch
   C. Torque wrench - 0 to 200 pound-inches
   D. Thermostat Calibration Kit - 834698-1, Griffith Enterprises, 300 East Cherry, Cottonwood, AZ 86326 (test using thermostat calibration kit)
   E. Thermostat Calibration Kit - 290417-2-1, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170 (This is an alternative to the thermostat calibration kit 834698-1.)
   F. Thermostat Calibration Kit - 833657-1, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170 (This is an alternative to the thermostat calibration kit 834698-1.)
3. Prepare to Test APU Control Thermostat (Using Airplane Instrumentation)
   A. If it is necessary, do the two tests of the APU EGT indicating system (AMM 49-71-0/501) to make sure the APU EGT indicator is serviceable.
   B. Operate APU (AMM 49-11-0/201).
   C. Observe airplane EGT and duct pressure indicator.
      (1) Position APU BLEED switch (located on the P5 forward overhead panel) to ON.
      (2) Position engines 1 and 2 BLEED switches (located on the P5 forward overhead panel) to OFF.
      (3) Position ISOLATION VALVE switch to AUTO.
      (4) Position L PACK switch to ON and note pneumatic pressure.
      (5) Position R PACK switch to ON and allow EGT to stabilize.

          NOTE: APU bleed air valve should be modulating towards closed position. Verify by observing an appreciable drop in APU bleed duct pressure after inclusion of the second pack.

      (6) Record EGT. If EGT is not within range of 620°C (1148°F) and 650°C (1202°F), thermostat should be replaced or removed, adjusted and reinstalled.



APU Control Thermostat
Figure 501

4. Prepare to Adjust APU Control Thermostat (Using Thermostat Calibration Kit)

NOTE: Prior to performing check and calibration procedure for the APU control thermostat, make sure the outlet pressure for the air pressure regulator is within the limits (AMM 49-52-21/501). A high outlet pressure will, in effect, increase the thermostat setting; a low output pressure will, in effect, decrease the thermostat setting.
For extended APU service life, the EGT set-point is set at the lower EGT limit range of 580-600°C (1076-1112°F). A lower EGT set-point may cause main engine start problems. A higher EGT set-point will correct the main engine start problems. The EGT set-point must not be more than 650°C (1202°F). The recommended EGT limit range is 620-650°C (1148-1202°F).

A. Remove the EGT thermocouple probe (AMM 49-71-21/401).
B. Install the test thermocouple:
   (1) Install the test thermocouple from the thermocouple calibration kit.
   (2) Connect the test thermocouple cable to the calibration kit.
C. Do a check of the set-point for the thermostat temperature control and the control time for the rate of the load control valve:
   (1) Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   (2) Set the BATTERY SWITCH to the ON position.
   (3) With one person in the cockpit and one person monitoring the indicator on the calibration kit, operate the APU (AMM 49-11-0/201):
      (a) Let the APU become stable for 1 to 2 minutes with no load applied.
      (b) Record the EGT indication from the EGT indicator in the cockpit.
   (4) Set the L PACK and R PACK valve switches to the ON position.
   (5) Make sure the engines 1 and/or 2 BLEED switches on the P5 forward overhead panel are in the OFF position.
   (6) Set the ISOLATION VALVE switch to the AUTO position.
   (7) Set the APU BLEED AIR valve switch to the ON position.
   (8) Set the cabin temperature selector to the MANUAL COLD position until the air mix valves indicate COLD.
   (9) Incrementally put an electrical load of 60 amps on the APU electrical generator.
   (10) Let the EGT become stable for 1 to 2 minutes.

(11) Monitor the temperature indicator in the calibration kit to see when the EGT becomes stable.
  (a) This temperature is the control temperature of the thermostat and must be between 620-650°C (1148-1202°F).

NOTE: This temperature must not be more than 650°C (1202°F).

(12) Set the L PACK and R PACK valve switches to the OFF position.
(13) Set the cabin temperature selector to the OFF position.
(14) Set the APU BLEED AIR valve switch to the OFF position.
(15) Set the ISOLATION VALVE switch to the CLOSE position.
(16) Remove the electrical load of 60 amps from the electrical generator.
(17) Let the APU become stable for 1 to 2 minutes with no load applied.
(18) Set the APU master switch to the OFF position.
(19) If EGT in step (11) was not met, adjust APU control thermostat per par. 6.

5. Adjust APU Control Thermostat (Using Airplane Instrumentation) (Fig. 501)
  A. Remove APU control thermostat (AMM 49-52-31/401).
  B. Adjust thermostat as follows:
    (1) Remove ball valve assembly from thermostat body assembly.
    (2) Remove and measure total thickness of shim stack, using a micrometer.
    (3) Determine the total thickness of shim stack required to adjust thermostat to crack (bleed air) so that engine operating EGT will be within 620°C (1148°F) - 650°C (1202°F).

NOTE: The thermostat crack point is changed approximately 17°C (63°F) with each 0.001-inch change in the total thickness of thermostat shim stack. Removing shims raises the crack point, adding shims lowers the crack point.

NOTE: The following procedure may be used as an example:
If thickness of shim stack is 0.068 inch and observed EGT reading is 34°C (93°F) below 620°C (1148°F) subtract 0.002 inch from the 0.068-inch shim stack to obtain total thickness required. Select from available shim sizes the required 0.066-inch thickness.

    (4) Reinstall thermostat ball valve assembly into thermostat body and tighten to 150-175 pound-inches.

NOTE: Do not overtorque ball valve assembly and thermostat body. Overtorquing can cause EGT to again be out of required range.

    (5) Reinstall thermostat (AMM 49-52-31/401).

C. Do this procedure: Prepare to Test APU Control Thermostat (Using Airplane Instrumentation) per par. 3. If the thermostat is still out of limits repeat par. 5.

6. Adjust APU Control Thermostat (Using Thermostat Calibration Kit) (Fig. 501)
   A. If the control temperature of the APU control thermostat is not in the limits, adjust the thermostat:
      (1) Remove the APU control thermostat (AMM 49-52-31/401).
      (2) Remove the ball valve assembly from the thermostat.
      (3) Remove and measure the total thickness of the shim stack with a micrometer.
      (4) Determine the total thickness of the shim stack that is necessary to adjust the thermostat to crack (bleed air) to get an EGT indication between 620-650°C (1148-1202°F).

          NOTE: The crack point for the thermostat is changed approximately 17°C (63°F) with each 0.001 inch change in the total thickness of the shim stack. Removing the shims will raise the crack point for the thermostat. Adding the shims will lower the crack point for the thermostat.
          The following procedure may be used as an example: If the thickness of the shim stack is 0.068 inch and the EGT indication is 34°C (93°F) below 620°C (1148°F), subtract 0.002 inch from the thickness of the shim stack. The thickness of the shim stack must be 0.066 inch. Get the necessary shim sizes for this thickness.

      (5) Install the ball valve assembly to the thermostat.
      (6) Tighten the ball valve assembly to 150-175 pound-inches.

          NOTE: Do not overtighten the ball valve assembly to the thermostat. Overtightening can cause the calibration of the thermostat to move out of the EGT indication range.

      (7) Install the APU control thermostat (AMM 49-52-31/401).
   B. Do this procedure: Prepare to Adjust Control Thermostat (Using Thermostat Calibration Kit) per par. 4 and the above step if it is necessary to correctly adjust the control temperature.

7. Test and/or Adjust EGT Indicating System (Using Thermostat Calibration Kit)
   A. Remove the test thermocouple:
      (1) Disconnect the test thermocouple from the calibration kit.
      (2) Remove the test thermocouple from the APU.
      (3) Install the EGT thermocouple probe (AMM 49-71-21/401).
   B. Operate the APU (AMM 49-11-0/201):
      (1) Let the APU become stable for 1 to 2 minutes with no load applied.
      (2) Record the EGT indication from the EGT indicator in the cockpit.

(3) Compare the EGT indication from step 4.C.(3)b) and step 7.B.(2).
(4) If the difference of the two EGT indications is more than 5°C (41°F), do the adjustment/test of the EGT indicating system (AMM 49-71-0/501).

8. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Position BATTERY SWITCH to OFF and remove placard.
   E. Position engines 1 and 2 BLEED switches to ON.

PROPORTIONAL CONTROL VALVE - REMOVAL/INSTALLATION

1. General
   A. This procedure contains the removal and the installation tasks for the proportional control valve (PCV).
   B. The PCV is on the bottom right side of the APU, above the ignition unit. You can get access to the valve through the APU cowl door.
2. Proportional Control Valve (PCV) Removal (Fig. 401)
   A. Prepare to Remove the PCV
      (1) Set the switch and the circuit breaker:
         (a) Set the APU master switch, on the P5 overhead panel, to the OFF position and attach a DO-NOT-OPERATE tag.
         (b) Open this circuit breaker and attach DO-NOT-CLOSE tag:
            1) E3-3 Electrical Shelf, APU Control Unit
      (2) Open the APU cowl door:
         (a) Open the latches for the APU cowl door.
         (b) Open the APU cowl door.
         (c) Connect the door support rods.
      (3) Remove the lower shroud:

         CAUTION: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

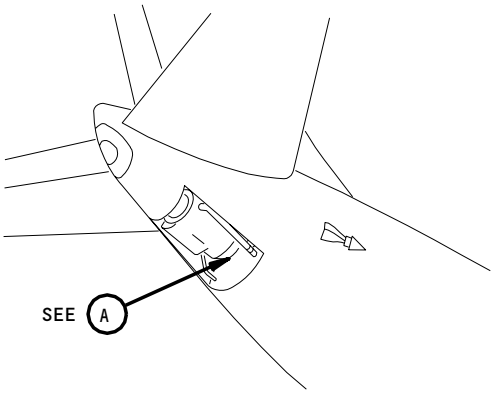
         (a) Hold the lower shroud and open the shroud latches.
         (b) Remove the lower shroud.
   B. Remove the PCV:
      (1) Disconnect the electrical connector from the PCV.
      (2) Disconnect the control air line from the PCV.
      (3) Remove the two bolts and the washers that attach the PCV to the bracket.
      (4) Remove the PCV from the bracket.
3. Proportional Control Valve (PCV) Installation (Fig. 401)
   A. Install the PCV:
      (1) Put the PCV in its position on the bracket.
      (2) Install the two bolts and the washers that attach the PCV to the bracket.
      (3) Connect the control air line to the PCV.
      (4) Connect the electrical connector to the PCV.
   B. Restore the Airplane to Normal Configuration
      (1) Install the lower shroud:

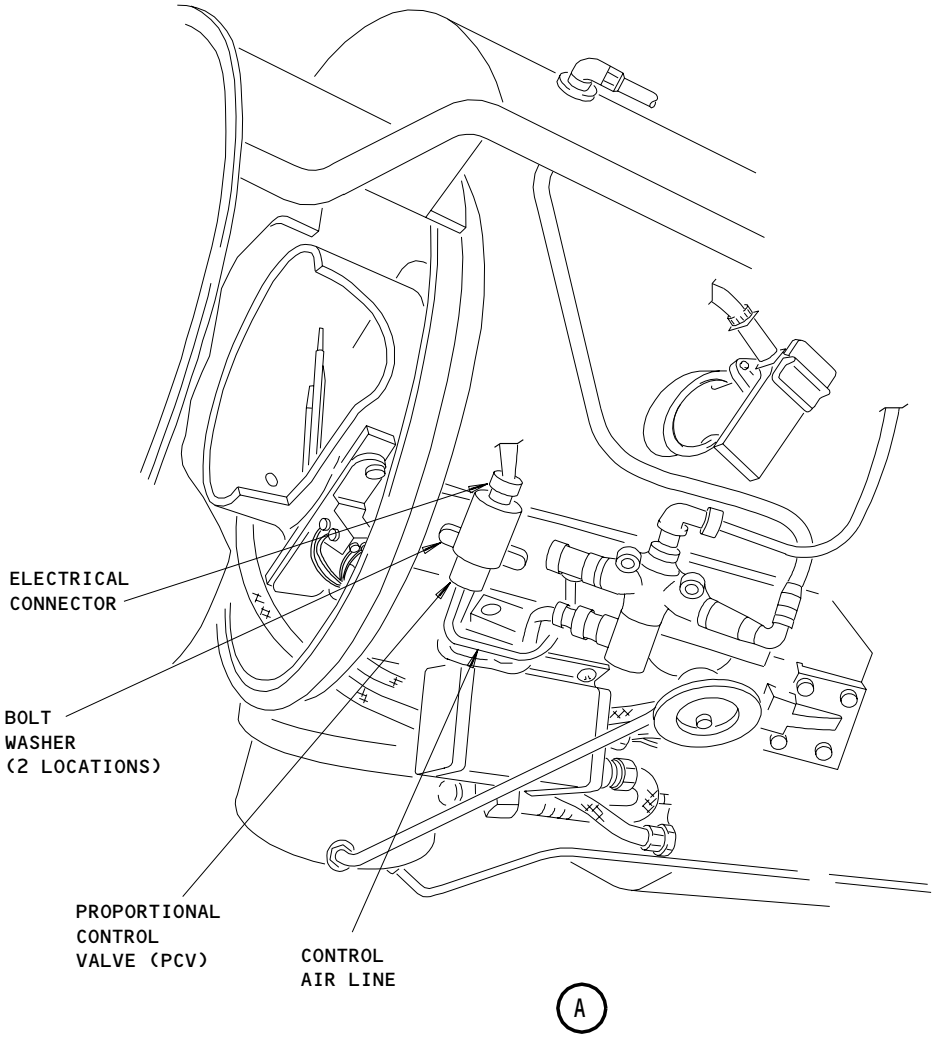
         CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCH (5 MM) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS AND LOWER SHROUD. BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

(a) Hold the lower shroud against the upper shroud.
(b) Close the shroud latches.

(2) Close the APU cowl door:
(a) Disconnect the door support rods.
(b) Put the door support rods in the clips on the APU cowl door.
(c) Close the APU cowl door.
(d) Close the latches for the APU cowl door.

(3) Set the circuit breaker and the switch:
(a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit
(b) Remove the DO-NOT-OPERATE tag from the APU master switch on the P5 overhead panel.





Proportional Control Valve Installation
Figure 401

SURGE BLEED VALVE - REMOVAL/INSTALLATION

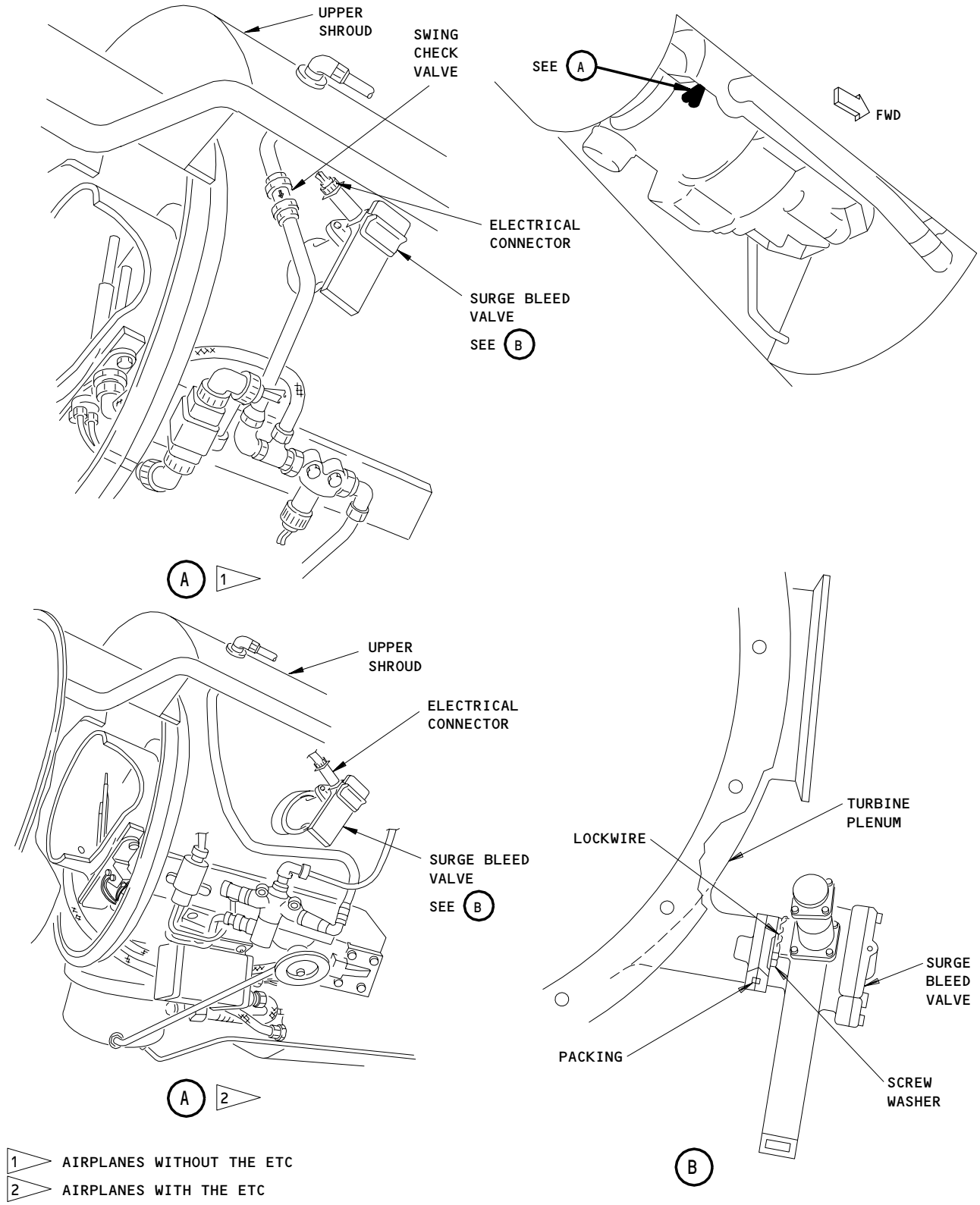
1. Prepare for Surge Bleed Valve Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard "APU in-work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Surge Bleed Valve
   A. Disconnect electrical connector (Fig. 401).
   B. Remove lockwire and remove attaching screws.
   C. Remove surge bleed valve and discard O-ring.
3. Install Surge Bleed Valve
   A. Position new O-ring in groove on flange of new or serviceable valve.
   B. Position valve on turbine plenum and install washers and screws (Fig. 401).
   C. Tighten screws to torque of 20 to 25 pound-inches and lockwire.
   D. Connect electrical connector to valve.
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.
      EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
E. Remove placards and position BATTERY SWITCH to ON.
F. Perform operational test of surge bleed valve (Ref Adjustment/Test).



Surge Bleed Valve Installation
Figure 401

SURGE BLEED VALVE-ADJUSTMENT/TEST

1. General
   A. Performing the surge bleed valve test requires that ground personnel be stationed near the APU (APU access doors closed) while it is operating at rated rpm. Because the surge bleed valve operates only when the APU rpm is above 95% and the airplane is airborne, testing on the ground necessitates tricking the surge bleed valve circuitry into believing the airplane is in flight. This is accomplished by opening circuit breaker C404, LANDING GEAR LIGHTS, on panel P6-2.

      CAUTION: EAR PROTECTION MUST BE WORN BY PERSONNEL WORKING IN AREA OF APU BEING TESTED.

2. Test Surge Bleed Valve
   A. Operate APU - Engine Start Procedure (Ref 49-11-0, Maintenance Practices).
   B. Ensure all of following valves are closed:
      (1) Air conditioning valves
      (2) Main engine bleed valves
      (3) Thermal anti-icing valves
      (4) Tire seal valves (on airplanes with inflatable tire seal)
      (5) APU bleed air valve
   C. Open circuit breaker C404, LANDING GEAR LIGHTS, Panel P6-2. Verify that surge bleed valve has opened by noting increased air flow from APU accessory cooling air exhaust port.

      NOTE: Increased air flow should be accompanied by increased EGT and noise level.

   D. Position APU bleed air valve switch to ON. Note lower noise level and decreased air flow at cooling air exhaust port, indicating surge bleed valve closure.
   E. Close circuit breaker C404, panel P6-2 and position APU bleed air valve switch to OFF.
   F. Shut down APU - Engine Shutdown Procedure (Ref 49-11-0, Maintenance Practices).

SWING CHECK VALVE - REMOVAL/INSTALLATION

1. Prepare for Swing Check Valve Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard.
   B. Open circuit breaker on M280 module - APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
   D. Support lower shroud, open shroud latches, and remove shrould.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROULD.

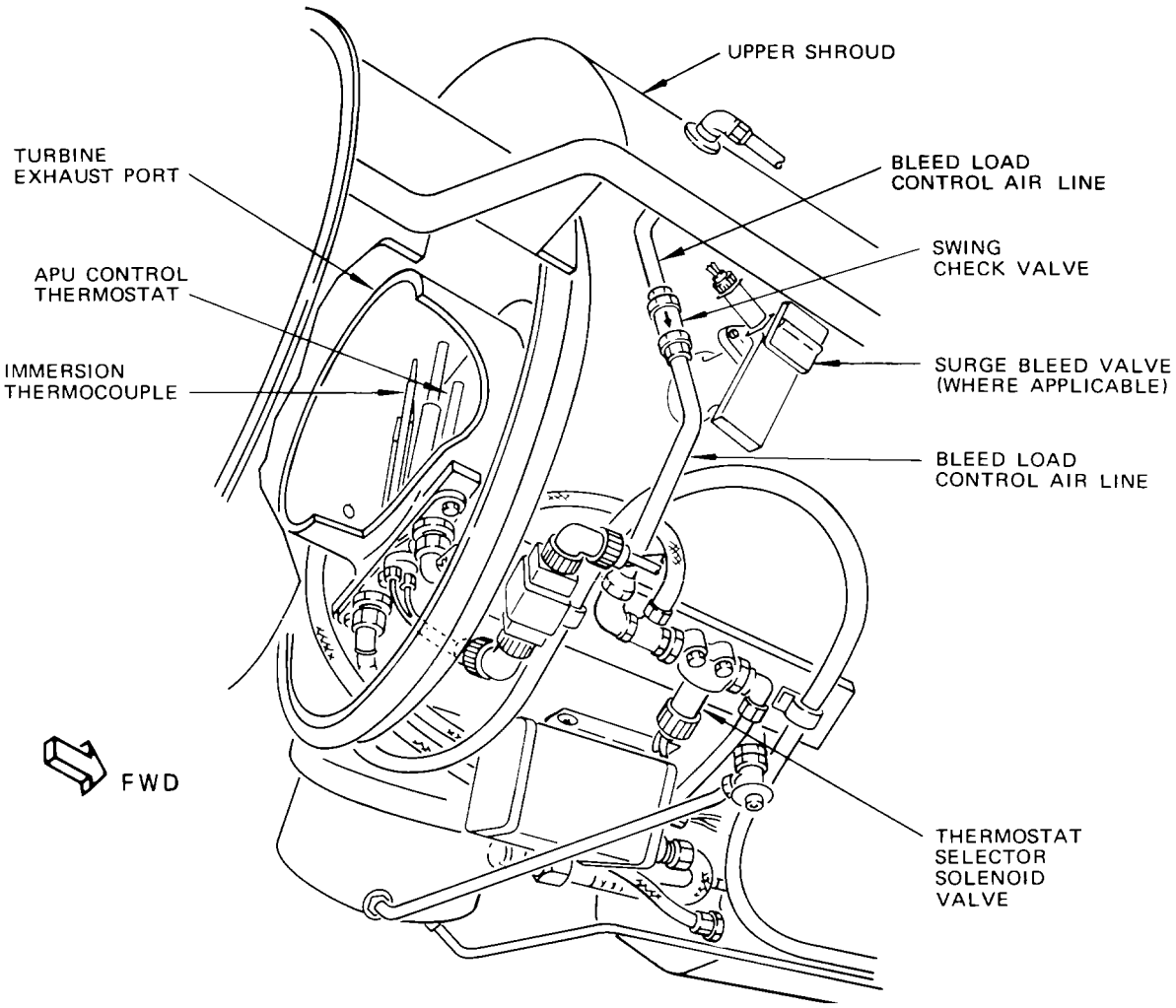
2. Remove Swing Check Valve (Fig. 401)
   A. Loosen tubing B-nuts on each end of swing check valve and at lower end of bleed load control air line.
   B. Disconnect upper end of bleed load control air line from swing check valve and move out of way.
   C. Disconnect swing check valve from upper bleed load control air line and remove.
3. Install Swing Check Valve

   NOTE: Position swing check valve with word "hinge" on hex flat in upper most position and arrow on body pointing in direction of air flow (from load control valve to APU control thermostat).

   A. Connect swing check valve to upper bleed load control air line.
   B. Connect lower bleed load control air line to swing check valve and tighten nuts at both ends of lower bleed air line and on upper end of swing check valve.
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Close and latch APU compartment door.
   D. Close circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to on and remove placard.



DETAIL A

APU Bleed Air System Component Location
Figure 401

THERMOSTAT SELECTOR SOLENOID VALVE - REMOVAL/INSTALLATION

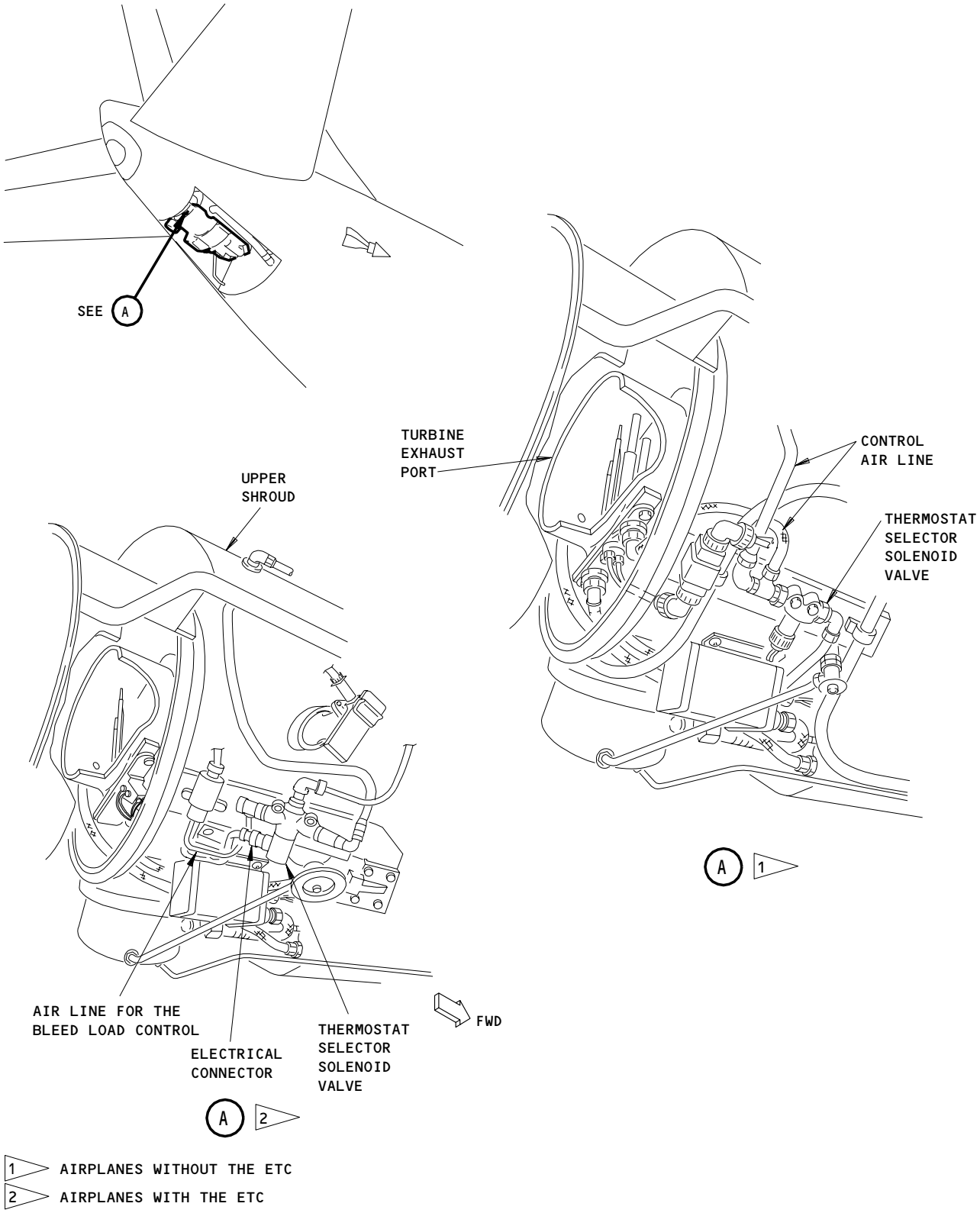
1. Prepare for Thermostat Selector Solenoid Valve Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard.
   B. Open circuit breaker on M280 module, APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Thermostat Selector Solenoid Valve (Fig. 401)
   A. Disconnect electrical plug from thermostat selector solenoid valve.
   B. Disconnect air lines (three) from fittings engaging thermostat selector solenoid valve. Tag identify as an aid for reconnecting.
   C. Remove two bolts, nuts and washers securing solenoid valve to bracket and remove valve.
   D. Remove fittings. Remove and discard packings.
3. Install Thermostat Selector Solenoid Valve (Fig. 401)
   A. Install new packings on fittings and install fittings in thermostat selector solenoid valve.
   B. Install bolts, nuts and washers and secure thermostat selector solenoid valve to mounting bracket. Tighten nuts to torque value of 20-25 pound-inches.
   C. Connect air lines to fittings in thermostat selector solenoid valve. Remove, if used, identification tags.
   D. Connect electrical plug to thermostat selector solenoid valve and safety wire.
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



Thermostat Selector Solenoid Valve Installation
Figure 401

APU OVERTEMPERATURE CONTROL THERMOCOUPLE - REMOVAL/INSTALLATION

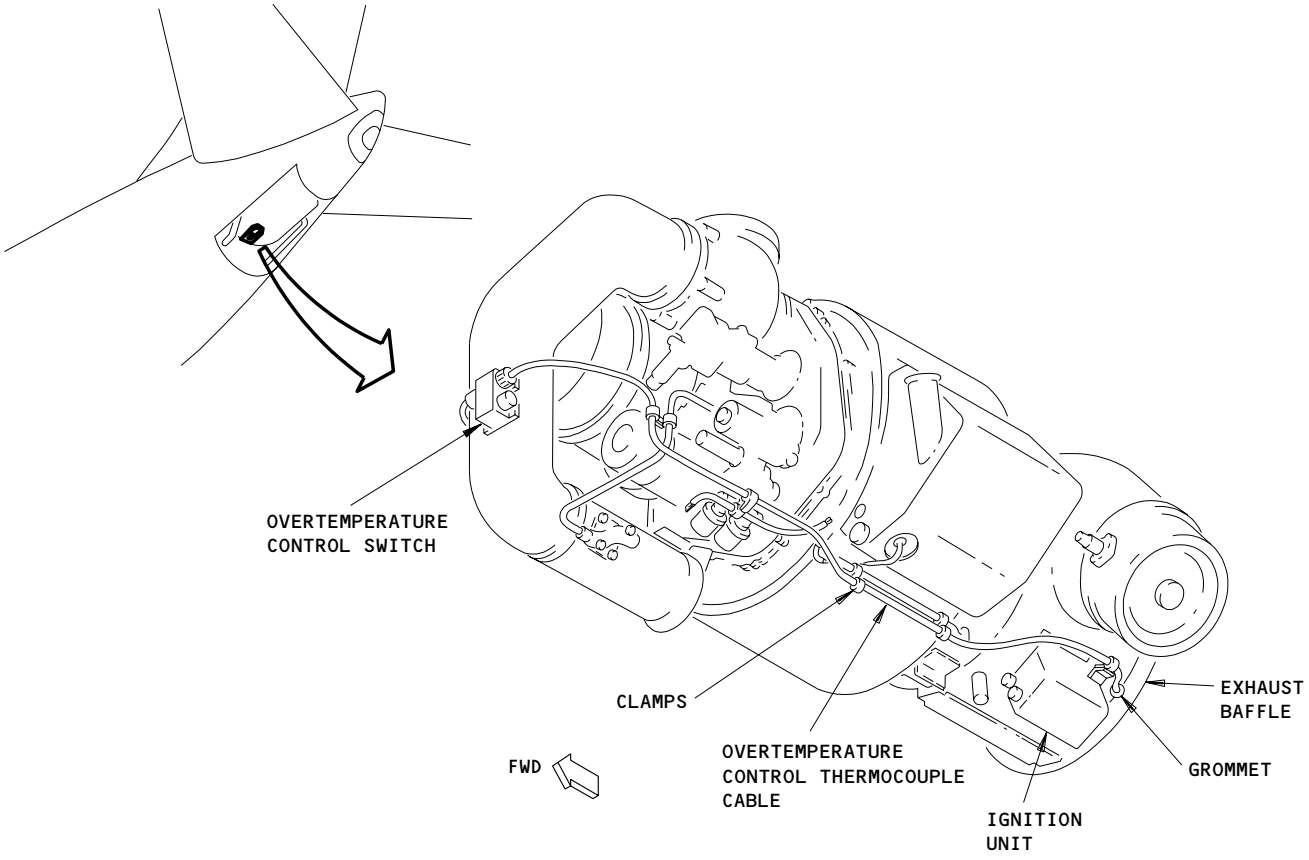
1. Equipment and Materials
   A. Antiseize Compound - Fel-Pro C-5A, Felt Products Corp., Skokie, Illinois
2. Prepare for Thermocouple Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
   D. Support lower shroud, open shroud latches, and remove shroud.

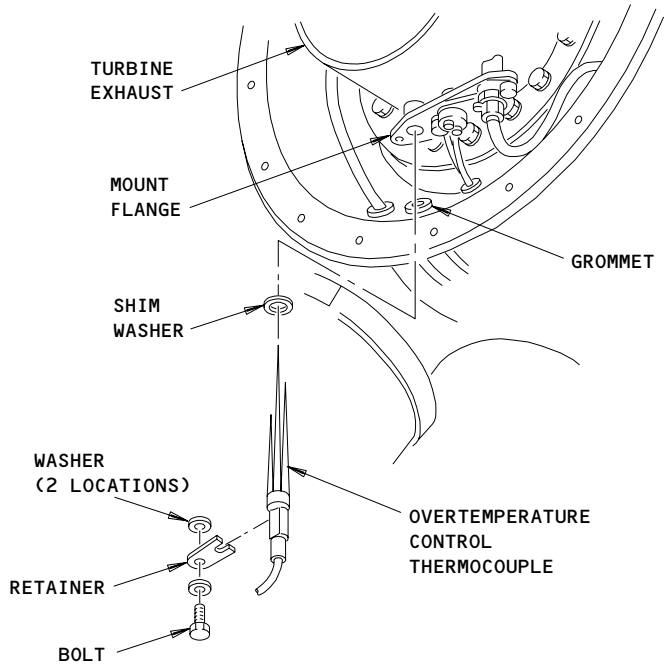
      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Thermocouple (Fig. 401)
   A. Disconnect electrical connector from overtemperature control switch and remove clamps securing thermocouple cable to tube assemblies.
   B. Remove retainer attaching bolt, washers, and retainer.
   C. Remove thermocouple in a straight line from mount flange.
   D. Remove grommet and pull thermocouple through exhaust baffle.
4. Install Thermcouple
   A. Feed thermocouple through hole in exhaust baffle and install grommet.
   B. Insert thermocouple into mount flange with sufficient amount of shim washers under thermocouple collar to provide 0.10- to 0.20-inch pinch fit between plate retainer and boss of exhaust pipe assembly. Position thermocouple in boss of exhaust pipe assembly so that flat of thermcouple marked A is facing rear of engine (short probe of thermocouple shall face front of engine).
   C. Position retainer with two washers on thermocouple.
   D. Coat threads of retainer bolt with antiseize compound; install bolt with washer. Tighten bolt to torque range of 50 to 70 pound-inches.
   E. Secure cable assembly to tubing assembly with clamps. Ensure that thermocouple leads do not chafe adjacent lines, components or structure.
   F. Connect electrical connector to overtemperature control switch.
5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Position BATTERY SWITCH to ON and remove placard.





APU Overtemperature Thermocouple - Installation
Figure 401

OVERTEMPERATURE CONTROL SWITCH - REMOVAL/INSTALLATION

1. Prepare for Overtemperature Control Switch Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard.
   B. Open circuit breaker on M280 module, APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Overtemperature Control Switch (Fig. 401)
   A. Disconnect electrical connectors.
   B. Remove screws securing switch to cooling air crossover duct.

      NOTE: Do not remove cap from switch.

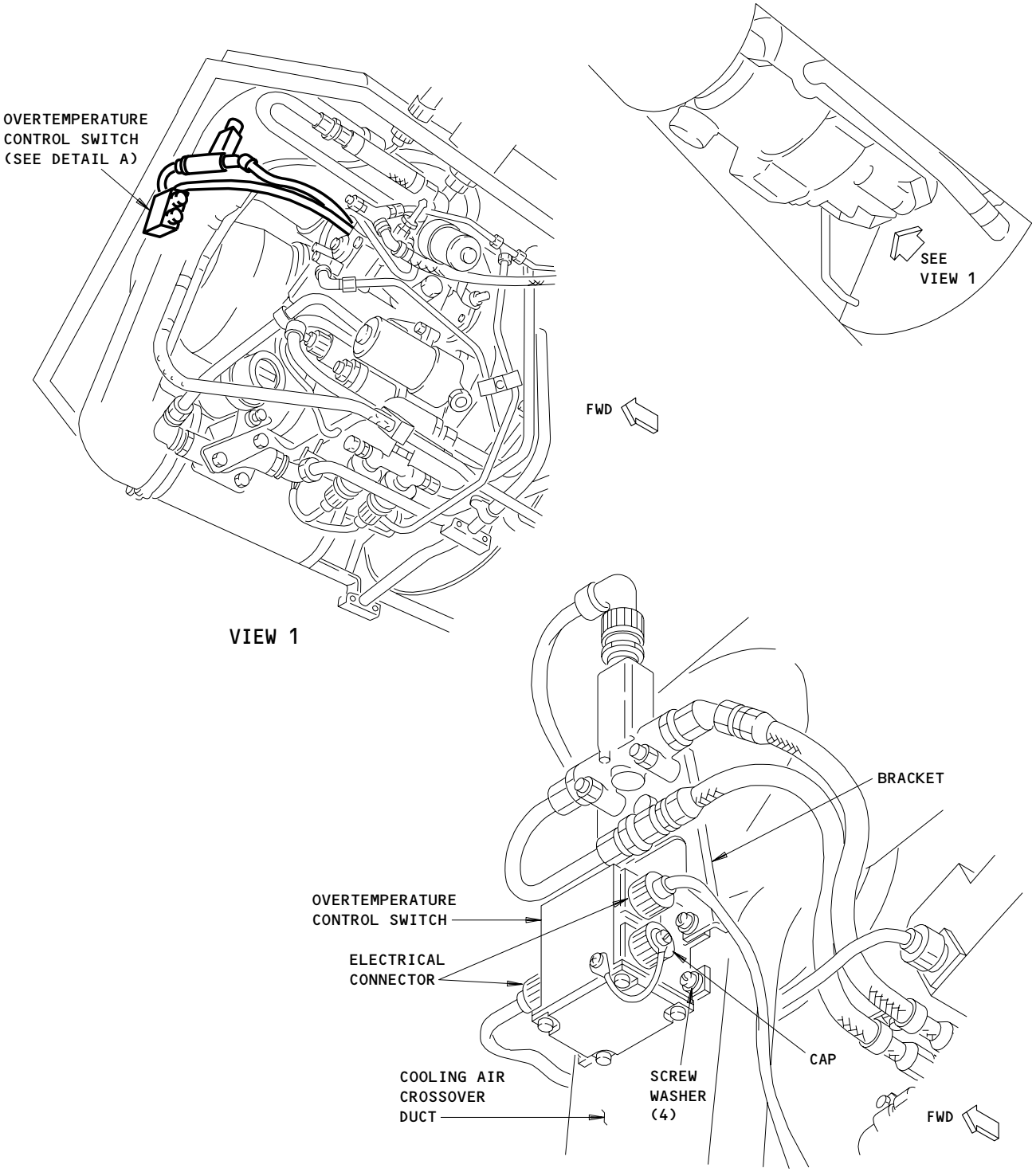
3. Install Overtemperature Control Switch (Fig. 401)

   CAUTION: PRIOR TO INSTALLING NEW SWITCH, CHECK PLUG D1572 TERMINALS A AND B TO GROUND FOR POSSIBLE SHORTING. A SHORT IN THE WIRE HARNESS WILL DAMAGE NEW SWITCH.

   A. Install switch, securing with screws and washers.
   B. Connect electrical connectors and secure as required.
4. Restore Airplane to Normal
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



Overtemperature Control Switch Installation
Figure 401

OVERTEMPERATURE CONTROL SWITCH - ADJUSTMENT/TEST

1. General
   A. The following procedures provide information for checking the overall integrity of the overtemperature switch system; adjusting the set point of the overtemperature switch, and instruction for deactivating the overtemperature switch if failed and no replacement is available.
2. Test Overtemperature Control Switch System (Fig. 502)
   A. Gain access to overtemperature control switch in APU compartment.
   B. Disconnect J1.
   C. Operate APU (AMM 49-11-0/201).
   D. Observe duct pressure indicator.
      (1) Position engines 1 and 2 BLEED switches (located on overhead panel P5) to OFF.
      (2) Position ISOLATION VALVE switch to AUTO.
      (3) Position APU BLEED valve switch to ON.
      (4) Position L or R PACK switch to ON and note pneumatic pressure.
   E. Confirm that APU is not delivering bleed air (i.e., no duct pressure and/or no rise in EGT). Overtemperature control switch, along with load control thermostat and thermostat selector solenoid valve integrity has been confirmed.
   F. Shut down APU (AMM 49-11-0/201).
   G. Reconnect lead to J1 receptacle of overtemperature control switch and lockwire.
   H. Restore Airplane to Normal Configuration
      (1) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
      (2) Position lower shroud against upper shroud and close shroud latches.

          CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

      (3) Disengage APU compartment access door support rods and stow rods. Close and latch access door.
3. Adjust Overtemperature Control Switch (Fig. 502)
   A. Equipment and Materials:
      (1) Thermostat Calibration Kit, P/N 290417-2-1
      (2) Thermocouple (Test) Assembly, P/N 290416-2
      (3) Cable Assembly (Thermocouple to Calibration Kit)
      (4) Temperature, Indicator, P/N 287512-1-1
      (5) Sealing Compound - Mold-Seal (TC 527)
   B. Adjust Overtemperature Control Switch.
      (1) Gain access to overtemperature control switch in APU compartment.
      (2) Remove engine EGT thermocouple probe and replace with test thermocouple from thermostat calibration kit.

(3) Connect cable assembly to test thermocouple and receptacle on calibration kit.
(4) Remove control air line from APU control thermostat and bulkhead fitting on tailpipe heat shield.
(5) Remove control thermostat from APU.

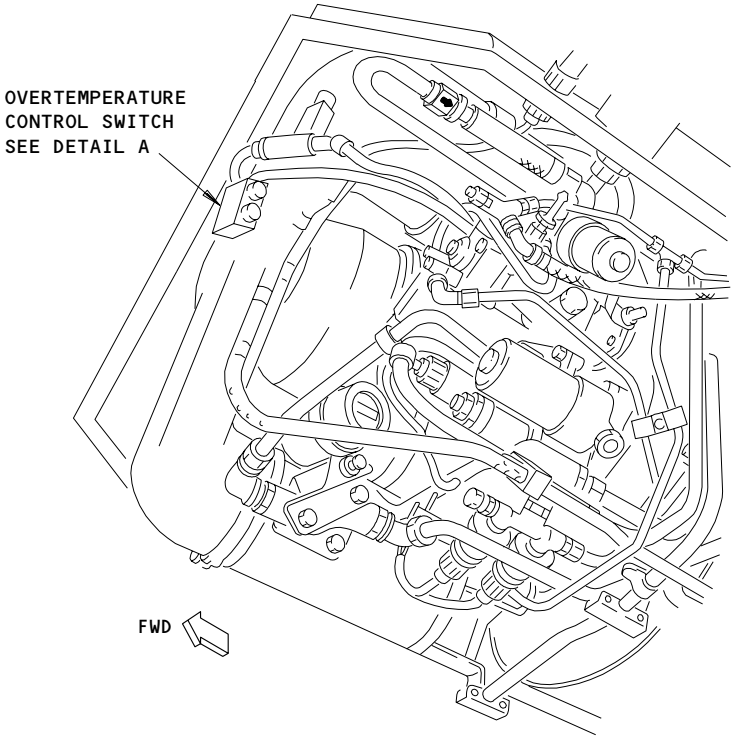
CAUTION: SUBJECTING CONTROL THERMOSTAT TO SLIGHTLY HIGHER THAN NORMAL TEMPERATURES WILL REDUCE SERVICE LIFE OF PART AND MAY ALTER SET POINTS OF THERMOSTAT.

(6) Connect flexible line between bulkhead fitting on tailpipe heat shield and fitting on calibration kit. Open calibration kit needle valve to full open position.
(7) Connect test temperature indicator to receptacle J3 of overtemperature control switch.
(8) Start APU (AMM 49-11-0/201). Allow engine to accelerate to no-load, governed speed, at the same time closing calibration kit needle valve slowly to get APU to idle speed.
(9) Position APU bleed air switch to ON.
(10) Position L PACK and R PACK switches to ON.
(11) Using calibration kit, slowly close needle valve until EGT stabilizes at 635 to 639°C (1175 to 1200°F).
(12) Compare EGT readings at calibration kit indicator and test temperature indicator connected in (7). EGT indications shall compare within +6/-6°C (+10/-10°F). If temperatures do not compare within specified limits, adjust as follows:
   (a) Remove end plate from overtemperature control.
   (b) Using a jewelers type screwdriver, turn temperature indicator adjustment screw until EGT indicators (calibration kit and test temperature indicator) compare within specified limit.

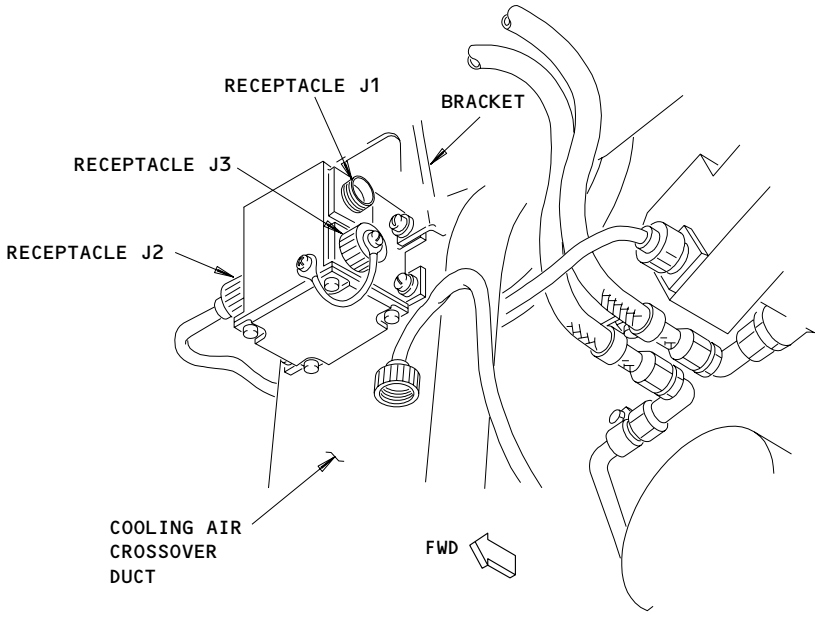
   NOTE: Each scale division represents approximately 17°C (30°F).

   (c) Recheck indicator comparison two successive times to ensure correct EGT readings by opening needle valve and repeating steps (11) and (12).
(13) With APU bleed air valve in ON position, slowly close calibration kit needle valve at a rate of 3°C (5°F) per second until overtemperature control trip point is reached or maximum trip point overtemperature specified in Table 1 is indicated on temperature gage.

NOTE: The overtemperature trip point will be noted by a drop in exhaust gas temperature (APU bleed air valve closes).



VIEW 1



DETAIL A

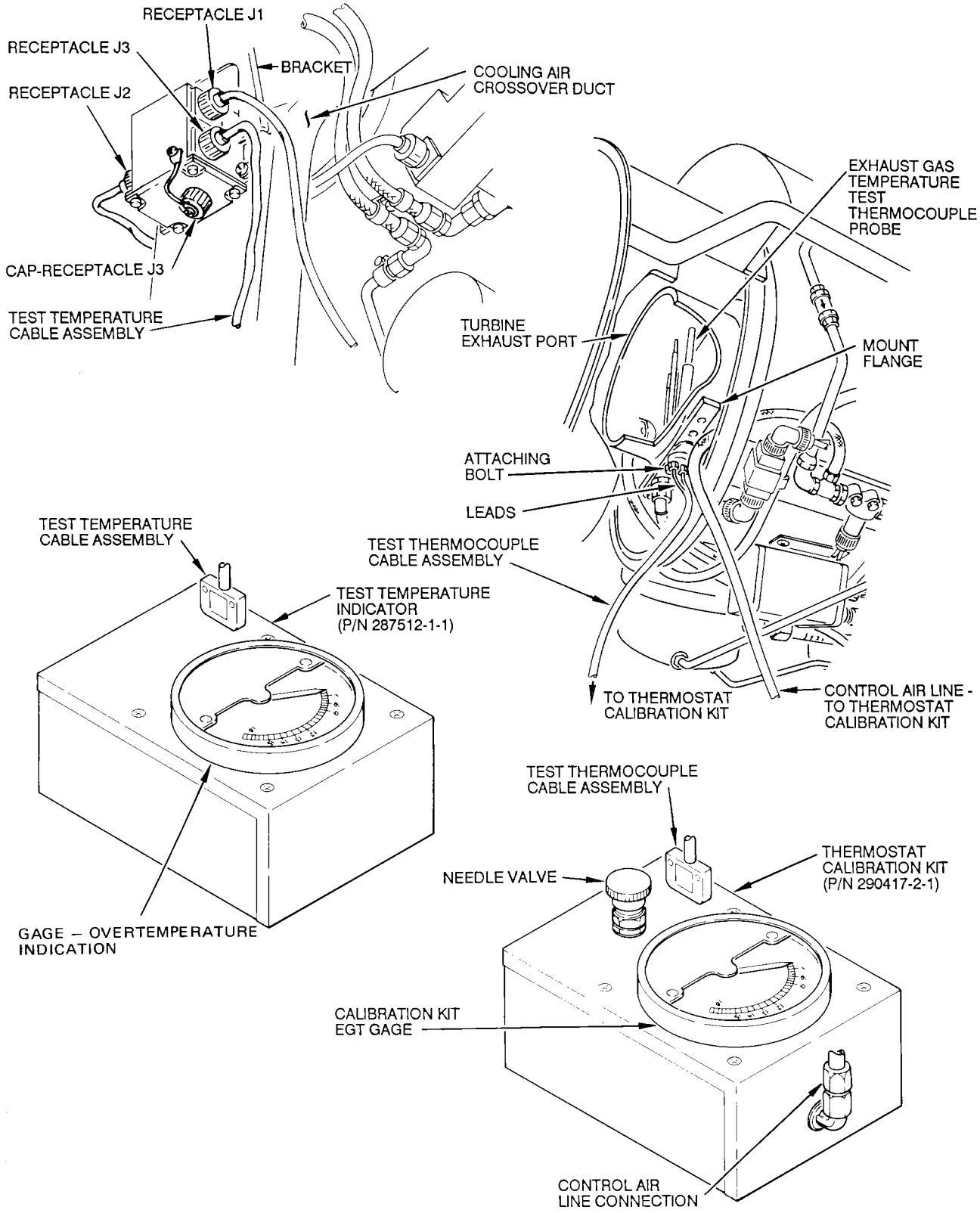
Overtemperature Control Switch Test
Figure 501

(14) Record trip point and remove load from engine.
(15) If trip point is not reached and not within limits of Table 1, the overtemperature control must be adjusted as follows:
(a) Remove end plate from overtemperature control.
(b) Using a jewelers screwdriver, turn adjustment screw until trip point is within specified limits. Each scale division represents approximately 17°C (30°F).
(c) Recheck trip point setting by repeating steps (13) and (14) two successive times.
(16) Position L PACK and R PACK switches to OFF.
(17) Shut down APU (AMM 49-11-0/201).
(18) Apply one drop sealing component to overtemperature control adjustment screws and adjoining surface. Reinstall end plate and secure with screws.
(19) Disconnect flexible line from bulkhead fitting on tail pipe heat shield.
(20) Reconnect control air line to APU control thermostat and bulkhead fitting.
(21) Check overtemperature control switch system operation (See par. 2., Steps B. thru G).
(22) Remove test thermocouple assembly and reinstall engine thermocouple and connect thermocouple wiring.
(23) Disconnect test temperature indicator from receptacle J3 of overtemperature control switch and reinstall cap on J3 receptacle.
(24) Cap and stow all parts of thermostat calibration kit.

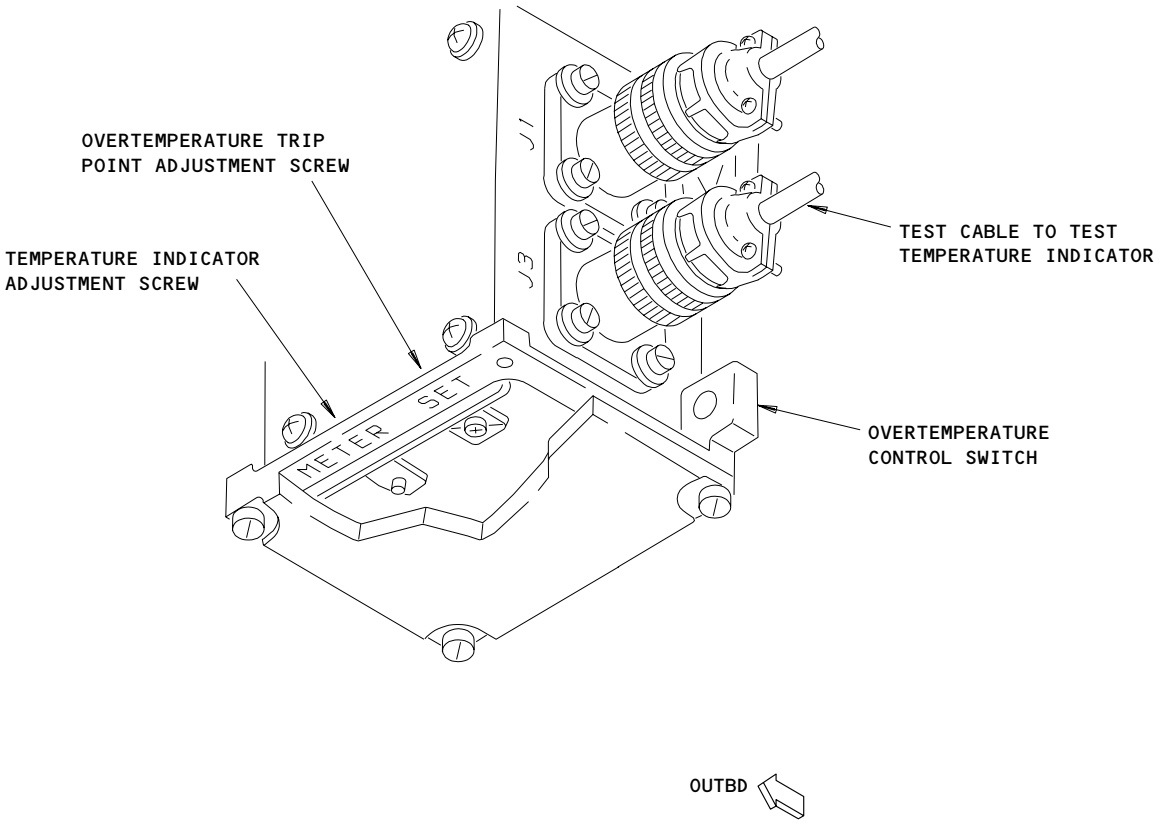
4. Overtemperature Control Switch Deactivation

A. There are two circumstances which can require deactivation of the overtemperature control switch:
(1) Operation of the overtemperature control switch is erratic or fails to close the APU bleed valve;
(2) The APU being installed is replacing an APU that has had the overtemperature control switch deactivated.

B. Deactivate the APU control switch as follows:
(1) Overtemperature Control Switch Deactivation (Preferred Method).
(a) Shut down APU (AMM 49-11-0/201).
(b) Remove connector from receptacle J2 of the overtemperature switch.
(c) Extract pins B and D from the connector.
(d) Cut wires from pins B and D and discard pins.
(e) Strip and splice the two wires together using an insulated splice (NAS 1388).
(f) Tape or tie wires and replace connector on receptacle J2.
(g) Start APU (AMM 49-11-0/201). Allow APU EGT to stabilize and switch APU bleed air to ON. Verify that pneumatic duct system is pressurized.



Overtemperature Control Switch Adjustment
Figure 502 (Sheet 1)



Overtemperature Control Switch Adjustment
Figure 502 (Sheet 2)

(2) Overtemperature Control Switch Deactivation (Optional Method).
(a) Shut down APU (AMM 49-11-0/201).
(b) Tie back and cap the already disconnected overtemperature thermocouple wire and connector.
(c) Fabricate a six inch jumper wire from BMS 13-31 Type 1, 18 gauge wire or equivalent.
(d) Attach new contact points P/N BACC47DR1 to each end of jumper wire.
(e) Insert jumper wire assembly into new plug BACC63BW10SLC4S (optional FRF6E10SL4501).
(f) Install new plug with jumper wire at receptacle J1.
(g) Start APU (Ref 49-11-0 MP). Allow APU EGT to stabilize and switch APU bleed air switch to ON. Verify that pneumatic duct system pressurized.

C. Shut down APU - Engine Shutdown Procedure (Ref 49-11-0 MP).

D. Secure APU Compartment.

Table 1
Engine Exhaust Gas Temperature (EGT) Settings

EGT Measurement	Pneumatic Thermostat	Overtemperature Control Trip Point *[1]	
	Max	Recommended	Max
Test Thermocouple	640 +10° -5°C (1184 +18° -9°F)	620 ±10C (1150 ±20F) *[2]	718 +0 -14C (1325 +0 -25F)

*[1] Set overtemperature control trip point at recommended temperature only when pneumatic thermostat is set at recommended temperature.

*[2] The manufacturer recommends these lowered temperature settings to increase the service life of the engine "hot" section.

COMPRESSOR DISCHARGE PRESSURE ORIFICED TEE - CLEANING/PAINTING

1. General
   A. The following procedure permits a quick economical means of cleaning and assuring that the 0.030-0.034-inch diameter orifice is unobstructed without removing the orificed tee assembly from the engine.
   B. Some installations may have modified the tee fitting by adding a 0.017-0.022-inch diameter orifice vent in upper part of tee. This orifice serves as the acceleration limiter orifice and replaces the orifice originally located in the acceleration limiter housing of the fuel control unit (AMM 49-31-101/601).

      CAUTION: APU MUST HAVE ONLY ONE ORIFICE IN COMPRESSOR DISCHARGE PRESSURE LINE TO ACCELERATION LIMITER. MORE THAN ONE VENT WILL RESULT IN ENGINE DAMAGE DUE TO HUNG STARTS.

2. Equipment and Materials
   A. Compressed Air Source - 100 psig max.
3. Prepare to Clean Orifice Tee
   A. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

4. Clean Orificed Tee (Fig. 701)
   A. Disconnect control air pressure line at fuel control acceleration limiter tee fitting. Plug control air pressure line.
   B. Disconnect control air pressure line at thermostat selector solenoid valve.
   C. Connect compressed air source (100 psig max) to control air pressure line.

      NOTE: Flow of air indicates that the orifice is unobstructed. If tee has orifice vent in upper part, hold finger over orifice while checking internal orifice for airflow. After flow has been noted, verify air flows through upper orifice. If necessary, use No. 77 drill to clear orifice passage.

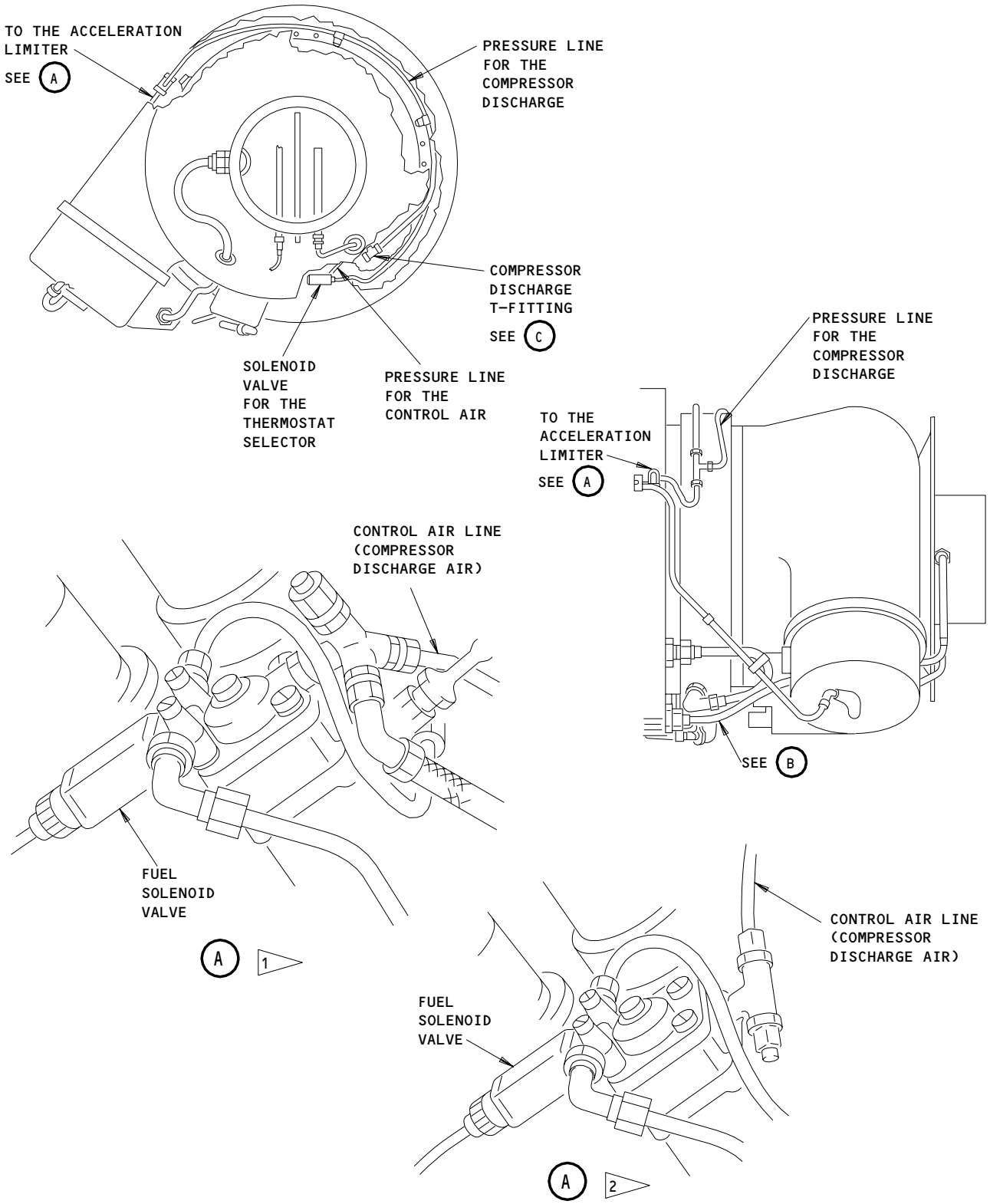
   D. Remove compressed air source and connect control air line to thermostat selector solenoid valve.

E. Remove plug from control air line and connect to acceleration limiter tee fitting on fuel control unit.
F. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096: Examine the air lines for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) During the APU operation, examine the air lines for leakage.
   (3) Do the APU normal shutdown (AMM 49-11-0/201).
   (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (5) If you found leakage, repair the cause of it.
G. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096: Examine the air lines for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) Do the APU normal shutdown (AMM 49-11-0/201).
   (3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (4) Visually examine the air lines for any signs of leakage:
      (a) If you found signs of leakage, repair the cause of it.

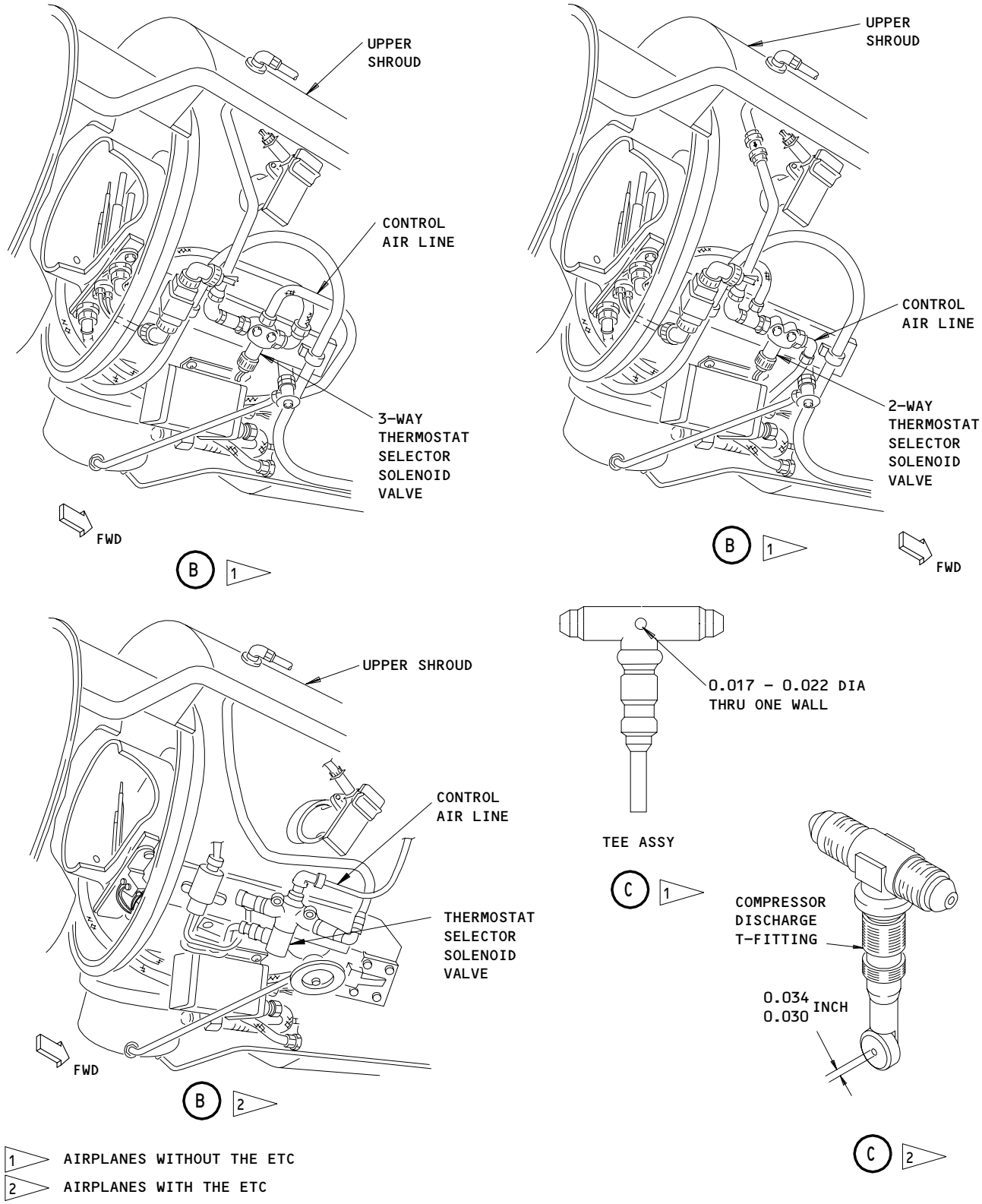
5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on APU control unit on E3-3 electronic shelf.
   E. Position BATTERY switch to ON and remove placards.



Compressor Discharge Pressure Orificed T Cleaning
Figure 701 (Sheet 1)



Compressor Discharge Pressure Orificed T Cleaning
Figure 701 (Sheet 2)

APU CONTROLS - DESCRIPTION AND OPERATION

1. General

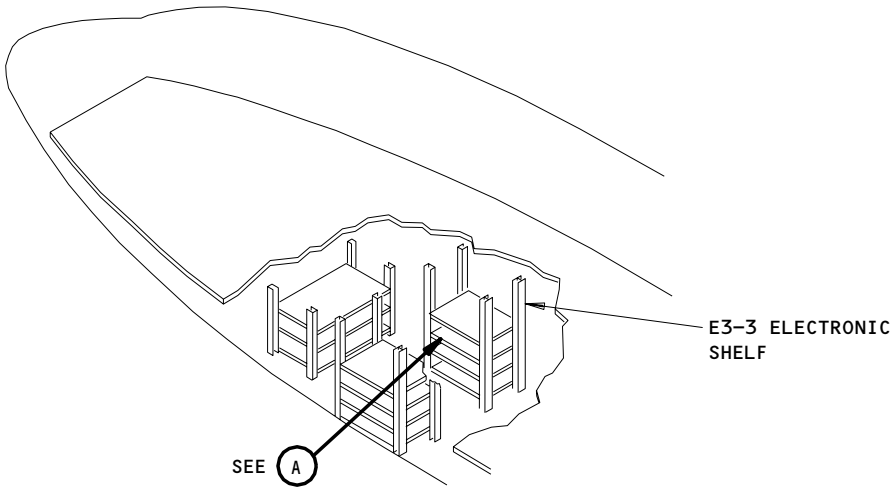
A. The APU controls supply the manual and automatic control to start, to stop and to operate the APU. The APU controls keep the APU operation below very important APU engine limits. When the APU starts, the control of the APU is fully automatic. The APU controls are:

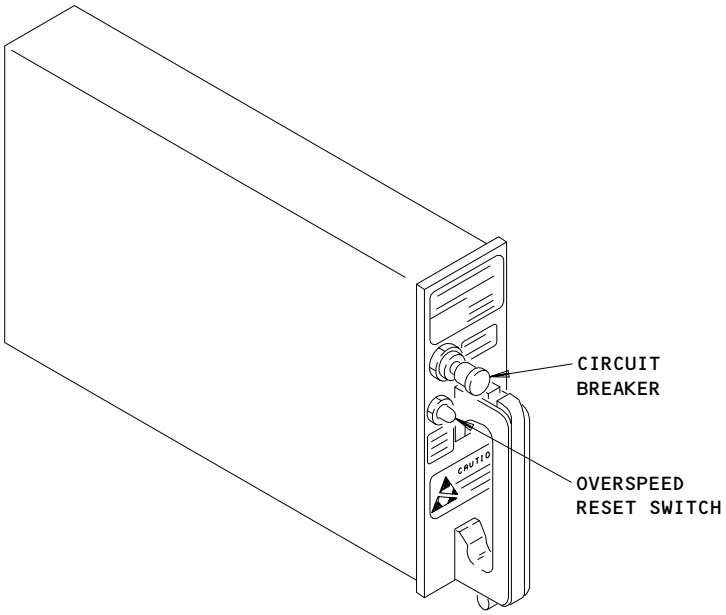
(1) The APU control unit
(2) The centrifugal speed switch
(3) The pneumatic solenoid valve
(4) The sequencing oil pressure switch (referred to as the sequencing switch for the oil pressure)
(5) The low oil pressure switch (referred to as the oil pressure switch)
(6) The high oil temperature switch (referred to as the oil temperature switch)
(7) The electronic temperature control (referred to as the ETC) (Airplanes with the ETC).

B. AIRPLANES WITHOUT THE ETC;
The APU control thermostat supplies additional control. For a more detailed description of the APU control thermostat, refer to AMM 49-31-00/0 and AMM 49-52-01/0.

C. AIRPLANES WITH THE ETC;
The proportional control valve supplies additional control. For a more detailed description of the proportional control valve, refer to AMM 49-52-01/0. The APU control unit is the main control for the APU operation. The APU control unit is found on the E3-3 electronic shelf in the electronics bay. The APU control unit has a sequence of events for the APU start and the APU operation. The APU control unit gives protection to the APU for overspeed, high oil temperature and low oil pressure.

D. The sequencing switch for the oil pressure permits the fuel and ignition to be supplied to the APU engine at the correct time during the APU start. The centrifugal or electronic speed switch stops the operation of the starter motor and ignition at the correct time during the APU start. Also, the centrifugal or electronic speed switch prevents the use of bleed air until the APU engine speed is 95% and keeps the APU engine from an overspeed. The oil pressure switch and oil temperature switch stop the APU if the oil temperature or oil pressure does not stay in the limits. The pneumatic solenoid valve supplies the compressed air to the centrifugal speed switch to stop the APU when the APU master switch is moved to the OFF position.

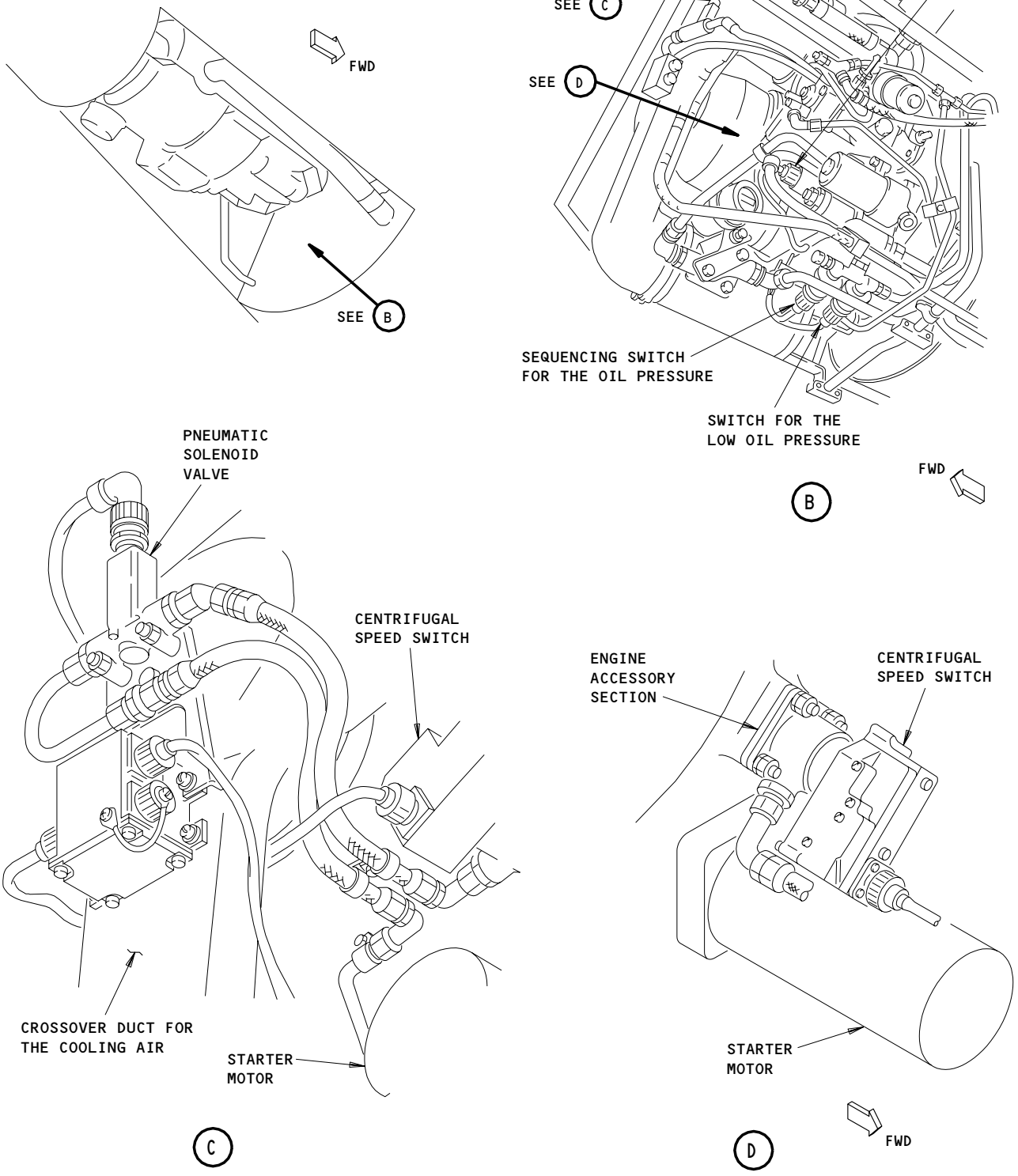




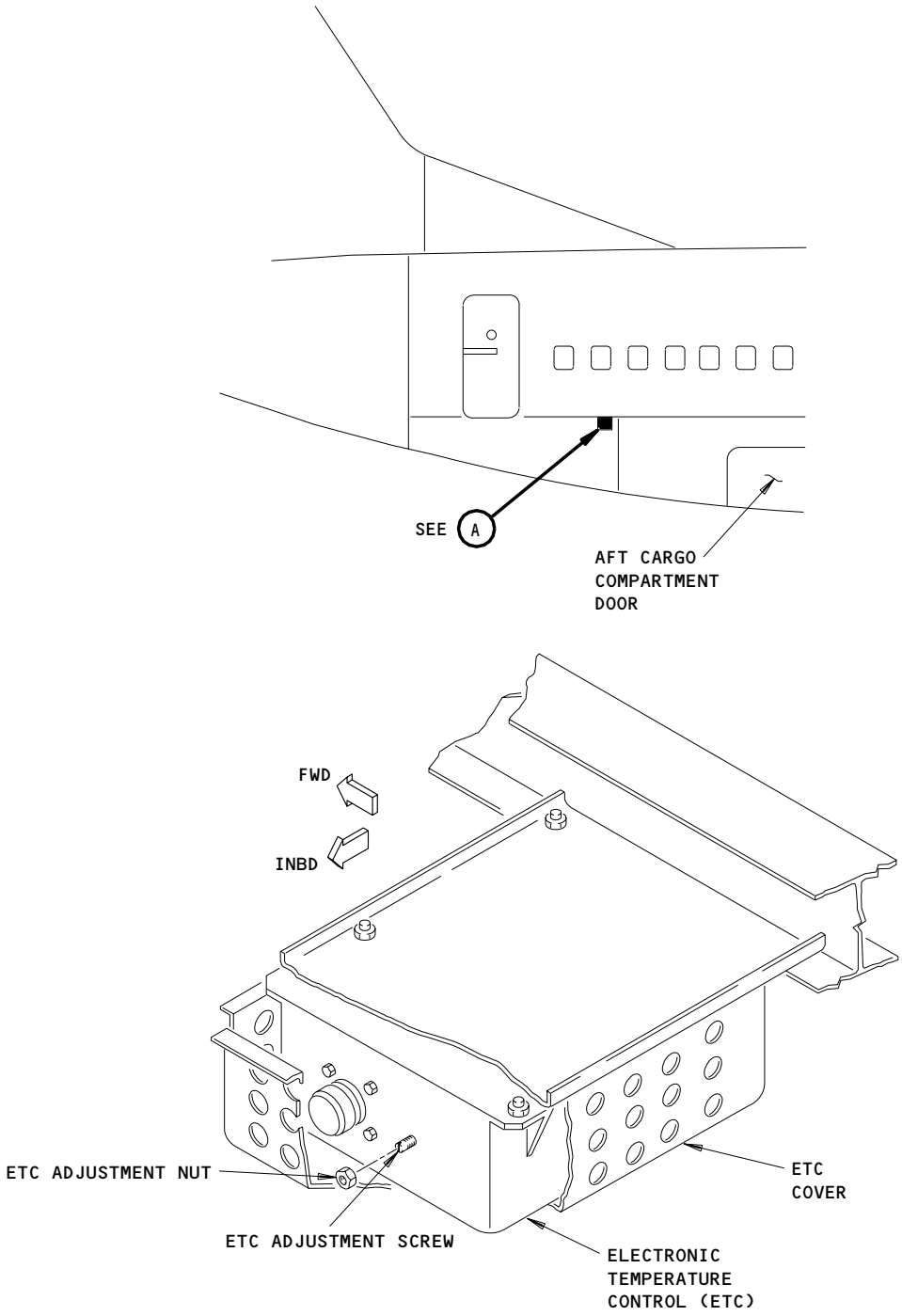
APU CONTROL UNIT

A

APU Control Component Location
Figure 1 (Sheet 1)



APU Control Component Location
Figure 1 (Sheet 2)



Electronic Temperature Control
Figure 2

2. APU Control Unit (Fig. 1)
   A. The APU control unit starts, operates and stops the APU. The APU control unit is installed in the lower section on the E3-3 electronic shelf. The APU control unit has eight relays and five printed circuit boards. The relays are the start and stop relays and five printed circuit boards. The relays are the start and stop relay K1, pneumatic solenoid relay K1-3, overspeed shutdown relay K2, overspeed anticycle relay K3, fire shutdown relay K4, low oil pressure shutdown relay K5, starter lockout relay K6 and relay K7. Relay K7 prevents a sudden drop in voltage. The printed circuit boards have transistors, silicon-controlled rectifiers, diodes, capacitors and resistors. There is a circuit breaker on the face of the APU control unit.
3. Centrifugal Switch (Fig. 1)
   A. The centrifugal speed switch controls the APU start, APU usual operation and overspeed protection. The centrifugal speed switch is found in the gearbox. The gear train in the gearbox turns the centrifugal speed switch. The centrifugal speed switch has a flyweight. governor, actuating lever, three spring-loaded pushrods and three switches.
   B. The three switches on the centrifugal speed switch are mechanically operated. AIRPLANES WITHOUT THE ETC; The 35% switch operates when the APU engine speed is approximately 14,500 to 16,000 rpm. AIRPLANES WITH THE ETC; The 50% switch operates when the APU engine speed is approximately 19,000 to 21,000 rpm. The 95% switch operates when the APU engine speed is approximately 37,300 to 38,900 rpm. The 110% switch operates when the APU speed is approximately 44,000 to 44,500 rpm. Also, compressed air operates the 110% switch when the pneumatic solenoid valve is energized.
4. Pneumatic Solenoid Valve (Fig. 1)
   A. The pneumatic solenoid valve controls the supply of compressed air to the 110% switch in the centrifugal speed switch. When the APU master switch is moved to the OFF position, the pneumatic solenoid valve opens and permits compressed air to go into the centrifugal speed switch. The compressed air closes the 110% switch and stops the APU. The pneumatic solenoid valve is installed to the crossover duct.
5. Sequencing Oil Pressure Switch (Fig. 1)
   A. The sequencing switch for the oil pressure makes sure the combustion does not start until the APU engine has 4.0 psig (27.6 kPa) oil pressure. The sequencing switch is found on the APU engine directly below the starter motor. The sequencing switch has an electrical connector, a connector for the oil pressure line and a switch. When the oil pressure increases to approximately 4.0 psig (27.6 kPa), the sequencing switch closes and permits electrical power to go to the fuel solenoid valve and the ignition unit.

6. Low Oil Pressure Switch (Fig. 1)
   A. The low oil pressure switch energizes the relay K5 in the APU control unit when the oil pressure in the APU engine goes below approximately 45 psig (310 kPa). The oil pressure switch is located on the APU engine adjacent to the sequencing switch. The oil pressure switch has an electrical connector, a connector for the oil pressure line and a switch.
7. Oil Temperature Switch (Fig. 1)
   A. The oil temperature switch energizes the relay K1 in the APU control unit to stop the APU when the oil temperature is greater than approximately 250°F (121°C) or 285°F (140°C). The oil temperature switch is installed on the oil pump housing.
8. Electronic Temperature Control (Airplanes with the ETC) (Fig. 2)
   A. The electronic temperature control (ETC) does a check of the exhaust gas temperature directly from the two ETC thermocouple probes. The ETC thermocouple probes are installed in the turbine exhaust port. The ETC also supplies the overload protection for the APU. When an overload condition occurs, the ETC sends a signal to the proportional control valve to close the bleed air valve. This will permit the EGT to decrease to the correct limit. After the EGT decreases to the correct limit, the ETC sends a signal to the proportional control valve to open the bleed air valve. During the APU operation, the ETC sends a signal to the EGT indicator on the P5 forward overhead panel. On some airplanes, the 6TG also sends the signal to the EGT indicator after the APU stops.
9. Operation
   A. After the APU master switch moves to the START position, the APU fuel valve opens, the air inlet door opens and the APU engine turns. When the oil pressure increases to approximately 4.0 psig (27.6 kPa), the sequencing switch for the oil pressure closes. This permits the electrical power to energize the fuel solenoid valve and the ignition unit. Combustion starts and the APU engine increases its speed.
   B. AIRPLANES WITHOUT THE ETC;
      When the APU engine speed is approximately 14,500 to 16,000 rpm, the 35% contact in the centrifugal speed switch opens.
   C. AIRPLANES WITH THE ETC;
      When the APU engine speed is approximately 19,000 to 21,000 rpm, the 50% contact in the centrifugal speed switch opens.
      (1) This removed the electrical power from the start relay R5 and stops the starter motor. The APU engine continues to increase its speed. When the oil pressure increases to approximately 55 psig (379 kPa), the oil pressure switch opens and the LOW OIL PRESSURE light goes off. When the APU engine speed increases to approximately 37,300 to 38,900 rpm, the 95% contact in the centrifugal speed switch closes. This removes the electrical power from the ignition unit and sends electrical power to the solenoid for the bleed air valve. Also, this sends electrical power to the elapsed time indicator and the oil pressure shutdown relay K5.

D. AIRPLANES WITH THE ETC;
The proportional control valve, ETC and ETC thermocouple probes supply the overload protection for the APU. While the EGT increases to a specified value, the ETC thermocouple prooes send signals to the ETC. The ETC compares the two signals and sends a signal to the proportional control valve to open. This will bleed the compressed air from the bleed air valve and move the bleed air valve to the closed position. With the bleed air valve in the closed position, the pneumatic load on the APU and the EGT decrease. When the EGT decreases to the correct limit, the ETC sends a signal to the proportional control valve to permit the bleed air valve to open. This will permit the airplane to use the bleed air from the APU.

E. The APU stops when the APU master switch is moved to the OFF position. The 110% contact in the centrifugal speed switch is energized. This is the same as an APU engine overspeed. When the 110% contact closes, electrical power is removed from the bleed air valve and the fuel solenoid valve. These valves close. Also, the TRIP coil in the start and stop relay K1 closes and the APU engine stops.

F. The APU stops automatically for an APU engine overspeed, APU fire, low oil pressure and high oil temperature. If there is an APU engine overspeed, the 110% contact in the centrifugal speed switch closes and the overspeed shutdown relay K1 is energized. If there is an APU fire, the fire shutdown relay K4 is energized. When the oil pressure in the APU engine decreases to approximately 45 psig (310 kPa), the low oil pressure shutdown relay K15 is energized. If one of these three relays is energized, the TRIP coil in the start and stop relay K1 closes and the APU stops. When tine oil temperature increases to approximately 250°F (121°C) or 285°F (140°C) electrical power is supplied to the base of transistor Q1-1. The trip coil in the start and stop relay K1 is energized and the APU stops.

APU CONTROL UNIT - REMOVAL/INSTALLATION

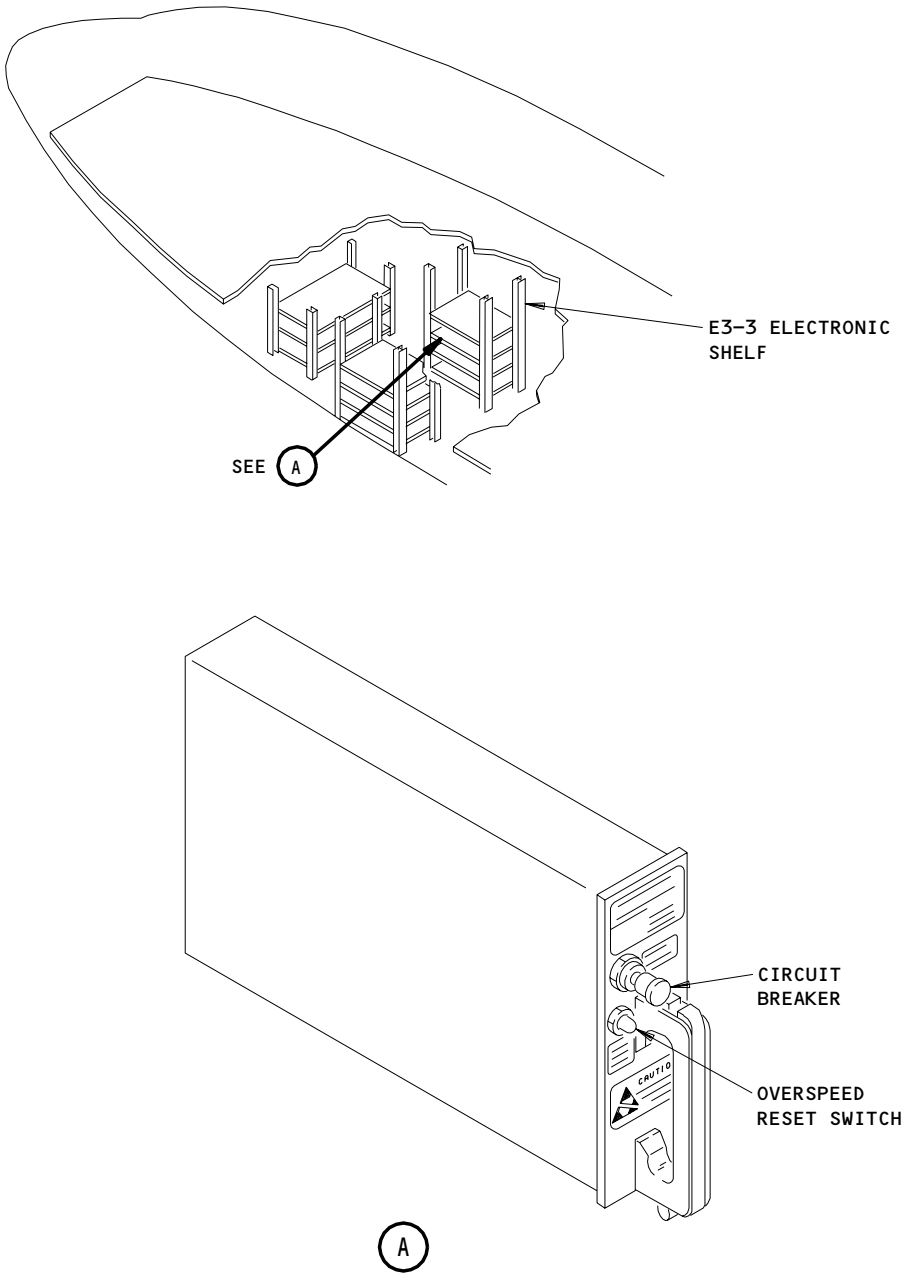
1. General
   A. The APU control unit is installed on the E3-3 electronic shelf. The E3-3 electronic shelf is found in the lower side of section 43.
2. APU Control Unit Removal (Fig. 401)
   A. Prepare to Remove the APU Control Unit.
      (1) Set these switches:
         (a) Set the APU master switch on the P5 forward overhead panel to OFF and attach a DO-NOT-OPERATE tag.
         (b) Set the BATTERY switch to OFF and attach a DO-NOT-OPERATE tag.
      (2) Open these circuit breakers on the P6 circuit breaker panel and attach DO-NOT-CLOSE tags:
         (a) APU CONT
         (b) APU GENERATOR CONTROL
      (3) Open the access door to the electronic equipment compartment.
   B. Remove the APU Control Unit
      (1) Do these tasks to remove the APU control unit:
         (a) "Electrical/Electronic Black Box Removal" (AMM 20-10-111/201).
         (b) "Metal-Encased ESDS LRUs Removal" (AMM 20-40-12/201).

            CAUTION: YOU MUST CAREFULLY DO THE STEPS IN THE TASKS TO REMOVE THE APU CONTROL UNIT. A FAILURE TO DO THE STEPS CORRECTLY CAN CAUSE DAMAGE TO THE EQUIPMENT.

3. APU Control Unit Installation (Fig. 401)
   A. Install the APU Control Unit
      (1) Do these tasks to install the APU control unit:
         (a) "Electrical/Electronic Black box Installation" (AMM 20-10-111/201).
         (b) "Metal-Encased ESDS LRUs Installation" (AMM 20-40-12/201).

            CAUTION: YOU MUST CAREFULLY DO THE STEPS IN THE TASKS TO INSTALL THE APU CONTROL UNIT. A FAILURE TO DO THE STEPS CORRECTLY CAN CAUSE DAMAGE TO THE EQUIPMENT.

   B. Restore the Airplane to Normal Configuration
      (1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 circuit breaker panel:
         (a) APU GENERATOR CONTROL
         (b) APU CONT
      (2) Remove the DO-NOT-OPERATE tag from the APU master switch on the P5 forward overhead panel.
      (3) Remove the DO-NOT-OPERATE tag from the BATTERY switch.



APU Control Unit Installation
Figure 401

(4) Do the APU operation test (AMM 49-11-0/501):
(a) Do the APU shutdown using the fire switch (AMM 49-11-0/201).

NOTE: Use one of the two fire handles to do a test of the circuit through the APU control unit.

(5) Close the access door to the electronic equipment compartment.

CENTRIFUGAL SWITCH - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Grease - BMS 3-33 (Preferred)
   B. Grease - MIL-PRF-23827 (Supercedes MIL-G-23827) (Alternate)
   C. Grease - MIL-G-21164 (Alternate)
2. Prepare for Centrifugal Switch Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

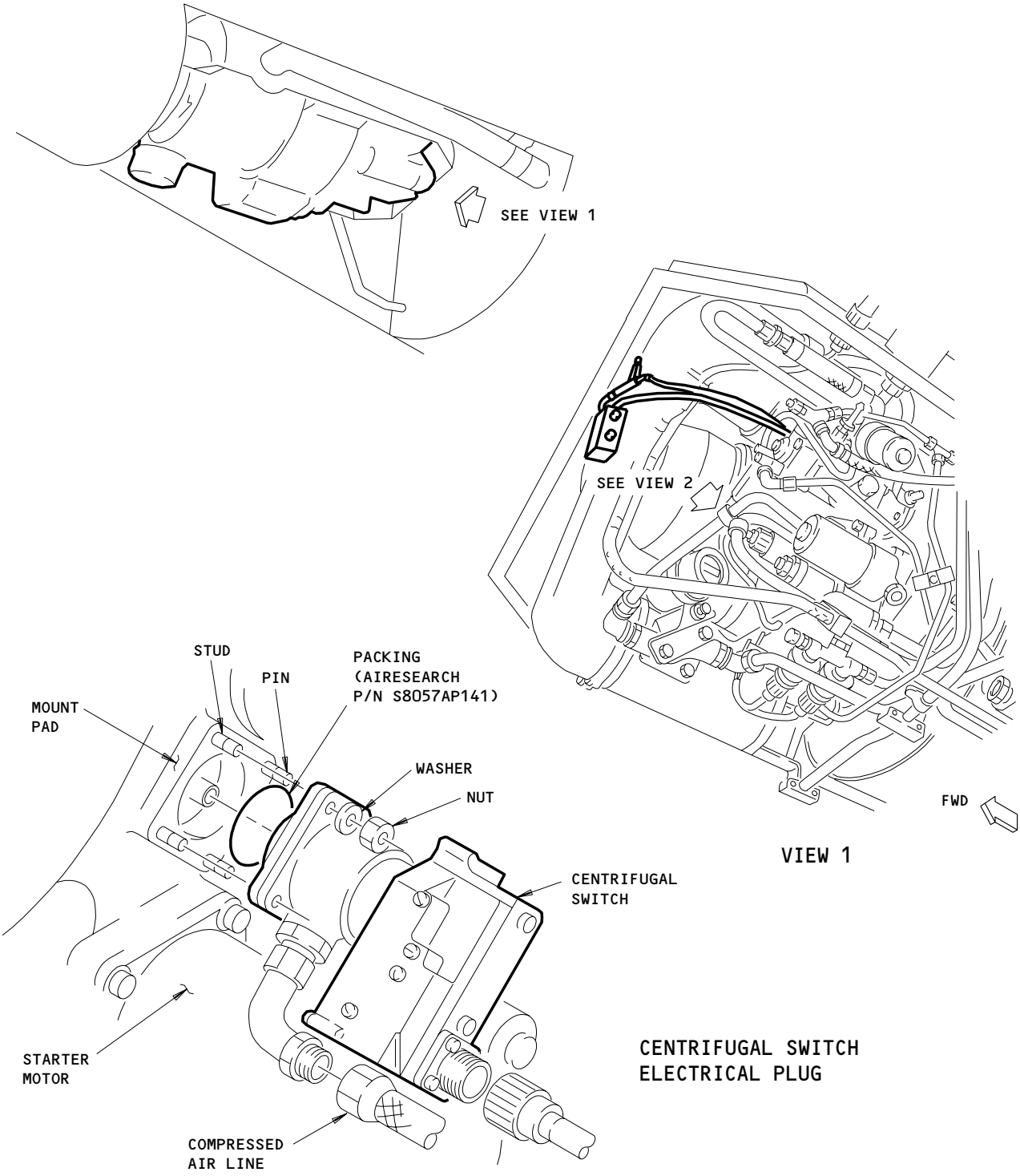
3. Remove Centrifugal Switch (Fig. 401)
   A. Disconnect electrical plug from centrifugal switch.
   B. Disconnect compressed air line from centrifugal switch.
   C. Remove switch attaching nuts and washers.
   D. Carefully withdraw switch in a straight line.
   E. Remove old packing and discard.
4. Install Centrifugal Switch (Fig. 401)
   A. Install new packing on switch mount pad.
   B. Apply light coat of lubricant to female splined shaft of accessory drive gear.
   C. Engage switch input shaft with driving shaft and slide switch onto mounting studs.

      CAUTION: ENSURE THAT SPLINES OF SHAFTS ARE ENGAGED PROPERLY BEFORE SLIDING SWITCH ONTO MOUNTING STUDS.

   D. Install switch attaching nuts and washers.

      NOTE: Nut at 9 o'clock position may be omitted to facilitate switch installation.

   E. Connect compressed air line to centrifugal switch.
   F. Connect electrical plug to centrifugal switch.
   G. Test centrifugal switch operation.
      (1) Start APU (Ref 49-11-0, Maintenance Practices).
      (2) Allow engine to stabilize.
      (3) Shut down APU (Ref 49-11-0, Maintenance Practices).



Centrifugal Switch Installation
Figure 401

5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.

PNEUMATIC SOLENOID VALVE - REMOVAL/INSTALLATION

1. Prepare for Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

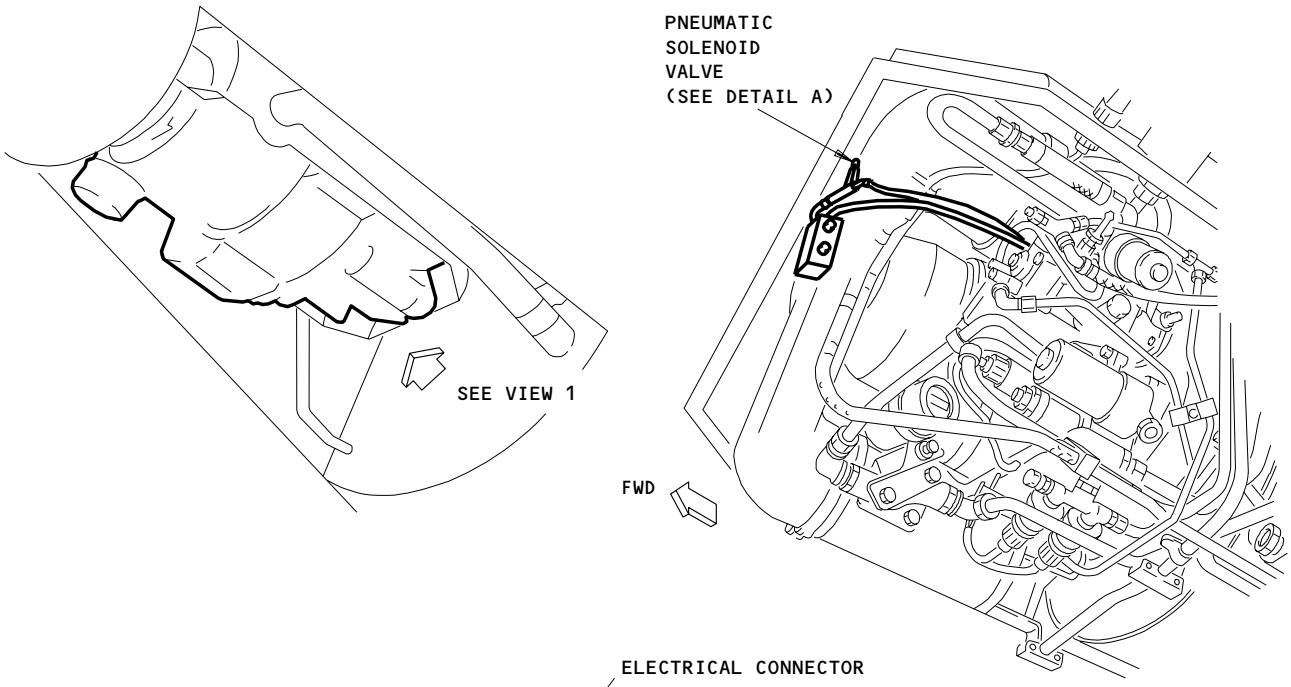
2. Remove Solenoid Valve (Fig. 401)
   A. Disconnect electrical plug from solenoid valve.
   B. Disconnect pneumatic lines from fittings on solenoid valve.
   C. Remove nuts and washers attaching solenoid valve to bracket on cooling air crossover duct, and remove valve.
3. Install Solenoid Valve (Fig 401)
   A. Position valve on bracket and attach with nuts and washers.
   B. Connect pneumatic lines to fittings on solenoid valve.

      NOTE: Do not cross lines. Upper fitting on solenoid valve must be connected to centrifugal switch.

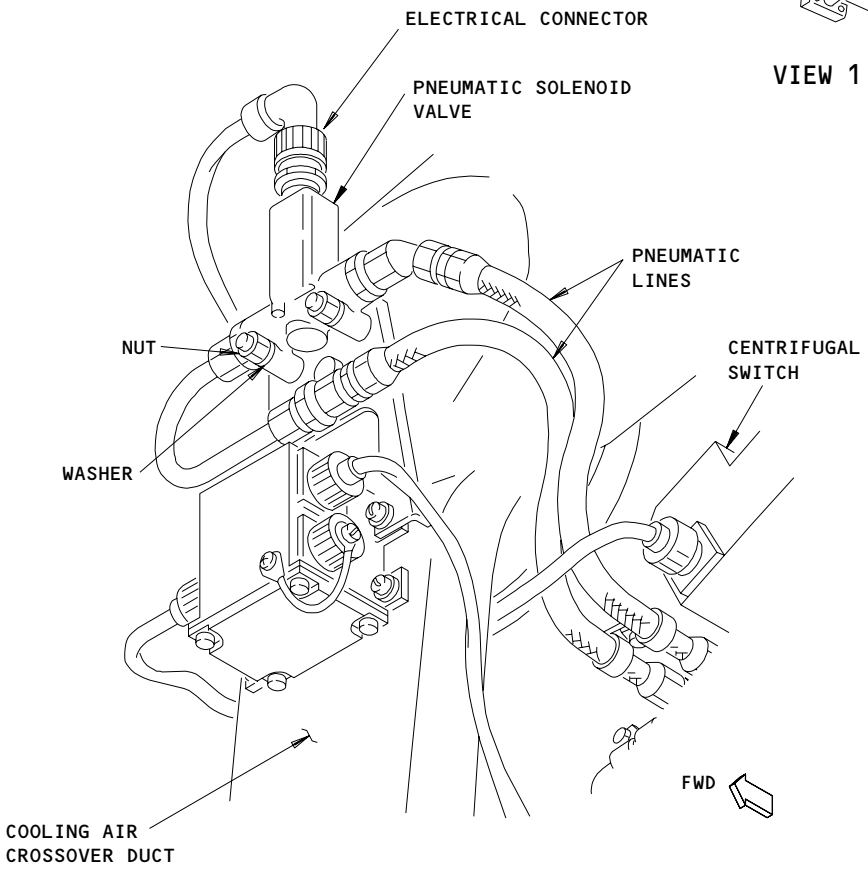
   C. Connect electrical plug to solenoid valve.
   D. Test operation of solenoid valve per 49-11-0.
4. Restore Airplane to Normal
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Remove placards and position BATTERY switch to OFF if electrical power no longer required on airplane.



VIEW 1



DETAIL A

Pneumatic Solenoid Valve Installation
Figure 401

COMPRESSOR INLET TEMPERATURE SENSOR - REMOVAL/INSTALLATION

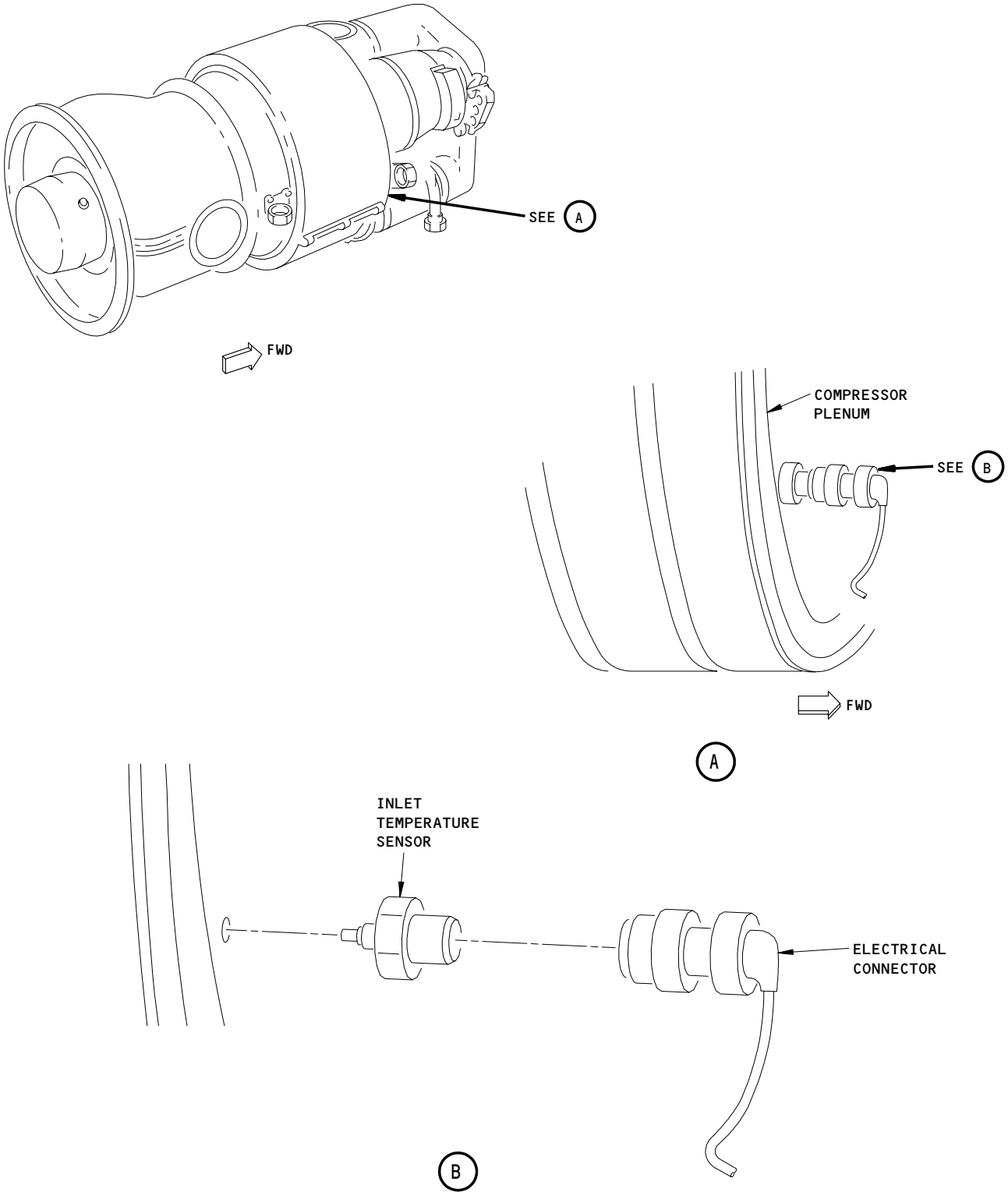
1. Prepare for the Compressor Inlet Temperature Sensor Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Compressor Inlet Temperature Sensor (Fig. 401)
   A. Disconnect the electrical connector from the compressor inlet temperature sensor.
   B. Install a cap on the electrical connector.
   C. Remove the compressor inlet temperature sensor from the compressor plenum.
3. Install Compressor Inlet Temperature Sensor (Fig. 401)
   A. Install the compressor inlet temperature sensor in the compressor plenum.
   B. Install a lockwire on the nut of the compressor inlet temperature sensor.
   C. Remove the cap from the electrical connector.
   D. Connect the electrical connector to the compressor inlet temperature sensor.
4. Restore Airplane to Normal Configuration
   A. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   B. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   C. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   D. Position BATTERY SWITCH to ON and remove placard.



Compressor Inlet Temperature Sensor Installation
Figure 401

SEQUENCING OIL PRESSURE SWITCH - REMOVAL/INSTALLATION

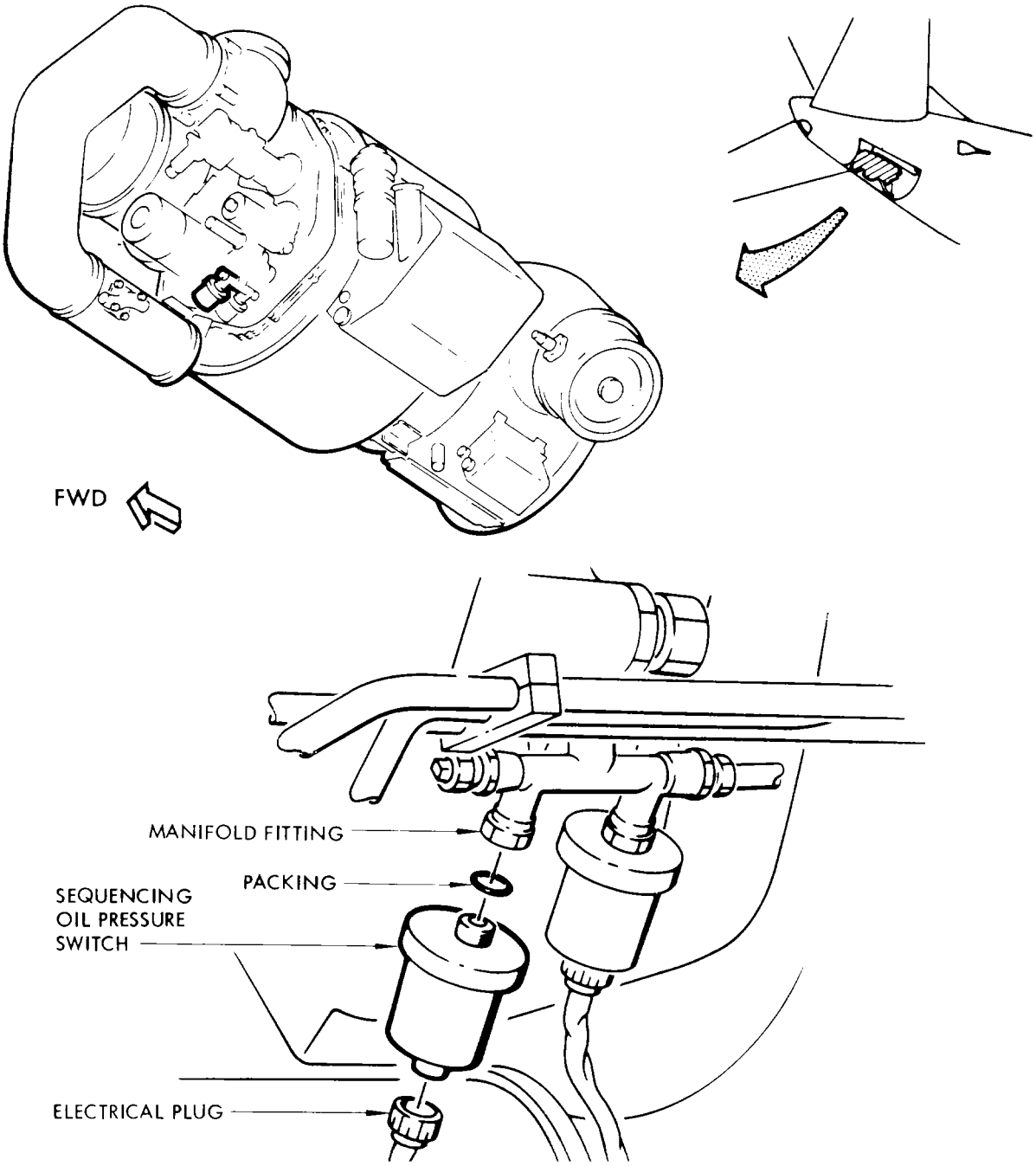
1. Prepare for Sequencing Oil Pressure Switch Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Sequencing Oil Pressure Switch
   A. Disconnect electrical plug from switch. (See figure 401.)
   B. Remove switch from manifold fitting.
   C. Remove packing from switch.
3. Install Sequencing Oil Pressure Switch
   A. Install new packing on switch. (See figure 401.)
   B. Install switch on manifold fitting.
   C. Connect electrical plug to switch.
   D. Test switch operation. Refer to 49-11-0.
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support and stow rods. Close and latch access doors.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



Sequencing Oil Pressure Switch Installation
Figure 401

LOW OIL PRESSURE SWITCH - REMOVAL/INSTALLATION

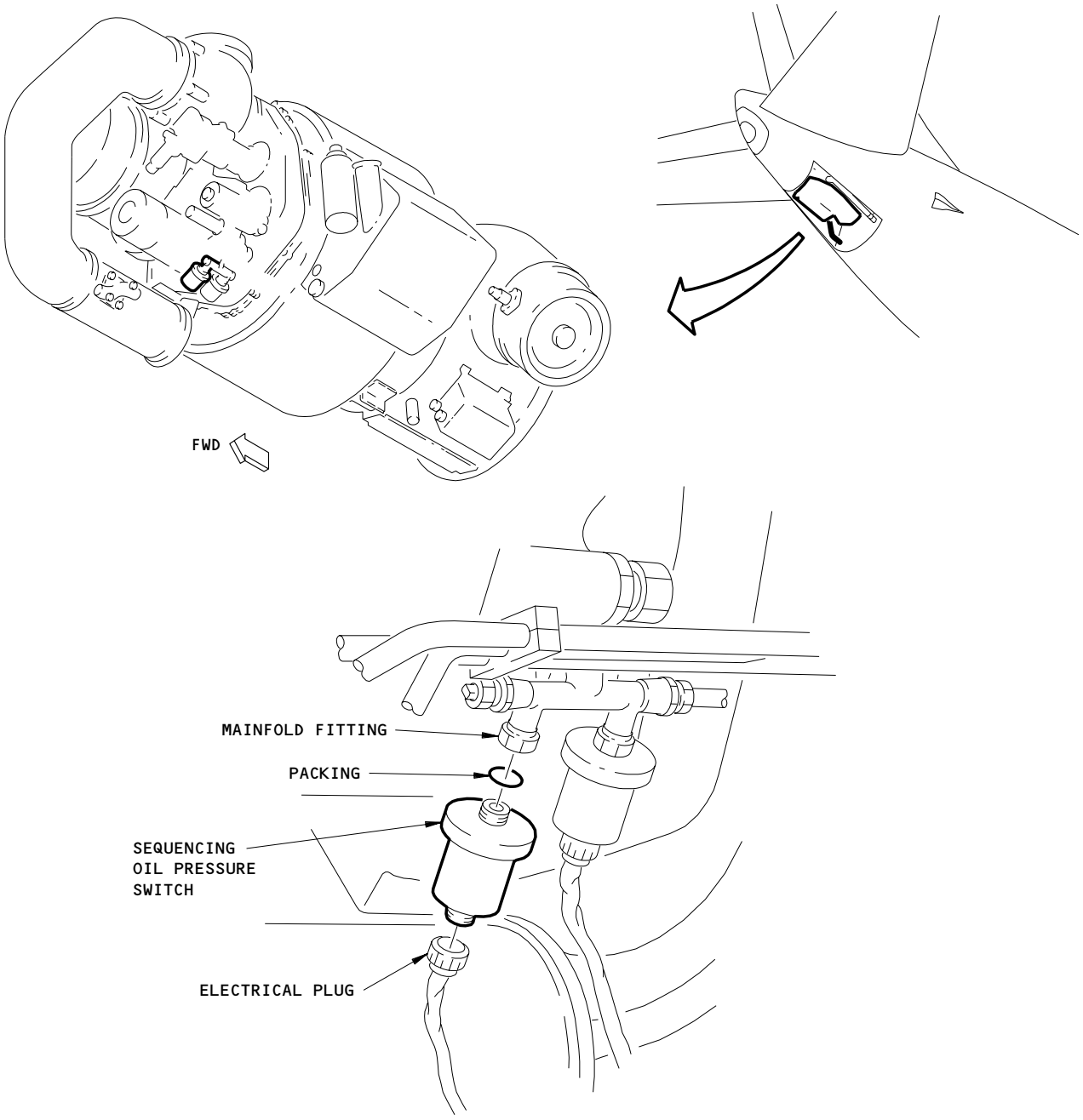
1. Prepare for Low Pressure Switch Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Low Oil Pressure Switch
   A. Disconnect electrical plug from switch. (See figure 401.)
   B. Remove switch from manifold fitting.
   C. Remove packing from switch.
3. Install Low Oil Pressure Switch
   A. Install new packing on switch. (See figure 401.)
   B. Install switch on manifold fitting.
   C. Connect electrical plug to switch.
   D. Test switch operation. Refer to 49-11-0.
4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.

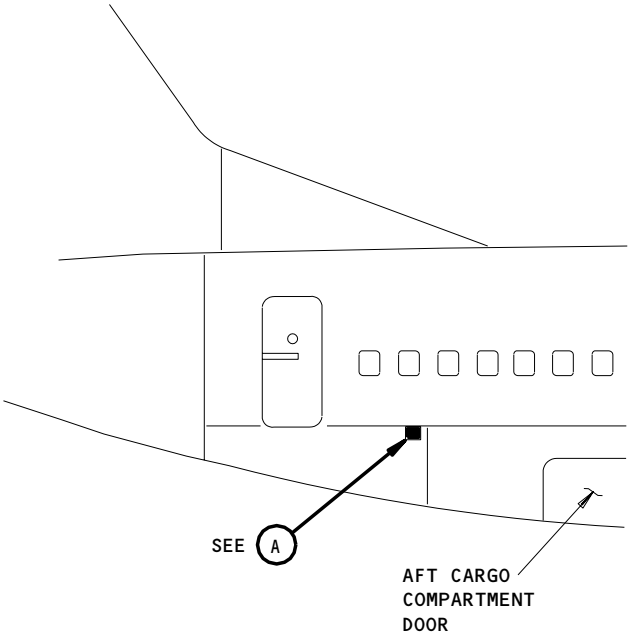


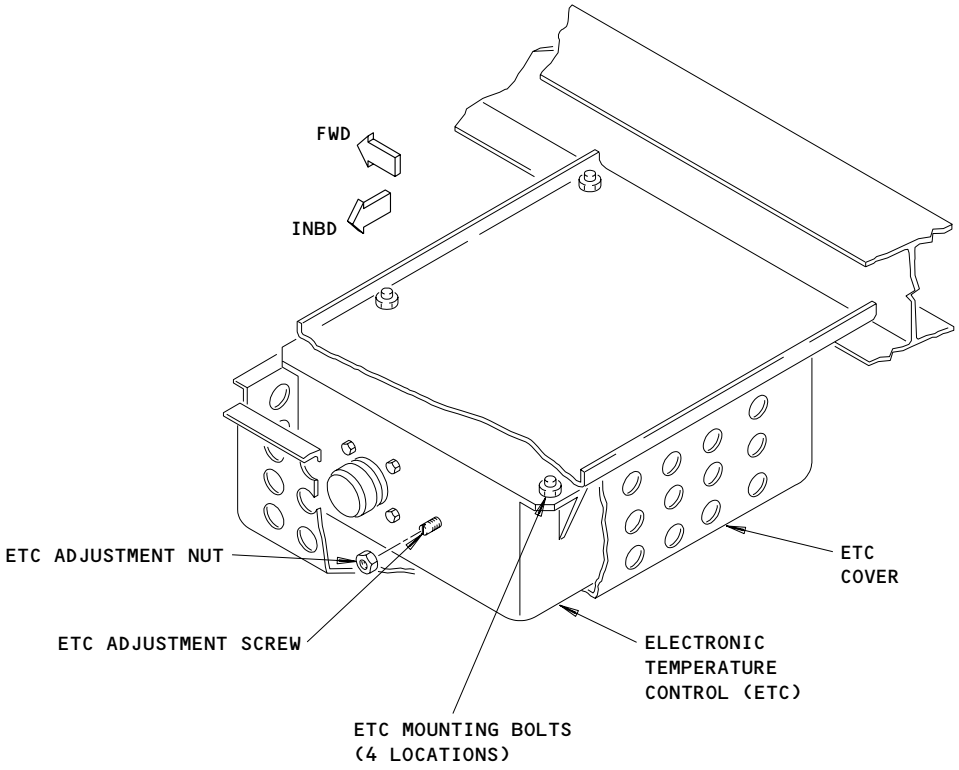
Low Oil Pressure Switch Installation
Figure 401

ELECTRONIC TEMPERATURE CONTROL - REMOVAL/INSTALLATION

1. General
   A. This procedure contains the removal and the installation tasks for the electronic temperature control (ETC).
   B. The ETC is in the equipment bay in the aft cargo compartment. You can get access to the ETC through the door for the aft cargo compartment.
2. Electronic Temperature Control (ETC) Removal (Fig. 401)
   A. Prepare to Remove the ETC
      (1) Set the switches and the circuit breakers:
         (a) Set the APU START SWITCH on the P5 overhead panel to OFF and attach a DO-NOT-OPERATE tag.
         (b) Set the BATTERY SWITCH to OFF and attach a DO-NOT-OPERATE tag.
         (c) Open these circuit breakers on the P6 circuit breaker panel and attach DO-NOT-CLOSE tags:
            1) APU CONT
            2) HOT BATT BUS
            3) BATT BUS
      (2) Open the door for the aft cargo compartment.
   B. Remove the ETC
      (1) Remove the seven bolts and the washers that attach the ETC cover to the cargo compartment ceiling.
         (a) Remove the ETC cover.
      (2) Disconnect the electrical connector from the ETC.
      (3) Remove the bolts and the washers that attach the ETC to the ceiling.
      (4) Remove the ETC.
      (5) Install caps on the electrical connectors and the ETC receptacle for protection.
3. Electronic Temperature Control (ETC) Installation (Fig. 401)
   A. Install the ETC
      (1) Attach the ETC to the ceiling with the bolts and the washers.
      (2) Remove the caps from the electrical connector and the ETC receptacle.
      (3) Connect the electrical connector to the ETC.
      (4) Attach the ETC cover to the ceiling with the seven bolts and the washers.
   B. Restore the Airplane to Normal Configuration
      (1) Close the door for the aft cargo compartment.
      (2) Set the circuit breakers and the switches:
         (a) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 circuit breaker panel:
            1) BATT BUS
            2) APU CONT
            3) HOT BATT BUS

(b) Remove the DO-NOT-OPERATE tags from the APU START SWITCH and the BATTERY SWITCH on the P5 overhead panel.





A

Electronic Temperature Control Installation
Figure 401

ELECTRONIC TEMPERATURE CONTROL - ADJUSTMENT/TEST

1. General
   A. This procedure contains an adjustment task for the electronic temperature control (ETC).
   B. You can adjust the ETC to get an EGT between 566°C (1050°F) and 649°C (1200°F). To adjust the ETC you must remove the ETC cover.
   C. The ETC is in the equipment bay in the aft cargo compartment. You can get access to the ETC through the door for the aft cargo compartment.
2. Electronic Temperature Control (ETC) Adjustment (Fig. 501)
   A. Prepare to Adjust the ETC
      (1) Open the door for the aft cargo compartment to get access to the compartment.
      (2) Remove the ETC cover:
         (a) Remove the seven bolts and the washers that attach the ETC cover to the cargo compartment ceiling.
         (b) Remove the ETC cover.
      (3) Disconnect the electrical connector from the T2 sensor.

         NOTE: The T2 sensor is at the 7:30 position on the inlet plenum.

   B. Adjust the ETC
      (1) Start and operate the APU at a stable speed without a load applied (Ref 49-11-0 MP).
      (2) Set the APU BLEED switch, on the P5 forward overhead panel to the ON position.
      (3) Set the ISOLATION VALVE switch, on the P5 forward overhead panel, to the OPEN position.
      (4) Set the L PACK and R PACK switches, on the P5 forward overhead panel, to the ON position.
      (5) Stop for 2 minutes.
      (6) Add a 100-amp electrical load to the APU electrical generator.
      (7) Monitor the APU EGT to make sure it is at the operators specific temperature between 566 and 649°C (1050-1200°F).
      (8) If the APU EGT is not at the correct temperature, adjust the ETC:
         (a) Remove the ETC adjustment nut from the ETC.
         (b) Turn the ETC adjustment screw clockwise to increase the EGT.

            NOTE: One full turn of the adjustment screw will change the EGT 3°C (6°F). The screw is a 25-turn adjustment screw without adjustment stops at the minimum and maximum positions. The screw will continue to turn after 25 turns, but the EGT will not change.

         (c) Turn the ETC adjustment screw counterclockwise to decrease the EGT.

(d) Install the adjustment nut on the ETC.

(9) Remove the 100-amp electrical load from the APU electrical generator.

(10) Set the L PACK and R PACK switches, on the P5 forward overhead panel to the OFF position.

(11) Set the ISOLATION VALVE switch, on the P5 forward overhead panel to the CLOSED position.

(12) Set the APU BLEED switch, on the P5 forward overhead panel to the OFF position.

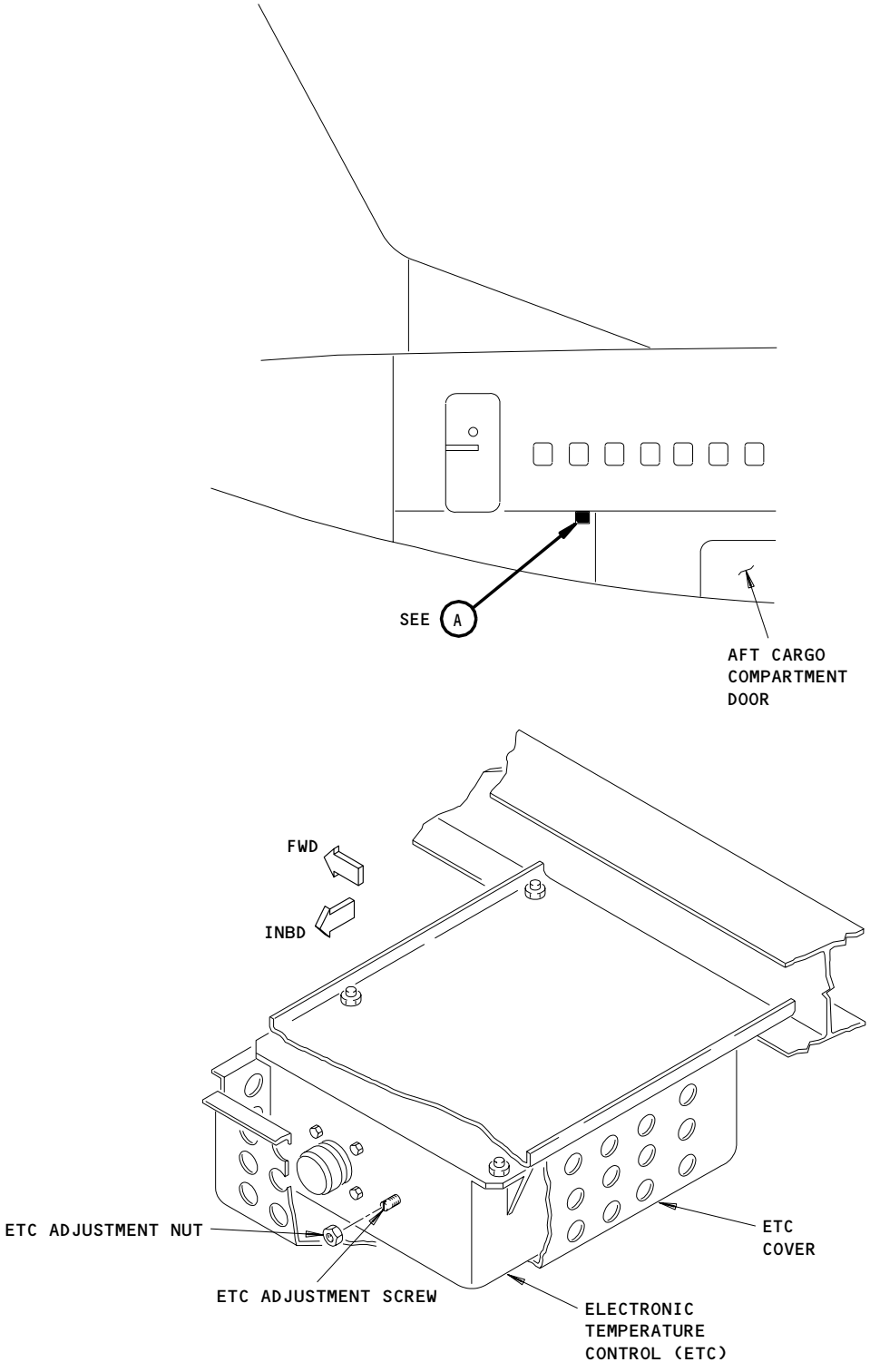
(13) Do a shutdown of the APU (Ref 49-11-0 MP).

C. Restore the Airplane to Normal Configuration

(1) Connect the electrical connector to the T2 sensor.

(2) Attach the ETC cover to the cargo compartment ceiling with the seven bolts and the washers.

(3) Close the door for the aft cargo compartment.



Electronic Temperature Control Adjustment
Figure 501

ELECTRONIC TEMPERATURE CONTROL - INSPECTION/CHECK

1. General
   A. This procedure contains a task which does a check of the EGT control point of the ETC. To do this task, you must operate the APU and apply an electrical load while you monitor the APU EGT.
2. ETC Exhaust Gas Temperature Control Point Check (Fig. 601)
   A. Prepare for the Test
      (1) Start and operate the APU (Ref 49-11-0 MP).
      (2) Let the engine operation become stable without a load applied.
      (3) Set the AC switch, on the P5 forward overhead panel, to APU GEN.
      (4) Make sure the engine operation is stable at a frequency of 405 +5 Hz with no load applied.
   B. Do the Test of the EGT Control Point
      (1) Set the APU BLEED switch, on the forward overhead panel, to the ON position.
      (2) Set the ISOLATION VALVE switch, on the P5 forward overhead panel, to the OPEN position.
      (3) Set the R PACK and L PACK switches, on the P5 forward overhead panel, to the ON position.
      (4) Stop for 2 minutes.
      (5) Add a 100-amp electrical load to the APU electrical generator.
      (6) If the maximum permitted temperature for the ETC is set to the recommended temperature of 620°C (1148°F), do these steps:
         (a) Monitor the APU EGT on the EGT indicator on the P5 forward overhead panel.
         (b) Write the APU EGT shown on the EGT indicator.
         (c) Compare the APU EGT indication with the value on Table 1.
         (d) Remove the 100-amp electrical load from the APU electrical generator.
         (e) Set the R PACK and L PACK switches, on the P5 forward overhead panel, to the OFF position.
         (f) Set the ISOLATION VALVE switch, on the P5 forward overhead panel, to the CLOSED position.
         (g) Set the APU BLEED switch, on the P5 forward overhead panel, to the OFF position.
         (h) Do a shutdown of the APU (Ref 49-11-0 MP).
         (i) If the APU EGT shown on the EGT indicator did not agree with the Table 1 value, adjust the ETC (Ref 49-61-71 A/T).
      (7) If the maximum permitted ETC temperature is set at the operators specified value, do these steps:
         (a) Disconnect the T2 bias connector from the ETC.
         (b) Monitor the maximum APU EGT permitted by the ETC.
         (c) Write the maximum APU EGT permitted by the ETC.
         (d) Remove the 100-amp electrical load from the APU electrical generator.

FULLY LOADED CONDITION [1]
APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
0	-18	516 ±10
2	-17	519 ±10
4	-16	521 ±10
6	-14	524 ±10
8	-13	527 ±10
10	-12	529 ±10
12	-11	532 ±10
14	-10	534 ±10
16	-9	537 ±10
18	-8	540 ±10
20	-7	542 ±10
22	-6	545 ±10
24	-4	548 ±10
26	-3	550 ±10
28	-2	553 ±10
30	-1	556 ±10
32	0	558 ±10
34	1	561 ±10
36	2	563 ±10
38	3	566 ±10
40	4	569 ±10
42	6	571 ±10
44	7	574 ±10
46	8	577 ±10
48	9	579 ±10

TABLE 1

[1] EGT INDICATION WITH THE APU IN THE FULLY LOADED CONDITION (BOTH A/C PACKS ON HIGH AND A 100 AMP ELECTRICAL LOAD) WITH A T2 BIAS FROM THE ETC (EGT SET-POINT AT 621°C).

Operation Limits
Figure 601 (Sheet 1)

FULLY LOADED CONDITION 1

APU EGT VS OUTSIDE AIR TEMPERATURE

OAT °F	OAT °C	APU EGT °C
50	10	580 ±10
52	11	584 ±10
54	12	588 ±10
56	13	590 ±10
58	14	592 ±10
60	16	595 ±10
62	17	598 ±10
64	18	600 ±10
66	19	603 ±10
68	20	606 ±10
70	21	608 ±10
72	22	611 ±10
74	23	613 ±10
76	24	616 ±10
78	26	619 ±10
80	27	621 ±10
82	28	621 ±10
84	29	621 ±10
86	30	621 ±10
88	31	621 ±10
90	32	621 ±10
92	33	621 ±10
94	34	621 ±10
96	36	621 ±10
98	37	621 ±10
100	38	621 ±10
102	39	621 ±10
104	40	621 ±10
106	41	621 ±10
108	42	621 ±10

TABLE 1 (CONT)

Operation Limits
Figure 601 (Sheet 2)

453114

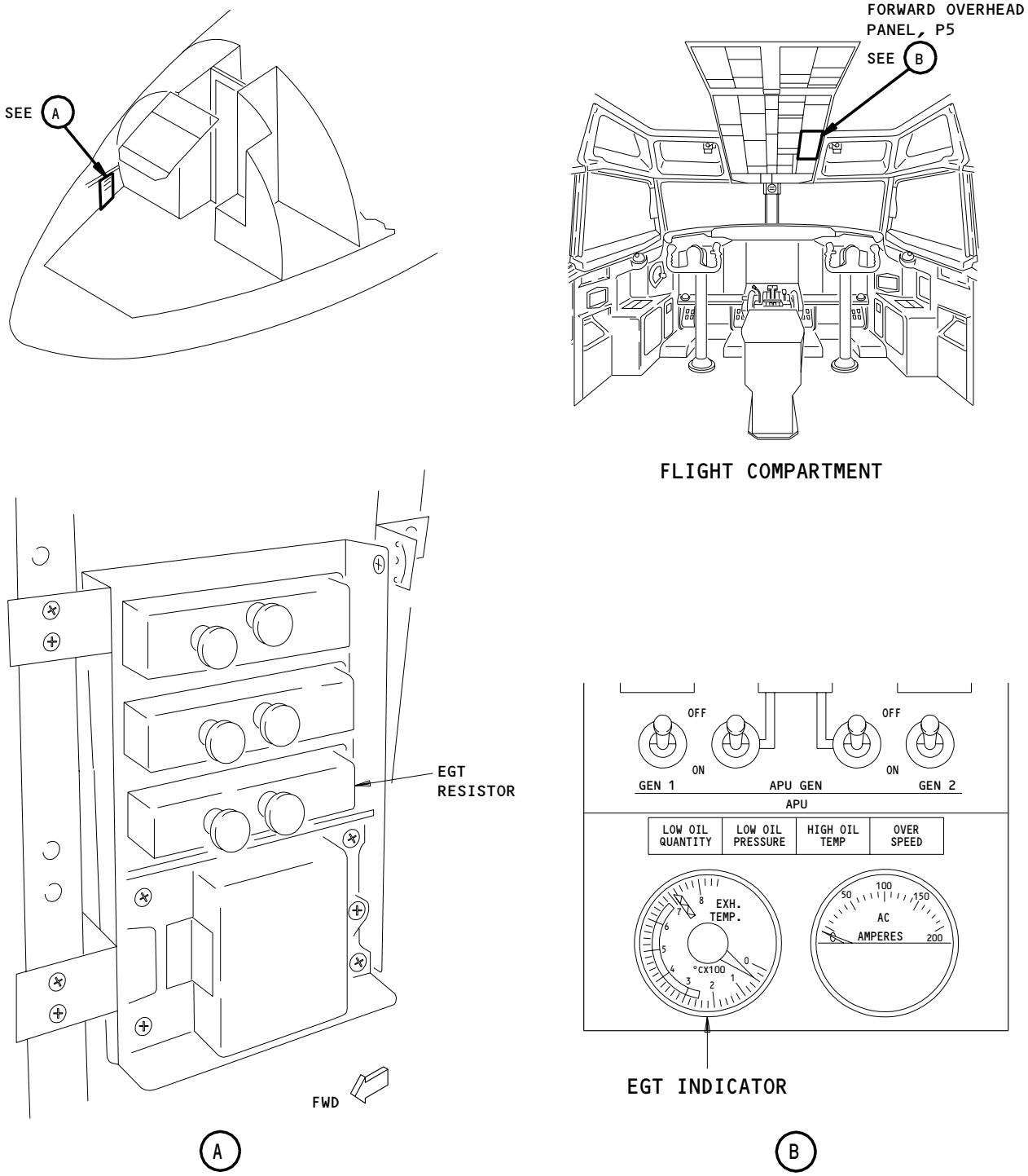
(e) Set the R PACK and L PACK switches to OFF.
(f) Set the APU BLEED switch to OFF.
(g) Do a shutdown of the APU (Ref 49-11-0 MP).
(h) If the maximum APU EGT permitted by the ETC does not agree with the operators value, adjust the ETC (Ref 49-61-71 A/T).

INDICATING - DESCRIPTION AND OPERATION

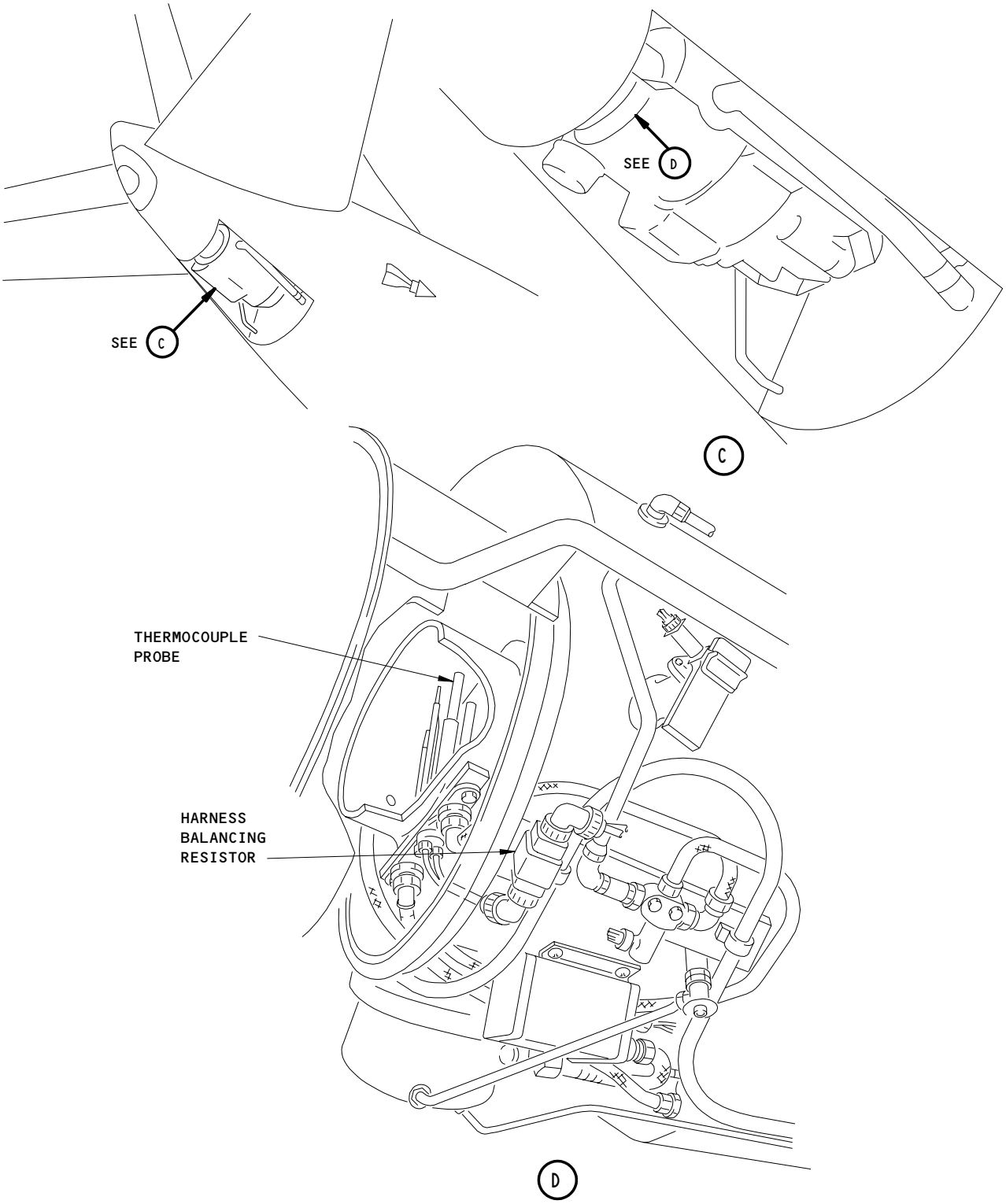
1. General
   A. The APU exhaust gas temperature (EGT) indicating system and the APU indicating system comprise the APU indicating. The APU EGT indicating system provides means of monitoring the turbine EGT on an indicator in the control cabin. The APU indicating system provide means for monitoring the engine overspeed and the elapsed time of the engine operation. The overspeed light is located on the forward overhead panel. The elapsed time indicator is located on the APU engine. For detail description of the APU indicating, refer to 49-71-0 (Airplanes without the ETC), 49-71-01 (Airplanes with the ETC), APU Exhaust Gas Temperature Indicating System and 49-72-0, APU Indicating System.

EGT INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The EGT indicating system measures the temperature of the APU engine exhaust. This temperature is shown on the EGT indicator on the P5 forward overhead panel. The EGT indicating system has a thermocouple probe, an EGT resistor, a harness balancing resistor, and an EGT indicator. The airplane wires are copper and constantan. The wires in the APU shroud are chromel and alumel because of the high temperatures.
   B. The thermocouple probe measures the EGT of the APU engine. The heat of the exhaust gases makes the thermocouple probe send a dc signal to the EGT indicator, on the P5 forward overhead panel, to show the correct temperature. The EGT resistor is part of the circuit. The EGT resistor and the harness balancing resistor adjust the EGT indicating system
2. Thermocouple Probe
   A. The thermocouple probe measures the temperature of the exhaust gases from the APU engine. The thermocouple probe is installed in the turbine exhaust port. The thermocouple probe has two stud terminals, a head, and a measurement junction. The thermocouple leads and studs are made of chromel and alumel materials. The alumel stud terminal (-) is larger than the chromel stud terminal (+).
3. EGT Resistor
   A. The EGT resistor permits the adjustment of the circuit for the EGT indicating system. The EGT resistor has a spool of No. 24 constantan wire, coarse adjustment terminals, and vernier adjustment terminals. The primary adjustment for the resistance removes wire from the resistance spool. Because of this, the EGT resistor has an extra spool of wire.
4. Harness Balancing Resistor
   A. The harness balancing resistor has a specified resistance value. The harness balancing resistor is installed for each APU engine. Do not replace the harness balancing resistor with any other resistance value.
5. EGT Indicator
   A. The EGT indicator is a millivoltmeter in a hermetically sealed case. The EGT indicator has an electrical plug on the rear side. The electrical plug connects the EGT indicator to the circuit for the EGT indicating system. The dial of the EGT indicator show temperatures from 0 to 850°C. There are color bands to show the usual and dangerous temperature ranges.
6. Operation (Fig. 2)
   A. The APU engine EGT indicating system consists of a thermocouple probe connected to an indicator and operates on self-generated power. The airplane power is used only for lighting of the indicator.
   A. The EGT indicating system has a thermocouple probe connected to the EGT indicator on the P5 forward overhead panel. The airplane electrical system only supplies the lighting for the EGT indicator.

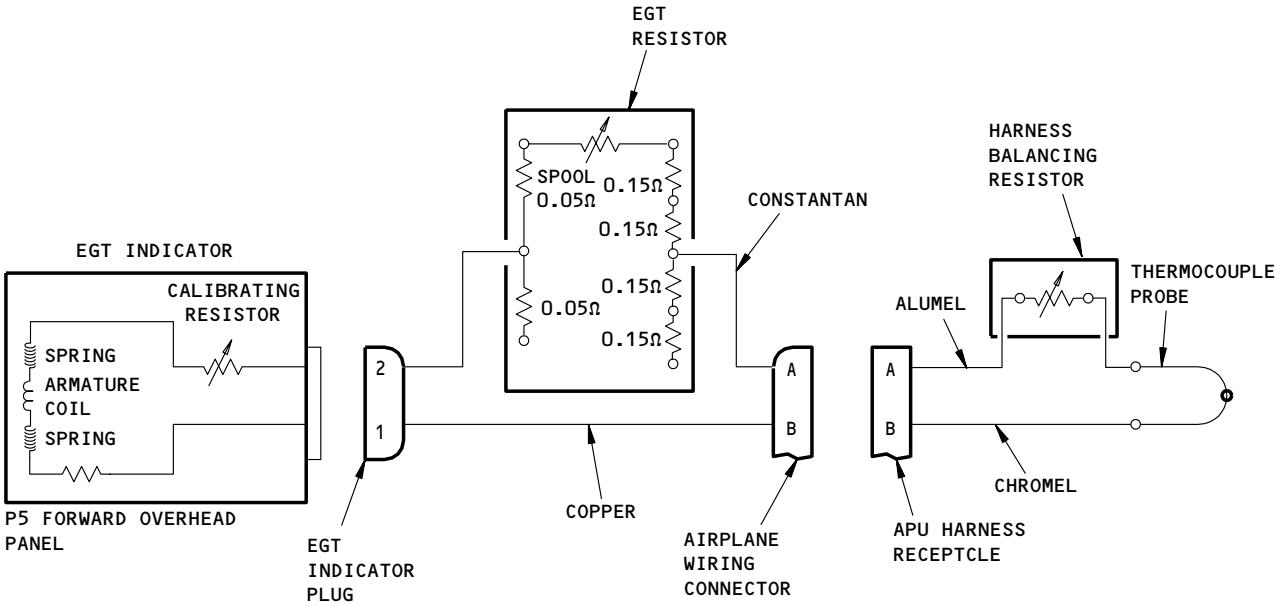


APU EGT Indicating System Component Location
Figure 1 (Sheet 1)



APU EGT Indicating System Component Location
Figure 1 (Sheet 2)

B. The temperature difference between the thermocouple probe (hot junction) and the EGT indicator (cold junction) make electrical signals in the circuit for the EGT indicating system. The difference between these electrical signals is in proportion to the difference in temperature between the thermocouple probe and the EGT indicator. Because the electrical signal only corresponds to a temperature difference, the ambient temperature of the control cabin must be added to the temperature difference to get the actual temperature of the exhaust gases. The temperature of the control cabin has small variations. The EGT indicator has a bimetal (thermostatic) spring to make allowances for these temperature changes. The EGT indicator does show the correct temperature for the exhaust gases in all ambient conditions.



APU EGT Indicating System Schematic
Figure 2

APU EXHAUST GAS TEMPERATURE INDICATING SYSTEM - ADJUSTMENT/TEST

1. General
   A. The APU exhaust gas temperature (EGT) indicating system test consists of two separate tests:
      (1) An insulation resistance test of the complete EGT circuit, including the EGT thermocouple probe.
      (2) A test of the installed EGT harness including balancing resistor.
      Tests may be performed independently or as a complete system test.
   B. When performing the insulation resistance test, the following information must be kept in mind:
      (1) On the APU engine, the leads are Alumel and Chromel. The Alumel lead is magnetic and negative and is color-coded green. The chromel lead is nonmagnetic and color-coded white. In the fuselage, the leads are copper and constantan. The copper lead is positive and color-coded red. The constantan lead is negative and color-coded yellow.
   C. The exhaust gas temperature (EGT) balancing resistor is located on the control cabin structure directly under the right No. 3 window. The circuit resistance is adjusted by moving the constantan leads from terminal to terminal on the coarse or vernier adjustments. The resistance increment between two coarse adjustment terminals is 0.15 ohm and between two vernier adjustment terminals is 0.05 ohm. External circuit resistance excluding the indicator and engine harness is 13.50 ohms nominal. To decrease the circuit resistance beyond coarse and vernier adjustment range, the wire on resistance spool is shortened. To increase the resistance beyond coarse and vernier adjustment range, the spare or new resistance spool is used and adjusted.
2. Insulation Resistance Test
   A. Equipment and Materials
      (1) Ohmmeter - capable of measuring resistance to 100,000 ohms
   B. Prepare for Insulation Resistance Test
      (1) Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work".
      (2) Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
      (3) Disconnect plug from APU EGT indicator on forward overhead panel.
      (4) Open APU compartment access door latches and open access door. Install door support rods.
      (5) Support lower shroud, open shroud latches, and remove shroud.

          CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

      (6) Disconnect engine EGT lead at receptacle in upper shroud.

C. Test Insulation Resistance
   (1) Test Insulation Resistance between EGT Indicator Plug and receptacle in upper shroud.
      (a) Connect one side of ohmmeter to receptacle pin A in upper shroud and other side of ohmmeter to ground.
      (b) Test lead for short to ground. Resistance must be more than 100,000 ohms.
      (c) Repeat steps (a) and (b) using receptacle pin B in upper shroud.
      (d) Remove ohmmeter from receptacle in upper shroud.
   (2) Test Insulation Resistance of APU Engine Leads
      (a) Connect one side of ohmmeter to one socket of engine lead plug and other side of ohmmeter to ground.
      (b) Test engine leads for shorts to ground. Resistance must be more than 10,000 ohms.
      (c) Remove ohmmeter from engine lead plug.

D. If balancing resistor test for the EGT is not necessary, restore airplane to normal configuration (AMM 49-71-0/501).

3. Exhaust Gas Temperature Balancing Resistor Test

A. Equipment and Materials
   (1) Wheatstone Bridge - approved to 13.50 ±0.01 ohms minimum
   (2) Multimeter - measurement range of 13.50 ±0.01 ohms, Model 8012A-01, Fluke, P.O. Box 9090, Everett, WA 98206-9090 (this is an alternative to the wheatstone bridge)

B. Prepare for EGT Balancing Resistor Test
   (1) Prepare same as for Insulation Resistor Test.
   (2) Install jumper across pins A and B on receptacle in upper shroud. The jumper must be of copper with resistance value not to exceed 0.05 ohm.

C. Test Exhaust Gas Temperature Balancing Resistor
   (1) Connect wheatstone bridge or the multimeter to receptacles 1 and 2 of plug disconnected from EGT indicator.
   (2) Measure circuit resistance. The resistance value shall be as shown in Table 501.

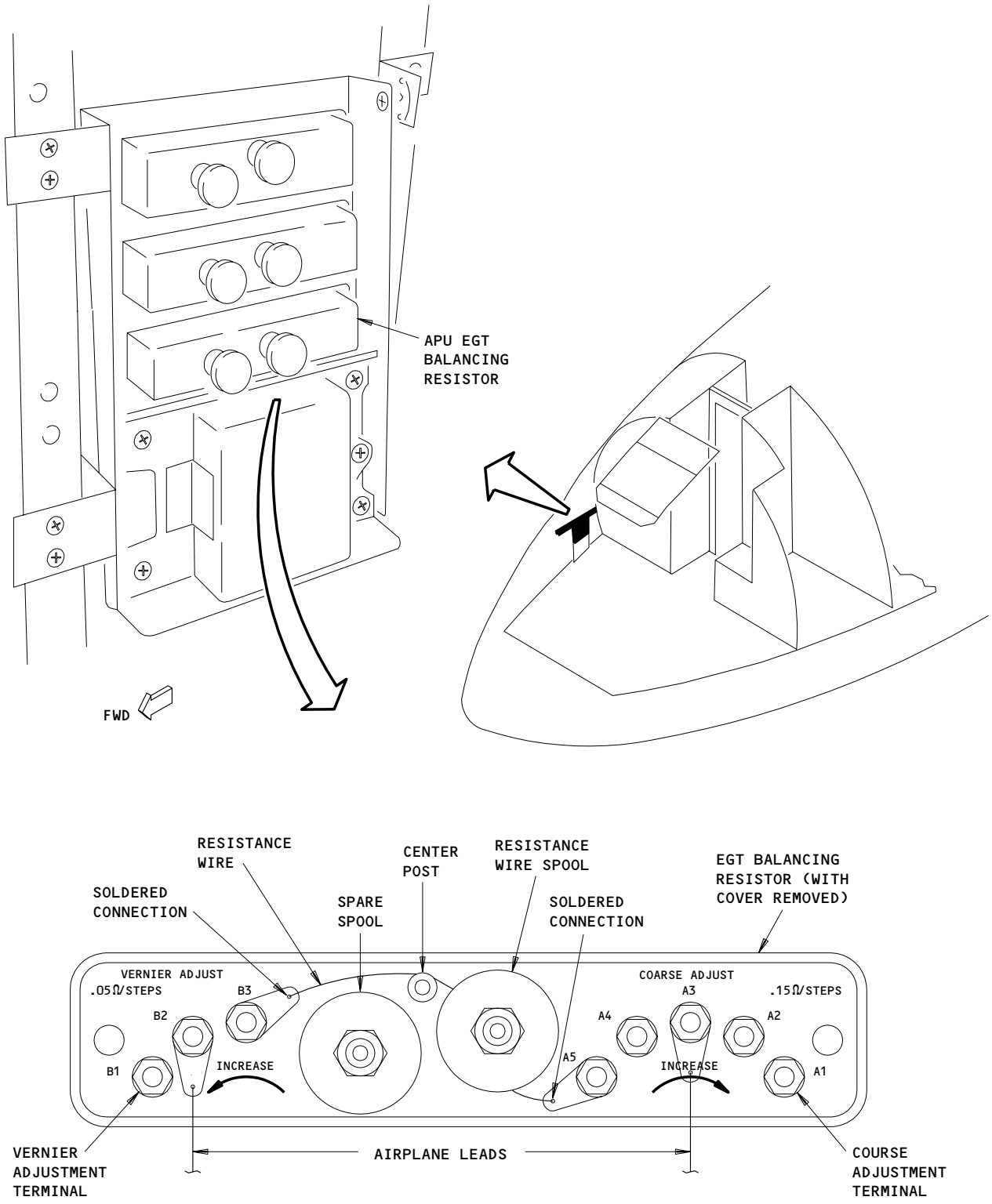
      NOTE: If resistance is not within tolerance, check circuit for loose, corroded or shorted connections. Dissimilar materials at connections (nuts, screws, washers, etc.) can also cause incorrect circuit resistance.

TABLE 501		
CIRCUIT RESISTANCE	AMBIENT TEMPERATURE	
13.53 ±0.05 OHMS	30 ±5°C	86 ±9°F
13.50 ±0.05 OHMS	20 ±5°C	68 ±9°F
13.47 ±0.05 OHMS	10 ±5°C	50 ±9°F
13.44 ±0.05 OHMS	0 ±5°C	32 ±9°F
13.41 ±0.05 OHMS	-10 ±5°C	14 ±9°F

(3) If circuit resistance value is met, disconnect wheatstone bridge or the multimeter from circuit and proceed to step D.
(4) If circuit resistance value is not met, proceed as follows:
  (a) Remove resistor cover (Fig. 501).
  (b) When circuit resistance is in the range of coarse and vernier adjustments, adjust resistor as described in step (5).
  (c) When circuit resistance is above the range of coarse and vernier adjustments, adjust resistor as described in step (6).
  (d) When circuit resistance is below the range of coarse and vernier adjustments, adjust resistor as described in step (7).
(5) Adjust resistor using coarse and vernier adjustments.
  (a) Reposition airplane lead from one coarse adjustment terminal to other coarse adjustment terminals and one vernier adjustment terminal to other vernier adjustment terminals until circuit resistance value shown in Fig. 501 is obtained.
  (b) Disconnect wheatstone bridge or the multimeter from circuit.
(6) Decrease circuit resistance using resistor spool.
  (a) Install jumper across pins 1 and 2 on EGT plug that is disconnected from indicator. The jumper must be of copper with resistance value not to exceed 0.05 ohm.
  (b) Connect one airplane lead to coarse adjustment terminal A3 and other airplane lead to vernier adjustment terminal B2 (Fig. 501).
  (c) Using soldering iron, disconnect resistance spool wire end from vernier adjustment terminal B3.
  (d) Connect one lead of wheatstone bridge or the multimeter to vernier adjustment terminal B3.
  (e) On the basis of approximately 0.7 ohm resistance per foot of wire, unwind amount of wire necessary to give approximately correct resistance.

(f) Remove enough insulation from resistance wire to make a good contact with wheatstone bridge or the multimeter lead; then connect other lead of wheatstone bridge or the multimeter to wire. Move lead along wire, removing wire insulation as required, until resistance value shown in Fig. 501 is obtained.
(g) Cut wire at this point and remove wheatstone bridge or the multimeter from circuit.
(h) Thoroughly scrape insulation from end of wire.
(i) Wind excess wire back on spool and once around center post, leaving sufficient length of wire to reach vernier adjustment terminal B3 for soldering.
(j) Solder end of wire to terminal.
(k) Remove jumper from EGT indicator plug.
(l) Check circuit resistance per steps (2) and (3).

(7) Increase circuit resistance using resistance spool.
(a) Disconnect wheatstone bridge or the multimeter from circuit.
(b) Install jumper across pins 1 and 2 on EGT plug that is disconnected from indicator. The jumper must be of copper with resistance value not to exceed 0.05 ohm.
(c) Connect one airplane lead to coarse adjustment terminal A3 and other airplane lead to vernier adjustment terminal B2 (Fig. 501).
(d) Using soldering iron, disconnect resistance spool wire ends from coarse adjustment terminal A5 and vernier adjustment terminal B3.
(e) Remove old resistance spool and replace with new or spare spool.
(f) Thoroughly scrape insulation from end of wire emerging from center of new spool.
(g) Solder cleaned wire end to coarse adjustment terminal A5.
(h) Connect one lead of wheatstone bridge or the multimeter to vernier adjustment terminal B3.
(i) Remove enough insulation from loose end of resistance wire to make a good contact with wheatstone bridge or the multimeter lead, then connect other lead of wheatstone bridge or the multimeter to wire.
(j) Measure circuit resistance and record.
(k) Remove lead of wheatstone bridge or the multimeter from loose end of resistance wire.
(l) On the basis of approximately 0.7 ohm resistance per foot of wire, unwind amount of wire necessary to give approximately correct resistance.



APU Exhaust Gas Temperature Indicating System Adjustment
Figure 501

(m) Remove enough insulation from resistance wire to make a good contact with wheatstone bridge or the multimeter lead; then connect other lead of wheatstone bridge or the multimeter to wire. Move lead along wire, removing wire insulation as required, until resistance value shown in Fig. 501 is obtained.
(n) Cut wire at this point and remove wheatstone bridge or the multimeter from circuit.
(o) Thoroughly scrape insulation from end of wire.
(p) Wind excess wire back on spool and once around center post, leaving sufficient length of wire to reach vernier adjustment terminal B3 for soldering.
(q) Solder end of wire to terminal.
(r) Remove jumper from EGT indicator plug.
(s) Check circuit resistance per steps (2) and (3).

(8) Install resistor cover.

D. Restore Airplane to Normal Configuration

(1) Connect plug to EGT indicator (if disconnected), safety wire, and install indicator on forward overhead panel.
(2) Remove jumper from EGT receptacle in upper shroud.
(3) Connect plug to receptacle in upper shroud and safety wire.
(4) Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
(5) Position lower shroud against upper shroud and close shroud latches.

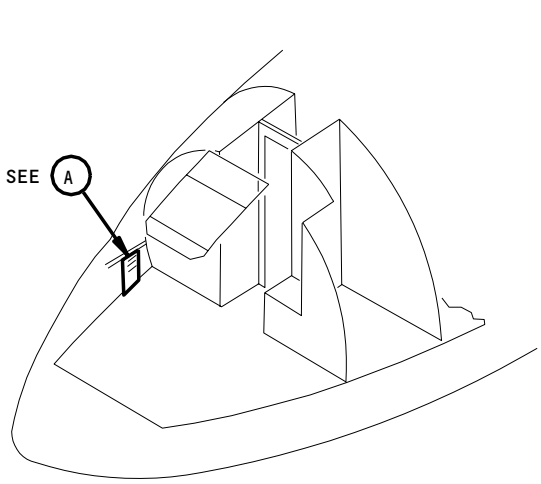
CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.

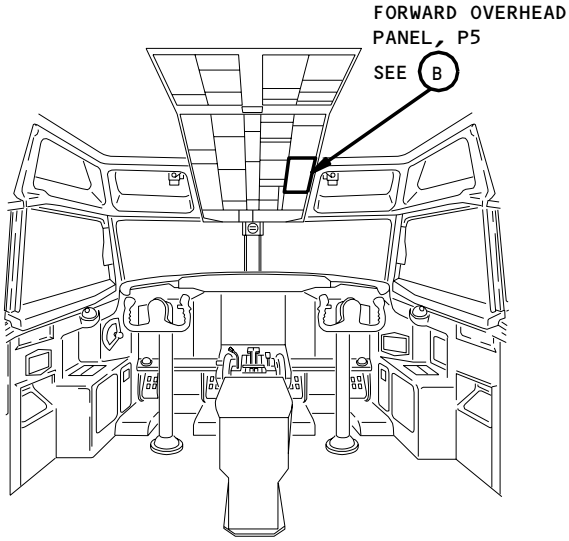
EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

(6) Disengage APU compartment access door rods and stow rods. Close and latch APU access door.
(7) Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
(8) Position BATTERY SWITCH to ON and remove placards.

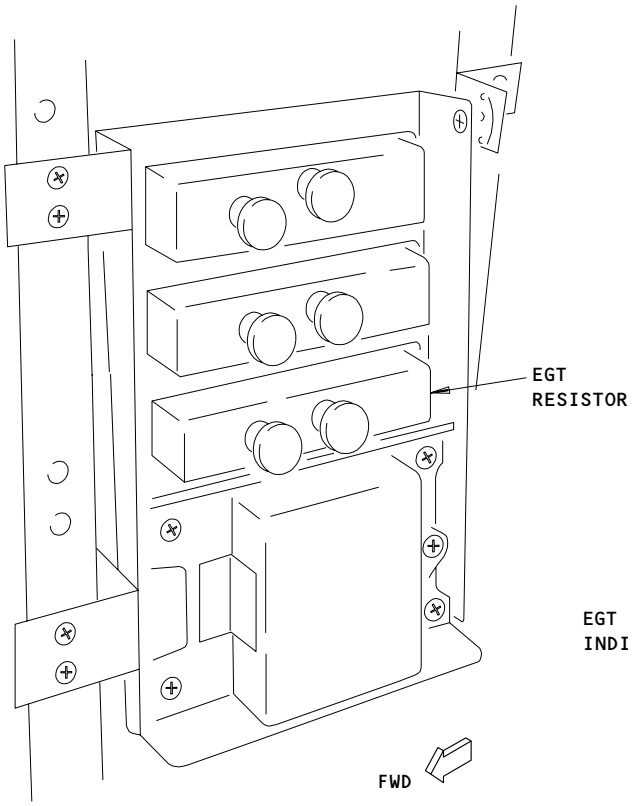
EGT INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The EGT indicating system measures the temperature of the APU engine exhaust. This temperature is shown on the EGT indicator on the P5 forward overhead panel. The EGT indicating system has two ETC thermocouple probes, an EGT resistor, and an EGT indicator. The airplane wires are copper and constantan. The wires in the APU shroud are chromel and alumel because of the high temperatures.
   B. The two ETC thermocouple probes measure the EGT of the APU engine. The heat of the exhaust gases make the ETC thermocouple probes send dc signals to the ETC. The ETC sends a signal to the EGT indicator, on the P5 forward overhead panel, to show the correct temperature. The EGT resistor is part of the circuit. The EGT resistor adjusts the EGT indicating system.
   C. The electronic temperature control (ETC) is part of the circuit between the two ETC thermocouple probes and the EGT indicator. The ETC is not a part of the EGT indicating system. For a more detailed description of the ETC, refer to 49-61-00 D&O.
2. ETC Thermocouple Probe
   A. The two ETC thermocouple probes measure the temperature of the exhaust gases from the APU engine. The ETC thermocouple probes are installed in the turbine exhaust port. The two ETC thermocouple probes have four stud terminals and four measurement junctions. The thermocouple leads and studs are made of chromel and alumel materials.
3. EGT Resistor
   A. The EGT resistor permits the adjustment of the circuit for the EGT indicating system. The EGT resistor has a spool of No. 24 constantan wire, coarse adjustment terminals, and vernier adjustment terminals. The primary adjustment for the resistance removes wire from the resistance spool. Because of this, the EGT resistor has an extra spool of wire. The EGT indicator is found in the control cabin directly below the right No. 3 window. The total resistance is 13.5 ohms without the EGT indicator, ETC thermocouple probes and APU engine harness.
4. EGT Indicator
   A. The EGT indicator is a millivolt meter in a hermetically sealed case. The EGT indicator has an electrical plug on the rear side. The electrical plug connects the EGT indicator to the circuit for the EGT indicating system. The dial of the EGT indicator shows temperatures from 0 to 850°C. There are color bands to show the usual and dangerous temperature ranges.
5. Operation (Fig. 2)
   A. The EGT indicating system has the two ETC thermocouple probes connected to the EGT indicator on the P5 forward overhead panel. The airplane electrical system supplies the power for the EGT indicating system.

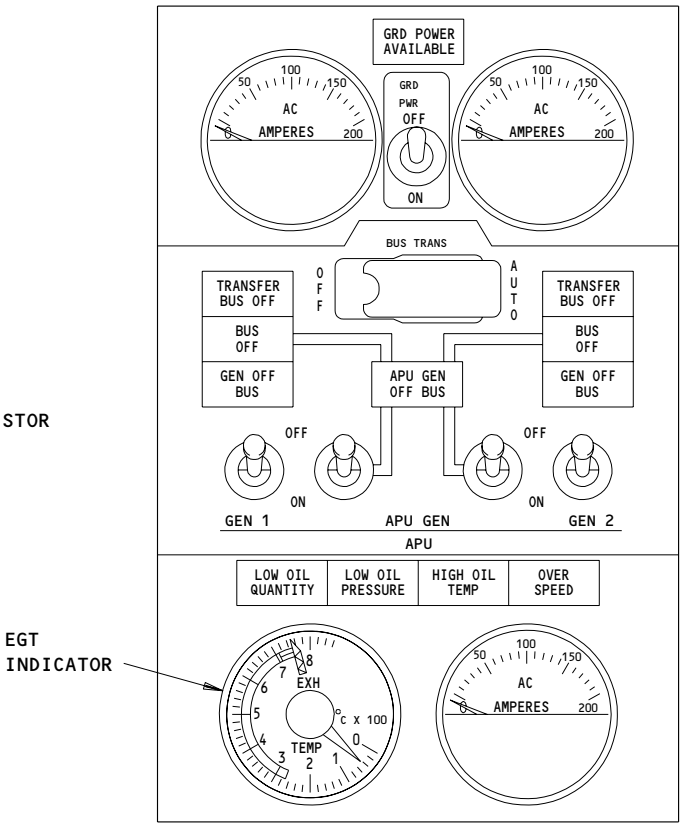




FLIGHT COMPARTMENT



A



FORWARD OVERHEAD PANEL, P5

B

APU EGT Indicating System Component Location
Figure 1 (Sheet 1)

EFFECTIVITY
Airplanes with the ETC

49-71-01

01 Page 2
Dec 01/04

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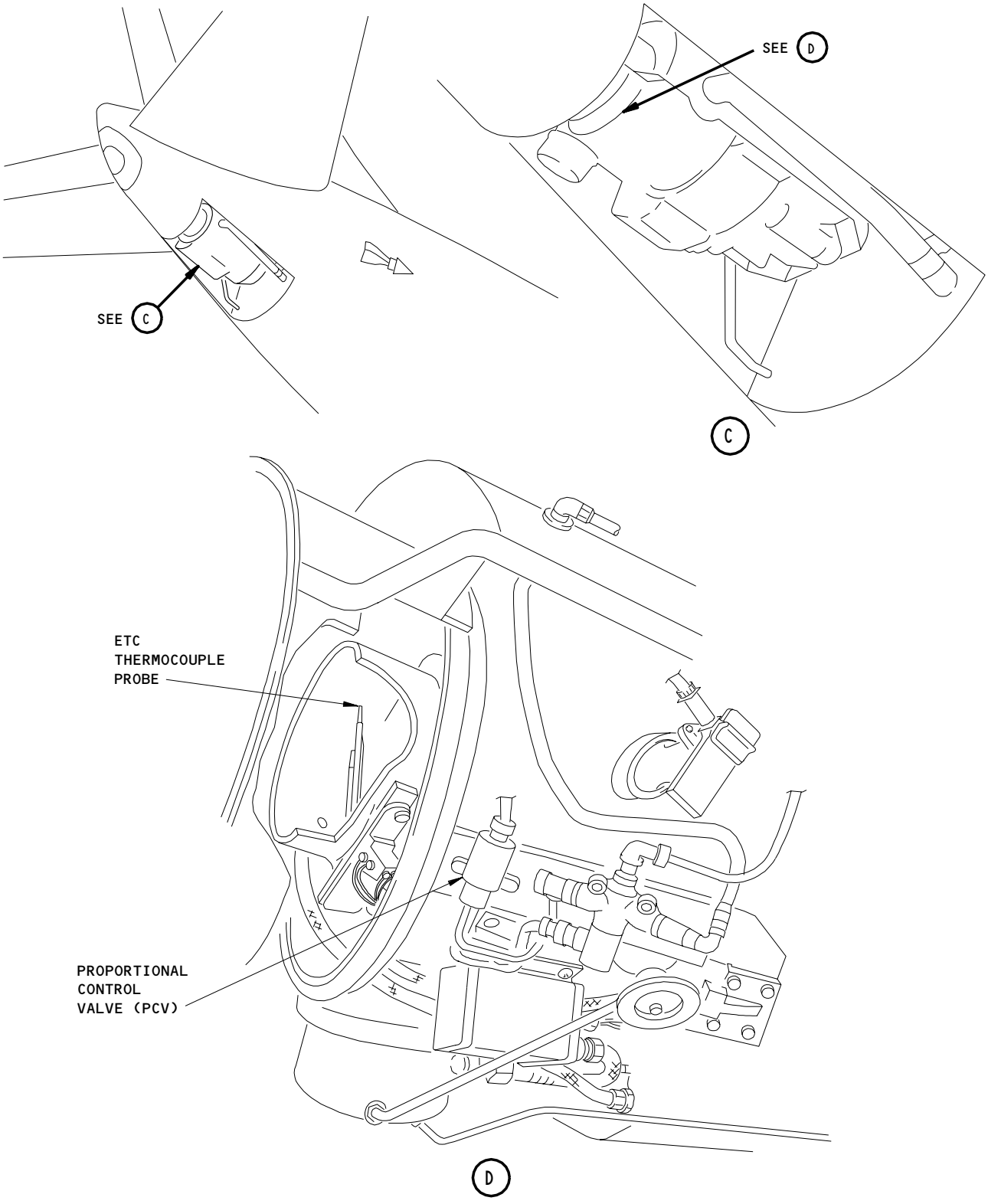

APU EGT Indicating System Component Location
Figure 1 (Sheet 2)

EFFECTIVITY
Airplanes with the ETC

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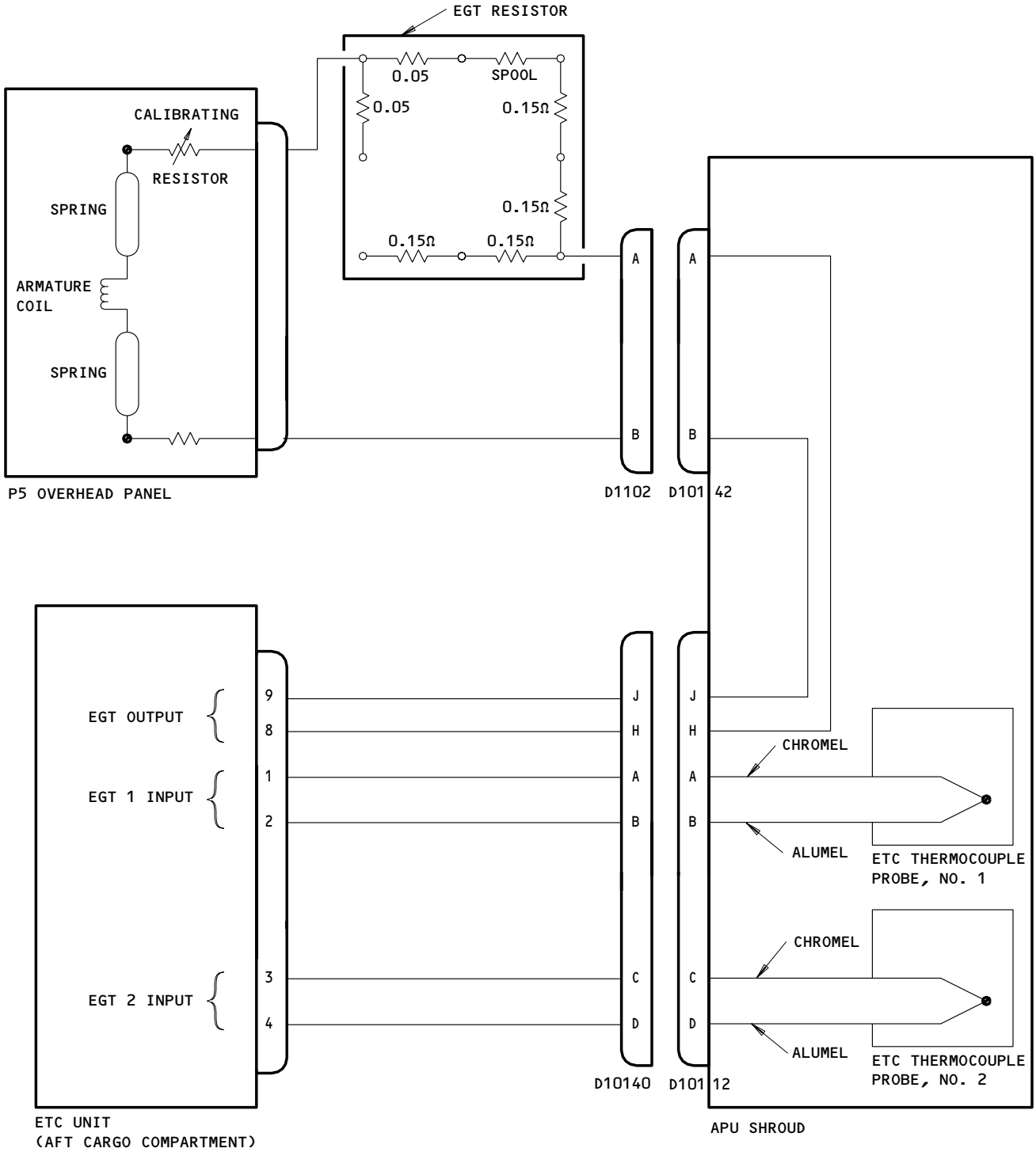


APU EGT Indicating System Schematic
Figure 2

B. The temperature difference between the ETC thermocouple probes (hot junction) and the EGT indicator (cold junction) make electrical signals in the circuit for the EGT indicating system. The difference between these electrical signals is in proportion to the difference in temperature between the ETC thermocouple probes and the EGT indicator. Because the electrical signals only correspond to a temperature difference, the ambient temperature of the control cabin must be added to the temperature difference to get the actual temperature of the exhaust gases. The temperature of the control cabin has small variations. The EGT indicator has a bimetal (thermostatic) spring to make allowances for these temperature changes. The EGT indicator does show the correct temperature for the exhaust gases in all ambient conditions.

EGT INDICATING SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure gives the tasks to do the two tests of the exhaust gas temperature (EGT) indicating system. The two tests are the insulation resistance test and the functional test of the EGT resistor. You can do these tests independently or together.
   B. On the APU engine, the electrical leads are chromel and alumel. The alumel lead is green, negative and magnetic. The chromel lead is white, positive and not magnetic. In the fuselage, the electrical leads are copper and constantan. The copper lead is positive and red. The constantan lead in negative and yellow.
   C. The EGT resistor is installed in the flight deck directly below the right No. 3 window. To change the circuit resistance, you move the constantan adjustment. The increment of resistance between two coarse adjustments is 0.15 ohm. The increment of resistance between the vernier adjustments is 0.05 ohm. The external circuit resistance is 13.50 ohms. This external resistance does not include the EGT indicator and the APU harness. To decrease the circuit resistance more than the range of the coarse and vernier adjustments, you make a shorter resistance spool. To increase the circuit resistance more than the range of the coarse and vernier adjustments, you use a spare or new resistance spool.
2. Insulation Resistance Test
   A. Equipment and Materials
      (1) Ohmmeter - Approved to 100,000 ohms
   B. Prepare for the Insulation Resistance Test
      (1) Set the switch and the circuit breaker:
         (a) Set the BATTERY SWITCH and APU START SWITCH on the P5 forward overhead panel to the OFF position and attach DO-NOT-OPERATE tags.
         (b) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
            1) E3-3 Electrical Shelf, APU Control Unit
      (2) Open the door for the aft cargo compartment to get access to the electronic temperature control (ETC).
   C. Do the Insulation Resistance Test
      (1) Disconnect the electrical connectors:
         (a) Disconnect the connector D446 from the EGT indicator on the P5 forward overhead panel.
         (b) Disconnect the connector D10114 from the ETC in the aft cargo compartment.
      (2) Do the test of the insulation resistance between the EGT indicator and the ETC:
         (a) Do a resistance check for connector D10114, pin 9 of the ETC to ground.
         (b) The resistance must be more than 100,000 ohms.

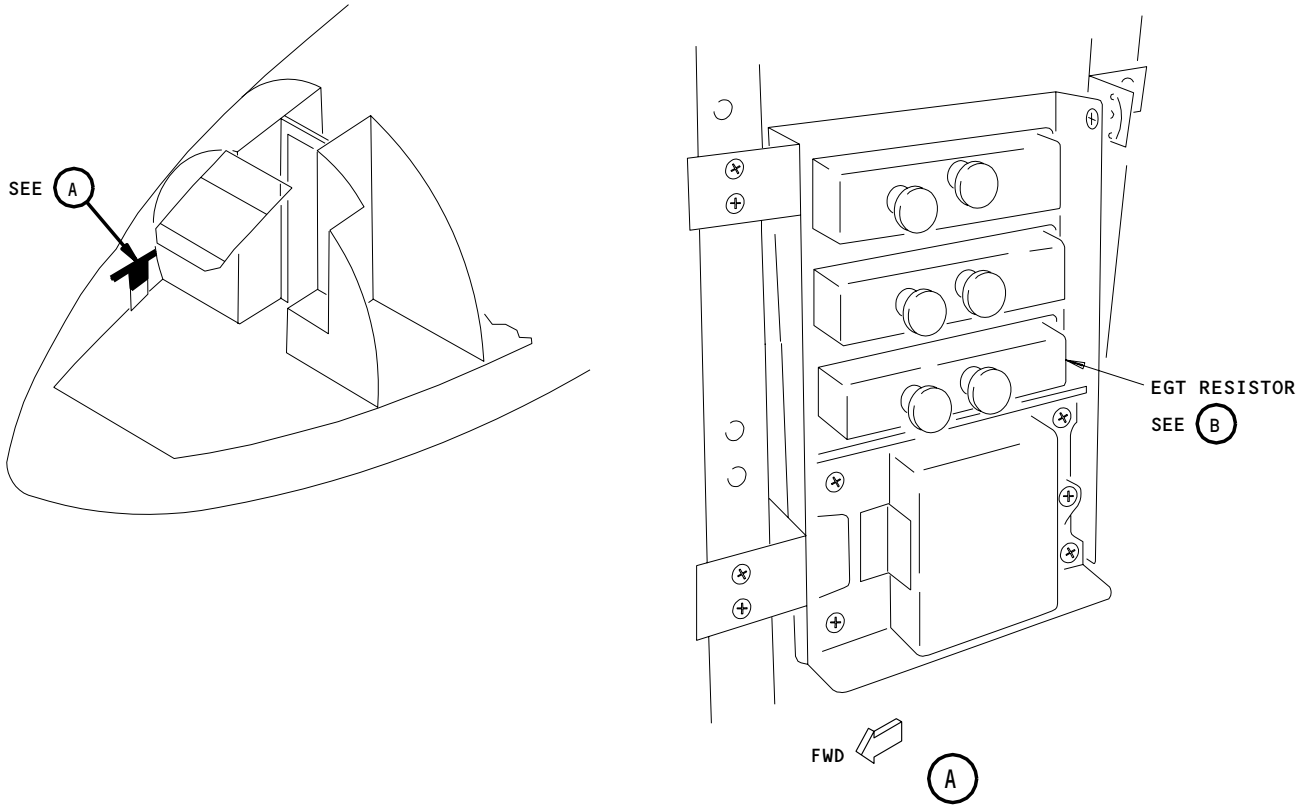
(c) Do a resistance check for connector D10114, pin 8 of the ETC to ground.
(d) The resistance must be more than 100,000 ohms.
(3) Do the test of the insulation resistance of the APU engine leads:
(a) Do a resistance check for connector D10114, pins 1 and 3 of the ETC to ground.
(b) The resistance must be more than 100,000 ohms.
(4) Connect the electrical connectors:
(a) Connect the connector D10114 to the ETC in the aft cargo compartment.
(b) Connect the connector D446 to the EGT indicator on the P5 forward overhead panel.

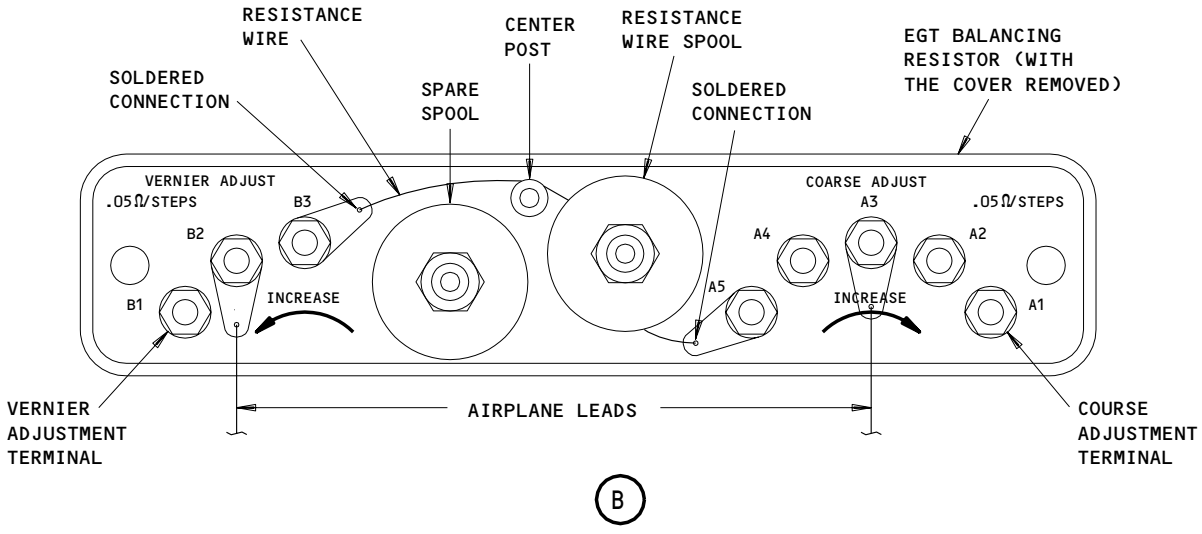
D. Restore the Airplane to the Normal Configuration
(1) Close the door for the aft cargo compartment.
(2) Set the circuit breaker and the switch:
(a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit
(b) Remove the DO-NOT-OPERATE tags from the APU START SWITCH and BATTERY SWITCH on the P5 forward overhead panel.

3. Functional Test - EGT Resistor (Fig. 501)
A. Equipment and Materials
(1) Wheatstone Bridge - approved to 13.50 ±0.01 ohms minimum
(2) Multimeter - measurement range of 13.50 ±0.01 ohms, Model 8012A-01, Fluke, P.O. Box 9090, Everett, WA 98206-9090 (this is an alternative to the wheatstone bridge)
(3) Soldering iron - 500-watt capacity
B. Prepare for EGT Resistor Test
(1) Set the switch and the circuit breaker:
(a) Set the BATTERY SWITCH and APU START SWITCH on the P5 forward overhead panel to the OFF position and attach DO-NOT-OPERATE tags.
(b) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
1) E3-3 Electrical Shelf, APU Control Unit
(2) Open the APU cowl door:
(a) Open the latches for the APU cowl door.
(b) Open the APU cowl door.
(c) Connect the door support rods.
(3) Remove the lower shroud:

CAUTION: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

(a) Hold the lower shroud and open the shroud latches.





EGT Resistor Adjustment
Figure 501

(b) Remove the lower shroud.

C. Do the ECT Resistor Test

(1) Disconnect the electrical connectors:

(a) Disconnect the connector D446 from the ECT indicator on the P5 forward overhead panel.

(b) Disconnect the connector D1102 for the APU engine lead from the ECT receptacle in the upper shroud.

(2) Do a test of the EGT resistor:

(a) Install a jumper across pins A and B of the connector D1102 for the APU engine lead.

NOTE: The jumper must be a copper wire with a resistance less than 0.05 ohm.

(b) Connect the wheatstone bridge or the multimeter to pins 1 and 2 of the connector D446 for the ECT indicator.

(c) Make sure the connections in the circuit are clean and correctly attached.

(d) Measure the circuit resistance.

NOTE: The circuit resistance value must agree with Table 501.

TABLE 501
CIRCUIT RESISTANCE FOR THE ECT INDICATOR

CIRCUIT RESISTANCE	AMBIENT TEMPERATURE
13.53 ±0.05 OHMS	30 ±5°C 86 ±9°F
13.50 ±0.05 OHMS	20 ±5°C 68 ±9°F
13.47 ±0.05 OHMS	10 ±5°C 50 ±9°F
13.44 ±0.05 OHMS	0 ±5°C 32 ±9°F
13.41 ±0.05 OHMS	-10 ±5°C 14 ±9°F

(3) If the circuit resistance does not agree with Table 501, adjust the EGT resistor:

(a) Remove the EGT resistor cover.

(b) If the adjustment is in the range of the coarse and vernier adjustment, use the adjustment terminals:

NOTE: The coarse adjustment terminals are on the right side of the EGT resistor. The vernier adjustment terminals are on the left side of the EGT resistor.

1) Move the airplane lead from one coarse adjustment terminal to a different coarse adjustment terminal.

NOTE: The circuit resistance must be in the range of the vernier adjustment.

2) Move the airplane lead from one vernier adjustment terminal to a different vernier adjustment terminal.

NOTE: The circuit resistance must agree with the values in Table 501.

3) Disconnect the wheatstone bridge or the multimeter from the resistance circuit.

(c) If the adjustment is above the range of the coarse and vernier adjustment, use the resistance spool.

NOTE: This step will decrease the circuit resistance.

1) Disconnect the wheatstone bridge or the multimeter from the resistance circuit.
2) Install a jumper between pins 1 and 2 on the connector for the EGT indicator.

NOTE: The jumper must be copper wire with a resistance value less than 0.05 ohm.

3) Connect one airplane lead to the coarse adjustment terminal (B2).

4) With the soldering iron, disconnect the end of the resistance spool wire from the vernier adjustment terminal (B3).
5) Connect one lead of the wheatstone bridge or the multimeter to the vernier adjustment terminal (B3).
6) Wind off the necessary quantity of wire to get the correct resistance.

NOTE: One foot of the wire is equal to 0.7 ohm.

7) Remove sufficient insulation from the resistance wire to make a good connection with the lead for the wheatstone bridge or the multimeter.
8) Connect the other lead of the wheatstone bridge or the multimeter to the resistance wire.
9) Move the lead of the wheatstone bridge or the multimeter down the resistance wire until you find the correct resistance value.

NOTE: As the lead of the wheatstone bridge or the multimeter moves down the resistance wire, remove the insulation from the resistance wire.

10) Cut the resistance wire at the location for the correct resistance value.
11) Remove the wheatstone bridge or the multimeter from the resistance circuit.
12) Make sure you remove all the insulation from the resistance wire.
13) Wind up the unwanted resistance wire in the resistance spool and one time around the center post.

NOTE: Let a sufficient length of the resistance wire stay so you can solder the resistance wire to the vernier adjustment terminal (B3).

14) With the soldering iron, connect the end of the resistance wire to the vernier adjustment terminal (B3).
15) Remove the jumper from pins 1 and 2 of the connector for the EGT indicator.
16) Do step C.(2) to make sure the circuit resistance agrees with Table 501.

(d) If the adjustment is below the range of the coarse and vernier adjustment, use the resistance spool.

NOTE: This step will increase the circuit resistance.

1) Disconnect the wheatstone bridge or the multimeter from the resistance circuit.
2) Install a jumper between pins 1 and 2 on the connector for the EGT indicator.

NOTE: The jumper must be a copper wire with a resistance less than 0.05 ohm.

3) Connect one airplane lead to the coarse adjustment terminal (A3).
4) Connect the other airplane lead to the vernier adjustment terminal (B2).
5) With the soldering iron, disconnect the ends of the resistance spool from the coarse adjustment terminal (A5) and vernier adjustment terminal (B3).
6) Remove the used resistance spool.
7) Replace the used resistance spool with a new resistance spool or a spare resistance spool.
8) Remove the insulation from the end of the wire at the center of the new resistance spool.
9) With the soldering iron, connect the clean end of the wire to the coarse adjustment terminal (A5).
10) Connect one lead of the wheatstone bridge or the multimeter to the vernier adjustment terminal (B3).
11) Remove sufficient insulation from the loose end of the resistance wire to make a good connection with the lead of the wheatstone bridge or the multimeter.
12) Connect the lead of the wheatstone bridge or the multimeter to the wire.
13) Measure the circuit resistance.
14) Make a record of the circuit resistance.

15) Wind off the necessary quantity of wire to get the correct resistance.

NOTE: One foot of the wire is equal to 0.7 ohm.

16) Remove sufficient insulation from the resistance wire to make a good connection with the lead for the wheatstone bridge or the multimeter.
17) Connect the other lead of the wheatstone bridge or the multimeter to the resistance wire.
18) Move the lead of the wheatstone bridge or the multimeter down the resistance wire until you find the correct resistance value.

NOTE: As the lead of the wheatstone bridge or the multimeter moves down the resistance wire, remove the insulation from the resistance wire.

19) Cut the resistance wire at the location for the correct resistance value.
20) Make sure you remove all the insulation from the resistance wire.
21) Wind up the unwanted resistance wire in the resistance spool and one time around the center post.

NOTE: Let a sufficient length of the resistance wire stay so you can solder the resistance wire to the vernier adjustment terminal (B3).

22) With the soldering iron, connect the end of the resistance wire to the vernier adjustment terminal (B3).
23) Remove the jumper from pins 1 and 2 of the connector for the EGT indicator.
24) Do step C.(2) to make sure the circuit resistance agrees with Table 501.

(4) If the circuit resistance agrees with Table 501, disconnect the wheatstone bridge or the multimeter.
(5) Connect the electrical connectors:
   (a) Remove the jumper from between pins A and B of the connector D1102 for the APU engine lead.
   (b) Connect the connector D1102 for the APU engine lead to the EGT receptacle in the upper shroud.
   (c) Connect the connector D446 to the EGT indicator on the P5 forward overhead panel.

D. Restore the Airplane to the Normal Configuration

(1) Install the lower shroud:

CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCH (5 MM) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS AND LOWER SHROUD. BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

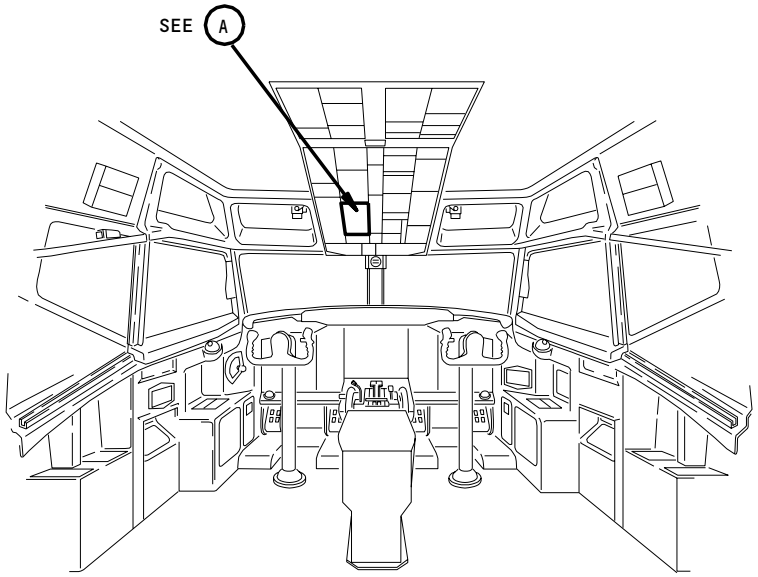
(a) Hold the lower shroud against the upper shroud.
(b) Close the shroud latches.

(2) Close the APU cowl door.
(a) Disconnect the door support rods.
(b) Put the door support rods in the clips on the APU cowl door.
(c) Close the APU cowl door.
(d) Close the latches for the APU cowl door.

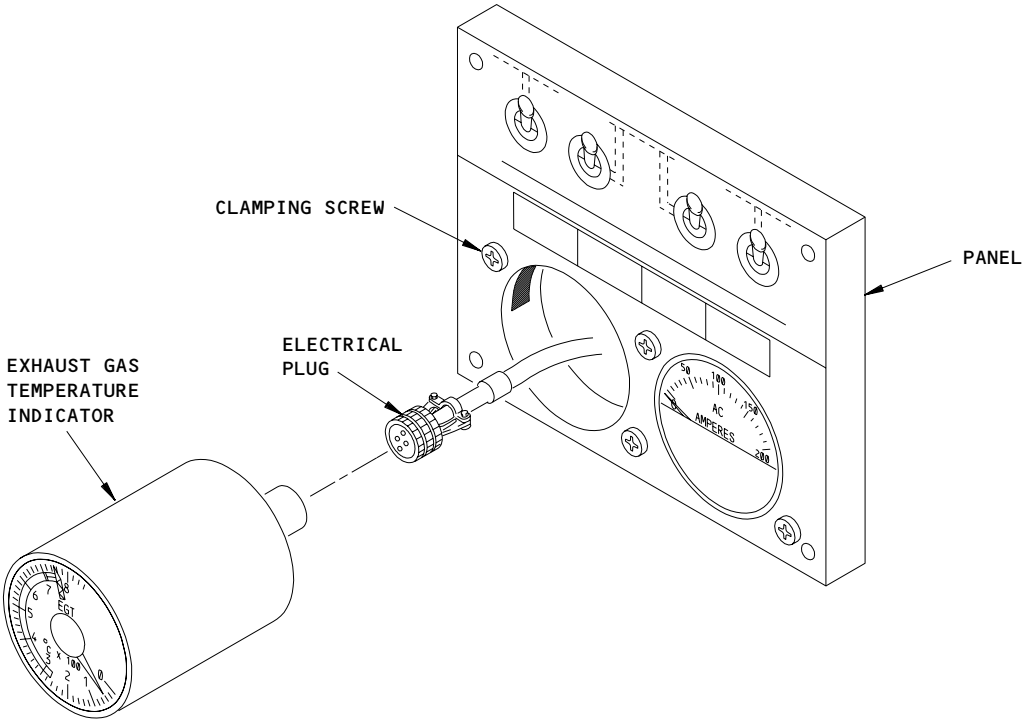
(3) Set the circuit breaker and the switch:
(a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit
(b) Remove the DO-NOT-OPERATE tag from the APU master switch on the P5 forward overhead panel.

EXHAUST GAS TEMPERATURE INDICATOR - REMOVAL/INSTALLATION

1. General
   A. This procedure contains the removal and installation tasks for the exhaust gas temperature (EGT) indicator. The EGT indicator is installed in the P5 forward overhead panel.
2. Exhaust Gas Temperature Indicator Removal (Fig. 401)
   A. Procedure
      (1) Set the switch and the circuit breaker:
         (a) Set the APU master switch on the P5 forward overhead panel to the OFF position and attach a DO-NOT-OPERATE tag.
         (b) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
            1) E3-3 Electrical Shelf, APU Control Unit
      (2) Remove the EGT indicator:
         (a) Turn the clamping screw counterclockwise to loosen the EGT indicator.
         (b) Pull the EGT indicator out of the panel.
         (c) Disconnect the electrical plug from the EGT indicator.
3. Exhaust Gas Temperature Indicator Installation (Fig. 401)
   A. Procedure
      (1) Install the EGT indicator: (Ref 49-11-00)
         (a) Connect the electrical plug to the EGT indicator.
         (b) Push the EGT indicator into the panel.
         (c) Turn the clamping screw clockwise to tighten the EGT indicator.
      (2) Set the circuit breaker and the switch:
         (a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
            1) E3-3 Electrical Shelf, APU Control Unit
         (b) Remove the DO-NOT-OPERATE tag from the APU master switch on the P5 forward overhead panel.
      (3) Start and operate the APU for a minimum of five minutes (Ref 49-11-00/201).
      (4) Look at the EGT indicator.
         (a) The temperature on the EGT indicator increases and becomes stable during the APU operation.
      (5) Shut down APU (Ref 49-11-00/201).



FLIGHT COMPARTMENT



Exhaust Gas Temperature Indicator Installation
Figure 401

EXHAUST GAS TEMPERATURE THERMOCOUPLE PROBE - REMOVAL/INSTALLATION

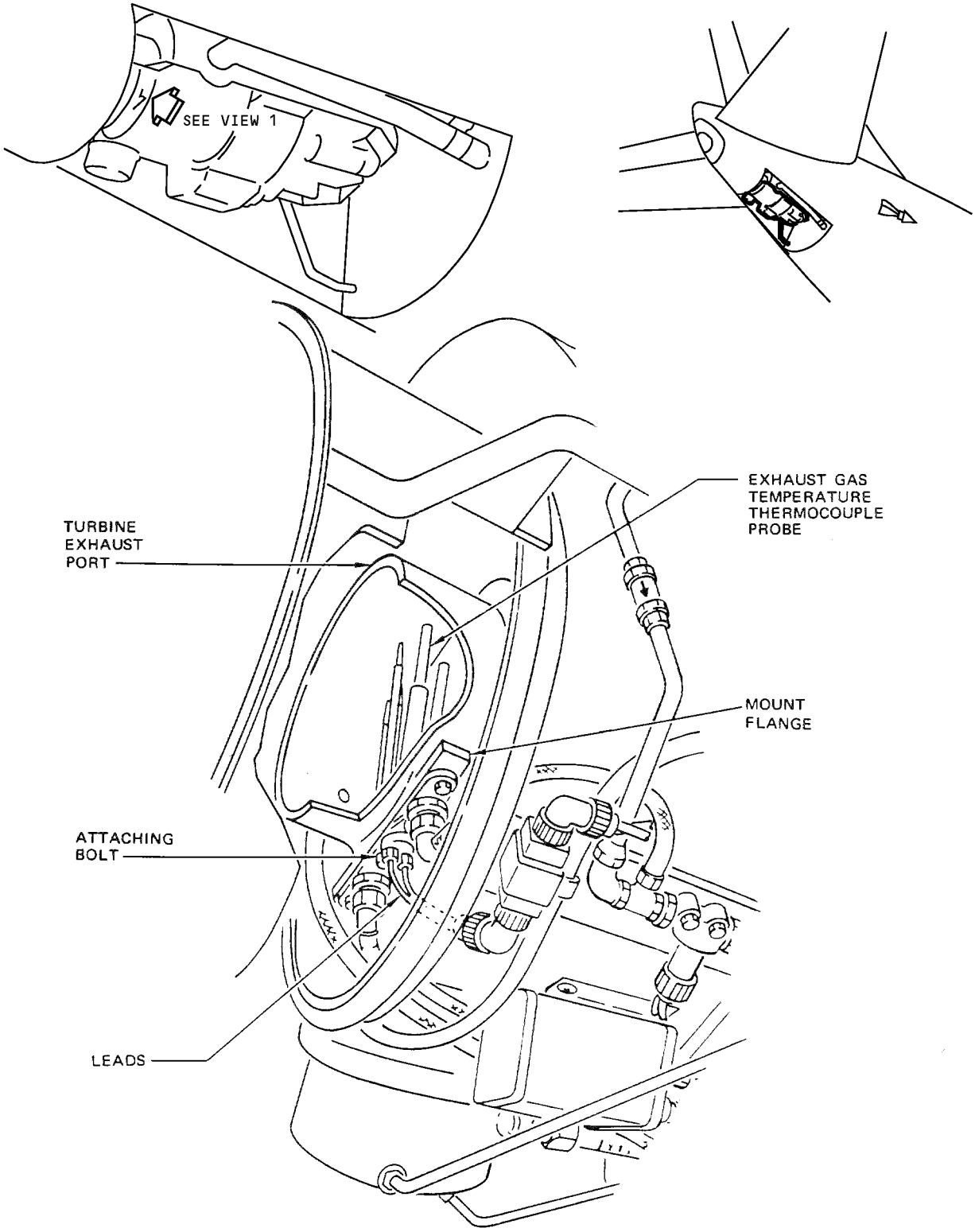
1. Equipment and Materials
   A. Antiseize Compound - Fel-Pro C-5, Felt Products Corp., Chicago, Illinois
2. Prepare for Exhaust Gas Temperature Thermocouple Probe Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module -APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Exhaust Gas Temperature Thermocouple Probe (Fig. 401)
   A. Disconnect leads from thermocouple probe terminals.
   B. Remove thermocouple probe attaching bolts and washers.
   C. Withdraw thermocouple probe from turbine exhaust port flange.
4. Install Exhaust Gas Temperature Thermocouple Probe (Fig. 401)
   A. Test thermocouple probe operation (Ref Exhaust Gas Temperature Thermocouple Probe - A/T).
   B. Insert thermocouple probe in turbine exhaust port flange so that smaller (chromel) terminal on probe is facing aft.
   C. Coat threads of thermocouple probe attaching bolts with antiseize compound. Install bolts with washers.
   D. Connect alumel (green) lead to thermocouple probe larger terminal and chromel (white) lead to smaller terminal.
5. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module -APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



VIEW 1

Exhaust Gas Temperature Thermocouple Probe Installation
Figure 401

EXHAUST GAS TEMPERATURE THERMOCOUPLE PROBE - ADJUSTMENT/TEST

1. Exhaust Gas Temperature Thermocouple Probe Test
   A. Equipment and Materials
      (1) Soldering iron - 500-watt capacity
   B. Test Exhaust Gas Temperature Thermocouple Probe
      (1) Remove probe from engine (Ref Exhaust Gas Temperature Thermocouple Probe - R/I).
      (2) Connect alumel (green) lead to thermocouple probe larger terminal and chromel (white) lead to smaller terminal.
      (3) Place hot soldering iron on thermocouple probe.

          WARNING: HEAT GUNS, SOLDERING GUNS AND SOLDERING IRONS ARE NOT EXPLOSION-PROOF. DO NOT USE WHERE FUEL OR FUEL VAPOR IS PRESENT (REF MM 20-10-171 MP).

          NOTE: Thermocouple junction is located approximately at center of probe. Soldering iron should, therefore, be placed on probe at center to assure adequate heat transfer.

      (4) Observe exhaust gas temperature indicator for temperature rise.
      (5) If no rise in temperature is evidenced in step (4), proceed as follows:
          (a) If indicator pointer does not move, replace thermocouple probe.
          (b) If indicator pointer moves down scale, probe is functional but leads to probe terminals are connected in reverse.
      (6) Disconnect leads to thermocouple probe.
      (7) Install probe in engine (Ref Exhaust Gas Temperature Thermocouple Probe - R/I).

ETC THERMOCOUPLE PROBE - REMOVAL/INSTALLATION

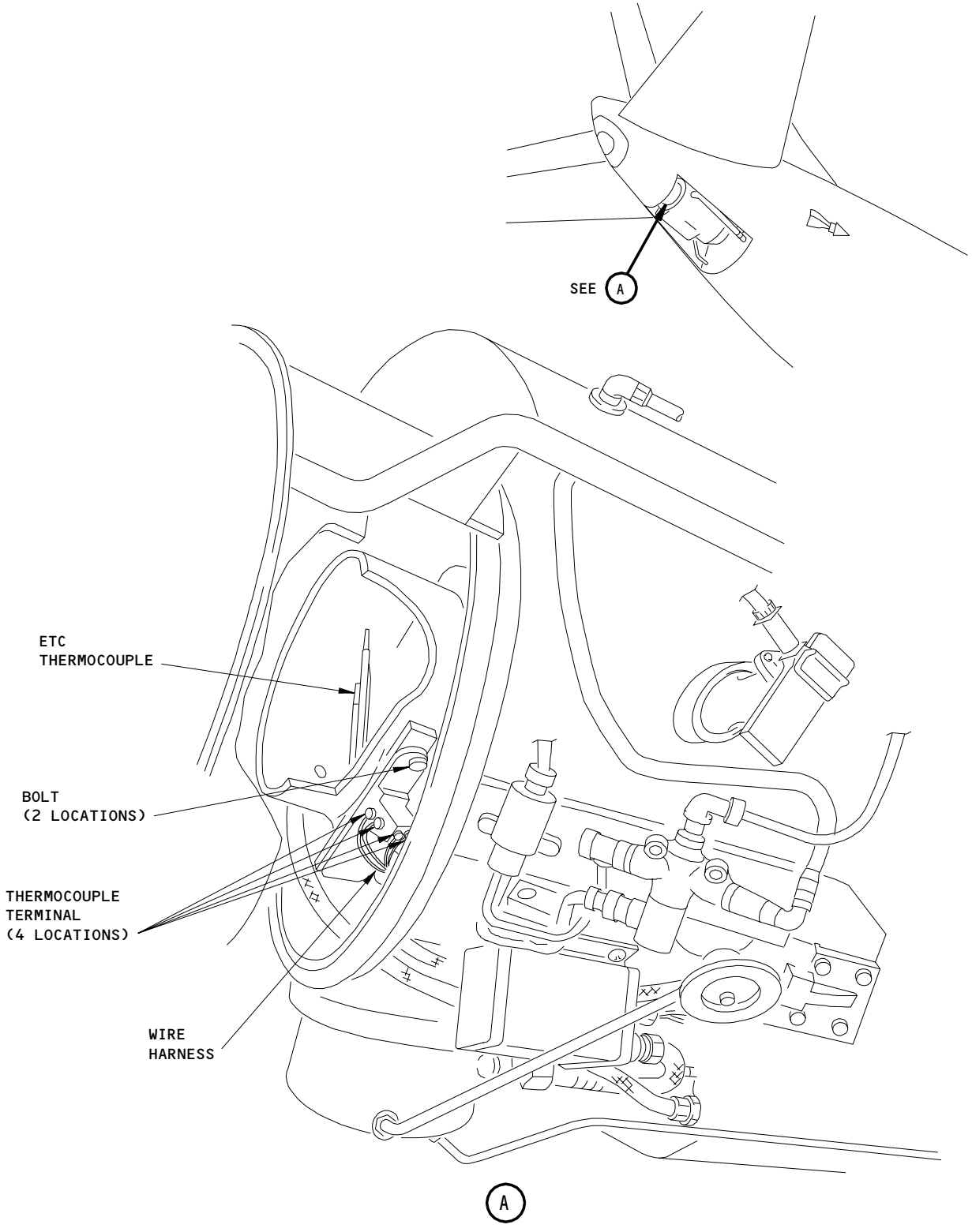
1. General
   A. This procedure contains the removal and installation tasks for the ETC thermocouple probe.
2. Equipment and Materials
   A. Antiseize Compound - Fel-Pro C-5A, Felt Product Corp., Chicago, Illinois
3. Prepare for ETC Thermocouple Removal
   A. Set the switch and the circuit breaker:
      (1) Set the BATTERY SWITCH and APU START SWITCH on the P5 forward overhead panel to the OFF position and attach DO-NOT-OPERATE tags.
      (2) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
         (a) E3-3 Electrical Shelf, APU Control Unit
   B. Open the APU cowl door:
      (1) Open the latches for the APU cowl door.
      (2) Open the APU cowl door.
      (3) Connect the door support rods.
   C. Remove the lower shroud:

      CAUTION: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

      (1) Hold the lower shroud and open the shroud latches.
      (2) Remove the lower shroud.
4. Remove the ETC Thermocouple Probe (Fig. 401)
   A. Disconnect the leads from the terminals of the thermocouple probe.
   B. Remove the bolts that attach the thermocouple probe.
   C. Remove the ETC thermocouple from the exhaust flange.
5. Install the ETC Thermocouple Probe (Fig. 401)
   A. Apply the high temperature compound (Fel-Pro C5-A) to the threads of the bolts.
   B. Put the ETC thermocouple in the exhaust flange.
   C. Attach the ETC thermocouple with the bolts.
      (1) Tighten the bolts the 50-70 pound-inches.
   D. Connect the leads to the studs of the ETC thermocouple.
6. Restore the Airplane to Normal Configuration
   A. Install the lower shroud:

      CAUTION: KEEP A MINIMUM CLEARANCE OF 0.18 INCH (5 MM) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS AND LOWER SHROUD.
      BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

      (1) Hold the lower shroud against the upper shroud.
      (2) Close the shroud latches.



ETC Thermocouple Probe Installation
Figure 401

B. Close the APU cowl door:
   (1) Disconnect the door support rods.
   (2) Put the door support rods in the clips on the APU cowl door.
   (3) Close the APU cowl door.
   (4) Close the latches for the APU cowl door.
C. Set the circuit breaker and the switch:
   (1) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
      (a) E3-3 Electrical Shelf, APU Control Unit
   (2) Remove the DO-NOT-OPERATE tag from the APU START SWITCH and BATTERY SWITCH on the P5 forward overhead panel.

ETC THERMOCOUPLE PROBE - ADJUSTMENT/TEST

1. General
   A. This task gives a task to do an operational test of the ETC thermocouple probe.
   B. The ETC thermocouple is installed on the rear of the APU engine. You can get access to the thermocouple through the APU cowl door.
2. ETC Thermocouple Probe Test
   A. Equipment and Materials
      (1) Airplanes with centrifugal switch, Gas Turbine Engine Tester - 290270-1-1, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, AZ 85072-2170
      (2) Airplanes with centrifugal switch, Tester Kit - 290419-1-1, AlliedSignal, Inc.
      (3) Airplanes with centrifugal switch, Electrical Cable Assembly - 2024497-1, AlliedSignal, Inc. (this is an alternative to the 290419-1-1 Tester Kit)
   B. Do the Test of the ETC thermocouple probe.
      (1) Set the switch and the circuit breaker:
         (a) Set the BATTERY SWITCH and APU START SWITCH, on the P5 forward overhead panel, to the OFF position and attach DO-NOT-OPERATE tags.
         (b) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
            1) E-3 Electrical Shelf, APU Control Unit
      (2) Open the APU cowl door:
         (a) Open the latches for the APU cowl door.
         (b) Open the APU cowl door.
         (c) Connect the door support rods.
      (3) Remove the lower shroud:

         CAUTION: BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

         (a) Hold the lower shroud and open the shroud latches.
         (b) Remove the lower shroud.
      (4) Do the test of the ETC thermocouple probe:
         (a) Remove the locknuts from the studs on the side of the ETC thermocouple probe in the tailpipe.

            NOTE: During this test, the ETC thermocouple leads must be connected to the ETC thermocouple probe at all times.

         (b) Connect the leads of the electrical cable assembly to the studs on the side of the ETC thermocouple probe with the locknuts.
         (c) Connect the electrical cable assembly to the tester receptacle.

(d) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit
(e) Remove the DO-NOT-OPERATE tags from the APU BATTERY SWITCH and BATTERY SWITCH on the P5 forward overhead panel.
(f) Start and operate the APU (AMM 49-11-0/201).
1) Let the APU operation become stable with no load applied.
2) Make sure the exit for the bleed air valve is clear.
(g) With no load applied, the engine speed must become stable at 101.3 to 102.5% rpm as shown on the tachometer indicator.
(h) Set the APU BLEED valve switch, on the P5 forward overhead panel, to the ON position.
(i) Set the air conditioning R PACK and L PACK valve switches, on the P5 forward overhead panel, to the ON position.
(j) Monitor the EGT indication at the engine tester and at the EGT indicator on the P5 forward overhead panel:

NOTE: The EGT indications from the engine tester and the EGT indicator must agree.

1) Make a record of the EGT indication on the engine tester.
2) Make a record of the EGT indication on the EGT indicator on the P5 forward overhead panel.
(k) Do the APU usual shutdown (AMM 49-11-0/201).
(l) Attach DO-NOT-OPERATE tags to the APU master switch and BATTERY SWITCH on the P5 forward overhead panel.
(m) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
1) E3-3 Electrical Shelf, APU Control Unit
(n) Remove the locknuts from the studs on the side of the ETC thermocouple probe in the tailpipe.
(o) Disconnect the leads of the electrical cable assembly from the studs on the side of the ETC thermocouple probe.
(p) Install the locknuts to the studs on the side of the ETC thermocouple probe.
(q) Do the above test steps again at the studs on the bottom of the ETC thermocouple probe.
(r) Do a check of the EGT indications for each set of studs:
1) If the EGT indications for each set of studs for the ETC thermocouple are within 25°C and agree within 12°C of the EGT indicator on the P5 forward overhead panel, no adjustment is necessary.
2) If the EGT indications for each set of studs for the ETC thermocouple are within 25°C but do not agree within 12°C of the EGT indicator on the P5 forward overhead panel, do the test for the EGT indicating system (AMM 49-71-0/501).

3) If the EGT indications for each set of studs for the ETC thermocouple probe are not within 25°C, do these steps:
   a) Do a check of the circuit for the No. 1 thermocouple probe between the receptacle D10112, pin A and pin B.
   b) Do a check of the circuit for the No. 2 thermocouple probe between the receptacle D10112, pin C and pin D.
   c) If there is a problem with the thermocouple loop(s), replace as necessary.
   d) Do the adjustment for the ETC (AMM 49-61-71/501).

(5) Install the lower shroud:

CAUTION: KEEP A MINIMUM CLEARANCE OF 0/18 INCH (5 MM) BETWEEN THE ENGINE, FIRE DETECTOR, CLAMPS AND LOWER SHROUD. BE CAREFUL WHEN YOU MOVE THE LOWER SHROUD. DAMAGE TO THE SHROUD DRAIN LINES CAN OCCUR.

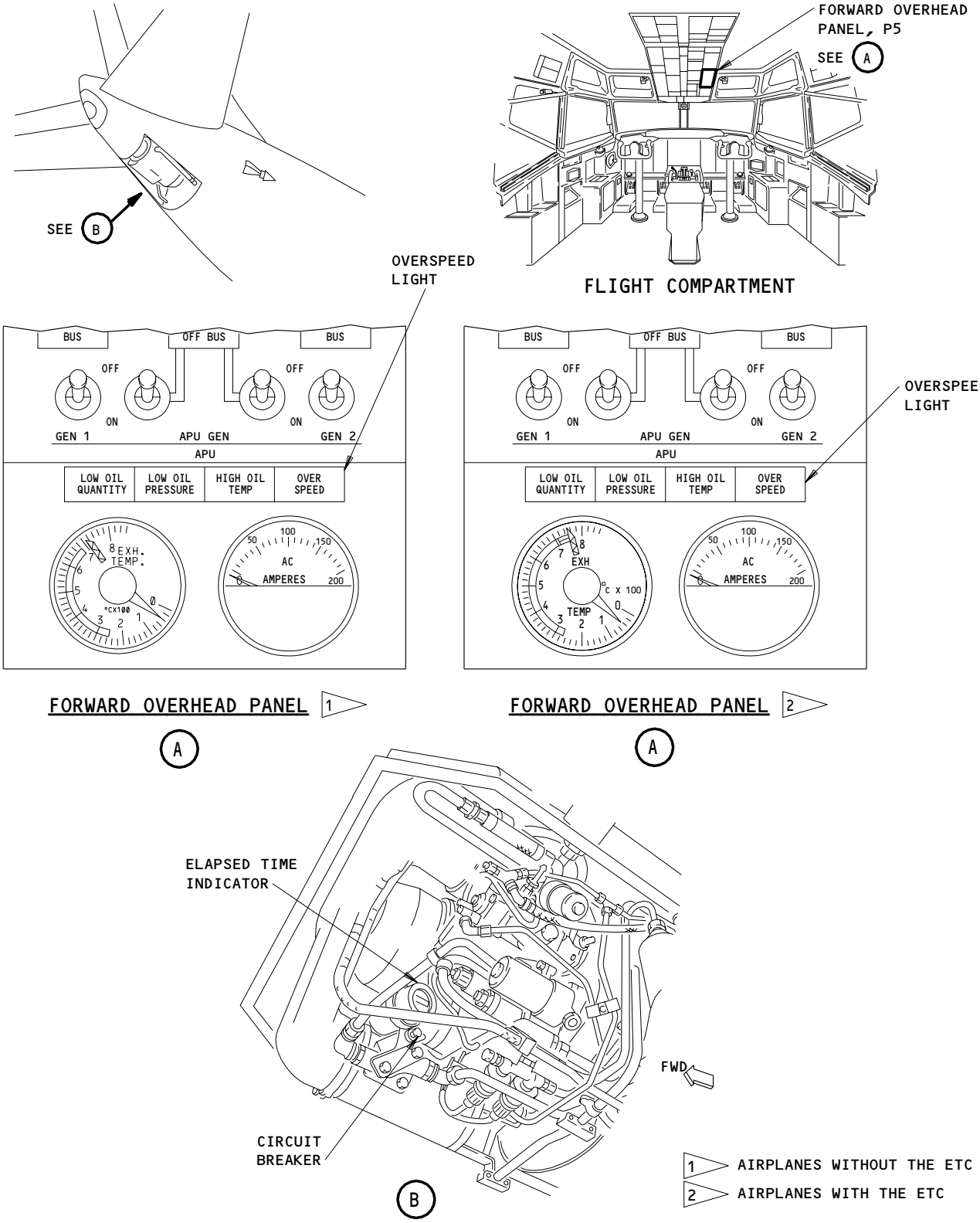
(a) Hold the lower shroud against the upper shroud.
(b) Close the shroud latches.

(6) Close the APU cowl door:
(a) Disconnect the door support rods.
(b) Put the door support rods in the clips on the APU cowl door.
(c) Close the APU cowl door.
(d) Close the latches for the APU cowl door.

(7) Set the circuit breaker and the switch:
(a) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) E3-3 Electrical Shelf, APU Control Unit
(b) Remove the DO-NOT-OPERATE tag from the APU START SWITCH and BATTERY SWITCH on the P5 forward overhead panel.

APU INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. APU indicating system consists of the engine overspeed light and the engine elapsed time indicator. The overspeed light is located in the control cabin; the elapsed time indicator is located on the engine. (See figure 1.)
2. Overspeed Light
   A. The overspeed light provides an indication when the APU engine has attained an overspeed condition. The light is amber in color and it is located on the forward overhead panel. (See figure 1.) The overspeed light is energized when the APU engine speed reaches 110 percent service speed. At this speed, the 110 percent switch actuates and closes the overspeed shutdown relay K2. When the relay is in closed position, the circuit is completed to the overspeed light.
   B. The overspeed light is connected to the APU annunciator light and to the master caution lights. When the overspeed light is energized, the APU annunciator and the overspeed lights are energized. Refer to Master Caution and Warning Lights, 33-15-0. The overspeed light is tested by pressing the light, or it is tested by actuation of the master test switch.
3. Elapsed Time Indicator
   A. The elapsed time indicator records the number of hours the APU engine has been operating. The indicator is basically an electric clock, enclosed in a hermetically sealed case. Total engine operating time is indicated by a digital counter that records the operating time in hours and tenths of hours. The indicator is shock mounted on the APU engine oil cooler. (See figure 1.)
   B. The elapsed time indicator is connected to the 95 percent switch and begins recording when the engine reaches 95 percent service speed, thus actuating the switch. The indicator continues to record the time while the engine is operating at or above 95 percent service speed. The indicator circuit is protected by a circuit breaker (figure 1) against sudden surges of current. When the circuit breaker is open, it can be reset by pushing in the reset button.



APU Indicating System Component Location
Figure 1

ELAPSED TIME INDICATOR - REMOVAL/INSTALLATION

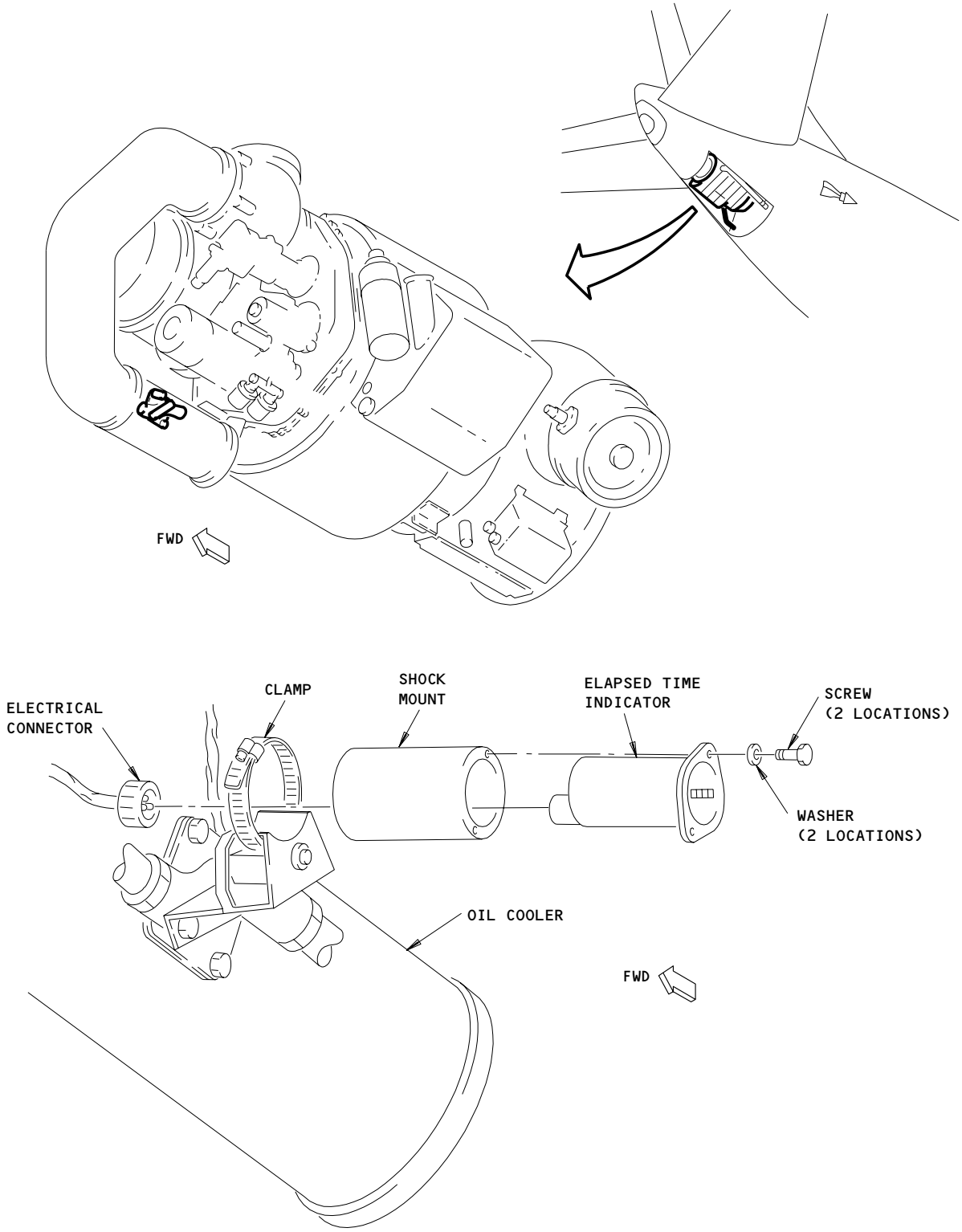
1. Prepare for Elapsed Time Indicator Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Elapsed Time Indicator
   A. Disconnect electrical plug from indicator. (See figure 401.)
   B. Loosen clamp attaching indicator to bracket on oil cooler; remove assembled indicator and shockmount.
   C. Remove screws attaching indicator to shockmount; separate indicator from shockmount.
3. Install Elapsed Time Indicator
   A. Position indicator in shockmount and install attaching screws (Fig. 401).
   B. Position assembled indicator and shockmount bracket and tighten indicator attaching clamp.
   C. Connect electrical plug to indicator.
4. Restore Airplane to Normal Configuration
   A. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD.
      EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

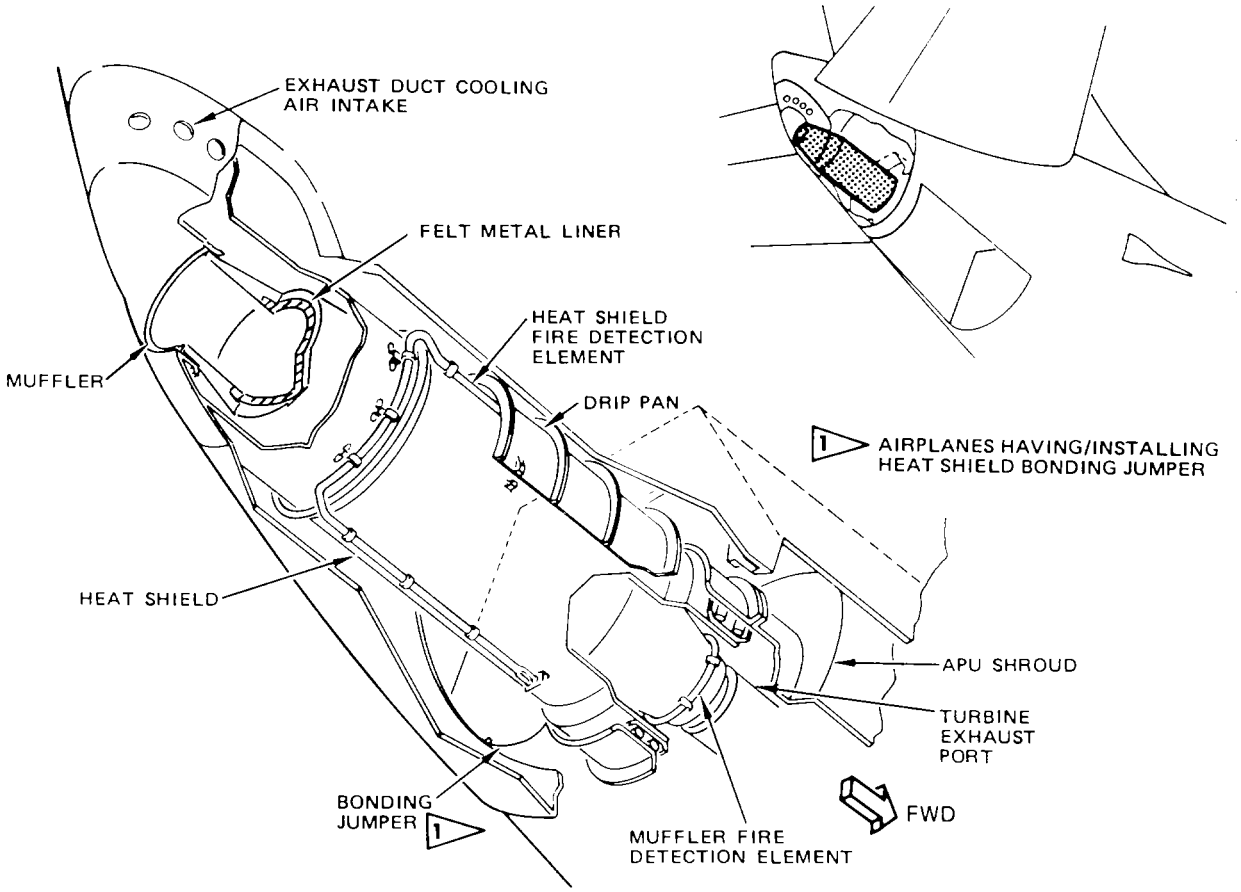
   B. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   C. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   D. Position BATTERY SWITCH to ON and remove placards.



Elapsed Time Indicator Installation
Figure 401

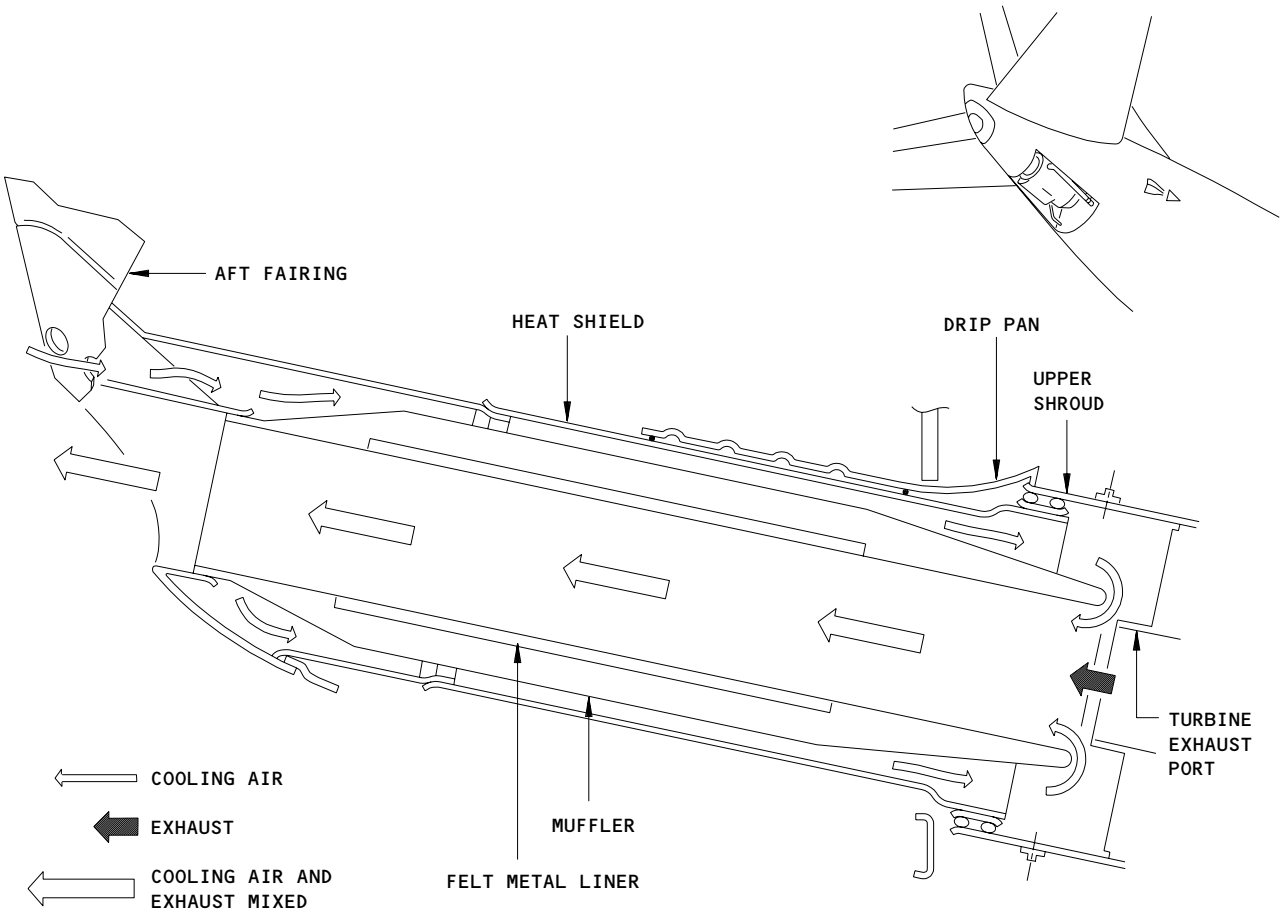
APU EXHAUST SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU exhaust system conducts the APU engine exhaust gases overboard and reduces the noise level of the high velocity gas flow. The system consists of an exhaust duct and an aft fairing. The duct and fairing are located in the tail section of the airplane (Fig. 1).
2. Exhaust Duct
   A. The exhaust duct consists of a heat shield and a muffler (Fig. 1). The muffler is fitted inside the heat shield in such a way that a cylindrical air space exists between the muffler and the heat shield. A felt metal liner is installed on the inside surface of the muffler for reducing the sound level of the APU exhaust. Two fire detector elements are attached to the exhaust duct assembly. One circles the forward end of the muffler and the second running laterally, is attached at top and bottom of the heat shield. For information regarding the fire protection of the APU, refer to 26-15-11/-12. At the forward end, the heat shield is supported by the engine shroud, and has a drip pan attached to protect the heat shield against hydraulic leakage. A bonding jumper, located at forward, lower left side of heat shield, provides a positive electrical ground to airplane structure (see Fig. 1 for effectivity). The muffler does not come in contact with the turbine section exhaust flange, there is a gap between the flange and the muffler. At the aft end, exhaust duct is supported by the aft fairing.
3. Aft Fairing
   A. The aft fairing supports the aft end of the exhaust duct. It consists of a machined casting that fairs with the airplane tail cone, and two short cylindrical ducts: an outer duct tat mates with the heat shield and an inner duct that mates with the muffler. (See figure 1.) The casting is provided with the holes for exhaust duct cooling air intake. The aft fairing is attached to the airplane tail cone skin and to the exhaust duct heat shield with bolts.
4. Operation
   A. When the APU is operating, high velocity exhaust gases flow overboard through the exhaust duct. (See figure 2.) The exhaust duct is air cooled by aspiration. The gas flow in the muffler develops negative pressure at the gap between the turbine exhaust flange and the forward end of the muffler. This draws the ambient cooling air through the air holes in the aft fairing. The cooling air passes between the inside surface of the heat shield and the outside surface of the muffler into the opening at of the turbine exhaust port, where it mixes with the engine exhaust gases and is exhausted overboard.



APU Exhaust System Component Location
Figure 1

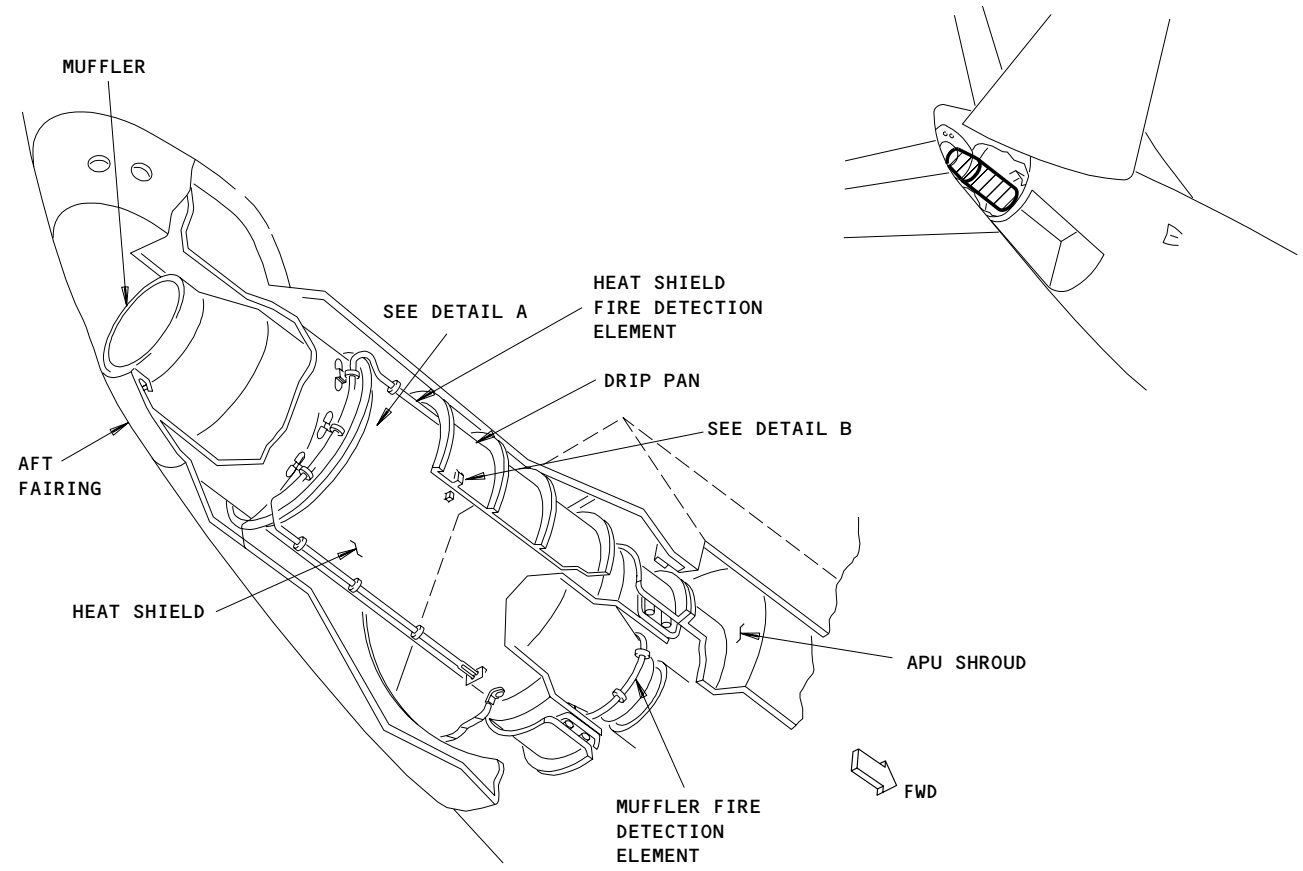
B. When the APU is operating, high velocity exhaust gases flow overboard through the exhaust duct. (See figure 1.) The exhaust duct is air cooled by aspiration. The gas flow in the muffler develops negative pressure at the gap between the turbine exhaust flange and the forward end of the muffler. This draws the ambient cooling air through the air holes in the aft fairing. The cooling air passes between the inside surface of the heat shield and the outside surface of the muffler into the opening at of the turbine exhaust port, where it mixes with the engine exhaust gases and is exhausted overboard.

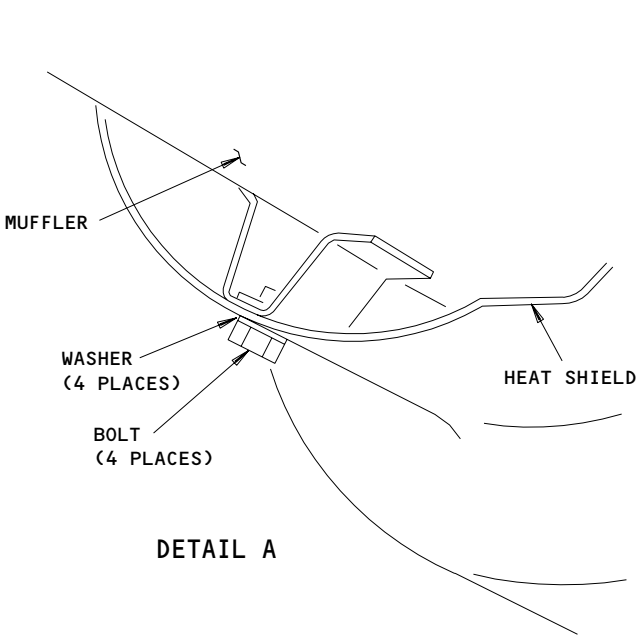


APU Exhaust System Schematic
Figure 2

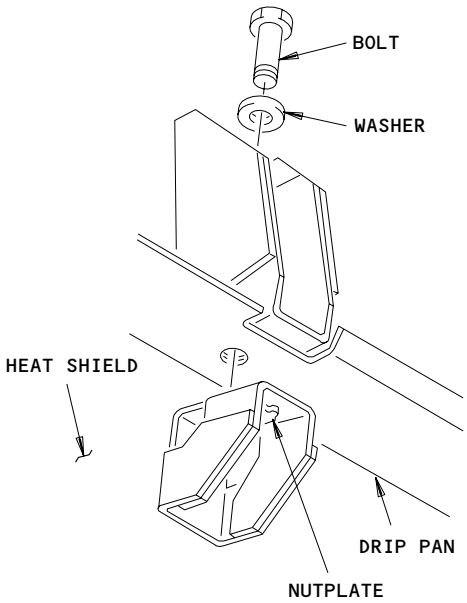
EXHAUST DUCT MUFFLER - REMOVAL/INSTALLATION

1. General
   A. The exhaust duct muffler is an integral part of the aft fairing assembly which consists of aft fairing, the exhaust duct heat shield, and exhaust duct muffler. If the muffler is to be removed, the aft fairing assembly must first be removed from airplane (49-81-31).
2. Remove Exhaust Duct Muffler (Fig. 40:k)
   A. Remove aft fairing (Ref 49-81-31).
   B. Remove bolts attaching muffler to heat shield.
   C. Remove muffler from heat shield.
   D. Remove fire detector element from fwd end and save for installation on replacement muffler assembly.
3. Install Exhaust Duct Muffler (Fig. 401)
   A. Install fire detector element on new muffler assembly.
   B. Install muffler in heat shield and fasten in place with bolts.
   C. Install aft fairing (Ref 49 81-31).





DETAIL A



DETAIL B

Exhaust Duct Muffler Installation
Figure 401

EXHAUST DUCT MUFFLER - INSPECTION/CHECK

1. Exhaust Duct Muffler Inspection
   A. Remove the exhaust duct muffler (AMM 49-81-11/401).
   B. Do a visual inspection of the exhaust duct muffler:
      (1) Examine the exhaust duct muffler for wrinkles.
         (a) Wrinkles lower than 1/4 inch and found along a smooth contour surface are permitted.
      (2) Examine the exhaust duct muffler for cracks.
         (a) A crack shorter than 2 inches is permitted on the exhaust duct muffler (shorter than 3 inches is permitted on the tube and liner assemblies).
         (b) The minimum spacing between the cracks must be more than two times the length of the crack.
         (c) The total length of all the cracks for one part must be less than 10 inches.
         (d) Cracks not longer than 1/2 inch are permitted from the rivet hole.
         (e) Cracks on adjacent rivet holes, on the edge of a part or on the bracket assemblies are not permitted.
      (3) Examine the external surfaces of the exhaust duct muffler for missing rivets.
         (a) Make sure there are at least three rivets installed between the two missing rivets for each row.
         (b) Make sure all rivets are installed on the bracket assemblies.
      (4) Examine the internal surfaces of the exhaust duct muffler for missing rivets and holes on the felt metal liner.
         (a) One missing rivet is permitted for each row.
         (b) APUs WITHOUT THE FULL-LENGTH FELT METAL LINER; Holes less than 0.20 inch in diameter are permitted on the felt metal liner.

            NOTE: Holes more than 0.20 inch in diameter can be repaired (OHM 49-13-01) if the adjacent surface material is not brittle (oxidized). If the adjacent surface material is oxidized and the holes are less than 0.50 inch in diameter, you must inspect the felt liner every 100 APU hours. You must replace the felt metal liner if the holes are more than 0.50 inch in diameter.

         (c) APUs WITH THE FULL-LENGTH FELT METAL LINER; Holes less than 0.020 inch in diameter are permitted on the felt metal liner.

            NOTE: You must repair the felt metal liner with a welded patch or replace the felt metal liner if the holes are more than 0.20 inch in diameter.

(5) If the visual inspection is not in the limits, replace the exhaust duct muffler (AMM 49-81-11/401).

C. Install the exhaust duct muffler (AMM 49-81-11/401).

EXHAUST DUCT MUFFLER - CLEANING/PAINTING

1. Exhaust Duct Muffler Cleaning
   A. Equipment and Materials
      (1) One gallon acetone
      (2) Caustic alkali cleaning solution - heavy-duty steam cleaning compound. Mix one part of caustic compound with 35 parts water.
      (3) Bristle brush
      (4) Detergent solution. Any commercially available detergent can be used. Mix in ratio of 1-1/2 pounds to 35 gallons of water.
   B. Clean Exhaust Muffler
      (1) Remove exhaust duct muffler. Refer to 49-81-11.
      (2) Flush unit with approximately 1 gallon of acetone and air dry.
      (3) Heat caustic alkali cleaning solution to 175°F and immerse muffler in solution. Leave muffler in solution for 5 minutes.
      (4) Agitate solution to wash muffler interior thoroughly, and lightly brush all over with bristle brush.
      (5) Remove muffler from cleaning solution and immerse in detergent solution heated to 175°F.
      (6) Agitate detergent solution and brush with bristle brush.
      (7) Remove muffler from detergent solution and stand it on one side to drain.
      (8) After draining, place muffler in a hot air environment at 150°F for 5 hours.
      (9) Remove muffler from hot air environment and cool to room temperature.
      (10) Install muffler on airplane. Refer to 49-81-11.

EXHAUST DUCT HEAT SHIELD - REMOVAL/INSTALLATION

1. General
   A. The exhaust duct heat shield is an integral part of the aft fairing assembly and cannot be replaced as a line maintenance item. If the exhaust duct heat shield is to be replaced, the aft fairing and exhaust duct heat shield must be replaced as an assembly (Ref 49-81-31, Removal/Installation).

AFT FAIRING - REMOVAL/INSTALLATION

1. General
   A. The aft fairing is an integral part of the aft fairing assembly. Therefore, the removal of the aft fairing consists of removing the complete aft fairing assembly. The aft fairing assembly consists of the aft fairing, the exhaust duct heat shield, and the exhaust duct muffler. If the muffler is to be removed, the aft fairing assembly must be removed from the airplane.
2. Equipment and Materials
   A. APU Heat Shield Installation/Removal Equipment - F80207-1; composed of the following:
      (1) Pusher Plate Assembly - F80207-8
      (2) Spring Clip - F80207-36 (4 required)
      (3) Flange Assembly - F80207-13 (2 required)
      (4) Flange Retainer AssemblyF80207-12 (2 required)
      (5) Reaction Plate AssemblyF80207-2
      (6) Push Rod Assembly - F80207-5
      (7) Threaded stud - F80207-46 (10 required)
      (8) Lock Nut - F80207-47 (10 required)
      (9) Puller Plate Assembly - F80207-6
      (10) Rod Extension Assembly - F80207-10
      (11) Pressure Pad Assembly - F80207-9
      (12) Take-Up-Rod - F80207-11
      (13) Pressure Pad Assembly Ball Lockpin - F80207-38
3. Prepare for Removal
   A. Position BATTERY SWITCH to OFF, and placard that APU is "in work."
   B. Remove access panel 3802.
4. Remove Aft Fairing Assembly (Fig. 401)
   A. Remove APU (Ref 49-11-0, Removal/Installation).
   B. Disconnect electrical connector from exhaust duct heat shield fire detection element and muffler heat detection element prior to removal of aft fairing.

      CAUTION: CARE MUST BE TAKEN SO THAT FIRE DETECTION ELEMENT ATTACHED TO HEAT SHIELD WILL NOT BE DAMAGED.

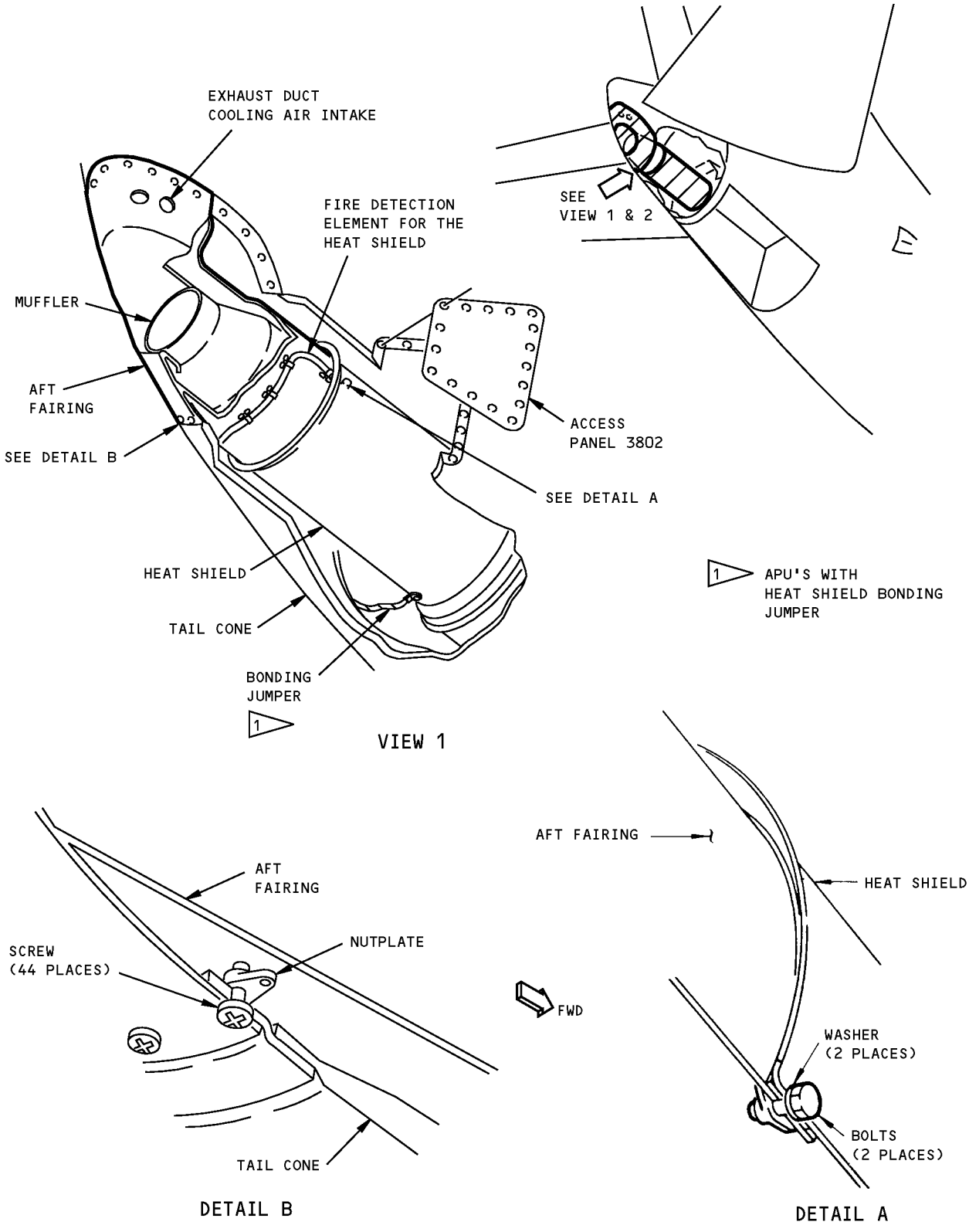
   C. Remove bolts and washers attaching drip pan to heat shield and position drip pan out of way for removal of aft fairing and heat shield assembly.
   D. Disconnect bonding jumper, if installed, at frame member below forward end of heat shield.
   E. Install pusher plate assembly in forward end of muffler by inserting spring clips and pressing firmly (Fig. 402, Detail A).

F. Position the two flange assemblies against the forward face of the stiffener angle of the upper shroud bellmouth and hold in place with one flange retainer assembly only installed on left-hand side.
G. Place reaction plate assembly on the aft face of the stiffener angle.
H. Position threaded studs in reaction plate assembly slots.
I. Clamp reaction plate assembly to flange assembly by hand tightening locknuts.
J. Thread the pushrod assembly through the reaction plates assembly until the pusher plate assembly is contacted.
K. Remove screws attaching aft fairing to tail cone (Fig. 401).
L. Rotate pushrod assembly until aft fairing assembly disengages from shroud (travel assembly should be approximately three inches for a gap to occur between the fairing and fuselage) (Fig. 402, Detail A).
M. Remove aft fairing assembly.
N. Remove APU Heat shield install/removal equipment from aft fairing assembly.
(1) If required, remove muffler from heat shield (AMM 49-81-11/401).

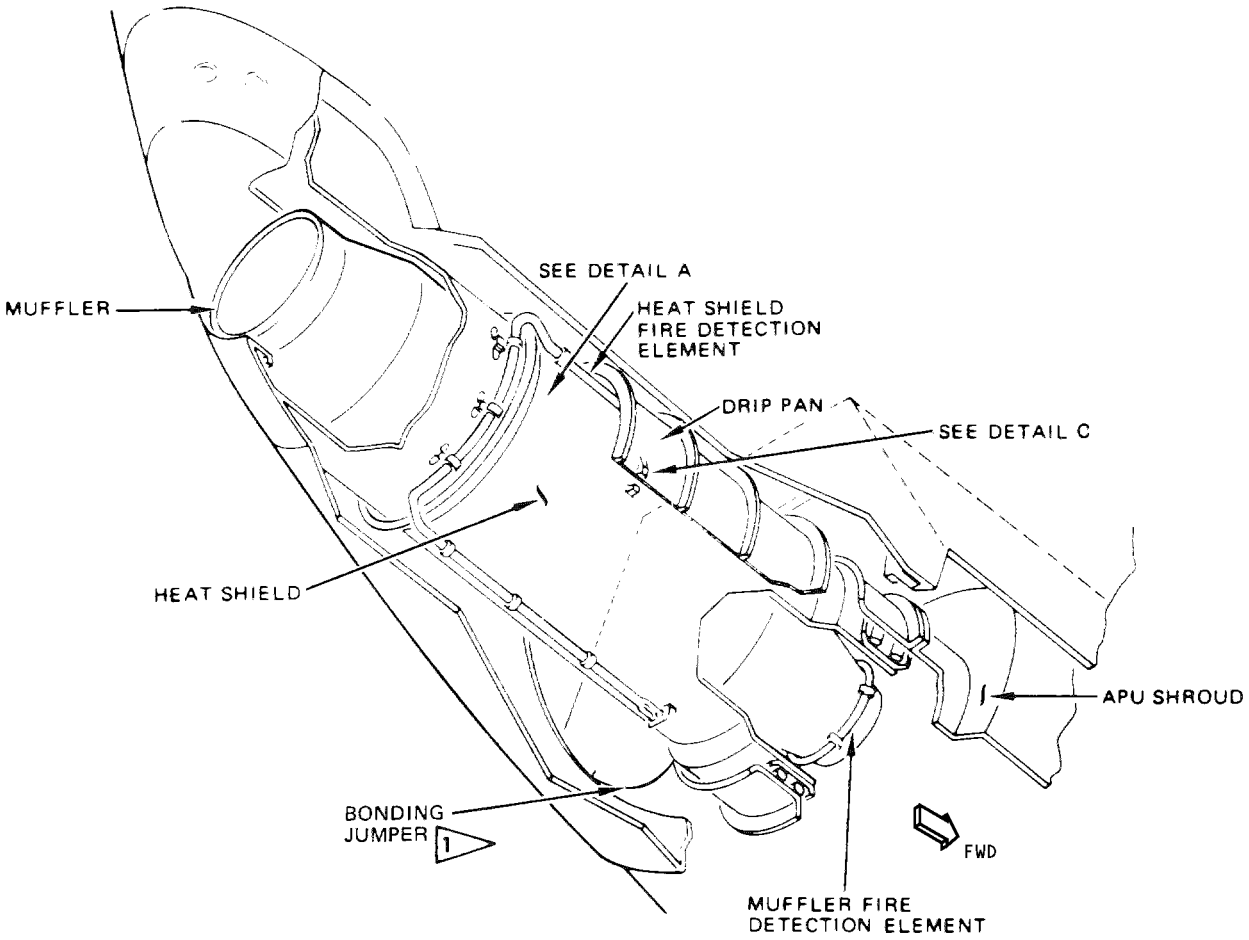
5. Install Aft Fairing Assembly (Fig. 401)
A. Install muffler inside of heat shield (AMM 49-81-11/401).
B. Position aft fairing assembly on tail cone.

CAUTION: ON AIRPLANES WITH FIRE DETECTION ELEMENT ATTACHED TO HEAT SHIELD, CARE MUST BE TAKEN SO THAT THE ELEMENT WILL NOT BE DAMAGED.

C. Install flange assembly and reaction plate assembly per steps 4.F. thru 4.I. (Fig. 402, Detail B).
D. Assemble the take-up rod and rod extension assembly.
E. Install take-up rod in reaction plate assembly and insert the rod handle which is stored on the reaction plate.
F. Put the puller plate assembly into the exhaust pipe against the end of the muffler and over the end of the rod extension. Secure with pressure pad assembly and ball lockpin.
G. Turn the take-up rod until the aft fairing assembly has traveled at least three inches in the shroud bellmouth and fairing is snug against the fuselage contour.
H. Install add tighten screws attaching aft fairing to tail cone (Fig. 401).
I. Remove APU heat shield install/removal equipment from aft fairing assembly.
J. Attach drip pan to heat shield with bolts and washers.
K. Connect bonding jumper, if installed, at frame, member below forward end of heat shield.
L. Connect electrical connector to heat shield and muffler fire and overheat detectors.
M. Install and secure access panel 3802.
N. Install APU (Ref 49-11-0 R/I).



Aft Fairing Assembly Installation
Figure 401 (Sheet 1)



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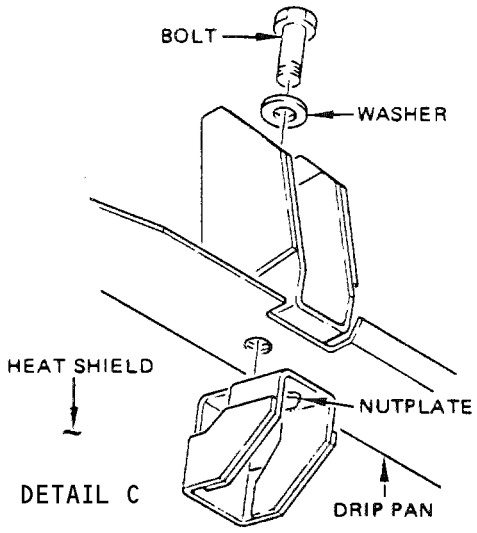
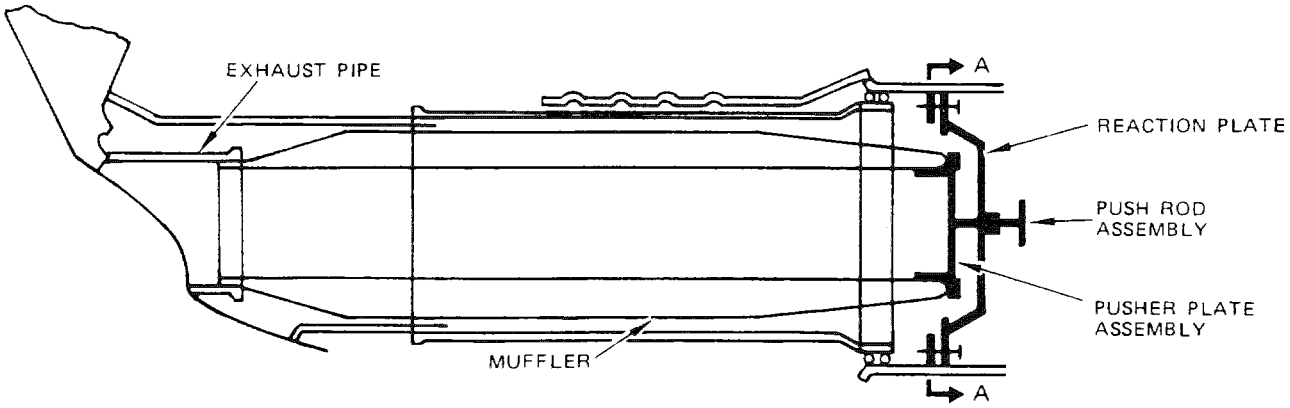


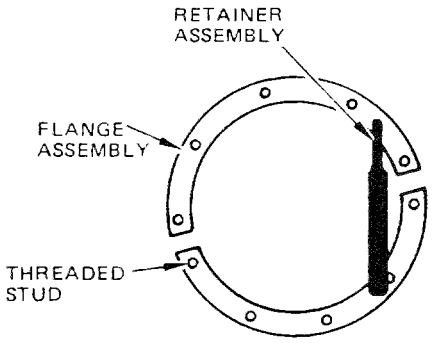
DETAIL C

Aft Fairing Assembly Installation
Figure 401 (Sheet 2)

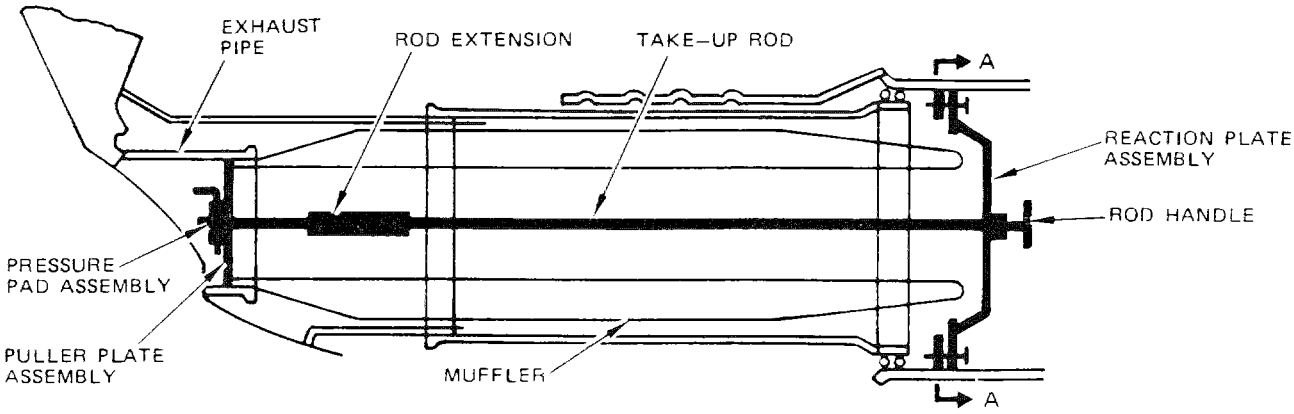


AFT FAIRING ASSEMBLY REMOVAL

DETAIL A



SECTION A-A



AFT FAIRING ASSEMBLY INSTALLATION

DETAIL B

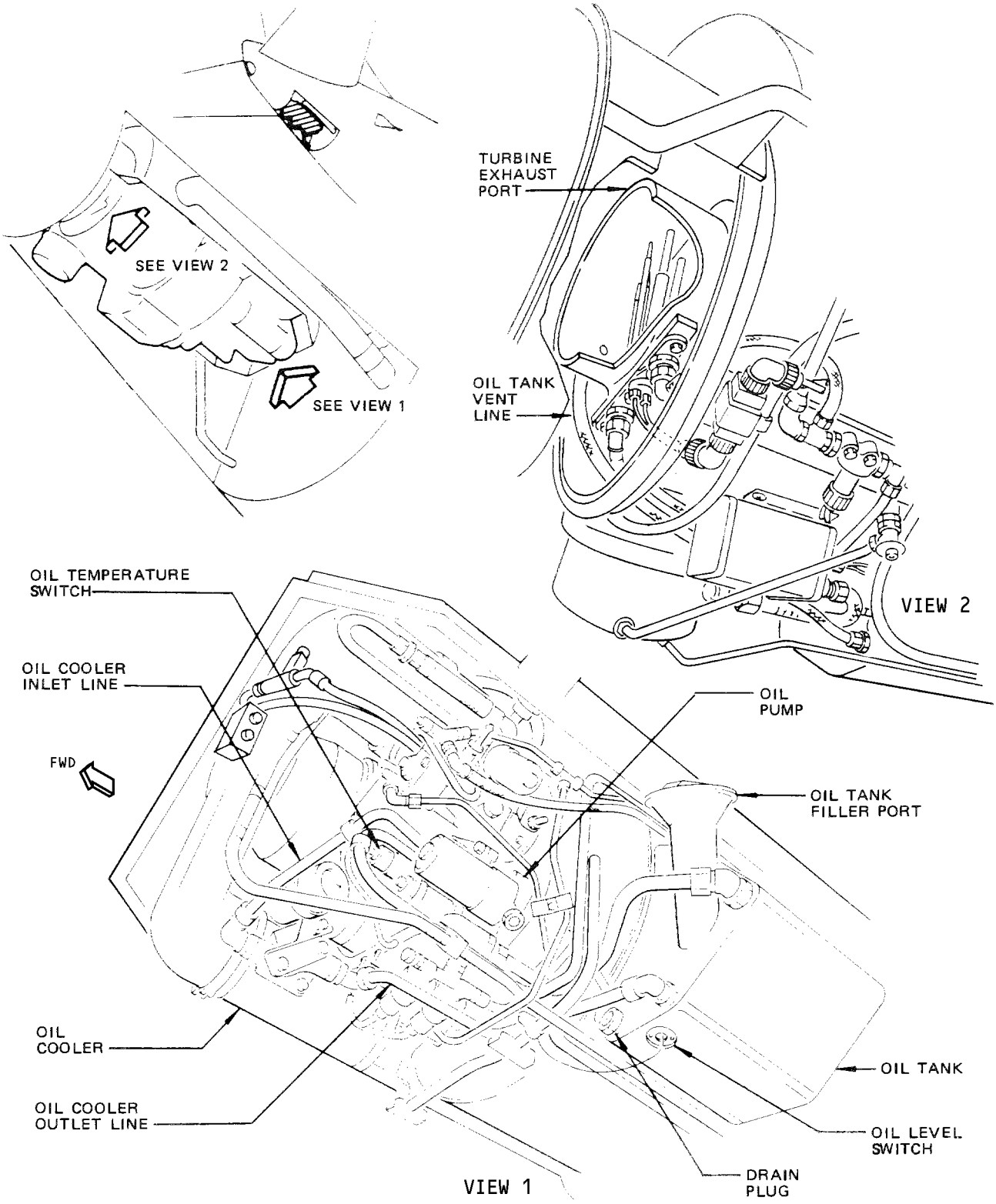
APU Heat Shield Instl/Removal Equipment
Figure 402

O. Remove placard from BATTERY SWITCH.
P. Test Fire and Overheat Detection System (AMM 26-15-01/501).

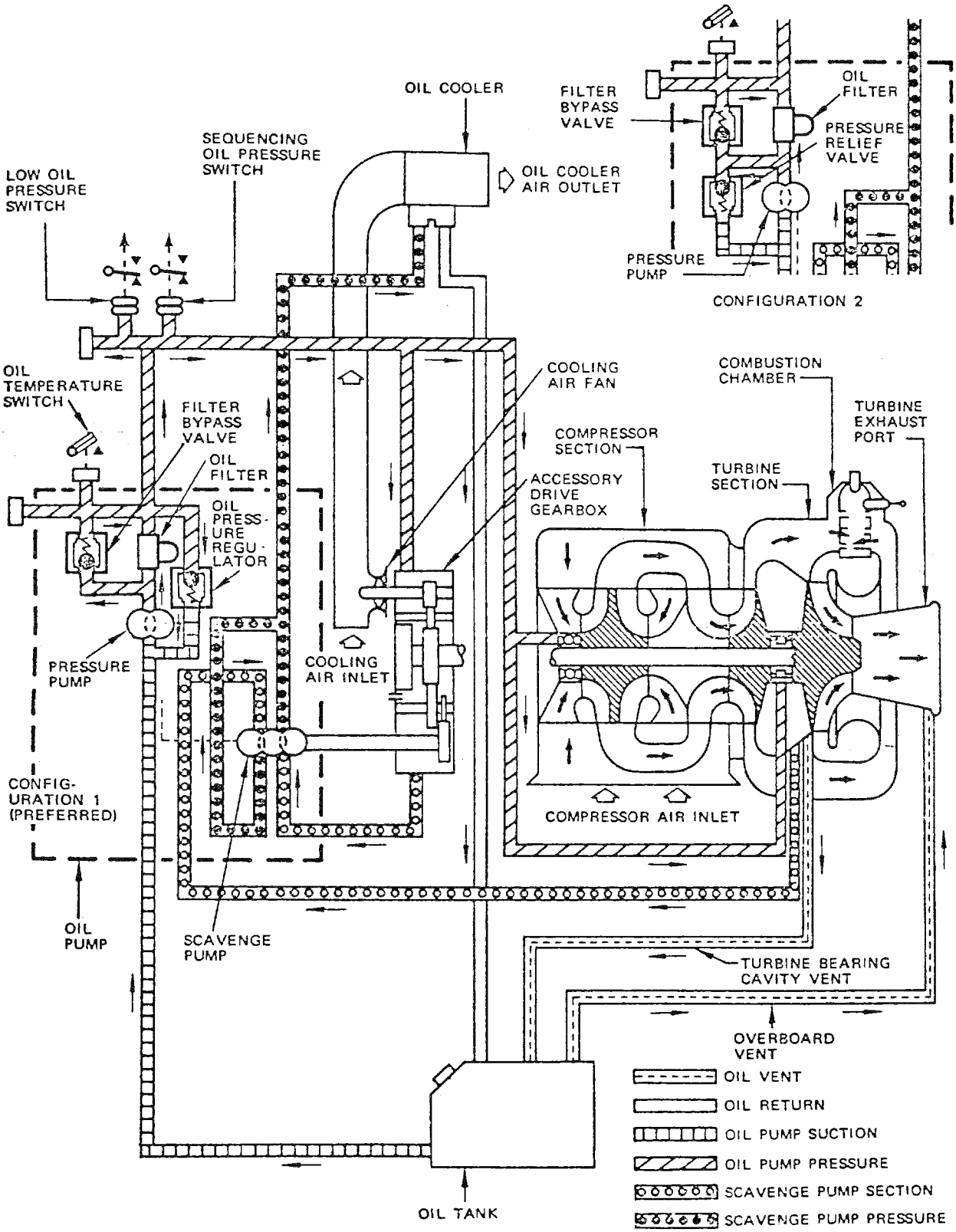
APU LUBRICATION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. Lubrication of the APU turbine engine is by a self-contained, positive pressure, dry-sump system, which cools and lubricates all gears and bearings in the engine by providing a pressurized supply of oil. The components of the system are the oil pump, oil cooler, and oil tank (Fig. 1).
   B. When the unit is started, the pressure pump draws oil from the oil tank and delivers it under pressure to the accessory drive section and to the bearing between the second stage compressor and the turbine. The oil drains into the accessory drive housing sump and into the second stage compressor and turbine bearing cavity. The scavenge pump draws the oil from the sump and bearing cavity and pumps it through the oil cooler back in to the tank.
2. Oil Pump
   A. The oil pump consists of separate pressure and scavenge pumps, pressure regulating valve, oil filter, and a filter bypass valve. The pump is installed on the accessory drive gearbox (Fig. 1).
   B. The pressure and scavenge pumps are driven by a common shaft. The pressure pump is a two gear, positive displacement pump which supplies oil underpressure to the bearings, gears, and shafts of the turbine engine. The scavenge pump is a three gear positive displacement pump which scavenges oil from the accessory drive oil sump and from the bearing cavity between the second stage compressor impeller and the turbine wheel. It returns the oil through the oil cooler to the oil tank. External outlet and inlet lines are connected to threaded ports in the body, but scavenging from the accessory drive gearbox is through an internal opening between the oil pump and the gearbox.
   C. The maximum delivery pressure is regulated by a spring-loaded relief valve contained within the pump body. The function of this valve is to open when the pressure pump delivery exceeds 90 psig system pressure, thus allowing oil to bypass back to the inlet side of the pressure pump to maintain nearly constant system pressure.
   D. The oil filter is located on the oil pump. It filters all the oil flowing from the pressure pump. The filter base is integral with the pump body. The removable case screwed into the base encloses a replaceable filter element.
   E. The filter bypass valve is a spring-loaded relief valve contained within the pump body. The function of this valve is to yield to pressure slightly in excess of normal filter resistance, so that if the filter should become blocked, oil is permitted to bypass the filter and maintain a flow through the system.

3. Oil Cooler
   A. The oil cooler is a cylindrical unit constructed of mechanically bonded aluminum tubes housed in a shell. It is installed on the lower front side of the APU (Fig. 1). Oil delivered by the scavenge pump passes around the tubes in the cooler before returning to the tank, while air supplied by the cooling fan flows through the tubes and cools the oil.
4. Oil Tank
   A. The oil tank contains the supply of oil for the system and is mounted on the left side of the APU (Fig. 1). Oil is drawn from the tank by the pressure pump and returned, through the oil cooler, by the scavenge pump. The tank is vented to the turbine exhaust. An air-oil separator in the tank separates the oil from the air going through the tank to the vent. An oil level switch, contained within the tank, is used to transmit a low oil quantity signal.
5. Operation
   A. When the unit is started, the oil pressure is supplied by the oil pressure pump gears through the oil pump filter (Fig. 2). If the filter is clogged, the bypass valve opens to permit continuing oil flow. From the oil pump, the oil is routed to the accessory drive gearbox and to the bearing between the second stage compressor impeller and the turbine wheel to provide pressure and spray lubrication for the engine gears and bearings. An oil pressure regulator valve in the oil pump operates to maintain the output oil pressure at 90 psig at 100% service speed.
   B. Lubricating oil in the unit drains into the accessory drive gearbox oil sump and 2nd-stage compressor and turbine bearing cavity. It is pumped from the sump and cavity by the oil scavenge pump gears (Fig. 2). Scavenge oil is directed through the oil cooler back to the oil tank. Any air trapped in the 2nd-stage compressor and turbine bearing cavity is released through the oil tank vent line into the turbine exhaust.



APU Lubrication System Component Location
Figure 1



APU Lubrication System Flow Diagram
Figure 2

OIL PUMP - UNIT SERVICING

1. Equipment and Materials
   A. Cleaning Solvent - Federal Specification P-D-680
2. Prepare for Oil Pump Servicing
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Replace Oil Filter Element (Fig. 301)
   A. Remove filter cap, packing, and filter element. Catch dripping oil in suitable container. Discard filter element and packings.
   B. Clean cap in solvent and dry thoroughly with clean, compressed air.

      WARNING: SOLVENT IS TOXIC; USE IN WELL-VENTILATED AREA. KEEP AWAY FROM FLAME.

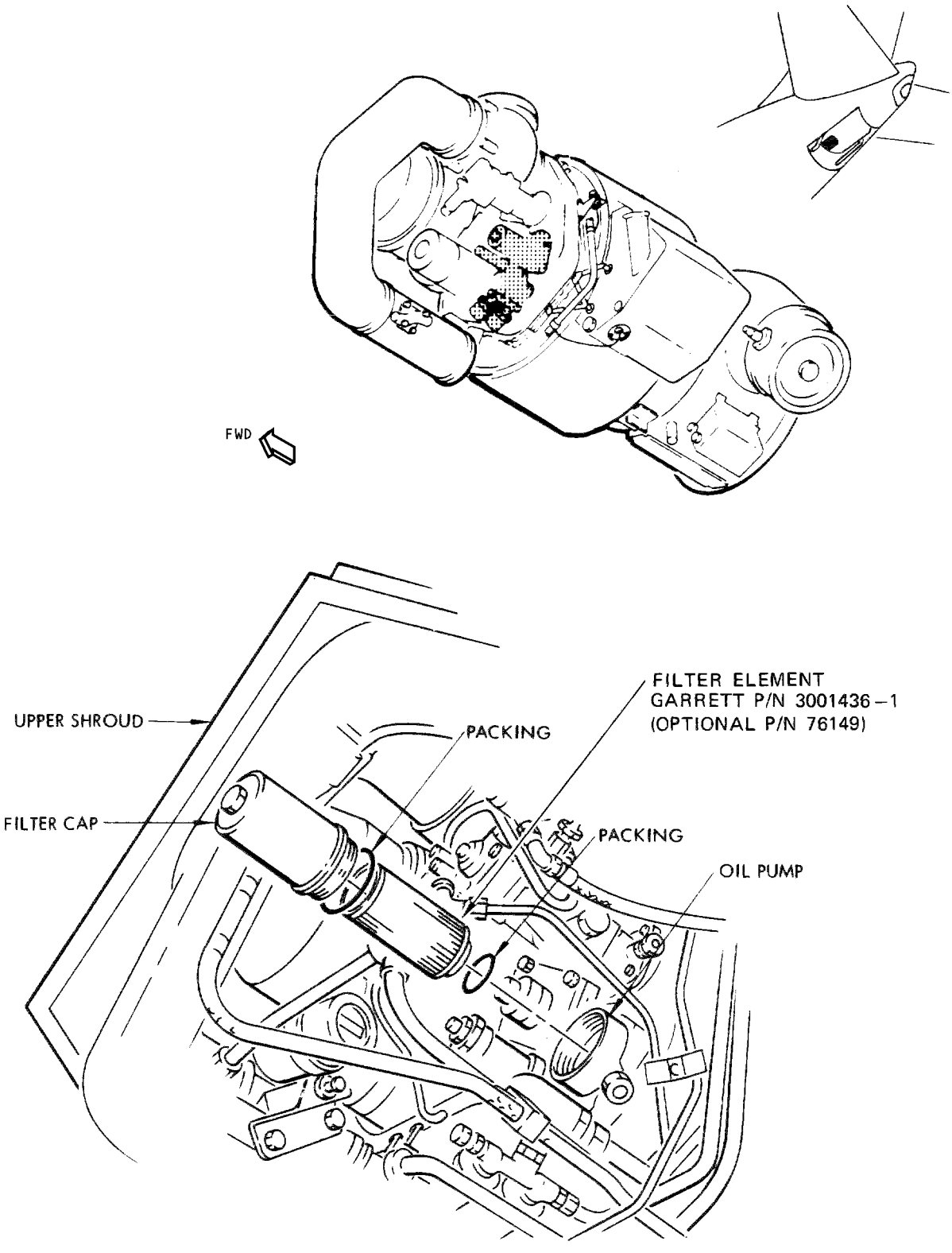
   C. Lubricate and install new O-ring packing in filter element.
   D. Lubricate and install new O-ring packing on filter cap.
   E. Place filter element on centering boss of oil pump housing.
   F. Position filter cap over filter element and screw cap into oil pump housing. Tighten cap and lockwire.

      CAUTION: DO NOT EXCEED TORQUE VALUE OF 25 POUND-INCHES WHEN TIGHTENING OIL FILTER CAP.

4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.



Oil Pump Unit Servicing
Figure 301

OIL PUMP - REMOVAL/INSTALLATION

1. General
   A. This section covers the removal and installation of the oil pump assembly consisting of an oil pump, oil filter, oil temperature switch, sequencing oil pressure switch and low oil pressure switch. For removal and installation of the sequencing oil pressure switch and low oil pressure switch, refer to 49-61-41 and 49-61-51 respectively.
2. Prepare to Remove Oil Pump
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Remove starter motor (Ref 49-41-11, Removal/Installation).
   F. Drain oil tank (Ref 49-91-31, Unit Servicing).
3. Remove Oil Pump (Fig. 401)

   CAUTION: IF OIL PUMP ASSEMBLY IS BEING REPLACED DUE TO INTERNAL FAILURE CHECK OIL FILTER ELEMENT AND ACCESSORY DRIVE GEARCASE FOR EVIDENCE OF METAL PARTICLES. REMOVE ALL VISIBLE PARTICLES FROM GEARCASE. ASCERTAIN CORRECT CAUSE OF FAILURE PRIOR TO INSTALLATION OF NEW OIL PUMP.

   A. Disconnect electrical plug from sequencing oil pressure switch.
   B. Disconnect electrical plug from low oil pressure switch.
   C. Disconnect oil cooler inlet line from fitting on oil pump. Catch dripping oil in suitable container.
   D. Disconnect oil pump inlet line from fitting on oil pump. Catch dripping oil in suitable container.
   E. Disconnect tester line from receptacle on oil pump.
   F. Disconnect electrical plug from oil temperature switch.
   G. Disconnect scavenge pump inlet line from oil pump. Catch dripping oil in suitable container.
   H. Disconnect gearbox inlet line from oil manifold fitting. Catch dripping oil in suitable container.
   I. Disconnect compressor inlet line from fitting on oil pump. Catch dripping oil in suitable container.
   J. Remove bolts and washers attaching oil pump assembly to accessory drive gearbox.

K. Carefully remove oil pump assembly from power plant.
L. Remove and discard packings.
M. If required to remove oil manifold, unscrew oil manifold from oil pump, and remove packing and nut.

4. Install Oil Pump (Fig. 401)
A. If oil manifold was removed from oil pump, install oil manifold on oil pump with nut and new packing.
B. Install new packings, lightly lubricated with petrolatum (VV-P-246, AMM 20-30-21/201) on oil pump housing.
C. Position oil pump assembly on accessory drive gearbox, aligning oil pump inlet line with fitting on oil pump inlet port (Fig. 401).
D. Attach oil pump assembly to accessory drive gearbox with bolts and washers. Tighten bolts to a torque value of 50-70 pound-inches.
E. Connect compressor inlet line to fitting on oil pump.
F. Connect gearbox inlet line to oil manifold fitting.
G. Connect scavenge pump inlet line to oil pump.
H. Connect electrical plug to oil temperature switch.
I. Connect tester line to receptacle on oil pump.
J. Connect oil pump inlet line to fitting on oil pump.
K. Connect oil cooler inlet line to fitting on oil pump.
L. Connect electrical plug to low oil pressure switch.
M. Connect electrical plug to sequencing oil pressure switch.
N. Install starter motor (AMM 49-41-11/401).
O. Fill oil tank (AMM 49-91-31/301).
P. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
Q. Position BATTERY switch to ON and remove placards.
R. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; examine the oil pump for leakage:
(1) Start and operate the APU (AMM 49-11-0/201).
(2) During the APU operation, examine the oil pump for leakage.
(3) Do the APU normal shutdown (AMM 49-11-0/201).
(4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(5) If you found leakage, repair the cause of it.
S. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; examine the oil pump for leakage:
(1) Start and operate the APU (AMM 49-11-0/201).
(2) Do the APU normal shutdown (AMM 49-11-0/201).
(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.

(4) Visually examine the oil pump for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

NOTE: If oil pump was replaced due to internal failure, check oil filter element (AMM 49-91-11/601).

T. Check oil pump pressure (AMM 49-91-11/501).

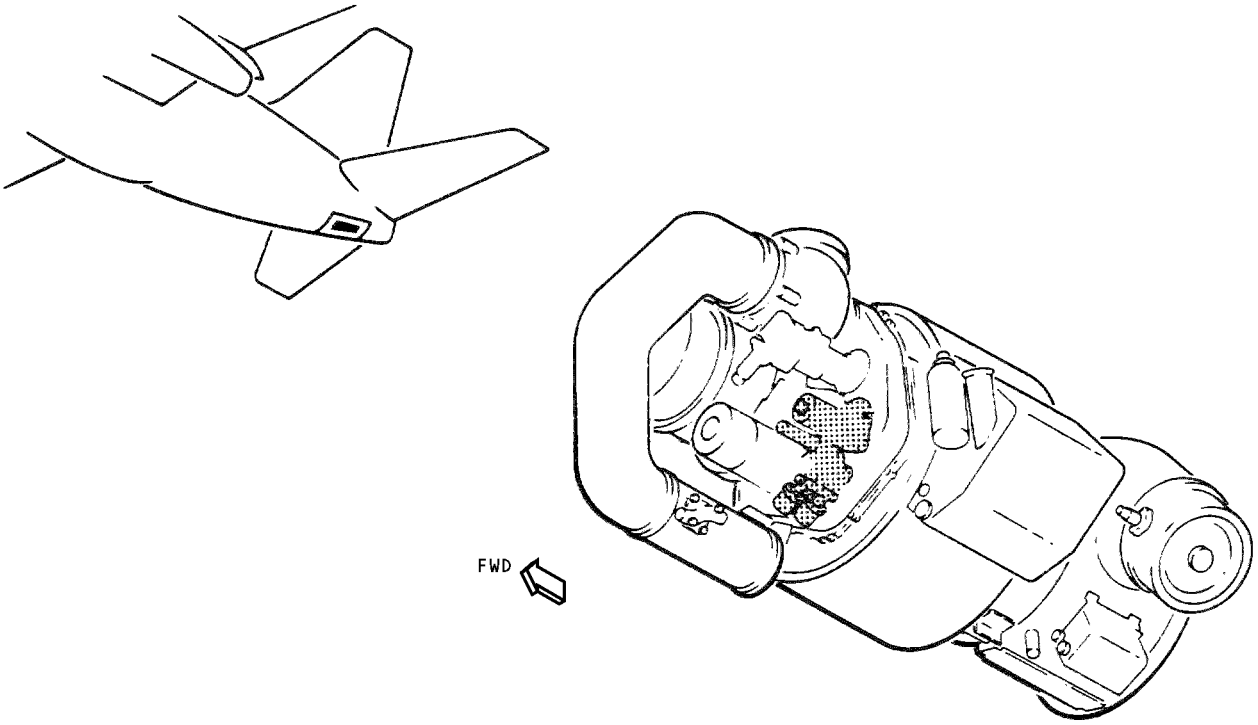
5. Restore Airplane to Normal Configuration

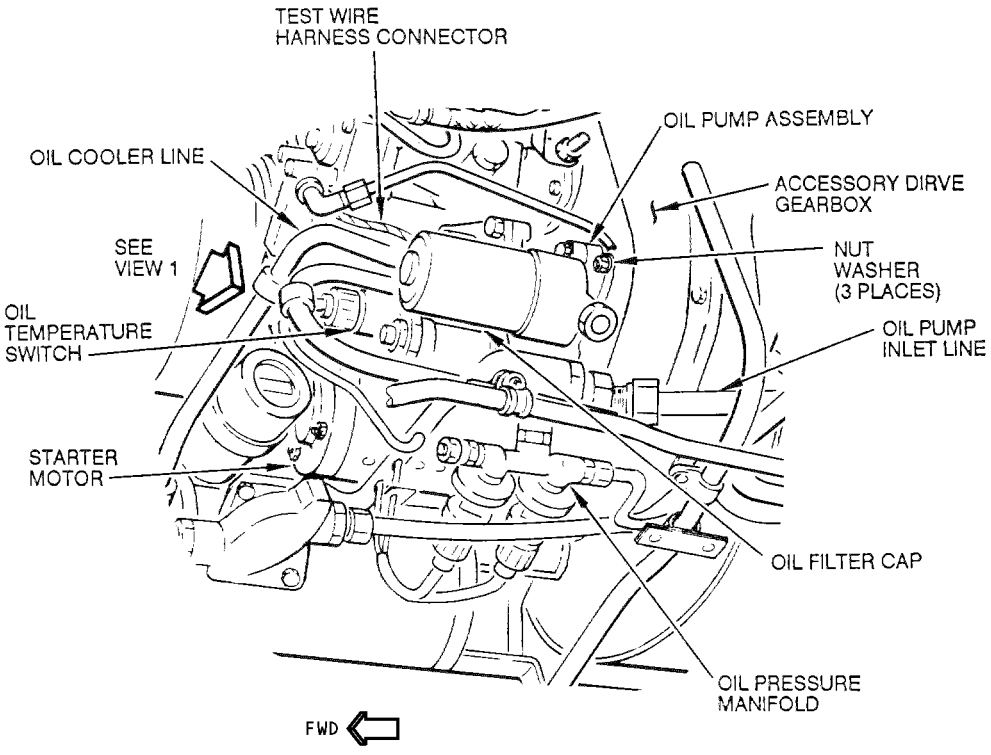
A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).

B. Position lower shroud against upper shroud and close shroud latches.

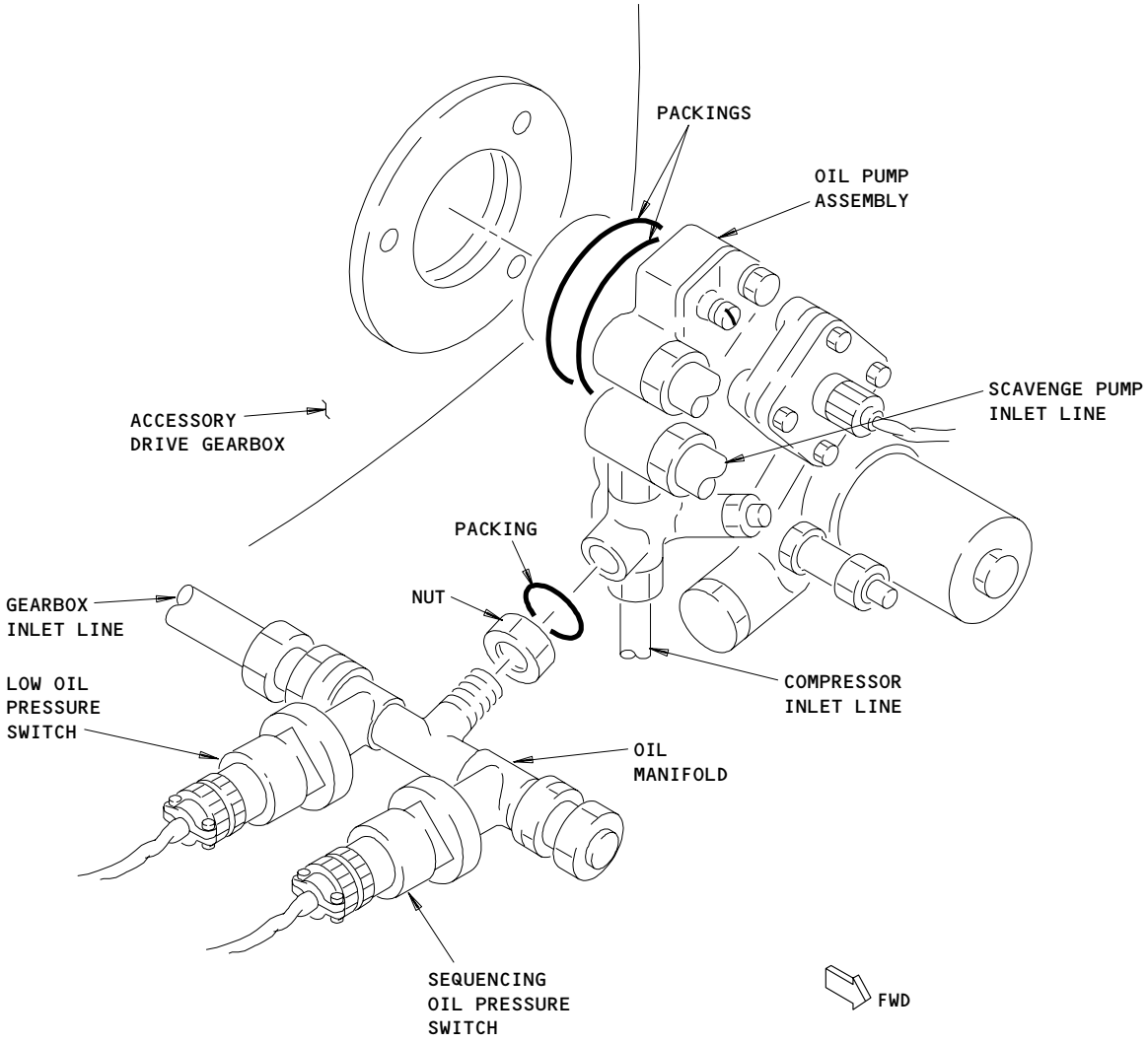
CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.





Oil Pump Installation
Figure 401 (Sheet 1)



VIEW 1

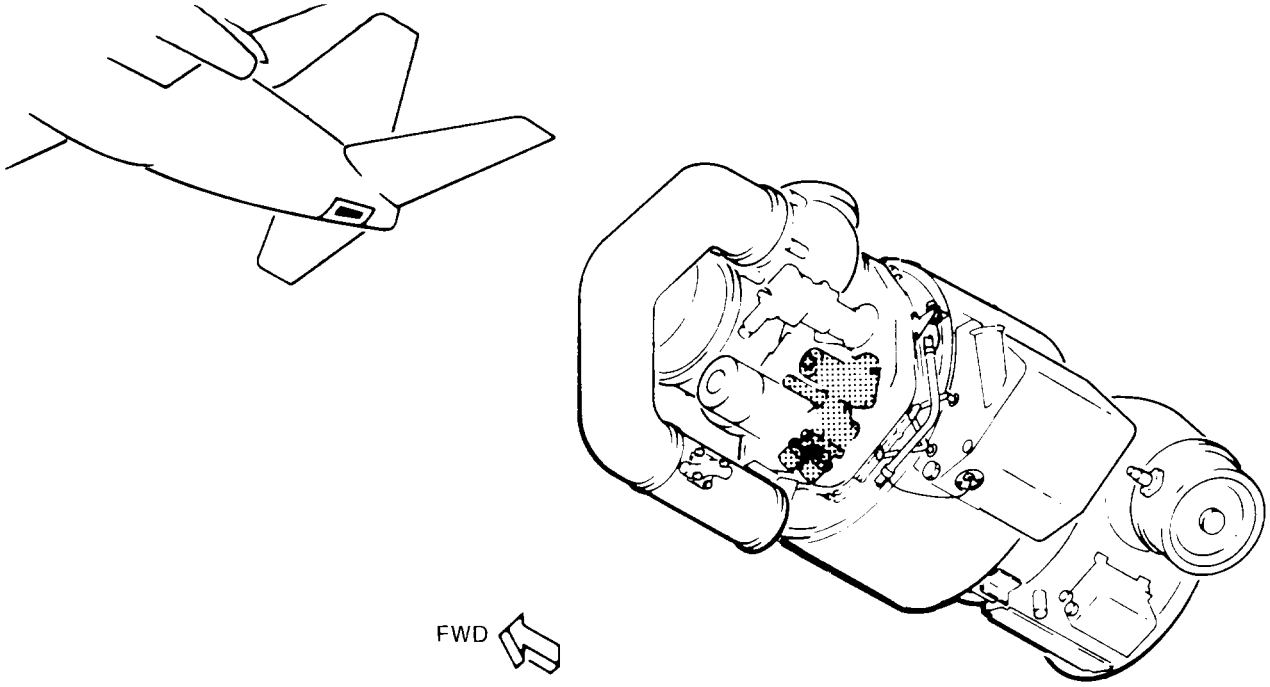
Oil Pump Installation
Figure 401 (Sheet 2)

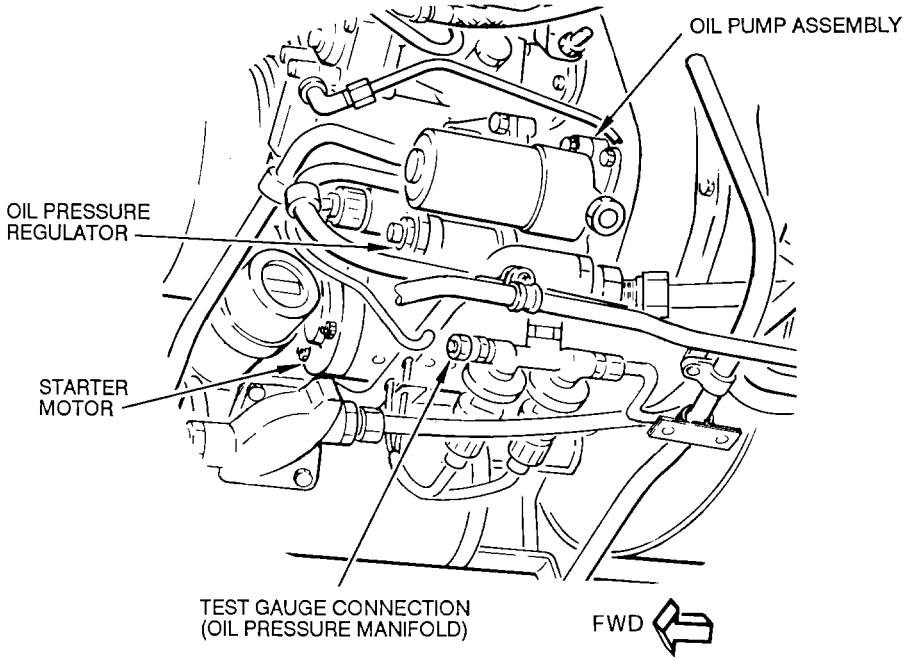
OIL PUMP - ADJUSTMENT/TEST

1. General
   A. An operational check of the oil pump should be made if any one of the following occurs: (1) the oil pump was disassembled; (2) the oil pump was removed and replaced; (3) the oil pressure switch was removed and replaced.
2. Equipment and Materials:
   A. Pressure gage - 0 to 200 psig and appropriate fittings
3. Test Oil Pump (Fig. 501)
   A. Remove cap from end of oil pressure manifold.
   B. Attach flexible oil line with oil pressure gage to manifold.
   C. Operate APU (Ref 49-11-0, Maintenance Practices).

      NOTE: Allow engine to accelerate to no-load steady state rpm.

   D. Oil pressure shall read 95 ±5 psig.
   E. If pressure is not within specified limits, shutdown engine and adjust oil pump.
      (1) Loosen locknut and adjust.
         (a) Turn adjusting screw clockwise to increase oil pressure.
         (b) Turn adjusting screw counterclockwise to decrease outlet pressure.
      (2) Tighten locknut and repeat steps C thru E.
   F. If pressure is within specified limits, shutdown engine.
   G. Remove flexible air line with pressure gage from manifold fitting and reinstall cap.





Oil Pump Adjustment
Figure 501

OIL PUMP - INSPECTION/CHECK

1. General
   A. Visually check filter element for metal particles and other foreign material which may indicate internal engine damage. If metal particles are indicated, change oil and oil filter element; then operate the APU for a minimum of fifteen minutes. If no further accumulation of metal particles after fifteen minutes, APU is acceptable for continued service. Further accumulation of metal particles during the fifteen minute run is unacceptable.

OIL TANK - UNIT SERVICING

1. Equipment and Materials
   A. Cleaning Solvent - Federal Specification P-D-680 (Ref 20-30-31)
   B. Lubricating Oil (MIL -L-7808, MIL-L-23699, Ref 20-30-21).
      (1) For additional information refer to P&WA Specification No. 521 (Service Bulletin No. 238), or Garrett (AiResearch) Report GT7800R.
   C. Container with 2-gallon capacity
2. Prepare for Oil Tank Servicing
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open access door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Service Oil Tank - Oil Change

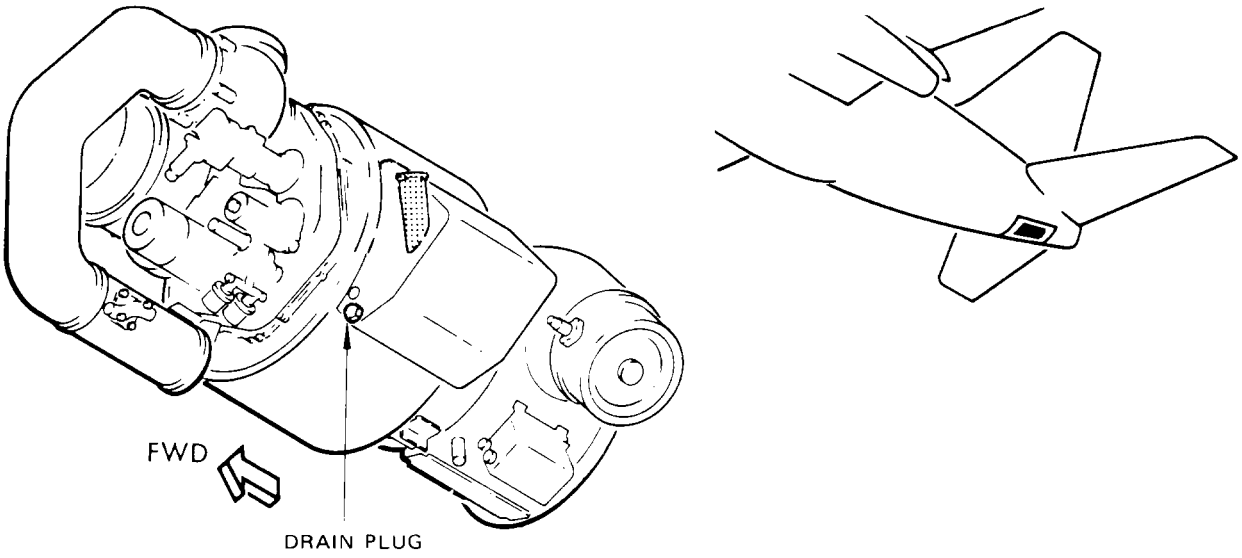
   CAUTION: ANY SUBSTITUTION OR USE OF NON-APPROVED LUBRICANTS, OR MIXING OF BRANDS OR TYPES OF LUBRICANTS MAY CAUSE CONSIDERABLE ENGINE DAMAGE.

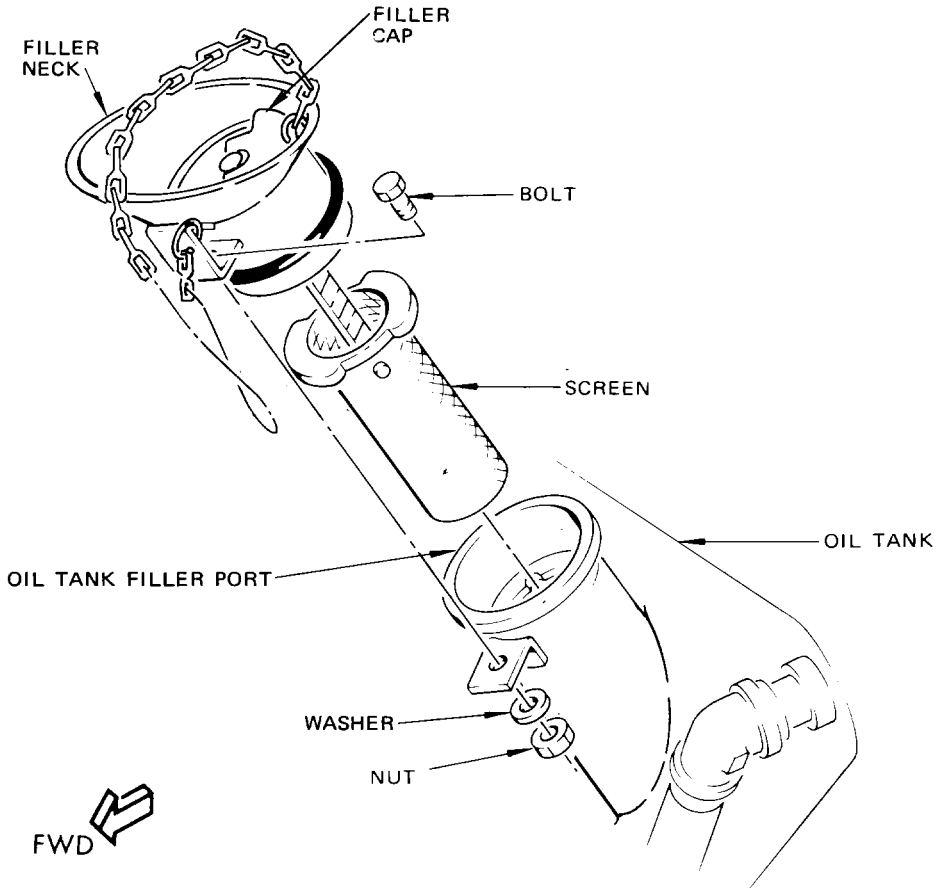
   A. Change lubricating oil using same brand or type.

      NOTE: Drain oil while engine is still warm from operation. If necessary, start and operate engine until oil reads normal operating temperature, then shut down engine and proceed with oil change while oil is hot.

      (1) Remove oil tank filler cap and dipstick.
      (2) Remove bolt, washer and nut attaching filler neck to bracket on oil tank filler port.
      (3) Remove filler neck from oil tank filler port.
      (4) Place container under oil tank drain port. Remove drain plug while oil is still warm, and allow oil to drain.

          WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.





Oil Tank–Unit Servicing
Figure 301

(5) Remove screen from oil tank filler port, wash in solvent, and dry with clean compressed air.

WARNING: SOLVENT IS TOXIC. USE IN WELL VENTILATED AREA. KEEP AWAY FROM FLAME.

(6) Install drain plug with new packing.
(7) Install screen in oil tank filler port.
(8) Examine O-ring seals on filler cap and filler neck and replace if damaged.
(9) Install filler neck on oil tank filler port. Attach filler neck to filler port with bolt, washer and nut.
(10) Fill oil tank with new oil to 6-quart mark on dipstick (Fig. 301).

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.

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

(11) Install filler cap in oil tank filler port.

B. Change lubricating oil using another approved brand or type.

NOTE: Drain oil while engine is still hot from operation. If necessary, start and operate engine until oil reaches normal operating temperature, then shut down engine and proceed with oil change while oil is hot.

(1) Remove oil tank filler cap and dipstick.
(2) Remove bolt, washer and nut attaching filler neck to bracket on oil tank filler port.
(3) Remove filler neck from oil tank filler port.
(4) Place container under oil tank drain port. Remove drain plug while oil is still warm, and allow oil to drain.

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.

(5) Remove screen from oil tank filler port, wash in solvent, and dry with clean compressed air.

WARNING: SOLVENT IS TOXIC. USE IN WELL VENTILATED AREA. KEEP AWAY FROM FLAME.

(6) Remove and discard oil filter element (Ref 49-91-11).
(7) Disconnect and drain oil from cooler and all associated oil lines. Reconnect lines.
(8) Install new oil filter element (Ref 49-91-11).
(9) Install drain plug with new packing.
(10) Install screen in oil tank filler port.
(11) Examine O-ring seals on filler cap and filler neck and replace if damaged.
(12) Install filler neck on oil tank filler port. Attach filler neck to filler port with bolt, washer and nut.
(13) Fill the oil tank to the 6 quart mark on the dipstick with an approved oil of a different brand than previously used (Fig. 301).

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH SKIN CAN CAUSE DERMATITIS, STAIN CLOTHING AND SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND THOROUGHLY WASH SKIN AFTER CONTACT. PAINTED SURFACES SHOULD BE CLEANED IMMEDIATELY AFTER CONTACT WITH OIL.

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

(14) Install the oil tank filler cap and dipstick.
(15) Motor the APU for 30 seconds to fill the oil pump, if it is necessary (Ref 49-11-00 MP).
(16) Operate the APU at the service speed with no load for 3 to 5 minutes (Ref 49-11-00 MP).
(17) Position the BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
(18) Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
(19) Repeat steps B.(1) thru B.(4), B.(6) thru B.(9) and B.(12) thru B.(14).
(20) Operate the APU for approximately 5 minutes (Ref 49-11-00 MP).
(21) Add oil, as necessary, to bring the oil level to the 6 quart mark on the dipstick.

4. Restore Airplane to Normal Configuration
   A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
   B. Position lower shroud against upper shroud and close shroud latches.

      CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

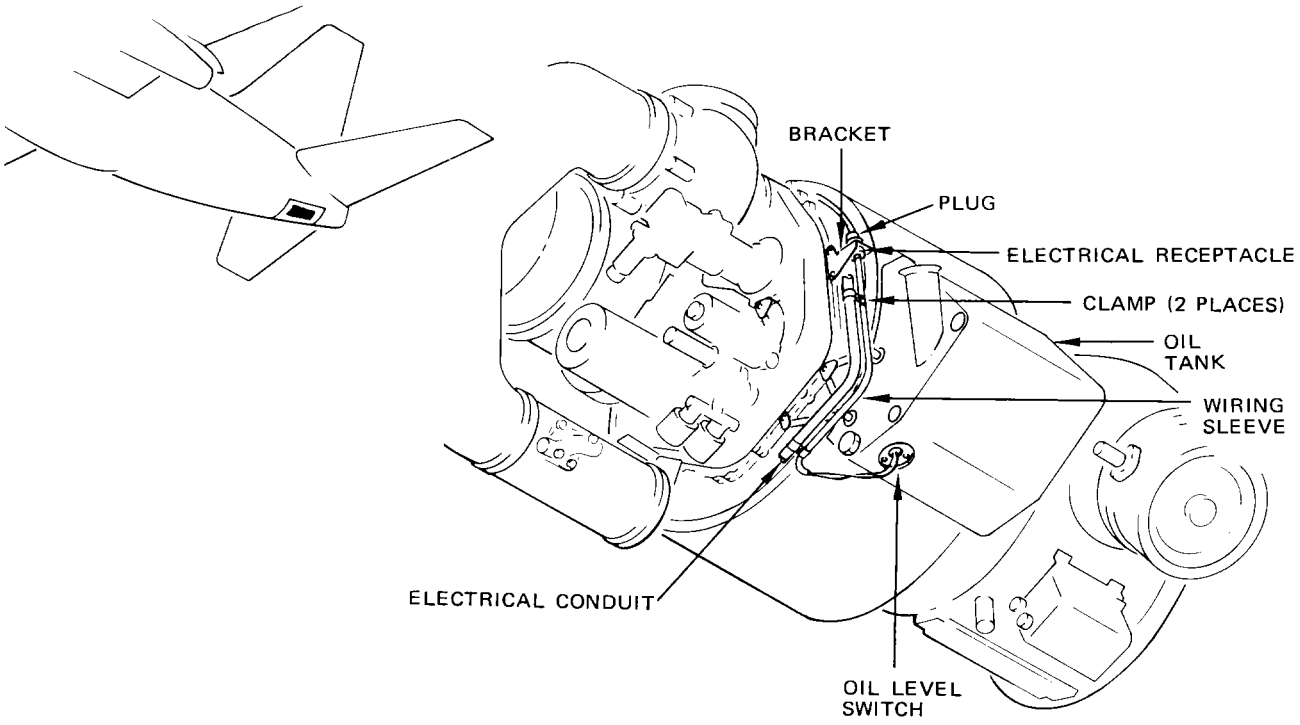
   C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.
   D. Close the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   E. Position BATTERY SWITCH to ON and remove placards.

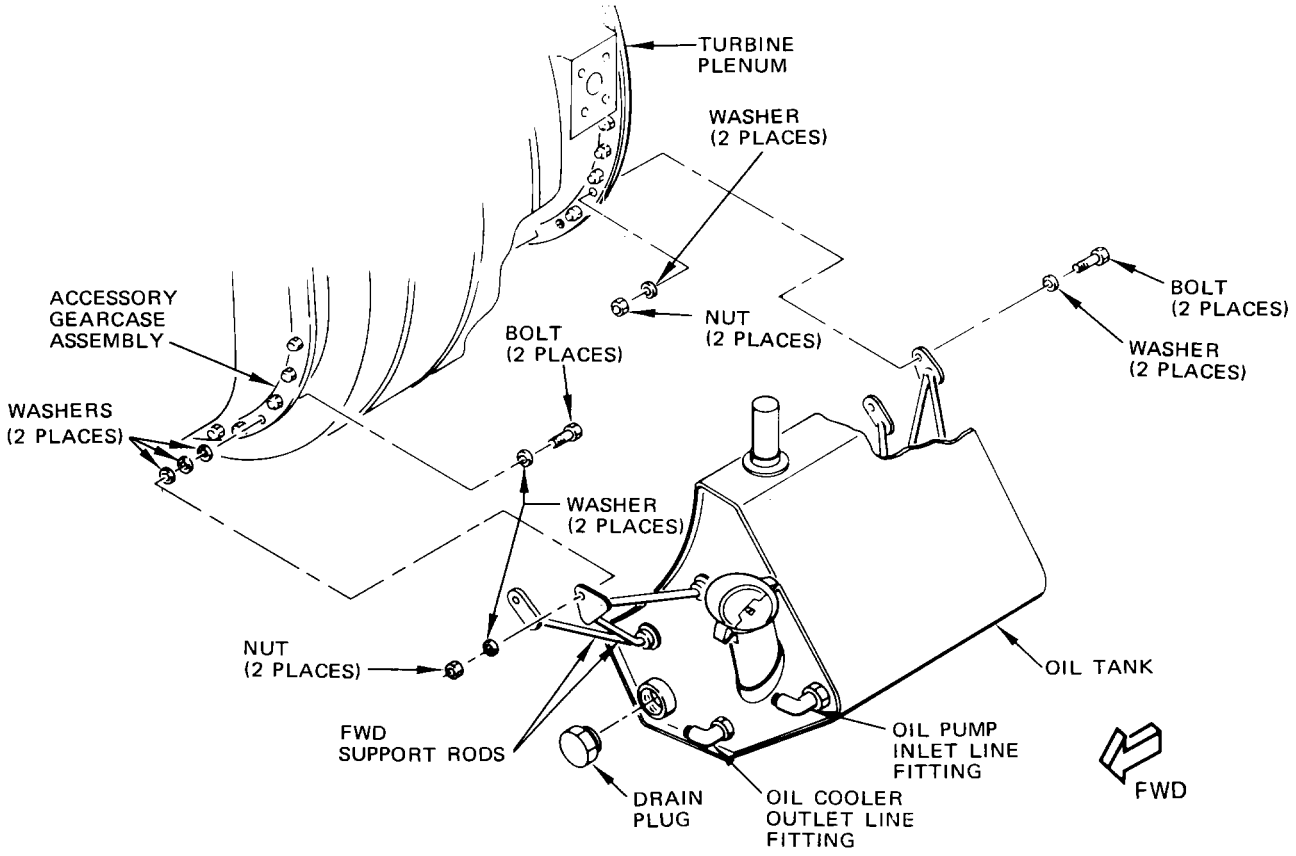
OIL TANK - REMOVAL/INSTALLATION

1. General
   A. This section covers the removal/installation of the APU oil tank and oil level switch as a unit. For removal of oil level switch, refer to 49-94-ll. Access to the oil tank is gained simply by removing the lower shroud, but due to space limitations, removal of the oil tank is simplified if the APU power plant is first lowered.
2. Prepare to Remove Oil Tank
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Drain oil tank. Refer to 49-91-31, Oil Tank - Unit Servicing.
3. Remove Oil Tank
   A. Disconnect oil cooler outlet line from fitting on oil tank. (See figure 401.)
   B. Disconnect oil pump inlet line from fitting on oil tank.
   C. Disconnect oil level switch electrical plug from receptacle, remove receptacle from bracket, and detach clamps holding wiring sleeve to electrical conduit.
   D. Disconnect turbine bearing cavity vent line from fitting on oil tank.
   E. Disconnect exhaust vent line from fitting on oil tank.
   F. Disconnect oil pump inlet line from oil pump assembly and remove oil pump inlet line to gain access to oil tank support rods.
   G. Remove nuts, washers, and bolts attaching forward support rods to lower left side of accessory gearcase assembly.
   H. Remove nuts, washers, and bolts attaching aft support rods to lower left side of turbine plenum assembly.
   I. Remove oil tank.
4. Install Oil Tank (Fig. 401)
   A. Position oil tank forward and aft support rods against lower left side of accessory gearcase and turbine plenum assembly flanges respectively, with oil tank filler port facing the forward direction.
   B. Attach aft support rods to lower left side of turbine plenum assembly flange with bolts, washers, and nuts.
   C. Attach forward support rods to lower left side of accessory gearcase assembly flange with bolts, washers, and nuts.





Oil Tank installation
Figure 401

D. Tighten forward support rod bolts to a torque of 40 to 45 inch-pounds and tighten aft support rod bolts to a torque of 90 to 110 inch-pounds.
E. Install oil pump inlet line.
   (1) Connect one end of oil pump inlet line to fitting on oil pump assembly.
   (2) Connect other end of oil pump inlet line to fitting on oil tank.
F. Connect oil cooler outlet line to fitting on oil tank.
G. Insert oil level switch electrical receptacle in bracket and secure with four sets of screws, washers, and nuts. Connect electrical plug to receptacle.
H. Clamp wiring sleeve to electrical conduit.
I. Connect turbine bearing cavity vent line to fitting on oil tank.
J. Connect exhaust vent line to fitting on oil tank.
K. Fill oil tank (AMM 49-91-31/301).
L. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
M. Position BATTERY switch to ON and remove placards.
N. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil tank for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) During the APU operation, examine the oil tank for leakage.
   (3) Do the APU normal shutdown (AMM 49-11-0/201).
   (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (5) If you found leakage, repair the cause of it.
O. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil tank for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) Do the APU normal shutdown (AMM 49-11-0/201).
   (3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (4) Visually examine the oil tank for any signs of leakage:
      (a) If you found signs of leakage, repair the cause of it.

5. Restore Airplane to Normal Configuration
A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

OIL COOLER - REMOVAL/INSTALLATION

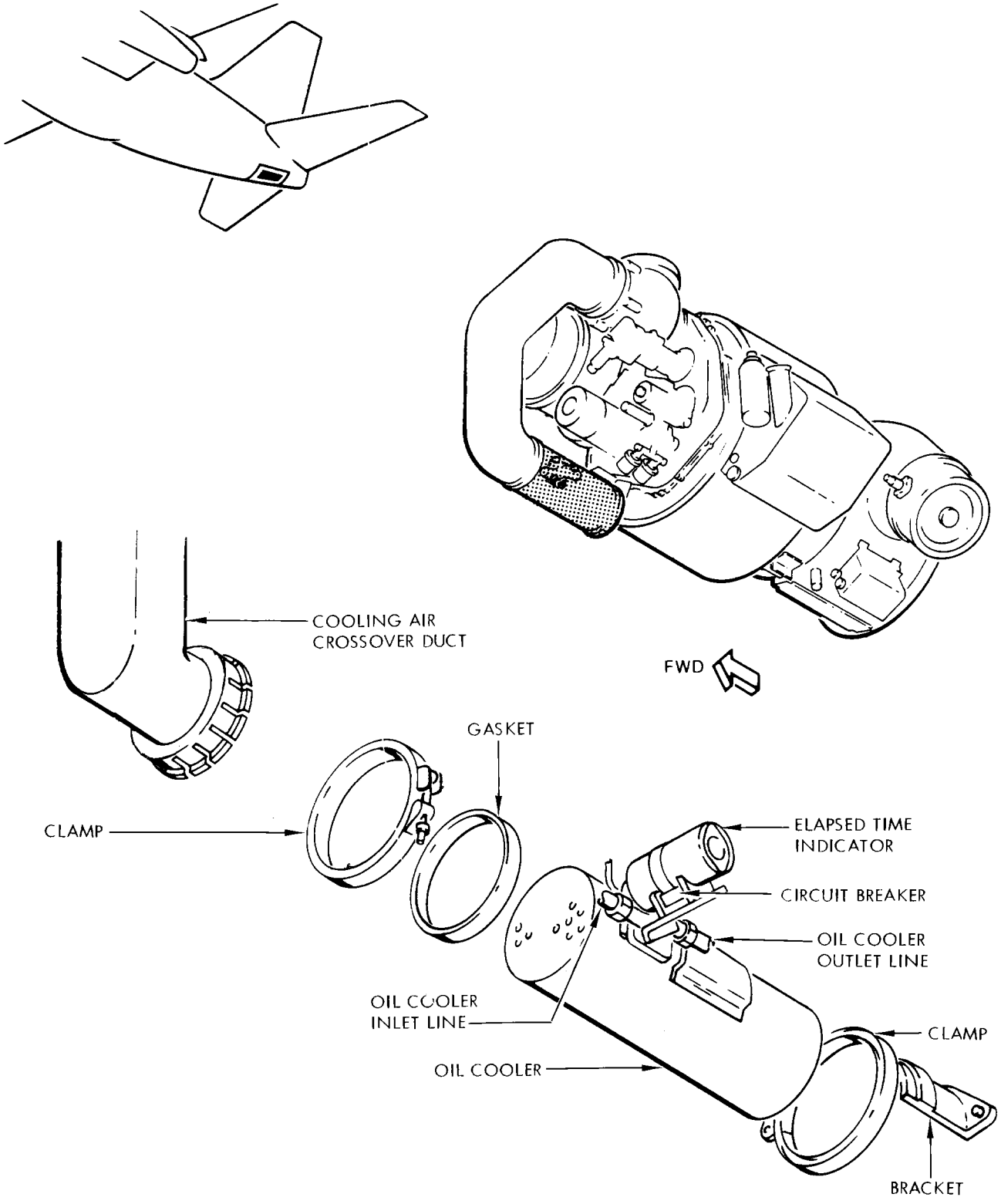
1. Prepare to Remove Oil Cooler
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU accessory unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

2. Remove Oil Cooler
   A. Disconnect electrical plug from elapsed time indicator. (See figure 401.)
   B. Tag and disconnect electrical leads from circuit breaker terminals.
   C. Disconnect oil cooler inlet line from fitting on oil cooler assembly.
   D. Disconnect oil cooler outlet line from fitting on oil cooler assembly.
   E. Remove clamp attaching cooling air crossover duct to oil cooler assembly.
   F. Remove clamp attaching oil cooler assembly to bracket on side of accessory drive gearbox.
   G. Remove oil cooler assembly.
   H. If required to remove elapsed time indicator, refer to 49-72-11, Elapsed Time Indicator - Removal/Installation.
3. Install Oil Cooler
   A. If elapsed time indicator was removed from oil cooler, install elapsed time indicator per 49-72-11.
   B. Position oil cooler assembly on cooling air crossover duct, aligning oil cooler inlet and outlet line fittings with inlet and outlet lines (Fig. 401).
   C. Using new gasket, install clamp attaching oil cooler assembly to cooling air crossover duct and tighten clamp.

      NOTE: Orient clamps with clamp nut at the 3 o'clock position when viewed from rear of engine. Clamp should not point downward.

   D. Install clamp attaching oil cooler assembly to bracket on side of accessory drive gearbox and tighten clamp.
   E. Connect oil cooler outlet line to fitting on oil cooler assembly.
   F. Connect oil cooler inlet line to fitting on oil cooler assembly.
   G. Remove tags and connect electrical leads to circuit breaker terminals.
   H. Connect electrical plug to elapsed time indicator.
   I. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.



Oil Cooler Installation
Figure 401

J. Position BATTERY switch to ON and remove placards.
K. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil cooler for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) During the APU operation, examine the oil cooler for leakage.
   (3) Do the APU normal shutdown (AMM 49-11-0/201).
   (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (5) If you found leakage, repair the cause of it.
L. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil cooler for leakage:
   (1) Start and operate the APU (AMM 49-11-0/201).
   (2) Do the APU normal shutdown (AMM 49-11-0/201).
   (3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
   (4) Visually examine the oil cooler for any signs of leakage:
      (a) If you found signs of leakage, repair the cause of it.

4. Restore Airplane to Normal Configuration
A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).
B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

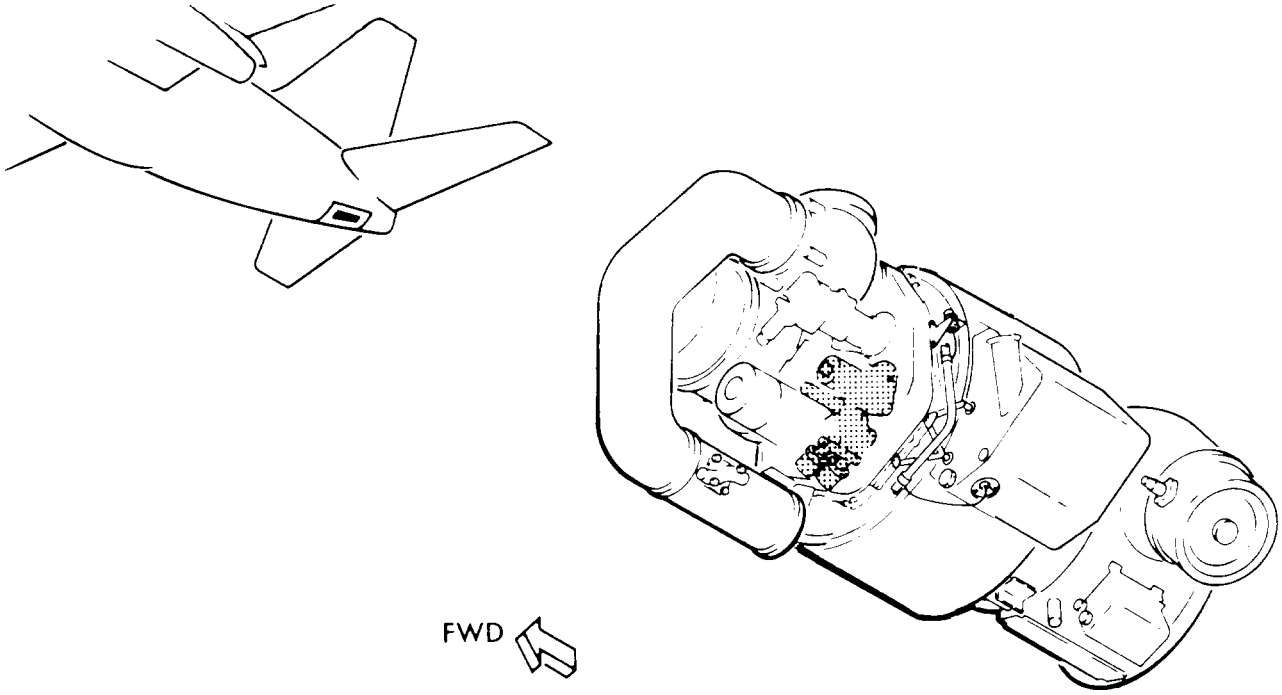
C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

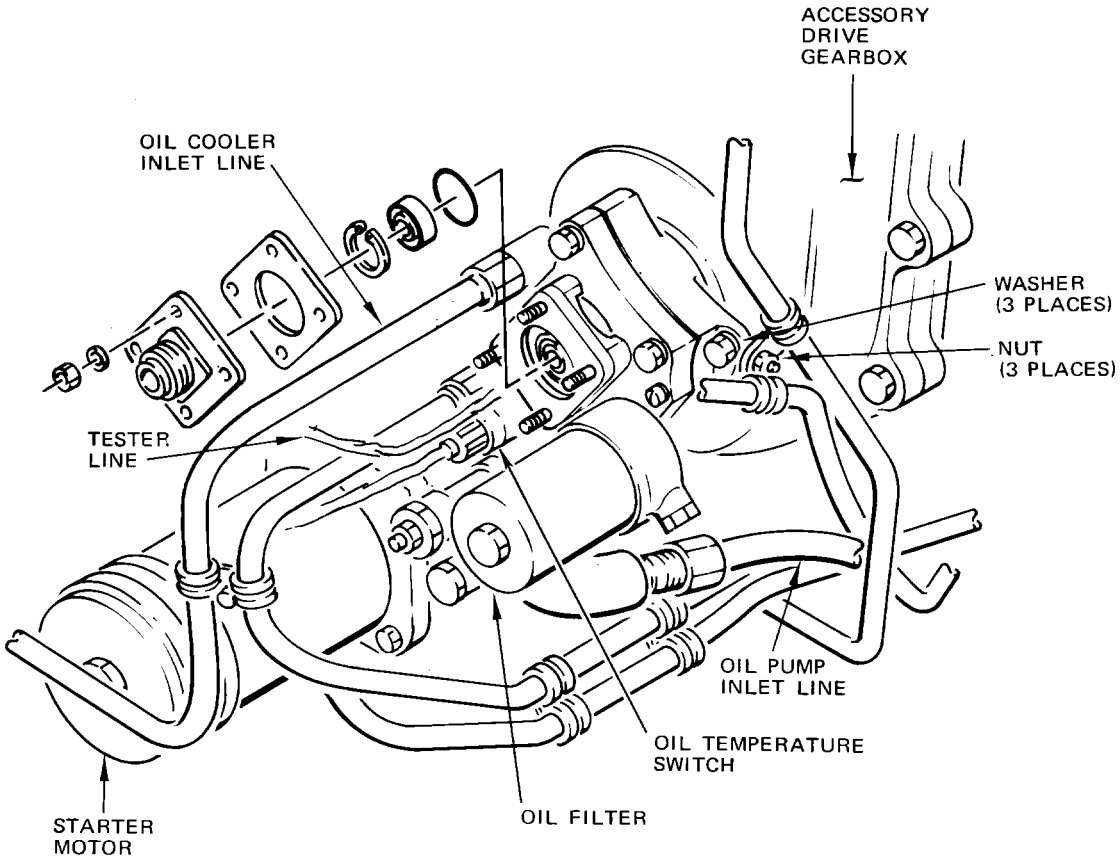
OIL PUMP DRIVE SHAFT SEAL - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Petrolatum - Braycote 248, Bray Oil Co., Los Angeles, California
   B. Seal Puller - 280209, AlliedSignal, Inc., Airline Services Division, P.O. Box 52170, Phoenix, Arizona 85072-2170
2. Prepare to Remove Oil Pump Drive Shaft Seal
   A. Position BATTERY SWITCH and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open circuit breaker on face of APU control unit (located in electrical and electronic bay).
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Oil Pump Drive Shaft Seal (Fig. 401)
   A. Remove tachometer-generator cover.
      (1) Disconnect electrical connector.
      (2) Remove four nuts and washers.
      (3) Remove cover and gasket.
   B. Remove ring securing seal.
   C. Using puller, remove seal and packing.
4. Install Oil Pump Drive Shaft Seal (Fig. 401)
   A. Coat new packing and new seal with petrolatum.
   B. Install new packing.
   C. Install new seal with lip facing outward.
   D. Secure seal in position with ring.
   E. Install tachometer-generator cover and gasket.
   F. Secure cover with nuts and washers.
   G. Connect electrical connector.
   H. Close the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   I. Position BATTERY switch to ON and remove placards.
   J. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil pump for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the oil pump for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) If you found leakage, repair the cause of it.





Oil Pump Drive Shaft Seal Installation
Figure 401

K. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil pump for leakage:
(1) Start and operate the APU (AMM 49-11-0/201).
(2) Do the APU normal shutdown (AMM 49-11-0/201).
(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(4) Visually examine the oil pump for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

5. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage.
(1) If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).

B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.

OIL TANK VENT LINE - INSPECTION/CHECK

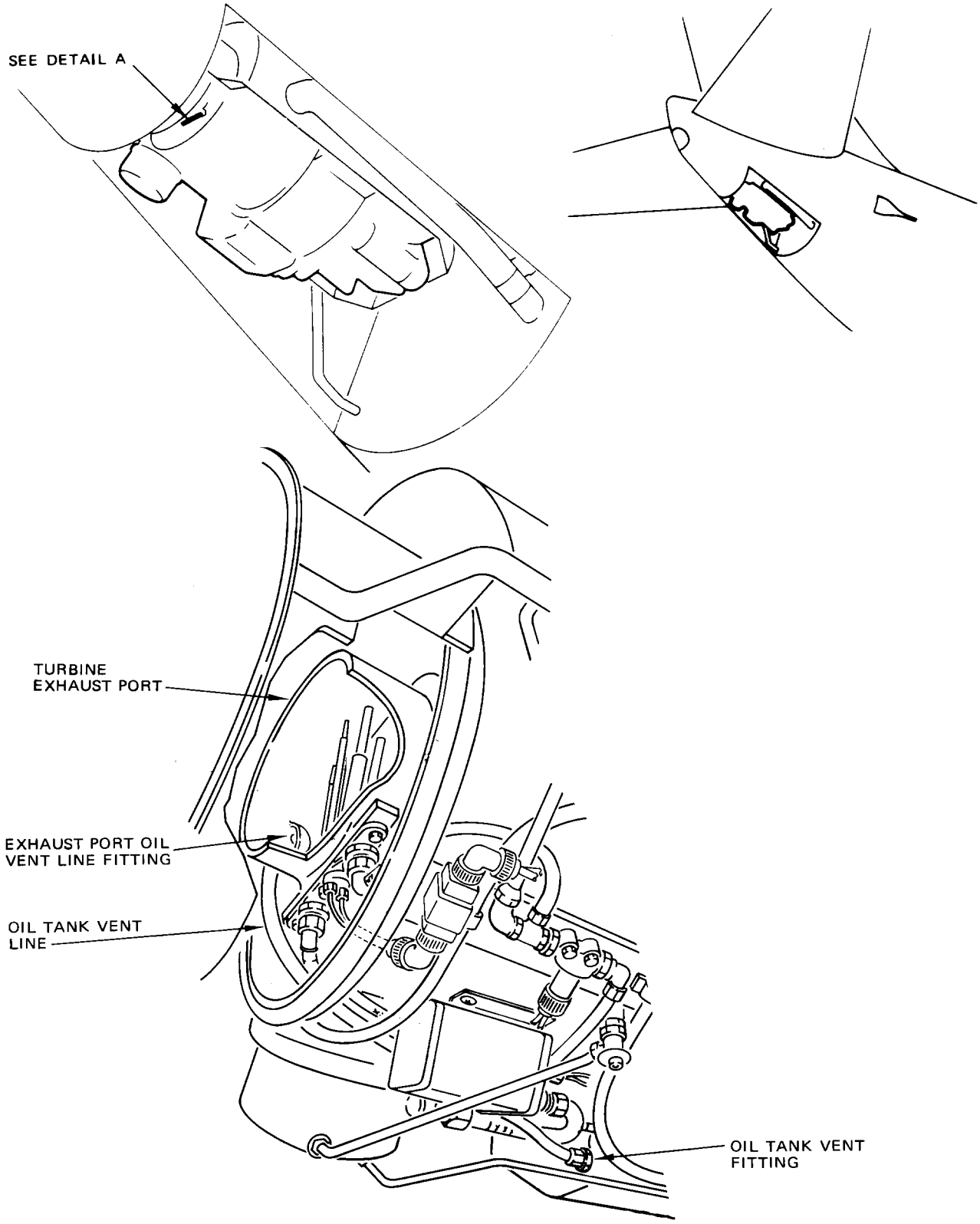
1. Oil Tank Vent Line Check
   A. Disconnect oil tank vent line at oil tank fitting and at exhaust port.

      NOTE: Have a container available to catch any residual oil that may be trapped in line.

   B. Check fitting and vent flange of exhaust port for oil residue or carbon buildup.
   C. Remove any buildup and blow out with compressed air.
   D. Check oil tank fitting. Remove any sludge that may have accumulated in fitting.

      NOTE: If oil tank vent fitting appears to have an abnormal buildup of sludge, oil tank should be removed and thoroughly cleaned.

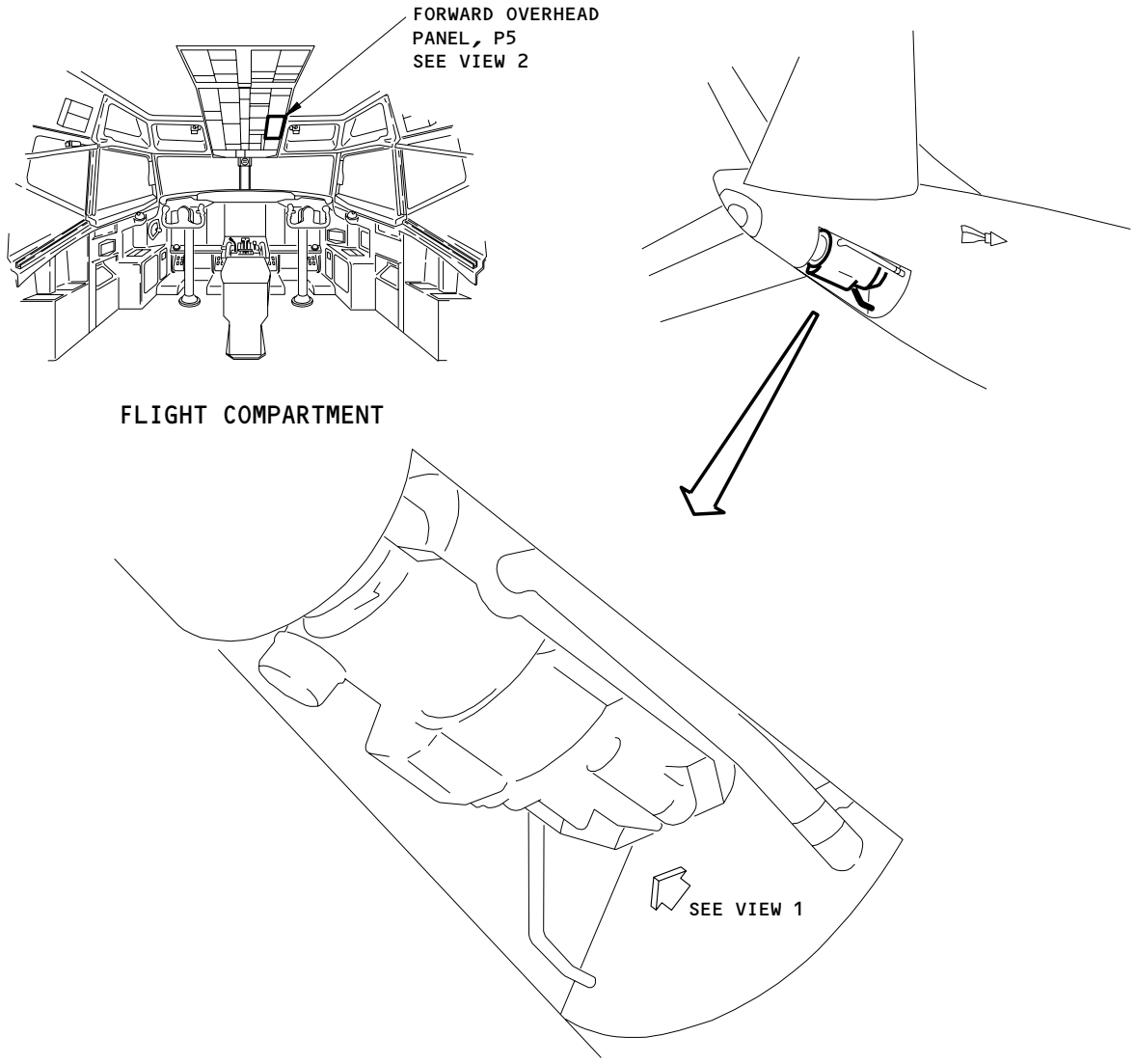
   E. Ensure oil tank vent line is clear of any sludge or carbon buildup.
   F. Connect vent line to oil tank vent fitting and exhaust port.



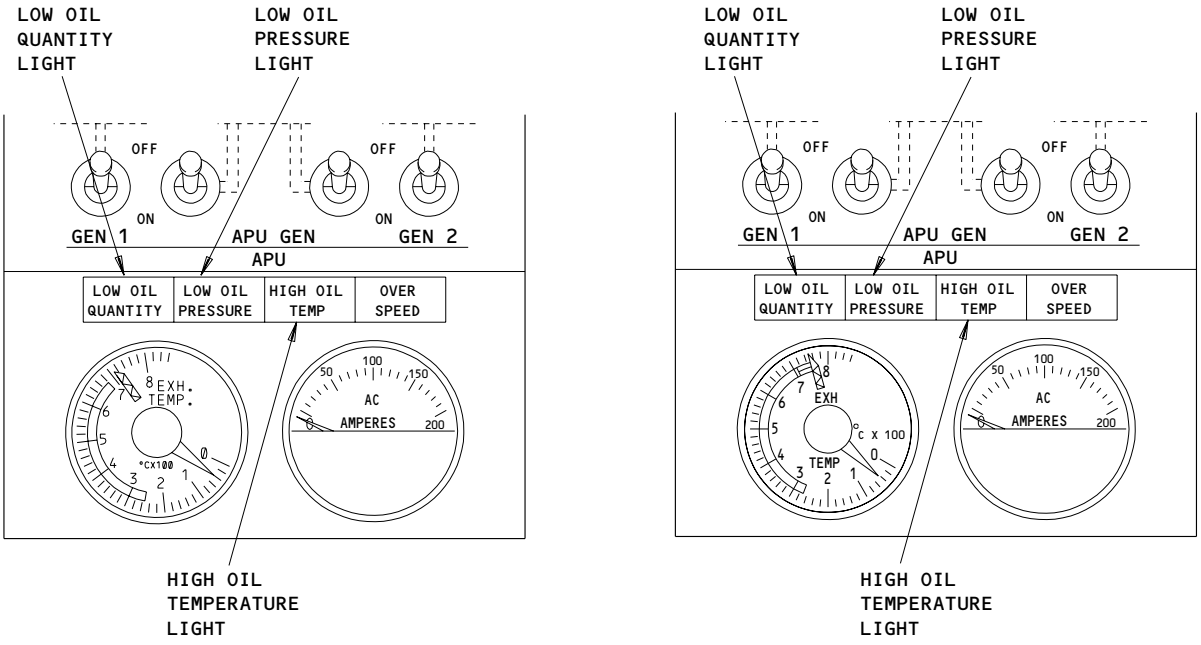
Oil Tank Vent Line Inspection
Figure 601

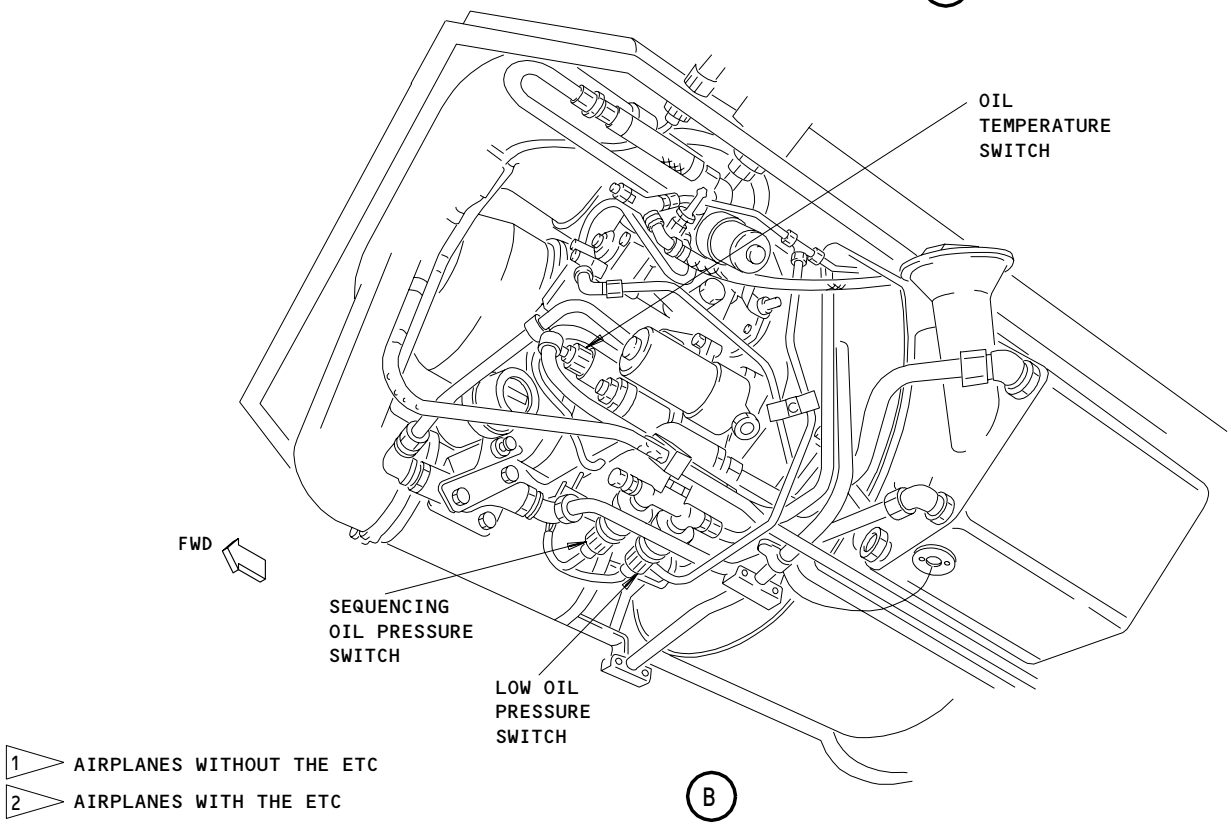
APU OIL INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU oil indicating system provides means of monitoring the high oil temperature, low oil pressure, and low oil quantity. The system consists of three indicating lights, a high oil temperature switch, a low oil pressure switch, and an oil quantity transmitter (Fig. 1). The high oil temperature light and the low oil pressure light are amber; the low oil quantity light is blue. All indicating lights are located on the forward overhead panel. The switches and transmitter are located on the APU engine.
   B. The high oil temperature light and the low oil pressure light are connected to the APU annunciator light and to the master caution lights, located on the center instrument panel (Fig. 1). When any one or a combination of the APU indicating lights are energized, the APU annunciator light and the master caution lights are energized (Ref Master Caution and Warning Lights, 33-15-0). The low oil quantity light is not incorporated in the annunciator light and master caution light circuit.
   C. Each APU indicating light can be tested individually by pressing the light, or all lights can be tested simultaneously when the master test switch is actuated.
2. High Oil Temperature Light
   A. The high oil temperature light is energized when the APU oil temperature reaches approximately 250°F (121°C) or 285°F (140°C). At this temperature, the oil temperature switch closes and completes the light circuit. For the high oil temperature switch description, refer to APU Controls, 49-61-0.
3. Low Oil Pressure Light
   A. The low oil pressure light is energized when the APU oil pressure is too low to operate the APU. The light is on while the APU engine builds up oil pressure during the engine start. When the oil pressure reaches approximately 55 psig, the low oil pressure switch actuates and the low oil pressure light is extinguished. During the APU operation, if the oil pressure drops to approximately 45 psig, the low oil pressure switch again actuates and the low pressure light is energized. For description of the low oil pressure switch, refer to APU Controls, 49-61-0.
4. Low Oil Quantity Light
   A. The low oil quantity light is energized when the APU oil quantity drops to 1-1/2 quarts and below. (Oil tank capacity is 1-3/4 U.S. gallons.) At this time the oil quantity microswitch closes and completes the light circuit.
5. Oil Level Switch
   A. The oil level switch consists of a tube, float, and magnetically controlled microswitch. The microswitch is float actuated when the oil tank oil quantity drops to 1-1/2 quarts or below. The oil level switch is located on the bottom end of the APU oil tank (Fig. 1).



APU Oil Indicating System Component Location
Figure 1 (Sheet 1)





APU Oil Indicating System Component Location
Figure 1 (Sheet 2)

OIL LEVEL SWITCH - REMOVAL/INSTALLATION

1. Prepare to Remove Oil Level Switch
   A. Position BATTERY switch and APU master switch to OFF and placard that APU maintenance is "in work."
   B. Open the circuit breaker on M280 module-APU control unit on E3-3 electronic shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

   E. Drain oil tank (AMM 49-91-31/301).
2. Remove Oil Level Switch (Fig. 401)
   A. Disconnect electrical plug from receptacle, remove receptacle from bracket, and detach clamps holding wire sleeve to electrical conduit.
   B. Remove screws and washers attaching oil level switch to oil tank.
   C. Remove oil level switch, O-ring and backup ring from oil tank. Discard O-ring.

      NOTE: Retain backup ring for installation with replacement switch.

3. Install Oil Level Switch (Fig. 401)
   A. Install new O-ring and backup ring on oil level switch.
   B. Insert oil level switch in oil tank and secure with four screws and washers.
   C. Attach electrical receptacle to bracket and secure with four screws, washers, and nuts. Connect electrical plug to receptacle.
   D. Clamp wiring sleeve to electrical conduit.
   E. Fill oil tank (AMM 49-91-31/301).
   F. Position BATTERY switch to ON and remove placard.
   G. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil level switch for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the oil level switch for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) If you found leakage, repair the cause of it.
   H. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil level switch for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Do the APU normal shutdown (AMM 49-11-0/201).

(3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
(4) Visually examine the oil level switch for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

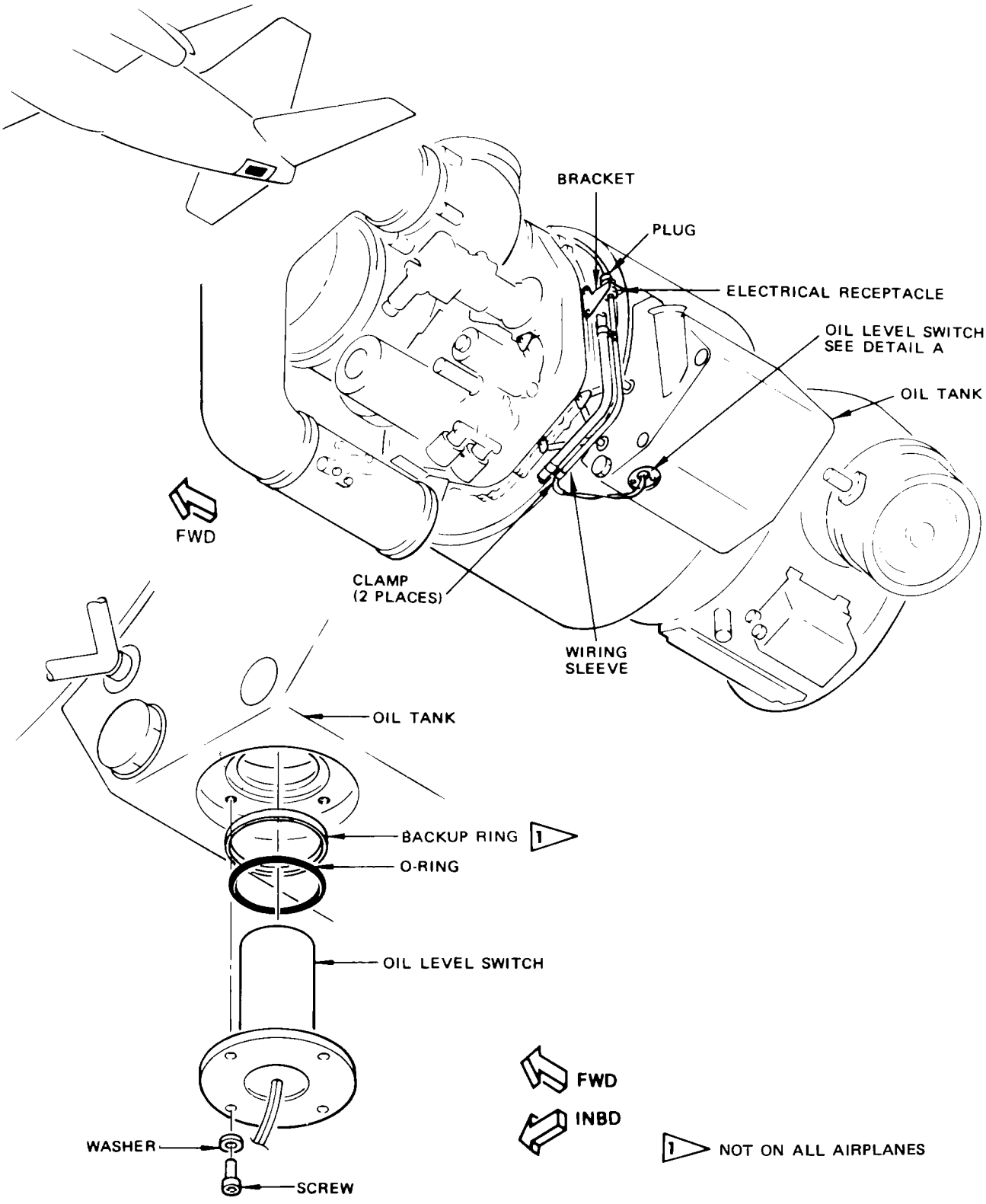
4. Restore Airplane to Normal Configuration

A. Examine the upper shroud seal for damage. If you find damage, repair or replace the upper shroud seal (AMM 49-12-51/401).

B. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

C. Disengage APU compartment access door support rods and stow rods. Close and latch access door.



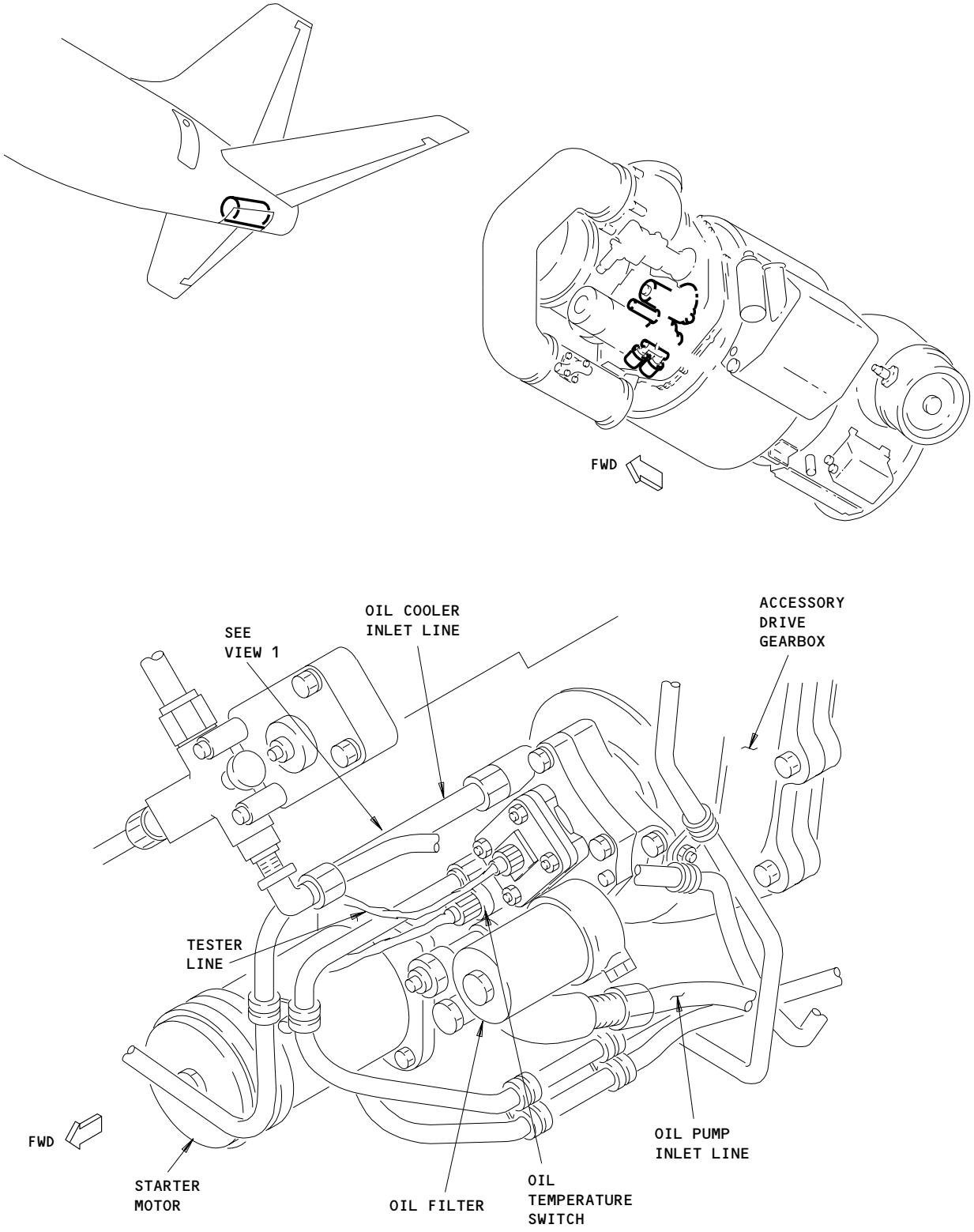
Oil Level Switch
Figure 401

OIL TEMPERATURE SWITCH - REMOVAL/INSTALLATION

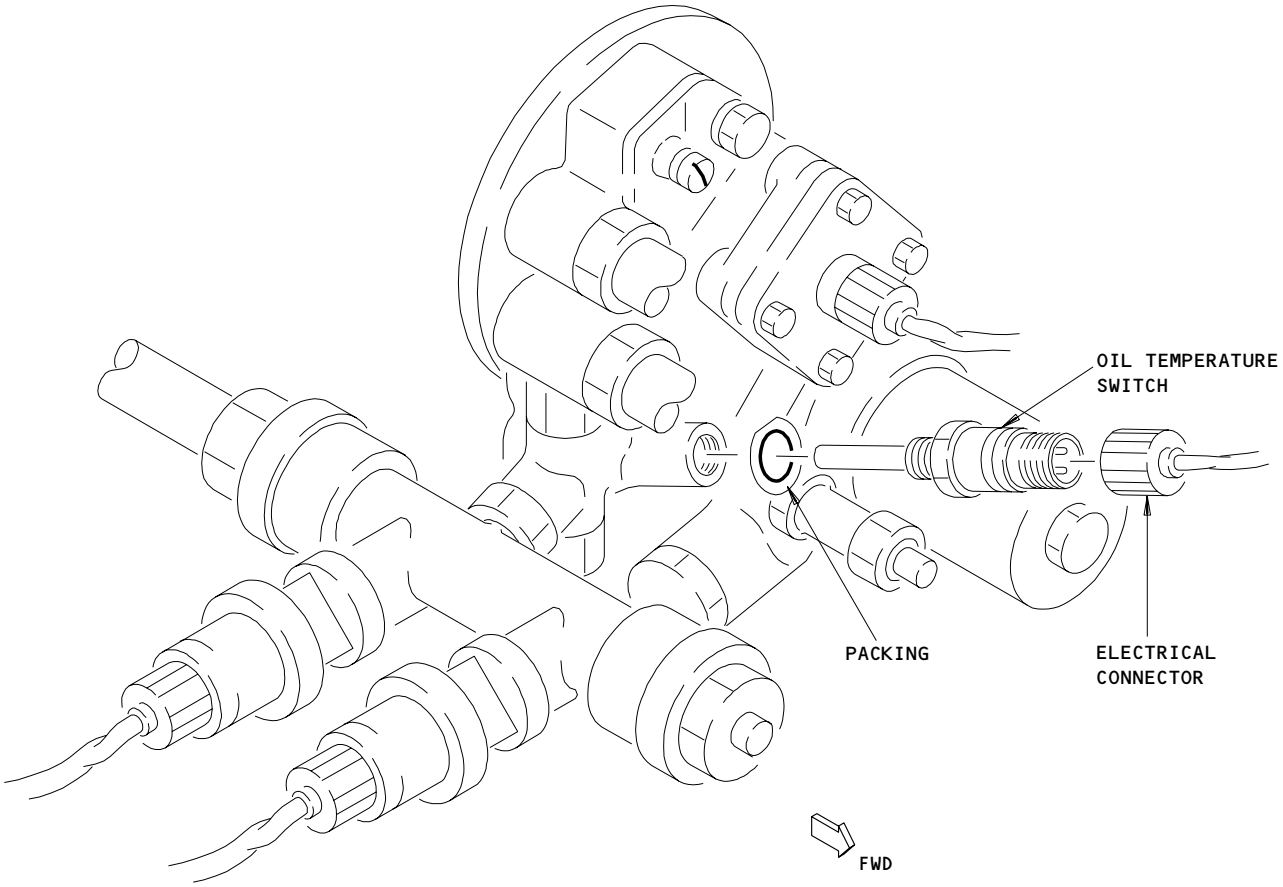
1. Equipment and Materials
   A. Compound - Crisco, Procter and Gamble Co., Cincinnati, Ohio, or equivalent
   B. Thread Compound - Liqui-Moly, Lockrey Co., Lubricants Division, Southampton, New York, or equivalent
2. Prepare for Removal
   A. Position BATTERY SWITCH and APU START SWITCH to OFF and placard to show that APU maintenance is in progress.
   B. Open circuit breaker on M280 module -APU accessory unit on E3-3 electrical shelf.
   C. Open APU compartment access door latches and open door. Install door support rods.
   D. Support lower shroud, open shroud latches, and remove shroud.

      CAUTION: EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

3. Remove Oil Temperature Switch (Fig. 401)
   A. Disconnect electrical connector.
   B. Remove oil temperature switch and packing.
4. Install Oil Temperature Switch (Fig. 401)
   A. Spread thin film of compound over a new packing.
   B. Apply thread compound to threads of switch.
   C. Install switch and new packing and lockwire.
   D. Connect electrical connector.
5. Restore Airplane to Normal
   A. Close circuit breaker on M280 module-APU control unit on E3-3 electrical shelf.
   B. Position BATTERY switch to ON and remove placard.
   C. APUs WITH ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil temperature switch for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) During the APU operation, examine the oil temperature switch for leakage.
      (3) Do the APU normal shutdown (AMM 49-11-0/201).
      (4) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.
      (5) If you found leakage, repair the cause of it.
   D. APUs WITHOUT ALLIEDSIGNAL SB GTCP85-49-7096; Examine the oil temperature switch for leakage:
      (1) Start and operate the APU (AMM 49-11-0/201).
      (2) Do the APU normal shutdown (AMM 49-11-0/201).
      (3) Attach a DO-NOT-OPERATE tag to the APU master switch on the P5 forward overhead panel.



Oil Temperature Switch Installation
Figure 401 (Sheet 1)



VIEW 1

Oil Temperature Switch Installation
Figure 401 (Sheet 2)

(4) Visually examine the oil temperature switch for any signs of leakage:
(a) If you found signs of leakage, repair the cause of it.

E. Position lower shroud against upper shroud and close shroud latches.

CAUTION: MAINTAIN A MINIMUM CLEARANCE OF 0.18 INCH BETWEEN ENGINE PLUMBING, FIRE DETECTOR, CLAMPS AND INSIDE SURFACE OF LOWER SHROUD. EXERCISE EXTREME CARE NOT TO DAMAGE SHROUD DRAIN LINES WHEN HANDLING SHROUD.

F. Disengage APU compartment access door support rods and stow rods. Close and latch access door.