

# CHAPTER

# 49

# AIRBORNE AUXILIARY POWER

# MD-80 AIRCRAFT MAINTENANCE MANUAL

## CHAPTER 49 AIRBORNE AUXILIARY POWER

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1	Feb 01/2016		303	Feb 01/2015		501	Feb 01/2016	
2	Feb 01/2015		304	Feb 01/2015		502	Feb 01/2016	
3	Feb 01/2016		305	Feb 01/2015		503	Feb 01/2016	
4	Feb 01/2016		306	Feb 01/2015		504	Feb 01/2016	
R 5	Aug 01/2016		307	Feb 01/2015		505	Feb 01/2016	
6	BLANK		308	Feb 01/2015		506	Feb 01/2016	
49-00-00 Config 1			309	Feb 01/2015		507	Feb 01/2016	
1	Feb 01/2015		310	Feb 01/2015		508	Feb 01/2016	
2	Feb 01/2015		311	Feb 01/2015		509	Feb 01/2016	
3	Feb 01/2015		312	Feb 01/2015		510	Feb 01/2016	
4	Feb 01/2015		313	Feb 01/2015		511	Feb 01/2016	
5	Feb 01/2015		314	BLANK		512	Feb 01/2016	
6	Feb 01/2016		49-00-00 Config 1			513	Feb 01/2016	
7	Feb 01/2016		501	Feb 01/2016		514	Feb 01/2016	
8	Feb 01/2015		502	Feb 01/2016		515	Feb 01/2016	
9	Feb 01/2015		503	Feb 01/2016		516	Feb 01/2016	
10	Feb 01/2016		504	Feb 01/2016		517	Feb 01/2016	
11	Feb 01/2016		505	Feb 01/2016		518	Feb 01/2016	
12	BLANK		506	Feb 01/2016		519	Feb 01/2016	
49-00-00 Config 1			507	Feb 01/2016		520	Feb 01/2016	
101	Feb 01/2015		508	Feb 01/2016		521	Feb 01/2016	
102	Feb 01/2015		509	Feb 01/2016		522	Feb 01/2016	
49-00-00 Config 1			510	Feb 01/2016		523	Feb 01/2016	
201	Feb 01/2015		511	Feb 01/2016		524	BLANK	
202	Feb 01/2015		512	Feb 01/2016		49-00-00 Config 3		
203	Feb 01/2015		513	Feb 01/2016		501	Feb 01/2016	
204	Feb 01/2015		514	Feb 01/2016		502	Feb 01/2016	
205	Feb 01/2015		515	Feb 01/2016		503	Feb 01/2016	
206	Feb 01/2015		516	Feb 01/2016		504	Feb 01/2016	
207	Feb 01/2016		517	Feb 01/2016		505	Feb 01/2016	
208	Feb 01/2015		518	Feb 01/2016		506	Feb 01/2016	
209	Feb 01/2015		519	Feb 01/2016		507	Feb 01/2016	
210	BLANK		520	Feb 01/2016		508	Feb 01/2016	
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510	Feb 01/2016		405	Feb 01/2015		504	Feb 01/2015	
511	Feb 01/2016		406	Feb 01/2015		505	Feb 01/2015	
512	Feb 01/2016		407	Feb 01/2015		506	Feb 01/2015	
513	Feb 01/2016		408	Feb 01/2015		49-10-04 Config 1		
514	Feb 01/2016		409	Feb 01/2015		201	Feb 01/2015	
515	Feb 01/2016		410	Feb 01/2015		202	Feb 01/2015	
516	Feb 01/2016		411	Feb 01/2015		203	Feb 01/2015	
517	Feb 01/2016		412	Feb 01/2015		204	Feb 01/2015	
518	Feb 01/2016		413	Feb 01/2015		205	Feb 01/2015	
519	Feb 01/2016		414	Feb 01/2016		206	Feb 01/2015	
520	Feb 01/2016		415	Feb 01/2015		207	Feb 01/2015	
521	Feb 01/2016		416	BLANK		208	BLANK	
522	Feb 01/2016		49-10-00			49-10-05 Config 1		
523	Feb 01/2016		501	Feb 01/2015		201	Feb 01/2015	
524	BLANK		502	Feb 01/2015		202	Feb 01/2015	
49-00-00			503	Feb 01/2015		203	Feb 01/2015	
701	Feb 01/2015		504	BLANK		204	Feb 01/2015	
702	Feb 01/2015		49-10-01			205	Feb 01/2015	
703	Feb 01/2015		201	Feb 01/2015		206	Feb 01/2015	
704	Feb 01/2015		202	Feb 01/2015		49-10-05 Config 1		
705	Feb 01/2015		203	Feb 01/2015		601	Feb 01/2015	
706	Feb 01/2015		204	Feb 01/2015		602	Feb 01/2015	
707	Feb 01/2015		49-10-02			603	Feb 01/2015	
708	BLANK		201	Feb 01/2015		604	BLANK	
49-10-00 Config 1			202	Feb 01/2015		49-10-06		
1	Feb 01/2015		203	Feb 01/2015		201	Feb 01/2015	
2	Feb 01/2015		204	BLANK		202	Feb 01/2015	
3	Feb 01/2015		49-10-03			203	Feb 01/2015	
4	Feb 01/2015		401	Feb 01/2015		204	Feb 01/2015	
5	Feb 01/2015		402	Feb 01/2015		205	Feb 01/2015	
6	BLANK		403	Feb 01/2015		206	BLANK	
49-10-00			404	Feb 01/2015		49-10-07		
401	Feb 01/2016		49-10-03			201	Feb 01/2015	
402	Feb 01/2015		501	Feb 01/2015		202	Feb 01/2015	
403	Feb 01/2015		502	Feb 01/2015		203	Feb 01/2015	
404	Feb 01/2016		503	Feb 01/2015		204	BLANK	

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201	Feb 01/2015		106	Feb 01/2015		401	Feb 01/2015	
202	BLANK		49-30-01 Config 1			402	Feb 01/2015	
49-20-00 Config 1			201	Feb 01/2015		403	Feb 01/2015	
1	Feb 01/2015		202	Feb 01/2015		404	BLANK	
2	Feb 01/2015		203	Feb 01/2015		49-30-07		
3	Feb 01/2015		204	Feb 01/2015		201	Feb 01/2015	
4	BLANK		49-30-02 Config 1			202	Feb 01/2015	
49-20-00			201	Feb 01/2015		203	Feb 01/2015	
601	Feb 01/2015		202	Feb 01/2015		204	BLANK	
602	BLANK		203	Feb 01/2015		49-31-00		
49-20-01			204	Feb 01/2015		1	Feb 01/2015	
201	Feb 01/2015		49-30-02			2	Feb 01/2015	
202	Feb 01/2015		701	Feb 01/2015		49-31-01		
203	Feb 01/2015		702	Feb 01/2015		201	Feb 01/2015	
204	Aug 01/2015		703	Feb 01/2015		202	Feb 01/2015	
205	Feb 01/2015		704	BLANK		203	Feb 01/2015	
206	Feb 01/2015		49-30-03 Config 1			204	BLANK	
207	Aug 01/2015		201	Feb 01/2015		49-31-02		
208	Feb 01/2015		202	Feb 01/2015		201	Feb 01/2015	
49-30-00 Config 1			203	Feb 01/2015		202	Feb 01/2015	
1	Feb 01/2015		204	Feb 01/2015		203	Feb 01/2015	
2	Feb 01/2015		49-30-04			204	Feb 01/2015	
3	Feb 01/2015		201	Feb 01/2015		49-31-03		
4	Feb 01/2015		202	Feb 01/2015		201	Feb 01/2015	
5	Feb 01/2015		203	Feb 01/2015		202	Feb 01/2015	
6	Feb 01/2015		204	Feb 01/2015		203	Feb 01/2015	
7	Feb 01/2015		205	Feb 01/2015		204	Feb 01/2015	
8	Feb 01/2015		206	BLANK		49-40-00 Config 1		
9	Feb 01/2015		49-30-05			1	Feb 01/2016	
10	BLANK		201	Feb 01/2015		2	Feb 01/2015	
49-30-00			202	Feb 01/2015		3	Feb 01/2015	
101	Feb 01/2015		203	Feb 01/2015		4	Feb 01/2015	
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105	Feb 01/2015		49-50-01 Config 1			203	Feb 01/2015	
106	Feb 01/2015		201	Feb 01/2015		204	BLANK	
107	Feb 01/2015		202	Feb 01/2015		49-50-10		
108	Feb 01/2015		203	Feb 01/2015		201	Feb 01/2015	
109	Feb 01/2015		204	BLANK		202	Feb 01/2015	
110	Feb 01/2016		49-50-03			203	Feb 01/2015	
49-40-01 Config 1			201	Feb 01/2015		204	BLANK	
201	Feb 01/2015		202	Feb 01/2015		49-60-00 Config 3		
202	Feb 01/2015		203	Feb 01/2015		1	Feb 01/2015	
203	Feb 01/2015		204	Feb 01/2015		2	Feb 01/2015	
204	Feb 01/2015		49-50-03			3	Feb 01/2015	
49-40-02			701	Feb 01/2015		4	BLANK	
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203	Feb 01/2016		704	BLANK		202	Feb 01/2015	
204	Feb 01/2015		49-50-05			203	Feb 01/2015	
205	Feb 01/2015		201	Feb 01/2015		204	Feb 01/2015	
206	Feb 01/2015		202	Feb 01/2015		49-60-02		
49-40-03 Config 1			203	Feb 01/2015		201	Feb 01/2015	
201	Feb 01/2015		204	BLANK		202	Feb 01/2015	
202	Feb 01/2015		49-50-06 Config 1			203	Feb 01/2015	
203	Feb 01/2015		201	Feb 01/2015		204	Feb 01/2015	
204	Feb 01/2015		202	Feb 01/2015		49-60-03		
49-40-03 Config 1			203	Feb 01/2015		201	Feb 01/2015	
601	Feb 01/2015		204	Feb 01/2015		202	Feb 01/2015	
602	Feb 01/2015		49-50-07			203	Feb 01/2015	
49-50-00 Config 1			201	Feb 01/2015		204	BLANK	
1	Feb 01/2016		202	Feb 01/2015		49-70-00 Config 1		
2	Feb 01/2016		49-50-08 Config 1			1	Feb 01/2015	
3	Feb 01/2016		201	Feb 01/2015		2	Feb 01/2015	
4	Feb 01/2015		202	Feb 01/2015		49-70-01		
49-50-00			203	Feb 01/2015		201	Feb 01/2015	
101	Feb 01/2015		204	BLANK		202	Feb 01/2015	
102	Feb 01/2015		49-50-09			49-71-00 Config 1		
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2	BLANK		204	Feb 01/2015		201	Feb 01/2015	
49-71-01			205	Feb 01/2015		202	Feb 01/2015	
201	Feb 01/2015		206	Feb 01/2016		203	Feb 01/2015	
202	BLANK		207	Feb 01/2016		204	BLANK	
49-71-02			208	Feb 01/2015		49-90-05 Config 1		
201	Feb 01/2015		209	Feb 01/2015		201	Feb 01/2015	
202	Feb 01/2015		210	Feb 01/2015		202	Feb 01/2015	
203	Feb 01/2015		211	Feb 01/2015		203	Feb 01/2015	
204	BLANK		212	Feb 01/2015		204	Feb 01/2015	
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1	Feb 01/2015		214	Feb 01/2015		201	Feb 01/2015	
2	BLANK		49-80-01			202	Feb 01/2015	
49-72-00			601	Feb 01/2015		203	Feb 01/2015	
101	Feb 01/2015		602	BLANK		204	Feb 01/2015	
102	Feb 01/2015		49-90-00 Config 1			49-90-06		
103	Feb 01/2015		1	Feb 01/2015		401	Feb 01/2015	
104	BLANK		2	Feb 01/2015		402	Feb 01/2015	
49-72-01			3	Feb 01/2015		403	Feb 01/2015	
401	Feb 01/2015		4	Feb 01/2015		404	BLANK	
402	Feb 01/2015		49-90-00			49-90-07		
403	Feb 01/2015		101	Feb 01/2015		201	Feb 01/2015	
404	BLANK		102	Feb 01/2015		202	Feb 01/2015	
49-72-01			103	Feb 01/2015		203	Feb 01/2015	
501	Feb 01/2015		104	BLANK		204	Feb 01/2015	
502	Feb 01/2015		49-90-01			49-90-08		
49-72-02			201	Feb 01/2015		201	Feb 01/2015	
201	Feb 01/2015		202	Feb 01/2015		202	Feb 01/2015	
202	BLANK		203	Feb 01/2015		203	Feb 01/2015	
49-80-00			204	BLANK		204	Feb 01/2015	
1	Feb 01/2015		49-90-03			49-90-09		
2	Feb 01/2015		201	Feb 01/2015		201	Feb 01/2015	
49-80-01			202	Feb 01/2015		202	Feb 01/2015	
201	Feb 01/2015		203	Feb 01/2015		203	Feb 01/2015	
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203	Feb 01/2015							

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204	BLANK							
49-90-15								
A 201	Aug 01/2016							
A 202	BLANK							

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<u>GENERAL - MAINTENANCE PRACTICES</u>	49-00-00	1	201	WJE ALL
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<u>AIR INLET DOORS - ADJUSTMENT/TEST</u>	49-10-03		501	WJE ALL
<u>AIR INLET DOOR ACTUATOR - MAINTENANCE PRACTICES</u>	49-10-04	1	201	WJE ALL
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<u>APU ACOUSTICAL MATERIAL - MAINTENANCE PRACTICES</u>	49-10-08		201	WJE ALL
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<u>ENGINE - INSPECTION/CHECK</u>	49-20-00		601	WJE ALL
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<u>COMBUSTION CHAMBER LINER AND TORUS - MAINTENANCE PRACTICES</u>	49-20-01		201	WJE ALL
<u>ENGINE FUEL AND CONTROL - DESCRIPTION AND OPERATION</u>	49-30-00	1	1	WJE ALL
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<u>FUEL TEMPERATURE SENSING AIR REGULATOR VALVE - MAINTENANCE PRACTICES</u>	49-31-02		201	WJE ALL
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<u>LOAD CONTROL VALVE - MAINTENANCE PRACTICES</u>	49-50-01	1	201	WJE ALL
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<u>CENTRIFUGAL SWITCH - MAINTENANCE PRACTICES</u>	49-60-01		201	WJE ALL
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## CHAPTER 49 AIRBORNE AUXILIARY POWER

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**AIRCRAFT MAINTENANCE MANUAL**  
**GENERAL - DESCRIPTION AND OPERATION**

**1. General**

- A. The auxiliary power unit (APU) supplies pneumatic and electrical power for ground starting of main engines, fuselage air-conditioning, and ground operation of the aircraft electrical system in the absence of ground power or an operating engine. The APU can also be operated in flight to provide an alternate source of electrical power.

NOTE: After APU shutdown in flight or just prior to takeoff, the RPM indicator may indicate up to 11% with the APU MASTER switch in the OFF position while the APU remains warm. This is a normal condition and is not an indication of a malfunction.

- B. The APU is mounted in a fireproof compartment in the lower aft portion of the fuselage, aft of the pressure bulkhead. Two large doors located at the bottom of the fuselage permit access to the APU. The demountable APU is attached to the aircraft by four adjustable mounts.

**2. Power Plant**

- A. The APU power plant includes the overall power package, the mounts, fireseals, attach fittings, electrical harness, APU door actuation, and engine drains. For a detailed description and operation of the power plant, refer to POWER PLANT - DESCRIPTION AND OPERATION, PAGEBLOCK 49-10-00/001 Config 1.

**3. Engine**

- A. The APU is a single-shaft, two-bearing, gas turbine engine, containing a two-stage centrifugal compressor, a single combustion liner, a single-stage radial inflow turbine, and accessory drive. The APU is provided with the following systems: engine fuel and control, ignition/starting, air, engine controls, indicating, exhaust, and oil. In addition, fire detection and fire extinguishing systems are provided for the APU. For a detailed description and operation of the engine, refer to ENGINE - DESCRIPTION AND OPERATION, PAGEBLOCK 49-20-00/001 Config 1.

**4. Engine Fuel and Control**

- A. The engine fuel and control is a fully automatic hydro-mechanical system, that utilizes pneumatic, electronic, and mechanical signals to schedule the correct fuel flow to the engine for all modes of engine operation. The engine fuel and control system consists of the fuel control, fuel pump, fuel filter element, fuel solenoid shutoff valve, and primary and secondary fuel manifolds and nozzles. For a detailed description and operation of the engine fuel and control system, refer to ENGINE FUEL AND CONTROL - DESCRIPTION AND OPERATION, PAGEBLOCK 49-30-00/001 Config 1.

**5. Ignition/Starting**

- A. The ignition/starting system is used for cranking the engine and for initial lightoff. Major components of the system consist of the ignition unit, ignitor plug, ignition lead, and starter motor. For a complete description and operation of the ignition/starting system, refer to IGNITION/STARTING - DESCRIPTION AND OPERATION, PAGEBLOCK 49-40-00/001 Config 1.

**WJE 417, 419**

**6. APU Inhibit Switch**

- A. The APU inhibit switch provides protection for the main engine upper right cowl door from APU exhaust heat damage. The switch prevents APU start while cowl door is open and also will shut down the APU if cowl is opened while APU is running. For a complete description and operation of the APU inhibit switch, refer to APU INHIBIT SWITCH - MAINTENANCE PRACTICES, PAGEBLOCK 71-10-10/201.

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### 7. Air

- A. Air for the gas turbine is inducted through a set of electrically controlled air inlet doors located on the lower surface of the APU demountable support box. The air induction system consists of a ram air door, two nonram doors and an electrically driven actuator controlled by a switch located in the flight compartment. Protection against ingestion of foreign objects is provided by a screen attached to the compressor inlet. For a detailed description and operation of the air system, refer to AIR - DESCRIPTION AND OPERATION, PAGEBLOCK 49-50-00/001 Config 1.

### 8. Engine Controls

- A. The engine control system provides means for controlling APU operations on the ground or in flight. The APU control panel is located in the flight compartment and is used for starting and stopping the unit, and for positioning the air inlet door. In addition, controls for application and removal of pneumatic and electrical power are provided on the panel.
- B. The external control panel is located on the left side of the aircraft just aft of the APU compartment. The APU cannot be started from controls on this panel, however, a switch is provided to shut down the APU and arm the fire extinguishing system. The panel is equipped with a fire warning indicator, a fire warning horn, agent bottle low pressure indicators, and switches to discharge the fire extinguisher bottles.
- C. The fire detection system operation and test, fire extinguishing system operation are controlled from the main instrument panel located in the flight compartment. The APU will shut down automatically when the fire extinguishing system is armed. For a detailed description and operation of engine controls, refer to ENGINE CONTROLS - DESCRIPTION AND OPERATION, PAGEBLOCK 49-60-00/001 Config 3.

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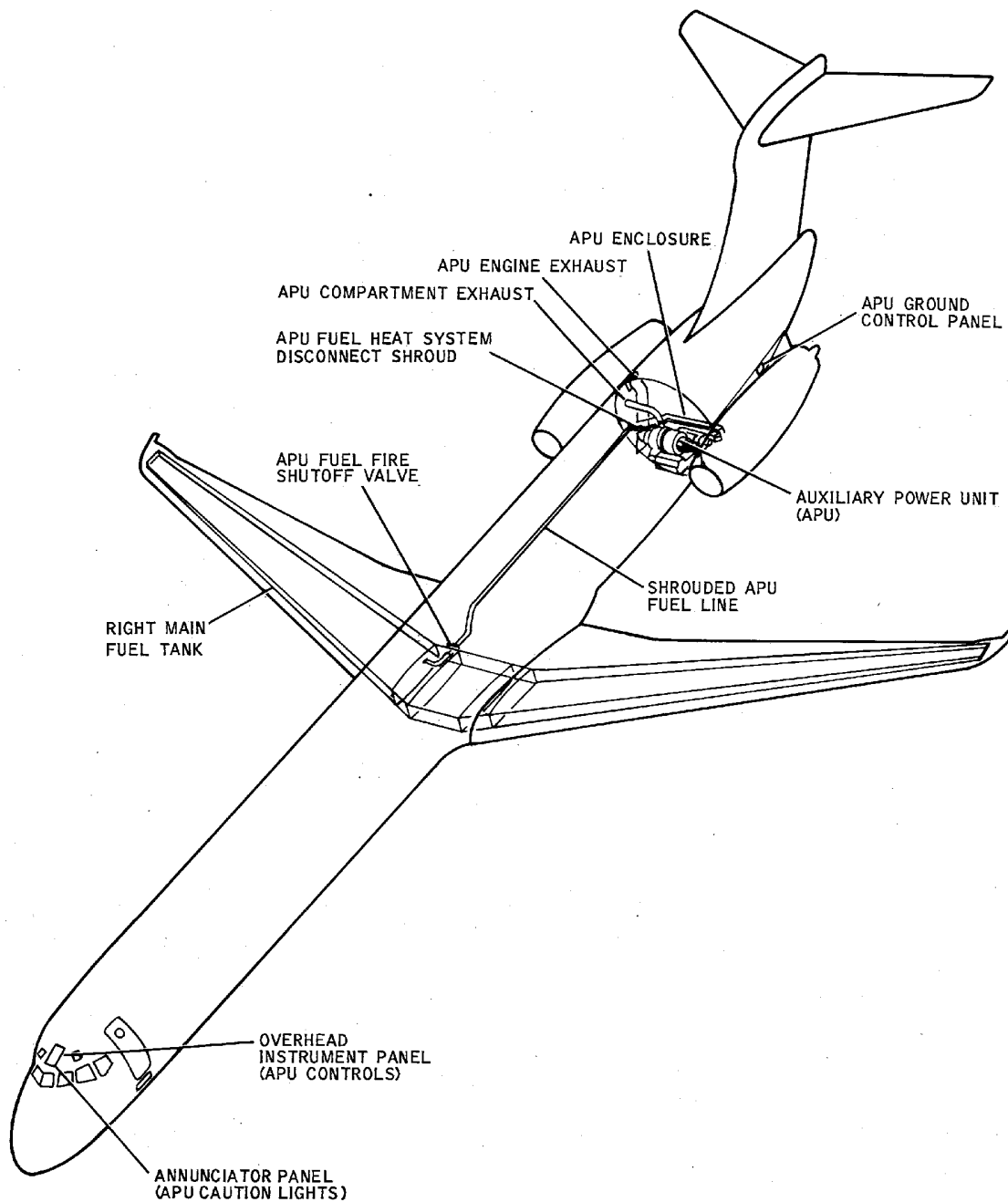
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**Auxiliary Power Unit -- Location**  
Figure 1/49-00-00-990-801

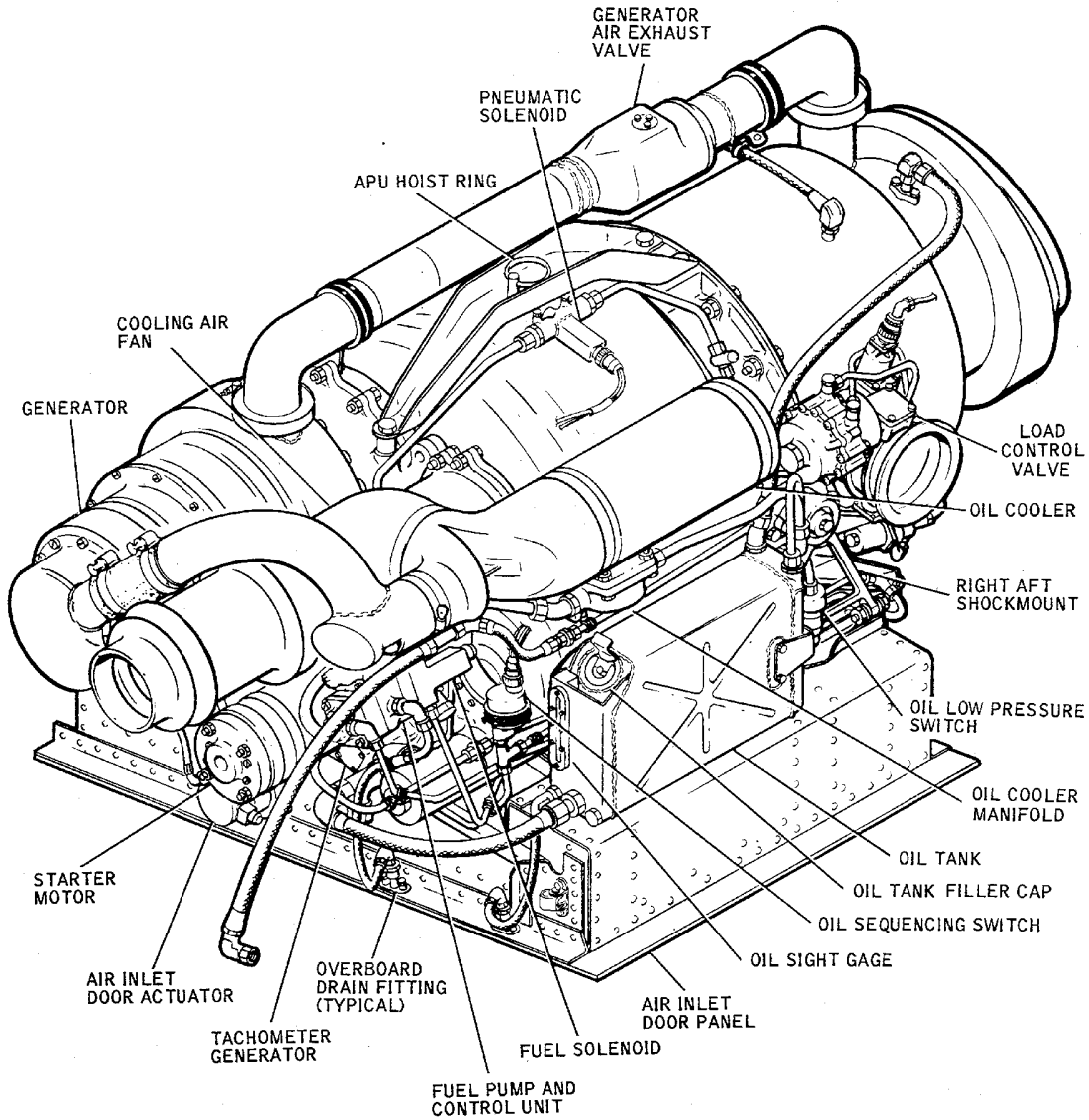
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BBB2-49-2

**Auxiliary Power Unit -- General Location  
Figure 2/49-00-00-990-802 (Sheet 1 of 2)**

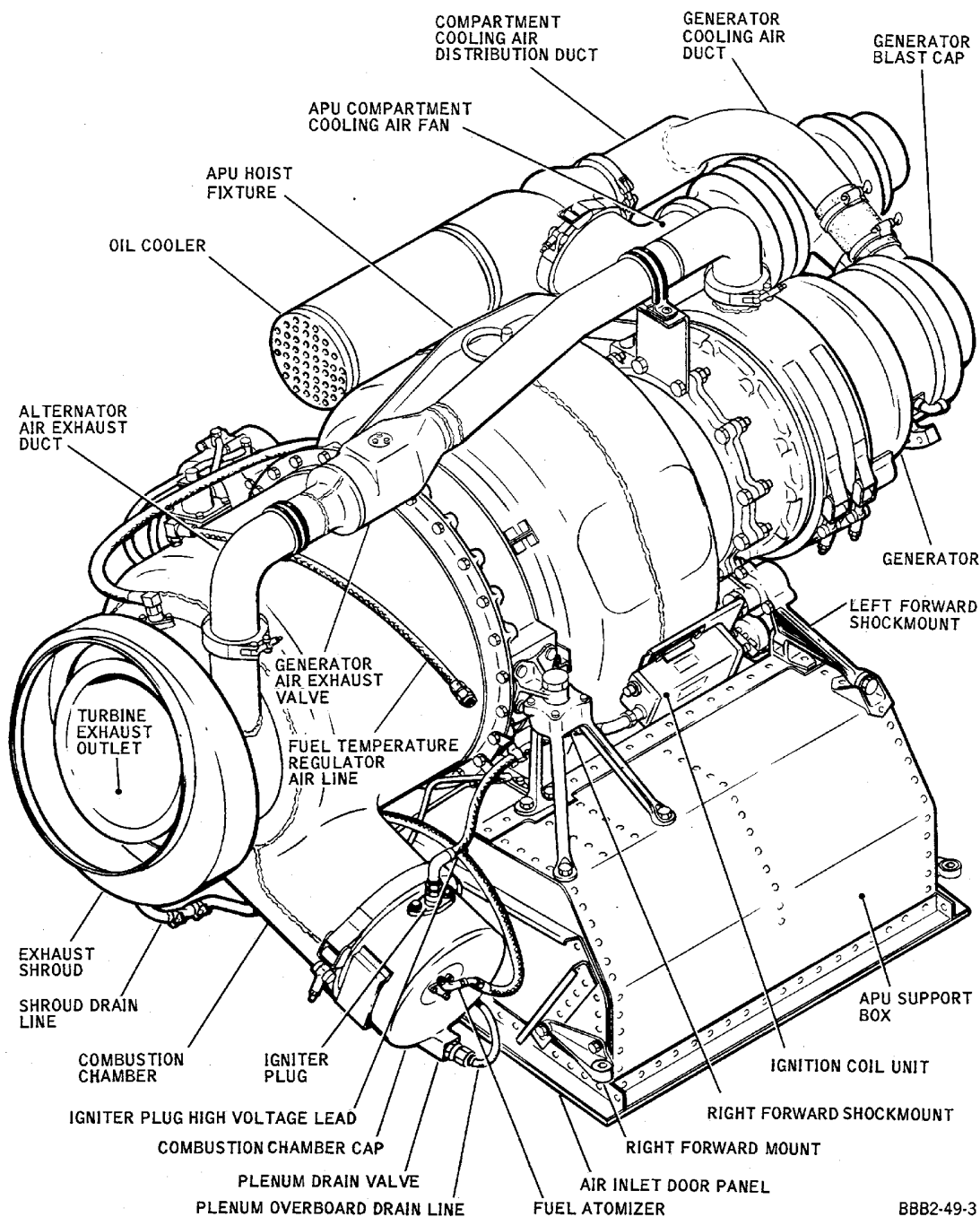
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**Auxiliary Power Unit -- General Location  
Figure 2/49-00-00-990-802 (Sheet 2 of 2)**

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### 9. Indicating

- A. The indicating system uses exhaust gas temperature and compressor rotor speed to monitor APU operation. A thermo-couple probe located in the turbine exhaust flange provides an exhaust gas temperature reading which is displayed on an indicator located on the overhead switch panel in the flight compartment. Compressor speed is displayed on a percentage-type indicator located on the overhead switch panel in the flight compartment. The indicator is powered by a tachometer generator located on the engine accessory drive. An APU EXT PWR light and electrical load indicator are also provided on the overhead switch panel in the flight compartment. Total APU operating time is recorded by an hourmeter mounted on the accessory drive. For a detailed description and operation of the indicating system, refer to INDICATING - DESCRIPTION AND OPERATION, PAGEBLOCK 49-70-00/001 Config 1.

### 10. Exhaust

- A. The exhaust system provides a means of conducting the APU exhaust gas overboard. This is accomplished by a completely shrouded exhaust duct vented to the atmosphere through an exit duct in the fuselage skin above the right main engine pylon. For a detailed description and operation of the exhaust system, refer to EXHAUST - DESCRIPTION AND OPERATION, PAGEBLOCK 49-80-00/001..

### 11. Oil

- A. The oil system provides lubrication and cooling for the APU bearings and accessory drives. This system is a dry-sump, self-contained lubrication system. Oil pressure, flow, and temperature are constantly maintained within the limits specified for the system. The oil system consists of the following major components: a supply tank, oil cooler, oil sequencing switch, and oil cluster. The oil cluster contains an oil pres-sure pump, dual scavenge pumps, oil filter and oil filter bypass valve, pressure relief valve, and oil overtemperature switch. The oil overtemperature switch actuates an oil temperature high caution light, located on the annunciator panel in the flight compartment. An oil pressure low switch, mounted on the oil tank, actuates an oil pressure low caution light located on the annunciator panel in the flight compartment. For a detailed description and operation of the oil system, refer to OIL - DESCRIPTION AND OPERATION, PAGEBLOCK 49-90-00/001 Config 1.

### 12. Operation

- A. APU operation is initiated by placing the BATT switch in the "ON" position thereby completing a circuit which energizes both the battery bus and dc transfer bus. The battery bus supplies power for the APU MASTER switch. The dc transfer bus supplies power to the engine start pump switch, the ram door interlock switch, and the oil pressure low switch.

**WJE 401-412, 414-419, 421, 423, 425, 426, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 892, 893; WJE 420, 422, 424, 427, 429, 891 PRE MD80-49-036**

- B. When the APU MASTER switch is moved from the OFF position to the momentary START position, the door actuator will rotate driving the air inlet doors to full ram position. As the doors start opening, the ram door interlock switch closes. The APU automatic starting relay allows 15 seconds for this to occur. Closing of the ram door interlock switch causes the start circuit to react automatically. During the initial start procedure, the electrical current bypasses the APU ballast and prevents a voltage drop at the igniter plug which could result in a lightoff failure. As the starter rotates, the starter pawls engage the accessory drive, causing compressor rotation. When this occurs, both turbine speed and oil system pressure begin to rise. At an oil pressure of approximately 2 psi (14 kPa)), the oil sequencing switch actuates and allows power to the fuel valve and igniter coil unit. The fuel pump and con-trol unit supply regulated fuel to the atomizer, and the igniter plug ignites the fuel.

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WJE ALL

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WJE 401-412, 414-419, 421, 423, 425, 426, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 892, 893; WJE 420, 422, 424, 427, 429, 891 POST MD80-49-036

- C. When the APU MASTER switch is moved from the OFF position to the momentary START position, the door actuator will rotate driving the air inlet doors to full ram position. As the doors start opening, the ram door interlock switch closes. The APU automatic starting relay allows 20 seconds for this to occur. Closing of the ram door interlock switch causes the start circuit to react automatically. During the initial start procedure, the electrical current bypasses the APU ballast and prevents a voltage drop at the igniter plug which could result in a lightoff failure. As the starter rotates, the starter pawls engage the accessory drive, causing compressor rotation. When this occurs, both turbine speed and oil system pressure begin to rise. At an oil pressure of approximately 2 psi (14 kPa), the oil sequencing switch actuates and allows power to the fuel valve and igniter coil unit. The fuel pump and control unit supply regulated fuel to the atomizer, and the igniter plug ignites the fuel.

### WJE ALL

- D. APU acceleration, assisted by the starter and internal combustion, continues to increase. The 35-percent switch in the centrifugal switch opens, and the starter relay deenergizes, stopping the starter. When the APU reaches 95-percent speed, the 95-percent switch in the centrifugal switch actuates. This action breaks the circuit to the igniter coil unit and supplies power to the hour-meter, which starts recording the engine operating time.
- E. The 95-percent switch holding relay completes the circuit to the warm-up time delay relay. The APU power available light comes on, indicating that APU is ready to accept an electrical load. After 60 seconds, the warm-up time delay relay completes the circuit to the bleed air switch, and the APU is ready to accept a pneumatic load.
- F. When the APU MASTER switch is moved to the OFF position for APU shutdown, the shutoff time delay relay will not permit a shut-down for 60 seconds.

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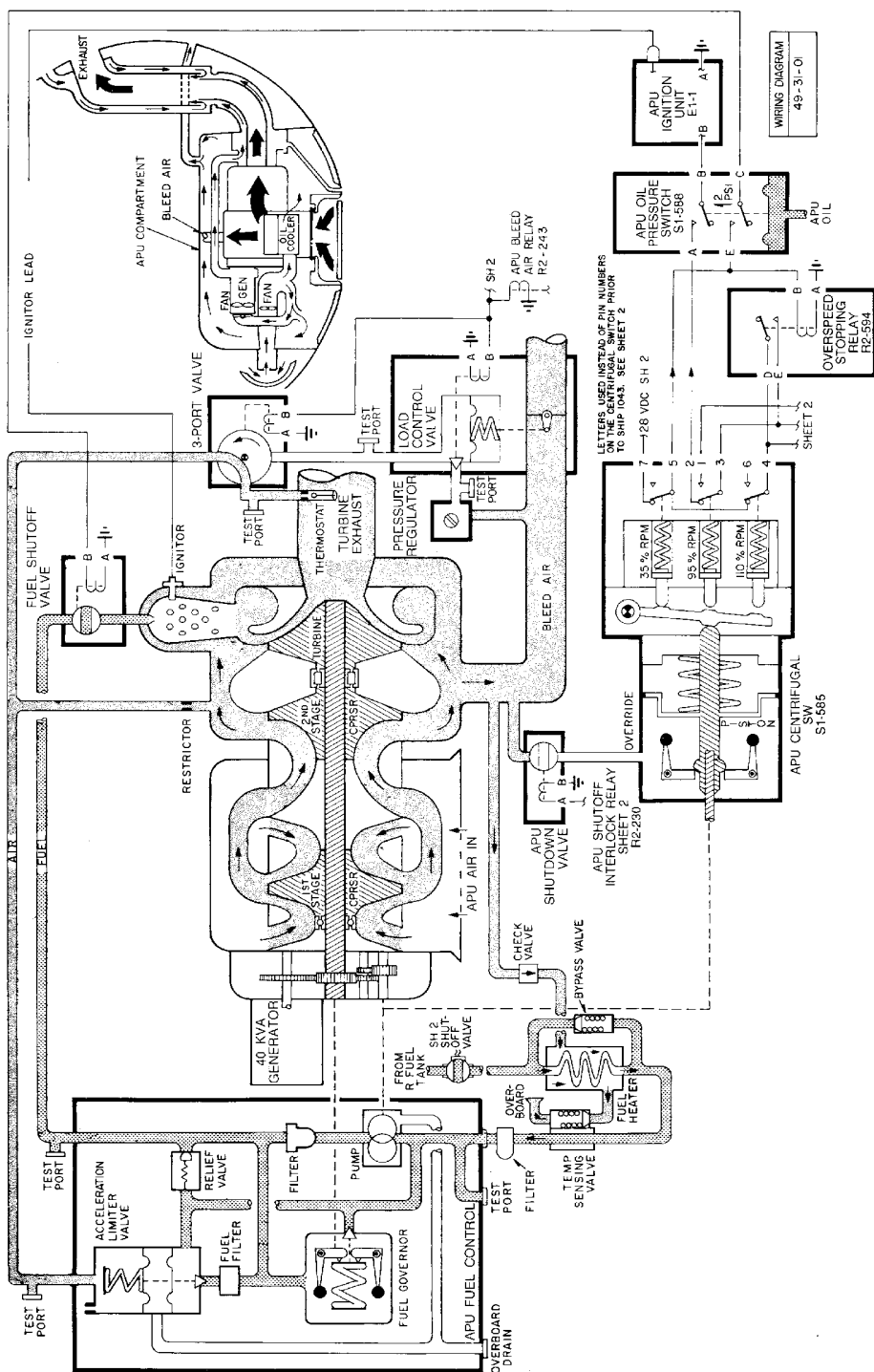
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APU Controls -- System Schematic  
Figure 3/49-00-00-990-806 (Sheet 1 of 4)

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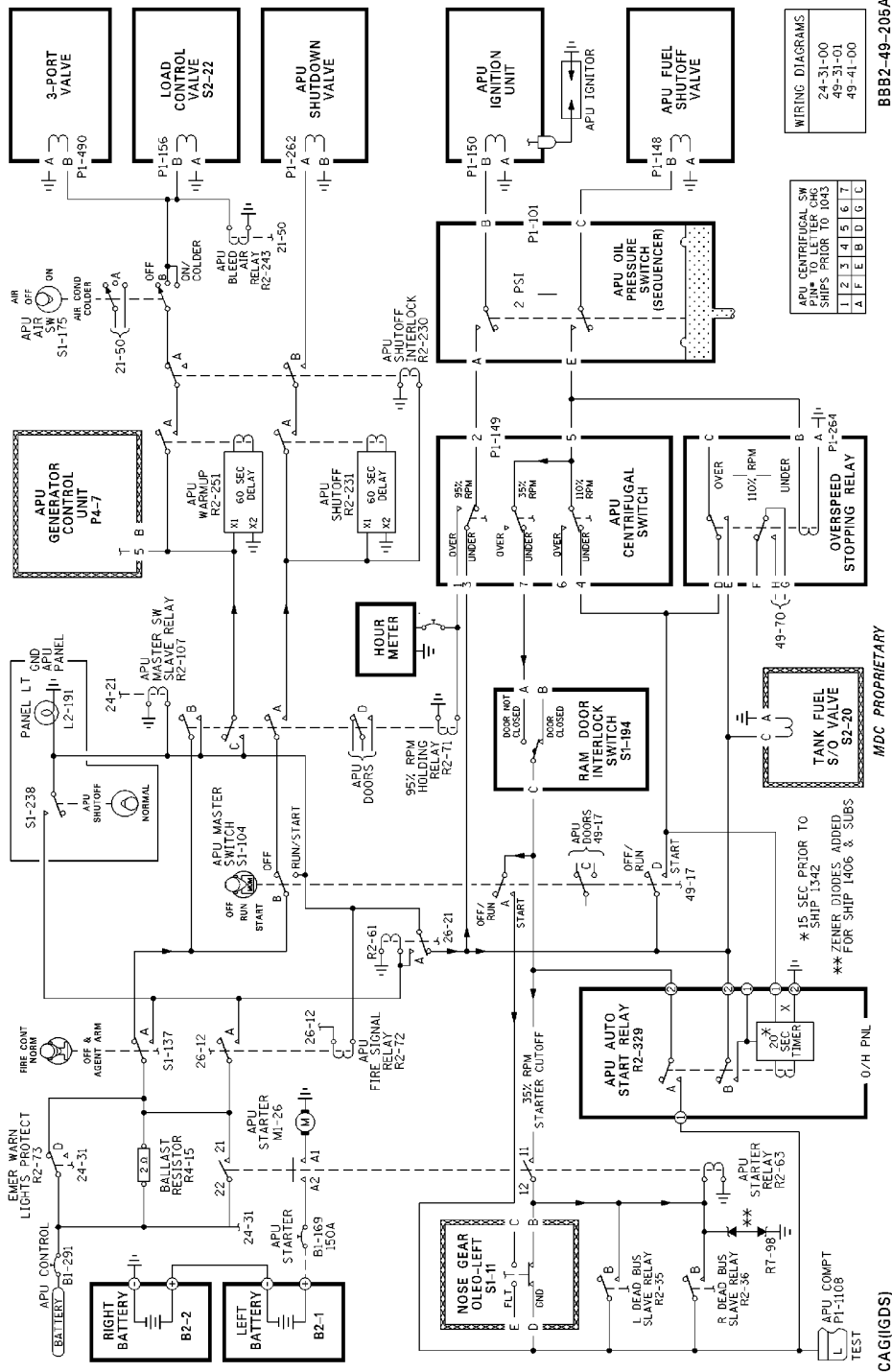
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**APU Controls -- System Schematic**  
Figure 3/49-00-00-990-806 (Sheet 2 of 4)

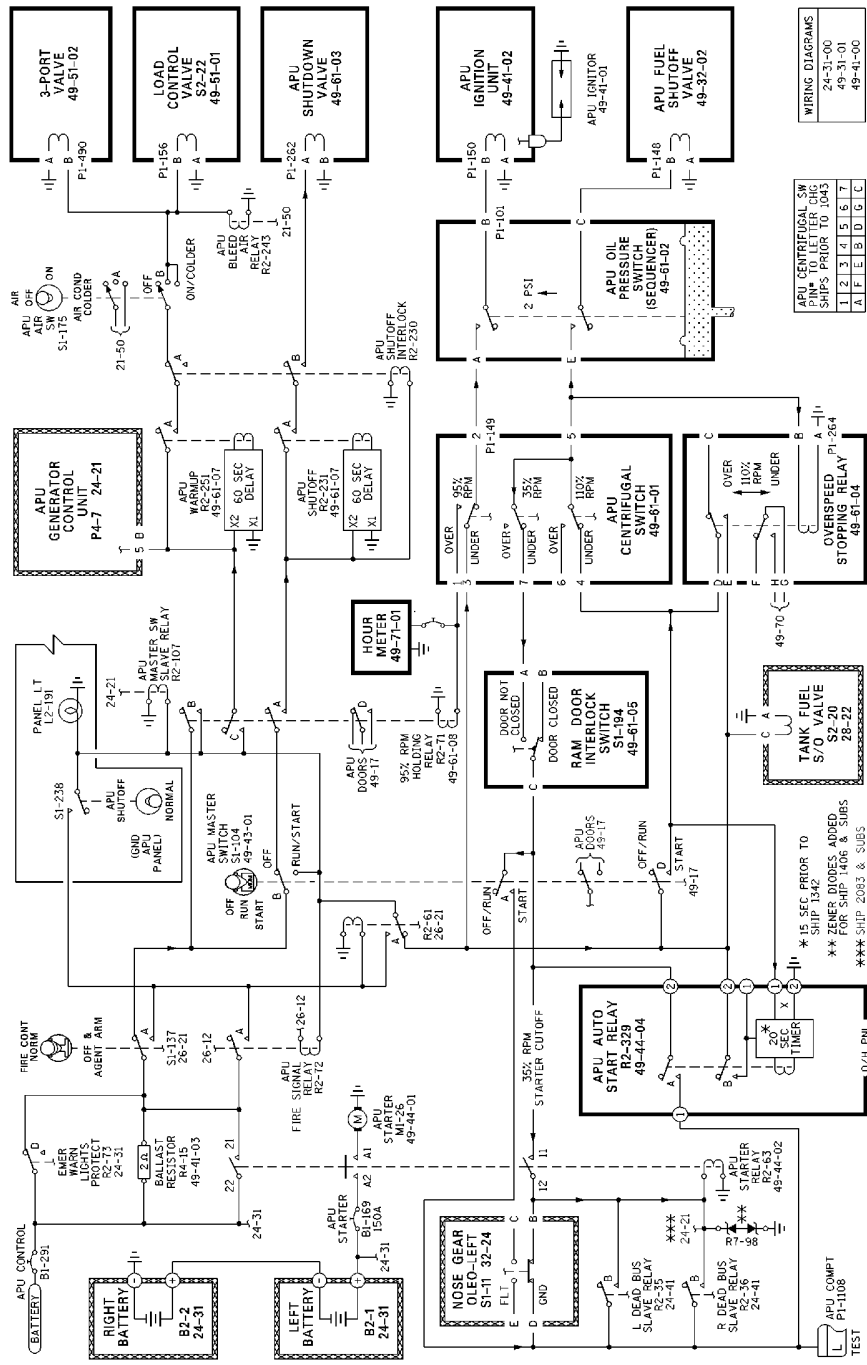
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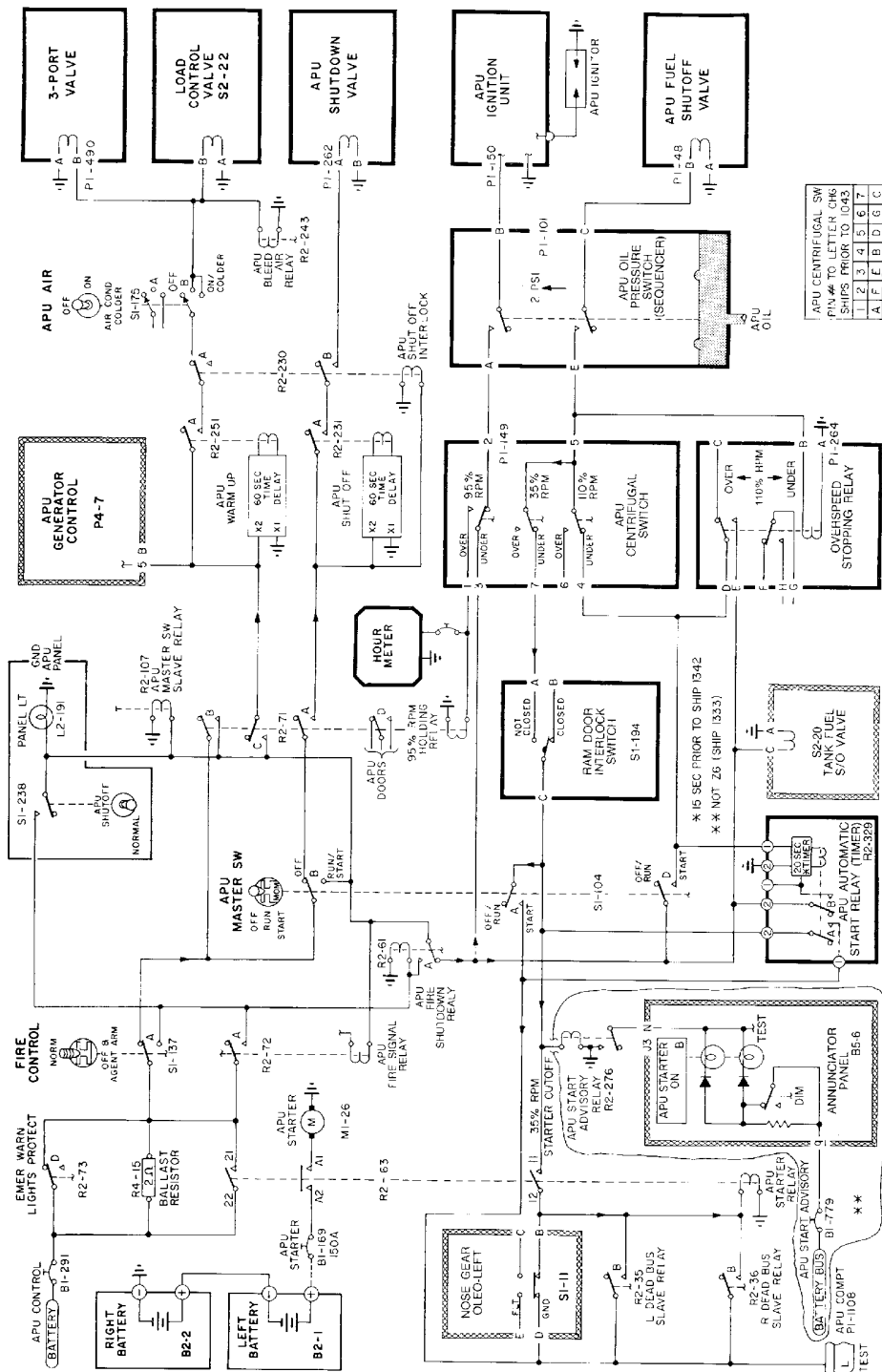
**APU Controls -- System Schematic**  
Figure 3/49-00-00-990-806 (Sheet 3 of 4)

EFFECTIVITY  
WJE 401-412, 414, 873, 874, 880, 881, 883, 884, 886, 887, 892, 893

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**APU Controls -- System Schematic**  
Figure 3/49-00-00-990-806 (Sheet 4 of 4)

EFFECTIVITY  
WJE 415-427, 429, 861-866, 868, 869, 871, 872,  
875-879, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### GENERAL - TROUBLE SHOOTING

#### 1. Description

- A. Step-by-step trouble shooting procedures for the APU are facilitated if suspected malfunctions are first isolated to specific systems. Systems for which trouble shooting information is provided in the following text are: fuel, ignition/starting, air, and oil.
- B. Figure 101 provides a key to sections in this chapter where detailed trouble shooting procedures are outlined. Each referenced figure applies only to the system covered by that section. Probable malfunctions are arranged in the sequence most likely to occur when starting, operating, or shutting down the APU.
- C. While trouble shooting may be accomplished with a minimum of equipment, operators having AiResearch Tester No. 290122, will find this tool useful in eliminating or reducing malfunctions in the various APU systems. In most cases no other equipment will be needed if a source of 28(±2)-volt dc power is available for operating the tester (GENERAL, SUBJECT 49-00-00, page 501).

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

**Table 101**

Name and Number	Manufacturer
APU tester, 290122-400	AiResearch
<u>NOTE:</u> For aircraft with APU EGT in degrees F.	
APU tester, 290122-500	AiResearch
<u>NOTE:</u> For aircraft with APU EGT in degrees C.	
APU tester cable 290214-3-1	AiResearch

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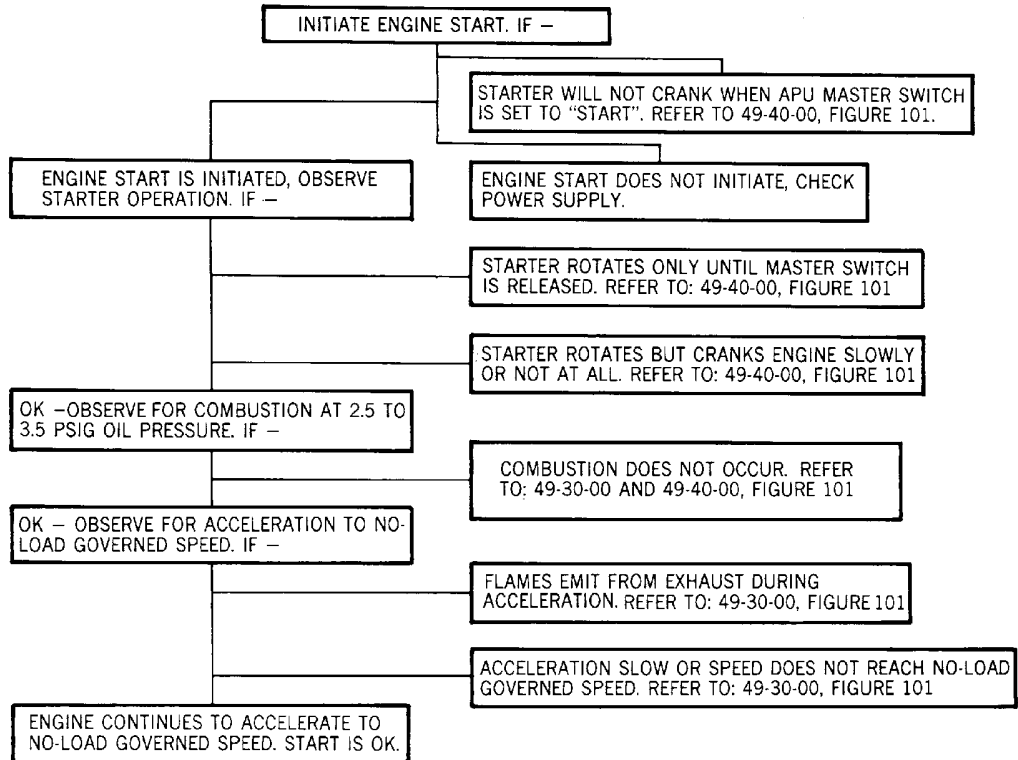
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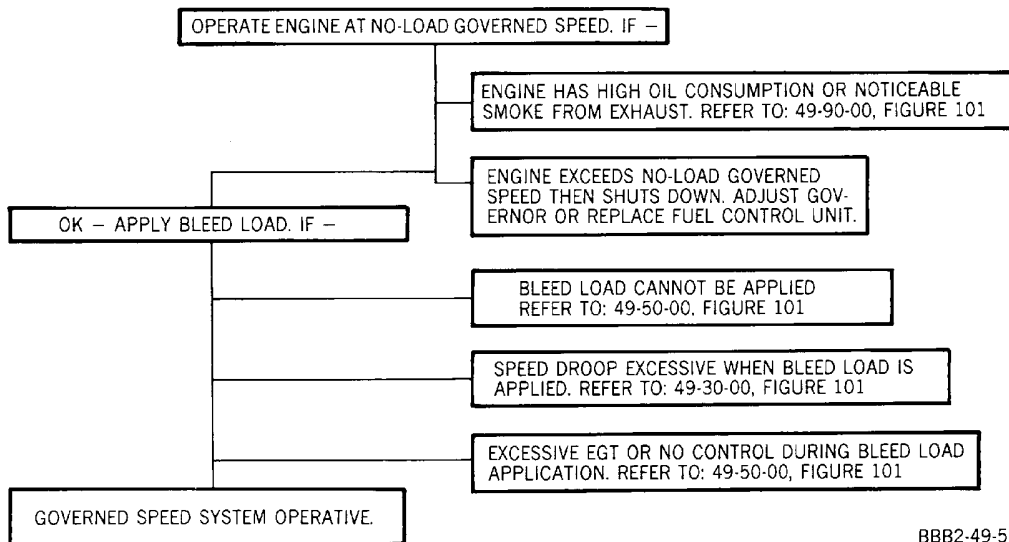
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## ENGINE START TROUBLE SHOOTING



## ENGINE GOVERNED SPEED OPERATION TROUBLE SHOOTING



BBB2-49-5B

### General -- Trouble Shooting Figure 101/49-00-00-990-849

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## GENERAL - MAINTENANCE PRACTICES

### 1. General

- A. Before any maintenance is performed on the APU, personnel should read and understand the following instructions. Careful adherence to these instructions will aid in maintaining a functional and trouble-free APU.

**WARNING:** PERSONNEL MUST STAND CLEAR OF APU AND TURBINE EXHAUST DURING GROUND OPERATIONS.

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

- B. The APU left and right access doors should be closed during normal ground operations to protect personnel and to ensure containment of fire agent if a fire shutdown should occur. For additional information on fire extinguishing procedures. Refer to GENERAL - DESCRIPTION AND OPERATION, PAGEBLOCK 26-00-00/001
- C. When aircraft is parked, the protective covers should be installed on the APU exhaust duct exit, compartment cooling air duct exit, and APU Exhaust cooling air inlet duct to prevent foreign objects from lodging in duct openings.(Table 201).

### 2. Equipment and Materials

**CAUTION:** MAKE CERTAIN PROTECTIVE COVERS ARE REMOVED BEFORE STARTING APU.

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201 Equipment and Materials**

Name and Number	Manufacturer
Protective cover (APU exhaust duct exit) 5916734 or, 5100161	Douglas Texstar Plastics, 1170 190th Street, Grand Prairie, Texas
Protective cover (APU compartment cooling air exhaust duct exit), 5916735 or, 59100162	Douglas Texstar Plastics, 1170 190th Street, Grand Prairie, Texas
Protective cover (APU cooling air inlet duct) 5100172	Texstar Plastics, 1170 190th Street, Grand Prairie, Texas
APU Inlet Doors Locking Tool.	ITEL 49-10-05

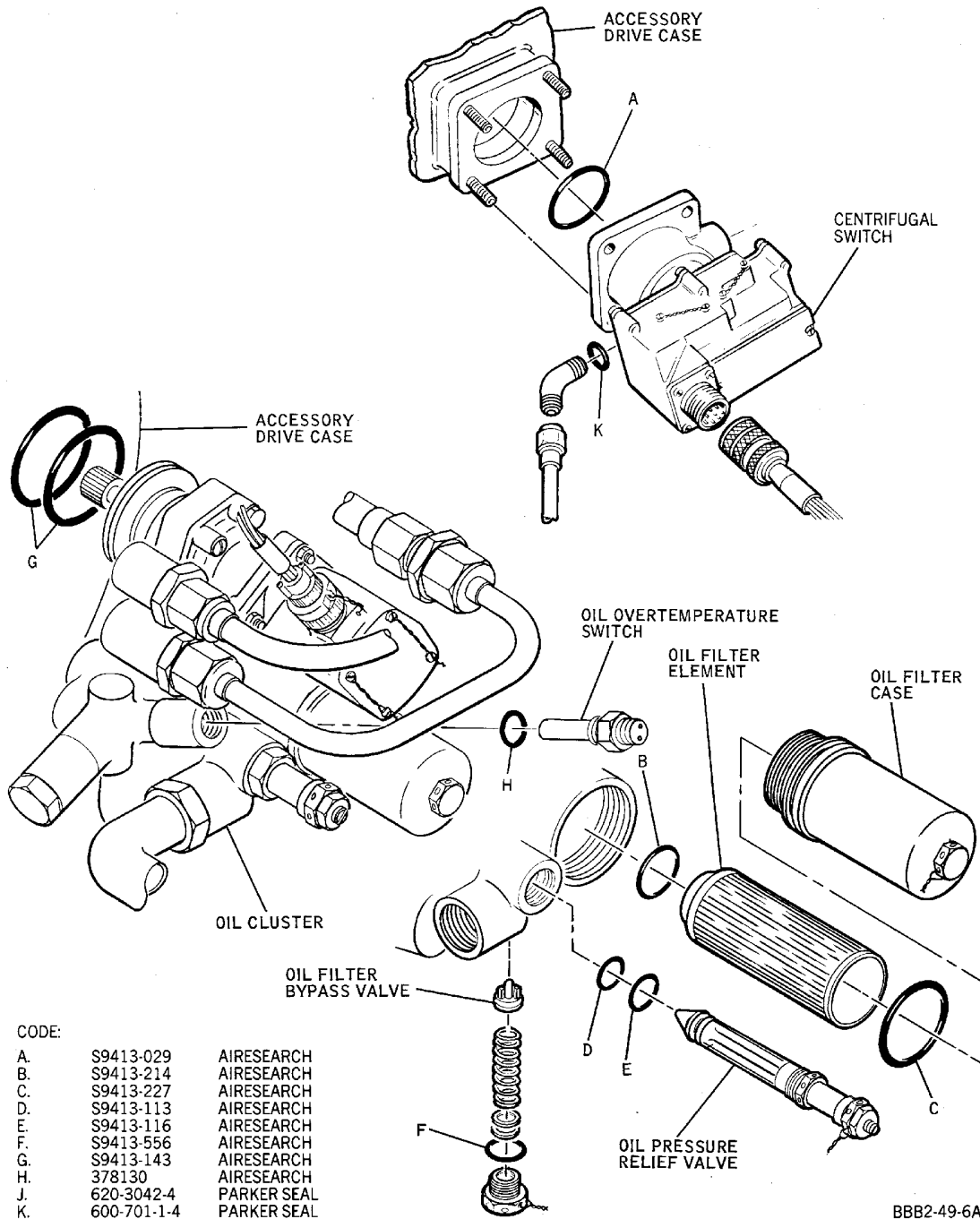
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**General -- Packing Location**  
**Figure 201/49-00-00-990-813 (Sheet 1 of 4)**

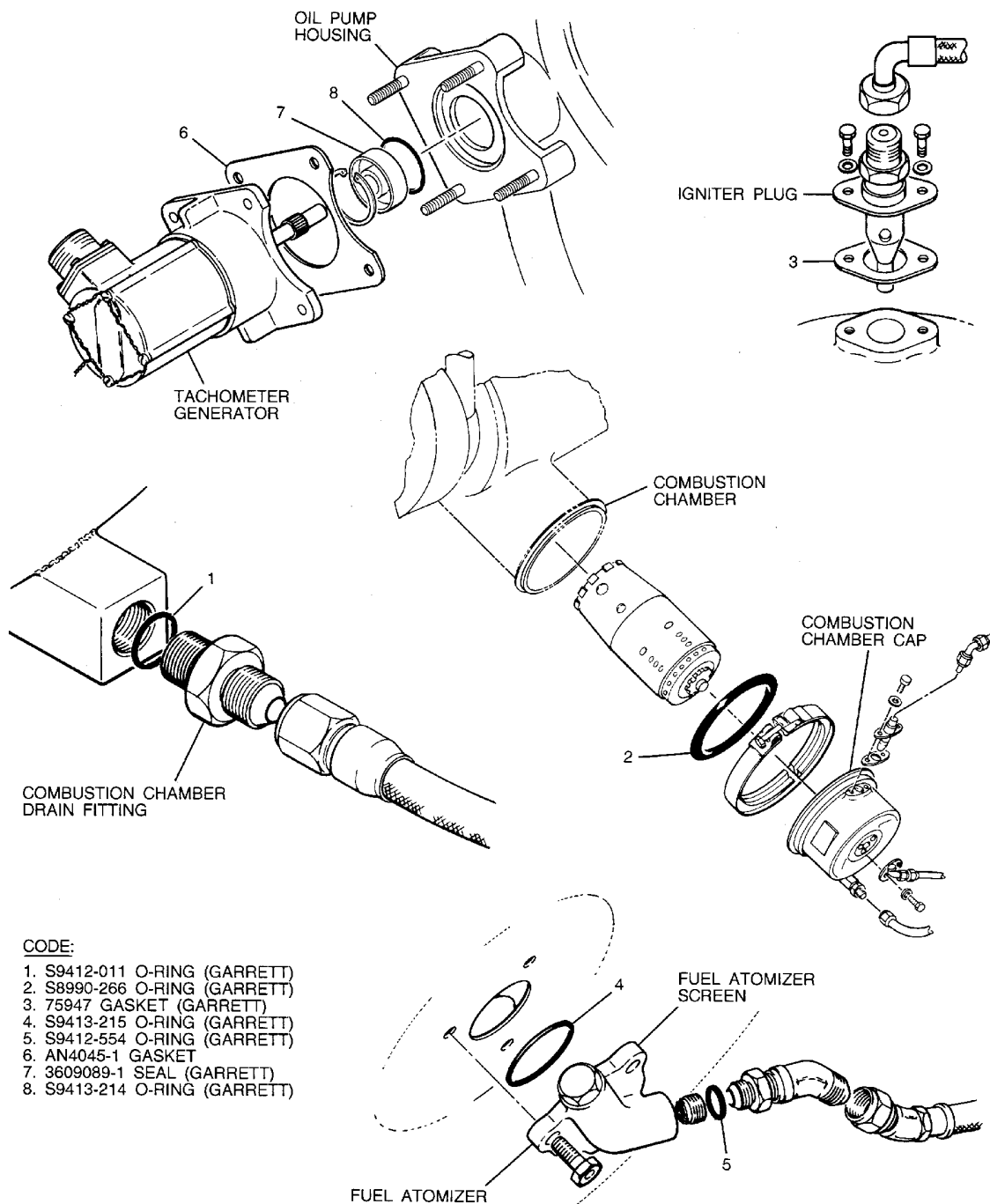
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**CODE:**

- 1. S9412-011 O-RING (GARRETT)
- 2. S8990-266 O-RING (GARRETT)
- 3. 75947 GASKET (GARRETT)
- 4. S9413-215 O-RING (GARRETT)
- 5. S9412-554 O-RING (GARRETT)
- 6. AN4045-1 GASKET
- 7. 3609089-1 SEAL (GARRETT)
- 8. S9413-214 O-RING (GARRETT)

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**General -- Packing Location**  
**Figure 201/49-00-00-990-813 (Sheet 2 of 4)**

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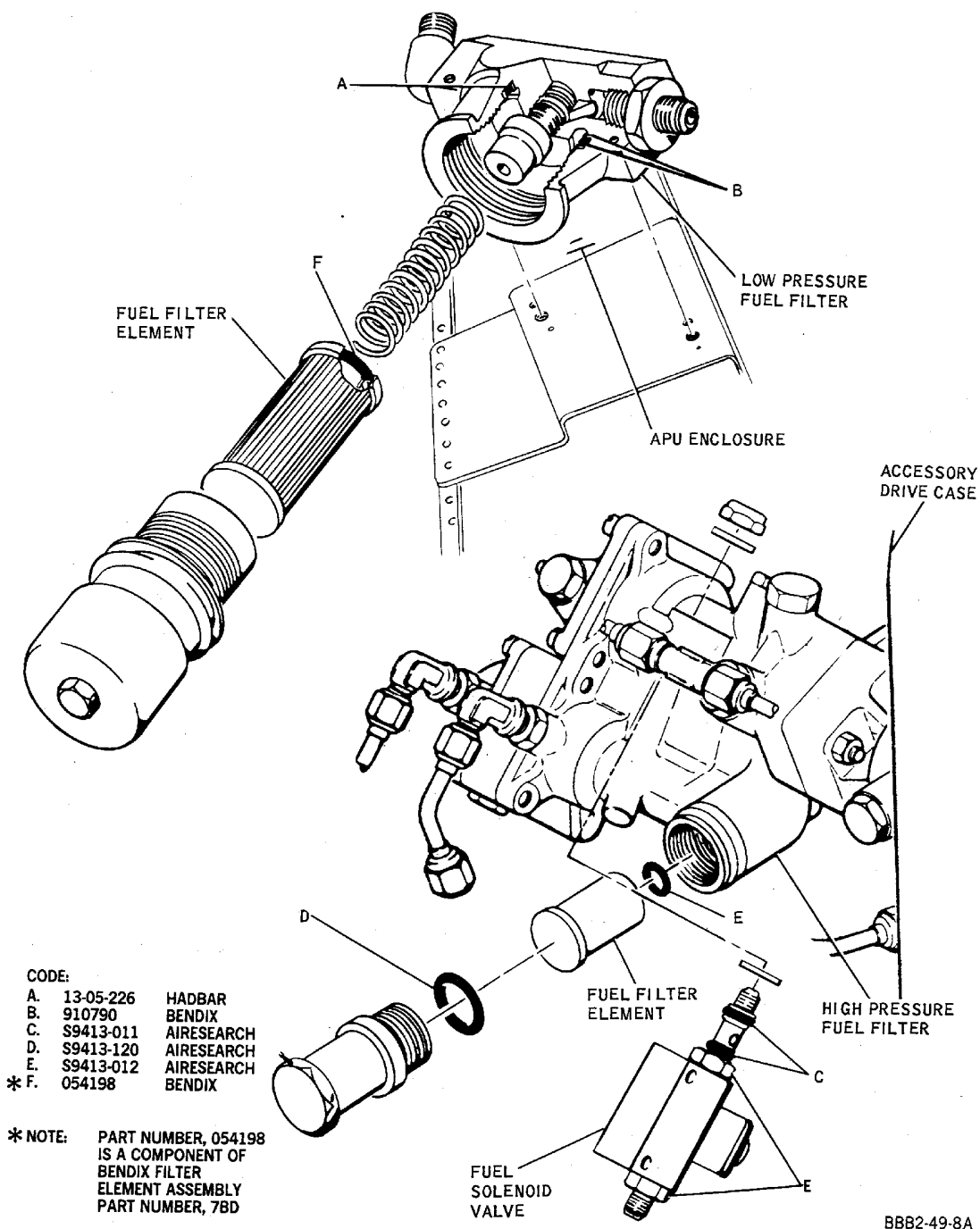
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**General -- Packing Location  
Figure 201/49-00-00-990-813 (Sheet 3 of 4)**

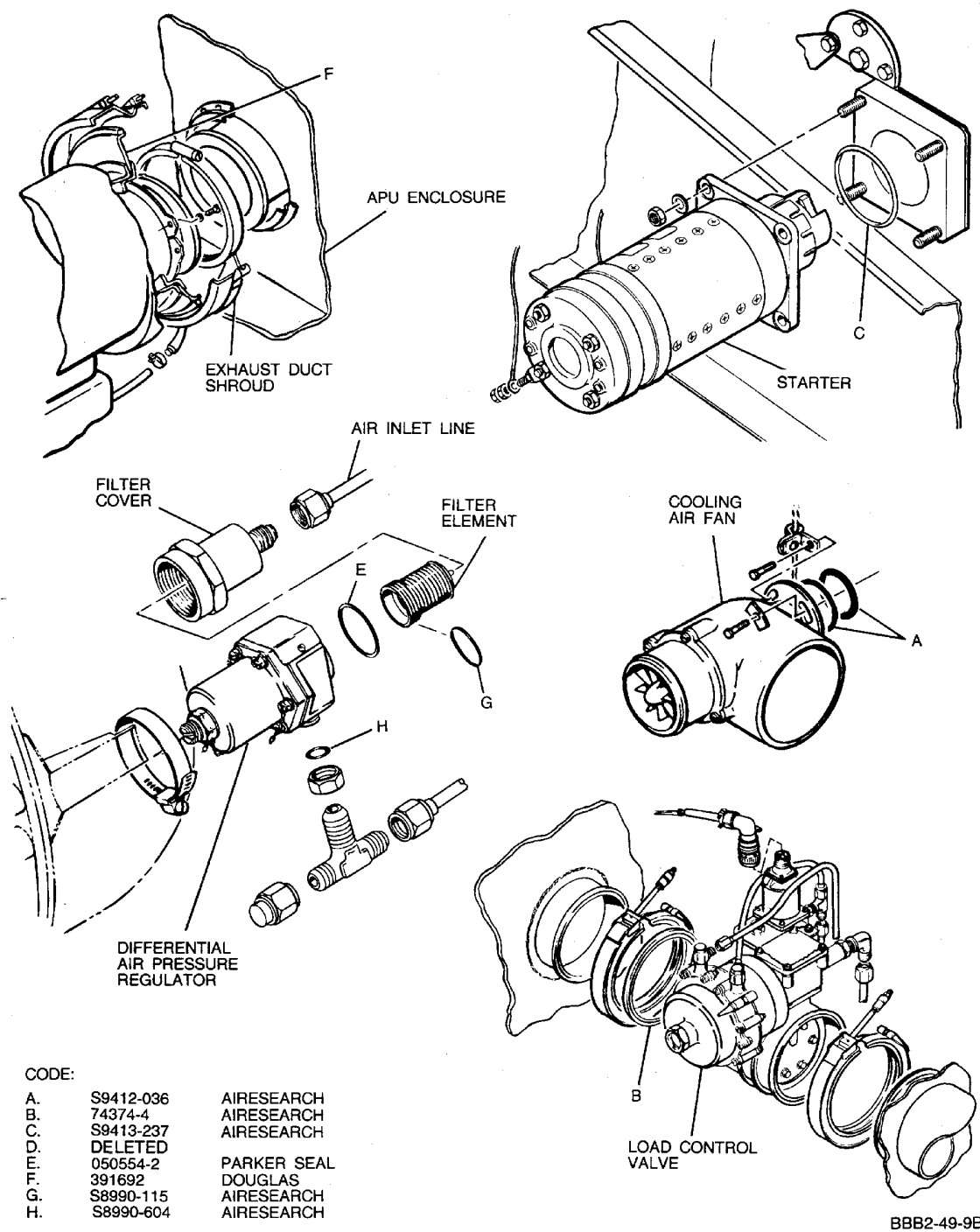
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**General -- Packing Location**  
**Figure 201/49-00-00-990-813 (Sheet 4 of 4)**

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### 3. Flight With Auxiliary Power Unit (APU) Removed

A. Aircraft may be operated with the APU removed; however, the following procedures shall be adhered to for flight under this condition.

- (1) Remove APU. (POWER PLANT - REMOVAL/INSTALLATION, PAGEBLOCK 49-10-00/401)
- (2) Remove APU demountable support box. (PAGEBLOCK 49-10-01/201)
- (3) Remove exhaust (inner) elbow duct, P/N 5915793-3, -105. (PAGEBLOCK 49-80-01/201)
- (4) Cap APU exhaust outlet at APU firewall with exhaust duct cover fabricated per Figure 202.
- (5) Cap fuel line with AN929-12 cap at low pressure filter reducer.
- (6) Cap cooling air intake duct on left firewall with cap fabricated per Figure 202.
- (7) Install airtight cap (Janitrol P/N E18D21 or locally manufactured) on pneumatic bleed air duct located on aft firewall.

NOTE: If cap is manufactured locally, For proper dimensions, refer to Figure 202.

- (8) Install dust covers on all open electrical connectors and receptacles. Coil and stow all loose electrical harnesses. (COIL AND STOW - MAINTENANCE PRACTICES, SWPM 20-10-04)
- (9) Deactivate APU inlet doors in closed position by leaving door actuator (Talley P/N 1051T100-9) installed. (Paragraph 4.)
- (10) Install APU demountable support box with air inlet doors attached, less APU and mounts.(PAGEBLOCK 49-10-01/201)
- (11) Close these access panels:

<u>Number</u>	<u>Name/Location</u>
---------------	----------------------

5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

- (12) Check following before initial flight:

(a) With the fuel line capped or plugged, do a leak check with APU fuel shutoff valve open and APU fuel feed line pressurized. This can be accomplished by:

- 1) Make sure that this circuit breaker is closed:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- 2) APU MASTER switch (S1-104).. "RUN"
- 3) Pressurize line using DC engine start pump or AC pumping unit.

(b) With the pneumatic bleed air duct capped do a leak check by pressurizing pneumatic duct using either appropriate engine or ground pneumatic source. (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 36-00-00/201)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (13) Open these circuit breakers and install safety tags:

#### EE COMPARTMENT

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
		B1-169	APU STARTER

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### LOWER EPC, DC TRANSFER BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	36	B1-195	GENERATOR CONTROL APU
U	39	B1-290	APU DOOR CONTROL

**WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893**

X	35	B1-157	APU OIL PRESSURE & TEMP CAUTION
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**WJE ALL**

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (14) Ensure following switches on overhead switch panel are in position indicated.
- (a) APU GEN--NORM
  - (b) APU L BUS..OFF
  - (c) APU R BUS..OFF
- (15) Disconnect electrical connector (P1-145) from fuel shutoff valve (Valcor P/N V14500-44) in right wheelwell and stow .(COIL AND STOW - MAINTENANCE PRACTICES, SWPM 20-10-04)

**WARNING:** REMOVAL OF APU WILL AFFECT AIRCRAFT CENTER OF GRAVITY. REFER TO APPROPRIATE WEIGHT AND BALANCE MANUAL FOR WEIGHT AND BALANCE REQUIREMENTS.

- (16) Calculate aircraft center of gravity and add ballast in aft cargo compartment per applicable Weight and Balance Manual.

**NOTE:** If aircraft is to be operated with APU removed for an extended period, the exhaust duct system should be periodically checked to ensure that there is no accumulation of debris.

- (17) Placard cockpit that APU has been removed.

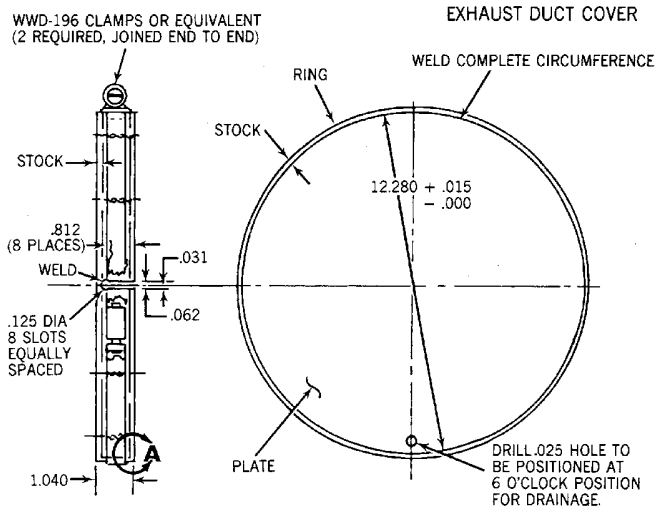
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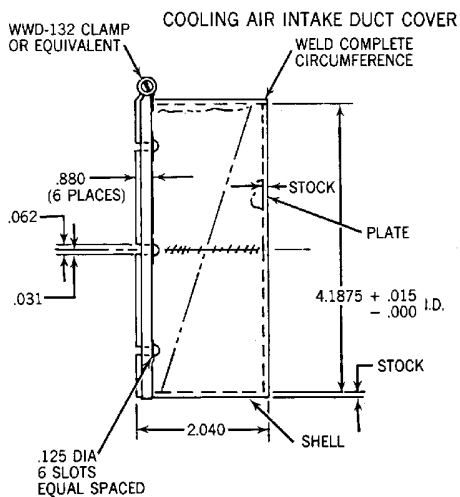
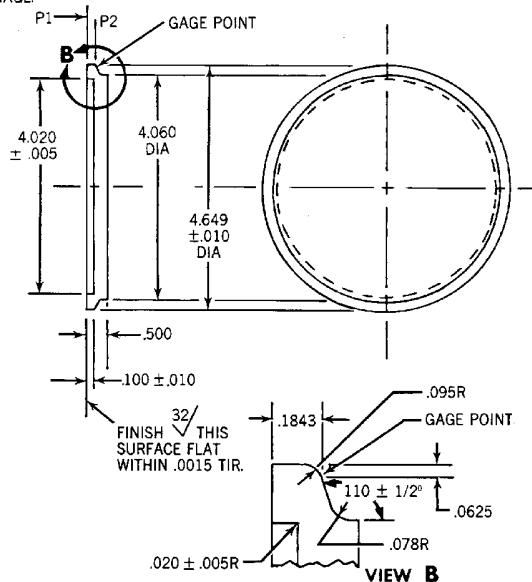


PART DESCRIPTION	STOCK SIZE (INCHES)	MATERIAL SPEC/ SUPPLIER
RING	1.0625 X 4.1 X .040	AL SHEET 6061 T6 QQ-Q-250/11
PLATE	12.5 X 12.5 X .040	AL SHEET 6061 T6 QQ-A-250/11
WWD-196 CLAMP (2)		WITTEK MFG LA GRANGE PARK, ILL.

NOTE:  
THIS PART MUST BE CAPABLE OF WITHSTANDING 140 PSIG AT 500°F IN THE DIRECTION P1-P2 AS SHOWN BY ARROW WHEN MATED WITH JANITROL HIGH PRESSURE FLANGE P/N 28D12 AND RETAINED WITH JANITROL COUPLING P/N 94H42-3-488-3.

PART DESCRIPTION	STOCK SIZE (INCHES)	MATERIAL SPEC
BLEED DUCT PLATE	5 X 5 X .500	AL STOCK 2219 T851 QQ-A-250/30

BLEED AIR DUCT CAP



PART DESCRIPTION	STOCK SIZE (INCHES)	MATERIAL SPEC/ SUPPLIER
SHELL	2.0625 X 13.5 X .040	AL SHEET 6061 T6 QQ-A-250/11
PLATE	4.250 X 4.250 X .040	AL SHEET 6061 T6 QQ-A-250/11
WWD-132 CLAMP		WITTEK MFG LA GRANGE PARK, ILL.

BBB2-49-103

**APU Deactivation Covers  
Figure 202/49-00-00-990-822**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. APU Inlet Doors Locking Tool.

- A. The APU inlet doors locking tool may be used when the APU door actuator fails in the closed position and replacement actuator is not readily available. Refer to ITEL 49-10-05

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### GENERAL - SERVICING

#### 1. General

- A. All new or overhauled engines not preserved for shipment or storage require only normal preparation for service. (Paragraph 3.)
- B. All new or overhauled engines with lubrication systems filled, and subsequently drained before shipment or storage must be filled with approved oil before starting the engine.
- C. All new or overhauled engines preserved for shipment or storage must be depreserved before they are operated. The oil system must be drained and filled with approved oil and the fuel system drained and purged before starting the engine. (Paragraph 5.)
- D. The preservation procedures that follow show the maximum desired storage periods without APU operation. Periodic no-load operation of the APU approximately every 2 months can avoid preservation requirements indefinitely. Periodic motoring of the APU every month can avoid preservation requirements for up to two years. Periodic operation of the APU can be scheduled with other aircraft operational checks during storage.
- E. The preservation procedures that follow are applicable to all reasonable storage environments. For mild environments you can find moderately reduced preservation requirements in the Honeywell Service Bulletin 49-7997.

NOTE: According to the service bulletin, mild environments during preservation have temperatures between 30°F (-1°C) to 125°F (52°C), humidity below 40%, and no salt air.

- F. The preservation procedures are intended as a baseline to establish what precautions should be taken during storage based on the operator's region and experience.
- G. The following procedures are for installed APU; however, preparations for service, or depreserving may be accomplished prior to installation if 28-volt dc power is available for motoring the engine. A source of approved fuel must be available also for purging the fuel system of preservative oil.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 301**

Name and Number	Manufacturer
Container, 2 gal (8 l)	
Cloth tape, metallized	
Desiccant, activated, bagged (MIL-D-3464E) DPM 5265	
Humidity indicator (MS20003) DPM 1162	

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 301 (Continued)**

Name and Number	Manufacturer
Lubricating oil, MIL-L-7808, DPM 6167 Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA
Lubricating oil, MIL-L-6081, grade 1005 or 1010 DPM 339	
Fuel, MIL-T-5624E	
Sheet plastic	

### 3. Prepare Engine for Service

A. A newly installed engine should be prepared for service as follows:

**NOTE:** No depreservation is required other than normal preparation for service procedures.

(1) Fill oil tank with approved oil.

(2) Start engine and allow to accelerate to no-load governed speed. (GENERAL, SUBJECT 49-00-00, page 501)

**NOTE:** Make certain hourmeter circuit breaker located on engine accessory drive is closed.

(3) Operate engine at no-load governed speed for three to five minutes.

(4) Shut down engine. (GENERAL, SUBJECT 49-00-00, page 501)

(5) Carefully check all lubrication lines and connections for leakage.

(6) Carefully check fuel lines and connections for leakage.

(7) Remove and replace fuel filter element and packings located in fuel control unit. (FUEL CONTROL UNIT FILTER, SUBJECT 49-30-02)

(8) Remove and replace oil filter element and packings located in oil cluster. (OIL FILTER, SUBJECT 49-90-06, page 201)

(9) Bleed APU fuel system. (Paragraph 6.)

(10) Start engine and run for acceptability. (GENERAL, SUBJECT 49-00-00, page 501)

(11) Shut down engine.

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

(12) Check oil level in sight gage located on left end of oil tank. If oil has dropped below full mark, replenish as necessary.

**NOTE:** Prior to oil servicing of the APU, operate the APU for 15 minutes and check the oil level within 30 minutes, service as required. Each operator should determine the time frame for checking the oil level within the thirty minute time frame according to their own maintenance procedures.

(13) Record all pertinent information, including new engine operating time in engine log book.

### 4. APU Preservation and Storage

A. APU Storage Without Preservation (On-Aircraft)

(1) To avoid APU preservation requirements do one of the steps that follow:

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (a) To avoid preservation requirements indefinitely, do a no-load operation of the Auxiliary Power Unit (APU) for a minimum of 10 minutes each 2 months or less. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2)

NOTE: Operation of the APU for 10 minutes will sufficiently lubricate the internal components the APU with engine oil. Also, the operation of the APU will dissipate collected moisture from the APU.

- (2) To avoid APU preservation requirements for up to two years, motor the APU each month.

### B. APU Preservation Between 1 And 2 Months (On-Aircraft)

- (1) Before you do the preservation procedure, obey the limitations that follow:

NOTE: No preservation of the APU is required for up to one month since the last operation.

- (a) If the APU was not preserved when the aircraft or vehicle was last powered, it can be preserved up to 1 month after the last operation. It is not necessary to return the APU to a repair facility.
- (b) The APU can be preserved up to 2 months after the last operation if, the aircraft is stored in a mild environment. It is not necessary to return the APU to a repair facility.

NOTE: According to Honeywell service bulletin 49-7997, mild environments have temperatures between 30°F (-1°C) to 125°F (52°C), humidity below 40%, and no salt air.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Make sure that the APU master switch in the flight compartment is in the OFF position. Install "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the switch.
- (4) Open APU access panel.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1016, OIL/LUBRICATING (DPM 3564)

HAZMAT 1000, REFER TO MSDS

- (5) Drain the APU oil as follows:
- (a) Put a 2 gal (8 l) container below oil tank drain cap.
- (b) Remove drain cap and allow oil to drain from tank and lines.
- (c) Install drain cap.

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- (6) Put "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the APU. Show on the tag the date of preservation and the date the preservation ends.
  - (7) Close APU access panel.
- C. APU Preservation Up To 3 Months (On-Aircraft)
- (1) Before you do the preservation procedure, obey the limitations that follow:
    - NOTE: No preservation of the APU is required for up to one month since the last operation.
    - (a) If the APU was not preserved when the aircraft or vehicle was last powered, it can be preserved up to 1 month after the last operation. It is not necessary to return the APU to a repair facility.
    - (b) The APU can be preserved up to 2 months after the last operation if, the aircraft is stored in a mild environment. It is not necessary to return the APU to a repair facility.
- NOTE: According to Honeywell service bulletin 49-7997, mild environments have temperatures between 30°F (-1°C) to 125°F (52°C), humidity below 40%, and no salt air.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Open these circuit breakers and install safety tags:

**LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Make sure that the APU master switch in the flight compartment is in the OFF position. Install "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the switch.
- (4) Open APU access panel.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1016, OIL/LUBRICATING (DPM 3564)

HAZMAT 1000, REFER TO MSDS

- (5) Drain the APU oil as follows:
  - (a) Put a 2 gal (8 l) container below oil tank drain cap.
  - (b) Remove drain cap and allow oil to drain from tank and lines.
  - (c) Install drain cap.
- (6) Install desiccant and seal the applicable fuselage openings as follows:
  - NOTE: Desiccant in the duct can help decrease corrosion, fungus and humidity in the sealed APU area.

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**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1403, DESSICANT/ACTIVATED/BAGGED (DPM 5265)

HAZMAT 1000, REFER TO MSDS

- (a) Hang one pound of bagged MIL-D-3464E (Type I or II) desiccant in the APU exhaust duct.
- (b) Seal the following openings on the fuselage surface with sheet plastic and metallized cloth tape.
  - APU exhaust exit
  - Exhaust shroud cooling air inlet
  - Air inlet door panel.

**NOTE:** Make sure to seal around the whole air inlet panel which contains the ram air inlet door and the nonram air inlet doors.

- (7) Put "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the APU. Show on the tag the date of preservation and the date the preservation ends.
- (8) Close APU access panel.

### D. APU Preservation Up To 6 Months (On-Aircraft)

- (1) Before you do the preservation procedure, obey the limitations that follow:

**NOTE:** No preservation of the APU is required for up to one month since the last operation.

- (a) If the APU was not preserved when the aircraft or vehicle was last powered, it can be preserved up to 1 month after the last operation. It is not necessary to return the APU to a repair facility.
- (b) The APU can be preserved up to 2 months after the last operation if, the aircraft is stored in a mild environment. It is not necessary to return the APU to a repair facility.

**NOTE:** According to Honeywell service bulletin 49-7997, mild environments have temperatures between 30°F (-1°C) to 125°F (52°C), humidity below 40%, and no salt air.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Open these circuit breakers and install safety tags:

#### LOWER EPC, DC TRANSFER BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Make sure that the APU master switch in the flight compartment is in the OFF position. Install "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the switch.

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- (4) Open APU access panel.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1016, OIL/LUBRICATING (DPM 3564)

HAZMAT 1000, REFER TO MSDS

- (5) Drain the APU oil as follows:

- (a) Put a 2 gal (8 l) container below oil tank drain cap.
- (b) Remove drain cap and allow oil to drain from tank and lines.
- (c) Install drain cap.

- (6) Install desiccant and seal the applicable fuselage openings as follows:

**NOTE:** Desiccant in the duct can help decrease corrosion, fungus and humidity in the sealed APU area.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1403, DESSICANT/ACTIVATED/BAGGED (DPM 5265)

HAZMAT 1000, REFER TO MSDS

- (a) Hang one pound of bagged MIL-D-3464E (Type I or II) desiccant with a humidity indicator in the APU exhaust duct.
- (b) Seal the following openings on the fuselage surface with sheet plastic and metallized cloth tape.
  - APU exhaust exit
  - Exhaust shroud cooling air inlet
  - APU air inlet door panel.

**NOTE:** Make sure to seal around the whole air inlet panel which contains the ram air inlet door and the nonram air inlet doors.

- (7) Put "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the APU. Show on the tag the date of preservation and the date the preservation ends.

- (8) Close APU access panel.

### E. APU Preservation Up To 24 Months (On-Aircraft)

- (1) Before you do the preservation procedure, obey the limitations that follow:

**NOTE:** No preservation of the APU is required for up to one month since the last operation.

- (a) If the APU was not preserved when the aircraft or vehicle was last powered, it can be preserved up to 1 month after the last operation. It is not necessary to return the APU to a repair facility.

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- (b) The APU can be preserved up to 2 months after the last operation if, the aircraft is stored in a mild environment. It is not necessary to return the APU to a repair facility.

NOTE: According to Honeywell service bulletin 49-7997, mild environments have temperatures between 30°F (-1°C) to 125°F (52°C), humidity below 40%, and no salt air.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Open these circuit breakers and install safety tags:

**LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Make sure that the APU master switch in the flight compartment is in the OFF position. Install "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the switch.
- (4) Open APU access panel.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1016, OIL/LUBRICATING (DPM 3564)

HAZMAT 1000, REFER TO MSDS

- (5) Drain the APU oil as follows:
- (a) Put a 2 gal (8 l) container below oil tank drain cap.
  - (b) Remove drain cap and allow oil to drain from tank and lines.
  - (c) Install drain cap.
- (6) Install desiccant and seal the applicable fuselage openings as follows:

NOTE: Desiccant in the duct can help decrease corrosion, fungus and humidity in the sealed APU area.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1403, DESSICANT/ACTIVATED/BAGGED (DPM 5265)

HAZMAT 1000, REFER TO MSDS

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**(WARNING PRECEDES)**

- (a) Hang two pounds of bagged MIL-D-3464E (Type I or II) desiccant with a humidity indicator in the APU exhaust duct.
- (b) Seal the following openings on the fuselage surface with sheet plastic and metallized cloth tape.
  - APU exhaust exit
  - Exhaust shroud cooling air inlet
  - APU air inlet door panel.

NOTE: Make sure to seal around the whole air inlet panel which contains the ram air inlet door and the nonram air inlet doors.
- (c) Examine the humidity indicators in the inlet and exhaust ducts every 30 days.
  - 1) If the humidity indicator shows that humidity is approaching 40% replace the bagged desiccant with new bagged desiccant.
  - 2) If the humidity indicator shows that internal parts of the APU have been exposed to humidity at or above 40%, do the steps that follow:
    - a) Do the depreservation procedure for APUs that were preserved and stored on-aircraft . (Paragraph 5.A.)
      - <1> Operate the APU at governed speed for five minutes
    - b) Do the preservation procedure for the required additional timeperiod. (Paragraph 4.)
- (7) Put "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the APU. Show on the tag the date of preservation and the date the preservation ends.
- (8) Close APU access panel.

**5. Depreserve Engine**

A. Depreservation of APU (Stored On-Aircraft)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that these circuit breakers are open and have safety tags:

**LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Make sure that the APU master switch in the flight compartment is in the OFF position with "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags attached.
- (3) Open APU access panel.
- (4) Make sure there are "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags on the APU. Make sure the tag shows the date of preservation and the date the preservation ends.

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**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1403, DESSICANT/ACTIVATED/BAGGED (DPM 5265)

HAZMAT 1000, REFER TO MSDS

- (5) Remove the covers and bagged desiccant as follows:
  - (a) Remove the covers from the fuselage openings that follow:
    - APU exhaust exit
    - Exhaust shroud cooling air inlet
    - APU air inlet door panel.
  - (6) Remove bagged desiccant from the exhaust duct.
    - (a) Also make sure that no desiccant is installed in the APU air inlet duct.
  - (7) Drain the residual oil from the Auxiliary Power Unit (APU) oil system as follows:
    - (a) Put a 2 gal (8 l) container below oil tank drain cap.
    - (b) Remove drain cap and allow residual oil to drain.
    - (c) Install drain cap.
  - (8) Prepare the APU for service as follows:
    - (a) Remove the "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags from the APU. Make sure the tag shows the date of preservation and the date the preservation ends.
    - (b) Do the prepare engine for service. (Paragraph 3.)
    - (c) In the flight compartment, remove the "APU DOES NOT OPERATE" and "APU IN PRESERVATION" tags from the APU master switch.
  - (9) Close APU access panel.
- B. Depreserve APU (Newly Installed)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Make certain APU master switch in flight compartment is in OFF position. Tag switch to indicate maintenance is being performed.

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- (3) Disconnect igniter coil unit by disconnecting wire No. E605K20 from terminal No. 2 located on accessory drive case.

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- (4) Place 2-gallon (4.570 liters) container below oil tank drain cap located on oil supply line to pump.
- (5) Remove drain cap and allow preservative oil to drain from tank and lines.
- (6) Install drain cap.

**CAUTION:** DO NOT MIX NAME BRAND OILS. OIL USED FOR FLUSHING APU MUST BE COMPATIBLE WITH OIL USED IN FINAL FILLING.

- (7) Fill tank with approved oil to full mark on sight gage located on left end of oil tank. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)
- (8) Disconnect fuel inlet line from fuel atomizer and direct this line to 2-gallon (4.570 liters) container.
- (9) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (10) Pressurize APU fuel system by energizing engine start pump. (ENGINE START PUMP, SUBJECT 28-20-08, page 201)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (11) Motor engine. (GENERAL, SUBJECT 49-00-00, page 501)
- (12) Continue motoring until fuel is clear of air and preservative oil and air bubbles.  
NOTE: Fuel drainage should be free of air and preservative oil after three controlled motoring cycles.
- (13) After evidence of preservative oil and air are flushed from fuel system, stop motoring operation. (GENERAL, SUBJECT 49-00-00, page 501)
- (14) Depressurize APU fuel system by stopping engine start pump. (ENGINE START PUMP, SUBJECT 28-20-08, page 201)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (15) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (16) Remove and replace fuel filter element and packings located in fuel control unit. (FUEL CONTROL UNIT FILTER, SUBJECT 49-30-02, page 201)
- (17) Remove oil drain cap and allow oil used for flushing lubricating system to drain from tank and lines.
- (18) Remove and replace oil filter and packings located in oil cluster. (OIL FILTER, SUBJECT 49-90-06, page 201)

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**CAUTION:** DO NOT MIX NAME BRAND OILS. HARMFUL CHEMICAL ACTION COULD RESULT.

- (19) Install drain cap and fill oil tank with approved oil. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)
- (20) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (21) Pressurize APU fuel system by energizing engine start pump. (ENGINE START PUMP, SUBJECT 28-20-08, page 201)
- (22) Motor engine until fuel is free of air induced by fuel filter change. (GENERAL, SUBJECT 49-00-00, page 501)
- (23) Stop motoring operation. (GENERAL, SUBJECT 49-00-00, page 501)
- (24) Depressurize APU fuel system by stopping engine start pump. (FUEL FILL CONTROL FLOAT SWITCH, SUBJECT 28-20-03, page 201)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (25) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (26) Connect fuel inlet line to fuel atomizer.
- (27) Connect wire No. E605K20 to terminal No. 2 on accessory drive case.
- (28) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (29) Start engine and run for acceptability. (GENERAL, SUBJECT 49-00-00, page 501)  
NOTE: Make certain hourmeter circuit breaker located on engine accessory drive is closed.
- (30) Shut down engine.

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (31) Check oil level in sight gage located on left end of oil tank. If oil level has dropped below fill mark, replenish as necessary.
- (32) Record all pertinent information, including new engine operating time in engine log book.

**6. Bleed APU Fuel System of Entrapped Air**

- A. Bleed Fuel System

NOTE: Fuel system should be bled of entrapped air after each APU fuel system component change.

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Make certain APU master switch is in OFF position. Tag switch to indicate that maintenance is being performed.

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- (3) Disconnect igniter coil by disconnecting wire No. E605K20 from terminal No. 2 on accessory drive case.
- (4) Disconnect fuel inlet line from fuel atomizer and direct this line to 2-gallon (4.570 liters) container.
- (5) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (6) Pressurize APU fuel system by energizing engine start pump. (ENGINE START PUMP, SUBJECT 28-20-08, page 201)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (7) Motor engine. (GENERAL, SUBJECT 49-00-00, page 501)
- (8) Continue motoring operation until fuel is free of entrapped air.  
NOTE: Fuel drainage should be free of air after one to three controlled motoring operations.
- (9) Stop motoring operation. (GENERAL, SUBJECT 49-00-00, page 501)
- (10) Depressurize APU fuel system by stopping engine start pump. (DISTRIBUTION, SUBJECT 28-20-00, page 201)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (11) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (12) Connect wire No. E605K20 to terminal No. 2 on accessory drive case.
- (13) Connect fuel inlet line to fuel atomizer.

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- (14) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (15) Start engine and allow to accelerate to no-load governed speed. (GENERAL, SUBJECT 49-00-00, page 501)

NOTE: Make certain hourmeter circuit breaker located on engine accessory drive is closed.

- (16) Shut down engine.

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## GENERAL - ADJUSTMENT/TEST

### 1. General

- A. The use of suitable test equipment will permit adjustment and test of the APU while the unit is installed in the airplane. A convenient source of 28(±2)-volt dc is required for operating test equipment.

**WARNING:** PERSONNEL MUST STAND CLEAR OF APU AND TURBINE EXHAUST DURING GROUND OPERATIONS.

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

- B. Adjustment of the auxiliary power unit is required to ensure optimum operation and to prolong the life of the unit. The following information outlines recommended methods for starting, stopping, motoring, adjusting, and testing the APU.
- C. The APU left and right access doors should be closed during engine runups to protect personnel, and to ensure containment of fire agent should a fire shutdown occur. The access doors may be left open, if desired, during motoring operations, since fuel and ignition will not be applied.
- D. The APU exhaust cooling air inlet and exit duct covers and exhaust duct covers must be removed.
- E. The APU air inlet doors and exhaust discharge area should be cleared of personnel, foreign objects, and loose equipment.
- F. All overboard drains in bottom of APU support box should be open and free of obstruction.
- G. Maintenance should not be performed on any APU system while that system is in operation.
- H. All systems associated with the APU should be serviced before operation.
- I. The APU can be started using the aircraft battery.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 501**

Name and Number	Manufacturer
APU tester, 290122	AiResearch
APU tester cable, 290214	AiResearch
Wheatstone Bridge Model 4289-2	Leads and Northrup
Pressure gage test set, 282645	AiResearch
Test set 290417-2-1	AiResearch
Suitable container, approximately 5 US gallons (4.2 Imperial gallons, 18.9 liters)	Commercially available

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**Table 501 (Continued)**

Name and Number	Manufacturer
Screwdriver and Wrench Assembly, 280253	AiResearch
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. APU Operating Limits

A. The following model Garrett APUs have been certified for the MD-80 aircraft.

**Table 502**

Model	Part Number
GTCP85-98D	380256-1
GTCP85-98W	380482-1
GTCP85-98DCK	381015-1
GTCP85-98DC(A)	3800362-1
GTCP85-98DC(B)	3800368-1
GTCP85-98DC(C)	3800440-1
GTCP85-98DHF	381276-1
GTCP85-98DHF(A)	381276-2
GTCP85-98DHF(B)	381276-3
GTCP85-98DHF(C)	381276-4
<p><b>CAUTION:</b> APU OPERATING WITH EXHAUST GAS TEMPERATURE ABOVE CONTINUOUS OPERATION LIMITS IS EVIDENCE OF ENGINE DISTRESS. APPROPRIATE CORRECTIVE ACTION SHOULD BE TAKEN TO RESTORE NORMAL OPERATION.</p>	
<p><b>CAUTION:</b> DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.</p>	

B. APU should not exceed the following limits during operation:

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**Table 503**

Observation	Condition	GTCP85-98 Limits				
		D, W	DCK	DHF	DC(A)	DC(B), (C)
Exhaust Gas Temperature (EGT)	Starting and acceleration (Maximum EGT)	760° (1400°F)	760°C (1400°F)	760°C (1400°F)	760°C (1400°F)	760° (1400°F)
	Recommended Operation (Maximum recommended for longer engine life)	621° (1150°F)	574°C (1066°F)	574°C (1066°F)	621°C (1150°F)	621°C (1150°F)
	Continuous Operation	710°C (1310°F)	630°C (1166°F)	630°C (1166°F)	677°C (1250°F)	677°C (1250°F)
	Never Exceed (Maximum Operation)	732°C (1350°F)	663°C (1225°F)	663°C (1225°F)	710°C (1310°F)	710°C (1310°F)
Turbine Speed	Continuous Operation (No Load) %RPM	41,100 ±100 (100.9%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)
	Continuous Operation (Full governed load)	40,400 ±200 (99.2%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)
	100 percent RPM	40,700	40,700	42,000	40,700	42,000
	Not To Exceed 10 Seconds (%RPM)	42,500 (104.4%)	42,500 (104.4%)	43,900 (104.5%)	42,500 (104.4%)	43,900 (104.5%)
	Absolute Maximum (RPM) (Percent RPM)	44,500 (109.3%)	44,500 (109.3%)	46,000 (109.5%)	44,500 (109.3%)	46,000 (109.5%)

**Table 504**

Observation	Condition	Limits
Turbine speed droop	Full load	400 rpm (minimum) (1.0 percent)  1000 rpm (maximum) (2.4 percent)
Fuel control unit leakage	From drive shaft seal  From acceleration limiter drain port	Ten drops per min. (maximum)  No leakage allowed.

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**Table 504 (Continued)**

Observation	Condition	Limits
From acceleration limiter housing vent hole	No leakage allowed.	
<p><b>NOTE:</b> The maximum exhaust gas temperatures may be exceeded during the start and acceleration period, providing the start time does not exceed the normal limits. If start time has exceeded normal limits, perform hot start check. (Paragraph 10.)</p>		
<p>* The manufacturer recommends the lowered EGT setting to increase the service life of the APU "hot section." The temperature may be adjusted as necessary to meet each individual operator's requirements. Operators are advised that a reduction of EGT will also reduce bleed air flow and can affect cabin temperatures especially under warmer ambient conditions.</p>		

### 4. APU Operation

**CAUTION:** TO AVOID POSSIBLE DAMAGE TO AIRSTAIR SHROUD WHEN APU IS BEING USED FOR PRESSURIZATION OR AIR-CONDITIONING, MAKE CERTAIN AIR-CONDITIONING PROCEDURES ARE OBSERVED.

#### A. Prestart Checks

- (1) Make certain that air inlet doors and exhaust duct areas are clear of personnel, foreign objects, and loose equipment.
- (2) Remove the safety tags and close these circuit breakers:

#### **EE COMPARTMENT**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
		B1-232	APU POWER PHASE A
		B1-231	APU POWER PHASE B
		B1-230	APU POWER PHASE C

#### **LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL
W	33	B1-814	APU FIRE CENTRAL AURAL WARNING
W	34	B1-405	APU FIRE WARNING HORN
W	35	B1-323	FIRE DETECTORS APU LOOP A
W	36	B1-324	FIRE DETECTORS APU LOOP B
W	42	B1-192	FIRE WARNING LIGHTS

#### **WJE 873, 874, 892, 893**

X	35	B1-157	APU OIL PRESSURE & TEMP CAUTION
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#### **WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893**

X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2
Z	41	B1-22	MASTER WARNING
Z	42	B1-227	MASTER CAUTION

#### **LOWER EPC, MISCELLANEOUS RIGHT DC BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
R	26	B1-71	FIREX AGENT LOW PRESSURE CAUTION

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### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
<b>WJE 401-404, 412, 414</b>			
B	20	B1-779	APU START ADVISORY
<b>WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893</b>			
B	21	B1-291	APU CONTROL

### OVERHEAD EMERGENCY DC BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	12	B1-165	EMERGENCY POWER IN USE LIGHTS

### UPPER EPC, FUEL - LEFT AC BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
H	19	B1-918	FWD RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

### UPPER EPC, GND SERV

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
J	19	B1-919	AFT RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

(3) Check following switch positions.

**Table 505**

Switch	Switch Locations	Position
EXT PWR	Overhead Switch Panel	OFF
BATT	Overhead Switch Panel	OFF
APU MASTER	Overhead Switch Panel	OFF
APU PWR	Overhead Switch Panel	OFF
EMER PWR	Overhead Switch Panel	OFF
APU DOORS	Overhead Switch Panel	AUTO
APU FIRE CONT	Overhead Switch Panel	OFF
APU FIRE AGENT DISCH NO. 1 & 2	Overhead Switch Panel	OFF
APU AIR	Overhead Switch Panel	OFF
APU L & R BUS	Overhead Switch Panel	OFF
EXT PWR L & R BUS	Overhead Switch Panel	OFF
AC BUS X TIE	Overhead Switch Panel	AUTO
DC BUS X TIE	Overhead Switch Panel	OPEN
APU FIRE DETECT LOOPS	Overhead Switch Panel	BOTH
AIR CONDITIONING HP BLD SUPPLY	Overhead Switch Panel	OFF

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 505 (Continued)**

Switch	Switch Locations	Position
ICE PROTECT, L & R ENG	Overhead Switch Panel	OFF
ICE PROTECT, WINDSHIELD	Overhead Switch Panel	OFF
ICE PROTECT, L & R AIR FOIL SYS	Overhead Switch Panel	OFF
ENG L & R FUEL HEAT	Overhead Switch Panel	OFF
ENG START PUMP	Overhead Switch Panel	OFF
ENG IGN	Overhead Switch Panel	OFF.

- (4) Check following indicating lights.

**Table 506**

Light	Location	Indication
APU GEN OFF	Overhead Annunciator Panel	OFF
APU FIRE	Overhead Annunciator Panel	OFF
FIRE DETECTOR LOOP	Overhead Annunciator Panel	OFF
APU OIL PRESS LOW	Overhead Annunciator Panel	OFF
APU OIL TEMP HIGH	Overhead Annunciator Panel	OFF
MASTER CAUTION	Pilots Instrument Panel	OFF
MASTER WARNING	Pilots Instrument Panel	OFF.

- (5) Check that engine fuel levers on pedestal are in OFF position.
- (6) Check that pneumatic crossfeed levers on aft pedestal are in CLOSED position.
- (7) Check following at APU external panel location on left side of aft fuselage.
- (a) APU SHUTOFF switch is in NORMAL position.
  - (b) AGENT 1 & 2 LOW lights are OFF.
  - (c) APU FIRE light is OFF.
- B. APU Air Inlet Doors Operational Check**
- (1) Accomplish prestart check. (Paragraph 4.A.)
  - (2) Place BATT switch in ON position.
  - (3) Place APU DOORS switch in NON-RAM position and hold for approximately 25 seconds. Observe that non-ram doors are open, and ram door is partially open at leading edge.
  - (4) Place APU DOORS switch in RAM position and hold for approximately 40 seconds. Observe that ram door is fully open. Non-ram doors may be partially open.
  - (5) Place APU DOORS switch in NON-RAM position and hold for approximately 40 seconds. Observe that ram door is partially open and non-ram doors are open.
  - (6) Place APU DOORS switch in AUTO position. Observe that ram and non-ram doors are closed.

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**WARNING:** BECAUSE OF POTENTIAL APU START, CLEAR ALL PERSONNEL AND EQUIPMENT FROM APU AREA.

**CAUTION:** IF APU STARTS, PLACE MASTER SWITCH IN OFF POSITION AND FIRE CONTROL SWITCH IN APU OFF, AGENT ARM POSITION.

- (7) Place APU MASTER switch in RUN position. Observe that ram door is open and non-ram doors may be open or closed.
- (8) Place APU MASTER switch in OFF position. Observe that ram door begins to close after approximately 30(±3) seconds, and non-ram doors close after ram door closes.
- (9) Place APU DOORS switch in OFF position. Observe that all doors are closed.
- (10) Place MASTER switch to START position and hold for approximately 5 seconds.
  - (a) Ram and non-ram doors should remain closed.
  - (b) APU should not start.
  - (c) If APU starts, place MASTER switch in OFF position, and check starter control wiring for discrepancies.
- (11) Return MASTER switch to OFF position.
- (12) Return APU DOORS switch to AUTO position.
- (13) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**5. Starting**

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

A. Start APU as follows:

- (1) Accomplish prestart checks. (Paragraph 4.A.)
- (2) Place BATT switch in ON position.
- (3) Place ENG START PUMP switch in ON position.
- (4) Place APU MASTER switch in momentary START position, no longer than one second, then release to RUN position.
- (5) Verify following:

- (a) APU OIL PRESS LOW caution light comes on momentarily and goes off below 95 percent rpm.
- (b) APU tachometer indicates engine rotation within 10 seconds.

NOTE: APU will automatically accelerate to governed speed, and EGT will be indicated on EGT gage.

- (6) Observe and record following during acceleration and steady-state operation.

NOTE: APU AIR switch should be placed in OFF position prior to APU RPM no-load governed speed check.

- (a) Ambient air temperature
- (b) Time to reach governed speed - 40 seconds maximum without SB GTCP-49-5196, 40-70 seconds with SB GTCP-49-5196 incorporated.

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- (c) EGT - do not exceed 760°C (1400°F) during acceleration - do not exceed 662°C (1225°F) during steady-state
- (d) APU startup time delay check - startup time delay between reaching governed speed and pneumatic pressure availability. Should be 60(±10) seconds
- (e) Pneumatic pressure (pressure indicator on overhead instrument panel) - 35 psig (241.5 kPa) minimum, 61 psig (420.9 kPa) maximum
- (f) APU RPM - no load governed speed - 101.4 percent maximum
- (g) APU shutdown time delay check - shutdown time delay between APU MASTER switch OFF and APU RPM initial decrease. Should be 60 (±10) seconds.

### B. Unsatisfactory Start

- (1) Immediately place APU MASTER switch in OFF position, and FIRE CONTROL switch in APU OFF/AGENT ARM position if any of following conditions occur:
  - (a) APU flame out (indicated by drop in EGT and RPM)
  - (b) EGT exceeds maximum (760°C (1400°F)) during start and acceleration, or maximum rated EGT (662°C (1225°F)) during steady-state no-load operation (perform hot start check (Paragraph 10.)).
  - (c) RPM exceeds 110 percent
  - (d) Hung start (indicated when APU reaches a steady-state condition below governed speed of 95 percent and/or APU EGT increases above 760°C (1400°F)).

## 6. APU Shutdown

### A. Shut down APU as follows:

- (1) Place APU L & R BUS switches in OFF position.
  - (2) Place APU MASTER switch in OFF position.
- NOTE: APU should shut down within 60(±10) seconds. This is indicated by a decrease in APU EGT and engine RPM.
- (3) Place BATT switch in OFF position.
  - (4) Place ENG START pump switch in OFF position.

## 7. Engine Motoring

### A. Motor APU With Fuel Purge

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- (2) Disconnect igniter coil unit by disconnecting wire No. E605K20 from terminal No. 2, located on accessory drive case.
- (3) Disconnect fuel line at fuel atomizer, and direct fuel line into suitable container.

EFFECTIVITY WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893
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- (4) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (5) Place BATT switch in ON position.  
 (6) Place APU MASTER switch in RUN position.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (7) Motor engine by placing APU MASTER switch momentarily in START position.  
 (8) Stop APU by placing MASTER switch or ground control switch in OFF position.  
 (9) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (10) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (11) Connect igniter coil unit by connecting wire No. E605K20 to terminal No. 2 located on accessory drive case.  
 (12) Connect fuel line to fuel atomizer.  
 (13) Place BATT switch in OFF position.  
 (14) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

## 8. Restart APU After Fire Shutdown

**WARNING:** STARTING APU BEFORE FIRE DAMAGE IS REPAIRED OR MALFUNCTION IS CORRECTED CAN ENDANGER BOTH PERSONNEL AND AIRCRAFT.

### A. Prepare To Start

**NOTE:** APU should not be restarted after a fire shutdown unless cause has been isolated and corrected, or resultant damage repaired.

- (1) Place APU MASTER switch in OFF position.  
 (2) Recharge fire agent. (PAGEBLOCK 26-20-01/201)  
 (3) Start APU. (Paragraph 4.)

### B. Dry Motor Engine

**NOTE:** Engine dry motoring is accomplished when performance of maintenance checks does not require fuel flow.

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove the electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (4) Place the BATT switch on the APU panel of the overhead panel to ON position.
- (5) Place APU MASTER switch to RUN position on the APU panel.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (6) Motor engine by placing APU MASTER switch momentarily in START position.
- (7) Stop APU by placing MASTER switch or ground control switch in OFF position.
- (8) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (9) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (10) Reinstall electrical connector P1-101 on the sequencing oil pressure switch.
- (11) Place BATT switch in OFF position.
- (12) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 9. Adjustment/Test APU

#### A. Precautionary Requirements

- (1) Shut down engine immediately if any of following conditions occur during test procedure.
  - (a) Tester oil pressure low light (red) remains on within 10 seconds after start.
  - (b) Ignition failure (flameout).

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- (c) Oil pressure displayed on tester oil pressure gage exceeds 80 psig (552 kpa).
- (d) Failure of tester 35 percent light to come on when start switch is placed in START position, or fails to go off when tester tachometer indicator displays 14,500 to 16,500 rpm.
- (e) Tester exhaust gas temperature indicator exceeds limits specified in (Paragraph 3.).
- (f) Tester tachometer indicator indicates engine speed exceeds 109.5 percent (46,000 rpm), or exceeds 104.5 percent (43,900 rpm) for longer than 10 seconds.

### B. Prepare Test Equipment For Use

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect engine electrical harness from receptacle located on left forward side of APU enclosure. (Figure 501)
- (3) Connect tester cable, AiResearch 290214, or equivalent as follows:
  - (a) Connect TESTER end of cable to receptacle located on tester, AiResearch 290122 control panel.
  - (b) Connect ENG CONN end to plug on engine electrical harness.
  - (c) Connect CUSTOMER CABLE to receptacle located on left for-ward side of APU enclosure.
- NOTE:** Connectors on ends of tester cable are identified by marker bands.
- (4) Prepare engine test panel located on right side of APU for test by removing caps from following test ports. (Figure 501)
  - (a) Remove cap from outlet fuel test port.
  - (b) Remove cap from control air pressure port.
  - (c) Remove cap from oil pressure port.
- (5) Connect tester control hoses to engine test panel as follows:
  - (a) Connect one end of outlet fuel pressure test hose to tester outlet fuel pressure port and other end to outlet fuel pressure port of engine test panel.
  - (b) Connect one end of control air pressure test hose to tester control air pressure port and other end to control air pressure port of engine test panel.
  - (c) Connect one end of oil pressure test hose to tester oil pressure port and other end to oil pressure port of engine test panel.
- (6) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**NOTE:** When removing tester and tester cable, make certain that caps are installed on engine test panel test ports, and that electrical harness is properly connected to airplane wiring.

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### C. Test Exhaust Gas Temperature Loop Resistance

- (1) Remove screws attaching tester control panel to tester. AiResearch 290122, and lift panel to gain access to temperature indicating circuit components. (Figure 501)
- (2) Tag and disconnect lead wires from terminals located at rear of exhaust gas temperature indicator case.
- (3) Connect Wheatstone Bridge, Model 4289-2, to disconnected wire leads (to measure resistance of thermocouple circuit).
- (4) Measure resistance of thermocouple circuit. Resistance should be 8.000 ( $\pm 0.035$ ) ohms.
- (5) If resistance is not within specified limit, adjust slide of variable resistor located in tester to obtain specified resistance.
- (6) Disconnect Wheatstone Bridge from exhaust gas temperature indicator leads.

**CAUTION:** MAKE CERTAIN WHITE CHROMEL WIRE IS CONNECTED TO CR TERMINAL AND GREEN ALUMEL WIRE IS CONNECTED TO AL TERMINAL.

- (7) Connect exhaust gas temperature indicator leads to terminals at rear of indicator case and remove tags.
- (8) Position control panel on tester and install screws.

### D. Check and Adjust Fuel Control Unit Acceleration Limiter Valve Cracking Pressure

**NOTE:** Use of tester, AiResearch 290122, is not required for the following test:

- (1) Remove cap from control air pressure test connection port on engine test panel in order to equalize pressure on the acceleration limiter diaphragm. (Figure 502)
- (2) Remove electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove plug from fuel control unit fuel pressure connection. Install suitable fitting.
- (4) Connect pressure gauge, AiResearch 282645 pressure gage set, and case set assembly to the fitting installed previously.
- (5) Dry Motor APU. (Paragraph 8.B.)
- (6) Note and record acceleration limiter valve cracking pressure at approximately 20 percent (8,000 to 9,000 rpm) engine speed. Acceleration limiter valve cracking pressure should be 58 to 62 psig (400.2 to 427.8 kpa).
- (7) If cracking pressure is not within limits, adjust acceleration limiter valve as follows:
  - (a) Loosen locknut and turn adjustment screw, using screw-driver and wrench assembly, AiResearch 280353. Turn adjusting screw clockwise to increase cracking pressure, and counterclockwise to decrease cracking pressure.
  - (b) When adjustment is satisfactory, tighten locknut, and check cracking pressure in accordance with Paragraph 9.D.(5) and Paragraph 9.D.(6). Safety locknut with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (8) Disconnect pressure gauge and case set assembly from fuel control unit. Remove fitting and reinstall plug.
- (9) Reinstall electrical connector P1-101 on the sequencing oil pressure switch (WDM 49-31-01).
- (10) Install cap on control air pressure connection port of engine test panel.



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**WARNING:** FIRE PROTECTION IS NOT AVAILABLE WITH APU ACCESS DOORS OPEN. MAKE CERTAIN FIRE PROTECTION EQUIPMENT IS AVAILABLE PRIOR TO ENGINE START.

E. Test Engine Start, Acceleration, Operation and Actuation of Automatic Controls

**NOTE:** If engine does not operate satisfactorily, shut down engine and correct malfunction (GENERAL, SUBJECT 49-00-00, page 101).

- (1) Connect tester, AiResearch 290122, to engine. (Paragraph 9.B.)
- (2) Place BLEED AIR load switch located on tester control panel, in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester start switch in START position.
- (4) Observe following sequence of events:
  - (a) Oil pressure low light and 35 percent switch come on immediately.
  - (b) Engine starts and accelerates smoothly as evidenced by:
    - 1) Oil pressure indicated on oil pressure gauge.
    - 2) Engine speed indicated on tachometer indicator.
    - 3) Compressor air pressure indicated on control air pressure indicator.
    - 4) Fuel pressure indicated on fuel pressure gauge.
    - 5) Exhaust gas temperature indicated on exhaust gas temperature indicator.

**CAUTION:** SHUT DOWN ENGINE IMMEDIATELY AND CORRECT MAL-FUNCTION IF EXHAUST GAS TEMPERATURE EXCEEDS LIMITS SPECIFIED IN PARAGRAPH 3. DURING START, ACCELERATION, AND OPERATION OF ENGINE.

- (c) When oil pressure reaches 2.5 to 3.5 psig (17.25 to 24.15 kpa) as indicated on oil pressure gage, fuel flow should be indicated on fuel pressure gage, verifying that fuel solenoid valve has opened.
- (d) When engine speed reaches approximately 35 percent, as displayed on tachometer indicator, 35 percent switch should actuate and open starter circuit indicated by tester 35 percent light going off.
- (e) When oil pressure reaches 55 psig (379.5 kpa) maximum, as indicated on oil pressure gage, oil pressure low light should go off, indicating satisfactory operation of oil low-pressure switch.

**CAUTION:** ENGINE OIL PRESSURE MUST NOT FLUCTUATE MORE THAN 3 PSIG (20.7 KPA) DURING STEADY STATE OPERATION.

- (f) When engine speed reaches approximately 75 percent, as displayed on tachometer indicator, engine oil pressure of 50 to 70 psig (345 to 483 kpa) should be displayed on oil pressure gage. Engine oil pressure should remain at 50 to 70 psig (345 to 483 kpa) for all operation above 75 percent speed.

**NOTE:** Because of pressure drop in oil line between oil pump and test panel connection, a pressure of 60 psig (414 kpa) at oil pressure gage represents a pressure of 90 psig (621 kpa) at oil pump discharge port.

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- (5) When engine speed reaches 95 percent, as displayed on tachometer indicator, actuation of 95 percent switch should open ignition circuit and close hourmeter circuit. Hour-meter should start recording engine operating time, and 95 percent light should come on.
- (6) Engine should continue to accelerate, and fuel governor located in fuel control unit should control engine speed at no-load governed speed, 102.1 to 102.6 percent (42,500  $\pm$ 100 rpm) maximum, displayed on tachometer indicator.

**NOTE:** Tester tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm.

- (7) Shut down engine, using stop switch on tester panel to energize pneumatic solenoid valve and actuate 110 percent overspeed switch in centrifugal switch.
- (8) Remove tester and tester cable.

### F. Check and Adjust Fuel Control Governor Speed Setting

- (1) Connect tester to engine. (Paragraph 9.B.)
- (2) Place tester LOAD switch in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester START switch in START position and allow engine to accelerate to no-load governed speed.
- (4) With no load applied, engine speed should stabilize at 102.6 percent maximum indicated on tester tachometer indicator.

**NOTE:** Tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm engine speed.

- (5) If steady-state no-load governed speed is not within limits of 102.1 to 102.6 percent (42,500  $\pm$ 100 rpm) indicated on tester tachometer indicator, adjust fuel governor as follows:
  - (a) Use screwdriver and wrench assembly, AiResearch 280353, to facilitate adjustment.
  - (b) To increase governor speed, turn adjusting screw clockwise; to decrease speed, turn adjusting screw counterclockwise.
  - (c) When adjustment is satisfactory, tighten locknut, and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### G. Check and Calibrate Pneumatic (Load Control) Thermostat

- (1) Remove engine exhaust gas temperature thermocouple (PAGEBLOCK 49-71-02/201). Install test thermocouple, AiResearch 290416-2.
- (2) Connect test set, AiResearch 290417-2-1, thermocouple cable to test thermocouple and exhaust gas temperature indicator on test set.
- (3) Check pneumatic (load control) thermostat temperature control point as follows:
  - (a) Start engine in accordance with Paragraph 4..

**NOTE:** If APU is not fully loaded, it is impossible to determine the setpoint of an installed thermostat. To properly load APU, it is necessary to impose a potential overload on the APU to insure that the thermostat is fully open and at its control temperature setpoint.

- (b) Open engine load control valve and turn on both air-conditioning packs (do not select "AIR CONDITIONING COLDER" position). Allow EGT to stabilize.

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**CAUTION:** DO NOT ALLOW TURBINE DISCHARGE TEMPERATURE TO EXCEED LIMITS SPECIFIED IN FIGURE.

- (c) Record EGT. If EGT is not within limits specified in Table 507, calibrate thermostat in accordance with Paragraph 9.G.(4).

**NOTE:** To avoid hot shutdown, remove load and operate for one minute at no-load condition prior to shutting down engine.

- (d) Remove pneumatic load and allow temperature to stabilize, then shut down engine.

- (4) Calibrate pneumatic (load control) thermostat, if required, as follows.

- (a) Determine thermostat control cracking temperature in accordance with Paragraph 9.G.(3).

**NOTE:** A locking device, two self-locking helicoil inserts, is incorporated in the thermostat adjustment collar to prevent collar from rotating and changing calibration in service. To ensure integrity of locking device, torque on adjustment collar should be checked during adjustment. If running torque of adjustment collar is less 20 inch-pounds (2.26 N·m), thermostat must be replaced.

**Table 507 Engine Exhaust Gas Temperature (EGT) Setting**

EGT Measurement	Pneumatic (Load Mode) Thermostat	
Test Set Thermocouple (GTCP85-98DHF)	Max 630°C(1166°F)	*Recommended 574(+0, -10)°C (1066(+0, -20)°F)
Test Set Thermocouple (GTCP85-98DC(B))	Max 677°C(1250°F)	Recommended 621°C(1150°F)
<p>* Manufacturer recommends these lowered temperature settings to increase service life of engine "hot" section. These temperatures may be adjusted as necessary to meet each individual operators requirements. Operators are advised that a reduction of EGT will reduce bleed airflow and can affect cabin temperatures under warmer ambient conditions.</p>		

- (b) Calibrate pneumatic thermostat to required setting as follows:

**NOTE:** Each index mark on adjustment collar is equivalent to 2°C (4°F).

- 1) Rotate adjustment collar clockwise (viewed from fitting end) to increase temperature setting.
- 2) Rotate adjustment collar counterclockwise to decrease temperature setting.

- (c) Check temperature control point in accordance with Paragraph 9.G.(3). Controlling temperature should repeat within 3°C (5°F) for two consecutive checks.

- (5) Remove test thermocouple from engine. Install engine exhaust gas temperature thermocouple. (PAGEBLOCK 49-71-02/201)

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**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (6) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed. Run engine approximately 2 minutes to stabilize operation.

**NOTE:** Because of the pressure drop in the oil line between the oil pump discharge port and APU test panel, a pressure of 70 psig (483 kpa) at the APU test panel represents a pressure of 100 psig (690 kpa) at the oil pump discharge port. Oil pressure fluctuations should not exceed 10 psig (69 kpa) during steady state operation.

- (7) Observe oil pressure indicated on oil pressure gage located on tester control panel. If oil pressure is not within 70( $\pm$ 10) psig (483( $\pm$ 10) kpa) APU test panel, (100( $\pm$ 10) psig (690( $\pm$ 69) kpa) oil pump discharge port), during steady state operation, adjust oil pressure relief valve cracking pressure as follows:

- (a) Loosen locknut and turn valve metering screw clockwise to increase cracking pressure (Figure 502).
- (b) Turn valve metering screw counterclockwise to decrease cracking pressure.
- (c) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### H. Check Oil Pressure Relief Valve Setting

- (1) Connect tester to engine. (Paragraph 9.B.)
- (2) Place LOAD switch in OFF position

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed. Run engine approximately 2 minutes to stabilize operation.

**NOTE:** Because of the pressure drop in the oil line between the oil pump discharge port and APU test panel, a pressure of 70 psig (483 kpa) at the APU test panel represents a pressure of 100 psig (690 kpa) at the oil pump discharge port. Oil pressure fluctuations should not exceed 10 psig (69 kpa) during steady state operation.

- (4) Observe oil pressure indicated on oil pressure gage located on tester control panel. If oil pressure is not within 70( $\pm$ 10) psig (483( $\pm$ 10) kpa) APU test panel, (100( $\pm$ 10) psig (690( $\pm$ 69) kpa) oil pump discharge port), during steady state operation, adjust oil pressure relief valve cracking pressure as follows:

- (a) Loosen locknut and turn valve metering screw clockwise to increase cracking pressure. (Figure 502)
- (b) Turn valve metering screw counterclockwise to decrease cracking pressure.
- (c) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### I. Check and Adjust Air Pressure Regulator Output Pressure

- (1) Connect engine to tester. (Paragraph 9.B.)
- (2) Remove cap from tee fitting located in outlet air pressure line between air pressure regulator and load control valve. (Figure 502)

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- (3) Connect one end of control air pressure hose to tee fitting and other end to control air pressure coupling on tester.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (4) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed.
- (5) Observe pressure indicated on control air pressure gage. Pressure should be 37.6 to 39.7 in/hg (1270.278 to 1341.225 mbar) (18.5 to 19.5 psig (127.6 to 134.5 kpa)).
- (6) If regulated outlet pressure is not within specified limits, shut down engine, and proceed as follows:
  - (a) Loosen locknut on end of air pressure regulator and turn adjustment screw clockwise to increase outlet pressure.
  - (b) Turn adjustment screw counterclockwise to decrease outlet pressure.
  - (c) Tighten locknut and repeat check procedure.
- (7) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### J. Check and Adjust Load Control Valve Opening Rate (Figure 502)

- (1) APU should be operating and stabilized at steady-state no-load RPM.
- (2) Open both pneumatic crossfeed valves.
- (3) Turn both air conditioning packs on.
- (4) Place APU AIR switch to ON position.
- (5) Pneumatic manifold pressure should peak and stabilize within 7 to 14 seconds.
- (6) If opening time is not within limits, proceed as follows:

**CAUTION:** DO NOT BOTTOM RATE ADJUSTMENT SCREW IN LOAD CONTROL VALVE, OR DAMAGE TO LOAD CONTROL VALVE COULD RESULT.

- (a) Hold load control valve rate adjustment screw and loosen locknut.
- (b) Turn rate adjustment screw clockwise to increase opening time.
- (c) Turn rate adjustment screw counterclockwise to decrease opening time.
- (d) Hold adjustment screw and tighten locknut.
- (7) Repeat procedures, Paragraph 9.J.(1) thru Paragraph 9.J.(6), until opening time is within required limits.

### K. Check Accessory Gear Case Negative Pressure

**NOTE:** Check shall only be accomplished during trouble shooting to determine cause of high oil consumption or notice-able oil smoke from exhaust. Connection of tester, AiResearch 290122, is not required for this check.

- (1) Remove vent plug from vent port on front of accessory drive gear case. (Figure 502)
- (2) Install a suitable bulkhead tee fitting in vent port. Install cap, with 0.035 to 0.040 inch (.088 to .1 cm) orifice in one of tee outlets.
- (3) Connect a suitable flexible hose to tee fitting and connect other end of hose to compound pressure gage, AiResearch 282645 pressure gage set.

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- (4) Start engine. (Paragraph 4.)
- (5) Allow engine to accelerate to no-load governed speed and run for approximately two minutes to stabilize operation.
- (6) Observe pressure reading on negative pressure gage; pressure should be -3 to -10 inches of mercury.
- (7) Shut down engine. (Paragraph 6.)
- (8) Remove flexible hose, pressure gage, and tee fitting.
- (9) Install vent plug in accessory drive gear case and safety vent plug with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

EFFECTIVITY

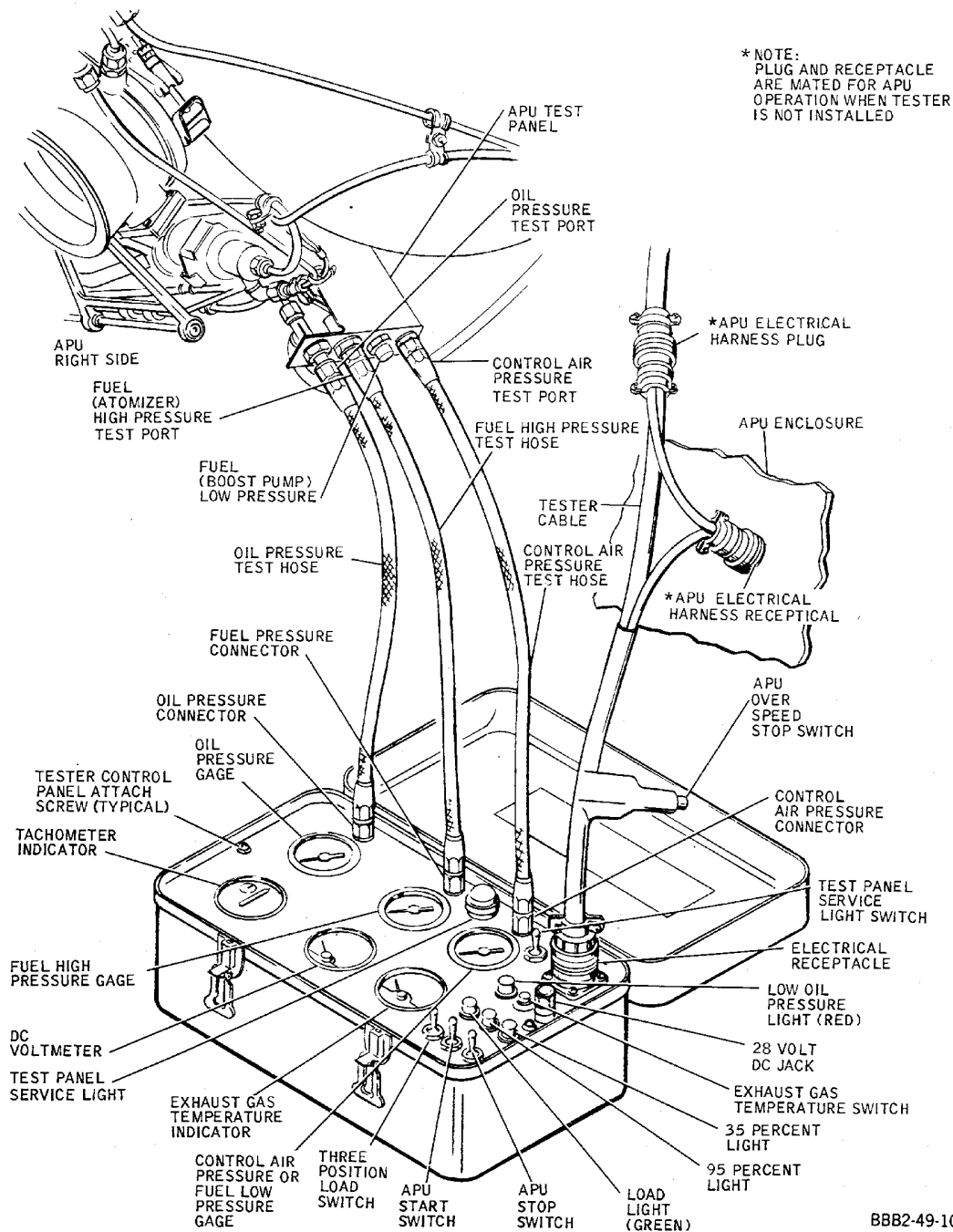
WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893

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**APU Tester -- Connections  
Figure 501/49-00-00-990-838**

EFFECTIVITY  
WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893

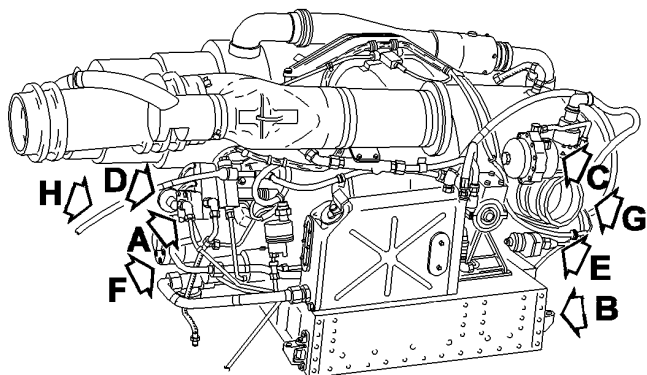
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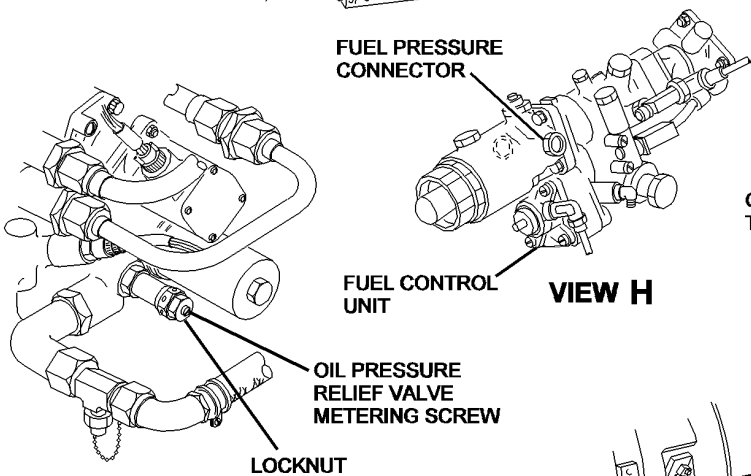
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FUEL CONTROL GOVERNOR  
ADJUSTMENT SCREW

ACCELERATION  
LIMITER  
ADJUSTMENT  
SCREW

**VIEW A  
FUEL CONTROL UNIT**



FUEL PRESSURE  
CONNECTOR

FUEL CONTROL  
UNIT

**VIEW F**

OIL PRESSURE  
RELIEF VALVE  
METERING SCREW

LOCKNUT

FUEL (BOOST PUMP)  
LOW PRESSURE  
TEST PORT

OIL PRESSURE  
TEST PORT

FUEL (ATOMIZER)  
HIGH PRESSURE  
TEST PORT

CONTROL AIR  
PRESSURE  
TEST PORT

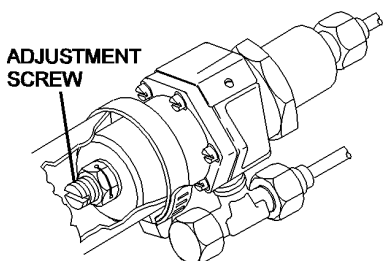
**VIEW B  
ENGINE TEST PANEL**

EXHAUST GAS  
TEMPERATURE  
THERMOCOUPLE

PLUG

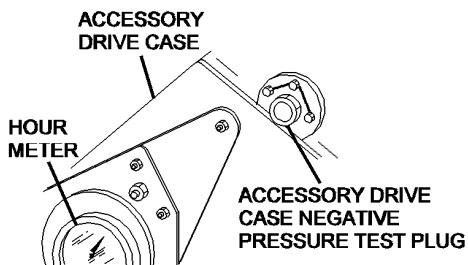
PNEUMATIC  
THERMOSTAT

**VIEW G  
(ROTATED 90 )**



ADJUSTMENT  
SCREW

**VIEW E  
AIR PRESSURE  
REGULATOR**

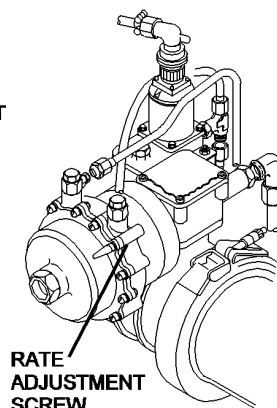


ACCESSORY  
DRIVE CASE

HOUR  
METER

ACCESSORY DRIVE  
CASE NEGATIVE  
PRESSURE TEST PLUG

**VIEW D  
PRESSURE TEST PLUG**



RATE  
ADJUSTMENT  
SCREW

**VIEW C  
LOAD CONTROL VALVE**

BBB2-49-11C  
S0008552042V2

APU -- Adjustment/Test  
Figure 502/49-00-00-990-839

EFFECTIVITY

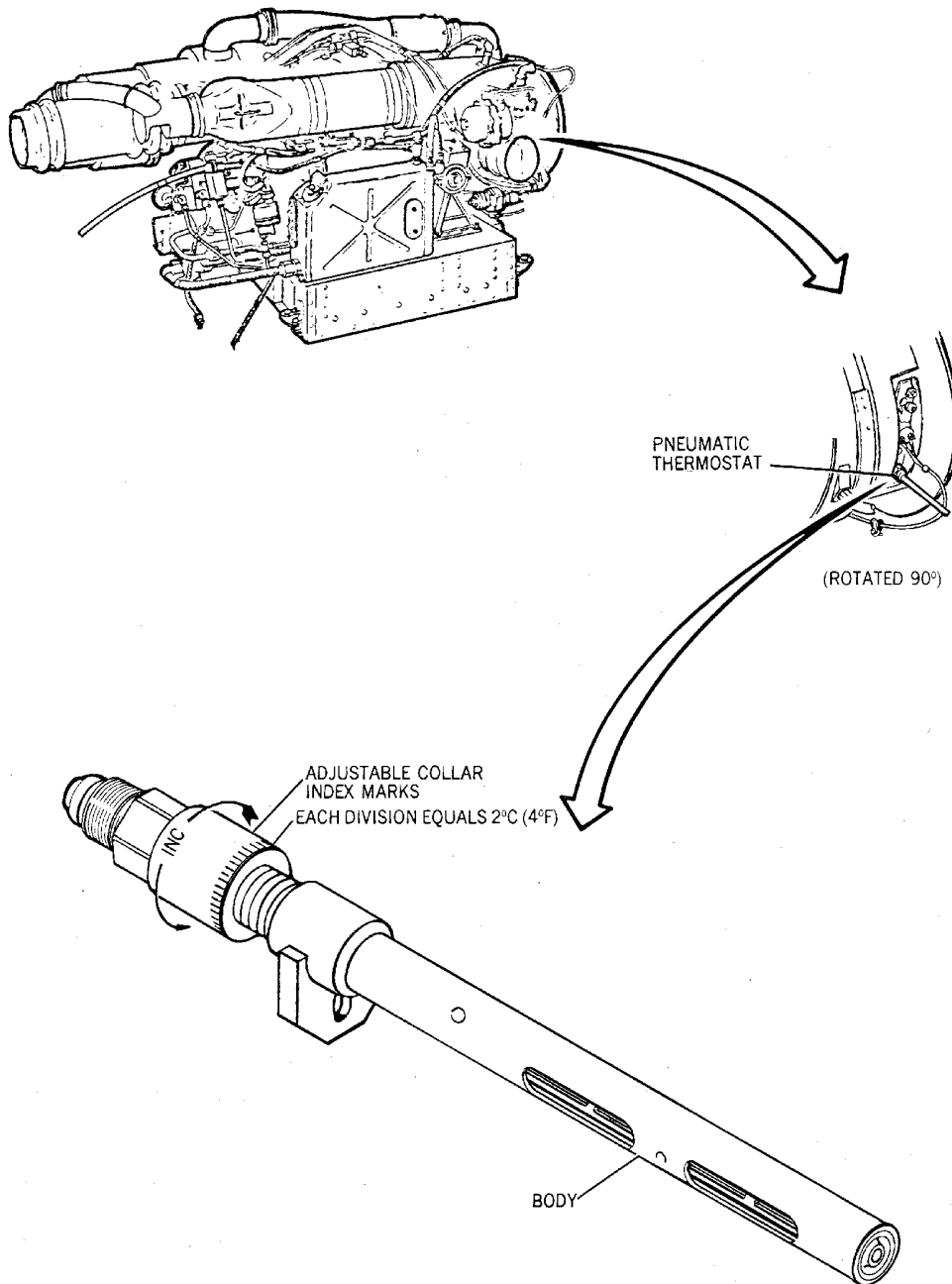
WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893

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BBB2-49-97A

**Pneumatic Thermostat -- Adjustment**  
**Figure 503/49-00-00-990-840**

EFFECTIVITY  
WJE 401-404, 412, 414, 873, 874, 886, 887, 892, 893

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 10. Hot Start Check

#### A. Perform Hot Start Check

- (1) Remove combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
- (2) Visually check hot section components to extent that components are visible through combustion unit opening in turbine plenum.  
NOTE: Normally available equipment, light, mirror, fiber optics, should be used to check components.
- (3) Check hot section components for evidence of distress.
  - (a) Turbine wheel blade tips for erosion/burning.
  - (b) Turbine wheel blades for erosion/rubbing.
  - (c) Turbine nozzle guide vanes for erosion.
  - (d) Turbine torus assembly for erosion.
- (4) If distress is indicated, remove APU for overhaul.
- (5) If no distress is indicated, APU may continue in service.
  - (a) Install replacement combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
  - (b) Replace fuel control unit. (FUEL CONTROL UNIT, SUBJECT 49-30-01)
  - (c) Check calibration of pneumatic thermostat. (Paragraph 9.G.)
  - (d) Check turbine plenum drain for obstructions.
  - (e) Check aircraft battery voltage (22 vdc minimum or 26 vdc minimum with charger connected).

### 11. Check for Turbine Wheel Failure

#### A. Indications Of Possible Turbine Wheel Failure

- (1) Flight compartment
  - (a) Sudden loss of APU RPM indication to zero.
  - (b) Sudden loss of APU EGT indication to zero.
  - (c) APU OIL PRESS LOW light comes ON.
  - (d) If during start sequence, APU STARTED circuit breaker may pop open.

#### B. Checks To Confirm Turbine Wheel Failure

- (1) Check inside turbine exhaust duct for fragments.
- (2) Remove combustion chamber liner and flex borescope.
- (3) If turbine wheel failure is confirmed:
  - (a) Check turbine plenum for perforations.
  - (b) Check exterior of turbine plenum for distortion.
- (4) If perforations in plenum exist, check APU compartment including walls, lines, wiring, and surrounding structure for damage.
- (5) If APU compartment walls are perforated, check tailcone wall, wiring, lines, and surrounding structure for damage.

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## GENERAL - ADJUSTMENT/TEST

### 1. General

- A. The use of suitable test equipment will permit adjustment and test of the APU while the unit is installed in the airplane. A convenient source of 28(±2)-volt dc is required for operating test equipment.

**WARNING:** PERSONNEL MUST STAND CLEAR OF APU AND TURBINE EXHAUST DURING GROUND OPERATIONS.

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

- B. Adjustment of the auxiliary power unit is required to ensure optimum operation and to prolong the life of the unit. The following information outlines recommended methods for starting, stopping, motoring, adjusting, and testing the APU.
- C. The APU left and right access doors should be closed during engine runups to protect personnel, and to ensure containment of fire agent should a fire shutdown occur. The access doors may be left open, if desired, during motoring operations, since fuel and ignition will not be applied.
- D. The APU exhaust cooling air inlet and exit duct covers and exhaust duct covers must be removed.
- E. The APU air inlet doors and exhaust discharge area should be cleared of personnel, foreign objects, and loose equipment.
- F. All overboard drains in bottom of APU support box should be open and free of obstruction.
- G. Maintenance should not be performed on any APU system while that system is in operation.
- H. All systems associated with the APU should be serviced before operation.
- I. The APU can be started using the aircraft battery.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**Table 501**

Name and Number	Manufacturer
APU tester, 290122-400	AiResearch
<b><u>NOTE:</u></b> For aircraft with APU EGT in degrees F.	
APU tester, 290122-500	AiResearch
<b><u>NOTE:</u></b> For aircraft with APU EGT in degrees C.	
APU tester cable, 290214-3-1	AiResearch
Wheatstone Bridge Model 4289-2	Leads and Northrup
Pressure gage test set, 282645	AiResearch
Test set 290417-2-1	AiResearch

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 501 (Continued)**

Name and Number	Manufacturer
Suitable container, approximately 5 US gallons (4.2 Imperial gallons, 18.9 liters)	Commercially available
Screwdriver and Wrench Assembly, 280253	AiResearch
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. APU Operating Limits

A. The following model Garrett APUs have been certified for the MD-80 aircraft.

**Table 502**

Model	Part Number
GTCP85-98D	380256-1
GTCP85-98W	380482-1
GTCP85-98DCK	381015-1
GTCP85-98DC(A)	3800362-1
GTCP85-98DC(B)	3800368-1
GTCP85-98DC(C)	3800440-1
GTCP85-98DHF	381276-1
GTCP85-98DHF(A)	381276-2
GTCP85-98DHF(B)	381276-3
GTCP85-98DHF(C)	381276-4

**CAUTION:** APU OPERATING WITH EXHAUST GAS TEMPERATURE ABOVE CONTINUOUS OPERATION LIMITS IS EVIDENCE OF ENGINE DISTRESS. APPROPRIATE CORRECTIVE ACTION SHOULD BE TAKEN TO RESTORE NORMAL OPERATION.

B. APU should not exceed the following limits during operation:

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 503**

Observation	Condition	GTCP85-98 Limits				
		D, W	DCK	DHF	DC(A)	DC(B), (C)
Exhaust Gas Temperature (EGT)	Starting and acceleration (Maximum EGT)	760° (1400°F)	760°C (1400°F)	760°C (1400°F)	760°C (1400°F)	760° (1400°F)
	Recommended Operation (Maximum recommended for longer engine life)	621° (1150°F)	574°C (1066°F)	574°C (1066°F)	621°C (1150°F)	621°C (1150°F)
	Continuous Operation	710°C (1310°F)	630°C (1166°F)	630°C (1166°F)	677°C (1250°F)	677°C (1250°F)
	Never Exceed (Maximum Operation)	732°C (1350°F)	663°C (1225°F)	663°C (1225°F)	710°C (1310°F)	710°C (1310°F)
Turbine Speed	Continuous Operation (No Load) %RPM	41,100 ±100 (100.9%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)
	Continuous Operation (Full governed load)	40,400 ±200 (99.2%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)
	100 percent RPM	40,700	40,700	42,000	40,700	42,000
	Not To Exceed 10 Seconds (%RPM)	42,500 (104.4%)	42,500 (104.4%)	43,900 (104.5%)	42,500 (104.4%)	43,900 (104.5%)
	Absolute Maximum (RPM) (Percent RPM)	44,500 (109.3%)	44,500 (109.3%)	46,000 (109.5%)	44,500 (109.3%)	46,000 (109.5%)

**Table 504**

Observation	Condition	Limits
Turbine speed droop	Full load	400 rpm (minimum) (1.0 percent)
		1000 rpm (maximum) (2.4 percent)
Fuel control unit leakage	From drive shaft seal	Ten drops per min. (maximum)
	From acceleration limiter drain port	No leakage allowed.
	From acceleration limiter housing vent hole	No leakage allowed.

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 504 (Continued)**

Observation	Condition	Limits
<p><b>NOTE:</b> The maximum exhaust gas temperatures may be exceeded during the start and acceleration period, providing the start time does not exceed the normal limits. If start time has exceeded normal limits, perform hot start check. (Paragraph 10.)</p>		
<p>* The manufacturer recommends the lowered EGT setting to increase the service life of the APU "hot section." The temperature may be adjusted as necessary to meet each individual operator's requirements. Operators are advised that a reduction of EGT will also reduce bleed air flow and can affect cabin temperatures especially under warmer ambient conditions.</p>		

- C. Recommended starter duty cycle: First start or attempt followed by five minutes off. Second start or attempt followed by five minutes off. Third start or attempt followed by one hour off should not be exceeded.

#### 4. APU Operation

**CAUTION:** TO AVOID POSSIBLE DAMAGE TO AIRSTAIR SHROUD WHEN APU IS BEING USED FOR PRESSURIZATION OR AIR-CONDITIONING, MAKE CERTAIN AIR-CONDITIONING PROCEDURES ARE OBSERVED.

##### A. Prestart Checks

- (1) Make certain that air inlet doors and exhaust duct areas are clear of personnel, foreign objects, and loose equipment.
- (2) Remove the safety tags and close these circuit breakers:

##### **EE COMPARTMENT**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
		B1-232	APU POWER PHASE A
		B1-231	APU POWER PHASE B
		B1-230	APU POWER PHASE C

##### **LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL
W	33	B1-814	APU FIRE CENTRAL AURAL WARNING
W	34	B1-405	APU FIRE WARNING HORN
W	35	B1-323	FIRE DETECTORS APU LOOP A
W	36	B1-324	FIRE DETECTORS APU LOOP B
W	42	B1-192	FIRE WARNING LIGHTS
X	35	B1-157	APU OIL PRESSURE & TEMP CAUTION
X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2
Z	41	B1-22	MASTER WARNING
Z	42	B1-227	MASTER CAUTION

##### **LOWER EPC, MISCELLANEOUS RIGHT DC BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
R	26	B1-71	FIREX AGENT LOW PRESSURE CAUTION

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### OVERHEAD EMERGENCY DC BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	12	B1-165	EMERGENCY POWER IN USE LIGHTS

### UPPER EPC, FUEL - LEFT AC BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
H	19	B1-918	FWD RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

### UPPER EPC, GND SERV

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
J	19	B1-919	AFT RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

(3) Check following switch positions.

**Table 505**

Switch	Switch Locations	Position
EXT PWR	Overhead Switch Panel	OFF
BATT	Overhead Switch Panel	OFF
APU MASTER	Overhead Switch Panel	OFF
APU PWR	Overhead Switch Panel	OFF
EMER PWR	Overhead Switch Panel	OFF
APU DOORS	Overhead Switch Panel	AUTO
APU FIRE CONT	Overhead Switch Panel	OFF
APU FIRE AGENT DISCH NO. 1 & 2	Overhead Switch Panel	OFF
APU AIR	Overhead Switch Panel	OFF
APU L & R BUS	Overhead Switch Panel	OFF
EXT PWR L & R BUS	Overhead Switch Panel	OFF
AC BUS X TIE	Overhead Switch Panel	AUTO
DC BUS X TIE	Overhead Switch Panel	OPEN
APU FIRE DETECT LOOPS	Overhead Switch Panel	BOTH
AIR CONDITIONING HP BLD SUPPLY	Overhead Switch Panel	OFF
ICE PROTECT, L & R ENG	Overhead Switch Panel	OFF
ICE PROTECT, WINDSHIELD	Overhead Switch Panel	OFF
ICE PROTECT, L & R AIR FOIL SYS	Overhead Switch Panel	OFF
ENG L & R FUEL HEAT	Overhead Switch Panel	OFF

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 505 (Continued)**

Switch	Switch Locations	Position
ENG START PUMP	Overhead Switch Panel	OFF
ENG IGN	Overhead Switch Panel	OFF

- (4) Check following indicating lights.

**Table 506**

Light	Location	Indication
APU GEN OFF	Overhead Annunciator Panel	OFF
APU FIRE	Overhead Annunciator Panel	OFF
FIRE DETECTOR LOOP	Overhead Annunciator Panel	OFF
APU OIL PRESS LOW	Overhead Annunciator Panel	OFF
APU OIL TEMP HIGH	Overhead Annunciator Panel	OFF
MASTER CAUTION	Pilots Instrument Panel	OFF
MASTER WARNING	Pilots Instrument Panel	OFF

- (5) Check following indicating lights.
- (6) Check that engine fuel levers on pedestal are in OFF position.
- (7) Check that pneumatic crossfeed levers on aft pedestal are in CLOSED position.
- (8) Check following at APU external panel location on left side of aft fuselage.
- (a) APU SHUTOFF switch is in NORMAL position.
  - (b) AGENT 1 & 2 LOW lights are OFF.
  - (c) APU FIRE light is OFF.

**B. APU Air Inlet Doors Operational Check**

- (1) Accomplish prestart check. (Paragraph 4.A.)
- (2) Place BATT switch in ON position.

**WJE 420, 422, 424, 427, 429, 891; without SB 49-36**

- (3) Place APU DOORS switch in NON-RAM position and hold for approximately 5 seconds. Observe that non-ram doors are open, and ram door is partially open at leading edge.
- (4) Place APU DOORS switch in RAM position and hold for approximately 9 seconds. Observe that ram door is fully open. Non-ram doors may be partially open or closed.
- (5) Place APU DOORS switch in NON-RAM position and hold for approximately 8 seconds. Observe that ram door is partially open at leading edge, and non-ram doors are open.

**WJE 420, 422, 424, 427, 429, 891; with SB 49-36**

- (6) Place APU DOORS switch in NON-RAM position and hold for approximately 25 seconds. Observe that non-ram doors are open, and ram door is partially open at leading edge.
- (7) Place APU DOORS switch in RAM position and hold for approximately 40 seconds. Observe that ram door is fully open. Non-ram doors may be partially open or closed.
- (8) Place APU DOORS switch in NON-RAM position and hold for approximately 40 seconds. Observe that ram door is partially open at leading edge, and non-ram doors are open.

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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WJE 420, 422, 424, 427, 429, 891

- (9) Place APU DOORS switch in AUTO position. Observe that ram and non-ram doors are closed.

**WARNING:** BECAUSE OF POTENTIAL APU START, CLEAR ALL PERSONNEL AND EQUIPMENT FROM APU AREA.

**CAUTION:** IF APU STARTS, PLACE MASTER SWITCH IN OFF POSITION AND FIRE CONTROL SWITCH IN APU OFF, AGENT ARM POSITION.

- (10) Place APU MASTER switch in RUN position. Observe that ram door is open and non-ram doors may be open or closed.
- (11) Place APU MASTER switch in OFF position. Observe that ram door begins to close after approximately 30(±3) seconds, and non-ram doors close after ram door closes.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (12) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (13) Place APU DOORS switch in OFF position. Observe that all doors are closed.
- (14) Place MASTER switch to START position and hold for approximately 5 seconds.
- (a) Ram and non-ram doors should remain closed.
- (b) APU should not start.
- (c) If APU starts, place MASTER switch in OFF position, and check starter control wiring for discrepancies.
- (15) Return MASTER switch to OFF position.
- (16) Return APU DOORS switch to AUTO position.
- (17) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 5. Starting

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

A. Start APU as follows:

- (1) Accomplish prestart checks. (Paragraph 4.A.)
- (2) Place BATT switch in ON position.
- (3) Place ENG START PUMP switch in ON position.
- (4) Place APU MASTER switch in momentary START position, no longer than one second, then release to RUN position.
- (5) Verify following:

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(a) APU OIL PRESS LOW caution light comes on momentarily and goes off below 95-percent rpm.

(b) APU tachometer indicates engine rotation within 10 seconds.

NOTE: APU will automatically accelerate to governed speed, and EGT will be indicated on EGT gage.

(6) Observe and record following during acceleration and steady-state operation.

NOTE: APU AIR switch should be placed in OFF position prior to APU RPM no-load governed speed check.

(a) Ambient air temperature

### WJE 420, 422, 424, 427, 429, 891; without SB 49-36 incorp.

(b) Time to reach governed speed - 30 seconds maximum. APU operating with Timed Acceleration Fuel Control. Time to reach governed speed is 55(±15) seconds maximum.

### WJE 420, 422, 424, 427, 429, 891; with SB 49-36

(c) Time to reach governed speed - 40 seconds maximum without SB GTCP 85-49-5196, 40-70 seconds with SB GTCP 85-49-5196 incorporated

### WJE 420, 422, 424, 427, 429, 891

(d) EGT - do not exceed 760°C (1400°F) during acceleration - do not exceed 662°C (1225°F) during steady-state

(e) APU start-up time delay check - startup time delay between reaching governed speed and pneumatic pressure avail ability. Should be 60(±10) seconds.

(f) Pneumatic pressure (pressure indicator on overhead instrument panel) - 35 psig (241.5 kPa) minimum, 61 psig (420.9 kPa) maximum

(g) APU RPM - no load governed speed - 101.4 percent maximum

(h) APU shutdown time delay check - shutdown time delay between APU MASTER switch OFF and APU RPM initial decrease. Should be 60(±10) seconds.

### B. Unsatisfactory Start

(1) Immediately place APU MASTER switch in OFF position, and FIRE CONTROL switch in APU OFF/AGENT ARM position if any of following conditions occur:

(a) APU flame out (indicated by drop in EGT and RPM)

(b) EGT exceeds maximum (760°C (1400°F)) during start and acceleration, or maximum rated EGT (662°C (1225°F)) during steady-state no-load operation (perform hot start check (Paragraph 10.)).

(c) RPM exceeds 110 percent

(d) Hung start (indicated when APU reaches a steady-state condition below governed speed of 95 percent and/or APU EGT increases above 760°C (1400°F)).

## 6. APU Shutdown

A. Shut down APU as follows:

(1) Place APU L & R BUS switches in OFF position.

(2) Place APU MASTER switch in OFF position.

NOTE: APU should shut down within 60(±10) seconds. This is indicated by a decrease in APU EGT and engine RPM.

(3) Place BATT switch in OFF position.

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- (4) Place ENG START pump switch in OFF position.

### 7. Engine Motoring

#### A. Motor APU With Fuel Purge

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- (2) Disconnect igniter coil unit by disconnecting wire No. E605K20 from terminal No. 2, located on accessory drive case.
- (3) Disconnect fuel line at fuel atomizer, and direct fuel line into suitable container.
- (4) Remove the safety tag and close this circuit breaker:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (5) Place BATT switch in ON position.
- (6) Place APU MASTER switch in RUN position.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (7) Motor engine by placing APU MASTER switch momentarily in START position.
- (8) Stop APU by placing MASTER switch or ground control switch in OFF position.
- (9) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (10) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (11) Connect igniter coil unit by connecting wire No. E605K20 to terminal No. 2 located on accessory drive case.
- (12) Connect fuel line to fuel atomizer.
- (13) Place BATT switch in OFF position.

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- (14) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 8. Restart APU After Fire Shutdown

**WARNING:** STARTING APU BEFORE FIRE DAMAGE IS REPAIRED OR MALFUNCTION IS CORRECTED CAN ENDANGER BOTH PERSONNEL AND AIRCRAFT.

#### A. Prepare To Start

**NOTE:** APU should not be restarted after a fire shutdown unless cause has been isolated and corrected, or resultant damage repaired.

- (1) Place APU MASTER switch in OFF position.
- (2) Recharge fire agent. (PAGEBLOCK 26-20-01/201)
- (3) Start APU. (Paragraph 4.)

#### B. Dry Motor Engine

**NOTE:** Engine dry motoring is accomplished when performance of maintenance checks does not require fuel flow.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove the electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (4) Place the BATT switch on the APU panel of the overhead panel to ON position.
- (5) Place APU MASTER switch to RUN position on the APU panel.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (6) Motor engine by placing APU MASTER switch momentarily in START position.
- (7) Stop APU by placing MASTER switch or ground control switch in OFF position.
- (8) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (9) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (10) Reinstall electrical connector P1-101 on the sequencing oil pressure switch.  
 (11) Place BATT switch in OFF position.  
 (12) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 9. Adjustment/Test APU

A. Precautionary Requirements

- (1) Shut down engine immediately if any of following conditions occur during test procedure.
- (a) Tester oil pressure low light (red) remains on within 10 seconds after start.
  - (b) Ignition failure (flameout).
  - (c) Oil pressure displayed on tester oil pressure gage exceeds 80 psig (552 kpa).
  - (d) Failure of tester 35 percent light to come on when start switch is placed in START position, or fails to go off when tester tachometer indicator displays 14,500 to 16,500 rpm.
  - (e) Tester exhaust gas temperature indicator exceeds limits specified in Paragraph 3..
  - (f) Tester tachometer indicator indicates engine speed exceeds 109.5 percent (46,000 rpm), or exceeds 104.5 percent (43,900 rpm) for longer than 10 seconds.

B. Prepare Test Equipment For Use

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect engine electrical harness from receptacle located on left forward side of APU enclosure. (Figure 501)  
 (3) Connect tester cable, AiResearch 290214, or equivalent as follows:
- (a) Connect TESTER end of cable to receptacle located on tester, AiResearch 290122 control panel.
  - (b) Connect ENG CONN end to plug on engine electrical harness.
  - (c) Connect CUSTOMER CABLE to receptacle located on left for-ward side of APU enclosure.

NOTE: Connectors on ends of tester cable are identified by marker bands.

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- (4) Prepare engine test panel located on right side of APU for test by removing caps from following test ports. (Figure 501)
  - (a) Remove cap from outlet fuel test port.
  - (b) Remove cap from control air pressure port.
  - (c) Remove cap from oil pressure port.
- (5) Connect tester control hoses to engine test panel as follows:
  - (a) Connect one end of outlet fuel pressure test hose to tester outlet fuel pressure port and other end to outlet fuel pressure port of engine test panel.
  - (b) Connect one end of control air pressure test hose to tester control air pressure port and other end to control air pressure port of engine test panel.
  - (c) Connect one end of oil pressure test hose to tester oil pressure port and other end to oil pressure port of engine test panel.
- (6) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

NOTE: When removing tester and tester cable, make certain that caps are installed on engine test panel test ports, and that electrical harness is properly connected to airplane wiring.

**C. Test Exhaust Gas Temperature Loop Resistance**

- (1) Remove screws attaching tester control panel to tester. AiResearch 290122, and lift panel to gain access to temperature indicating circuit components. (Figure 501)
- (2) Tag and disconnect lead wires from terminals located at rear of exhaust gas temperature indicator case.
- (3) Connect Wheatstone Bridge, Model 4289-2, to disconnected wire leads (to measure resistance of thermocouple circuit).
- (4) Measure resistance of thermocouple circuit. Resistance should be 8.000 ( $\pm 0.035$ ) ohms.
- (5) If resistance is not within specified limit, adjust slide of variable resistor located in tester to obtain specified resistance.
- (6) Disconnect Wheatstone Bridge from exhaust gas temperature indicator leads.

**CAUTION:** MAKE CERTAIN WHITE CHROMEL WIRE IS CONNECTED TO CR TERMINAL AND GREEN ALUMEL WIRE IS CONNECTED TO AL TERMINAL.

- (7) Connect exhaust gas temperature indicator leads to terminals at rear of indicator case and remove tags.
- (8) Position control panel on tester and install screws.

**D. Check and Adjust Fuel Control Unit Acceleration Limiter Valve Cracking Pressure**

NOTE: Use of tester, AiResearch 290122, is not required for the following test:

- (1) Remove cap from control air pressure test connection port on engine test panel in order to equalize pressure on the acceleration limiter diaphragm. (Figure 502)
- (2) Remove electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove plug from fuel control unit fuel pressure connection.

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- (4) Connect pressure gauge, AiResearch 282645 pressure gage set, to fuel control unit fuel pressure connection.
- (5) Dry Motor APU. (Paragraph 8.B.)
- (6) Note and record acceleration limiter valve cracking pressure at approximately 20 percent (8,000 to 9,000 rpm) engine speed. Acceleration limiter valve cracking pressure should be 58 to 62 psig (400.2 to 427.8 kpa).
- (7) If cracking pressure is not within limits, adjust acceleration limiter valve as follows:
  - (a) Loosen locknut and turn adjustment screw, using screw-driver and wrench assembly, AiResearch 280353. Turn adjusting screw clockwise to increase cracking pressure, and counterclockwise to decrease cracking pressure.
  - (b) When adjustment is satisfactory, tighten locknut, and check cracking pressure in accordance with Paragraph 9.D.(5) and Paragraph 9.D.(6). Safety locknut with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (8) Disconnect pressure gauge and case set assembly from the fuel control unit supply. Reinstall plug
- (9) Reinstall electrical connector P1-101 on the sequencing oil pressure switch. (WDM 49-31-01)
- (10) Install cap on control air pressure connection port of engine test panel.

**WARNING:** FIRE PROTECTION IS NOT AVAILABLE WITH APU ACCESS DOORS OPEN. MAKE CERTAIN FIRE PROTECTION EQUIPMENT IS AVAILABLE PRIOR TO ENGINE START.

E. Test Engine Start, Acceleration, Operation and Actuation of Automatic Controls

**NOTE:** If engine does not operate satisfactorily, shut down engine and correct malfunction.  
(GENERAL, SUBJECT 49-00-00, page 101)

- (1) Connect tester, AiResearch 290122, to engine. (Paragraph 9.B.)
- (2) Place BLEED AIR load switch located on tester control panel, in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester start switch in START position.
- (4) Observe following sequence of events:
  - (a) Oil pressure low light and 35 percent switch come on immediately.
  - (b) Engine starts and accelerates smoothly as evidenced by:
    - 1) Oil pressure indicated on oil pressure gauge.
    - 2) Engine speed indicated on tachometer indicator.
    - 3) Compressor air pressure indicated on control air pressure indicator.
    - 4) Fuel pressure indicated on fuel pressure gauge.
    - 5) Exhaust gas temperature indicated on exhaust gas temperature indicator.



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**CAUTION:** SHUT DOWN ENGINE IMMEDIATELY AND CORRECT MAL-FUNCTION IF EXHAUST GAS TEMPERATURE EXCEEDS LIMITS SPECIFIED IN PARAGRAPH 3. DURING START, ACCELERATION, AND OPERATION OF ENGINE.

- (c) When oil pressure reaches 2.5 to 3.5 psig (17.25 to 24.15 kpa) as indicated on oil pressure gage, fuel flow should be indicated on fuel pressure gage, verifying that fuel solenoid valve has opened.
- (d) When engine speed reaches approximately 35 percent, as displayed on tachometer indicator, 35 percent switch should actuate and open starter circuit indicated by tester 35 percent light going off.
- (e) When oil pressure reaches 55 psig (379.5 kpa) maximum, as indicated on oil pressure gage, oil pressure low light should go off, indicating satisfactory operation of oil low-pressure switch.

**CAUTION:** ENGINE OIL PRESSURE MUST NOT FLUCTUATE MORE THAN 3 PSIG (20.7 KPA) DURING STEADY STATE OPERATION.

- (f) When engine speed reaches approximately 75 percent, as displayed on tachometer indicator, engine oil pressure of 50 to 70 psig (345 to 483 kpa) should be displayed on oil pressure gage. Engine oil pressure should remain at 50 to 70 psig (345 to 483 kpa) for all operation above 75 percent speed.

**NOTE:** Because of pressure drop in oil line between oil pump and test panel connection, a pressure of 60 psig (414 kpa) at oil pressure gage represents a pressure of 90 psig (621 kpa) at oil pump discharge port.

- (5) When engine speed reaches 95 percent, as displayed on tachometer indicator, actuation of 95 percent switch should open ignition circuit and close hourmeter circuit. Hour-meter should start recording engine operating time, and 95 percent light should come on.
- (6) Engine should continue to accelerate, and fuel governor located in fuel control unit should control engine speed at no-load governed speed, 101 to 101.2 percent (42,500 ±100 rpm) maximum, displayed on tachometer indicator.

**NOTE:** Tester tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm.

- (7) Shut down engine, using stop switch on tester panel to energize pneumatic solenoid valve and actuate 110 percent overspeed switch in centrifugal switch.
- (8) Remove tester and tester cable.

### F. Check and Adjust Fuel Control Governor Speed Setting

- (1) Connect tester to engine. (Paragraph 9.B.)
- (2) Place tester LOAD switch in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester START switch in START position and allow engine to accelerate to no-load governed speed.
- (4) With no load applied, engine speed should stabilize at 102.6 percent maximum indicated on tester tachometer indicator.

**NOTE:** Tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm engine speed.

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- (5) If steady-state no-load governed speed is not within limits of 101 to 101.2 percent (42,500  $\pm$ 100 rpm) indicated on tester tachometer indicator, adjust fuel governor as follows:
  - (a) Use screwdriver and wrench assembly, AiResearch 280353, to facilitate adjustment.
  - (b) To increase governor speed, turn adjusting screw clockwise; to decrease speed, turn adjusting screw counterclockwise.
  - (c) When adjustment is satisfactory, tighten locknut, and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### G. Procedure for Adjusting Engine Speed for Engine Operating with Timed ACCEL FUEL CONTROL (TAFCU)

**NOTE:** For any Garrett APU Model GTCP85 operating with TAFCU part number 3608000-X, the engine governed speed can be adjusted if the speed is not within limits.

- (1) While engine is operating at no-load condition, check generator frequency (frequency limit and load condition according to Airframe Manufacturer Specification).
- (2) Remove lockwire from 100 percent governor adjustment and 100 percent governor locknut. (Figure 503, View A)

**CAUTION:** DO NOT REMOVE ADJUSTMENT COVER.

- (3) Using locknut wrench, P/N 833275-1, loosen 100 percent governor locknut while holding 100 percent governor adjustment with adjuster wrench, P/N 833274-1.

**CAUTION:** IN ANY CASE, DO NOT TURN 100 PERCENT GOVERNOR ADJUSTMENT BY MORE THAN A QUARTER TURN. IF ENGINE IS STILL NOT WITHIN LIMITS OR SPEED IS FLUCTUATING, REJECT TAFCU.

- (4) Engine speed is ready to be readjusted when 100 percent governor locknut is loosened. Turning 100 percent governor adjustment CCW will decrease engine speed and turning adjustment CW will increase engine speed.
- (5) When desired speed is attained, tighten 100 percent governor locknut by holding 100 percent governor adjustment and turning 100 percent governor locknut clockwise.
- (6) Recheck engine speed. If not within limits, perform Paragraph 9.G.(3) thru Paragraph 9.G.(5). If within limits, safety governor adjustment and locknut with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### H. Check and Calibrate Pneumatic (Load Control) Thermostat

- (1) Remove engine exhaust gas temperature thermocouple (PAGEBLOCK 49-71-02/201). Install test thermocouple, AiResearch 290416-2.
- (2) Connect test set, AiResearch 290417-2-1, thermocouple cable to test thermocouple and exhaust gas temperature indicator on test set.
- (3) Check pneumatic (load control) thermostat temperature control point as follows:
  - (a) Start engine in accordance with Paragraph 4..

**NOTE:** If APU is not fully loaded, it is impossible to determine the setpoint of an installed thermostat. To properly load APU, it is necessary to impose a potential overload on the APU to insure that the thermostat is fully open and at its control temperature setpoint.

- (b) Open engine load control valve and turn on both air-conditioning packs (do not select "AIR CONDITIONING COLDER" position). Allow EGT to stabilize.



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**CAUTION:** DO NOT ALLOW TURBINE DISCHARGE TEMPERATURE TO EXCEED LIMITS SPECIFIED IN FIGURE.

- (c) Record EGT. If EGT is not within limits specified in Table 507, calibrate thermostat in accordance with Paragraph 9.H.(4).

**NOTE:** To avoid hot shutdown, remove load and operate for one minute at no-load condition prior to shutting down engine.

- (d) Remove pneumatic load and allow temperature to stabilize, then shut down engine.
- (4) Calibrate pneumatic (load control) thermostat, if required, as follows.

- (a) Determine thermostat control cracking temperature in accordance with Paragraph 9.H.(3).

**NOTE:** A locking device, two self-locking helicoil inserts, is incorporated in the thermostat adjustment collar to prevent collar from rotating and changing calibration in service. To ensure integrity of locking device, torque on adjustment collar should be checked during adjustment. If running torque of adjustment collar is less 20 inch-pounds (2.26 N·m), thermostat must be replaced.

**Table 507 Engine Exhaust Gas Temperature (EGT) Setting**

EGT Measurement	Pneumatic (Load Mode) Thermostat	
Test Set Thermocouple (GTCP85-98DHF)	Max 630°C(1166°F)	*Recommended 574(+0, -10)°C (1066(+0, -20)°F)
Test Set Thermocouple (GTCP85-98DC(B))	Max 677°C(1250°F)	Recommended 621°C(1150°F)
* Manufacturer recommends these lowered temperature settings to increase service life of engine "hot" section. These temperatures may be adjusted as necessary to meet each individual operators requirements. Operators are advised that a reduction of EGT will reduce bleed airflow and can affect cabin temperatures under warmer ambient conditions.		

- (b) Calibrate pneumatic thermostat to required setting as follows:

**NOTE:** Each index mark on adjustment collar is equivalent to 2°C (4°F).

- 1) Rotate adjustment collar clockwise (viewed from fitting end) to increase temperature setting.
- 2) Rotate adjustment collar counterclockwise to decrease temperature setting.
- (c) Check temperature control point in accordance with Paragraph 9.H.(3). Controlling temperature should repeat within 3°C (5°F) for two consecutive checks.
- (5) Remove test thermocouple from engine. Install engine exhaust gas temperature thermocouple. (PAGEBLOCK 49-71-02/201)
- I. Check Oil Pressure Relief Valve Setting
  - (1) Connect tester to engine. (Paragraph 9.B.)
  - (2) Place LOAD switch in OFF position.

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**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed. Run engine approximately 2 minutes to stabilize operation.

**NOTE:** Because of the pressure drop in the oil line between the oil pump discharge port and APU test panel, a pressure of 70 psig (483 kpa) at the APU test panel represents a pressure of 100 psig (690 kpa) at the oil pump discharge port. Oil pressure fluctuations should not exceed 10 psig (69 kpa) during steady state operation.

- (4) Observe oil pressure indicated on oil pressure gage located on tester control panel. If oil pressure is not within 70( $\pm$ 10) psig (483( $\pm$ 10) kpa) APU test panel, (100( $\pm$ 10) psig (690( $\pm$ 69) kpa) oil pump discharge port), during steady state operation, adjust oil pressure relief valve cracking pressure as follows:
  - (a) Loosen locknut and turn valve metering screw clockwise to increase cracking pressure. (Figure 502)
  - (b) Turn valve metering screw counterclockwise to decrease cracking pressure.
  - (c) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### J. Check and Adjust Air Pressure Regulator Output Pressure

- (1) Connect engine to tester. (Paragraph 9.B.)
- (2) Remove cap from tee fitting located in outlet air pressure line between air pressure regulator and load control valve. (Figure 502)
- (3) Connect one end of control air pressure hose to tee fitting and other end to control air pressure coupling on tester.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (4) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed.
- (5) Observe pressure indicated on control air pressure gage. Pressure should be 37.6 to 39.7 in/hg (1270.278 to 1341.225 mbar) (18.5 to 19.5 psig (127.6 to 134.5 kpa)).
- (6) If regulated outlet pressure is not within specified limits, shut down engine, and proceed as follows:
  - (a) Loosen locknut on end of air pressure regulator and turn adjustment screw clockwise to increase outlet pressure.
  - (b) Turn adjustment screw counterclockwise to decrease outlet pressure.
  - (c) Tighten locknut and repeat check procedure.
- (7) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### K. Check and Adjust Load Control Valve Opening Rate (Figure 502)

- (1) APU should be operating and stabilized at steady-state no-load RPM.
- (2) Open both pneumatic crossfeed valves.

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- (3) Turn both air conditioning packs on.
- (4) Place APU AIR switch to ON position.
- (5) Pneumatic manifold pressure should peak and stabilize within 7 to 14 seconds.
- (6) If opening time is not within limits, proceed as follows:

**CAUTION:** DO NOT BOTTOM RATE ADJUSTMENT SCREW IN LOAD CONTROL VALVE, OR DAMAGE TO LOAD CONTROL VALVE COULD RESULT.

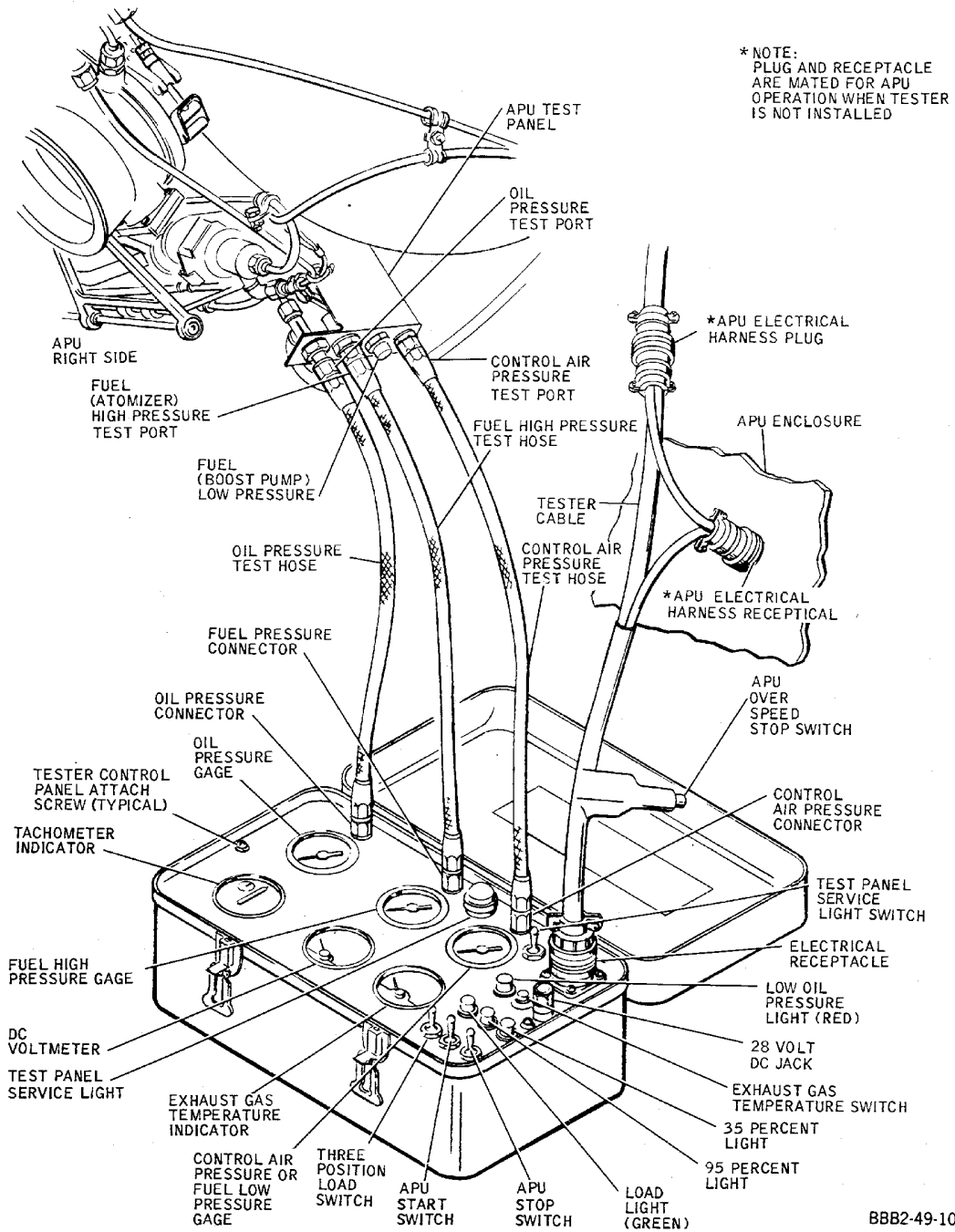
- (a) Hold load control valve rate adjustment screw and loosen locknut.
  - (b) Turn rate adjustment screw clockwise to increase opening time.
  - (c) Turn rate adjustment screw counterclockwise to decrease opening time.
  - (d) Hold adjustment screw and tighten locknut.
- (7) Repeat procedures, Paragraph 9.K.(1) thru Paragraph 9.K.(6), until opening time is within required limits.

### L. Check Accessory Gear Case Negative Pressure

**NOTE:** Check shall only be accomplished during trouble shooting to determine cause of high oil consumption or notice-able oil smoke from exhaust. Connection of tester, AiResearch 290122, is not required for this check.

- (1) Remove vent plug from vent port on front of accessory drive gear case (Figure 502).
- (2) Install a suitable bulkhead tee fitting in vent port. Install cap, with 0.035 to 0.040 inch (.088 to .1 cm) orifice in one of tee outlets.
- (3) Connect a suitable flexible hose to tee fitting and connect other end of hose to compound pressure gage, AiResearch 282645 pressure gage set.
- (4) Start engine. (Paragraph 4.)
- (5) Allow engine to accelerate to no-load governed speed and run for approximately two minutes to stabilize operation.
- (6) Observe pressure reading on negative pressure gage; pressure should be -3 to -10 inches of mercury.
- (7) Shut down engine. (Paragraph 6.)
- (8) Remove flexible hose, pressure gage, and tee fitting.
- (9) Install vent plug in accessory drive gear case and safety vent plug with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

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**APU Tester -- Connections**  
**Figure 501/49-00-00-990-841**

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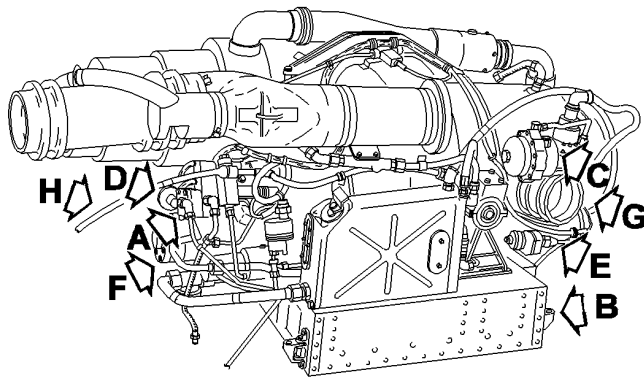
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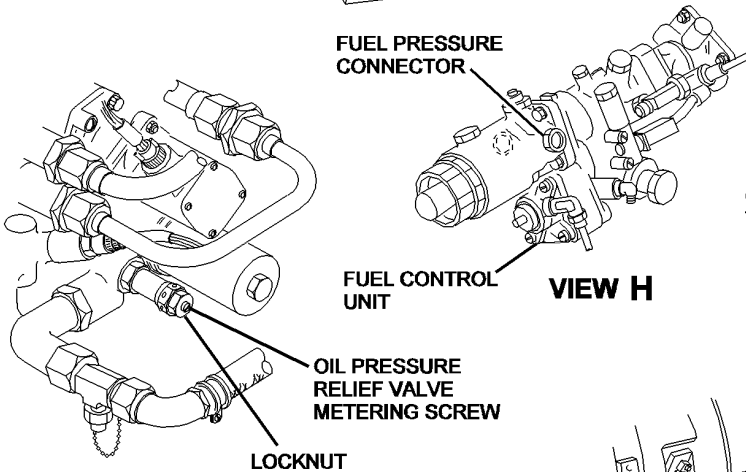
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FUEL CONTROL GOVERNOR  
ADJUSTMENT SCREW

ACCELERATION  
LIMITER  
ADJUSTMENT  
SCREW

**VIEW A  
FUEL CONTROL UNIT**



FUEL PRESSURE  
CONNECTOR

FUEL CONTROL  
UNIT

OIL PRESSURE  
RELIEF VALVE  
METERING SCREW

LOCKNUT

**VIEW F**

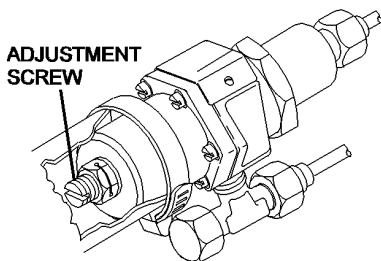
FUEL (BOOST PUMP)  
LOW PRESSURE  
TEST PORT

OIL PRESSURE  
TEST PORT

FUEL (ATOMIZER)  
HIGH PRESSURE  
TEST PORT

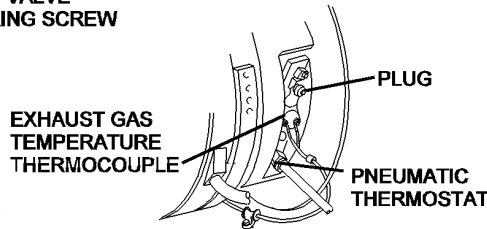
CONTROL AIR  
PRESSURE  
TEST PORT

**VIEW B  
ENGINE TEST PANEL**



ADJUSTMENT  
SCREW

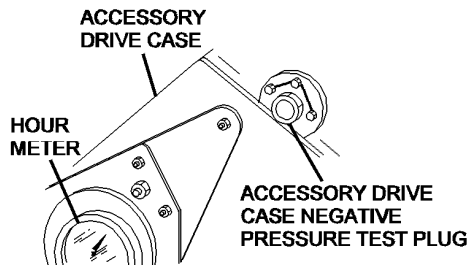
**VIEW E  
AIR PRESSURE  
REGULATOR**



EXHAUST GAS  
TEMPERATURE  
THERMOCOUPLE

PNEUMATIC  
THERMOSTAT

**VIEW G  
(ROTATED 90 )**

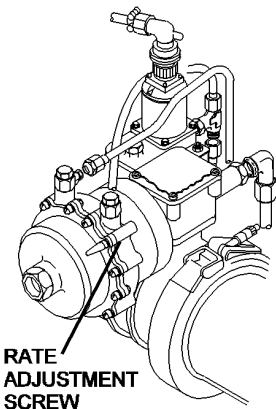


ACCESSORY  
DRIVE CASE

HOUR  
METER

ACCESSORY DRIVE  
CASE NEGATIVE  
PRESSURE TEST PLUG

**VIEW D  
PRESSURE TEST PLUG**



RATE  
ADJUSTMENT  
SCREW

**VIEW C  
LOAD CONTROL VALVE**

BBB2-49-11C  
S0008552042V2

APU -- Adjustment/Test  
Figure 502/49-00-00-990-842

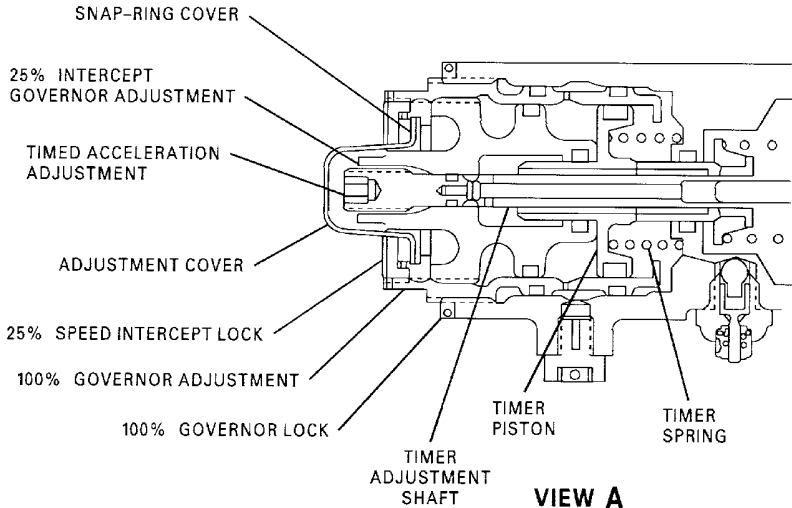
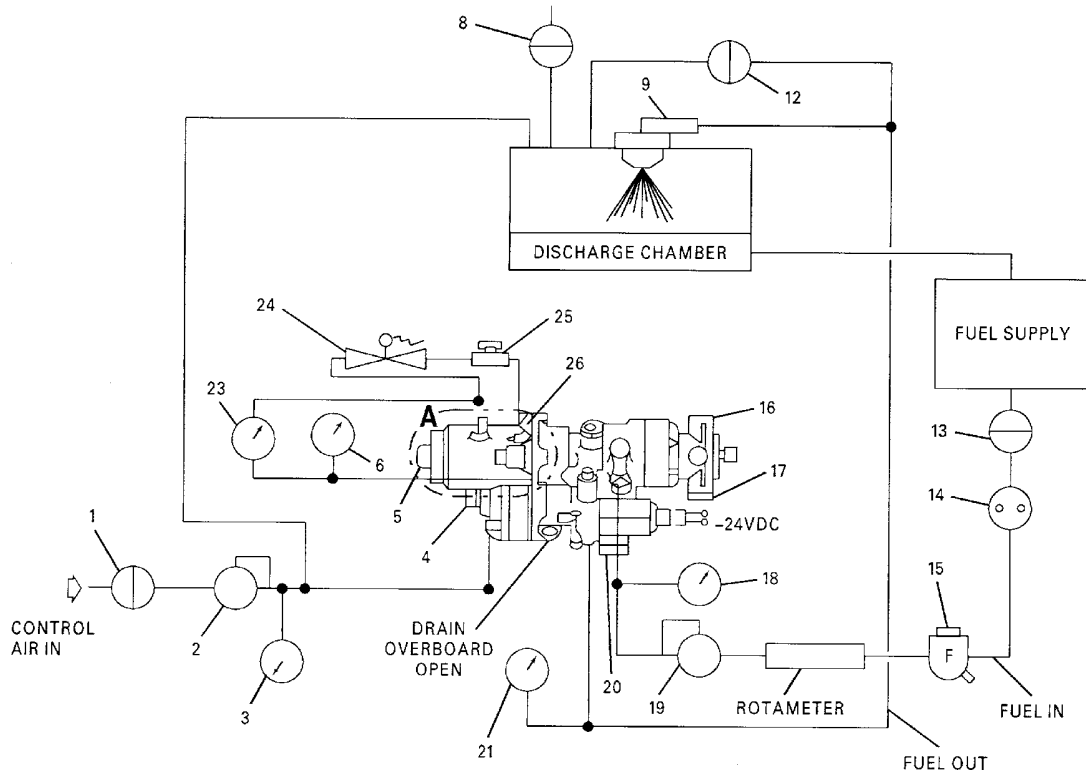
EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

TP-80MM-WJE

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**NOTE:**  
CLOCKWISE ROTATION  
OF ALL ADJUSTMENTS  
INCREASE VALUES

**VIEW A**  
**GOVERNOR ACCELERATION LIMITER  
ADJUSTMENTS**

CAG(IGDS)

BBB2-49-190

**Governor Acceleration Adjustments  
Figure 503/49-00-00-990-843**

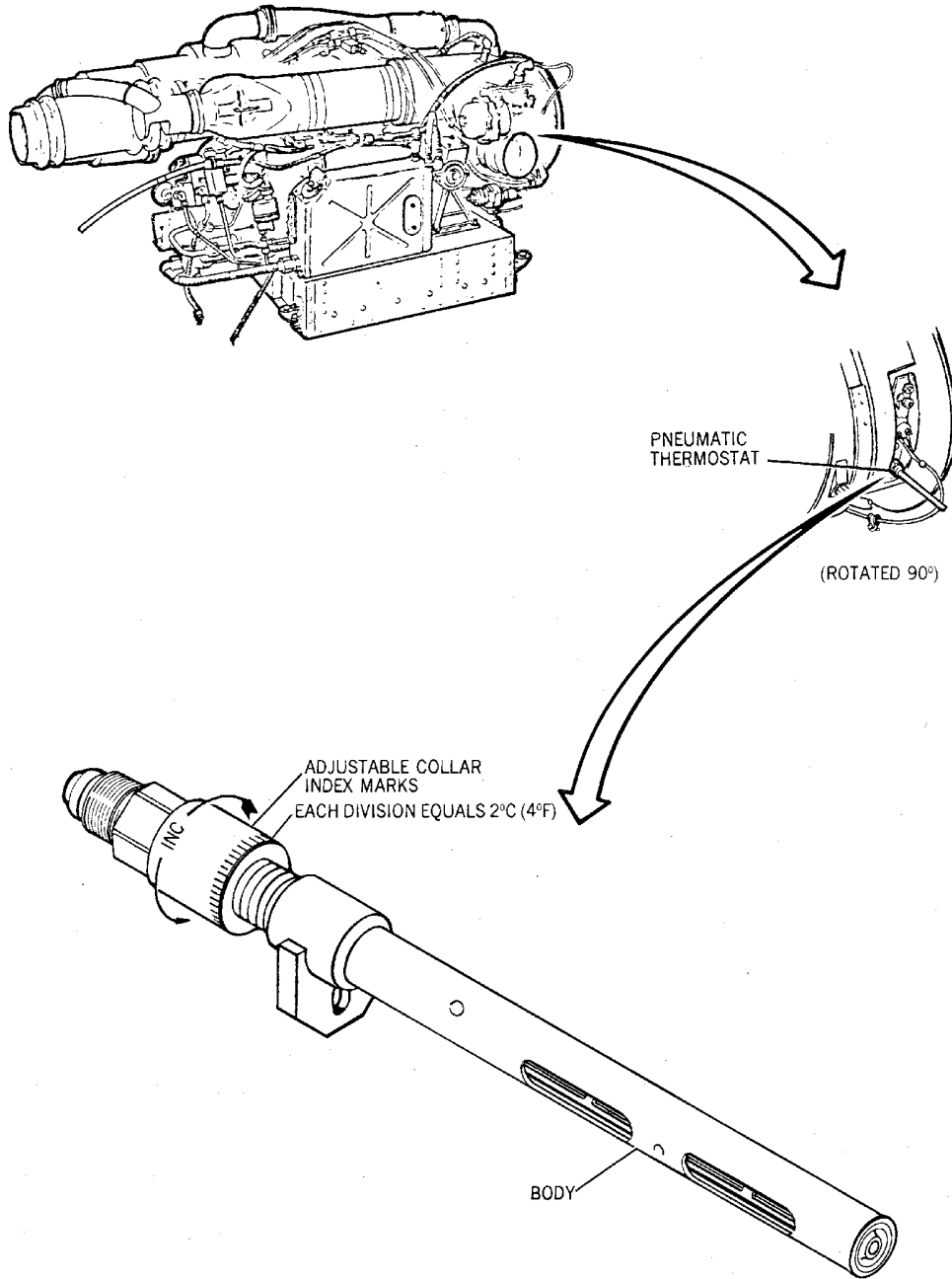
EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-97A

**Pneumatic Thermostat -- Adjustment**  
**Figure 504/49-00-00-990-844**

EFFECTIVITY  
WJE 420, 422, 424, 427, 429, 891

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 10. Hot Start Check

#### A. Perform Hot Start Check

- (1) Remove combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
- (2) Visually check hot section components to extent that components are visible through combustion unit opening in turbine plenum.  
NOTE: Normally available equipment, light, mirror, fiber optics, should be used to check components.
- (3) Check hot section components for evidence of distress.
  - (a) Turbine wheel blade tips for erosion/burning.
  - (b) Turbine wheel blades for erosion/rubbing.
  - (c) Turbine nozzle guide vanes for erosion.
  - (d) Turbine torus assembly for erosion.
- (4) If distress is indicated, remove APU for overhaul.
- (5) If no distress is indicated, APU may continue in service.
  - (a) Install replacement combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
  - (b) Replace fuel control unit. (FUEL CONTROL UNIT, SUBJECT 49-30-01)
  - (c) Check calibration of pneumatic thermostat. (Paragraph 9.H.)
  - (d) Check turbine plenum drain for obstructions.
  - (e) Check aircraft battery voltage (22 vdc minimum or 26 vdc minimum with charger connected).

### 11. Check for Turbine Wheel Failure

#### A. Indications Of Possible Turbine Wheel Failure

- (1) Flight compartment
  - (a) Sudden loss of APU RPM indication to zero.
  - (b) Sudden loss of APU EGT indication to zero.
  - (c) APU OIL PRESS LOW light comes ON.
  - (d) If during start sequence, APU STARTED circuit breaker may pop open.

#### B. Checks To Confirm Turbine Wheel Failure

- (1) Check inside turbine exhaust duct for fragments.
- (2) Remove combustion chamber liner and flex borescope.
- (3) If turbine wheel failure is confirmed:
  - (a) Check turbine plenum for perforations.
  - (b) Check exterior of turbine plenum for distortion.
- (4) If perforations in plenum exist, check APU compartment including walls, lines, wiring, and surrounding structure for damage.
- (5) If APU compartment walls are perforated, check tailcone wall, wiring, lines, and surrounding structure for damage.



# MD-80 AIRCRAFT MAINTENANCE MANUAL

## GENERAL - ADJUSTMENT/TEST

### 1. General

- A. The use of suitable test equipment will permit adjustment and test of the APU while the unit is installed in the airplane. A convenient source of 28(±2)-volt dc is required for operating test equipment.

**WARNING:** PERSONNEL MUST STAND CLEAR OF APU AND TURBINE EXHAUST DURING GROUND OPERATIONS.

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

- B. Adjustment of the auxiliary power unit is required to ensure optimum operation and to prolong the life of the unit. The following information outlines recommended methods for starting, stopping, motoring, adjusting, and testing the APU.
- C. The APU left and right access doors should be closed during engine runups to protect personnel, and to ensure containment of fire agent should a fire shutdown occur. The access doors may be left open, if desired, during motoring operations, since fuel and ignition will not be applied.
- D. The APU exhaust cooling air inlet and exit duct covers and exhaust duct covers must be removed.
- E. The APU air inlet doors and exhaust discharge area should be cleared of personnel, foreign objects, and loose equipment.
- F. All overboard drains in bottom of APU support box should be open and free of obstruction.
- G. Maintenance should not be performed on any APU system while that system is in operation.
- H. All systems associated with the APU should be serviced before operation.
- I. The APU can be started using the aircraft battery.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**Table 501**

Name and Number	Manufacturer
APU tester, 290122-400 <sup>*[1]</sup>	AiResearch
APU tester, 290122-500 <sup>*[2]</sup>	AiResearch
APU tester cable, 290214-3-1	AiResearch
Wheatstone Bridge Model 4289-2	Leads and Northrup
Pressure gage test set, 282645	AiResearch
Test Thermocouple 290416-2	AiResearch
Test set 290417-2-1	AiResearch

**EFFECTIVITY**

**WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 501 (Continued)**

Name and Number	Manufacturer
Suitable container, approximately 5 US gallons (4.2 Imperial gallons, 18.9 liters)	Commercially available
Screwdriver and Wrench Assembly, 280253	AiResearch
Lockwire, NASM20995N32, DPM 684	Not Specified

\*[1] For aircraft with APU EGT in degrees F.

\*[2] For aircraft with APU EGT in degrees C.

### 3. APU Operating Limits

A. The following model Garrett APUs have been certified for the MD-80 aircraft.

**Table 502**

Model	Part Number
GTCP85-98D	380256-1
GTCP85-98W	380482-1
GTCP85-98DCK	381015-1
GTCP85-98DC(A)	3800362-1
GTCP85-98DC(B)	3800368-1
GTCP85-98DC(C)	3800440-1
GTCP85-98DHF	381276-1
GTCP85-98DHF(A)	381276-2
GTCP85-98DHF(B)	381276-3
GTCP85-98DHF(C)	381276-4

**CAUTION:** APU OPERATING WITH EXHAUST GAS TEMPERATURE ABOVE CONTINUOUS OPERATION LIMITS IS EVIDENCE OF ENGINE DISTRESS. APPROPRIATE CORRECTIVE ACTION SHOULD BE TAKEN TO RESTORE NORMAL OPERATION.

B. APU should not exceed the following limits during operation:

**EFFECTIVITY**

**WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 503**

Observation	Condition	GTCP85-98 Limits				
		D, W	DCK	DHF, DHF(A), (B), (C)	DC(A)	DC(B), (C)
Exhaust Gas Temperature (EGT)	Starting and acceleration (Maximum EGT)	760° (1400°F)	760°C (1400°F)	760°C (1400°F)	760°C (1400°F)	760° (1400°F)
	Recommended Operation (Maximum recommended for longer engine life)	621° (1150°F)	574°C (1066°F)	574°C (1066°F)	621°C (1150°F)	621°C (1150°F)
	Continuous Operation	710°C (1310°F)	630°C (1166°F)	630°C (1166°F)	677°C (1250°F)	677°C (1250°F)
	Never Exceed (Maximum Operation)	732°C (1350°F)	663°C (1225°F)	663°C (1225°F)	710°C (1310°F)	710°C (1310°F)
Turbine Speed	Continuous Operation (No Load) %RPM	41,100 ±100 (100.9%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)	41,700 ±100 (102.4%)	42,500 ±100 (101.2%)
	Continuous Operation (Full governed load)	40,400 ±200 (99.2%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)	40,900 ±300 (100.5%)	42,200 ±400 (100.7%)
	100 percent RPM	40,700	40,700	42,000	40,700	42,000
	Not To Exceed 10 Seconds (%RPM)	42,500 (104.4%)	42,500 (104.4%)	43,900 (104.5%)	42,500 (104.4%)	43,900 (104.5%)
	Absolute Maximum (RPM) (Percent RPM)	44,500 (109.3%)	44,500 (109.3%)	46,000 (109.5%)	44,500 (109.3%)	46,000 (109.5%)

**Table 504**

Observation	Condition	Limits
Turbine speed droop	Full load	400 rpm (minimum) (1.0 percent)
		1000 rpm (maximum) (2.4 percent)
Fuel control unit leakage	From drive shaft seal	Ten drops per min. (maximum)
	From acceleration limiter drain port	No leakage allowed.
	From acceleration limiter housing vent hole	No leakage allowed.

**EFFECTIVITY**

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 504 (Continued)**

Observation	Condition	Limits
<p><b>NOTE:</b> The maximum exhaust gas temperatures may be exceeded during the start and acceleration period, providing the start time does not exceed the normal limits. If start time has exceeded normal limits, perform hot start check. (Paragraph 10.)</p>		
<p>* The manufacturer recommends the lowered EGT setting to increase the service life of the APU "hot section." The temperature may be adjusted as necessary to meet each individual operator's requirements. Operators are advised that a reduction of EGT will also reduce bleed air flow and can affect cabin temperatures especially under warmer ambient conditions.</p>		

- C. Recommended starter duty cycle: First start or attempt followed by five minutes off. Second start or attempt followed by five minutes off. Third start or attempt followed by one hour off should not be exceeded.

#### 4. APU Operation

**CAUTION:** TO AVOID POSSIBLE DAMAGE TO AIRSTAIR SHROUD WHEN APU IS BEING USED FOR PRESSURIZATION OR AIR-CONDITIONING, MAKE CERTAIN AIR-CONDITIONING PROCEDURES ARE OBSERVED.

##### A. Prestart Checks

- (1) Make certain that air inlet doors and exhaust duct areas are clear of personnel, foreign objects, and loose equipment.
- (2) Remove the safety tags and close these circuit breakers:

##### **EE COMPARTMENT**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
		B1-232	APU POWER PHASE A
		B1-231	APU POWER PHASE B
		B1-230	APU POWER PHASE C

##### **LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL
W	33	B1-814	APU FIRE CENTRAL AURAL WARNING
W	34	B1-405	APU FIRE WARNING HORN
W	35	B1-323	FIRE DETECTORS APU LOOP A
W	36	B1-324	FIRE DETECTORS APU LOOP B
W	42	B1-192	FIRE WARNING LIGHTS

**WJE 405, 407-409, 411, 416, 425, 426, 861, 862, 868, 880, 881, 883, 884**

X	35	B1-157	APU OIL PRESSURE & TEMP CAUTION
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**WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884**

X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2
Z	41	B1-22	MASTER WARNING
Z	42	B1-227	MASTER CAUTION

##### EFFECTIVITY

**WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### LOWER EPC, MISCELLANEOUS RIGHT DC BUS

Row   Col   Number   Name

WJE 405, 407-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

R      26    B1-71      FIREX AGENT LOW PRESSURE CAUTION

### OVERHEAD BATTERY BUS

Row   Col   Number   Name

WJE 406, 875-879

B      20    B1-779      APU START ADVISORY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

B      21    B1-291      APU CONTROL

### OVERHEAD EMERGENCY DC BUS

Row   Col   Number   Name

WJE 405-409, 411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

A      12    B1-165      EMERGENCY POWER IN USE LIGHTS

WJE 410

A      13    B1-165      EMERGENCY POWER IN USE LIGHTS

### UPPER EPC, FUEL - LEFT AC BUS

Row   Col   Number   Name

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

H      19    B1-918      FWD RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

### UPPER EPC, GND SERV

Row   Col   Number   Name

J      19    B1-919      AFT RIGHT FUEL TANK BOOST PUMP PHASE A, B, & C

- (3) Check following switch positions.

**Table 505**

Switch	Switch Locations	Position
EXT PWR	Overhead Switch Panel	OFF
BATT	Overhead Switch Panel	OFF
APU MASTER	Overhead Switch Panel	OFF
APU PWR	Overhead Switch Panel	OFF
EMER PWR	Overhead Switch Panel	OFF
APU DOORS	Overhead Switch Panel	AUTO
APU FIRE CONT	Overhead Switch Panel	OFF
APU FIRE AGENT DISCH NO. 1 & 2	Overhead Switch Panel	OFF
APU AIR	Overhead Switch Panel	OFF

**EFFECTIVITY**

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 505 (Continued)**

Switch	Switch Locations	Position
APU L & R BUS	Overhead Switch Panel	OFF
EXT PWR L & R BUS	Overhead Switch Panel	OFF
AC BUS X TIE	Overhead Switch Panel	AUTO
DC BUS X TIE	Overhead Switch Panel	OPEN
APU FIRE DETECT LOOPS	Overhead Switch Panel	BOTH
AIR CONDITIONING HP BLD SUPPLY	Overhead Switch Panel	OFF
ICE PROTECT, L & R ENG	Overhead Switch Panel	OFF
ICE PROTECT, WINDSHIELD	Overhead Switch Panel	OFF
ICE PROTECT, L & R AIR FOIL SYS	Overhead Switch Panel	OFF
ENG L & R FUEL HEAT	Overhead Switch Panel	OFF
ENG START PUMP	Overhead Switch Panel	OFF
ENG IGN	Overhead Switch Panel	OFF

(4) Check following indicating lights.

**Table 506**

Light	Location	Indication
APU GEN OFF	Overhead Annunciator Panel	OFF
APU FIRE	Overhead Annunciator Panel	OFF
FIRE DETECTOR LOOP	Overhead Annunciator Panel	OFF
APU OIL PRESS LOW	Overhead Annunciator Panel	OFF
APU OIL TEMP HIGH	Overhead Annunciator Panel	OFF
MASTER CAUTION	Pilots Instrument Panel	OFF
MASTER WARNING	Pilots Instrument Panel	OFF

(5) Check following indicating lights.

(6) Check that engine fuel levers on pedestal are in OFF position.

(7) Check that pneumatic crossfeed levers on aft pedestal are in CLOSED position.

(8) Check following at APU external panel location on left side of aft fuselage.

(a) APU SHUTOFF switch is in NORMAL position.

(b) AGENT 1 & 2 LOW lights are OFF.

(c) APU FIRE light is OFF.

**B. APU Air Inlet Doors Operational Check**

(1) Accomplish prestart check. (Paragraph 4.A.)

(2) Place BATT switch in ON position.

(3) Place APU DOORS switch in NON-RAM position and hold for approximately 25 seconds. Observe that non-ram doors are open, and ram door is partially open at leading edge.

**EFFECTIVITY**

**WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884**

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- (4) Place APU DOORS switch in RAM position and hold for approximately 40 seconds. Observe that ram door is fully open. Non-ram doors may be partially open or closed.
- (5) Place APU DOORS switch in NON-RAM position and hold for approximately 40 seconds. Observe that ram door is partially open at leading edge, and non-ram doors are open.
- (6) Place APU DOORS switch in AUTO position. Observe that ram and non-ram doors are closed.

**WARNING:** BECAUSE OF POTENTIAL APU START, CLEAR ALL PERSONNEL AND EQUIPMENT FROM APU AREA.

**CAUTION:** IF APU STARTS, PLACE MASTER SWITCH IN OFF POSITION AND FIRE CONTROL SWITCH IN APU OFF, AGENT ARM POSITION.

- (7) Place APU MASTER switch in RUN position. Observe that ram door is open and non-ram doors may be open or closed.
- (8) Place APU MASTER switch in OFF position. Observe that ram door begins to close after approximately 30(±3) seconds, and non-ram doors close after ram door closes.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (9) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (10) Place APU DOORS switch in OFF position. Observe that all doors are closed.
- (11) Place MASTER switch to START position and hold for approximately 5 seconds.
  - (a) Ram and non-ram doors should remain closed.
  - (b) APU should not start.
  - (c) If APU starts, place MASTER switch in OFF position, and check starter control wiring for discrepancies.
- (12) Return MASTER switch to OFF position.
- (13) Return APU DOORS switch to AUTO position.
- (14) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**5. Starting**

**CAUTION:** MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

- A. Start APU as follows:
  - (1) Accomplish prestart checks. (Paragraph 4.A.)
  - (2) Place BATT switch in ON position.
  - (3) Place ENG START PUMP switch in ON position.

EFFECTIVITY <b>WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884</b>
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- (4) Place APU MASTER switch in momentary START position, no longer than one second, then release to RUN position.
- (5) Verify following:
  - (a) APU OIL PRESS LOW caution light comes on momentarily and goes off below 95-percent rpm.
  - (b) APU tachometer indicates engine rotation within 10 seconds.  
NOTE: APU will automatically accelerate to governed speed, and EGT will be indicated on EGT gage.
- (6) Observe and record following during acceleration and steady-state operation.  
NOTE: APU AIR switch should be placed in OFF position prior to APU RPM no-load governed speed check.
  - (a) Ambient air temperature
  - (b) Time to reach governed speed - 40 seconds maximum without SB GTCP 85-49-5196, 40-70 seconds with SB GTCP 85-49-5196 incorporated
  - (c) EGT - do not exceed 760°C (1400°F) during acceleration - do not exceed 662°C (1225°F) during steady-state
  - (d) APU start-up time delay check - startup time delay between reaching governed speed and pneumatic pressure availability. Should be 60(±10) seconds.
  - (e) Pneumatic pressure (pressure indicator on overhead instrument panel) - 35 psig (241.5 kPa) minimum, 61 psig (420.9 kPa) maximum
  - (f) APU RPM - no load governed speed - 101.4 percent maximum
  - (g) APU shutdown time delay check - shutdown time delay between APU MASTER switch OFF and APU RPM initial decrease. Should be 60(±10) seconds.

### B. Unsatisfactory Start

- (1) Immediately place APU MASTER switch in OFF position, and FIRE CONTROL switch in APU OFF/AGENT ARM position if any of following conditions occur:
  - (a) APU flame out (indicated by drop in EGT and RPM)
  - (b) EGT exceeds maximum (760°C (1400°F)) during start and acceleration, or maximum rated EGT (662°C (1225°F)) during steady-state no-load operation (perform hot start check (Paragraph 10.)).
  - (c) RPM exceeds 110 percent
  - (d) Hung start (indicated when APU reaches a steady-state condition below governed speed of 95 percent and/or APU EGT increases above 760°C (1400°F)).

## 6. APU Shutdown

### A. Shut down APU as follows:

- (1) Place APU L & R BUS switches in OFF position.
- (2) Place APU MASTER switch in OFF position.  
NOTE: APU should shut down within 60(±10) seconds. This is indicated by a decrease in APU EGT and engine RPM.
- (3) Place BATT switch in OFF position.
- (4) Place ENG START pump switch in OFF position.

EFFECTIVITY  
WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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### 7. Engine Motoring

#### A. Motor APU With Fuel Purge

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- (2) Disconnect igniter coil unit by disconnecting wire No. E605K20 from terminal No. 2, located on accessory drive case.
- (3) Disconnect fuel line at fuel atomizer, and direct fuel line into suitable container.
- (4) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (5) Place BATT switch in ON position.
- (6) Place APU MASTER switch in RUN position.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (7) Motor engine by placing APU MASTER switch momentarily in START position.
- (8) Stop APU by placing MASTER switch or ground control switch in OFF position.
- (9) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (10) Open this circuit breaker and install safety tag:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (11) Connect igniter coil unit by connecting wire No. E605K20 to terminal No. 2 located on accessory drive case.
- (12) Connect fuel line to fuel atomizer.
- (13) Place BATT switch in OFF position.

<p>EFFECTIVITY</p> <p>WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884</p>
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- (14) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 8. Restart APU After Fire Shutdown

**WARNING:** STARTING APU BEFORE FIRE DAMAGE IS REPAIRED OR MALFUNCTION IS CORRECTED CAN ENDANGER BOTH PERSONNEL AND AIRCRAFT.

#### A. Prepare To Start

**NOTE:** APU should not be restarted after a fire shutdown unless cause has been isolated and corrected, or resultant damage repaired.

- (1) Place APU MASTER switch in OFF position.
- (2) Recharge fire agent. (PAGEBLOCK 26-20-01/201)
- (3) Start APU. (Paragraph 4.)

#### B. Dry Motor Engine

**NOTE:** Engine dry motoring is accomplished when performance of maintenance checks does not require fuel flow.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove the electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (4) Place the BATT switch on the APU panel of the overhead panel to ON position.
- (5) Place APU MASTER switch to RUN position on the APU panel.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (6) Motor engine by placing APU MASTER switch momentarily in START position.
- (7) Stop APU by placing MASTER switch or ground control switch in OFF position.
- (8) If APU ground control switch was used to stop unit, make certain MASTER switch is in OFF position.

#### EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (9) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (10) Reinstall electrical connector P1-101 on the sequencing oil pressure switch.  
 (11) Place BATT switch in OFF position.  
 (12) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### 9. Adjustment/Test APU

A. Precautionary Requirements

- (1) Shut down engine immediately if any of following conditions occur during test procedure.
- (a) Tester oil pressure low light (red) remains on within 10 seconds after start.
  - (b) Ignition failure (flameout).
  - (c) Oil pressure displayed on tester oil pressure gage exceeds 80 psig (552 kpa).
  - (d) Failure of tester 35 percent light to come on when start switch is placed in START position, or fails to go off when tester tachometer indicator displays 14,500 to 16,500 rpm.
  - (e) Tester exhaust gas temperature indicator exceeds limits specified in Paragraph 3..
  - (f) Tester tachometer indicator indicates engine speed exceeds 109.5 percent (46,000 rpm), or exceeds 104.5 percent (43,900 rpm) for longer than 10 seconds.

B. Prepare Test Equipment For Use

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect engine electrical harness from receptacle located on left forward side of APU enclosure. (Figure 501)  
 (3) Connect tester cable, AiResearch 290214, or equivalent as follows:
- (a) Connect TESTER end of cable to receptacle located on tester, AiResearch 290122 control panel.
  - (b) Connect ENG CONN end to plug on engine electrical harness.
  - (c) Connect CUSTOMER CABLE to receptacle located on left forward side of APU enclosure.

NOTE: Connectors on ends of tester cable are identified by marker bands.

EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

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- (4) Prepare engine test panel located on right side of APU for test by removing caps from following test ports. (Figure 501)
  - (a) Remove cap from outlet fuel test port.
  - (b) Remove cap from control air pressure port.
  - (c) Remove cap from oil pressure port.
- (5) Connect tester control hoses to engine test panel as follows:
  - (a) Connect one end of outlet fuel pressure test hose to tester outlet fuel pressure port and other end to outlet fuel pressure port of engine test panel.
  - (b) Connect one end of control air pressure test hose to tester control air pressure port and other end to control air pressure port of engine test panel.
  - (c) Connect one end of oil pressure test hose to tester oil pressure port and other end to oil pressure port of engine test panel.
- (6) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

NOTE: When removing tester and tester cable, make certain that caps are installed on engine test panel test ports, and that electrical harness is properly connected to airplane wiring.

#### C. Test Exhaust Gas Temperature Loop Resistance

- (1) Remove screws attaching tester control panel to tester. AiResearch 290122, and lift panel to gain access to temperature indicating circuit components. (Figure 501)
- (2) Tag and disconnect lead wires from terminals located at rear of exhaust gas temperature indicator case.
- (3) Connect Wheatstone Bridge, Model 4289-2, to disconnected wire leads (to measure resistance of thermocouple circuit).
- (4) Measure resistance of thermocouple circuit. Resistance should be 8.000 ( $\pm 0.035$ ) ohms.
- (5) If resistance is not within specified limit, adjust slide of variable resistor located in tester to obtain specified resistance.
- (6) Disconnect Wheatstone Bridge from exhaust gas temperature indicator leads.

**CAUTION:** MAKE CERTAIN WHITE CHROMEL WIRE IS CONNECTED TO CR TERMINAL AND GREEN ALUMEL WIRE IS CONNECTED TO AL TERMINAL.

- (7) Connect exhaust gas temperature indicator leads to terminals at rear of indicator case and remove tags.
- (8) Position control panel on tester and install screws.

#### D. Check and Adjust Fuel Control Unit Acceleration Limiter Valve Cracking Pressure

NOTE: Use of tester, AiResearch 290122, is not required for the following test:

- (1) Remove cap from control air pressure test connection port on engine test panel in order to equalize pressure on the acceleration limiter diaphragm. (Figure 502)
- (2) Remove electrical connector P1-101 at sequencing oil pressure switch in order to disable ignition and fuel flow (WDM 49-31-01).
- (3) Remove plug from fuel control unit fuel pressure connection. Install suitable fitting.

#### EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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- (4) Connect pressure gauge, AiResearch 282645 pressure gage set, and case set assembly to the fitting installed previously.
- (5) Dry Motor APU. (Paragraph 8.B.)
- (6) Note and record acceleration limiter valve cracking pressure at approximately 20 percent (8,000 to 9,000 rpm) engine speed. Acceleration limiter valve cracking pressure should be 58 to 62 psig (400.2 to 427.8 kpa).
- (7) If cracking pressure is not within limits, adjust acceleration limiter valve as follows:
  - (a) Loosen locknut and turn adjustment screw, using screw-driver and wrench assembly, AiResearch 280353. Turn adjusting screw clockwise to increase cracking pressure, and counterclockwise to decrease cracking pressure.
  - (b) When adjustment is satisfactory, tighten locknut, and check cracking pressure in accordance with Paragraph 9.D.(5) and Paragraph 9.D.(6). Safety locknut with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (8) Disconnect pressure gauge and case set assembly from fuel control unit. Remove fitting and reinstall plug.
- (9) Reinstall electrical connector P1-101 on the sequencing oil pressure switch (WDM 49-31-01).
- (10) Install cap on control air pressure connection port of engine test panel.

**WARNING:** FIRE PROTECTION IS NOT AVAILABLE WITH APU ACCESS DOORS OPEN. MAKE CERTAIN FIRE PROTECTION EQUIPMENT IS AVAILABLE PRIOR TO ENGINE START.

E. Test Engine Start, Acceleration, Operation and Actuation of Automatic Controls

**NOTE:** If engine does not operate satisfactorily, shut down engine and correct malfunction.  
(GENERAL, SUBJECT 49-00-00, page 101)

- (1) Connect tester, AiResearch 290122, to engine. (Paragraph 9.B.)
- (2) Place BLEED AIR load switch located on tester control panel, in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester start switch in START position.
- (4) Observe following sequence of events:
  - (a) Oil pressure low light and 35 percent switch come on immediately.
  - (b) Engine starts and accelerates smoothly as evidenced by:
    - 1) Oil pressure indicated on oil pressure gauge.
    - 2) Engine speed indicated on tachometer indicator.
    - 3) Compressor air pressure indicated on control air pressure indicator.
    - 4) Fuel pressure indicated on fuel pressure gauge.
    - 5) Exhaust gas temperature indicated on exhaust gas temperature indicator.

EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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**CAUTION:** SHUT DOWN ENGINE IMMEDIATELY AND CORRECT MAL-FUNCTION IF EXHAUST GAS TEMPERATURE EXCEEDS LIMITS SPECIFIED IN PARAGRAPH 3. DURING START, ACCELERATION, AND OPERATION OF ENGINE.

- (c) When oil pressure reaches 2.5 to 3.5 psig (17.25 to 24.15 kpa) as indicated on oil pressure gage, fuel flow should be indicated on fuel pressure gage, verifying that fuel solenoid valve has opened.
- (d) When engine speed reaches approximately 35 percent, as displayed on tachometer indicator, 35 percent switch should actuate and open starter circuit indicated by tester 35 percent light going off.
- (e) When oil pressure reaches 55 psig (379.5 kpa) maximum, as indicated on oil pressure gage, oil pressure low light should go off, indicating satisfactory operation of oil low-pressure switch.

**CAUTION:** ENGINE OIL PRESSURE MUST NOT FLUCTUATE MORE THAN 3 PSIG (20.7 KPA) DURING STEADY STATE OPERATION.

- (f) When engine speed reaches approximately 75 percent, as displayed on tachometer indicator, engine oil pressure of 50 to 70 psig (345 to 483 kpa) should be displayed on oil pressure gage. Engine oil pressure should remain at 50 to 70 psig (345 to 483 kpa) for all operation above 75 percent speed.

**NOTE:** Because of pressure drop in oil line between oil pump and test panel connection, a pressure of 60 psig (414 kpa) at oil pressure gage represents a pressure of 90 psig (621 kpa) at oil pump discharge port.

- (5) When engine speed reaches 95 percent, as displayed on tachometer indicator, actuation of 95 percent switch should open ignition circuit and close hourmeter circuit. Hour-meter should start recording engine operating time, and 95 percent light should come on.
- (6) Engine should continue to accelerate, and fuel governor located in fuel control unit should control engine speed at no-load governed speed, 101 to 101.2 percent (42,500  $\pm$ 100 rpm) maximum, displayed on tachometer indicator.

**NOTE:** Tester tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm.

- (7) Shut down engine, using stop switch on tester panel to energize pneumatic solenoid valve and actuate 110 percent overspeed switch in centrifugal switch.
- (8) Remove tester and tester cable.

### F. Check and Adjust Fuel Control Governor Speed Setting

- (1) Connect tester to engine. (Paragraph 9.B.)
- (2) Place tester LOAD switch in OFF position. (Figure 501)

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place tester START switch in START position and allow engine to accelerate to no-load governed speed.
- (4) With no load applied, engine speed should stabilize at 102.6 percent maximum indicated on tester tachometer indicator.

**NOTE:** Tachometer indication of 100 percent engine speed is equivalent to 42,000 rpm engine speed.

#### EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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- (5) If steady-state no-load governed speed is not within limits of 101 to 101.2 percent (42,500  $\pm$ 100 rpm) indicated on tester tachometer indicator, adjust fuel governor as follows:
  - (a) Use screwdriver and wrench assembly, AiResearch 280353, to facilitate adjustment.
  - (b) To increase governor speed, turn adjusting screw clockwise; to decrease speed, turn adjusting screw counterclockwise.
  - (c) When adjustment is satisfactory, tighten locknut, and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### WJE 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872

- G. Procedure for Adjusting Engine Speed for Engine Operating with Timed ACCEL FUEL CONTROL (TAFUCU)

NOTE: For any Garrett APU Model GTCP85 operating with TAFUCU part number 3608000-X, the engine governed speed can be adjusted if the speed is not within limits.

- (1) While engine is operating at no-load condition, check generator frequency (frequency limit and load condition according to Airframe Manufacturer Specification).
- (2) Remove lockwire from 100 percent governor adjustment and 100 percent governor locknut. (Figure 503, View A)

**CAUTION:** DO NOT REMOVE ADJUSTMENT COVER.

- (3) Using locknut wrench, P/N 833275-1, loosen 100 percent governor locknut while holding 100 percent governor adjustment with adjuster wrench, P/N 833274-1.

**CAUTION:** IN ANY CASE, DO NOT TURN 100 PERCENT GOVERNOR ADJUSTMENT BY MORE THAN A QUARTER TURN. IF ENGINE IS STILL NOT WITHIN LIMITS OR SPEED IS FLUCTUATING, REJECT TAFUCU.

- (4) Engine speed is ready to be readjusted when 100 percent governor locknut is loosened. Turning 100 percent governor adjustment CCW will decrease engine speed and turning adjustment CW will increase engine speed.
- (5) When desired speed is attained, tighten 100 percent governor locknut by holding 100 percent governor adjustment and turning 100 percent governor locknut clockwise.
- (6) Recheck engine speed. If not within limits, perform Paragraph 9.G.(3) thru Paragraph 9.G.(5). If within limits, safety governor adjustment and locknut with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

- H. Check and Calibrate Pneumatic (Load Control) Thermostat

- (1) Remove engine exhaust gas temperature thermocouple (PAGEBLOCK 49-71-02/201). Install test thermocouple, AiResearch 290416-2.
- (2) Connect test set, AiResearch 290417-2-1, thermocouple cable to test thermocouple and exhaust gas temperature indicator on test set.
- (3) Check pneumatic (load control) thermostat temperature control point as follows:

- (a) Start engine in accordance with Paragraph 4..

NOTE: If APU is not fully loaded, it is impossible to determine the setpoint of an installed thermostat. To properly load APU, it is necessary to impose a potential overload on the APU to insure that the thermostat is fully open and at its control temperature setpoint.

- (b) Open engine load control valve and turn on both air-conditioning packs (do not select "AIR CONDITIONING COLDER" position). Allow EGT to stabilize.

#### EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

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**CAUTION:** DO NOT ALLOW TURBINE DISCHARGE TEMPERATURE TO EXCEED LIMITS SPECIFIED IN FIGURE.

- (c) Record EGT. If EGT is not within limits specified in Table 507, calibrate thermostat in accordance with Paragraph 9.H.(4).

**NOTE:** To avoid hot shutdown, remove load and operate for one minute at no-load condition prior to shutting down engine.

- (d) Remove pneumatic load and allow temperature to stabilize, then shut down engine.
- (4) Calibrate pneumatic (load control) thermostat, if required, as follows.
  - (a) Determine thermostat control cracking temperature in accordance with Paragraph 9.H.(3).

**NOTE:** A locking device, two self-locking helicoil inserts, is incorporated in the thermostat adjustment collar to prevent collar from rotating and changing calibration in service. To ensure integrity of locking device, torque on adjustment collar should be checked during adjustment. If running torque of adjustment collar is less 20 inch-pounds (2.26 N·m), thermostat must be replaced.

**Table 507 Engine Exhaust Gas Temperature (EGT) Setting**

EGT Measurement	Pneumatic (Load Mode) Thermostat	
Test Set Thermocouple (GTCP85-98DHF, DHF(A), DHF(B), DHF(C))	Max 630°C(1166°F)	*Recommended 574(+0, -10)°C (1066(+0, -20)°F)
Test Set Thermocouple (GTCP85-98DC(A), DC(B), DC(C))	Max 677°C(1250°F)	Recommended 621°C(1150°F)
* Manufacturer recommends these lowered temperature settings to increase service life of engine "hot" section. These temperatures may be adjusted as necessary to meet each individual operators requirements. Operators are advised that a reduction of EGT will reduce bleed airflow and can affect cabin temperatures under warmer ambient conditions.		

- (b) Calibrate pneumatic thermostat to required setting as follows:
 

**NOTE:** Each index mark on adjustment collar is equivalent to 2°C (4°F).

  - 1) Rotate adjustment collar clockwise (viewed from fitting end) to increase temperature setting.
  - 2) Rotate adjustment collar counterclockwise to decrease temperature setting.
- (c) Check temperature control point in accordance with Paragraph 9.H.(3). Controlling temperature should repeat within 3°C (5°F) for two consecutive checks.

- (5) Remove test thermocouple from engine. Install engine exhaust gas temperature thermocouple. (PAGEBLOCK 49-71-02/201)

I. Check Oil Pressure Relief Valve Setting

- (1) Connect tester to engine. (Paragraph 9.B.)
- (2) Place LOAD switch in OFF position.

EFFECTIVITY

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (3) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed. Run engine approximately 2 minutes to stabilize operation.

**NOTE:** Because of the pressure drop in the oil line between the oil pump discharge port and APU test panel, a pressure of 70 psig (483 kpa) at the APU test panel represents a pressure of 100 psig (690 kpa) at the oil pump discharge port. Oil pressure fluctuations should not exceed 10 psig (69 kpa) during steady state operation.

- (4) Observe oil pressure indicated on oil pressure gage located on tester control panel. If oil pressure is not within 70(±10) psig (483(±10) kpa) APU test panel, (100(±10) psig (690(±69) kpa) oil pump discharge port), during steady state operation, adjust oil pressure relief valve cracking pressure as follows:
  - (a) Loosen locknut and turn valve metering screw clockwise to increase cracking pressure. (Figure 502)
  - (b) Turn valve metering screw counterclockwise to decrease cracking pressure.
  - (c) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### J. Check and Adjust Air Pressure Regulator Output Pressure

- (1) Connect engine to tester. (Paragraph 9.B.)
- (2) Remove cap from tee fitting located in outlet air pressure line between air pressure regulator and load control valve. (Figure 502)
- (3) Connect one end of control air pressure hose to tee fitting and other end to control air pressure coupling on tester.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

- (4) Momentarily place START switch in START position, and allow engine to accelerate to no-load governed speed.
- (5) Observe pressure indicated on control air pressure gage. Pressure should be 37.6 to 39.7 in/hg (1270.278 to 1341.225 mbar) (18.5 to 19.5 psig (127.6 to 134.5 kpa)).
- (6) If regulated outlet pressure is not within specified limits, shut down engine, and proceed as follows:
  - (a) Loosen locknut on end of air pressure regulator and turn adjustment screw clockwise to increase outlet pressure.
  - (b) Turn adjustment screw counterclockwise to decrease outlet pressure.
  - (c) Tighten locknut and repeat check procedure.
- (7) When adjustment is satisfactory, tighten locknut and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### K. Check and Adjust Load Control Valve Opening Rate (Figure 502)

- (1) APU should be operating and stabilized at steady-state no-load RPM.
- (2) Open both pneumatic crossfeed valves.

EFFECTIVITY  
WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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- (3) Turn both air conditioning packs on.
- (4) Place APU AIR switch to ON position.
- (5) Pneumatic manifold pressure should peak and stabilize within 7 to 14 seconds.
- (6) If opening time is not within limits, proceed as follows:

**CAUTION:** DO NOT BOTTOM RATE ADJUSTMENT SCREW IN LOAD CONTROL VALVE, OR DAMAGE TO LOAD CONTROL VALVE COULD RESULT.

- (a) Hold load control valve rate adjustment screw and loosen locknut.
  - (b) Turn rate adjustment screw clockwise to increase opening time.
  - (c) Turn rate adjustment screw counterclockwise to decrease opening time.
  - (d) Hold adjustment screw and tighten locknut.
- (7) Repeat procedures, Paragraph 9.K.(1) thru Paragraph 9.K.(6), until opening time is within required limits.

### L. Check Accessory Gear Case Negative Pressure

**NOTE:** Check shall only be accomplished during trouble shooting to determine cause of high oil consumption or notice-able oil smoke from exhaust. Connection of tester, AiResearch 290122, is not required for this check.

- (1) Remove vent plug from vent port on front of accessory drive gear case (Figure 502).
- (2) Install a suitable bulkhead tee fitting in vent port. Install cap, with 0.035 to 0.040 inch (.088 to .1 cm) orifice in one of tee outlets.
- (3) Connect a suitable flexible hose to tee fitting and connect other end of hose to compound pressure gage, AiResearch 282645 pressure gage set.
- (4) Start engine. (Paragraph 4.)
- (5) Allow engine to accelerate to no-load governed speed and run for approximately two minutes to stabilize operation.
- (6) Observe pressure reading on negative pressure gage; pressure should be -3 to -10 inches of mercury.
- (7) Shut down engine. (Paragraph 6.)
- (8) Remove flexible hose, pressure gage, and tee fitting.
- (9) Install vent plug in accessory drive gear case and safety vent plug with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

EFFECTIVITY

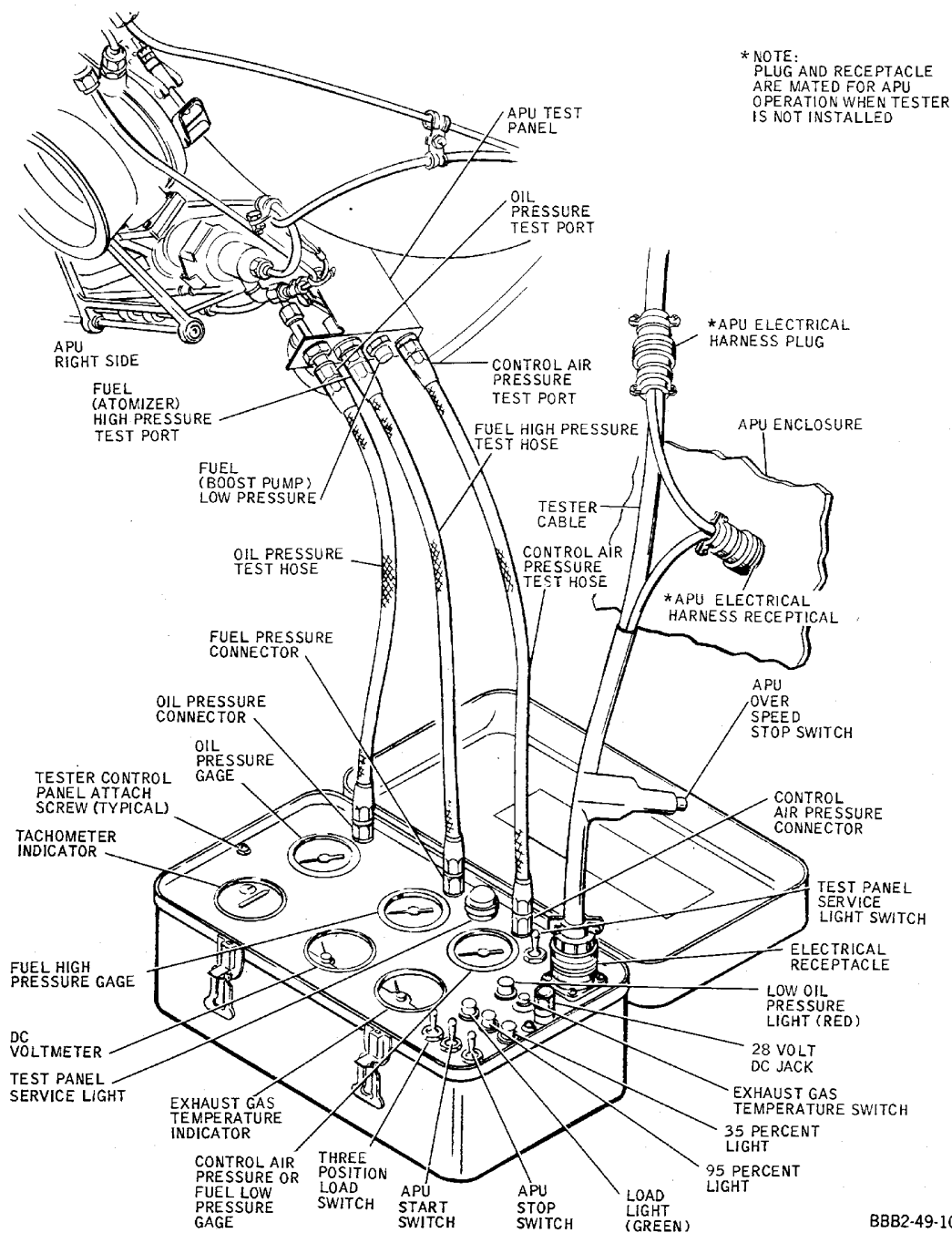
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868, 869, 871, 872, 875-881, 883, 884

TP-80MM-WJE

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8BB2-49-10

**APU Tester -- Connections  
Figure 501/49-00-00-990-845**

**EFFECTIVITY**

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866, 868, 869, 871, 872, 875-881, 883, 884

TP-80MM-WJE

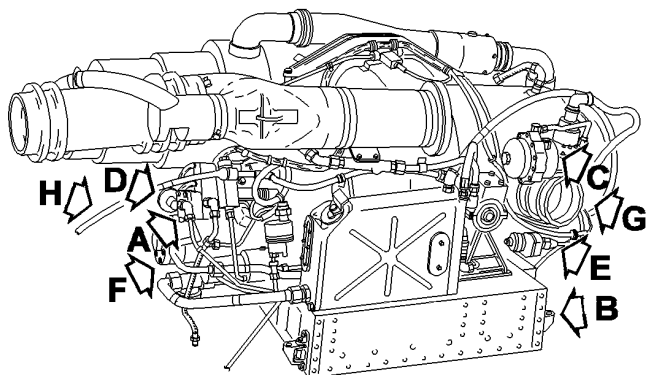
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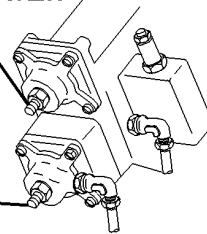
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AIRCRAFT MAINTENANCE MANUAL**

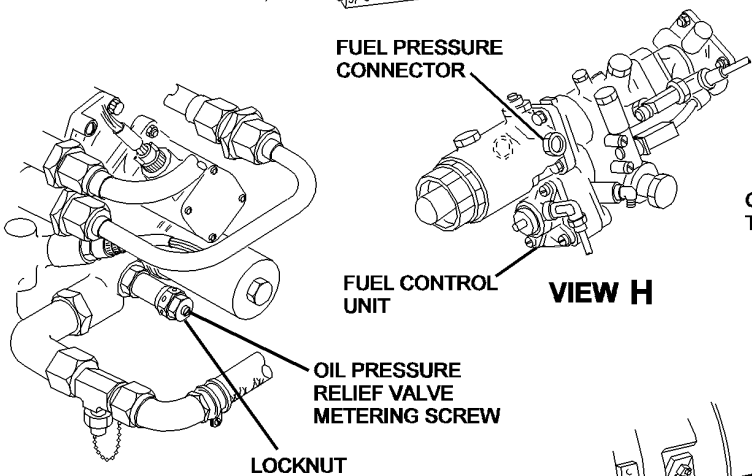


FUEL CONTROL GOVERNOR  
ADJUSTMENT SCREW

ACCELERATION  
LIMITER  
ADJUSTMENT  
SCREW



**VIEW A  
FUEL CONTROL UNIT**



FUEL PRESSURE  
CONNECTOR

FUEL (BOOST PUMP)  
LOW PRESSURE  
TEST PORT

OIL PRESSURE  
TEST PORT

FUEL CONTROL  
UNIT

**VIEW H**

CONTROL AIR  
PRESSURE  
TEST PORT

FUEL (ATOMIZER)  
HIGH PRESSURE  
TEST PORT

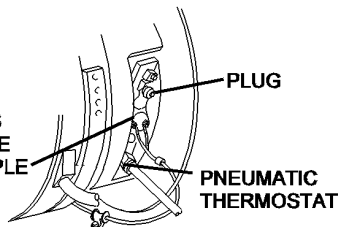
**VIEW B**

**ENGINE TEST PANEL**

**VIEW F**

LOCKNUT

OIL PRESSURE  
RELIEF VALVE  
METERING SCREW

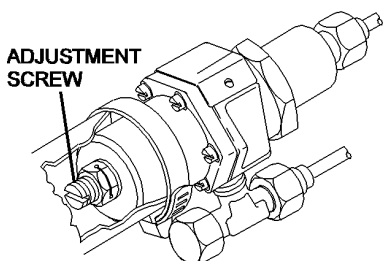


EXHAUST GAS  
TEMPERATURE  
THERMOCOUPLE

PLUG

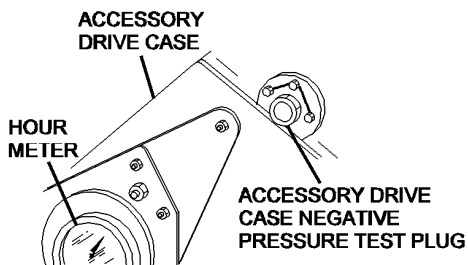
PNEUMATIC  
THERMOSTAT

**VIEW G  
(ROTATED 90 )**



ADJUSTMENT  
SCREW

**VIEW E  
AIR PRESSURE  
REGULATOR**

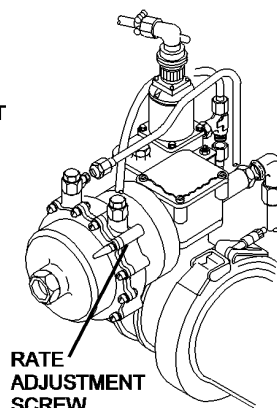


ACCESSORY  
DRIVE CASE

HOURLY  
METER

ACCESSORY DRIVE  
CASE NEGATIVE  
PRESSURE TEST PLUG

**VIEW D  
PRESSURE TEST PLUG**



RATE  
ADJUSTMENT  
SCREW

**VIEW C  
LOAD CONTROL VALVE**

BBB2-49-11C  
S0008552042V2

**APU -- Adjustment/Test  
Figure 502/49-00-00-990-846**

**EFFECTIVITY**

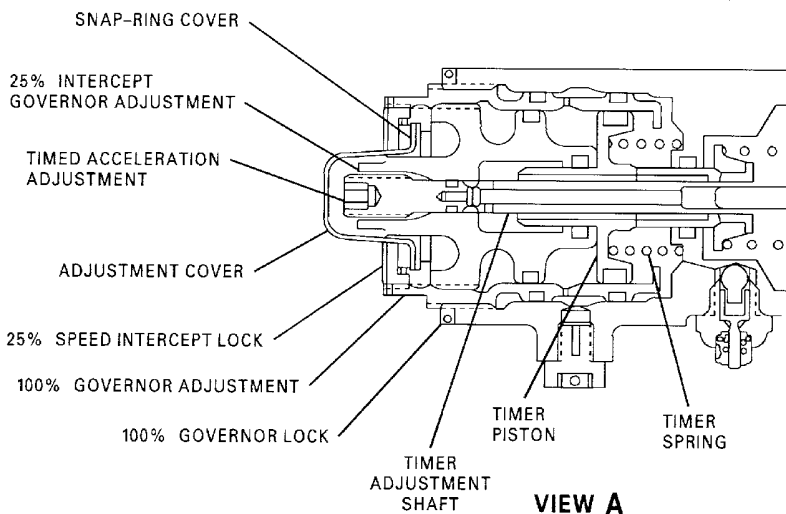
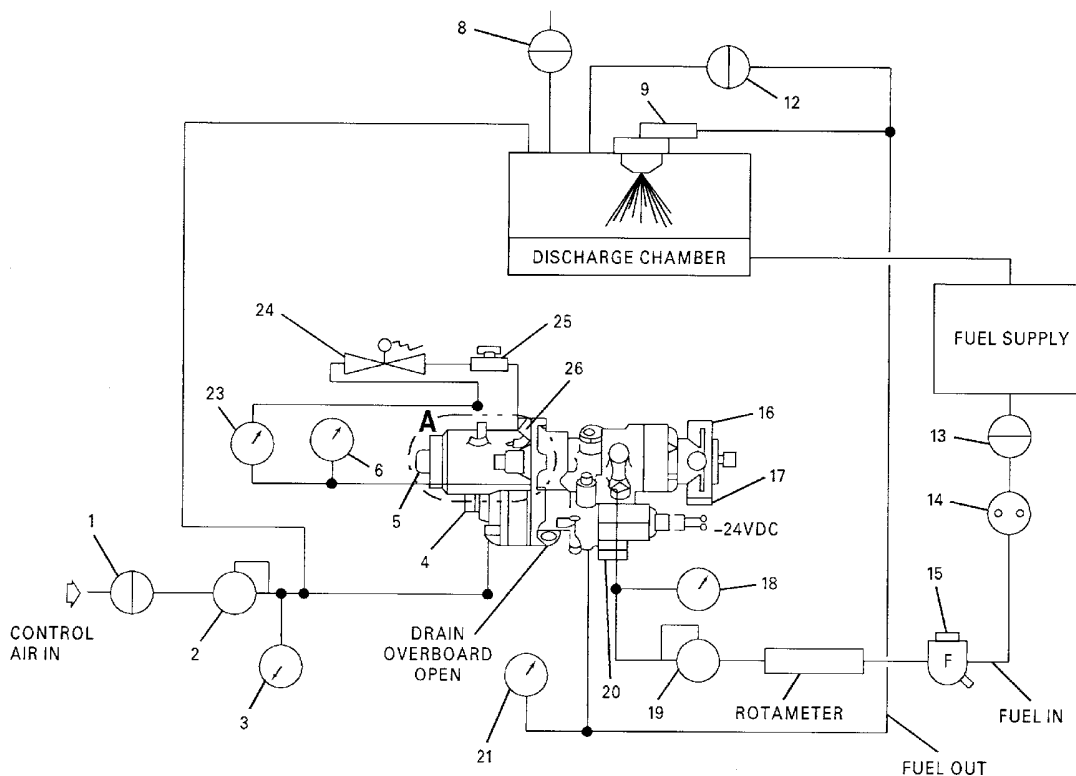
WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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**NOTE:**  
CLOCKWISE ROTATION  
OF ALL ADJUSTMENTS  
INCREASE VALUES

**GOVERNOR ACCELERATION LIMITER  
ADJUSTMENTS**

CAG(IGDS)

BBB2-49-190

**Governor Acceleration Adjustments  
Figure 503/49-00-00-990-847**

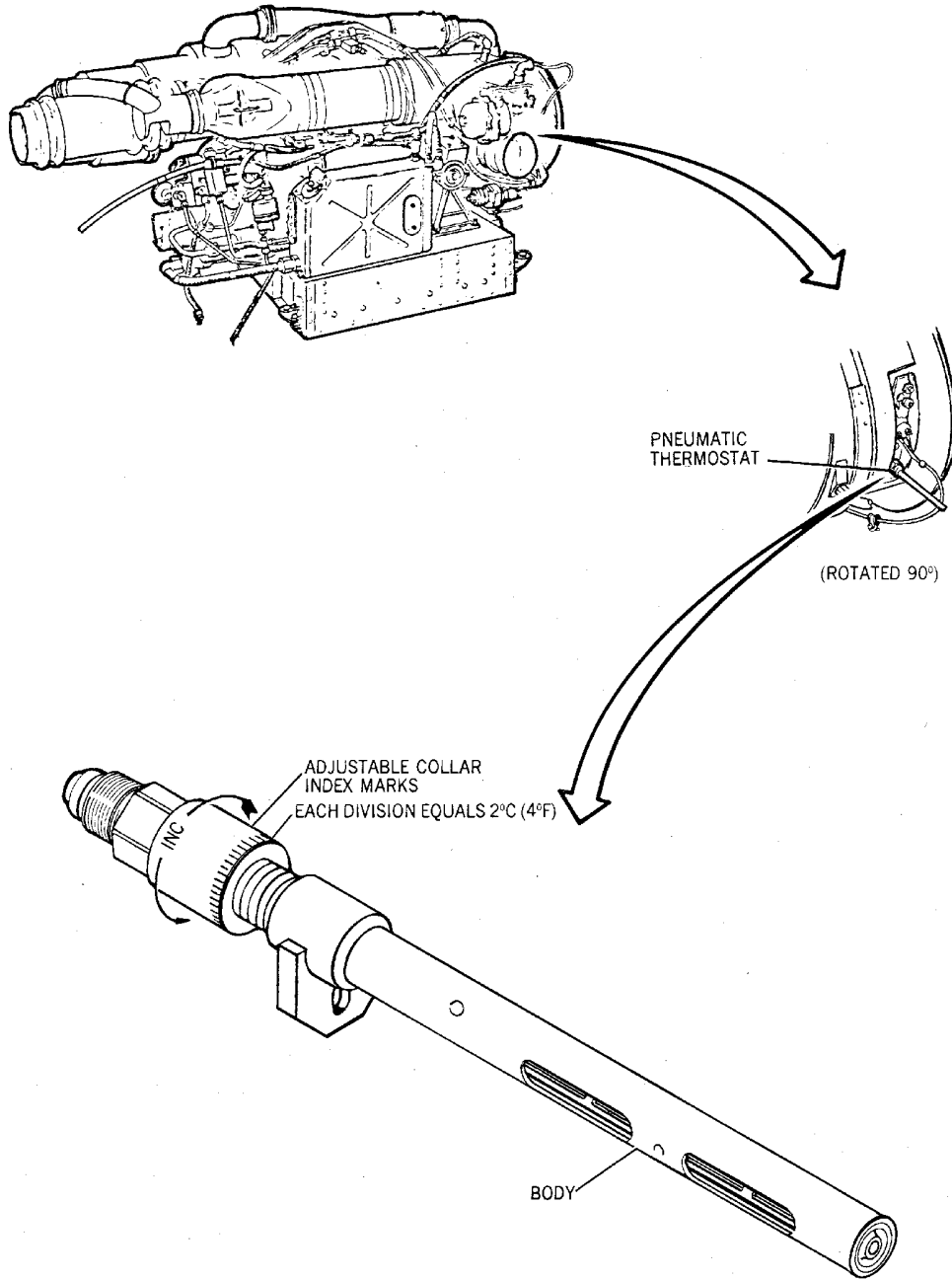
EFFECTIVITY  
WJE 415-419, 421, 423, 425, 426, 861-866, 868, 869,  
871, 872

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BBB2-49-97A

**Pneumatic Thermostat -- Adjustment**  
**Figure 504/49-00-00-990-848**

**EFFECTIVITY**

WJE 405-411, 415-419, 421, 423, 425, 426, 861-866,  
868, 869, 871, 872, 875-881, 883, 884

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 10. Hot Start Check

#### A. Perform Hot Start Check

- (1) Remove combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
- (2) Visually check hot section components to extent that components are visible through combustion unit opening in turbine plenum.  
NOTE: Normally available equipment, light, mirror, fiber optics, should be used to check components.
- (3) Check hot section components for evidence of distress.
  - (a) Turbine wheel blade tips for erosion/burning.
  - (b) Turbine wheel blades for erosion/rubbing.
  - (c) Turbine nozzle guide vanes for erosion.
  - (d) Turbine torus assembly for erosion.
- (4) If distress is indicated, remove APU for overhaul.
- (5) If no distress is indicated, APU may continue in service.
  - (a) Install replacement combustor unit. (COMBUSTION CHAMBER LINER AND TORUS, SUBJECT 49-20-01)
  - (b) Replace fuel control unit. (FUEL CONTROL UNIT, SUBJECT 49-30-01)
  - (c) Check calibration of pneumatic thermostat. (Paragraph 9.H.)
  - (d) Check turbine plenum drain for obstructions.
  - (e) Check aircraft battery voltage (22 vdc minimum or 26 vdc minimum with charger connected).

### 11. Check for Turbine Wheel Failure

#### A. Indications Of Possible Turbine Wheel Failure

- (1) Flight compartment
  - (a) Sudden loss of APU RPM indication to zero.
  - (b) Sudden loss of APU EGT indication to zero.
  - (c) APU OIL PRESS LOW light comes ON.
  - (d) If during start sequence, APU STARTED circuit breaker may pop open.

#### B. Checks To Confirm Turbine Wheel Failure

- (1) Check inside turbine exhaust duct for fragments.
- (2) Remove combustion chamber liner and flex borescope.
- (3) If turbine wheel failure is confirmed:
  - (a) Check turbine plenum for perforations.
  - (b) Check exterior of turbine plenum for distortion.
- (4) If perforations in plenum exist, check APU compartment including walls, lines, wiring, and surrounding structure for damage.
- (5) If APU compartment walls are perforated, check tailcone wall, wiring, lines, and surrounding structure for damage.



## MD-80 AIRCRAFT MAINTENANCE MANUAL

### GENERAL ON-WING CLEANING PROCEDURE - CLEANING/PAINTING

#### 1. General

- A. The following APU cleaning procedures are provided for on-wing use in order to reduce the build up of various contaminants, including hydraulic and lubricating fluids, in the APU compressor air inlet, power section compressor, and load compressor. These procedures can be used to help prevent the build-up of contaminants in these areas before they can have an adverse impact on APU performance or bleed air quality.
- B. The cleaning procedure consists of an optional "crank wash" procedure and a standard "running wash" procedure. The crank wash procedure introduces the cleaning solution into the APU inlet while the APU is motored using the starter. Following the crank wash, the APU is allowed to soak with the ingested cleaning solution for a brief period of time before following with the running wash procedure. The running wash procedure introduces the cleaning solution into the APU inlet while the APU is operating at no-load speed. In general, the use of the optional crank wash procedure should be more effective at removing the build-up of various contaminants, but may also be more inconvenient to implement due to the potential need to capture cleaning effluents during the procedure. The crank wash procedure is not a stand-alone procedure, and must always be followed by the running wash procedure.

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 701**

Name and Number	Manufacturer
Gas turbine compressor cleaner concentrate (ZOK 27)	Zokman Products, Inc 1220 East Gump Road Fort Wayne, IN 46845
Gas turbine compressor cleaner concentrate (ZOK mx)	Zokman Products, Inc 1220 East Gump Road Fort Wayne, IN 46845
Deionized water source (4 gallons)	
Protection equipment from cleaning solution manufacturer (gloves, goggles)	Zokman Products, Inc. 1220 East Gump Road Fort Wayne, IN 46845
Pneumatic system airflow limiting adapter P/N 5916778-1	ITEL 30-10-01
Fluid containers capable of being pressurized for cleaning solution (3 gallons)	
Containers for disposing dirty or contaminated cleaning fluid (5 gallons)	

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 701 (Continued)**

Name and Number	Manufacturer
Plastic Unthreaded Connector Cap (DPM 1931-1 MS90376)	

### 3. Cleaning Procedure

#### A. Cleaning Setup Requirements

- (1) Open APU ram air inlet door by selecting RAM position using cockpit overhead APU DOORS switch.
  - (a) Make sure RAM air door is open, and place APU DOORS switch in OFF position.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (b) Open this circuit breaker and install safety tag:

#### **LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

- (2) Open these access panels:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

- (3) Make certain APU AIR switch is OFF position.

#### B. Crank Wash Procedure (Optional)

**NOTE:** The crank wash procedure may be used prior to the running wash procedure in the next section in order to enhance the cleaning effectiveness. The running wash procedure must be performed immediately following the completion of the crank wash procedure.

**NOTE:** The crank wash procedure must not be performed if the ambient temperature is less than 40°F (4°C).

- (1) If APU has recently been operated, allow APU to cool for minimum of 1 hour prior to performing crank wash cleaning procedure.
- (2) Disconnect Fuel Solenoid Valve P1-148 electrical connector, shown in Figure 701.
  - (a) Put a unthreaded circular connector plastic caps, G60065 on the electrical connector.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1804, ZOK MX

HAZMAT 1000, REFER TO MSDS

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### (WARNING PRECEDES)

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1803, ZOK 27

HAZMAT 1000, REFER TO MSDS

- (3) Prepare 1.5 gal (5.7 l) - 2 gal (8 l) of ZOK 27 or ZOK MX cleaning solution in delivery canister. Mix one part concentrated cleaner to 4 parts deionized water.

**NOTE:** The effectiveness of the cleaning procedure may be enhanced by heating the cleaning solution mixture to 140°F (60°C) - 180°F (82°C) prior to being sprayed into the APU inlet.

- (4) While spraying prepared cleaning solution into ram air inlet door, motor APU with starter motor for approximately 20-25 seconds and shut APU down. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2)
- (a) Flow rate should not exceed 1 gpm (4 l/min).
- (b) Vary position of spray nozzle to provide for adequate distribution of cleaning solution into APU inlet.

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF 90 SECONDS ON.

- (5) Allow APU starter motor to cool for at least 5 minutes.
- (6) Repeat Paragraph 3.B.(4) again.
- (7) Allow APU to soak with ingested cleaning solution for 15-30 minutes.
- (8) Check the electrical connectors for damage and unwanted material. (GENERAL INSTALLATIONS HARDWARE - MAINTENANCE PRACTICES, SWPM 20-20-03)
- (9) Reconnect Fuel Solenoid Valve P1-148 electrical connector, shown in Figure 701
- (10) Close these access panels:

<b>Number</b>	<b>Name/Location</b>
---------------	----------------------

5903A	Auxiliary Power Unit Service Access LH
-------	--

5904A	Auxiliary Power Unit Service Access RH
-------	--

- (11) Perform running wash procedure described in next section with remaining cleaning solution. (Paragraph 3.C.)

### C. Running Wash Procedure

**NOTE:** The running wash procedure must not be performed if the ambient temperature is less than 40°F (4°C).

**NOTE:** The first step is not necessary if the crank wash procedure was performed in the previous section. If the crank wash was performed, go to Paragraph 3.C.(2) and use the remaining cleaning solution to perform the running wash procedure.

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**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1804, ZOK MX

HAZMAT 1804, ZOK MX

HAZMAT 1000, REFER TO MSDS

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1803, ZOK 27

HAZMAT 1000, REFER TO MSDS

- (1) Prepare 1.5 gal (5.7 l) - 2 gal (8 l) of the ZOK 27 or ZOK MX cleaning solution in the delivery canister. Mix one part concentrated cleaner to 4 parts deionized water. No mixing is required for RTU cleaner.

**NOTE:** The effectiveness of the cleaning procedure may be enhanced by heating the cleaning solution mixture to 140°F (60°C) - 180°F (82°C) prior to being sprayed into the APU inlet.

- (2) Start APU using normal procedures and accelerate to no-load governed speed. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2GENERAL, SUBJECT 49-00-00)
- (3) Allow all monitored APU parameters to stabilize with APU AIR OFF and no shaft load.
- (4) With APU operating at no-load speed, spray prepared cleaning solution into ram air inlet door until prepared cleaning solution is depleted. Flow rate should not exceed one gallon per minute. Vary position of spray nozzle to provide for approximately equal distribution of cleaning solution between power section compressor and load compressor.
- (5) With APU continuing to operate at no-load speed, perform APU rinse cycle using same procedure as wash cycle except using 1.5 gal (5.7 l) – 2 gal (8 l) of deionized water in place of cleaning solution. Flow rate should not exceed 1 gpm (4 l/min). Vary position of spray nozzle to provide for approximately equal distribution of cleaning solution between power section compressor and load compressor. above)
- (6) Continue to operate APU at no-load speed for 5 minutes following completion of rinse cycle to dry APU.
- (7) Place Left and Right PNEU XFEED VALVE in closed position in cockpit.
- (8) Install Airflow Limiting adapter P/N 5916778-1 (or equivalent) to Ground Pneumatic Connection.

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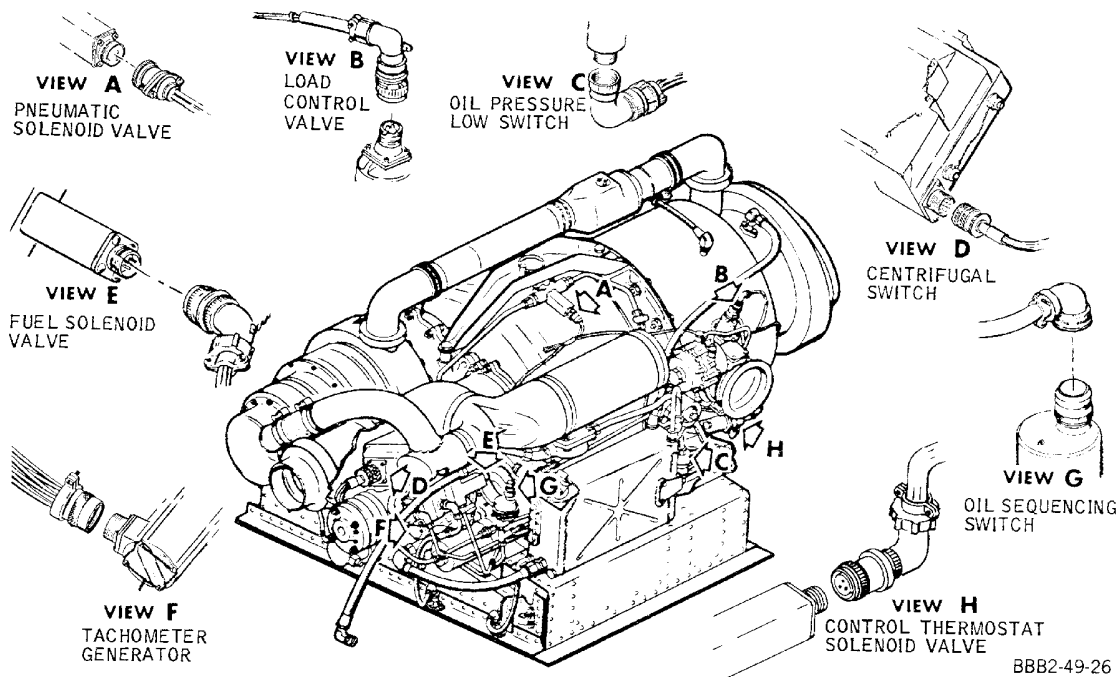
**WARNING:** PERSONNEL SHOULD STAND CLEAR OF THE HOT APU AIR EXHAUSTING FROM THE FLOW LIMITING ADAPTER. THIS WILL PREVENT POSSIBLE DEATH OR INJURY.

- (9) Place APU AIR switch to ON position.
- (10) Allow APU to run until there are no signs of residual cleaning fluid exhausting from the airflow limiting adapter.
- (11) Place APU AIR OFF.
- (12) Shut APU down using normal procedures. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2)
- (13) Remove Airflow Limiting adapter P/N 5916778-1 (or equivalent) from Ground Pneumatic Connection.
- (14) Remove the safety tag and close this circuit breaker:

### LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	39	B1-290	APU DOOR CONTROL

- (15) Place APU DOORS switch in AUTO position. Make sure RAM air door closes.



**Electrical Harness**  
**Figure 701/49-00-00-990-812 (Sheet 1 of 3)**

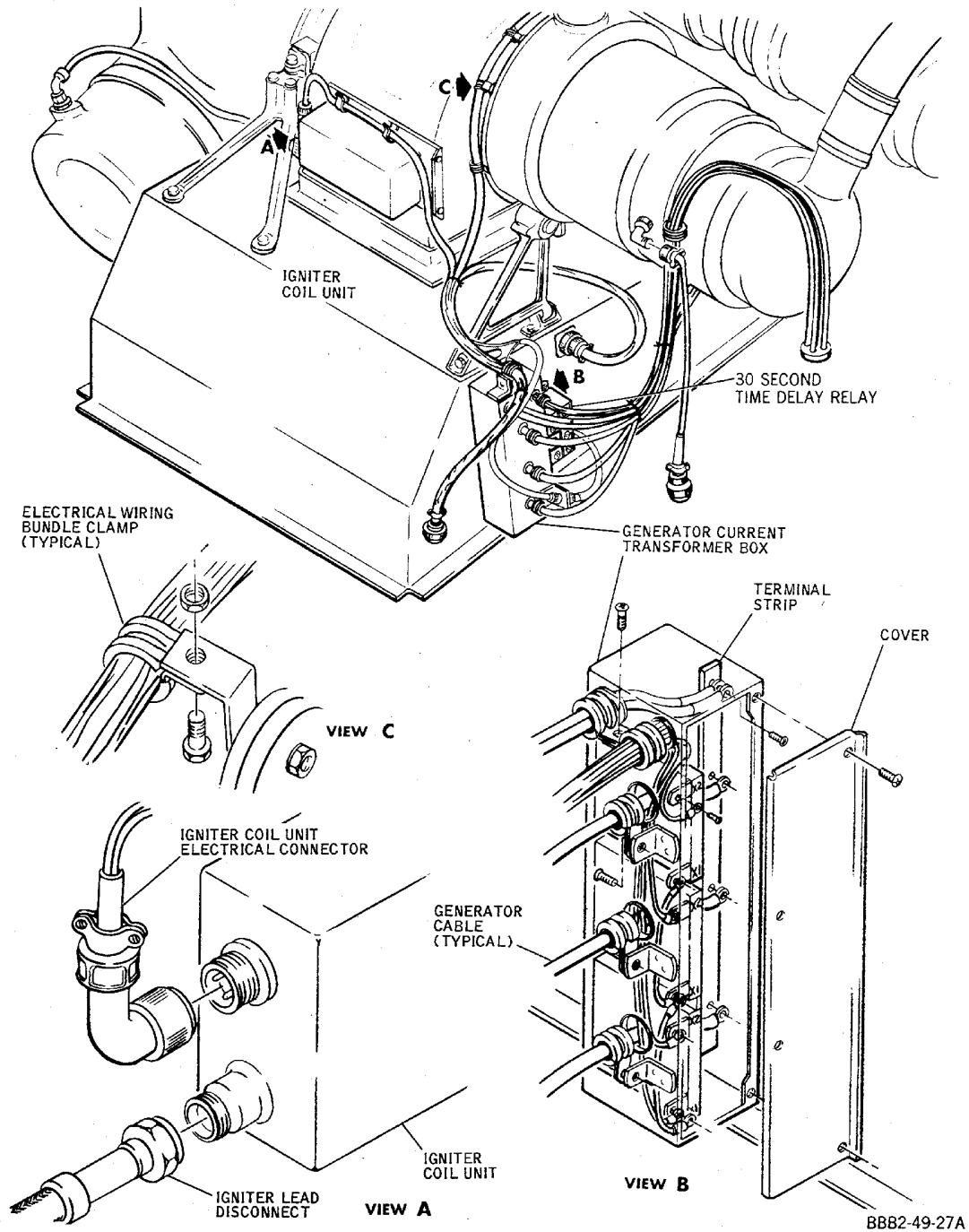
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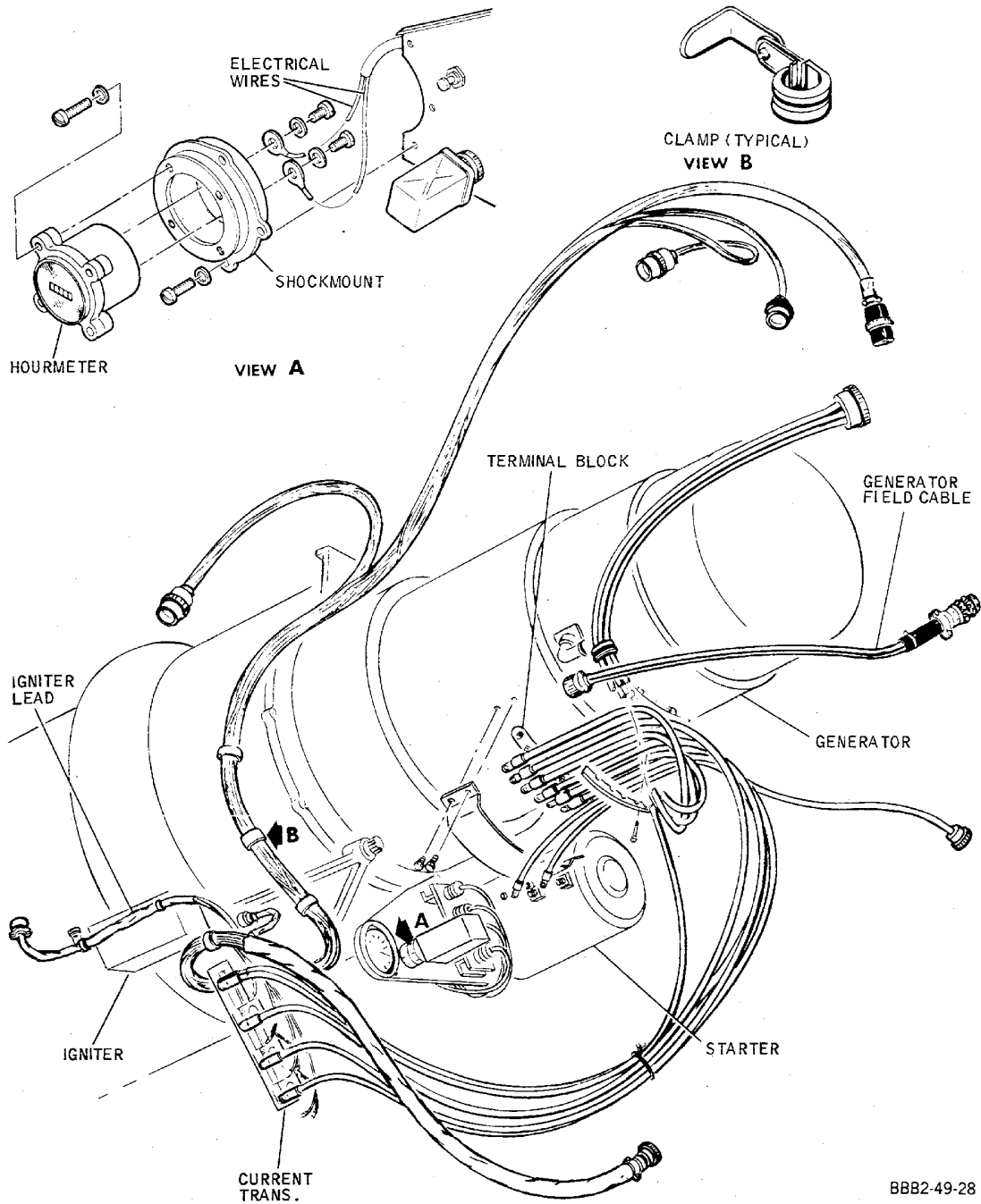


**Electrical Harness**  
**Figure 701/49-00-00-990-812 (Sheet 2 of 3)**

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WJE ALL

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88B2-49-28

**Electrical Harness**  
Figure 701/49-00-00-990-812 (Sheet 3 of 3)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### POWER PLANT - DESCRIPTION AND OPERATION

#### 1. General

- A. The APU consists of a gas turbine compressor and power unit driving a 40-kva generator, identical to the main engine-mounted generators. This unit is mounted transversely on the bottom centerline of the aircraft immediately aft of the rear pressure bulkhead. A fireproof enclosure surrounds the APU and separates it from the aft accessory compartment.
- B. The lower side of the APU enclosure, coincident with the fuselage skin, consists of two large access doors and a removable compressor air inlet door panel. The access doors are held closed by camloc fasteners to facilitate rapid servicing and inspection of the unit.

#### 2. Mounts

##### A. Description

- (1) The APU mounting system consists of two separate installations classified in accordance with their function in the following text. The mount installations are identified as engine mounts and APU mounts.
  - (a) Engine Mounts - The engine mounts consist of three vibration-isolated mounts attaching the gas turbine to the APU support box. The engine left forward and right aft mounts attach the turbine to the support box by a bolt and spacer arrangement. The engine right forward mount is rigidly bolted to the support box.
  - (b) All engine mounts are fitted with doughnut-type vibration isolators consisting of two-part stainless steel construction. The isolator has an inner core containing felted inconel wire in the outer race. The isolator, outer ring rides on the felted isolation material providing a vibration damping joint between fittings on the turbine and the mount frames attached to the support box.
  - (c) APU Mounts - The APU mounts consist of four demountable installations attaching the complete APU to the airframe. One mount is installed at each corner of the APU support box and separates into two sections when the APU is removed from the airplane. One section of each mount remains bolted to the fuselage structure inside the APU enclosure when the unit is removed. The mating sections are attached to the support box and removed with the APU.

#### 3. APU Installation

##### A. Description

- (1) The installation design permits removal and replacement of most APU accessory components including the generator, starter and fuel control, without removing the engine from the aircraft and with minimum removal of items not associated directly with the component being removed. The engine and mounts, together with its inlet assembly, are removed as a unit, vertically downward from the aircraft.

#### 4. Inlet Doors

##### A. Description

- (1) The compressor air inlet assembly comprises an actuated ram air scoop located directly under the engine for starting and separate, actuated, flush inlet doors for normal operation on the ground and during flight operations. The interior of the air inlet is baffled and lined to suppress the compressor noise.

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### 5. Ventilation

#### A. Description

- (1) Ventilating air for cooling the generator, the oil cooler, and the APU compartment is obtained from the aft accessory compartment and is ducted through a fire isolation valve into the APU enclosure. Air for generator cooling is supplied by a fan which draws air from the ventilating duct and forces it through the generator and out through a duct into the annular shroud around the APU exhaust. From the exhaust shroud, air and turbine gases are vented overboard by an exhaust-driven eductor.
- (2) The remainder of the ventilating air is ducted into the APU-driven cooling fan which forces the air through the APU oil cooler into the general compartment. Some of the fan air is diverted from the oil cooler into a distribution duct which directs cooling air to the APU enclosure. The compartment is vented through a sound suppressing muffler and thence overboard by an air discharge duct.

### 6. Exhaust

#### A. Description

- (1) The APU exhaust is directed upwards from the enclosure to an aperture in the fuselage skin above the right engine pylon.

### 7. APU Enclosure

#### A. Description

- (1) The APU enclosure is equipped with a dual fire detector element similar to that used on the main engines. Fire warning and extinguishing controls are provided in the flight compartment and also on an external APU control panel, accessible from the ground. Extinguishing agent for the APU enclosure is obtained from the two main engine fire bottles.

### 8. Engine Drains

#### A. Description

- (1) The APU drain system consists of drains leading from the Fuel Control Unit (FCU) acceleration limiter head, FCU drive shaft seal, oil tank fill scupper, combustion chamber liner and exhaust system drain shroud.
- (2) The drain leading from the FCU acceleration limiter head is routed to a tee fitting. One drain line leading from the tee fitting is routed to a check valve mounted on the Left Hand (LH) side of the APU inlet box. The other drain line leading from the tee fitting is routed to a drain mast mounted on the LH side of the aircraft.

NOTE: Refer to GENERAL, SUBJECT 49-00-00, APU Operating Limits, for FCU acceleration limiter head leakage limit.

- (3) The drain line leading from the FCU drive shaft seal is routed to a tee fitting. The drain line from the oil tank filler scupper is also routed to this tee fitting. The resulting single drain line is routed from the tee fitting to a drain mast mounted on the LH side of the APU inlet box.

NOTE: Refer to GENERAL, SUBJECT 49-00-00, APU Operating Limits, for FCU drive shaft seal leakage limit.

- (4) The drains leading from the combustion chamber liner and the exhaust system drain shroud are routed to drain masts located on the right hand side of the APU inlet box.

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WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 9. APU Engine

#### A. Description

- (1) The APU engine is a self-contained power plant requiring only a connection to the aircraft fuel supply and dc electrical power (battery) to maintain a constant output of electrical and pneumatic power. An internal system of pneumatic and electromechanical controls provides automatic and coordinated control of engine starts, acceleration, and operation. A minimum of additional controls, external to the engine, are required for initiating starts, monitoring engine operation, and stopping the engine.
- (2) The engine contains its own lubrication system complete with pumps and oil tank. APU power is developed through compression of ambient air by a two-stage centrifugal compressor. The compressed air, mixed with fuel and ignited, drives a radial inward-flow turbine wheel. Power produced by the turbine wheel drives the compressor and accessories mounted on the accessory drive case.

### 10. Power Plant

#### A. Description

- (1) The power plant provides self sufficiency in the area of ground power and can supply both electrical and pneumatic power on the ground and electrical power in flight.

### 11. Operation

#### A. Placing the APU MASTER switch in the RUN position will result in the following action with the air inlet door switch in the auto position.

- (1) The ram air inlet door will run to the ram position.
- (2) The 95% switch relay contacts for the load control valve will be armed.
- (3) The oil sequencing switch contacts for ignition will be armed.
- (4) The fuel/fire shutoff valve will open.

#### B. Placing the APU MASTER switch momentarily in the START position results in the following action.

- (1) The starter relay will close.
- (2) The fuel solenoid valve contacts of the oil sequencing switch will be armed.
- (3) The APU OIL PRESS LOW caution light will come on.
- (4) The holding circuit for the holding relay will close.

#### C. As the APU starts to rotate the following actions will result.

- (1) The oil and fuel pressure starts to rise.
- (2) The oil sequencing switch closes and energizes the fuel solenoid valve and ignition simultaneously.

#### D. The APU, assisted by the starter and energy from fuel combustion, continues to accelerate until at 35% speed the 35% switch opens and the starter relay opens shutting off the starter. At 95% speed the 95% switch changes contacts and the following action results.

- (1) The ignition system is deenergized and combustion is sustained by heat.
- (2) The hourmeter is energized and starts recording APU operation.
- (3) The 95% relay is energized and the air inlet door control relay is armed.
- (4) The 95% relay closes contacts arming the load control switch, the fire shutdown relay, and the pneumatic solenoid valve.

#### E. When it is desired to shut down the APU, the APU MASTER switch is placed in the OFF position.

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**AIRCRAFT MAINTENANCE MANUAL**

- F. As the APU speed decelerates to 95% speed, the 95% relay and the hourmeter are deenergized. This opens contacts to the pneumatic solenoid valve deenergizing it and the fuel solenoid valve.
- G. Actuation of the 110% switch will cause the holding relay to drop out and deenergize the fuel solenoid valve.

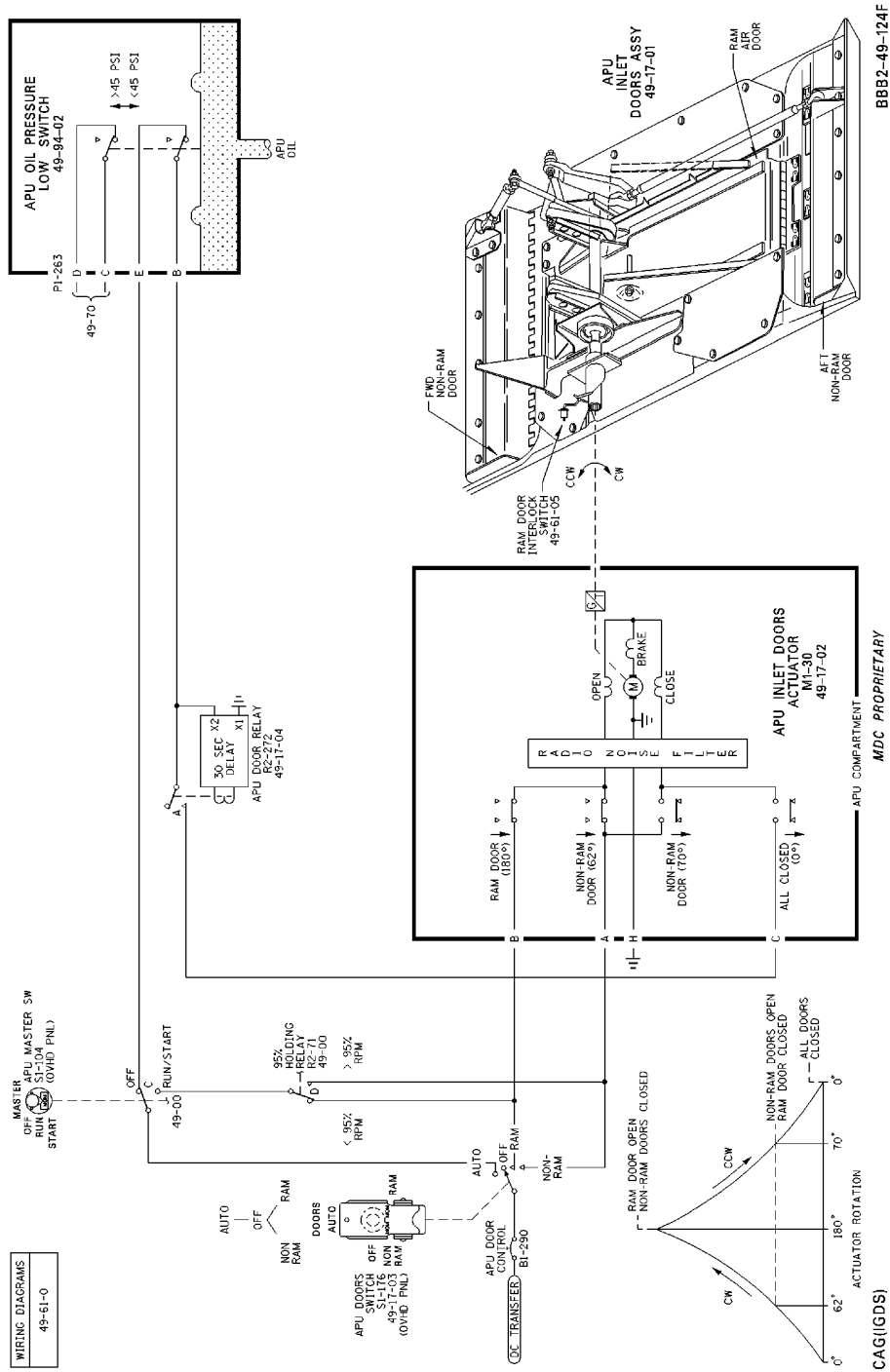
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**APU Doors Actuation  
Figure 1/49-10-00-990-801**

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**POWER PLANT - REMOVAL/INSTALLATION**

**1. General**

- A. The Auxiliary Power Unit (APU) is mounted inside an enclosure in the fuselage aft lower section. Access to the APU is through doors located on the left and right sides of the APU. Access to hoist attach area is through the tail cone access door.

**WJE 401-412, 414-427, 429, 861-866, 868, 869, 871-874, 880, 881, 883, 884, 886, 887, 891-893 PRE DC9-49-052**

- B. During removal operations all electrical wiring, fuel lines, ducting and unit corner mounts are disconnected and the APU is lowered to suitable ground support equipment. Removal is accomplished by using a hoist suspended from the fuselage upper structure, through a removable step located in the ventral stairway, and through a removable access cover in the APU enclosure.

**WJE 875-879; WJE 401-412, 414-427, 429, 861-866, 868, 869, 871-874, 880, 881, 883, 884, 886, 887, 891-893 POST DC9-49-052**

- C. Make sure to follow the instructions on the removal and installation placard installed on the APU enclosure. During removal operations all electrical wiring, fuel lines, ducting and unit corner mounts are disconnected and the APU is lowered to suitable ground support equipment. Removal is accomplished by using a hoist suspended from the fuselage upper structure, through a removable step located in the ventral stairway, and through a removable access cover in the APU enclosure. (Figure 402)

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- D. When interchanging between various APU engines, the Exhaust Gas Temperature (EGT) limitation ratings of the APU engine must be equal to or greater than the faceplate limitation markings on the APU EGT indicator. For the maximum allowable gage limit marking values associated with the various approved APU engines. (Table 401)

**Table 401 APU EGT indicator markings**

APU ENGINE	YELLOW ARC °C	RED LINE °C
GTCP85-98D DAC P/N 380256-1	710-732	732
GTCP85-98DC (A),(B),(C)	677-710	710
GTCP85-98DCK DAC P/N 381015-1-2	621-663	663
GTCP85-DHF (A), (B), (C) DAC P/N 381276-1	630-663	663

**NOTE:** For EGT indicator maintenance practices and removal/installation. (EXHAUST GAS TEMPERATURE INDICATOR, SUBJECT 49-71-01)

**2. Equipment and Materials**

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

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**Table 402**

Name and Number	Manufacturer
"DO NOT OPERATE" tag	
AN & MS threaded plug, DPM 2932, STD-6220	Comm Available
APU Hoist Adapter 3955380-501	The Boeing Co. ITEL 49-10-03
264RW-202 Dynamometer	TCI Scales, Snohomish, WA ITEL 49-10-03
<u>NOTE:</u> The 264RW-202 Dynamometer is used with the 3955380-501 hoist adapter.	
APU handling fixture, 5916710-1	The Boeing Co. ITEL 49-10-01
Container	
Sealant, Silicone, Two-Part, Gen. Purpose DMS 1799 #90-006 with Cat. 90-006-2 or #RTV-88 with Cat. RTV-9910	Integral Products, Inc., Torrance, CA, .
Lockwire, NASM20995N32 DPM 684	Not Specified
String tie, fiberglass DMS 2959 Size 2	

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 3. Removal/Installation APU

**WARNING:** IF A KNOWN AUXILIARY POWER UNIT (APU) INTERNAL FAILURE HAS OCCURRED, MAKE CERTAIN ALL PERSONNEL ARE CLEAR OF THE APU ENCLOSURE AS THE LAST APU TO FUSELAGE MOUNT BOLTS ARE REMOVED. TO AVOID FURTHER DAMAGE AS A RESULT OF THE APU FALLING, DOUGLAS SUGGESTS THE APU BE SUPPORTED FROM BELOW DURING REMOVAL.

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**WARNING:** DO NOT LET THE HOIST DYNAMOMETER SHOW MORE THAN A 500 LB (227 KG) LOAD DURING THE REMOVAL AND INSTALLATION OF THE APU. DAMAGE TO THE APU HOIST FITTING CAN OCCUR. A DAMAGED APU HOIST FITTING CAN CAUSE THE APU TO FALL AND CAN CAUSE INJURY TO PERSONNEL AND DAMAGE TO THE EQUIPMENT.

**WARNING:** MAKE SURE HOIST BAR AND RING ARE CORRECTLY ATTACHED AND OPERATE SAFELY PRIOR TO APU INSTALLATION OR REMOVAL. DO NOT STAND DIRECTLY BELOW APU DURING INSTALLATION OR REMOVAL AS HOIST BAR OR RING COULD BREAK, RESULTING IN SERIOUS BODILY INJURY OR DEATH.

**CAUTION:** MAKE CERTAIN APU HOIST IS CAPABLE OF SUPPORTING WEIGHT OF 600 POUNDS (272.4 KG) MINIMUM. TO AVOID EXCESSIVE WEAR ON APU HOIST FITTING, USE 1/2-INCH DIAMETER PIN TO CONNECT HOIST RING TO FITTING.

**CAUTION:** TO AVOID EXCESSIVE WEAR ON APU HOIST FITTING, USE 1/2-INCH DIAMETER PIN TO CONNECT HOIST RING TO FITTING. THIS WILL HELP TO PREVENT DAMAGE TO THE EQUIPMENT.

**CAUTION:** MAKE CERTAIN THAT THE PERSON OPERATING THE HOIST CAN COMMUNICATE WITH THE PERSON WATCHING FOR INTERFERENCE BETWEEN THE APU AND AIRCRAFT. THIS WILL HELP PREVENT DAMAGE TO THE EQUIPMENT.

**CAUTION:** MAKE CERTAIN APU HOIST IS CAPABLE OF SUPPORTING WEIGHT OF 1500 POUNDS MINIMUM. THIS WILL HELP PREVENT DAMAGE TO EQUIPMENT.

**CAUTION:** THE LOAD ON THE AIRCRAFT STRUCTURE MUST NOT EXCEED 1500 LB (680 KGS). THIS WILL PREVENT DAMAGE TO THE AIRCRAFT STRUCTURE.

#### A. Remove APU

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open these circuit breakers and install safety tags:

#### **LOWER EPC, DC TRANSFER BUS**

<b><u>Row</u></b>	<b><u>Col</u></b>	<b><u>Number</u></b>	<b><u>Name</u></b>
X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2

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### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Open these access panels:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

- (3) Extend ventral stairway.
- (4) Remove demountable ventral stairway step located above APU hoist access cover.
- (5) Open this access panel:
- | <u>Number</u> | <u>Name/Location</u> |
|---------------|----------------------|
| 5908A         | APU Hoist Clevis     |
- (6) Remove screws from vertical flange of guide and aft support for ceiling panel.
- (7) Support te panel, and disengage quick-release fasteners. Ensure all fasteners are fully disengaged. Remove panel.
- (a) Make sure that the all fasteners are fully disengaged and remove the panel.

**CAUTION:** DO NOT ATTEMPT TO PRY PANEL FROM CEILING.

- (8) If panel does not drop out of ceiling easily, hold panel to left or right as far as possible, and lower opposite edge of panel, removing panel.
- (9) Raise stairway movable ceiling to normal position (stairway extended).

**WJE 875-879; WJE 401-412, 414-427, 429, 861-866, 868, 869, 871-874, 880, 881, 883, 884, 886, 887, 891-893  
POST DC9-49-052**

- (10) Make sure to follow the instructions on the placard on the top of the APU enclosure.

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**CAUTION:** TO AVOID EXCESSIVE WEAR ON APU HOIST FITTING, USE 1/2-INCH DIAMETER PIN TO CONNECT HOIST RING TO FITTING. THIS WILL HELP TO PREVENT DAMAGE TO THE EQUIPMENT.

- (11) Attach APU hoist adapter to fitting located on fuselage structure above APU.
- (12) Attach load measuring device to free end of hoist adapter cable.
- (13) Attach hoist to free end of load measuring device.
- (14) Attach free end of hoist to ring located on top of demountable hoist fixture on APU.

**WARNING:** EXTREME CARE SHOULD BE EXERCISED TO ENSURE THAT HOIST IS LOCKED AND CANNOT FREEWHEEL AFTER APU MOUNTS ARE DISCONNECTED. OTHERWISE SERIOUS INJURY TO PERSONNEL COULD RESULT.

**CAUTION:** TO PREVENT OVERLOADING OF APU HOIST RING, BE CAREFUL NOT TO OVERTENSION HOIST CABLE WHEN SLACK IS BEING TAKEN UP.

- (15) Carefully take up slack until weight of APU is supported by hoist.
- (16) Disconnect APU electrical connectors located at upper left side of APU enclosure.
- (17) Slip end of fan air supply flexible duct off flange of fan air supply valve and pull downward to clear valve.

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (18) Use a suitable container to catch the small amount of fuel remaining in low-pressure fuel filter or fuel outlet line.
- (19) Disconnect fuel outlet line from low-pressure fuel filter located on left side of APU enclosure.
  - (a) Install AN threaded plugs on all open lines.

**CAUTION:** EXERCISE CARE TO PREVENT DAMAGE TO BLEED AIR OUTLET DUCT DURING APU REMOVAL.

- (20) Disconnect clamp connecting load control valve to bleed air outlet duct located on aft side of APU enclosure.
- (21) Disconnect drain line from bottom of exhaust duct shroud.
- (22) Disconnect exhaust duct shroud clamps and remove shroud sections from exhaust duct.
- (23) Disconnect clamp connecting inner exhaust elbow duct to exhaust duct flange.
- (24) Carefully push inner exhaust elbow duct outboard until flush with flange on APU enclosure and tape in place.
- (25) Disconnect fuel heat system air supply line.

**WARNING:** MAKE SURE HOIST BAR AND RING ARE CORRECTLY ATTACHED AND OPERATE SAFELY PRIOR TO APU INSTALLATION OR REMOVAL. DO NOT STAND DIRECTLY BELOW APU DURING INSTALLATION OR REMOVAL AS HOIST BAR OR RING COULD BREAK, RESULTING IN SERIOUS BODILY INJURY OR DEATH.

**CAUTION:** MAKE CERTAIN WEIGHT OF APU IS SUPPORTED BY HOIST BEFORE DISCONNECTING MOUNTS.

**CAUTION:** HOIST ATTACH FIXTURE RING IS NOT AT APU CENTER OF GRAVITY AND WILL AFFECT APU WEIGHT AND BALANCE WHEN MOUNTS ARE DISCONNECTED. TO PREVENT DAMAGE TO APU AND/OR AIRCRAFT STRUCTURE, MAKE CERTAIN APU IS PROPERLY SUPPORTED WHEN DISCONNECTING MOUNTS AND WHILE LOWERING APU FROM ENCLOSURE.

- (26) Disconnect APU mounts by removing only lower nuts and washers from mounting bolts. Do not disturb upper nuts on forward mounting bolts, or serrated plates on aft corners of APU support box.

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**WARNING:** WHEN YOU RAISE THE APU, MAKE SURE IT MOVES FREELY AND DOES NOT CATCH ON THE APU ENCLOSURE. IF THE APU CATCHES AND SUBSEQUENTLY BREAKS FREE, DAMAGE TO THE APU HOIST FITTING CAN OCCUR. A DAMAGED APU HOIST FITTING CAN CAUSE THE APU TO FALL AND CAUSE INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

**CAUTION:** APU WEIGHT AND BALANCE WILL BE AFFECTED IF GENERATOR OR OTHER MAJOR COMPONENTS ARE REMOVED BEFORE APU IS REMOVED.

- (27) Operate the hoist and carefully lower the APU from the APU enclosure, while at the same time observing the load measuring device. Make sure that the unit clears the aircraft structure. Stop lowering the APU if the load measuring device begins to indicate a decreasing load value. Raise the APU if necessary to clear any interference with aircraft structure before lowering the APU again.

**WARNING:** TO PREVENT INJURY TO PERSONNEL, TEMPORARILY INSTALL VENTRAL STAIR STEP (APU HOIST ACCESS) IF APU IS NOT TO BE IMMEDIATELY INSTALLED.

**CAUTION:** IF APU WAS STOPPED WITH AIR INLET DOORS OPEN, USE HANDLING FIXTURE THAT WILL ACCEPT THIS CONDITION. WEIGHT OF APU MUST NOT REST ON AIR INLET PANEL.

- (28) Lower APU into position on suitable ground handling fixture and install bolts, nuts, and washers.
- (29) Remove air inlet door panel from demountable support box if panel is to be installed on new APU equipped with demountable support box. (AIR INLET DOOR PANEL - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-02/201)
- (30) Remove APU demountable support box with air inlet door panel attached if both units are to be installed on new APU. (APU DEMOUNTABLE SUPPORT BOX - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-01/201)
- (31) Do a visual inspection of the APU exhaust duct. (EXHAUST DUCT AND SHROUD - INSPECTION/CHECK, PAGEBLOCK 49-80-01/601)
- (32) Do an inspection of the APU engine and airframe mount assemblies and attaching hardware. (APU MOUNTS AND VIBRATION ISOLATORS - INSPECTION/CHECK, PAGEBLOCK 49-10-05/601 Config 1)

### B. Install APU

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that these circuit breakers are open and have safety tags:

#### LOWER EPC, DC TRANSFER BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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- (2) Make sure that these access panels are open:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH
5908A	APU Hoist Clevis

- (3) Perform maintenance operational check of APU fire shutoff solenoid valve.  
(PAGEBLOCK 28-20-14/201)

- (4) Inspect the area of forward frame of APU enclosure adjacent to aircraft centerline as follows:

- (a) Open these access panels:

<u>Number</u>	<u>Name/Location</u>
5913A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5914A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5915A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5916A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure

- (b) Inspect area adjacent to pressure bulkhead for moisture accumulation and/or corrosion.

- 1) If moisture is present, remove moisture, and dry area thoroughly.
- 2) If corrosion is detected, take proper corrective action as required. (SRM 51-10-03)

- (c) Make sure the area is dry and free of corrosion

- (d) Close these access panels:

<u>Number</u>	<u>Name/Location</u>
5913A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5914A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5915A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure
5916A	Area Between Aft Pressure Bulkhead and Forward Side of APU Enclosure

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1022, SILICONE RTV (DMS QPL 1799)

HAZMAT 1000, REFER TO MSDS

- 1) Seal the access panels with a fillet seal of RTV-88 (DMS 1799)

- (5) Position APU (on handling fixture) under APU compartment. (Figure 401)

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**CAUTION:** TO AVOID EXCESSIVE WEAR ON APU HOIST FITTING, USE 1/2-INCH DIAMETER PIN TO CONNECT HOIST RING TO FITTING. THIS WILL HELP TO PREVENT DAMAGE TO THE EQUIPMENT.

- (6) Attach APU hoist adapter cable to fitting located on fuselage structure above APU.
  - (a) Attach load measuring device to free end of hoist adapter cable.
  - (b) Attach hoist to free end of load measuring device.

**CAUTION:** MAKE CERTAIN THAT THE PERSON OPERATING THE HOIST CAN COMMUNICATE WITH THE PERSON WATCHING FOR INTERFERENCE BETWEEN THE APU AND AIRCRAFT. THIS WILL HELP PREVENT DAMAGE TO THE EQUIPMENT.

- (7) Attach free end of hoist to ring located on top of demountable hoist fixture on APU.

**CAUTION:** TO PREVENT OVERLOADING OF APU HOIST RING, BE CAREFUL NOT TO OVERTENSION HOIST CABLE WHEN SLACK IS BEING TAKEN UP.

**CAUTION:** THE LOAD ON THE AIRCRAFT STRUCTURE MUST NOT EXCEED 1500 LB (680 KGS). THIS WILL PREVENT DAMAGE TO THE AIRCRAFT STRUCTURE.

- (8) Carefully take up slack until weight of APU is supported by hoist.

**CAUTION:** MAKE CERTAIN INNER EXHAUST ELBOW DUCT REMAINS TAPED TO FLANGE OF APU ENCLOSURE.

- (9) Remove nuts, bolts, and washers attaching APU to handling fixture.
- (10) If air inlet door panel was removed from APU demountable support box in Paragraph 3.A.(29) install the panel.(AIR INLET DOOR PANEL - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-02/201)
- (11) If APU demountable support box, with air inlet door panel attached, was removed in Paragraph 3.A.(30), install the demountable support box.(APU DEMOUNTABLE SUPPORT BOX - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-01/201)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** DO NOT LET THE HOIST DYNAMOMETER SHOW MORE THAN A 500 LB (227 KG) LOAD DURING THE REMOVAL AND INSTALLATION OF THE APU. DAMAGE TO THE APU HOIST FITTING CAN OCCUR. A DAMAGED APU HOIST FITTING CAN CAUSE THE APU TO FALL AND CAN CAUSE INJURY TO PERSONNEL AND DAMAGE TO THE EQUIPMENT.

**WARNING:** WHEN YOU RAISE THE APU, MAKE SURE IT MOVES FREELY AND DOES NOT CATCH ON THE APU ENCLOSURE. IF THE APU CATCHES AND SUBSEQUENTLY BREAKS FREE, DAMAGE TO THE APU HOIST FITTING CAN OCCUR. A DAMAGED APU HOIST FITTING CAN CAUSE THE APU TO FALL AND CAUSE INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

**WARNING:** EXTREME CARE SHOULD BE EXERCISED TO ENSURE THAT HOIST IS LOCKED AND CANNOT FREEWHEEL AFTER APU MOUNTS ARE DISCONNECTED. OTHERWISE SERIOUS INJURY TO PERSONNEL COULD RESULT.

**CAUTION:** APU WEIGHT AND BALANCE WILL BE AFFECTED IF GENERATOR OR OTHER MAJOR COMPONENTS ARE NOT INSTALLED.

**CAUTION:** MAKE CERTAIN THAT THE PERSON OPERATING THE HOIST CAN COMMUNICATE WITH THE PERSON WATCHING FOR INTERFERENCE BETWEEN THE APU AND AIRCRAFT. THIS WILL HELP PREVENT DAMAGE TO THE EQUIPMENT.

**CAUTION:** THE LOAD ON THE AIRCRAFT STRUCTURE MUST NOT EXCEED 1500 LB (680 KGS). THIS WILL PREVENT DAMAGE TO THE AIRCRAFT STRUCTURE.

- (12) Operate hoist and carefully raise APU inside enclosure, making certain unit clears aircraft structure.
  - (13) Install nuts and washers on APU aft mount bolts and tighten to torque of 800 in-lb (90 N·m) to 1140 in-lb (129 N·m).
  - (14) Install nuts and washers on APU forward mount bolts and tighten to torque of 260 in-lb (29 N·m) to 320 in-lb (36 N·m).
  - (15) Tighten forward jamnuts to torque of 260 in-lb (29 N·m) to 320 in-lb (36 N·m).
- NOTE:** If adjustments are required to fair the APU air inlet panel with fuselage. (POWER PLANT - ADJUSTMENT/TEST, PAGEBLOCK 49-10-00/501)
- (16) Compress fan air supply flexible duct and slip end of duct over flange of fan air supply valve located on left side of APU enclosure.
  - (17) Connect APU electrical connectors at upper left side of APU enclosure and safety with lockwire.
  - (18) Connect fuel outlet line to low-pressure fuel filter on upper left side of APU enclosure.
  - (19) Install clamp connecting aft flange of load control valve to bleed air duct flange on aft side of APU enclosure. Tighten clamp to torque of 55 in-lb (6.21 N·m) to 65 in-lb (7.34 N·m).
  - (20) Remove tape holding inner exhaust elbow duct in outer elbow and position inner elbow on exhaust duct flange by indexing pin.
  - (21) Install clamp connecting inner exhaust elbow duct to exhaust duct flange and tighten T-bolt nut as follows:
    - (a) Tighten nut to 15 in-lb (2 N·m) free running torque.

**NOTE:** Free running torque value is established when nut is run on T-bolt sufficiently to lock the clamp on the duct.

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- (b) Tighten T-bolt nut an additional 50 in-lb (5.65 N·m) to 70 in-lb (7.91 N·m) above free running torque established in Paragraph 3.B.(21)(a), giving a final torque of approximately 65 in-lb (7.34 N·m) to 85 in-lb (9.60 N·m).
- (22) Position exhaust duct shroud sections on exhaust duct and tighten clamps.
- (23) Connect exhaust duct shroud drain line to fitting on bottom of shroud.
- (24) Connect air line to fuel heat system air supply line.
- (25) Disconnect and remove APU hoist, load measuring device and hoist adapter cable.
- (26) Close this access panel:
- | <u>Number</u> | <u>Name/Location</u> |
|---------------|----------------------|
| 5908A         | APU Hoist Clevis     |
- (27) Install demountable step on ventral stairway.
- (28) Lower stairway movable ceiling.
- (29) Position stairway ceiling panel in ceiling, starting right or left edge of panel first, then, moving opposite edge into position.
- NOTE: If the ceiling panel is a snug fit in the ceiling, it is permissible to "bump" the panel into position, using the palm of the hand.
- (30) Engage all quick-release fasteners, and install screws that attach vertical flange of guide to aft support for ceiling panel.
- (31) Raise stairway movable ceiling to normal (stairway extended) position.
- (32) Remove the safety tags and close these circuit breakers:

### LOWER EPC, DC TRANSFER BUS

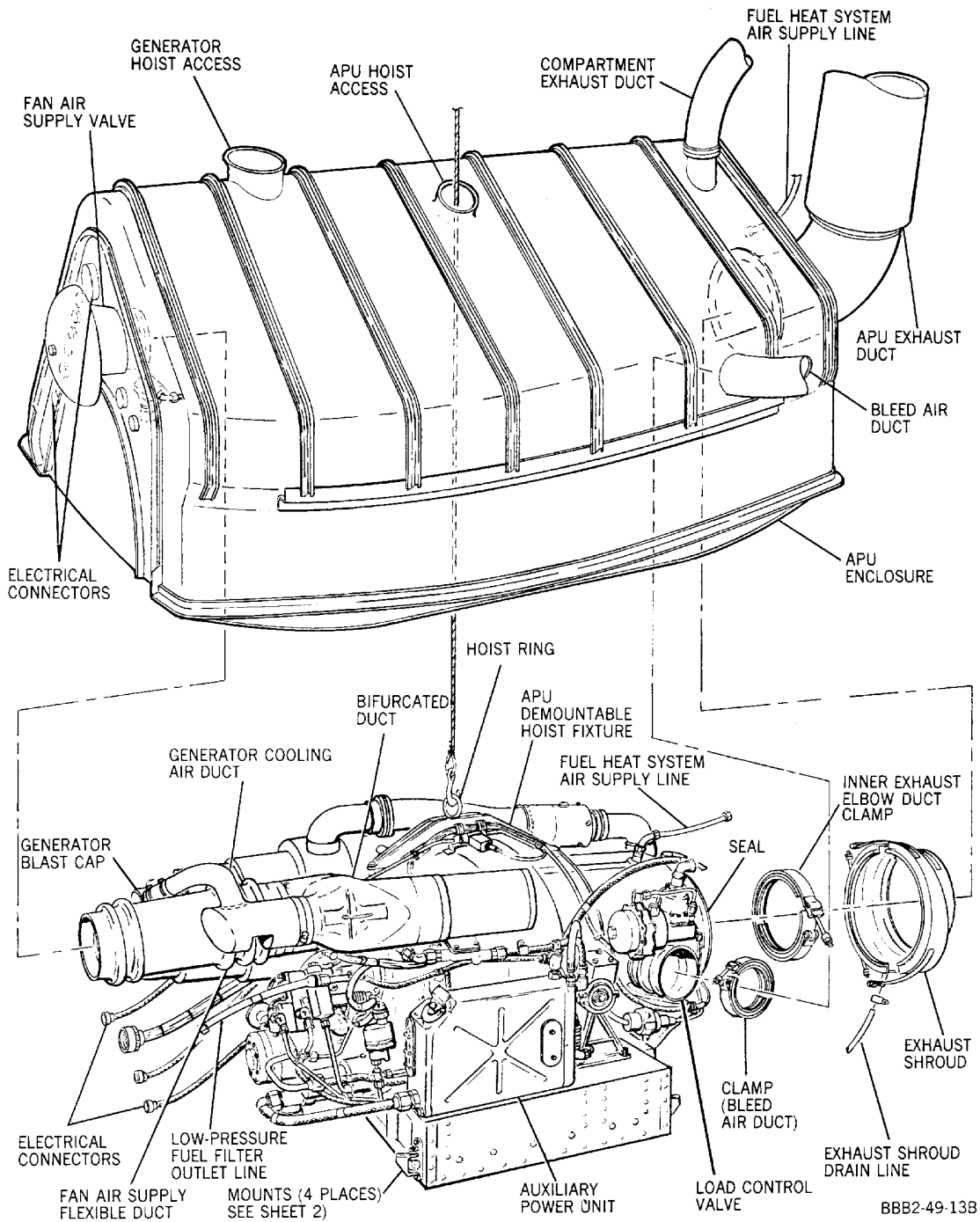
<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
X	41	B1-95	FIRE EXTINGUISHING CONTROL BOTTLE 1
X	42	B1-96	FIRE EXTINGUISHING CONTROL BOTTLE 2

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (33) Close these access panels:
- | <u>Number</u> | <u>Name/Location</u>                   |
|---------------|--|
| 5903A         | Auxiliary Power Unit Service Access LH |
| 5904A         | Auxiliary Power Unit Service Access RH |
- (34) Remove APU start switch warning flag.

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**Power Plant -- Removal/Installation  
Figure 401/49-10-00-990-809 (Sheet 1 of 3)**

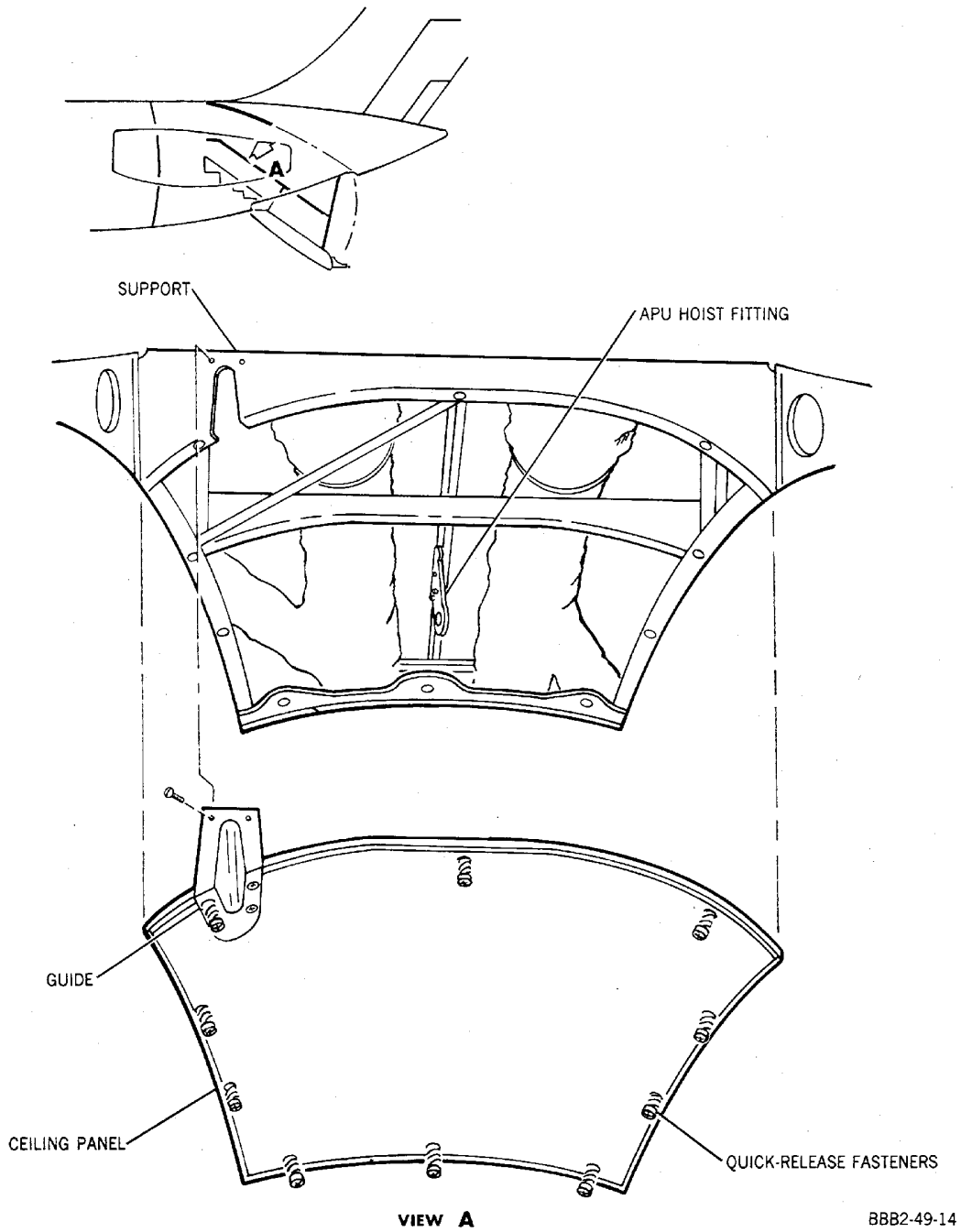
EFFECTIVITY  
WJE ALL

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**Power Plant -- Removal/Installation**  
**Figure 401/49-10-00-990-809 (Sheet 2 of 3)**

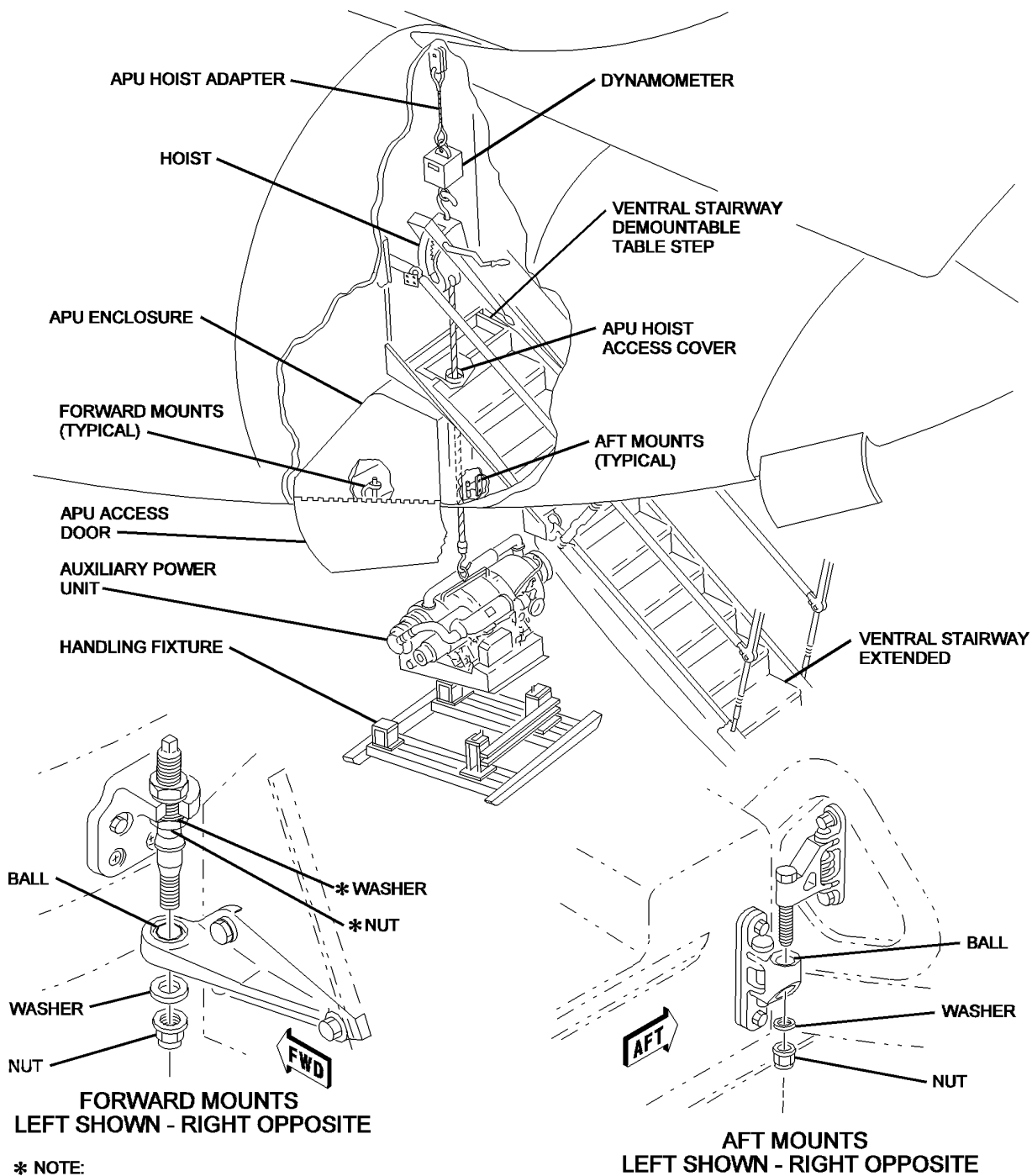
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\* NOTE:

IF ADDITIONAL THREADS ARE REQUIRED TO PERMIT UPWARD ADJUSTMENT OF MOUNT, REMOVE NUT AND WASHER INDICATED BY ASTERISK.

BBB2-49-15C  
S0006552072V3

**Power Plant -- Removal/Installation  
Figure 401/49-10-00-990-809 (Sheet 3 of 3)**

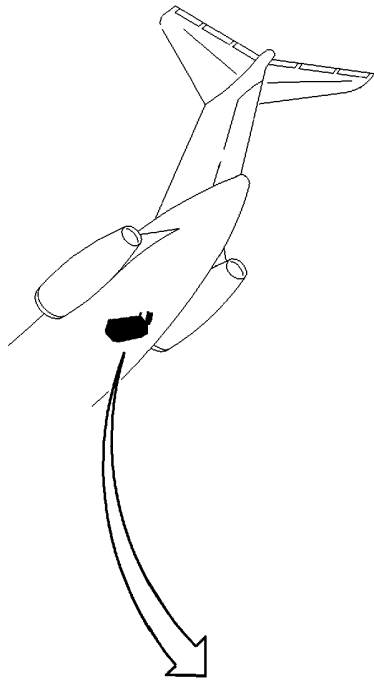
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**APU  
REMOVAL/INSTALLATION**

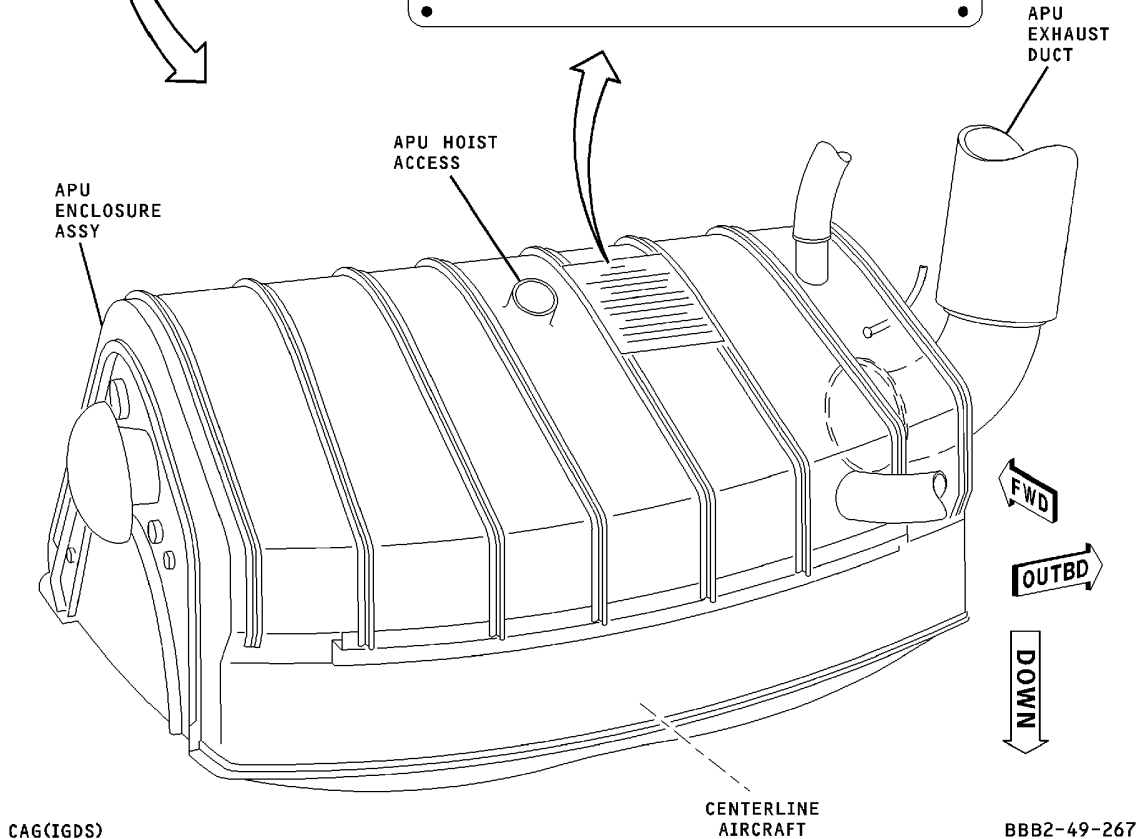
**CAUTION: LOAD ON AIRCRAFT STRUCTURE  
NOT TO EXCEED 1500 LBS.**

**BEFORE OPERATING HOIST**

1. USE 1/2 INCH DIAMETER PIN TO CONNECT HOIST RING TO FITTING.
2. INSTALL DYNAMOMETER OR LOAD CELL TO MONITOR TENSION IN HOIST CABLE.
3. ENSURE HOIST CANNOT FREEWHEEL WHEN APU MOUNTS ARE DISCONNECTED.

**DURING HOIST OPERATION**

1. ENSURE APU WEIGHT IS SUPPORTED AND PROPERLY DISTRIBUTED BY HOIST.
2. ENSURE THAT APU OR HOIST CABLE HOOK DOES NOT BIND OR SNUB ON APU ENCLOSURE WHEN BEING RAISED OR LOWERED.
3. BE CAREFUL NOT TO OVER TENSION CABLE WHEN APU MOUNTS ARE ENGAGED.



**Removal/Installation Placard  
Figure 402/49-10-00-990-810**

**EFFECTIVITY**  
WJE 875-879; WJE 401-412, 414-427, 429, 861-866,  
868, 869, 871-874, 880, 881, 883, 884, 886, 887,  
891-893 POST DC9-49-052

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test APU

#### A. Test APU

- (1) Check all fittings and mounts for security.
- (2) Check APU demountable support box and air inlet doors for proper fit. (AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501)
- (3) Service APU oil system. (AUXILIARY POWER UNIT (APU) - SERVICING, PAGEBLOCK 12-12-01/301)
- (4) Start APU and check operation. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2)
- (5) Check APU fuel lines, pneumatic ducts, and exhaust ducts for leaks.
  - (a) No leaks are allowed.

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## POWER PLANT - ADJUSTMENT/TEST

### 1. General

- A. Some minor adjustments to the APU mounting system may be necessary when an existing unit is replaced in order to fair the inlet panel with the surrounding fuselage area. Adjustment provisions are incorporated in the APU mounting system and are adjustable as outlined in Paragraph 3..
- B. The weight of the APU must be supported at all times while adjustments are being accomplished in order to prevent unnecessary strain on the other mounts.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

**Table 501**

Name and Number	Manufacturer
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. Adjustment/Test APU Mounts

#### A. Adjust Mounts

- (1) Make certain slack is removed from APU hoist cable.  
NOTE: Numbers in parentheses in the following text correspond to callouts in Figure 501.
- (2) Adjust forward mount to fair APU air inlet panel with fuselage within  $\pm.045$  inch (1.14 mm) as follows.
  - (a) Loosen nuts (6 and 11), turn bolt (5) counterclockwise to adjust APU upward to fair with fuselage. Tighten nut (6) to torque of 260 to 320 inch-pounds (29.38 to 36.16 N·m) and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)  
NOTE: If dimension between fitting and support angle is equal to or less than 0.887 inches (22.53 mm), jam nut (11) and washer may be omitted.
  - (b) Loosen nuts (6 and 11), turn bolt (5) clockwise to adjust APU downward to fair with fuselage. Tighten nut (6) to torque of 260 to 320 inch-pounds (29.38 to 36.16 N·m) and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (3) Adjust aft mounts to fair APU air inlet panel with fuselage (within  $\pm.045$  inch (1.14 mm)) as follows.
  - (a) Loosen bolt (7) and bolt (8).
  - (b) Move hinge plate (9) down on serrated plate (10) as necessary to adjust APU upward to fair with fuselage.
  - (c) Move hinge plate (9) up on serrated plate (10) as necessary to adjust APU downward to fair with fuselage.
  - (d) After fairing aft end of APU air inlet panel with fuselage, tighten bolts to torque of 50 to 70 inch-pounds (5.65 to 7.91 N·m).
- (4) Disconnect and remove APU hoist. (POWER PLANT, SUBJECT 49-10-00, page 401)
- (5) Check all fittings and mounts for security.
- (6) Check APU demountable support box and air inlet doors for proper fit.  
NOTE: Proper fit of support box is accomplished when air inlet panel is faired with fuselage within  $\pm.045$  inch (1.14 mm)). Refer to AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501 for proper fit of air inlet doors.

EFFECTIVITY  
WJE ALL

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- (7) Service APU oil system. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, Page 301)
- (8) Check APU fuel lines, pneumatic ducts, and exhaust ducts for leaks.
- (9) Start APU and check operation in accordance with GENERAL, SUBJECT 49-00-00, page 501.

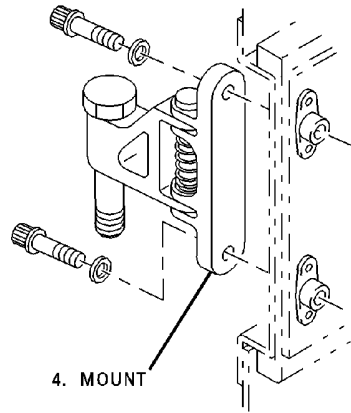
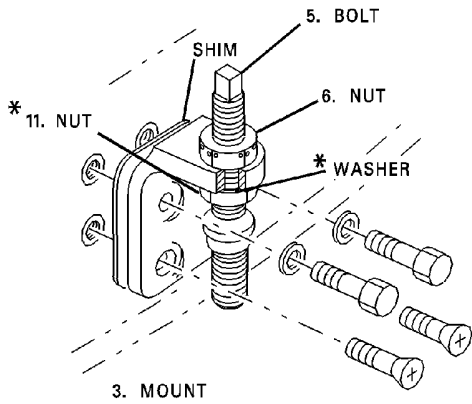
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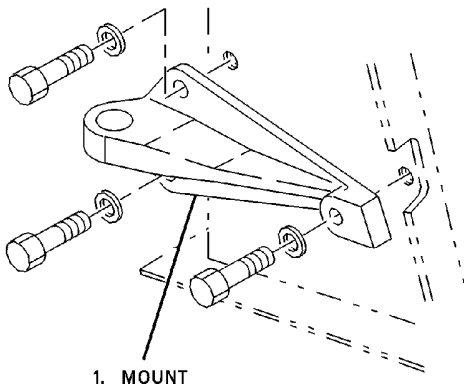
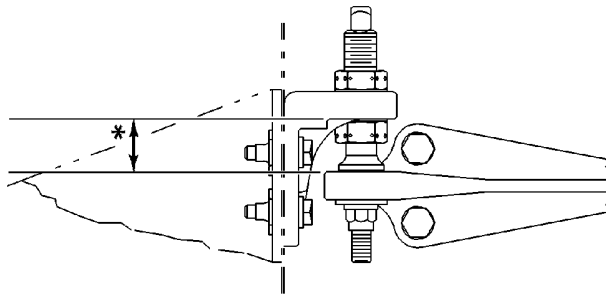
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AIRCRAFT MAINTENANCE MANUAL**



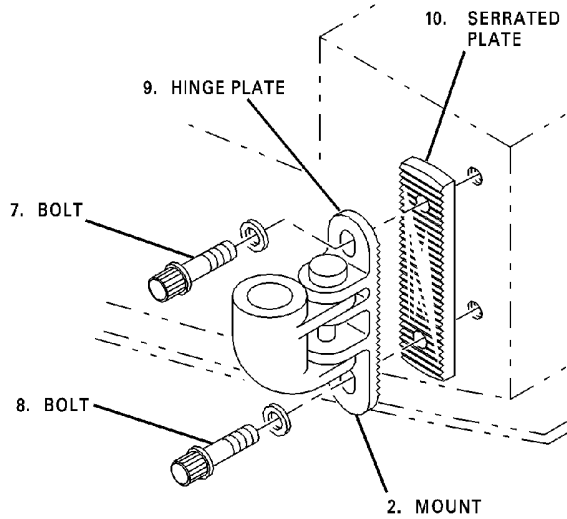
**NOTE:**  
\* IF THIS DIMENSION IS EQUAL TO OR LESS THAN 0.887 in. (22.53 mm) OMIT JAM NUT (11) AND WASHER BETWEEN FITTING AND SUPPORT ANGLE



**LEFT MOUNT SHOWN  
RIGHT MOUNT OPPOSITE**

**NOTE:**  
\* MOUNTS 1 AND 3 MATE TO FORM THE COMPLETE FORWARD MOUNT. MOUNTS 2 AND 4 MATE TO FORM THE COMPLETE AFT MOUNT.

CAG(IGDS)



BBB2-49-16B

**APU Mounts -- Adjustment  
Figure 501/49-10-00-990-811**

EFFECTIVITY  
WJE ALL

TP-80MM-WJE

**49-10-00**

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### APU DEMOUNTABLE SUPPORT BOX - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUT-DOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The APU demountable support box serves as a mounting base for the unit when it is installed in the airplane, or mounted on a ground handling fixture. The box is attached to the engine by vibration-isolated mounts located at three of its four corners. All mounts must be disconnected when removing the box from the engine. Removal of the demountable support box can be accomplished when the APU is removed from the aircraft. The unit must be supported by a hoist and partially lowered from its compartment, or it must be lowered to a suitable ground handling fixture.

#### 2. Removal/Installation APU Demountable Support Box

##### A. Remove Demountable Support Box

**NOTE:** The following procedure is applicable to demountable support boxes with either long or short seals for forward nonram door.

- (1) Remove APU. (POWER PLANT, SUBJECT 49-10-00, page 401)

**NOTE:** APU may be placed on suitable ground handling fixture, or be allowed to suspend on hoist sufficiently below enclosure to ensure accessibility. Regardless of methods used, make certain that hoist is locked and that it is supporting weight of unit before removing engine mount bolts.

- (2) Disconnect electrical connector from ram door interlock switch.

**NOTE:** If it is desirable to remove ram door interlock switch, refer to Paragraph 2.C..

- (3) Remove air inlet doors panel (PAGEBLOCK 49-10-02/201).

- (4) Remove bolts and washers attaching forward right side engine mount to nutplates inside demountable support box. (Figure 201)

- (5) Remove nuts, bolts, washers, and bushings attaching forward left side engine mount to fittings on demountable support box.

**CAUTION:** WEIGHT AND BALANCE OF APU WILL BE AFFECTED WHEN ENGINE MOUNT BOLTS ARE REMOVED.

- (6) Remove nuts, bolts, washers, and bushings attaching aft right side engine mount to fittings on demountable support box.

- (7) Raise hoist until APU clears demountable support box.

- (8) Remove demountable support box.

- (9) Check seal for forward nonram air inlet door and if seal does not seal properly or damage is evident accomplish following steps.

(a) Remove screws and washers attaching seal, strip, and shim to forward inner end of demountable support box.

(b) Install screws and washers attaching new seal, with strip and shim to demountable support box.

##### B. Install Demountable Support Box

- (1) Position new demountable support box on handling fixture.

- (2) Carefully lower APU hoist until unit is in position and engine mounts mate with attach points on demountable support box. (Figure 201)

EFFECTIVITY  
WJE ALL

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- (3) Install bolts and washers attaching forward right side engine mount to nutplates inside demountable support box.
- (4) Install nuts, bolts, washers, and bushings attaching left forward engine mount to fittings on demountable support box.
- (5) Loosen two bolts attaching aft right side engine mount fitting to serrated plate on demountable support box.

**NOTE:** Bolts should be sufficiently loose to allow serrations to move freely from one detent to another.

- (6) Install nuts, bolts, washers, and bushings attaching aft right side engine mount to previously loosened fitting.
- (7) Adjust fitting and serrated plate as necessary to prevent preloading engine mount.
- (8) Tighten fitting attach bolts.
- (9) Install APU. (POWER PLANT, SUBJECT 49-10-00, page 401)
- (10) Install air inlet doors panel. (PAGEBLOCK 49-10-02/201)

**CAUTION:** IF RAM DOOR INTERLOCK SWITCH WAS REMOVED, MAKE CERTAIN THAT AIR INLET DOORS ARE IN FULL OPEN POSITION BEFORE INSTALLING SWITCH, OTHERWISE DAMAGE MAY RESULT TO SWITCH.

- (11) Connect electrical connector to ram door interlock switch.
- (12) If air inlet doors panel does not fair with fuselage, adjust APU mounts, refer to POWER PLANT - ADJUSTMENT/TEST, PAGEBLOCK 49-10-00/501.

### C. Remove Ram Door Interlock Switch

- (1) Disconnect electrical connector from switch.
- (2) Remove bolts and washers attaching switch to APU support box.
- (3) Remove switch.

### D. Install Ram Door Interlock Switch

- (1) Verify distance between nearest face of switch mounting flange and center of switch arm roller is 1.300 ( $\pm 0.125$ ) inches. If not, replace switch.

**CAUTION:** MAKE CERTAIN AIR INLET DOORS ARE IN FULL OPEN POSITION AND DOOR ACTUATOR CAM IS POSITIONED ON PROPER SIDE OF SWITCH ARM BEFORE INSTALLING SWITCH, OR SWITCH WILL BE DAMAGED.

- (2) Position switch in APU support box.
- (3) Install bolts and washers attaching switch to APU support box.
- (4) Connect electrical connector to switch.

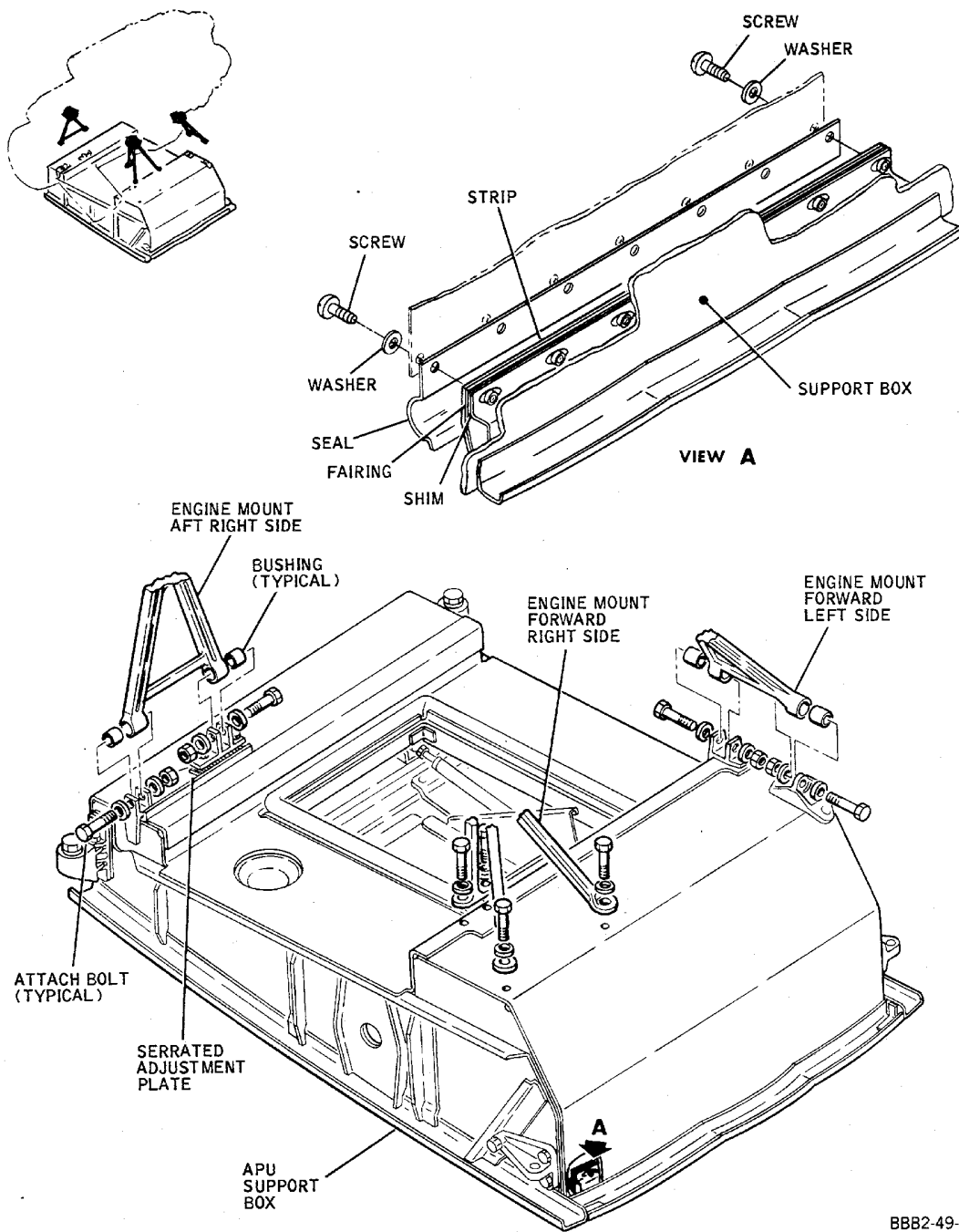
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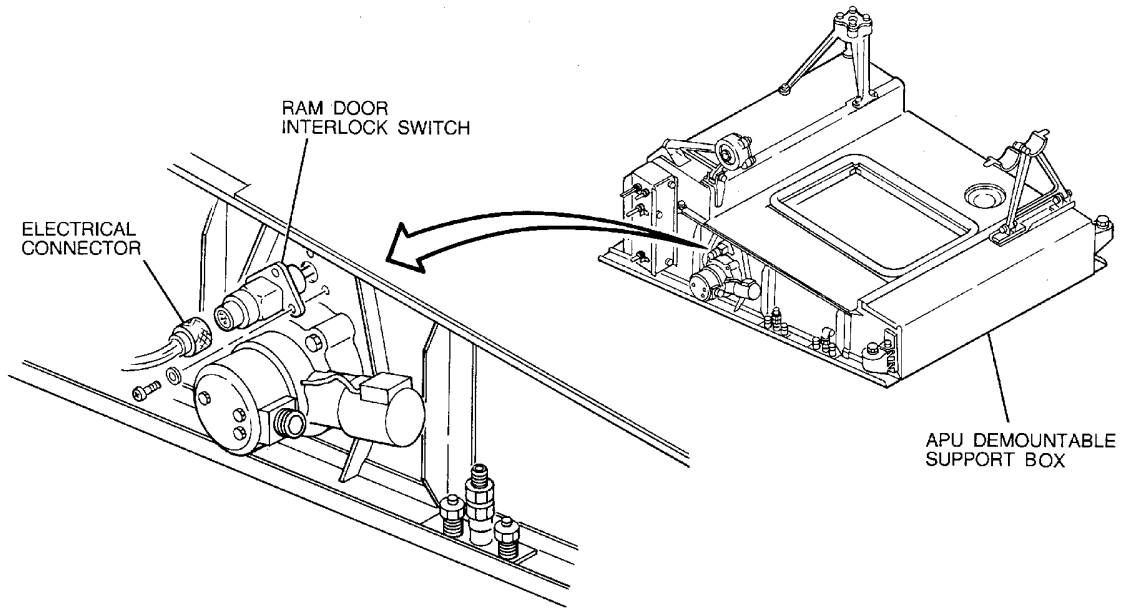
**APU Demountable Support Box -- Installation  
Figure 201/49-10-01-990-801**

EFFECTIVITY  
WJE ALL

**49-10-01**

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**Ram Door Interlock Switch -- Removal/Installation  
Figure 202/49-10-01-990-802**

EFFECTIVITY  
WJE ALL

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**AIR INLET DOOR PANEL - MAINTENANCE PRACTICES**

**1. General**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The air inlet door panel is mounted on the lower structure of the APU support box and consists of the ram air door, nonram air doors, a small pressure relief door, and the door actuating mechanism. This panel is accessible when the APU left and right access doors are open. The panel can be removed when the APU is installed in the aircraft, or when it is mounted on suitable ground handling fixture.

**2. Removal/Installation Air Inlet Door Panel**

A. Remove Panel

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove screws attaching ram door interlock switch to demountable support box.  
(3) Remove switch from box leaving switch connected to electrical connector.  
(4) Remove air inlet door actuator. (AIR INLET DOOR ACTUATOR, SUBJECT 49-10-04, page 201)

**CAUTION:** SUPPORT AIR INLET DOOR PANEL WHEN REMOVING FINAL SCREWS.

- (5) Remove screws attaching air inlet door panel to flange of APU support box. (Figure 201)

B. Install Panel

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**CAUTION:** MAKE CERTAIN ALL RETRACTABLE OVERBOARD DRAIN FITTINGS CLEAR CUTOUTS IN PANEL.

- (2) Position air inlet panel on APU support box. (Figure 201)  
(3) Install screws attaching air inlet panel to APU support box.

**NOTE:** If adjustments are required to fair air inlet panel with fuselage (PAGEBLOCK 49-10-00/501).

- (4) Install air inlet door actuator. (AIR INLET DOOR ACTUATOR, SUBJECT 49-10-04, page 201)

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- (5) Verify distance between nearest face of mounting flange of APU ram door interlock switch and center of switch arm roller is 1.300 ( $\pm 0.125$ ) inches. If not, replace switch.

**CAUTION:** MAKE CERTAIN DOOR ACTUATOR CAM IS POSITIONED ON PROPER SIDE OF SWITCH ARM AND RAM AIR DOOR IS FULLY OPEN BEFORE INSTALLING SWITCH, OR SWITCH WILL BE DAMAGED.

- (6) With ram air door in full open position insert ram door interlock switch in demountable support box.
- (7) Install screws attaching ram door interlock switch to demountable support box.
- (8) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

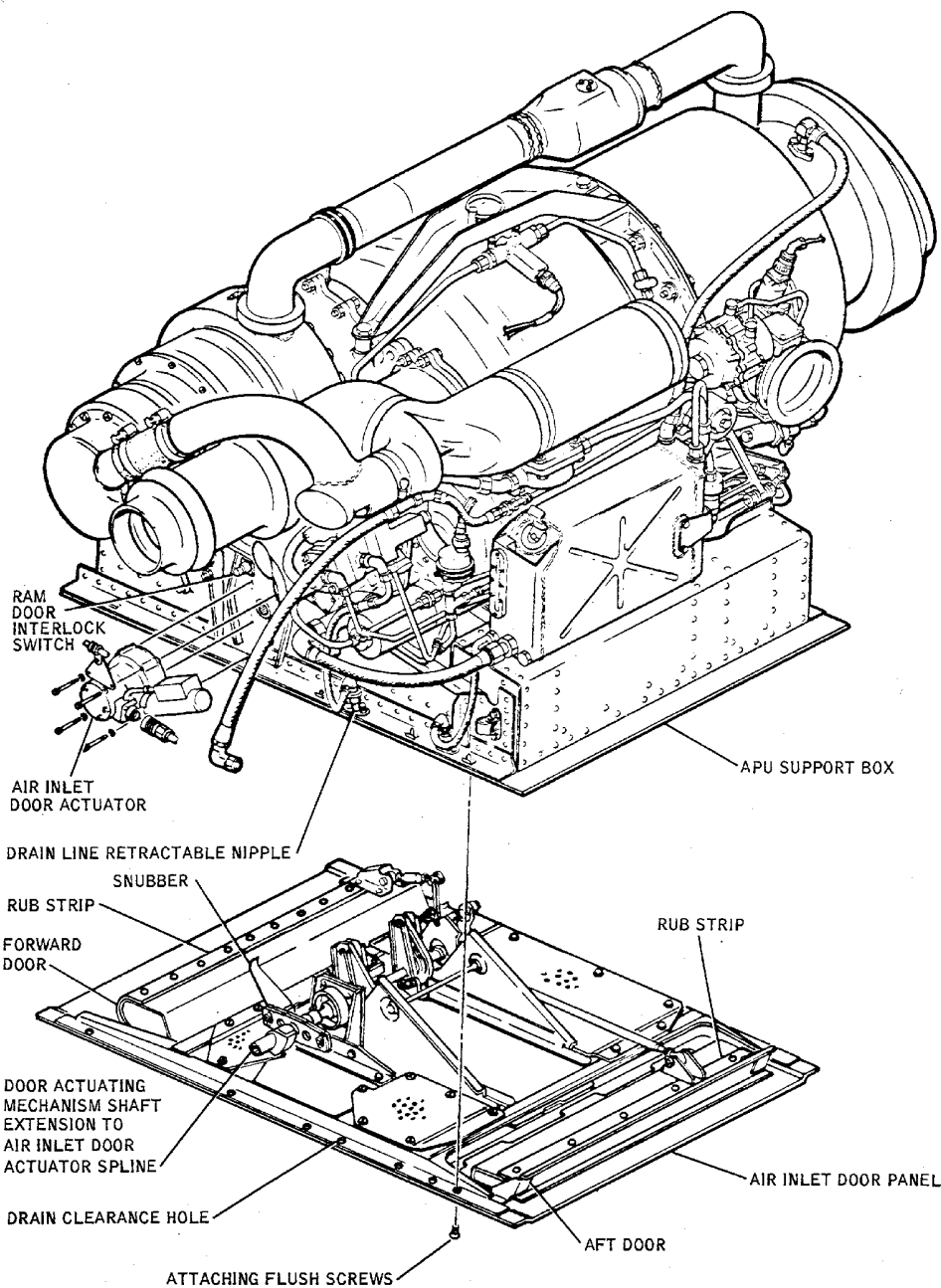
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**Air Inlet Door Panel -- Installation  
Figure 201/49-10-02-990-801**

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### AIR INLET DOORS - REMOVAL/INSTALLATION

#### 1. General

**CAUTION:** IF RAM DOOR INTERLOCK SWITCH IS REMOVED DURING FOLLOWING PROCEDURE, MAKE CERTAIN THAT RAM AIR DOOR IS IN FULL OPEN POSITION AND THAT ACTUATOR CAM IS ON PROPER SIDE OF SWITCH ARM WHEN SWITCH IS INSTALLED, OTHERWISE DAMAGE MAY RESULT TO SWITCH.

- A. The APU ram air inlet door, nonram air inlet doors, and drive shaft mechanism are major components of the air inlet door panel located on the lower surface of the demountable support box. The air inlet door panel must be removed from the demountable support box to gain access for the removal procedures outlined in the following text (PAGEBLOCK 49-10-02/201).

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following listed item:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 401**

Name and Number	Manufacturer
Lubricant, Dry Film DMS 1762 Type 7E	Saint-Gobain Wayne, New Jersey -OR- Zipchem North Hollywood, CA

#### 3. Removal/Installation Ram and Nonram Air Inlet Doors and Actuating Mechanism

- A. Remove Forward Nonram Air Inlet Door
  - (1) Remove nut, bolt, washer, and spacers attaching forward actuating rod to door. (Figure 401)
  - (2) Remove screws attaching aft side of door hinge to air inlet door panel.
  - (3) Remove door.
- B. Install Forward Nonram Air Inlet Door
  - (1) Position door on air inlet door panel. (Figure 401)
  - (2) Install screws attaching aft side of door hinge to air inlet door panel.
  - (3) Install bolt, nut, washer, and spacers attaching forward actuating rod to door.
  - (4) Check door for proper operation. (AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501)
  - (5) With door open, spray door seal with thin layer of dry film lubricant, and close door.
- C. Remove Aft Nonram Air Inlet Door
  - (1) Remove nut, bolt, washer and spacers attaching aft actuating rod to door. (Figure 401)
  - (2) Remove screws attaching forward side of door hinge to air inlet door panel.
  - (3) Remove door.
- D. Install Aft Nonram Air Inlet Door
  - (1) Position door on air inlet door panel. (Figure 401)

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- (2) Install screws attaching forward side of door hinge to air inlet door panel.
  - (3) Install bolt, nut, washer, and spacers attaching aft actuating rod to door.
  - (4) Check adjustment of door. (AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501)
- E. Remove Ram Air Inlet Door
- (1) Remove nut, bolt, washer, spacers, and bushings attaching left side linkage to door. (Figure 401)
  - (2) Remove nut, bolt, washer, spacers, and bushings attaching right side linkage to door.
  - (3) Remove screws attaching aft side of door hinge to air inlet door panel.
  - (4) Remove door.
- F. Install Ram Air Inlet Door
- (1) Position door on air inlet door panel. (Figure 401)
  - (2) Install screws attaching aft side of door hinge to air inlet door panel.
  - (3) Install bolt, nut, washer, spacers, and bushings attaching left side linkage to door.
  - (4) Install bolt, nut, washer, spacers, and bushings attaching right side linkage to door.
  - (5) Check adjustment of door. (AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501)
- G. Remove Ram and Nonram Air Inlet Doors Actuating Mechanism
- (1) Remove bolt, nut and washer attaching adapter and cam to drive shaft. (Figure 401)
  - (2) Remove adapter and cam.
  - (3) Remove bolt, nut, and washers attaching forward actuating rod to crank.
  - (4) Remove bolt, nut, and washers attaching aft actuating rod to crank.
  - (5) Remove bolts, nuts, washers, spacers, and bushings attaching left side of ram air door to link on drive shaft.
  - (6) Remove bolts, nuts, washers, spacers, and bushings attaching right side of ram air door to link on drive shaft.
  - (7) Remove bolts, nuts, and washers attaching left side bearing housing to support on air inlet door panel.
  - (8) Remove bolts, nuts, and washers attaching right side bearing housing to support on air inlet door panel.
  - (9) Remove bolts and washers attaching left side bearing housing to nutplates in air inlet door panel.
  - (10) Remove bolts and washers attaching right side bearing housing to nutplates in air inlet door panel.
  - (11) Carefully remove door actuating mechanism from air inlet door panel.
- H. Install Ram and Nonram Air Inlet Doors Actuating Mechanism
- (1) Position door actuating mechanism on air inlet door panel. (Figure 401)
  - (2) Install bolts and washers attaching left side bearing housing to nutplates in air inlet door panel.
  - (3) Install bolts and washers attaching right side bearing housing to nutplates in air inlet door panel.
  - (4) Install bolts, nuts, and washers attaching left side bearing housing to support on air inlet door panel.

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- (5) Install bolts, nuts, and washers attaching right side bearing housing to support on air inlet door panel.
- (6) Install bolts, nuts, washers, spacers, and bushings attaching left side ram air door slide bearing to link on drive shaft.
- (7) Install bolts, nuts, washers, spacers, and bushings attaching right side ram air door slide bearing to link on drive shaft.
- (8) Install bolt, nut, and washer attaching aft actuating rod to crank.
- (9) Install bolt, nut, and washer attaching forward actuating rod to crank.
- (10) Position adapter and cam on drive shaft.

NOTE: Cam striker plate should be at 10 o'clock position when viewed from left side of panel and drive shaft in doors closed position.

- (11) Install bolt, nut, and washer attaching adapter and cam to drive shaft.
- (12) Rig door actuating mechanism and adjust doors to fair with air inlet door panel. (AIR INLET DOORS - ADJUSTMENT/TEST, PAGEBLOCK 49-10-03/501)

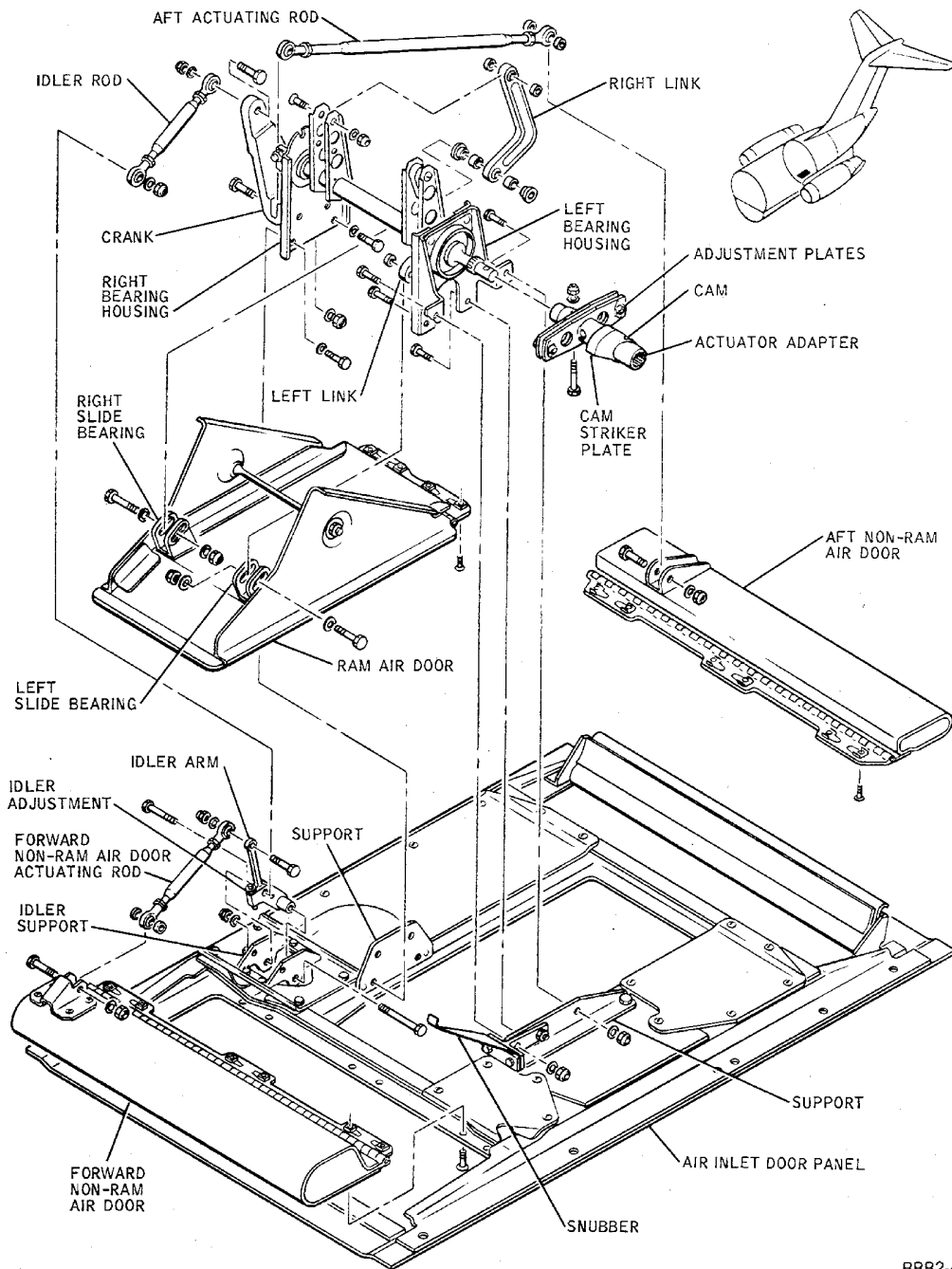
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**Air Inlet Doors -- Installation  
Figure 401/49-10-03-990-801**

EFFECTIVITY  
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**49-10-03**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### AIR INLET DOORS - ADJUSTMENT/TEST

#### 1. General

- A. This section outlines procedures for adjusting and testing forward and aft nonram air inlet doors.
- B. Provisions are also provided for fairing left and right side of ram air door when fairing is necessary. The air inlet door panel must be removed to gain access for Adjustment/Test. (PAGEBLOCK 49-10-02/201)

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 501**

Name and Number	Manufacturer
Rig pin 1/4-inch diameter, RP-2	Commercially available
Bonded laminated stock (20) laminations .003 inch aluminum	Commercially available
Push-pull gage 0 to 80 pounds, 80 D	John Chatillon and Sons 85 Cliff St. New York, New York
Lubricant, Dry Film DMS 1762 Type 7E	Saint-Gobain Wayne, New Jersey -OR- Zipchem North Hollywood, CA
Protractor	Commercially available
<u>NOTE:</u> Rig pin is contained in kit 5916717 which may be purchased from The Boeing Company.	

#### 3. Adjustment/Test Air Inlet Doors and Door Actuating Mechanism

- A. Adjust Ram Air Inlet Door
  - (1) Remove air inlet panel from demountable support box. (PAGEBLOCK 49-10-02/201)  
NOTE: Do not install rig pin when adjusting ram air inlet door.
  - (2) Remove bolts, nuts, washers, spacers, and bushings attaching left side of door to link on cross shaft. (Figure 501)
  - (3) Remove bolts, nuts, washers, spacers, and bushings attaching right side of door to link on cross shaft.
  - (4) Remove bolts and washers attaching left bearing slide to nutplates in door.
  - (5) Remove bolts and washers attaching right bearing slide to nutplates in door.

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- (6) Adjust door to fair with door seal by shimming under left or right slide bearing as required.

**NOTE:** With non-ram doors actuating rods disconnected, shim slides individually to ensure that linkage is pulled over center and the ram door evenly closes when a force of approximately 10 pounds (4.54 kg) is applied to the top of the left or right linkage. (Figure 501)

- (7) With required thickness shim in position, install bolts and washers attaching slide bearing to left side of door.
- (8) With required thickness shim in position, install bolts and washers attaching slide bearing to right side of door.
- (9) Install bolts, nuts, washers, spacers, and bushings attaching left side of door to link on cross shaft.
- (10) Install bolts, nuts, washers, spacers, and bushings attaching right side of door to link on cross shaft.
- (11) Install air inlet door panel on demountable support box. (PAGEBLOCK 49-10-02/201)
- (12) Perform operational check of air inlet doors. (GENERAL, SUBJECT 49-00-00, page 501)

### B. Adjust Forward and Aft Nonram Doors

- (1) Remove air inlet door panel from demountable support box. (PAGEBLOCK 49-10-02/201)
- (2) Check idler (1) for 4.468 inch (11.35 cm) dimension as shown on Figure 501. Idler (1) is dimensionally positioned during manufacturing assembly. Dimension called out should be retained during lifetime of panel unless replacement idler (1) is installed.
- (3) Disconnect one end of rods (5), (6) and (7). (Figure 501)
- (4) Install .250 inch (.635 cm) diameter rig pins in idler (1) at check point NO. 1 and in cross shaft (2) at check point NO. 2.
- (5) Using two "C" clamps (one on each outboard side), secure aft nonram door in closed position against landing.
- (6) Install rod (7) as follows:
- Adjust rod ends until rig pin at check point NO. 2 slides in and out easily.
  - Lengthen rod by rotating one rod end one complete turn.
  - Rig pin at check point NO. 2 should now be difficult to remove or install by hand.
  - Leave rig pin installed.
- (7) Using two "C" clamps (one on each outboard side), secure forward nonram door in closed position against landing.
- (8) Install rod (5) as follows:
- Adjust rod ends until rig pin at check point NO. 1 slides in and out easily.
  - Lengthen rod by rotating one rod end one complete turn.
  - Rig pin at check point NO. 1 should now be difficult to remove or install by hand.
  - Leave rig pin installed.
- (9) Install rod (6) by adjusting rod ends. Rod should slide on easily.

**CAUTION:** CHECK ROD END WITNESS HOLE TO ENSURE ADEQUATE ENGAGEMENT OF ROD END THREADS.

- (10) Check that witness hole in rod ends of rods (5), (6) and (7) is at least partially covered.

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- (11) Adjust stop screw (4) on idler arm (3) to .010( $\pm$ .005) inch (.0025( $\pm$ .0013) cm) and tighten jam nut.
- (12) Check that all rod end jam nuts are tight.
- (13) Remove all "C" clamps and rig pins.
- (14) Install air inlet door panel on demountable support box. (PAGEBLOCK 49-10-02/201)
- (15) Perform operational check of air inlet doors. (GENERAL, SUBJECT 49-00-00, page 501)

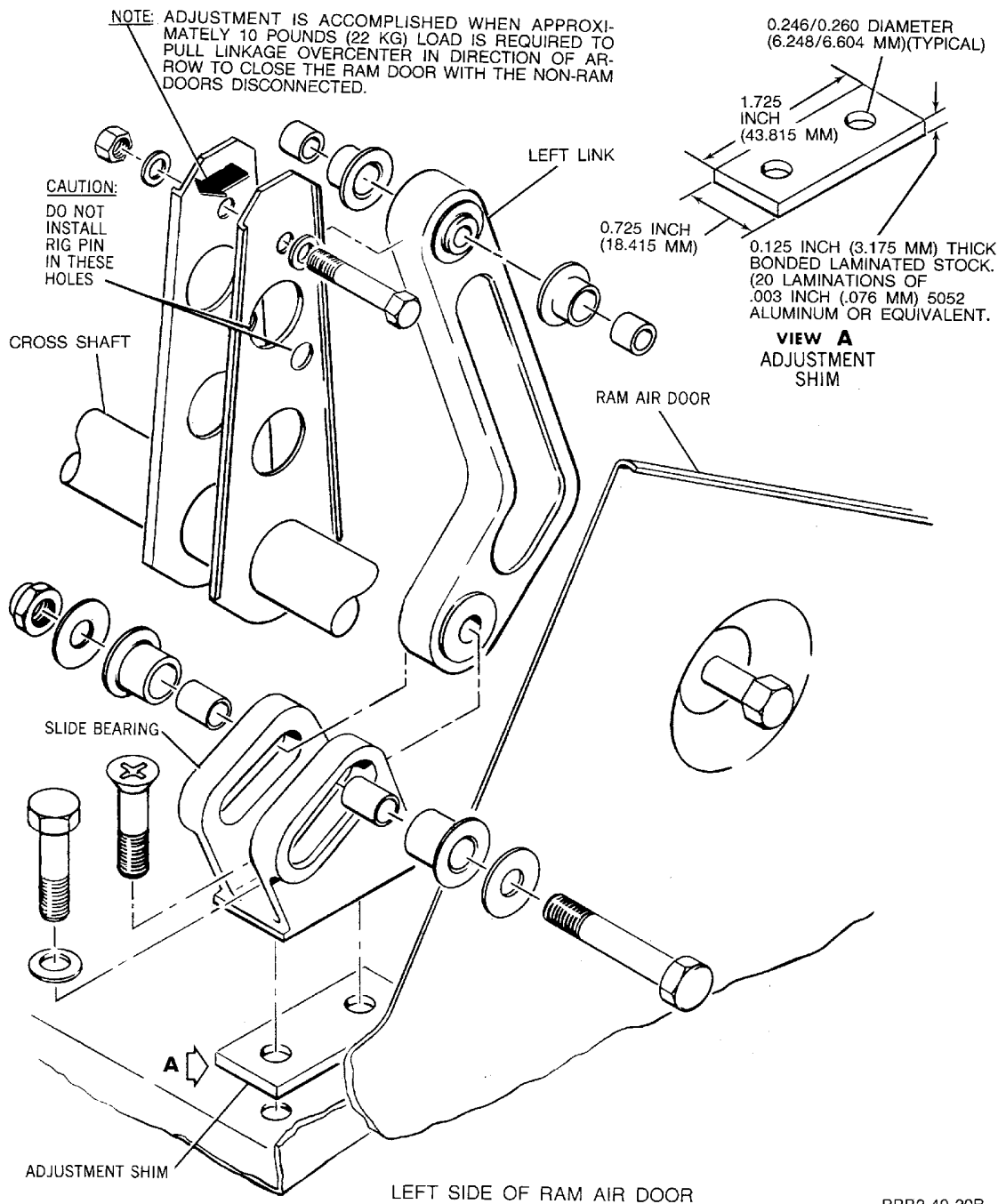
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**Air Inlet Doors -- Adjustment**  
**Figure 501/49-10-03-990-802 (Sheet 1 of 3)**

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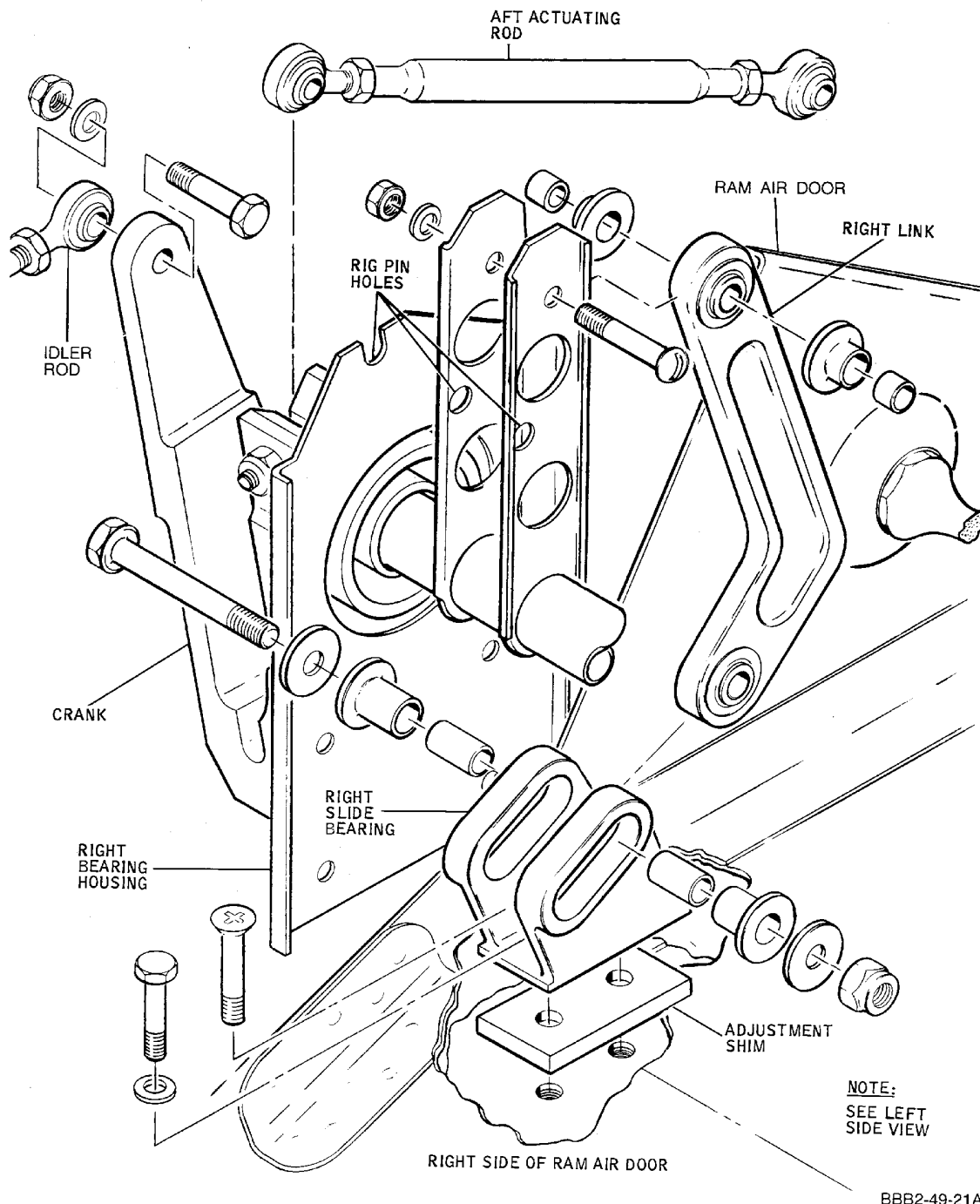
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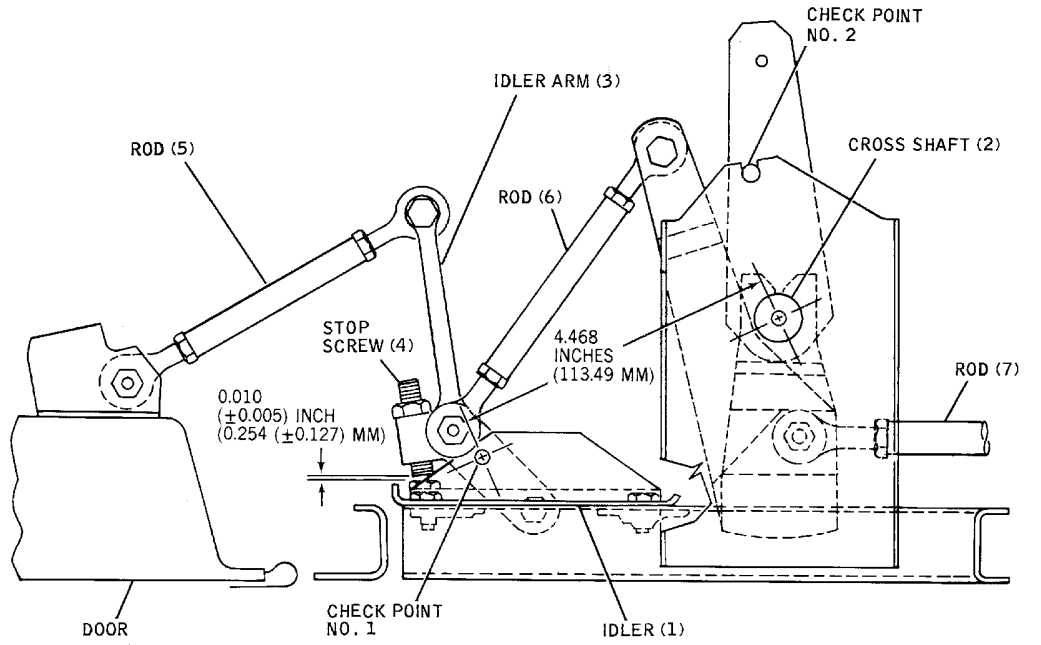


**Air Inlet Doors -- Adjustment**  
**Figure 501/49-10-03-990-802 (Sheet 2 of 3)**

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**Air Inlet Doors -- Adjustment**  
**Figure 501/49-10-03-990-802 (Sheet 3 of 3)**

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## AIR INLET DOOR ACTUATOR - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**WARNING:** HANDLING OF OVERHAULED DOOR ACTUATORS DURING INSTALLATION CAN CAUSE DAMAGE TO ACTUATOR MOTOR HOUSING. WHEN INSTALLING ACTUATORS PARKED AT 0 DEGREES (ALL DOORS CLOSED) PRELOAD MUST BE PUT ON ACTUATOR. USING ACTUATOR MOTOR AS LEVER WILL DAMAGE ACTUATOR MOTOR HOUSING. AT 62 DEGREES NON-RAM AIR DOORS WILL BE FULL OPEN AND THE RAM AIR DOORS WILL BE FULL CLOSED. IN THIS CONFIGURATION, ACTUATOR IS SET AT 62 DEGREES, AND ACTUATOR CAN BE INSTALLED WITH NO PRE-LOAD. IF ACTUATOR SPLINED OUTPUT SHAFT IS PARKED AT 62 DEGREES, TO INSTALL, POSITION NON-RAM DOORS FULL OPEN AND RAM AIR DOOR CLOSED. ONLY INSTALL ACTUATORS WHEN NON-RAM DOORS AND RAM DOORS ARE PARKED IN SAME CONFIGURATION AS ACTUATOR.

- A. The air inlet door actuator, used to drive the ram and nonram air inlet doors is located on the left side of the APU support box. The actuator may be removed when the APU is installed in the aircraft. Access is through the APU left access door.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following item:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Antiseize compound, DOD-L-25681 DPM 5782	E/M Corp. North Hollywood, CA
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. Removal/Installation Air Inlet Door Actuator

- A. Remove Actuator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open these circuit breakers and install safety tags:

**LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

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### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from actuator motor. (Figure 201)
- (3) Remove bolts and washers attaching actuator to APU support box.
- (4) Carefully disengage shaft splines and remove actuator.
- (5) To ensure that all mechanical linkages are functioning properly, push in on forward non-ram door until mechanism unlocks by traveling over center and ram door drops open by its own weight. (As ram door moves to full open position, non-ram doors will close.)

#### B. Install Actuator

- (1) Ensure that actuator is in door closed (zero) position by applying 28 vdc to pin C of actuator receptacle. This can be accomplished as follows:
  - (a) APU Door Switch -- AUTO
  - (b) APU Master Switch -- OFF

**WARNING:** DUE TO POSSIBILITY OF DRIVE SHAFT ROTATING, POSITION ACTUATOR TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO AIRCRAFT STRUCTURE.

- (c) Connect electrical connector to actuator.
  - (d) Energize DC transfer bus.
  - (e) APU Door Control Circuit Breaker -- CLOSED.
- (2) Deenergize DC transfer bus and make sure the following circuit breakers are open:

### LOWER EPC, DC TRANSFER BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Disconnect electrical connector from actuator.

**WARNING:** MOLYBDENUM DISULFIDE SILICONE LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN MOLYBDENUM DISULFIDE SILICONE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET MOLYBDENUM DISULFIDE SILICONE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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**(WARNING PRECEDES)**

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (4) Apply antiseize compound (MIL-L-25681) to actuator drive shaft splines.
- (5) Ensure that APU air inlet doors are in closed position.
- (6) Align actuator drive shaft splines with adapter splines by indexing missing splines (master tooth).
- (7) Engage mating splines and rotate actuator until bolt hole of mounting base aligns with mating hole in APU support box.
- (8) Install actuator mounting bolt and washer.
- (9) Rotate actuator counterclockwise until remaining holes in mounting base are aligned with mating holes in APU support box. Install bolts and washers.

NOTE: Preloading (rotating) actuator counterclockwise as much as 1/2 hole diameter to align second and subsequent bolt holes is permissible.

- (10) If excess preload is encountered, rig inlet door linkage to actuator as follows:
  - (a) Remove actuator and manually operate door mechanism to full ram door open (180°) position to gain access to adapter plates. (Figure 201)
  - (b) Temporarily disconnect ram door from linkage at slotted hole attachment. (Figure 202 (Sheet 1) and Figure 202 (Sheet 2))
  - (c) Rotate cross shaft to place all doors at 0 degree (closed position) and install inlet mechanism cross shaft rig pin at check point two. (Figure 202 (Sheet 3))

**CAUTION:** DO NOT ADJUST ADAPTER HALVES TO PRELOAD ANY DOOR IN CLOSED POSITION AS THIS WILL RESULT IN EXCESSIVE PRELOAD ON REMAINING TWO DOORS. EXCESSIVE PRELOAD CAN RESULT IN OVERSTRESS AND SUBSEQUENT FAILURE OF DOOR DRIVE LINKAGE AND/OR ACTUATOR INTERNAL DAMAGE. RAM AND NON-RAM DOORS MUST BE ADJUSTED INDIVIDUALLY PER MAINTENANCE MANUAL, CHAPTER 49-10-03.

- (d) Loosen two adapter clamp bolts attaching adapter halves.
- (e) Install actuator (must be at 0 degree position).
- (f) Tighten adapter clamp bolts and tighten to torque of 100 to 140 inch-pounds (11.3 to 15.8 N·m).
- (g) Remove rig pin.
- (h) Connect ram door.
- (11) Connect electrical connector to actuator and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (12) Remove the safety tags and close these circuit breakers:

**LOWER EPC, DC TRANSFER BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
U	39	B1-290	APU DOOR CONTROL

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (13) Perform air inlet door operational check. (GENERAL, SUBJECT 49-00-00, page 501)

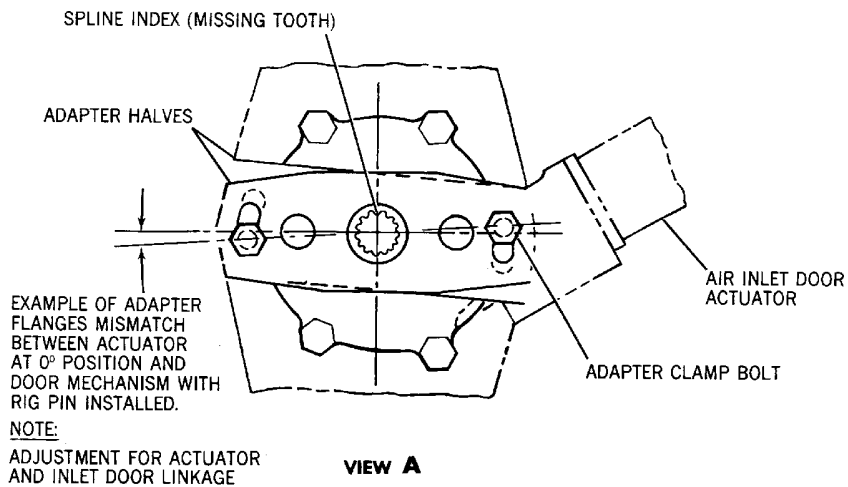
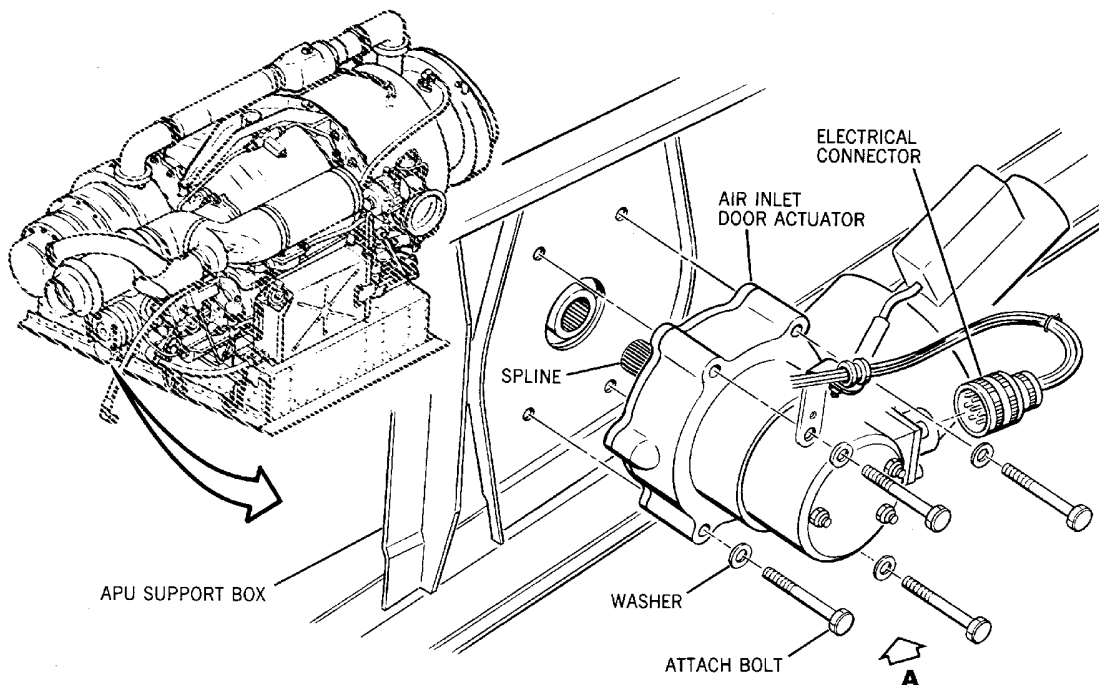
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**Air Inlet Door Actuator -- Installation  
Figure 201/49-10-04-990-801**

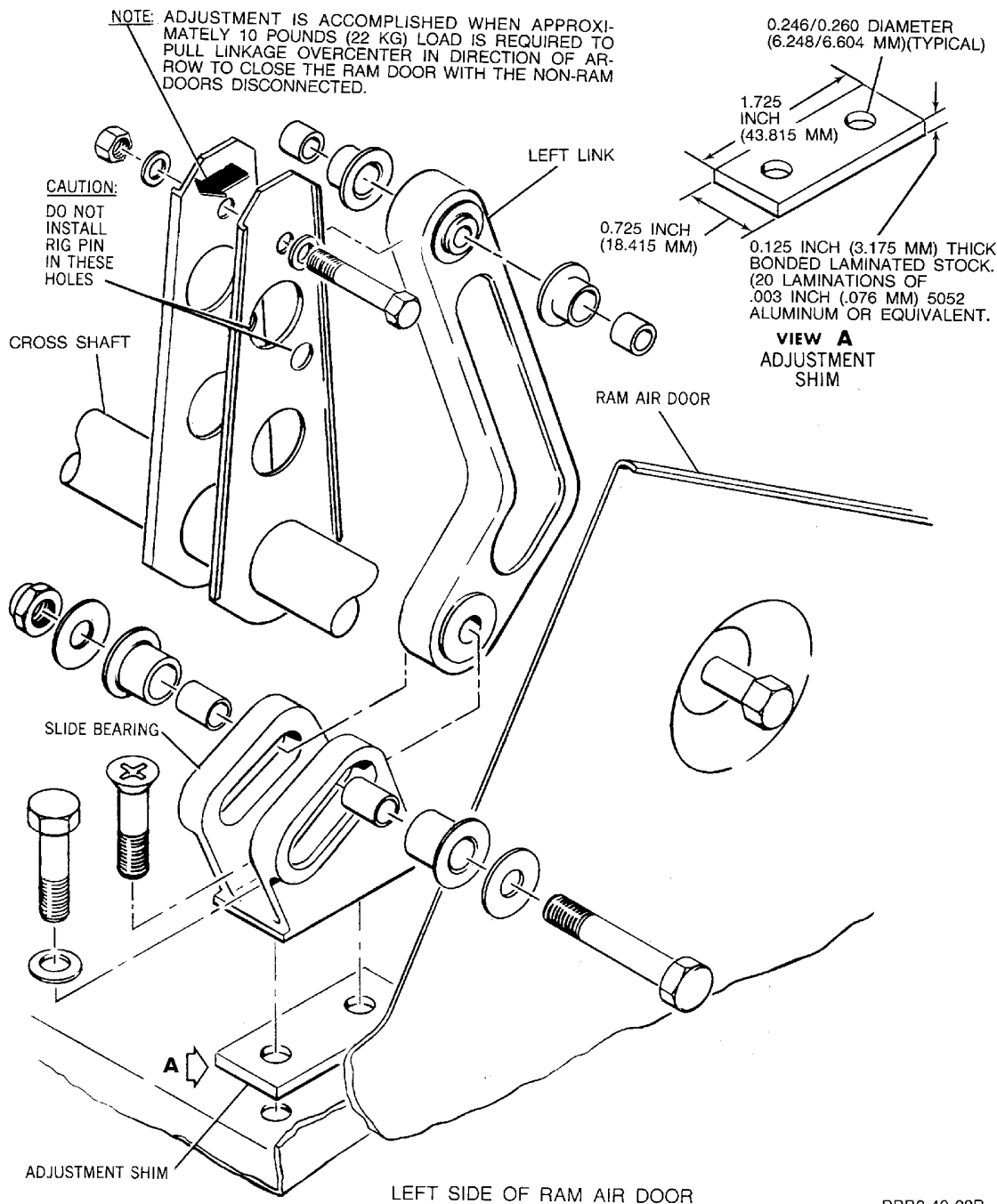
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BBB2-49-20B

**Air Inlet Doors -- Adjustment**  
**Figure 202/49-10-04-990-804 (Sheet 1 of 3)**

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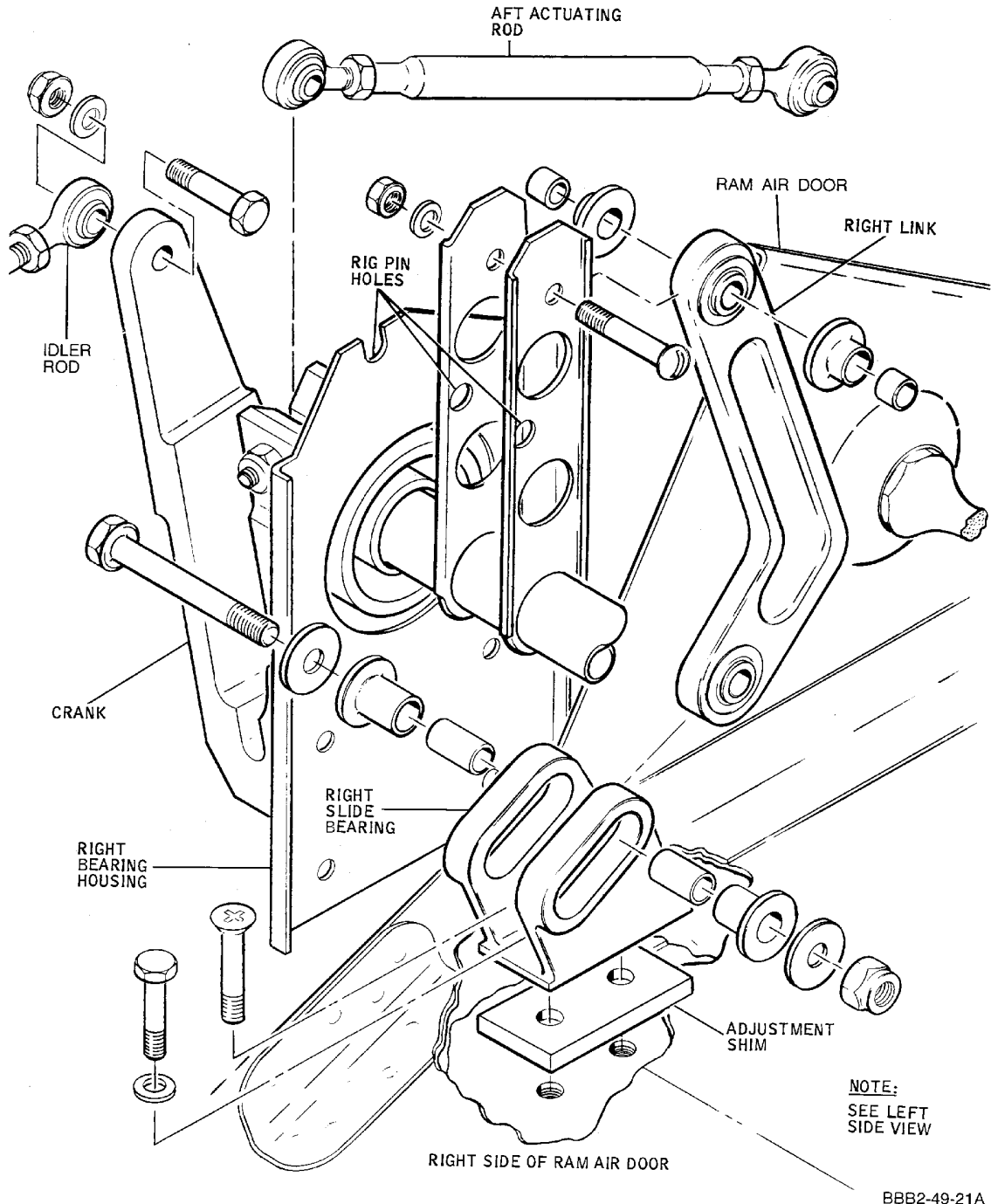
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BBB2-49-21A

**Air Inlet Doors -- Adjustment**  
**Figure 202/49-10-04-990-804 (Sheet 2 of 3)**

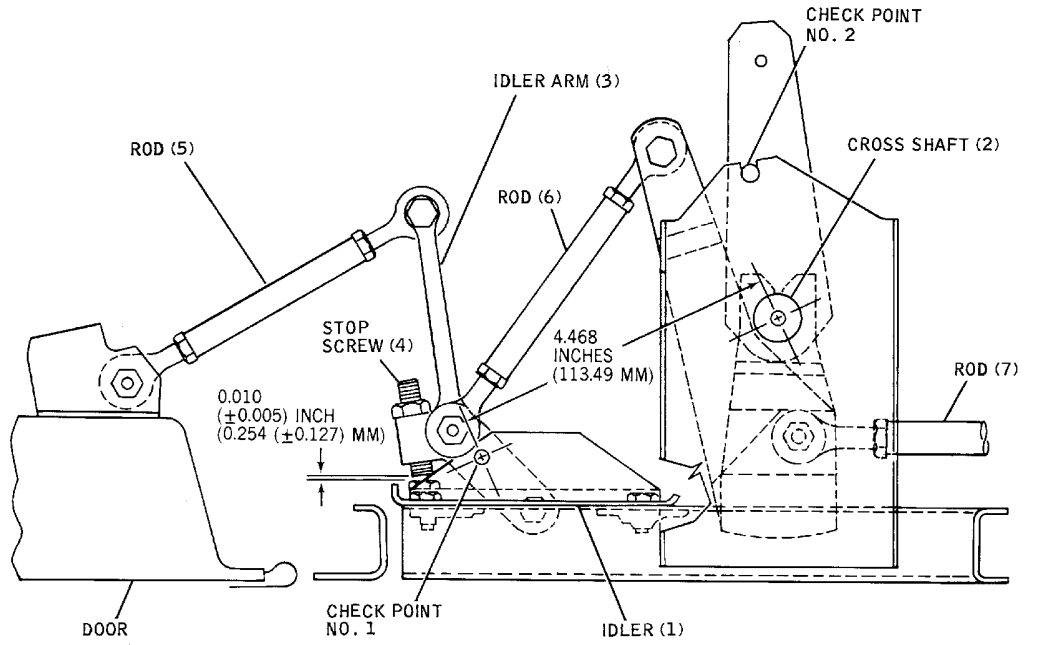
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**Air Inlet Doors -- Adjustment**  
**Figure 202/49-10-04-990-804 (Sheet 3 of 3)**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## APU MOUNTS AND VIBRATION ISOLATORS - MAINTENANCE PRACTICES

### 1. General

- A. The engine and APU mounts are accessible only when the unit is removed from the airplane and adequately supported by suitable equipment.

**CAUTION:** WEIGHT OF ENGINE MUST BE SUPPORTED BY HOIST OR OTHER EQUIPMENT BEFORE REMOVING ANY ENGINE MOUNT.

- B. The vibration isolator in the engine aft mount can be removed without removing the mount frame from the APU. The engine left and right forward mounts must be removed from the APU for access to the vibration isolators.

**CAUTION:** REMOVE AND CHECK ALL REMAINING APU MOUNTS WHEN REPLACEMENT IS DUE TO APPARENT DAMAGE SUSTAINED IN FLIGHT OR AT TIME OF LANDING.

- C. The APU mount sections remaining attached to the airframe are accessible through APU left and right access doors.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Hoist, *Optional	Optional
APU handling fixture, 5916710	Douglas Aircraft Co.
<b>CAUTION:</b> MAKE CERTAIN APU HOIST IS CAPABLE OF SUPPORTING WEIGHT OF 600 (272.4 KG) POUNDS MINIMUM.	
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. Removal/Installation Engine/APU Mounts and Vibration Isolators

- A. Remove Aft Vibration Isolator
- (1) Remove nut and washer attaching vibration isolator to stud on diffuser housing. (Figure 201)
  - (2) Remove nut, washer, and bolt attaching vibration isolator retaining cap to aft mount.
  - (3) Remove vibration isolator from stud and check for wear or physical damage. If wear is excessive or part is damaged, replace isolator.

- B. Install Aft Vibration Isolator
- (1) Position vibration isolator on stud. (Figure 201)

**CAUTION:** DO NOT OVERTIGHTEN NUT.

- (2) Install washer and nut attaching vibration isolator to stud.
- (3) Close vibration isolator retaining cap and install bolt, washer, and nut.

- C. Remove Engine Aft Mount

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- (1) Remove vibration isolator from engine aft mount. (Paragraph 3.A.)
  - (2) Remove nuts, bolts, washers, and spacers attaching mount to fittings on APU support box. (Figure 201)
  - (3) Remove engine aft mount.
- D. Install Engine Aft Mount
- (1) Position engine aft mount in fittings on APU support box. (Figure 201)
  - (2) Install nuts, bolts, washers, and spacers attaching engine mount to fittings on APU support box.
  - (3) Install vibration isolator in engine mounts. (Paragraph 3.B.)
- E. Remove Right Forward Engine Mount and Vibration Isolator
- (1) Remove nut, washer, and bolt attaching engine mount and vibration isolator to fitting on diffuser housing. (Figure 201)
  - (2) Remove bolts and washers attaching engine mount to APU support box.
  - (3) Remove engine mount.
  - (4) Remove bolts and washers attaching vibration isolator retainer to engine mount.
  - (5) Remove vibration isolator from engine mount and check for wear or physical damage. If wear is excessive or part is damaged, replace isolator.
- F. Install Right Forward Engine Mount and Vibration Isolator
- (1) Position vibration isolator in engine mount. (Figure 201)
  - (2) Install bolts and washers attaching retainer and vibration isolator to engine mount and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
  - (3) Position engine mount on fittings attached to APU support box.
  - (4) Install bolts and washers attaching engine mount to fittings on APU support box.
- CAUTION:** DO NOT OVERTIGHTEN NUT.
- (5) Install bolt, washer, and nut attaching vibration isolator to fitting on diffuser housing.
- G. Remove Left Forward Engine Mount and Vibration Isolator
- (1) Remove nut, bolt, and washer attaching engine mount and vibration isolator to gear housing. (Figure 201)
  - (2) Remove nuts, bolts, and washers and spacers attaching engine mount to fittings on APU support box.
  - (3) Remove engine mount.
  - (4) Remove bolts and washers attaching vibration isolator retainer to engine mount.
  - (5) Remove vibration isolator from engine mount and check for wear or physical damage. If wear is excessive or part is damaged, replace vibration isolator.
- H. Install Left Forward Engine Mount and Vibration Isolator
- (1) Position vibration isolator in engine mount. (Figure 201)
  - (2) Install bolts and washers attaching retainer and vibration isolator to engine mount and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
  - (3) Position engine mount on fittings attached to APU support box.
  - (4) Install nuts, bolts, washers, and spacers attaching engine mount to support box.

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**CAUTION:** DO NOT OVERTIGHTEN NUT.

(5) Install bolt, washer, and nut attaching vibration isolator to fitting on gear housing.

I. Remove APU Mounts

NOTE: Numbers in parentheses in the following text correspond to callouts on Figure 201.

(1) Remove bolts attaching mount (1) to air inlet box.

(2) Remove bolts attaching mount (2) to air inlet box.

(3) Remove bolts attaching mount (3) to lower fuselage frame.

(4) Remove bolts attaching mount (4) to lower fuselage frame.

J. Install APU Mounts

NOTE: When replacing mount with new part, adjust as described in Paragraph 4..

(1) Install bolts attaching mount (1) to air inlet box.

(2) Install bolts attaching mount (2) to air inlet box.

(3) Install bolts attaching mount (3) to lower fuselage structure.

(4) Install bolts attaching mount (4) to lower fuselage structure.

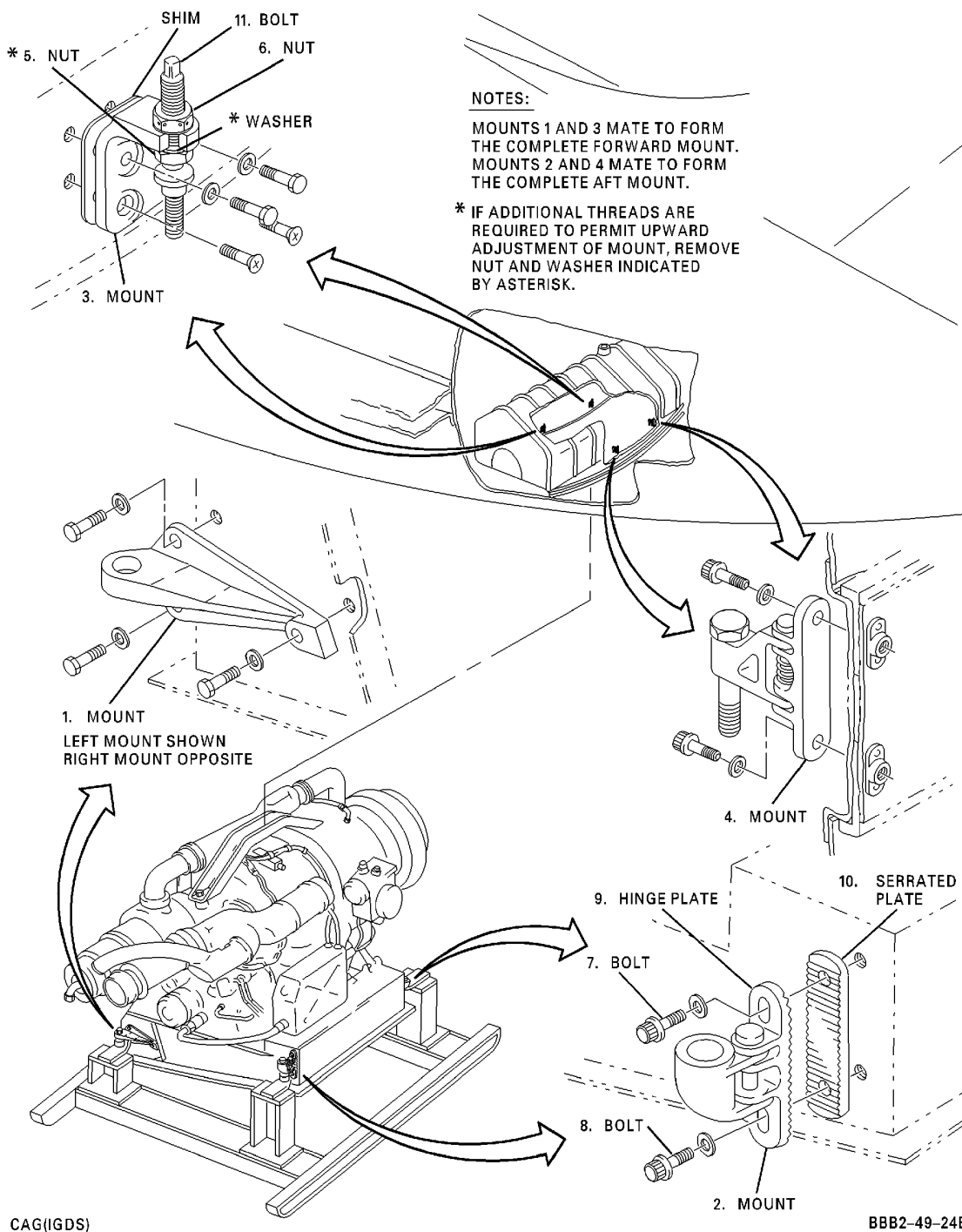
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**APU Mounts -- Installation**  
**Figure 201/49-10-05-990-801**

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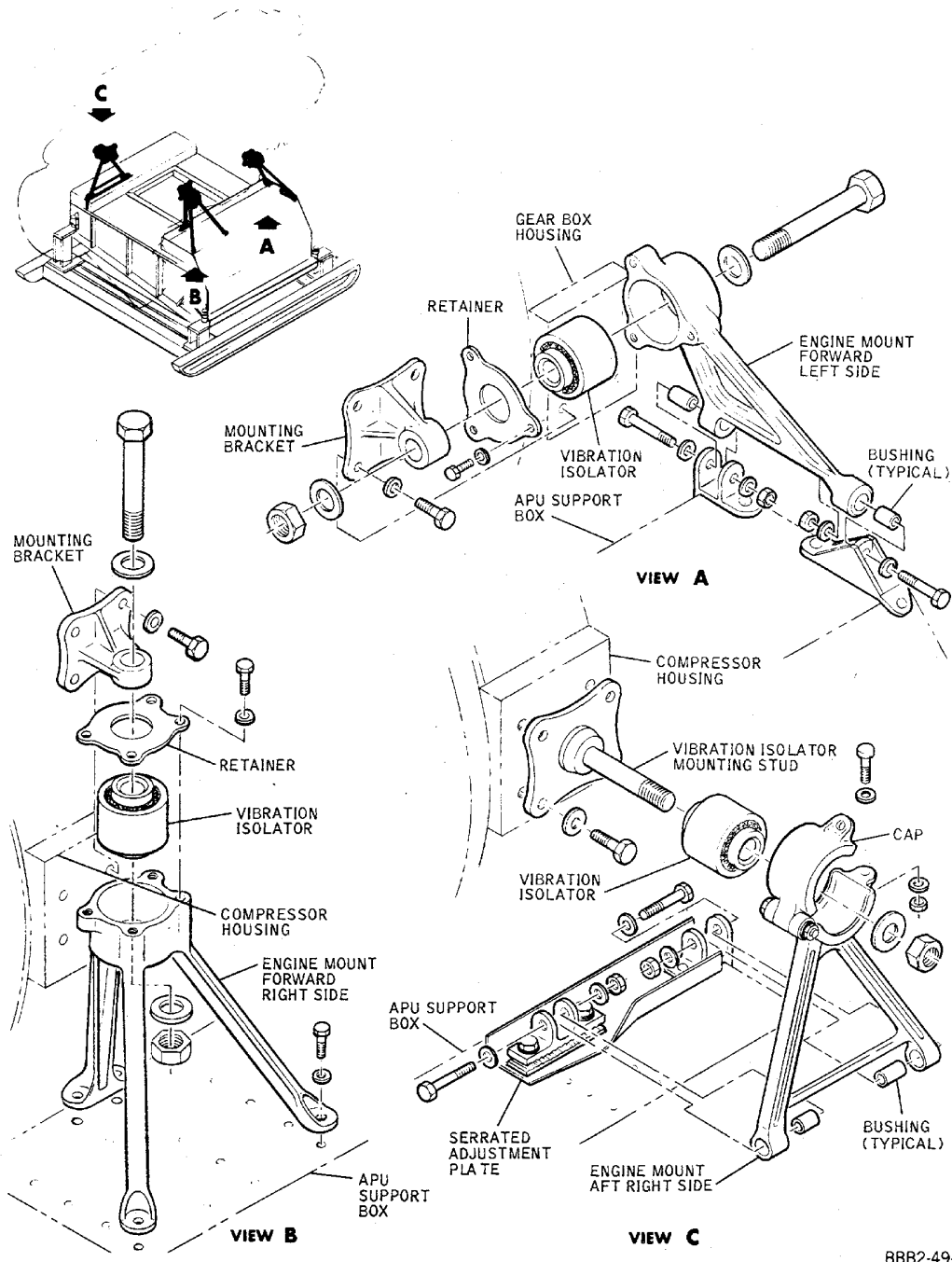
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**Engine Mounts and Vibration Isolators -- Installation**  
**Figure 202/49-10-05-990-802**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test APU Mounts

#### A. Adjust APU Mounts

**CAUTION:** PERFORM ALL ADJUSTMENTS TO MOUNTS WHILE APU IS INSTALLED.

- (1) Install APU. Make certain slack is removed from hoist cable. (POWER PLANT, SUBJECT 49-10-00, page 401)
- (2) Adjust forward mount to fair APU air inlet panel with fuselage within  $\pm 0.045$  inch (1.14 mm) as follows:
  - (a) Loosen nuts (5 and 6), turn bolt (11) counterclockwise to adjust APU upward to fair with fuselage.
  - (b) Loosen nuts (5 and 6), turn bolt (11) clockwise to adjust APU downward to fair with fuselage.
- (3) After fairing is complete, tighten nuts and to torque of 260 to 320 inch-pounds (29.38 to 36.16 N·m). Safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (4) Adjust aft mount to fair APU air inlet panel with fuselage within  $\pm 0.045$  inch (1.14 mm) as follows:
  - (a) Loosen bolt (7) and bolt (8).
  - (b) Move hinge plate (9) down on serrated plate (10) as necessary to adjust APU upward to fair with fuselage.
  - (c) Move hinge plate (9) up on serrated plate (10) as necessary to adjust APU downward to fair with fuselage.
- (5) After fairing is complete, tighten bolts to torque of 50 to 70 inch-pounds (5.65 to 7.91 N·m).
- (6) Disconnect and remove hoist. (POWER PLANT, SUBJECT 49-10-00, page 401)

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**APU MOUNTS AND VIBRATION ISOLATORS - INSPECTION/CHECK**

**1. General**

A. This procedure contains MSG-3 task card data.

**TASK 49-10-05-211-801**

**2. Detailed Inspection of the APU Engine and Airframe Mount Assemblies and Attaching Hardware**

**A. Detailed Inspection of the APU Engine and Airframe Mount Assemblies and Attaching Hardware**

SUBTASK 49-10-05-211-001

- (1) Do a detailed inspection of the APU engine and airframe mount assemblies and attaching hardware. (Figure 601Figure 602)
  - (a) Check the engine mounts for damage, security, condition and that the vibration isolators are serviceable.
  - (b) Check the APU mounts for damage, security and condition and that the attaching hardware is serviceable.

———— **END OF TASK** ————

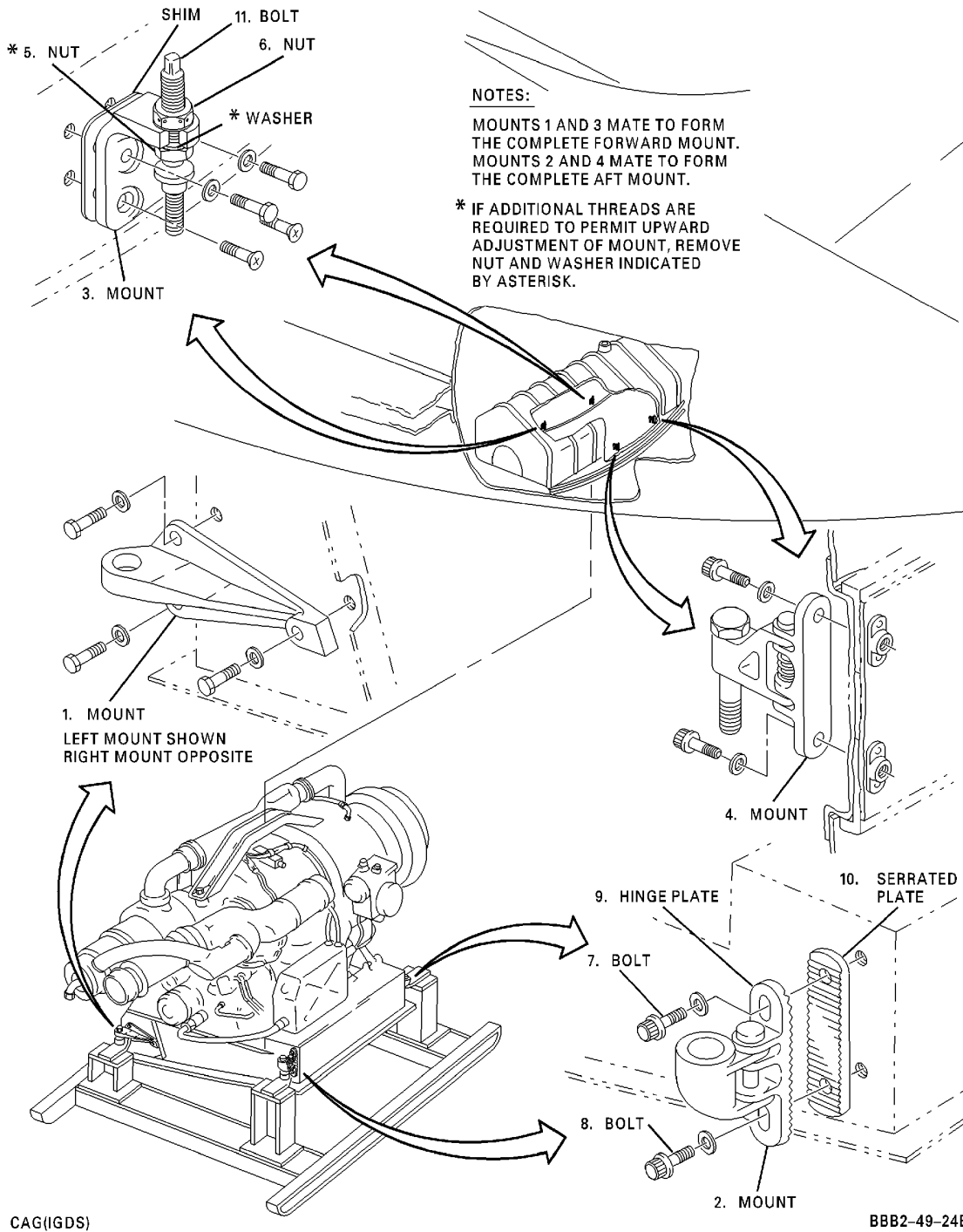
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**APU Airframe Mounts**  
**Figure 601/49-10-05-990-805**

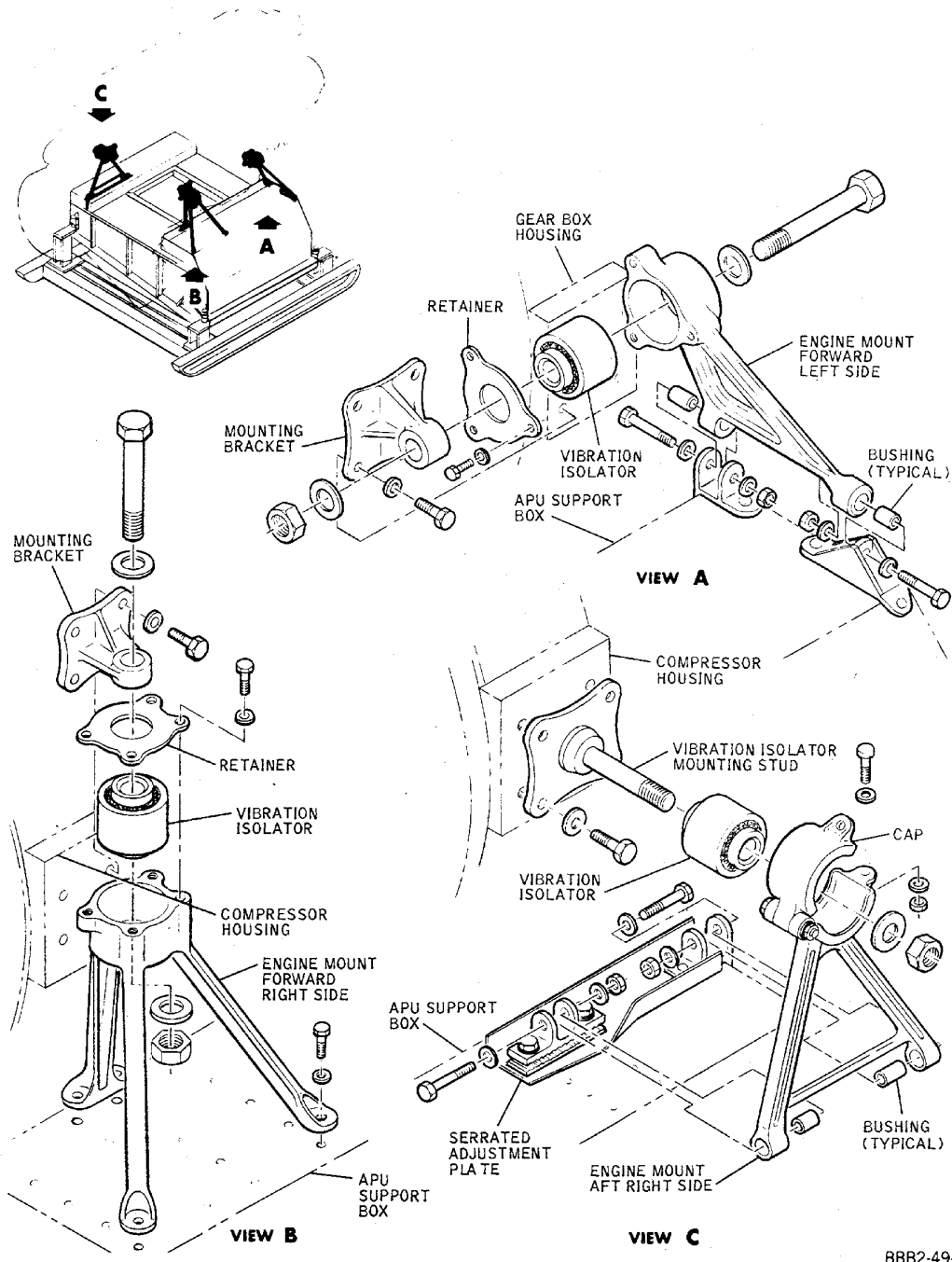
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**APU Engine Mounts  
Figure 602/49-10-05-990-806**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### ELECTRICAL HARNESS - MAINTENANCE PRACTICES

#### 1. General

- A. The APU electrical harness is attached to the unit by clip-mounted clamps. Since many of the attach points are similar, detailed removal and installation procedure for individual clamps is omitted in the following text. The electrical connectors and their respective item numbers are listed in Table 201.
- B. Other electrical cables on the APU (not included in the engine harness) are covered by the following procedure. These components are: the generator field and power cables and the APU starter motor cable. All wiring including electrical harness is accessible when the APU is removed from the airplane. The APU hourmeter will also require removal for access to electrical leads.

#### 2. Removal/Installation Electrical Harness

- A. Remove Electrical Harness
  - (1) Remove APU from aircraft. (POWER PLANT, SUBJECT 49-10-00, page 401).
  - (2) Disconnect electrical connectors listed in Table 201.
  - (3) Remove screws and washers attaching cover to current trans-former box.
  - (4) Tag and disconnect transformer leads inside current trans-former box.  
NOTE: To avoid losing, leave jumpers attached to transformers.
  - (5) Disconnect clamp on outside of current transformer box and pull out wire bundle.
  - (6) Remove hourmeter for access to electrical leads.
    - (a) Remove hourmeter clamp tag and disconnect leads.
    - (b) Tag and disconnect leads from hourmeter circuit breaker.
  - (7) Tag and disconnect wires from terminal strip on hourmeter support.
  - (8) Disconnect all remaining clamps and remove electrical harness from APU.

**Table 201 Engine Electrical Connectors**

Connector Name	Number
Oil Sequencing Switch	P1-101
Nonram Air Door Interlock Switch	P1-116
Tachometer Generator	P1-126
Generator Field Cable	*P1-147
Fuel Solenoid Valve	P1-148
Centrifugal Switch	P1-149
Ignition Coil Unit	P1-150
Air Inlet Door Actuator	P1-155
Load Control Valve	P1-156
Pneumatic Solenoid Valve	P1-262
Oil Low-pressure Switch	P1-263
Overspeed Stopping and Holding Relay	P1-264
Control Thermostat Solenoid Valve	P1-490
<u>NOTE:</u> Disconnecting electrical connector P1-147 removes the generator field cable from APU.	

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**Table 202 Engine Electrical Connectors**

Connector	Number	Mating Receptacle
APU Controls	P1-1108	R1-1108
APU Generator Power	P1-1109	R1-1109
APU Generator Field	P1-1110	R1-1110
Starter	P1-1111	R1-1111
<p><b>NOTE:</b> All connectors listed in this table are disconnected from mating receptacles located on the enclosure when the APU is removed from airplane.</p>		

**B. Install Electrical Harness**

- (1) Position electrical harness on APU.
- (2) Attach electrical harness to APU by installing clamps.
- (3) Connect electrical leads to terminal strip on hourmeter support and remove tags.
- (4) Connect electrical leads to hourmeter circuit breaker and remove tags.
- (5) Connect electrical leads to hourmeter and remove tags.
- (6) Install hourmeter.
- (7) Insert terminal ends of wire bundle in current transformer box.

**CAUTION:** MAKE CERTAIN JUMPER WIRES ARE INSTALLED CORRECTLY.

- (8) Connect electrical leads to terminal post in current transformer box and remove tags.
- (9) Attach wire bundle to current transformer box by attaching clamp to box.
- (10) Connect electrical connectors listed in Table 201.

**C. Remove Generator and Starter Motor Cables**

- (1) Remove terminal strip cover from generator housing.
- (2) Tag and disconnect generator cables from terminal post.
- (3) Tag and disconnect starter motor electrical leads.
- (4) Remove bolts, nuts, and washers attaching cable support block to generator.
- (5) Remove generator and starter motor cables.

**D. Install Generator and Starter Motor Cables**

- (1) Position generator cable clock support on generator.
- (2) Install bolts, nuts, and washers attaching generator cable support block to generator.
- (3) Connect electrical leads to starter and remove tags.
- (4) Connect electrical leads to generator terminal posts and remove tags.
- (5) Tighten nuts attaching generator cables to terminal post to torque of 144 to 168 inch-pounds.
- (6) Install terminal strip cover.
- (7) Install APU. (POWER PLANT, SUBJECT 49-10-00, page 401)

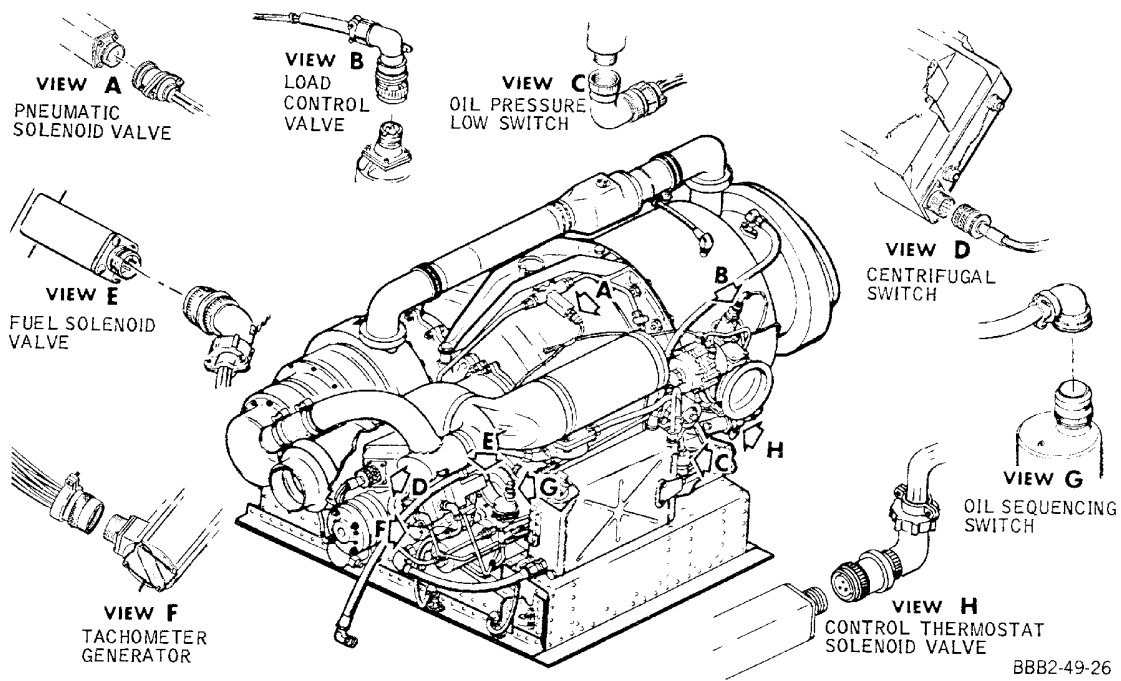
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Electrical Harness -- Installation  
Figure 201/49-10-06-990-801 (Sheet 1 of 3)

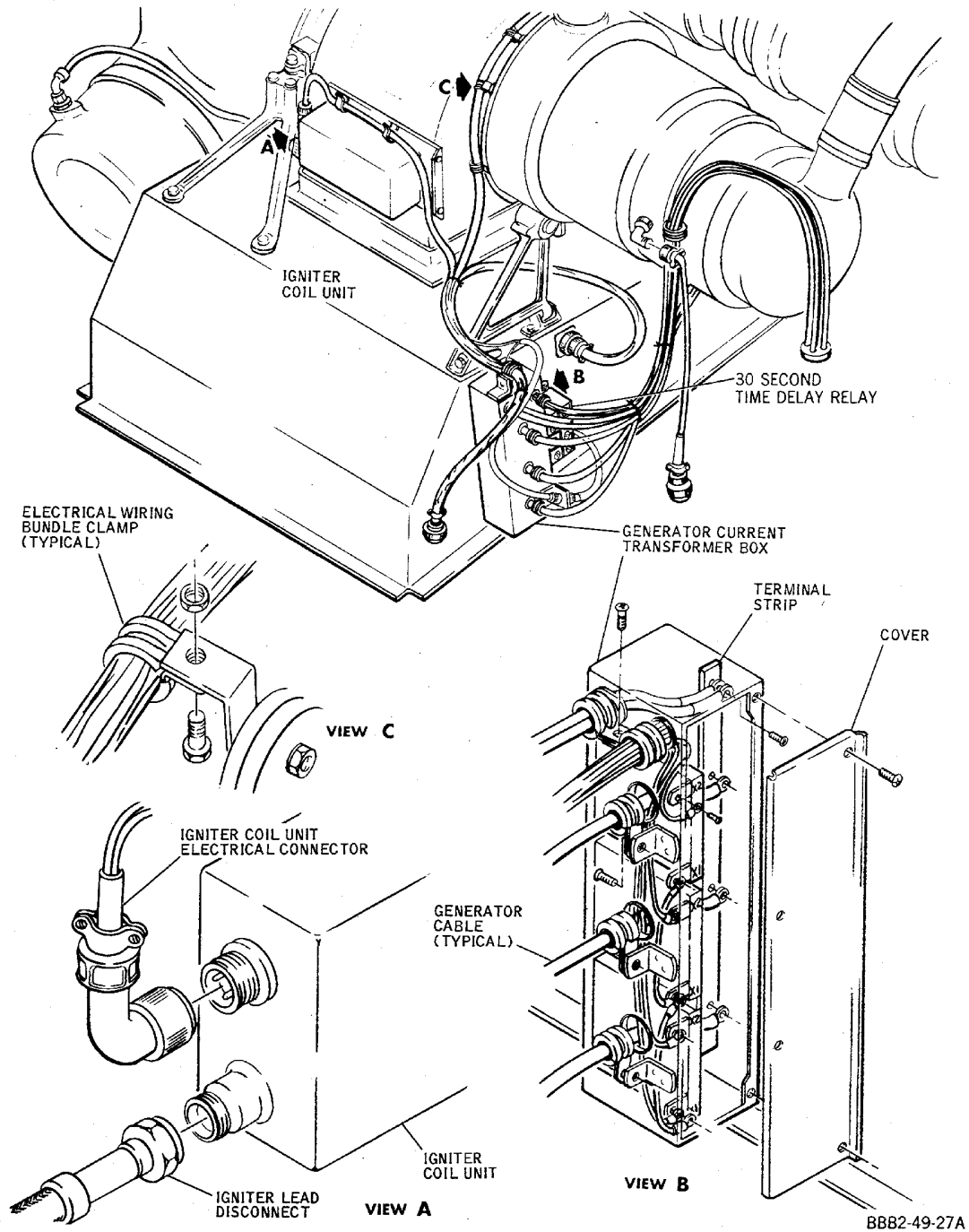
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**Electrical Harness -- Installation**  
**Figure 201/49-10-06-990-801 (Sheet 2 of 3)**

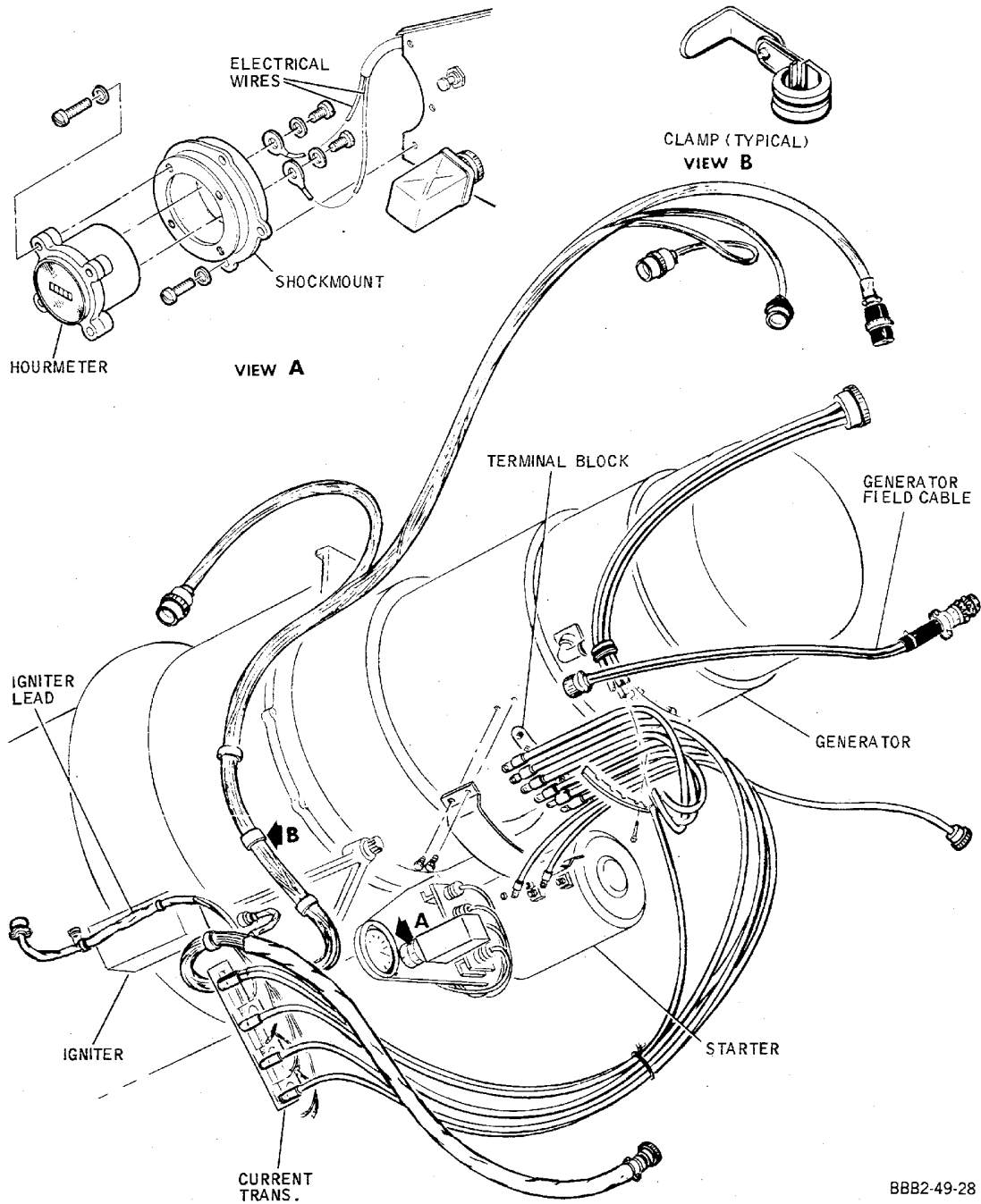
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**Electrical Harness -- Installation**  
**Figure 201/49-10-06-990-801 (Sheet 3 of 3)**

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### APU EXHAUST SHROUD DRAIN TUBE - MAINTENANCE PRACTICES

#### 1. General

- A. This maintenance practice provides removal/installation procedures for the APU exhaust shroud drain tube. The drain tube is located on the lower right side of the APU demountable support box.

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Name and Number	Manufacturer
Mandrel	Locally
Lubricant, Metalworking Drawing (DPM 5737)	Chemetall Oakite Products
Nylon Tubing, Rigid (DMS 1864), Type 1	

#### 3. Removal/Installation APU Exhaust Shroud Drain Tube

##### A. Remove Drain Tube

- (1) Remove remaining broken tube section by cutting off or by heating and pulling tube section off of drain line.

##### B. Install Drain Tube

- (1) Cut the new nylon rigid tubing (DMS 1864, Type 1) to a length of 3.125 in. (79.38 mm).
- (2) Cut a 30 degree angle in one end and leave the other end squared.
- (3) Locally fabricate a mandrel from metal round stock 0.75 in. (19.05 mm) approximately 3.00 in. (76.20 mm) in length.

NOTE: Do not over heat the tubing as it will become distorted and collapse.

- (4) Expand only the squared end of the tube with the mandrel to a depth of 0.8125 in. (20.64 mm) as follows:
  - (a) Clamp the squared off end of the nylon rigid tube approximately 0.50 in. (12.70 mm) below the total length for expansion.
  - (b) Preheat the exposed end of the tube to a maximum of 250°F (121°C). This step is not necessary if the frictional heat caused in the expansion process is limited to no more than 300°F (149°C).

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1813, METALWORKING DRAWING LUBRICANT (DPM 5737)

HAZMAT 1000, REFER TO MSDS

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### (WARNING PRECEDES)

- (c) With either the tube or the mandrel being rotated 200-500 RPM, push the mandrel into the tube as it is rotated. Do not heat the tube end above 300°F (149°C). Use lubricant (DPM 5737) as coolant.
- (d) Stop the rotation and remove the mandrel as soon as full depth is reached.
- (5) Flush expanded end of nylon tubing in warm water to remove all lubricant. Dry thoroughly.
- (6) Install the expanded tube end over the mating APU exhaust shroud drain.
- (7) Carefully and evenly apply a 400°F (204°C) maximum heat source to the expanded nylon tube end until it has shrunk tightly on to the drain.

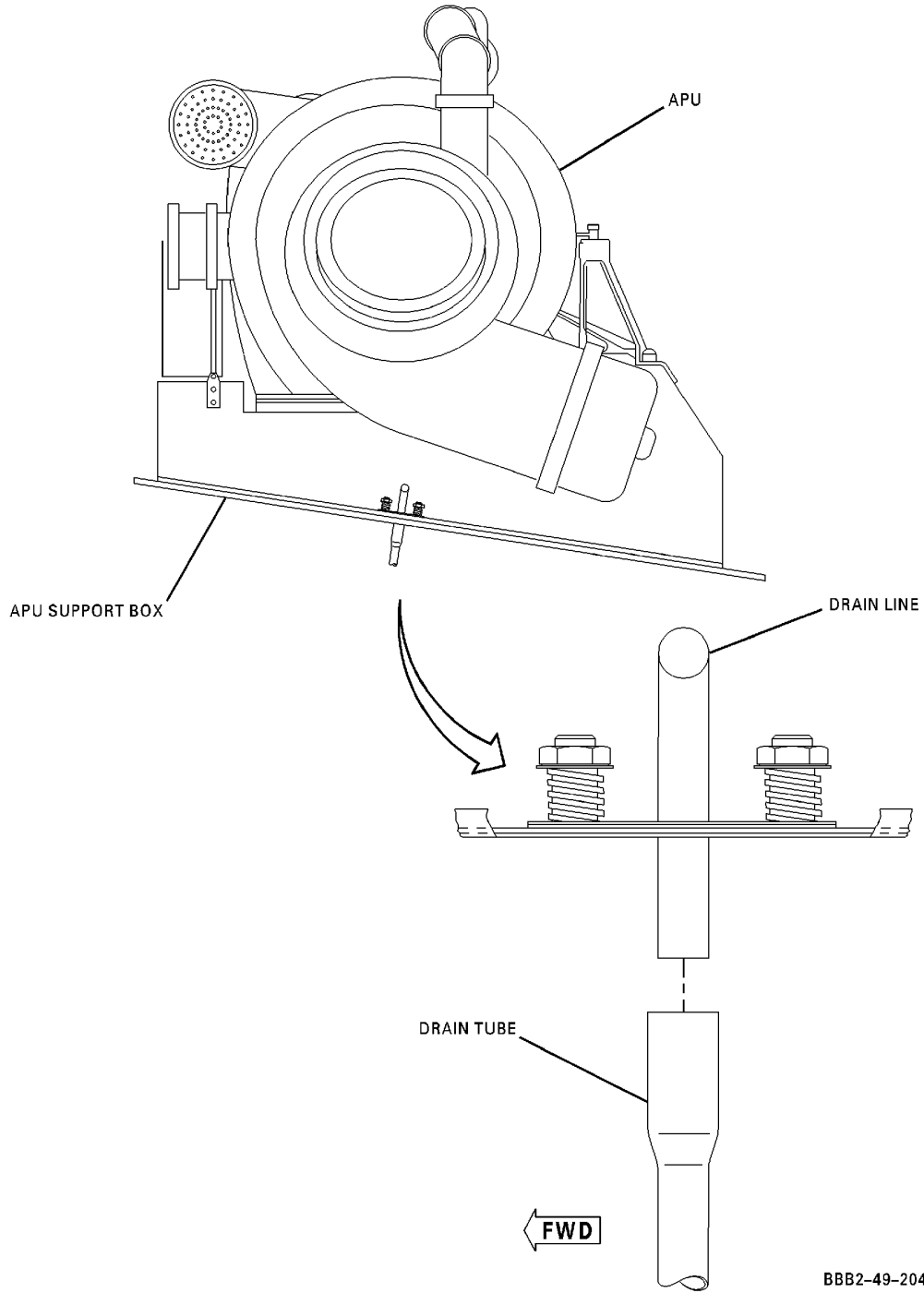
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**APU Exhaust Shroud Drain Tube -- Removal/Installation**  
**Figure 201/49-10-07-990-801**

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### APU ACOUSTICAL MATERIAL - MAINTENANCE PRACTICES

#### 1. General

- A. This procedure has the Inspection/check instructions for the Auxiliary Power Unit (APU) enclosure acoustic blankets.
- B. The acoustic blankets are installed in the APU enclosure.

#### 2. Inspection/Check APU Acoustical Material

- A. Perform an Inspection/Check of the APU Acoustical Material
  - (1) Remove the air inlet door panel. (AIR INLET DOOR PANEL - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-02/201)
  - (2) Check the APU acoustical material for damage, condition, and fluid contamination.
    - (a) If the acoustical material has been damaged or contaminated (absorbed) by fluids (oil, fuel, or hydraulic fluid), replace the APU acoustical material. ( OVERHAUL MANUAL WITH ILLUSTRATED PARTS LIST, APU Inlet Box Assembly 49-10-1)
  - (3) Install the air inlet door panel. (AIR INLET DOOR PANEL - MAINTENANCE PRACTICES, PAGEBLOCK 49-10-02/201)

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**ENGINE - DESCRIPTION AND OPERATION**

**1. General**

- A. The auxiliary power unit (APU) engine provides mechanical shaft power for driving aircraft accessories and bleed air for main engine starting and cabin air conditioning and pressurization. The APU engine consists of an air inlet section, compressor section, combustion section, turbine section, and accessory drive section.

**2. Air Inlet Section**

- A. Description
- (1) The air inlet section of the engine receives air supply through the APU inlet doors. (POWER PLANT, SUBJECT 49-10-00, page 1)

**3. Compressor Section**

- A. Description
- (1) The compressor section consists of a two-stage centrifugal compressor. The compressor is enclosed in the compressor inlet plenum assembly. The first and second stage impellers are pneumatically connected through interstage ducts.

**4. Combustion Section**

- A. Description
- (1) The combustion section consists of a combustion liner which provides an area for burning the fuel/air mixture. The liner is perforated to provide the correct fuel/air ratio and burning rate. The fuel atomizer and igniter plug are mounted on the liner.

**5. Turbine Section**

- A. Description
- (1) The turbine section consists of a single-stage turbine wheel (coupled to the compressor shaft), turbine plenum, torus, turbine nozzle, and blade containment ring.
- (2) The turbine plenum encloses the turbine components and provides a receiver for the compressed air from the compressor discharge housing.
- (3) The turbine torus directs hot gases to the turbine nozzle which encompasses the turbine wheel blades, and also directs the gases against the turbine blades.
- (4) The blade containment ring encloses the turbine wheel blades and directs the exhaust gases to the turbine exhaust duct.

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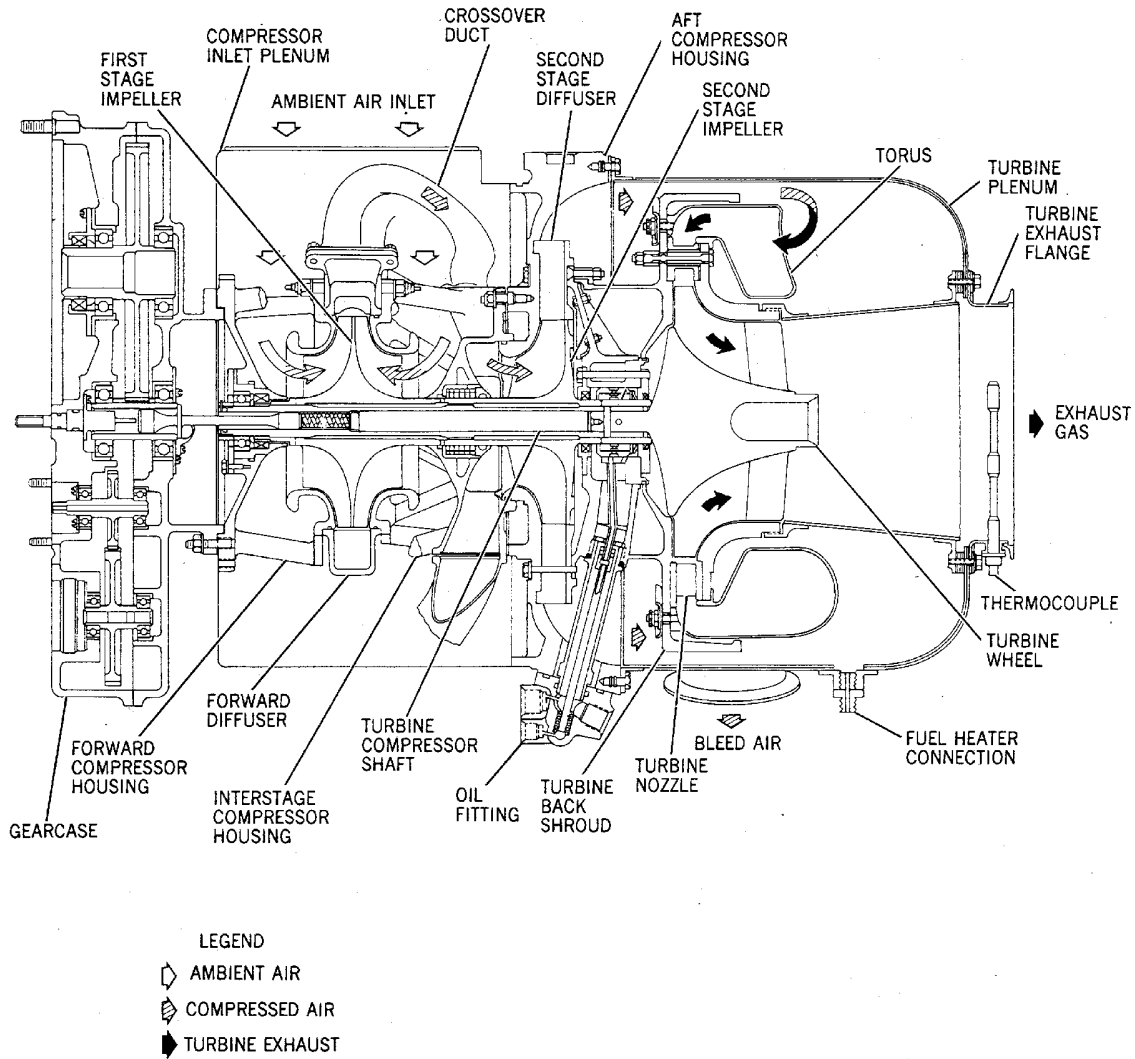
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**APU Engine -- Schematic  
Figure 1/49-20-00-990-801**

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### 6. Accessory Drive Section

#### A. Description

- (1) The accessory drive gearcase is located on the forward end of the engine. A torsion shaft couples the compressor/ turbine shaft to the main drive gear in the gearcase.
- (2) The main drive gear transmits power through the reduction gear system to drive the accessories at the required speed for each accessory.
- (3) The arrangement of the accessory gear train permits the starter to drive all the accessories in addition to driving the compressor impellers and turbine wheel during the starting cycle.
- (4) Engine-driven accessories include the cooling air fan, fuel control unit, oil pump, centrifugal switch, electrical starter, tachometer-generator, and generator.

### 7. Operation

A. When the starter is energized, the rotating starter drive pawls engage a jaw in the accessory gearcase and begins to drive the gear train. The gear train drives the compressor and turbine wheel, oil pump, tachometer-generator, fuel control unit, and centrifugal switch assembly.

- (1) As the compressor and turbine rotates, ambient air is drawn through the inlet into the compressor section. The air is compressed by the compressor first-stage impeller and routed through the interstage ducts to the compressor second-stage impeller for further compression. The compressed air is discharged into a deswirl assembly, then directed into the turbine plenum, and finally into the combustion chamber.
- (2) When engine speed reaches the required value, rising oil pressure activates the sequencing oil pressure switch which completes the circuit to the fuel solenoid valve and ignition unit. The fuel solenoid valve is energized, and opens to allow fuel flow to the fuel atomizer. The fuel atomizer sprays fuel of the proper pattern and flow into the combustion chamber where the fuel and compressed air is mixed. The ignition unit produces electrical energy to fire the igniter plug and ignite the fuel/air mixture in the combustion chamber.
- (3) High velocity, hot gases produced by combustion of fuel/air mixture flows into the turbine torus and then through the turbine nozzle to the turbine wheel. The energy of the gases is absorbed by the rotation of the turbine wheel. Spent gases are discharged overboard through the turbine exhaust duct. A portion of the power developed at the turbine wheel is used to drive the compressor impellers, accessory gear train, and accessories. The remainder of the power is available for output shaft power to drive other equipment when no-load governed speed is attained.
- (4) Acceleration of engine continues through the combined force of the starter and energy of the hot gases. When engine speed reaches the required value, the 35-percent switch in the centrifugal switch assembly opens, and opens the starter electrical circuit. Starter rotation ceases, and the starter drive pawls disengage from the accessory gear train. When oil pressure reaches a preset value, the low oil pressure switch electrical circuit is opened.
- (5) The engine continues to accelerate, and when engine speed reaches the required value, the 95-percent switch in the centrifugal switch assembly closes. This action opens the ignition unit electrical circuit and closes the hourmeter electrical circuit. The igniter plug stops firing, and combustion is self-sustaining. The hourmeter begins to record operating time. Acceleration continues until no-load governed speed is reached.
- (6) After steady-stage, no-load governed speed is attained, shaft power loads or bleed air loads may be imposed within the specified ranges.

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## ENGINE - INSPECTION/CHECK

### 1. General

A. This procedure contains MSG-3 task card data.

#### **TASK 49-20-00-210-801**

### 2. General Visual Inspection of the APU Turbine Plenum Drain

#### **A. Prepare for General Visual Inspection of APU Turbine Plenum Drain**

SUBTASK 49-20-00-865-001

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-20-00-010-001

(2) Open the access panel.

#### **B. General Visual Inspection of APU Turbine Plenum Drain**

SUBTASK 49-20-00-210-001

(1) Do a general visual inspection of the turbine plenum drain.

#### **C. Job Close--up**

SUBTASK 49-20-00-410-001

(1) Close the access panel.

SUBTASK 49-20-00-865-002

(2) Remove the safety tag and close this circuit breaker:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

————— **END OF TASK** —————

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## COMBUSTION CHAMBER LINER AND TORUS - MAINTENANCE PRACTICES

### 1. General

- A. The combustion chamber liner is located inside the combustion chamber cap on the APU right side. Access is through the APU right access door. The igniter plug must be removed before removing the liner from the combustion chamber.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Cleaning agent	
Solvent MIL-PRF-680 Type 1	

### 3. Removal/Installation Combustion Chamber Liner

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. Remove Liner

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** IGNITER COIL UNIT ON APU CONTAINS BOTH HIGH AND LOW ENERGY SECTIONS. CONTACT WITH EXPOSED IGNITERS CAN BE LETHAL. WAIT 4 MINUTES AFTER IGNITION SYSTEM IS INOPERATIVE BEFORE ATTEMPTING REMOVAL OR INSTALLATION OF IGNITERS.

- (2) Remove igniter plug. (IGNITER PLUG - MAINTENANCE PRACTICES, PAGEBLOCK 49-40-01/201 Config 1)
- (3) Remove fuel atomizer. (PAGEBLOCK 49-30-04/201)
- (4) Disconnect combustion chamber drain line from fitting in combustion chamber cap. (Figure 201)
- (5) Remove coupling attaching combustion chamber cap to combustion chamber.
- (6) Remove and discard packing.
- (7) Remove combustion chamber cap.
- (8) Carefully withdraw liner from combustion chamber.

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### B. Install Liner

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position combustion chamber cap over liner. (Figure 201)
- (3) Rotate combustion chamber cap until igniter plug holes in cap and liner are aligned with each other.
- (4) Install fuel atomizer. (PAGEBLOCK 49-30-04/201)
- (5) Install igniter plug, leaving electrical connector disconnected. (IGNITER PLUG - MAINTENANCE PRACTICES, PAGEBLOCK 49-40-01/201 Config 1)
- (6) Position new packing on combustion chamber.
- (7) Position coupling on combustion chamber cap.
- (8) Carefully insert liner into combustion chamber.
- (9) Rotate combustion chamber liner and cap until igniter plug is on top vertical centerline and combustion chamber drain fitting is on bottom vertical centerline of combustion chamber.
- NOTE: Electrical connector and combustion chamber drain line must line up mating connections.
- (10) Install combustion chamber coupling and tighten nut to torque of 50 to 70 inch-pounds (5.65 to 7.91 N·m).
- (11) Connect electrical connector to igniter plug.(IGNITER PLUG - MAINTENANCE PRACTICES, PAGEBLOCK 49-40-01/201 Config 1)
- (12) Connect fuel line to fuel atomizer.
- (13) Connect combustion chamber drain line to combustion chamber drain fitting.
- (14) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

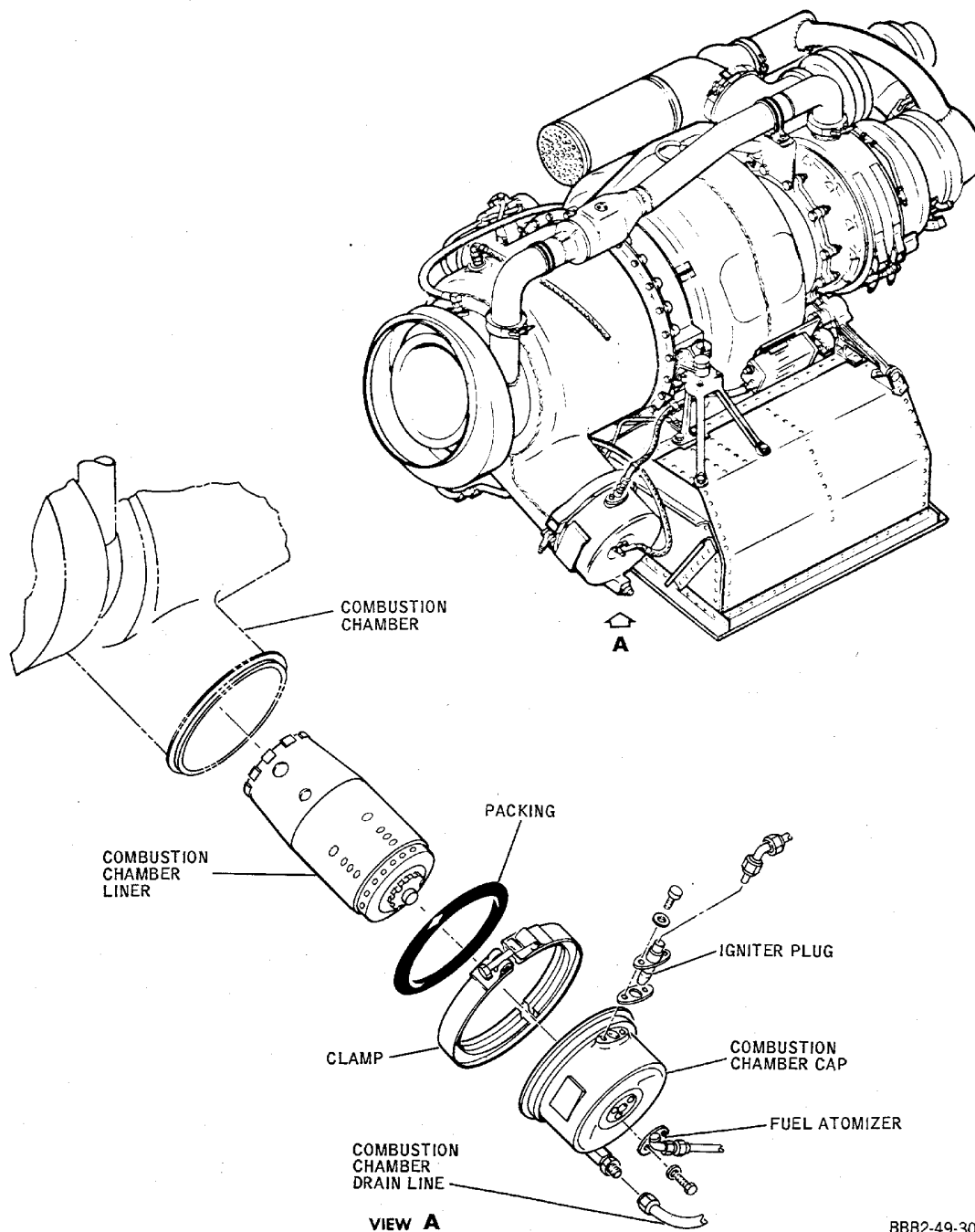
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**Combustion Chamber Liner -- Installation**  
Figure 201/49-20-01-990-801

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### 4. Inspection/Check Hot Section Components

#### A. Check Liner (Figure 202).

**CAUTION:** BROKEN WELD JOINTS MUST BE REPAIRED. IF MORE THAN FOUR BROKEN WELD JOINTS EXIST, REPLACE LINER.

- (1) Liner must be replaced:
  - (a) When a crack connects any two holes (item 1).
  - (b) When a crack is over .250 inch long (6.35 mm) (item 2).
  - (c) When cracks are separated by less than .250 inch (6.35 mm) material (item 3).
  - (d) When less than 0.030-inch (.762 mm) metal remains after corrosion or erosion (item 4).
  - (e) When spacer thickness is less than .020 inch (.508 mm) (item 5).
  - (f) When buckling has deformed liner more than .125 inch (3.175 mm) (item 6).
  - (g) When cracks occur which could cause metal to break away (item 7).
  - (h) When cracks in swirl deflector flange exceed .250 inch (6.35 mm) (item 8).

#### B. Check Torus Area

**NOTE:** The following procedure must be accomplished when the combustion chamber liner is removed from the APU.

- (1) Check containment ring (through liner opening in plenum) for security of mounting.
  - (a) Check containment ring by exerting finger pressure on ring and ensuring that ring cannot be moved to a "cocked" position. Freedom of ring to "float" is normal, however, axial movement shall not exceed .125 inch (3.175 mm).
  - (b) If ring position is suspected, use inspection mirror and flashlight to ensure that two washers (that may be viewed) are in place and no evidence of washer fretting beyond 50 percent of original thickness is indicated.
  - (c) If axial movement exceeds .125 inch (3.175 mm) or washer fretting is beyond 50 percent of original thickness is indicated, remove APU.
- (2) Check turbine plenum gasket for evidence of deterioration or leakage. If deterioration or leakage is indicated and APU exhibits excessive EGT, hung starts or falls off-line under full load, remove APU.
- (3) Check turbine plenum gasket for evidence of deterioration or leakage. If deterioration or leakage is indicated, remove APU.
- (4) Visually check turbine plenum for cracks in welds and adjoining material. If cracks are indicated, remove APU.
- (5) Visually check turbine nozzle, torus, turbine/exducer wheel by observing through liner opening in plenum. (Figure 203 or Figure 204)

**NOTE:** The purpose of this inspection is to check for obvious distress, to the extent possible through the opening available, using fiber optics or inspection mirror and flashlight or equivalent. Dimensional measurements of cracks, worn area, deformations, and eroded areas are not a requirement of this inspection. If severe distress exceeds the limits shown in Figure 203 or Figure 204, remove APU.

### 5. Cleaning Combustion Chamber Liner

#### A. Remove carbon deposits from liner with nonabrasive materials.

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**CAUTION:** DO NOT USE METAL TOOLS, STEEL WOOL, OR CARBORUNDUM TYPE MATERIALS.

- (1) Loosen excess carbon by scraping liner with soft plastic or wood.
- (2) Remove loosened carbon with compressed air or soft brush.

**WARNING:** MIL-PRF-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN MIL-PRF-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET MIL-PRF-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

B. Remove carbon deposits from liner with the chemical cleaning agent that follows.

- (1) Solvent clean using MIL-PRF-680, Type 1 solvent.

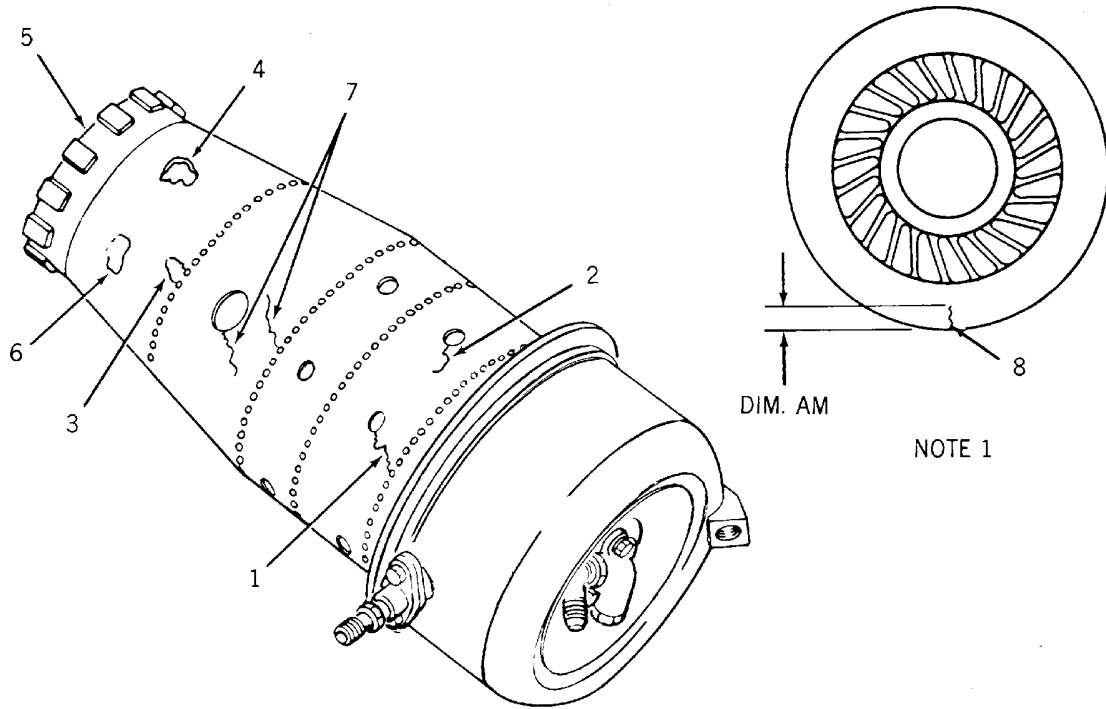
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NOTE: 1. SWIRL DEFLECTOR INSPECTION  
FOR COMBUSTION LINER LOOKING  
THROUGH OPENING IN LINER.

DIM. AM 0.250 IN. (6.35 MM) MAX

F-19A-7074

BBB2-49-31A

**Combustion Chamber Liner -- Inspection/Check  
Figure 202/49-20-01-990-802**

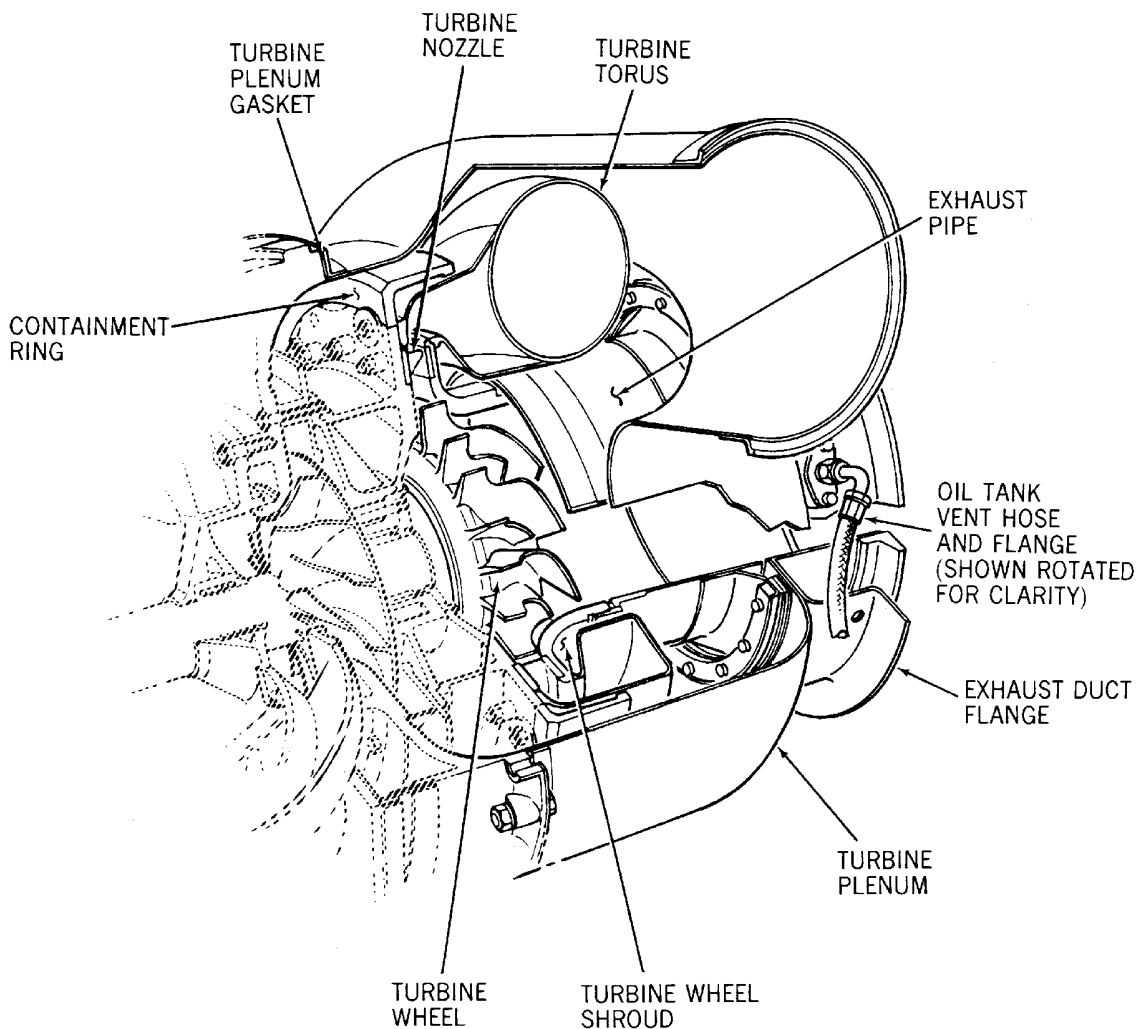
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F-19A-2989

BBB2-49-118

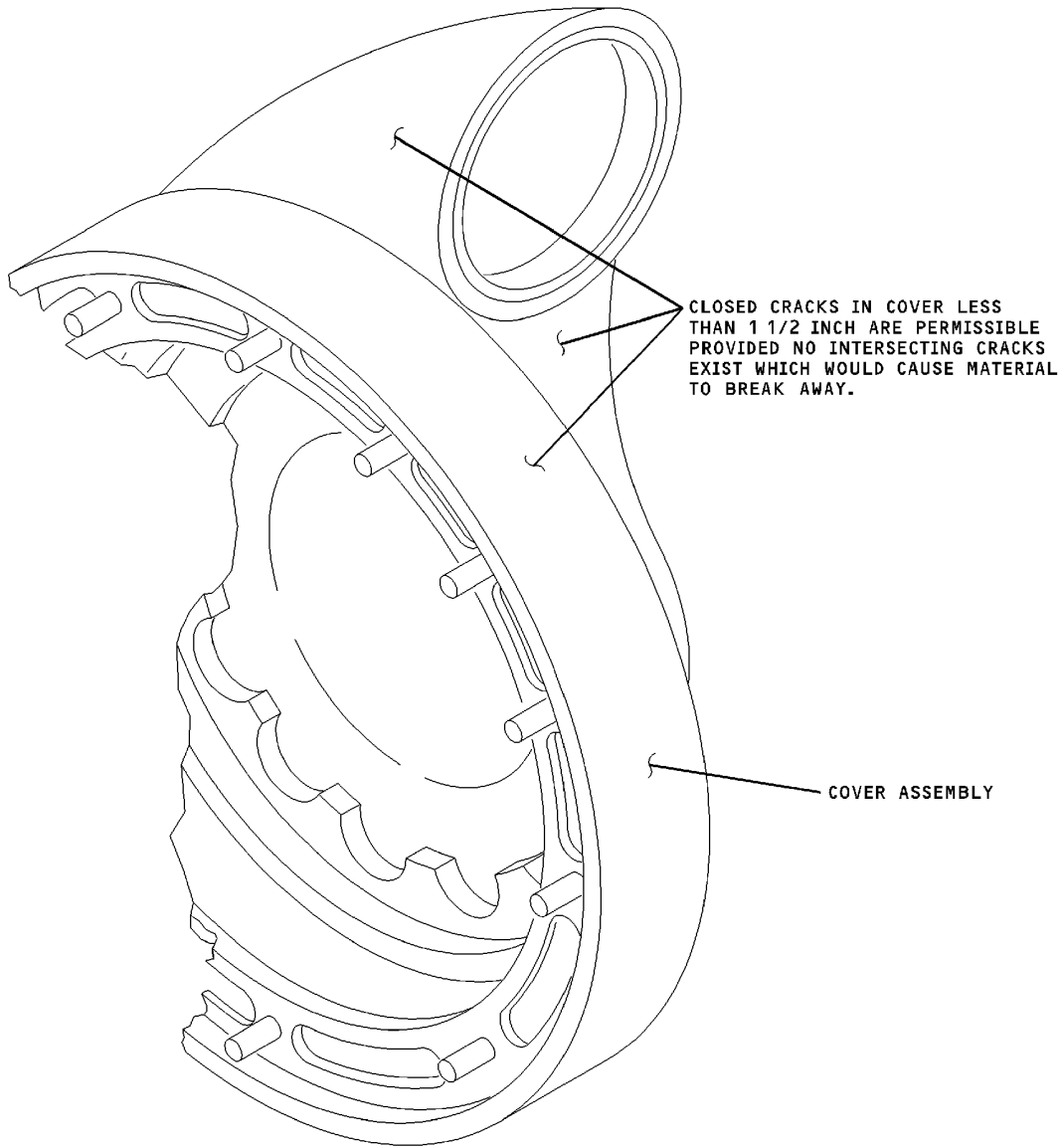
Hot Section Components -- Inspection/Check  
Figure 203/49-20-01-990-804

EFFECTIVITY  
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



**TURBINE TORUS ASSEMBLY  
INSPECTION/CHECK HOT SECTION COMPONENTS**

CAG(IGDS)

BBB2-49-274

**Hot Section and Combustor -- Inspection/Check  
Figure 204/49-20-01-990-805**

EFFECTIVITY  
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**MD-80  
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**ENGINE FUEL AND CONTROL - DESCRIPTION AND OPERATION**

**1. General**

- A. The APU fuel system is fully automatic in operation, and does not require manipulation of the controls by the operator. After actuation of the gas turbine start switch, the fuel system functions to provide the correct amount of fuel flow for smooth acceleration of the engine to 100-percent speed; thereafter, it modulates the fuel flow as necessary to keep the gas turbine speed constant under varying pneumatic bleed and electrical loads. Provisions are also incorporated to protect the turbine from excessive temperature during its acceleration and from overload conditions.
- B. The APU fuel system has three major components: a fuel control unit consisting of fuel pump and fuel solenoid valve; a fuel atomizer, and a control thermostat. The functions of these components are discussed under their respective titles in this section.

**2. Fuel Control Unit**

**CAUTION: FUEL PUMP MUST NEVER BE DRIVEN WHILE DRY.**

- A. The APU Fuel control unit is mounted on the engine accessory drive. The pump receives fuel from the airplane's supply through a low-pressure fuel filter located inside the APU enclosure and delivers regulated, pressurized fuel to the turbine combustion chamber. Lubrication of the pump mechanism is provided by fuel passing through and around bearing surfaces and other moving parts. This method of lubrication makes it highly important that sufficient fuel is present to ensure adequate lubrication every time the pump is operated.
- B. The fuel pump is a two-gear positive displacement pump, driven by the engine accessory drive through a splined shaft arrangement. The outboard end of the pump also drives the fuel governor. The internal structure of pump and control unit is shown schematically in Figure 1.
  - (1) The pump case contains two integrally shafted gears used to force fuel through the other fuel control components. Both idler and driven gears are located between spring-loaded bronze bushings. During normal bushing wear the springs exert continuous force against the bushings. This action aids in maintaining the desired clearance between bushings and gears, thereby minimizing internal pump leakage which could damage the drive shaft seal. This seal provides protection against leakage from the pump case into the mounting base. A drain line is attached to a port in the bottom of the pump mounting base to allow any fuel leaking by the seal to be discharged overboard instead of entering the accessory drive case.
  - (2) The fuel pump drive shaft seal is further protected from excessive pump case pressure by a seal relief valve. This valve consists of a spring-loaded ball set to relieve when the internal case pressure exceeds that of the fuel inlet port by 25 psig (172.5 kPa). Fuel relieved by the seal relief valve is returned to the pump inlet port.
  - (3) Pressurized fuel from the pump is forced through a high-pressure filter located on the lower aft side of the pump case. The element in this filter is of the paper cartridge type and must be periodically checked for contamination and replaced when necessary. This filter does not have provisions for bypassing fuel if it should become clogged. Partial blockage of the filter could slow the APU below the 95-percent speed, making it impossible to apply pneumatic or electrical loads. Total blockage would result in flame-out from fuel starvation and the APU would stop.

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- C. The fuel governor is located outboard of the fuel pump and supplied power through a tongue and groove connection with the pump drive shaft. The fuel governor regulates engine speed by varying the fuel flow to meet all electrical and pneumatic load conditions. By varying the amount of fuel, the governor enables the engine to run at nearly constant speed thus maintaining the frequency value of the ac generator. At start and while the engine is accelerating below 95-percent speed, the fuel valve is held closed by the governor speeder spring. As speed approaches 95-percent, the governor flywheel attains sufficient force to overcome the speeder spring and slide the fuel valve off its seat, uncovering the outboard holes in the hollow governor shaft. When the valve cracks, excess fuel enters the governor drive shaft through the forward holes and is bypassed through the inboard holes in the shaft and returned to the pump inlet. This reduces the fuel pressure below the valve set by the acceleration limiter. The governor further reduces excess power until the turbine speed levels off and governed speed is maintained.
- (1) When a load is applied to the APU, the engine momentarily loses speed until the governor senses the turbine droop. When this happens, the force of the speeder spring will be out of balance with the flyweights and will move the fuel valve closer to its seat. This reduces the fuel being bypassed and increases the amount delivered to the fuel atomizer, resulting in a corresponding increase in speed which will again bring spring and flyweight forces into balance.
  - (2) The speed adjustment on the outboard end of the fuel governor is used to adjust the speeder spring. This adjustment determines the speed at which the flyweights must turn in order to restore inbalance with the spring.
- D. The high-pressure relief valve is located below and forward of the fuel governor. This valve consists of a spring-loaded ball and a removable seat fitted with O-rings to prevent fuel leak-age. The valve is preset to relieve the fuel pressure which tends to build up in the governor case when the APU is stopped by the operator or by one of the automatic shutdown devices. When the fuel solenoid valve is closed, fuel cannot bypass through the valve and will be trapped in the governor housing. For a brief interval the fuel pump will continue to pump additional fuel into the governor housing while the APU windmills to a stop. When this condition arises the increased pressure will crack the high-pressure relief valve and excess fuel will bypass back to the pump inlet relieving the internal case pressure.
- E. The acceleration limiter is located forward of the fuel governor and consists of a half-ball valve, a spring-loaded diaphragm, and provisions for adjusting the valve cracking pressure. The limiter is operated by compressor discharge air taken from the turbine compressor through a control air line. Fuel flow to the atomizer is regulated by the acceleration limiter which functions as an air-controlled fuel bypass valve.
- (1) The acceleration limiter functions in response to compressor discharge pressure. Discharge air from the compressor acts against the control air diaphragm in the limiter holding the half-ball on its seat. When fuel pressure exceeds the value set by the cracking limit of the limiter, the half-ball is lifted from its seat allowing fuel, not needed by the atomizer, to bypass back to the pump inlet. As the APU accelerates, more controlled air is delivered to the control air diaphragm and fuel pressure will raise in proportion to air pressure. The ratio of air to fuel is highly important if the acceleration limiter is to function as required. Cracking pressure is set by installing a pressure gage in the fuel pump outlet port and adjusting the screw on the out-board end of the limiter case while motoring the engine (GENERAL, SUBJECT 49-00-00, page 501). In addition to periodic checks, the acceleration limiter must be checked when a new or over-hauled unit is installed in the airplane.
- F. The fuel solenoid valve consists of a solenoid coil, a movable plunger, and a valve body fitted with two lapped seats.

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- (1) The solenoid coil is retained in a housing capped by an electrical connector and attached to the valve body with screws. The coil is connected to the movable plunger by a coil spring recessed in the end of the shaft. The opposite end of the plunger terminates in a tang-shaped body with a hole drilled through the flat sides. This hole is fitted with two small spring-loaded carbon discs which seal both lapped fuel ports in the valve body when the solenoid is deenergized.
- (2) When the turbine attains a speed of approximately 10 percent, an electrical signal from the oil pressure sequencing switch energizes the fuel solenoid valve. The energized solenoid core magnetically attracts the valve plunger, pulling it away from the valve body until both carbon discs clear the lapped valve seats. Since the valve ports are now cleared, fuel then passes relatively unopposed through the valve body.
- (3) In the event of turbine overspeed, the fuel solenoid valve will be deenergized by action of the centrifugal switch's 110-percent switch. When this occurs, the plunger, no longer attracted to the solenoid core, is pushed into the valve body by the coiled spring. The carbon discs now block incoming fuel and the valve is closed, stopping the turbine.
- (4) Closing the APU master switch or the fire shutdown switch in the flight compartment or the action of the automatic shut-down initiated by a fire warning signal will also result in deenergizing the fuel solenoid valve and shutting off the fuel supply to the fuel control.

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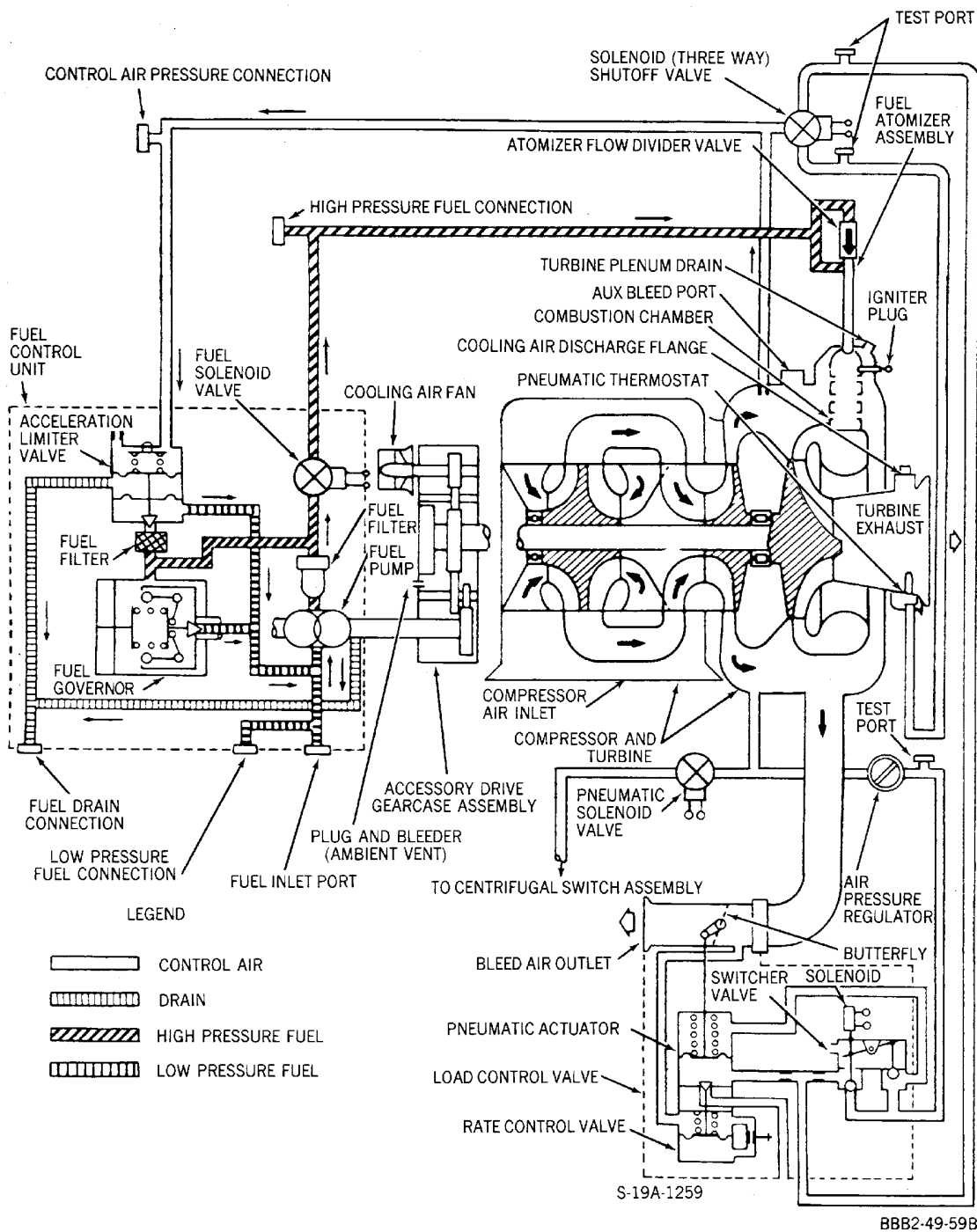
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Engine Fuel and Control -- Schematic  
Figure 1/49-30-00-990-801

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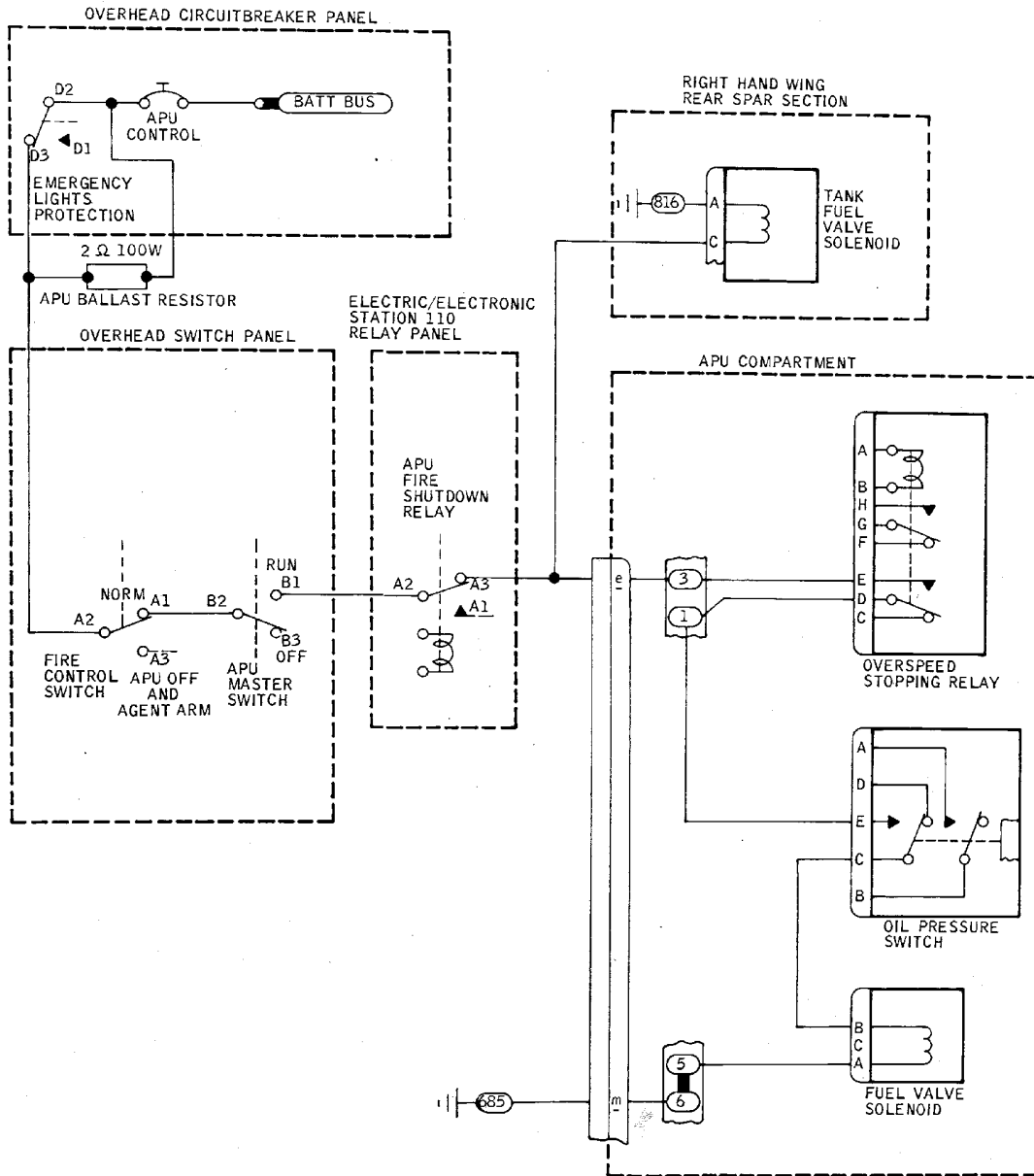
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BBB2-49-33

Engine Fuel and Control -- Electrical Schematic  
Figure 2/49-30-00-990-802

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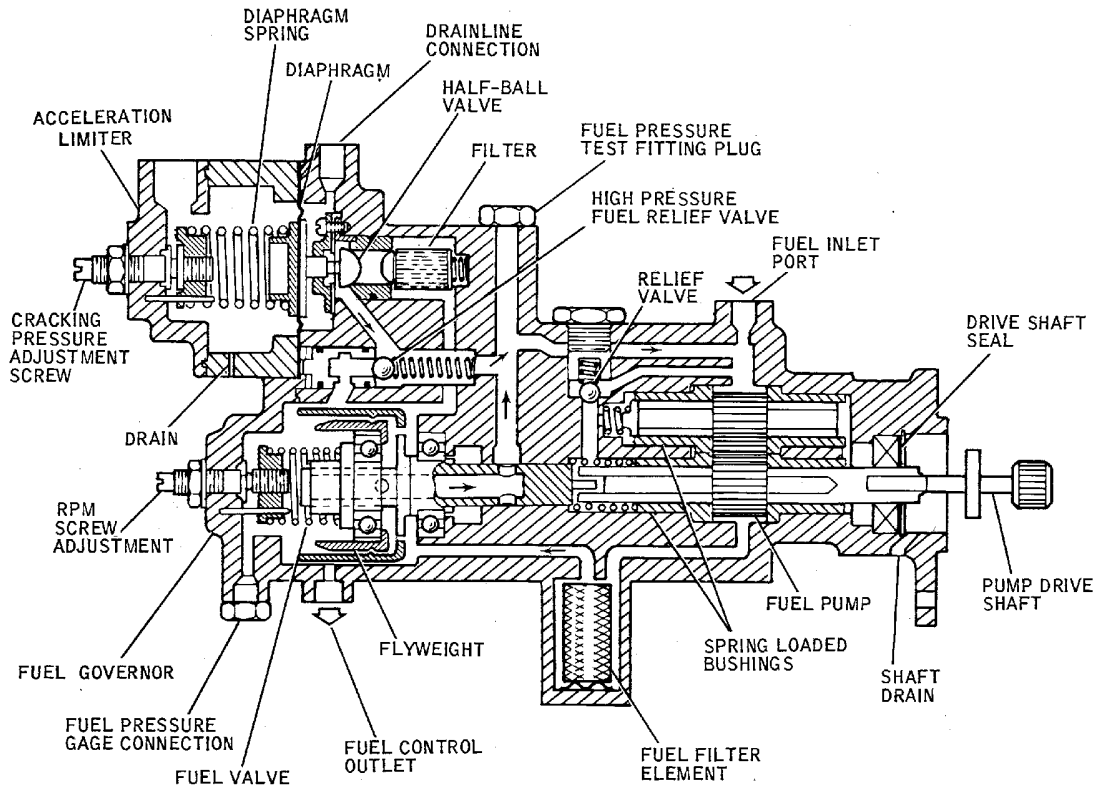
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BBB2-49-34

**Engine Fuel Pump and Control Unit -- Schematic  
Figure 3/49-30-00-990-804**

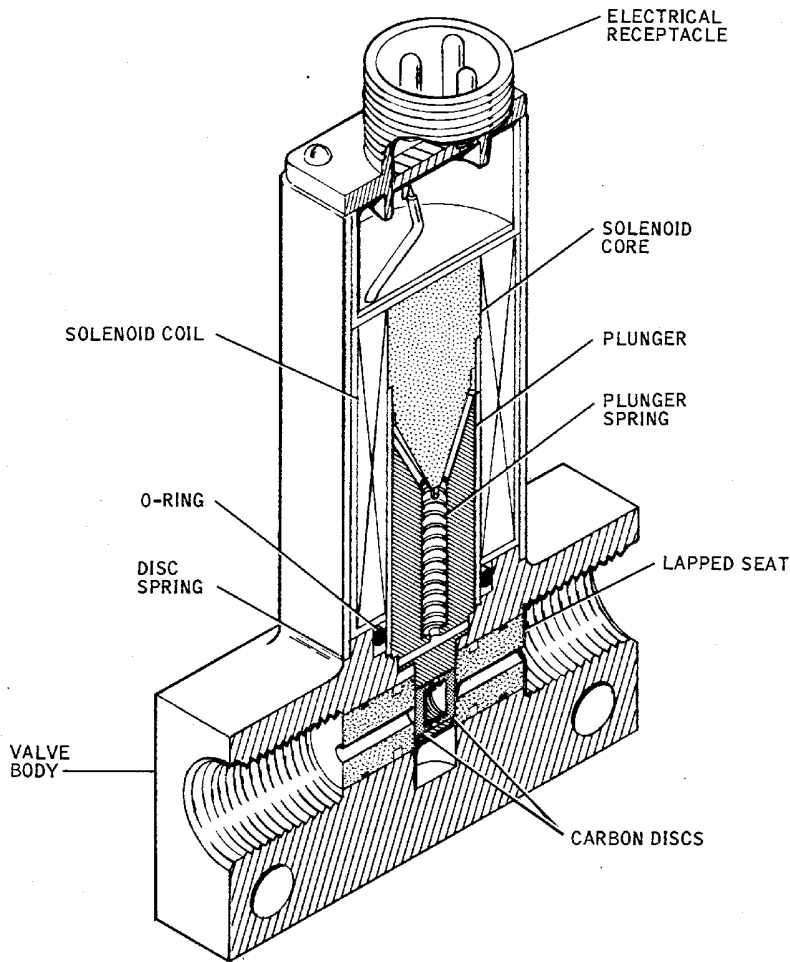
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NOTE:  
VALVE SHOWN IN  
ENERGIZED POSITION

BB82-49-35

Fuel Solenoid Valve -- Schematic  
Figure 4/49-30-00-990-805

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### 3. Fuel Atomizer

- A. The fuel atomizer is mounted on the end of the engine combustion chamber cap and fits through the cap into the combustion chamber liner. The atomizer consists of housing containing, a distributor head, flow divider valve, air inlet screen, and primary and secondary orifice plates. The housing incorporates a fuel inlet port and provides an outlet port.

### 4. Control Thermostat

- A. Turbine acceleration and overtemperature conditions are controlled by a thermostat mounted on the lower surface of the turbine exhaust flange. The body of the thermostat is located in the turbine exhaust gas path and a control air line connects the exterior housing to the acceleration limiter located in the fuel control unit. Adjustments to the acceleration and over-temperature control thermostat should not be made at the field maintenance level.
- (1) Major components of the acceleration and overtemperature control thermostat are: a spring-loaded ball valve, a steel housing fitted with a threaded boss for attaching the control air line, and an outer housing containing a number of slots. The slots allow control air to escape under over-temperature conditions. Access to the thermostat is through the APU right access door.

### 5. Operation

- A. The gas turbine derives power from burning fuel, which must utilize regulated flow to control the power developed and thereby, control the speed. If the power developed exceeds the power required for pneumatic and electrical loads, the difference will go into increasing the speed. Conversely, if the power required exceeds the power developed, the gas turbine slows down. Therefore, to operate at a constant speed, the fuel flow must be varied in such a way that the power developed just equals that required at the desired speed.
- B. Another requirement of the fuel system is to provide regulated fuel so the engine will accelerate in the shortest possible time without exceeding the maximum turbine temperature. The amount of fuel which can be injected safely into the combustion chamber varies directly with the compressor airflow. At low speed very little air flows through the turbine so the fuel flow must be limited to a low value to protect the turbine from excessive temperature. As the speed increases, the compressor pumps more air through the turbine and more fuel can be added thus providing the turbine with enough power for smooth, steady acceleration without excessive temperature.
- C. Control of fuel flow during acceleration of the gas turbine is based on the following premises.
- (1) Measuring the fuel pressure provides a regulated flow of fuel through the fuel atomizer.
- (2) Compressor pressure is a reliable indication of turbine airflow. When compressor pressure is used to control fuel pressure, the fuel flow will be proportional to the turbine airflow. The first requirement is fulfilled by the speed governor. The acceleration limiter functions to satisfy the second requirement. Both the speed governor and acceleration limiter are components of the fuel control unit.

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- D. The fuel pump is capable of supplying more fuel to the atomizer than the combustion chamber requires. Therefore, to control fuel flow the fuel pump pressure at the atomizer must be regulated. Being a positive displacement type, the fuel pump will attempt to produce sufficient pressure at its discharge to move all of its flow capacity. The amount of pressure required to do this depends on the amount of resistance to flow which the pump senses at its discharge. If the resistance to flow is large, the pump will produce a high pressure to force all of its flow capacity through the restriction; small resistance to flow would require less pressure. Thus, by varying the size of restriction that the pump senses, pump discharge pressure may be varied. If the fuel control valve is closed, pump discharge will be high due to the large resistance to flow offered by the fuel atomizer. Opening the control valve reduces the total resistance to flow that the pump senses, reducing the pump discharge pressure. In both cases, the total flow of the pump is essentially the same; however, due to the lower pressure at the pump discharge when the valve is opened, only a portion of the total flow is forced through the fuel atomizer. The remaining portion bypasses the atomizer and flows through the control valve, where it returns to the fuel pump. Thus, by varying the position of the control valve, the fuel pressure may be varied, permitting only that amount of fuel required for engine operation to flow into the combustion chamber. All excess pump flow is bypassed and recirculated through the pump.
- E. The control valve could be manually actuated to control engine speed and acceleration. However, since the amount of fuel required to run the engine at any speed varies with load and inlet air conditions the engine would require the constant attention of an operator. To relieve the operator of the necessity of resetting the fuel control valve for changes in load or variations in ambient conditions, the control valve is operated automatically by the speed governor, and a similar control valve is operated by the acceleration control. The governor controls fuel flow only after the engine attains rated speed. The acceleration limiter positions the control valve to the necessary fuel flow schedule to accelerate the engine to rated speed.
- F. Any rise in exhaust gas temperature will affect a properly calibrated control thermostat. Since the thermostat housing and the rod containing the ball valve are made of dissimilar material both components are affected by temperature change. Under operating conditions the steel housing contracts or expands faster than the rod. Under contraction, when the system is cool, the housing keeps the ball valve on its seat. This condition allows no controlled air to escape through the valve. However, an increase in exhaust gas temperature causes the steel housing to expand rapidly pulling the ball valve off its seat and allowing control air to be dumped into the exhaust chamber. The resultant drop in control air pressure causes a corresponding reduction in the amount of fuel the acceleration limiter is scheduling to the fuel atomizer. Thus, the control thermostat acts as a control air bleed when turbine temperature rises, enabling the acceleration limiter to limit the amount of fuel supplied the combustion chamber.

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## ENGINE FUEL AND CONTROL - TROUBLE SHOOTING

### 1. General

- A. Trouble shooting procedures for the APU fuel system are outlined in the following figures (Figure 101, Sheets Figure 101 (Sheet 1) through Figure 101 (Sheet 5)). Personnel should check the following before starting to trouble shoot the fuel system.
- (1) Make certain that the fuel system upstream from the APU is operative.
  - (2) Tighten all loose connections and replace broken wires.
  - (3) Make certain the APU ground control panel access door is open.
  - (4) Make certain that the APU fire control switch, located on the APU ground control panel, is in the NORMAL position.
- B. Operators using AiResearch Tester No. 290122-500 should refer to GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 101**

Name and Number	Manufacturer
APU Tester, 290122-400 <sup>*[1]</sup>	ITEL 49-01-01
APU Tester, 290122-500 <sup>*[2]</sup>	ITEL 49-01-01
APU Tester cable, 290214-1-1 <sup>*[3]</sup>	ITEL 49-01-01

\*[1] Measures Exhaust Gas Temperature (EGT) in °C

\*[2] Measures EGT in °F

\*[3] Used with the 290122 Series testers.

### 3. Trouble Shooting APU Fuel System

- A. For trouble shooting procedure, refer to Figure 101 using applicable sheet.

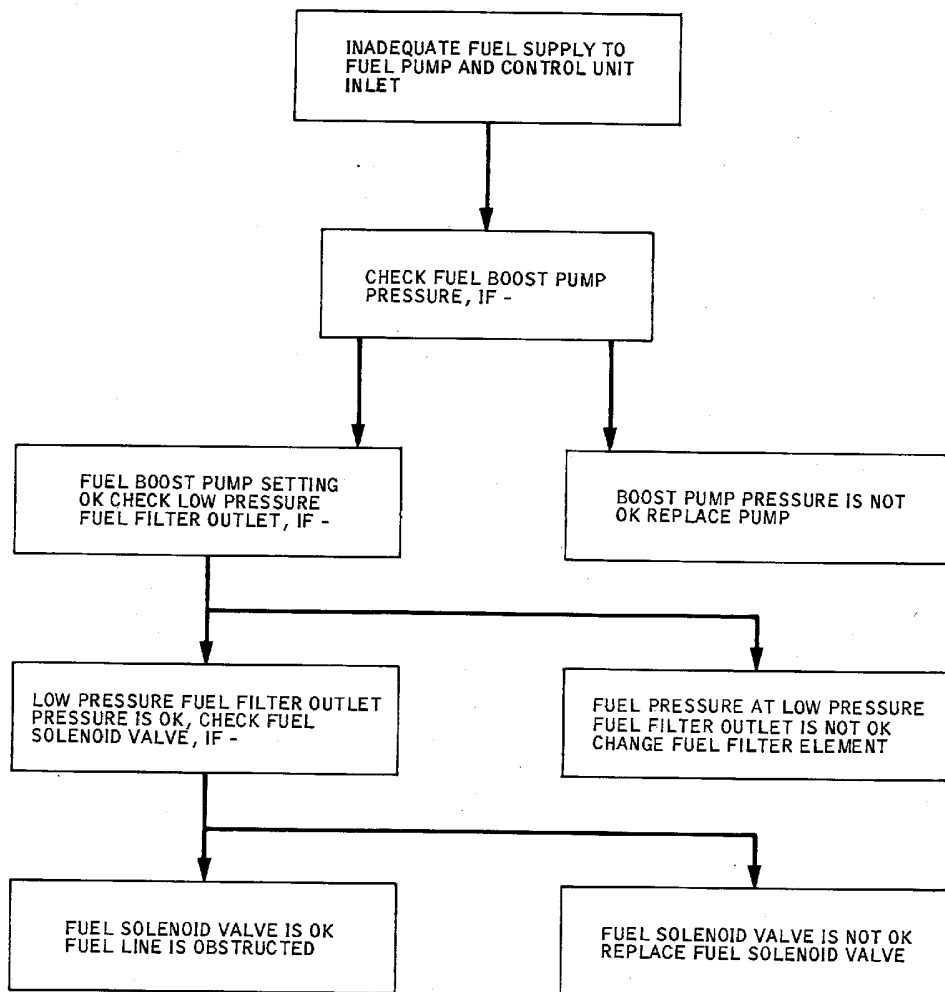
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Fuel Pump and Control Unit -- Trouble Shooting  
Figure 101/49-30-00-990-807 (Sheet 1 of 5)

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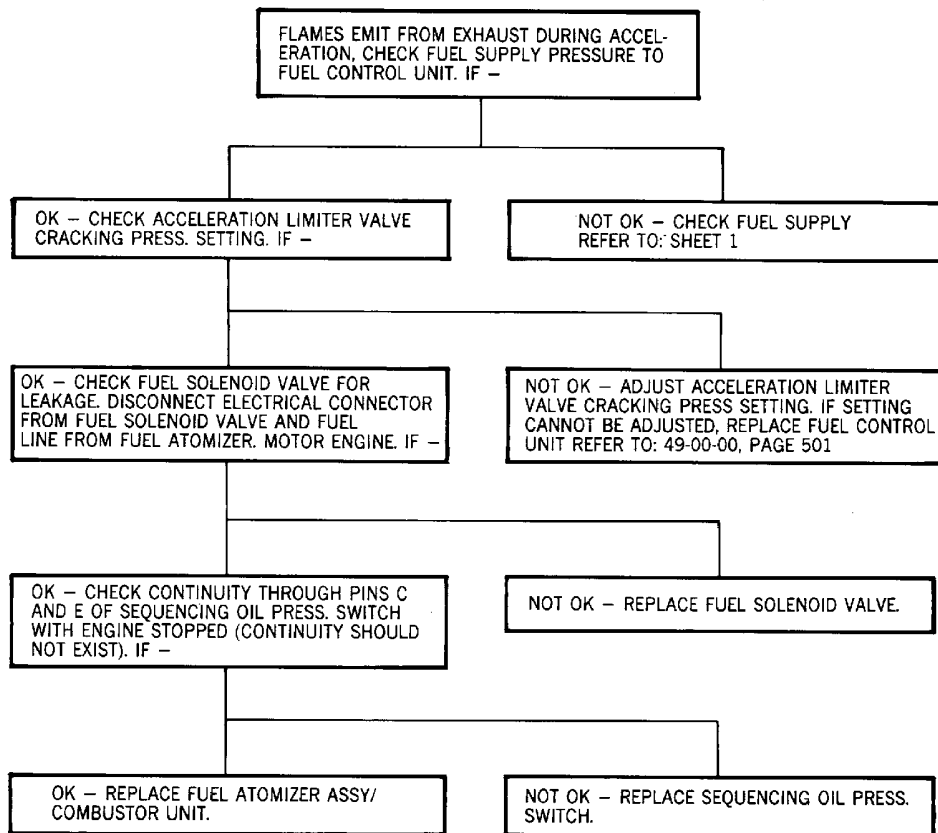
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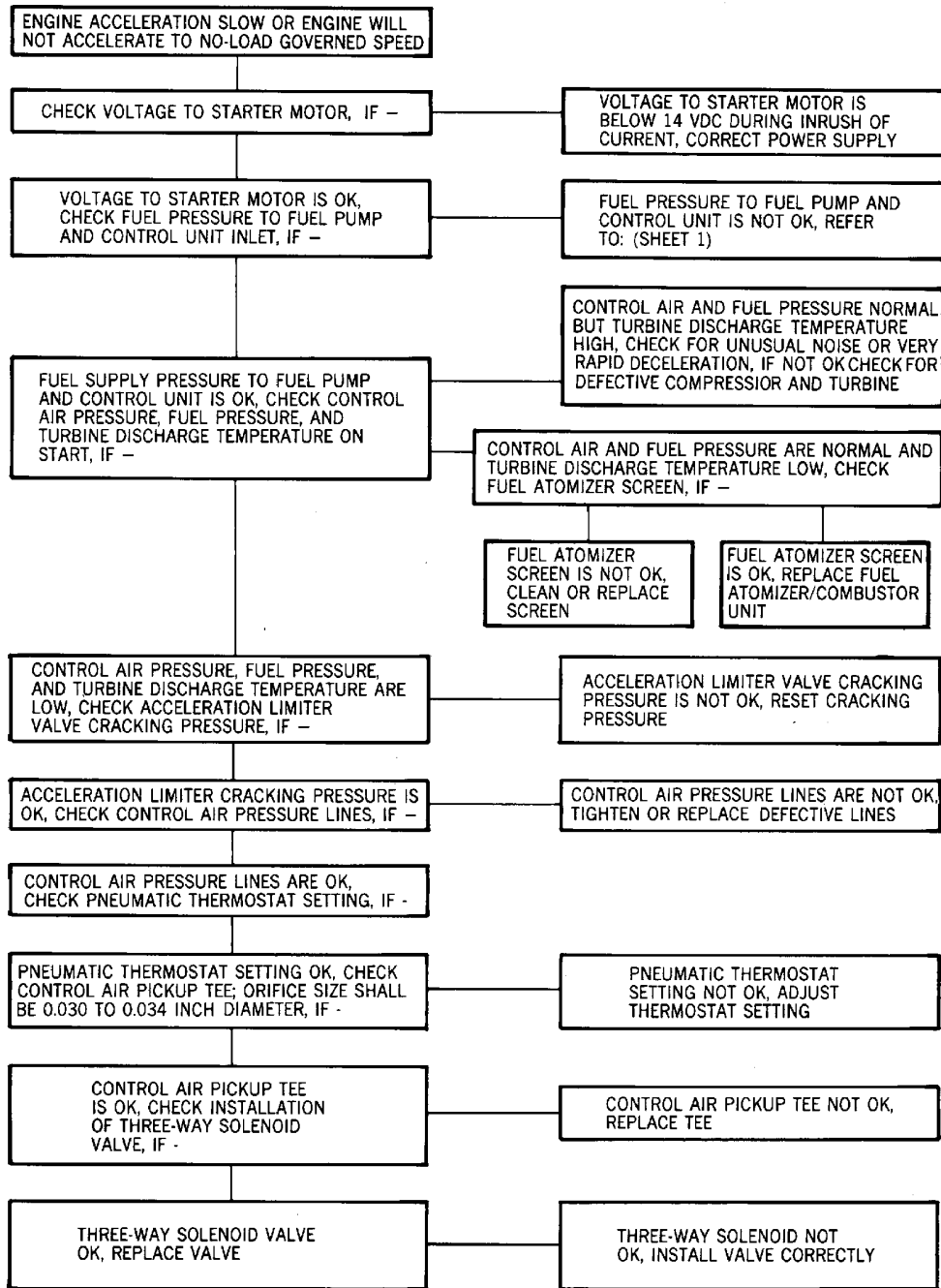
**Fuel Pump and Control Unit -- Trouble Shooting  
Figure 101/49-30-00-990-807 (Sheet 2 of 5)**

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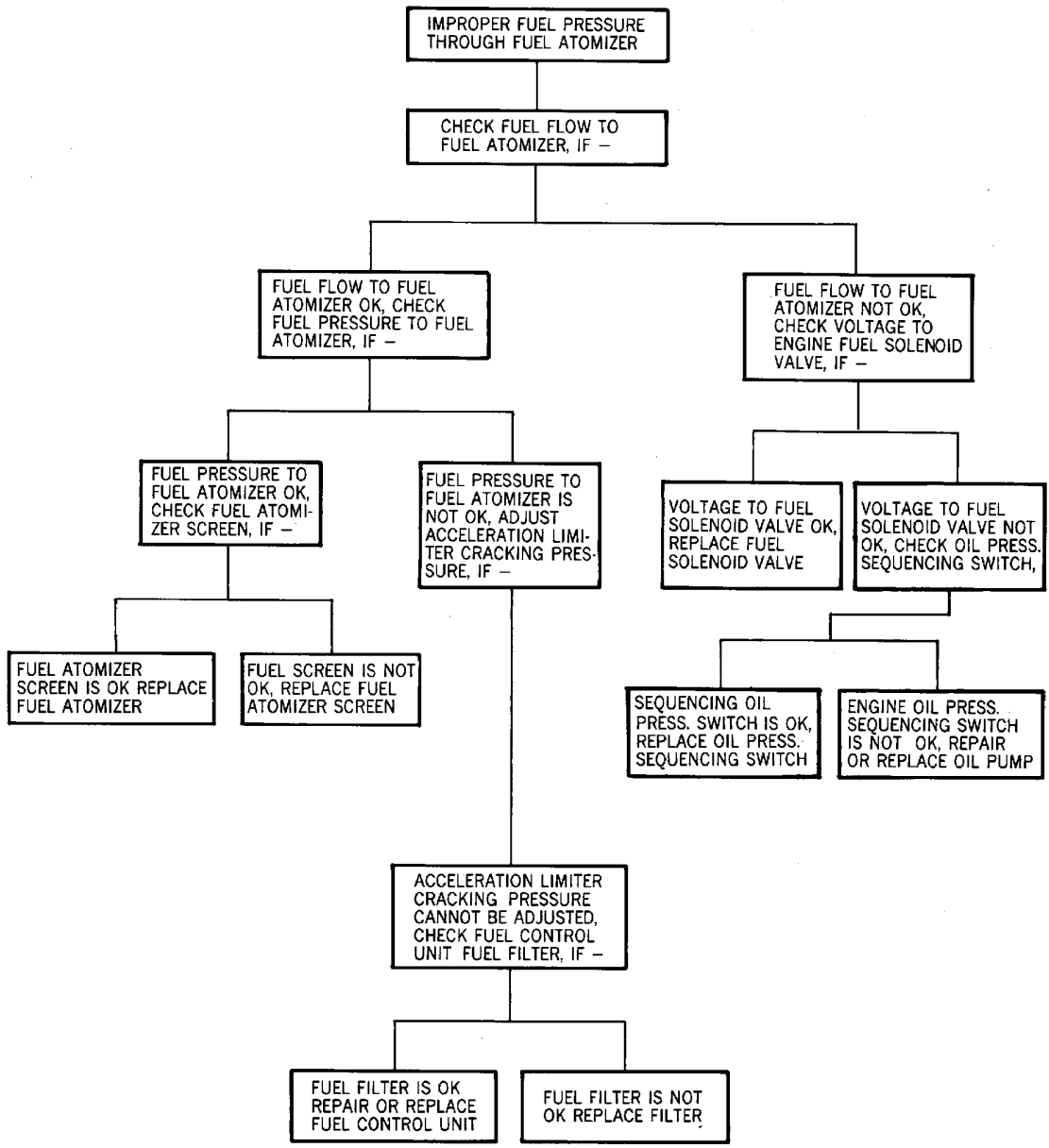
**Fuel Pump and Control Unit -- Trouble Shooting**  
**Figure 101/49-30-00-990-807 (Sheet 3 of 5)**

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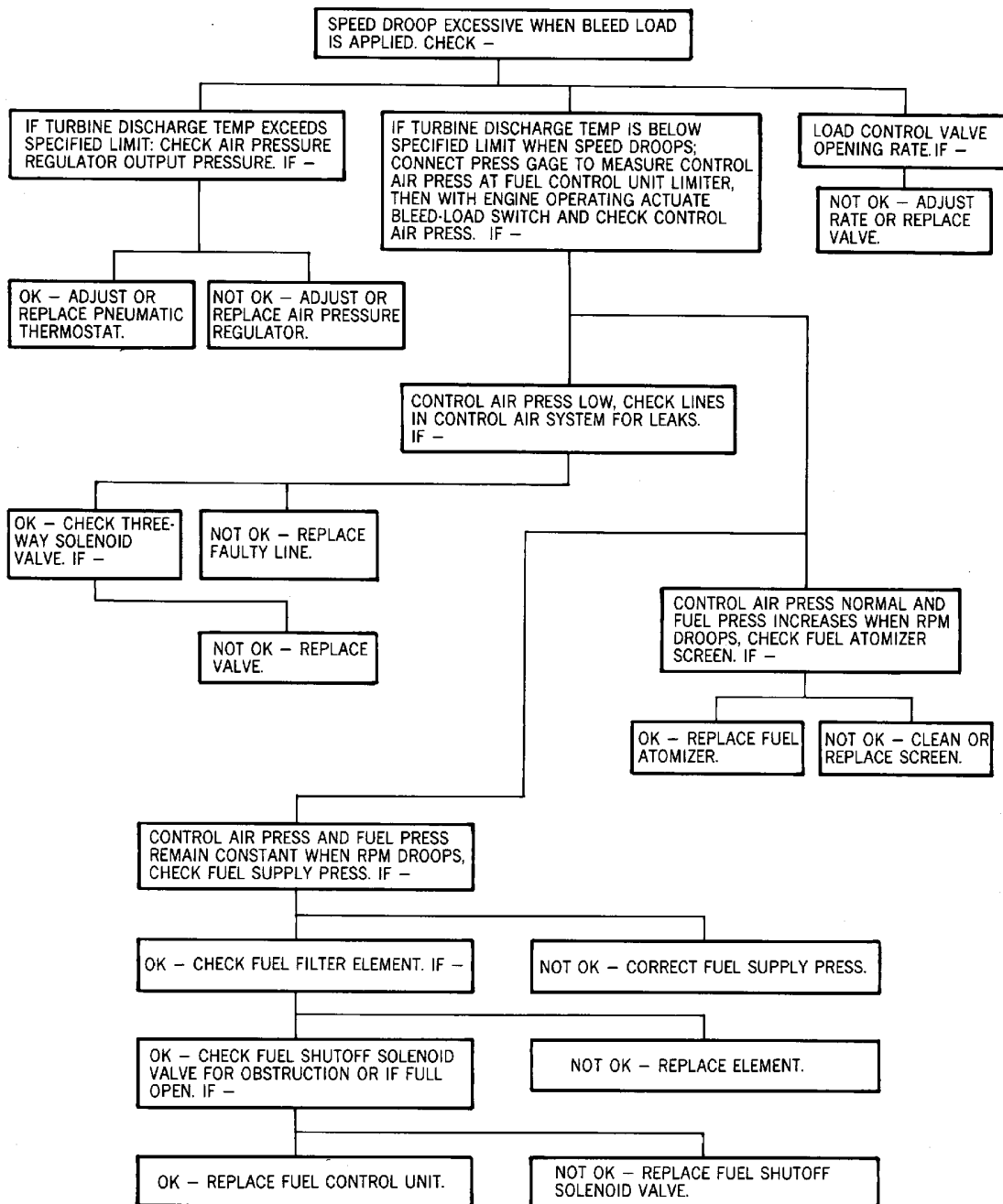
**Fuel Pump and Control Unit -- Trouble Shooting  
Figure 101/49-30-00-990-807 (Sheet 4 of 5)**

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BBB2-49-40A

**Fuel Pump and Control Unit -- Trouble Shooting**  
Figure 101/49-30-00-990-807 (Sheet 5 of 5)

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## FUEL CONTROL UNIT - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The fuel control unit contains the fuel pump, fuel solenoid valve, fuel governor, and acceleration limiter valve. This unit is mounted on the engine accessory drive case and driven by a splined shaft. Access to the fuel control unit is through APU left access door.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following item:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Grease Mobil 29 DPM 6188 MIL-G-81827	Mobil Oil Corp. Burbank, CA
Grease Aeroshell 23C DPM 6188 MIL-G-81827	Shell International Petroleum Co., Los Angeles, CA
Grease Royco 22MS DPM 6188 MIL-G-81827	Royal Lubricants Roseland, NJ

### 3. Removal/Installation Fuel Control Unit

- A. Remove Fuel Control Unit

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect the tube assembly from the elbow on the outboard end of the fuel control unit. (Figure 201)
- (3) Disconnect control air line from fitting on outboard end of fuel governor housing.
- (4) Disconnect low-pressure fuel test line from fitting inboard of fuel solenoid valve.
- (5) Disconnect low-pressure fuel inlet line from fitting out-board of fuel solenoid valve.

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- (6) Disconnect fuel supply line from fuel solenoid valve.
- (7) Disconnect pump seal drain line from elbow on control unit.
- (8) Remove nuts and washers attaching fuel control unit to mounting studs on accessory drive case.
- (9) Carefully withdraw splined shaft of fuel control unit from mating splines of accessory gear case.
  - (a) If the splined shaft will not withdraw easily, hold the seal retainer flange against the drive pad to withdraw the splined shaft.  
NOTE: This will prevent the gear shaft to axially shift out of position.
  - (b) If, after the Fuel Control Unit (FCU) is removed, the gear shaft is shifted out of position, rotate the gear shaft as needed to re-engage the gear teeth and push the gear shaft back into position.
- (10) Pull fuel control unit out sufficiently to gain access to fuel solenoid valve wiring, disconnect electrical connector, and remove control unit.

### B. Install Fuel Control Unit

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** GREASE LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN GREASE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET GREASE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (2) Lightly coat square drive flats and splined teeth of fuel control unit with grease.
- (3) Connect electrical connector to fuel solenoid valve.
- (4) Position fuel control unit and engage splined shaft with mating splines of accessory gear case.

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- (5) Install nuts and washers attaching fuel control unit to studs on accessory gear case. Tighten nuts to torque of 70 to 90 inch-pounds (8 to 10 N·m).

NOTE: Three locations only, due to inaccessability of nut at the inboard location.

- (6) Connect pump seal drain line to elbow on control unit.  
(7) Connect fuel supply line to fuel solenoid valve.  
(8) Connect low-pressure fuel inlet line to fitting outboard of fuel solenoid valve.  
(9) Connect low-pressure fuel test line to fitting inboard of fuel solenoid valve.  
(10) Connect the tube assembly to the elbow on the outboard end of the fuel control unit..  
(11) Connect control air line to fitting on outboard end of governor housing.  
(12) Bleed APU fuel system. (GENERAL, SUBJECT 49-00-00, page 301)  
(13) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (14) To perform functional test or make necessary adjustments to fuel control unit, refer to GENERAL, SUBJECT 49-00-00, page 501.

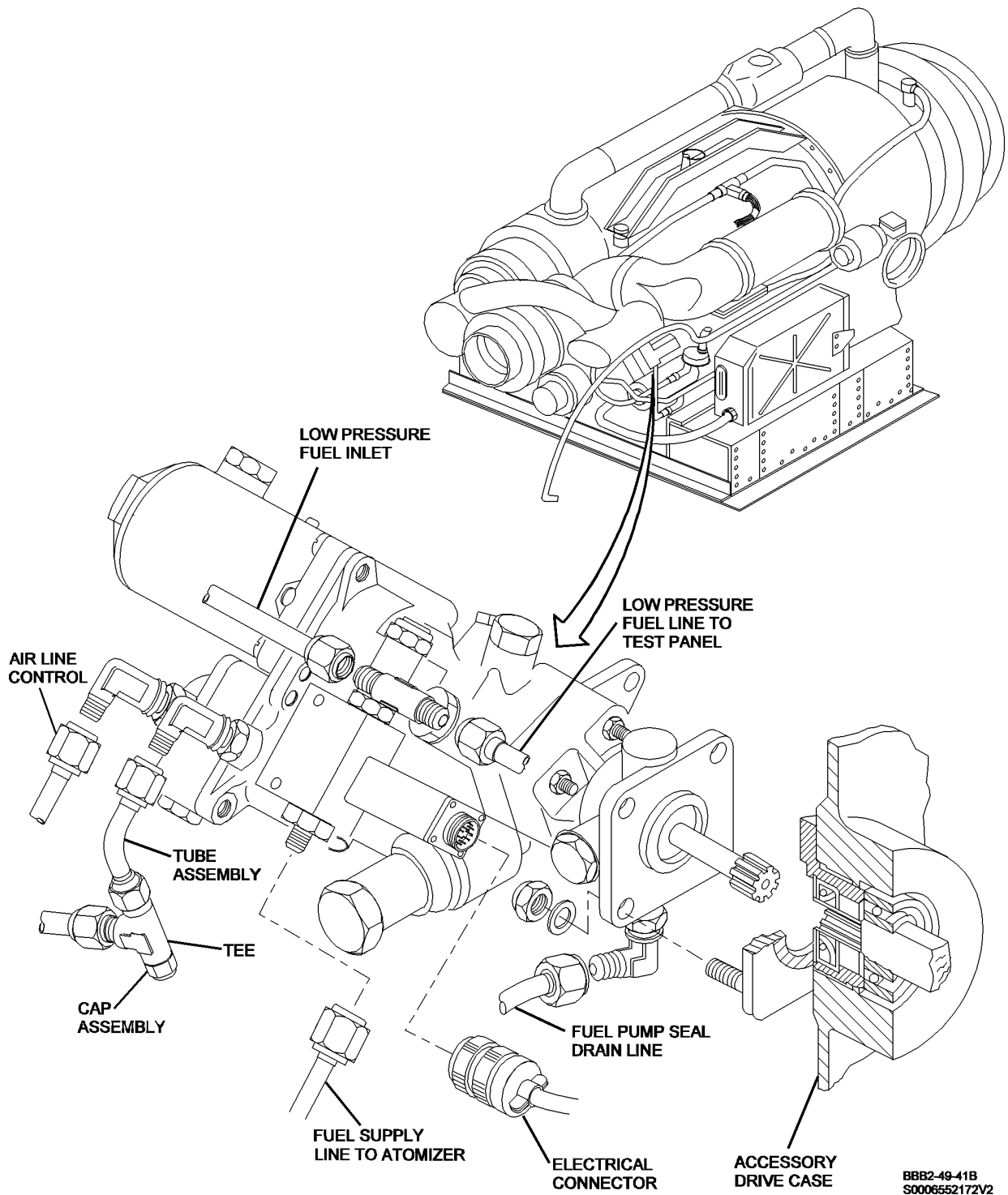
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Fuel Control Unit -- Installation  
Figure 201/49-30-01-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### FUEL CONTROL UNIT FILTER - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The fuel control unit filter element is contained in the filter housing which is mounted on the aft end of the fuel pump. Access to the filter is through the APU left access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following item:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Fuel, MIL-T-5624, Grade JP4 DPM 387 or Grade JP5, DPM 387-5	
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Fuel Control Unit Filter

- A. Remove Filter Element

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove filter cap. (Figure 201)  
 (3) Remove filter element and O-rings and discard.

- B. Install Filter Element

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** JET FUEL B (JP-4 FUEL) IS AN AGENT THAT IS EXPLOSIVE, FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN JET FUEL B (JP-4 FUEL) IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET JET FUEL B (JP-4 FUEL) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** JET FUELS A AND A-1 (JP-5 FUEL) ARE AGENTS THAT ARE, FLAMMABLE, EXPLOSIVE, POISONOUS AND IRRITANTS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN JET FUELS A AND A-1 (JP-5 FUEL) ARE USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET JET FUELS A AND A-1 (JP-5 FUEL) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

- (2) Lightly coat O-rings with fuel (MIL-T-5624, Grade JP4 or JP5).
- (3) Insert new filter element and new O-rings in filter housing. (Figure 201)
- (4) Install filter cap. Tighten to torque of 100 to 120 inch-pounds (11 to 14 N·m).
- (5) Safety filter cap to fuel solenoid valve with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (6) Bleed APU fuel system. (GENERAL, SUBJECT 49-00-00, page 301)

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- (7) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

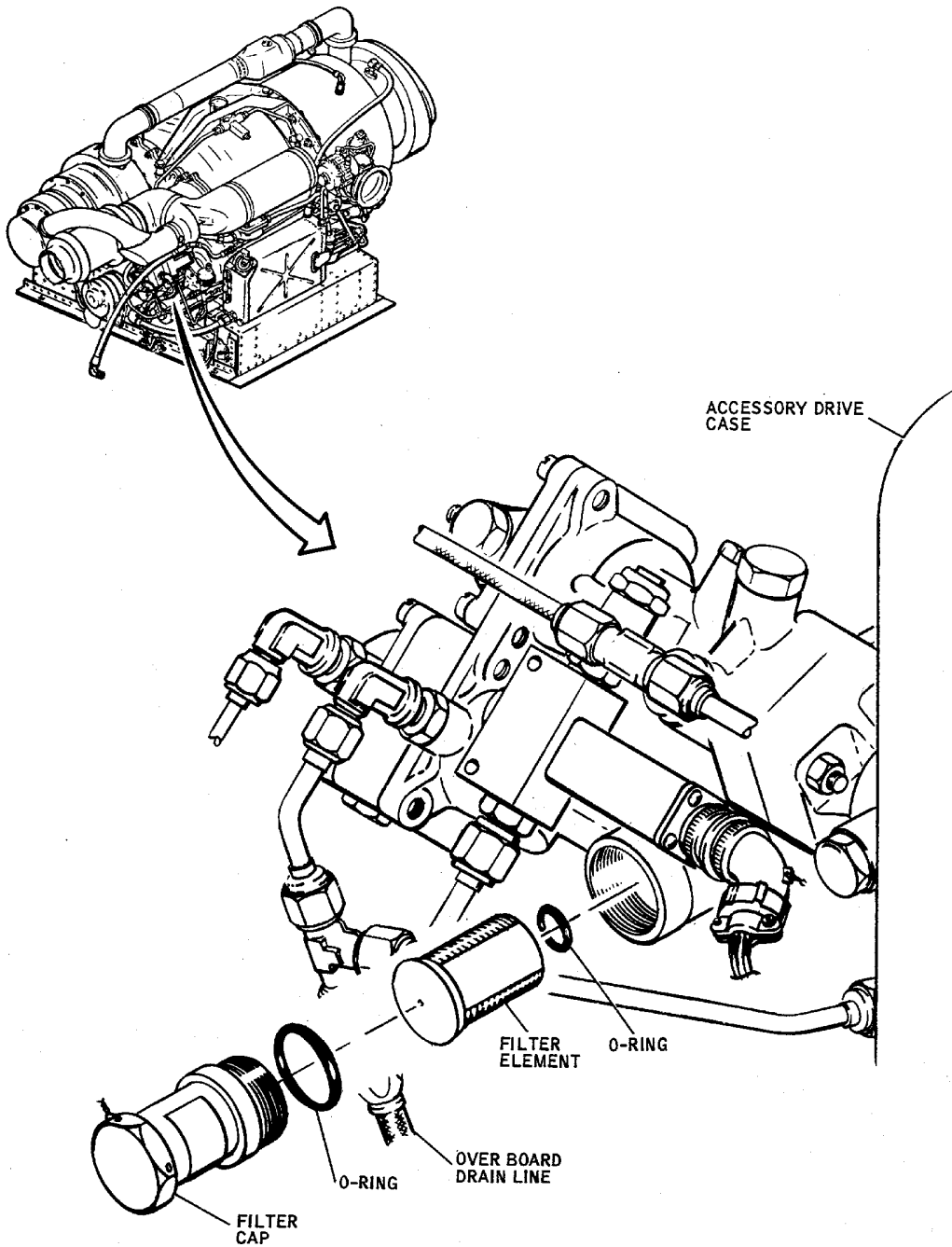
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BBB2-49-42A

Fuel Control Unit Filter -- Installation  
Figure 201/49-30-02-990-801

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## FUEL CONTROL UNIT FILTER - CLEANING/PAINTING

### 1. General

A. This procedure contains MSG-3 task card data.

#### **TASK 49-30-02-902-801**

### 2. Clean and Inspect Fuel Control Inlet Filter

NOTE: This procedure is a scheduled maintenance task.

#### A. **References**

<u>Reference</u>	<u>Title</u>
49-00-00 P/B 301 Config 1	GENERAL - SERVICING

#### B. **Consumable Materials**

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of the necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

<u>Reference</u>	<u>Description</u>	<u>Specification</u>
D60062	Oil - Preservation Oil Grade 1010	DPM 339 (MIL-PRF-6081)
G60137	Fuel - Jet	DPM 387 (MIL-PRF-5624, Grade JP-4)
G60138	Fuel - Jet	DPM 387-5 (MIL-PRF-5624, Grade JP-5)
G60170	Lockwire - .032 Inconel Annealed	DPM 684 (NASM20995N)

#### C. **Prepare to Clean and Inspect Fuel Control Inlet Filter**

SUBTASK 49-30-02-020-001

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-30-02-010-001

(2) Open access panel.

#### D. **Clean and Inspect Fuel Control Inlet Filter**

SUBTASK 49-30-02-902-001

(1) Remove filter cap (Figure 701)

(2) Remove filter element and O-rings. Discard O-rings.

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SUBTASK 49-30-02-211-001

- (3) Inspect fuel control inlet filter for contamination and flush fuel filter with preservation oil grade 1010 oil, D60062.

SUBTASK 49-30-02-430-001

- (4) Lightly coat new O-rings with fuel, G60137 or fuel, G60138.
- (5) Insert serviceable filter and new O-ring in filter housing.
- (6) Install filter cap. Torque to 110 ±10 in-lb (12 ±2 N·m).
- (7) Safety filter cap to fuel solenoid valve with .032 inconel lockwire, G60170.
- (8) Bleed APU fuel system. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1)

### E. Job Close Up

SUBTASK 49-30-02-410-001

- (1) Close access panel

SUBTASK 49-30-02-942-002

- (2) Remove all tools and make sure area is clean.

SUBTASK 49-30-02-430-002

- (3) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

————— END OF TASK —————

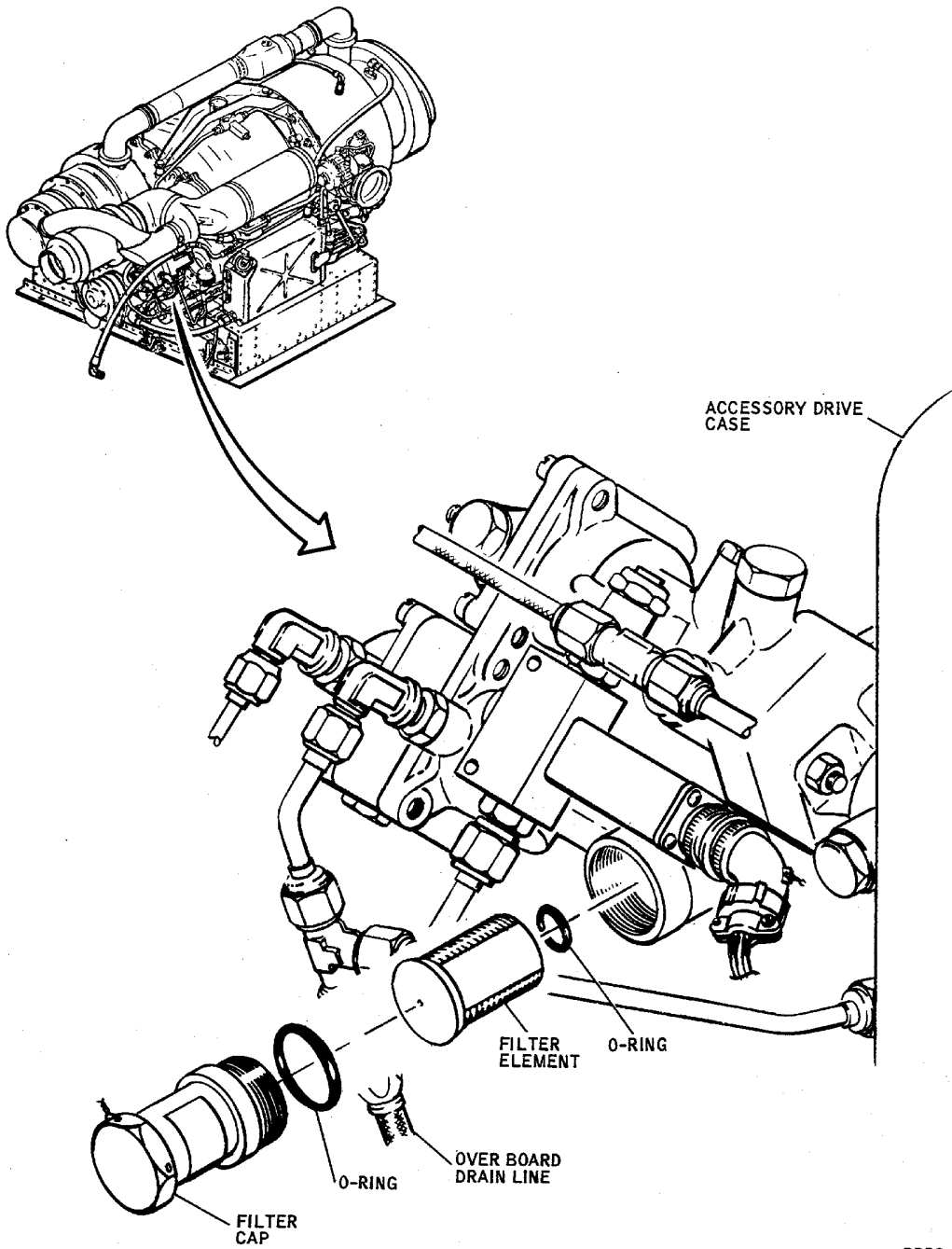
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**FUEL CONTROL INLET FILTER**  
Figure 701/49-30-02-990-803

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### FUEL SOLENOID VALVE - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The APU fuel solenoid valve is mounted on the fuel control unit housing, located on the lower front of the accessory gearcase. Access to the solenoid valve is through the APU left access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following item:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Fuel, MIL-T-5624, Grade JP4 DPM 387 or Grade JP5 DPM 387-5	

#### 3. Removal/Installation Fuel Solenoid Valve

- A. Remove Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from solenoid valve. (Figure 201)  
 (3) Disconnect fuel line from solenoid valve.

**NOTE:** A suitable container is required to catch small amount of fuel remaining in line or valve.

- (4) Remove solenoid valve retaining nut and washer.  
 (5) Slide solenoid valve down and out of fuel control housing to disengage support fitting.  
 (6) Remove support fitting from solenoid valve. Discard O-rings.  
 (7) Remove union from solenoid valve. Discard O-ring.

- B. Install Valve

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** JET FUEL B (JP-4 FUEL) IS AN AGENT THAT IS EXPLOSIVE, FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN JET FUEL B (JP-4 FUEL) IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET JET FUEL B (JP-4 FUEL) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** JET FUELS A AND A-1 (JP-5 FUEL) ARE AGENTS THAT ARE, FLAMMABLE, EXPLOSIVE, POISONOUS AND IRRITANTS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN JET FUELS A AND A-1 (JP-5 FUEL) ARE USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET JET FUELS A AND A-1 (JP-5 FUEL) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

- (2) Lightly coat new O-ring with fuel (MIL-T-5624, Grade JP4 or JP5) and install on support fitting and union.
- (3) Install support fitting and union on solenoid valve.
- (4) Insert solenoid valve support fitting into fuel control housing.
- (5) Install washer on support fitting.
- (6) Install solenoid valve retaining nut. Tighten nut to torque of 100 to 110 inch-pounds (11 to 12 N·m).

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- (7) Connect fuel line to solenoid valve.
- (8) Connect electrical connector to solenoid valve.
- (9) Bleed APU fuel system. (GENERAL, SUBJECT 49-00-00GENERAL, SUBJECT 49-00-00, page 301)
- (10) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

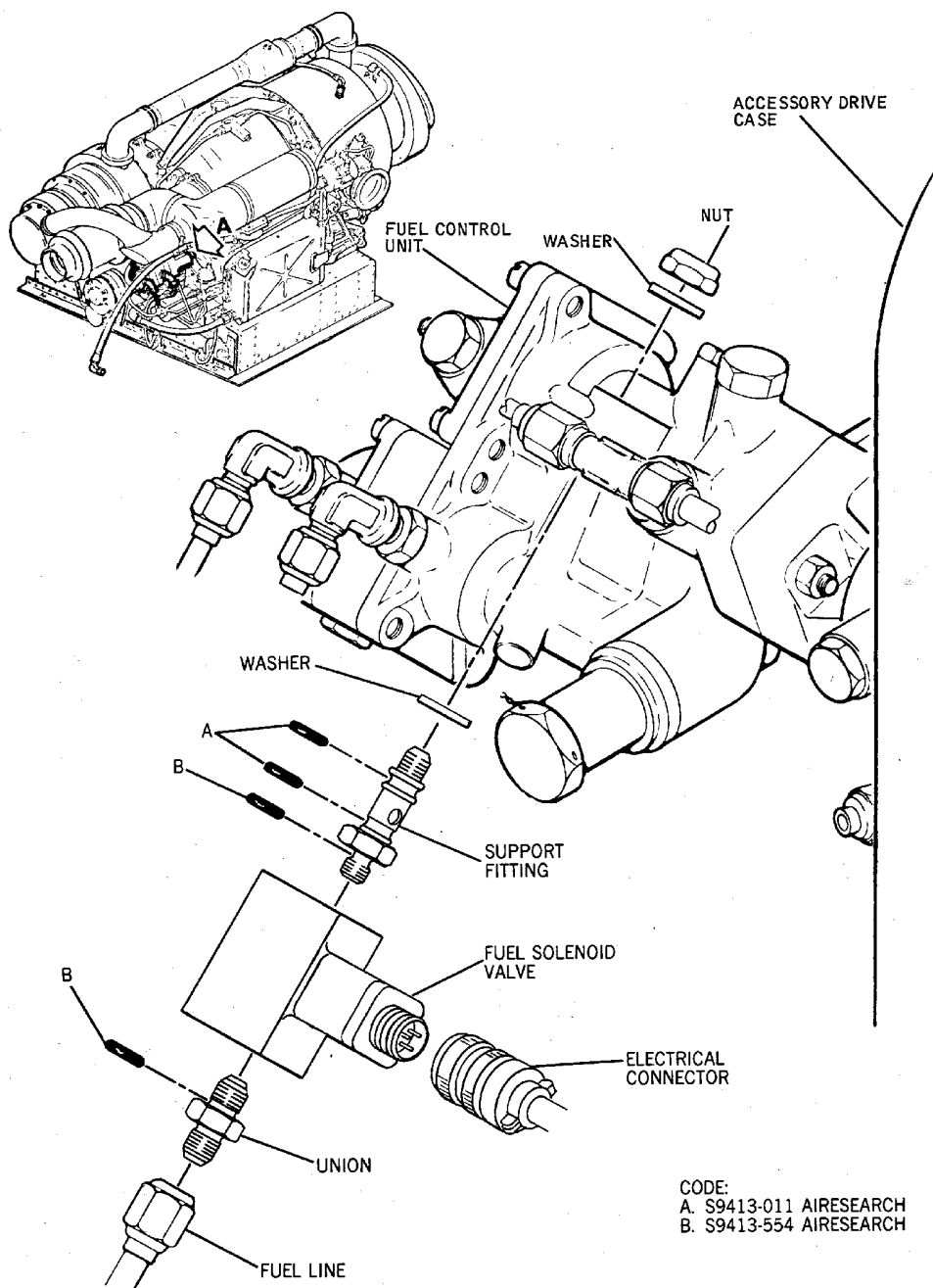
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BBB2-49-43A

Fuel Solenoid Valve -- Removal/Installation  
Figure 201/49-30-03-990-801

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## FUEL ATOMIZER - MAINTENANCE PRACTICES

### 1. General

- A. This procedure has maintenance practice for fuel atomizer. The procedure includes:
- Removal of fuel atomizer
  - Installation of fuel atomizer
  - Cleaning fuel atomizer screen.
- B. The fuel atomizer is mounted on the combustion chamber cap located on the right side of the Auxiliary Power Unit (APU). Access is through the APU right access door.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container	
Solvent, Fed. Spec. (P-D-680) DPM 518	
Compound, Fel-Pro C-5A, DPM 377 MIL-A-907	Fel Products Mfg. Co. Skokie, IL.
Torque wrench, 0-150 inch-pounds	
APU Start switch warning flag	
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. Removal/Installation Fuel Atomizer

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. Remove Atomizer
- (1) Install warning flag on APU start switch.

**WARNING:** TAG AND SAFETY CIRCUIT BREAKERS.

- (2) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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- (3) Disconnect fuel line from atomizer. (Figure 201)  
NOTE: A suitable container is required to catch small amount of fuel that may remain in line.
- (4) Remove fuel atomizer attaching bolts, washers and identification tag.
- (5) Carefully remove fuel atomizer and shim washer. Discard packings.

**B. Install Atomizer (Figure 201)**

- (1) Make sure that warning flag is on APU start switch.

**WARNING:** TAG AND SAFETY CIRCUIT BREAKERS.

**CAUTION:** MAKE CERTAIN ATOMIZER WITH CORRECT PART NUMBER IS INSTALLED. REPLACE REMOVED PART WITH ATOMIZER HAVING SAME GARRETT PART NUMBER OR STARTING DIFFICULTIES MAY OCCUR.

- (2) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** HIGH TEMPERATURE ANTISEIZE IS AN AGENT THAT IS POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HIGH TEMPERATURE ANTISEIZE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HIGH TEMPERATURE ANTISEIZE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (3) Coat threads of atomizer attaching bolts with (Fel-Pro, C5-A) compound.
- (4) Install new packing in groove of shim washer.
- (5) Install new packing in groove of fuel atomizer.
- (6) Install shim washer and fuel atomizer on combustor cap.
- (7) Tighten fuel atomizer attaching bolts to torque of 40 to 50 inch-pounds (4.5 to 5.7 N·m) and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (8) Install identification tag.
- (9) Connect fuel line to atomizer. Torque fuel line to 135-150 in-lb (15.3-16.9 N·m).

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(10) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

(11) Remove warning flag on APU start switch.

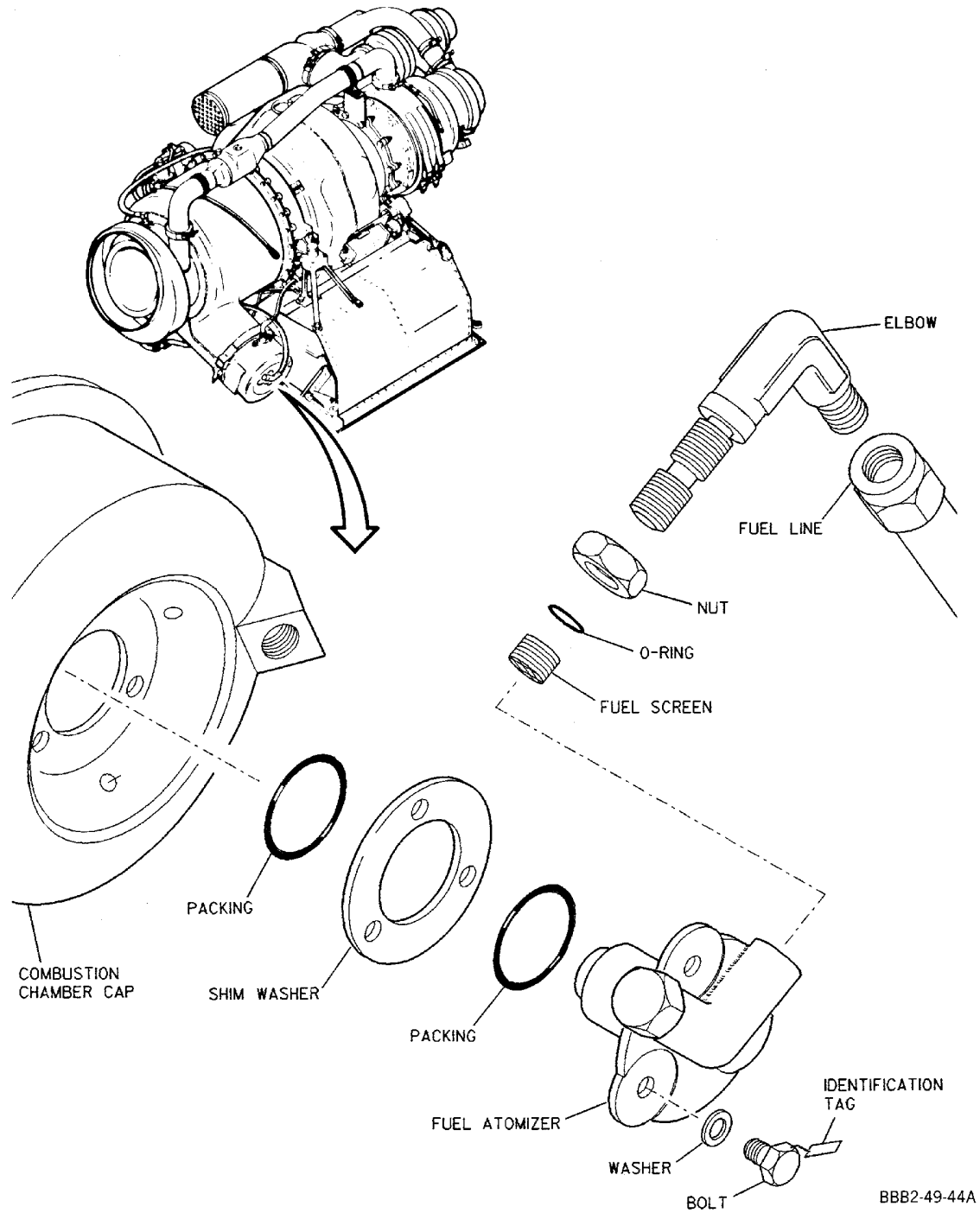
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**Fuel Atomizer -- Removal/Installation**  
**Figure 201/49-30-04-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Cleaning/Painting Fuel Atomizer Screen

#### A. Clean Fuel Atomizer Screen

- (1) Remove fuel atomizer. (Paragraph 3.A.)
- (2) Remove elbow from fuel atomizer. (Figure 201)
- (3) Remove O-ring.

**CAUTION:** AVOID DAMAGE TO INTERNAL THREADS IN ATOMIZER HEAD WHEN REMOVING RETAINING NUT AND FUEL SCREEN.

- (4) Remove fuel screen by carefully turning retaining nut counterclockwise with screwdriver.

**WARNING:** DRY CLEANING SOLVENT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN DRY CLEANING SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET DRY CLEANING SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (5) Wash fuel screen in solvent (Fed. Spec. P-D-680) and dry thoroughly with filtered compressed air.
- (6) Install fuel screen in atomizer head.
- (7) Install O-ring and retaining nut on elbow and install elbow into atomizer head.
- (8) Install fuel atomizer. (Paragraph 3.B.)
- (9) Torque jam nut to 90-110 in-lb (10.2-12.4 N·m).

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### LOW-PRESSURE FUEL FILTER - MAINTENANCE PRACTICES

#### 1. General

- A. This procedure has the removal and installation of the following components:
- Fuel filter housing
  - Fuel filter element
- B. The low-pressure fuel filter assembly, hat is attached to a bracket on the left wall of the APU enclosure and contains a replaceable filter element.

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Container	
"Do Not Operate" tag	STD-858
Torque wrench (0-200 inch pounds range)	
Threaded plug for AN fittings (DPM 5607-1)	
Pneumatic Lubricant grease DPM 333 (AMS-G-4343)	ANDEROL, Inc., East Hanover, NJ, #Royco 43
Lockwire, NASM20995N32 DPM 684	Not Specified

#### 3. Removal/Installation Low-Pressure Fuel Filter Housing Assembly

- A. Low-Pressure Fuel Filter Housing Assembly Removal

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) On the overhead APU panel, put a "Do Not Operate" tag on the MASTER switch.
- (3) Open this access panel:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH

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**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (4) Remove the fuel filter housing assembly as follows:

**NOTE:** A suitable container is required to catch small amount of fuel remaining in line.

- (a) Disconnect the fuel line from elbow on the inlet port .
  - 1) Install an DPM 5607 plug on the fuel line.
  - 2) If a new assembly is to be installed, remove the elbow, nut, and gasket.
- (b) Disconnect the fuel line the from outlet port.
  - 1) Install an DPM 5607 plug on the fuel line.
  - 2) If a new assembly is to be installed. Remove the reducer and O-ring from the outlet port.
- (c) Remove the two bolts, washers and spacers that attach the filter to the bracket.
- (d) Remove the fuel filter assembly.

**B. Low-Pressure Fuel Filter Housing Assembly Installation**

**NOTE:** If filter housing is being replaced by a new part, the unions must be removed from both ports. Unions are installed in new filter housing using new O-rings.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) On the overhead APU panel, make sure that a “Do Not Operate” tag is on the MASTER switch.  
 (3) Make sure that this access panel is open:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH

- (4) Install the fuel filter housing assembly as follows:
- (a) Prepare the fuel filter housing assembly for electrical bond. (ELECTRICAL BONDING - MAINTENANCE PRACTICES, SWPM 20-50-01)
  - (b) Position fuel filter on bracket and install the two bolts, washers and spacers.
  - (c) Do the electrical bond check of the fuel filter housing assembly. (ELECTRICAL BONDING - MAINTENANCE PRACTICES, SWPM 20-50-01)

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- (d) If a new filter housing assembly is installed do the steps that follows:
  - 1) Install the elbow, nut and O-ring on the inlet side of the assembly.
  - 2) Install the reducer and O-ring from the outlet port.
  - 3) Connect outlet fuel line to reducer on the outlet port.
- (e) Connect the inlet fuel line to the elbow on the inlet port.
- (5) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (6) Bleed APU fuel system. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1)
- (7) Make sure that this access panel is open:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
- (8) On the overhead APU panel, remove the "Do Not Operate" tag from the MASTER switch.

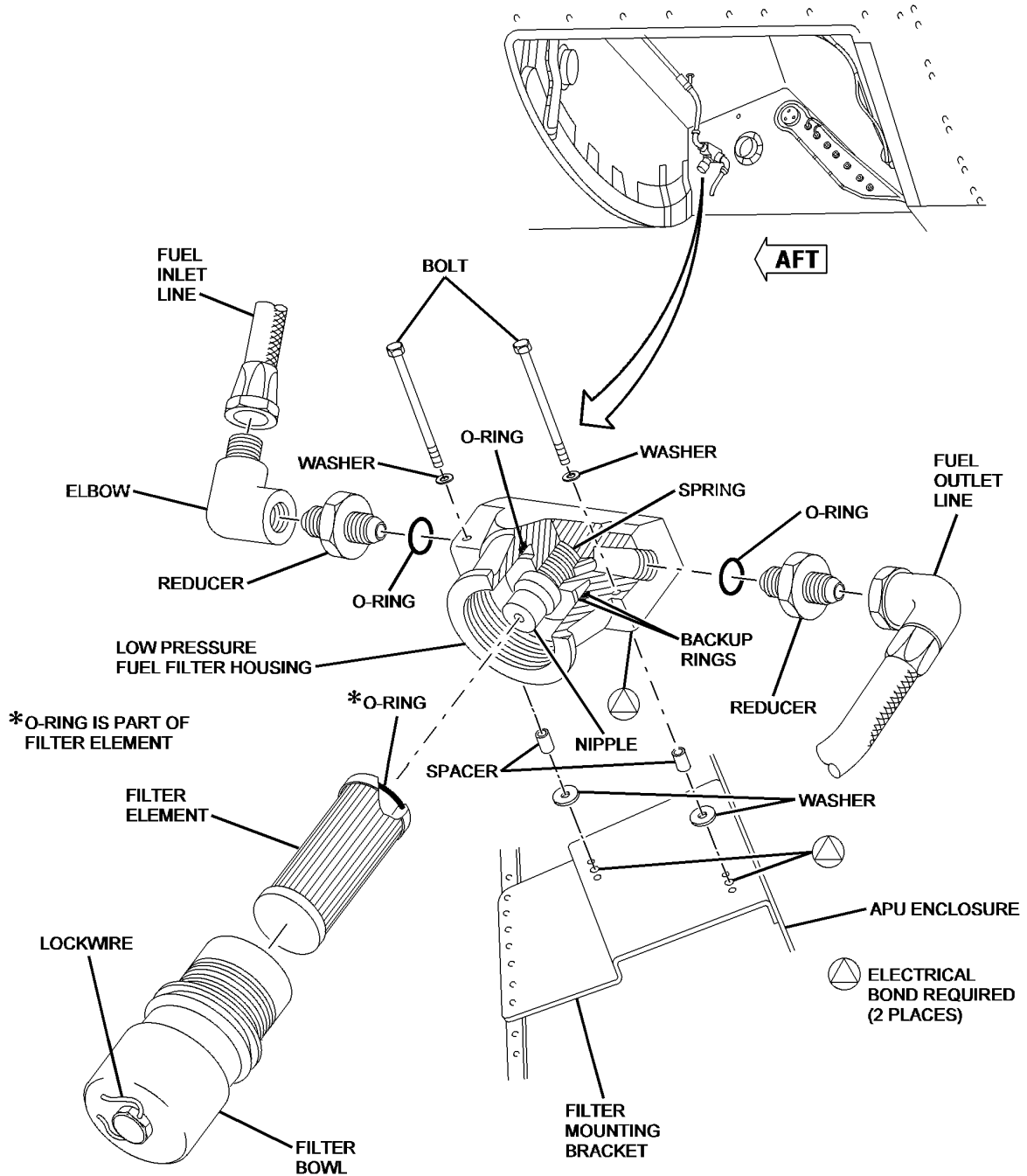
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**Low-Pressure Fuel Filter -- Removal/Installation  
Figure 201/49-30-05-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Removal/Installation Low-Pressure Fuel Filter Element

#### A. Low-Pressure Fuel Filter element removal

- (1) On the overhead APU panel, put a “Do Not Operate” tag on the MASTER switch.

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- (2) Open this access panel:

**Number**      **Name/Location**

5903A      Auxiliary Power Unit Service Access LH

- (3) Remove the fuel filter element as follows: (Figure 201)

- (a) Remove and discard safety wire.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (b) Remove filter bowl from housing.

**NOTE:** A suitable container is required to catch small amount of fuel remaining in filter or line.

- (c) Remove the filter element from the housing.

#### B. Low-Pressure Fuel Filter element Installation

- (1) On the overhead APU panel, make sure that a “Do Not Operate” tag is on the MASTER switch.

- (2) Make sure that this access panel is open:

**Number**      **Name/Location**

5903A      Auxiliary Power Unit Service Access LH

- (3) Install the Fuel Filter element as follows: (Figure 201)

- (a) Before you install the filter element, check O-ring and backup rings in the housing. If damage is evident replace the damaged rings.

**NOTE:** Filter element has new O-ring already installed

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1404, LUBRICANT/GREASE/PNEUMATIC (DPM 333)

HAZMAT 1000, REFER TO MSDS

- (b) Lubricate the O-ring with pneumatic lubricant grease.

- (c) Slip the filter element over nipple in housing.

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- (d) Install filter bowl into the housing, torque to 150 in-lb (17 N·m), and safety with lockwire.  
(LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (4) Make sure that this access panel is open:
- | <u>Number</u> | <u>Name/Location</u>                   |
|---------------|--|
| 5903A         | Auxiliary Power Unit Service Access LH |
- (5) On the overhead APU panel, remove the “Do Not Operate” tag from the MASTER switch.
- (6) Bleed APU fuel system. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### LOW PRESSURE FUEL FILTER - REMOVAL/INSTALLATION

**1. General**

A. This procedure contains MSG-3 task card data.

**TASK 49-30-05-901-801**

**2. Discard Low Pressure Fuel Filter Element**

NOTE: This procedure is a scheduled maintenance task.

**A. References**

Reference	Title
20-10-18 P/B 201	LOCKWIRE SAFETYING - MAINTENANCE PRACTICES
49-00-00 P/B 301 Config 1	GENERAL - SERVICING

**B. Tools/Equipment**

Reference	Description
STD-1015	Wrench - Torque, 0 to 200 in-lbs (0 to 22.59 N·m)

**C. Consumable Materials**

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of the necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Reference	Description	Specification
G60170	Lockwire - .032 Inconel Annealed	DPM 684 (NASM20995N)

**D. Prepare to Discard Low Pressure Fuel Filter Element**

SUBTASK 49-30-05-865-001

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-30-05-010-001

(2) Open access panel.

SUBTASK 49-30-05-020-001

(3) Remove the low pressure fuel filter element as follows:

(a) Remove filter bowl from housing. (Figure 401)

NOTE: A suitable container is required to catch small amount of fuel remaining in filter or line.

(b) Remove filter element from housing.

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SUBTASK 49-30-05-211-001

- (4) Inspect the fuel filter element for contamination, then discard the element.

SUBTASK 49-30-05-420-002

- (5) Install a serviceable filter as follows:
  - (a) Before installing filter element, check O-ring and backup rings in housing. If damage is evident replace damaged rings.
  - (b) Slip filter element over nipple in housing.
  - (c) Install filter bowl in housing, use a torque wrench, STD-1015 and torque to 150 in-lb (17 N·m), and safety with .032 inconel lockwire, G60170. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

### E. Job Close-up

SUBTASK 49-30-05-420-001

- (1) Remove all tools and make sure area is clean.

SUBTASK 49-30-05-865-002

- (2) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-30-05-410-002

- (3) Close access panel.

SUBTASK 49-30-05-200-001

- (4) If necessary, bleed APU fuel system of entrapped air. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1)

————— **END OF TASK** —————

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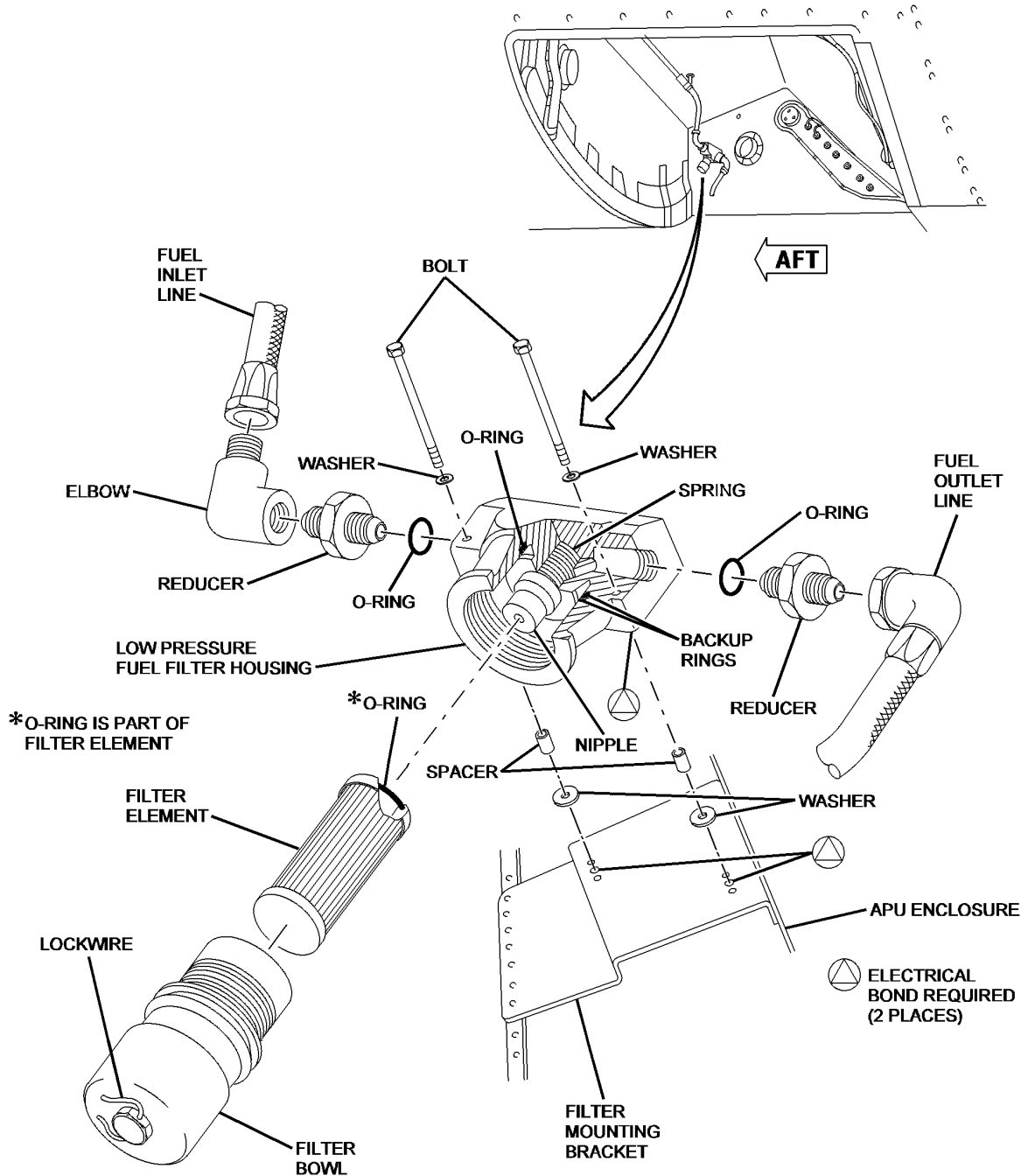
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**LOW-PRESSURE FUEL FILTER**  
Figure 401/49-30-05-990-802

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### COMBUSTION CHAMBER DRAIN FITTING - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The combustion chamber drain fitting is located in the lower side of the combustion chamber cap. Access to the fitting is through the APU right access door.

#### 2. Removal/Installation Combustion Chamber Drain Fitting

- A. Remove Combustion Chamber Drain Fitting

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect drain line from fitting on combustion chamber cap. (Figure 201)
- (3) Remove fitting from combustion chamber cap.
- (4) Remove O-ring from fitting.

- B. Install Combustion Chamber Drain Fitting

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Install new O-ring on fitting (Figure 201).
- (3) Install drain fitting in combustion chamber cap.
- (4) Connect drain line to fitting.
- (5) Remove the safety tag and close this circuit breaker:

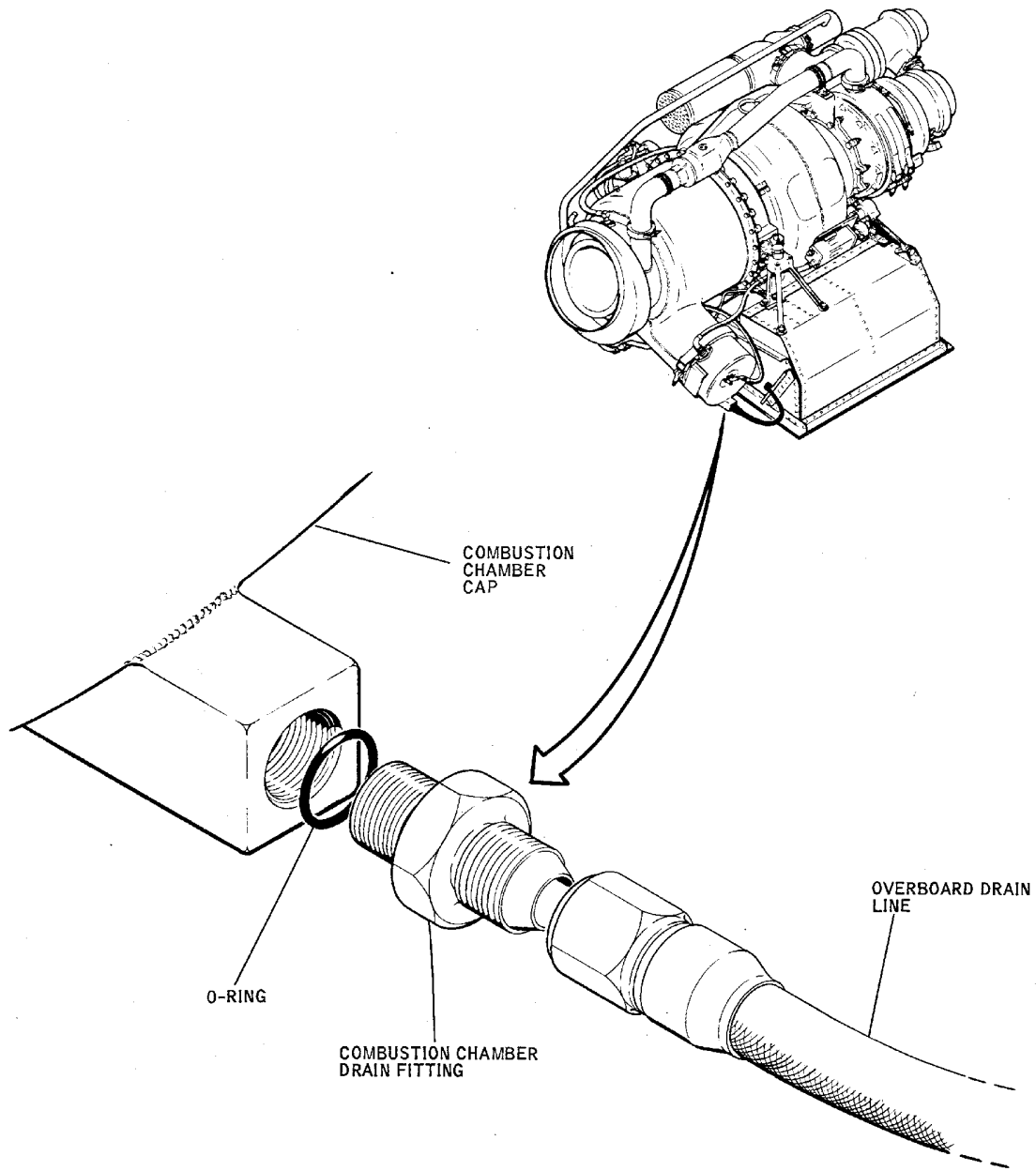
**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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**Combustion Chamber Drain Fitting -- Installation**  
Figure 201/49-30-07-990-801

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### 3. Inspection/Check Combustion Chamber Drain Fitting

#### A. Check Drain Line

- (1) Check drain line and union at combustion chamber cap to ensure that union and line are free of carbon or other obstructions.

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### FUEL HEAT SYSTEM - DESCRIPTION AND OPERATION

#### 1. General

- A. The fuel heat system consists of the following major components: a fuel heater, airflow check valve, fuel heater bypass valve, and a fuel temperature sensing air regulator valve. These components and connecting air and fuel lines function to heat the APU fuel supply.
- B. The fuel heat system is located inside the APU compartment enclosure, and mounted with clamps attached to stiffeners on the enclosure. The APU must be removed from the airplane when it is desirable to remove the complete fuel heat system. However, the airflow check valve and the fuel temperature sensing air regulator valve, and some fuel lines are accessible through the APU left and right access doors while the unit is installed in the airplane.

#### 2. Operation

- A. The APU fuel heat system operates automatically by action of the fuel temperature sensing air regulator valve. When temperature of fuel passing through this valve drops to a predetermined value, the valve will open allowing warm compressor bleed air to circulate around the fuel line inside the fuel heater shroud. Air used to warm fuel is exhausted overboard after passing through the fuel heater and fuel temperature sensing air regulator valve. In this manner, fuel is warmed to a controlled temperature as it flows through the heater.
- B. The fuel temperature sensing air regulator valve is a vernatherm-type valve and solely temperature sensitive. As temperature of fuel passing through this valve varies, the valve will modulate airflow through the heater and exhaust this air overboard, thus maintaining fuel temperature within specified limits.
- C. The airflow check valve is located in the compressor bleed air supply line. This valve is held in an open position by pressure of bleed air from the turbine exhaust plenum while the engine is in operation. The valve is normally closed when the unit is not in operation. The valve prevents backflow of fuel into the bleed air plenum in the event of an internal fuel heater leak.
- D. The fuel bypass valve is located in an unshrouded fuel line between the inlet and outlet ports of the fuel heater. When the pressure differential across the valve exceeds 1 1/2 psig the fuel bypass valve will open and permit the APU to continue operation with fuel bypassing the heater.

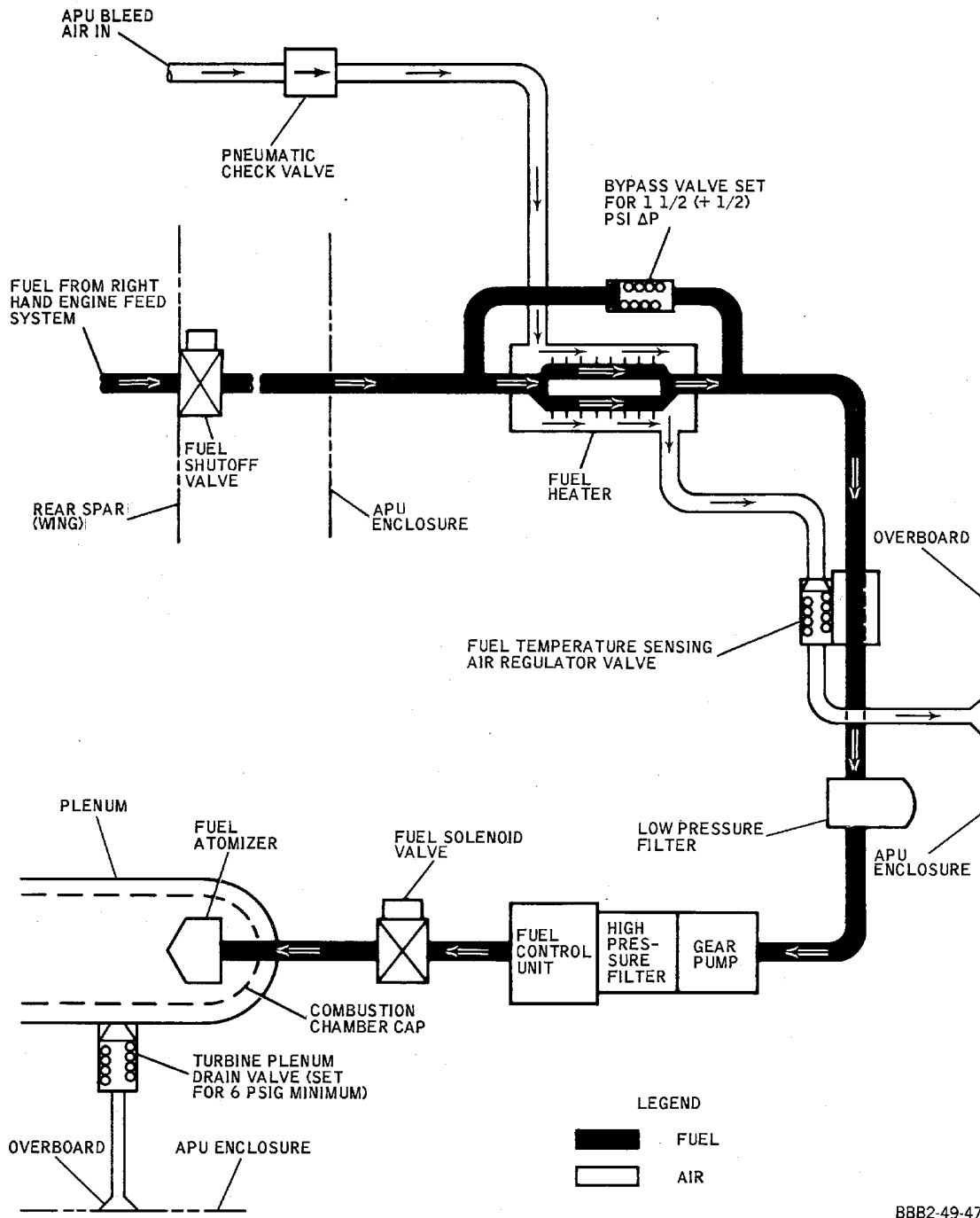
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BBB2-49-47

**Fuel Heat System -- Schematic  
Figure 1/49-31-00-990-801**

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**AIRCRAFT MAINTENANCE MANUAL**  
**FUEL HEATER - MAINTENANCE PRACTICES**

**1. General**

A. Methods for removing the complete fuel heat system will vary according to individual requirements.

**2. Equipment and Materials**

NOTE: Equivalent substitutes may be used instead of the following item:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
AN & MS threaded plug, DPM 2932, STD-6220	Comm Available

**3. Removal/Installation Fuel Heater**

A. Remove the APU from the aircraft. (POWER PLANT - REMOVAL/INSTALLATION, PAGEBLOCK 49-10-00/401)

NOTE: Some system components may be removed while the APU is installed in the aircraft,

B. Remove Fuel Heater:(Figure 201)

- (1) Disconnect line from air outlet fitting on left end of heater.
- (2) Disconnect line from air inlet fitting on right end of heater.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (3) Disconnect fuel outlet line from elbow on left end of heater.
- (4) Disconnect fuel inlet line from tee on right end of heater.
- (5) Disconnect fuel lines from the check valve.
  - (a) Record location and arrow direction on the check valve.
- (6) Remove the screw, washer, clamp and check valve.
  - (a) Record the location of all the attaching hardware for the clamps.
- (7) Remove screws, washers, and clamps attaching heater to enclosure.
- (8) Remove fuel heater.
- (9) Remove elbow, nut, and gasket from the fuel outlet of the heater.
- (10) Remove tee, nut, and gasket from the fuel inlet of the heater.
- (11) Put AN & MS threaded plug, DPM 2932, STD-6220 on all open fuel air lines.

C. Install Fuel Heater(Figure 201)

- (1) Install tee, nut, and new gasket on the fuel inlet of the heater.

NOTE: Do not tighten the nut at this time.

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- (2) Install elbow, nut, and new gasket on the fuel outlet of the heater.

NOTE: Do not tighten the nut at this time.

- (3) Position fuel heater inside enclosure.

- (4) Install screws, washers, spacers, check valve and clamps attaching fuel heater to enclosure.

NOTE: Not all aircraft require the spacer.

- (a) Make sure the check valve is installed in the location and direction as recorded during the removal.

NOTE: Do fully tighten the clamp attaching hardware until all the fuel heater lines are connected.

**WARNING**: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (5) Connect fuel inlet line to tee on the fuel inlet of heater.
- (a) Connect the fuel inlet bypass line to the check valve and the tee fitting.
- (6) Connect fuel outlet line to elbow on the fuel outlet of heater.
- (a) Connect the fuel inlet bypass line to the check valve from the on the fuel outlet tee fitting.
- (7) Connect line to air inlet fitting on right end of heater.
- (8) Connect line to air outlet fitting on left side of heater.
- (9) Tighten all the clamp attaching hardware.
- (10) Tighten all the B-nuts and nuts on the elbow and tee fitting.
- D. Install the APU. (POWER PLANT - REMOVAL/INSTALLATION, PAGEBLOCK 49-10-00/401)
- (1) Bleed APU fuel system. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1

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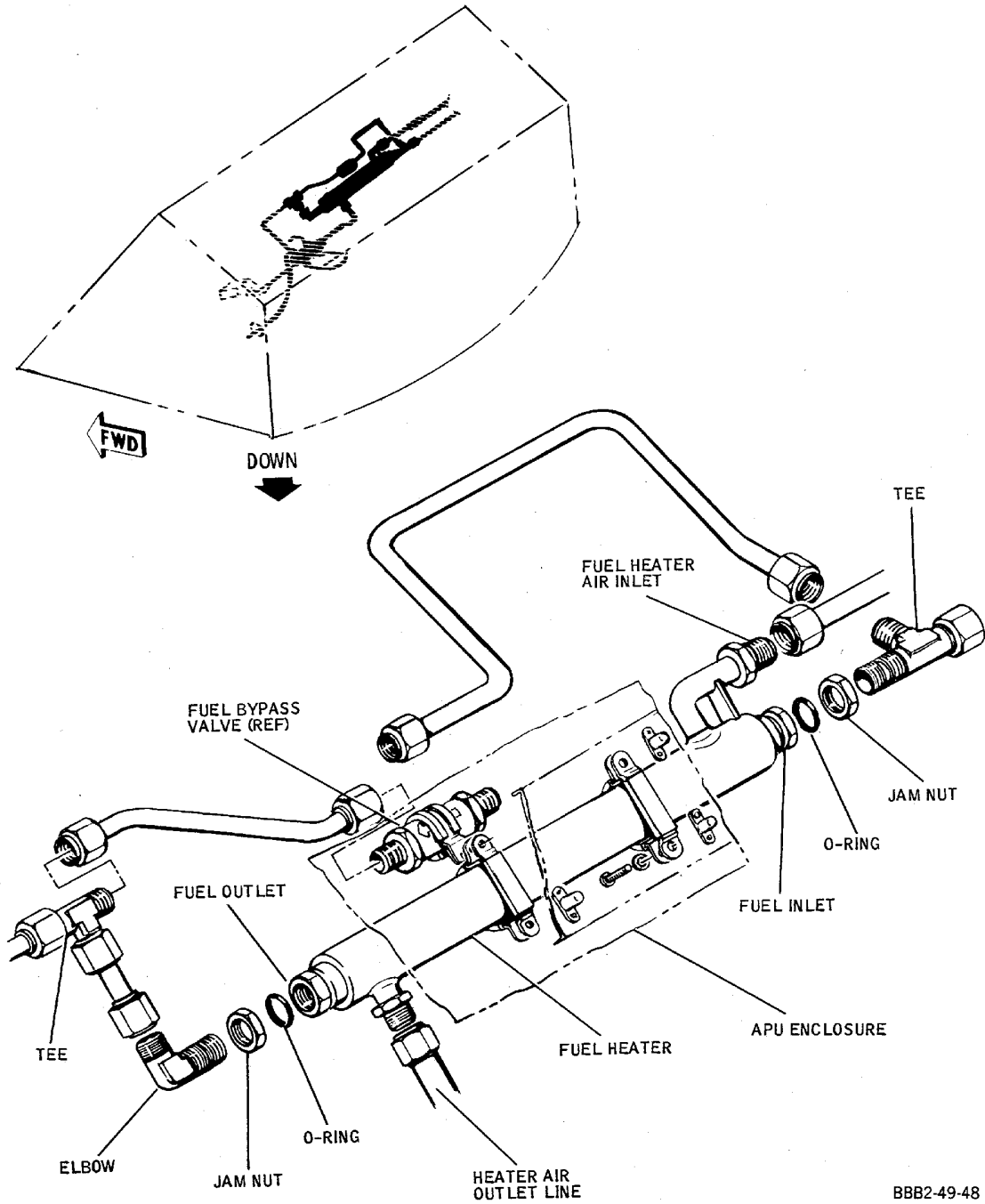
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**Fuel Heater -- Removal/Installation  
Figure 201/49-31-01-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### FUEL TEMPERATURE SENSING AIR REGULATOR VALVE - MAINTENANCE PRACTICES

**1. General**

A. The fuel temperature sensing air regulator valve is located in the APU enclosure above the left side of the APU. The valve is accessible with the APU installed.

**2. Equipment and Materials**

NOTE: Equivalent substitutes may be used instead of the following listed item:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
AN & MS threaded plug, DPM 2932, STD-6220	Comm Available
Container	

**3. Removal/Installation Fuel Temperature Sensing Air Regulator Valve**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

A. Remove Fuel Temperature Sensing Air Regulator Valve as follows:(Figure 201)

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

(2) Open this access panel:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

(3) Disconnect the fuel line (2) between the fuel heater and fuel temperature sensing air regulator valve (1).

(4) Disconnect the fuel line (3) from the tee fitting to the fuel temperature sensing air regulator valve (1).

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- (5) Disconnect the fuel line (4) from the bulkhead fitting to the fuel temperature sensing air regulator valve (1).
- (6) Disconnect the fuel line (5) from the fuel filter to the fuel temperature sensing air regulator valve (1).
- (7) Install AN & MS threaded plug, DPM 2932, STD-6220 on all open lines.
- (8) Remove valve.

**B. Install Valve (Figure 201)**

- (1) Make sure that this access panel is open:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (3) Position valve inside APU enclosure.

**WARNING:** USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1044, JET FUELS A AND A-1 (JP-5 FUEL)

HAZMAT 1000, REFER TO MSDS

- (4) Connect the fuel line (2) between the fuel heater and fuel temperature sensing air regulator valve (1).
- (5) Connect the fuel line (3) from the tee fitting to the fuel temperature sensing air regulator valve (1).
- (6) Connect the fuel line (4) from the bulkhead fitting to the fuel temperature sensing air regulator valve (1).
- (7) Disconnect the fuel line (5) from the fuel filter to the fuel temperature sensing air regulator valve (1).
- (8) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (9) Bleed APU fuel system. (GENERAL - SERVICING, PAGEBLOCK 49-00-00/301 Config 1)
- (10) Check the valve for leaks.
  - (a) No leaks are permitted.

EFFECTIVITY WJE ALL	
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49-31-02

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AIRCRAFT MAINTENANCE MANUAL**

(11) Close this access panel:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH

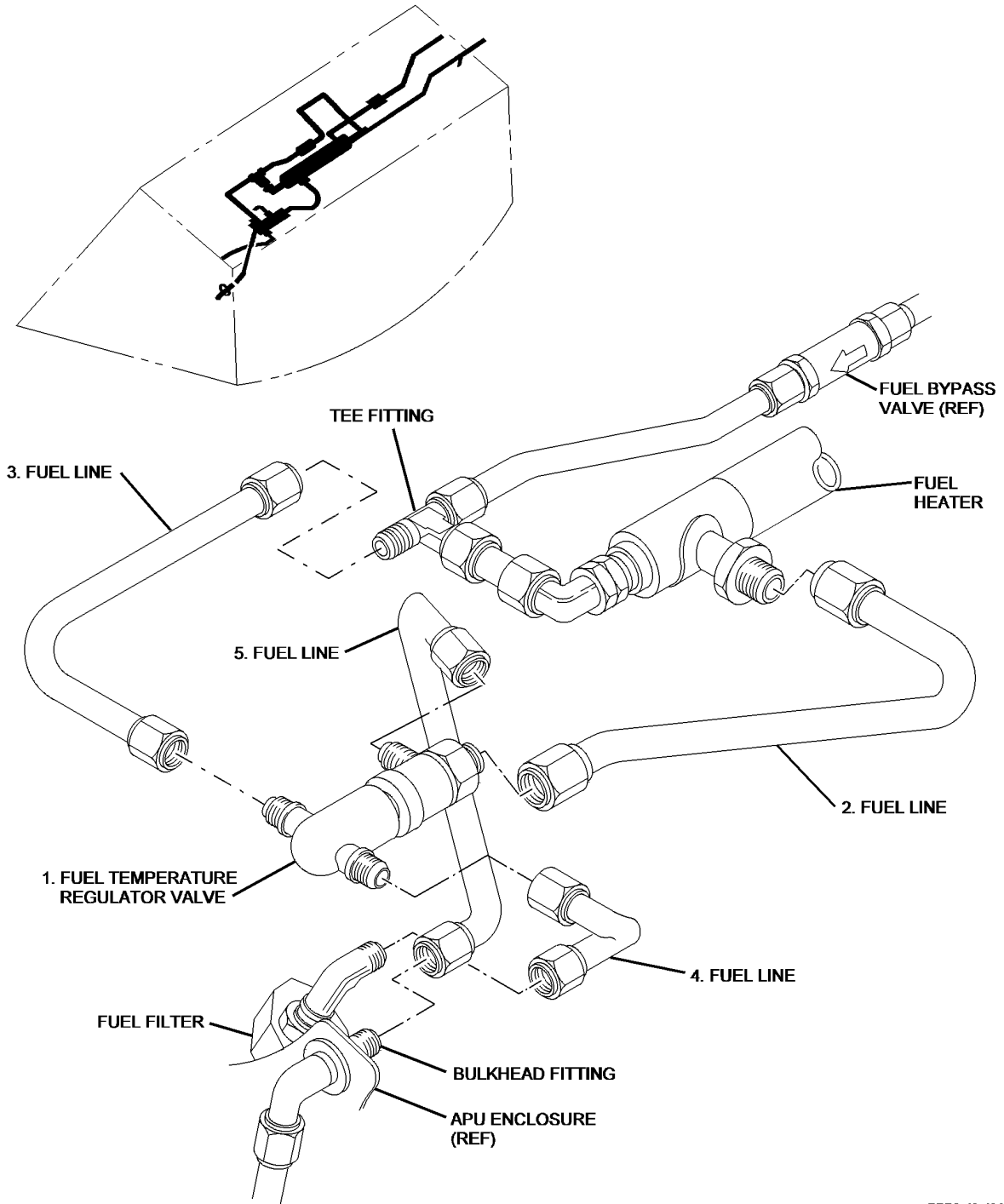
EFFECTIVITY  
WJE ALL

TP-80MM-WJE

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BBB2-49-49A  
S0006552248V2

Fuel Temperature Sensing Air Regulator Valve -- Removal/Installation  
Figure 201/49-31-02-990-801

EFFECTIVITY  
WJE ALL

## 49-31-02

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### FUEL HEAT SYSTEM DISCONNECT SHROUD - MAINTENANCE PRACTICES

#### 1. General

- A. The major components of the fuel heat system are mounted on the upper inside surface of the APU enclosure. This section of the system is connected to a shrouded fuel supply line located between the enclosure and the pressure bulkhead. Provisions for disconnecting the fuel supply line are provided by a dis-connect shroud mounted on the enclosure right side.
- B. The APU must be removed to accomplish removal/installation of the fuel supply line extending through the enclosure. (POWER PLANT, SUBJECT 49-10-00, page 401)

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container	
Petrolatum, VV-P-236 DPM 675	Commercially available
Douglas solvent No. 2 DPM 518	Commercially available
Sealant, RTV-1016 with catalyst RTV-9910 DMS 1799(C)	General Electric Silicone Products Dept., Machanicsville Road, Waterford, N.Y.

#### 3. Removal/Installation Fuel Heat System Disconnect Shroud and Fuel Line

- A. Remove Disconnect Shroud
  - (1) Disconnect shroud drain line from fitting on shroud and remove O-ring. (Figure 201)
  - (2) Remove two clamps and connecting strip from fuel inlet side of shroud.  
NOTE: Clamps, strip and hardware should be temporarily connected to avoid loss of small parts.
  - (3) Remove nut and self-contained split ring from flange of bulkhead connector.
  - (4) Slide shroud back sufficiently from bulkhead connector to gain access to fuel line union and electrical bonding jumper.
  - (5) Remove O-ring from flange on end of fuel inlet line shroud.
  - (6) Disconnect electrical bonding jumper and remove clamp from outlet side of fuel line coupling.
  - (7) Disconnect coupling and remove O-ring.  
NOTE: Container should be provided to catch fuel remaining in line.
  - (8) Remove bolts and washers attaching bulkhead connector to APU enclosure.
  - (9) Remove bulkhead connector and gasket.

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (10) Remove O-ring from flange of bulkhead connector.
- B. Remove Fuel Line
- (1) Accomplish Paragraph 3.A., Paragraph 3.A.(1) thru Paragraph 3.A.(10).
  - (2) Remove two clamps attaching fuel inlet line to upper surface of APU enclosure.
  - (3) Disconnect fuel line from tee located on end of fuel heater.
  - (4) Remove fuel line through opening in APU enclosure.
- C. Install Fuel Line
- (1) Insert end of fuel line through opening in APU enclosure and position flange on attach area. (Figure 201)

**WARNING:** SILICONE SEALANT IS AN AGENT THAT IS POISONOUS, CARCINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SILICONE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (2) Apply faying surface of sealant (RTV-1016) between fuel line flange and APU enclosure.
  - (3) Install new O-ring in cavity of bulkhead connector, making certain not to twist or roll O-ring during installation.
  - (4) Install bulkhead connector and gasket by installing screws and nuts attaching fuel line flange to APU enclosure.
  - (5) Connect outlet end of fuel line to tee on fuel heater.
  - (6) Install two clamps securing fuel line to upper surface of APU enclosure.
  - (7) Accomplish Paragraph 3.D., Paragraph 3.D.(1) thru Paragraph 3.D.(11).
- D. Install Disconnect Shroud

**WARNING:** WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

EFFECTIVITY  
WJE ALL

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### (WARNING PRECEDES)

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (1) Lightly lubricate new O-ring with Petrolatum (VV-P-236), and position in fuel line coupling. (Figure 201)
- (2) Make certain ends of fuel lines are aligned and tighten coupling.

**NOTE:** If pressure check of fuel lines is necessary, refer to DISTRIBUTION, SUBJECT 28-20-00, page 601.

**WARNING:** DRY CLEANING SOLVENT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN DRY CLEANING SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET DRY CLEANING SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (3) Clean area where electrical bonding jumper and clamp are to be attached using Douglas solvent (No. 2), refer to Paragraph 2..

**NOTE:** Area must be free of oil and other foreign material to ensure electrical bond.

- (4) Install clamp and electrical bonding jumper.
- (5) Install new O-ring in flange on end of fuel inlet line shroud.
- (6) Lightly coat O-ring with Petrolatum (VV-P-236), and slide shroud into position.
- (7) Lightly coat threads of nut and flange of bulkhead connector with Petrolatum (VV-P-236).
- (8) Carefully start nut (with self-contained split ring) on bulkhead connector, then tighten.
- (9) Install two clamps and connecting strip at inlet side of shroud.
- (10) Lightly coat new O-ring with Petrolatum (VV-P-236), and position in shroud drain line coupling.
- (11) Tighten shroud drain line coupling.
- (12) Perform pressure check of shroud system. (DISTRIBUTION, SUBJECT 28-20-00, page 601)

EFFECTIVITY  
WJE ALL

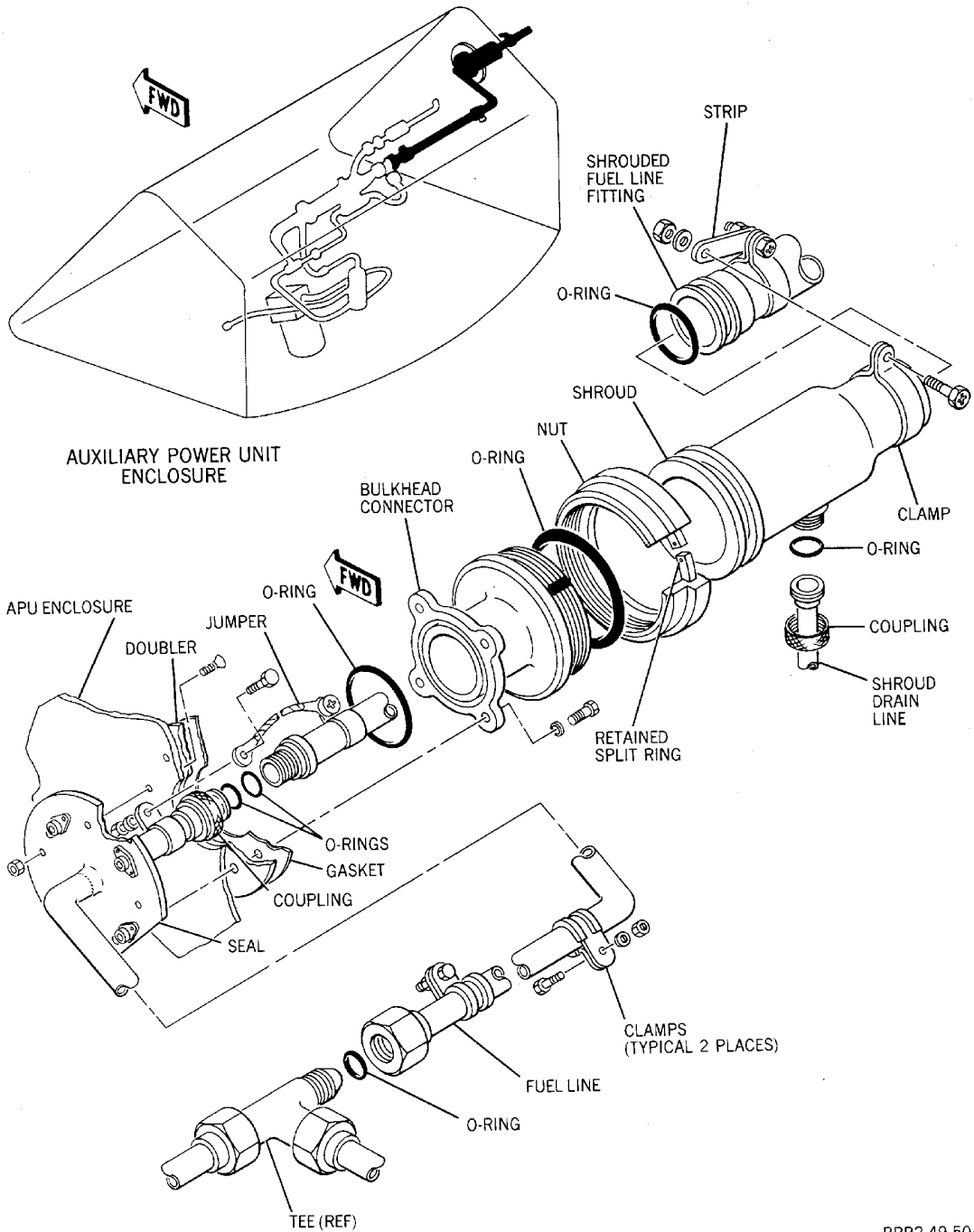
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AIRCRAFT MAINTENANCE MANUAL**



BBB2-49-50A

**Fuel Heat System Disconnect Shroud -- Installation  
Figure 201/49-31-03-990-801**

EFFECTIVITY  
WJE ALL

**49-31-03**

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### IGNITION/STARTING - DESCRIPTION AND OPERATION

#### 1. General

- A. The ignition/starting system is initially energized manually by momentarily placing the APU Master switch in the START position, but all subsequent operations are fully automatic. Major components of the ignition/starting system are the starter motor, ignition unit, igniter plug, ignition leads, and necessary wiring and relays.

#### 2. Operation

**CAUTION:** DO NOT EXCEED STARTER DUTY CYCLE OF ONE ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. SECOND ATTEMPT/START FOLLOWED BY FIVE MINUTES OFF. THIRD ATTEMPT/START FOLLOWED BY ONE HOUR OFF. THIS WILL HELP PREVENT HEAT DAMAGE TO THE STARTER.

**WJE 401-412, 414-419, 421, 423, 425, 426, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 892, 893; WJE 420, 422, 424, 427, 429, 891 PRE MD80-49-036**

- A. APU start is initiated by momentarily placing the APU MASTER switch in the START position then releasing it to the RUN position. This action causes the air inlet door actuator to rotate, driving the ram door to full ram position. As the door starts opening, the ram door interlock switch closes. The APU automatic starting relay allows 15 seconds for this to occur. Closing of the ram door interlock switch causes the start circuit to react automatically.

**WJE 401-412, 414-419, 421, 423, 425, 426, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 892, 893; WJE 420, 422, 424, 427, 429, 891 POST MD80-49-036**

APU start is initiated by momentarily placing the APU MASTER switch in the START position then releasing it to the RUN position. This action causes the air inlet door actuator to rotate, driving the ram door to full ram position. As the door starts opening, the ram door interlock switch closes. The APU automatic starting relay allows 20 seconds for this to occur. Closing of the ram door interlock switch causes the start circuit to react automatically.

#### **WJE ALL**

- (1) The starter relay and holding relay close, supplying power to the fuel solenoid contacts of the oil sequencing switch causing the APU OIL LOW caution light on the annunciator panel to come on.

#### **WJE 412, 414, 875-879**

- (2) When the APU start advisory relay closes, the APU STARTER ON light on the annunciator panel will come on.

#### **WJE 401-410, 412, 414-419, 421, 423, 425, 426, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 892, 893**

- (3) The starter begins to rotate as soon as the holding relay circuit closes. When oil pressure rises to 2.5 to 3.5 psig, the oil sequencing switch closes to energize the fuel solenoid valve and ignition system. The igniter plug now fires, igniting the fuel/air mixture in the combustion chamber. At 35 percent of engine speed, the 35-percent switch of the centrifugal switch is opened, breaking the circuit to the starter.

#### **WJE 420, 422, 424, 427, 429, 891**

- (4) The starter begins to rotate as soon as the holding relay circuit closes. When oil pressure rises to 2.5 to 3.5 psig, the oil sequencing switch closes to energize the fuel solenoid valve and ignition system. The igniter plug now fires, igniting the fuel/air mixture in the combustion chamber. At 35 percent of engine speed, the 35-percent switch of the centrifugal switch or electronic speed switch is opened, breaking the circuit to the starter.

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

WJE ALL

- (5) When engine speed reaches 95 percent, the 95-percent switch of the centrifugal switch closes and opens the ignition system circuit. The load control valve bleed air relay is energized, and the hourmeter starts recording APU operation time. The ram door closes and the non-ram doors open.

EFFECTIVITY  
WJE ALL

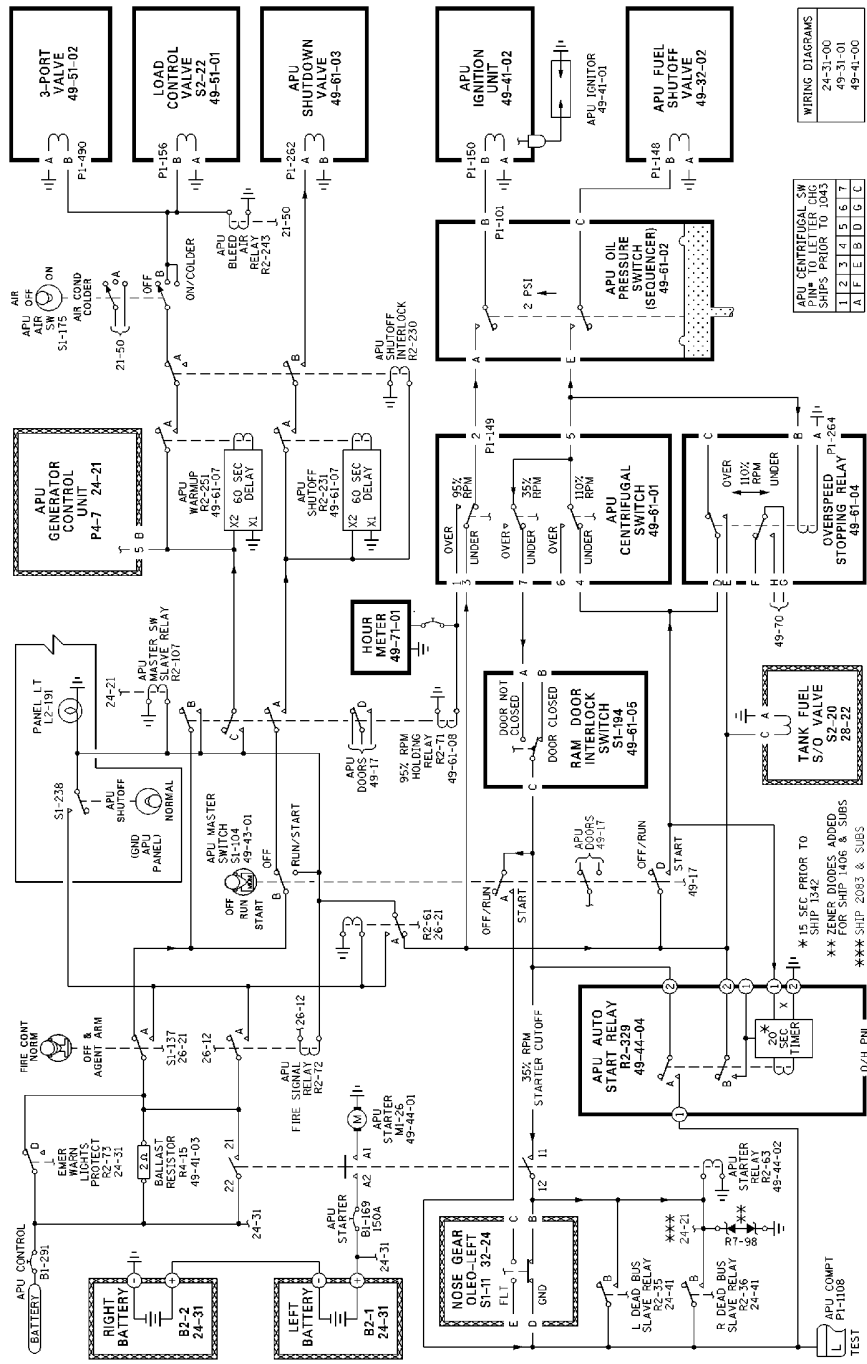
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**49-40-00**

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WIRING DIAGRAMS

24-21-00
49-31-01
49-41-00

APU CENTRIFUGAL SW SHIPS PRIOR TO 10A5

1	2	3	4	5	6	7
A	T	E	B	D	B	L
C						

OVERSPEED STOPPING RELAY

A	B
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
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97	98
99	100

BBB2-49-100J

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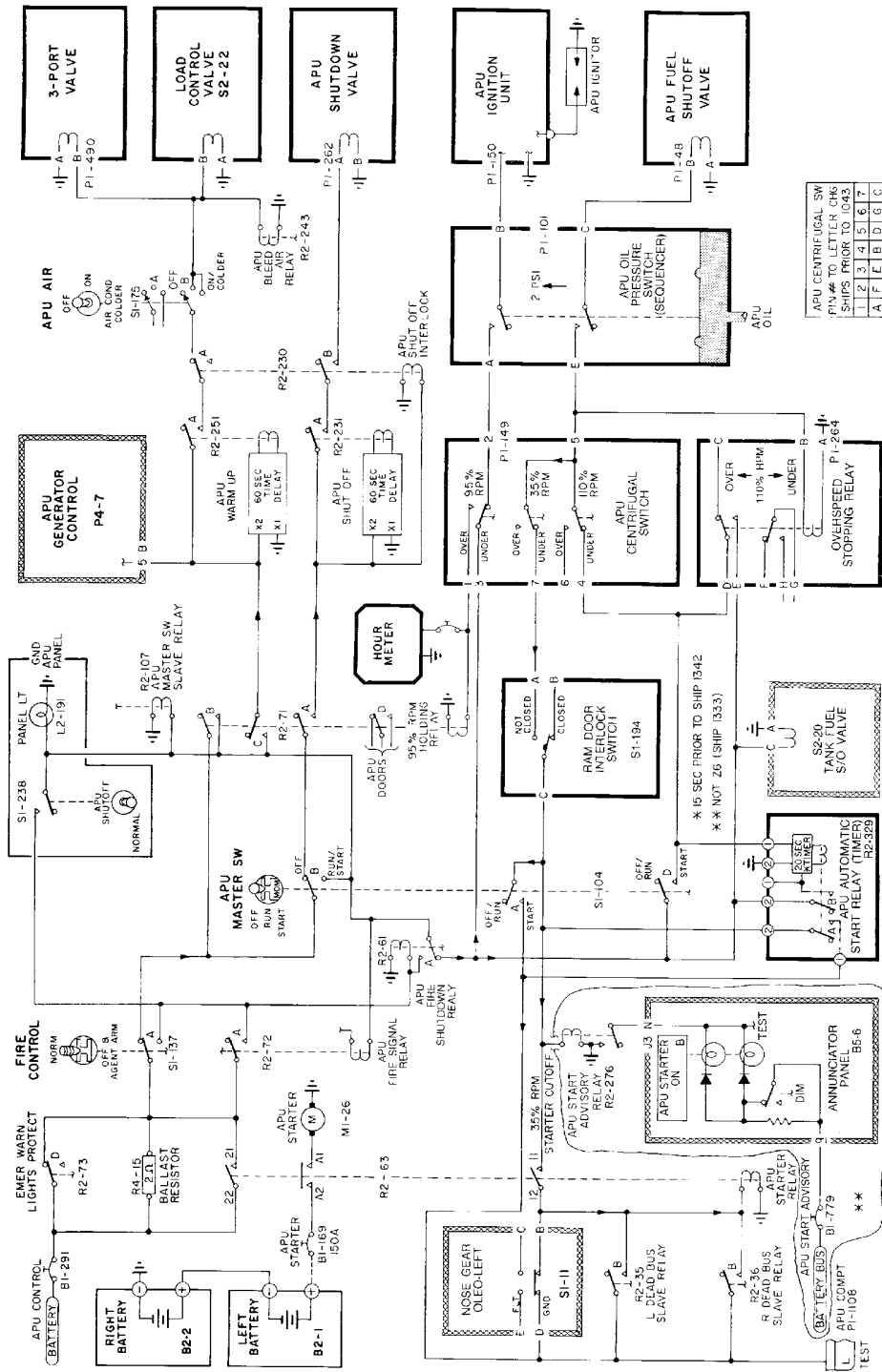
CAG(IGDS)

APU Ignition/Starting -- Schematic  
Figure 1/49-40-00-990-805

EFFECTIVITY  
WJE ALL

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BBB2-49-98G

APU CENTRIFUGAL SW			
PIN # TO LETTER CHG			
1	2	3	4
A	F	E	B
D	G	I	C

MDC PROPRIETARY

APU Ignition/Starting -- Schematic  
Figure 2/49-40-00-990-806

EFFECTIVITY  
WJE 875-879

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**MD-80**  
**AIRCRAFT MAINTENANCE MANUAL**  
**IGNITION/STARTING - TROUBLE SHOOTING**

**1. General**

- A. Trouble shooting procedures for the Ignition/Starting system are outlined in Figure 101. Personnel should check the following before starting to trouble shoot the Ignition/Starting system.
  - (1) Make certain that source of 28 volt ac power is available.
  - (2) Make certain that APU FIRE control switch, located on ground control panel, is in the NORMAL position.
  - (3) Verify that the APU fuel system is operative.
  - (4) Tighten all loose connections and replace broken wires.
- B. Operators using AiResearch Tester No. 290122 should refer to (GENERAL, SUBJECT 49-00-00, page 501)

**2. Equipment and Materials**

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 101**

Name and Number	Manufacturer
APU Tester, 290122	AiResearch
APU Tester cable, 290214	AiResearch

**3. Trouble Shooting Ignition/Starting System**

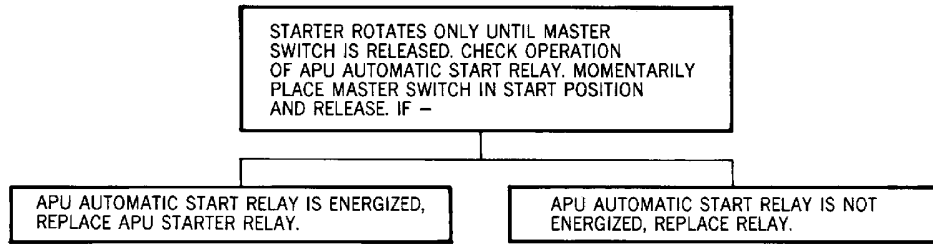
- A. For trouble shooting procedure, refer to Figure 101 using applicable sheet.

EFFECTIVITY  
 WJE ALL

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BBB2-49-52A

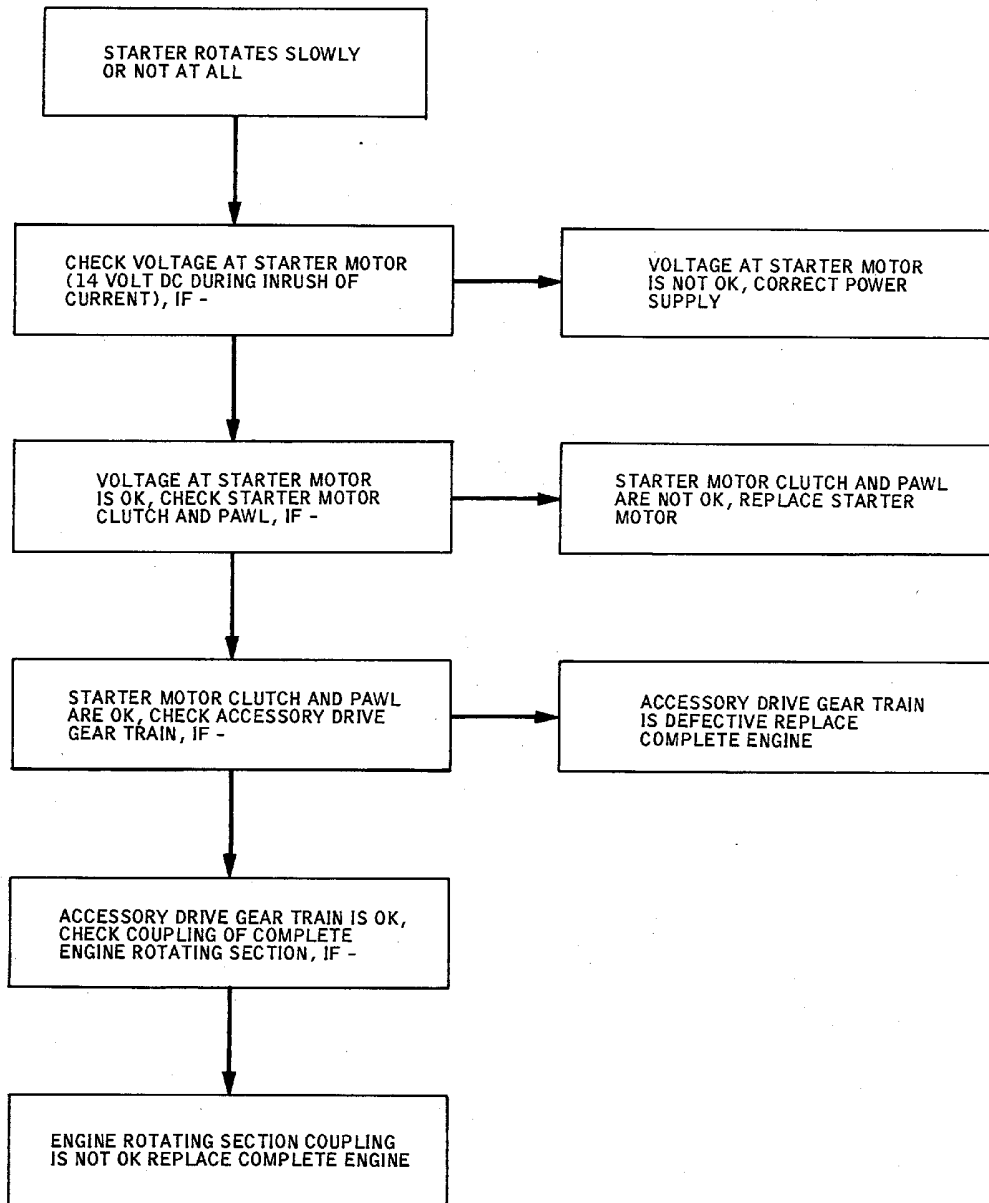
## Ignition/Starting -- Trouble Shooting Figure 101/49-40-00-990-801 (Sheet 1 of 7)

EFFECTIVITY  
WJE ALL

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AIRCRAFT MAINTENANCE MANUAL**



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**Ignition/Starting -- Trouble Shooting  
Figure 101/49-40-00-990-801 (Sheet 2 of 7)**

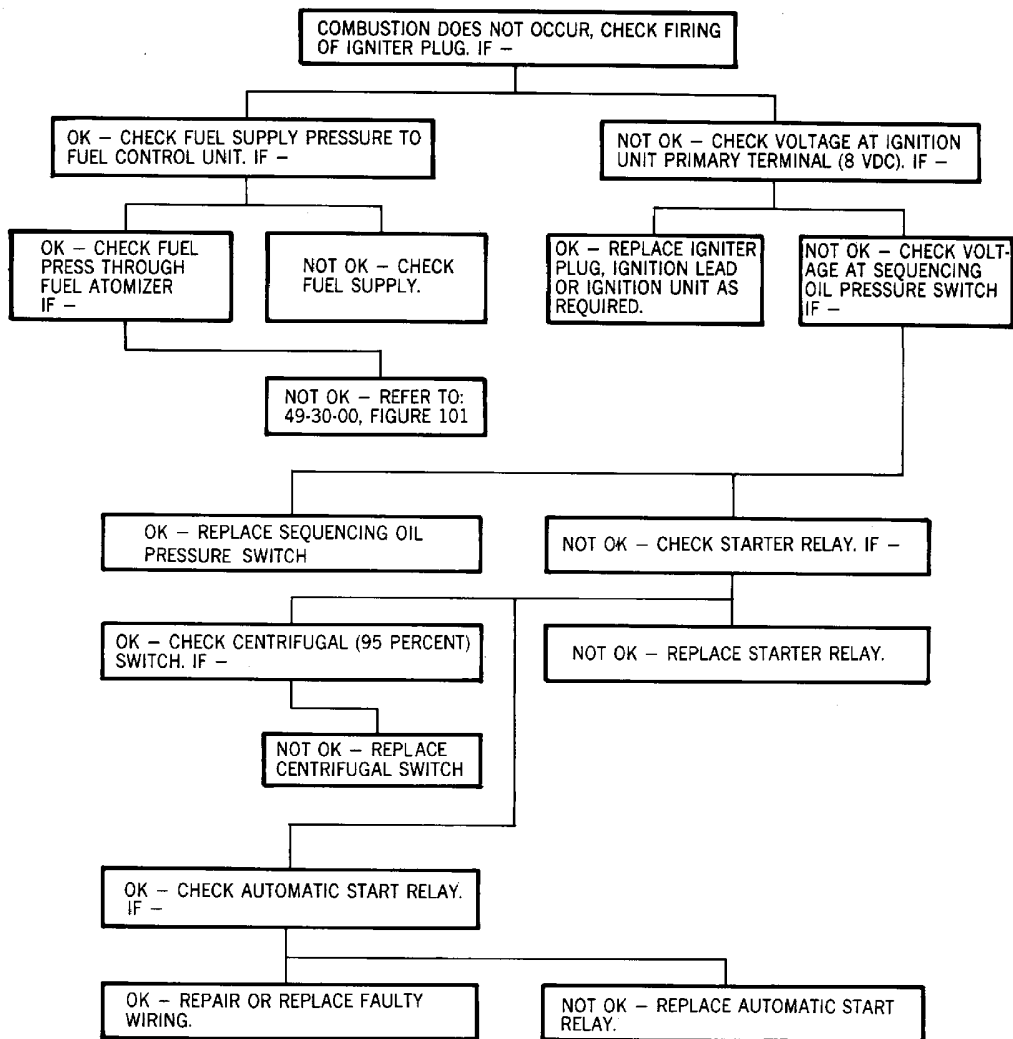
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WJE ALL

**49-40-00**

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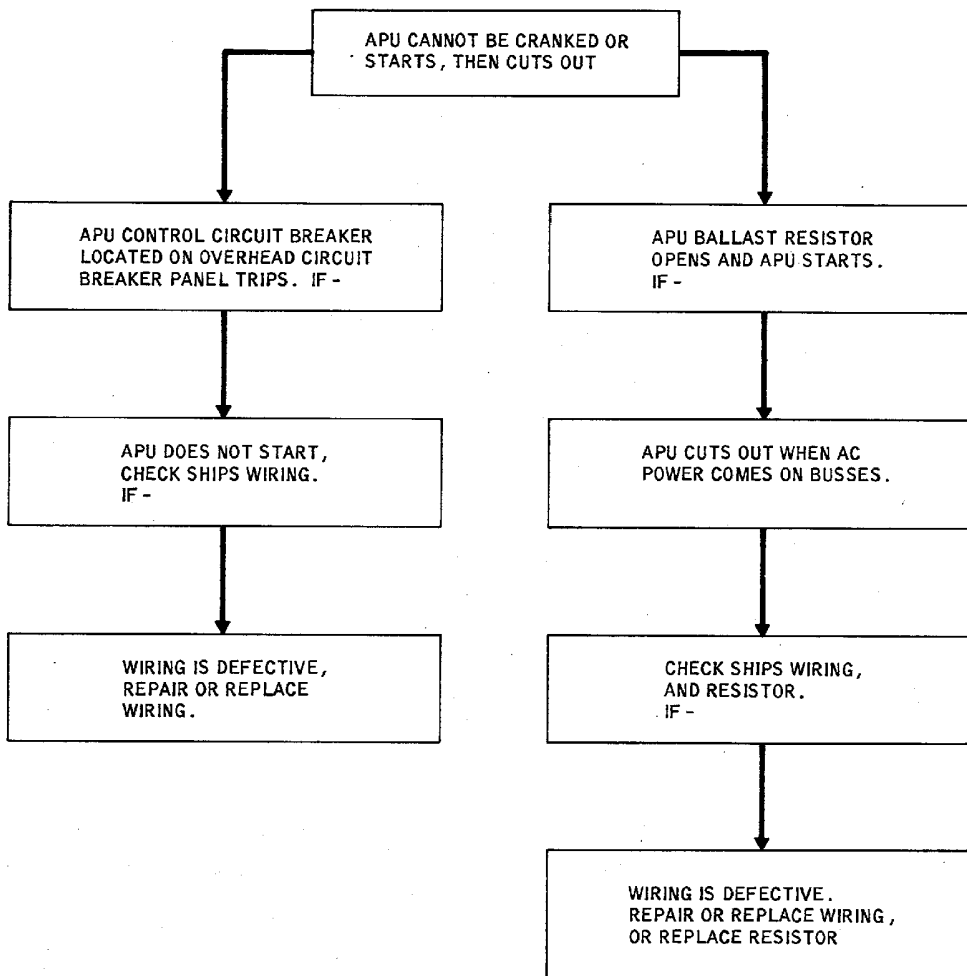
**Ignition/Starting -- Trouble Shooting  
Figure 101/49-40-00-990-801 (Sheet 3 of 7)**

EFFECTIVITY  
WJE ALL

**49-40-00**

TP-80MM-WJE

# MD-80 AIRCRAFT MAINTENANCE MANUAL



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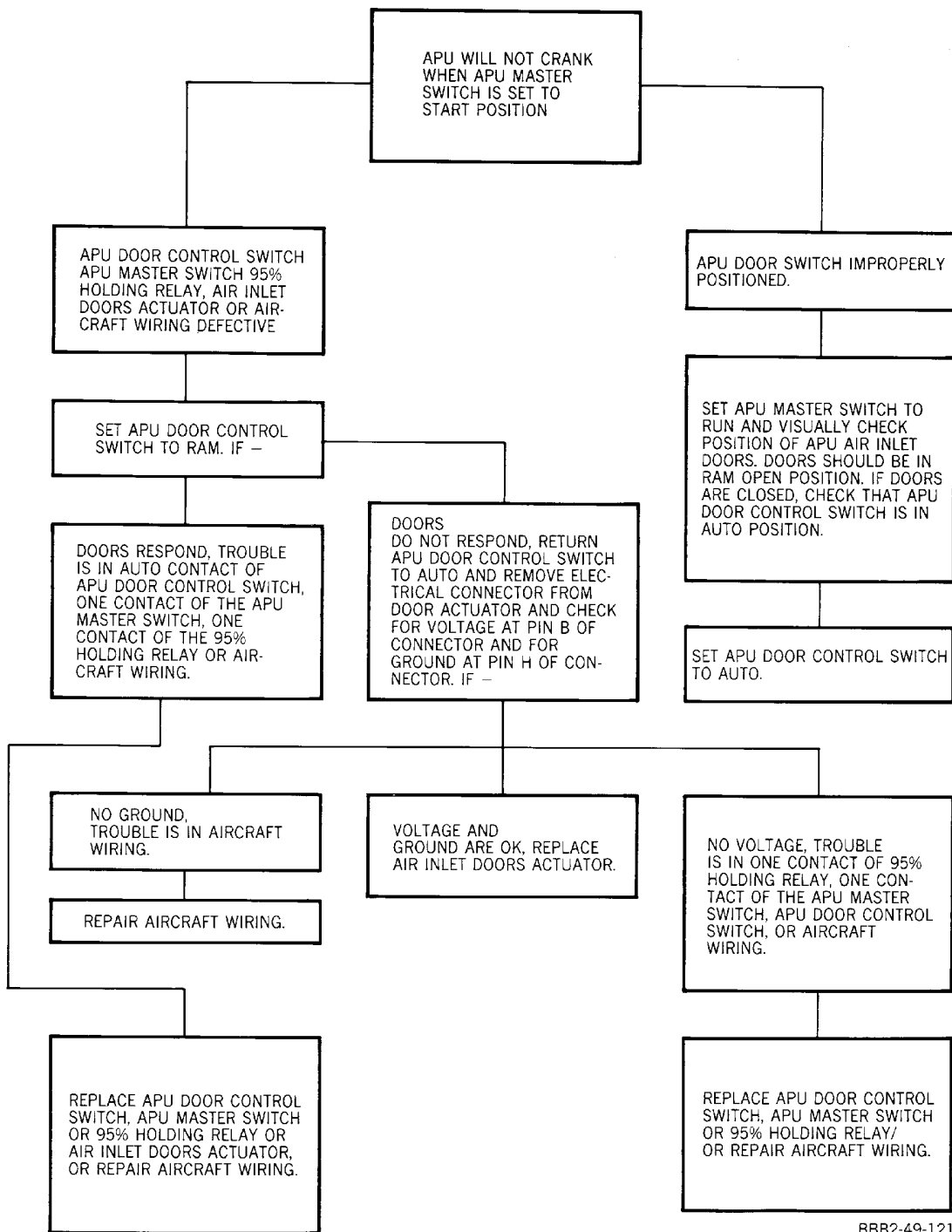
Ignition/Starting -- Trouble Shooting  
Figure 101/49-40-00-990-801 (Sheet 4 of 7)

EFFECTIVITY  
WJE ALL

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## 49-40-00

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AIRCRAFT MAINTENANCE MANUAL**



BBB2-49-121

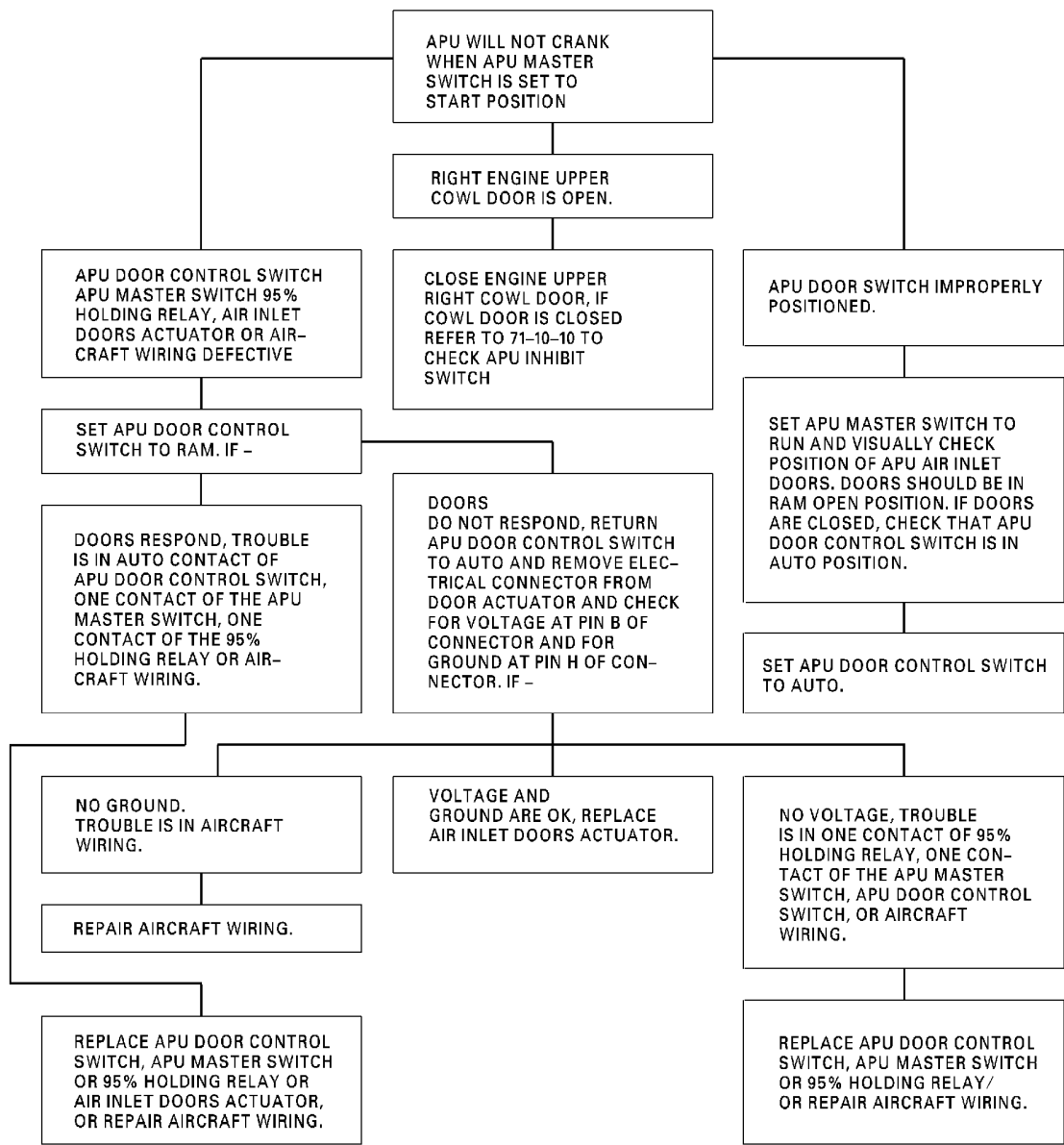
**Ignition/Starting -- Trouble Shooting  
Figure 101/49-40-00-990-801 (Sheet 5 of 7)**

EFFECTIVITY  
WJE ALL

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CAG(IGDS)

BBB2-49-206

**Ignition/Starting -- Trouble Shooting  
Figure 101/49-40-00-990-801 (Sheet 6 of 7)**

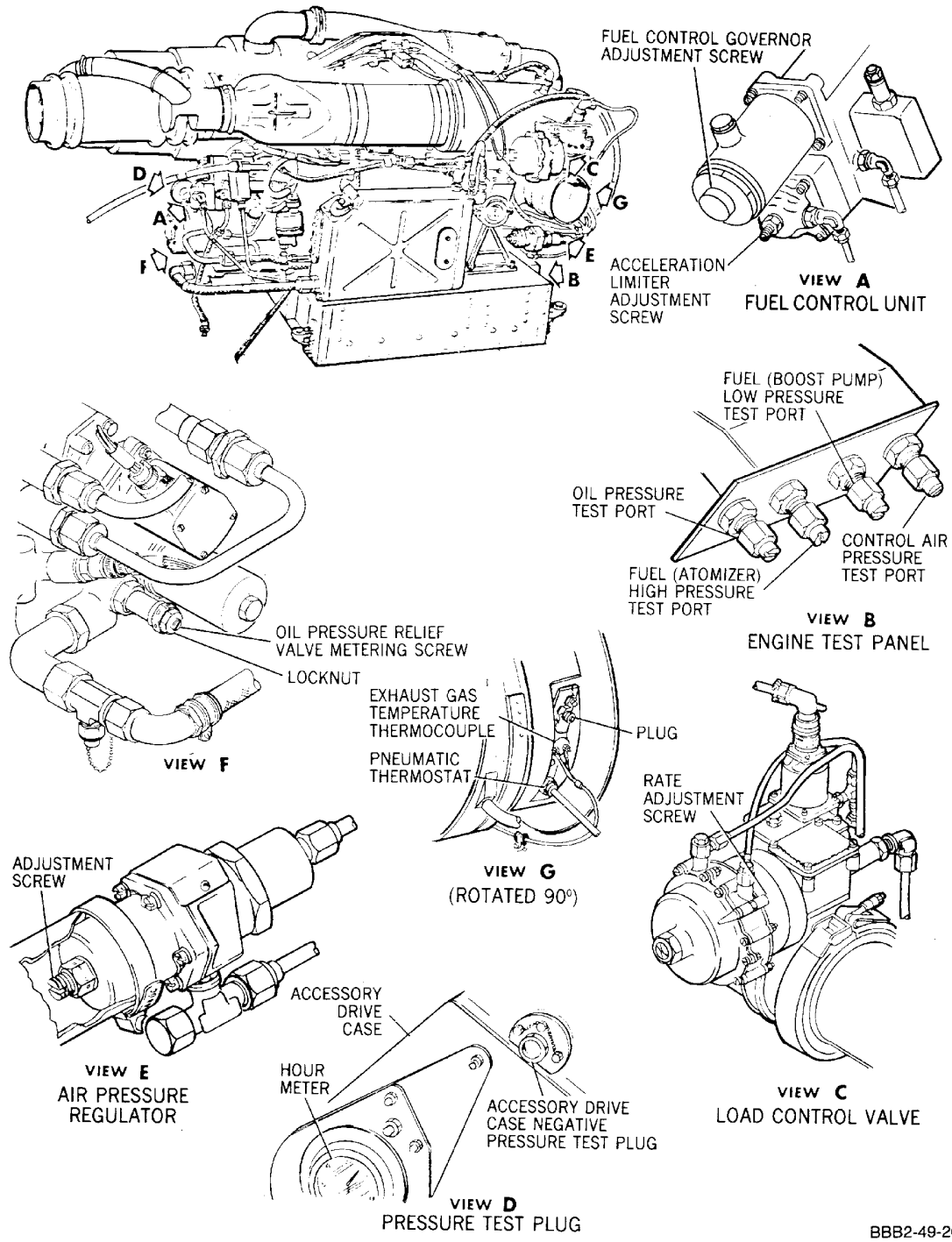
EFFECTIVITY  
WJE 875-879

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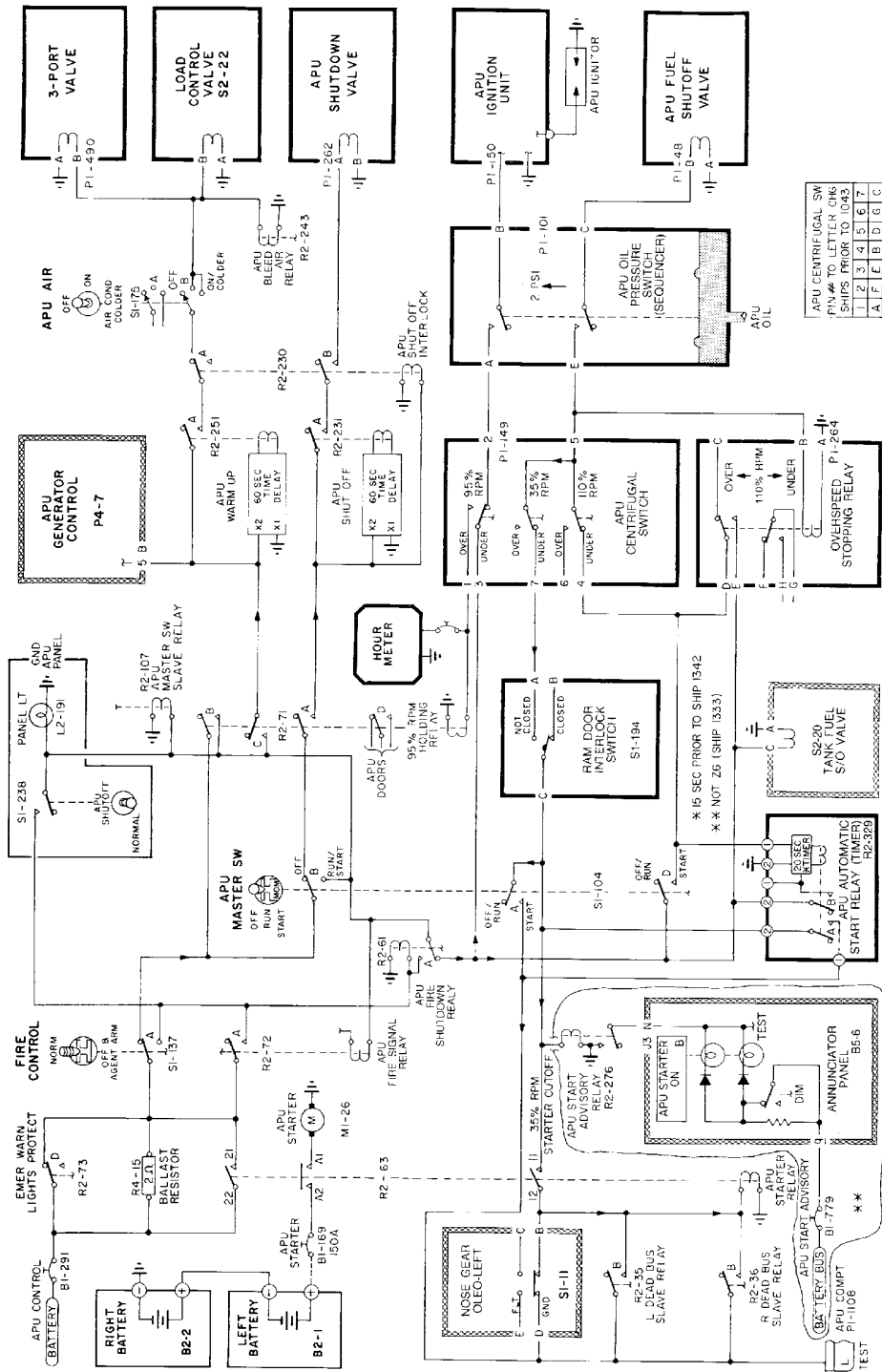
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**Ignition/Starting -- Trouble Shooting**  
**Figure 101/49-40-00-990-801 (Sheet 7 of 7)**

EFFECTIVITY  
 WJE 417, 419

**49-40-00**

# MD-80 AIRCRAFT MAINTENANCE MANUAL



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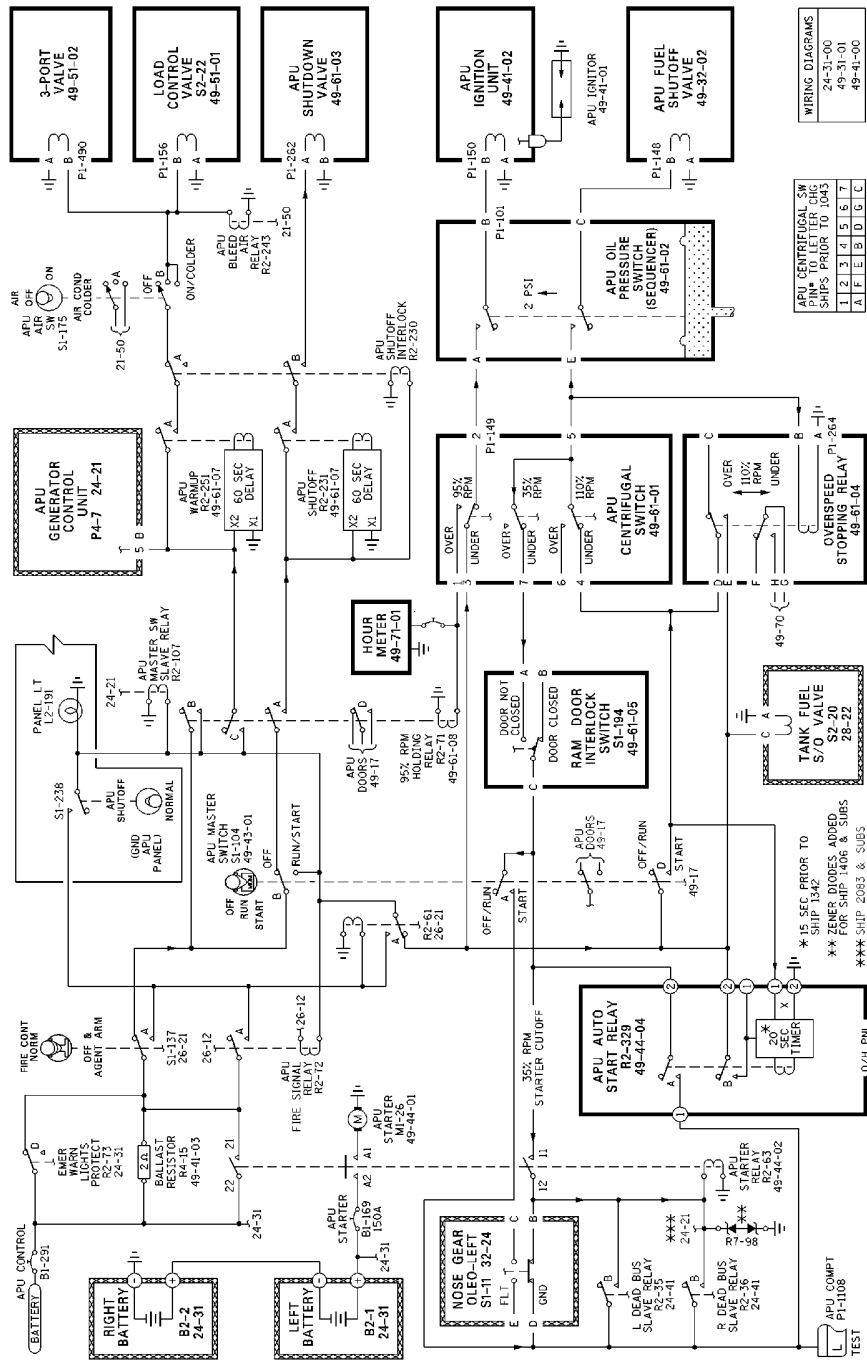
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APU Starting -- Ignition and Control  
Figure 102/49-40-00-990-802 (Sheet 1 of 2)

EFFECTIVITY  
WJE 410, 875-879

49-40-00

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**APU Starting -- Ignition and Control  
Figure 102/49-40-00-990-802 (Sheet 2 of 2)**

**EFFECTIVITY**

**WJE 401-409, 411, 412, 414-427, 429, 861-866, 868, 869, 871-874, 880, 881, 883, 884, 886, 887, 891-893**

**TP-80MM-WJE**

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CAG(IGDS)

# 49-40-00

**MD-80**  
**AIRCRAFT MAINTENANCE MANUAL**  
**IGNITER PLUG - MAINTENANCE PRACTICES**

**1. General**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The igniter plug is mounted on the APU combustion chamber cap. Access to igniter is through APU right access door.

**2. Equipment and Materials**

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Solvent, Fed Spec P-D-680 DPM 518	
Compound, High-temperature Fel Pro C5-A DPM 377	Fel Pro Inc., Div of Felt Products Mfg. Co. 7450 N. McCormick Blvd. Skokie, IL 60076
Torque wrench (0 - 100 inch- pounds (11.3 N·m) range)	
Lockwire, NASM20995N32, DPM 684	Not Specified

**3. Removal/Installation Igniter Plug**

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR 4 MINUTES BEFORE DISCONNECTING WIRE.

- A. Remove Igniter Plug

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect igniter plug lead from igniter plug. (Figure 201)
- (3) Remove igniter plug attaching bolts, washers, and retainer.

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (4) Carefully withdraw igniter plug from combustion chamber cap.
- (5) Remove gasket and discard.

B. Install Igniter Plug

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position new gasket on igniter plug mounting bass. (Figure 201)
- (3) Carefully insert igniter plug into combustion chamber cap.

**WARNING:** HIGH TEMPERATURE ANTISEIZE IS AN AGENT THAT IS POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HIGH TEMPERATURE ANTISEIZE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HIGH TEMPERATURE ANTISEIZE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (4) Lightly coat igniter plug attaching bolt threads with compound (Fel-Pro C5-A).
- (5) Install igniter plug retainer and attaching bolts and washers. Tighten bolts to torque of 50 to 70 inch-pounds (5.65 - 7.91 N·m).
- (6) Safety igniter plug mounting bolts with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (7) Connect igniter plug lead to igniter plug, tighten electrical connector to torque of 35 inch-pounds (3.96 N·m).
- (8) Safety igniter plug lead electrical connector with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (9) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

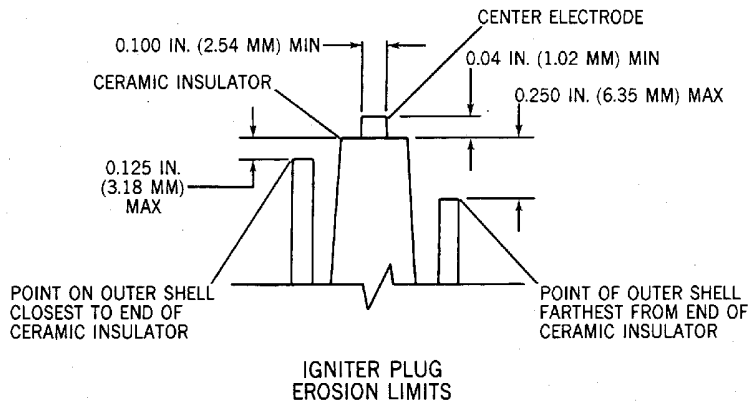
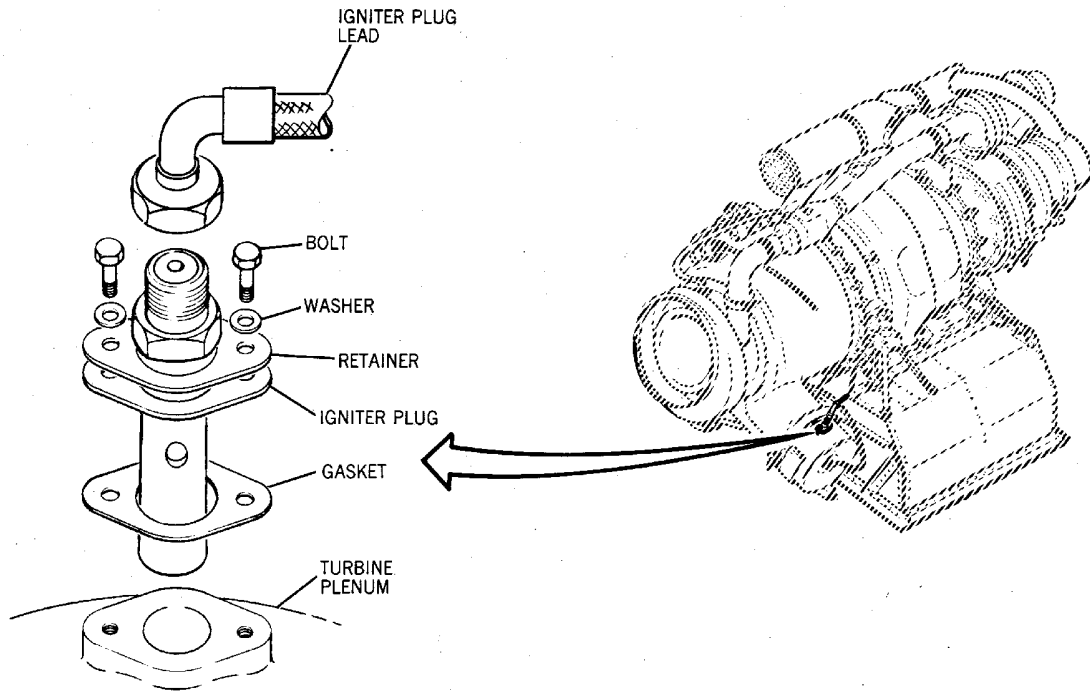
EFFECTIVITY  
WJE ALL

TP-80MM-WJE

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AIRCRAFT MAINTENANCE MANUAL**



BBB2-49-56A

**Igniter Plug -- Removal/Installation**  
**Figure 201/49-40-01-990-801**

EFFECTIVITY  
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### 4. Inspection/Check Igniter Plug

#### A. Check Igniter Plug

- (1) Check ceramic parts of plug for cracks and chipping
- (2) Check center electrode. Electrode outside diameter shall be 0.100 inch (2.54 mm) or greater at narrowest cross-section and shall protrude beyond ceramic insulator at least 0.04 inch (1.02 mm).
- (3) Check outer shell. Gap between end of ceramic insulator and outer shell shall not exceed 0.250 inch (6.35 mm) at farthest point. If gap at farthest point is 0.250 inch (6.35 mm), gap at closest point shall not exceed 0.125 inch (3.18 mm).
- (4) Check for cracks in brazed joint of flange to igniter plug body.

#### B. Check Igniter Plug for Satisfactory Operation

- (1) Connect 14 volt dc power supply to satisfactory igniter coil unit.
- (2) Connect igniter coil unit test wiring to igniter plug.
- (3) Check spark rate of plug when current is applied. Plug shall have minimum spark rate of one spark per second and spark continuously.

### 5. Cleaning/Painting

#### A. Clean Igniter Plug

**CAUTION:** DO NOT USE METAL OR ABRASIVE MATERIALS WHEN CLEANING ELECTRODE.

- (1) Clean electrode with stiff bristle brush.

**WARNING:** DRY CLEANING SOLVENT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN DRY CLEANING SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET DRY CLEANING SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (2) Wipe plug with solvent (Fed Spec P-D-680).

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WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### IGNITER COIL UNIT - MAINTENANCE PRACTICES

#### 1. General

**WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893**

- A. The igniter coil unit is mounted on the forward side of the APU inlet plenum. Access to the coil is through the APU left access door. Access to igniter plug is through the APU right access door.

**WJE ALL**

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following item:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Torque wrench (0 - 150 inch pounds range)	
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Igniter Coil Unit

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893**

**WARNING:** IGNITER COIL UNIT VOLTAGE IS SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE. APU MASTER SWITCH MUST BE IN OFF POSITION, AND IGNITION INOPERATIVE FOR A MINIMUM OF 5 MINUTES BEFORE REMOVING IGNITER. TO ENSURE THAT IGNITION UNIT CAPACITORS ARE COMPLETELY DISCHARGED, SHORT IGNITER LEAD TO GROUND IMMEDIATELY AFTER DISCONNECTING LEAD.

- A. Remove Igniter Coil Unit  
(Figure 201)

**WJE ALL**

- (1) Open the applicable access panels:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893**

- (3) Disconnect igniter plug high voltage lead from igniter plug. Install protective cover over end of lead.

**WJE ALL**

- (4) Remove ignition unit as follows:

- (a) Disconnect electrical connector from ignition unit.

- 1) Put a unthreaded circular connector plastic caps, G60065 on the connector.

**WJE ALL; PRE GARRETT SB GTCP85-49-5744 AND GTCP85-49-6774**

- 2) Remove the ignition harness from the clip.

**WJE ALL; POST GARRETT SB GTCP85-49-5744 AND GTCP85-49-6774**

- 3) Remove the ignition harness from the two clips.

**WJE ALL**

- (b) Disconnect the ignition lead from the unit.

**WJE ALL; POST GARRETT SB GTCP85-49-6774**

- (c) Remove the four screws, washers, nuts, and two clips.

**WJE ALL; PRE GARRETT SB GTCP85-49-5744 AND GTCP85-49-6774**

- (d) Remove the ignition unit from the bracket.

**WJE ALL; POST GARRETT SB GTCP85-49-5744**

- (e) Remove the attaching nuts washers and remove the ignition unit from the shock mounted plate.

**WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893**

- (5) Disconnect clamp from high voltage lead at plenum flange.  
 (6) Remove igniter coil unit with high voltage lead attached.  
 (7) Remove high voltage lead from igniter coil unit and retain for installation.

**WJE ALL**

B. Install Igniter Coil Unit

- (1) Make sure the applicable panels are open:

<u>Number</u>	<u>Name/Location</u>
5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

EFFECTIVITY  
**WJE ALL**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WJE ALL; PRE GARRETT SB GTCP85-49-5744**

- (3) Position igniter coil unit on mount bracket and install the bolts, washers, clip, and nuts. Torque the nuts to 20 in-lb (2 N·m) to 25 in-lb (3 N·m).

**WJE ALL; POST GARRETT SB GTCP85-49-6774**

- (4) Position igniter coil unit on mount bracket and install the bolts, washers, clips, and nuts. Torque the nuts to 20 in-lb (2 N·m) to 25 in-lb (3 N·m).

**WJE ALL; POST GARRETT SB GTCP85-49-5744**

- (5) Position igniter coil unit on shock-mount plate of sliding mount bracket, install attaching nuts and tighten to torque of 20 in-lb (2 N·m) to 25 in-lb (3 N·m).

**WJE ALL; PRE GARRETT SB GTCP85-49-5744**

- (6) Put the ignition harness in the clip

**WJE ALL; POST GARRETT SB GTCP85-49-5744 AND GTCP85-49-6774**

- (7) Put the ignition harness in the two clips

**WJE ALL**

- (8) Check connector for damage and unwanted material. GENERAL INSTALLATIONS  
HARDWARE - MAINTENANCE PRACTICES, SWPM 20-20-03

**WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893**

- (9) Connect ignition harness lead to coil unit and tighten electrical connector to torque of 90 to 95 inch-pounds (10.17 to 10.74 N·m).
- (10) Position and connect igniter plug high voltage lead to igniter coil unit and tighten electrical connector to torque of 35 in-lb (4 N·m).
- (11) Slide igniter coil unit into position and install sliding mount bracket attaching screws.
- (12) Connect high voltage lead to igniter plug. Tighten nut to torque of 35 inch-pounds (3.96 N·m).
- (13) Clamp high voltage lead at plenum flange.

**WJE ALL**

- (14) Close the applicable access panels:

**Number      Name/Location**

5903A	Auxiliary Power Unit Service Access LH
5904A	Auxiliary Power Unit Service Access RH

- (15) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

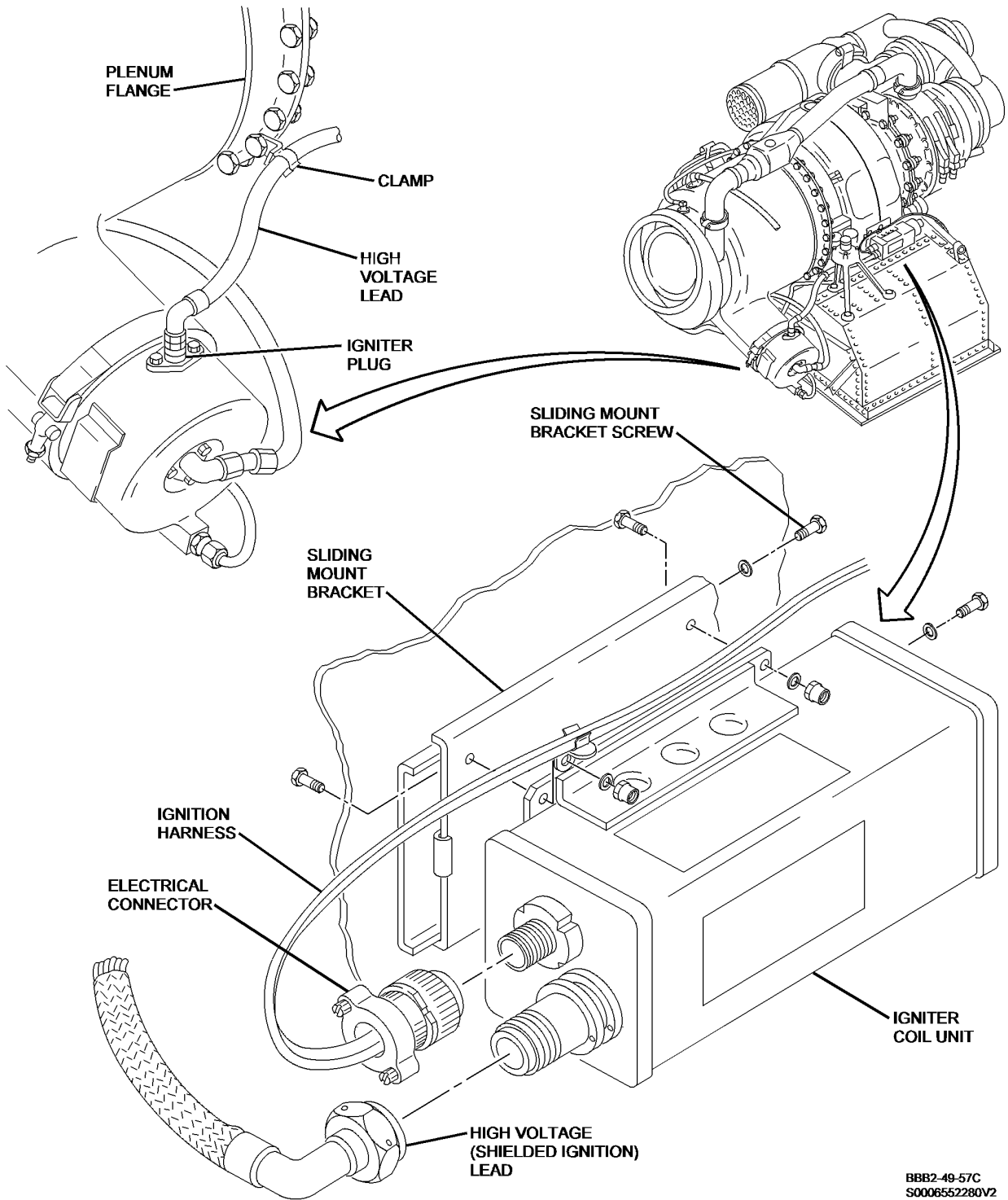
<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

EFFECTIVITY  
WJE ALL

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



**Ignition Unit -- Removal/Installation**  
Figure 201/49-40-02-990-801 (Sheet 1 of 3)

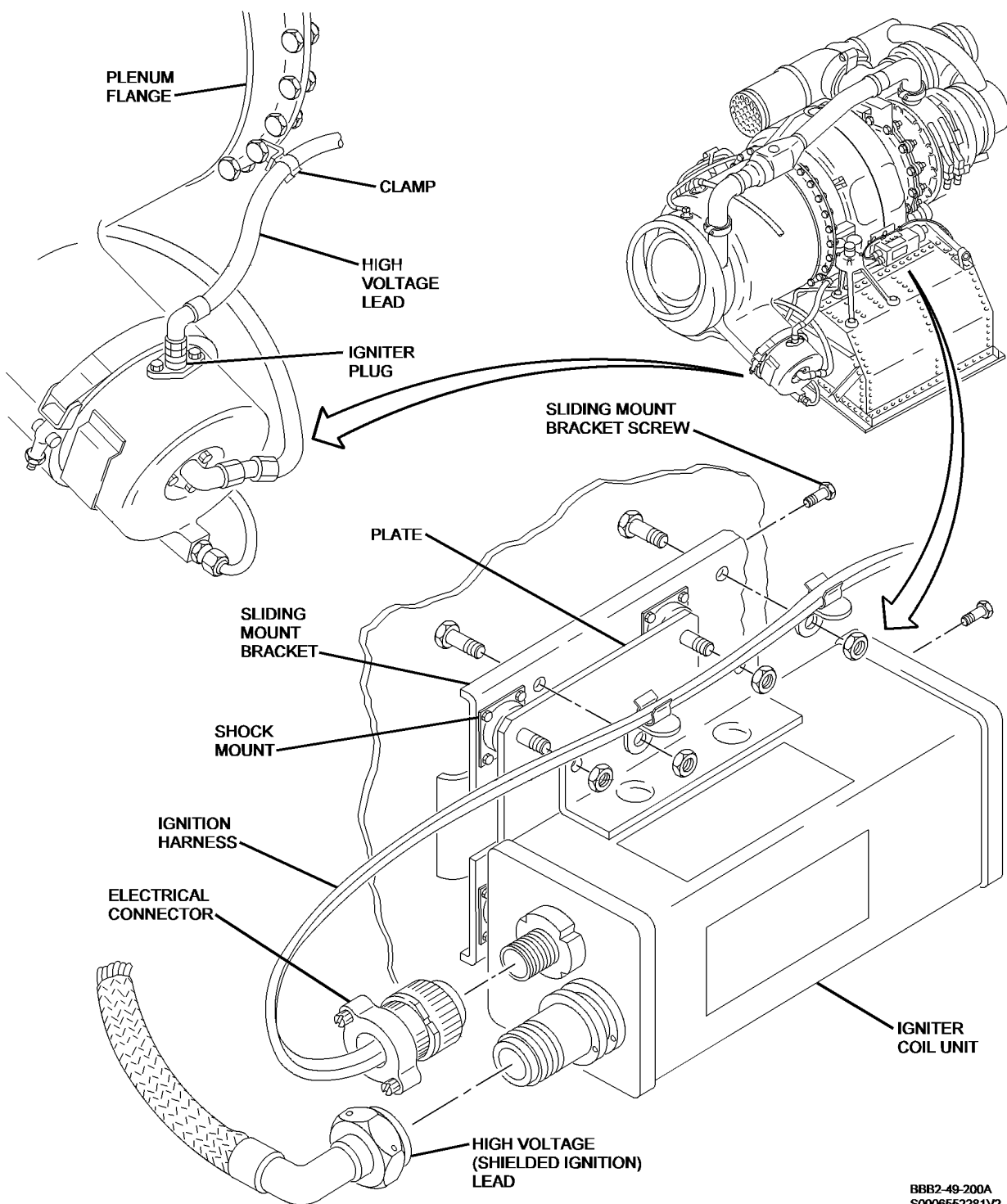
EFFECTIVITY  
WJE ALL; PRE GARRETT SB GTCP85-49-5744 AND  
GTCP85-49-6774

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-200A  
S0006552281V2

**Igniter Unit -- Removal/Installation**  
Figure 201/49-40-02-990-801 (Sheet 2 of 3)

EFFECTIVITY  
WJE ALL; POST GARRETT SB GTCP85-49-5744

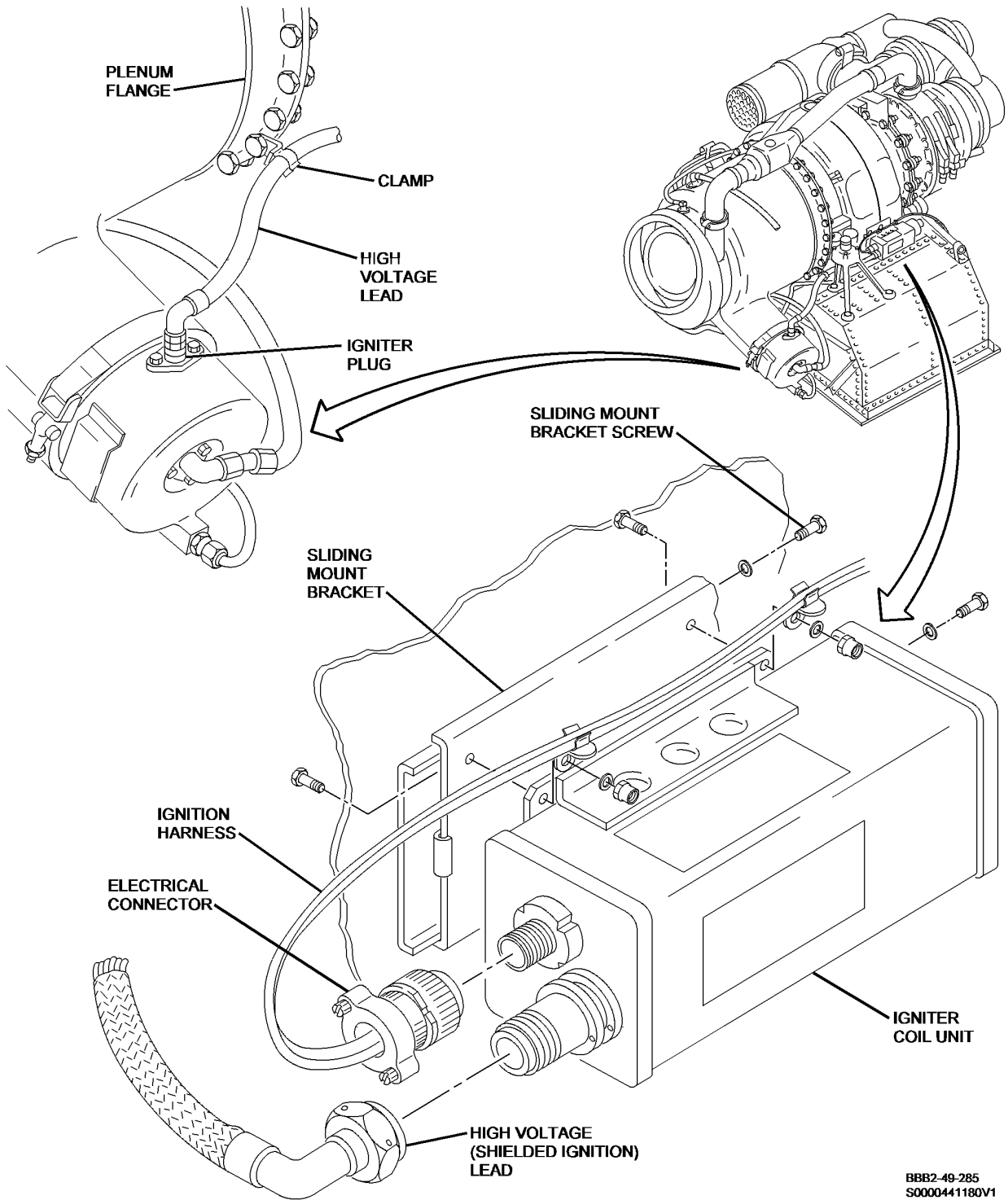
## 49-40-02

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-285  
S0000441180V1

**Ignition Unit -- Removal/Installation**  
Figure 201/49-40-02-990-801 (Sheet 3 of 3)

EFFECTIVITY  
WJE ALL; POST GARRETT SB GTCP85-49-6774

## 49-40-02

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### STARTER - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**CAUTION:** IF STARTER IS BEING REPLACED DUE TO A CLUTCH FAILURE, CHECK THE CLUTCH PORTION OF THE STARTER ASSEMBLY FOR MISSING PARTS. IF ALL CLUTCH PARTS ARE NOT PRESENT, VISUALLY INSPECT THE GEARBOX DRIVE PAD AND REMOVE ANY BROKEN CLUTCH PARTS WHICH ARE VISIBLE FROM THE DRIVE PAD OPENING.

**CAUTION:** FAILURE OF CENTRIFUGAL SWITCH CAN CAUSE STARTER FAILURE. CHECK SWITCH FOR SHEARED DRIVE SHAFT.

SHUT DOWN APU IMMEDIATELY IF TESTER 35 PERCENT LIGHT FAILS TO COME ON WHEN START SWITCH IS PLACED IN START POSITION, OR FAILS TO GO OFF WHEN TESTER TACHOMETER INDICATOR DISPLAYS 14,500 TO 16,500 RPM.

- A. The starter is mounted on the left side of the APU accessory drive case. Access to the starter is through the APU left access door.

#### 2. Removal/Installation Starter

##### A. Remove Starter

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Tag and disconnect electrical leads from starter terminals (Figure 201).
- (3) Remove nuts and washers from starter mounting studs.  
**NOTE:** Support starter when removing last nut.
- (4) Carefully withdraw starter from mounting studs.
- (5) Remove O-ring from accessory drive case.

##### B. Install Starter

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Install new O-ring on accessory drive case.
- (3) Position starter and tilt slightly while rotating shaft until starter pawls mesh with mating drive shaft.

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WJE ALL

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- (4) Carefully slide starter on mounting studs.
- (5) Install starter mounting nuts and washers.
- (6) Torque the nuts 70.0 in-lb (7.9 N·m) to 90.0 in-lb (10.2 N·m).
- (7) Remove tags and connect electrical leads to starter terminals.
- (8) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

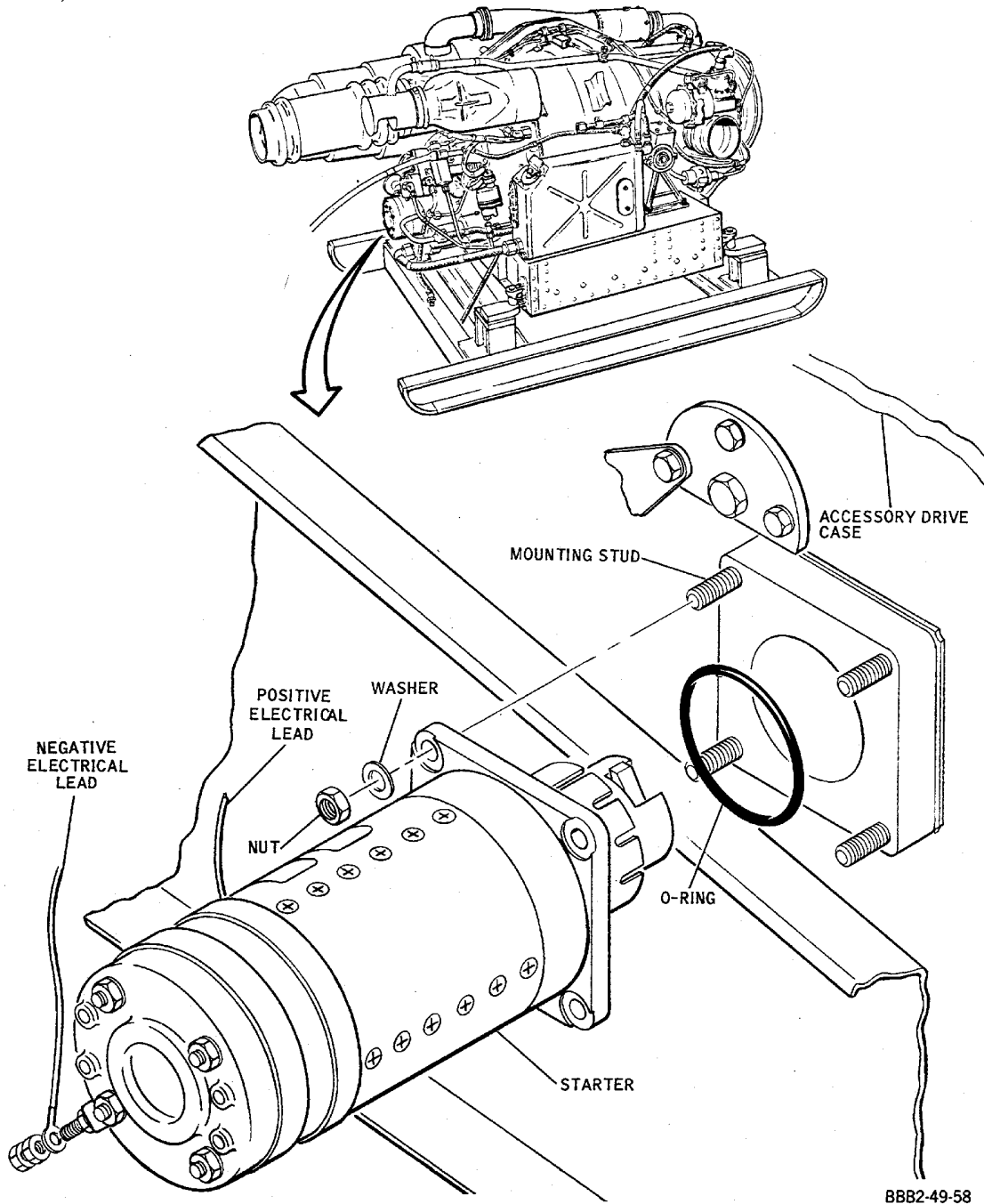
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BBB2-49-58

**Starter -- Installation**  
**Figure 201/49-40-03-990-801**

EFFECTIVITY  
WJE ALL

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### 3. Adjustment/Test

#### A. Test Starter

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Allow engine to stabilize.
- (3) Perform visual inspection of starter installation prior to and shortly after shutdown, check for oil leaks.
- (4) Shut down APU. (GENERAL, SUBJECT 49-00-00, page 501)

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## STARTER - INSPECTION/CHECK

### 1. General

A. This procedure contains MSG-3 task card data.

#### **TASK 49-40-03-220-801**

### 2. Detailed Inspection of the APU Starter Brushes (GTCP85-98 APU)

NOTE: This procedure is a scheduled maintenance task.

#### A. Tools/Equipment

<u>Reference</u>	<u>Description</u>
STD-6638	Air Source - Compressed, Clean, Filtered, and Dry, 0 - 100 psi

#### B. Prepare for Detailed Inspection of the APU Starter Brushes

SUBTASK 49-40-03-865-003

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-40-03-010-002

(2) Open the access door.

SUBTASK 49-40-03-010-003

(3) Remove the attaching nuts and clamp from the starter brush cover.

#### C. Detailed Inspection of the APU Starter Brushes

SUBTASK 49-40-03-100-001

(1) Remove any accumulation of brush residue with air source, STD-6638.

SUBTASK 49-40-03-220-001

(2) Check starter brushes for wear as follows:

- (a) Measure the distance from the top of the brush holder cap to the top of each brush assembly.
- (b) If the brush assembly wear exceeds 0.390 in. (9.906 mm), replace the starter.

NOTE: A 0.340 in. (8.636 mm) distance from the top of the brush holder cap to the top of each brush assembly equates to approximately 400 APU operating hours remaining, a 0.290 in. (7.366 mm) distance equates to approximately 800 APU operating hours remaining.

SUBTASK 49-40-03-211-002

(3) Inspect the brush assembly leads for discoloration.

- (a) If leads are discolored, remove starter.

SUBTASK 49-40-03-211-003

(4) Check starter terminals for damage and security.

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WJE ALL

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**D. Job Close-up**

SUBTASK 49-40-03-410-002

(1) Install the starter brush cover.

SUBTASK 49-40-03-410-003

(2) Close the access door.

SUBTASK 49-40-03-865-004

(3) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

————— **END OF TASK** —————

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### AIR - DESCRIPTION AND OPERATION

#### 1. General

**WJE 401-404, 407, 408, 410-412, 414-427, 429, 861-866, 868, 869, 871-880, 886, 887, 891-893**

- A. The APU air system consists of two separate systems. The systems are the cooling air system and bleed air system. The cooling air system provides cooling air for the APU engine lubricating oil, ac generator, and APU compartment. The bleed air system provides and controls bleed air from the engine compressor to the main engine pneumatic starters, air conditioning system and other pneumatic units.

**WJE 405, 406, 409, 881, 883, 884**

- B. The APU air system consists of two separate systems. The systems are the cooling air system and bleed air system. The cooling air system provides cooling air for the APU engine lubricating oil, ac generator, and APU compartment. The bleed air system provides and controls bleed air from the engine compressor to the main engine pneumatic starters, air conditioning system and other pneumatic units. On ship 49900 and ships with option SCN 6336 installed, the system also incorporates an economy mode to reduce APU fuel consumption in the cabin conditioning mode. Fuel consumption is reduced by maintaining the lowest possible APU bleed airflow that will meet cabin temperature requirements.

**WJE ALL**

- C. The cooling air system consists of a fan air supply valve mounted on the left side of the APU compartment, an engine-driven cooling air fan mounted on the accessory drive case, and necessary ducting to circulate the cooling air.
- (1) Fan Air Supply Valve - The fan air supply valve is connected to the cooling air fan by a removable duct section. The air supply valve consists of a short flanged duct section, an insulated hood, and a housing incorporating a flapper.
  - (2) Cooling Air Fan - The engine-driven cooling air fan provides cooling air for the APU engine lubricating oil, ac generator, and APU compartment. The cooling air fan draws cooling air through the fan air supply valve.

**WJE 401-404, 407, 408, 410-412, 414-427, 429, 861-866, 868, 869, 871-880, 886, 887, 891-893**

- D. The bleed air system consists of a load control valve, pneumatic thermostat, and a three-way solenoid shutoff valve.
- (1) Load Control Valve - The load control valve acts as a shut-off valve to control the flow of bleed air from the APU compressor section.
  - (2) Pneumatic Thermostat - The pneumatic thermostat is a single, dual purpose thermostat that functions both as an acceleration and load control thermostat. The pneumatic thermostat is mounted on the lower surface of the turbine exhaust flange. A control air line connects the pneumatic thermostat to the load control valve.
  - (3) Three-Way Solenoid Shutoff Valve - The three-way solenoid shutoff valve is installed in the pneumatic line between the pneumatic thermostat and the fuel control unit acceleration limiter valve. When actuated, the three-way solenoid valve interconnects the pneumatic thermostat and load control valve.

**WJE 405, 406, 409, 881, 883, 884**

- E. The bleed air system consists of a load control valve, pneumatic thermostat, and a three-way solenoid shutoff valve, two-way economy solenoid, and an economy mode selector switch located on the overhead panel in the flight compartment.

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WJE ALL

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### WJE 405, 406, 409, 881, 883, 884 (Continued)

- (1) Load Control Valve - The load control valve acts as a shut-off valve to control the flow of bleed air from the APU compressor section.
- (2) Pneumatic Thermostat - The pneumatic thermostat is a single, dual purpose thermostat that functions both as an acceleration and load control thermostat. The pneumatic thermostat is mounted on the lower surface of the turbine exhaust flange. A control air line connects the pneumatic thermostat to the load control valve.
- (3) Three-Way Solenoid Shutoff Valve - The three-way solenoid shutoff valve is installed in the pneumatic line between the pneumatic thermostat and the fuel control unit acceleration limiter valve. When actuated, the three-way solenoid valve interconnects the pneumatic thermostat and load control valve.
- (4) Economy Mode Selector Switch - The two-position (NORM and ECON) switch, located on the overhead panel in the flight compartment, is used to select the mode of operation desired.
- (5) Two-Way Economy Solenoid - The two-way economy solenoid is installed between the load control valve and three-way solenoid shutoff valve. When actuated, the two-way economy solenoid vents air from the load control valve actuator through the adjustable orifice to control the amount of bleed airflow from the APU.

### WJE ALL

#### 2. Operation

##### A. Cooling Air System

- (1) At start of APU rotation, the cooling air fan is driven by the engine accessory drive. The fan begins to draw in cooling air for the oil cooler, ac generator, and APU compartment. The fan air supply flapper valve swings inboard allowing air supplied from the aft accessory compartment to flow into the cooling air system. Noise resulting from the inrush of air is reduced by the sound-suppressing material lining the fan air supply valve hood.
- (2) On shutdown, the flapper valve swings back to the closed position. In the event of a fire shutdown, the valve will seal off the cooling air duct and prevent the fire extinguishing agent from escaping into the aft accessory compartment.
- (3) Cooling air flows from the discharge side of the cooling air fan housing into a bifurcated duct connected to the oil cooler and generator crossover duct. The diverter in the duct routes some of the incoming air through the oil cooler where it is used to cool engine lubricating oil. Air passing through the oil cooler is vented into the APU compartment. The remaining air enters a crossover duct attached to the generator blast cap where a portion of the air is allowed to escape through a slot in the duct upstream from the generator. This air is used to cool the APU compartment by circulating around the unit before being exhausted through a sound-suppressing exit duct attached to the top right side of the enclosure.
- (4) Generator cooling air flows through the crossover duct and enters the blast cap. From point of entry this airstream flows inboard, cooling the generator before passing from the shroud into the generator exhaust duct. After entering the exhaust duct, the air flows through a flapper valve and is directed into the space between inner and outer exhaust elbows where it is used for cooling the exhaust ducting. Most of the air entering the exhaust shrouding is ducted downward against the lower outboard surface of the inner elbow where turbine exhaust gases impinge. The air then passes overboard with the turbine exhaust gases.

##### B. Bleed Air System

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- (1) During the starting sequence, the pneumatic thermostat is in the acceleration mode. The thermostat opens to decrease control-air pressure to the fuel control unit acceleration limiter valve, whenever a predetermined engine exhaust gas temperature (EGT) is reached. This, in turn, decreases fuel to the engine combustor to limit EGT and prevent engine overtemperature.
- (2) When the APU AIR switch is actuated, the three-way solenoid shutoff valve is activated and shuts off compressor discharge air to the pneumatic thermostat switching it to the load control mode. The thermostat opens to bleed air from the pneumatic actuator of the load control valve, whenever a predetermined EGT is reached. This action decreases bleed-air flow from the engine by modulating (closing) the load control valve to limit EGT and prevent engine over-temperature.
- (3) When the engine is operating at governed speed, the air pressure regulator receives air pressure from the engine compressor section. This pressure is referenced across the air pressure regulator and discharged as constant control air through the load control valve switcher valve to the lower chamber in the load control valve actuator. Air pressure in this chamber acts on the diaphragm and linkage mechanism to hold the load control valve butterfly closed.
- (4) When the APU AIR switch is actuated, the load control valve solenoid operates the switcher valve to divert regulated control air to the upper chamber in the load control valve actuator. Air pressure in this chamber acts on the diaphragm and linkage mechanism to move the load control valve butterfly to the open position allowing bleed air to flow.

### WJE 405, 406, 409, 881, 883, 884

- (5) When economy mode selector switch is set in the ECON position, the two-way economy solenoid is energized and vents load control valve actuator pressure through the adjustable orifice to reduce bleed airflow to match cabin temperature demand. The reduction in bleed airflow results in reduction in EGT and a corresponding reduction in fuel consumption. The economy mode of operation does not affect APU starting. During a start, the thermostat controls APU EGT to 1150°F (621°C) to retain maximum start reliability and full bleed airflow capability for aircraft main engine starting.

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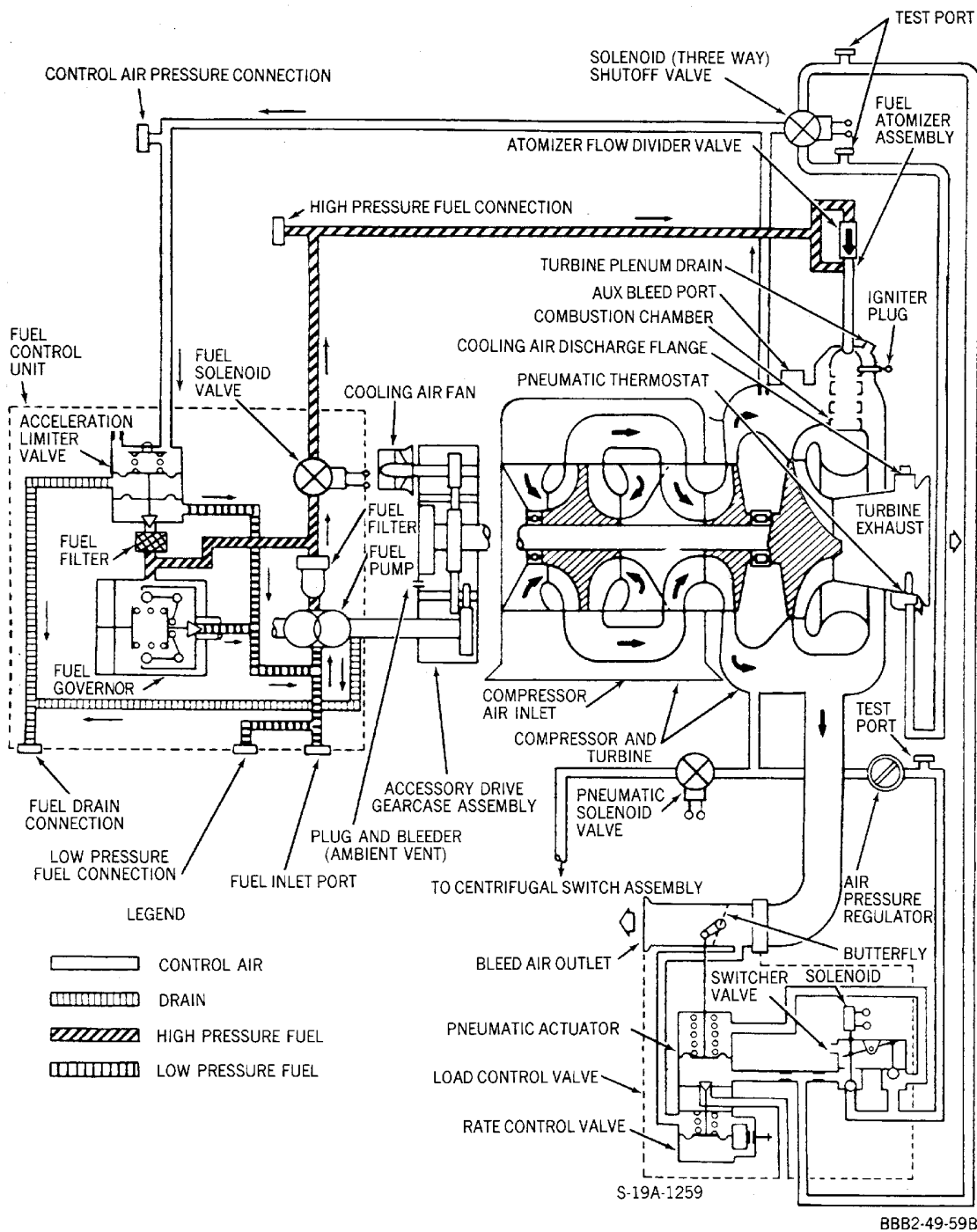
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Cooling and Bleed Air Systems -- Schematic  
Figure 1/49-50-00-990-801

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## APU BLEED AIR SYSTEM-TROUBLE SHOOTING

### 1. General

- A. Trouble shooting procedures for the APU cooling air and bleed air systems are outlined in Figure 101.
- B. Personnel should check the following before proceeding to trouble shoot the air and bleed air systems.
  - Provide source of 28 Alternating Current Volts (VAC) power.
  - Tighten all loose connections and replace broken wires.
- C. Operators using AiResearch Tester No. 290122 should refer to GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 101**

Name and Number	Manufacturer
APU Tester, 290122	ITEL 49-01-01
APU Adapter Cable 290214	ITEL 49-01-01

### 3. Trouble Shooting APU Bleed Air System

- A. Make sure that this access panel is open:

<u>Number</u>	<u>Name/Location</u>
5909C	APU Emergency Shutoff, Fire Extinguisher Switches (Ground Manual Operation Only)

- (1) Make certain that APU control switch, located on ground control panel, is in the NORMAL position.

- B. For trouble shooting procedure, refer to Figure 101.

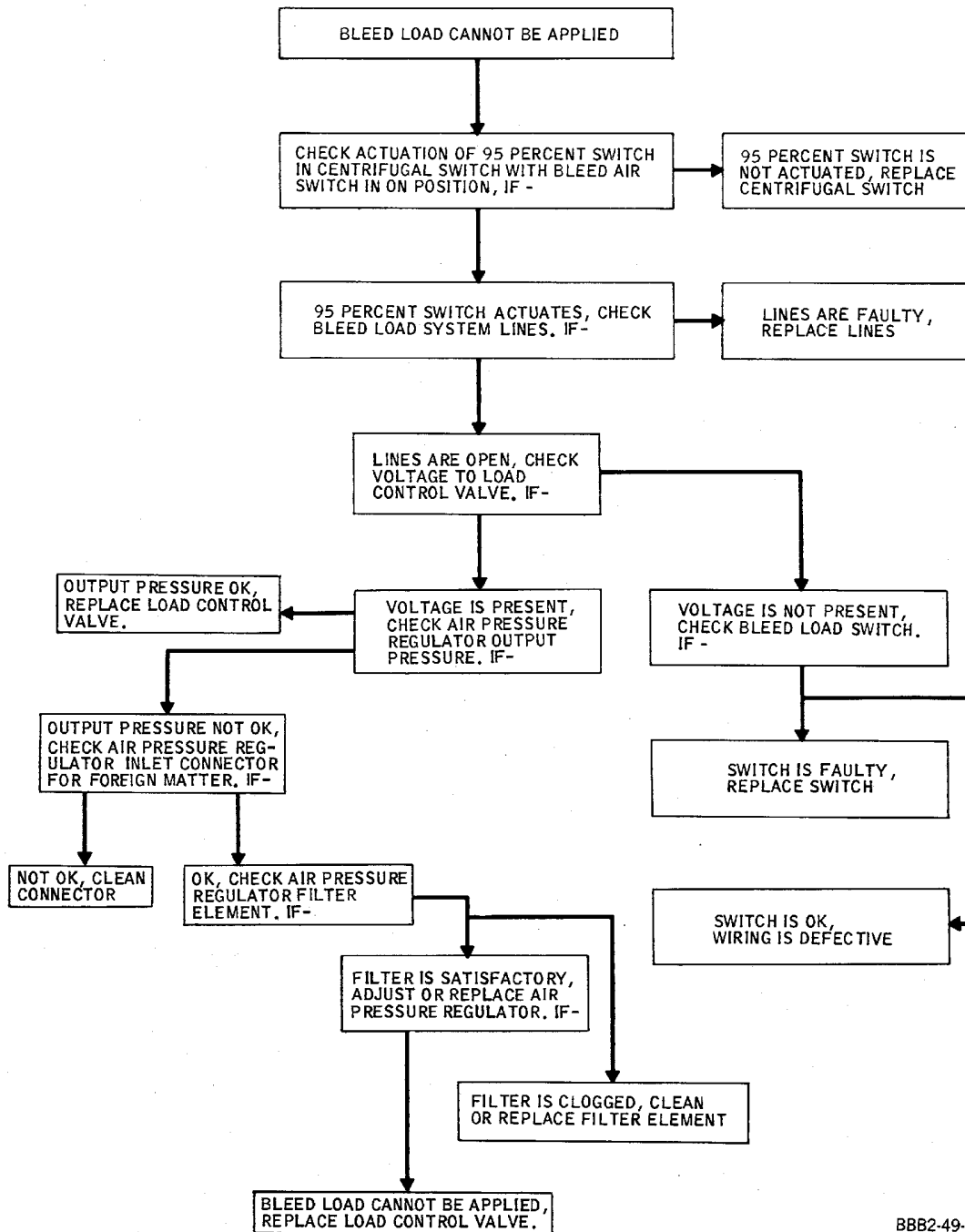
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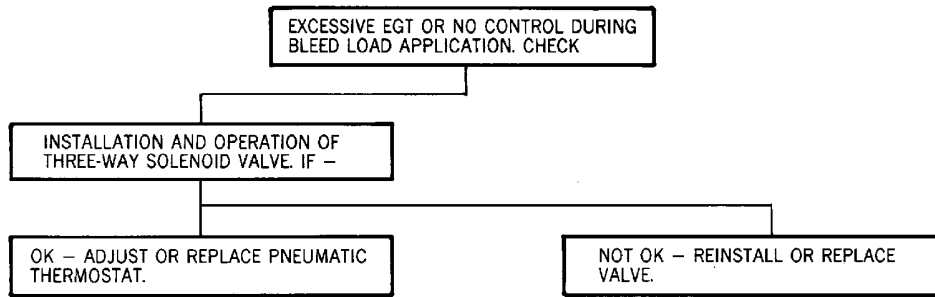
**Air -- Troubleshooting**  
**Figure 101/49-50-00-990-803 (Sheet 1 of 2)**

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**Air -- Trouble Shooting**  
**Figure 101/49-50-00-990-803 (Sheet 2 of 2)**

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## LOAD CONTROL VALVE - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The APU load control valve is located on the aft end of the turbine plenum and to the right of the oil tank. Access to the valve is through the APU right access door.

### 2. Removal/Installation Load Control Valve

- A. Remove Load Control Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from load control valve solenoid. (Figure 201)
- (3) Disconnect regulator control air line from elbow fitting.
- (4) Disconnect thermostat control line from bottom port of tee.
- (5) Disconnect and remove clamp from bleed air outlet duct.
- (6) Disconnect and remove clamp from turbine plenum.

**NOTE:** Support valve while removing second clamp. Rotating valve slightly will provide better access to clamp nut.

- (7) Lift valve clear of APU.
- (8) Remove gasket from turbine plenum flange.

- B. Install Load Control Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position new gasket on turbine plenum flange. (Figure 201)
- (3) Position valve on bleed air outlet duct.
- (4) Install clamp on bleed air outlet duct fingertight, making certain that adjusting bolt is accessible.
- (5) Rotate valve until control air line and bleed control line can be connected.
- (6) Install clamp on turbine plenum.
- (7) Complete installation of clamp on bleed air outlet duct.
- (8) Connect regulator control air line to elbow fitting.

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- (9) Connect thermostat control line to bottom on port of tee.
- (10) Connect electrical connector to solenoid valve.
- (11) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (12) To perform functional test or make necessary adjustments to load control valve refer to GENERAL, SUBJECT 49-00-00, page 501.

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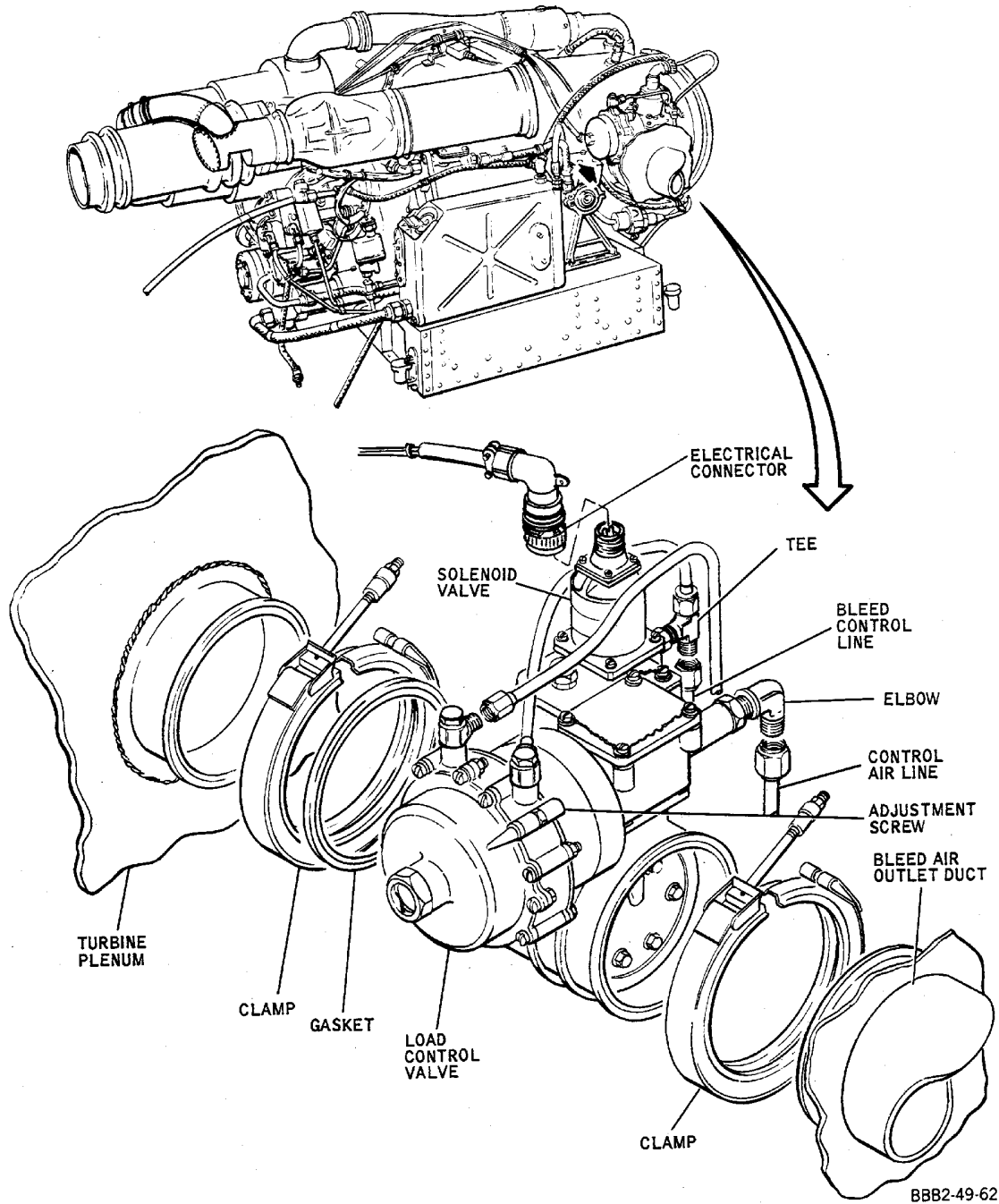
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**Load Control Valve -- Installation**  
**Figure 201/49-50-01-990-801**

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### AIR PRESSURE REGULATOR - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The air pressure regulator is clamp-mounted to a mounting bracket located under the bleed load control valve on the left side of the APU. Access to the pressure regulator is through the APU right access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Paint Stripper, Transpo	Turco Products Co.
Solvent, TT-M-261	Commercially available
Grease, MIL-G-6032	Commercially available
Source of clean, dry compressed air	
Torque wrench, (0-100 inch pounds range)	

#### 3. Removal/Installation Air Pressure Regulator

- A. Remove Regulator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect air line from inlet port of pressure regulator. (Figure 201)
- (3) Disconnect air line from outlet port of pressure regulator.
- (4) Loosen mounting clamp and slide pressure regulator off mounting bracket.

- B. Install Regulator

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position pressure regulator on mounting bracket and secure clamp. (Figure 201)

**CAUTION:** TO PREVENT FITTING FROM SHEARING OFF AT FILTER COVER, DO NOT EXCEED TORQUE OF 65 INCH-POUNDS (7.35 N·M) WHEN TIGHTENING AIR INLET LINE NUT.

- (3) Connect air line to inlet port of pressure regulator.
- (4) Connect air line to outlet port of pressure regulator.
- (5) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

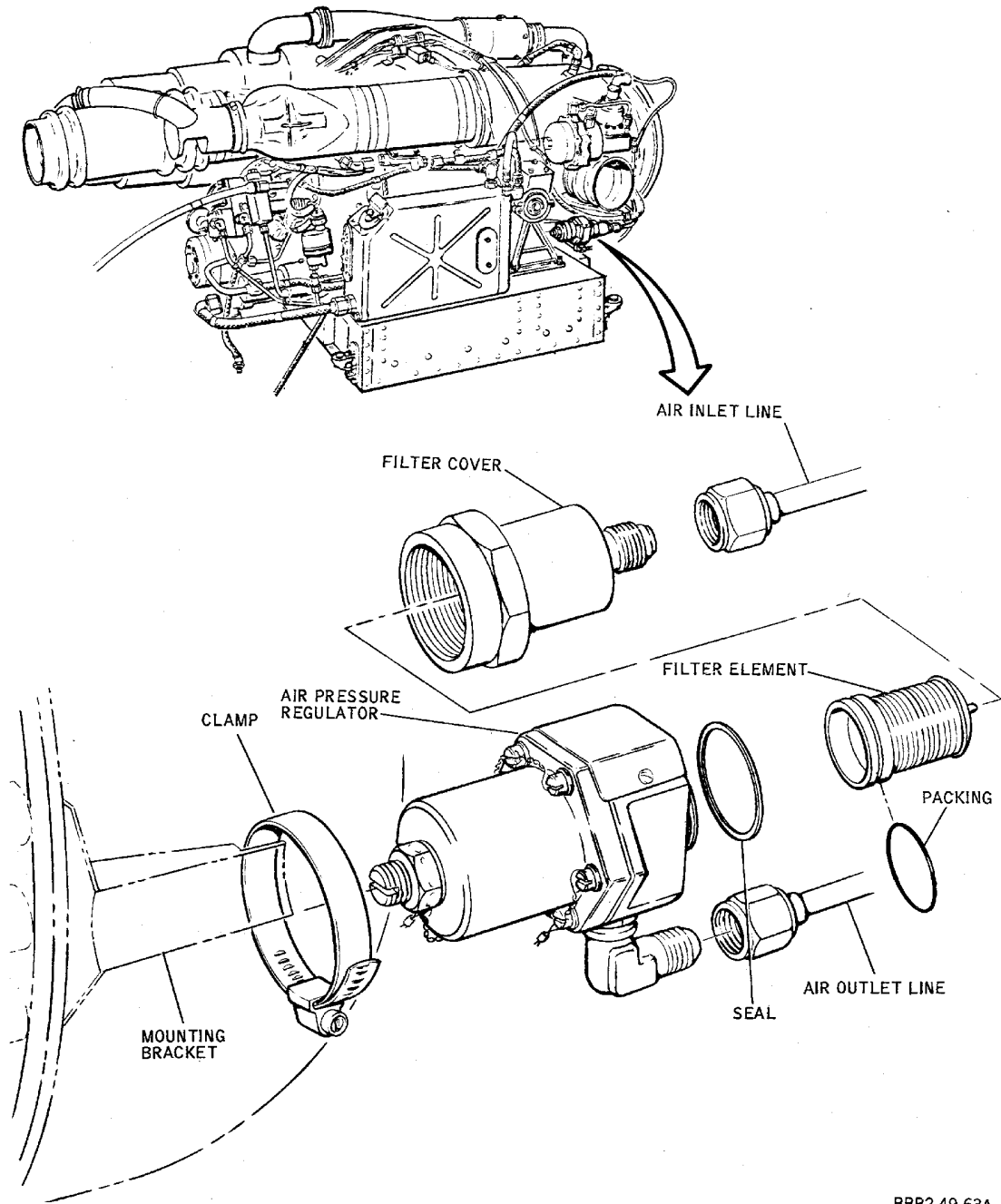
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**Air Pressure Regulator -- Installation**  
**Figure 201/49-50-03-990-801**

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### 4. Removal/Installation Air Pressure Regulator Filter Element

#### A. Remove Regulator Filter Element

- (1) Remove air pressure regulator. (Paragraph 3.)
- (2) Remove filter cover and discard seal. (Figure 201)
- (3) Remove filter element.
- (4) Remove packing from filter element and discard.
- (5) Remove seal from cover and discard.

#### B. Install Regulator Filter

- (1) Install new packing on filter element.
- (2) Install new filter cover seal.
- (3) Coat external threads of regulator with grease (MIL-G-6032), and install filter cover.
- (4) Install filter cover.
  - (a) Tighten the filter cover manually.
  - (b) Continue until it bottoms against the regulator housing.
- (5) Install air pressure regulator on APU. (Paragraph 3.)
- (6) To perform functional test or adjustment air pressure regulator cracking pressure refer to GENERAL, SUBJECT 49-00-00, page 501.

### 5. Cleaning/Painting Air Pressure Regulator Filter Element

#### A. Clean Filter Element

- (1) Remove filter element. (Paragraph 4.)
- (2) Clean filter element in paint stripper solution (Transpo, Turco Products Co.).
- (3) Rinse filter in solvent (TT-M-261) and air dry with clean, dry compressed air.
- (4) Install filter element and filter cover using new packing and seal. (Paragraph 4.)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### AIR PRESSURE REGULATOR - CLEANING/PAINTING

**1. General**

A. This procedure contains MSG-3 task card data.

**TASK 49-50-03-902-801**

**2. Cleaning APU Air Pressure Regulator Filter Element**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**NOTE:** This procedure is a scheduled maintenance task.

**A. Consumable Materials**

**NOTE:** Equivalent replacements are permitted for the items that follow.

**NOTE:** It is possible that some materials in the Consumable Materials chart cannot be used for some or all of the necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

<u>Reference</u>	<u>Description</u>	<u>Specification</u>
D60167	Compound (Sealube)	473-001-9001

**B. Prepare to Clean the APU Air Pressure Regulator Filter Element**

SUBTASK 49-50-03-865-001

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-50-03-010-001

(2) Open the access panels.

**C. Clean the APU Air Pressure Regulator Filter Element**

SUBTASK 49-50-03-020-001

(1) Remove the air pressure regulator filter element as follows: (Figure 701)

(a) Remove the air pressure regulator.

- 1) Disconnect air line from inlet port of pressure regulator.
- 2) Disconnect air line from outlet port of pressure regulator.
- 3) Loosen mounting clamp and slide pressure regulator off mounting bracket.

(b) Remove the air pressure regulator filter element.

- 1) Remove filter cover and discard seal.
- 2) Remove filter element.

SUBTASK 49-50-03-902-001

(2) Send the air pressure regulator filter element for cleaning..

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SUBTASK 49-50-03-420-002

- (3) Install the air pressure regulator filter element as follows:
  - (a) Install a serviceable filter element
    - 1) Apply sealube, D60167 to threaded portion of air pressure regulator.
    - 2) Install new packing on filter element.
    - 3) Install the filter element with packing in the air pressure regulator.
    - 4) Install seal and filter cover on air pressure regulator.
  - (b) Install air pressure regulator on APU.
    - 1) Connect air line to inlet port of pressure regulator.
    - 2) Connect air line to outlet port of pressure regulator.

### D. Job Close-up

SUBTASK 49-50-03-410-001

- (1) Close the access panels.

SUBTASK 49-50-03-942-001

- (2) Remove all the tools and equipment from the work area. Make sure the area is clean.

SUBTASK 49-50-03-865-002

- (3) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

————— END OF TASK —————

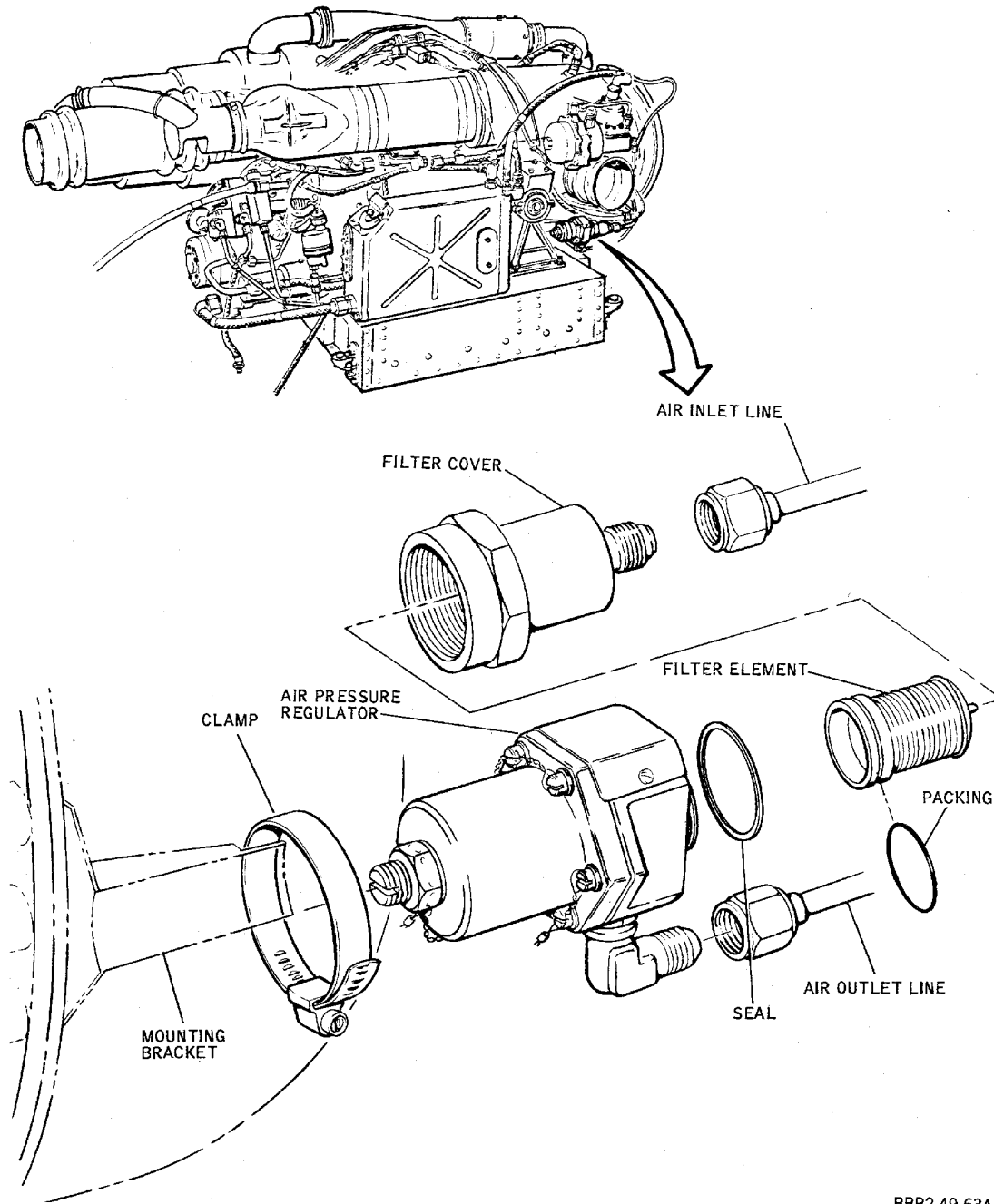
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**AIR PRESSURE REGULATOR**  
Figure 701/49-50-03-990-802

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## FAN AIR SUPPLY VALVE - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The fan air supply valve is mounted outside of the APU enclosure on the left side of the airplane. Access to the valve attach bolts is through the APU left access door. Access to the valve installation is through the tailcone access door and aft accessory compartment.

### 2. Removal/Installation Fan Air Supply Valve

#### A. Remove Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove fan air supply valve attaching bolts from inside APU enclosure. (Figure 201)
- (3) Remove fan air supply valve from inside aft accessory compartment.

#### B. Install Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position fan air supply valve on outside of APU enclosure. (Figure 201)
- (3) Install fan air supply valve attach bolts inside APU enclosure.
- (4) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

#### C. Remove Valve Hood

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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- (2) Remove bolts, nuts, and washers attaching valve hood to valve inside aft accessory compartment. (Figure 201)

D. Install Valve Hood

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position valve hood on valve. (Figure 201)

**NOTE:** Before installing valve hood, make certain inlet screen and surrounding areas are free of foreign debris.

- (3) Install hood attach bolts, nuts, and washers.
- (4) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

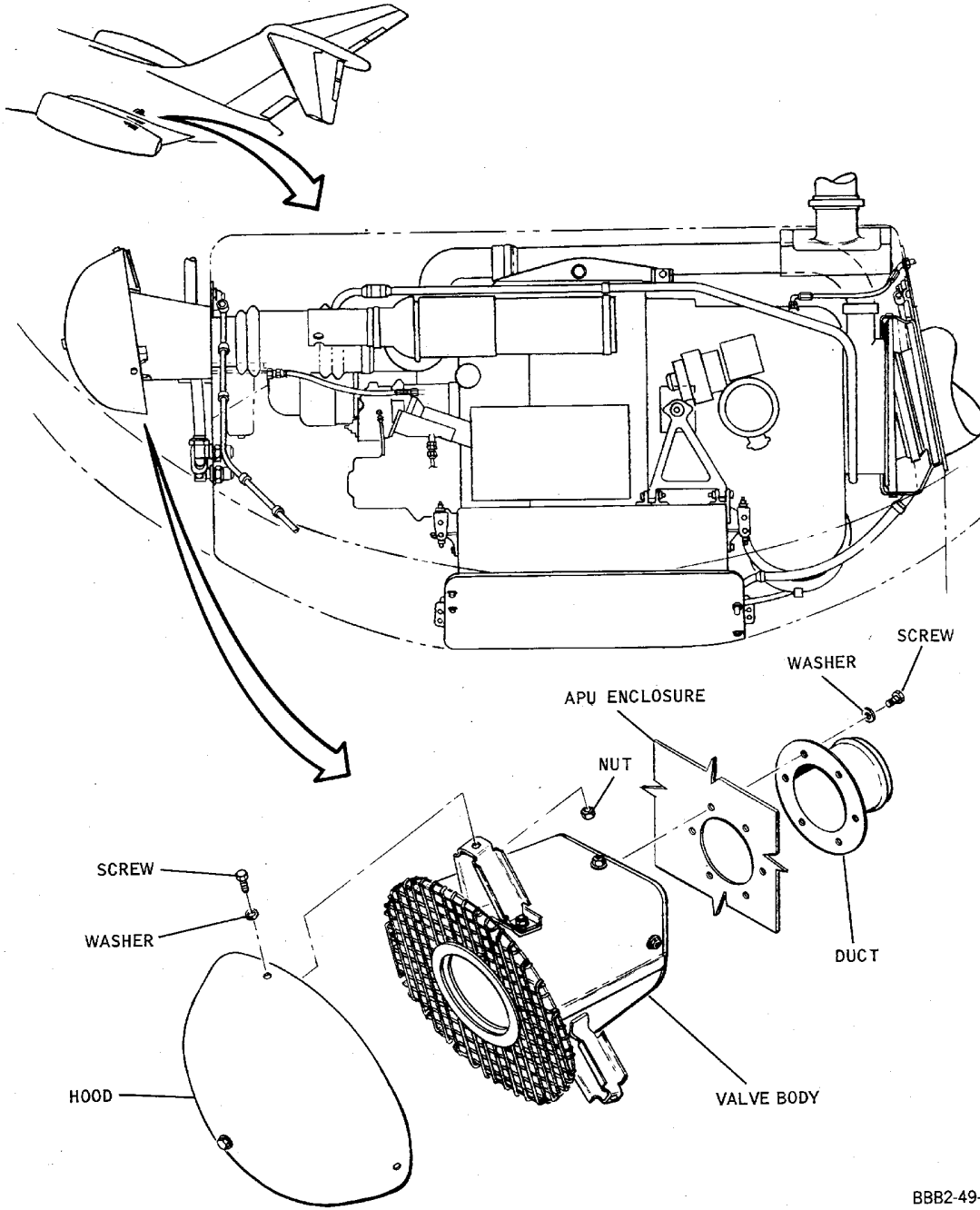
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Fan Air Supply Valve -- Installation  
Figure 201/49-50-05-990-802

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## ACCESSORY COOLING AIR FAN - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The accessory cooling air fan is mounted on the upper left side of the APU accessory drive gearcase. Access to the cooling air fan is through the APU left access door.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Lubricating oil, (MIL-L-7808) DPM 6167, Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA
Torque wrench, (0-100 inch- pounds (0-11.3 N·m) range)	

### 3. Removal/Installation Accessory Cooling Air Fan

- A. Remove Cooling Air Fan

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove clamp connecting generator crossover duct to bifurcated duct. (Figure 201)
- (3) Remove clamp connecting generator crossover duct to fitting on generator blast cap.
- (4) Remove generator crossover duct.
- (5) Remove clamp connecting bifurcated duct to oil cooler flange.
- (6) Remove clamp connecting bifurcated duct to flange on aft side of cooling air fan housing.
- (7) Remove bifurcated duct.
- (8) Remove clamp connecting flexible duct to cooling air fan housing.
- (9) Compress and remove flexible duct.

**CAUTION:** PULL COOLING AIR FAN SLOWLY OUT OF GEARCASE IN STRAIGHT LINE TO PREVENT DAMAGE TO FAN DRIVE SHAFT AND/OR GEARCASE DRIVE SPLINES.

- (10) Remove bolts and washers attaching cooling air fan to accessory drive case.

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- (11) Carefully disengage cooling air fan drive shaft splines and remove fan.
- (12) Remove and discard O-rings.

B. Install Cooling Air Fan

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (2) Lightly coat new O-rings with oil, (MIL-L-7808), and install on cooling air fan. (Figure 201)
- (3) Carefully insert cooling air fan drive shaft into accessory drive case and engage splines.
- (4) Lightly coat cooling air fan attaching bolt threads with oil, (MIL-L-7808), and install bolts and washers. Tighten bolts to torque of 50 to 70 inch-pounds (5.65 to 7.91 N·m).
- (5) Position flexible duct between cooling air fan and fan air supply valve inlet flange.  
**NOTE:** Clamping of flexible duct at fan air supply valve is not required.
- (6) Install clamp connecting flexible duct to cooling air fan housing.
- (7) Position bifurcated duct on cooling air fan housing and oil cooler flange.
- (8) Install clamp connecting bifurcated duct to cooling air fan housing. Tighten clamp nut to torque of 20 to 25 inch-pounds (2.26 to 2.83 N·m).
- (9) Install clamp connecting bifurcated duct to oil cooler flange. Tighten clamp nut to torque of 20 to 25 inch-pounds (2.26 to 2.83 N·m).
- (10) Position generator crossover duct on outboard end of bifurcated duct and flange of generator blast cap.
- (11) Install clamp connecting generator crossover duct to out-board end of bifurcated duct.

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- (12) Install clamp connecting end of generator crossover duct to generator blast cap.
- (13) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

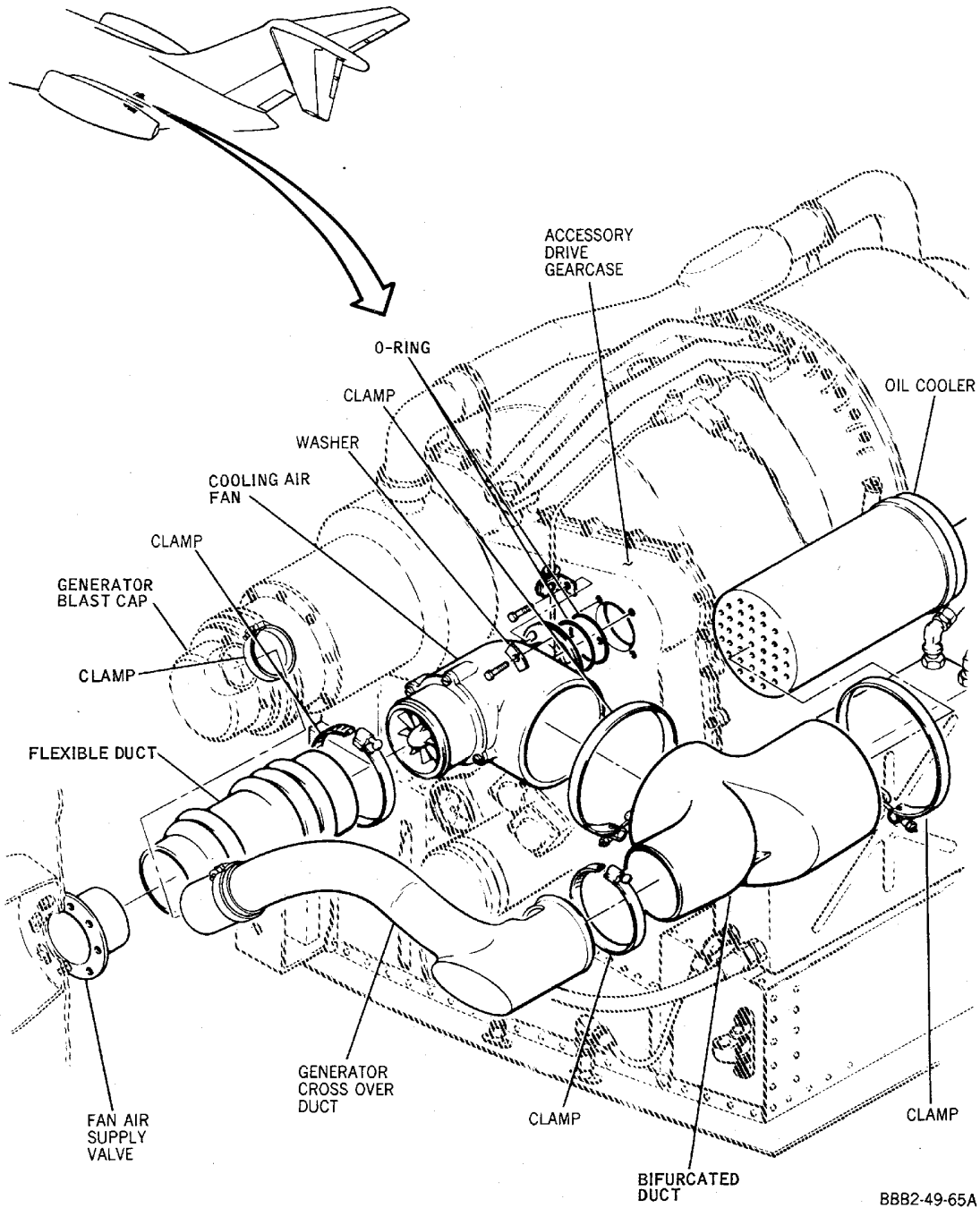
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**Accessory Cooling Air Fan -- Installation**  
**Figure 201/49-50-06-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### COMPARTMENT VENTILATING EXHAUST DUCT - MAINTENANCE PRACTICES

#### 1. General

- A. The compartment ventilating exhaust duct is connected to the right upper side of the APU enclosure and vents the compartment to atmosphere through an exit duct located in the fuselage skin. Exhaust noise is reduced by a sound-suppressing muffler located on the inside surface of the APU enclosure below the exhaust duct. The exhaust duct can be removed from the aft accessory compartment. Access to the aft accessory compartment is through the tailcone access door.

#### 2. Removal/Installation Compartment Ventilating Exhaust Duct

##### A. Remove Exhaust Duct

- (1) Remove clamp securing upper end of exhaust duct to flexible duct section on fuselage skin. (Figure 201)
- (2) Remove clamp securing lower end of exhaust duct to sleeve on APU enclosure.
- (3) Remove exhaust duct.

##### B. Install Exhaust Duct

- (1) Position exhaust duct on sleeve attached to enclosure and fit upper end to flexible duct. (Figure 201)
- (2) Install clamp securing lower end of exhaust duct to sleeve on APU enclosure.
- (3) Install clamp securing upper end of exhaust duct to flexible duct.

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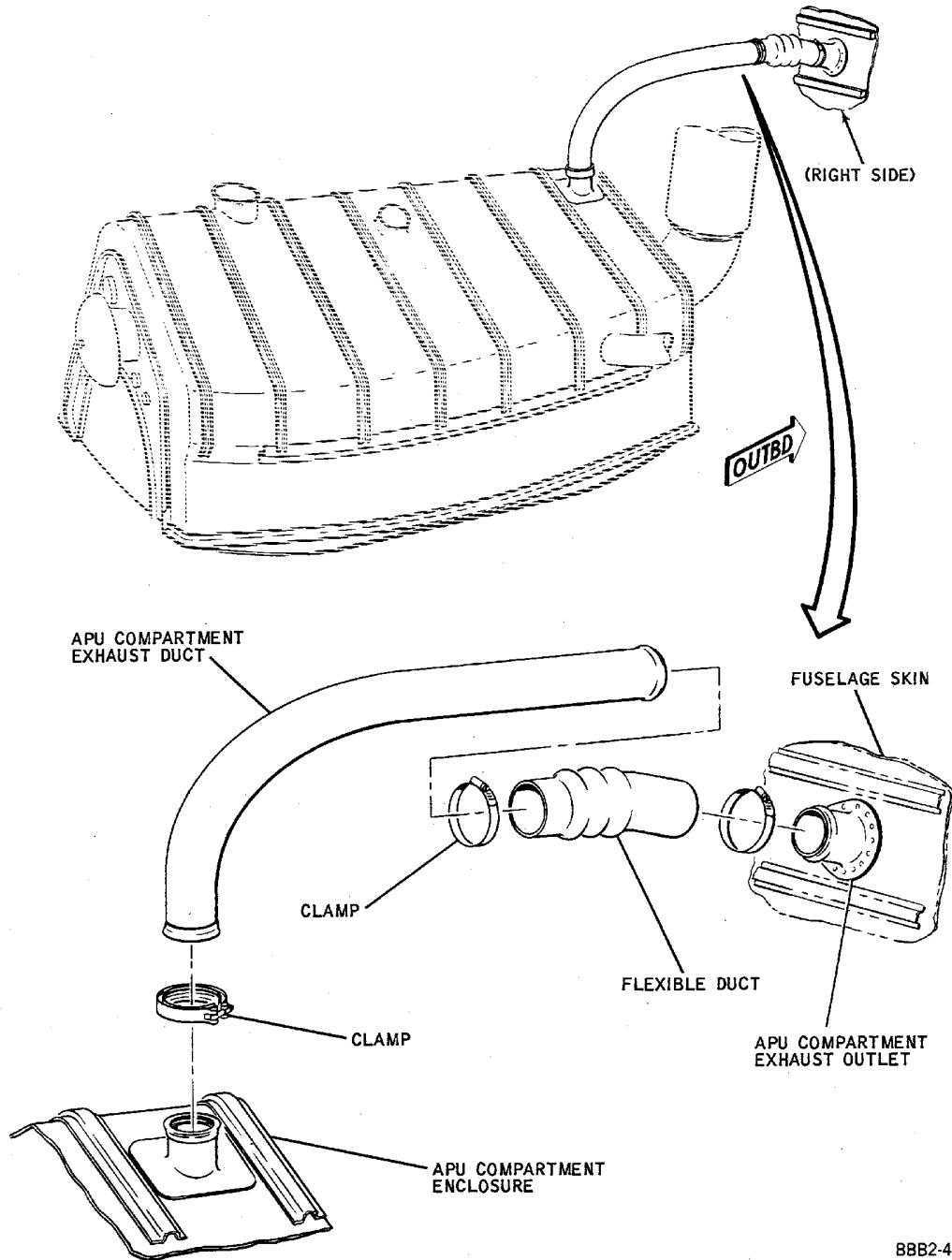
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



Compartment Ventilating Exhaust Duct -- Installation  
Figure 201/49-50-07-990-801

EFFECTIVITY  
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49-50-07

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### GENERATOR EXHAUST VALVE AND DUCT - MAINTENANCE PRACTICES

#### 1. General

- A. The generator cooling air is exhausted through a duct incorporating a flapper valve. The duct is clamp-mounted on top of the APU. Exhaust gases are prevented from entering the generator by the flapper valve. The exhaust duct and valve are removed as a unit.
- B. Access to the left end of the duct is through the generator hoist access door. This door is located in the top left surface of the APU enclosure in the aft accessory compartment. Access to the aft accessory compartment is through the tailcone access door.

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- C. Access to the right end of the exhaust duct is through the APU right access door. Removal is facilitated by taking the duct out the right access door.

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Torque wrench (0 - 75 inch pounds range)	

#### 3. Removal/Installation Generator Exhaust Valve and Duct

- A. Remove Exhaust Valve and Duct

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove clamp securing exhaust duct to support located aft of generator shroud. (Figure 201)
- (3) Disconnect clamp securing fuel temperature regulator air line to exhaust duct.
- (4) Disconnect clamp securing exhaust duct to turbine plenum sleeve.
- (5) Slip exhaust duct outboard until end of duct clears elbow located on generator shroud.

- B. Install Exhaust Valve and Duct

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position exhaust duct and slip left end inside elbow located on generator shroud until elbow on opposite end is aligned with sleeve on turbine plenum. (Figure 201)
- (3) Install clamp securing exhaust duct to sleeve on turbine plenum and tighten to torque of 35 to 45 inch-pounds.
- (4) Install clamp securing exhaust duct to support aft of generator shroud.
- (5) Install clamp securing fuel temperature regulator air line to exhaust duct.
- (6) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

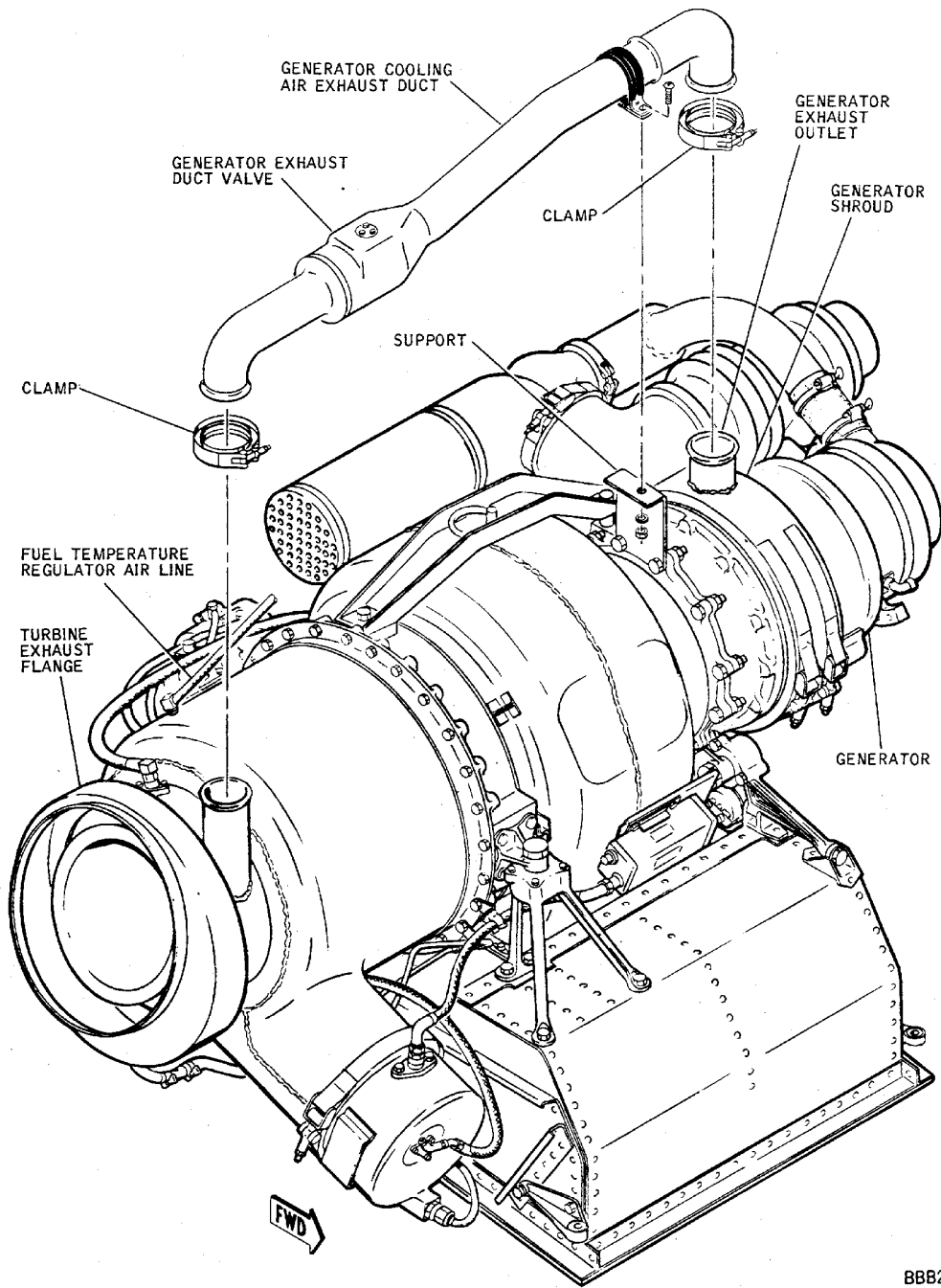
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**Generator Cooling Air Exhaust Valve and Duct**  
Figure 201/49-50-08-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### PNEUMATIC THERMOSTAT - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The pneumatic thermostat is mounted on the lower side of the APU turbine exhaust chamber, with the thermostat body extending into the exhaust path. The thermostat is connected to the load pneumatic valve by the bleed pneumatic air line. Access to the thermostat is through the APU right access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Compound, High-temperature Fel-Pro C-5A DPM 377	Fel-Pro Inc., Div of Felt Products Mfg Co, 7450 N. McCormick Blvd, Skokie, IL 60076
Torque wrench (0 - 75 inch pounds range)	

#### 3. Removal/Installation Pneumatic Thermostat

- A. Remove Pneumatic Thermostat

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**CAUTION:** TO PREVENT DAMAGE TO THERMOSTAT BLEED CONTROL AIR LINE, HOLD THERMOSTAT HEX FITTING WITH WRENCH WHEN LOOSENING NUT.

- (2) Disconnect bleed control air line from thermostat. (Figure 201)
- (3) Loosen bleed control air line from load control valve and rotate line clear of thermostat.
- (4) Remove thermostat attaching bolt and washer.
- (5) Carefully remove thermostat and shim washers from exhaust flange mounting boss.

**NOTE:** Record amount and thickness of shim washers to facilitate installation.

- B. Install Pneumatic Thermostat

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**CAUTION:** WHEN REPLACING THERMOSTAT, MAKE CERTAIN THERMOSTAT WITH CORRECT PART NUMBER IS INSTALLED.

- (2) Select correct amount and thickness of shim washers, as removed, to obtain 0.010 to 0.020 inch (0.025 to 0.051 mm) pinch fit between thermostat mounting flange and turbine flange.
- (3) Install selected shim washers and thermostat.

**WARNING:** HIGH TEMPERATURE ANTISEIZE IS AN AGENT THAT IS POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HIGH TEMPERATURE ANTISEIZE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HIGH TEMPERATURE ANTISEIZE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (4) Coat thermostat attaching bolt threads with compound, (Fel-Pro C-5A).
- (5) Install thermostat attaching bolt and washer. Tighten bolt to torque of 70 inch-pounds (7.91 N·m).

**CAUTION:** TO PREVENT DAMAGE TO THERMOSTAT BLEED CONTROL AIR LINE, HOLD THERMOSTAT HEX FITTING WITH WRENCH WHEN LOOSENING NUT.

- (6) Connect bleed control air line to thermostat.
- (7) Tighten bleed control air line connection on load control valve.
- (8) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (9) To perform functional test or make necessary adjustment to pneumatic thermostat, refer to GENERAL, SUBJECT 49-00-00, page 501.

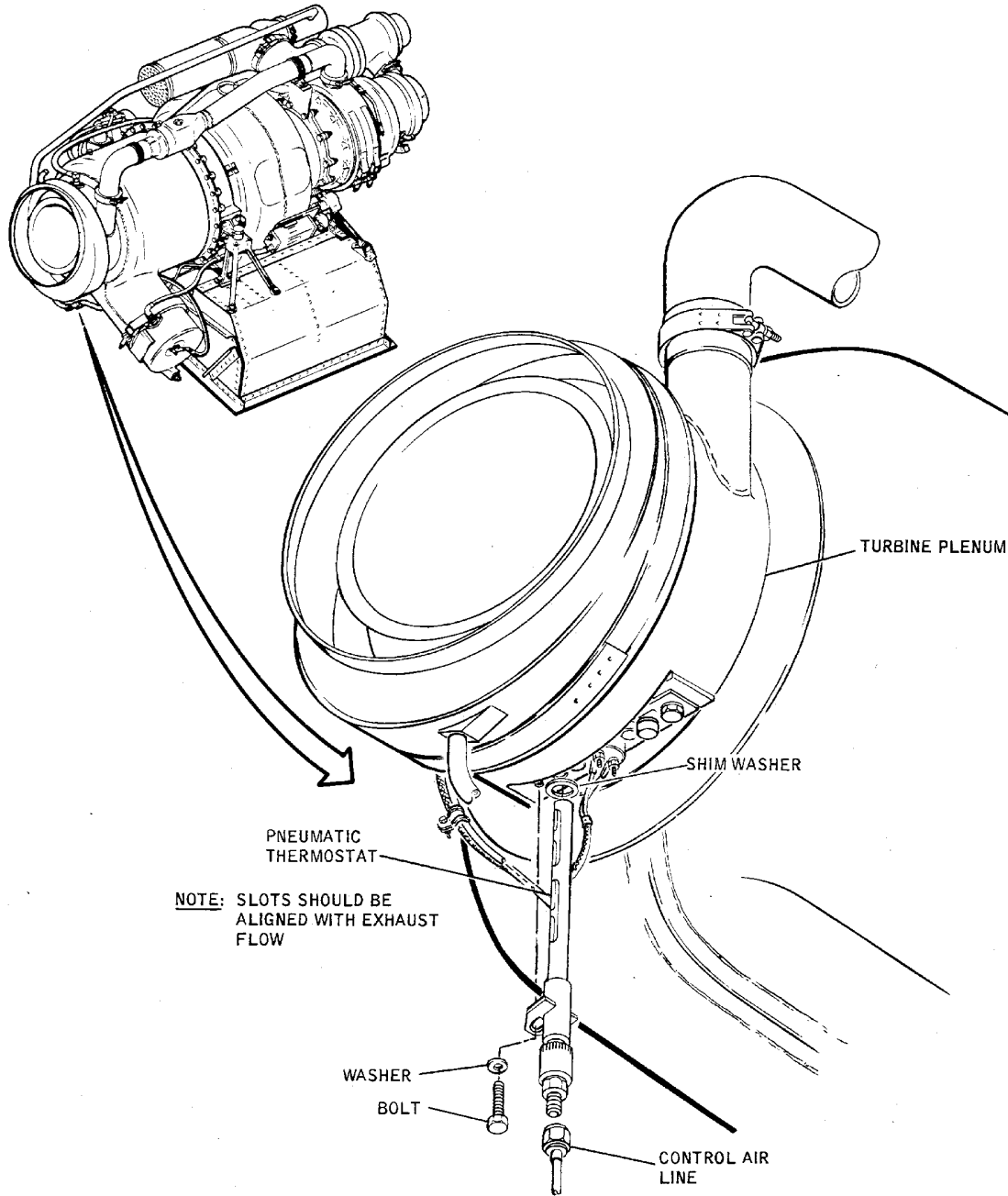
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-68A

**Pneumatic Thermostat -- Installation**  
**Figure 201/49-50-09-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### THREE-WAY SOLENOID SHUTOFF VALVE - MAINTENANCE PRACTICES

#### 1. General

- A. The three-way solenoid shutoff valve is mounted on the APU test panel below the turbine exhaust chamber. The valve is connected between the pneumatic thermostat and the acceleration limiter on the fuel control by means of a bleed air line. Access to the solenoid shutoff valve is through the APU right access door.

#### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Torque wrench (0 - 50 inch pounds (0-5.65 N·m) range)	

#### 3. Removal/Installation Three-way Solenoid Shutoff Valve

- A. Remove Solenoid Shutoff Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

Row	Col	Number	Name
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from solenoid valve. (Figure 201)  
 (3) Disconnect air lines from solenoid valve.  
 (4) Remove bolts, washers and shield attaching solenoid valve to mounting bracket.  
 (5) Remove solenoid valve.

- B. Install Solenoid Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

Row	Col	Number	Name
B	21	B1-291	APU CONTROL

- (2) Position solenoid valve on mounting bracket and secure using sheild, washers and bolts. (Figure 201)  
 (3) Tighten bolts to torque of 20 to 25 inch-pounds (2.26 to 2.83 N·m).  
 (4) Connect air lines to solenoid valve.  
 (5) Connect electrical connector to solenoid valve.

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- (6) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

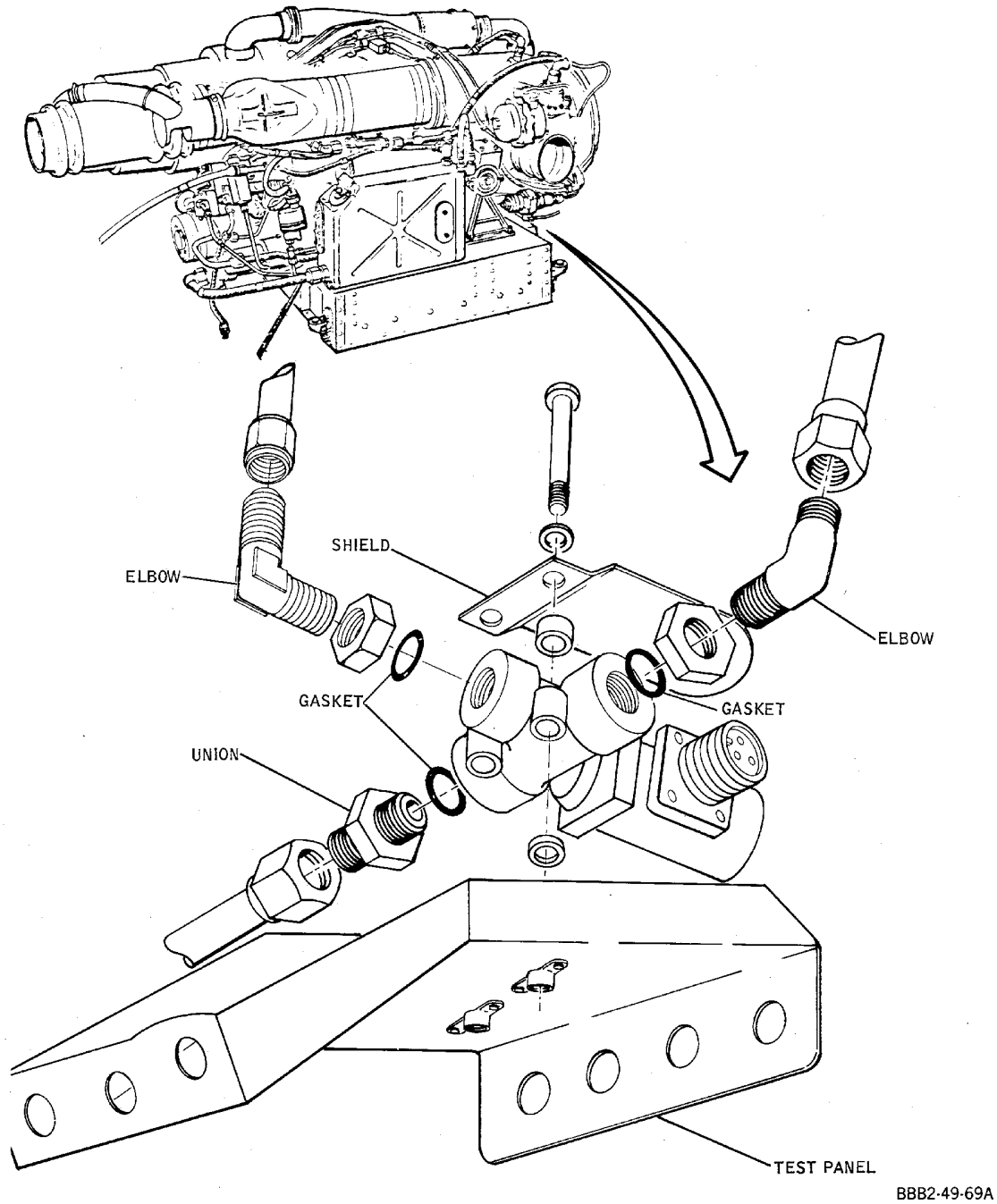
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



**Three-Way Solenoid Shutoff Valve -- Installation**  
Figure 201/49-50-10-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### ENGINE CONTROLS - DESCRIPTION AND OPERATION

#### 1. Description

- A. The engine controls system is fully automatic and does not require manual control under normal operating conditions. The system consists of a multiple centrifugal switch mounted on the engine accessory drive case, an oil sequencing switch mounted on the oil pump flange, a pneumatic solenoid valve mounted on top of the compressor plenum, a relay mounted on the APU right side adjacent to the hourmeter and necessary wiring and pneumatic lines.
- B. The centrifugal switch is driven by the turbine's accessory drive through a splined drive shaft. The drive shaft is mounted on ball bearings and lubricated by the accessory drive oil supply.
- C. The switch drive shaft has a knife-edge flyweight support located outboard from the drive shaft bearing housing. Notched flyweights are pivoted on this support with the toe of each flyweight positioned under the outer race of a ball bearing on the actuating shaft. This arrangement allows the flyweights to revolve around the nonrotating actuating shaft in response to turbine speed transmitted by the drive shaft.
- D. The terminal end of the drive shaft is fitted with a shimmed tip which acts against a lever arm. The lever arm is pivoted at one side of the switch housing and makes contact, in sequence, with three small spring-set pistons. The pistons are of different lengths, relative to the lever arm, and are set by adjusting screws located under the switch cover. The switches are adjusted to operate at approximately 35 percent, 95 percent, and 110 percent of turbine speed, when actuated, the 35-percent switch turns off the starter. The 95-percent switch turns off the turbine ignition and starts the hourmeter. The 110-percent switch is actuated under overspeed condition and initiates an automatic shutdown of the engine.
- E. The centrifugal switch is also equipped to receive an air supply from the compressor, which applies pressure to the actuating shaft flange. This pressure causes the shaft to extend, engaging the 110-percent switch and stopping the APU. The air supply is controlled by a pneumatic solenoid valve located on top of the compressor plenum and is actuated during normal shutdown of the APU, thereby checking the 110-percent switch and providing a convenient method of stopping.
- F. The oil sequencing switch is located in the oil pressure line outboard of the oil tank on the APU left side. This switch ensures that the APU lubrication system is operating before the ignition system can be energized. It also ensures that the unit has gained sufficient speed to provide adequate airflow before delivering regulated fuel to the combustion chamber. Major components are: a diaphragm, an actuating arm, and a dual-purpose switch.
- G. The pneumatic solenoid valve consists of a solenoid coil, a movable plunger, and a valve body fitted with two lapped seats.
- H. The solenoid coil is retained in a housing capped by an electrical connector and attached to the valve body with screws. The coil is connected to the movable plunger by a coil spring recessed in the end of the shaft. The opposite end of the plunger terminates in a tang-shaped body with a hole drilled through the flat sides. This hole is fitted with two small spring-loaded carbon discs which seal both lapped air ports in the valve body when the solenoid is deenergized.

#### 2. Operation

- A. When the centrifugal switch shaft begins to rotate, the fly-weights respond to centrifugal force and move the actuating shaft outward against the lever arm actuating the switches. Since the 35-percent switch piston is longer than the 95- and 110-percent switch pistons, and located nearer the lever arm pivot, it acts on the arm during actuation of all the switches. A change in the setting of the 35-percent switch will also affect the setting of 95- and 110-percent switches. However, a drift in the setting of the 110-percent switch will affect only the 110-percent switch.

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- B. As the actuating shaft moves outboard, the 35-percent switch activated by the lever arm turns off the starter motor. During continued acceleration the flange on the actuating shaft con-tacts the mainspring retainer and begins to compress the spring. As compression increases, this spring compensates for the difference in flyweight force between the actuation of the 35- and 95-percent switches by adding its force to that of the outer springs.
- C. At 95-percent turbine speed, the lever arm actuates the 95- percent switch and ignition is turned off and hourmeter started.
- D. During normal operation (at full speed) the actuator shaft flange contacts the mainspring retainer and seals off the sensor housing from the switch housing. This seal forms a piston between the two housings against which air pressure from the compressor is applied when the pneumatic solenoid valve is opened to check for proper operation of the overspeed switch during a normal shutdown procedure. The air pressure com-presses the mainspring and lowers the force opposing the out-ward movement of the flyweights. As a result, the flyweights move the actuating shaft against the lever arm and trip the 110-percent switch initiating shutdown of the engine. The air pressure built up behind the piston eventually disappears due to leakage into the switch housing and the piston force is removed. The lever arm will now return to its normal position, although the pneumatic solenoid may remain open. However, the turbine electrical circuitry is arranged to remain deenergized once it is broken by action of the overspeed switch. After the engine stops, or the pneumatic solenoid closes, air pressure remaining within the switch will bleed out through holes in the mounting base.
- E. When the APU master switch is momentarily placed in the start position, the unit begins to rotate and oil pressure starts to rise. At start of rotation both fuel and ignition circuits are deenergized. When the oil pressure reaches 2.5 to 3.5 psig (17.25 to 24.15 kPa), the switch diaphragm moves the arm actuating the switch. This action completes electrical circuits to the fuel solenoid valve and to the igniter coil unit. As a result of switch action the igniter plug fires, and fuel being delivered to the combustion chamber is ignited.

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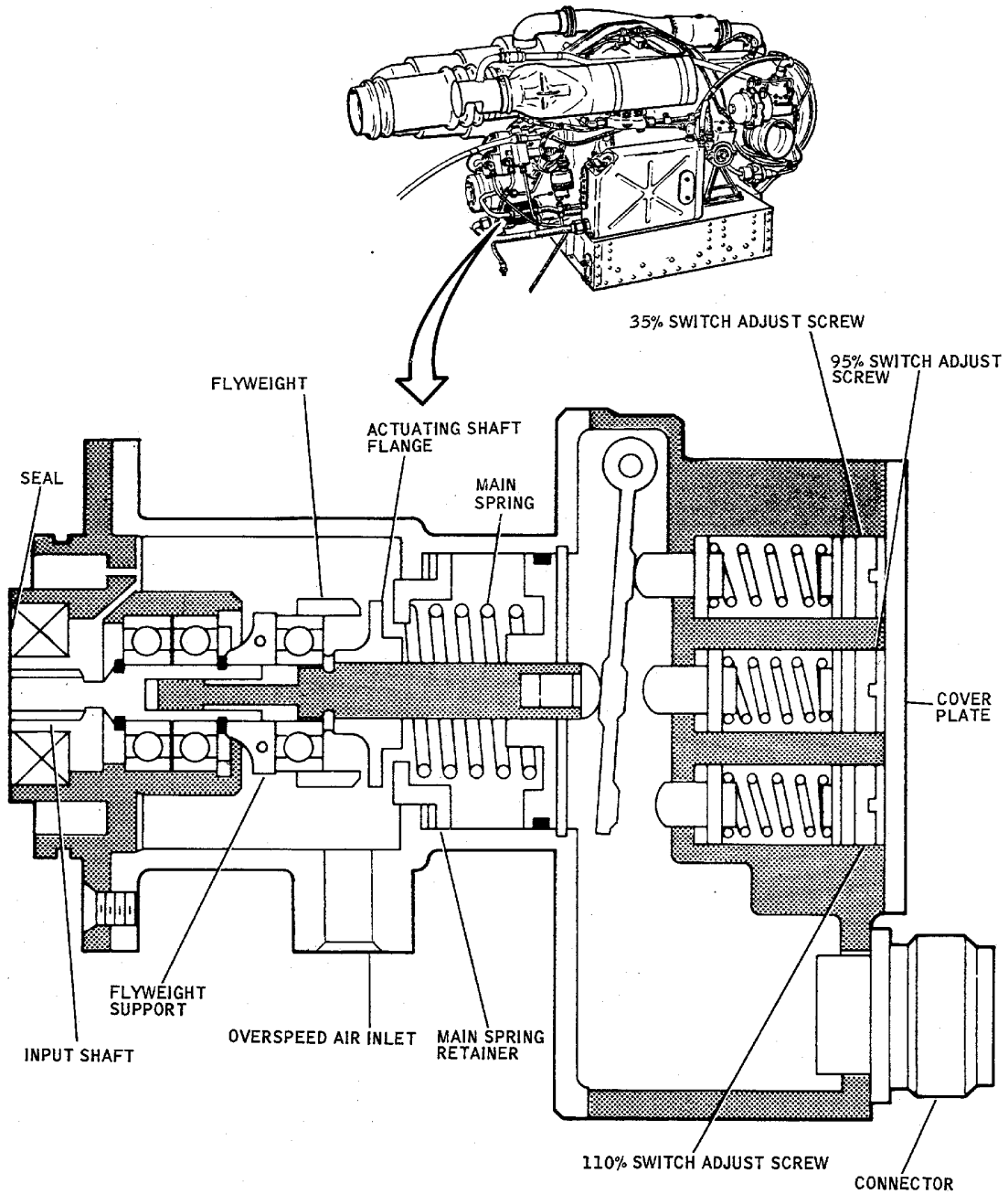
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BBB2-49-70

**Centrifugal Switch -- Schematic**  
**Figure 1/49-60-00-990-802**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### CENTRIFUGAL SWITCH - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The centrifugal switch is mounted on the accessory drive case, located on the left side of the APU. Access to the switch is through the APU left access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items.

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Grease MIL-G-21164	
Oil MIL-L-7808 DPM 6167 Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA

#### 3. Removal/Installation Centrifugal Switch

- A. Remove Centrifugal Switch

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from centrifugal switch.
- (3) Disconnect air inlet line from centrifugal switch.
- (4) Remove centrifugal switch attaching nuts.

**CAUTION:** TO PREVENT DAMAGE TO DRIVE SHAFT, WITHDRAW CENTRIFUGAL SWITCH IN A STRAIGHT LINE.

- (5) Carefully withdraw centrifugal switch from accessry gearcase in a straight line. Remove and discard O-ring.

- B. Install Centrifugal Switch

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (2) Lightly lubricate new O-ring with oil (MIL-L-7808) and install on centrifugal switch.
- (3) Lightly coat centrifugal switch drive shaft splines with grease (MIL-G-21164).

**CAUTION:** MAKE CERTAIN THAT CENTRIFUGAL SWITCH DRIVE SHAFT SPLINES ARE ALIGNED WITH MATING SPLINES OF ACCESSORY DRIVE OR DAMAGE TO SHAFTS COULD RESULT.

- (4) Position centrifugal switch and engage drive shaft splines with mating splines of accessory drive.
- (5) Install centrifugal switch attaching nuts. Tighten nuts to torque of 70 to 90 inch-pounds (7.91 to 10.17 N·m).
- (6) Connect electrical connector to centrifugal switch.
- (7) Connect air inlet line to centrifugal switch.
- (8) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

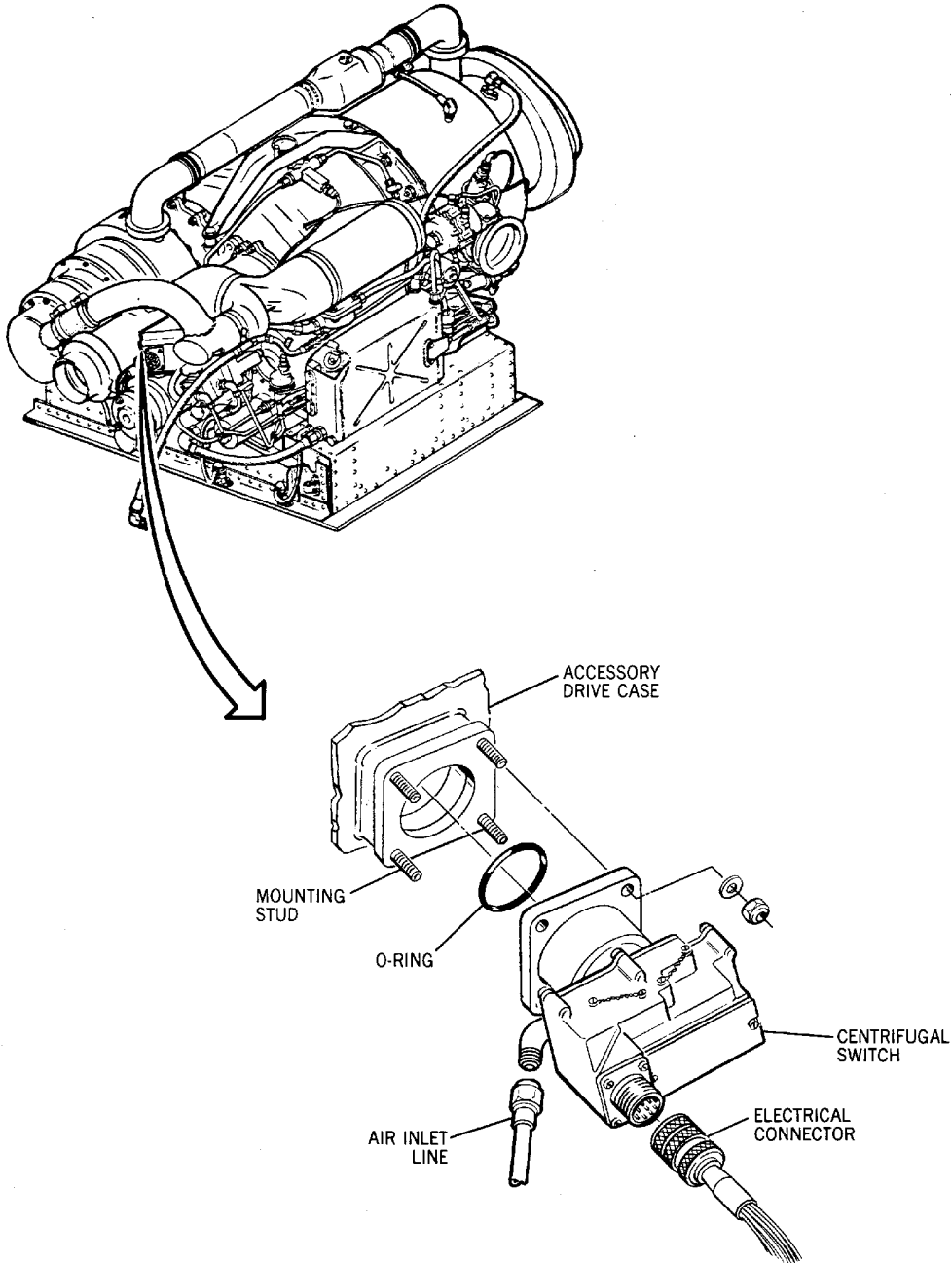
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-71A

**Centrifugal Switch -- Removal/Installation**  
Figure 201/49-60-01-990-801

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AIRCRAFT MAINTENANCE MANUAL**

**4. Adjustment/Test Centrifugal Switch**

NOTE: No adjustment of centrifugal switch is permitted at field level.

**A. Test Centrifugal Switch**

- (1) Perform operation check of all switch actuations. (GENERAL, SUBJECT 49-00-00, page 501)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL SEQUENCING SWITCH - MAINTENANCE PRACTICES

**1. General**

A. The oil sequencing switch is located on the left side of the APU, near the oil tank, aft of the accessory drive case. Access to the switch is through APU left access door.

**2. Equipment and Materials**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**NOTE:** Equivalent substitutes may be used instead of following items.

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Container	

**3. Removal/Installation Oil Sequencing Switch**

A. Remove Oil Sequencing Switch

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

(2) Disconnect electrical connector from switch. (Figure 201)

(3) Disconnect oil inlet line from tee at bottom of switch.

**NOTE:** Provide suitable container in which to catch oil remaining in line or switch.

(4) Disconnect oil outlet line from tee bottom of switch.

(5) Loosen clamp and remove switch.

(6) Remove nut, tee, and packing from outlet port of switch.

B. Install Oil Sequencing Switch

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

(2) Position tee, nut, and new packing in outlet port of switch.

(3) Install tee.

EFFECTIVITY <b>WJE ALL</b>
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**CAUTION:** MAKE CERTAIN CLAMP DOES NOT COVER VENT HOLES IN SWITCH HOUSING.

- (4) Position switch and install mounting clamp loosely. (Figure 201)
- (5) Connect oil inlet line to tee on bottom of switch.
- (6) Connect oil outlet line to tee on bottom of switch.
- (7) Connect electrical connector to switch.
- (8) Tighten switch mounting clamp.
- (9) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

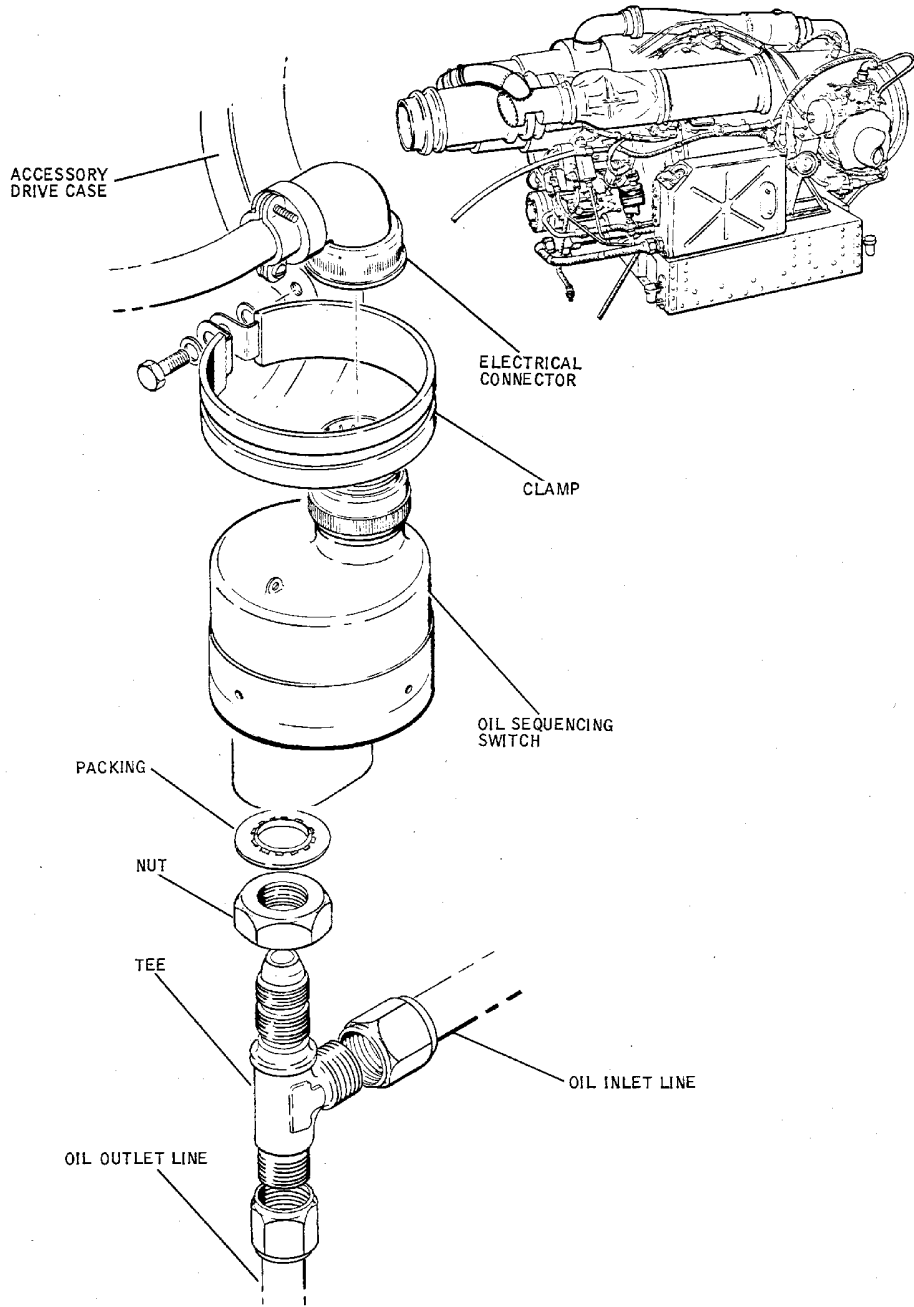
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BBB2-49-72

**Oil Sequencing Switch -- Installation**  
**Figure 201/49-60-02-990-801**

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WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Sequencing Switch

#### A. Test Oil Sequencing Switch

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)

NOTE: Operation of the oil sequencing valve is assured When engine rotation begins before combustion.

- (2) Allow engine to accelerate to no-load governed speed.
- (3) Check oil line connection for leakage.
- (4) Shut down APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (5) Check oil level in sight gage located on left side of oil tank. If level has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### PNEUMATIC SOLENOID VALVE - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUT-DOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The pneumatic solenoid valve is located on top of the APU compressor case forward of the oil cooler. The solenoid valve is removed through the APU enclosure hoist access door, located in the aft accessory compartment. Access to the aft accessory compartment is through the tailcone access door. Access to the APU hoist access door is through the access panel in the walk-way.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Lockwire, NASM20995N20, DPM 684	Not Specified
Torque wrench, (0 - 50 inch-pounds range)	

#### 3. Removal/Installation Pneumatic Solenoid Valve

- A. Remove Solenoid Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Open tailcone access door.  
 (3) Open APU hoist access panel in aft accessory compartment walkway.  
 (4) Disconnect clamp and remove generator hoist access cover from APU enclosure.  
 (5) Disconnect air inlet line from solenoid valve. (Figure 201)  
 (6) Disconnect air outlet line from solenoid valve.  
 (7) Remove bolts and washers attaching solenoid valve to mounting bracket on compressor case.  
 (8) Carefully pull solenoid valve through opening in APU enclosure.  
 (9) Disconnect electrical connector.

- B. Install Solenoid Valve

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Connect electrical connector and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)(Figure 201)
- (3) Carefully insert solenoid valve through opening in APU enclosure and position on mounting bracket.
- (4) Install solenoid valve on mounting bracket. Torque bolts from 20 to 25 inch-pounds.
- (5) Connect air inlet line to solenoid valve.
- (6) Connect air outlet line to solenoid valve.
- (7) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

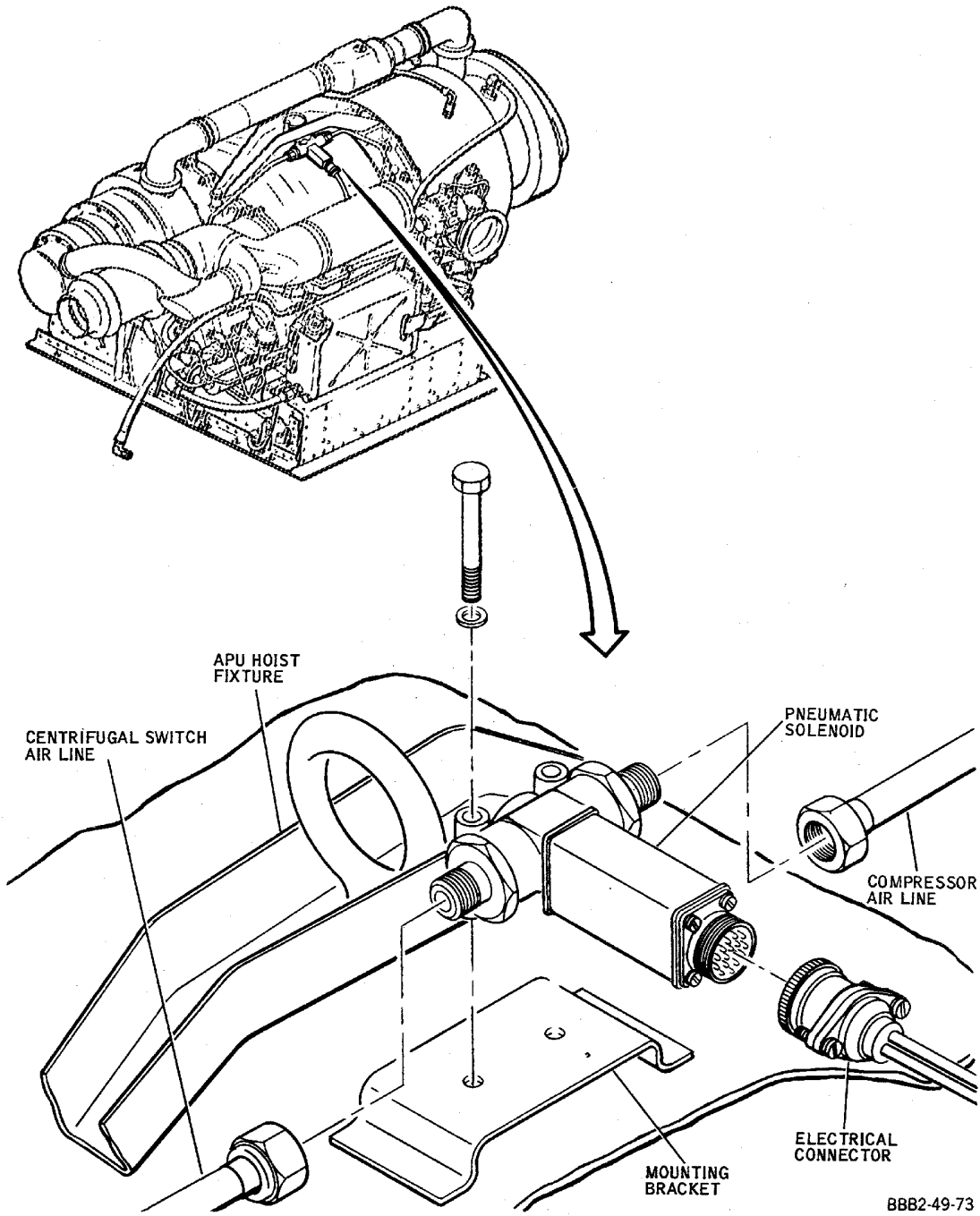
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**Pneumatic Solenoid Valve -- Installation**  
Figure 201/49-60-03-990-801

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## 49-60-03

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**AIRCRAFT MAINTENANCE MANUAL**  
**INDICATING - DESCRIPTION AND OPERATION**

**1. General**

- A. The hourmeter of the indicating system records total engine operating time.
- B. The engine Exhaust Gas Temperature (EGT) system is covered in EXHAUST GAS TEMPERATURE SYSTEM, SUBJECT 49-71-00, and the engine tachometer system is covered in TACHOMETER SYSTEM, SUBJECT 49-72-00

**2. Description**

- A. The APU engine hourmeter is a shockproof electric clock enclosed in a watertight case. The hourmeter indicates elapsed engine operating time by means of a single hand and graduated dial. Total engine operating time is recorded by a digital counter that records in hours and tenths of hours. The hour-meter is mounted in a shock absorbing isolation ring attached to a bracket mounted on the engine accessory drive housing.

**3. Operation**

- A. The engine hourmeter is connected electrically to the 95- percent switch in the centrifugal switch. The hourmeter starts recording when engine turbine speed increases sufficiently to actuate the 95-percent switch. It will continue to indicate elapsed time and record total operating time as long as the engine operates above the setting of the 95-percent switch. When engine speed decreases below the switch setting, the clock will stop.
- B. Accuracy of the hourmeter record is maintained by recording the time shown on the hourmeter in the engine record and transferring this reading to a tab and attaching it to the new hourmeter every time a replacement is made.

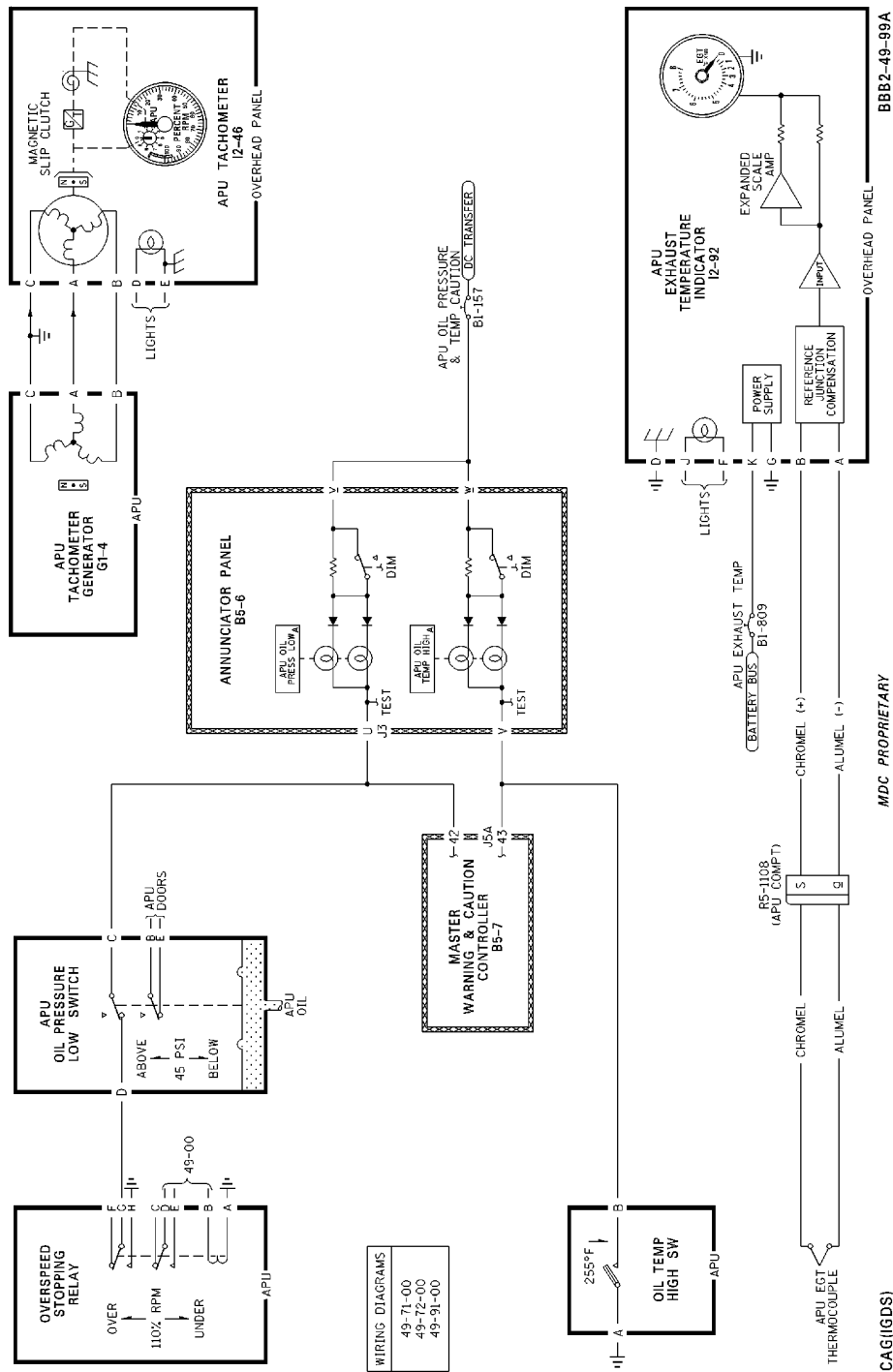
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**APU Indicating**  
Figure 1/49-70-00-990-801

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**AIRCRAFT MAINTENANCE MANUAL**  
**HOURLMETER - MAINTENANCE PRACTICES**

**1. General**

- A. The hourmeter is located on the left side of the APU below the generator. Access to the hourmeter is through the APU left access door.

**2. Removal/Installation Hourmeter**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUT-DOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. Remove Hourmeter

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Record total APU operation time and date before removing hourmeter.
- (3) Remove screws attaching hourmeter to shockmount and shock-mount to bracket on accessory drive case.
- (4) Tag and disconnect electrical wires from hourmeter.

**CAUTION:** USE EXTREME CARE IN HANDLING HOURLMETER.

- (5) Carefully remove hourmeter from shockmount.

- B. Install Hourmeter

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position hourmeter in shockmount making certain face is rotated as shown in Figure 201.
- (3) Remove tags and connect electrical wires to hourmeter.
- (4) Position hourmeter and shockmount on bracket and install screws.
- (5) If hourmeter is being replaced by new part, total APU operating time should be transcribed to tag attached to new hourmeter.
- (6) Remove the safety tag and close this circuit breaker:

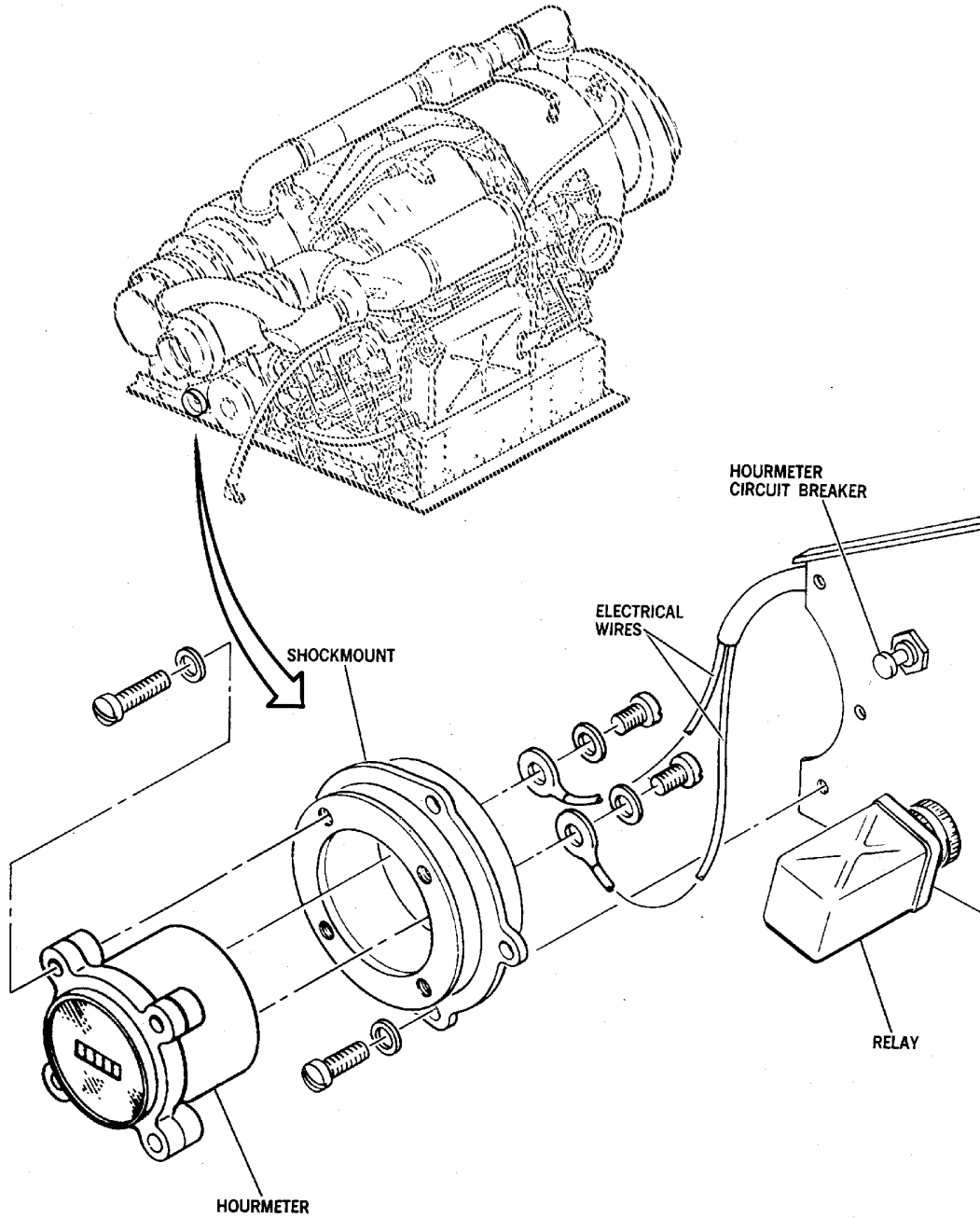
**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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**Hourmeter -- Installation**  
**Figure 201/49-70-01-990-801**

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## 49-70-01

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### EXHAUST GAS TEMPERATURE SYSTEM - DESCRIPTION AND OPERATION

#### 1. General

- A. The exhaust gas temperature (EGT) system provides a continuous readout of the exhaust gas temperature while the APU is operating. The system is composed of an EGT indicator, thermocouple probe, and necessary wiring.
- (1) Exhaust gas temperature indicator - the exhaust gas temperature indicator is located on the forward overhead switch panel in the flight compartment.
  - (2) Thermocouple probe - the thermocouple probe is mounted on the turbine exhaust flange in a position to be completely immersed in the turbine exhaust gas.

#### 2. Operation

- A. After APU start is initiated, the thermocouple probe will continuously monitor the EGT until the unit is shut down. The thermocouple probe creates a small current which is proportional to the temperature of the exhaust gas of the APU during operation. A Chromel wire (white) and an Alumel wire (green) carries the current to the system wiring. The system wiring then carries the current to the EGT indicator where it is displayed as EGT.

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### EXHAUST GAS TEMPERATURE INDICATOR - MAINTENANCE PRACTICES

#### 1. General

- A. The APU exhaust gas temperature indicator is located on the overhead switch panel in the flight compartment.

**CAUTION:** MAKE CERTAIN INDICATOR HAS BEEN CALIBRATED BEFORE INSTALLATION.

- B. After removal, install shorting wire between the thermocouple terminals on the indicator. This dampens the movement of the indicator pointer to prevent possible damage during handling. Remove the shorting wire before installation of the thermo-couple leads.

#### 2. Removal/Installation Exhaust Gas Temperature Indicator

- A. Remove Indicator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Loosen indicator mounting clamp screw.  
 (3) Carefully pull indicator clear of panel.  
 (4) Disconnect electrical connector.  
 (5) Disconnect thermocouple leads and install shorting wire between terminals.

- B. Install Indicator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove shorting wire and connect thermocouple leads to terminals.  
 (3) Connect electrical connector.  
 (4) Tighten indicator mounting clamp.  
 (5) Remove the safety tag and close this circuit breaker:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## EXHAUST GAS TEMPERATURE THERMOCOUPLE - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The EGT thermocouple is mounted on the lower side of the APU exhaust duct flange. Access to the thermocouple is through the APU right access door.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Antiseize compound, DOD-L-25681 DPM 5782	E/M Corp. North Hollywood, CA
Lockwire, NASM20995N32, DPM 684	Not Specified

### 3. Removal/Installation Thermocouple

- A. Remove Thermocouple

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Tag and disconnect electrical leads. (Figure 201)
- (3) Remove thermocouple mounting bolts.
- (4) Carefully withdraw thermocouple from mounting boss.

- B. Install Thermocouple

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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- (2) Carefully insert thermocouple body into exhaust duct flange and rotate until holes in attach flange line up with holes in exhaust flange. (Figure 201)

**WARNING:** MOLYBDENUM DISULFIDE SILICONE LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN MOLYBDENUM DISULFIDE SILICONE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET MOLYBDENUM DISULFIDE SILICONE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

- (3) Apply antiseize compound (MIL-L-25681) to bolt threads before installing.
- (4) Safety thermocouple attach bolts with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (5) Remove tags and connect electrical cables.
- (6) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

EFFECTIVITY  
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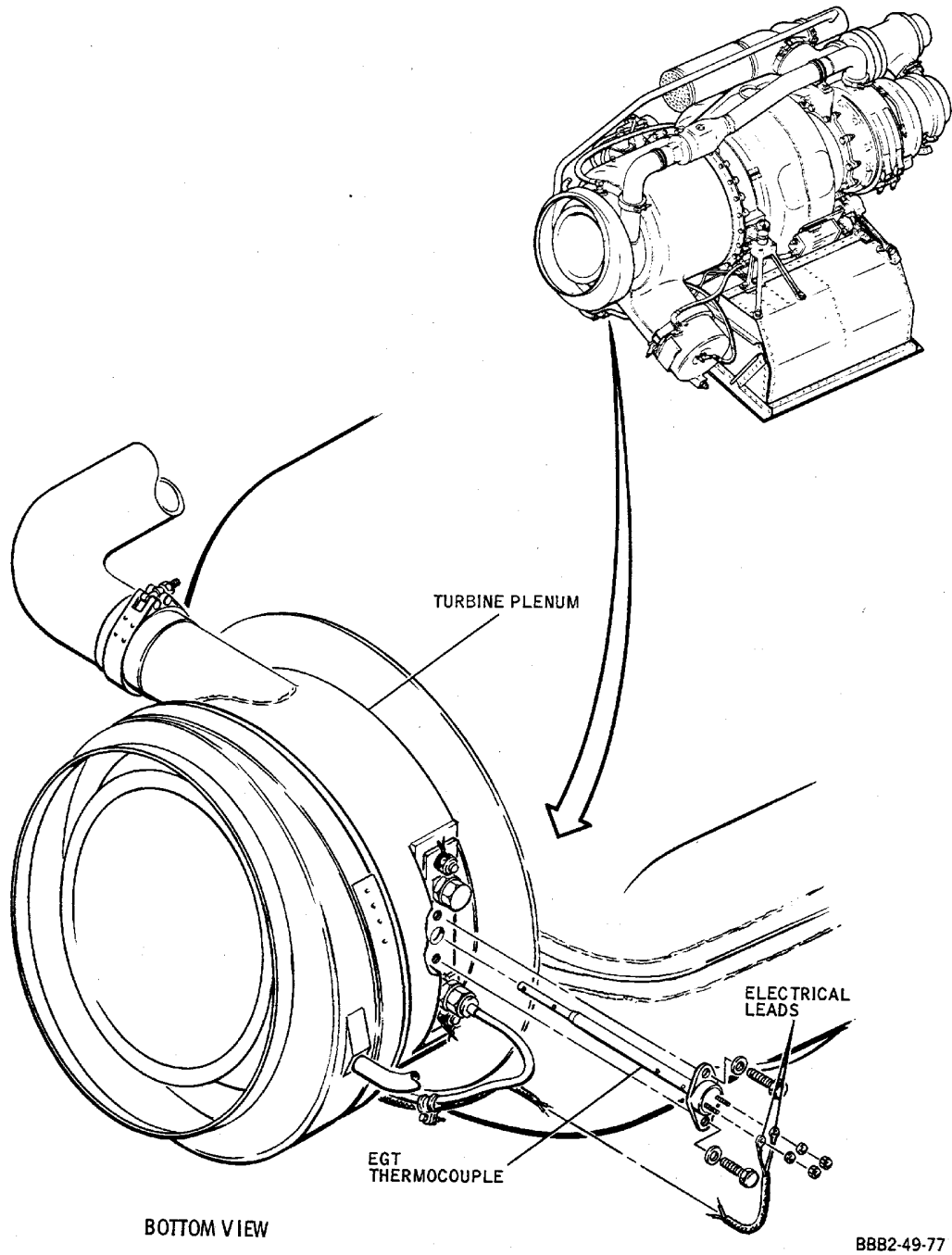
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Exhaust Gas Temperature Thermocouple -- Installation  
Figure 201/49-71-02-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### TACHOMETER SYSTEM - DESCRIPTION AND OPERATION

#### 1. General

- A. The tachometer system consists of an APU-mounted tachometer generator and an indicator mounted on the upper instrument panel in the flight compartment.
- B. The tachometer generator is a 3-phase, mechanically driven, synchronous motor. The generator is contained in a housing mounted on the APU accessory drive gear case.
- C. The tachometer indicator is an integrally lighted, magnet drag-type indicating mechanism, contained in a hermetically sealed case. The indicator is not adjustable at field maintenance level.

#### 2. Operation

- A. The tachometer generator creates voltage and frequency as it is driven by the accessory drive output. Increase or decrease in accessory drive speed proportionally increases or decreases the voltage and frequency output of the generator. The output is fed through the system wiring to the indicator where it is translated and displayed as percent rpm.

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**TACHOMETER SYSTEM - TROUBLE SHOOTING**

**1. General**

- A. This procedure outlines a method of trouble shooting the APU tachometer system when one of the following conditions exists:
- (1) Tachometer indicator does not function. (Figure 101 (Sheet 1))
  - (2) Tachometer indicator reads low, or indicator pointer fluctuates excessively. (Figure 101 (Sheet 2))

**2. Equipment and Materials**

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 101**

Name and Number	Manufacturer
Grease, MIL-G-81322 DPM 327	Texaco Inc., 4401 Atlantic Ave., Long Beach, CA 90807
APU Tester, 290122	AiResearch
APU Tester cable, 290124	AiResearch
Tachometer indicator testor, (TAKCAL)(V98869)	B and H Instrument Co., Inc.

**3. Trouble Shooting**

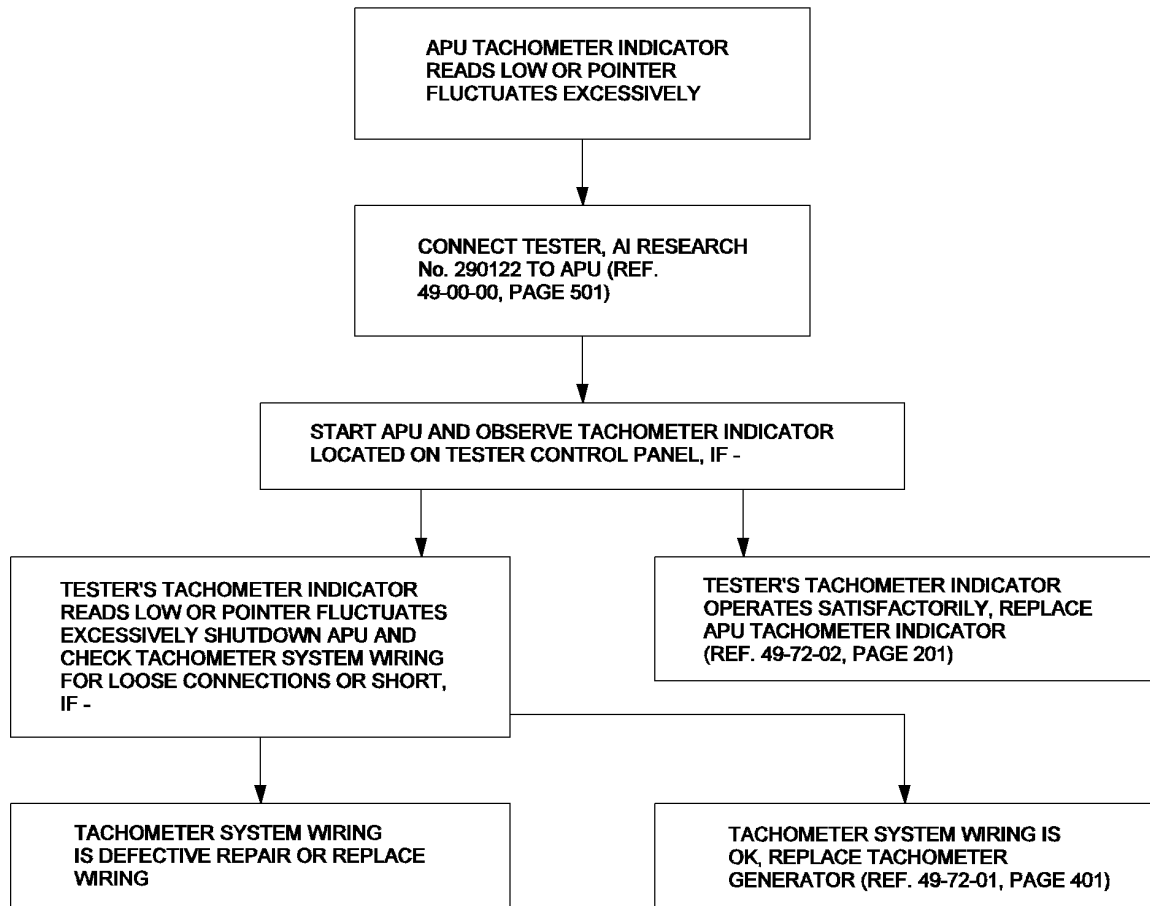
- A. To trouble shoot APU tachometer system proceed as shown on Figure 101.

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Tachometer System -- Trouble Shooting  
Figure 101/49-72-00-990-801 (Sheet 1 of 2)

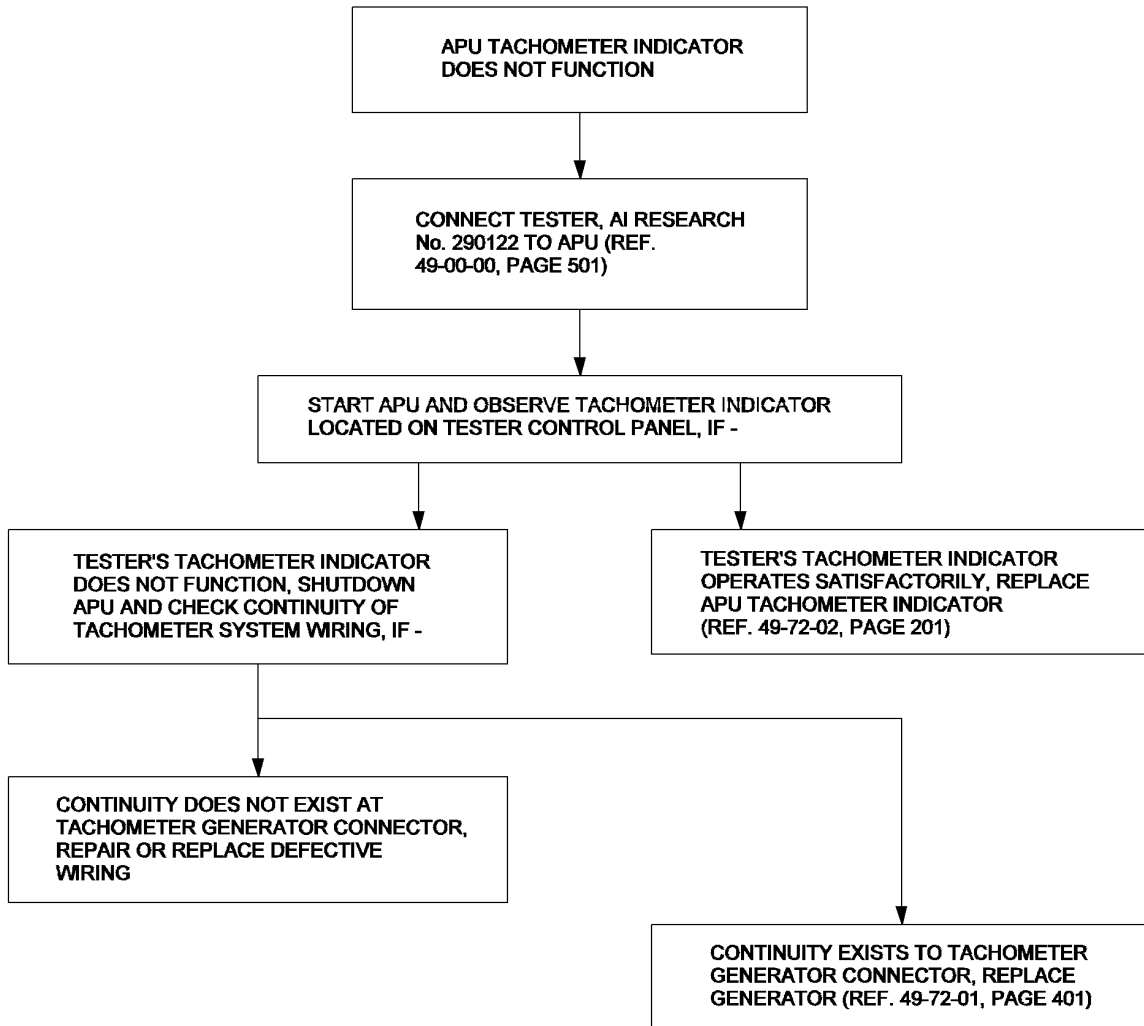
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Tachometer System -- Trouble Shooting  
Figure 101/49-72-00-990-801 (Sheet 2 of 2)

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## 49-72-00

# MD-80 AIRCRAFT MAINTENANCE MANUAL

## TACHOMETER GENERATOR - REMOVAL/INSTALLATION

### 1. General

- A. The tachometer generator is mounted on the left side of the APU and is driven by the engine accessory drive. Access to the generator is through the APU left access door.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 401**

Name and Number	Manufacturer
Plastic Unthreaded Connector Cap (DPM 1931-1 MS90376)	

### 3. Removal/Installation Tachometer Generator

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN BEFORE ATTEMPTING MAINTENANCE PROCEDURES, OR INJURY TO PERSONNEL COULD RESULT.

**WARNING:** MAKE CERTAIN THAT APU MASTER SWITCH IN FLIGHT COMPARTMENT IS IN OFF POSITION.

- A. Remove Generator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect tachometer generator electrical connector. (Figure 401)  
 (3) Install unthreaded circular connector plastic caps, G60065 on the electrical connector.  
 (4) Remove tachometer generator mounting nuts.  
 (5) Carefully disengage splined shaft and remove tachometer generator.  
 (6) Remove gasket.

- B. Install Generator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (2) Install new gasket on tachometer generator mounting pad.
- (3) Carefully insert tachometer generator drive shaft in mounting boss and engage splines.
- (4) Install tachometer generator and torque mounting nuts to 25 in-lb (3 N-m)..
- (5) Check the electrical connector for damage and unwanted material. (GENERAL INSTALLATIONS HARDWARE - MAINTENANCE PRACTICES, SWPM 20-20-03)
- (6) Connect tachometer generator electrical connector.
- (7) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (8) Perform functional test of tachometer system at next engine run. (GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 1 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 3 or GENERAL - ADJUSTMENT/TEST, PAGEBLOCK 49-00-00/501 Config 2 )

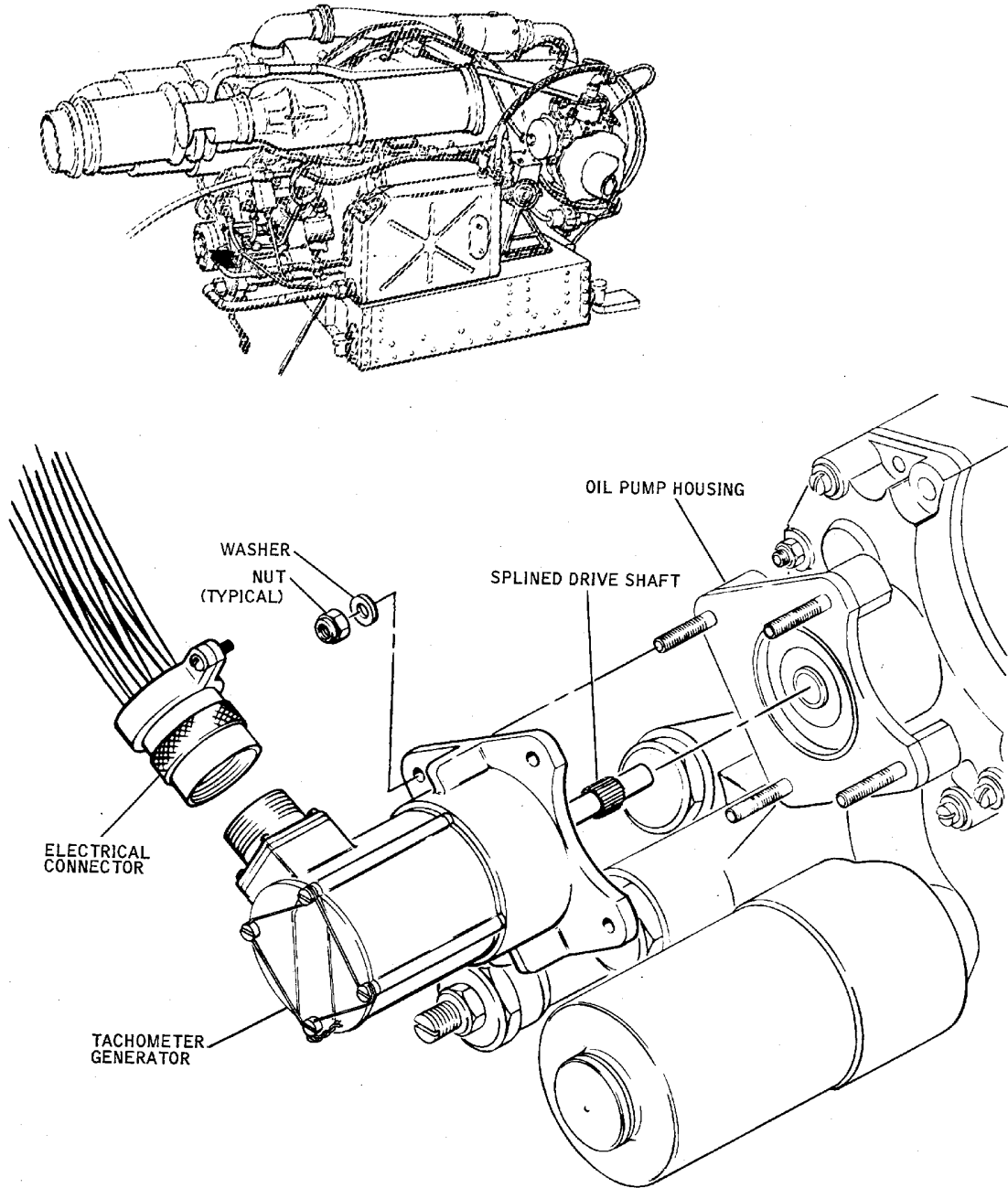
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**Tachometer Generator --Removal/ Installation  
Figure 401/49-72-01-990-801**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## TACHOMETER SYSTEMS - ADJUSTMENT/TEST

### 1. General

A. The APU tachometer generator is tested with the unit shut down. Two methods for testing the tachometer are provided in the following procedures.

### 2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 501**

Name and Number	Manufacturer
Standard test generator	
Electric motor	
Adapter harness	Fabricate locally
Portable tachometer tester, Model T.T. Type M-5	United Manufacturing Division, UMC Electronics Company, North Haven, Conn.
Lockwire, NASM20995N20, DPM 684	Not Specified

### 3. Adjustment/Test Tachometer System

#### A. Test Tachometer System

- (1) Disconnect tachometer generator electrical connector.
- (2) If test generator can be mated to tachometer generator electrical connector, proceed with test. If test generator cannot be mated to tachometer generator electrical connector, fabricate adapter harness and connect as follows:
  - (a) Using adapter harness, connect test generator to pin A of tachometer generator electrical connector.
  - (b) Using adapter harness, connect test generator to pin B of tachometer generator electrical connector.
  - (c) Using adapter harness, establish ground connection to pin C of tachometer generator electrical connector.
- (3) Drive test generator using electric motor and check values shown in Table 502. Tachometer indicator in flight department must reflect the following percentages within noted tolerances.
 

NOTE: Clear indicator by tapping lightly before reading. Indicator pointers must operate smoothly over scale and glass cover should fit tight and be free of cracks.
- (4) Disconnect test generator from electric motor.
- (5) Disconnect test generator and adapter harness from tachometer generator electrical connector.
- (6) Connect tachometer generator electrical connector and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**Table 502 Percentage Chart**

Generator RPM	Indicator Percent of RPM	Tolerance in Percent of RPM
0	0	±0.50
840	20	±0.50
2520	60	±0.80
4200	100	±0.50

**B. Test Tachometer Generator Using Type M-5 Tachometer Tester**

- (1) Remove tachometer generator from APU. (TACHOMETER GENERATOR - REMOVAL/INSTALLATION, PAGEBLOCK 49-72-01/401)
- (2) Mount tachometer generator on tester two-to-one speed booster.
- (3) Carefully insert booster drive shaft into tester gear box.
- (4) Position swing clamps and secure booster to tester with clamp nuts.
- (5) Connect tester power cable to 115v, 60 cycle power source.
- (6) Connect tester tachometer test generator cable to tester.
- (7) Connect other end of test cable to tachometer generator mounted on tester.
- (8) Place tester selector switch in generator test position.
- (9) Place tester power switch in on position.
- (10) Turn rpm control switch to any desired speed.
- (11) With engine tachometer generator running at selected speed read master indicator on tester.
- (12) Place tester selector switch in indicator test position and read master indicator on tester.  
NOTE: This action drives the master tachometer generator located on tester.
- (13) Refer to comparison table inside tester cover and check reading obtained in Paragraph 3.B.(12) with reading obtained in Paragraph 3.B.(11).
- (14) When malfunction is indicated replace defective tachometer indicator.
- (15) Remove and stow test equipment.

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### TACHOMETER INDICATOR - MAINTENANCE PRACTICES

**1. General**

A. The tachometer indicator is located on the overhead instrument panel in the flight compartment.

**2. Removal/Installation Tachometer Indicator**

A. Remove Indicator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Loosen indicator mounting clamp.
- (3) Carefully pull indicator clear of panel.
- (4) Disconnect indicator electrical connector.

B. Install Indicator

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Connect indicator electrical connector.
- (3) Carefully insert indicator into panel.
- (4) Tighten indicator mounting clamp.
- (5) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

EFFECTIVITY WJE ALL	
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**AIRCRAFT MAINTENANCE MANUAL**  
**EXHAUST - DESCRIPTION AND OPERATION**

**1. General**

- A. Exhaust gases from the APU are conducted through a shrouded duct system and vented to atmosphere above the right engine pylon. This system is used to protect the APU compartment and the aft accessory compartment from excessive temperatures which could result from delivery of hot exhaust gases through ducting in these compartments. Cooling air is circulated in the annular space between primary exhaust ducts and the shrouds. The exhaust system consists of the following major components: a short section of demountable exhaust duct shroud, an inner elbow, an outer elbow, a length of demountable duct, and a short length of unshrouded duct.
- B. A drain for draining moisture from the exhaust duct shrouds is located on the lower surface of the demountable shroud. This shroud must be removed to gain access to the coupling attaching the inner elbow to the exhaust flange. The demountable exhaust duct shroud and both elbows are accessible through the APU right access door. Access to the remainder of the shrouded exhaust ducts, located in the aft accessory compartment, is through the tailcone access door.

**2. Operation**

- A. When the APU is in operation, cooling air passing through the generator is collected and ducted through a check valve to the turbine exhaust shroud. This air enters the exhaust duct shroud and is diverted to the lower side by a baffle attached to the shroud seal support. The baffle is provided with an outlet on the lower side which directs the cool air flow to the lower outboard external surface of the exhaust elbow, to provide maximum cooling where exhaust gases impinge on the inside surface. From this point the cooling air is allowed to flow up and around the exhaust duct until vented to atmosphere through a short section of duct near the upper end.
  - (1) During APU operation when a bleed air load is being applied, the exhaust system is protected by the load control thermo-stat which will modulate the load control valve towards the closed position when exhaust temperatures rise above the thermostat setting. This action will increase the amount of compressor air available to the combustor/turbine section and thereby alleviate the overtemperature condition.
  - (2) Whenever APU is operating, the exhaust gas temperature is constantly displayed on the EGT indicator in the flight compartment.

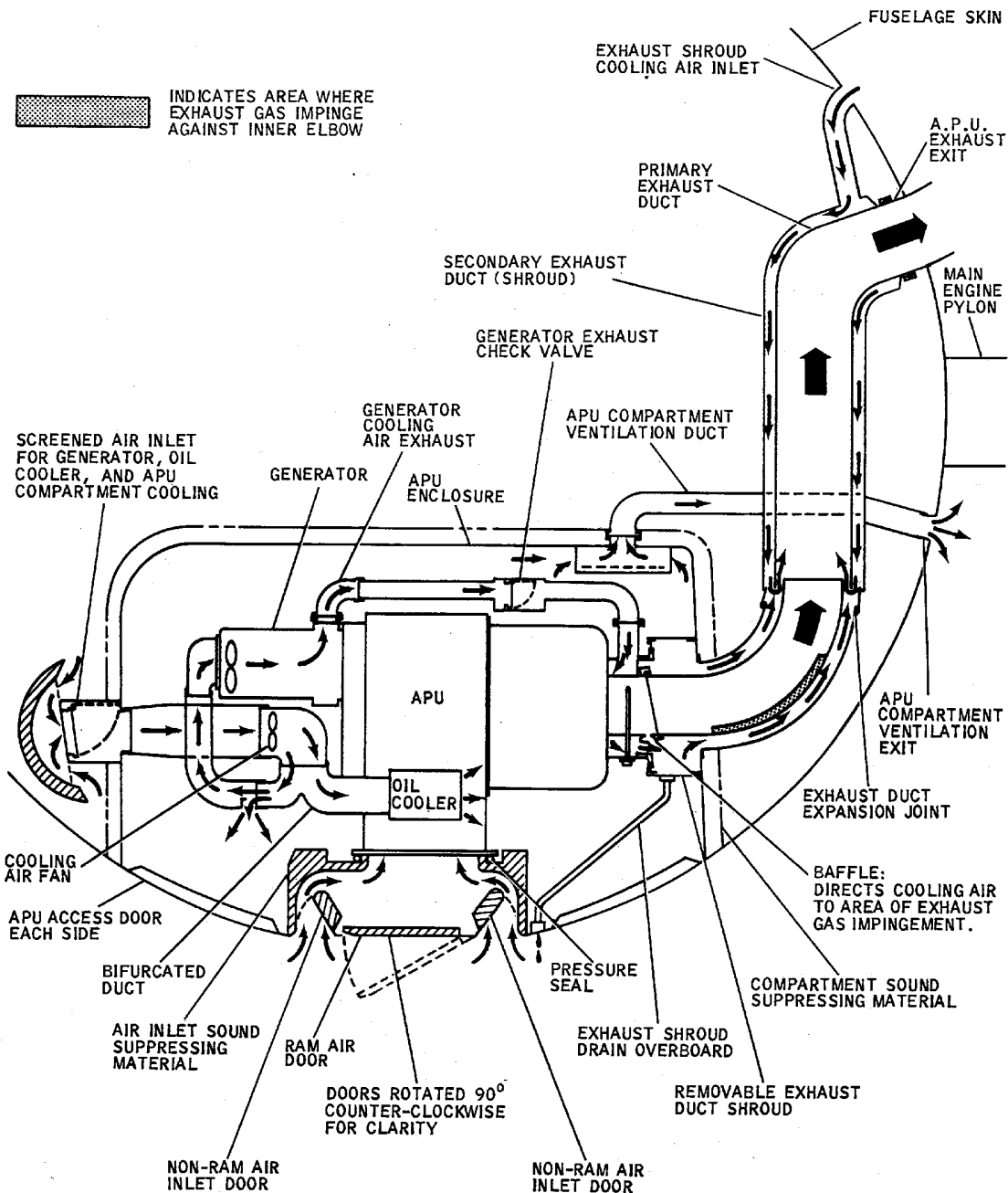
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**APU Exhaust -- Schematic  
Figure 1/49-80-00-990-801**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## EXHAUST DUCT AND SHROUD - MAINTENANCE PRACTICES

### 1. General

A. The APU exhaust duct and duct shroud are located between the exhaust flange components inside the APU enclosure and the exit duct in the fuselage skin above the enclosure. The exhaust duct, insulation blanket, and lower and upper duct clamps are located in the aft accessory compartment on the right side of the enclosure. Access is through either the tailcone access door or emergency exit in the aft pressure bulkhead. Access to the exhaust duct flange and duct shroud is through the APU right access door.

### 2. Equipment and Materials

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**NOTE:** Equivalent substitutes may be used instead of the following items.

**Table 201**

Name and Number	Manufacturer
Lockwire, NASM20995N32, DPM 684	Not Specified
Torque wrench (0-100 inch pounds range)	

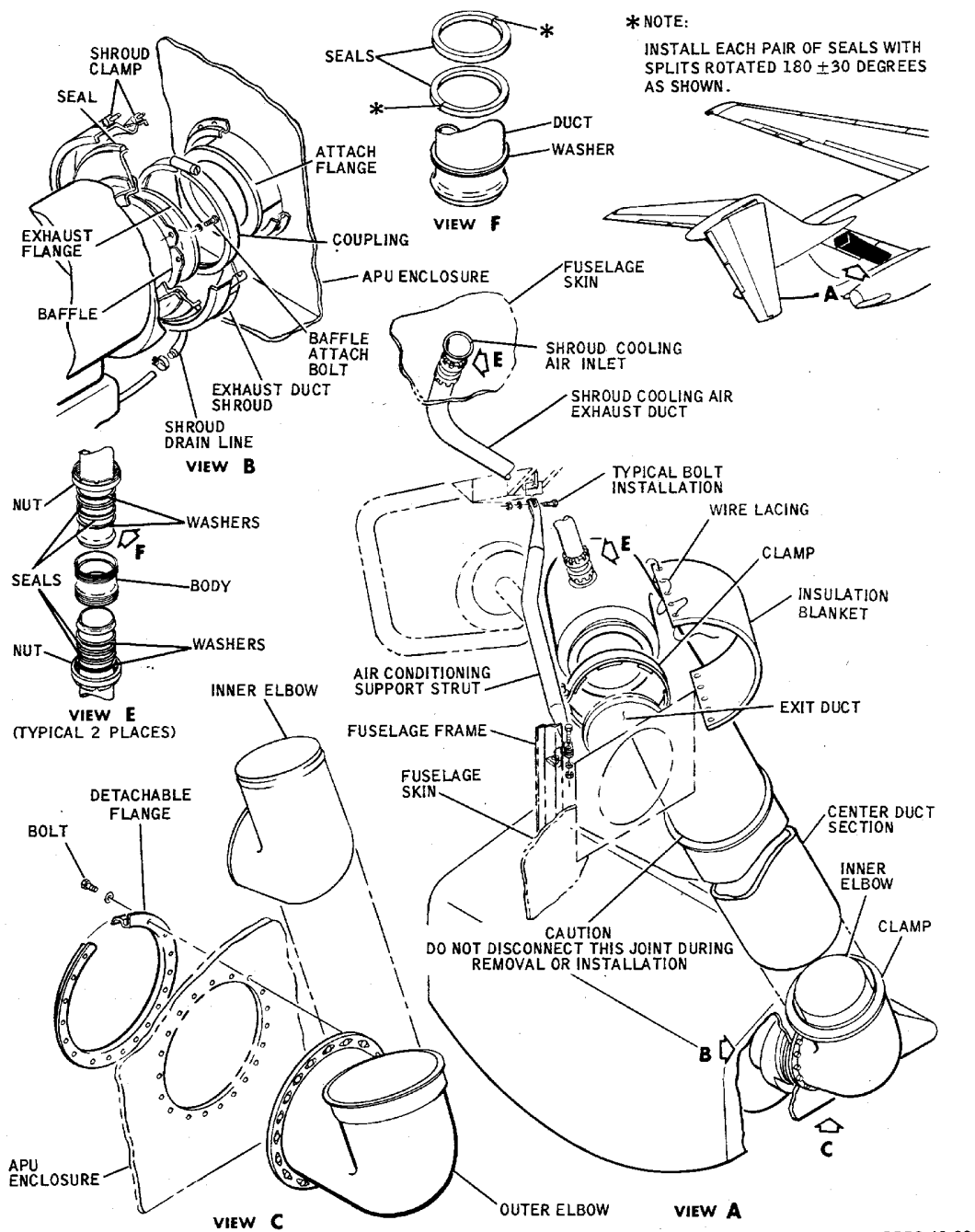
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**Exhaust Duct and Shroud -- Installation**  
Figure 201/49-80-01-990-801 (Sheet 1 of 2)

**EFFECTIVITY**

WJE 401-406, 409, 412, 414-416, 418, 420, 422, 424-427, 429, 861-866, 868, 873, 874, 880, 881, 883, 884, 886, 887, 891-893

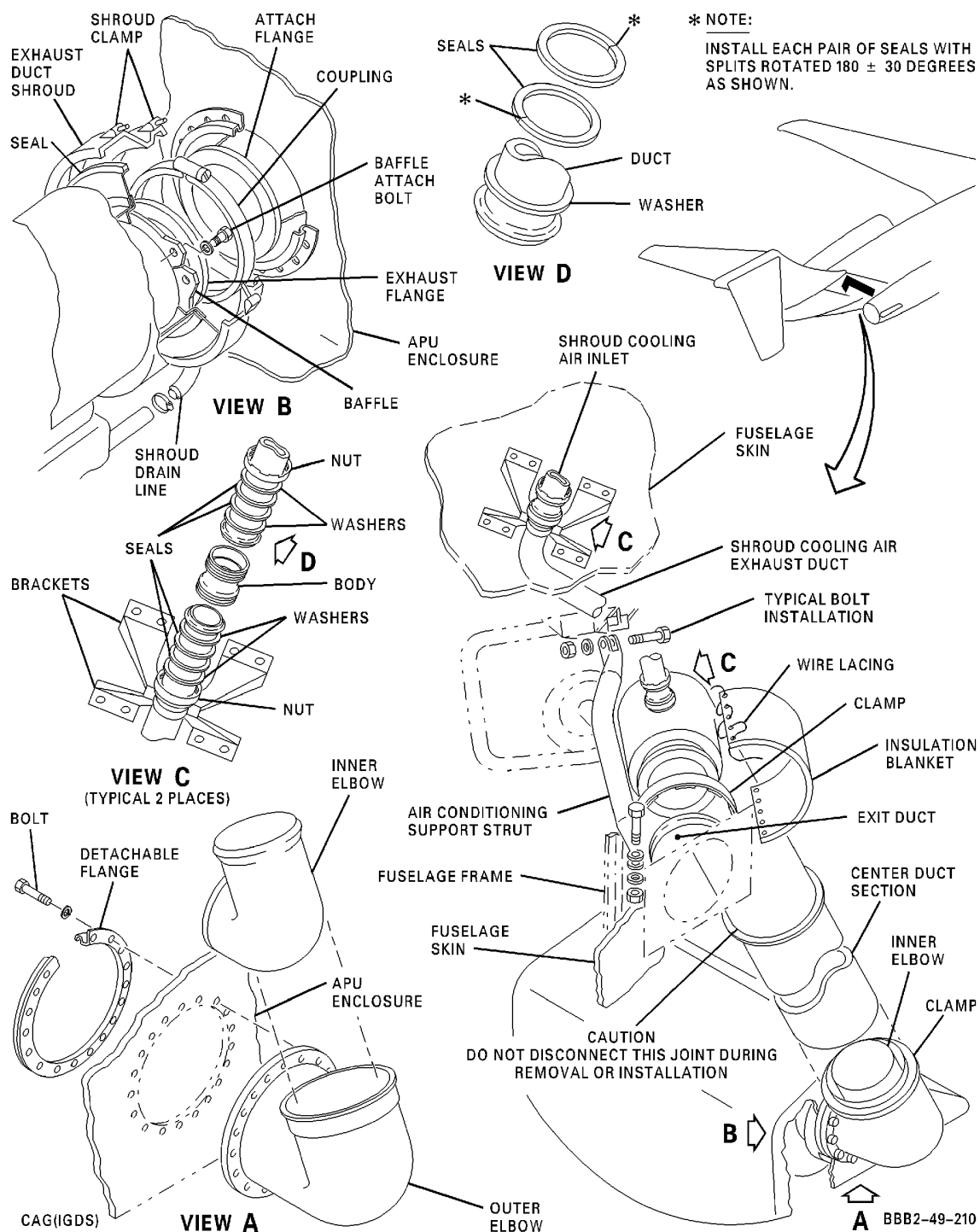
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**Exhaust Duct and Shroud -- Installation**  
**Figure 201/49-80-01-990-801 (Sheet 2 of 2)**

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WJE 407, 408, 410, 411, 417, 419, 421, 423, 869, 871,  
872, 875-879

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 3. Removal/Installation Exhaust Duct and Shroud

**NOTE:** Exterior surfaces of exhaust shroud center duct section and outer elbow are acceptable for continued service with paint which is cracked, flaked or peeled, or if slightly discolored or charred. Ducts exhibiting these conditions should be routed to the shop for repainting per Douglas OHM 49-50-8 when removed from the aircraft for other causes. Excessive paint discoloration or charring may be an indication of exhaust duct leakage and should be checked for condition.

#### A. Remove Exhaust Duct Shroud

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

**CAUTION:** EXERCISE EXTREME CARE WHEN HANDLING EXHAUST DUCT. DUCT SHOULD NOT BE INSTALLED IN DAMAGED CONDITION AS DENTS IN EITHER INNER DUCT OR OUTER SHROUD COULD IMPEDE GAS FLOW AND RESULT IN HOT SPOTS OR EXHAUST DUCT FAILURE.

- (1) Open this circuit breaker and install safety tag:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect shroud drain line. (Figure 201)
- (3) Remove shroud clamp from attach flange on enclosure.
- (4) Remove shroud clamp from seal on exhaust flange.
- (5) Remove exhaust duct shroud.
- (6) Rotate seal and check for damage. If damage is evident, install new seal. (Paragraph 3.F.)

#### B. Install Exhaust Duct Shroud

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position shroud to attach flange on enclosure and seal on exhaust flange. (Figure 201)
- (3) Install shroud clamp on enclosure attach flange.
- (4) Install shroud clamp on exhaust flange seal.
- (5) Connect shroud drain line to shroud.
- (6) Remove the safety tag and close this circuit breaker:

#### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

#### C. Remove Air Baffles

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove exhaust duct shroud. (Paragraph 3.A.)
- (3) Remove bolts, nuts, and washers attaching air baffles to seal retainer. (Figure 201)
- (4) Remove baffles and check for distortion and possible cracks in area around bolt holes. If damage is evident, replace baffle.

D. Install Air Baffles

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position baffles on seal retainer and install bolts, nuts, and washers. (Figure 201)
- (3) Install exhaust duct shroud. (Paragraph 3.B.)
- (4) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

E. Remove Exhaust Duct Shroud Seal and Retainer

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove exhaust duct shroud. (Paragraph 3.A.)
- (3) Remove air baffles. (Paragraph 3.C.)
- (4) Remove coupling attaching inner elbow to exhaust flange. (Figure 201)
- (5) Slide inner elbow up in outer elbow for access to seal retainer attach bolts.
- (6) Remove bolts, nuts, and washers attaching seal retainer to exhaust flange.

F. Install Exhaust Duct Shroud Seal and Retainer

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position seal and retainer on exhaust flange. (Figure 201)
- (3) Install bolts, nuts, and washers attaching seal retainer to exhaust flange.
- (4) Install air baffles. (Paragraph 3.D.)
- (5) Position inner elbow on exhaust flange.
- (6) Tighten selflocking nut on T-bolt to 15 inch-pounds free running torque.

**NOTE:** Free running torque values are established when the nut is run on T-bolt sufficiently to lock the coupling on the duct.

- (7) Torque nut on T-bolt an additional 50 to 70 inch-pounds above free running torque established in step (7), giving a final torque of approximately 65 to 85 inch-pounds.
- (8) Install exhaust duct shroud. (Paragraph 3.B.)
- (9) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

#### G. Remove Exhaust Cooling Air Inlet Duct

- (1) Disconnect lower end of air inlet duct from flange on exhaust duct as follows: (Figure 201)
  - (a) Back lower nut off connector body and leave in position on flange of exhaust duct.
  - (b) Back upper nut off connector body and move both connector and nut upward to clear duct joint.
- (2) Disconnect upper end of air inlet duct from flange on fuselage skin.

**WJE 401-412, 414-427, 429, 861-866, 868, 869, 871, 872, 875-881, 883, 884, 886, 887, 891**

- (a) On aircraft with support bracket installed, remove clamp, bolts, nuts and washers securing upper end of air inlet duct to support bracket.

#### WJE ALL

- (b) Back upper nut off connector body and move upward on air inlet flange.
- (c) Back lower nut off connector body and slip downward to clear duct joint.
- (d) Remove air inlet duct.
- (3) Remove sections of both upper and lower connectors from air inlet duct.

#### H. Install Exhaust Cooling Air Duct

- (1) Position sections of both upper and lower connectors on new air duct. (Figure 201)
- (2) Check all seals on both upper and lower connectors for visible damage and replace if necessary.

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**CAUTION:** LAMINATED GRAPHITE SEALS ARE VERY FRAGILE AND MUST BE HANDLED WITH EXTREME CARE. SEALS DAMAGED BY CARELESS HANDLING MUST BE REPLACED.

- (3) Install each pair of seals with split rims 180(±30) degrees apart as shown. (Figure 201 for proper installation.)

**NOTE:** If necessary remove seal laminations as necessary to obtain required tolerance.

**CAUTION:** MAKE CERTAIN THAT GAP BETWEEN UPPER END OF DUCT AND MATCHING FLANGE IS HELD BETWEEN 0 TO 5/8 INCH TOLERANCE.

- (4) Position duct at upper inlet flange and slide connector body over joint.
- (5) Tighten both nuts on upper connector handtight. Safety nuts with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (6) Align lower end of duct with matching flange on APU exhaust duct.
- (7) Install lower connector as outlined in steps Paragraph 3.H.(1) through Paragraph 3.H.(5) observing all CAUTIONS and NOTES.

**WJE 401-412, 414-427, 429, 861-866, 868, 869, 871, 872, 875-881, 883, 884, 886, 887, 891**

- (8) On aircraft with support bracket, install clamp, bolts, nuts and washers securing upper end of air inlet duct to support bracket.

**WJE ALL**

- I. Remove Center Duct Section

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

**CAUTION:** DO NOT DISCONNECT CENTER JOINT OF CENTER DUCT SECTION. IF JOINT IS DISCONNECTED DURING REMOVAL. CONSIDERABLE DIFFICULTY WILL BE ENCOUNTERED DURING INSTALLATION OF DUCT.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove cooling air duct. (Paragraph 3.G.)
  - (a) Remove clamp attaching cooling air duct sleeve to center duct section.
  - (b) Remove clamp attaching cooling air duct sleeve to inlet port.
  - (c) Remove cooling air duct.
- (3) Remove air-conditioning support strut as follows:
  - (a) Remove bolt, nut, and washer attaching strut to right primary heat exchanger.
  - (b) Remove bolt, nut, and washer attaching strut to fuselage structure.
  - (c) Remove strut.
- (4) Remove wire lacing and insulation blanket from center duct section.
- (5) Remove clamp attaching center duct section to exit duct.
- (6) Remove clamp attaching center duct section to outer elbow.
- (7) Remove center duct section.

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**CAUTION:** EXERCISE EXTREME CARE WHEN HANDLING EXHAUST DUCT. DUCT SHOULD NOT BE INSTALLED IN DAMAGED CONDITION AS DENTS IN EITHER INNER DUCT OR OUTER SHROUD COULD IMPEDE GAS FLOW AND RESULT IN HOT SPOTS OR EXHAUST DUCT FAILURE.

J. Install Center Duct Section

**NOTE:** If center duct clamp at center joint has been removed, reassemble by aligning arrows and install clamp. If arrows are not present, assemble outer exhaust shrouds and rotate until inner duct brackets contact. Back shrouds off about 0.060 inch and install clamp.

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position center duct section and align slots in mating flanges at exit duct. (Figure 201)
- (3) Install clamp connecting center duct section to exit duct fingertight.
- (4) Install clamp connecting center duct section to outer elbow fingertight.
- (5) Tighten clamp connecting center duct section to exit duct and torque to 10(±5) inch-pounds.
- (6) Tighten clamp connecting center duct section to outer elbow and torque from 50 to 70 inch-pounds.

**NOTE:** End of blanket should extend to within 1/4-inch maximum from fuselage skin.

**CAUTION:** MAKE CERTAIN INSULATION BLANKET PROVIDES MAXIMUM COVERAGE AT UPPER END OF DUCT TO ENSURE PROTECTION OF LONGERONS AND ADJACENT STRUCTURE FROM EXHAUST HEAT DAMAGE.

- (7) Position insulation blanket and lace with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (8) Install air-conditioning support strut as follows:
  - (a) Position strut on attach fittings.
  - (b) Install bolt, nut, and washer attaching strut to fuselage structure.
  - (c) Install bolt, nut, and washer attaching strut to right primary heat exchanger.
- (9) Install exhaust cooling air duct as outlined in Paragraph 3.H..
- (10) Install exhaust duct shroud. (Paragraph 3.B.)
- (11) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

K. Remove Exhaust Duct Elbows

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove exhaust duct shroud. (Paragraph 3.A.)
- (3) Remove center duct section. (Paragraph 3.I.)
- (4) Remove bolts and washers from flange on APU enclosure. (Figure 201)
- (5) Remove outer elbow and detachable flange.
- (6) Remove coupling attaching elbow to exhaust flange.
- (7) Remove inner elbow.

L. Install Exhaust Duct Elbows

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Apply faying surface seal of silicone sealant, RTV-88 to flange of outer elbow and detachable flange. (Figure 201)
- (3) Install bolts and washers attaching outer elbow to APU enclosure.
- (4) Position inner elbow.
- (5) Position coupling on inner elbow and exhaust flange.
- (6) Tighten self-locking nut on T-bolt to 15 inch-pounds free running torque.

**NOTE:** Free running torque values are established when the nut is run on T-bolt sufficiently to lock coupling on the duct.

- (7) Torque nut on T-bolt an additional 50 to 70 inch-pounds above free running torque established in step Paragraph 3.L.(6), giving a final torque of approximately 65 to 85 inch-pounds.

**NOTE:** Check that clearance between inner elbow and outer elbow on forward side is at least 3/4 inch (19.05 mm). If not, indexing pin may require relocation as shown on Figure 203.

- (8) Install center duct section. (Paragraph 3.J.)
- (9) Install exhaust duct shroud. (Paragraph 3.B.)
- (10) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

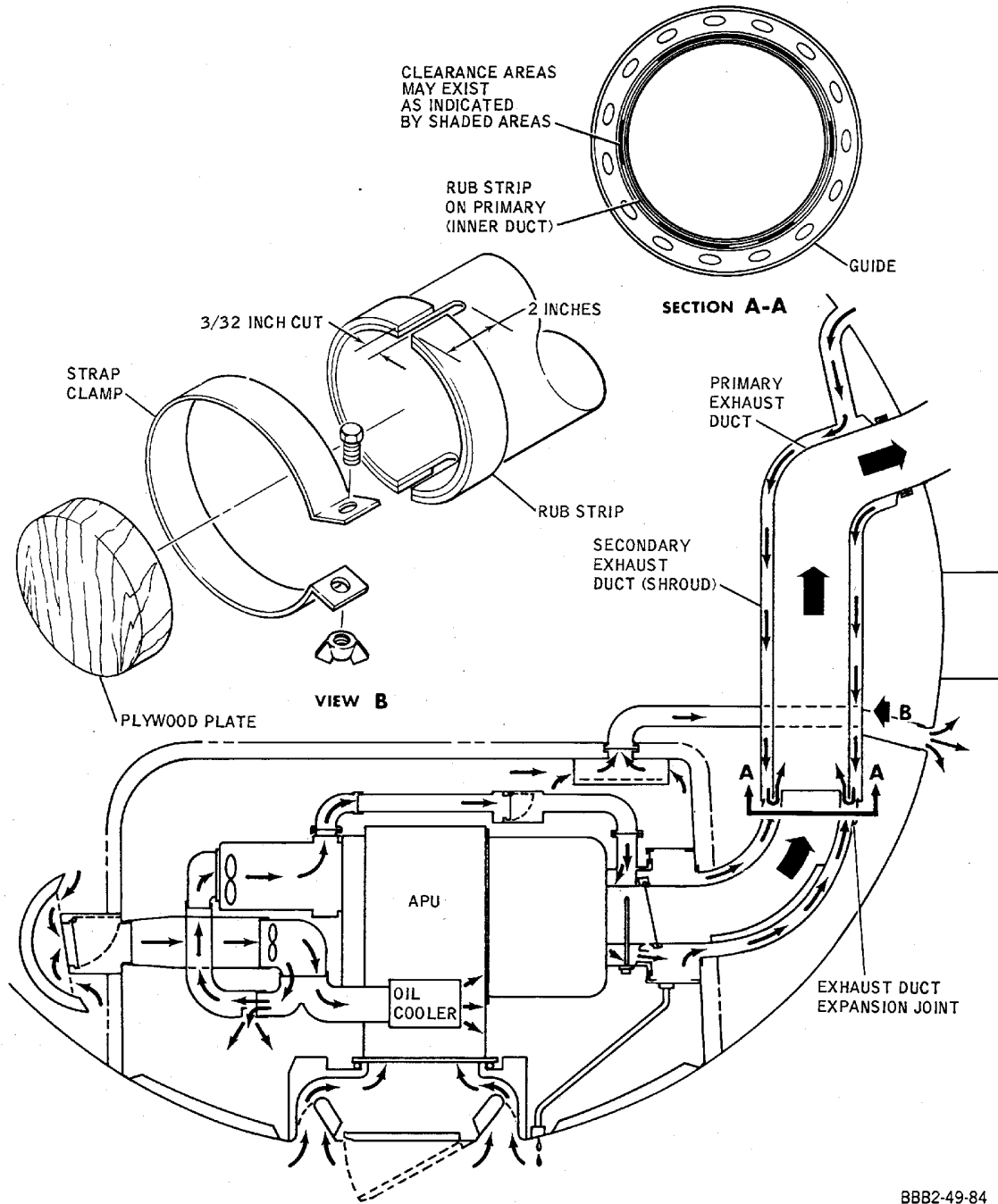
<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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**Exhaust Duct and Shroud -- Approved Repair  
Figure 202/49-80-01-990-802**

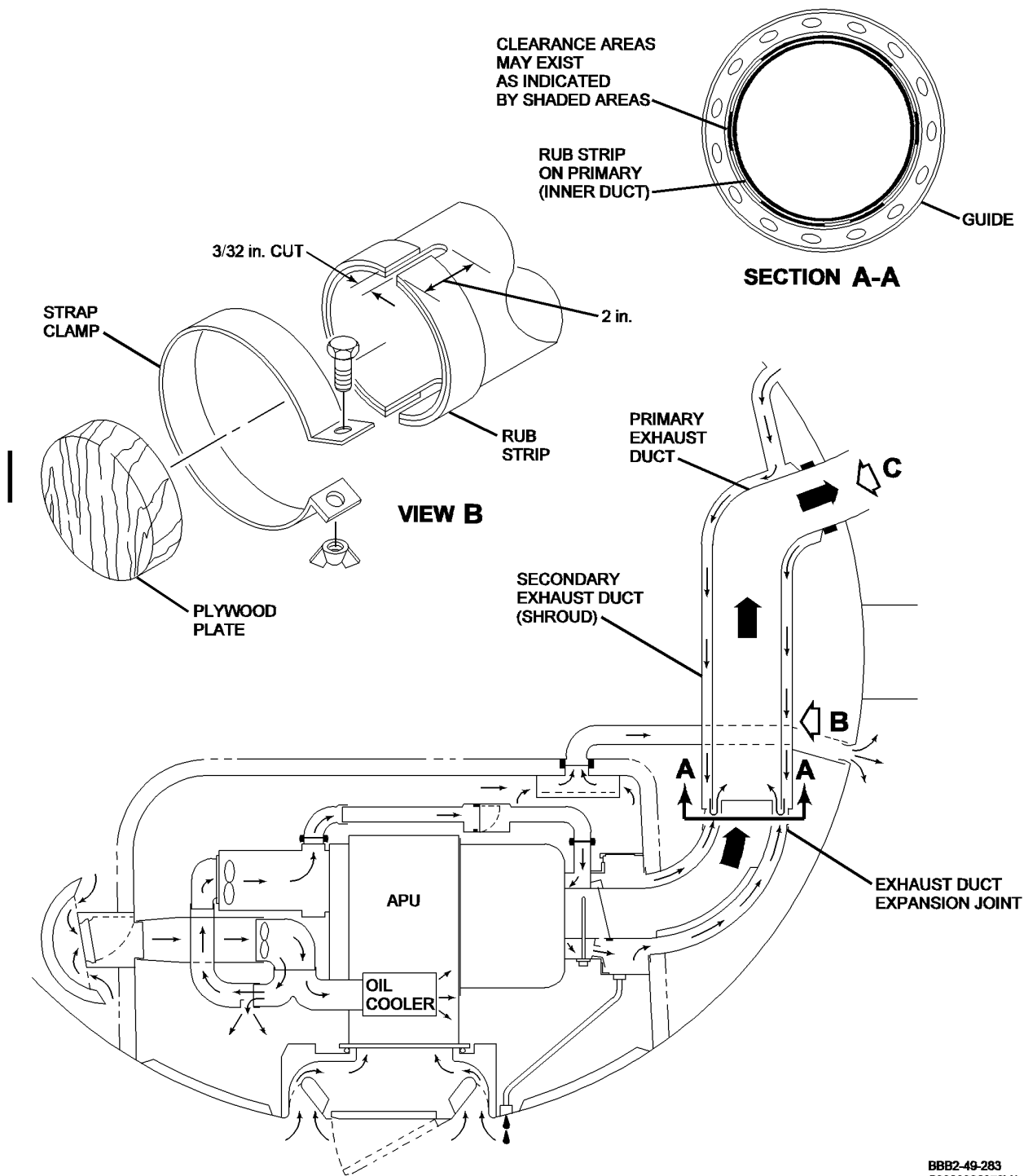
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**Exhaust Duct -- Rework  
Figure 203/49-80-01-990-803 (Sheet 1 of 2)**

EFFECTIVITY  
WJE ALL

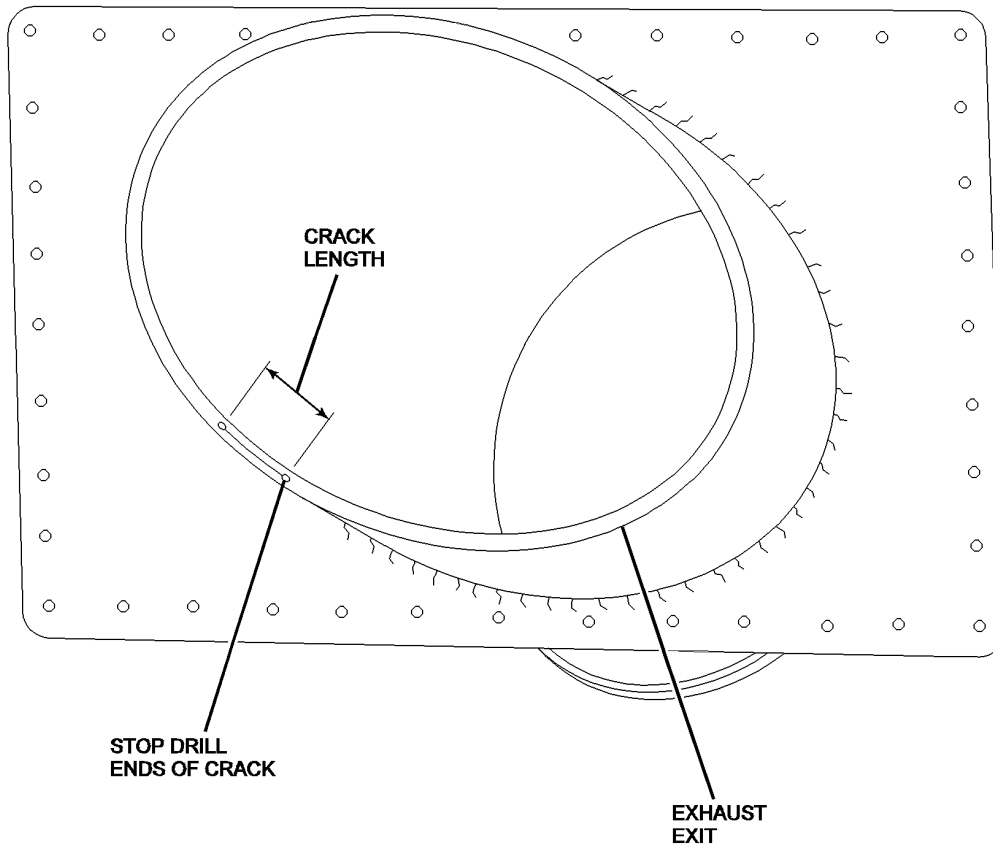
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**VIEW C**

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**Exhaust Duct -- Rework  
Figure 203/49-80-01-990-803 (Sheet 2 of 2)**

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### 4. Approved Repairs Exhaust Duct and Shroud

#### A. Exhaust Pipe Expansion Joint Clearance

NOTE: This procedure is recommended when either the APU or exhaust duct is removed for maintenance.

- (1) Remove inner elbow for access to expansion joint.
- (2) Insert .032 inch strip of sheet stock between guide and rub strip on lower end of exhaust duct. (Figure 202)
- (3) One half of duct circumference should be sufficiently clear to accept .032 inch strip without forcing.

NOTE: Intermittent clearances may be encountered and are acceptable provided one half or more of duct circumference has .032 inch or more expansion capability.

- (4) If .020 inch strip cannot be inserted sufficiently to meet requirements as indicated in step Paragraph 4.A.(3), inner exhaust duct should be modified as follows:
  - (a) Make two 3/32 inch cuts through pipe and rub strips approximately two inches long and diametrically opposed as shown on Figure 202.

**CAUTION:** PLATE IS NECESSARY TO PREVENT LOSS OF DUCT CONCENTRICITY WHEN TIGHTENING CLAMP.

- (b) Insert 9 7/8 inch diameter plywood plate in end of duct and tighten strap clamp until ends of both cuts are closed.
  - (c) Remove plywood plate and tackweld ends of both slots.
  - (d) Remove strap clamp and weld slots completely from inside duct.
  - (e) Grind outer surface of weld in rub strip area until surface is smooth.
- (5) Install inner elbow.

#### B. Exhaust Exit Assembly

NOTE: This procedure may be performed with the exhaust exit assembly installed on the aircraft.

- (1) Cracks along the edge of the APU exhaust exit assembly flange are permitted if they are within the following limits: (Figure 203, View C)
  - (a) Maximum number of cracks: 2.
  - (b) Maximum length of any crack: 1.5 inches.
  - (c) Distance between cracks: Not less than 3.0 inches.
- (2) The APU may be operated with no restrictions if the cracks are within limits as described above and both ends of each crack are stop drilled with a .062 inch diameter hole.
- (3) If APU exhaust exit assembly flange cracking exceeds the limits described above, repair cracks as follows:
  - (a) Clean surfaces to be welded as given by OHM 49-50-8, paragraph 3. After solvent cleaning is done, remove high temperature oxides from surfaces to be welded by wire brushing with a stainless steel wire brush or by 180-240 grit aluminum oxide cloth.

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**CAUTION:** ATTACH THE GROUND LEAD FROM THE WELDING POWER SUPPLY DIRECTLY TO THE PART BEING WELDED. PROVIDE AN ELECTRICAL GROUND FOR THE AIRCRAFT. HAVE FIRE EXTINGUISHING EQUIPMENT AVAILABLE WHEN WORKING ON FUELED AIRCRAFT.

- (b) Perform a gas tungsten arc weld repair of cracks in accordance with OHM 49-50-8, paragraph 5.B. Use type 347 weld filler per AMS 5680 or equivalent specification for welding the 321 stainless steel material of the exit assembly.
- (c) Perform local penetrant inspection of weld repair area to ensure cracks have been completely repaired.
- (d) Leave the weld bead intact. Do not grind the weld bead.

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**EXHAUST DUCT AND SHROUD - INSPECTION/CHECK**

**1. General**

A. This procedure contains MSG-3 task card data.

**TASK 49-80-01-210-801**

**2. General Visual Inspection of the APU Exhaust Duct Interior**

**A. General Visual Inspection of the APU Exhaust Duct Interior**

SUBTASK 49-80-01-210-001

(1) Do a general visual inspection of the inside of the APU exhaust duct.

———— **END OF TASK** ————

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL - DESCRIPTION AND OPERATION

#### 1. General

- A. The APU oil system is a positive pressure, dry sump type providing pressure lubrication for the gears and bearings of the engine and accessory drive. The system also provides scavenging of oil from the areas being lubricated, and cooling of oil before returning it to the tank. The system consists of the oil tank, pressure pump, pressure regulating valve, oil pressure sequencing switch, filter, filter bypass valve, oil temperature high switch, oil cooler, check valve, and scavenge pump.

#### 2. Storage

A. Description

- (1) The oil tank, located on the left side of the APU, is attached to the accessory drive and engine cases. The total capacity of the tank is approximately 1 US gallon (0.8326 Imperial gallon, 3.7850 liters).
- (2) A quantity sight gage is located on the left side of the oil tank and is visible when the APU left access door is open.

#### 3. Distribution

A. Description

- (1) The oil pump assembly combines in a single component, the lubricating pressure pump, pressure regulating valve, oil filter, oil filter bypass valve, and dual scavenge pump.
  - (a) The pressure pump is driven by the input shaft of the oil pump assembly. The pressure pump draws oil from the tank and supplies pressurized oil to lubricate the gears and bearings of the engine and accessory gearcase.
  - (b) The pressure regulating valve is a spring-loaded valve, adjusted to maintain oil pressure for proper lubrication, and is set for a maximum of 90 psig (621 kpa).
  - (c) The oil filter removes contaminants from the oil down-stream of the pressure pump. If the filter becomes clogged, and prevents adequate oil flow for lubrication, the filter bypass valve will open and allow oil to flow to bearings and gears without passing through filter.
- (2) The oil temperature high switch is mounted on the oil pump assembly and is electrically connected to the APU OIL TEMP HIGH light on the annunciator panel in the flight compartment. The light comes on and displays oil over-temperature warning when oil temperature exceeds 121°C (250°F).
- (3) The low oil pressure switch is clamped to a bracket mounted on the oil pump assembly. The switch is connected electrically to the APU OIL PRESS LOW light on the annunciator panel. The switch will close and cause the APU OIL PRESS LOW light to come on when oil pressure drops below a predetermined value.
- (4) The oil pressure sequencing switch is clamped to a bracket mounted on the oil pump assembly. The switch acts as a speed switch to turn on the fuel and ignition at approximately 10 percent engine rpm.
- (5) The oil cooler is mounted on the left side of the APU. The cooler is an air-to-oil heat exchanger consisting of thin-walled aluminum tubes bonded to header plates and baffles enclosed in an outer shell.
- (6) The dual scavenge pump is a part of the oil pump assembly. The pump has three pump gears, but has the effective displacement of two separate pumps. The scavenge pump draws oil from the accessory gearcase and turbine bearing sumps, routes it through the cooler, and returns it back to the tank.

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- (7) The oil check valve is located in the oil scavenge return line between the oil cooler and the oil cluster. The check valve prevents oil from draining from the oil cooler into the accessory gear case through the scavenge pump gears.

### B. Operation

- (1) Oil is drawn from the tank by the system pressure pump. The pump produces a greater flow of oil than is actually required by the system. The oil pressure regulating valve compensates for the excess flow by relieving oil back to the pump inlet. The regulating valve is set to limit the flow of oil at 90(±10) psig (621(±69) kpa).
- (2) Oil pumped from the tank by the pressure pump is directed through the filter. If the filter is clogged, the oil pressure will rise sufficiently to actuate the filter bypass valve. This action allows oil to bypass the filter and provide a continual flow of oil to lubricate the engine gears and bearings.
- (3) Oil from the filter is routed through discharge ports to fittings and jets on the accessory gearcase and compressor housing to provide jet and splash lubrication for the engine bearings and gears.
- (4) Oil entering the accessory gearcase comes in contact with the oil temperature high switch. If the temperature of the oil is above 121°C (250°F), the switch closes and completes the warning light circuit causing the APU OIL TEMP HIGH light on the annunciator panel to come on.
- (5) At approximately 10 percent engine rpm, and an oil pressure of 2.5 to 5 psig (17.25 to 34.5 kpa), the oil pressure sequencing switch closes and completes the electrical circuit to the fuel solenoid valve and ignition exciter. The switch ensures that oil system is functioning before allowing engine light off, and delays admission of fuel and ignition in the combustion chamber until engine has reached sufficient motoring speed to produce adequate air flow for combustion.
- (6) The low oil pressure switch protects against operating APU with insufficient pressure for adequate lubrication. The switch will close and cause the APU OIL PRESS LOW light on the annunciator panel to come on. The light remains on during the start cycle and goes off prior to 95 percent rpm and remains off, however, a drop in oil pressure below 45 psig (310.5 kpa) will cause the light to come on.
- (7) Lubricating oil is collected in the accessory gearcase and turbine bearing sumps. One-half of the dual scavenge pump removes oil from the accessory gearcase sump, and the other half removes oil from the turbine bearing sump. The scavenge pump halves are connected internally to a common discharge port from which scavenge oil is routed through the oil cooler and to the oil tank.
- (8) Air trapped in the system is separated from the oil by the tank air-oil separator and vented to the turbine exhaust so that, should inadequate separation of air and oil occur, the oil carried with the vented air is vaporized.

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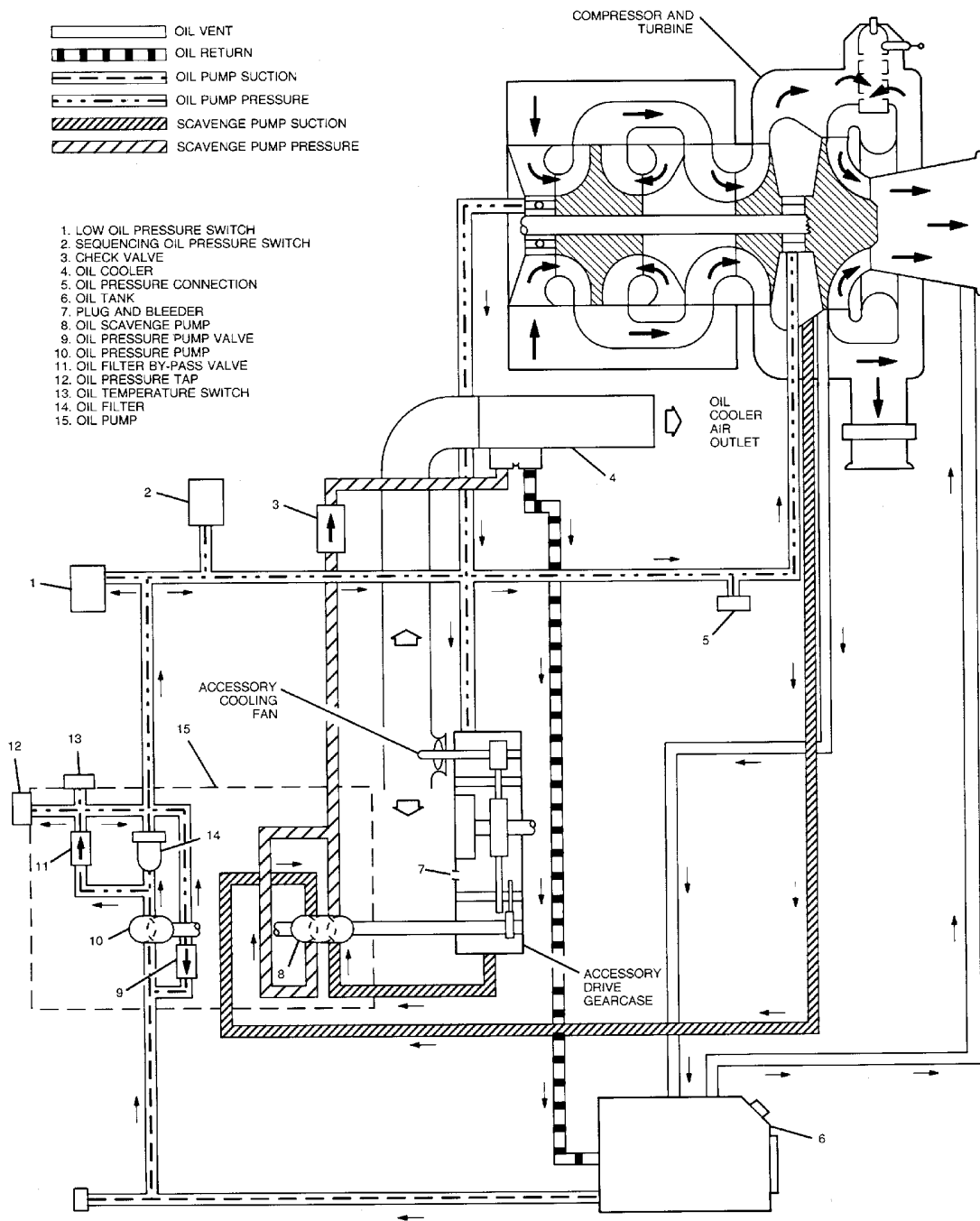
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**Oil -- Schematic  
Figure 1/49-90-00-990-803**

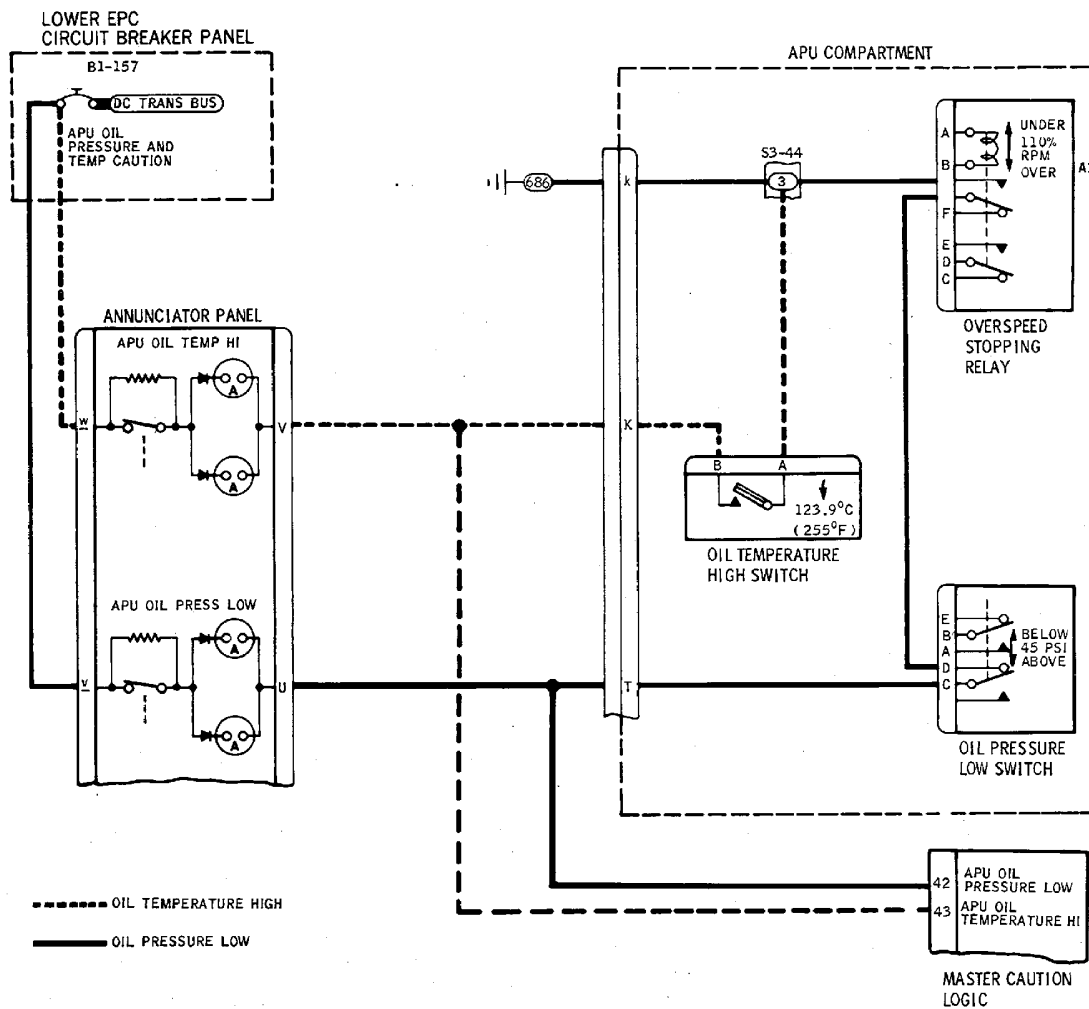
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**Oil -- Electrical Schematic  
Figure 2/49-90-00-990-804**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL - TROUBLE SHOOTING

**1. General**

A. Trouble shooting procedures for the oil system are outlined in the following chart. Operators using AiResearch tester No. 290122 should refer to GENERAL, SUBJECT 49-00-00, page 501.

**2. Equipment and Materials**

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 101**

Name and Number	Manufacturer
APU Tester, 290122	AiResearch
APU Tester Cable, 290214	AiResearch
Lubricating Oil, MIL-L-7808 DPM 6167 Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA

**3. Trouble Shooting Oil System**

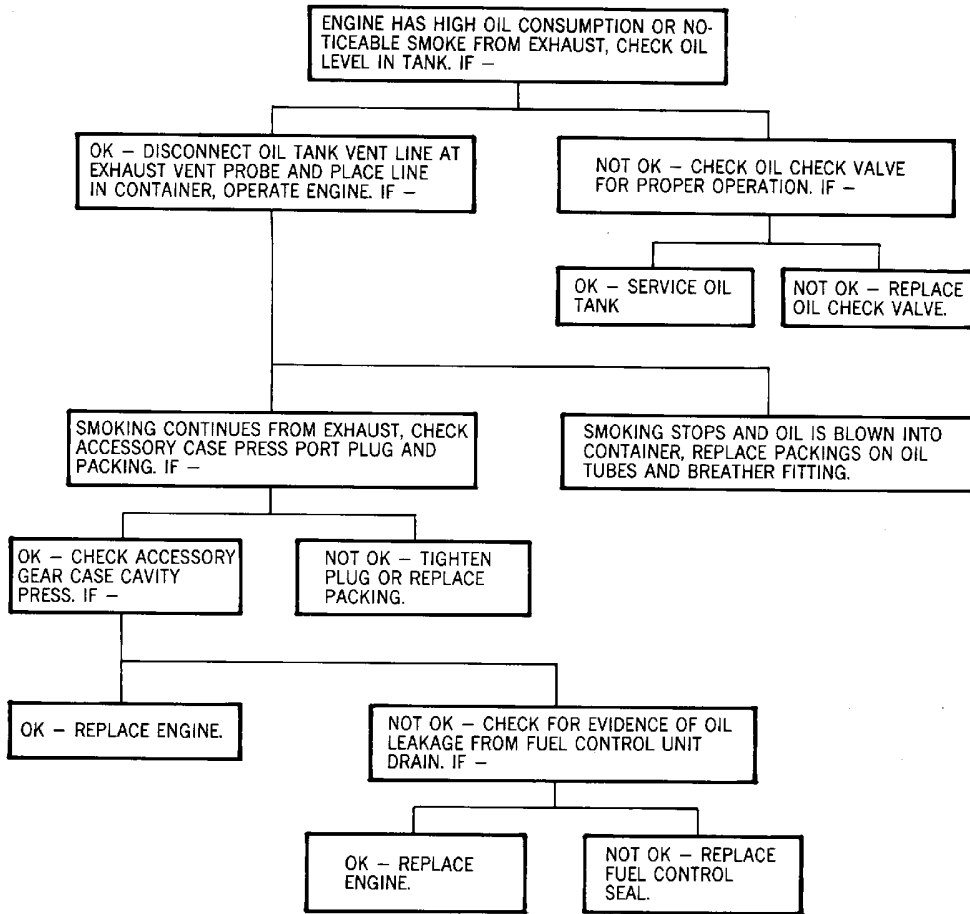
A. For trouble shooting procedure, refer to Figure 101.

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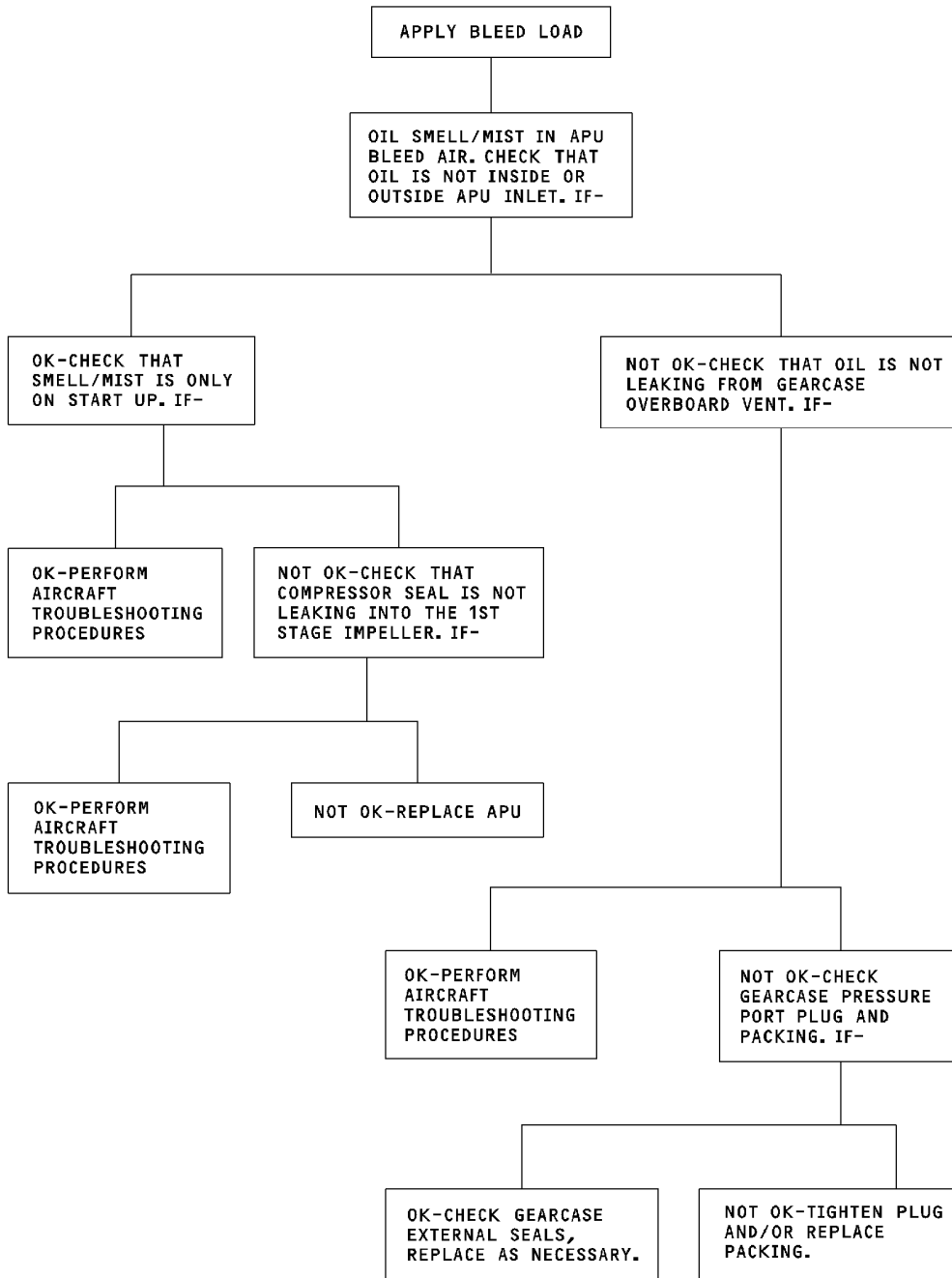
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**Oil -- Trouble Shooting  
Figure 101/49-90-00-990-801**

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CAG(IGDS)

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**APU Oil Smell/Mist in Cabin -- Trouble Shooting  
Figure 102/49-90-00-990-802**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL TANK - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil tank is located on the aft side of the APU and is accessible when the APU is removed from the aircraft.

#### 2. Removal/Installation Oil Tank

##### A. Remove Oil Tank

- (1) Remove APU. (PAGEBLOCK 49-10-00/401)
- (2) Drain APU oil tank. (GENERAL, SUBJECT 49-00-00, page 301)  
**NOTE:** Before starting removal procedure, provide suitable containers in which to catch oil remaining in the system.
- (3) Disconnect oil pump suction line. (Figure 201)  
**NOTE:** Cap suction fitting on tank to contain residual oil during removal.
- (4) Disconnect oil tank vent line. Check that line and opening in flange are not obstructed.
- (5) Disconnect scavenge pump pressure line from oil cooler.
- (6) Disconnect right side bearing sump/vent line.
- (7) Disconnect fuel pump seal drain line from tee at scupper drain port.
- (8) Disconnect scupper drain line.
- (9) Remove oil low-pressure switch from right side of tank. (PAGEBLOCK 49-90-03/201)
- (10) Remove bolts and washers attaching oil tank to left side support.
- (11) Remove bolts and washers attaching oil tank to right side support.
- (12) Remove oil tank from APU.

##### B. Install Oil Tank

- (1) Position oil tank on APU. (Figure 201)
- (2) Install bolts and washers attaching oil tank to right side support.
- (3) Install bolts attaching oil tank to left side support.
- (4) Connect oil pump suction line.
- (5) Connect oil tank vent line.
- (6) Connect scavenge pump pressure line from oil cooler.
- (7) Connect right side bearing sump vent line.
- (8) Connect fuel pump seal drain line.
- (9) Connect scupper drain line.
- (10) Install oil pressure low switch on right side of tank. (PAGEBLOCK 49-90-03/201)
- (11) Fill oil tank. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)
- (12) Install APU. (POWER PLANT, SUBJECT 49-10-00, page 401)

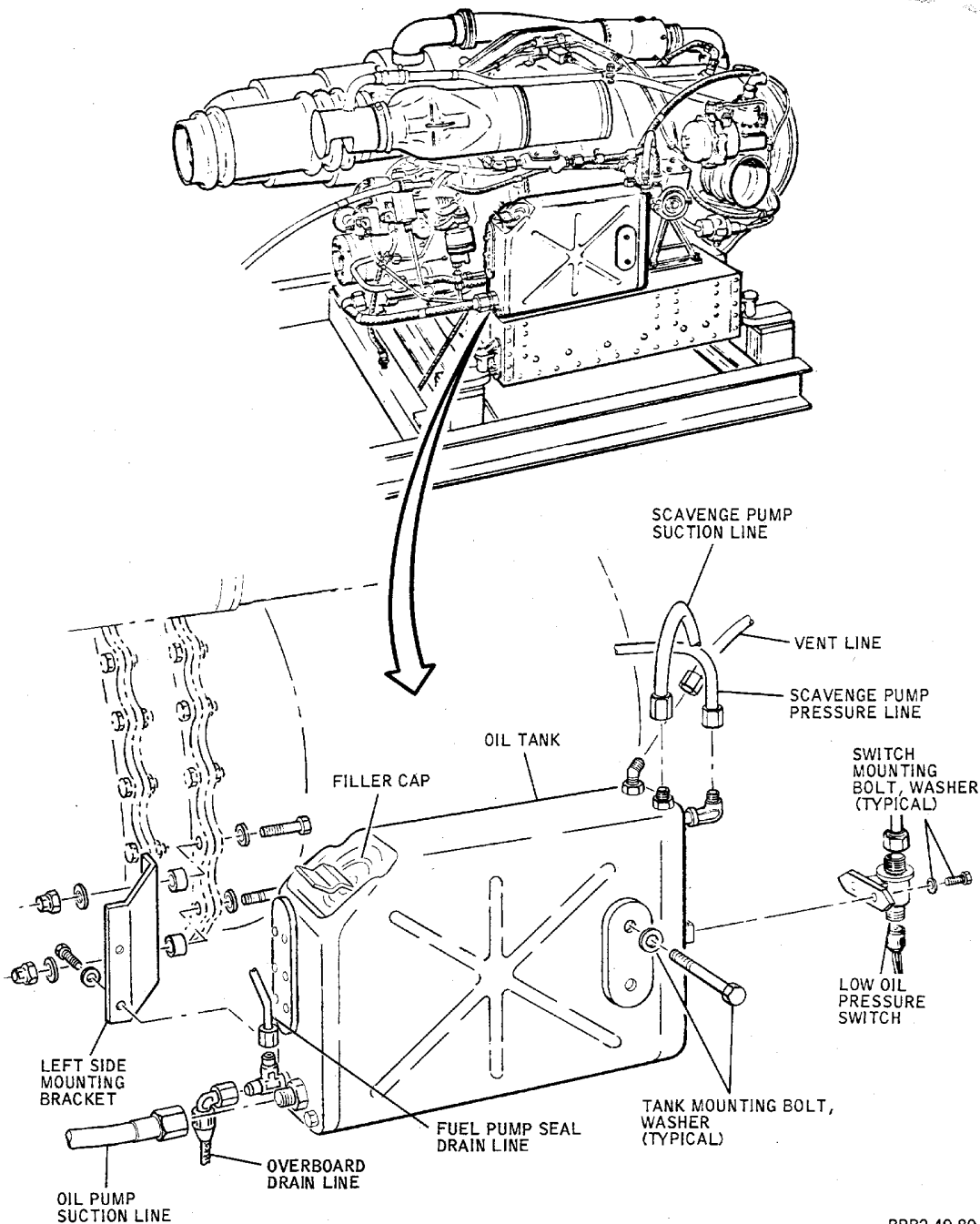
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Oil Tank -- Installation  
Figure 201/49-90-01-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 3. Adjustment/Test Oil Tank Connections

#### A. Test Oil Tank Connection

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Check tank connections and lines for leakage.
- (3) If leakage occurs shut down unit, correct trouble, then recheck.
- (4) Shut down APU. (GENERAL, SUBJECT 49-00-00, page 501)

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (5) Check oil level in sight gage located on left side of oil tank. If oil has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL PRESSURE LOW SWITCH - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil pressure low switch is mounted on a bracket located on the right side of the oil tank. Access to the switch is through the APU right access door.

#### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Suitable container approximately 1 US gallon (.83 Imperial gallon, or 3.79 liters)	
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Oil Pressure Low Switch

- A. Remove Switch

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

##### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**NOTE:** Before starting removal procedure, provide suitable container in which to catch oil remaining in line.

- (2) Disconnect oil line from switch. (Figure 201)
- (3) Remove screws and washers attaching switch to support and withdraw switch until electrical connector is accessible.
- (4) Disconnect electrical connector from switch.

- B. Install Switch

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Connect electrical connector to switch.
- (3) Position switch on support and install screws and washers.
- (4) Connect oil line to switch.
- (5) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

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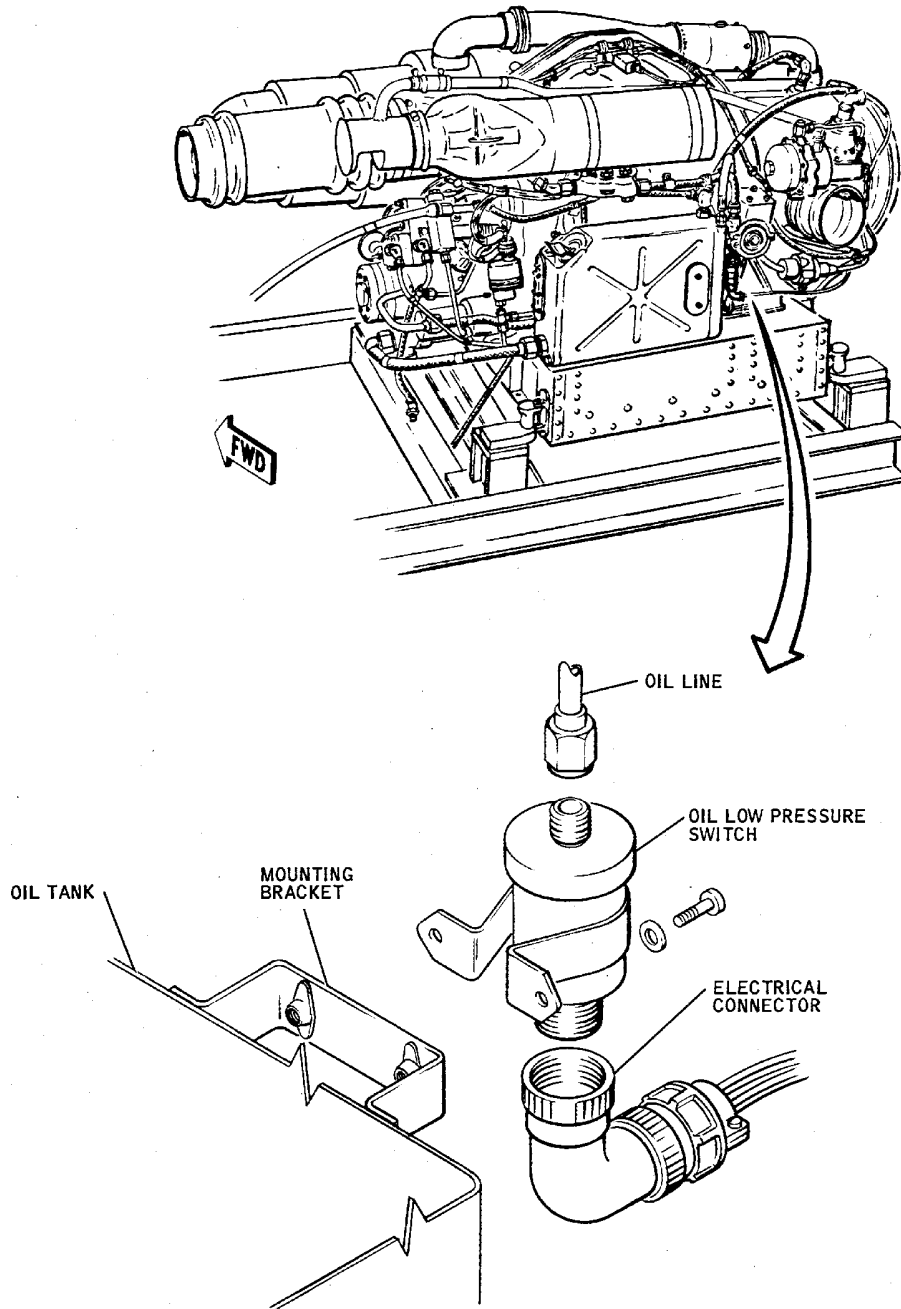
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**Oil Low-pressure Warning Switch -- Installation**  
**Figure 201/49-90-03-990-801**

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### 4. Adjustment/Test Oil Pressure Low Switch

#### A. Test Oil Pressure Low Switch

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Check oil line connection for leakage.

NOTE: Verify oil pressure low switch operation by observing tachometer indicator and oil pressure low caution light in flight compartment. Caution light should go off prior to 95 percent rpm.

- (3) Shut down APU. (GENERAL, SUBJECT 49-00-00, page 501).

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (4) Check oil level in sight gage located on left side of oil tank. If oil has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301).

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**AIRCRAFT MAINTENANCE MANUAL**  
**OIL COOLER - MAINTENANCE PRACTICES**

**1. General**

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The APU oil cooler is clamp-mounted on supports bolted to the turbine housing above the oil tank and is accessible when the APU is removed from the aircraft.

**2. Removal/Installation Oil Cooler**

A. Remove Cooler

- (1) Remove APU. (PAGEBLOCK 49-10-00/401)
- (2) Disconnect oil line from inlet port on manifold and cap fitting. (Figure 201)  
NOTE: Provide suitable containers in which to catch oil remaining in cooler or lines.
- (3) Disconnect oil line from outlet port on manifold and cap fitting.
- (4) Loosen and remove clamp from right end of oil cooler.
- (5) Loosen and remove clamp from left end of oil cooler.
- (6) Slide oil cooler to right (inboard), and slip cooling air duct off left end of cooler.
- (7) Remove oil cooler from APU.

B. Install Cooler

- (1) Position oil cooler, and slip left end of cooler into cooling air duct.
- (2) Install clamp loosely on left end of cooler.
- (3) Install clamp loosely on right end of cooler.
- (4) Rotate cooler and align inlet and outlet ports with oil lines.
- (5) Connect oil outlet line to outlet port on manifold.
- (6) Connect oil inlet line to inlet port on manifold.
- (7) Tighten clamp on left end of oil cooler.
- (8) Tighten clamp on right end of oil cooler.
- (9) Install APU. (PAGEBLOCK 49-10-00/401)

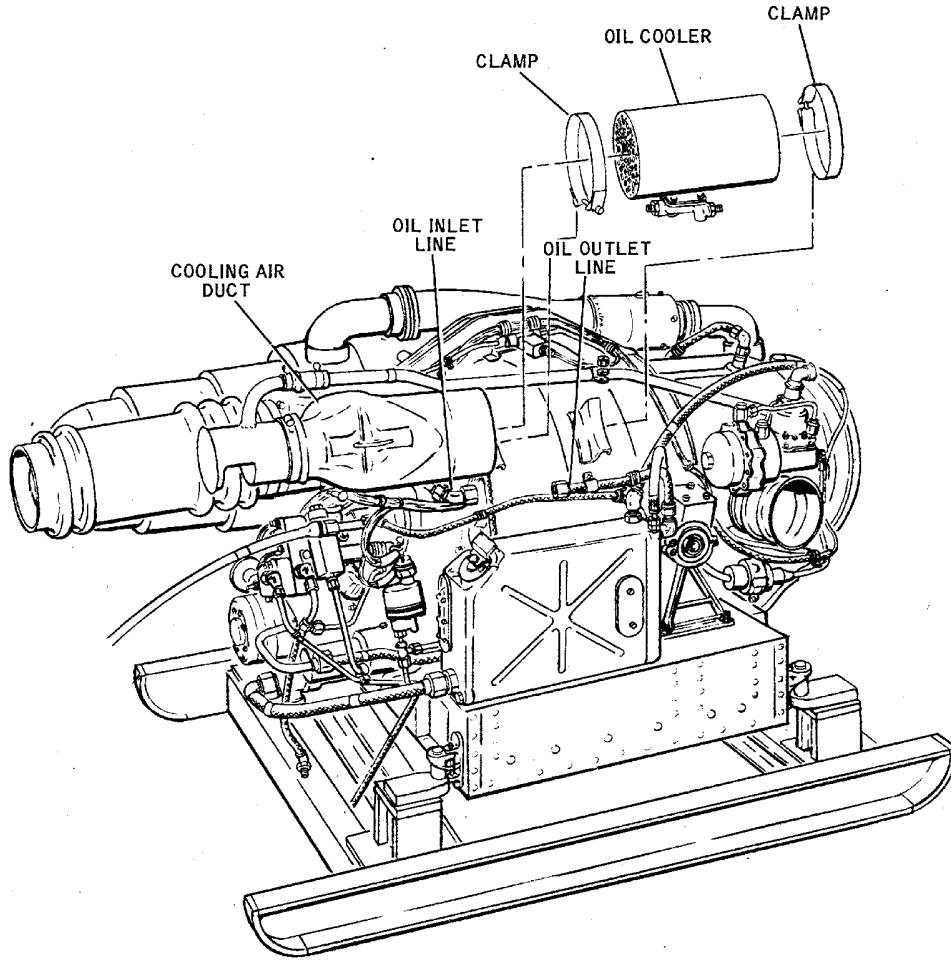
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**49-90-04**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-91

**Oil Cooler -- Installation**  
**Figure 201/49-90-04-990-802**

EFFECTIVITY  
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## 49-90-04

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 3. Adjustment/Test Oil Cooler

#### A. Test Oil Cooler

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Check oil cooler oil-in and oil-out lines and connections for leaks. If leakage occurs, tighten connections.
- (3) Check oil cooler air exhaust for airflow.

**NOTE:** Oil particles in cooler exhaust indicate internal leakage and require replacement of cooler.

- (4) Shut down APU. (GENERAL, SUBJECT 49-00-00, page 501)

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (5) Check oil level in sight gage located on left side of oil tank. If oil has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

EFFECTIVITY  
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**49-90-04**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL CLUSTER - MAINTENANCE PRACTICES

#### 1. General

- A. A number of oil system components are mounted on the cluster located on the left side of the APU. These components include the high-pressure oil pump, dual scavenge pumps, oil filter, oil pressure regulator valve, and oil temperature bulb. In addition, the oil cluster housing provides a mounting pad for the tachometer generator. (TACHOMETER GENERATOR, SUBJECT 49-72-01)

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- B. The oil cluster is removed as a unit while the APU is installed in the aircraft. It is not necessary to remove the tachometer generator before removing the oil cluster. The oil tank should be drained before removing the oil cluster. Access to the cluster is through the APU left access door.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container, 5 US gallons (19.93) liters	
Container, 1 US gallon (3.79) liters	
Lubricating oil, MIL-L-7808 DPM 6167 Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA

#### 3. Removal/Installation Oil Cluster

- A. Remove Oil Cluster

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Drain APU oil tank. (PAGEBLOCK 49-00-00/301 Config 1)  
 (3) Disconnect electrical connector from tachometer generator. (Figure 201)  
 (4) Disconnect electrical connector from oil temperature bulb.

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**49-90-05**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (5) Disconnect oil pump suction line.
- (6) Disconnect oil pump pressure line.
- (7) Disconnect scavenge pump suction line.
- (8) Disconnect scavenge pump pressure line.
- (9) Disconnect oil sequencing switch line.
- (10) Remove bolts attaching oil cluster housing to accessory drive case.
- (11) Carefully disengage oil pump drive shaft splines and remove oil cluster.
- (12) Remove O-rings.

B. Install Oil Cluster

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position new O-rings on oil pump drive shaft. (Figure 201)
- (3) Carefully insert oil pump drive shaft into accessory drive and engage mating splines.
- (4) Install bolts attaching oil cluster to accessory drive case.
- (5) Connect oil sequencing switch line.
- (6) Connect scavenge pump pressure line.
- (7) Connect scavenge pump suction line.
- (8) Connect oil pump pressure line.
- (9) Connect oil pump suction line.
- (10) Connect electrical connector to oil temperature bulb.
- (11) Connect electrical connector to tachometer generator.
- (12) Fill APU oil tank. (PAGEBLOCK 12-12-01/301)
- (13) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

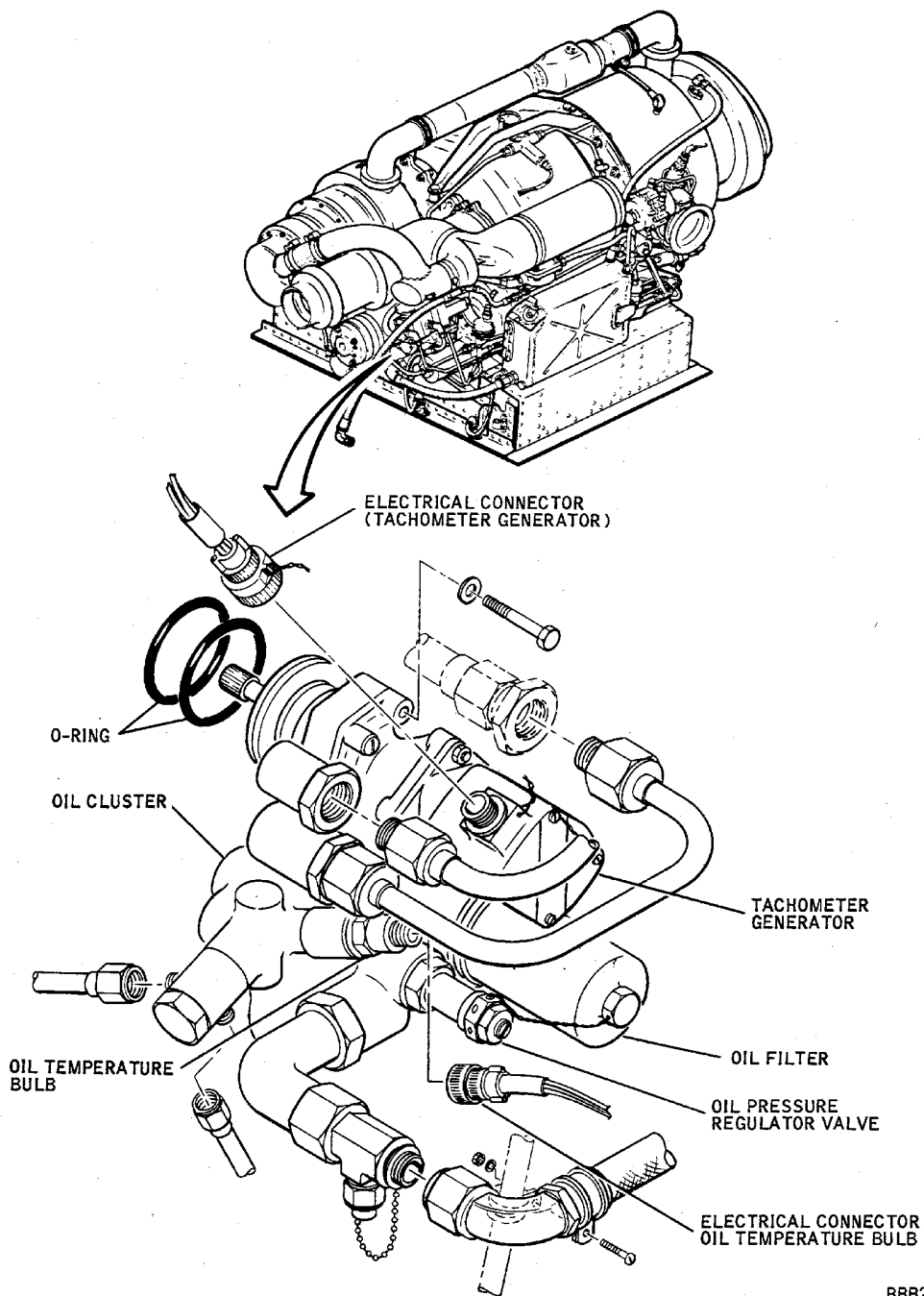
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**49-90-05**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-92

**Oil Cluster -- Installation**  
**Figure 201/49-90-05-990-801**

EFFECTIVITY  
WJE ALL

TP-80MM-WJE

## 49-90-05

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Cluster

#### A. Test Oil Cluster

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Check oil cluster and connections for leaks. If no leaks occur, allow engine to run at no-load governed speed for at least 1 minute.

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (3) Shut down APU and check level of oil in sight gage located on left side of oil tank. If oil has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

EFFECTIVITY  
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**49-90-05**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL FILTER - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The APU oil filter is located on the lower left side of the oil cluster. It is not necessary to drain the oil tank when replacing the filter element, but a container should be provided to catch residual oil trapped in the filter case. Access to oil filter is through APU left access door.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container	
Lubricating oil, MIL-L-7808 or equivalent DPM 6167 Castrol 399	Castrol Inc. Bray Products Div. Irvine, CA
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Oil Filter

- A. Remove Oil Filter

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove filter case. (Figure 201)
- (3) Remove filter element from case. (Paragraph 5.)
- (4) Remove O-rings.

- B. Install Oil Filter Element

EFFECTIVITY WJE ALL
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TP-80MM-WJE

**49-90-06**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Install new O-ring in outboard end of filter case. (Figure 201)
- (3) Install new filter element in filter case.
- (4) Install new O-ring on inboard end of filter element.

**CAUTION:** DO NOT EXCEED 25 INCH-POUNDS (28.8 N·M) TORQUE WHEN TIGHTENING FILTER CASE.

- (5) Install filter case on oil cluster housing and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (6) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

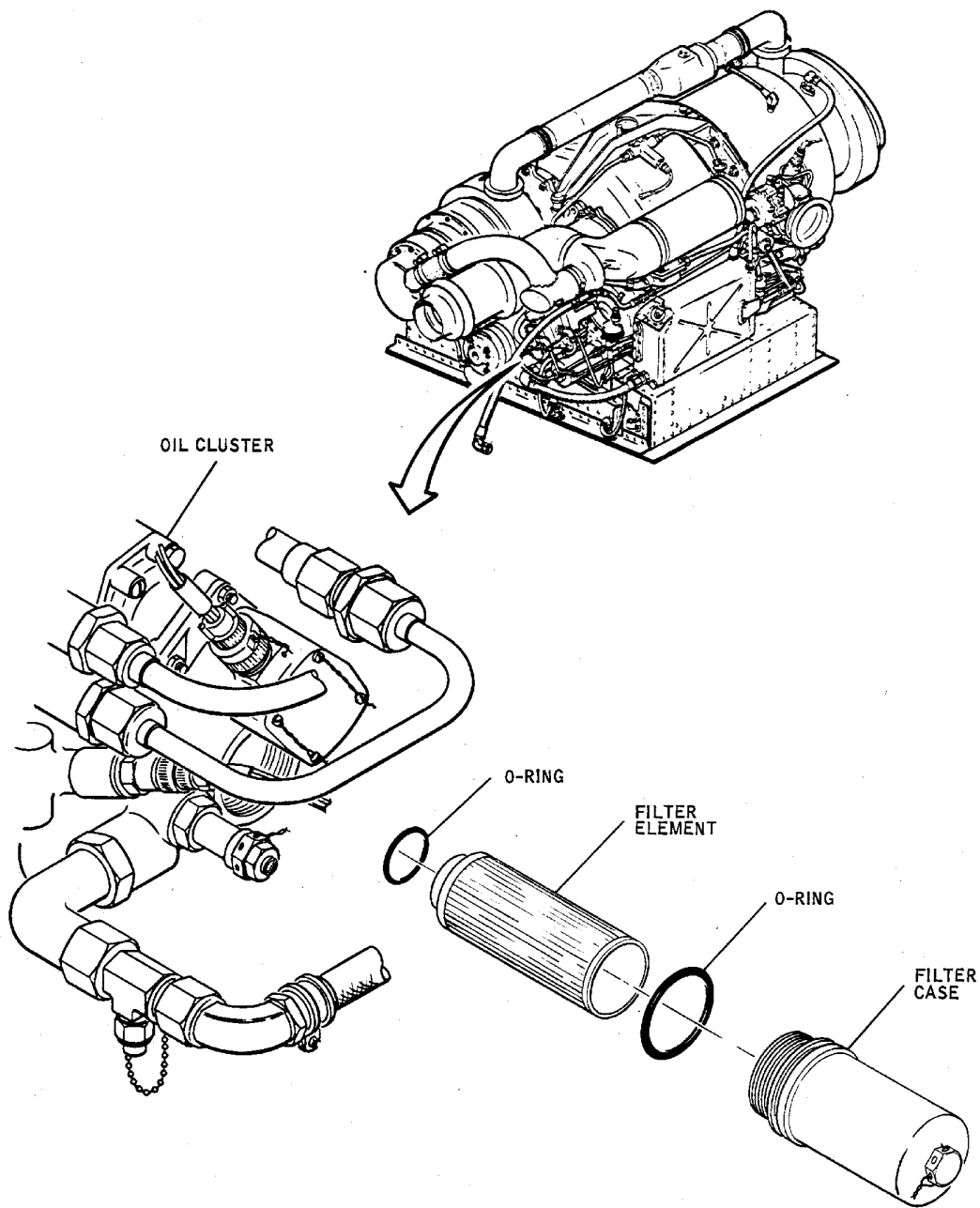
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-93

**Oil Filter Element -- Installation**  
**Figure 201/49-90-06-990-801**

EFFECTIVITY  
WJE ALL

TP-80MM-WJE

## 49-90-06

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Filter

#### A. Test Oil Filter

- (1) Start APU. (GENERAL, SUBJECT 49-00-00, page 501)
- (2) Test filter case for leakage. If no leaks occur, allow engine to run at no-load governed speed for at least 1 minute.

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (3) Shut down APU (GENERAL, SUBJECT 49-00-00, page 501) and check level of oil in sight gage located on left side of oil tank. If oil has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page, 301)

### 5. Inspection/Check Oil Filter

#### A. Check Oil Filter

- (1) Remove oil filter. (Paragraph 3.)
- (2) After removal of filter, check element for excessive metal particles, or foreign materials which could indicate damage to engine.

**NOTE:** Fine metal particles indicate normal engine wear. Larger metal particles indicate internal damage.

- (3) Install oil filter. (Paragraph 3.)

EFFECTIVITY  
WJE ALL

TP-80MM-WJE

**49-90-06**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## OIL FILTER - REMOVAL/INSTALLATION

### 1. General

A. This procedure contains MSG-3 task card data.

#### **TASK 49-90-06-901-801**

### 2. Discard APU Oil Filter Element

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

**CAUTION:** DO NOT MIX NAME BRAND OILS WHEN FILLING OIL TANK. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** This procedure is a scheduled maintenance task.

#### A. References

<u>Reference</u>	<u>Title</u>
20-10-18 P/B 201	LOCKWIRE SAFETYING - MAINTENANCE PRACTICES
49-90-06 P/B 201 Config 1	OIL FILTER - MAINTENANCE PRACTICES

#### B. Consumable Materials

**NOTE:** Equivalent replacements are permitted for the items that follow.

**NOTE:** It is possible that some materials in the Consumable Materials chart cannot be used for some or all of the necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

<u>Reference</u>	<u>Description</u>	<u>Specification</u>
G60170	Lockwire - .032 Inconel Annealed	DPM 684 (NASM20995N)
G60803	Lockwire - Stainless Steel, 316 (0.032 in. diameter)	DPM 5865 (NASM20995C32)

#### C. Prepare for the Discard of the APU Oil Filter Element

SUBTASK 49-90-06-865-001

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Make sure that this circuit breaker is open and has safety tag:

#### **OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

SUBTASK 49-90-06-010-001

(2) Open APU access doors.

#### D. Discard APU Oil Filter Element

SUBTASK 49-90-06-020-001

(1) Remove the APU oil filter case. (OIL FILTER - MAINTENANCE PRACTICES, PAGEBLOCK 49-90-06/201 Config 1) (Figure 401)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

- (2) Remove filter element from case.
- (3) Remove O-rings.

**SUBTASK 49-90-06-901-002**

- (4) Inspect the APU oil filter element for contamination, then discard the filter element.

**SUBTASK 49-90-06-420-001**

- (5) Install a new APU oil filter element. (OIL FILTER - MAINTENANCE PRACTICES, PAGEBLOCK 49-90-06/201 Config 1)
  - (a) Install new O-ring in outboard end of filter case.
  - (b) Install new filter element in filter case.
  - (c) Install new O-ring on inboard end of filter element.

**CAUTION:** DO NOT EXCEED 25 INCH-POUNDS (28.8 N·M) TORQUE WHEN TIGHTENING FILTER CASE.

- (d) Install filter case on oil cluster housing and safety with .032 inconel lockwire, G60170 or lockwire, G60803. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

**SUBTASK 49-90-06-865-002**

- (6) Remove the safety tag and close this circuit breaker:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

### E. Job Close-up

**SUBTASK 49-90-06-410-001**

- (1) Leak check oil filter.
- (2) Close opened access panels.

**SUBTASK 49-90-06-840-001**

- (3) Remove all the tools and equipment from the work area. Make sure the area is clean.

————— **END OF TASK** —————

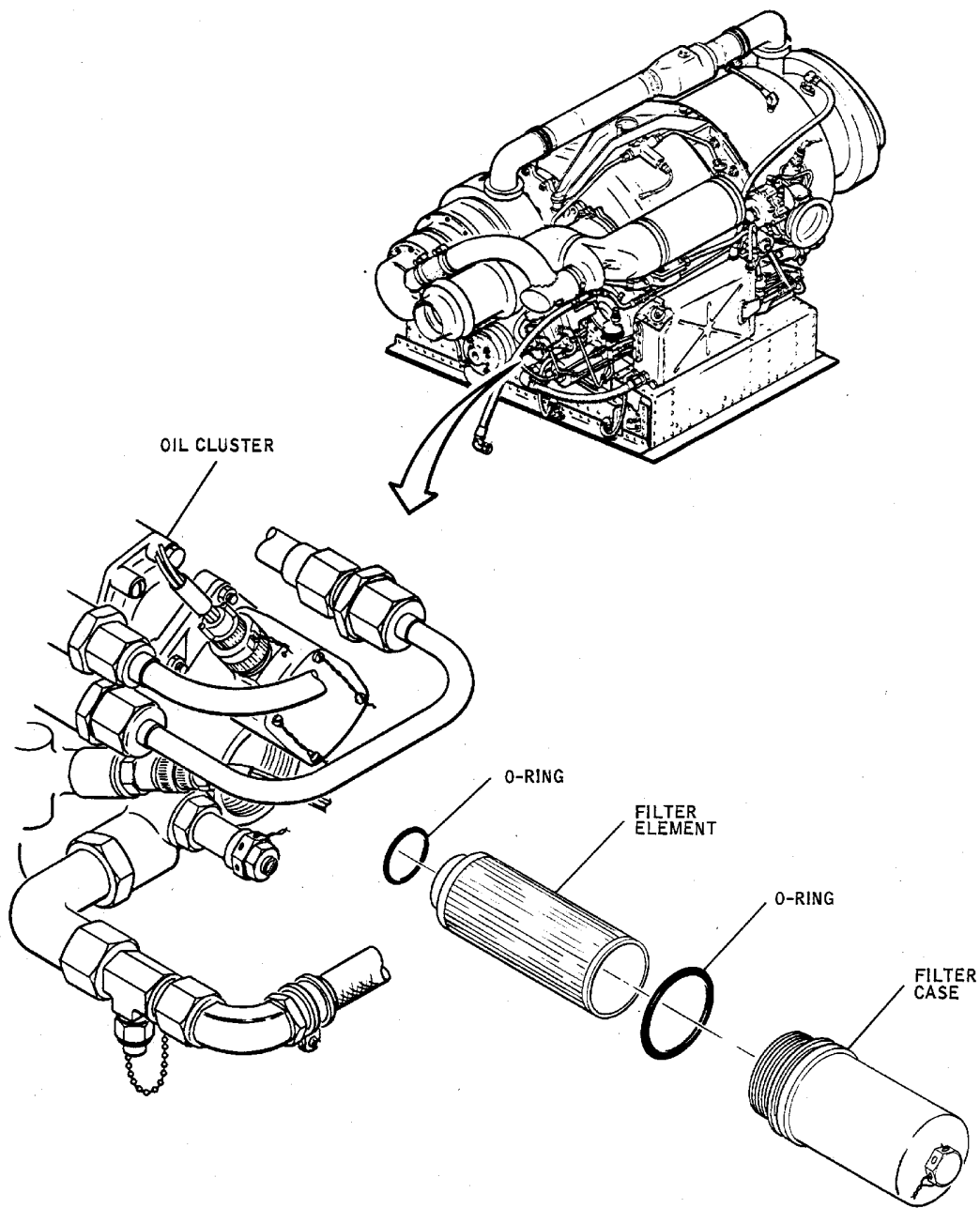
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BBB2-49-93

**OIL FILTER ELEMENT -- REMOVAL/INSTALLATION**  
Figure 401/49-90-06-990-803

EFFECTIVITY  
WJE ALL

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL PRESSURE RELIEF VALVE - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil pressure relief valve is mounted in the oil pump housing located on the left side of the APU. Access to the relief valve is through the left access door.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container	
Lubricating oil, MIL-L-7808 or equivalent DPM 6167 Castrol 399	Castrol, Inc. Bray Products Div. Irvine, CA
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Oil Pressure Relief Valve

- A. Remove Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**NOTE:** Be ready to catch oil in container when pressure relief valve is removed from housing.

- (2) Remove oil pressure relief valve from pump housing. (Figure 201)
- (3) Remove O-rings.

- B. Install Valve

EFFECTIVITY  
WJE ALL

**49-90-07**

## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Install O-rings on valve body. (Figure 201)
- (3) Install valve and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (4) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

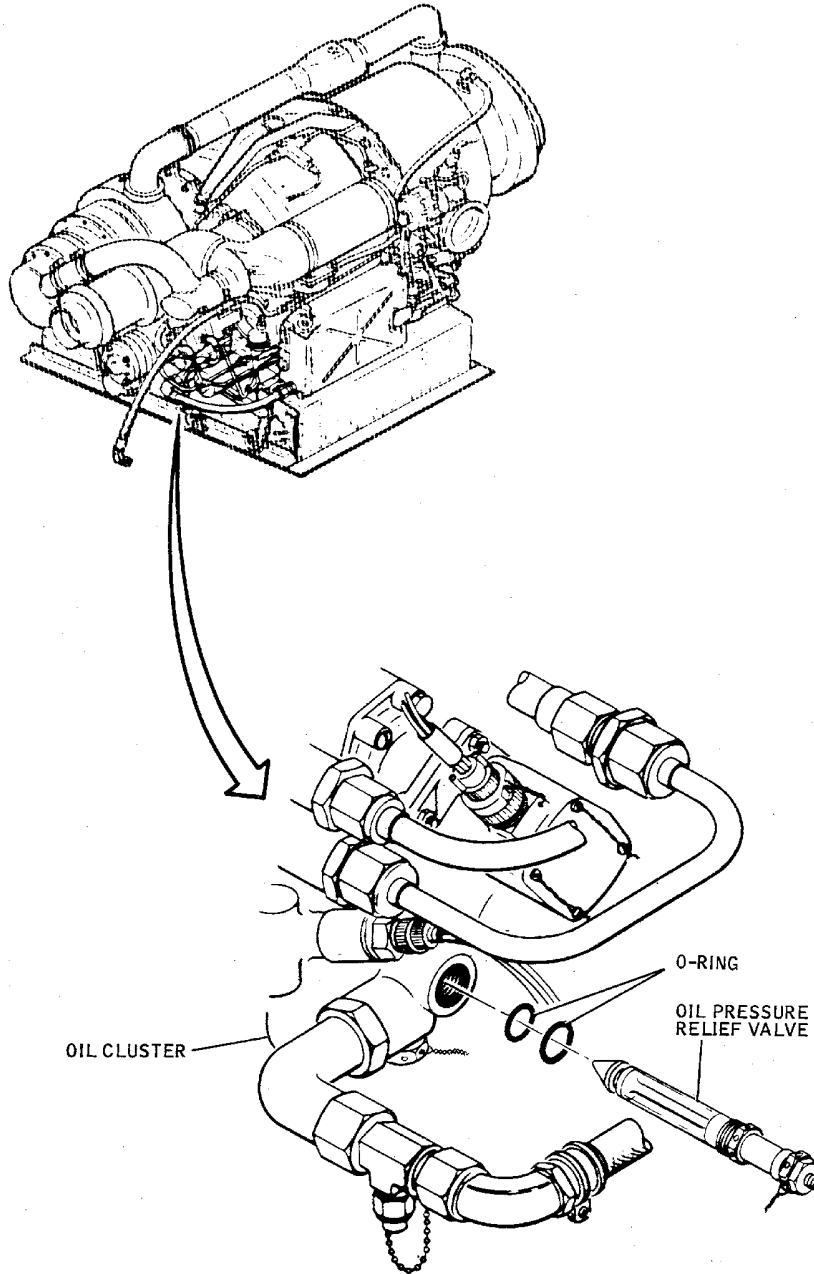
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**49-90-07**

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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-94

**Oil Pressure Relief Valve -- Installation**  
Figure 201/49-90-07-990-801

EFFECTIVITY  
WJE ALL

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## 49-90-07

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Pressure Relief Valve

#### A. Test Valve For Leakage

- (1) At next engine run check valve for leakage.
- (2) Check valve cracking pressure and adjust if necessary, refer to GENERAL, SUBJECT 49-00-00, page 501.

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (3) After engine shutdown check level of oil in sight gage located on left end of oil tank. If oil level has dropped below full mark, replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

EFFECTIVITY  
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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL OVERTEMPERATURE SWITCH - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil overtemperature switch is mounted in the APU oil cluster downstream of the pump. The oil cluster is located on the left side of the APU and is accessible through the left access door.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Container	
Lubricating oil, MIL-L-7808 or equivalent DPM 6167 Castrol 399	Castrol, Inc. Bray Products Div. Irvine, CA
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Oil Overtemperature Switch

- A. Remove Switch

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Disconnect electrical connector from switch. (Figure 201)  
 (3) Remove switch from housing.  
 (4) Remove O-ring from switch.

- B. Install Switch

EFFECTIVITY  
WJE ALL

**49-90-08**

## MD-80 AIRCRAFT MAINTENANCE MANUAL

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Position O-ring on switch. (Figure 201)
- (3) Install switch and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (4) Connect electrical connector.
- (5) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

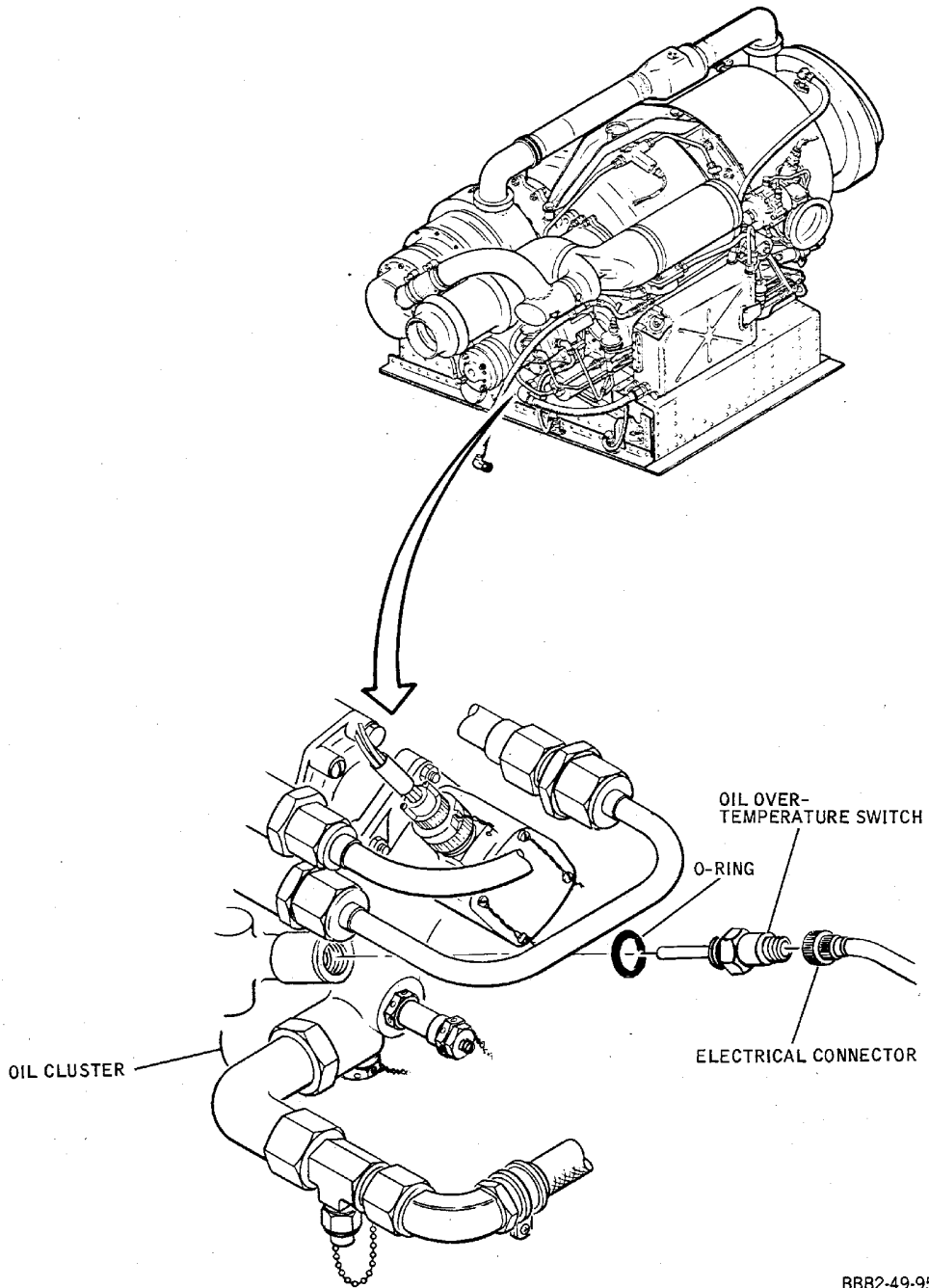
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



BBB2-49-95

**Oil Overtemperature Switch -- Installation**  
Figure 201/49-90-08-990-801

EFFECTIVITY  
WJE ALL

TP-80MM-WJE

## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Overtemperature Switch

#### A. Test Switch For Leakage

- (1) At next engine run, check switch for leakage.

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (2) After engine shutdown, check level of oil in sight gage located on left end of oil tank. If oil level has dropped below full mark replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### OIL FILTER BYPASS VALVE - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil filter bypass valve is mounted in the oil pump housing adjacent to the oil filter on the left side of the APU. Access to the bypass valve is through the left access door.

#### 2. Equipment and Materials

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

**NOTE:** Equivalent substitutes may be used instead of the following listed items:

**NOTE:** Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

**Table 201**

Name and Number	Manufacturer
Container	
Lubricating oil MIL-L-7808 or equivalent	
Lockwire, NASM20995N32, DPM 684	Not Specified

#### 3. Removal/Installation Oil Filter Bypass Valve

- A. Remove Bypass Valve

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

Row	Col	Number	Name
B	21	B1-291	APU CONTROL

- (2) Remove oil filter bypass valve cap.  
 (3) Remove gasket, washers, spring, and valve seat.

- B. Install Bypass Valve

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Install new gasket on bypass valve cap. (Figure 201)
- (3) Position valve seat, spring, and washers in pump housing.
- (4) Install bypass valve cap and safety with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)
- (5) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

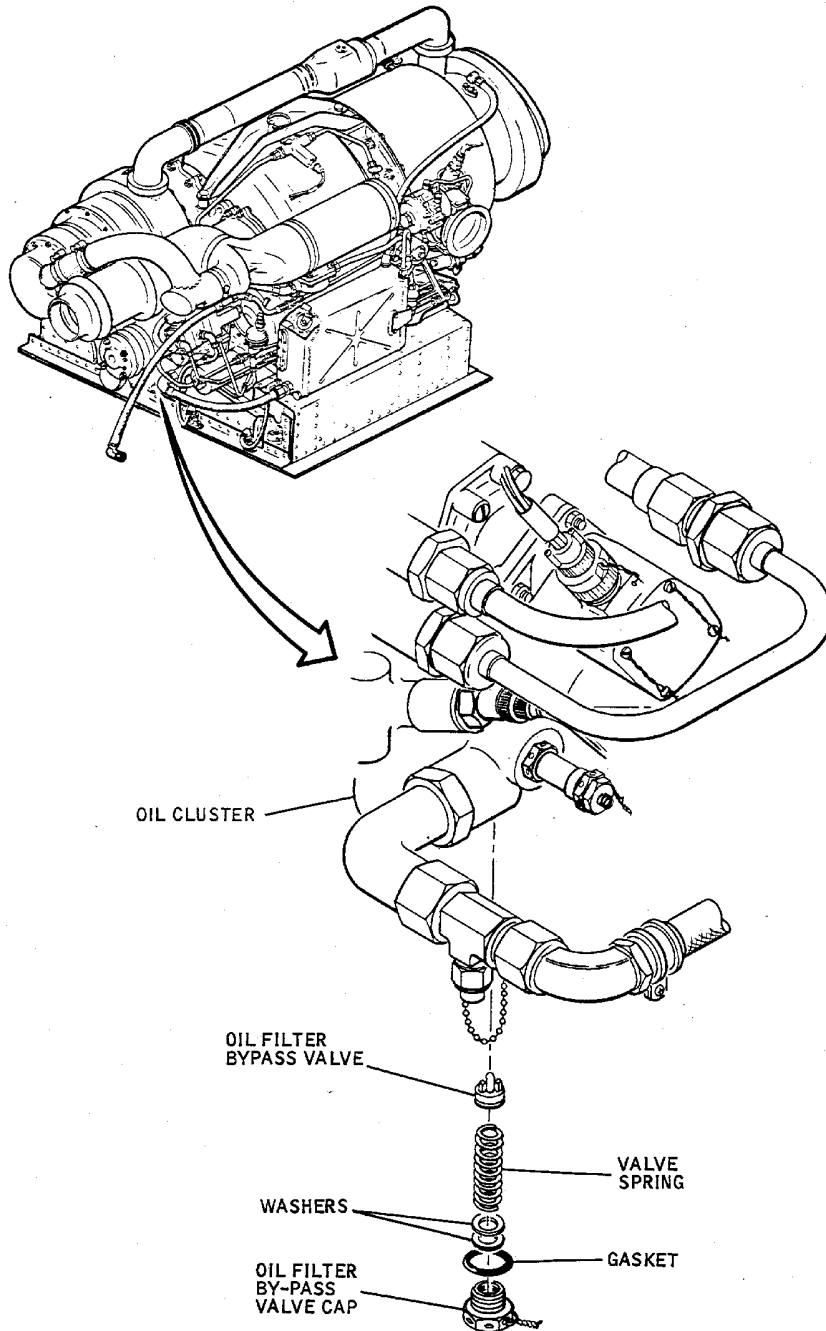
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Oil Filter Bypass Valve -- Installation  
Figure 201/49-90-09-990-801

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### 4. Adjustment/Test Oil Filter Bypass Valve

#### A. Test Valve For Leaks

- (1) At next engine run, check valve cap for leakage.

**CAUTION:** DO NOT MIX NAME BRAND OILS. ADDED OIL MUST BE COMPATIBLE WITH OIL IN TANK.

- (2) After engine shutdown, check level of oil in sight gage located on left end of tank. If oil level has dropped below full mark replenish as necessary. (AUXILIARY POWER UNIT (APU), SUBJECT 12-12-01, page 301)

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# MD-80 AIRCRAFT MAINTENANCE MANUAL

## OIL PUMP DRIVE SHAFT SEAL - MAINTENANCE PRACTICES

### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. This maintenance practice provides removal/installation procedures for the oil pump drive shaft seal.
- B. The removal/installation of the drive shaft seal can be accomplished with the APU installed on the aircraft. It is necessary to remove the tachometer generator to gain access to the seal.

### 2. Equipment and Materials

**NOTE:** Equivalent substitutes may be used instead of the following items:

**NOTE:** It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

**Table 201**

Name and Number	Manufacturer
Oil (MIL-L-7808 DPM 6167, Castrol 399, or MIL-L-23699 DPM 3564)	Castrol, Inc. Bray Products Div. Irvine, CA
Aeroshell Turbine Oil 500	Shell Chemical Co. Downey, CA
Lubricant (OS-124)	Monsanto Co. St. Louis, MO
Seal Puller (280209)	Garrett Corp. Phoenix, AZ

### 3. Removal/Installation Oil Pump Drive Shaft Seal

- A. Remove Drive Shaft Seal

**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Open this circuit breaker and install safety tag:

**OVERHEAD BATTERY BUS**

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

- (2) Remove tachometer generator. (PAGEBLOCK 49-72-01/401)
- (3) Remove retaining ring.
- (4) Using seal puller (Garrett 280209), remove drive shaft seal and discard.
- (5) Remove O-ring and discard.

- B. Install Drive Shaft Seal

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**WARNING:** TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Make sure that this circuit breaker is open and has safety tag:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

**WARNING:** SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SYNTHETIC BASE OIL AIRCRAFT TURBINE ENGINE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

**WARNING:** LUBRICATING OIL IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN LUBRICATING OIL IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET LUBRICATING OIL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE MIST.

**WARNING:** REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

- (2) Lightly lubricate new O-ring and new drive shaft seal with oil (MIL-L-7808 or MIL-L-23699) or lubricant (OS-124).

- (3) Install O-ring and drive shaft seal.

NOTE: Drive shaft seal should be installed with lip facing outward.

- (4) Install retaining ring.
- (5) Install tachometer generator. (PAGEBLOCK 49-72-01/401)
- (6) Remove the safety tag and close this circuit breaker:

### OVERHEAD BATTERY BUS

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
B	21	B1-291	APU CONTROL

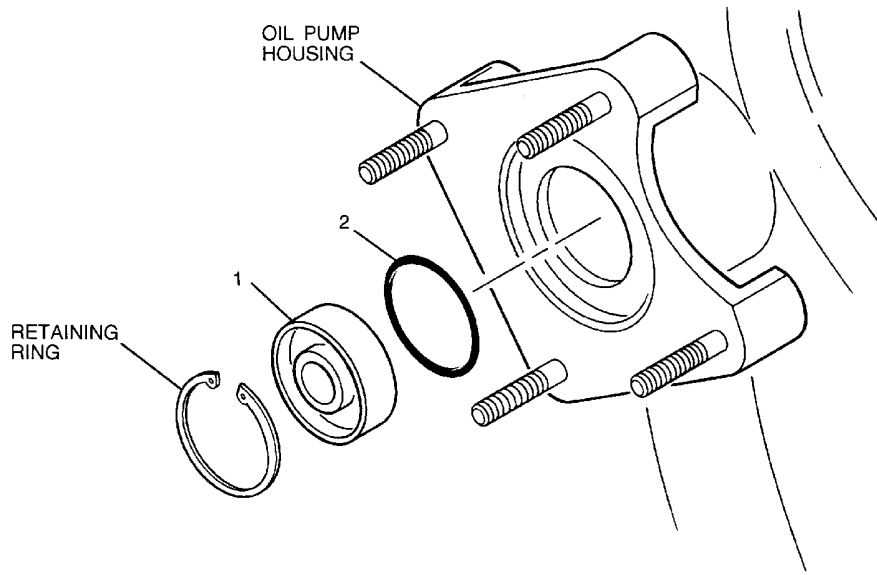
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# MD-80 AIRCRAFT MAINTENANCE MANUAL



CODE:

1. 3609089-1 SEAL GARRETT
2. S9413-214 O-RING GARRETT

BBB2-49-127

**Oil Pump Drive Shaft Seal -- Removal/Installation**  
**Figure 201/49-90-10-990-801**

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## MD-80 AIRCRAFT MAINTENANCE MANUAL

### APU OIL HIGH TEMPERATURE - MAINTENANCE PRACTICES

#### 1. General

**WARNING:** MAKE CERTAIN APU HAS COOLED SUFFICIENTLY AFTER SHUTDOWN TO PERMIT SKIN CONTACT. MAKE CERTAIN APU MASTER SWITCH IN FLIGHT COMPARTMENT IS OFF.

- A. The oil temperature high switch is mounted on the oil pump assembly. Oil entering the accessory gearcase comes in contact with the oil temperature high switch. If the temperature of the oil is above 121°C (250°F), the switch closes and completes the warning light circuit causing the APU OIL TEMP HIGH light on the annunciator panel to come on.
- B. This procedure outlines a method of trouble shooting for high APU oil temperature.

#### 2. Trouble Shooting for High APU Oil Temperature

A. Inspect the APU cooling fan for the following:

- (1) Make certain the inlet screen and surrounding areas are free of foreign debris.
- (2) Check the cooling fan inlet duct for obstruction, air leaks, and disconnection of the duct.
- (3) Check the duct between the cooling fan and the oil cooler for obstruction, air leaks, and disconnection of the duct.
- (4) Inspect the cooling fan blades for Foreign Object Damage (FOD).

B. Inspect the oil cooler air passages for obstruction from dirt or sludge.

**NOTE:** If the cooling fan has a shaft oil seal leak, the combination of oil residue and dirt/dust in the cooling system can form a sludge accumulation in the air passages that can adversely affect oil cooling performance.

- (1) If severe dirt or sludge accumulation is found, remove the oil cooler for cleaning. (OIL COOLER - MAINTENANCE PRACTICES, PAGEBLOCK 49-90-04/201)

C. Inspect the bleed air duct Janitrol flange connections in the aft accessory compartment for bleed air leaks.

**NOTE:** Since APU cooling air is taken from the aft accessory compartment, an excessively hot aft accessory compartment environment can cause the APU oil temperature to become elevated during hot day ground operation. High APU oil temperature conditions due to bleed air leaks can occur during ground operation without necessarily triggering a TAIL TEMP HIGH alert in the cockpit.

- (1) Place aluminum foil, G60133 over the joints.
- (2) Pressurize the pneumatic system using APU bleed air. (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 36-00-00/201)
- (3) Inspect the aluminum foil, G60133 for ruptures due to a bleed air leak.
- (4) Inspect the bleed air ducts for cracks that could cause hot bleed air to discharge into the aft accessory compartment.
- (5) Check the bleed air duct insulation for deterioration.

D. If you cannot correct the problem, replace the oil temperature high switch. (OIL OVERTEMPERATURE SWITCH - MAINTENANCE PRACTICES, PAGEBLOCK 49-90-08/201)

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