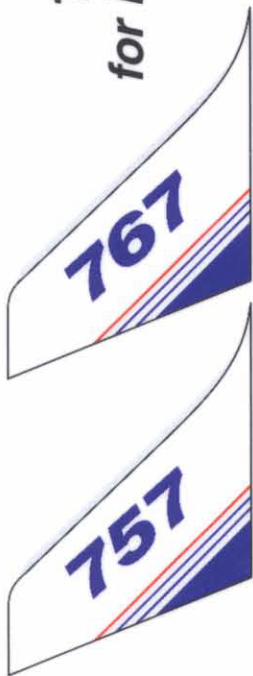


757/767

**Auxiliary Power Unit  
Troubleshooting Guide  
for Electronic Control Unit  
P/N 2117342-19/-20  
Configurations**



**NOTE TO USERS: THIS GUIDE CONTAINS EXTRACTS OF THE APU TRAINING MATERIAL  
BASED ON THE AIRCRAFT MAINTENANCE MANUAL. IN ALL CASES THE AIRCRAFT  
MAINTENANCE MANUAL TAKES PRECEDENCE OVER ANY INFORMATION IN THIS GUIDE.**

**FOR TRAINING USE ONLY  
JANUARY 2001  
31-15671**

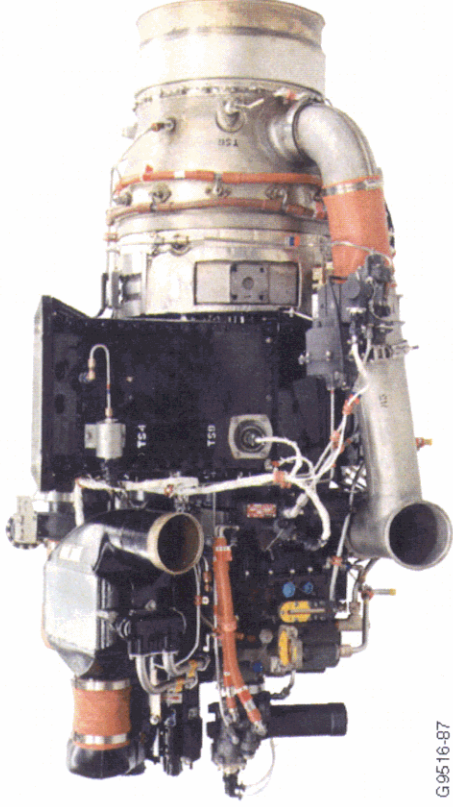
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## LIST OF ABBREVIATIONS/ACRONYMS

A/a	Ampere
ac	Alternating Current
ALF	Aft Looking Forward
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio Incorporated (Inc.)
ATP	Acceptance Test Procedure
BITE	Built-In-Test Equipment
Btu/lb	British Thermal Unit Per Pounds
C	Centigrade
cm <sup>3</sup>	Cubic Centimeters
COR(R)	Corrected
CTA	Current Transformer Assembly
CW	Clockwise
dc	Direct Current
DP( $\Delta$ P)	Delta (Differential) Pressure

## LIST OF ABBREVIATIONS/ACRONYMS (CONT)

ECU	Electronic Control Unit
ECS	Environmental Control System
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
eng	Engine
EXC	Excess
F	Fahrenheit
FCU	Fuel Control Unit
FD	Fairchild Dornier
FLHV	Fuel Lower Heat Value
FLT	Flight
GCU	Generator Control Unit
GPM/gpm	Gallons Per Minute
HP/hp	Horsepower
Hz	Hertz

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## LIST OF ABBREVIATIONS/ACRONYMS (Cont)

K/k	Thousand
kW	Kilowatts
IGN	Ignition
in-lb	Inch - Pounds
inH <sub>2</sub> O	Inches of Water
inHg	Inches of Mercury
in/min	Inches Per Minute
in/sec	Inches Per Second
ITRAC	Internal Trouble Reporting and Correction
lb/hr	Pounds Per Hour
lb/min	Pounds Per Minute
lb/sec	Pounds Per Second
LCV	Load Control Valve
LRU	Line Replaceable Unit

## LIST OF ABBREVIATIONS/ACRONYMS (Cont)

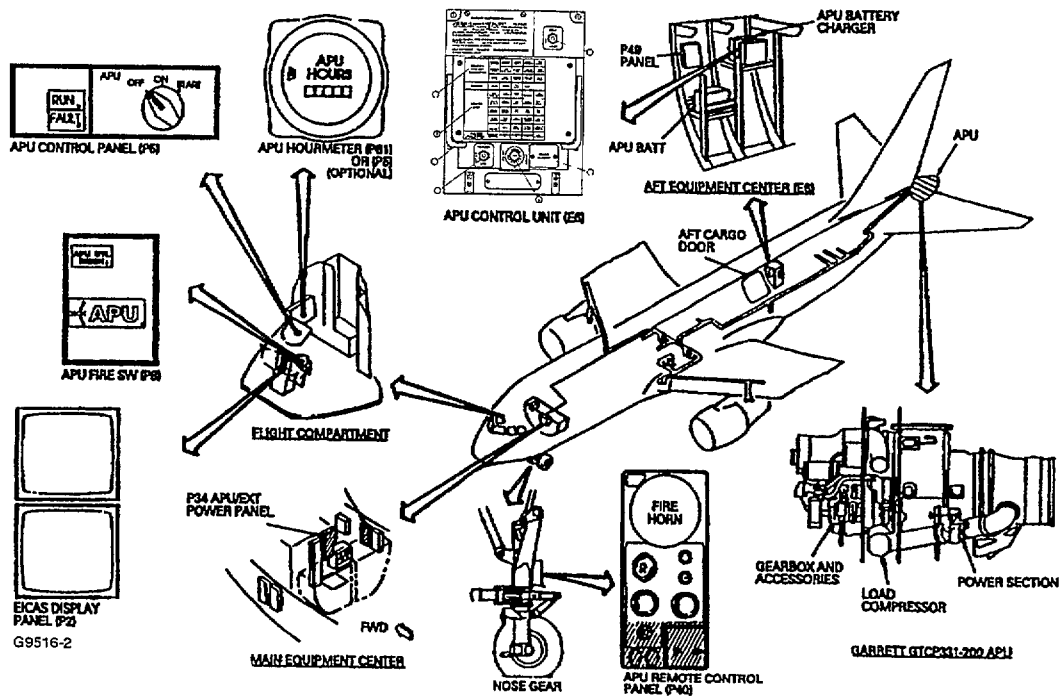
MES	Main Engine Start
N	Speed
PB	Bleed Pressure
PC	Personal Computer
Pcell	Test Cell Pressure
psi	Pound(s) Per Square Inch
psia	Pound(s) Per Square Inch, Absolute
psid	Pound(s) Per Square Inch, Differential
psig	Pound(s) Per Square Inch, Gage
POS	Position
P/N	Part Number
ppm	Pound(s) Per Minute
PS	Static Pressure
PS8	Lab Tailpipe Static Pressure
PT	Total Pressure
P2	Inlet Pressure

## LIST OF ABBREVIATIONS/ACRONYMS (Cont)

RPM/rpm	Revolutions Per Minute
RTL	Ready to Load
SCV	Surge Control Valve
SD	Shutdown
SHP/shp	Shaft Horsepower
S/N	Serial Number
TB	Bleed Temperature
TDC	Top Dead Center
TEMP	Temperature
TICA	Test Instruction Change Authorization
TT	Total Temperature
T2	Inlet Temperature
T5	Turbine Exhaust Temperature
V	Volt(s)
WB	Bleed Flow
WF	Fuel Flow

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# 767 AUXILIARY POWER SYSTEM



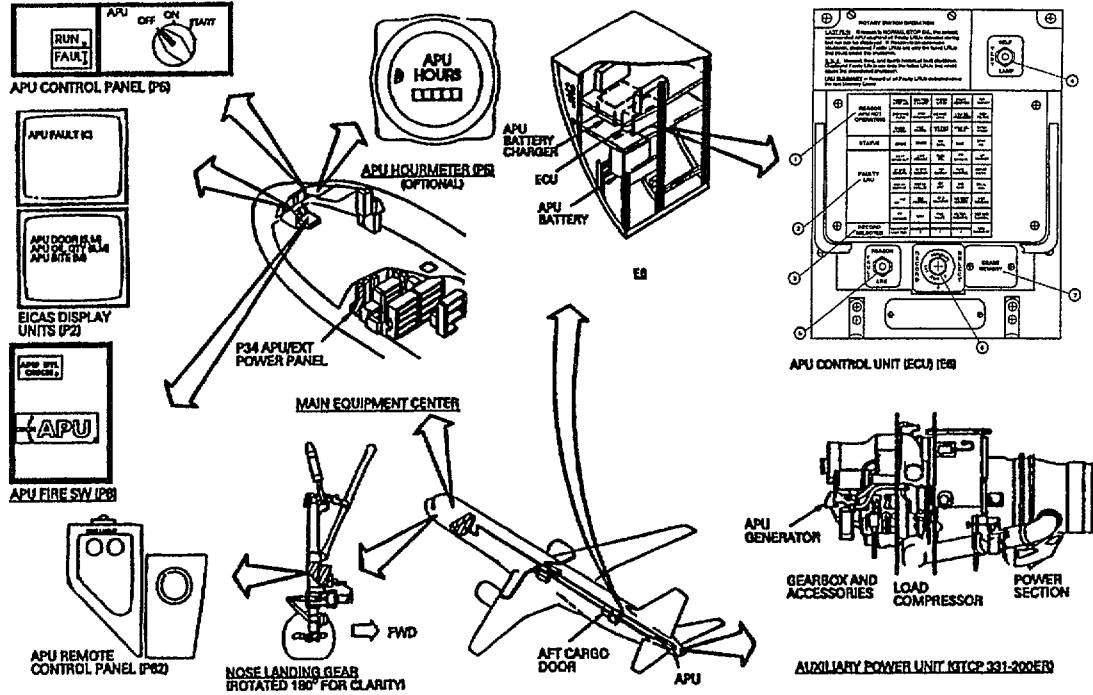
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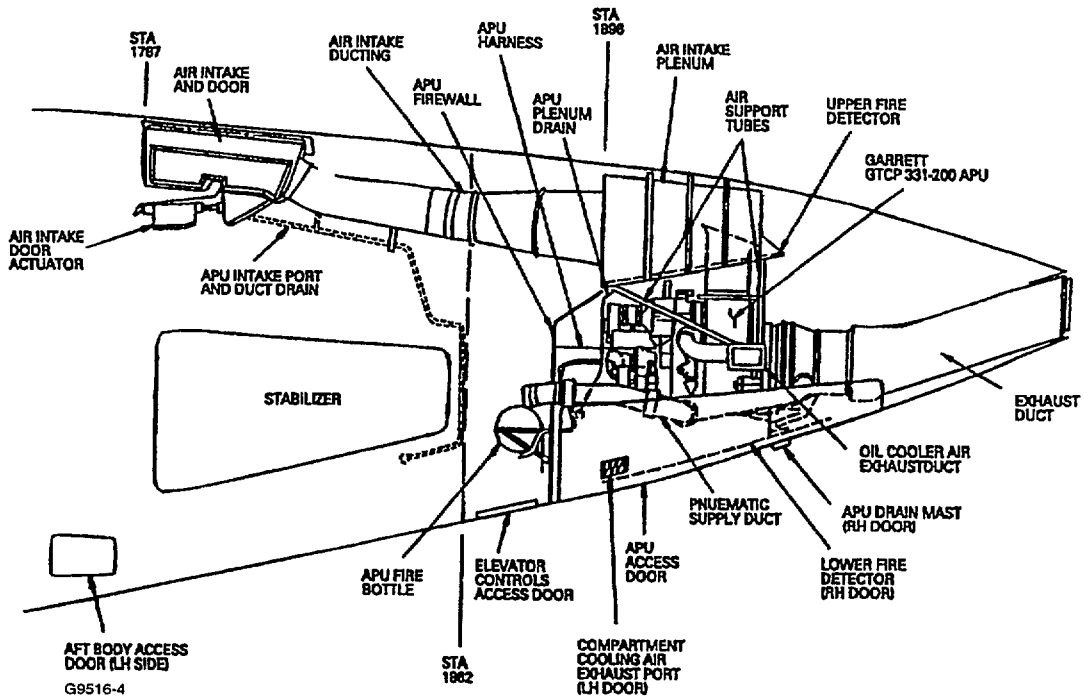
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# 757 AUXILIARY POWER SYSTEM



# APU INSTALLATION (757 SHOWN - 767 SIMILAR)

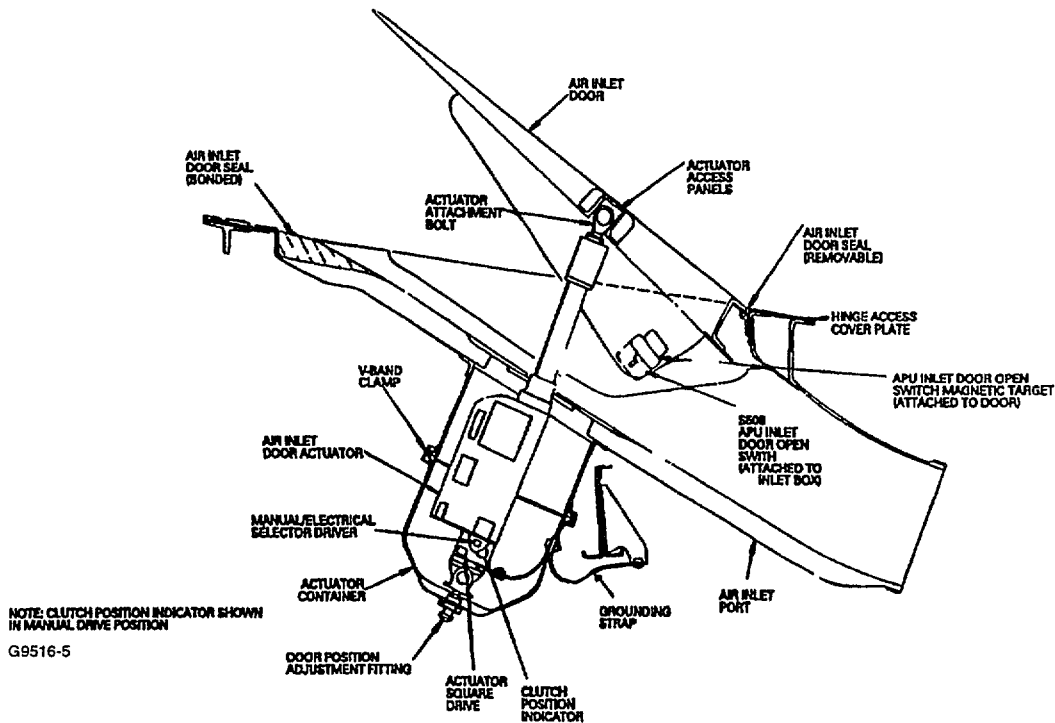


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# APU AIR INLET DOOR AND ACTUATOR (767)



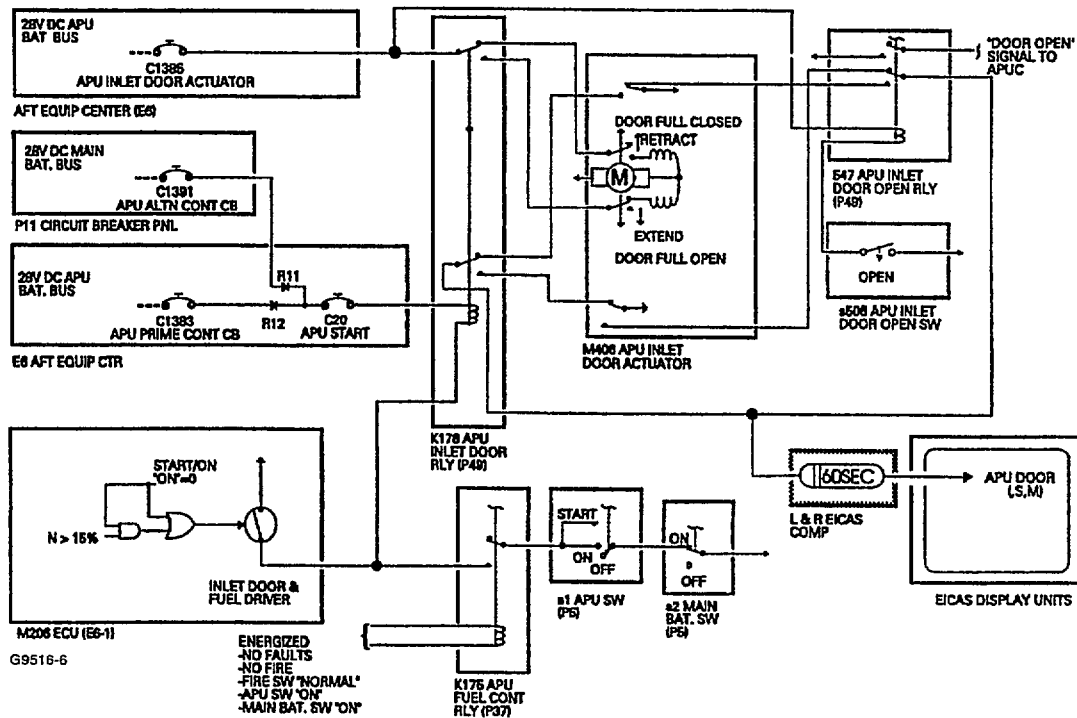
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# APU AIR INLET DOOR OPERATION (767)

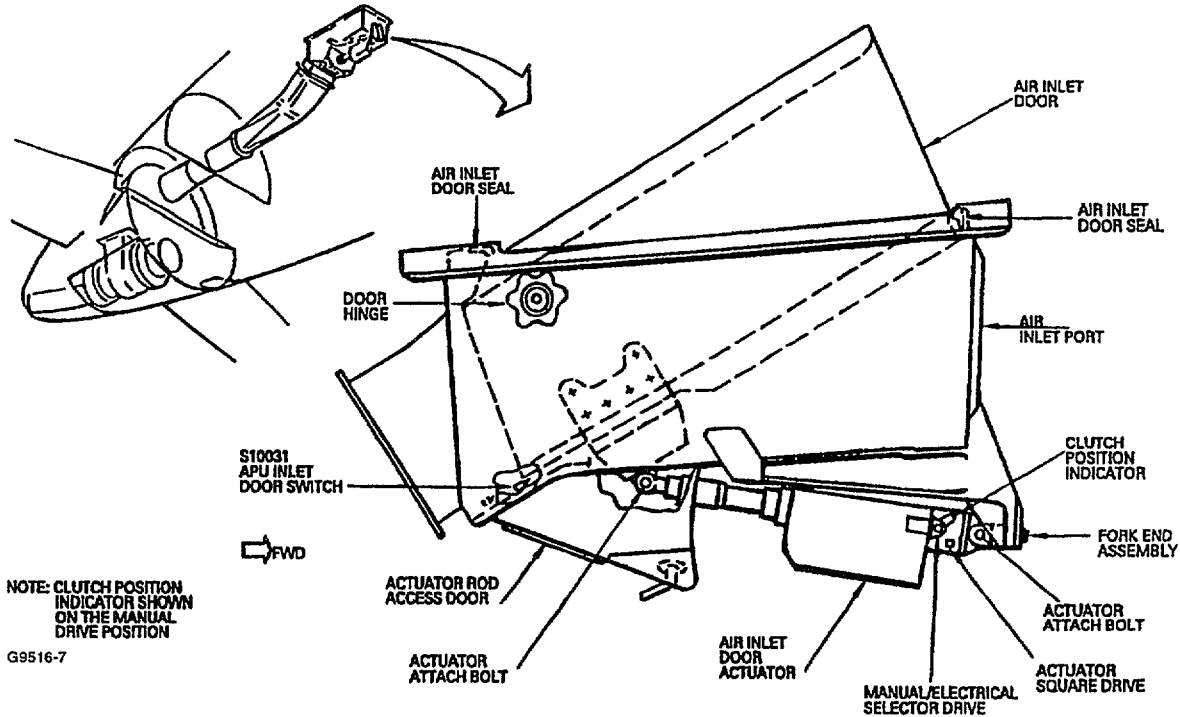


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# APU AIR INLET DOOR AND ACTUATOR (767)

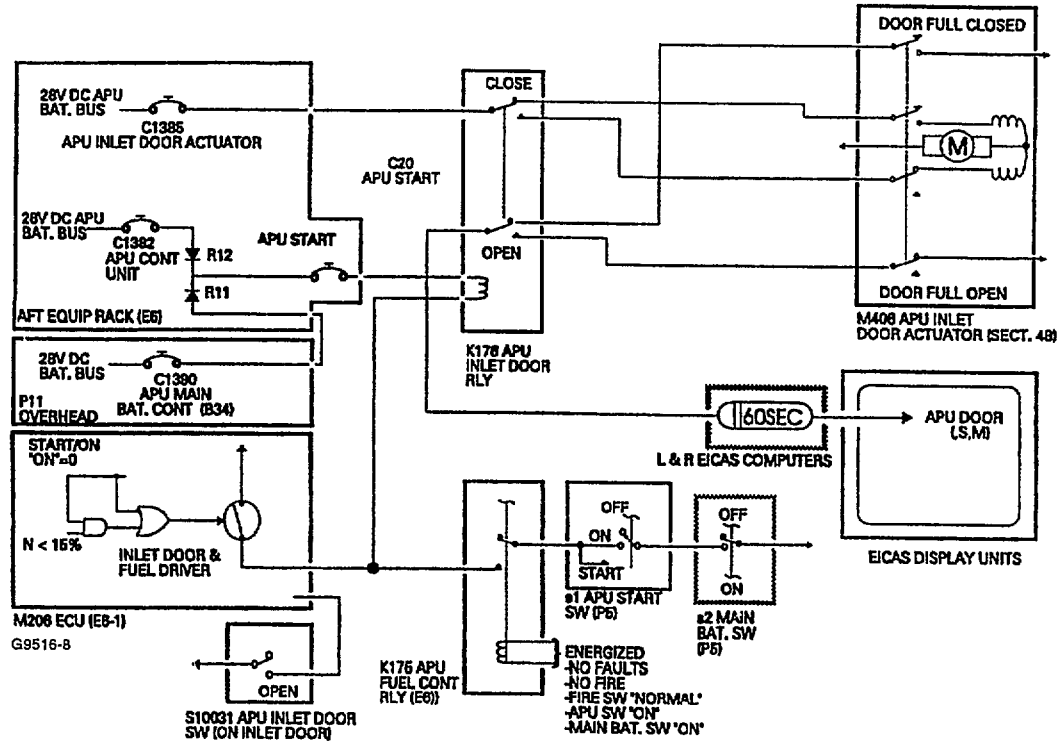


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# APU AIR INLET DOOR OPERATION (757)

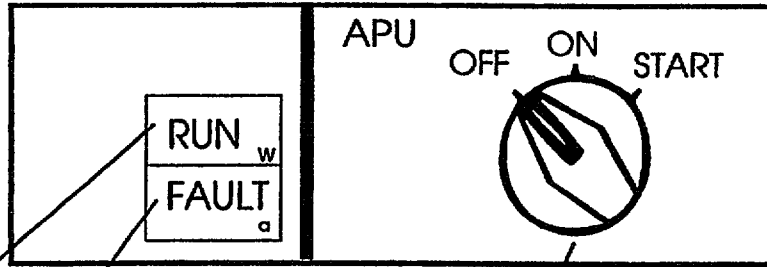


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# APU UNIT



## APU RUN LIGHT (White)

Comes on when APU is at operating speed.

## APU FAULT LIGHT (Amber)

- ON** -When protection circuits detect a fault.  
-Momentary during start and normal shutdown when fuel valve is not in commanded position.

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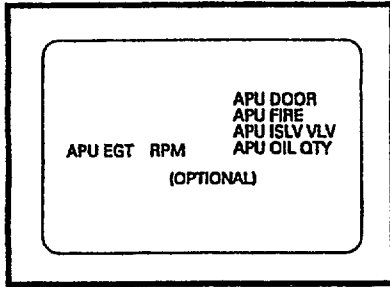
## APU SELECTOR

- ON** -Operating position. Opens APU inlet door and fuel valve, and if AC power not available starts the DC fuel pump. Provides arming circuit for APU bleed valve.
- START** -Momentary position spring loaded to ON when released. Initiates starting sequence.
- OFF** -Closes APU bleed valve if open. Initiates 60 second APU cool down cycle. If bleed valve was closed for longer than 60 seconds, APU will shut down immediately.  
Resets fault circuit.

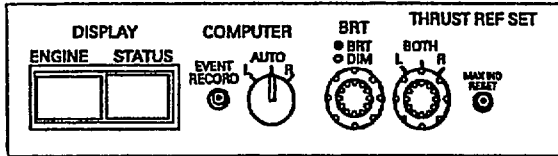
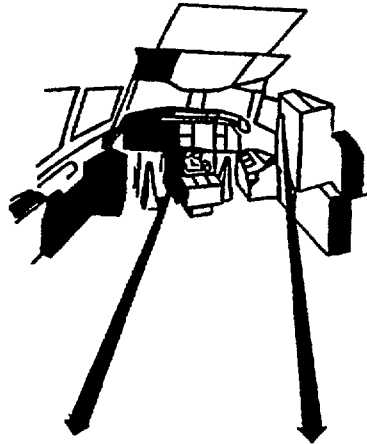
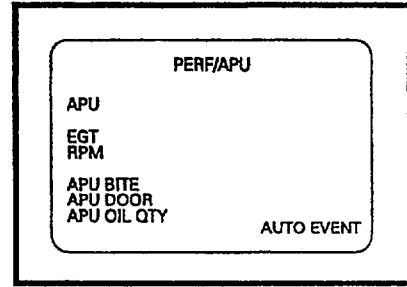
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# EICAS DISPLAYS

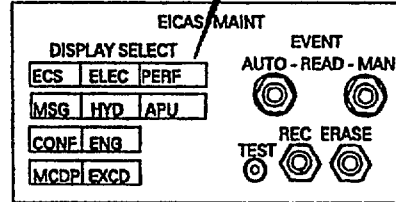
**LOWER EICAS DISPLAY UNIT (P2)**



**LOWER EICAS DISPLAY UNIT (P2)**



**PILOT'S DISPLAY SELECT PANEL (P9)**



**EICAS MAINTENANCE PANEL (P81)**

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# APU SPEED SWITCH POINTS

Loads	Start Signal	Percent of APU Speed					
		7	50	85	95	107	109
Fuel Solenoid	Off	On	--	--	--	Off	Off
Fuel Torquemotor	Active	--	--	--	--	--	Off
Ignition	Off	On	--	--	Off	Off	Off
Start Relay	On	--	Off**	--	--	Off	Off
SCV Torquemotor	Active	--	--	--	--	--	--
IGV TM	Off	--	--	--	Active*	--	--
Fault Relay	--	--	--	--	--	On	On
Generator Load Available	Off	--	--	--	On*	Off	Off
Flow Divider Solenoid	Off	--	--	ON	--	Off	Off
Bleed Air Valve Relay	--	--	--	--	On*	Off	Off
Deoil Solenoid	--	Off	--	--	On***	Off	Off
APU Shutdown	On****	--	--	--	--	--	--

\* After 2 sec. delay.  
 \*\* For P2 ≥3.29 psia only, for -18 through -20 ECU, starter cutoff will be switched to 55%.  
 For ground starts only, the starter cutoff will be switched to 42-50% engine speed.  
 \*\*\* On rolldown only.  
 \*\*\*\* Turned off if N <15% and shutdown or stop is in progress.

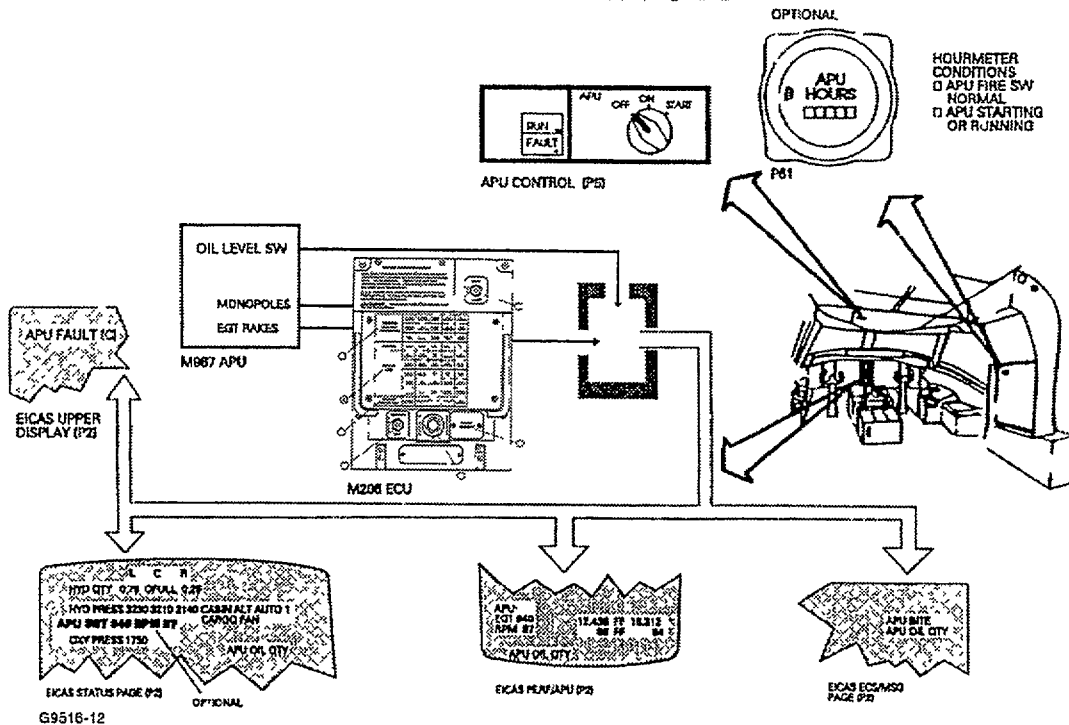
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1-10

# APU INDICATION



G9516-12

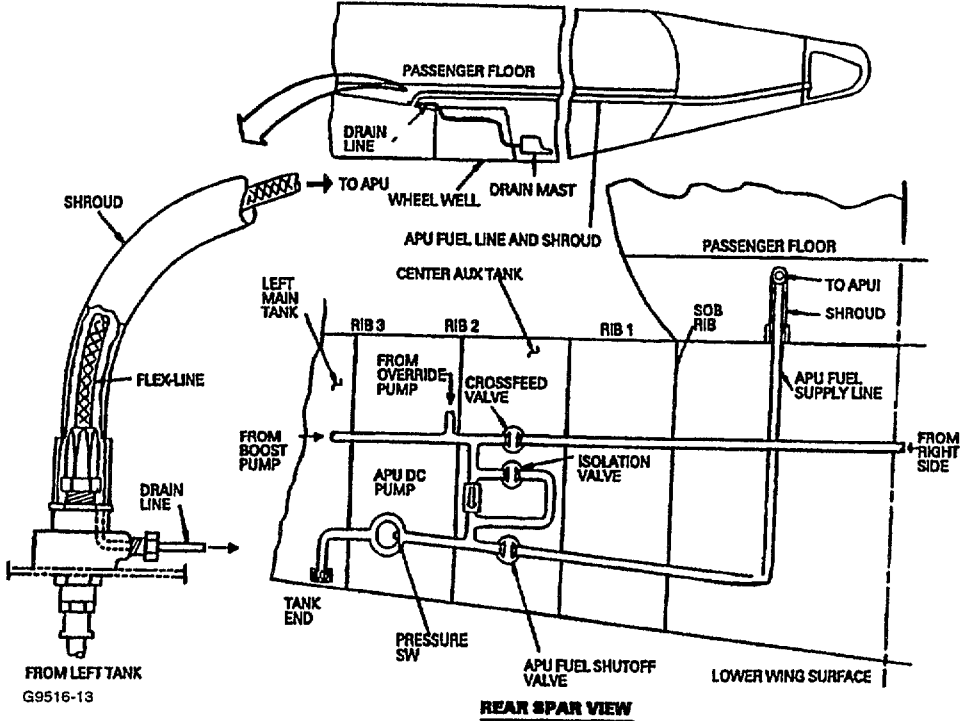
OPTIONAL

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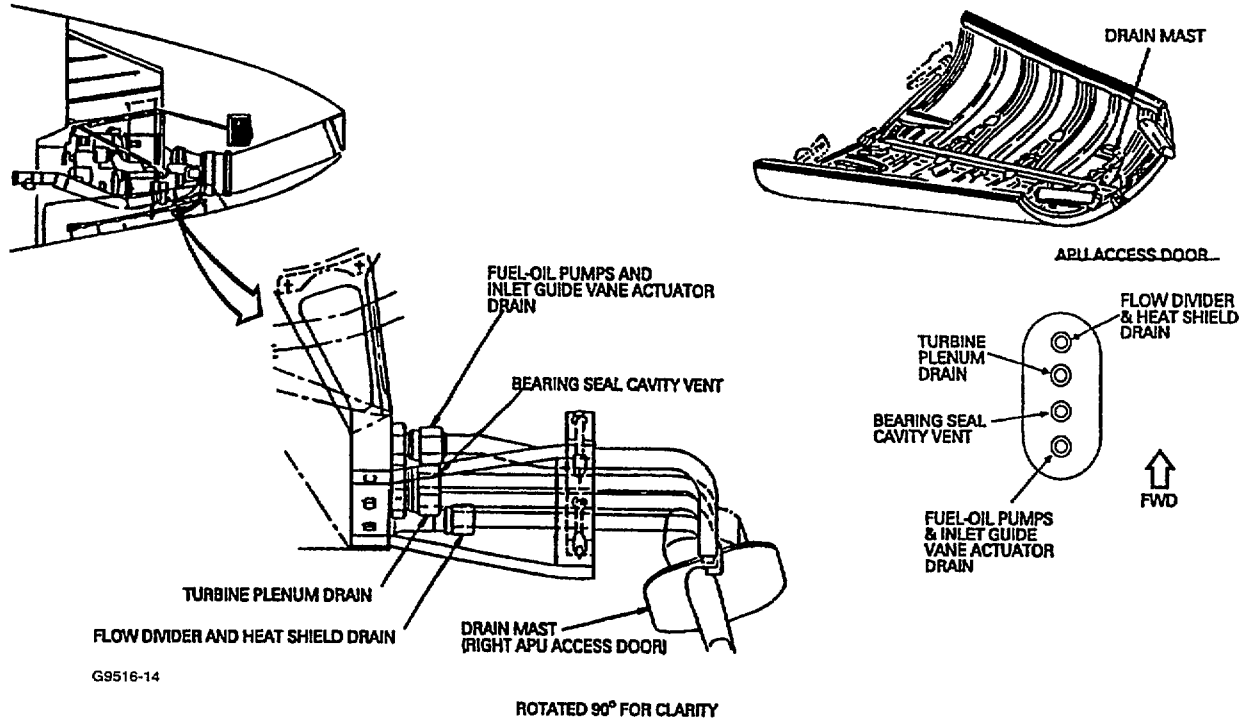
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# 767 APU FUEL FEED SYSTEM (757 SIMILAR)



# 767 APU DRAIN AND VENT ASSEMBLY

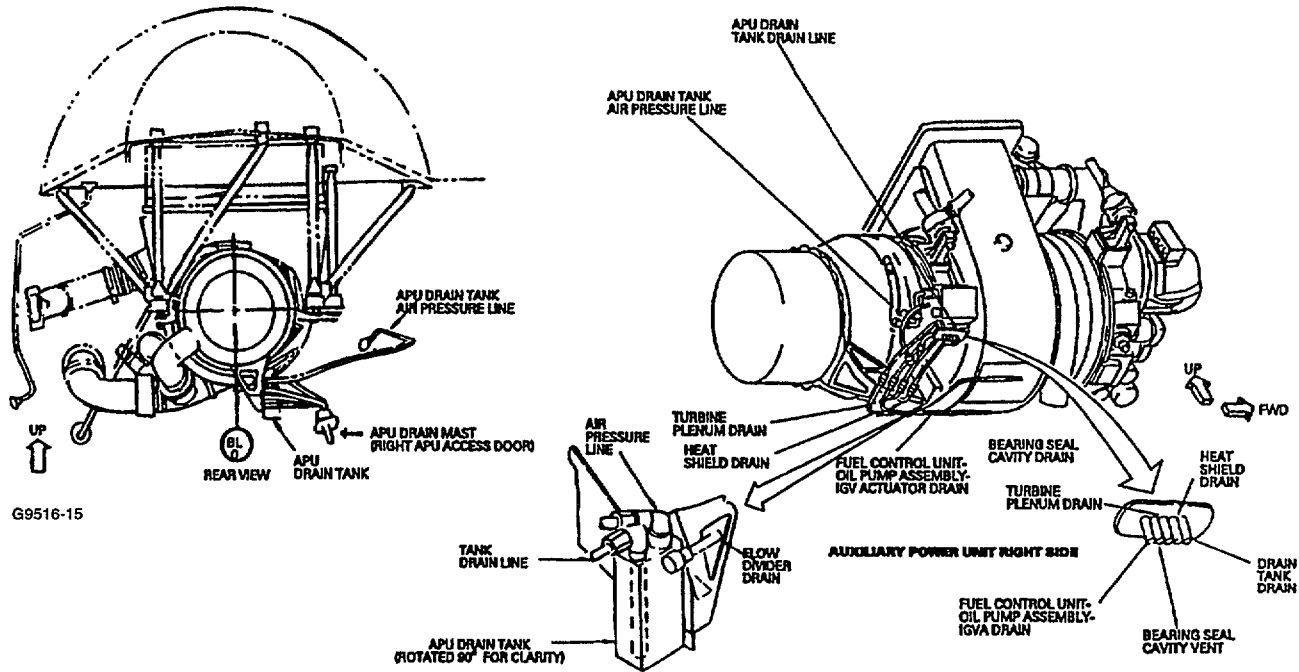


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# 757 APU DRAIN AND VENT ASSEMBLY



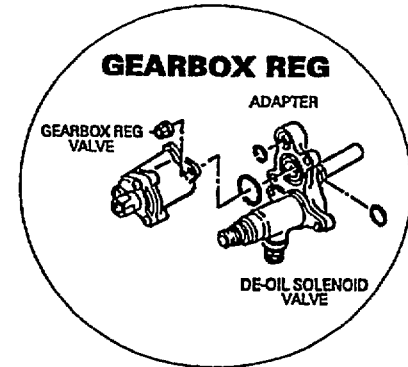
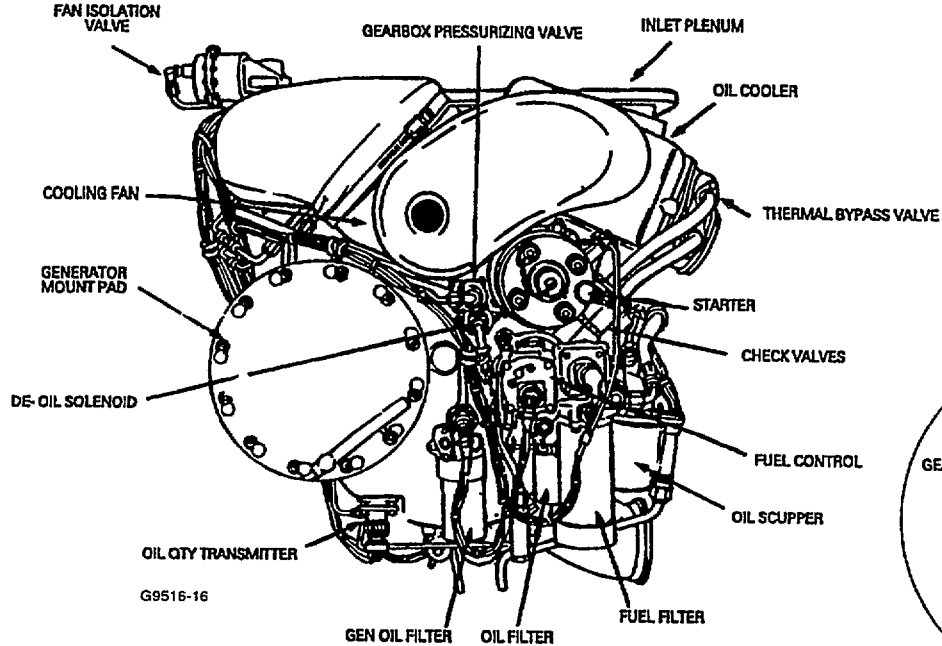
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# GTCP331-200 FRONT VIEW



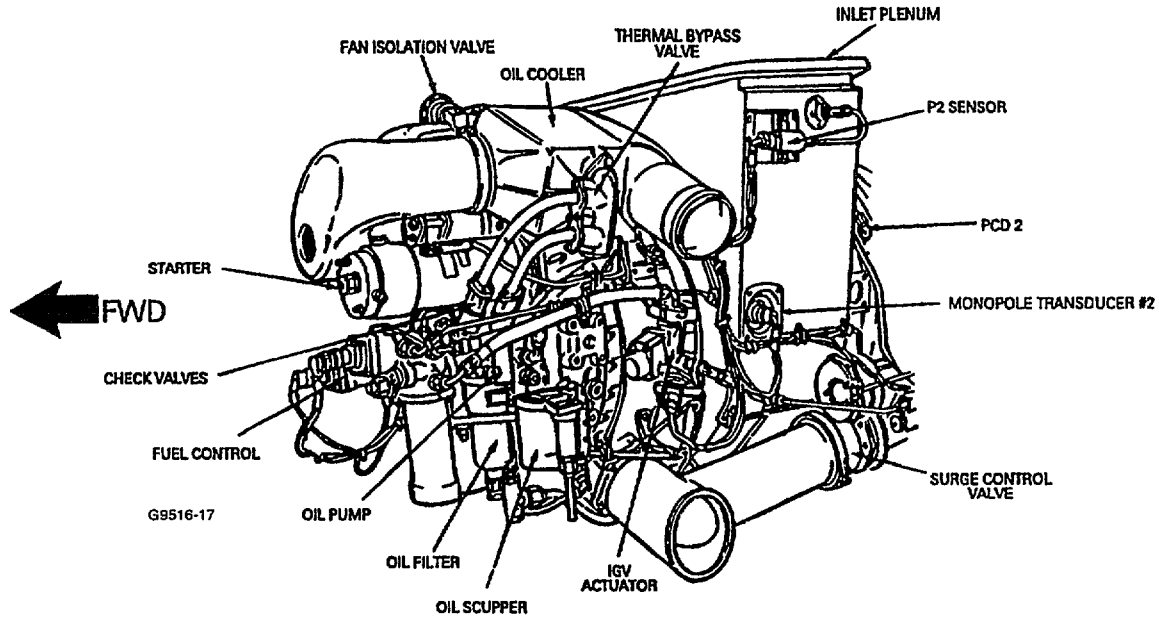
*For Reference Only*

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2-1

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# GTCP331-200 LEFT SIDE VIEW



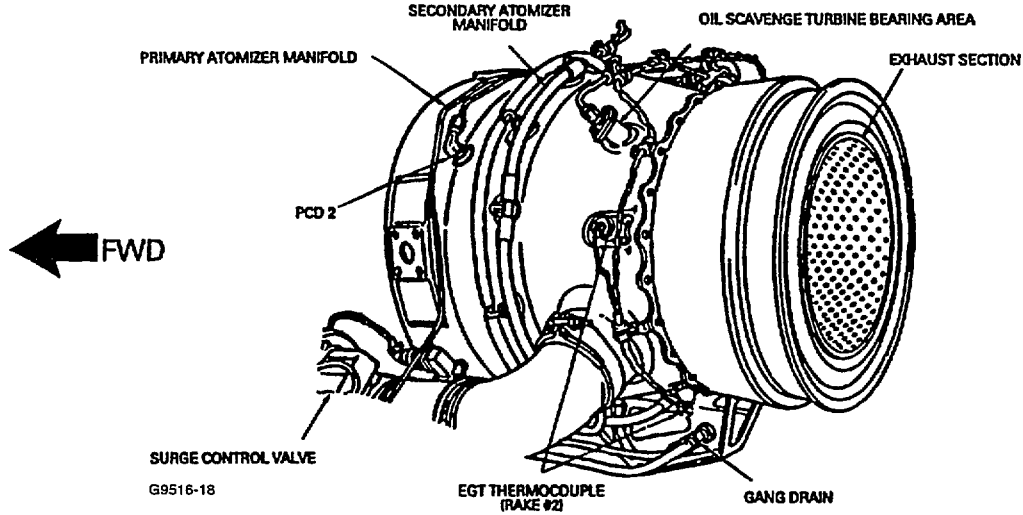
*For Reference Only*

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2-2

# GTCP331-200 LEFT SIDE VIEW



*For Reference Only*

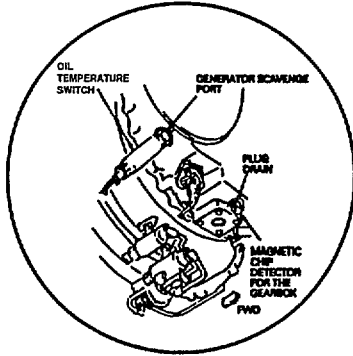
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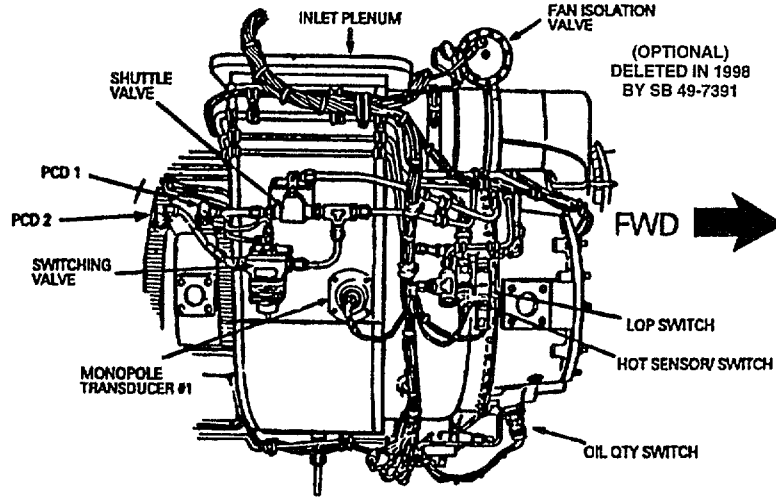
2-3



# GTCP331-200 RIGHT SIDE VIEW



G9516-19



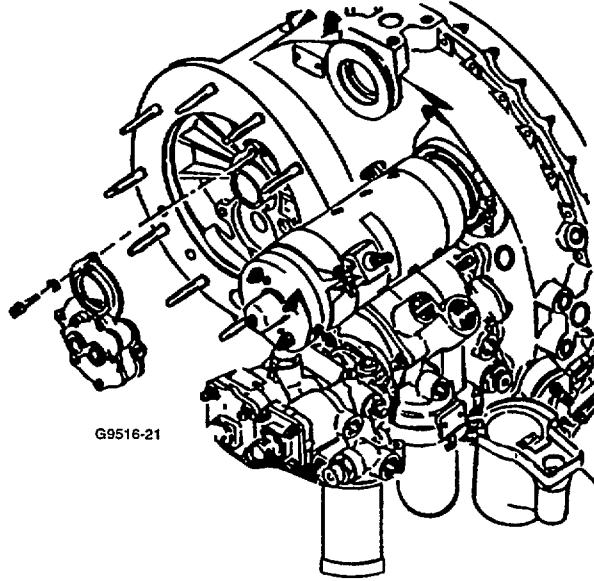
*For Reference Only*

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2-4

# GENERATOR SCAVENGE PUMP



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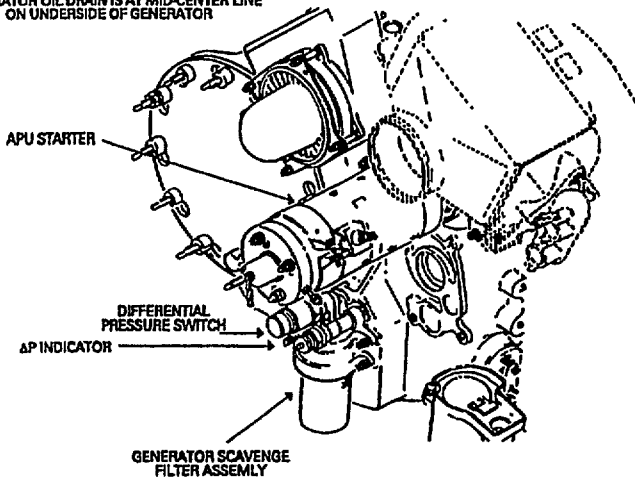
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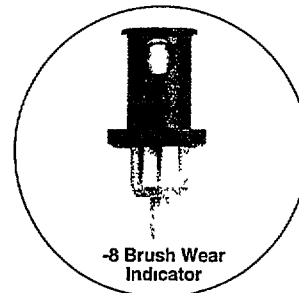
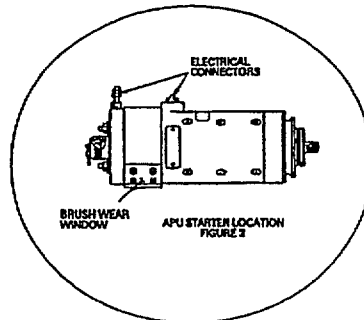
# GENERATOR SCAVENGE FILTER/ $\Delta$ P INDICATOR/ $\Delta$ P SWITCH

NOTE  
GENERATOR OIL DRAIN IS AT MID-CENTER LINE  
ON UNDERSIDE OF GENERATOR



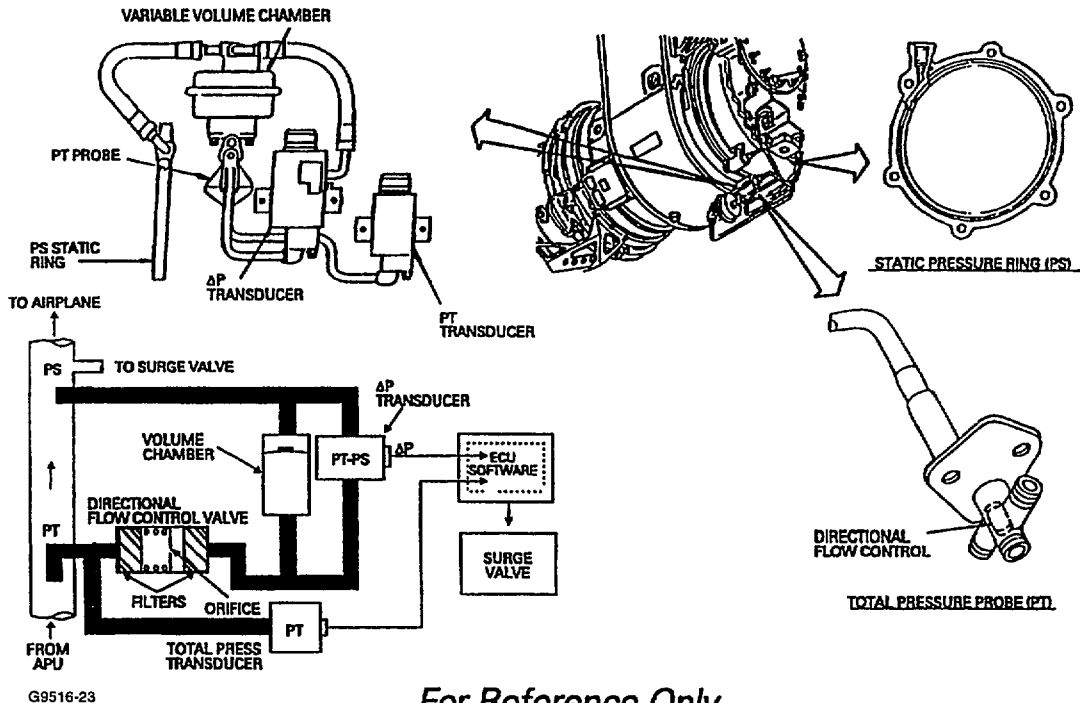
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# FLOW SENSORS AND TRANSDUCERS



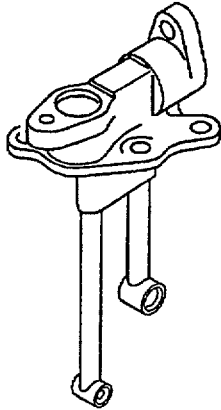
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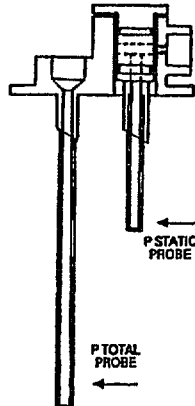
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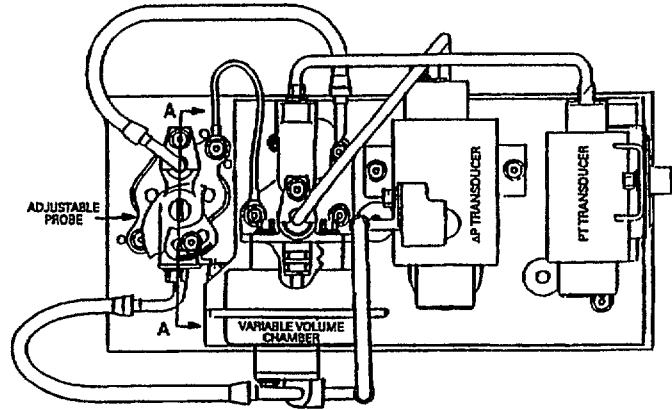
# ALTERNATE FLOW SENSOR CONFIGURATION (MODULE ASSEMBLY)



Probe From  
-7 Assembly



SECTION A-A



*For Reference Only*

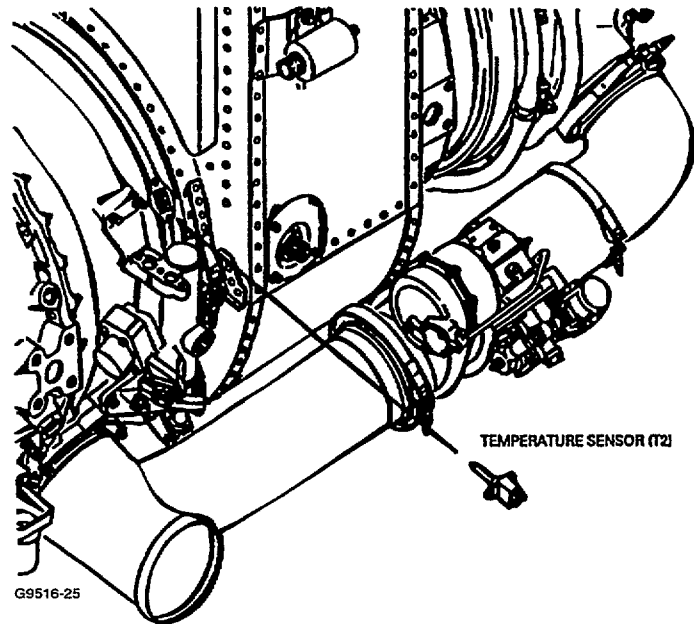
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# LOAD COMPRESSOR INLET TEMPERATURE SENSOR



G9516-25

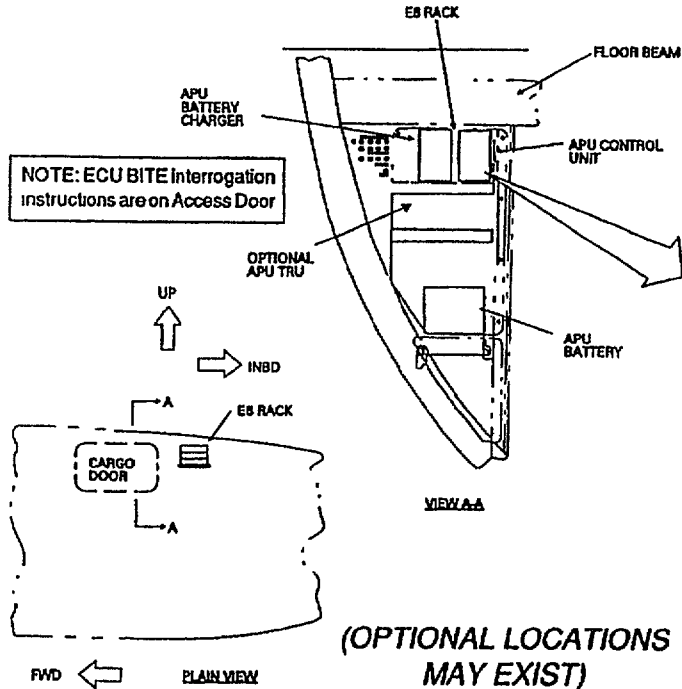
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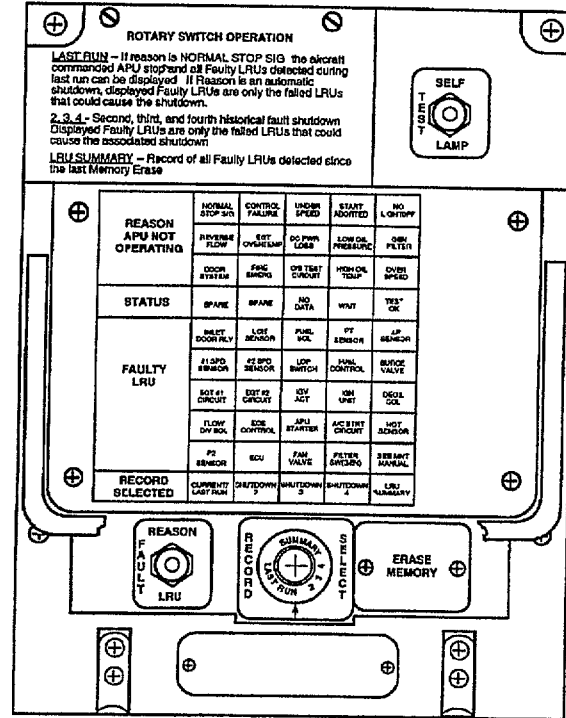
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# APU CONTROL UNIT (ECU)

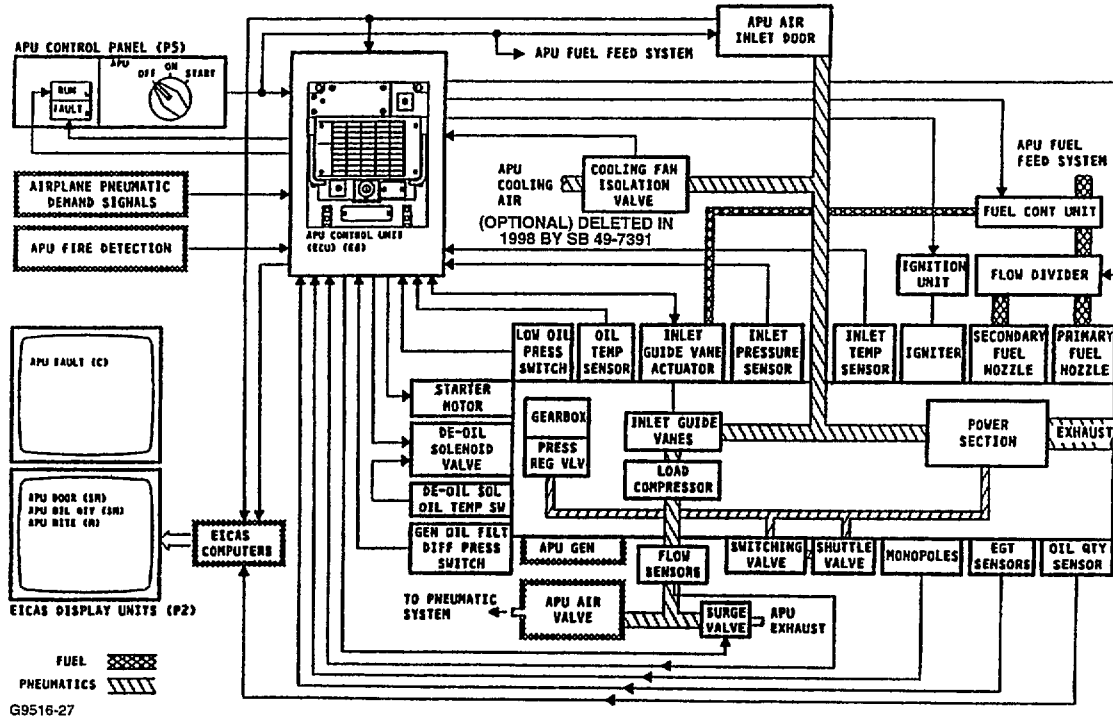


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# APU SYSTEMS AND COMPONENTS



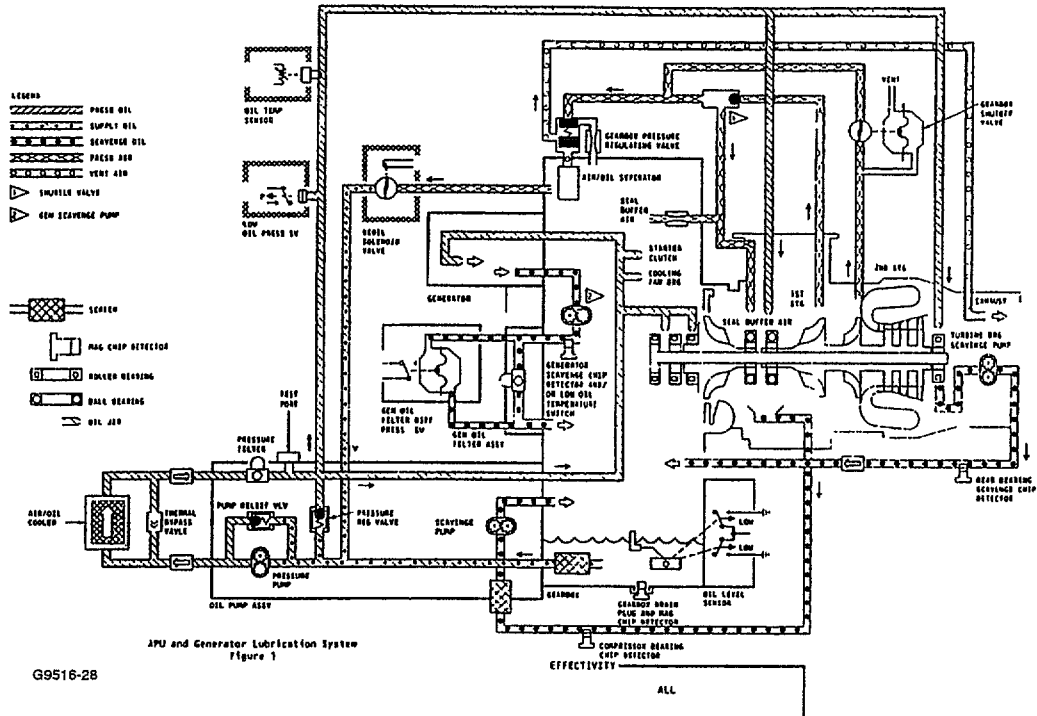
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# APU AND GENERATOR LUBRICATION SYSTEM



APU and Generator Lubrication System  
Figure 1

G9516-28

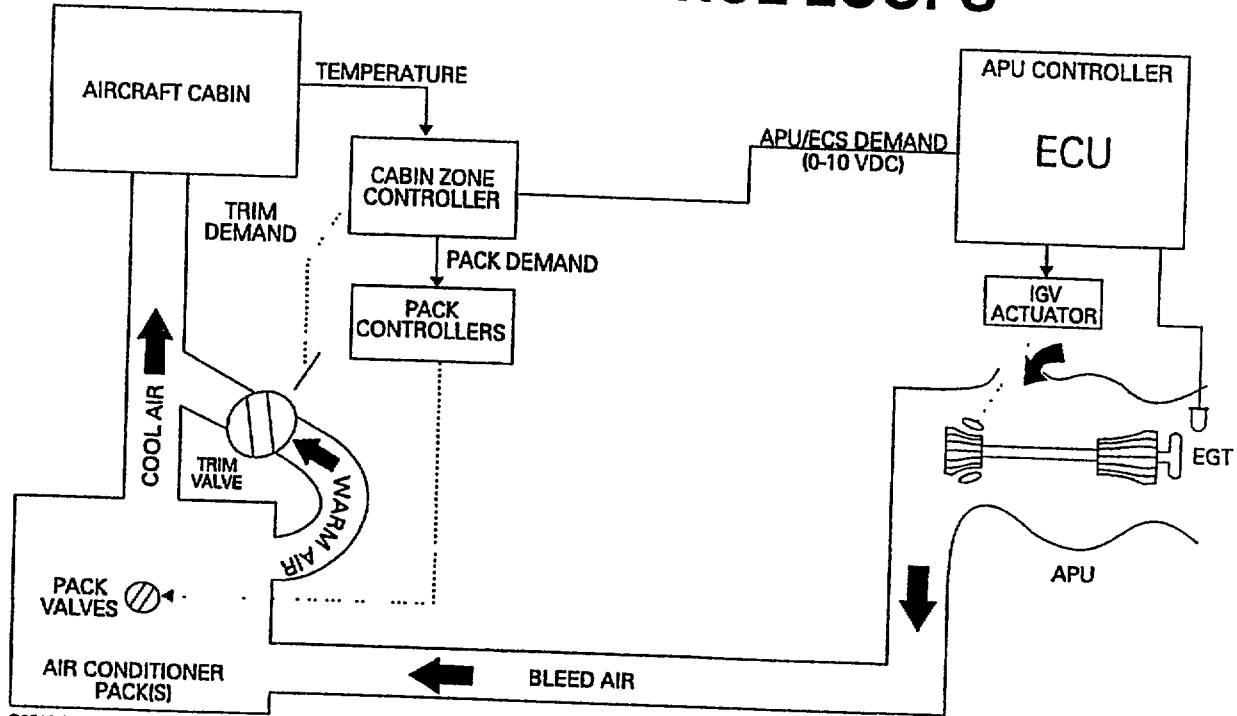
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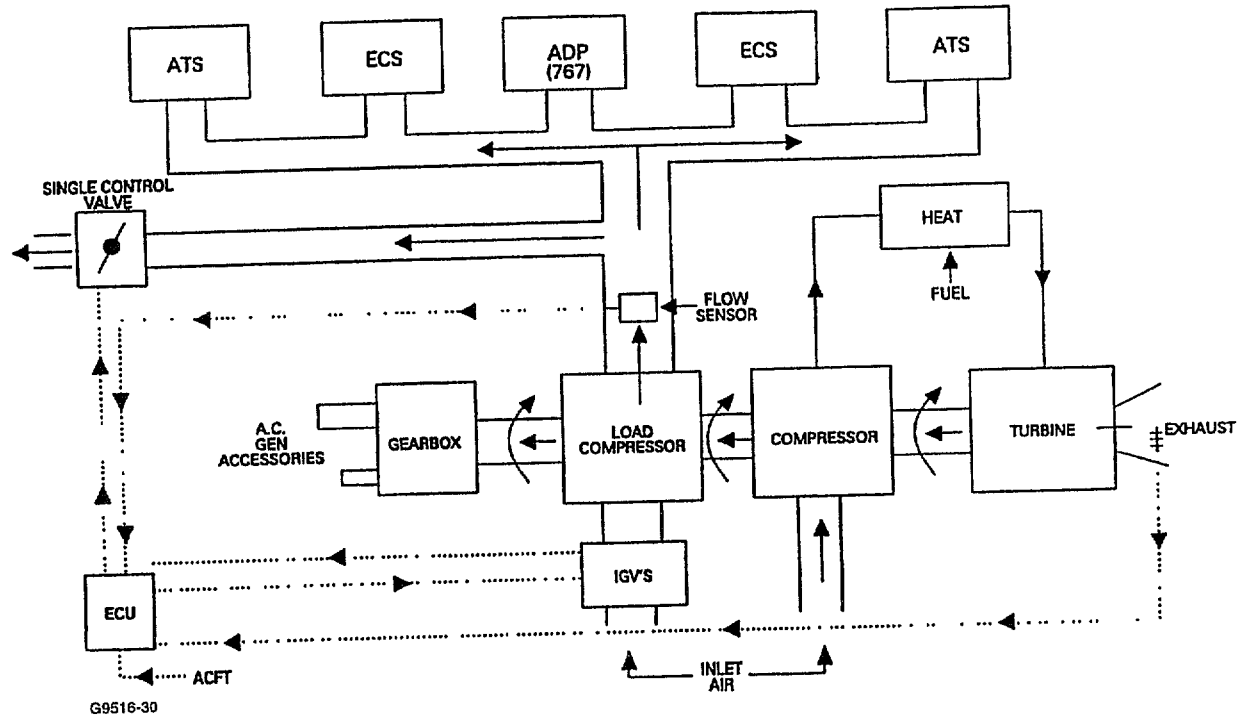
3-2

# APU/ECS CONTROL LOOPS



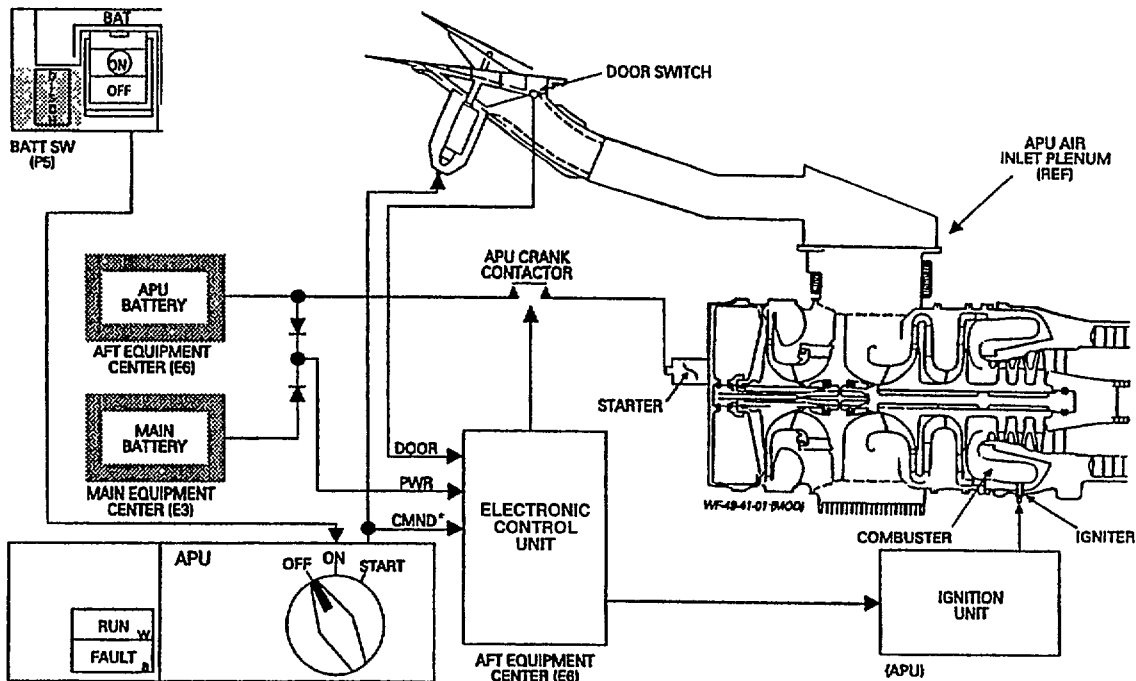
G9516-29

# SURGE CONTROL SYSTEM



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# APU IGNITION/STARTING SYSTEM



ELECTRONIC CONTROL UNIT (ECU)

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\*Refer to the Boeing FIM for relay interaction

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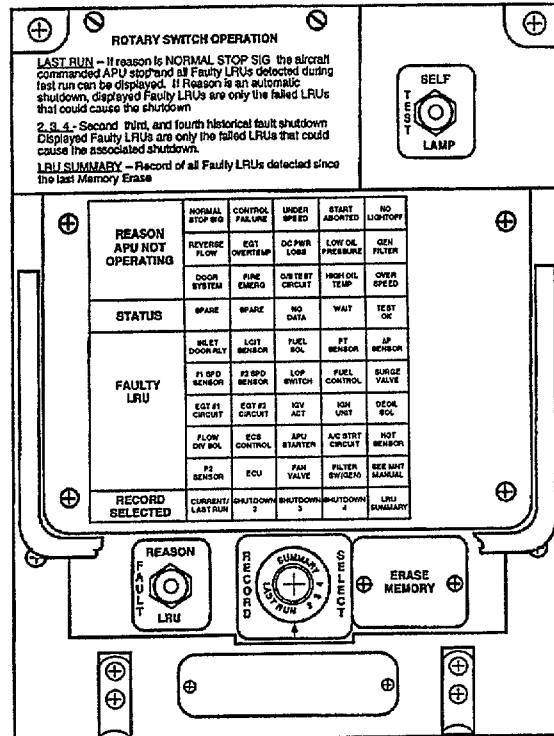
# **ECU Interrogation Procedure**

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4-1

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# ECU FRONT PANEL DISPLAY



G9516-88A

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4-2

**For Interrogation, refer to decal on inside of ECU door.**

# **ECU BITE AUTOMATIC SHUTDOWN/START INHIBIT FAULT INDICATIONS**

G9516-34

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### **OVERSPEED**

APU speed exceeds 107%

### **EGT OVERTEMP**

EGT exceeds the overtemperature schedule (1200°F/649°C on speed, higher during starts) for 1 second.

### **LOW OIL PRESSURE**

Speed is greater than 95% and the LOP signal (from LOP switch) is present for 15.5 seconds in flight or approximately 1 second on the ground

Two consecutive LOP shutdowns on start will flash the LOP light on the ECU front panel (during BITE interrogation) and inhibit further starts until the ECU memory is cleared (Ground operation only)

### **HIGH OIL TEMP**

Oil temperature has exceeded 310 ±30°F for 15 seconds while over 95% APU speed

### **NO LIGHT-OFF**

Speed is greater than 7% and EGT has not increased 150°F, compared to EGT at 7%, in 30 seconds

### **FIRE EMERG**

A "Fire Shutdown" signal has been received from the aircraft

### **START ABORTED**

- (1) Speed is less than 95% and both EGT thermocouple rakes fail or signals are lost.
- (2) Speed is less than 95%, but acceleration is less than 0.2% per second for 15 seconds and the inlet door is open
- (3) Also caused by resultant speed in ECU to be zero when speed sensors are failed if speed has not reached 95% during the start attempt.

### **UNDERSPEED**

- (1) Speed had exceeded 95% and then drops below 60% for 1 second.
- (2) Speed had exceeded 95% and then drops below 88% and the rate of acceleration is less than 0.2% per second for 5 seconds.
- (3) May be caused by both speed signals failed if speed has been greater than 95%.

### **DOOR SYSTEM**

- (1) The "INLET DOOR OPEN" signal is not received within 30 seconds of the commanded APU start and subsequently RUN switch turned off
- (2) Speed is greater than 7% for 0.5 second and the inlet door begins to close or the signal is lost.

### **REVERSE FLOW**

Speed is greater than 50% and LCIT (T2) has either exceeded 400F or has increased at a very rapid rate indicated either a reverse flow from main engine bleed or APU load compressor surge.

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### **GEN FILTER**

Oil temperature is greater than 115°F and the generator oil filter delta-P switch is sensed open for 5 second.

### **DC POWER LOSS**

DC power to the ECU is interrupted for more than 50 msec. The ECU will not realize the power loss until the next prestart BITE at which time the fault will be stored and the start allowed.

### **O/S TEST CIRCUIT**

Speed is greater than 85 percent 20 seconds following a commanded (after cooldown) or automatic shutdown. Further APU starts will be prevented until the ECU is replaced.

### **CONTROL FAILURE**

Indicates a sensed internal failure of the ECU, which could affect safe operation of the APU. Starts will be prevented as long as the failure is detected or until the ECU is replaced

### **NORMAL STOP SIG**

Indicates the APU shutdown due to normal removal of the aircraft run signal. The lamp will only illuminate with the rotary switch in the "LAST RUN" position and will be erased at the next APU start.

# **ECU FAULTY UNIT LAMP DESCRIPTIONS**

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### **APU STARTER**

Assumed failure based on the presence of voltage at the starter with no acceleration above 7% and no A/C start circuit failure. Poor battery condition, clutch damage or restricted APU rotation can result in an APU starter fault.

### **A/C STRT CIRCUIT**

Assumed failure of the aircraft start circuit if the ECU starter relay driver output is energized, speed is below 20% and no voltage is detected at the starter motor for 5 seconds. It is also faulted if the ECU starter relay driver output is not energized, speed is above 95% and voltage is still detected at the starter motor (stuck relay).

### **INLET DOOR RLY**

Tested in prestart and self-test modes for short circuits.

### **IGN UNIT**

Tested for open and short circuits continuously if energized.

### **FUEL SOL**

Tested for open and short circuits continuously if energized.

### **FLOW DIV SOL**

Tested for open and short circuits continuously if energized.

## **FUEL CONTROL**

The FCU torque motor is energized and tested for open and short circuits during the prestart and self-test BITE modes

### **#1 and #2 SPD SENSOR**

Assumed failure after APU speed has exceeded 50% and is then sensed below 30% by either speed sensor (monopole) unless a commanded or automatic shutdown is in progress.

The APU will operate with one functional speed sensor but operation will be prevented or aborted if both sensors are faulted. During operation the highest value between the two speed sensors is used for APU control.

### **EGT #1 and EGT #2 CIRCUIT**

Tested for circuit integrity, signal greater than minus 100°F, in all three BITE modes. In monitor mode if the two EGT thermocouple rake signals differ more than 150°F, with APU speed greater than 95%, the rake providing the lowest value will be faulted.

The APU will operate with one functional thermocouple rake. If both T/C rakes are faulted, prior to or during the APU start, operation will be prevented or aborted. If both T/C rakes are faulted, and APU speed is greater than 95%, the APU will continue to operate but bleed operation will be prevented (SCV opened and IGVs closed).

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## **P2 SENSOR**

Tested for open circuits and proper range in all three BITE modes.

The APU will operate on the ground with a faulted P2 Sensor using an alternate programmed value, but in flight, bleed operation will be prevented (SCV opened and IGVs closed). A calibration shift toward the high end, within range, can result in low bleed pressure. A calibration shift toward the high or low end, within range, can result in failed APU starts and/or an erroneous PT Sensor fault indication.

## **LCIT SENSOR**

Tested for open circuits in all three BITE modes, the dominant failure being an open circuit.

The APU will operate with a faulted LCIT sensor, without protection from a "Reverse Flow" condition, using an alternate programmed value based on the P2 input signal

## **PT SENSOR**

Tested for proper range in all three BITE modes. The PT sensor is also compared to the P2 sensor value during APU speed less than 12% ground operation and faulted if the signal is not within 3 psia. (The P2 could be the faulty unit)

The APU will operate with a faulted PT sensor but bleed operation will be prevented (SCV opened and IGVs closed). A calibration shift toward the high end, within range, can result in low bleed pressure. A calibration shift toward the low end, within range, can result in a surge condition.

## **•P SENSOR**

Tested for proper range in all three BITE modes. Also test for •P greater than 0.25 psid if IGVs open greater than 60 degrees for 5 seconds and speed >95%.

The APU will operate with a faulted DP sensor but bleed operation will be prevented (SCV opened and IGVs closed). A calibration shift toward the high end, within range, can result in low bleed pressure. A calibration shift toward the low end, within range, can result in a surge condition.

## **IGV ACT**

Torque motor tested in prestart and self-test BITE for open and short circuits. Actuator position is compared to the commanded position through the LVDT sensor if speed is greater than 7%. LVDT tests are performed in all three BITE modes.

The APU will operate with a faulted IGV actuator but bleed operation will be prevented (SCV opened and IGVs closed). Mechanical binding of the IGVs can result in an IGV actuator fault.

## **SURGE VALVE**

The SCV torque motor is energized and tested for open and short circuits in the prestart and self-test BITE modes.

The APU may operate with a faulted surge control valve but bleed operation will be prevented (SCV opened and IGVs closed).



### **ECS CONTROL**

Aircraft ECS signal is tested for proper demand voltage (-0.3 to 9.9 Vdc) with APU in ECS mode and APU speed greater than 95%.

The APU will operate with a faulted aircraft demand signal but the IGVs will be positioned to provide maximum ECS position.

### **DEOIL SOL**

Tested for open and short circuits continuously if energized.

### **LOP SWITCH**

Tested for proper electrical position (open) in the prestart and self-test BITE modes.

The APU will operate with a faulted low oil pressure switch but without protection from a low oil pressure condition.

### **HOT SENSOR**

Tested for proper range (minus 100°F to 482°F) in the prestart and self-test BITE modes and when APU speed is greater than 95%.

The APU will operate with a faulted high oil temperature sensor, if low temperature as in shorted, but without protection from a high oil temperature condition.

### **FILTER SW (GEN)**

Tested for proper electrical position (closed) in the prestart and self-test BITE modes

The APU will operate with a faulted generator oil filter differential pressure switch, but without protection from a clogged generator filter.

### **ECU**

Tested for multiple internal circuit conditions in all three BITE modes. Illumination of the ECU fault light indicates the ECU failed one or more of these times.

The APU will continue to operate unless the fault detected affects the ability to safely operate the APU in which case APU operation will be prevented or aborted.

Any serious BITE-detected internal fault in the ECU or mag latch tripped.

### **FAN VALVE (-19 and prior ECUs)**

Tested for proper electrical position (open, indicating the valve is closed) in prestart and self-test BITE modes. In the monitor mode it is tested for electrical position (closed, indicating the valve is open) with the APU speed greater than 95% and faulted after 5 seconds.

The APU will operate with a faulted fan isolation valve, but an eventual high oil temperature condition and shutdown will occur if the valve fails to open. If this condition occurs and the fan isolation valve has been prematurely removed from the APU, per Service Bulletin 49-7391, and replaced with a straight duct or hollow valve body, the actual problem relates to low oil pressure or late oil pressure condition and should be investigated accordingly.

(-20 ECU)

Tested for proper electrical position (open, indicating the valve is closed) in prestart and self-test BITE modes. In the monitor mode it is tested for electrical position (closed, indicating the valve is open) with the APU speed greater than 95% and faulted after 16 seconds.

The APU will operate with a faulted fan isolation valve, but an eventual high oil temperature condition and shutdown will occur if the valve fails to open.

### **SEE MNT MANUAL**

This fault will occur if overcurrent is detected in driver circuit maintenance lamps, bleed-air relay, generator-available relay, or fault relay.

When no faulty unit is detected this lamp will illuminate to indicate further troubleshooting is required.

## MINIFLAG DESCRIPTION

The ECU offers another troubleshooting tool in addition to the front panel BITE lamp display. This tool, called miniflags, was primarily established for bench troubleshooting of the ECU but also includes many codes useful for troubleshooting the APU. The miniflags are comprised of 143 fault codes using the 2117432-19 and -20 ECU, which identify detected faults.

## MINIFLAG INTERROGATION PROCEDURE

When the APU is not running, the LMPTST mode then causes all five columns of lamps to illuminate column by column, from left to right. Each column shall illuminate for 4 seconds and extinguish, followed sequentially by the next columns. Lamp brightness will be consistent between lamp test and miniflag display.

Following the lamp test, the ECU shall enter into miniflag display mode. The LRU and ECU miniflag faults (miniflags 1 through 128) are displayed in sequence. If no miniflag information exists, OK should be displayed. This sequential display shall be repeated each time the LAMP TEST button is momentarily pressed. After completion of lamp test and miniflag display mode, the ECU shall read the RUN switch. If a start is being commanded, the ECU shall initiate PSBITE; otherwise, it shall power down and disconnect from the dc power.

If the lamp test switch remains on following the completion of miniflag display, the front panel selector switch positions are displayed. Each row of the display represents a selector switch (8 switches), and each column represents a position (5 positions). The top left corner represents selector switch 1, position 1. The top right corner represents selector switch 1, position 5. The bottom row is not used by this test. The row above the bottom row is used to display the position of the RECORD SELECT switch. Positions 1 to 5 are displayed from left to right, respectively. If for 60 seconds none of the switch positions are changed, the special test mode is terminated.

## MINIFLAG INTERROGATION PROCEDURE (Cont)

When the APU is running, placing the test switch in the LAMP position will skip the lamp test and will immediately display all LRU and ECU miniflag faults and APU system diagnostic miniflag faults in sequence (miniflags 1 through 199). The miniflags will continue to be displayed only while TEST switch is held in the LAMP position. Continuing to hold the TEST switch in the LAMP position will keep the display alive and display the miniflags in a continuous loop from lowest to highest.

Miniflags are intended to supply more detailed diagnostics than are available from the faulty LRU display. Miniflags are numbered 1 through 199 and are grouped as follows:

- (1) 1 to 128 - LRU and ECU miniflags (EAROM)
- (2) 129 to 199 - APU system diagnostics (RAM)

During the self-test mode, all LRU and ECU miniflags shall be recorded. During prestart and monitor BITE modes, only those miniflags that have been detected during the current run shall be available for display during the current APU run. At the completion of the APU run, upon receiving a stop or shutdown signal, all LRU and ECU miniflags (1 to 128) since the last memory erase shall be available for display, and all APU system diagnostic miniflags (129 to 199) shall be deleted.

The function of APU system diagnostic miniflags (129 to 199) is to provide a method of troubleshooting the APU system during operation. The status of these miniflag faults shall be maintained continuously while the APU is running. If the fault condition exists, the miniflag will be set. If the fault condition goes away, the miniflag will be cleared.

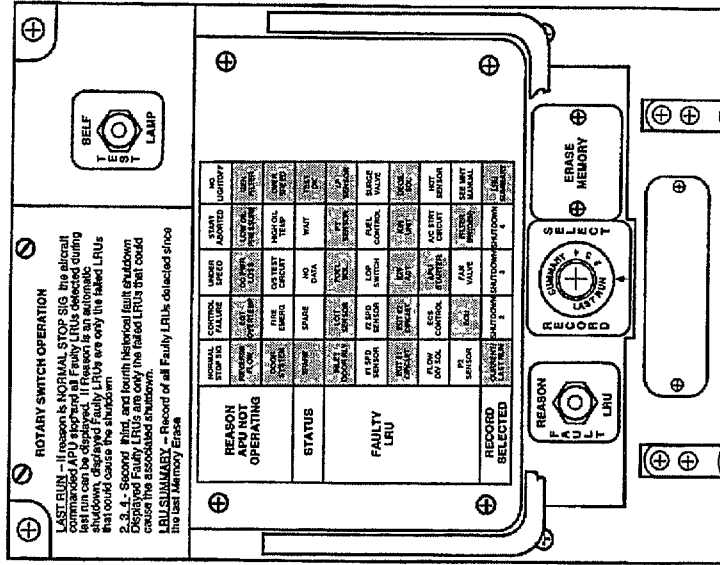
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## **TROUBLESHOOTING USING MINIFLAGS**

Each miniflag code corresponds to a specific detected fault as shown in the table. For each FAULT CODE the table shows the corresponding front panel BITE LAMP, if any, that will illuminate along with the miniflag. The table also provides a description of the fault (MINIFLAG INTERPRETATION) and the component(s) (PROBABLE FAULTY UNIT) that may cause the fault

**NOTE:** Any fault with PROBABLE FAULTY UNITS other than the ECU could be caused by the listed component, the ECU, or the wiring between.

# MINIFLAGS DISPLAY INDICATORS FORM AN "OK"



G9516-48A

31-15671

5-4

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
1	#1 SPD SENSOR	Failed speed input 1	#1 Monopole (right), wiring or ECU
2	#2 SPD SENSOR	Failed speed input 2	#2 Monopole (left), wiring or ECU
3-6	ECU	Internal ECU fault	ECU
7	SEE MNT MANUAL	Indicates aircraft faults	See Miniflags 75-78
8	none	Spare	none
9	LCIT SENSOR	LCIT (T2) signal out of range	LCIT sensor, wiring or ECU
10	HOT SENSOR	Oil Temp Sensor out of range	Oil temp sensor, wiring or ECU
11	EGT #1 CIRCUIT	Failed EGT Thermocouple #1 or EGT #2 reads +150F more than EGT #1 onspeed	#1 EGT rake, wiring or ECU Possible power section distress
12	EGT #2 CIRCUIT	Failed EGT Thermocouple #2 or EGT #1 reads +150F more than EGT #2 onspeed	#2 EGT Rake, wiring or ECU. Possible power section distress
13	none	Spare	

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
14	PT SENSOR	PT transducer out of range. Or differs more than 3 psig from the P2 reading (on the ground during APU rolldown)	PT transducer, P2 transducer, contaminated sensor system/plumbing, wiring or ECU
15	•P SENSOR	DP transducer out of range or has an output of less than 0.25 psig when the IGV position is sensed mostly open	Delta P transducer, contaminated sensor system/plumbing, wiring or ECU
16	P2 SENSOR	P2 transducer out of range or less than 8 psig on the ground	P2 transducer, contaminated sensor system/plumbing, wiring or ECU
17	FILTER SWITCH (GEN)	Generator oil filter switch failed open	Generator filter switch, wiring or ECU
18	FAN VALVE	Cooling fan isolation valve failed. The normally open switch is sensed closed prior to APU operation or open during operation	Cooling fan isolation valve, wiring or ECU.
19	LOP SWITCH	LOP switch failed closed (shorted) prior to APU start	LOP switch, wiring or ECU
20	none	Spare	none
21	ECU	Internal ECU fault	ECU

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
22	GEN FILTER	Blocked generator filter, pressure switch, wiring or ECU	
23	ECS CONTROL	ECS demand signal out of range	Zone temp control or ECU.
24	none	Spare	none
25	FUEL SOL	Fuel solenoid circuit is open or shorted	Fuel shutoff solenoid, wiring or ECU
26	DEOIL SOL	Deoil solenoid circuit is open or shorted.	Deoil solenoid, wiring or ECU
27	FLOW DIV SOL	Flow divider solenoid circuit is open or shorted	Flow divider solenoid, wiring or ECU
28	IGN UNIT	Ignition unit circuit is open or shorted	Ignition unit, wiring or ECU.
29-30	ECU	Internal ECU fault.	ECU
31	none	Spare	none
32-33	ECU	Internal ECU fault	ECU

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
34	A/C STRT CIRCUIT	The aircraft start circuit failed. Voltage found at starter motor with APU speed greater than 95% or no voltage found during start	Aircraft start relays, wiring or ECU
36-39	ECU	Internal ECU fault.	ECU
40	none	Spare	none
41	FUEL CONTROL	Fuel control torque motor circuit is open or shorted	Fuel control, wiring or ECU
42	IGV ACT	IGV actuator torque motor or LVDT circuit is open or shorted or IGV Actuator position does not match the commanded position	IGV actuator, binding IGV assembly, wiring or ECU
43	SURGE VALVE	Surge control valve torque motor circuit is open or shorted.	Surge control valve, wiring or ECU.
44-45	ECU	Internal ECU fault	ECU
46	none	Internal ECU fault. Will not affect APU operation	ECU

<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
47	INLET DOOR RLY	Overcurrent found on the inlet door relay	Inlet door relay, wiring, ECU
48	ECU	Internal ECU fault	ECU
49-64	none	Spare	none
65	ECU	Internal ECU fault.	ECU
66	IGV ACT	IGV actuator position does not match the commanded position.	IGV actuator, binding IGV assembly, wiring or ECU
67-74	none	Spare	none
75	SEE MNT MANUAL	Maintenance lamp circuit.	Maintenance lamp circuit
76	SEE MNT MANUAL	Bleed-air relay circuit	Bleed-air relay circuit
77	SEE MNT MANUAL	Generator-available relay circuit	Generator-available relay circuit
78	SEE MNT MANUAL	Fault relay circuit overheat	Fault relay circuit overheat
79	none	Spare	none

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
80 - 81	none	Spare	none
82-84	ECU	Internal ECU fault	ECU
85	none	Spare	none
86	none	Internal ECU fault.	ECU
87-88	none	Spare	none
89	ECU	Internal ECU fault	ECU
90	FUEL SOL	Fuel solenoid circuit is open.	Fuel shutoff solenoid, wiring or ECU.
91	IGN UNIT	Ignition unit circuit is open.	Ignition unit, wiring or ECU.
92	ECU	Internal ECU fault	ECU
93	none	Spare	none
94 - 95	ECU	Internal ECU fault	ECU

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
96	none	Spare	none
97	ECU	Internal ECU fault	ECU
98	none	Spare	none
99-100	ECU	Internal ECU fault.	ECU
101	FUEL CONTROL	Fuel control torque motor circuit is open	Fuel control, wiring, ECU.
102 - 104	none	Spare	none
105	ECU	Internal ECU fault	ECU
106	IGV ACT	IGV actuator torque motor circuit is open or shorted	IGV actuator, wiring or ECU
107	ECU	Internal ECU fault	ECU
108	FUEL SOL	Fuel shutoff solenoid mechanically stuck open. APU did not shutdown when commanded	Fuel shutoff solenoid
109 - 111	none	Spare	none
111	none	Spare	none

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<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
112	ECU	Internal ECU fault Will affect APU operation	ECU
113	none	Spare	none
114	none	Spare	none
113 - 115	none	Spare	none
115	none	Spare	none
116-119	ECU	Internal ECU fault.	ECU
120	PT SENSOR DELTA P SENSOR P2 SENSOR	Internal ECU fault. Transducer supply voltage	ECU, wiring
121-125	ECU	Internal ECU fault	ECU
126	IGV ACT	IGV actuator LVDT voltage is out of expected range	IGV actuator, wiring or ECU
127	IGV ACT	IGV actuator LVDT secondary voltage is out of expected range	IGV actuator, wiring or ECU
128	ECU	Internal ECU fault	ECU

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## DIAGNOSTIC MINIFLAGS ACTIVE DURING APU OPERATION

FAULT CODE	BITE LAMP	MINIFLAG INTERPRETATION	PROBABLE FAULTY UNIT(S)
129	none	Spare	none
130	none	The APU is currently operating in duct pressurization mode (DPM).	Normal operation if DPM is commanded
131	none	The APU is currently operating in air driven pump (ADP) mode	Normal operation if ADP is commanded
132	none	The APU is currently operating in in-flight mode.	Normal operation if aircraft is in flight, air-ground is pulled or squat switches inactivated.
133	none	The APU is currently operating in environmental control system (ECS) mode	Normal operation if ECS is commanded.
134	none	The APU is currently operating in main engine start (MES) mode	Normal operation if MES is commanded
135-139	none	Spare	none
140	none	The surge control valve is commanded closed Torque motor greater than 95 milliamps	Normal operation under heavy bleed demand

<b>FAULT CODE</b>	<b>BITE LAMP</b>	<b>MINIFLAG INTERPRETATION</b>	<b>PROBABLE FAULTY UNIT(S)</b>
141	none	The surge control valve is commanded open Torque motor less than 10 milliamps.	Normal operation without bleed demand selected
142	none	IGV 10-V position is currently 5 degrees different than the commanded position.	IGV actuator, binding IGV assembly, wiring or ECU. This miniflag can indicate IGV system problems that could eventually result in pneumatic problems and additional faults.
143	none	The APU is operating under EGT temperature trim (limits).	Could indicate power section deterioration, poor fuel/air distribution or internal restriction that could reduce pneumatic output
144 - 199	none	Spare	none

# Troubleshooting Procedures

**Note:** Familiarity with the entire contents of this publication will significantly increase troubleshooting effectiveness. The ECU BITE Interrogation and Interpretation as well as the ECU Miniflag section provide detailed information about APU and LRU faults.

<b><u>No.</u></b>	<b><u>Symptom</u></b>
<b>1</b>	<b>NO START</b>
<b>2</b>	<b>AUTOSHUTDOWN FROM ON-SPEED OPERATION</b>
2A	LOW OIL PRESSURE
2B	HIGH OIL TEMP
2C	REVERSE FLOW
2D	UNDERSPEED
2E	OVERSPEED
2F	EGT OVERTEMP

# Troubleshooting Procedures (Cont)

<u>No.</u>	<u>Symptom</u>
<b>2</b>	<b>AUTOSHUTDOWN FROM ON-SPEED OPERATION (Cont)</b>
2G	DC PWR LOSS
2H	UNDERSPEED
2I	GEN FILTER
2J	DOOR SYSTEM
2K	FIRE EMERG
2L	CONTROL FAILURE
<b>3</b>	<b>PNEUMATIC SYSTEM PROBLEMS</b>
3A	NO DUCT PRESSURE
3B	LOW DUCT PRESSURE - ALL MODES
3C	LOW DUCT PRESSURE - SOME MODES
3D	FLUCTUATING DUCT PRESSURE

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# Troubleshooting Procedures (Cont)

<u>No.</u>	<u>Symptom</u>
<b>4</b>	<b>OIL/FUEL SYSTEM PROBLEMS</b>
4A	HIGH OIL CONSUMPTION
4B	FUEL OIL OL LEAKS FROM DRAIN MAST
4C	APU OIL LEVEL CHANGES
4D	FUEL IN THE OIL
4E	LOW OIL QUANTITY MESSAGE
<b>5</b>	<b>APU GENERATOR FAILS TO LOAD OR DROPS OFF LINE</b>

## PROCEDURE 1

Symptom	Isolation Procedure	Probable Cause	Notes
No Start	Attempt to start APU. Note minimum battery voltage, EGT and speed at shutdown. If battery voltage drops below 18 V	Discharged battery	
No rotation	Run light does not blink twice after activating start switch.	Start switch No power to ECU	
	Run light blinks, but APU does not crank with no APU fault light. "APU DOOR" message on EICAS after 60 seconds	APU inlet door not opening Inlet door switch Inlet door actuator	Door open Door closed
	"APU FAULT" light – check ECU BITE "Reason for APU not Operating" for: <ul style="list-style-type: none"> <li>• Start Aborted</li> <li>• Fire Emergency</li> <li>• Door System</li> <li>• Control Failure</li> <li>• Overspeed Test Circuit or Gen Failure</li> </ul>	Component identified by "Faulty APU" with APU fault shutdown message	BITE indication for any component can be caused by the component, the ECU or the wiring in between
	ECU BITE Faulty Unit Light is "APU Starter" <ul style="list-style-type: none"> <li>• Starter appears damaged, burned or brushwear indicator shows less than 1/8 inch</li> <li>• Hand cranking APU through starter is not easy</li> </ul>	Starter  Starter	ECU sees voltage at starter with no speed indication

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## PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
No rotation (Cont)	ECU BITE Faulty Unit Light is "APU Starter" (Cont) <ul style="list-style-type: none"> <li>• Starter rotates when removed from APU, APU does not</li> <li>• APU rotates by hand but not during start</li> <li>• During start attempt, APU rotates with no speed indication</li> </ul> ECU BITE Faulty Unit Light is "A/C STRT CIRCUIT"	APU  Starter clutch, starter Speed monopoles, wiring Aircraft start circuit (relays, wiring battery)	Internal drag   ECU powers aircraft start relay but no voltage is detected at starter
APU rotates with NO EGT RISE ("NO LIGHT-OFF" on BITE)	Ignitor plug cannot be heard firing during start Perform ECU BITE check.  Fuel is not available at FCU inlet Disconnect fuel control to flow divider line. Fuel does not flow when APU is motored.	Ignition unit Ignition lead Ignitor plug ECU Wiring Aircraft fuel system ECU fuel filter FCU Oil Pump	*       Shaft Sheared
*Note: If APU FAULT light illuminates when start is initiated and does not extinguish, APU fuel shutoff valve in left wing may not be open			

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## PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
APU rotates with NO EGT RISE ("NO LIGHT-OFF" on BITE) (Cont)	More than 237 cc flows in 15 seconds.  Disconnect secondary manifold output from flow divider and motor APU (ignition unit disconnected). More than 15 drops comes from flow divider secondary port or drain port while starter energized. Fuel supply and ignition are good.	FCU   Primary fuel manifold	Coked or plugged nozzles
APU lights off but does not reach governed speed ("START ABORTED" OR "EGT OVERTEMP" on BITE)	Shutdown occurs below 45 percent speed and max EGT exceeds 700°C. <ul style="list-style-type: none"> <li>• Visually inspect starter for damaged/overtemp or brushwear indicator shows less than 1/8 inch</li> <li>• Hand cranking APU through starter is not easy</li> <li>• APU does not rotate or does not rotate smoothly with starter hand rotation</li> </ul>	Starter  Starter Generator APU Starter clutch	Internal drag Internal drag

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### PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
<p>APU lights off but does not reach governed speed ("START ABORTED" OR "EGT OVERTEMP" on BITE) (Cont)</p>	<ul style="list-style-type: none"> <li>• Disconnect fuel solenoid and motor APU, APU does not reach 16 percent speed even though hand cranking is free</li> <li>• Excessive noise from gearbox during motoring</li>   <li>• Visually inspect IGVs and linkage</li> <li>• IGVs partially open with actuator rod fully extended (1 inch)</li> <li>• IGV actuator rod not fully extended (1 inch) with IGVs /linkage not binding</li> <li>• IGV pull check exceeds 15 pounds</li> <li>• With IGV linkage cover removed, observe if IGVs actuate open during start</li>   <li>• Check APU inlet screen for obstruction</li> </ul>	<p>Starter Starter clutch</p> <p>Start relay, K-197 Start contactor, K-117</p> <p>IGVs broken/missing Linkage damaged/worn IGV rigging</p> <p>IGV actuator</p> <p>IGV assembly ECU Ignition Unit</p> <p>Inlet screen blockage</p>	 <p>Chattering contacts Disconnect APU battery cable prior to replacing</p> <p>Replace APU Repair Recommend rerigging in APU shop or test cell Replace IGV actuator</p> <p>Replace APU</p> <p>EMI source (battery charger, ignition unit)</p>

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## PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
APU lights off but does not reach governed speed ("START ABORTED" OR "EGT OVERTEMP" on BITE) (Cont)	<ul style="list-style-type: none"> <li>• Check flow divider for internal leakage per NO EGT RISE procedure</li> <li>• If all above checks are good, these LRUs could cause the problem with no good isolation procedure</li> </ul> Shutdown occurs above 45% speed and max EGT exceeds 700°C <ul style="list-style-type: none"> <li>• Troubleshooting is same as above except starter and starter clutch can be eliminated</li> </ul> EGT does not reach 700°C during failed start <ul style="list-style-type: none"> <li>• Check flow divider for internal leakage per NO EGT RISE procedure</li> <li>• These LRUs could cause the problem with no good isolation procedure</li> </ul>	Flow divider  FCU ECU Primary fuel manifold   Flow divider  P2 sensor FCU ECU Primary fuel manifold	Coked or plugged nozzles          Calibration shift

### PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
<p>APU does not start in-flight or immediately after landing, but starts normally otherwise</p>	<p>Reported no EGT rise with shutdown below 25% speed ("NO LIGHT-OFF" on BITE)</p> <ul style="list-style-type: none"> <li>• Check flow divider for internal leakage per NO EGT RISE procedure</li> <li>• Check tube from inlet plenum to P2 sensor and port in plenum for blockage (high altitude no-starts only)</li> <li>• These LRUs can cause the problem with no good isolation procedure</li> </ul> <p>Reported APU light-off, but does not reach governed speed ("Start Aborted, EGT Overtemp" on BITE)</p> <ul style="list-style-type: none"> <li>• Perform ECU BITE check. If DEOIL SOL light</li> <li>• If not flagged the deoil solenoid may still be faulty. It can be checked by applying 24-28V across solenoid pins to see if it actuates</li> </ul>	<p>Flow divider</p> <p>Blocked tube</p> <p>FCU ECU P2 sensor Primary fuel manifold Ignition unit</p> <p>Deoil solenoid Wiring Deoil solenoid</p>	<p>Calibration shift</p> <p>Electronically faulty</p> <p>Mechanically faulty</p>

### PROCEDURE 1 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
APU does not start in-flight or immediately after landing, but starts normally otherwise (Cont)	<ul style="list-style-type: none"><li>If EGT exceeded 850°C or "EGT OVERTEMP" on BITE</li><li>Otherwise troubleshoot per APU LIGHT OFF BUT DOES NOT REACH GOVERNED SPEED ground procedure</li></ul>	P2 sensor FCU ECU	Clibration shift (high altitude only)

## Procedure 2

Symptom	Isolation Procedure	Probable Cause	Notes
<p>APU shutdown from on-speed operation</p>	<p>Perform ECU BITE check. There are 11 possible automatic shutdowns from on-speed operation that will be displayed in the "FAULT DISPLAY". Most of the shutdown faults can be caused by one or more of the possible "FAULTY UNITS" that may be displayed on the lower panel</p> <p>For shutdowns that do not have an associated FAULTY UNIT or are not cured by diagnosis of the displayed FAULTY UNIT go to the troubleshooting procedure for the displayed shutdown fault.</p> <p>If BITE info is not available perform the following.</p> <ul style="list-style-type: none"> <li>• Attempt to start APU. If it will not start go to "NO START" troubleshooting procedure (1)</li> <li>• Autoshutdown occurs within 20 seconds of reaching 95 percent speed with speed below 102 percent and EGT below 600°C go to "LOP" followed by "HOT" troubleshooting procedures (2A and 2B)</li> </ul>	<p>FAULTY UNIT from BITE display</p>	<p>Most may be caused by displayed unit, ECU, or wiring in between</p>

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### Procedure 2 (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
<p>APU shutdown from on-speed operation (Cont)</p>	<ul style="list-style-type: none"> <li>• Idle EGT exceeds 370°C</li> <li>• Speed droops when load is applied</li>   <li>• EGT fluctuates rapidly</li>   <li>• EGT exceeds 600°C at shutdown</li> <li>• Speed exceeds 105 percent FCU</li> <li>• Shutdown occurs during bleed load. Go to "REVERSE FLOW troubleshooting procedure (2C)</li> <li>• Autoshutdown is followed by inhibited start Cycle APU switch to "OFF" followed by another start attempt.                             <ul style="list-style-type: none"> <li>- If second attempt is inhibited, go to "LOP" troubleshooting procedure (2A) or "HOT" troubleshooting procedure (2B)</li> </ul> </li> <li>• Shutdowns occur after more than 15 minutes of operation under heavy load, go to "HOT" troubleshooting procedure (2B)</li> </ul>	<p>APU internal damage                      FCU                      P2 sensor                      ECU                      EGT Sensors/Wiring                      FCU                      ECU</p>	<p>Replace APU</p> <p>Calibration shift</p>
	<p>Shutdowns occur randomly. If fault repeats after ECU replacement and connector check shutdown fault from ECU BITE is crucial for further troubleshooting</p>	<p>ECU</p>	<p>Check connectors for bent or broken pins</p>

### Procedure 2A

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshtutdown – Low Oil Pressure (LOP)	Check APU oil level <ul style="list-style-type: none"> <li>• If low</li> <li>• If overserviced, remove excess oil</li> </ul>	Low oil level  Overservice	Check APU for leakage/consumption Check for fuel odor (fuel leaking into gearbox)
	Start APU (after oil level confirmed good) and operate in ECS mode. (Start may be inhibited until ECU memory is cleared) <ul style="list-style-type: none"> <li>• If APU operates more than 20 seconds after                              reaching 95 percent speed before LOP                              shutdown</li> <li>• If LOP autoshtutdown occurs within 20                              seconds after 95 percent speed, check oil                              filter                              Connctect pressure gauge to lube pump                              discharge test port                             <ul style="list-style-type: none"> <li>– Oil pressure is greater than 40 psig</li> <li>– Oil pressure is less than 60 psig</li> </ul> </li> </ul>	LOP switch Oil foaming  Oil filter  LOP switch Wiring ECU Lube pump Deoil solenoid valve	Intermittent contact Contamination  Plugged  Calibration shift  Stuck open (confirm by removing and visually inspecting)

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Procedure 2A (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – Low Oil Pressure (LOP) (Cont)		Oil cooler, lines or check valves APU	Plugged  Internal leak



## Procedure 2B

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – High Oil Temperature (HOT)	Check oil cooler air path for dirt/plugging	Dirty oil cooler	Check cooling fan for oil leak
	Check air path from inlet screen in APU plenum to oil cooler discharge from airplane for obstructions or leaks	Blocked inlet screen plugged, collapsed, delaminated ducts	If cooling fan inlet duct delaminated, check fan isolation valve for proper muscle air supply operation
	Cooling fan is broken or does not rotate with APU rotation	Cooling fan	Replace APU
	Shutdown occurs within 15 seconds of APU reaching governed speed after start with cool oil.	ECU HOT sensor Wiring	
	Remove HOT sensor and place in an ice bath. Using an Ohm meter resistance should be 88-92 ohms.	HOT sensor	
	If no physical abnormalities are found, these may cause the shutdown	HOT sensor Wiring ECU Oil cooler	Thermostat stuck or oil passage plugged
* If inlet filter on SCV has been fitted in inverted position Fan isolation valve will have no muscle air (Pre SB 49-7192).			

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## Procedure 2C

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown REVERSE FLOW	LCIT sensor has loose or broken connection	Loose wires	Intermittent connection
	Check SCV position indicator with APU not running. If not fully open-	SCV	
	Shutdown occurs when APU is running with bleed valve closed and main engines not running.	LCIT sensor Wiring ECU	
	Shutdown occurs only when main engines are running	APU check valve	
	Shutdown occurs during APU bleed load operation <ul style="list-style-type: none"> <li>• These components are most likely cause of problem</li> <li>• Check directional flow valve orifice/filter for plugging</li> <li>• Check static sensor ring or probe plugging, obstruction, or broken</li> <li>• Check pressure sensing system plumbing for leaks or obstructions</li> <li>• Borescope load compressor</li> </ul>	SCV  Delta P transducer P Total Transducer P Total probe P Total Static sensor  Sensor plumbing  Load compressor damage	Possible SCV filter plugging or muscle air problem Calibration shift Calibration shift  *On many APUs the entire pressure sensor assembly is replaced as a module  Replace APU

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### Procedure 2D

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – UNDERSPEED	APU runs normally at idle but speed droops when load is applied	FCU P2 sensor Fuel flow divider	Calibration shift APU hot section
	Idle EGT exceeds 370°C	APU internal damage	Replace APU

### Procedure 2E

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – OVERSPEED	Perform ECU BITE self test. If ECU FAULTY UNIT light comes on:	ECU	
	Start APU. If APU shuts down during start for “NO LIGHT-OFF”, “EGT OVERTEMP” OR “OVERSPEED”, or shutdown occurs just after shedding load	FCU Flow Didider	
	Shutdown occurs without APU speed indication exceeding 102 percent	ECU	

## Procedure 2F

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – EGT OVERTEMP	Most "OVERTEMP" or "EGT OVERTEMP" autoshutdowns from on-speed will be followed by inability to start the APU		
	APU will not successfully start <ul style="list-style-type: none"> <li>• IGV ACT flagged on ECU BITE</li>   <li>• Hand rotate APU through starter checking for drag or unusual noise</li> <li>• No FAULTY UNITS on ECU BITE and APU rotation is free</li> </ul>	IGV actuator IGVs binding IGV linkage APU internal damage Generator FCU	Replace APU Repair Replace APU Replace Generator
	APU starts and has autoshutdown from on-speed (load generator and run ECS) <ul style="list-style-type: none"> <li>• EGT exceeds 600°C</li>   <li>• EGT is less than 600°C (may be unstable)</li> </ul>	FCU EGT sensors/wiring ECU EGT sensors/wiring	

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## Procedure 2G

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown- DC PWR LOSS	Shutdown occurs if DC power supply to the ECU is interrupted for more than 50 msec.		
	If there was a DC power loss or unusual power transient during APU operation the APU system is normal		Ensure "ALT CONT" or APU MN BAT CONT circuit breaker on cockpit overhead panel is closed
	Start APU, load generator, and operate ECS If fault repeats	ECU	Could be wiring or connectors

### Procedure 2H

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown- UNDERSPEED	Are either both #1 or #2 SPD SENSOR UNIT lights on? <ul style="list-style-type: none"><li data-bbox="321 218 412 239">• Yes</li> <li data-bbox="321 306 402 327">• No</li></ul>	Speed Monopoles Wiring  ECU	

### Procedure 2I

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – GEN FILTER	Replace generator filter element	Generator Oil Filter	
	Start APU. If shutdown repeats, check generator filter differential pressure switch for continuity with APU not running <ul style="list-style-type: none"> <li>• Continuity</li> </ul>	Generator Oil Filter Pressure Switch	
	<ul style="list-style-type: none"> <li>• Open</li> </ul> Shutdowns occur randomly	ECU Generator Oil Filter Pressure Switch	Intermittently closes due to vibration



### Procedure 2J

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown - DOOR SYSTEM	Check APU inlet door system and switch. Autoshutdown can only occur after the door-open switch signal is received to allow APU to start	Inlet Door Switch Wiring Door Actuation System	Probable intermittent
	If fault repeats after door, switch, and input wiring checkout	ECU	

### Procedure 2K

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – FIRE EMERG	APU shutdown occurs due to receipt of a “FIRE SHUTDOWN” signal from the airplane		
	If shutdown repeats, check airplane fire shutdown circuit to ECU	APU fire relay Wiring	
	If no fault found in airplane circuit, replace ECU	ECU	

## Procedure 2L

Symptom	Isolation Procedure	Probable Cause	Notes
Autoshutdown – "CONTROL FAILURE"	Check ECU connectors for bent or broken pins	Connectors	
	If connectors okay and fault repeats	ECU	

### Procedure 3A

Symptom	Isolation Procedure	Probable Cause	Notes
<p>No duct pressure (&lt;3psi duct pressure)</p>	<p>Start APU. Ensure main engine bleed air switches are in the OFF position. Open isolation valve. Select APU bleed valve to the open position.</p> <ul style="list-style-type: none"> <li>• If left and right engine bleed "OFF" lights are not illuminated and "VALVE" light on APU bleed valve switch does not illuminate and then extinguish after 3 – 10 seconds</li> <li>• If left and right engine bleed "OFF" lights are illuminated and APU bleed valve switch does not illuminate and then extinguish</li> <li>• If "VALVE" light on APU bleed valve switch does illuminate and then extinguish after 3 – 10 seconds</li> </ul>	<p>Left or right PRSOV</p> <p>APU bleed valve Bleed valve relay</p> <p>ECU/wiring IGV actuator EGT #1 circuit and EGT #2 circuit •P sensor P Total sensor P2 sensor</p> <p>IGV assembly</p> <p>ECU</p>	<p>Closed switch not contracting Refer to Boeing FIM, AT A36 "BLEED OFF light not illuminated" procedures Refer to Boeing FIM&lt; AT A36 "APU VALVE light" procedures.</p> <p>No bleed signal BITE = IGV ACT</p> <p>BITE = •P sensor BITE = PT sensor Calibration Shift No BITE Binding/BITE = IGV ACT</p>

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### Procedure 3B

Symptom	Isolation Procedure	Probable Cause	Notes
<p>Low duct pressure in all pneumatic modes. (Low air &gt; 2 psi)</p>	<p>Start APU. Ensure main engine bleed air switches are off. Activate bleed air valve switch, open isolation valve.</p> <ul style="list-style-type: none"> <li>• Duct pressure is low in DPM, ECS MES, and de-ice</li> </ul>	<p>SCV</p> <p><math>\Delta</math>P sensor</p> <p>P Total sensor</p> <p>LCIT sensor</p> <p>Flow sensor probes</p> <p>Aircraft duct leaks</p>	<p>No BITE info internal leakage, mechanical problem or leaking muscle air supply</p> <p>No BITE info-transducer shifted low</p> <p>No BITE info-transducer shifted low</p> <p>No BITE info-output shift</p> <p>Broken or dirty</p>

### Procedure 3C

Symptom	Isolation Procedure	Probable Cause	Notes
<p>Low duct pressure <u>not</u> in all pneumatic modes. (Low air &gt; 2 psi.)</p>	<p>Start APU. Ensure main engine bleed-air switches are off. Activate bleed-air switch and open isolation valve. (APU now in duct pressure mode)</p> <ul style="list-style-type: none"> <li>• Low duct pressure in DPM only?</li> </ul> <p>Turn on packs, one at a time.</p> <ul style="list-style-type: none"> <li>• Low duct pressure in one pack only (Isolate which one)</li> </ul> <ul style="list-style-type: none"> <li>• Low duct pressure with both packs on, or either pack? (But not DPM and not MES)</li> </ul> <p>Turn off packs. Turn on MES</p> <ul style="list-style-type: none"> <li>• Low duct pressure in MES, one main engine only?</li> </ul> <ul style="list-style-type: none"> <li>• Low duct pressure in MES only, either engine?</li> </ul>	<p>Surge valve</p> <p>Pack controller</p> <p>Aircraft PRSOV Leak in aircraft ducting Cabin temp controller</p> <p>Aircraft isolation valve</p> <p>Starter valve or valve controller Aircraft ducting</p> <p>IGV actuator or IGV assembly</p>	<p>No BITE info – valve quick dump instability No BITE info</p> <p>No BITE info Check all clamps, weld seams No BITE info</p> <p>Leaking valve No BITE info No BITE info- valve not closing properly Leaks – check clamps and weld seams BITE info – “IGV ACT” – IGV mechanism will not open fully</p>

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### Procedure 3C (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
Low duct pressure <u>not</u> in all pneumatic modes. (Low air > 2 psi) (Cont)	<ul style="list-style-type: none"> <li>Put APU in duct pressure mode. If EGT exceeds 500°C, the APU performance has deteriorated to the point that should be overhauled</li> </ul>	APU performance deterioration  Load compressor damage	No BITE info – APU will not hold EGT and pressure with excessive hot section deterioration No BITE info
Note: For all problems where “Probable Cause” is not an APU component, refer to Boeing FIM, ATA Chapter 36.			

### Procedure 3D

Symptom	Isolation Procedure	Probable Cause	Notes
Fluctuating duct pressure	Start APU. Ensure main engine bleed switches are off. Activate bleed air switch and open isolation valve. <ul style="list-style-type: none"> <li>• Duct pressure unsteady? ±5 to ±10 psi fluctuation</li> <li>• Duct pressure “dumping” at regular intervals   <math display="block">\left( \begin{array}{c} +0 \\ -20 \end{array} \right) \text{ psi fluctuation}</math> </li> <li>• Duct pressure “dumping” at regular intervals   <math display="block">\left( \begin{array}{c} +0 \\ -20 \end{array} \right) \text{ psi fluctuation}</math> </li> </ul>	Surge valve IGV actuator P total transducer DP transducer  Load compressor damage LCIT sensor	No BITE info-valve internal leak or mechanical problem No BITE info-transducer calibration shift. APU operating too close to surge  No BITE info-APU removal required No BITE info-check leads for tight connection
	Turn on packs one at a time <ul style="list-style-type: none"> <li>• Fluctuating duct pressure in one pack only? (Isolate left or right)</li> </ul>	Pack controller Pack valve Surge valve, PT, DP transducers	No BITE info  No BITE info-mechanical problem



### Procedure 3D (Cont)

Symptom	Isolation Procedure	Probable Cause	Notes
Fluctuating duct pressure (Cont)	Turn on both packs <ul style="list-style-type: none"> <li>• Fluctuating duct pressure in both packs?</li> </ul> Turn off packs. Turn on MES. <ul style="list-style-type: none"> <li>• Fluctuating duct pressure in MES?</li> </ul>	Cabin temp control Surge valve, PT, DP transducers  Surge valve DP, PT transducers IGV actuator Main engine starter valve	No BITE info No BITE info-mechanical problem  No BITE info-mechanical problem  No BITE info-mechanical problem
Note: For all problems where "Probable Cause" is not an APU component, refer to Boeing FIM< ATA Chapter 36.			



### Procedure 4B

Symptom	Isolation Procedure	Probable Cause	Notes
Fuel or oil leaks from drain mast during APU operation	Determine which drain mast port is leaking		
	Forward (767)/second from the (757) port is the flow divider drain (fuel discharge from this port at APU is normal)	Flow divider	
	Aft most port is for the FCU and IGV actuator. Oil leak from this port indicates FCU	FCU	Shaft seal leak
	Fuel leak from the aft port can come from either the FCU or IGV actuator. Break the drain line at the T fitting between the two to determine which one is leaking	FCU IGV actuator	Shaft seal leak
	The second from the aft port is for internal bearing seal cavity vents. Oil leakage from this port indicates internal APU seal problems	APU	Oil leakage within overall APU consumption limit is allowable



### Procedure 4D

Symptom	Isolation Procedure	Probable Cause	Notes
Fuel in the oil	The only known failure to get fuel in the oil is leakage from the FCU into the oil pump. This can usually be confirmed by removing the FCU and finding fuel in the cavity between the pumps (should be oil only)	FCU	Drain and flush APU oil system

### Procedure 4E

Symptom	Isolation Procedure	Probable Cause	Notes
Low oil quantity (LOQ) message	Check APU oil level	Low oil level	Check for leakage/oil consumption
	Verify that static and running oil levels correspond on sight gauge (static FULL goes to running FULL after startup) If not, go to "OIL LEVEL CHANGES" troubleshooting procedure (4C)		
	If repeated or random LOQ messages are noted with properly serviced APU	LOQ switch, oil level sensor or wiring	Nor wired through ECU

## Procedure 5

Symptom	Isolation Procedure	Probable Cause	Notes
APU generator fails to load or drops off line	With no pneumatic load on the APU attempt to transfer electric load to APU generator. If APU speed drops more than 2 percent-	FCU ECU P2 sensor	Calibration shift
	Check for ECU generator load relat output signal. If not present when APU speed is over 95 percent-	ECU	
	Check generator scavenge chip collector. If generator failed, remove chip collector assembly, if more than 1 cup of oil drains out-	Generator Generator scavenge pump	
	Troubleshoot generator and generator system (Chapter 24)		