

SECTION 5

AUXILIARY POWER UNIT (APU)

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SECTION 5AUXILIARY POWER UNIT (APU)

1. GENERAL

Airborne auxiliary power is supplied by a Garrett GTCP-36-100 (E) Auxiliary power unit (APU) which supplies pneumatic and shaft power for essential aircraft services independent of ground facilities. The unit is cleared for in-flight start up to 20,000 feet, and is fully operational from sea level to 30,000 feet.

Clean compressed air produced by the APU is used for cabin and flight compartment air conditioning on the ground, and ground and in-flight start of engines. The shaft power is used to drive an electrical generator for supply of ground electrical power and in-flight standby conditions.

The APU is mounted on a support skid assembly within a anodized aluminum enclosure in the rear fuselage behind the rear pressure bulkhead. Access is through the rear fuselage equipment bay door. The APU is self-contained and requires only a source of fuel and dc electrical power.

Under normal operating conditions, fuel is provided under pressure from a canister type pump mounted in the right main tank. Shrouded fuel lines pass the fuel, through an APU fuel selector valve mounted between the wing and the fuselage, to the APU fuel control unit. The APU fuel selector valve is normally controlled by a START/STOP switch/light on the APU control panel, if the PWR-FUEL ON/OFF switch/light is on. The valve will close automatically to shut off fuel to the APU whenever the APU fire extinguishing system is activated.

Under negative G conditions, to prevent an abnormal APU shutdown, fuel is automatically supplied to the APU from the left main engine fuel supply. A tap off in the left main engine fuel supply tube in the left pylon supplies fuel, through a shutoff valve and check valve assembly, to a bulkhead connector on the APU enclosure left wall. From the bulkhead connector, a fuel tube connects with the main fuel inlet tube to the APU fuel control unit.

Electrical power for starting the APU is provided by the aircraft internal battery or by an external dc power supply.

An inlet duct located on the top rear fuselage provides entry for APU inlet air. Ducting channels the inlet air through the enclosure roof to the APU air inlet. APU exhaust gases are vented from the APU exhaust nozzle through the enclosure side wall and, via ducting, to the APU exhaust outlet duct on the right side rear fuselage.

On aircraft 5041 and 5146,
Ventilation air for the APU enclosure is drawn from outside ambient air through an APU enclosure vent duct, mounted on the left side of the aircraft.

An APU CONTROL panel, located on the flight compartment overhead panel, contains essential indicators and control switch/lights. An APU FAULT panel, located behind an access door on the left side rear fuselage, contains fault flag indicators, a fault flag indicator IND RESET button and a remote APU STOP button.

SECTION 5

2. APU CONTROL (Figure 1)

An electronic control unit (ECU) is mounted on the APU support beam on the left of the APU enclosure. The ECU monitors engine speed, exhaust gas temperature, oil pressure and temperature and overcurrent conditions during APU operation. Signals from sensors on the APU are relayed through the ECU to the appropriate indicators on the APU CONTROL and APU FAULT panels. The ECU also shuts down the APU under certain fault conditions (refer to paragraph 4.).

Fire protection is from a single Firex bottle mounted on the fuselage structure outside the APU enclosure. Indication and control is from the flight compartment (refer to SECTION 9, FIRE PROTECTION).

3. START SYSTEM (Figures 1 and 2)

28-volt dc power from the battery bus is required to start the APU and is available from the battery alone, an external dc power source or whenever one of the engine driven generators is on line. During start, 28-volt dc power is also supplied by the APU auxiliary battery to the ECU. The auxiliary power prevents automatic start shutdown that would otherwise occur during cold weather starts if the ECU detected a large voltage drop on the battery bus.

On aircraft 5001 to 5134, cold weather starting of the APU is improved by the addition of an auxiliary battery and by allowing the APU firewall shut-off valve to open when the APU fuel pump is selected on. A panel is added to control the auxiliary battery charger.

On aircraft 5135 and subsequent and aircraft incorporating Canadair Service Bulletin 601-0418, the electronic control unit for the APU receives a source of voltage from the IRS battery No. 2 for improved cold weather starting.

The start cycle is initiated by pressing in the PWR-FUEL ON/OFF switch/light, followed by the START/STOP switch/light on the APU control panel. The PWR-FUEL ON/OFF switch/light energizes the APU fuel pump, completes an electrical power supply circuit to the START/STOP switch/light, and opens the engine-mounted fuel shut-off valve. When the START/STOP switch/light is pressed in, the APU starter motor is energized and the STARTER legend on the switch/light comes on. At 10% rpm, the ignition system is energized. At 60% rpm, the STARTER light goes out, indicating that the starter has disengaged. At 95% rpm, ignition is de-energized and a green APU RDY light on the START/STOP switch/light comes on. The engine accelerates to 100% rpm. Normally, the engine accelerates to running rpm in not more than 60 seconds.

4. SHUTDOWN (Figures 1 and 3)

Normal shutdown of the APU is accomplished by removing all loads from the unit, then pressing out the START/STOP switch/light on the APU CONTROL panel. When the APU has completely stopped, pressing out the PWR-FUEL ON/OFF switch/light de-energizes the APU fuel pump and disconnects the electrical power supply circuit to the START/STOP switch/light.

Remote APU shutdown is accomplished by pressing the APU STOP pushbutton on the external APU FAULT panel. After a remote shutdown, the PWR-FUEL ON/OFF switch/light and the START/STOP switch/light must be pressed out to reset the APU starting system.

The APU electronic control unit shuts down the APU automatically for any of the following reasons:

- APU overspeed
- Overcurrent
- High exhaust gas temperature
- Low oil pressure
- High oil temperature
- Generator adapter low oil pressure
- Generator adapter high oil temperature

White triangle flag indicators on the APU FAULT panel show the fault responsible for the automatic shutdown.

5. BLEED AIR SYSTEM

The APU supplies compressed air to the 10th stage bleed air manifold and shaft horse power to drive the APU generator, which supplies the aircraft electrical systems.

The BLEED AIR switch/light controls two valves: a surge valve, which prevents compressor surge by bleeding off air if there is excessive pressure, and a load control valve, which opens to deliver the bleed air to the 10th stage bleed air manifold.

After the EGT and rpm have stabilized and the green APU RDY light comes on, bleed air may be selected by pressing in the BLEED AIR switch/light. The surge valve then closes and the load control valve opens.

When bleed air is no longer required, the system is shutdown by pressing out the BLEED AIR switch/light.

6. OIL SYSTEM

The APU engine oil system provides pressure oil and splash lubrication for all drive gears and shaft bearings in the APU engine. If low oil pressure occurs during APU operation, a low oil pressure switch, located in the engine gearcase, transmits a signal and illuminates the LO PRESS light on the APU CONTROL panel. Similarly, a high temperature switch, located near the oil pressure switch, transmits a signal to illuminate the HI TEMP light. The APU generator adapter has a self-contained oil system for lubrication and cooling. Adapter oil LO PRESS and HI TEMP warning lights are also provided.

**PWR FUEL ON/OFF
SWITCH/LIGHT**

When pressed in, fuel booster pump is energized and power is connected to START/STOP switch/light.

Amber PUMP INOP light comes on when switch/light is pressed and fuel booster pump fails.

When pressed out, fuel booster pump is deenergized and power is removed from START/STOP switch/light.

If the APU FIRE PUSH switch/light is pressed after a fire warning, the fuel shutoff valve closes and diverts fuel back to the tank. The white SOV CLOSED light comes on.

START/STOP SWITCH/LIGHT

When pressed in, both APU fuel feed system shutoff valves open, starter motor is energized and amber STARTER light comes on. At 60% rpm, amber STARTER light goes out. At 95% rpm and 4 ± 1 seconds later, green APU READY light comes on.

When pressed out, APU READY light goes out, fuel solenoid valve closes and APU shuts down.

BLEED AIR SWITCH/LIGHT

When pressed in, green OPEN light comes on, load control valve opens and APU air is available for aircraft systems.

When pressed out, load control valve closes and OPEN light goes out.

Amber FAILED light comes on if load control valve fails to respond to switch/light commands or if engine bleed air is selected and load control valve fails to close.

NOTE

ON A/C 5135 and SUBS and A/C POST SB 601-0394 the flight data recorder system records the opening and closing of the load control valve (LCV)

ADAPTER OIL FAULT LIGHTS

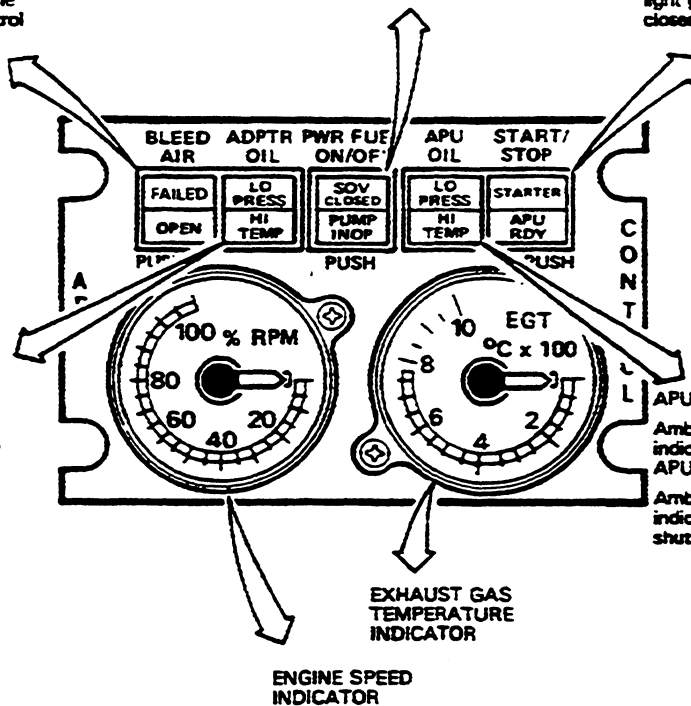
Amber HI TEMP light comes on to indicate generator adapter high oil temperature. APU shuts down automatically.

Amber LO PRESS light comes on to indicate generator adapter low oil pressure. APU shuts down automatically.

APU OIL FAULT LIGHTS

Amber HI TEMP light comes on to indicate APU high oil temperature. APU shuts down automatically.

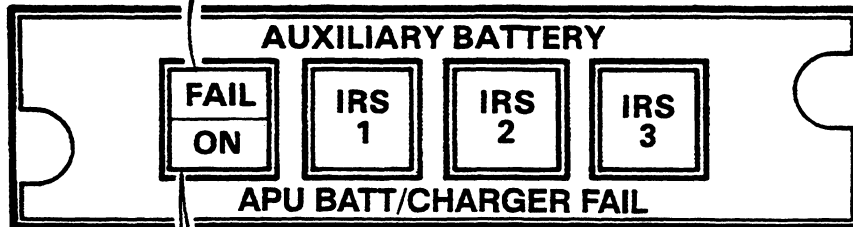
Amber LO PRESS light comes on to indicate APU low oil pressure. APU shuts down automatically.



OVERHEAD PANEL

FAIL LIGHT

Amber light comes on if auxiliary battery is not providing 28 volt dc output or if internal monitoring detects a failure.



EFFECTIVITY: A/C 5001 TO 5134

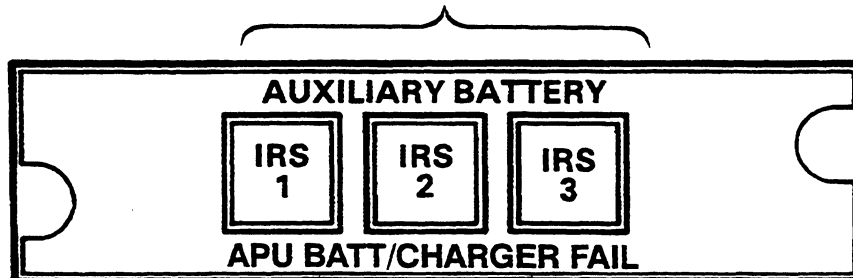
ON LIGHT

White ON light comes on when PWR FUEL ON/OFF switch/light is pressed in to indicate that auxiliary battery is providing full 28 volt dc output to APU start system.

AUXILIARY BATTERY CHARGER FAIL ANNUNCIATOR
Comes on (amber) to indicate that the lock-up battery is not charging.

NOTE

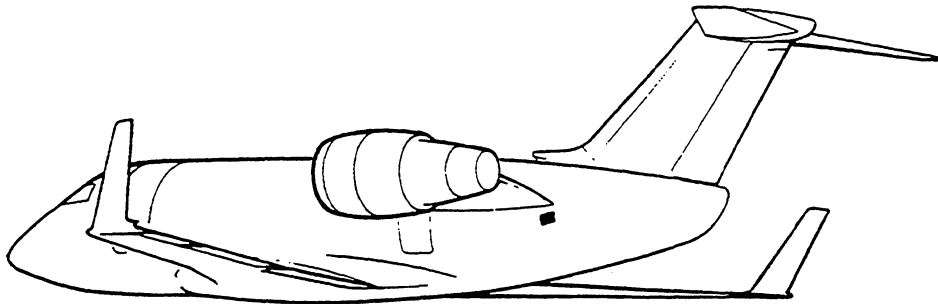
IRS 2 auxiliary battery powers the APU ECU



EFFECTIVITY: A/C 5135 AND SUBS AND
POST SB 601-0418

COPILOT'S CONSOLE

Auxiliary Battery Panel
Figure 2



APU OVERCURRENT FAULT FLAG

White triangles indicate overcurrent fault. APU shuts down automatically.

APU OVERSPEED FAULT FLAG

White triangles indicate APU overspeed. APU shuts down automatically.

APU EGT HIGH FAULT FLAG

White triangles indicate APU high exhaust gas temperature. APU shuts down automatically.

APU OIL PRESS LOW FAULT FLAG

White triangles indicate APU low oil pressure. APU shuts down automatically.

APU OIL TEMP HIGH FAULT FLAG

White triangles indicate APU high oil temperature. APU shuts down automatically.

GEN ADAPTER OIL PRESS LOW FAULT FLAG

White triangles indicate generator adapter low oil pressure. APU shuts down automatically.

GEN ADAPTER OIL TEMP HIGH FAULT FLAG

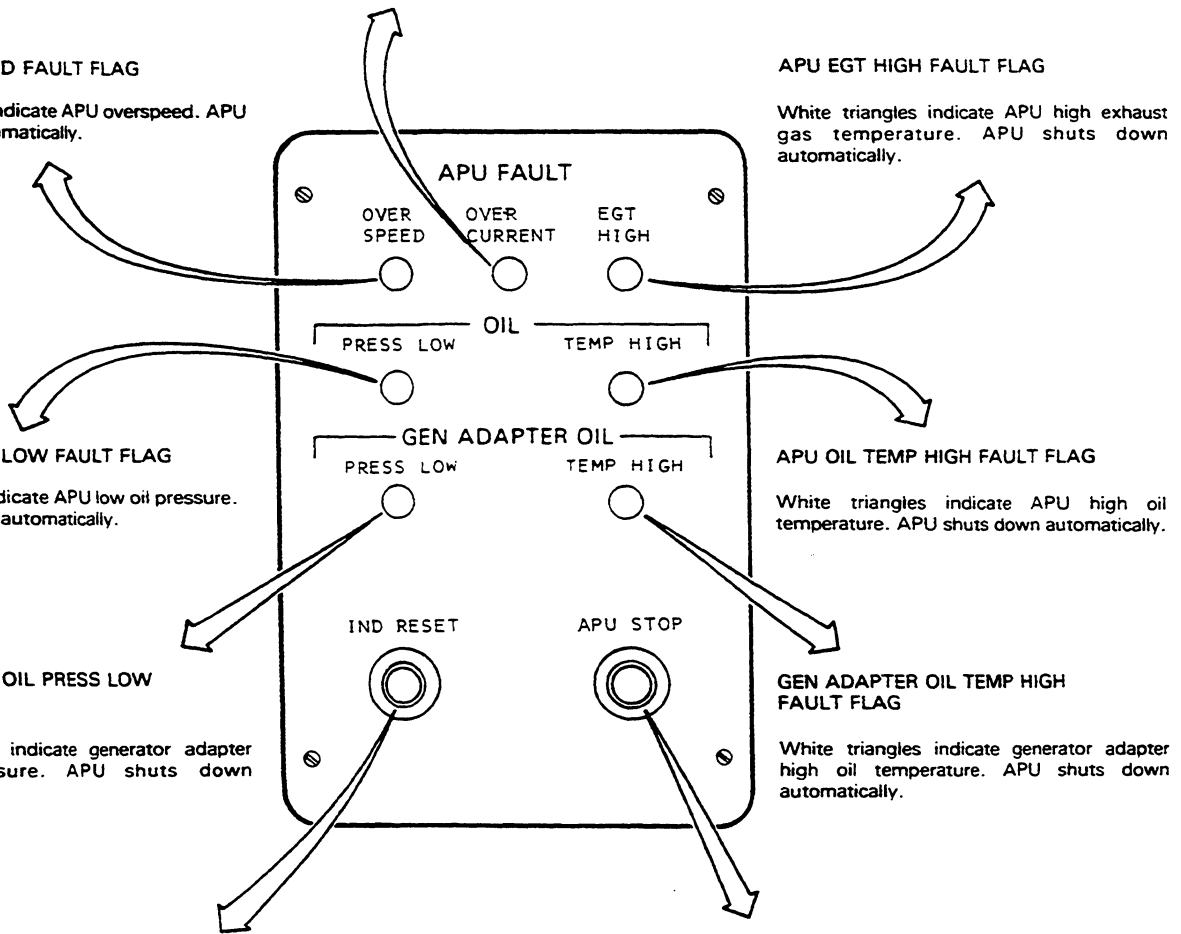
White triangles indicate generator adapter high oil temperature. APU shuts down automatically.

IND RESET PUSHBUTTON

When pressed, fault flags are reset by rotating them out of view. If condition has not been corrected, flags stay in view.

APU STOP PUSHBUTTON

When pressed, stops APU at any time.



**APU Fault Indications
Figure 3**