

*Reference to Figure 84 APS3200 System Schematic*

## **ATA 49 AUXILIARY POWER UNIT**

### **49-00 APS AUXILIARY POWER UNIT**

#### **SYSTEM DESCRIPTION**

##### **APU Main Components**

- Gearbox (with AC generator and APU accessory drive)
- Load compressor (centrifugal type provided with inlet guide vanes)
- Air inlet plenum (air intake and air distribution)
- Power section including:
  - a centrifugal compressor
  - a reverse flow combustion chamber
  - a two stage axial flow turbine

##### **Electronic Control Box**

The ECB is an electronic controller of FADEC type (Full Authority Digital Electronic Control). It controls and monitors the Auxiliary Power System. With the APU Master Switch to ON the ECB will be powered from the aircraft electrical system. When the APU is running a Permanent Magnet Generator (PMG) will backup the ECB power. The ECB is installed in the aft cargo compartment behind a sidewall panel.

##### **Air Intake Flap Actuator**

The actuator is electrically driven and includes position switches as feedback signal to the ECB. "FLAP OPEN" is essential for an APU start. The actuator includes an manual override drive.

##### **Fuel Control Unit**

Controlled by the ECB the FCU meters fuel for combustion and delivers fuel pressure for bleed control valve and inlet guide vane actuation. The FCU includes fuel pumps, a fuel filter, a servovalve, a 3 way solenoid valve and pressure regulating valves.

##### **Gearbox and Lubrication System**

The system components are all located on the gearbox except the oil cooler which is located on the APU left side. The oil sump is formed by the lower part of the gearbox. The gearbox has a fill tube for gravity filling, an overflow drain, a pressure fill connector and a sight glass.

The pressure pump draws the oil from the sump and delivers it under pressure to the sumps. After lubrication, the oil falls to the bottom of the sumps and is immediately scavenged by two scavenge pumps.

##### **Starter**

The starter gets electrical power via two start contactors. At 55 % APU speed the power is removed. It is equipped with a visual and an optional electrical (voltage sensing) brush wear indication. After three unsuccessful starts the motor must cool down for at least 60 minutes.

##### **Ignition Unit**

The ignition exciter transforms the low DC voltage into a high energy supply for the two igniters. The exciter is energized during start up to 55 speed%.

##### **Bleed Control Valve**

The BCV has compressed air inlet, exhaust and aircraft outlets. It mainly consists of a flap which directs the compressed air to the exhaust system when closed or to the aircraft pneumatic system when open.

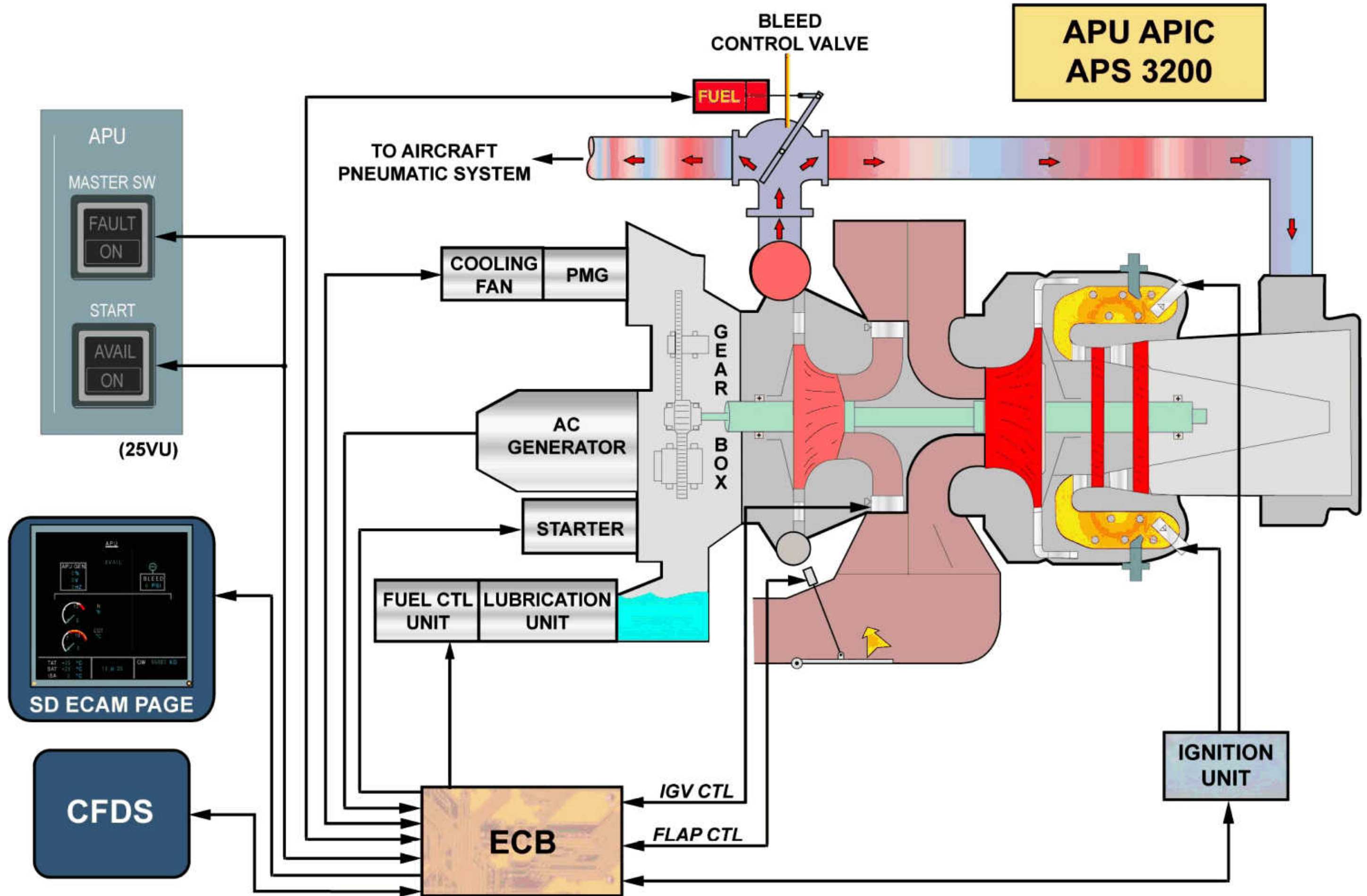
The diverter valve also includes a visual position indicator. It is actuated by servo fuel pressure delivered by the FCU.

##### **Inlet Guide Vanes**

The inlet guide vane system controls the air flow into the load compressor in order to avoid overtemperature of the power section. The inlet guide vanes are mounted in a support assembly which is connected to a single actuator. The actuator is powered by servo fuel pressure delivered by the FCU.

##### **Cooling Fan**

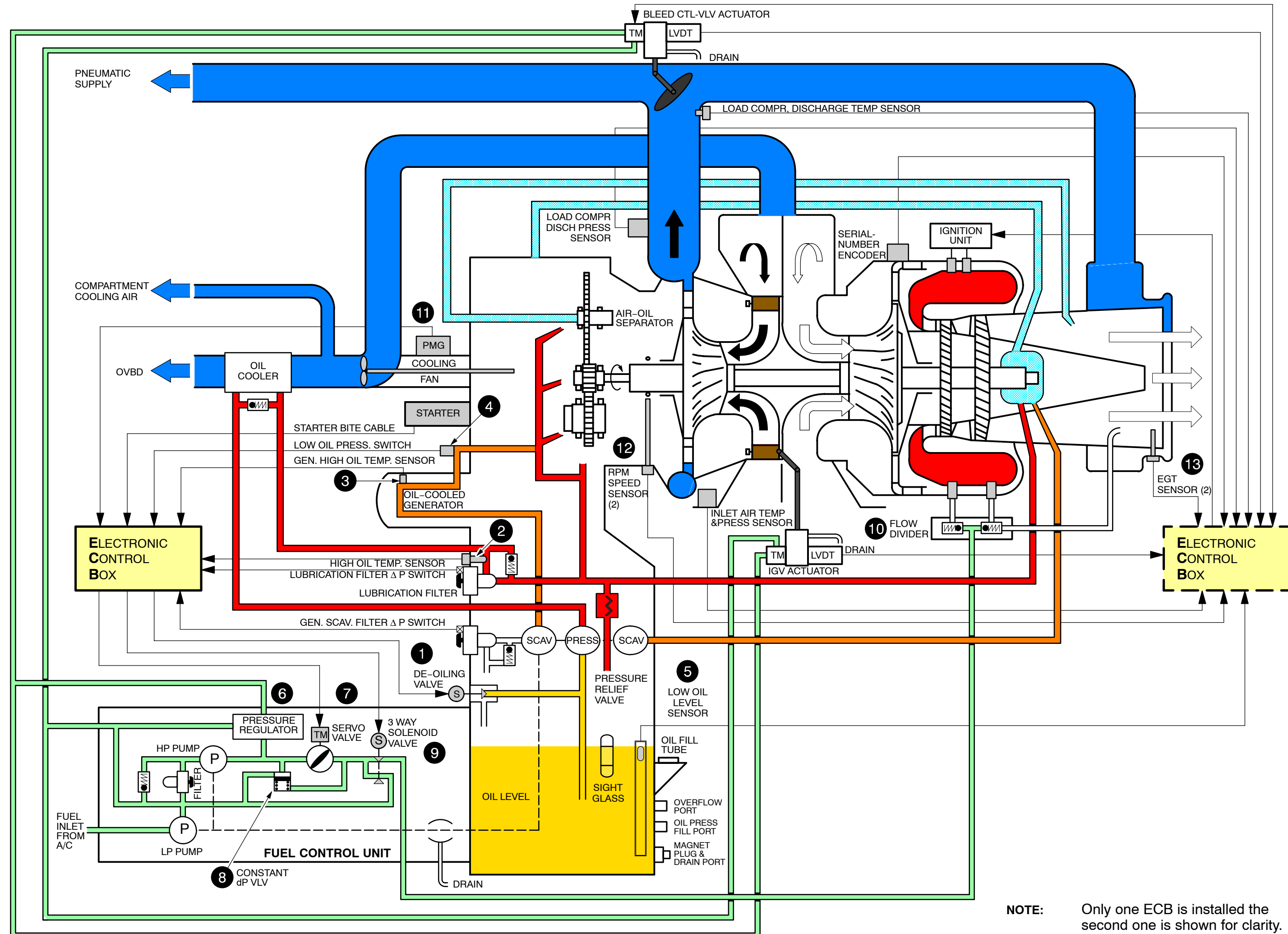
The cooling fan provides air circulation for the oil cooler and for the ventilation of the engine compartment. On the APS 3200 the cooling fan integral generator ( PMG ) also provides an emergency direct current supply to the electronic control box, should the Main supply fail.



**Reference to Figure 85 APS3200 Operational Schematic**

**COMPONENT DESCRIPTION**

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|---|--|
| <p><b>1 De-Oiling Valve</b><br/>Energized open during APU start until 55% and during shut down between 95% and 7%.</p> <p><b>2 High Oil Temperature Sensor</b><br/>Signal to ECB &gt;135°C.</p> <p><b>3 Generator High Oil Temperature Sensor</b><br/>Signal to ECB &gt;185°C.</p> <p><b>4 Low Oil Pressure Switch</b><br/>Signal to ECB &lt;35 psi.</p> <p><b>5 Low Oil Level Sensor</b><br/>Checked for 8 seconds during power up for CFDS menu: APU DATA/OIL OK or LOW. Signal to ECB &lt;2.6 liter for LOW OIL LEVEL ECAM advisory.</p> <p><b>6 Pressure Regulator</b><br/>Provides servo fuel to IGV actuator and bleed control valve (≈250 psi).</p> <p><b>7 Servo Valve</b><br/>Meters fuel flow during start and normal running conditions.</p> <p><b>8 Constant dP-Valve</b><br/>Keeps a constant pressure difference across the servo valve to obtain a flow only depending upon the metering valve position.</p> | <p><b>9 3-Way Solenoid Valve</b><br/>Opens and closes the fuel supply for start and shutdown. During start energized open &gt;3%.</p> <p><b>10 Flow Divider</b><br/>Depending on fuel pressure fuel is routed to 3 pilot (&gt;20 psi) or 6 main injectors (&gt;200 psi). During shutdown the fuel remaining in the pilot fuel manifold and injectors is purged to the exhaust.</p> <p><b>11 Permanent Magnetic Generator</b><br/>Electrical back-up power source and back-up overspeed signal (&gt;107%) for ECB.</p> <p><b>12 RPM Speed Sensors</b><br/>Two sensors are connected to the ECB which calculates the average value of the sensor signals. When the difference is greater than 5%, the sensor with the highest value is selected. &lt;95% or &gt;105% is considered as under- or overspeed.</p> <p><b>13 EGT Sensors</b><br/>Two chromel/alumel type sensors are connected to the ECB to calculate the average EGT value. If the difference is &gt;41°C the higher value is selected. If the value is &lt;120°C or &gt;1200°C a system failure is declared.</p> |
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NOTE: Only one ECB is installed the second one is shown for clarity.

Reference to Figure 86 Honeywell 131-9(A) Basic Schematic

## 49-00 APU GENERAL

### APU VENDOR DIFFERENCES DESCRIPTION

Component	Honeywell 36-300	APS3200	Honeywell 131-9 (A)
Power Section	One stage Radial Turbine	Two stage Axial Turbine	Two stage Axial Turbine
Oil System	<ul style="list-style-type: none"> <li>Oil Heater installed (21°-43°)</li> <li>De-Oiling Valve only active if oil temp is &lt;-7°C or FL &gt; 28</li> </ul>	<ul style="list-style-type: none"> <li>no Oil Heater installed</li> <li>De-Oiling Valve active during every start</li> </ul>	<ul style="list-style-type: none"> <li>Oil Heater installed</li> <li>De-Oiling Valve only active if oil temp is &lt;-7°C or Fuel Temp &lt;-12.2°C or FL &gt; 25</li> </ul>
Starting System	Starter Motor active between 0 and 50%. Ignition active between 7 and 95%.	Starter Motor and Ignition active between 0 and 55%	Starter Motor active between 0 and 50% (above 20000 ft up to 58%). Ignition active between 0 and 60% speed.
Ignition System	One Ignitor Plug	Two Ignitor Plugs	One Ignitor Plug
Fuel System	Six Dual Fuel Injectors (Primary and Secondary)	Six Main Fuel Injectors and three Pilot Injectors.	Ten Dual Fuel Injectors (Primary and Secondary) and one Fuel Divider Solenoid for Secondary Fuel Manifold Shut-Off.
Speed Control	99% if T <sub>amb</sub> <30°C 101% if T <sub>amb</sub> >30°C or MES or Inflight OPS.	Constant speed 100%	Normal 99.1% speed. ECS and <-18°C or >35°C or MES 100% speed.
Cooldown Timer	60 sec at N=75%	120 sec at N=100%	60 sec at N=100%
Inlet Guide Vanes	14 Vanes Closed at start initiation 10° OPEN at 50% speed 22° OPEN at 75% speed	24 Vanes Closed at start initiation 40°-83° OPEN at ECS 83° OPEN at MES	Closed at start initiation 15° OPEN if FL<20 22° OPEN at 90% speed Remain at 15° >FL25 50°-90° OPEN at ECS 90° OPEN at MES
Air Bleed System	One Load Bleed Valve, electrically activated and pneumatically operated. One SCV electrically activated and pneumatically operated.	One Load Bleed Valve, electrically activated and servo fuel operated.	One Load Bleed Valve, electrically activated and pneumatically operated. One SCV electrically activated and servo fuel operated.
ECB Power Supply	Interrupt supply via the APU mounted AC Generator	Interrupt supply via PMG (40V DC)	Interrupt supply via the APU mounted AC Generator. Up to 200 ms internally via ECB itself
Control System	APU identification via IDENT PLUG	APU identification via IDENT PLUG	APU identification via Data Memory Module and additional interrogation of APU operation via the CFDS System possible.



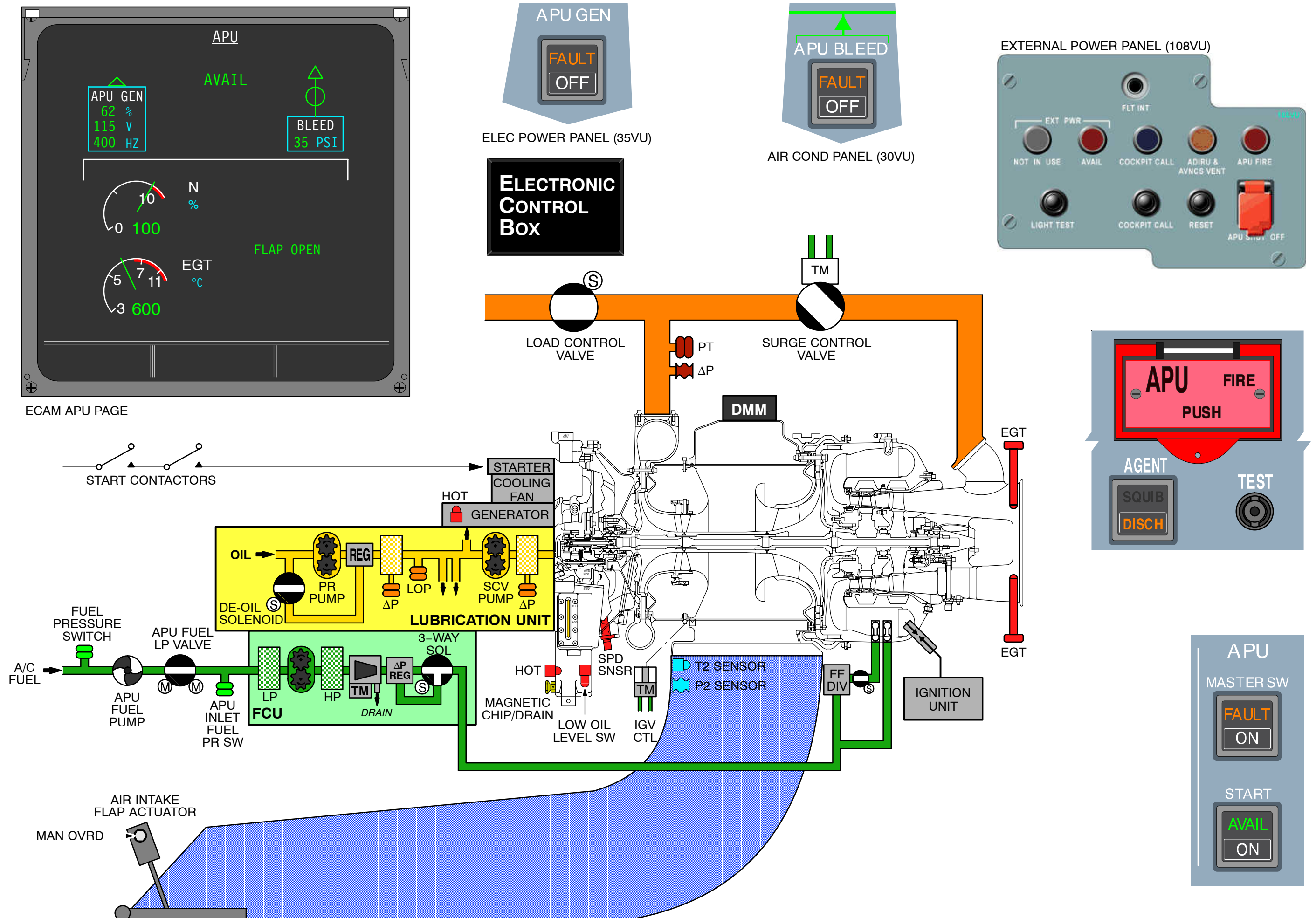


Figure 86 Honeywell 131-9(A) Basic Schematic Page 172