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R **49.30 ELECTRICAL SUPPLY**

GENERAL

The Auxiliary Power Unit (APU) is a self-contained unit which makes the aircraft independent of external pneumatic and electrical power supply.

On ground

– It supplies bleed air for starting the engines and for the air conditioning system.
– It supplies electrical power to the electrical system.

During Take-Off

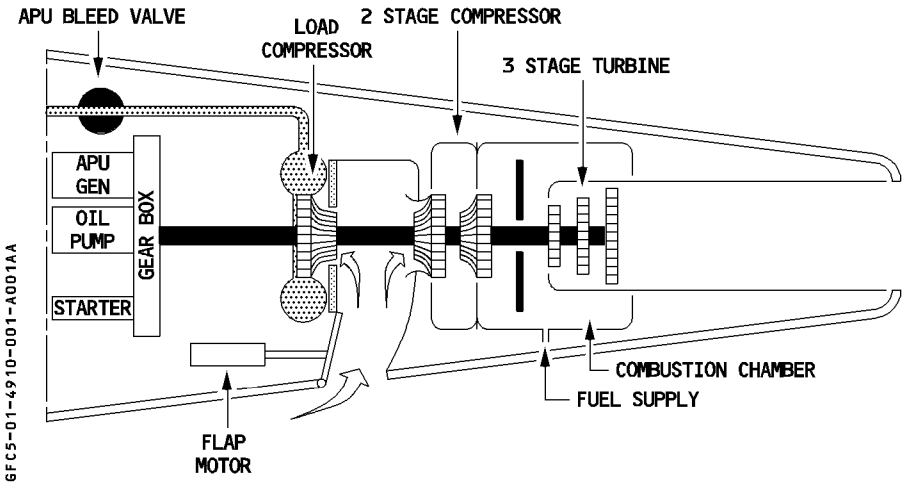
It supplies bleed air for air conditioning, thus avoiding a reduction in engine thrust caused by the use of engine bleed air for this purpose when optimum aircraft performance is required.

In Flight

· It backs up the Electrical system
· It backs up the Air conditioning
· It can be used to start the engines

The APU may obtain power for starting from the aircraft's batteries or in combination with the external power or from ground service, or normal aircraft supply.
APU starting is permitted throughout the normal flight envelope except when APU battery only is supplying (Refer to FCOM 3.01.49).
The ECAM displays APU parameters.

FOR INFO



MAIN COMPONENTS

APU ENGINE

The basic element of the APU is a single shaft gas turbine which delivers mechanical shaft power for driving the accessory gearbox (electrical generator) and produces bleed air (engine starting and pneumatic supply).

ELECTRONIC CONTROL BOX

The Electronic Control Box (ECB) is primarily a full authority digital electronic controller that performs the APU system logic for all modes of APU operation such as
- Sequence and monitoring of start
- Speed and temperature monitoring
- Monitoring of bleed air (IGV)
- Sequence of shut down (manual, protective or inhibited)

AIR INTAKE SYSTEM

The air intake and an electrically operated flap allow external air to reach the compressor inlet.

STARTER

The ECB controls the electric starter. The starter engages if the air intake is fully open and the MASTER SW and the START pushbutton are ON.

FUEL SYSTEM

The APU is supplied from the trim tank transfer line (Refer to 1.28.10)
The ECB controls the fuel flow.

OIL SYSTEM

The APU has an integral independent lubrication system (for lubrication and cooling).

INLET GUIDE VANES (IGV)

The IGVs control bleed air flow, and a fuel-pressure-powered actuator positions the IGVs. The ECB controls the actuator in response to aircraft demand.

AIR BLEED SYSTEM

The ECB controls the APU BLEED valve. It is automatically closed above 25000 ft (climbing) or 23000 ft (descending).

CONTROLS

R The flight crew uses the controls on the APU panel for routine shutdown. For emergency
R shutdown :
R – The flight crew can push the APU FIRE handle, or
R – The ground crew can push the APU SHUT OFF pushbutton on the interphone panel under
R the nose fuselage or the APU EMER SHUT DOWN pushbutton on the refueling/defueling
R panel.

GROUND OPERATIONS SAFETY DEVICES

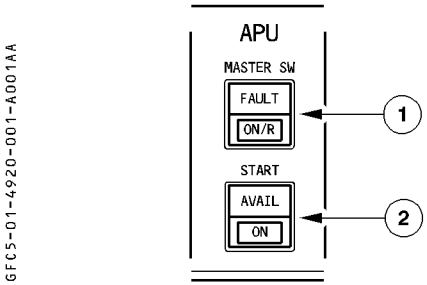
– APU FIRE WITH AUTOMATIC SHUTDOWN
The APU may run, without cockpit crew supervision, when the aircraft is on ground. In case of fire in the APU compartment :
· APU fire warnings operate in the cockpit
· A horn in the nose gear bay sounds
· The "AVAIL" light goes off.
· The "FAULT" light on the MASTER SW comes on
· The APU shuts down
· The APU fire extinguisher discharges.

Note : On ground, the No Break Power Transfer (NBPT) function is inhibited, in the following cases of APU shutdown :
– The APU is shut down, by using the APU SHUT OFF switch on the external power panel (925 VU).
– An APU emergency shutdown is triggered, by using the APU EMER SHUT DOWN switch on the REFUEL/DEFUEL panel (990 VU).
– An automatic APU shutdown is triggered by the ECB.
– The APU is shut down, by using the APU FIRE pushbutton.

OPERATION UNDER FAILURE CONDITIONS

– APU FAULT WITH AUTOMATIC SHUTDOWN
The following failures cause an automatic shutdown :
1. Overspeed
2. Certain critical ECB internal failures
3. Underspeed
4. Start abort
R 5. Low oil pressure
6. High oil temperature
7. Load compressor overtemperature
8. Generator high oil temperature
9. DC power interrupt (BAT OFF, when aircraft on batteries only)
10. Overtemperature
11. Certain ECB internal failures
Failure causes 1 and 2 lead to an automatic shutdown (protective shutdown) in all flight phases. For failures 3 through 11, the automatic shutdown is inhibited to ensure APU availability (inhibited shutdown in flight phase 2 to 9).

OVERHEAD PANEL



(1) MASTER SW pushbutton

This pushbutton controls the electric supply for APU operation, and its protective features. It also controls the start and shutdown sequences.

ON/R : – The blue ON light comes on.
– Electric power goes to the APU system, and the ECB performs a power-up test.
– The APU air-intake flap opens.
– The APU fuel isolation valve and APU LP valve open.
– Depending on the transfer activities of the trim tank, and on the pressure in the trim tank line, the FWD APU and AFT APU fuel pumps operate.
– If the aircraft has ground power or main generator power, the APU page appears on the ECAM display.

Off : Manual shutdown sequence.
– The ON light of the MASTER SW goes off.
– The APU keeps running for a cooling period of 105 sec. at 100% speed.
– Then, after an additional running period of 15 seconds (for No Break Power Transfer), the APU shuts down and the AVAIL light goes off.
– At N 7 %, the air-inlet flap closes.

Note : Switching OFF then ON the MASTER SW resets the ECB.

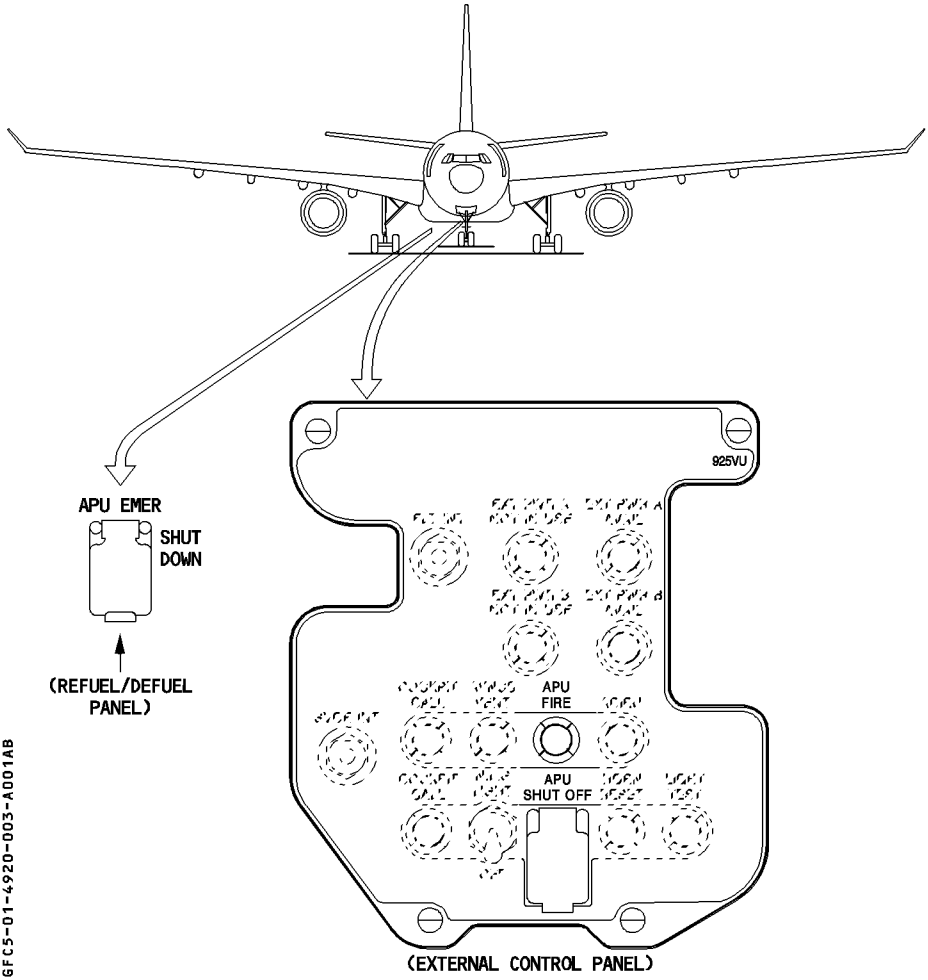
FAULT lt : This amber light comes on, and a caution appears on the ECAM, when an
R automatic APU shutdown occurs (Refer to 1.49.10).

② START pushbutton

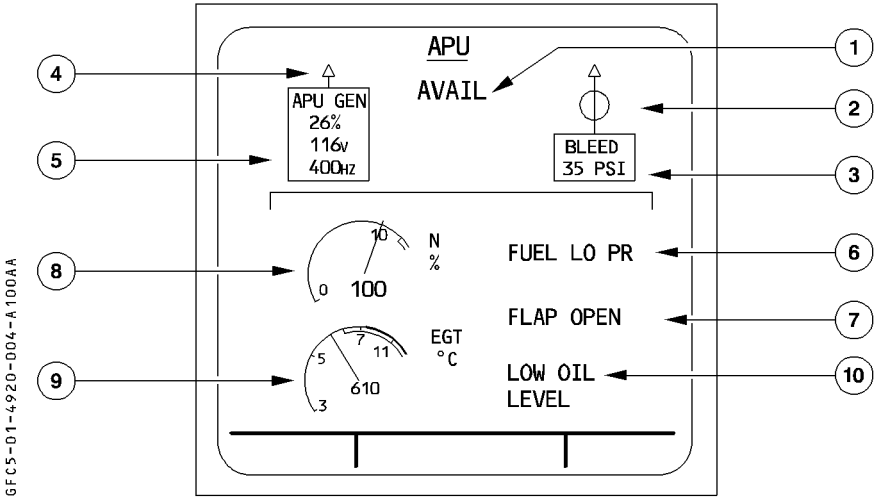
ON : The blue light comes on.
When the flap is completely open, the APU starter is energized.
When N = 7 %, ignition is turned on.
R When N = 50 %, the APU starter is de-energized, and ignition is turned off.
R When N = 95 %, the ON light on the START pushbutton goes off and AVAIL comes on in green.
– The APU may now supply bleed air and electrical power to the aircraft systems
10 seconds later, the APU page disappears from the ECAM display.

AVAIL lt : This light comes on green, when N reaches 95 %.

EXTERNAL CONTROLS



ECAM APU PAGE



(1) AVAIL indication

Displayed green when APU N above 95 %

(2) APU bleed valve position

Displayed only if the APU MASTER SW is ON/R.

R ⦶ green : APU valve fully open.
R ⊖ green : APU valve not fully open and APU BLEED pushbutton is OFF.
R ⊖ amber : APU valve not fully open if APU BLEED pushbutton is ON

(3) APU bleed air pressure

This box displays the relative bleed air pressure in green.
It shows an amber XX when the ADIRS 1 is not available, or selected OFF.

(4) APU GEN line contactor indication

Displayed in green when the APU GEN line contactor is closed. In white when if line contactor is open.

R (5) APU GEN

Identical to APU GEN parameters on ELEC page.

R (6) FUEL LO PR

R Displayed amber if of APU fuel low pressure detection

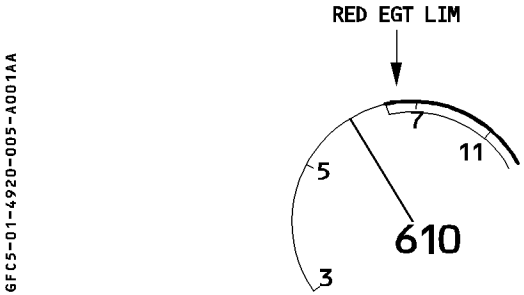
R (7) FLAP OPEN

R Displayed green when APU air intake flap is fully open (MASTER SW pushbutton at ON)

R (8) APU N

R – Displays APU speed in green
R – Becomes red when N ≥107 %.

R (9) APU EGT

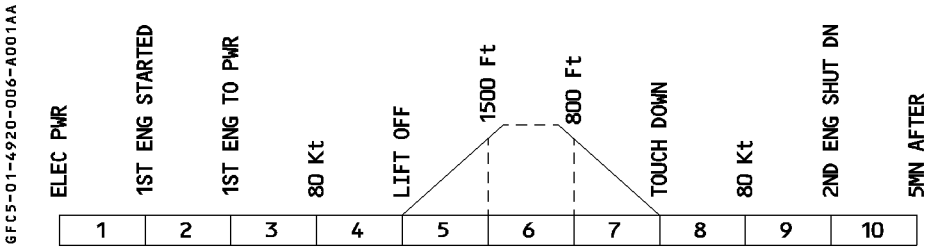


R – Displays APU EGT (needle and digital indication) in green
R – It pulses when the ECB detects an advisory
– Becomes red when EGT ≥ RED EGT LIM* associated with automatic shut down
R * ECB calculates the RED EGT LIM and transmits it to the ECAM, it is equal to
R the lower border of the red sector. It is a function of N during start and a
R function of ambient temperature and pressure when APU is running.
R Maximum EGT during start : 1250° C (refers to 0 % APU speed)
R Maximum EGT with APU running : 650° C (Sea level, standard day).

(10) LOW OIL LEVEL

R Advisory : displayed if the ECB detects a low APU oil level when the aircraft is on
R the ground and the APU is not running.

WARNINGS AND CAUTIONS



R

E/WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
AUTO SHUT DOWN Automatic shut down of APU for a reason other than a fire	SINGLE CHIME	MASTER CAUT	APU	APU MASTER sw FAULT lt	3, 4, 5 7, 8
EMER SHUT DOWN Use of APU shut off pushbutton on interphone panel or on refueling/defueling panel or APU FIRE pushbutton pushed. If non automatic shut down a failure has been detected by the ECB, but the APU remains available.					

MEMO DISPLAY

– APU AVAIL message is displayed in green when APU N is above 95 %.

BUS EQUIPMENT LIST

FOR INFO

R

	NORM			EMER ELEC			
	AC	DC	DC BAT	AC ESS	DC ESS	HOT	APU BAT BUS
ECB SUPPLY					X (2)		X (1)
STARTER MOTOR	APU TR						X

R *(1) ECB is supplied by APU HOT BUS on ground if APU BAT BUS is not supplied*

R *(2) This supply is necessary only during the APU start (due to a loss of voltage on the APU BAT BUS during this phase).*