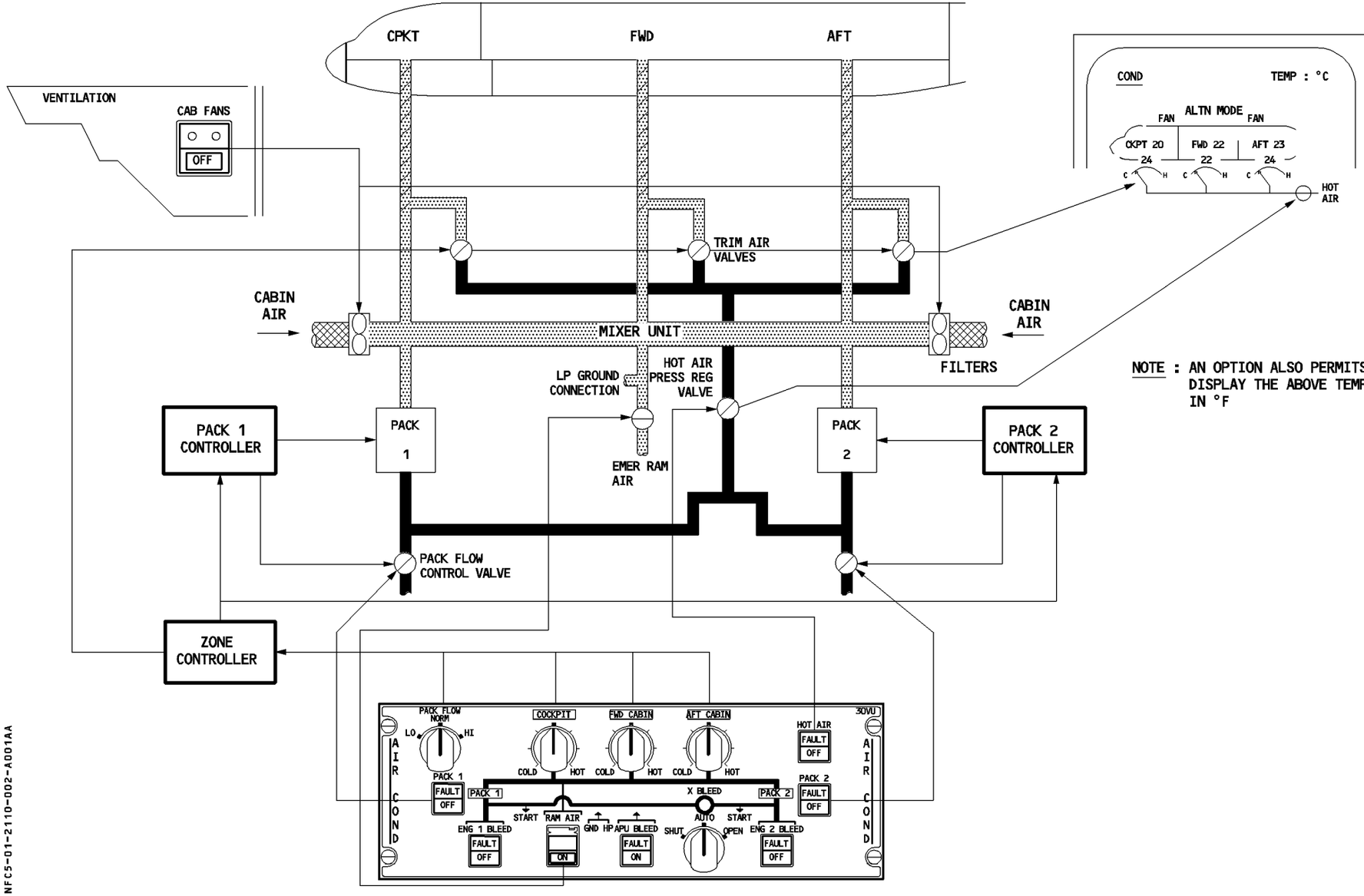
21.00 CONTENTS

GENERAL

The air conditioning system operation is fully automatic.
It provides a continual renewal of air and maintains a constant selected temperature in the three following zones : COCKPIT, FWD CABIN, AFT CABIN which are independently controlled.
The air is supplied by the pneumatic system, via :
– two pack flow control valves
– two packs
– the mixing unit, which mixes the air coming from the cabin and from the packs.
It is then distributed to the cockpit and the cabin.
The temperature regulation is optimized through the hot air pressure regulating valve and the trim air valves which add hot air tapped upstream of the packs to the mixing unit air.
In an emergency, a ram air inlet can provide ambient air to the mixing unit.
The temperature regulation is controlled by a zone controller and two pack controllers.
Flight deck and cabin temperature can be selected from the AIR COND panel in the cockpit.
Low pressure air is supplied to the mixing unit by a ground connection.



NOTE : AN OPTION ALSO PERMITS TO DISPLAY THE ABOVE TEMPERATURE IN °F

MAIN COMPONENTS

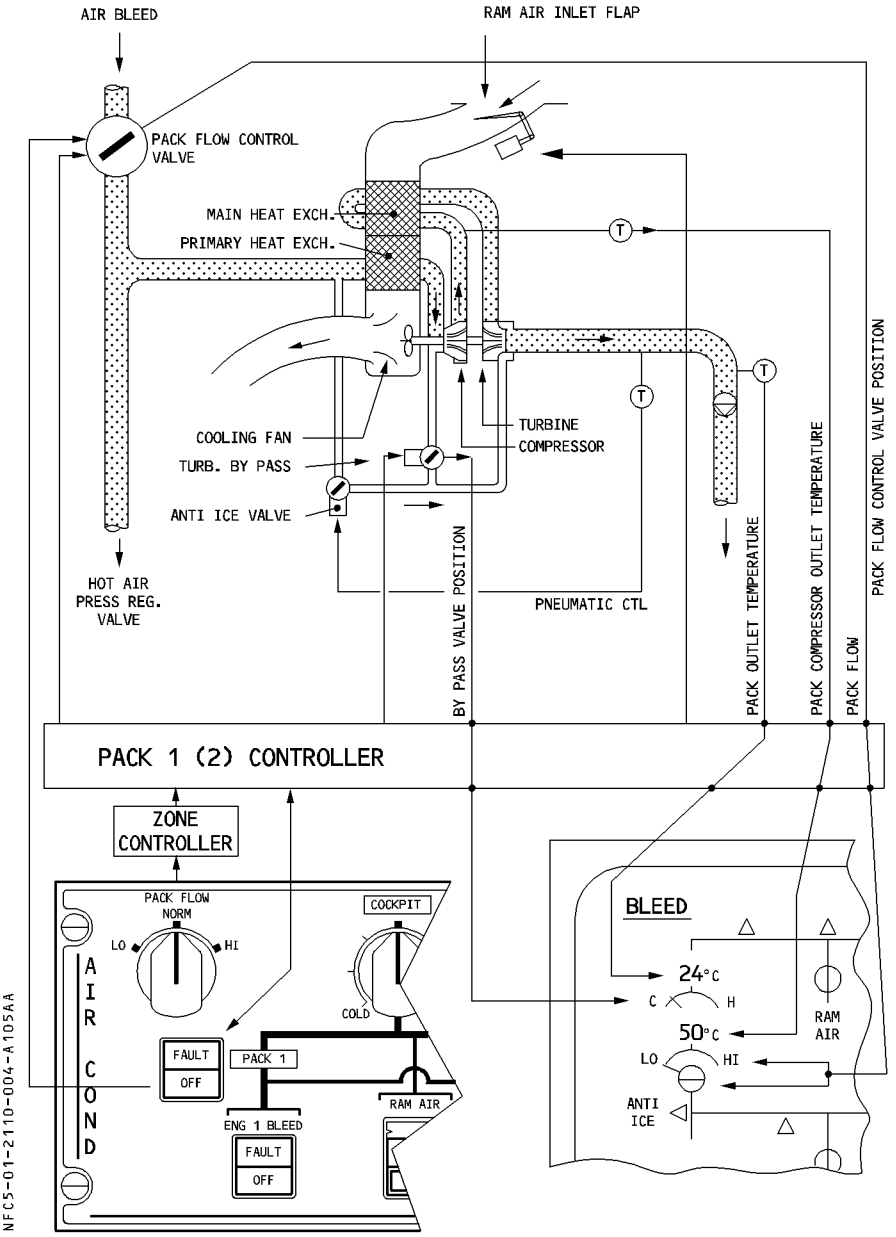
AIR CONDITIONING PACK

The two packs operate automatically and independently of each other. Pack operation is controlled by pack controller signals.
Warm pre-conditioned bleed air enters the cooling path via the pack valve and is ducted to the primary heat exchanger.
Then the cooled bleed air enters the compressor section of the air-cycle machine and is compressed to a higher pressure and temperature.
It is cooled again in the main heat exchanger and enters the turbine section, where it expands and in expanding generates power to drive the compressor and cooling air fan. The removal of energy during this process reduces the temperature of the air, resulting in very low air temperature at turbine discharge.

FOR INFO

A water separator system dries the air before it enters the turbine section.

PACK SCHEMATIC (SIMPLIFIED)



PACK FLOW CONTROL VALVE

This valve is pneumatically-operated and electrically-controlled. It regulates the air flow in accordance with signals received from the pack controller.
In the absence of air pressure, a spring keeps the valve closed.
The valve closes automatically in case of pack overheating, engine starting, or operation of the fire or ditching pushbutton.
The valve is controlled from the AIR COND panel.

RAM AIR

An emergency ram air inlet ventilates the cockpit and cabin to remove smoke, or if both packs fail.
The emergency ram air inlet valve is controlled by the RAM AIR pushbutton on the AIR COND panel.
This pushbutton opens the ram air valve, provided that ditching is not selected.
R When the RAM AIR pushbutton is ON : The outflow valve opens about 50 %, provided that
R it is under automatic control and $\triangle P$ is less than one psi. The outflow valve does not
R automatically open if it is under manual control, even if $\triangle P$ is less than one psi. If $\triangle P$ is greater than one psi, the check valve located downstream the ram air door will not open, even if the ram air door has been selected open. No airflow will then be supplied.

MIXER UNIT

This unit mixes cold fresh air from the packs with the cabin air being recirculated through recirculation fans. The mixer unit is also connected to the emergency ram air inlet and the low pressure ground inlets.

HOT-AIR PRESSURE-REGULATING VALVES

This valve regulates the pressure of hot air, tapped upstream of the packs.
It is pneumatically-operated and electrically-controlled from the HOT AIR pushbutton on the AIR COND panel. In the absence of air, a spring keeps the valve closed.
The valve closes automatically, if :
– The duct overheats, or
– The cockpit trim air valve fails, or
– Both cabin trim air valves fail.
The hot-air pressure-regulating valve remains operative, even if either the forward or aft cabin trim air valve fails.

TRIM AIR VALVES

These valves are electrically-controlled by the zone controller. A trim air valve, associated with each zone, adjusts the temperature by adding hot air.

TEMPERATURE AND FLOW REGULATION

Temperature regulation is automatic and controlled by one zone controller and two pack controllers.

PACK CONTROLLER

Each pack controller regulates the temperature of its associated pack, in accordance with a demand signal from the zone controller, by modulating the bypass valve and the ram air inlet flaps.
The ram air inlet flaps close during takeoff and landing to avoid ingestion of foreign matter.

Note : During takeoff, the ram air inlet flaps close when TO. power is set and the main landing gear struts are compressed.
During landing they close as soon as the main landing gear struts are compressed, as long as speed is at or above 70 knots.
They open 20 seconds after the speed drops below 70 knots.

The pack controllers also regulate flow by modulating the associated pack flow control valve.

ZONE CONTROLLER

PACK FLOW CONTROL

The crew can use the PACK FLOW selector to adjust the pack flow for the number of passengers and for external conditions.
Whatever the crew selects, the system delivers high flow for any of the following circumstances :
– in single-pack operation,
– when the APU is supplying bleed air.
The system delivers normal flow if the crew selects LO flow and the temperature demand cannot be satisfied.

Engine pressure demand
When the cooling demand in one zone cannot be satisfied, if the bleed pressure is too low, the zone controller sends a pressure demand signal to both Engine Interface Units (EIU) to increase the minimum idle and to raise the bleed pressure.

APU flow demand
When the APU bleed valve is open, the zone controller signals the APU's Electronic Control Box (ECB) to increase the APU flow output when any zone temperature demand cannot be satisfied.

TEMPERATURE REGULATION

The zone controller regulates the temperature of the two cabin zones and the cockpit.

BASIC TEMPERATURE REGULATION

The flight crew uses the temperature selectors on the air conditioning panel in the cockpit to select the reference temperatures. The zone controller computes a temperature demand from the selected temperature and the actual temperature.
The actual temperature is measured by sensors :
– in the cockpit, for the cockpit zone
– in the lavatory extraction circuit and galley ventilation system, for the cabin.
A signal corresponding to the lowest demanded zone temperature goes to the pack controller, which then makes both packs produce the required outlet temperature.

OPTIMIZED TEMPERATURE REGULATION

The zone controller optimizes the temperature by action on the trim air valves.
The temperature selection range is from 18°C (64°F) to 30°C (86°F).

SYSTEM OPERATION UNDER FAILURE CONDITION

Each controller consists of a primary channel that is normally in control and a secondary channel that acts as a backup if the primary channel fails.

ZONE CONTROLLER

PRIMARY CHANNEL FAILURE

The secondary channel operates as backup.
The flow setting function and optimized temperature regulation are not available. HOT AIR and TRIM AIR valves close.
The zones are controlled to 24°C (76°F) (backup regulation). Pack 1 controls the cockpit temperature. Pack 2 controls the FWD and AFT cabin temperatures.
ALTN MODE appears on the ECAM (Electronic Centralized Aircraft Monitoring) COND page.

SECONDARY CHANNEL FAILURE

This has no effect on zone temperature regulation.
Backup mode is lost.

PRIMARY AND SECONDARY CHANNEL FAILURE

Optimized and backup temperature regulation is lost.
The packs deliver a fixed temperature : 20°C (68°F) for pack 1, 10°C (50°F) for pack 2. The
R failure removes all information from the ECAM COND page, which then displays PACK REG.

PACK CONTROLLERS

PRIMARY CHANNEL FAILURE

The secondary computer operates as a backup.
Regulation is not optimized.
Pack flow is fixed at the previous setting.

SECONDARY CHANNEL FAILURE

This failure has no effect on pack regulation. Backup mode is lost.
ECAM signals related to the corresponding pack are lost.

PRIMARY AND SECONDARY CHANNEL FAILURE

As a backup, corresponding pack outlet temperature is controlled by the anti-ice valve and is stabilized to a temperature between 5°C (41°F) and 30°C (86°F) in a maximum of 6 minutes.
ECAM signals, related to the corresponding pack, are lost.

AIR CYCLE MACHINE FAILURE

If the Air Cycle Machine (ACM) fails (compressor/turbine seizure), the affected pack may be operated in heat exchanger cooling mode.
Warm pre-conditioned bleed air enters the cooling path via the pack valve, and goes to the primary heat exchanger. Then, the main part of the cooled air goes directly downstream of the ACM turbine through the bypass valve, and the rest goes through the failed ACM.
The ACM seizure reduces the pack flow.
As for normal pack operation :

- The pack controller regulates temperature, in accordance with zone controller demand, by modulating the bypass valve and the ram air inlet flap.
- The zone controller regulates the hot air flow through the trim air valves to optimize cockpit/cabin temperature regulation. Hot air flow is lower than in normal pack operation, because pack flow is reduced.

HOT AIR PRESSURE REGULATING VALVE FAILURE

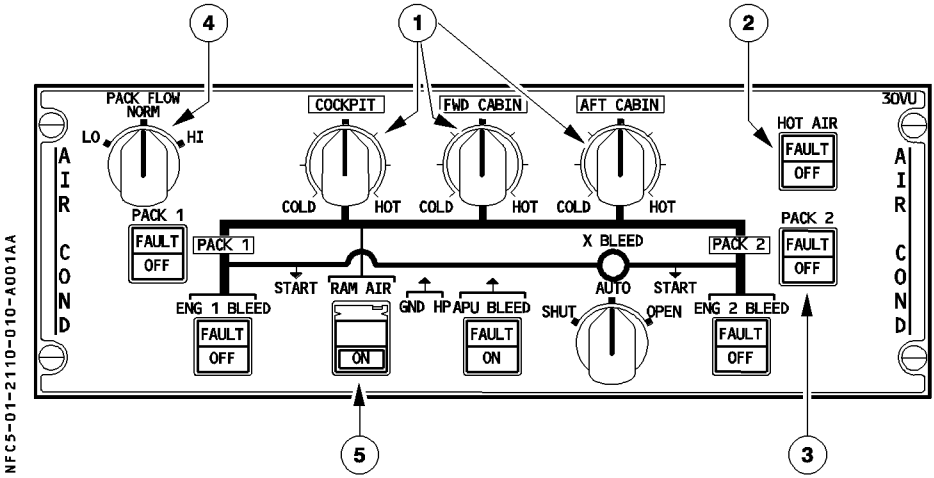
Failed open : No effect.
Failed closed : Optimized regulation is lost. Trim air valves are driven to the full closed position. Pack 1 controls the cockpit temperature to the selected value, and pack 2 controls the cabin temperature (FWD and AFT) to the mean value, of the selected temperatures.

TRIM AIR VALVE FAILURE

Optimized temperature regulation of the corresponding zone is lost.

CONTROLS AND INDICATORS

CONTROLS ON OVERHEAD PANEL



(1) Zone temperature sel

- 12 o'clock position : 24°C (76°F).
- COLD position : 18°C (64°F).
- HOT position : 30°C (86°F).

(2) HOT AIR pushbutton

On : The valve regulates hot air pressure.
OFF : The valve closes, and the trim air valves close.
The FAULT circuit is reset.
FAULT : The amber light, and associated ECAM caution come on when duct overheat is detected. The fault circuit detects an overheat when the duct
R temperature reaches 88°C (190°F).
The valve and the trim air valves close automatically.
The FAULT light goes off when the temperature drops below 70°C (158°F), and the flight crew selects OFF.

③ PACK pb

On : The pack flow control valve is automatically controlled.
It opens, except in the following cases :
– Upstream pressure below minimum ;
– Compressor outlet overheat ;
– Engine start sequence :
1. If the crossbleed valve is closed, the valve located on the starting engine side immediately closes, when the MODE selector is set to IGN (or CRK).
2. It remains closed on the starting engine side (provided the crossbleed valve is closed) when :
· The MASTER switch is set to ON (or the MAN START pushbutton is set to ON), and
· The start valve is open, and
· N2 < 50 %.

Note : If the crossbleed valve is open at engine start, both pack flow control valves close.

3. On ground, reopening of the valves is delayed for 30 seconds to avoid a supplementary pack closure cycle during second engine start.
– The fire pushbutton, of the engine on the related side, is pressed,
– Ditching is selected.

OFF : The pack flow control valve closes.

FAULT lt : Comes on amber, and a caution appears on the ECAM, if the pack flow control valve position disagrees with the selected position, or in the case of compressor outlet overheat or pack outlet overheat.

④ PACK FLOW sel

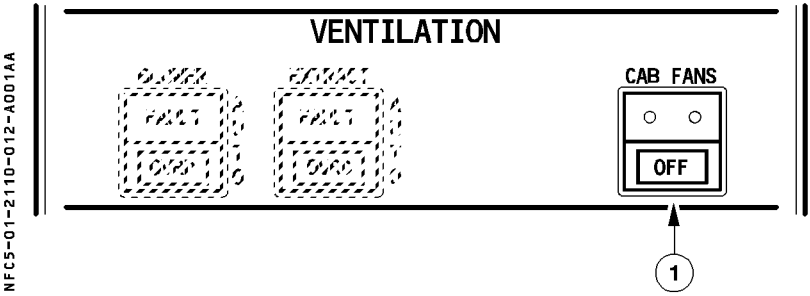
· Permits the selection of pack valve flow, according to the number of passengers and ambient conditions (smoke removal, hot or wet conditions).
LO (80 %) – NORM (100 %) – HI (120 %).
· Manual selection is irrelevant in single pack operation, or with APU bleed supply. In these cases, HI is automatically selected.
· If LO is selected, the pack flow can be automatically selected up to 100 % when the cooling demand cannot be satisfied.

(5) RAM AIR pb (guarded)

ON : The ON light comes on white.
If the DITCHING pushbutton, on the CABIN PRESS panel, is in normal position :
- The RAM air inlet opens.
- If $\Delta p \geq 1$ psi : The outflow valve control remains normal. No emergency RAM air flows in.

R - If $\Delta p < 1$ psi : The outflow valve opens to about 50 % when under automatic
R control. It does not automatically open when it is under manual control.
R Emergency RAM airflow is directly supplied to the mixer unit.

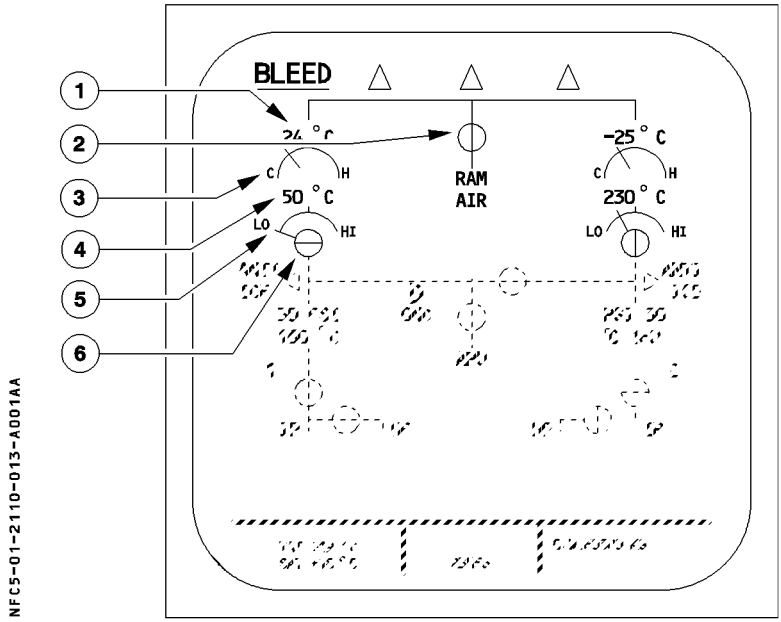
Off : The RAM air inlet closes.



(1) CAB FAN pushbutton

On : The two cabin fans are on.
OFF : The two cabin fans are off.

ECAM BLEED PAGE



(1) Pack outlet temperature

R It normally appears in green – But, it appears in amber, if the temperature is higher than
R 90°C.

(2) RAM AIR inlet

R Crossline – Green : The flap is normally closed.
R In transit – Amber : The flap is partially open
R Inline – Amber : The flap is normally open on ground.
R Inline – Amber : The flap is fully open in flight.

(3) Pack by pass valve position

It normally appears in green.
C = Cold – Valve closed
H = Hot – Valve open.

(4) Pack compressor outlet temperature

R It normally appears in green. But, it appears in amber, if the temperature is higher
R than 230°C.

(5) Pack flow

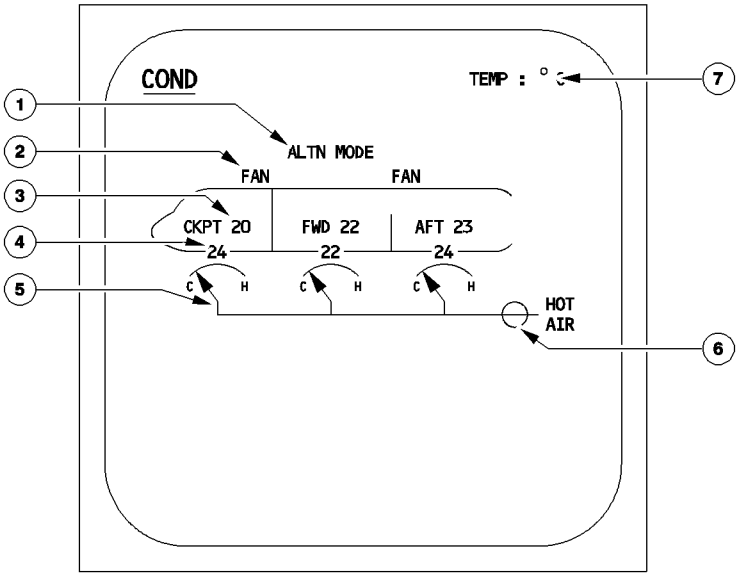
Indication is normally green. Becomes amber if pack flow control valve is closed.

Note : The pack flow indication can be up to 30 % below the actual flow rate.

(6) Pack flow control valve

⏀ Green : not closed.
⏀ Amber : not closed, disagree with control position.
⊖ Green : fully closed.
⊖ Amber : fully closed, disagree with control position.

ECAM COND PAGE



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(1) Zone controller fault indication

ALTN MODE : Primary zone controller fault (green).
PACK REG : Zone controller fault (basic regulation by packs only) (green).
No indication : Zone controller normal operation.

(2) Cabin FAN fault indication

Appears amber if fault detected.

(3) Zone temperature indication

It is green.

(4) Zone duct temperature

It is normally green, and becomes amber at 80°C (176°F).

(5) Zone trim air valve position indication

It is normally green, and becomes amber, if the valve fails.
C = Cold valve is fully closed.
H = Hot valve is fully open.

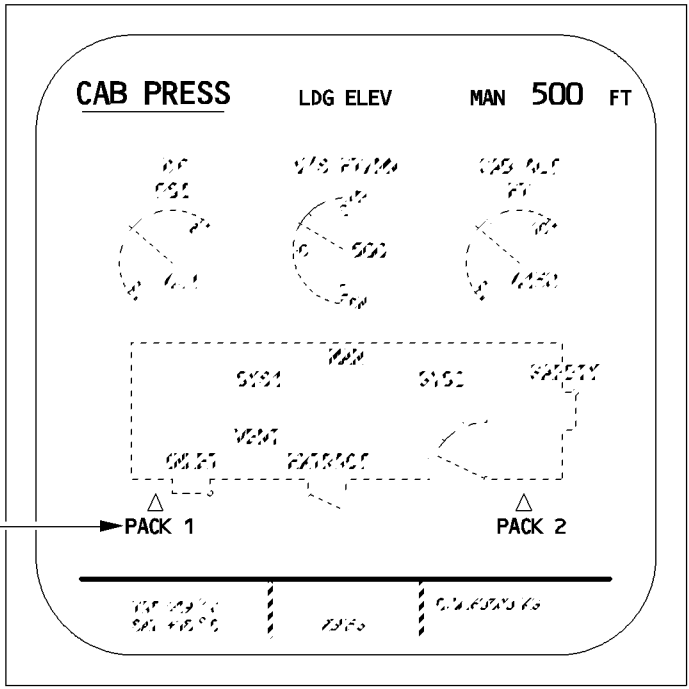
(6) Hot air pressure regulating valve

R In line – Green : The valve is open.
R In line – Amber : The valve is not closed ; disagrees with the control position.
R Crossline – Green : The valve is fully closed, and the pushbutton is at auto.
R Crossline – Amber : The valve is closed, and pushbutton is OFF, or the valve
R disagree is closed.

(7) TEMP

R Unit of measure (°C or °F) is indicated in cyan.

ECAM CAB PRESS PAGE



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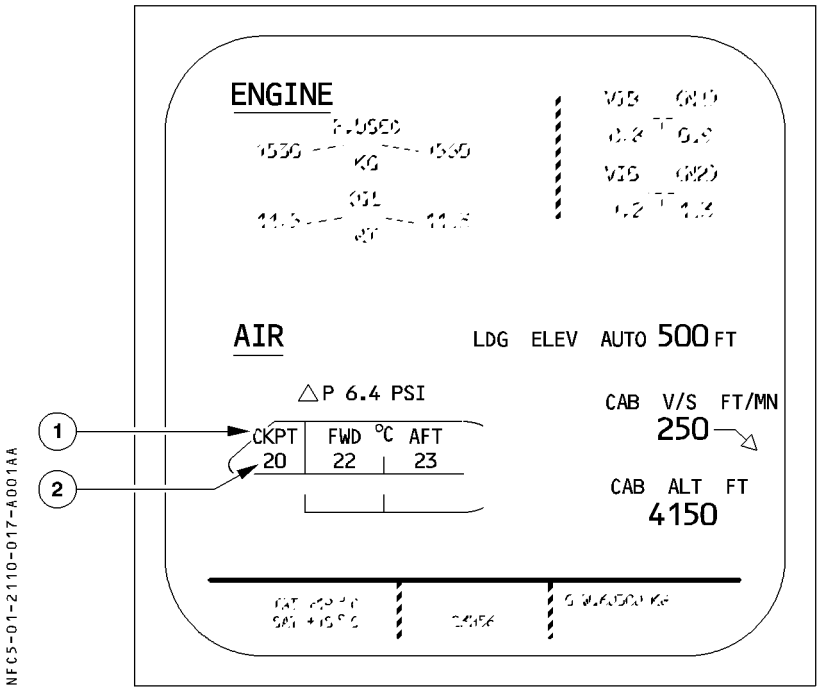
(1) PACK indication

Triangle normally green, PACK 1(2) indication normally white. Both become amber when pack flow control valve is closed with associated engine running.

R

ECAM CRUISE PAGE

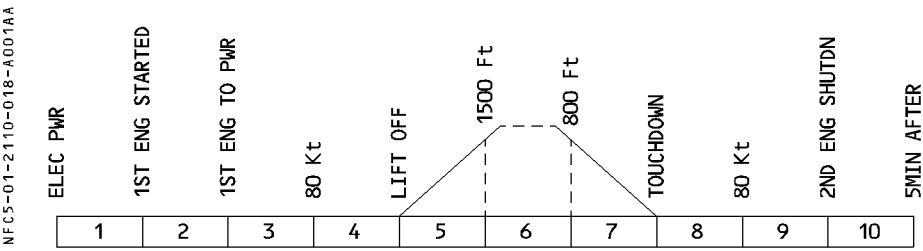


(1) Zone indication

This field also displays the temperature scale in use (°C or °F).

(2) Zone temperature

WARNINGS AND CAUTIONS



R

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
PACK 1 (or 2) OVHT Pack compressor outlet temperature above 260°C, or pack outlet temp above 95°C.	SINGLE CHIME	MASTER CAUT	BLEED	PACK FAULT lt	3, 4, 5, 7, 8
PACK 1 (or 2) FAULT Pack valve disagree with selected position, or Pack compressor outlet temperature above 230°C four times during one flight.					
PACK 1 + 2 FAULT One pack off, then the other fault					
PACK 1 (2) OFF Pack pb at off with no failure				NIL	1, 2, 3, 4, 5, 7 8, 9, 10
CKPT (FWD CAB OR AFT CAB) DUCT OVHT Duct temperature above 88°C.			COND	HOT AIR FAULT lt	3, 4, 5, 7, 8
HOT AIR FAULT Hot air pressure regulating valve disagrees with selected position					
L + R CAB FAN FAULT Both fan failure				NIL	
PACK 1(2) REGUL FAULT Pack main channel, or pack main and secondary channels failed.	NIL	NIL	BLEED		
ZONE REGUL FAULT Zone controller main channel, or main and secondary channels failed.			COND		
LAV + GALLEY FAN FAULT			NIL		3, 4, 5, 7, 8, 9
TRIM AIR SYS FAULT One trim air valve fault, or overpressure downstream hot air valve.					3, 4, 5, 7, 8

MEMO DISPLAY

RAM AIR ON appears in green if the ram air pushbutton switch is ON.

GENERAL

The cabin pressurization system has four general functions :
- Ground function : Fully opens the outflow valve on ground.
- Prepressurization : During takeoff, increases cabin pressure to avoid a surge in cabin pressure during rotation.
- Pressurization in flight : Adjusts cabin altitude, and rate of change to provide passengers with a comfortable flight.
- Depressurization : After touchdown, gradually releases residual cabin overpressure before the ground function fully opens the outflow valve.

The system consists of :
- Two Cabin Pressure Controllers (CPC)
- One outflow valve, with an actuator that incorporates three motors (two for automatic operation, one for manual operation)
- One control panel
- Two safety valves

Any one of the three independent electric motors may power the outflow valve.
Normally, one of the two cabin pressure controllers operates the outflow valve by means of its associated automatic motor.
In case of ditching, an override switch on the control panel allows the flight crew to close the outflow valve and all valves below the flotation line.
The flight crew can set the system to operate automatically, semi-automatically, or manually.
In normal operation, cabin pressurization is fully automatic.

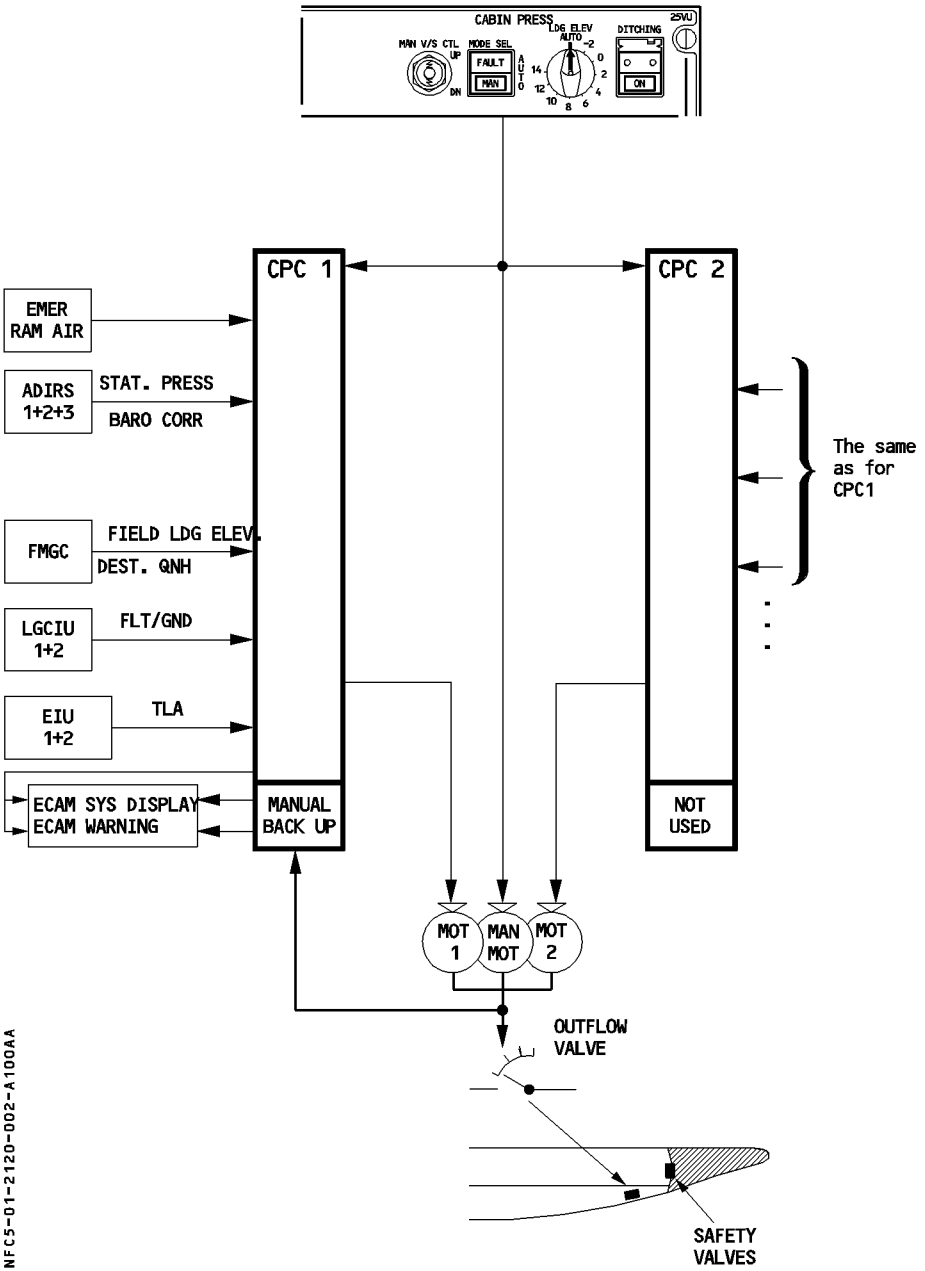
AUTOMATIC OPERATION

The flight crew monitors the operation of the system, but does nothing to control it. Air pressure in the cabin follows external schedules that the system receives as signals from the Flight Management and Guidance System (FMGS).
When FMGS data is not available for automatic pressurization, the crew only needs to select the landing field elevation.
R The pressurization system then uses the manually-selected landing field elevation for
R internal schedules.

MANUAL OPERATION

In manual mode, the flight crew controls the cabin altitude via the manual motor of the outflow valves, by operating controls on the pressurization control panel.

SCHEMATICS


CABIN PRESS
MAN V/S CTL
UP
DN
MODE SEL
FAULT
MAN
AUTO
LDG ELEV
AUTO
DITCHING
ON
25VU
CPC 1
CPC 2
EMER RAM AIR
ADIRS 1+2+3
STAT. PRESS
BARO CORR
FMGC
FIELD LDG ELEV.
DEST. QNH
LGCIU 1+2
FLT/GND
EIU 1+2
TLA
ECAM SYS DISPLAY
ECAM WARNING
MANUAL BACK UP
NOT USED
The same as for CPC1
MOT 1
MAN MOT
MOT 2
OUTFLOW VALVE
SAFETY VALVES
NFCS-01-2120-002-A100AA

MAIN COMPONENTS

CABIN PRESSURE CONTROLLERS

Two identical, independent, digital controllers automatically control the system, by maintaining the proper cabin pressure. They receive signals from the Air Data Inertial Reference System (ADIRS), the Flight Management and Guidance Computer (FMGC), the Engine Interface Unit (EIU), and the Landing Gear Control Interface Unit (LGCIU).
When the system is in automatic or semi-automatic mode, one controller is active, the other is on standby.
The controllers also generate signals for the Electronic Centralized Aircraft Monitoring (ECAM).
For operation in manual mode, each controller has a backup section, which is powered by an independent power supply in the controller N°1 position. This section also has a pressure sensor that generates the cabin altitude and pressure signal for the ECAM, when MAN mode is selected.
The controllers communicate with each other via a cross-channel link.

OUTFLOW VALVE

The outflow valve is on the right-hand side of fuselage, behind the aft cargo compartment and below the flotation line.
The outflow valve assembly consists of a flush, skin-mounted, rectangular frame, carrying inward and outward opening flaps linked to the actuator. The actuator contains the drives of the two automatic motors and the manual motor. Either of two automatic motors operates the valve in automatic mode, and the manual motor operates it in manual mode.
In automatic mode, the operating controller signals the position of the valve to the ECAM.
In manual mode, the backup section of the N° 1 controller signals the position of the valve to the ECAM.

Note : When the RAM AIR pushbutton is ON, and $\triangle p$ is below 1 psi, the system drives the outflow valve about 50 % open if it is under automatic control. If the system is under manual control, the outflow valve does not automatically open, even if $\triangle p$ is below 1 psi.

SAFETY VALVES

Two independent pneumatic safety valves prevent cabin pressure from going too high (8.6
R psi above ambient) or too low (1 psi below ambient).
They are located on the rear pressure bulkhead, above the flotation line.

SYSTEM OPERATION

AUTOMATIC PRESSURE CONTROL MODE

- Two identical, independent, automatic systems (each consisting of a controller and its associated motors) control cabin pressure.
  Either system controls the single outflow valve.
  Only one controller operates at a time.
  An automatic transfer occurs :
  · 70 seconds after each landing.
  · If the operating system fails.
- The controller automatically controls the cabin pressure. It limits the cabin pressure to 8000 feet maximum and optimizes it during climb and descent phases.
- The controller normally uses the landing elevation and the QNH from the FMGC, and the pressure altitude from ADIRS.
  If FMGC data are not available, the controller uses the captain Baro Reference from the ADIRS and the LDG ELEV selection.
- Pressurization is assumed through the following modes :

Ground (GN)

Before takeoff, and 55 seconds after landing, the outflow valve fully opens to ensure that there is no residual cabin pressure. At touchdown, any remaining cabin pressure is released at a cabin vertical speed of 500 feet/minute.

Takeoff (TO)

R To avoid a pressure surge at rotation, the controller pre-pressurizes the aircraft at a rate of 400 feet/minute, until the $\triangle P$ reaches 0.1 PSI. At lift-off, the controller initiates the climb phase.

Climb (CL)

During climb, the cabin altitude varies according to a fixed pre-programmed law that takes into account the aircraft's actual rate of climb.

Cruise (CR)

During cruise, the controller maintains cabin altitude at the level-off value, or at the landing field elevation, whichever is higher.

Descent (DE)

During descent, the controller maintains a cabin rate of descent, such that cabin pressure equals the landing field pressure, just before landing.
The maximum descent rate is 750 feet/minute.

Abort (AB)

If the aircraft does not climb after takeoff, the abort mode prevents the cabin altitude from climbing.
Cabin pressure is set back to the takeoff altitude + 0.1 PSI.

PRESSURIZATION MODES SWITCHING

FOR INFO

	FROM	GN	TO	GN	CL	AB	TO	CL	CR	CR	DE	DE	AB
	TO	TO	CL	CL	AB	GN	GN	CR	CL	DE	CL	GN	CL
CONDITIONS	ENG 1 and ENG 2 TLA ≥ MCT (*)	1					0						
	L/G sys 1 or sys 2 COMPRESSED	1					1						
	One L/G sys UNLOADED and A/C speed above 100 kt		1	1									
	One L/G sys COMPRESSED and A/C speed below 100 kt					1						1	
	A/C ALT. < 8000 FT				1A								
	A/C ALT. ≥ 8000 FT							1					
	A/C ALT. CHANGE SINCE T/O ≤ 5075 SLFT				1A								
	A/C ALT. CHANGE SINCE T/O ≥ 5075 SLFT							1					
	A/C RATE OF CLIMB ≥ 21 SL FPM FOR 60 SEC.										1		1
	A/C RATE OF CLIMB ≥ 100 SL FPM FOR 30 SEC.							0	1				
	A/C RATE OF DESCENT ≥ 200 SL FPM FOR 30 SEC.				1								
	A/C RATE OF DESCENT ≥ 250 SL FPM FOR 30 SEC									1			

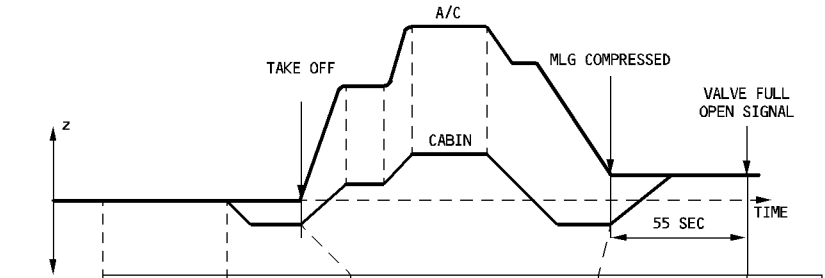
0 : Condition not valid
1 : Condition valid
1A : Only one A condition necessary
(*) : Engine running

Example

The cabin pressure controller switches from CL (climb) mode to AB (abort) mode when:
- the aircraft is below 8000 feet, or the aircraft has changed altitude less than 5075 feet since takeoff and,
- the aircraft rate of descent is greater than 200 feet/minute for 30 seconds.

PRESSURIZATION FLIGHT PROFILE

R



	GROUND	PREPRESSU	PRESSURIZATION	DEPRESS	GROUND
CABIN V/S		-400 ft/min		+500 ft/min	
CABIN Δ P		+0.1 PSI	≤+8.06 PSI	+0.1 PSI	

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MANUAL PRESSURE CONTROL MODE

If both automatic systems fail, the flight crew may use the CABIN PRESS control panel to take over manual control of cabin pressurization.
· Press the MODE SEL pushbutton to select MAN, and
· Push the MAN V/S CTL switch UP or DN to increase or decrease cabin altitude.
The first of these actions cuts off power to the AUTO motors, and enables the MAN motor to control the outflow valve.

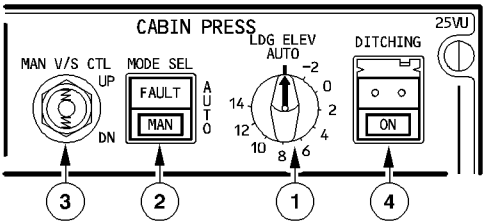
Note : 1. Due to the slow operation of the outflow valves in manual mode, and the limited resolution of the outflow valves' position on the ECAM, the visual ECAM indication of a change in the outflow valves' position can take up to 5 seconds.
2. As the pressurization system is manually-controlled, the outflow valve does not open automatically at touchdown.

DITCHING

To prepare for ditching, the flight crew must press the DITCHING pushbutton on the CABIN PRESS control panel to close the outflow valve, the emergency ram air inlet, the avionics
R ventilation inlet and extract valves, and the pack flow control valves.

CONTROLS AND INDICATORS

OVERHEAD PANEL



NFCS-01-2120-008-A100AA

① LDG ELEV sel

AUTO : The pressurization system uses the FMGS data to construct an optimized pressure schedule.
To exit the AUTO position, pull out and turn the selector.

Other positions : The pressurization schedule does not use the landing elevation from the FMGS, but instead uses the landing elevation selected with this knob (from – 2000 to + 14000 feet) as its reference.

R *Note : The LDG ELEV selector scale is only given as an indication ;*
R *refer to the ECAM information for accurate adjustment.*

② MODE SEL pb

AUTO : Automatic mode is operating. One of the two systems controls the outflow valve.

Note : If the pilot suspects that the operating pressurization system is not performing properly, he can attempt to select the other system by switching the MODE SEL pushbutton to MAN, for at least 10 seconds, then returning it to AUTO.

MAN : This legend appears in white, and FAULT does not come on. The flight crew then uses the MAN V/S CTL switch to control the outflow valve.

FAULT lt : This legend appears in amber and the ECAM caution light comes on only when both automatic systems are faulty.

Note : The pilot may notice a variation in the CAB ALT indication on the ECAM PRESS page, when the system switches from the cabin
R *pressure control AUTO mode to MAN mode, due to the reduced*
R *resolution of the backup pressure sensor.*

③ MAN V/S CTL toggle switch

The switch, springloaded to neutral, controls the outflow valve position through operation of the MAN motor, when the MODE SEL pushbutton is in the MAN position.
UP : The valve moves towards the open position.
DN : The valve moves towards the closed position.

Note : The outflow valve operates slowly, so the pilot must hold the toggle switch in the UP or DN position until reaching the target V/S.

④ DITCHING guarded pushbutton

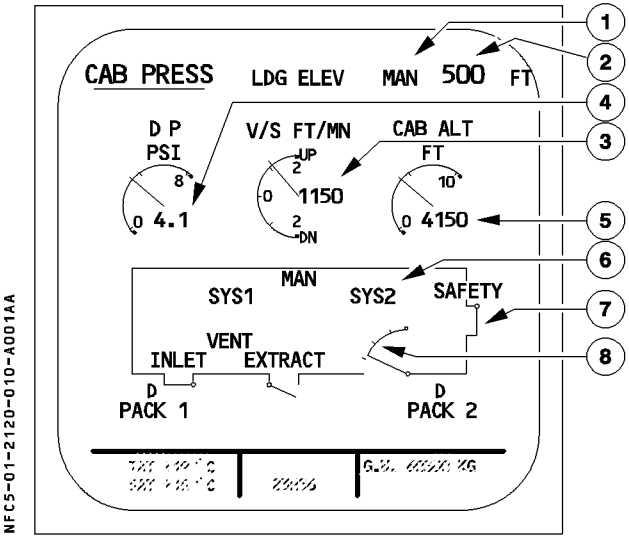
Normal : The system functions normally.
ON : The operating system sends a "close" signal to the outflow valve, emergency ram air inlet, avionics ventilation inlet and extract valves, and
R pack flow control valves.

Note : The outflow valve will not close automatically, if it is under manual control.

CAUTION

If the ditching pushbutton is set to ON, on ground, with the low pressure ground cart connected and all doors closed, a differential pressure will build up.

ECAM CAB PRESS PAGE



NFC5-01-2120-010-A001AA

① LDG ELEV AUTO/MAN

- LDG ELEV AUTO appears in green when the LDG ELEV selector is in AUTO.
- LDG ELEV MAN appears in green when the LDG ELEV selector is not in AUTO.

R - Neither appears when the MODE SEL pushbutton switch is in MAN.

② Landing elevation

R The landing elevation selected either automatically by the FMGS or manually by the pilot appears in green (but not when the MODE SEL pushbutton switch is in MAN).

③ V/S FT/MIN (cabin vertical speed)

The analog and digital presentations appear in green when V/S is in the normal range. They appear in amber when V/S ≥ 2000 feet/minute.
The digital presentation pulses when V/S > 1800 feet/minute (resets at 1600 feet/minute).

④ △P PSI (cabin differential pressure)

The analog and digital presentations appear in green when △P is in the normal range.
R They appear in amber when △P ≤ – 0.4 psi or ≥ 8.5 psi.
The digital presentation pulses if △p > 1.5 psi (resets at 1 psi) during flight phase 7. (See page 14 to identify flight phases).

⑤ CAB ALT FT (cabin altitude)

The analog and digital presentations appear in green, in normal range.
They appear in red if the cabin altitude goes above 9550 feet.
The digital presentation pulses if the cabin altitude is at or above 8800 feet (resets at 8600 feet).

⑥ Active system indication (SYS 1 or SYS 2 or MAN)

SYS 1 or SYS 2 appears in green when active and in amber when faulty. When either system is inactive, its title does not appear.
MAN appears in green when the MODE SEL switch is in MAN.

⑦ Safety valve position

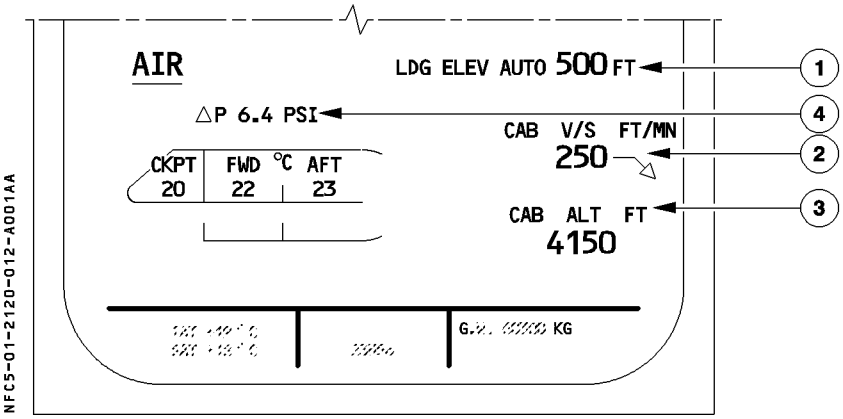
SAFETY appears in white and the diagram in green when both safety valves are fully closed. SAFETY and the diagram appear in amber when either valve is not closed.

Note : The safety valve opens when the cabin differential pressure is between 8.2 and 8.9 psi. The range is due to the reduced accuracy of △P measurements (in MAN mode), combined with the decrease in cabin differential pressure that occurs immediately after the safety valves open.

⑧ Outflow valve position

The diagram is green when the valve is operating normally.
The diagram becomes amber when the valve opens more than 95 % during flight.

ECAM CRUISE PAGE



(1) LDG ELEV AUTO/MAN

Identifical to CAB PRESS page

R (2) CAB V/S FT/MIN (cabin vertical speed)

Green, in normal range.
Amber, when out of normal range : V/S ≥ 2000 feet/minute
R Pulses when V/S > 1800 feet/minute (resets at 1600 feet/minute)

R (3) CAB ALT FT (cabin altitude)

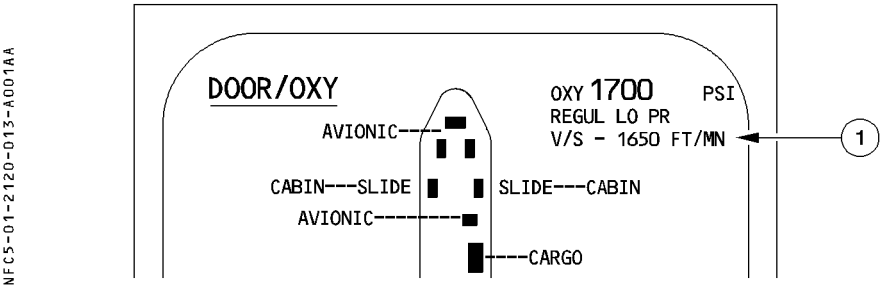
Green, in normal range.
Red, for excessive cabin altitude : ≥ 9550 feet.
R Pulses for cabin altitude at or above 8800 feet (resets at 8 600 feet)

(4) △P indication

Normally green.
Amber when out of normal range △p ≤ – 0.4 psi or ≥ 8.5 psi.

R

ECAM DOOR PAGE

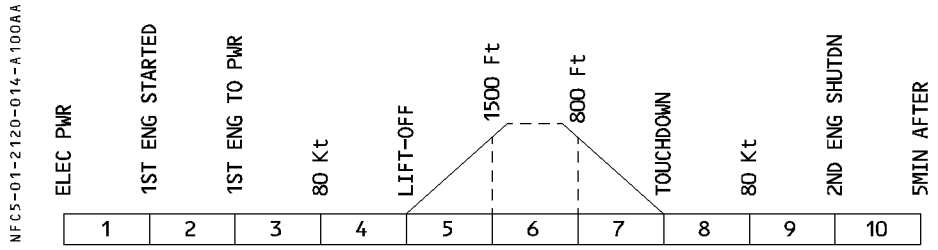


(1) V/S (cabin vertical speed)

This number only appears during flight phases 5, 6 and 7. (See page 14 for flight phase definitions).

- It is normally green.
- It becomes amber when the V/S is greater than 2000 feet/minute, or less than – 2000 feet/minute.

WARNINGS AND CAUTIONS



R

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
EXCESS CAB ALT : Cabin altitude exceeds : – In CLB and DES the higher of : 9550 feet or landing field elevation plus 1000 feet – In CRZ 9550 feet	CRC	MASTER WARN	CAB PRESS	NIL	2, 3, 4 5, 7, 8 9, 10
SYS 1 + 2 FAULT Both pressure controllers fail.	SINGLE CHIME	MASTER CAUT	CAB PRESS	MODE SEL FAULT lt	4, 5, 7, 8
LO DIFF PR Time to reach $\triangle P = 0 < 1.5$ minutes, and time to reach $\triangle P = 0 \leq$ (time for cab alt to reach landing elevation) + 30 seconds and aircraft is at least 3000 ft above landing field. Note : The warning is maintained when the aircraft descends below 3000 ft above landing field.				NIL	2, 3, 4 5, 7, 8 9, 10
OUTFLOW VALVE NOT OPEN Valve not fully open on ground (time delay 3 minutes)					3, 4, 5 6, 7, 8
SAFETY VALVE OPEN Either safety valve not fully closed on ground or not fully closed for more than 1 minute in flight.					4, 5, 7 8, 9, 10
LDG ELEV FAULT No FMGS LDG ELEV data is available.					3, 4, 5 7, 8 9, 10
SYS 1 (or 2) FAULT Pressure controller fault.	NIL	NIL			3, 4, 5 7, 8

MEMO DISPLAY

The "MAN LDG ELEV" message is displayed in green, if the LDG ELEV selector is not in the AUTO position.

GENERAL

The ventilation system includes ventilation for :
- the avionics, controlled by the avionics equipment ventilation controller (AEVC),
- the battery,
- the lavatories and galleys.

Note : For a discussion of cargo ventilation, see 1.21.40.

AVIONICS VENTILATION

GENERAL

The avionics ventilation system is fully automatic.
It cools the electrical and electronic components in the avionics compartment and on the flight deck, including the instrument and circuit breaker panels. It uses two electric fans to force the circulation of cooling air.
Whatever the configuration of the avionics ventilation system is, a part of the avionics ventilation air is sucked from the cockpit through the different cockpit panels.

MAIN COMPONENTS

FANS

Two electric fans operate continuously as long as the aircraft electrical system is supplied. They make the air circulate around the avionics equipment.

SKIN AIR INLET AND EXTRACT VALVES

These valves admit air from outside the aircraft and evacuate hot air from inside the aircraft.

SKIN EXCHANGE INLET AND OUTLET BYPASS VALVES

These valves permit air to circulate between the avionics bay and the space under the cargo compartment floor.

AIR CONDITIONING INLET VALVE

This valve opens to permit the air conditioning circuit to supply fresh air to the avionics bay.

SKIN EXCHANGE ISOLATION VALVE

This valve connects or isolates the skin heat exchanger.

AVIONICS EQUIPMENT VENTILATION COMPUTER (AEVC)

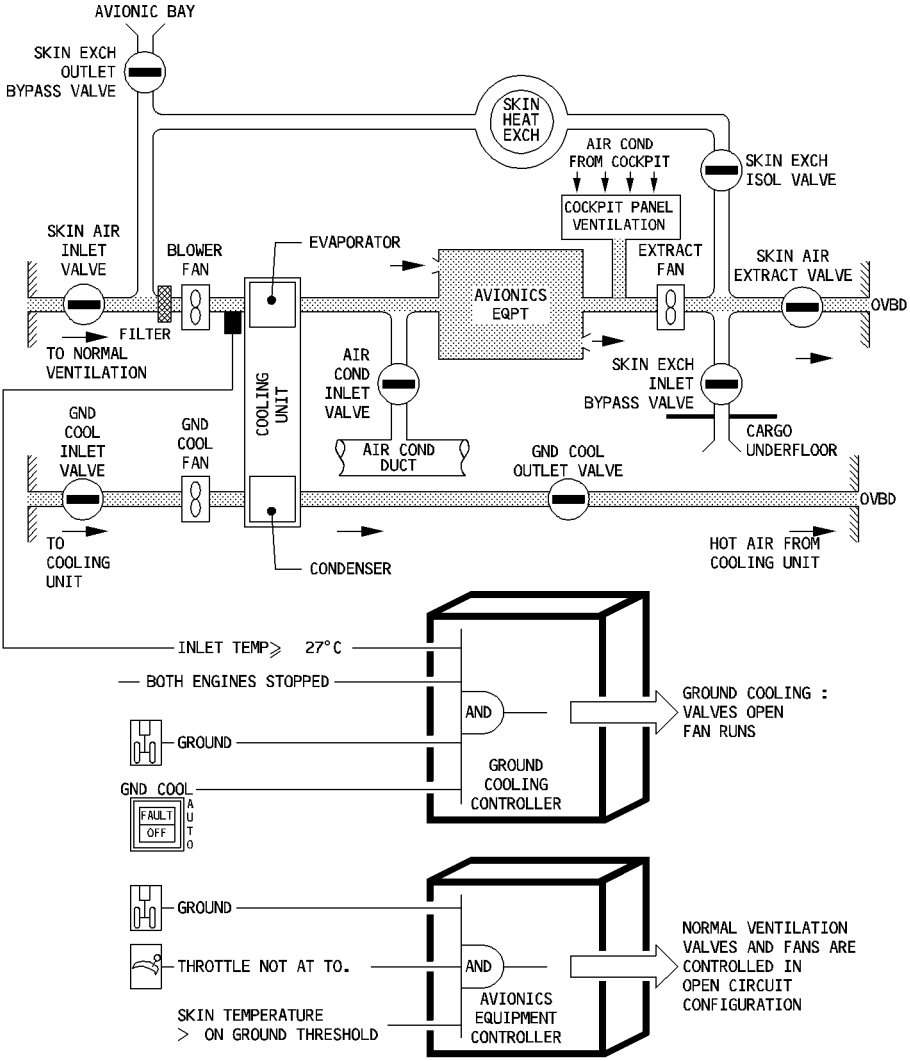
The AEVC controls the operation of all fans and valves in the avionics ventilation system.

NORMAL OPERATION, OPEN-CIRCUIT CONFIGURATION

GROUND OPERATIONS

The open-circuit configuration operates when skin temperature is above the on-ground threshold.

On-ground threshold = + 12°C (53°F), temperature increasing, or
= + 9°C (48°F), temperature decreasing.



NORMAL OPERATION, CLOSE-CIRCUIT CONFIGURATION

Flight operations

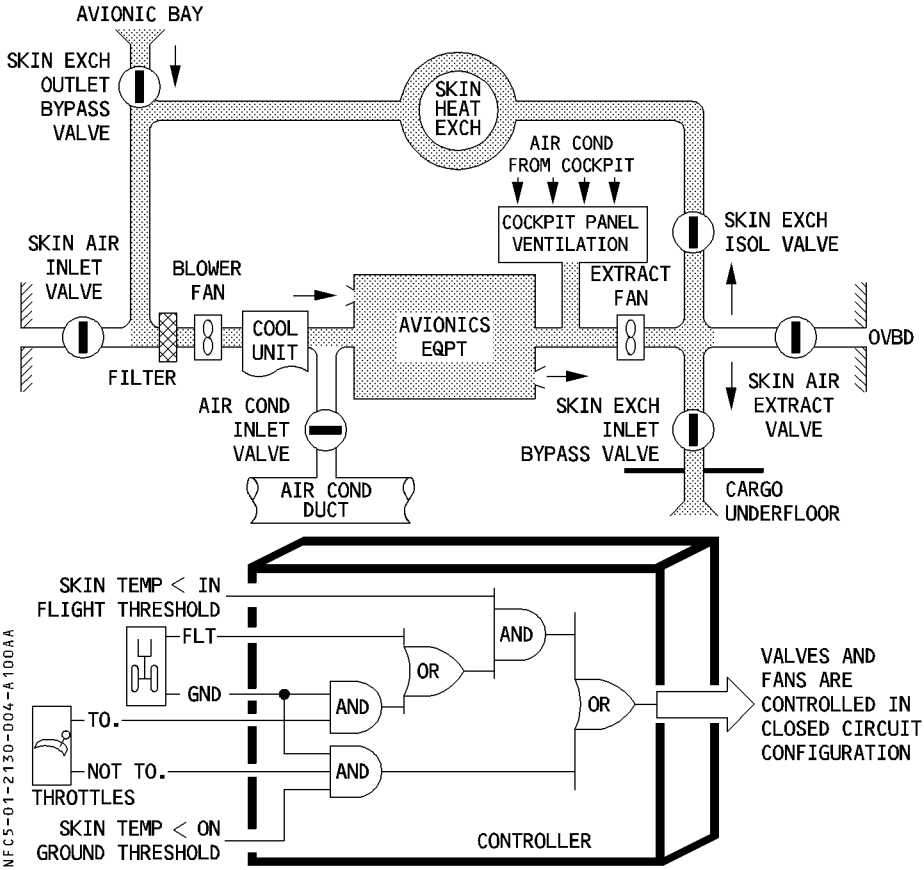
The close-circuit configuration operates when skin temperature is beneath the in-flight threshold.

In flight threshold = + 35°C (95°F), temperature increasing, or
= + 32°C (90°F), temperature decreasing.

Ground operations

The close-circuit configuration operates when skin temperature is beneath the on-ground threshold.

On ground threshold = + 12°C (53°F), temperature increasing, or
= + 9°C (48°F), temperature decreasing.

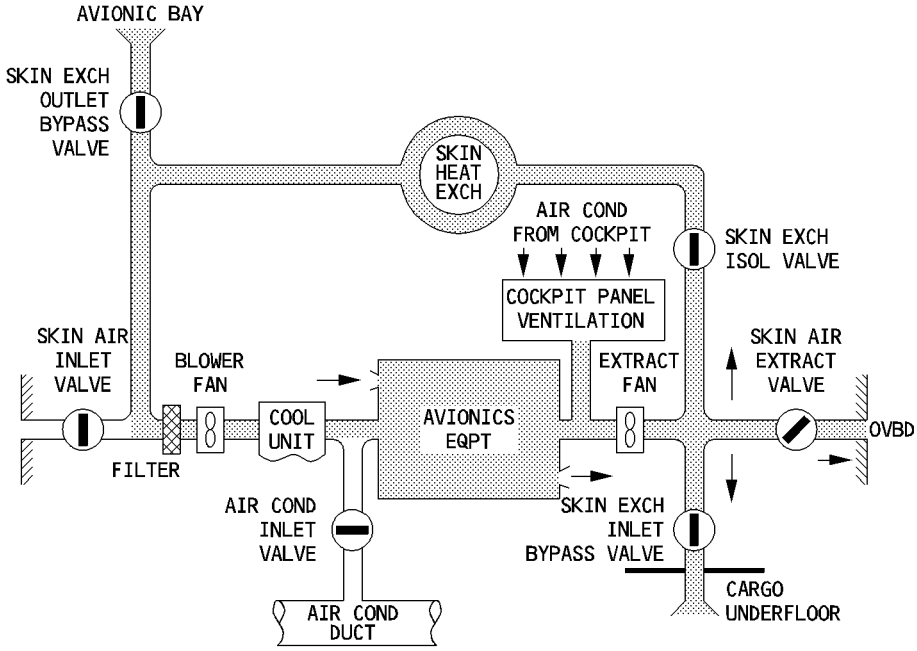


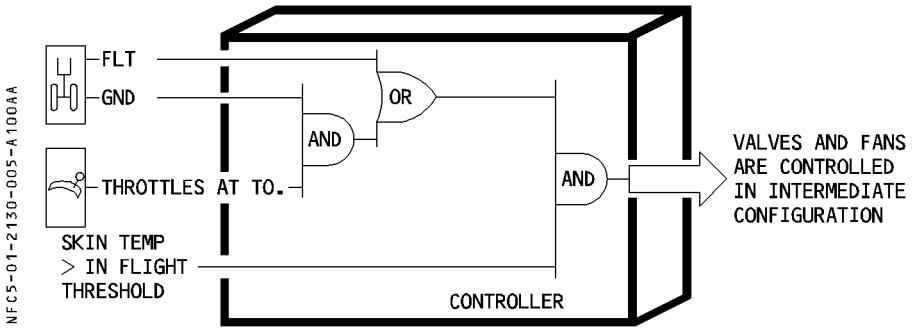
NORMAL OPERATION, INTERMEDIATE CONFIGURATION

Flight operations

The intermediate configuration operates when skin temperature is above the in-flight threshold.

In flight threshold = + 35°C (95°F), temperature increasing, or
= + 32°C (90°F), temperature decreasing.

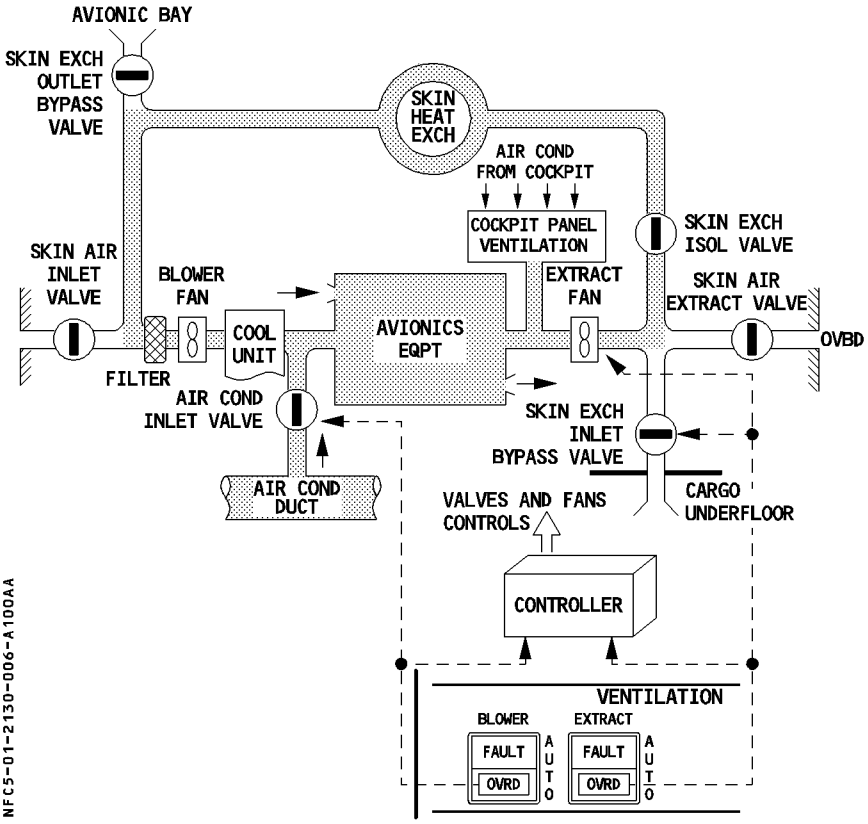




ABNORMAL OPERATION

BLOWER FAULT or EXTRACT FAULT warning

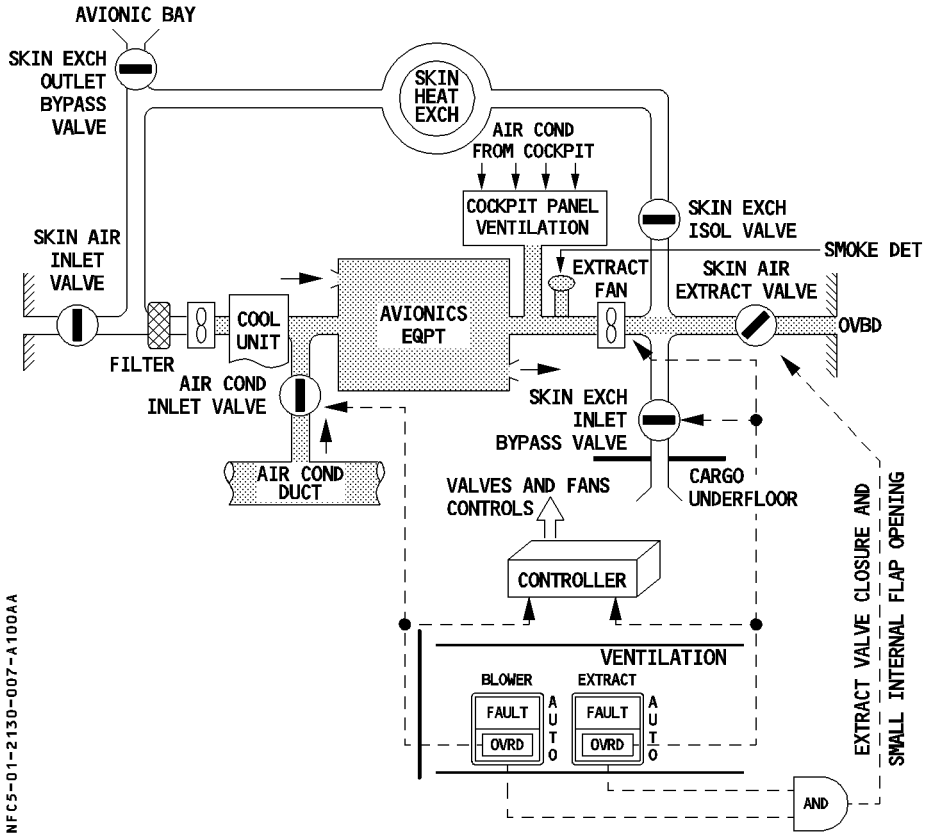
When the BLOWER or the EXTRACT pushbutton switch is set at the OVRD (override) position, the system is in closed-circuit configuration and adds air from the air conditioning system to the ventilation air.



When the BLOWER pushbutton switch is set at OVRD, the blower fan is stopped and the extract fan continues to run.
When the EXTRACT pushbutton switch is set at OVRD, the extract fan is controlled directly from the pushbutton. Both fans continue to run.

Smoke configuration

When the smoke detector detects smoke in the avionics ventilation air the BLOWER and the EXTRACT FAULT lights come on.
When both the BLOWER and the EXTRACT pushbuttons are set to the OVRD position, the air conditioning system supplies cooling air, which is then exhausted overboard. The blower fan stops.



Controller failure

The system goes to the same configuration as above, except that the skin exchange isolation valve stays open.
The inlet valve and the skin exchange inlet bypass valve remain in the position they were in before the failure occurred.
The extract fan keeps running.

AVIONICS GROUND COOLING

GENERAL

The avionics ground cooling is fully automatic.
It ensures the cooling on ground of the avionics ventilation air in case of outside extreme hot air.
The cooling system is integrated into the avionics ventilation system, but operates independently.

MAIN COMPONENTS

The cooling system consists of :
- 1 inlet valve,
- 1 ground cool fan,
- 1 cooling unit, consisting in a freon gas closed-cycle refrigeration system,
- 1 outlet valve,
- 1 controller.

SYSTEM OPERATION

The ambient air used by the cooling unit is drawn from outside by the ground cooling fan through the inlet valve.
Air from the cooling unit is discharged overboard via the outlet valve.
The operation of the cooling unit, the inlet valve, the ground cooling fan and the outlet valve is controlled by the ground cooling controller.
Ground cool valves open when :
- the aircraft is on ground, and
- the engines are stopped, and
- the ground cool pushbutton is at auto position.

The cooling unit operates when :
- above conditions are met, and
- the temperature of avionics ventilation air is greater than 27°C (80°F).

The ground cool unit automatically stops when :
- the engines start,
- the ventilation air temperature is lower than 22°C (72°F),
- the ventilation air temperature reaches the upper limit of 62°C (144°F).

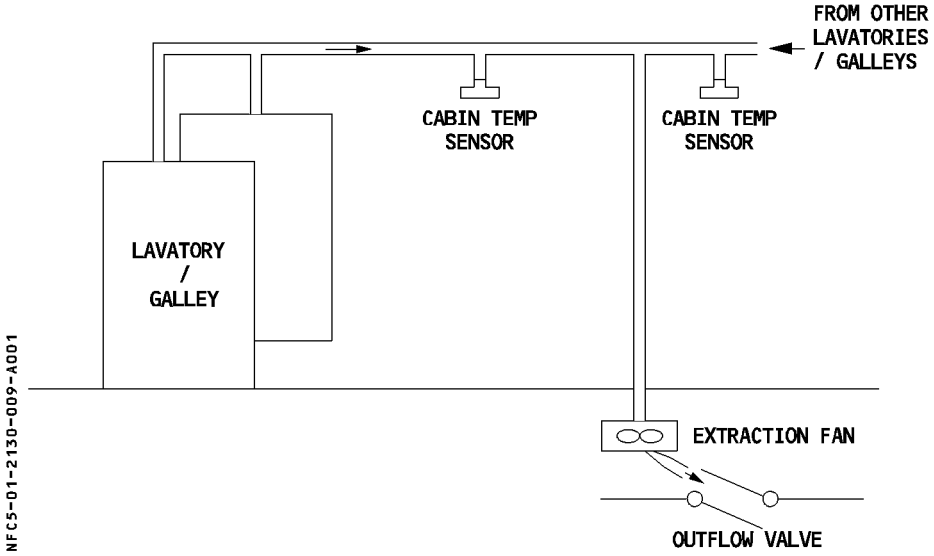
System faults are signalled by the controller to the ECAM and the ground crew call system.

BATTERY VENTILATION

A venturi in the skin of the aircraft draws air from the space around the batteries and vents it overboard. The resulting airflow ventilates the batteries.

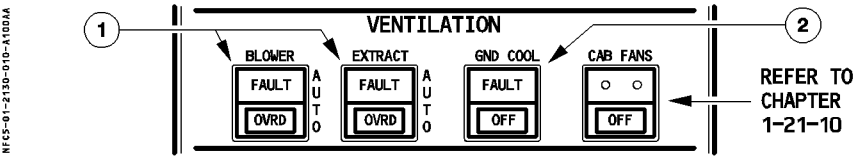
LAVATORY AND GALLEY

An extraction fan draws ambient cabin air through the lavatories and galleys and exhausts it near the outflow valve.
The extraction fan runs continually when electric power is available.



CONTROLS AND INDICATORS

OVERHEAD PANEL



(1) BLOWER and EXTRACT pb sw

AUTO : When both pushbutton switches are on AUTO :
- On the ground before the application of TO power, the ventilation system is in open circuit configuration (closed configuration when the skin temperature is below the ground threshold).
- On the ground after the application of TO power, and in flight, the ventilation system is in closed circuit configuration.

OVRD : When either pushbutton switch is on OVRD :
- The system goes to closed circuit configuration.
- Air from the air conditioning system is added to ventilation air. (The blower fan stops if the BLOWER pushbutton switch is in the OVRD position).

When both pushbutton switches are on OVRD :
- Air flows from the air conditioning system and then overboard.
- The extract fan continues to run.

FAULT lt : Lights up amber (and ECAM activates)
in the blower switch, if :
- blowing pressure is low*
- duct overheats*
- computer power supply fails
- smoke warning is activated

in the extract switch, if :
- extract pressure is low*
- computer power supply fails
- smoke warning is activated.

* If the warning occurs on the ground when the engines are stopped, the external horn sounds.

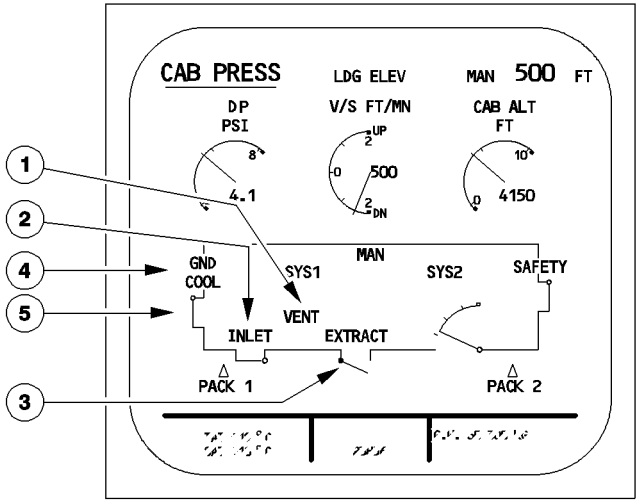
(2) GND COOL pb sw

AUTO : The inlet and outlet valves open, the ground cooling fan and the ground cool unit start automatically when the aircraft is on ground with the engines stopped and inlet temperature ≥ 27°C.

OFF : The ground cool unit stops, the valves close and the fan stops.

FAULT lt : Lights up amber, the ECAM and the ground crew call system activate when a fault is detected in the ground cool unit, valves or fan.

ECAM CAB PRESS PAGE



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(1) VENT

This normally appears in white. It becomes amber if there is a BLOWER FAULT, EXTRACT FAULT, or AVNCS SYS FAULT.

(2) INLET and EXTRACT indications

Normally white. Corresponding indication becomes amber in case of BLOWER FAULT or EXTRACT FAULT.

(3) INLET and EXTRACT valve diagrams

This indicates that the valve is fully closed.
It is normally green, but is amber if there is a disagreement.

This indicates that the valve is fully open.
It is normally green, but is amber if there is a disagreement.

NOTE: Because of the accuracy of the temperature sensors, on the ground the closed or open indication may become amber when the temperature is close to the valve opening or closing threshold.

This indicates that the inlet valve is in transit (inlet valve only).
It is amber.

This indicates that the extract valve is partially open (the extract valve is closed but a small internal flap is open).

It is normally green, but is amber when the valve failed in transit.

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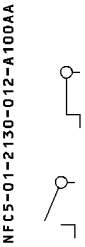
(4) GND COOL indication

The indication is normally white. It becomes amber if the inlet or the outlet ground cooling valve is not fully closed when at least one engine is running or in flight.

(5) GND COOL inlet/outlet valves position



This indicates that the inlet and outlet valves are fully closed. It is green.

This indicates that the inlet or the outlet valve is not fully closed.
It is normally green.
It is amber when at least one engine is running or in flight.

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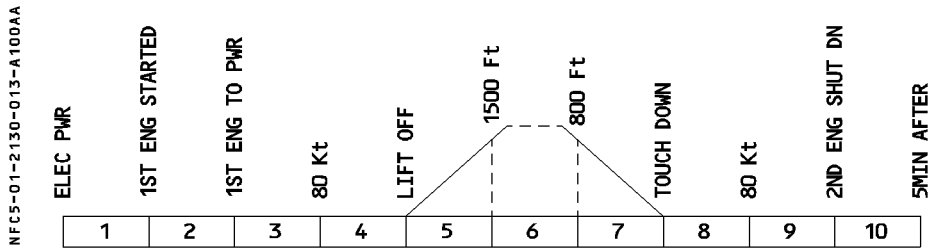
WARNINGS AND CAUTIONS



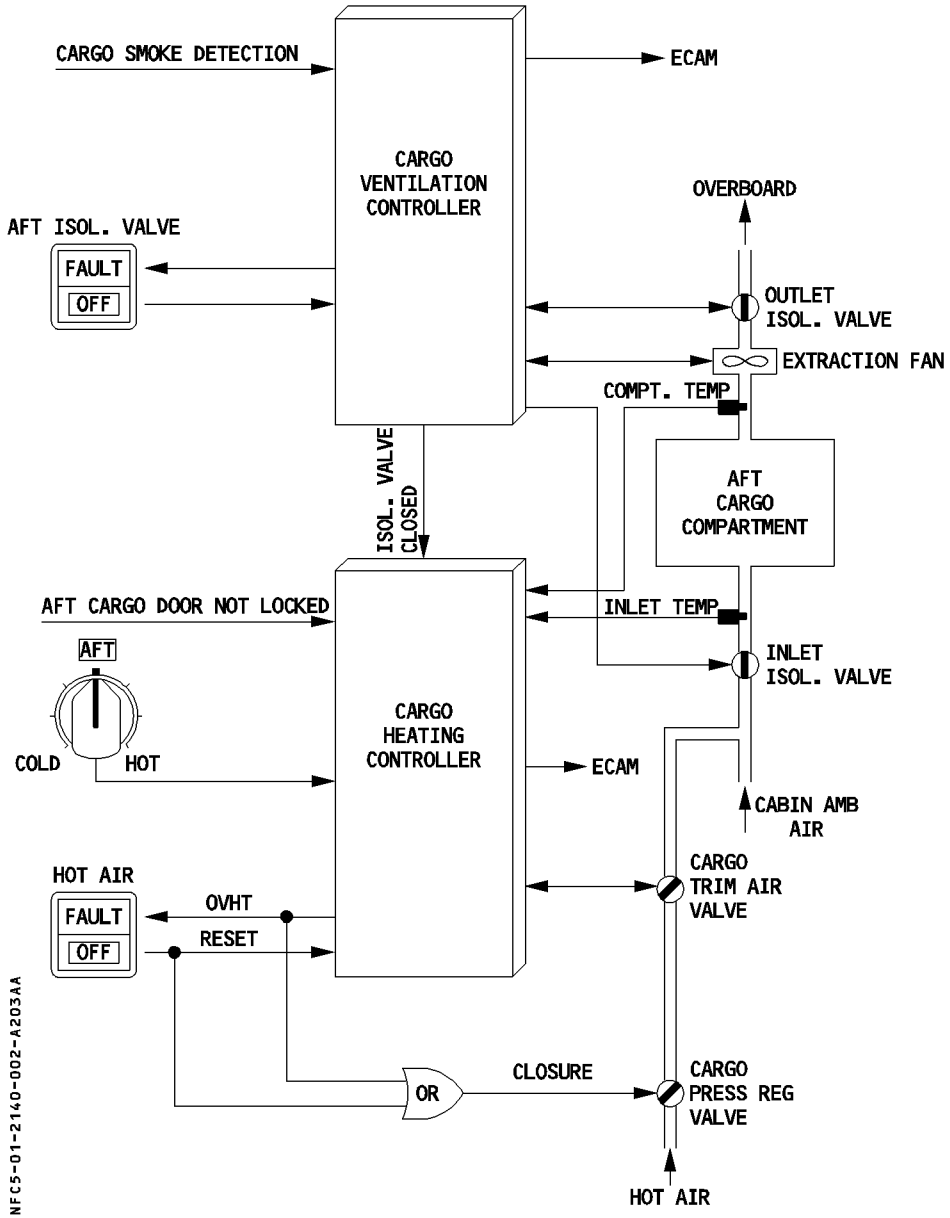
R

E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
BLOWER FAULT Blowing pressure low or duct overheat	SINGLE CHIME	MASTER CAUT	CAB PRESS	BLOWER* FAULT lt	3, 4, 5, 7, 8
EXTRACT FAULT Extract pressure low				EXTRACT* FAULT lt	
SKIN VALVE FAULT 1. Extract valve fully open in phase 3 or 2. Extract valve fully open in flight or 3. Inlet valve not fully closed in flight				NIL	4, 5, 7, 8
AVNCS SYS FAULT Power up test not satisfactory or AEVC not supplied or valves position disagree				BLOWER and EXTRACT FAULT lts**	3, 4, 5, 6, 7, 8 9
VENT GND COOL FAULT Ground cool inlet or outlet valve disagree or ground cool unit fault				GND* COOL FAULT lt	

* Associated with ground external call.
** Only in case of AEVC power supply failure on ground.

GENERAL

An extraction fan draws air from the cargo compartments (◁) and exhausts it overboard. Air from the cabin replaces the exhausted air, thus ventilating the cargo compartments. The system can add hot bleed air to the air entering from the cabin, thus giving the flight crew control of the temperature in the forward or aft (◁) cargo compartment.


CARGO SMOKE DETECTION
ECAM
CARGO VENTILATION CONTROLLER
OVERBOARD
AFT ISOL. VALVE
FAULT
OFF
OUTLET ISOL. VALVE
EXTRACTION FAN
COMPT. TEMP
ISOL. VALVE CLOSED
AFT CARGO COMPARTMENT
AFT CARGO DOOR NOT LOCKED
INLET TEMP
AFT
INLET ISOL. VALVE
COLD
HOT
CARGO HEATING CONTROLLER
ECAM
CABIN AMB AIR
HOT AIR
CARGO TRIM AIR VALVE
FAULT
OFF
OVHT
RESET
CLOSURE
OR
CARGO PRESS REG VALVE
HOT AIR
NFC5-01-2140-002-A203AA

SYSTEM OPERATION

AFT CARGO COMPARTMENT VENTILATION

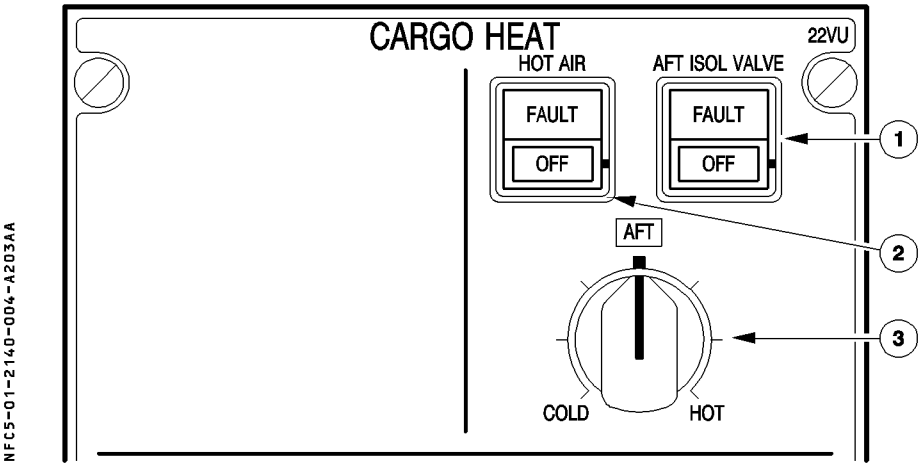
Air from the cabin goes via the inlet isolation valve to the aft cargo compartment, driven by an extraction fan. Air is controlled by the outlet isolation valve and then goes outboard through the outflow valve.
The cargo ventilation controller controls the operation of the inlet and outlet isolation valves and the extraction fan.
When the isolation valves are fully open, the extraction fan operates continuously when the aircraft is on the ground and during flight.
The controller closes the isolation valves and stops the extraction fan when :
– the flight crew turns the AFT ISOL VALVE pushbutton switch OFF.
– The aft cargo smoke detection unit detects smoke.

AFT CARGO COMPARTMENT HEATING

The ventilation system for the aft cargo compartment uses hot engine bleed air (upstream of the packs), mixing it with the ambient cabin air that flows through the cargo compartment.
The cargo regulating valve regulates the pressure of this hot air supply, and the trim air valve, which is modulated electrically by the controller, controls the flow.
The cargo pressure regulating valve is pneumatically operated and electrically controlled from the HOT AIR pushbutton on the CARGO HEAT panel.
The hot air is controlled by the cargo trim air valve which is modulated electrically by the controller.
The hot air is then mixed with air from the cabin and supplied to the cargo compartment through the ventilation inlet isolation valve.
According to the temperature selector demand, the controller regulates the amount of hot air added by the trim air valve, until the desired temperature is reached.
If the inlet temperature exceeds 70° C, the controller closes the trim air valve.
If the inlet temperature exceeds 88° C, the controller interprets this as a duct overheat and closes the pressure regulating valve. This valve then remains closed until the flight crew resets the system by pressing the HOT AIR pushbutton — which it cannot do until the temperature drops below 70° C.

CONTROLS AND INDICATORS

OVERHEAD PANEL



(1) AFT ISOL VALVE pb sw

The switch controls the aft isolation valves and the extraction fan.

Auto : The inlet and outlet isolation valves open and the extraction fan runs if there is no smoke detected in the aft cargo bay.

OFF : The inlet and outlet isolation valves and the trim air valve close, the extraction fan stops.

FAULT lt : The light comes on amber associated with ECAM caution when either inlet or outlet valve is not in the selected position.

(2) HOT AIR pb sw

Auto : The pressure regulating valve regulates hot air pressure.

OFF : The pressure regulating valve closes.
Fault circuit is reset.

R FAULT lt : The light comes on amber associated with ECAM caution when a duct overheat is detected (88° C – 190° F).
The light goes out when the temperature drops below 70° C (158° F) and OFF is selected. Then, if the pushbutton is set to on, the system is reset.

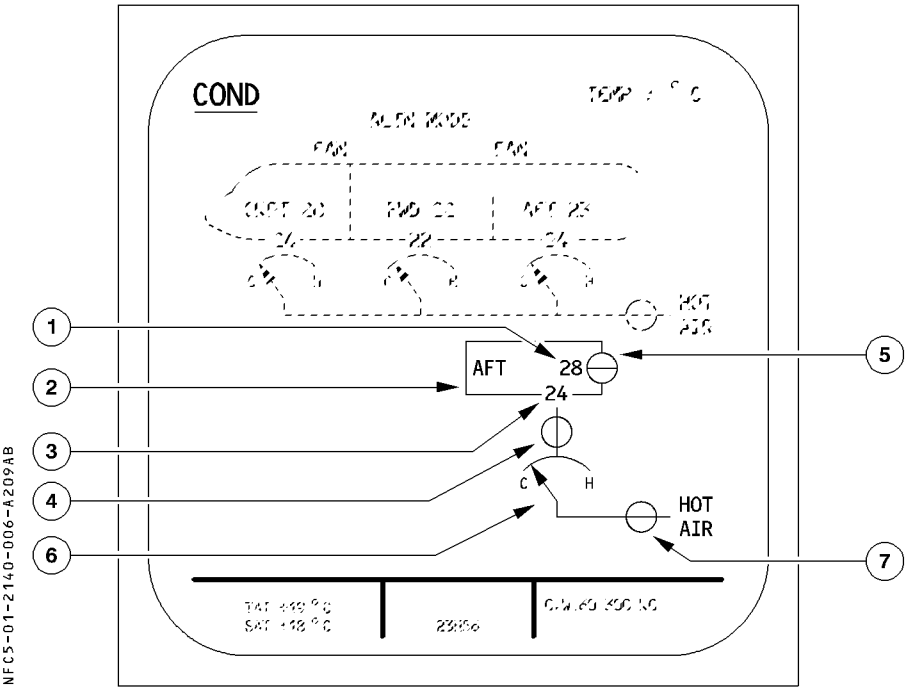
③ Temperature selector

R – COLD position : Approximately 5° C (41° F)
R – HOT position : Approximately 26° C (79° F)
R – Middle position : Approximately 15° C (59° F)

R *Note : 1. The cargo compartment temperature may vary, depending on external factors*
R *(flight duration, outside temperature...).*
2. The actual temperature in the bulk cargo compartment may be 10° C (18° F) lower than the selected temperature.

ECAM COND PAGE

R



(1) Cargo compartment temperature

This indication is green.

(2) Zone indication

This indication is white.

(3) Duct inlet temperature

This is normally green, it becomes amber when T ≥ 80° C.

R (4) Inlet isolation valve

R Vertical and green : valve is open
R Horizontal and amber : valve is closed

R (5) Outlet isolation valve

R Horizontal and green : valve is open.
R Vertical and amber : valve is closed.

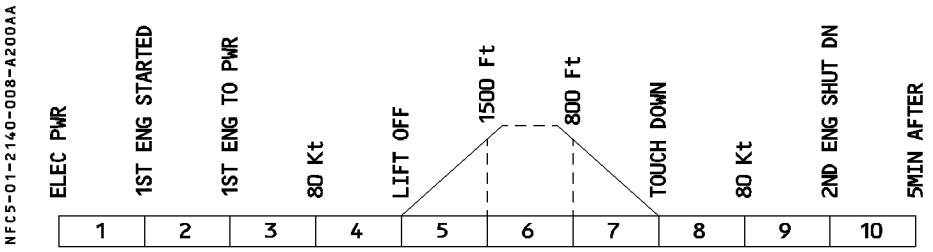
R (6) Trim air valve

R H - Hot (Green) : valve is open.
R C - Cold (Green) : valve is closed.

(7) Hot air pressure regulating valve

In line and green : valve is open.
In line and amber : valve failed open.
Cross line and green : valve normally closed with the pushbutton in ON position.
Cross line and amber : valve is closed and the pushbutton in OFF position.

WARNINGS AND CAUTIONS



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
AFT (FWD) CARGO DUCT temperature OVHT Duct Temperature > 88° C (190° F)	SINGLE CHIME	MASTER CAUT	COND	HOT AIR FAULT lt	3, 4, 5 7, 8
AFT (FWD) CRG HEAT FAULT Cargo heating controller fault	NIL	NIL		NIL	
AFT (FWD) CRG VENT FAULT Cargo fan fault			NIL		
AFT (FWD) CRG ISOL VALVE Cargo isolation valve disagreement				ISOL VALVE FAULT lt	

BUS EQUIPMENT LIST

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			NORM		EMER ELEC		
			AC	DC	AC ESS	DC ESS	HOT
AIR COND	PACK CONT	1 PRIM. SEC.	AC1 AC1	DC1 DC1			
		2 PRIM. SEC.	AC2 AC2	DC2 DC2			
	ZONE CONT	PRIM. SEC.	AC1 AC2	DC1 DC2			
	PACK 1 VALVE CLOSURE					SHED	
	PACK 2 VALVE CLOSURE			DC2			
	RAM AIR INLET					X	
PRESS	CAB PRESS CONT	1				X	
		2		DC2			
		MANUAL CTL		DC BAT			
VENT	CABIN FANS	1	AC1	DC1			
		2	AC2	DC2			
	AEVC			DC1		SHED	
	AVIONIC FANS	FAN BLOWER	AC1	DC1			
		EXTRACT	AC2			SHED	
	GND COOL UNIT◁	UNIT FAN CONTROL	AC2 AC1 DC1				
FWD/ AFT CARGO	VENT CONT ◁					SHED	
	HEAT CONT ◁					SHED	
	VENT/HEAT FANS(S) ◁		AC1				