

	AIR COND/PRESS/VENT		1.21.20	P 1
	PRESSURIZATION		SEQ 100	REV 16

GENERAL

In normal operation, pressurization control is fully automatic.

The system consists of :

- Two Cabin Pressure Controllers (CPC)
- Two outflow valves, with actuators that incorporate three motors (two for automatic operation, one for manual operation)
- One control panel
- Three safety valves
- Two negative relief valves

Any one of the three independent electric motors can power the outflow valves.

Normally, one of the two cabin pressure controllers operates the outflow valves 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 valves, and all valves below the flotation line. The flight crew can set the system to operate automatically, semi-automatically, or manually.

AUTOMATIC OPERATION

The flight crew monitors system operation, 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.

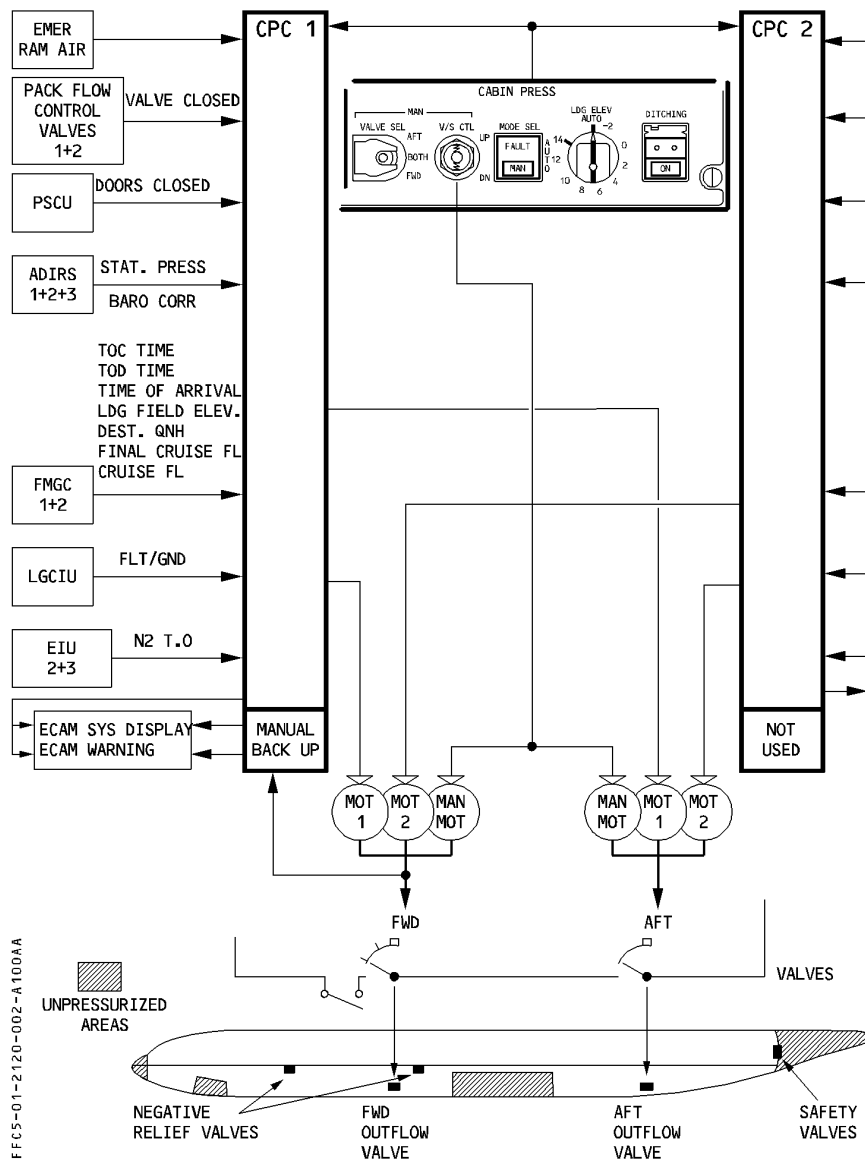
The pressurization system then uses the manually-selected landing field elevation for internal schedules.

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.

Manual operation has priority over all other modes.

SCHEMATICS



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MAIN COMPONENTS

CABIN PRESSURE CONTROLLERS

Two identical, independent, automatic digital controllers control the system, and automatically maintain 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), the Landing Gear Control Interface Unit (LGCIU), the Proximity Switch Control Unit (PSCU), and the pack flow control valves.

When the system is in automatic or semi-automatic mode, one controller is active, and 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 N° 1 controller 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 VALVES

The outflow valves are below the flotation line. Each 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 two automatic motors, and the drive of the manual motor. Either of the 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. The outflow valves automatically close, if the cabin altitude reaches 15 000 feet, provided that the valves are in automatic mode.

When one pack is OFF and Δp is above 4 psi, the aft outflow valve closes and the forward outflow valve controls the cabin pressure.

Note : When the RAM AIR pushbutton is ON, and Δp is below 1 psi, the system drives the outflow valves about 50 % open if it is under automatic control. If the system is under manual control, the outflow valves do not automatically open, even if ΔP is less than 1 PSI.

SAFETY VALVES

Three independent pneumatic safety valves prevent the cabin pressure from going too high (8.85 psi above ambient) or too low (0.73 psi below ambient).

They are on the rear pressure bulkhead, above the flotation line.

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NEGATIVE RELIEF VALVE

One is below the floor level, aft of left door n° 1. The other is below the floor level aft of left door n° 2 both above the flotation line.

They assist the safety valves to prevent the cabin pressure from going too low.

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 two outflow valves.
 Only one controller operates at a time.
 An automatic transfer occurs :
 - 80 seconds after each landing.
 - If the operating system fails.
- The controller normally uses the landing elevation and QNH from FMGC, and the pressure altitude from ADIRS.
 If FMGC data are not available, the controller uses captain Baro Reference from the ADIRS and the LDG ELEV selection.
- Pressurization is assumed through the following modes :

Ground (GND)

Before takeoff and 80 seconds after landing, the system keeps the outflow valves fully open to ensure there is no residual pressure differential inside the aircraft.

At touchdown, to release any remaining pressure differential, a depressurization sequence maintains the cabin rate of descent at 500 feet/minute.

Takeoff (TO)

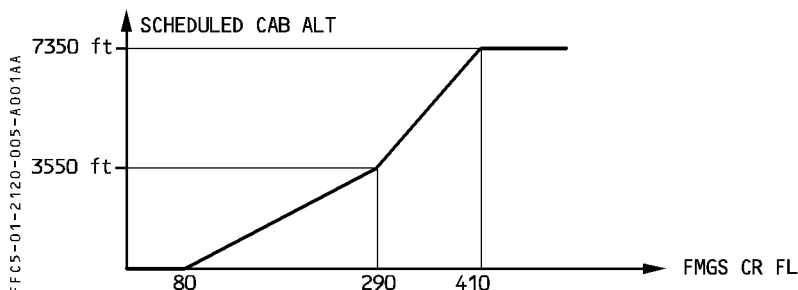
To avoid a pressure surge at rotation, the controller prepressurizes the aircraft at a rate of – 328 feet/minute until the pressure differential reaches 0.1 psi. At lift-off, the controller initiates the climb phase.

Climb in internal mode (CI)

CAB V/S varies, according to a preprogrammed law, in order to reach the scheduled CAB ALT at the top of climb defined by the FMGS cruise FL.

The CAB V/S is limited to 1000 feet/minute.

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The LDG ELEV selector has no effect in climb.

If FMGS cruise FL is not valid, the default FL 410 is used.

Climb in external mode (CE)

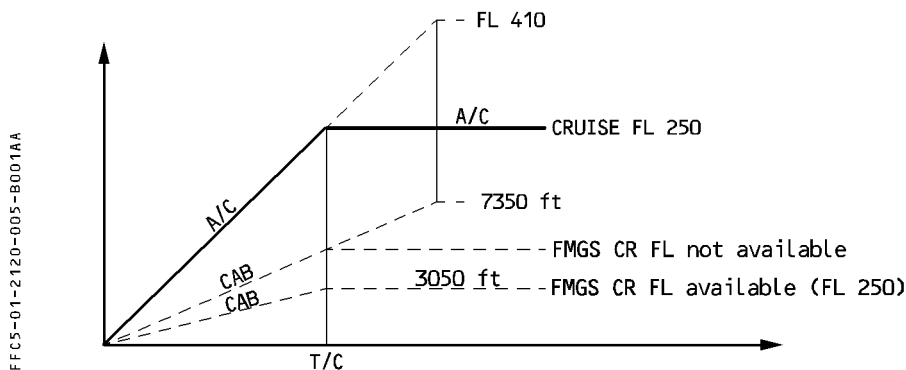
CAB ALT varies according to FMGS estimated times and planned cruise FL.

The cabin climb rate is limited to 1000 feet/minute.

Cruise (CRZ)

When the CPC switches to CRZ mode, the cabin altitude is controlled to the lower of cabin altitude reached at the top of climb, or the scheduled CAB ALT for the actual cruise flight level. If the cabin altitude at the top of climb is higher (no FMGS CR FL available), it will descend with a rate of 300 feet/minute to the scheduled CAB ALT.

If a LDG ELEV above the actual CAB ALT is selected (manual or FMGS), the cabin altitude increases up to the higher of CAB ALT, at the top of climb, or to the LDG ELEV minus 6000 feet). The cabin altitude is limited to a maximum of 7350 feet.



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Descent in internal mode (DI)

Pressure rate is optimized so that cabin pressure reaches landing field pressure + 0.1 psi just prior to landing. The cabin descent rate is limited to 750 feet/minute.

Descent in external mode (DE)

CAB altitude varies according to FMGS-estimated times, and cabin pressure reaches landing field pressure + 0.1 psi just prior to landing.

The cabin descent rate is limited to 750 feet/minute.

Abort (AB)

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

PRESSURIZATION MODES SWITCHING

		FROM	GND	TO	GND	CL	AB	TO	CL	CRZ	CRZ	DES	DES	AB
		TO	TO	CL	CL	AB	GND	GND	CRZ	CL	DES	CL	GND	CL
C O N D I T I O N S	ENG 2 and ENG 3 TLA $\geq$ CL (Engine Running)	1						0						
	MAIN L/G SYS1 and SYS2 COMPRESSED	1	0	0										
	MAIN L/G SYS1 or SYS2 COMPRESSED					1	1					1		
	ALL Doors Closed	1		1										
	A/C ALT < 8000ft and A/C ALT change since TO > 5000ft								1a					
	A/C ALT < 8000ft or A/C ALT change since TO > 5000ft				1									
	A/C Rate of Climb > 50 SLFPM for 32 seconds													1
	A/C Rate of Climb > 50 SLFPM for 48 seconds										1			
	A/C Rate of Climb > 250 SLFPM for 32 seconds								1					
	A/C Rate of Climb < 50 SLFPM for 32 seconds								1					
	A/C Rate of Descent > 150 SLFPM for 32 seconds										1			
	A/C Rate of Descent > 250 SLFPM for 16 sec				1									
	A/C ALT > A/C ALT at switch into CRZ + 380 SLFT									1				
	A/C ALT > CRZ FL + 180 SLFT								1b					
	End of Cruise Flag set				0									
	Special Function f (ALT, LFE)										1			

0: INVALID CONDITION

a: ONLY CLIMB INTERNAL

1: VALID CONDITION

b: ONLY CLIMB EXTERNAL

1 2

3 4 5

6

MAXIMUM DIFFERENTIAL PRESSURE LIMITER FUNCTION

The function is only available in automatic mode.

If the differential pressure is above 8.70 psi, the operation controller maintains the Δp constant, to avoid overpressurization. As a result, the outflow valves open and the CAB V/S increases. Once the differential pressure has decreased below the threshold, normal automatic control of the valves resumes, which generally causes the valves to go towards the closed position.

CAUTION

Except the outflow valve position indication, and the Δp value on the ECAM PRESS page, there is no indication in the cockpit that the limiter function is activated.

Once the Δp limiter function has opened the valves, do not counteract the automatic operation by trying to close the valves in manual mode.

Due to the slow movement of the outflow valves in manual mode, the valves cannot be closed fast enough and the cabin altitude quickly increases above 20000 feet (even if an emergency descent is initiated simultaneously). The automatic mode provides the safest and the quickest way to reduce differential pressure, and recover normal pressure control.

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MANUAL PRESSURE CONTROL MODE

If both automatic systems should fail, the flight crew may use the CABIN PRESS control panel to manually control cabin pressurization.

- Press the MODE SEL pushbutton to select MAN, and
- Push the MAN V/S CTL toggle switch UP or DN to increase or decrease cabin altitude.

According to the VALVE SEL position, the flight crew manually controls both, or only one, outflow valve(s). If only one outflow valve is selected, the other one remains under automatic control.

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 valves do not automatically open 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 valves, the emergency ram air inlet, the avionics ventilation inlet and extract valves, and the pack flow control valves. The cabin fans stop.

PREVENTION OF PRESSURIZATION WITH A DOOR NOT CLOSED AND LOCKED

On ground, at takeoff power application, if at least one door is not closed and locked, the CPC will remain in ground mode (outflow valves open).

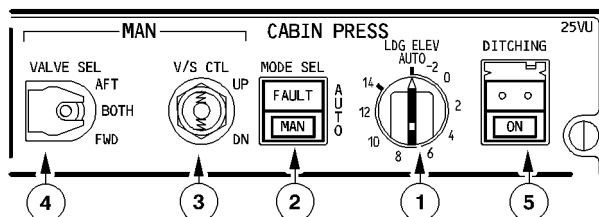
Note : As a backup, the zone controller closes the pack valves (Refer to 1.21.10).

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CONTROLS AND INDICATORS

OVERHEAD PANEL

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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.

Note : The LDG ELEV selector scale is only given as an indication ; 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 valves.

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 3 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 system.
- FAULT It : This legend appears in amber and the ECAM caution only comes on when both automatic systems are faulty.

Note : The pilot may notice variations (up to ± 1000 feet) in the CAB ALT indication on the ECAM PRESS page, when the system switches from the cabin pressure control AUTO mode to MAN mode, due to reduced resolution of the back up pressure sensor.

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③ V/S CTL toggle

The switch is spring loaded to neutral and controls the outflow valve position selected through the VALVE SEL. It controls the MAN motor, when the MODE SEL pushbutton is in the MAN position.

UP : The valve(s) move(s) towards the open position.
DN : The valve(s) move(s) towards the closed position.

④ VALVE SEL guarded sel

AFT : The aft outflow valve can be manually controlled. The forward outflow valve remains under automatic control.
BOTH(guarded position) : Both outflow valves can be manually controlled.
FWD : The forward outflow valve can be manually controlled. The aft outflow valve remains under automatic control.

⑤ DITCHING guarded pb

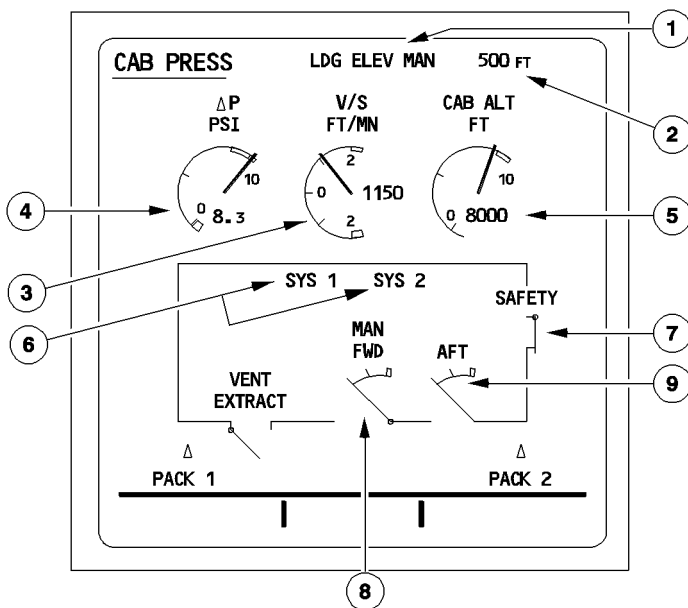
Normal : The system functions normally.
ON : The outflow valves, emergency ram air inlet, avionics ventilation overboard valve, cargo compartment isolation valves, and pack flow control valves close.
The ON light appears in white.
The cabin fans are stopped.

Note : *The outflow valve(s) will not close automatically, if it (they) is (are) under manual control.*

CAUTION

1. On ground, if the ditching pushbutton is set to ON, with the low pressure ground cart connected and all doors closed, a differential pressure will build up.
2. As the galley and toilet extract fan starts before the outflow valves are reopened, a small amount of negative differential pressure builds up when the ditching pushbutton is released.

ECAM CAB PRESS PAGE



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① LDG ELEV AUTO / MAN

- LDG ELEV AUTO : appears in green when the LDG ELEV selector is in AUTO. Becomes amber if the landing elevation is not transmitted by the FMGS.
- LDG ELEV MAN : appears in green when the LDG ELEV selector is not in AUTO. Neither appear when the MODE SEL pushbutton switch is in MAN and the VALVE SEL selector is in BOTH, or when the LDG ELEV selector is faulty.

② Landing Elevation

Landing elevation selected either automatically by the FMGS or manually by the pilot appears in green. (But not when the MODE SEL pushbutton is in MAN position and the VALVE SEL is in BOTH position).

③ V/S FT/MIN (cabin vertical speed)

The analog and digital presentation appear in green when V/S is in the normal range. The digital presentation pulses when V/S is greater than or less than 1800 feet/minute.

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④ △P PSI (cabin differential pressure)

The scale is displayed in white. The needle and the ΔP digital value appear in green when ΔP is in the normal range. They appear in amber when $\Delta P < -0.2$ psi or $\Delta P > 8.85$ psi.

The digital presentation pulses if $\Delta p > 1.5$ psi during final approach (flight phase 7).

⑤ CAB ALT FT (cabin altitude)

The scale is displayed in white. The needle and the altitude appear in green in normal range. They appear in red, if the cabin altitude goes above 9550 feet.

The cabin altitude value and the needle pulse in green when $8800 \text{ ft} < \text{CAB ALT} < 9550 \text{ ft}$.

⑥ Active system indication (SYS 1 or SYS 2)

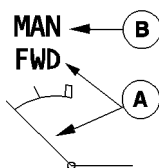
SYS 1 or SYS 2 appears in green when active, and in amber when faulty.

⑦ Safety valve position

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

Note : The safety valve opens when the cabin differential pressure is between 8.75 and 8.95 psi.

⑧ Forward outflow valve position



Ⓐ When the valve is operating normally, the needle is green and the FWD indication appears in white.

Both become amber when the valve :

- Opens more than 95 % during flight, or
- Fails under automatic control.

Ⓑ When the valve is under manual control, the MAN indication appears in green.

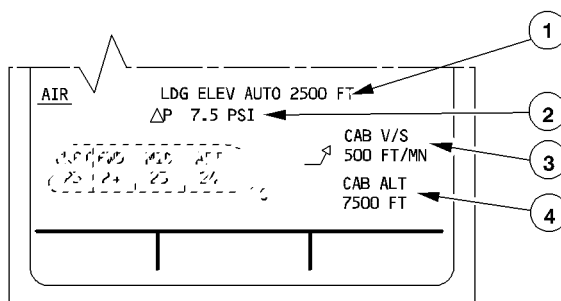
⑨ Aft outflow valve position

Identical to the forward outflow valve.

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ECAM CRUISE PAGE

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① LDG ELEV AUTO / MAN

Identical to the CAB PRESS page.

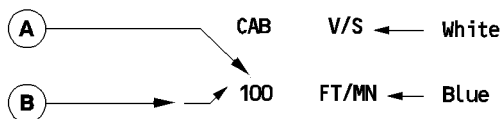
② ΔP indication

- It is normally in green.
- It pulses green between 1.5 and 8.85 psi, when the aircraft is in final approach.
- It becomes amber below -0.2 psi, or above + 8.85 psi.

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③ CAB V/S FT/MN (cabin vertical speed indication)

In AUTO PRESS mode



Ⓐ Absolute value of cabin vertical speed is normally green.

It pulses green above 1800 feet/minute or below – 1800 feet/minute

Ⓑ ↗ : displayed green when the cabin vertical speed is between 25 and 1800 feet/minute.

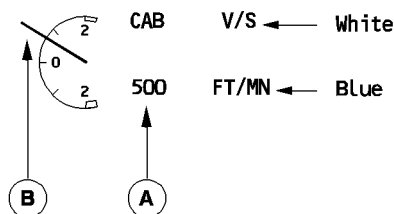
pulsing green when the cabin vertical speed is above 1800 feet/minute.

↘ : displayed green when the cabin vertical speed is between -1800 and -25 feet/minute.

pulsing green when the cabin vertical speed is below -1800 feet/minute.

nothing is displayed when the cabin vertical speed is between -25 and +25 feet/minute.

In MAN PRESS mode (MODE SEL pushbutton at MAN and VALVE SEL at BOTH position):



Ⓐ Identical to AUTO PRESS mode, but minus sign is added for negative values.

Ⓑ The needle for the cabin vertical speed indication is normally green.

It pulses green below -1800 feet/minute or above +1800 feet/minute.

④ CAB ALT FT (cabin altitude indication)

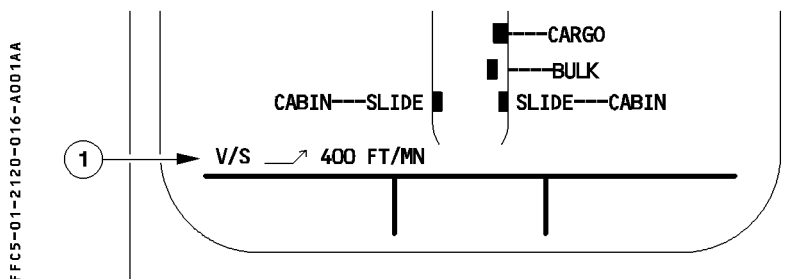
Refer to CAB ALT value on CAB PRESS page.

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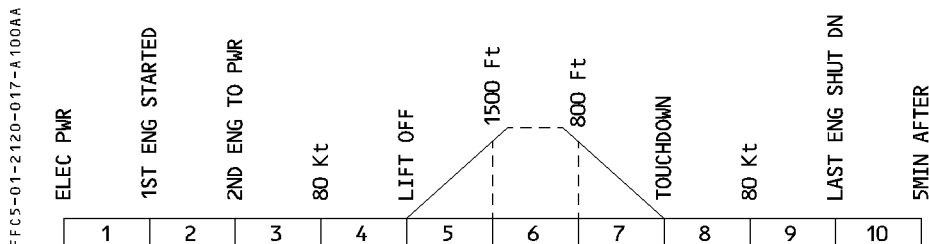
ECAM DOOR/OXY PAGE



① Identical with cabin vertical speed indication on cruise page when in AUTO PRESS mode.

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		SEQ 100	REV 15

WARNINGS AND CAUTIONS



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB	
EXCESS CABALT Cabin altitude exceeds – In CLB (DES) the higher of both : 9550 ft or takeoff (landing) field pressure altitude + 1000 ft – In CRZ9550ft	CRC	MASTER WARN	CAB PRESS	NIL	1 to 5 7 to 10	
SYS 1 + 2 FAULT Both pressure controllers fault	SINGLE CHIME	MASTER CAUT		MODE SEL FAULT It	4, 5, 7, 8	
LO DIFF PR Time to reach ΔP = 0 < 1.5 minutes Not active below (Landing field pressure altitude +1500 SLFT)				NIL	1 to 5 7 to 10	
FWD (AFT) OFV NOT OPEN Outflow valve not fully open on ground (time delay 3 minutes)					3 to 8	
SAFETY VALVE OPEN Safety valves not fully closed.					2 to 5 7, 8	
LDG ELEV FAULT No data available with LDG ELEV sel at AUTO					1, 3, 4, 5 7 to 10	
SYS 1 (or 2) FAULT Pressure controller fault					NIL	NIL

MEMO DISPLAY

- MAN LDG ELEV message is displayed in green, if the LDG ELEV selector is not in the AUTO position.
This message becomes amber in Phases 1 and 2.