02-21 ATA 21 – AIR CONDITIONING AND PRESSURIZATION

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INTRODUCTION

In order to maintain a comfortable area inside the airplane, the F2000EX EASy is equipped with an air conditioning and pressurization system.

The air conditioning system regulates the flow and temperature of air into the cockpit, cabin, toilets, baggage compartment and nose cone for conditioning purpose.

The pressurization system regulates the cabin pressure depends on:

- aircraft altitude,
- aircraft vertical speed,
- the maximum differential pressure supported by the system.

Both systems have an automatic mode and a manual mode, allowing the pilot to control directly the valves.

They use hot air supplied by the engines and/or the APU.

In case of failure (overpressure, negative pressure, maximum altitude), protections ensure that limitations are observed.

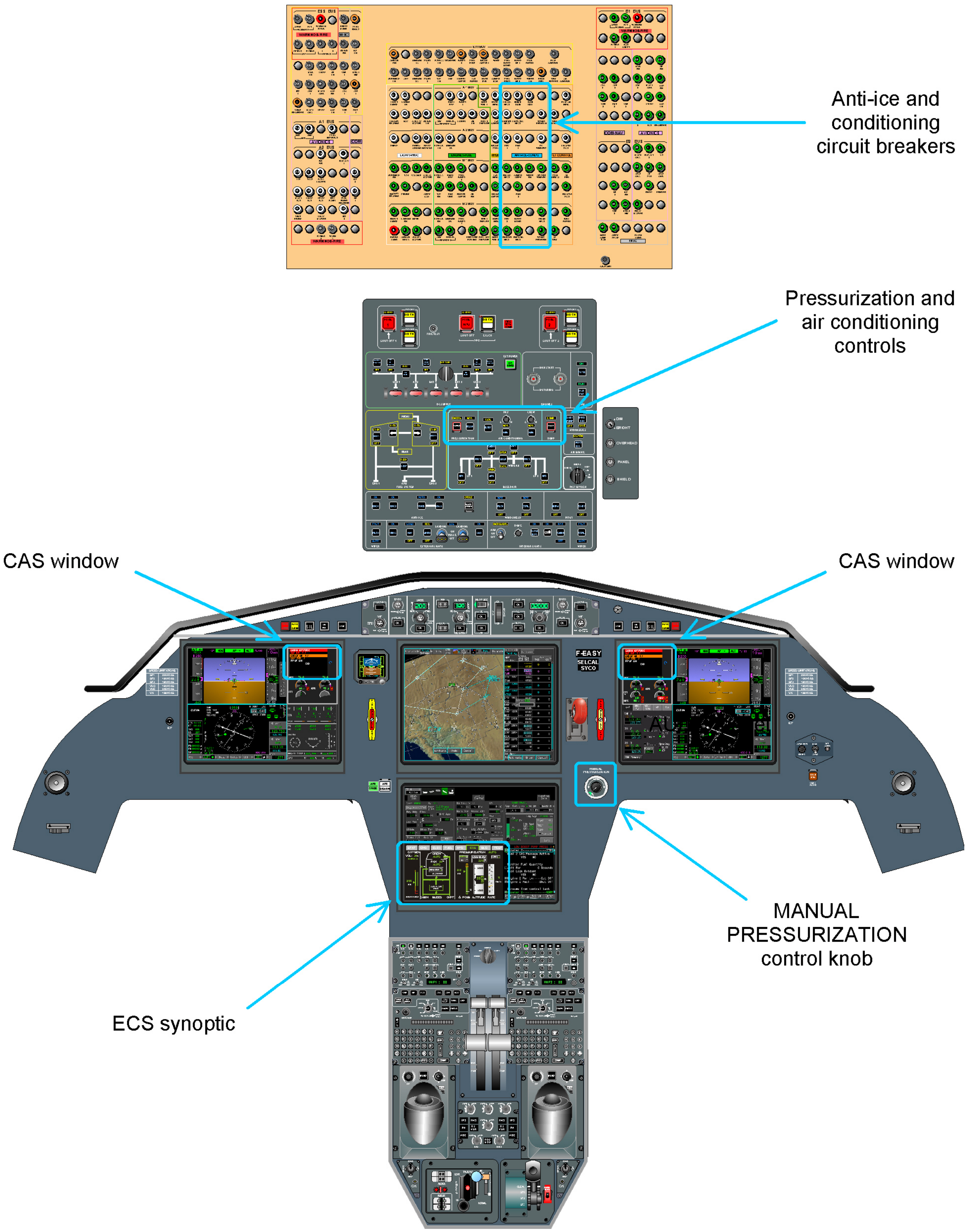


FIGURE 02-21-05-00 FLIGHT DECK OVERVIEW

SOURCES

The air conditioning system uses air supplied by:

- engine No 1,
- engine No 2,
- APU.

➢ *For more information, refer to CODDE 1 / Chapter 02 / ATA 36.*

The conditioned air is a mixture of:

- hot air directly supplied by engines HP and LP ports, or the APU,
- cold air (hot bleed air cooled in the air conditioning unit),
- recycled cabin air.

The air conditioning heat exchanger is ventilated:

- in flight, with external air supplied through a ram air inlet located on the fin root,
- on ground or in flight at low speed, with air flow created by a venturi effect using hot air injection into the dual exchanger outlet duct section.

AIR CONDITIONING	PRESSURIZATION
Engine 1, engine 2 or APU bleed air Recycled cabin air Ram air (for heat exchanger ventilation)	Conditioned air

EQUIPMENT LOCATION

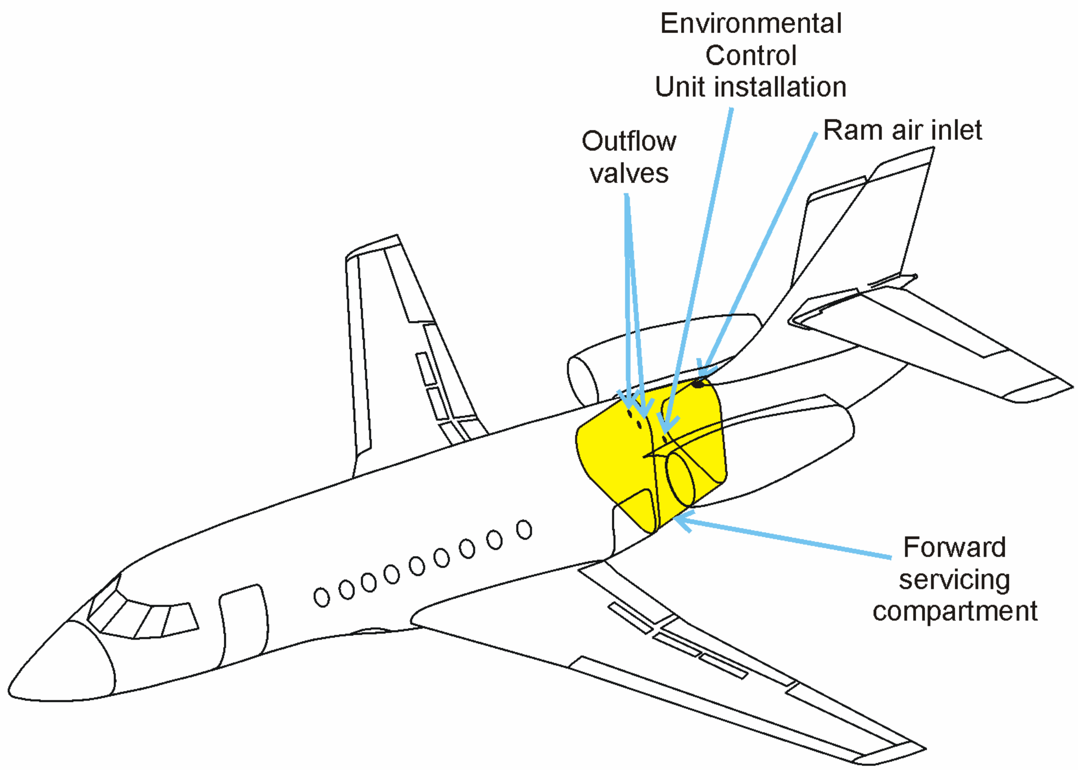


FIGURE 02-21-05-01 LOCATION OF MAIN COMPONENTS

DESCRIPTION

GENERAL

The air conditioning system consists of:
- Environmental Control Unit (ECU),
- Temperature Control System (TCS),
- distribution system,
- ventilation system.

The system is supplied with hot air coming from the common feeder duct of the bleed air system.

The hot air enters the conditioning system via two cockpit temperature control valves and two cabin temperature control valves.

These valves control the amount of air directed to the ECU, and hot air by-passing the ECU. Cold air generated by the ECU is mixed with hot bleed air inside the cockpit and cabin ducts to obtain the desired air temperature. Cold air from the ECU is also supplied to the gaspers and used for cockpit avionics cooling.

The cockpit and cabin temperature control valves are controlled in automatic or manual mode from the AIR CONDITIONING overhead panel.

ENVIRONMENTAL CONTROL UNIT (ECU)

The purpose of the environmental control unit is to generate the cold air required for cockpit and passenger cabin air conditioning.

The ECU is mainly composed of:

- a dual heat exchanger (primary and secondary),
- a heat exchanger jet pump and associated valve,
- a turbocooler,
- a condenser,
- a water separator,
- an atomizer,
- a turbine outlet temperature control valve.

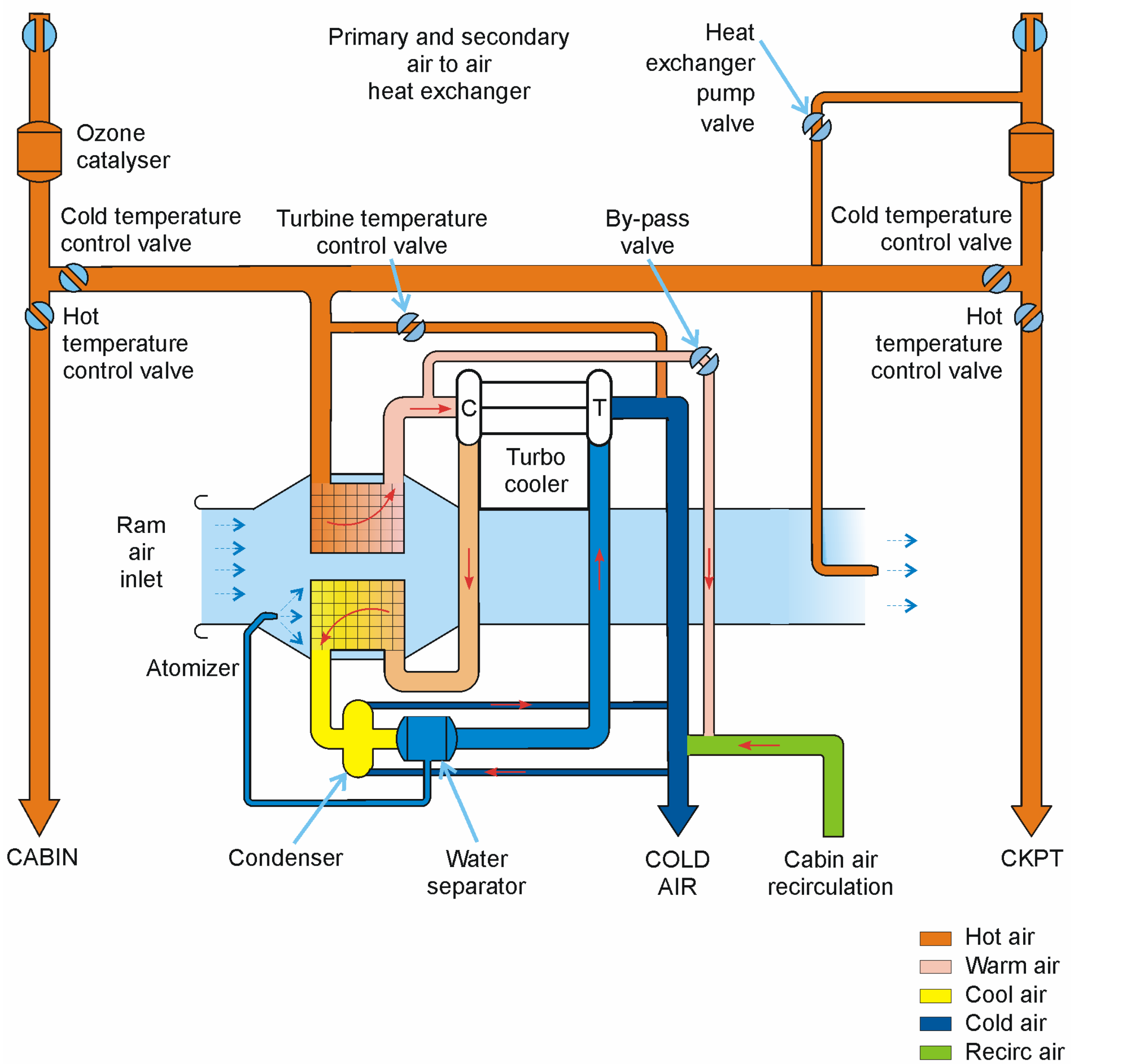


FIGURE 02-21-10-00 ECU SCHEMATIC

Dual Heat exchanger

The dual heat exchanger is a single unit containing two independent heat exchangers: a primary exchanger and a secondary exchanger. The primary exchanger supplies air to the compressor of the turbocooler and the secondary exchanger supplies air to the turbine of the turbocooler. It is located in the forward servicing compartment.

Heat exchanger jet pump

The jet pump is an injector located downstream the heat exchanger cold side. It increases the ram air flow through the heat exchanger.

Heat exchanger jet pump valve

The normally closed jet pump valve controls the bleed air to the dual heat exchanger jet pump. It opens automatically when increased ram-air flow is required (e.g. low airplane speed).

Turbocooler

The turbocooler is a single stage compressor and turbine. The turbocooler operates in conjunction with the heat exchangers and the water separator. The purpose of the turbocooler is to cool engine bleed air.

By-pass valve

Only airplanes below serial number 56 are equipped with by-pass valve.

The turbo-compressor is automatically by-passed by air coming from the primary heat exchanger in order to keep a comfortable air flow entering the cabin at high altitude.

Condenser

Associated with the water separator, the condenser removes moisture from bleed air in the ECU system.

Water-separator

The water separator separates and collects the water droplets formed in the condenser. The water is then routed to the atomizer.

Atomizer

The atomizer receives water from the water separator and discharges it as a fine mist. The mist is directed to the secondary exchanger inlet. The evaporating mist lowers the ram air temperature and contributes to the cooling process.

Turbine outlet temperature control valve

The turbine outlet temperature control valve regulates air temperature at the turbine outlet by regulating bleed air flow to the casting of the turbocooler.

Turbine outlet temperature sensors

The two turbine outlet temperature sensors monitor the temperature of air flowing through the turbine outlet duct. They are used to control the turbine outlet temperature control valve.

Recirculation valve

The cabin air recirculation duct is equipped with a re-circulation valve located in the aft toilet compartment. This valve closes automatically when the airplane reaches an altitude of 15,000 ft, to prevent cabin air from returning to the unpressurized area.

The re-circulation valve is electrically powered for normal operation. In case of failure, it can be manually closed by a mechanical control lever located on the valve.

Overheat detection system

The overheat detection system consists of a sensor located in the turbocooler compressor outlet duct.

The **ECU OVHT** CAS message is displayed when the duct temperature reaches or exceeds 230°C (446°F).

TEMPERATURE CONTROL SYSTEM (TCS)

The cabin and cockpit temperatures are controlled by the air conditioning computer located in the baggage compartment. They are adjusted by mixing hot bleed air with cold air from the ECU to obtain the desired temperatures.

The air conditioning computer relies on three independent computers:

- a cockpit computer which ensures automatic cockpit temperature control, temperature control at the cooling unit outlet, and the indication of compressor overheating.
- a cabin computer which ensures automatic control of the cabin temperature and indication of compressor overheating,
- a computer which controls the valves respectively for cabin and cockpit systems in manual mode; temperature regulation at the cooling unit outlet in manual mode, and the emergency function which controls the conditioning valves.

The TCS can operate in three modes:

- automatic mode (AUTO),
- manual mode (MAN),
- emergency mode (EMERG).

Temperature control valves

The temperature control valves of the cabin and cockpit conditioning system are identical. They control the air flow and temperature supplied to the cabin and cockpit. Each assembly consists of a butterfly valve and an actuator. The actuator receives inputs from either the automatic or manual temperature control system.

The temperature control valves also act as shut-off valves to the air systems when the overhead panel bleed air CKPT and CABIN pushbuttons are set to OFF.

DISTRIBUTION AND VENTILATION SYSTEM

The air conditioning distribution is divided into four parts:
- a cockpit conditioned air system,
- a cabin conditioned air system,
- an instrument panel cooling system,
- the cold air gaspers.

A manual valve, when open, interconnects the cockpit and cabin conditioned air systems.

The ventilation system uses series of ducts and a fan to ventilate:
- the cockpit ducts: the cockpit conditioning ducts are routed along the right side of the fuselage and supply conditioned air to the entrance area, the cockpit, the windshields and the foot warmers. Each pilot selects the direction of the conditioned air supply (to the windshield for defogging or to the foot warmer) with a control lever on the instrument panel. An additional control lever located on the left side console enables to control cold air flow to the glareshield,
- the cabin ducts: air is distributed on the left and right sides at ceiling and floor levels,
- the toilet compartments: the air is picked off from the cabin conditioned air and delivered at the lower part of the toilet compartment,
- the Multifunction Display Unit (MDU) / Primary Display Unit (PDU): cooling of the components of the instrument panel is achieved by airflow coming from the crew gasper system,
- the nose cone: an electric blower ventilates the nose cone during ground operations and in flight at low altitude (differential pressure < 0.7 psi). In flight, ventilation is also provided by the cockpit conditioned air through a calibrated orifice. The air is evacuated through the nose gear well.

An ozone catalyser is installed in each conditioning system to limit the quantity of ozone concentration in cabin.

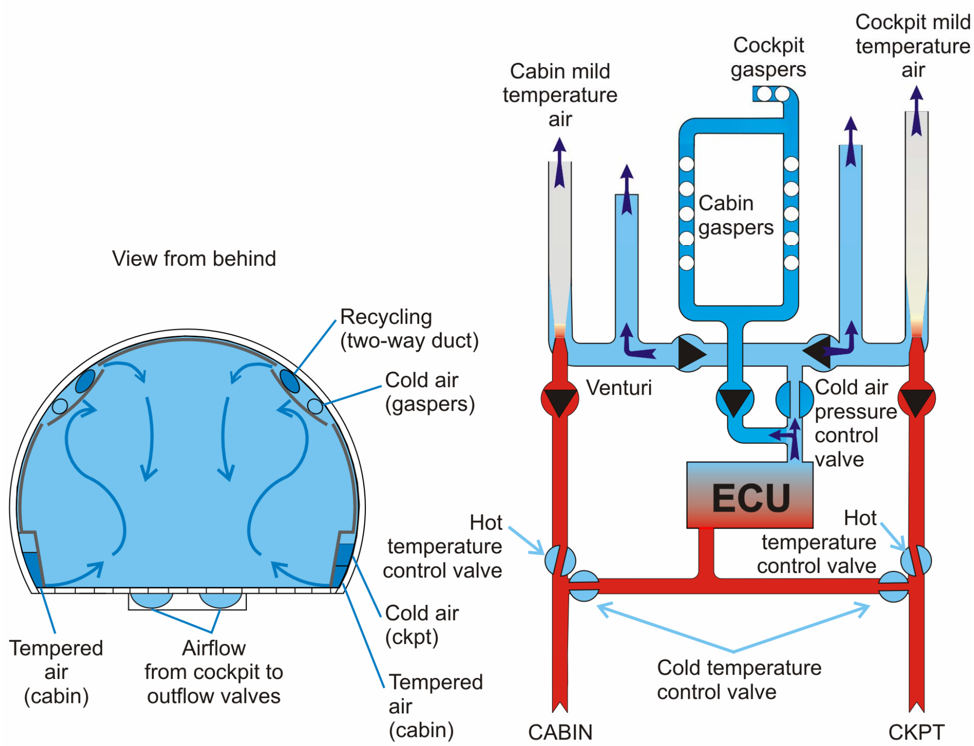


FIGURE 02-21-10-01 AIR CONDITIONING COOLING SYSTEM SCHEMATIC

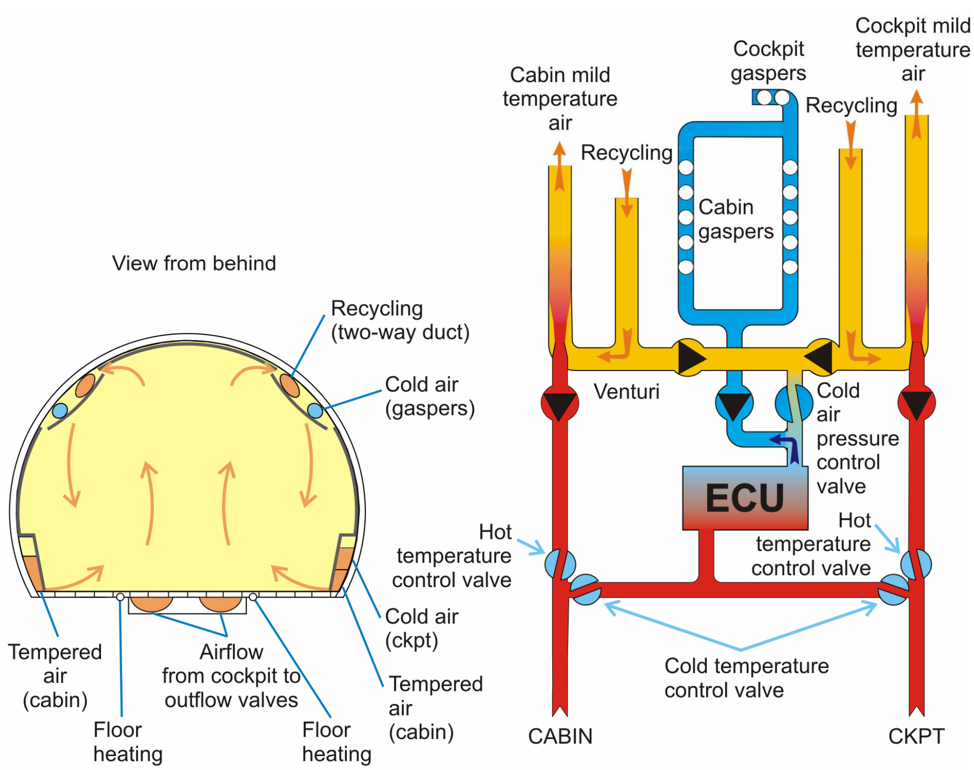


FIGURE 02-21-10-02 AIR CONDITIONING HEATING SYSTEM SCHEMATIC

Cabin ducts

Passenger and crew conditioned air ducts may be manually interconnected to allow either the cabin or the cockpit distribution system to supply both ducting systems. The manual interconnection valve is located on the lower right-hand side of the cabin area.

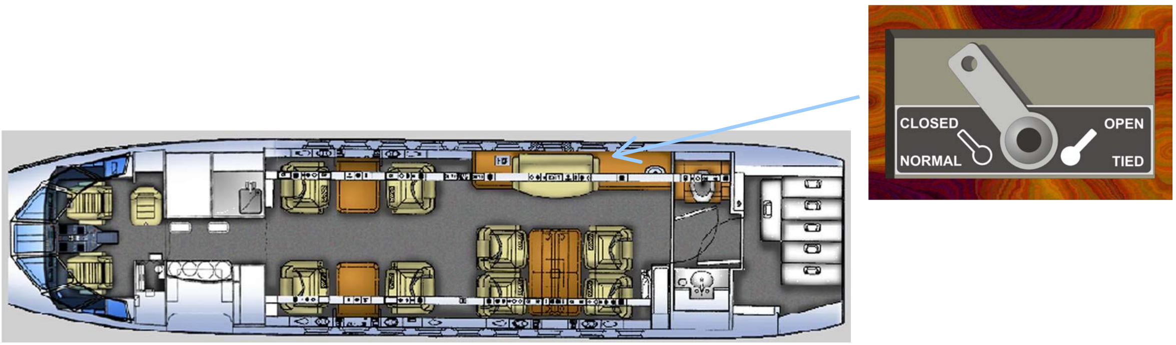


FIGURE 02-21-10-03 CONDITIONING CONTROL LEVER

Two-way ducts

The two-way ducts are routed along the top of the cabin. These two-way ducts have two functions:

- distribute cold air to the upper part of the cabin when the air conditioning requires a temperature drop,
- recycle air from the cabin and mix it with conditioned air when conditioning requires a temperature rise.

Gasper ducts

The duct system providing cold air to the gaspers is a two-branch system:

- the RH branch supplies the RH cabin gaspers, the crew gaspers, cold air for the MDU / PDU and cold air to the glareshield.
- the LH branch supplies the LH cabin gaspers.

Cold air is directly bled from the turbocooler outlet.

Air supplied to the gaspers and for MDU / PDU cooling is maintained at a constant pressure through a pressure control valve.

Floor heating

Air is distributed between the floor panels and the fuel tanks by a manifold supplied with cabin conditioning air. In addition to that air, cockpit air is evacuated underneath the floor panels to help floor heating.

Air evacuation

Cabin air is evacuated via the toilets and the baggage compartment through the outflow valves.

Cockpit air is evacuated from the rear of the pilot and copilot consoles, circulates underneath the cabin floor and is directed to the outflow valves.

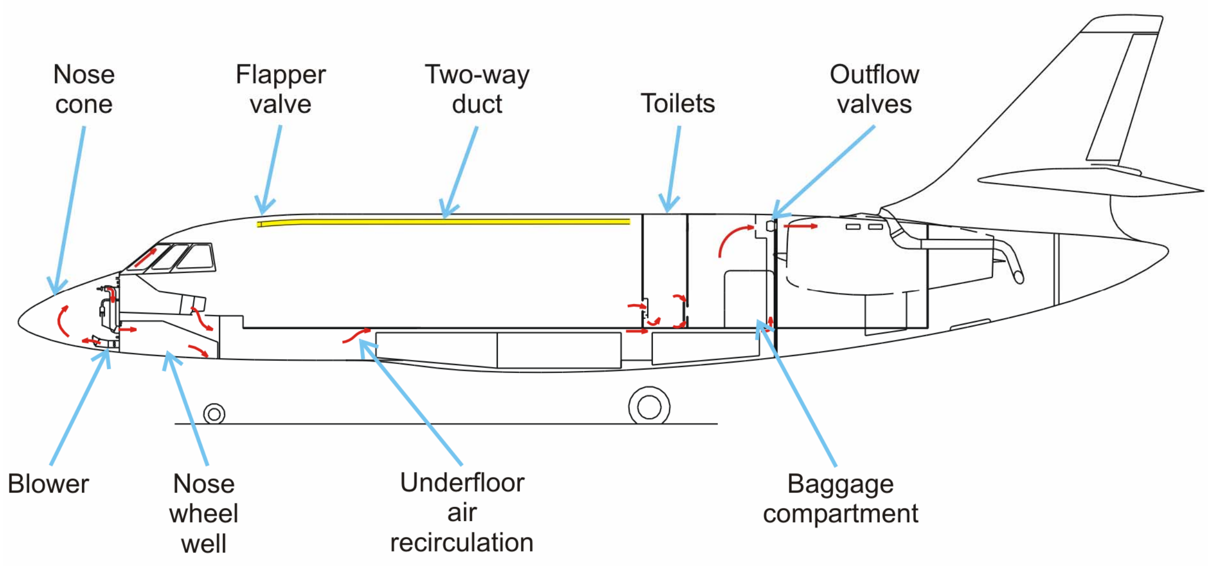


FIGURE 02-21-10-04 AIR EVACUATION SYSTEMS

Sensors

Temperature sensors located in the cabin and cockpit ducts provide air temperature inputs to the air conditioning computer.

Temperature switches are activated when air duct temperature is over 95°C (203°F) with display of the COND: CREW OVHT or COND: PAX OVHT CAS message and of amber corresponding lines in the Environmental Control System (ECS) synoptic.

MODES

Automatic and manual mode

In automatic mode, the air conditioning computer controls hot and cold temperature control valves to adjust the temperature to the rotactor position.

In MAN mode, the pilot directly controls the valve positions via rotactors.

Emergency mode

In EMERG mode, warm air is supplied to the cabin and cockpit, even in case of cold air unit failure. Actuating the EMERG pushbutton closes the two cold temperature control valves. The two hot temperature control valves can be controlled by the rotactor.

CONTROL AND INDICATION

CONTROL

Overhead panel

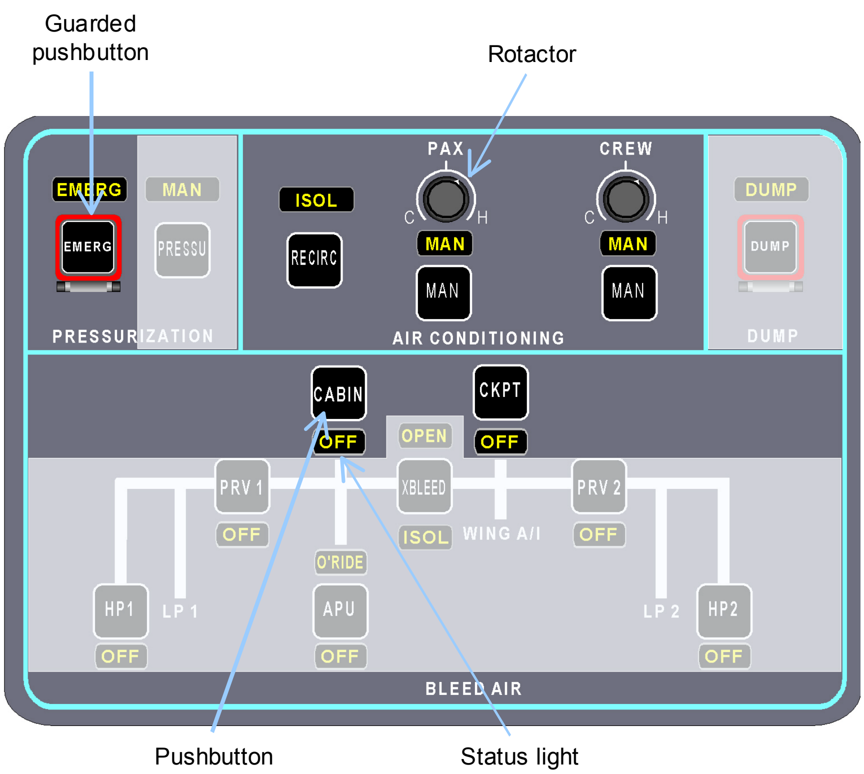


FIGURE 02-21-10-05 AIR CONDITIONING AND BLEED AIR OVERHEAD PANELS

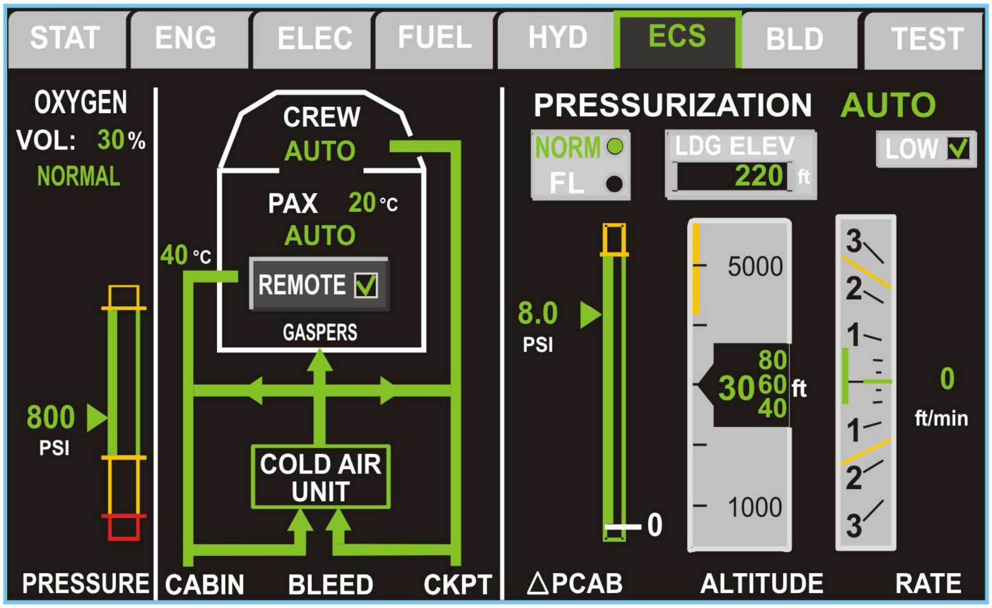
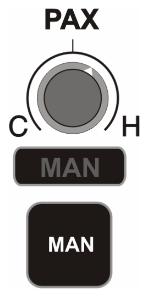
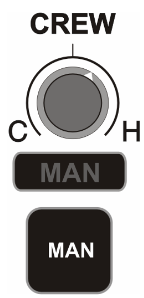


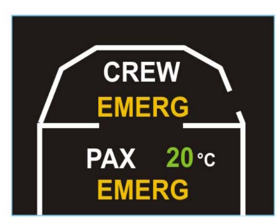
FIGURE 02-21-10-06 ECS SYNOPTIC

In automatic mode, by selecting the REMOTE soft key, the cabin temperature can be controlled directly from a rotactor located in the cabin (VIP seat).

Synthetic table

<table>
<tr><th>CONTROL</th><th>FUNCTION</th><th colspan="2">TO ACTIVATE
TO DE-ACTIVATE</th><th>SYNOPTIC</th></tr>
<tr><td rowspan="2">
</td><td rowspan="2">Automatic mode:
the PAX/CREW rotactor is used to select cabin/cockpit temperature

Manual mode:
the PAX/CREW rotactor is used to control the position of the cabin/cockpit temperature control valves</td><td>Automatic mode</td><td></td><td></td></tr>
<tr><td>Push MAN</td><td></td><td></td></tr>
<tr><td></td><td>Closes the two cold temperature control valves</td><td>Guarded (AUTO mode)

Raise the guard and push EMERG</td><td>
</td><td></td></tr>
</table>

CONTROL	FUNCTION	TO ACTIVATE TO DE-ACTIVATE		SYNOPTIC
ISOL RECIRC	Automatic operation of the recirculation valve	automatic mode	ISOL RECIRC	No synoptic
	ISOL position, closure of the recirculation valve	Push ISOL	ISOL RECIRC	No synoptic

INDICATION

Air conditioning indications and system status are displayed on the ECS synoptic.

Command indication includes the cabin temperature selection remote mode and the cabin and cockpit operating mode. System status items include actual cabin temperature, cabin duct temperature and ECU status.

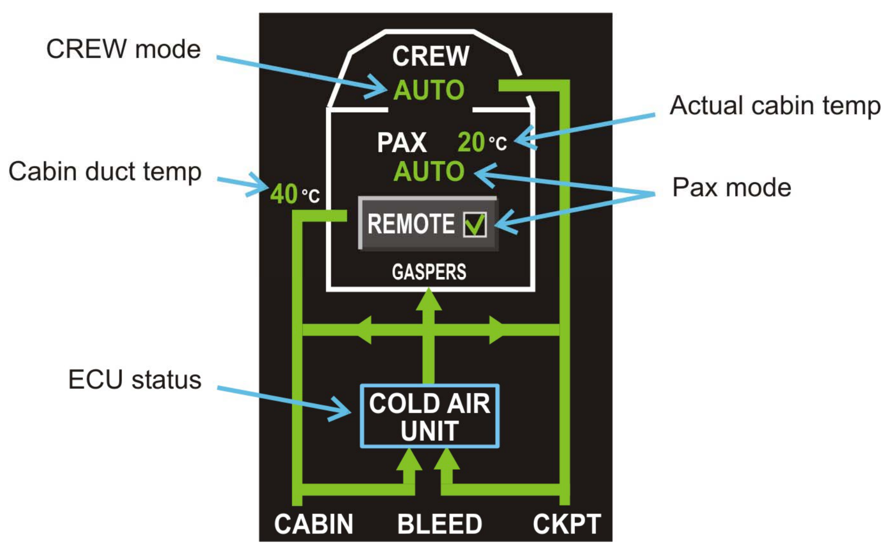
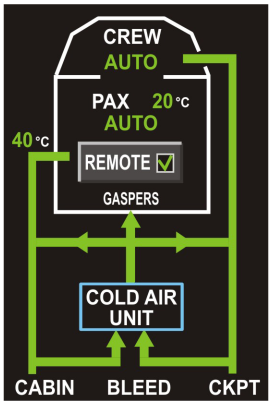
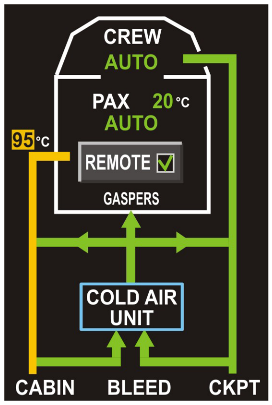


FIGURE 02-21-10-07 AIR CONDITIONING INDICATIONS

Cold air unit and air flow line synoptic

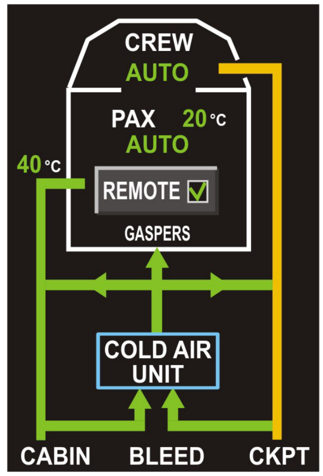


Normal operation



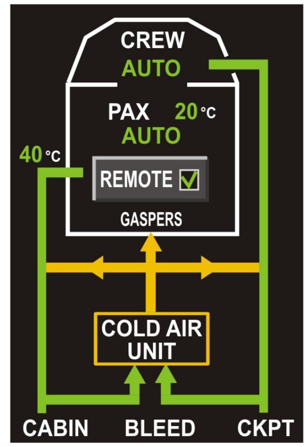
T cabin duct air > 95°C (203°F)

COND: PAX OVHT
CAS message



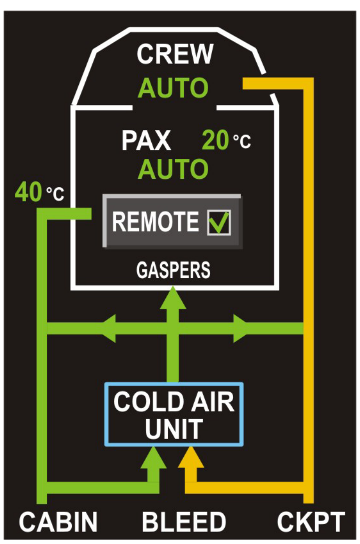
T cockpit duct air > 95°C (203°F)

COND: CREW OVHT
CAS message



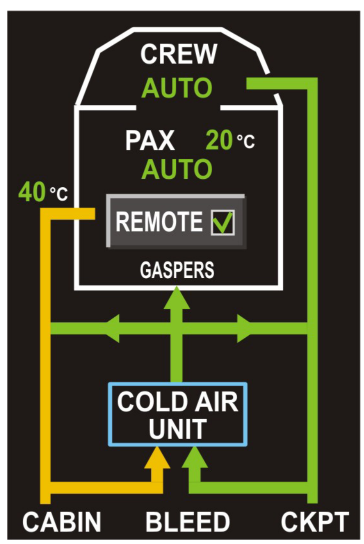
T ECU compressor outlet air > 230°C (446°F)

ECU OVHT
CAS message



Cockpit temperature control valves not closed and cockpit duct overpressure detected

COND: CKPT OVERPRESS
CAS message

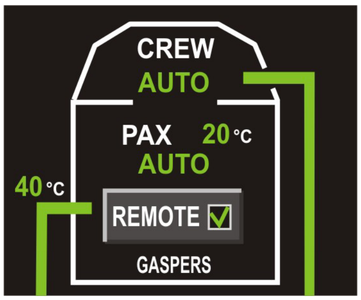


Cabin temperature control valves not closed and cabin duct overpressure detected

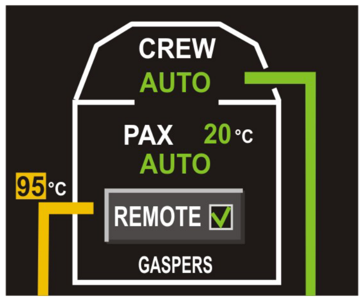
COND: CABIN OVERPRESS
CAS message

Cabin duct temperature indication

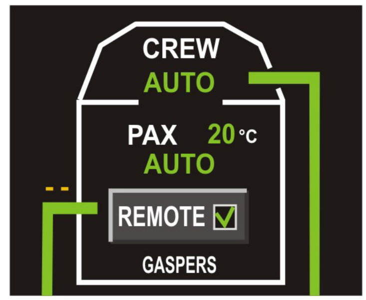
The cabin duct temperature indication is shown on the left of the PAX control mode display. The indication is based on the cabin duct temperature. When the signal is invalid, two amber dashes are displayed. In case of passenger conditioning overheat, the temperature is displayed in black on amber background.



Normal



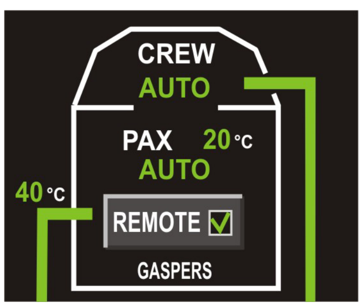
Cabin duct overheat



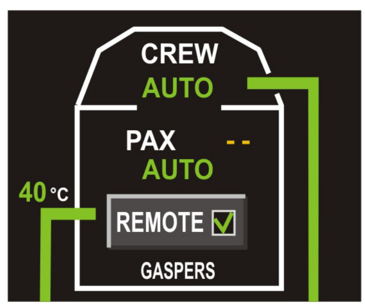
Invalid signal

Cabin temperature indication

The cabin temperature indication is shown on the right of the PAX label. When the signal is invalid, two amber dashes are displayed.



Normal



Invalid signal

SYSTEM PROTECTION

GENERAL

Electrical circuit protection is provided by conventional trip-free circuit breakers located above the overhead panel.

CIRCUIT BREAKERS

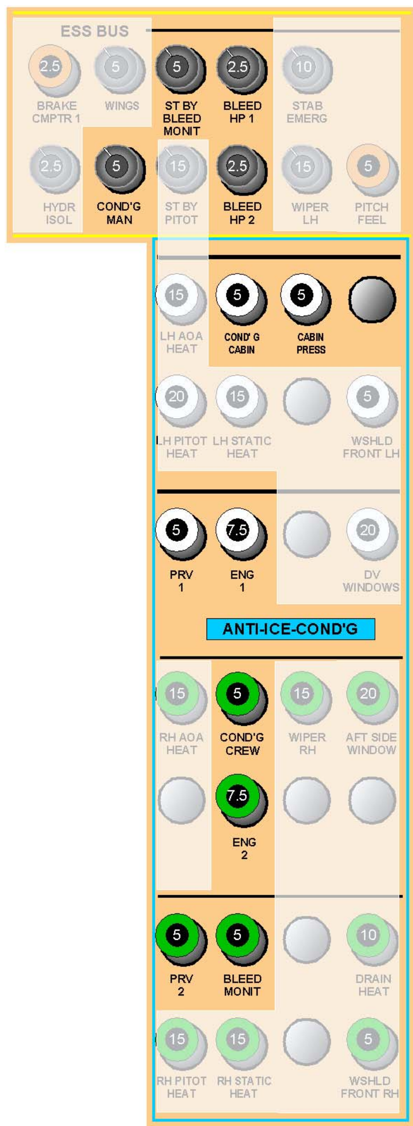


FIGURE 02-21-10-08 AIR CONDITIONING AND PRESSURIZATION CIRCUIT BREAKERS

NORMAL OPERATION

In the following, typical in-flight situation has been selected to help the crew to understand the symbols provided in the various panels and displays.

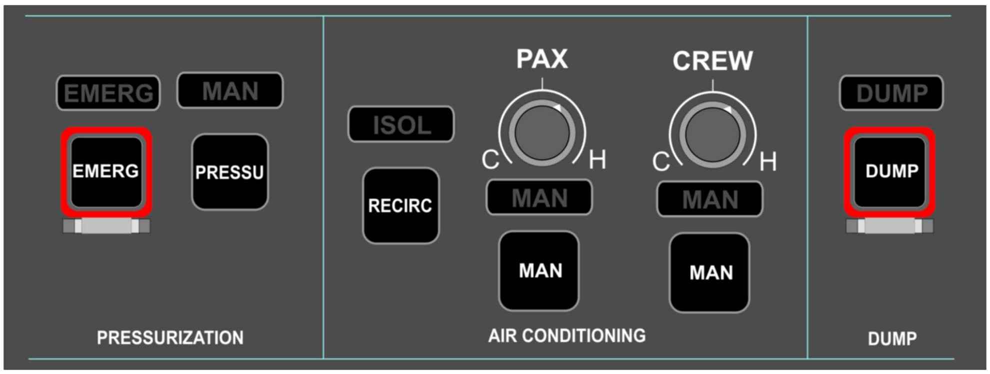


FIGURE 02-21-10-09 OVERHEAD PANEL

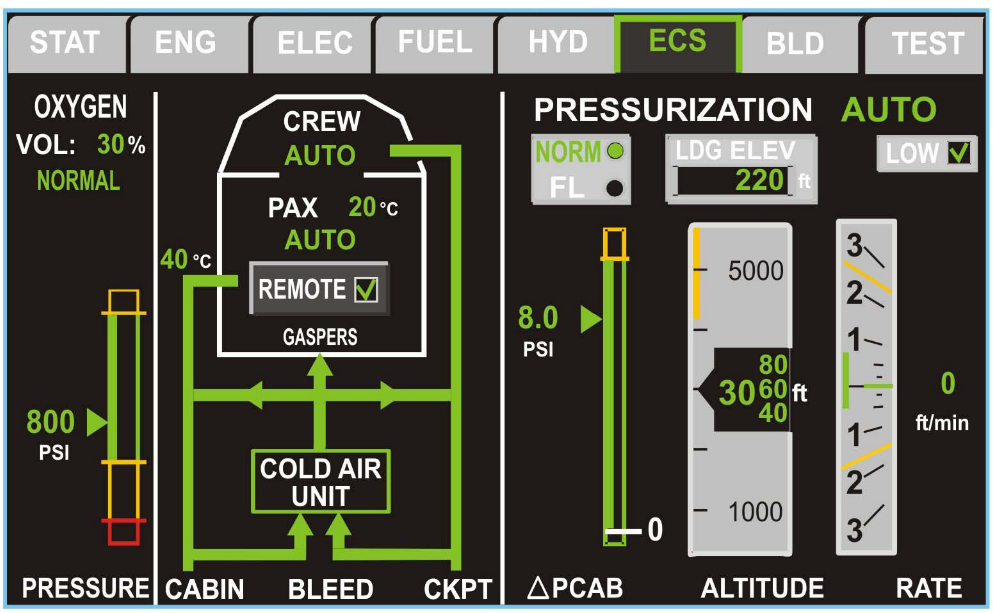


FIGURE 02-21-10-10 ECS SYNOPTIC DURING NORMAL OPERATION

ABNORMAL OPERATION

In the following, typical abnormal operations have been selected to help the crew to understand the symbols provided in the various panels and displays.

AIR CONDITIONING WITH PAX OVERHEAT

Abnormal status

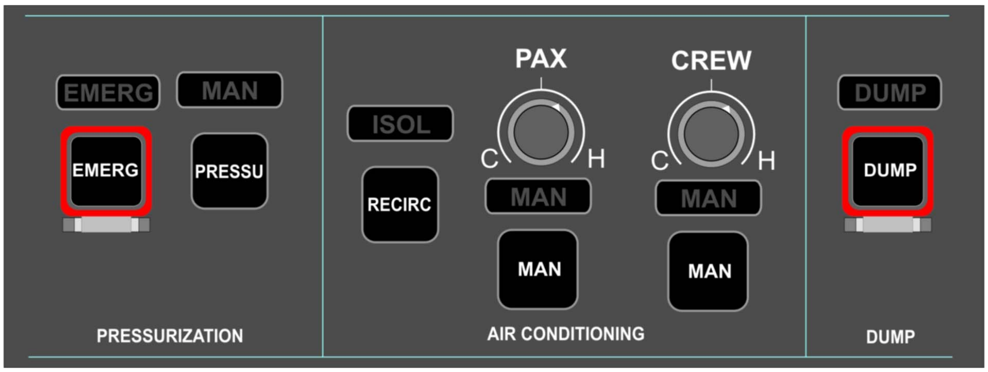


FIGURE 02-21-10-11 OVERHEAD PANEL

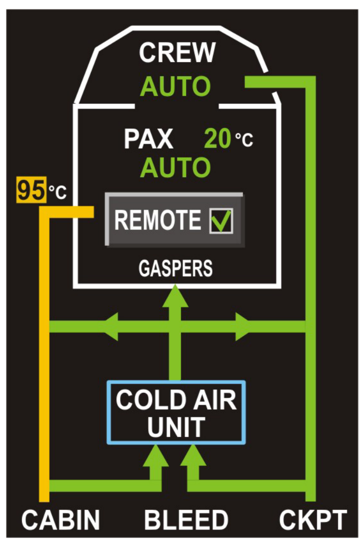


FIGURE 02-21-10-12 ECS SYNOPTIC DURING PAX OVERHEAT

CONTEXT	RESULT
Cabin conditioning distribution system overheat	COND: PAX OVHT CAS message + light on CABIN air flow line in amber

After procedure complete

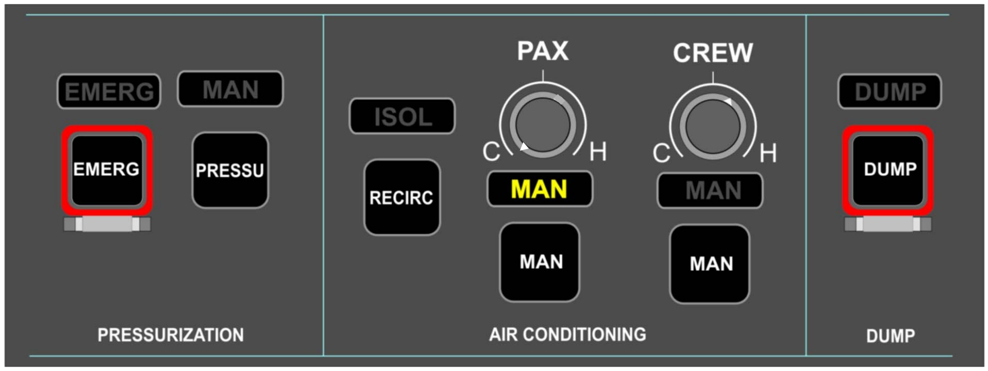


FIGURE 02-21-10-13 OVERHEAD PANEL WITH PAX CONTROLLER IN MANUAL MODE AND FULL COLD

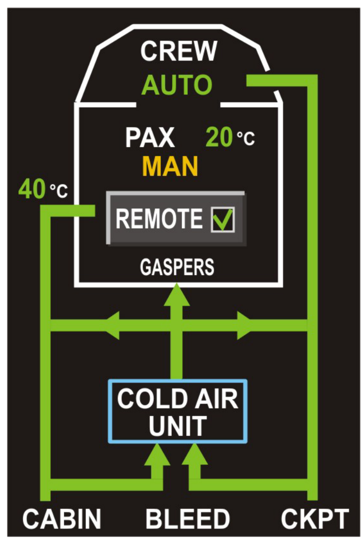


FIGURE 02-21-10-14 ECS SYNOPTIC WITH CABIN IN MANUAL MODE

ACTION	RESULT
MAN pushed	- CABIN air conditioning in manual mode - MAN status light in amber - PAX rotactor in full cold position - REMOTE status deselected

AIR CONDITIONING WITH ECU OVERHEAT

Abnormal status

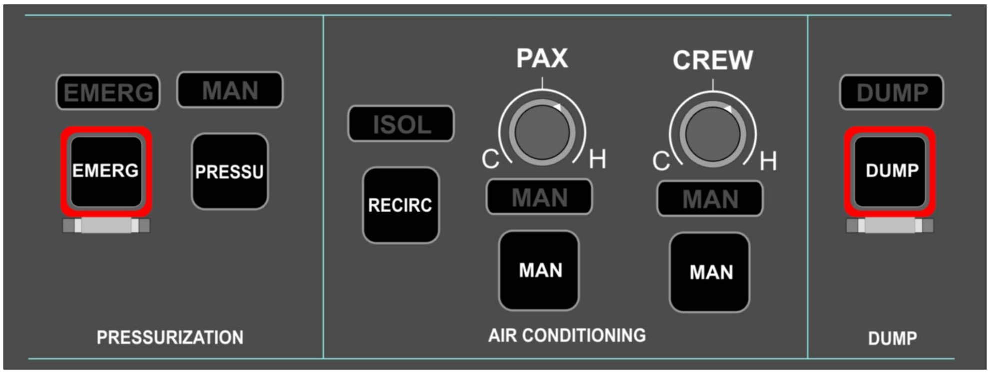


FIGURE 02-21-10-15 OVERHEAD PANEL

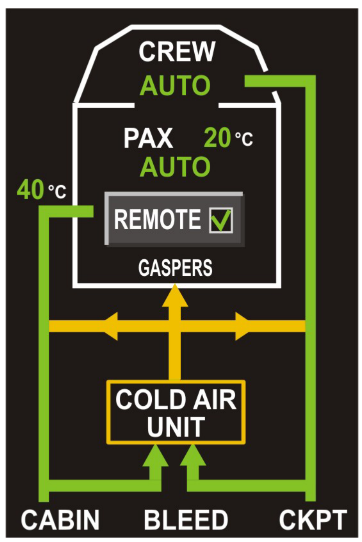


FIGURE 02-21-10-16 ECS SYNOPTIC DURING ECU OVERHEAT

CONTEXT	RESULT
Environmental Control Unit overheat	ECU OVHT CAS message + light on COLD AIR UNIT air flow lines in amber

After procedure complete

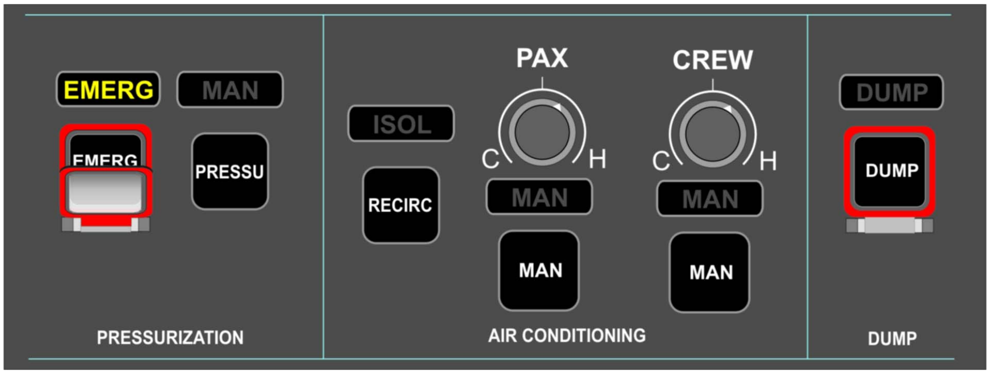


FIGURE 02-21-10-17 OVERHEAD PANEL WITH EMERG SELECTION

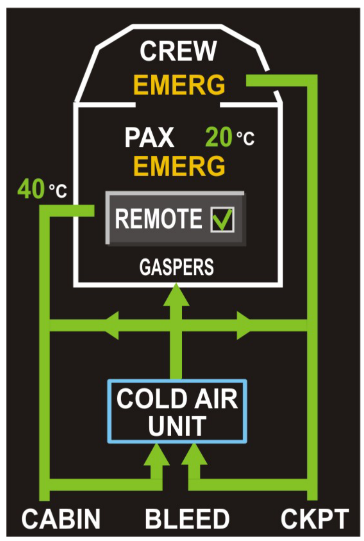


FIGURE 02-21-10-18 ECS SYNOPTIC IN EMERGENCY MODE

ACTION	RESULT
Raise the guard and push on EMERG pushbutton	- CABIN air conditioning in emergency mode - EMERG status light in amber - PAX and CREW rotactors are used to adjust the two hot temperature control valves - REMOTE soft key deselected

CAS MESSAGES

CAS MESSAGE	DEFINITION
COND: CKPT OVERPRESS	Cockpit temperature control valves not closed and cockpit overpressure detected
COND: CABIN OVERPRESS	Cabin temperature control valves not closed and cabin overpressure detected
COND: CREW OVHT	Cockpit distribution duct overheat
COND: PAX OVHT	Cabin distribution duct overheat
COND: PAX + CREW AUTO FAIL	PAX/CREW automatic temperature computer failed
COND: PAX + CREW MAN FAIL	PAX/CREW manual temperature computer failed
COND CMPTR FAULT CODE	Parking only, a failure message that may affect dispatch has been recorded by the air conditioning computer
ECU OVHT	ECU overheat {temperature > 230°C (446°F)}
NOSE CONE OVHT	Nose cone overheat
RECIR ISOL	Failure of the recirculation valve
COND CMPTR FAULT CODE	In flight, a failure message has been recorded by the air conditioning computer

ERRONEOUS INDICATION

On ground, when performing a TEST LIGHTS, the COND CMPTR FAULT CODE CAS message is abnormally systematically posted.

As this CAS message is self latched, it must be cleared using the CLR FAULT soft key.

DESCRIPTION

GENERAL

The purpose of pressurization is to maintain a certain level of pressure inside the fuselage that is comfortable for the passengers and crew, taking into account structural limits of the airframe, whatever the flying conditions.

The air conditioning system provides the pressurized areas with air at mild temperature.

The pressurization system can operate in three modes:

- automatic mode,
- manual mode,
- rapid depressurization mode.

The airplane comprises two pressurized areas:

- the cockpit, passenger cabin, toilets and baggage compartment, from frame 0 to frame 26, supplied with air by the air conditioning system,
- the nose cone, supplied with cabin conditioning air and slightly pressurized in flight by an automatic control system.

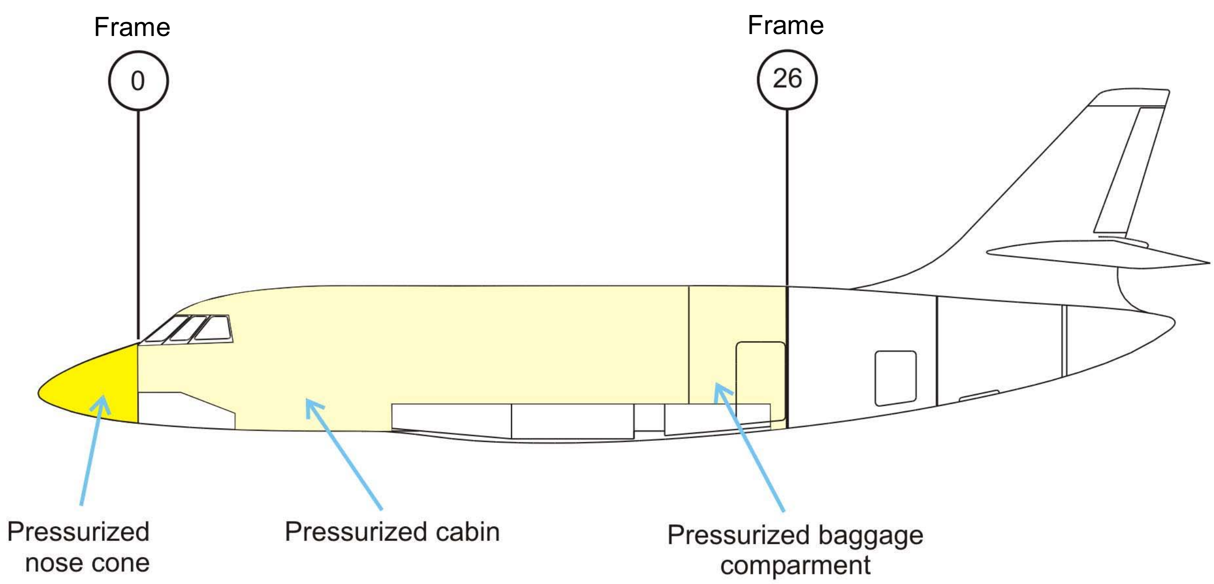


FIGURE 02-21-15-00 PRESSURIZED AREAS

Pressurization is achieved by regulating cabin conditioning airflow through two outflow valves located in the rear bulkhead of the pressurized area: one electro-pneumatic main valve, and one pneumatic emergency valve.

In normal mode, the Cabin Pressure Controller (CPC) electrically controls the electro-pneumatic main outflow valve, and the emergency outflow valve is pneumatically slaved to the first one.

In manual mode, the emergency outflow valve is pneumatically controlled by the manual cabin altitude rate setting knob, the electro-pneumatic valve is closed. Pneumatic operation is used as a backup mode in case of automatic mode failure.

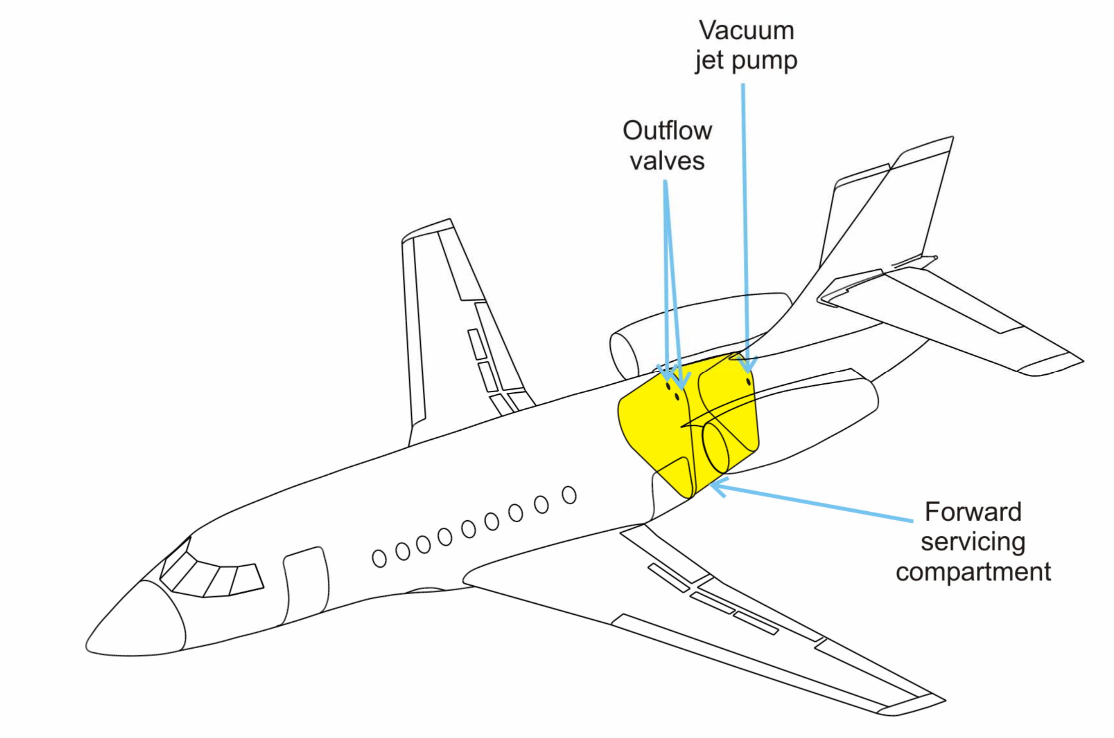


FIGURE 02-21-15-01 LOCATION OF MAIN PRESSURIZATION COMPONENTS

The pressurization system is connected to the avionics system to:

- allow the crew to select the different automatic modes (NORM or FL),
- activate the LOW rate mode,
- enter the landing field elevation,
- take into account the barometric setting and if available, FMS data,
- provide the CPC with airplane altitude and vertical speed,
- display the cabin pressurization parameters and CAS messages to the crew.

PRESSURIZATION SYSTEM COMPONENTS

Cabin Pressure Controller (CPC)

The digital cabin pressure controller manages cabin pressurization in automatic mode.

The CPC is composed of:

- a digital Printed Circuit Board (PCB) with a pressure and temperature sensor to achieve automatic pressure control,
- an analog PCB with a pressure sensor which provides a second indication of cabin pressure and cabin pressure rate of change. This output is the only available data in manual mode.

The CPC is located in the LH electrical cabinet behind the pilot seat and is controlled by the pressurization controls located on the overhead panel.

The CPC is electrically energized only in the automatic operation mode.

Electro-pneumatic main outflow valve

The electro-pneumatic main outflow valve is mounted on the rear bulkhead of the pressurized area. The outflow valve controls cabin pressurization by actuating atmospheric chambers. A flexible diaphragm connected to the poppet valve separates each chamber. A spring in the control chamber determines a fail-safe closed position for the poppet.

The pressure in the control chamber is determined by a torque motor quadrant in response to output signals received from the CPC. The quadrant alternately opens two nozzles, one admits cabin pressure into the control chamber (moving the poppet toward the closed position) and the other nozzle connects the control chamber to the vacuum pressure line (reducing pressure inside the control chamber and inducing the poppet towards the open position).

The function of the main outflow valve is, in response to signals from the CPC, to regulate the airflow exiting the cabin, so as to:

- maintain the programmed cabin altitude,
- limit the rate of climb and descent.

The electro-pneumatic main outflow valve control chamber includes:

- a cabin altitude limitation capsule,
- an overpressure limitation capsule,
- a negative pressure relief valve to prevent negative differential pressure.

The cabin altitude limitation capsule detects the absolute pressure in the cabin. When the set pressure is reached (cabin altitude 14,500 ± 500 ft), a valve linked to this capsule interconnects the control chamber to the cabin pressure, which tends to close the outflow valve and pressurize the cabin again.

The overpressure limitation capsule receives the external static pressure and the cabin pressure. When the difference between the two pressures reaches the calibration value of 9.3 psi (644 mbar), the capsule opens a valve and connects the control chamber to the outside, hence opening the outflow valve and causing depressurization of the cabin.

The negative pressure relief valve allows the outflow valve to open when the external pressure is higher than the cabin internal pressure.

Pneumatic emergency outflow valve

The emergency outflow valve is identical to the electropneumatic valve and comprises:

- a pneumatic relay,
- an overpressure limitation capsule,
- a cabin altitude limitation capsule,
- a quick-closing electric valve to induce rapid closing for take-off,
- a negative pressure relief valve.

The emergency outflow valve is pneumatically operated. Pneumatic operation is based on pressure difference between controlled and actual cabin pressure as determined by a pneumatic relay.

The control chambers of the two outflow valves interconnect so that in automatic mode the pneumatic valve is slaved to the electropneumatic valve, whereas in manual mode the pneumatic valve operates on its own, with the electropneumatic valve closed.

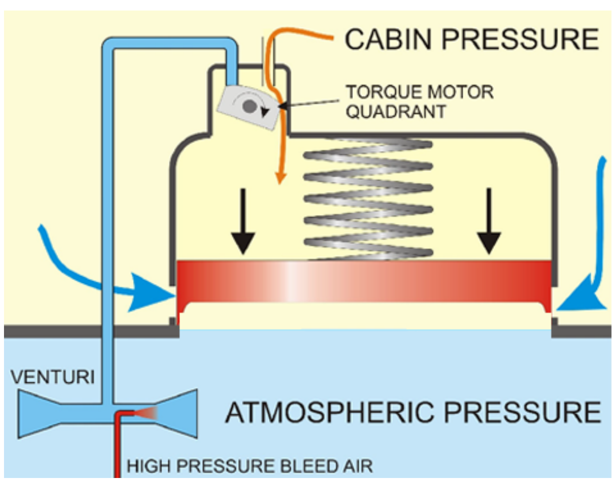


FIGURE 02-21-15-02 OUTFLOW VALVE IN CLOSED POSITION

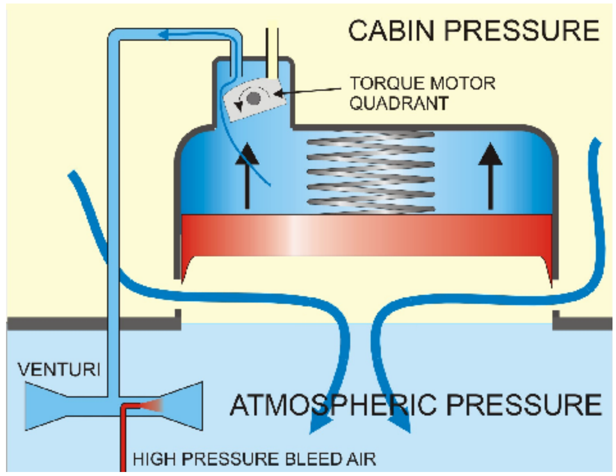


FIGURE 02-21-15-03 OUTFLOW VALVE IN OPEN POSITION

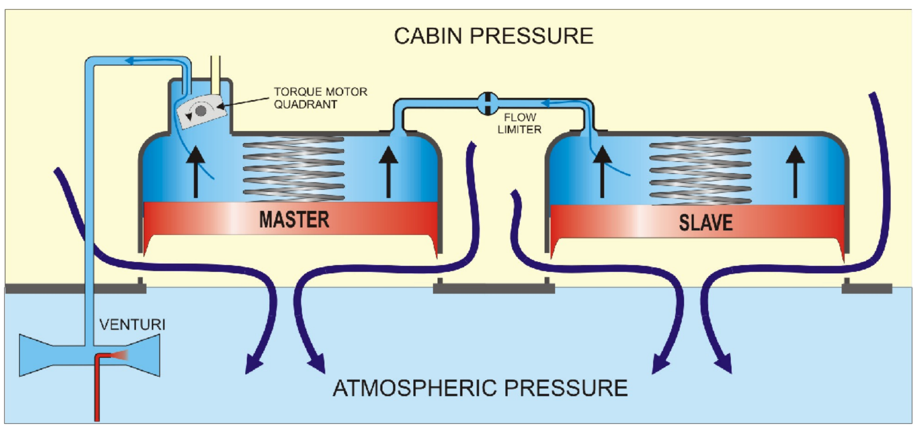


FIGURE 02-21-15-04 MAIN AND EMERGENCY OUTFLOW VALVES IN AUTOMATIC MODE

Vacuum jet pump

The vacuum jet pump produces a flow from a line supplied by No 1 and 2 engines LP bleed air or by the APU bleed air system when the airplane is on ground. The vacuum jet pump provides negative pressure produced by venturi-effect to operate the main and emergency outflow valves during automatic operation and during manual control of the pressurization system.

PRESSURIZATION SYSTEM OPERATION

Automatic pressurization mode

In automatic mode, the CPC automatically controls cabin altitude and pressurization rate of change according to programmed laws and landing field elevation.

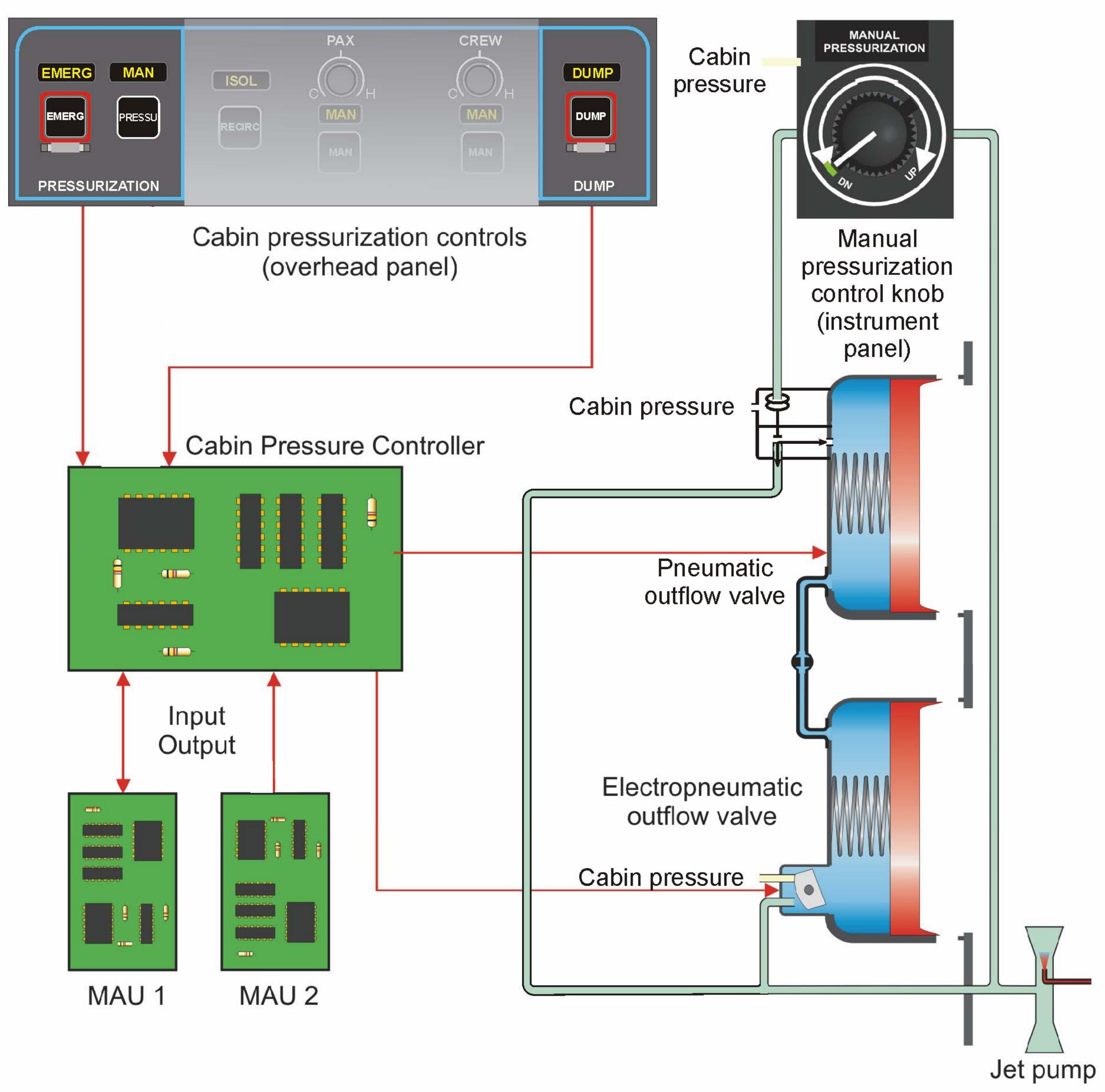


FIGURE 02-21-15-05 ARCHITECTURE OF THE AUTOMATIC PRESSURIZATION MODE

The automatic mode has two main laws of operation:

- the normal (NORM) law,
- the Flight Level (FL) law,

with, in either mode, a LOW cabin altitude rate of change option.

It also provides a high-altitude landing and take-off mode.

- **NORM law**

  This mode provides the most comfortable pressurization mode by limiting the cabin pressure rate of change during climb and descent based on aircraft vertical flight plan data provided by the FMS (time to top of climb, time to destination, cruising level).

- **FL law**

  This mode is intended to maintain a low cabin altitude of 1,000 ft until the airplane reaches 22,000 ft (Δp = 9 psi). Climb to 47,000 ft is possible in this mode but cabin pressure variation is less comfortable above 22,000 ft.

- **LOW cabin rate**

  LOW cabin altitude rate of change can be activated with either NORM or FL laws to limit the rate of change to lower values:

  + 400 / - 300 ft/min instead of + 460 / - 400 ft/min.

- **High-altitude landing and take-off**

  Without any additional crew action, in case of landing or take-off above 8,000 ft, the nominal excessive cabin altitude 9,700 ft (+/- 250 ft) threshold is automatically modified, by the pressurization system, during descent or take-off, and set to the landing field elevation + 1,700 ft (limited to 14,500 ft).

- **Descent sequence**

  When rate of descent is established at 500 ft/min or steeper, the target cabin altitude is set to the field altitude entered in the LDG ELEV box of the ECS page minus 300 ft. The reason for this slight pressurization is to avoid a cabin pressure bump during touchdown.

  At touchdown, the automatic depressurization sequence achieves a fast return to landing field pressure.

MAN pressurization mode

This mode is to be selected in case of failure of the automatic pressurization mode. The crew directly controls the cabin altitude rate of climb or descent with the MANUAL PRESSURIZATION control knob.

EMERG pressurization mode

This mode allows an emergency air conditioning supply, in the pressurized areas, by closing the two cold temperature control valves and setting the two hot temperature control valves to the full hot position.

DUMP depressurization mode

In case of failure of the pressurization system to achieve the correct cabin pressure at destination, the cabin pressure can be dumped by forcing the outflow valves to full open position.

NOSE CONE PRESSURIZATION

The nose cone is ventilated during ground and low altitude flight operations. It is also pressurized in normal flight conditions and the transition from ventilation to pressurization is entirely automatic. The function of the pressurization is to ensure a positive differential pressure of the nose cone in order to achieve sufficient sealing.

CONTROL AND INDICATION

CONTROL

Overhead panel

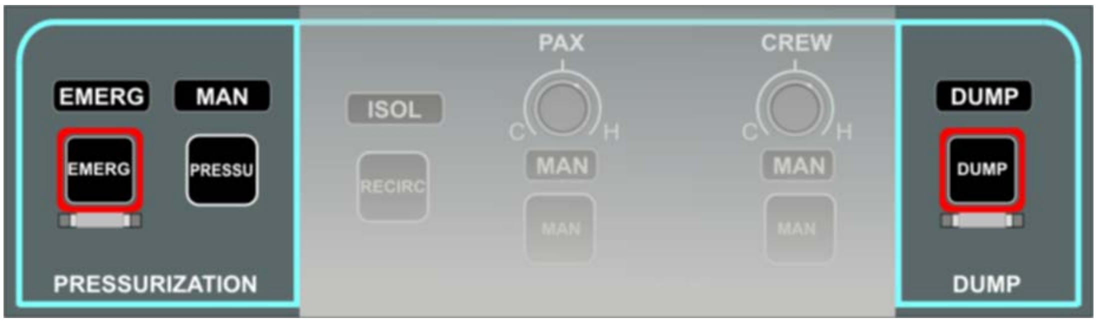


FIGURE 02-21-15-06 OVERHEAD PANEL

Instrument panel

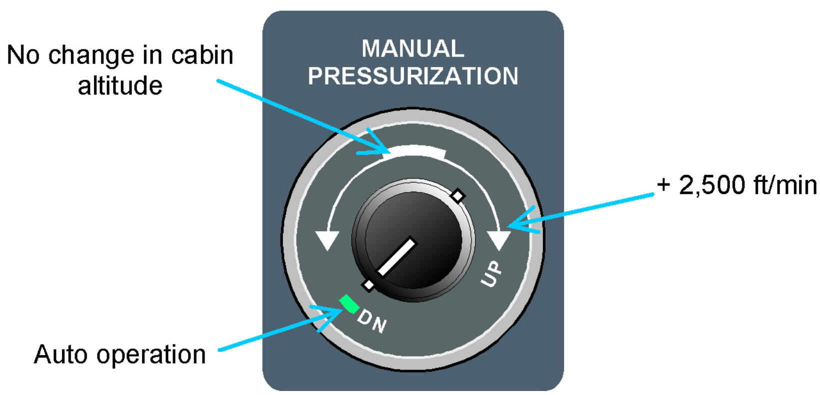


FIGURE 02-21-15-07 MANUAL PRESSURIZATION CONTROL KNOB

The MANUAL PRESSURIZATION control knob allows to control the rate of climb from - 1,500 ft/min to + 2,500 ft/min. A constant cabin pressure may be achieved by adjusting the MANUAL PRESSURIZATION control knob within the white area until the cabin altitude rate of change indicator stabilizes at zero.

The rest position is in front of the green line in automatic mode. Prior to the selection of the MAN mode, put the knob into the white area. In MAN mode, turn the knob until the desired cabin altitude rate of change is achieved.

ECS synoptic

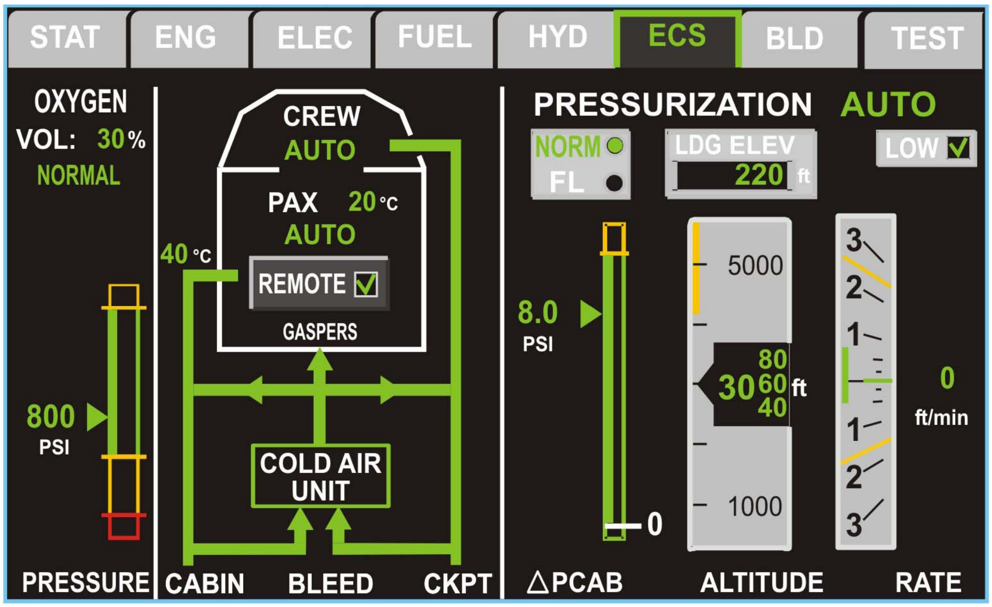


FIGURE 02-21-15-08 ECS SYNOPTIC

Through the ECS synoptic boxes with the Cursor Control Display (CCD), the flight crew can:

- activate mode selection of NORMAL or FLIGHT LEVEL laws,
- enter the destination landing field elevation through the LDG ELEV box (thus overriding the flight plan parameter),
- activate the selection of LOW cabin rate.

Synthetic table

<table>
<tr><th rowspan="2">CONTROL</th><th rowspan="2">FUNCTION</th><th colspan="2">TO ACTIVATE</th><th rowspan="2">SYNOPTIC</th></tr>
<tr><th colspan="2">TO DEACTIVATE</th></tr>
<tr><td rowspan="2"></td><td rowspan="2">- Allows the selection of AUTO / MAN mode of the pressurization system
- In MAN mode,
- use the MANUAL PRESSURIZATION control knob</td><td>Automatic mode</td><td></td><td>AUTO</td></tr>
<tr><td>Push on:
MAN mode</td><td></td><td>MAN</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">- Allows a rapid depressurization by forcing the outflow valves to fully open</td><td>Guarded:
Automatic mode</td><td></td><td>AUTO</td></tr>
<tr><td>Raise the guard and push on:
DUMP mode</td><td></td><td>DUMP</td></tr>
</table>

INDICATION

ECS synoptic

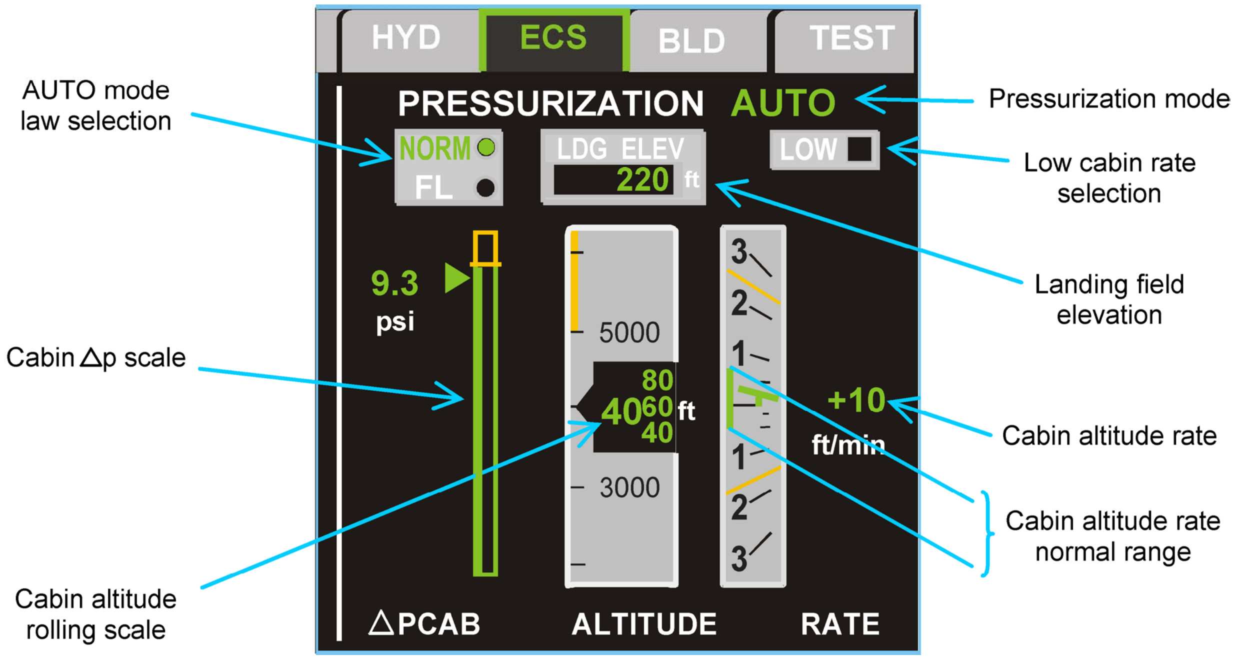


FIGURE 02-21-15-09 ECS SYNOPTIC IN AUTOMATIC MODE

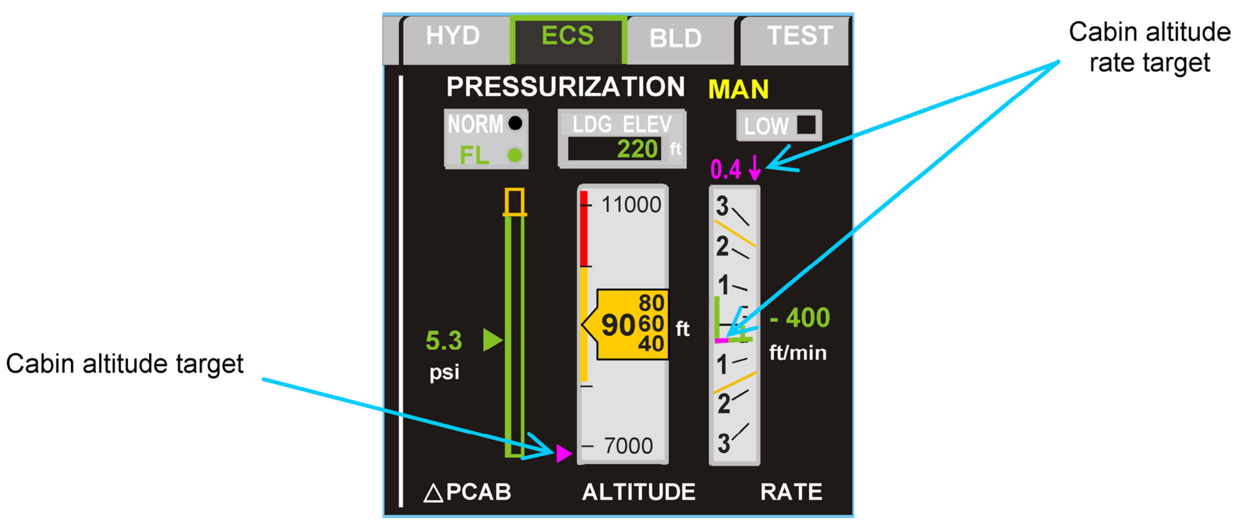
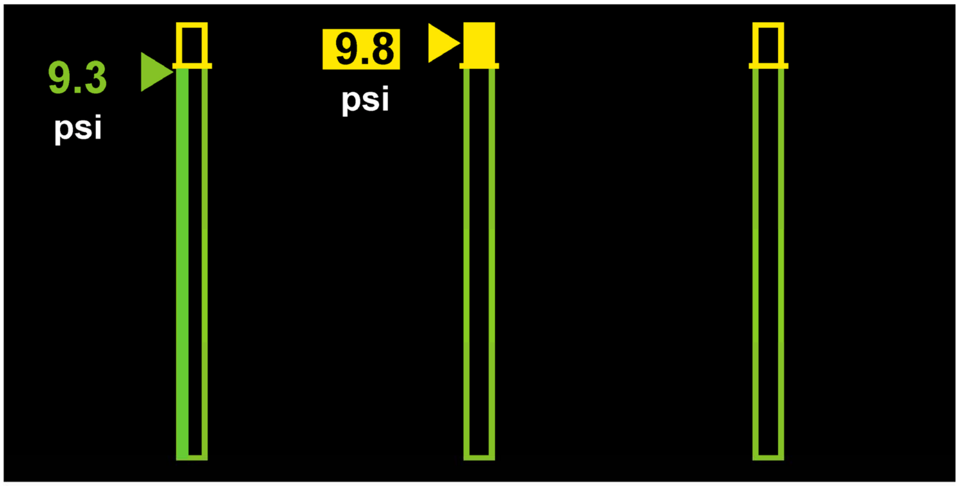


FIGURE 02-21-15-10 ECS SYNOPTIC IN MAN MODE

Symbology

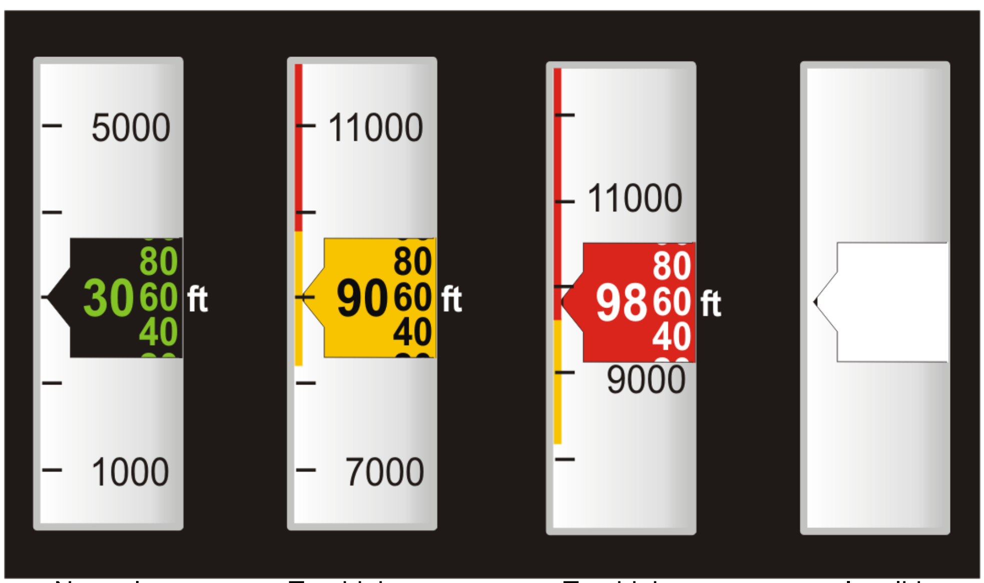


Normal operation

Overpressure

Invalid data

FIGURE 02-21-15-11 CABIN DIFFERENTIAL PRESSURE INDICATIONS



Normal operation

Too high cabin altitude 8,200 < Z < 9,700

Too high cabin altitude Z > 9,700

Invalid data

FIGURE 02-21-15-12 CABIN ALTIMETER INDICATIONS

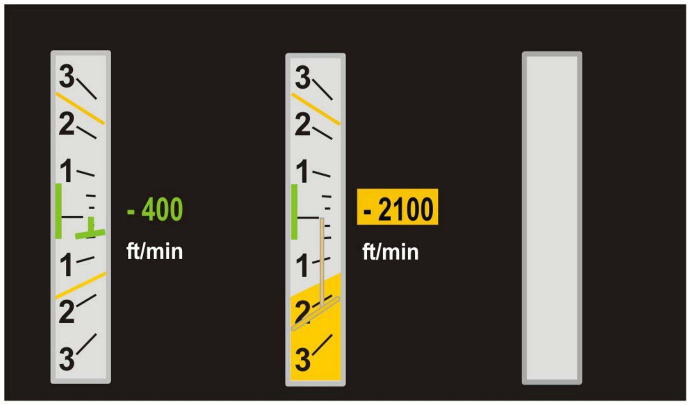


FIGURE 02-21-15-13 CABIN VARIOMETER INDICATIONS

NOTE

ERRONEOUS INDICATION

Loss of cabin altitude and cabin vertical speed indications when:
- Zcab: loss when Zcab < - 1,600 ft or > + 26,000 ft (loss of Zcab results in loss of △P),
- Vzcab: loss when Vzcab < -2.100 ft/min or > + 3,000 ft/min (independent of Zcab and △P).

STATUS synoptic

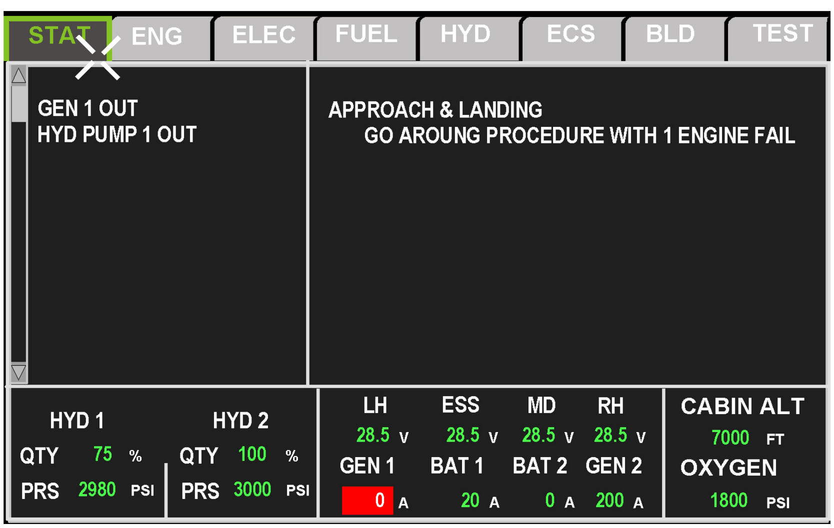


FIGURE 02-21-15-14 STAT SYNOPTIC

SYSTEM PROTECTION

CIRCUIT BREAKERS

The electrical circuit protection is provided by conventional trip-free circuit breakers located above the overhead panel (refer to Air conditioning).

PRESSURIZATION SYSTEM PROTECTION

Pressurization system protection consists of maximum differential pressure limitation, negative differential pressure prevention and cabin altitude limitation. Each outflow valve performs all protections.

Maximum differential pressure limitation

The CPC automatically maintains a normal differential pressure limit of 9 psi (620 mbar).

An overpressure limitation capsule located in each outflow valve controls the maximum cabin differential pressure at 9.3 psi (644 mbar).

The **CABIN PRESSURE TOO HIGH** CAS message appears when the cabin differential pressure is above safety overpressure relief valve threshold of 9.44 psi (651 mbar).

Maximum cabin altitude limitation

An altitude limitation capsule contained in each outflow valve maintains the cabin pressure at the altitude of 14,500 ft in case of depressurization due to:

- CPC failure,
- DUMP pushbutton activation,
- permanent cabin rate of climb in manual mode.

Negative differential pressure prevention

The negative pressure relief valve protects the structure from the effects of negative differential pressure (outside pressure above cabin pressure). Only the negative pressure relief valve can override the maximum altitude limitation.

NOSE CONE BULKHEAD PRESSURE RELIEF VALVE

A pressure relief valve in the nose cone bulkhead provides structural protection in case the calibrated holes provided for airflow evacuation are clogged. The relief valve is intended to operate when the difference between nose cone pressure and atmospheric pressure reaches 1.59 psi (110 mbar).

NORMAL OPERATION

In the following, typical in-flight situation has been selected to help the crew to understand the symbols provided in the various panels and displays.

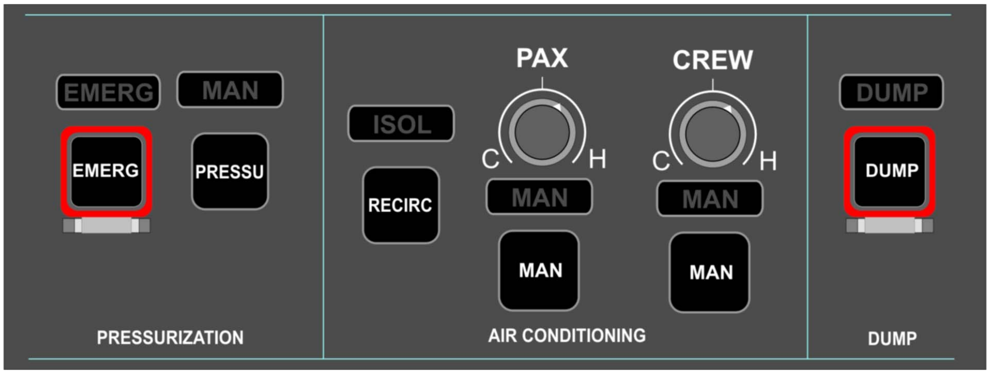


FIGURE 02-21-15-15 OVERHEAD PANEL DURING NORMAL OPERATION

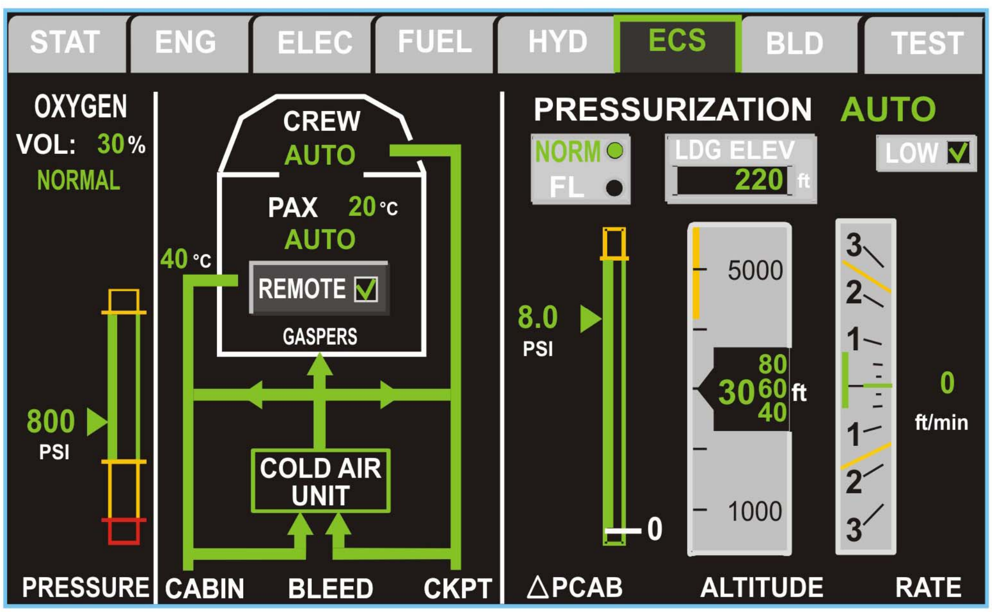


FIGURE 02-21-15-16 ECS SYNOPTIC DURING NORMAL OPERATION

ABNORMAL OPERATION

In the following, typical abnormal operations have been selected to help the crew to understand the symbols provided in the various panels and displays.

PRESSURIZATION WITH COMPUTER FAILURE

Abnormal status

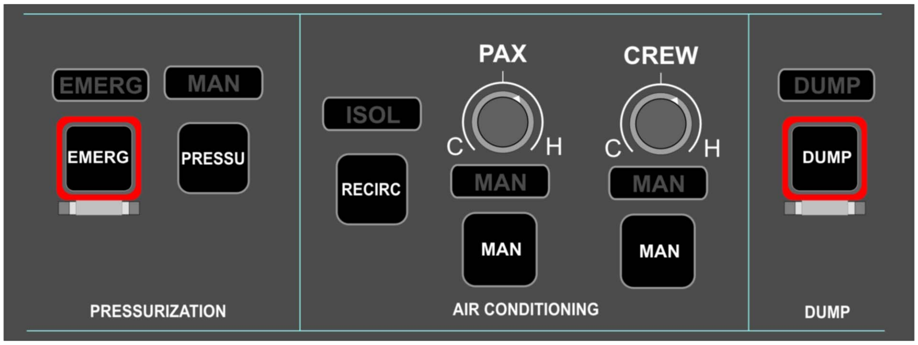


FIGURE 02-21-15-17 OVERHEAD PANEL

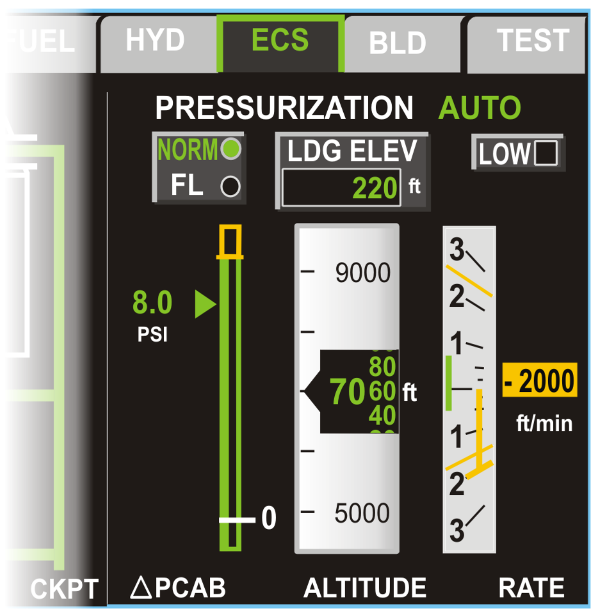
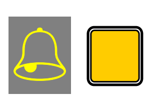


FIGURE 02-21-15-18 ECS SYNOPTIC DURING PRESSURIZATION COMPUTER FAILURE

CONTEXT	RESULT
CABIN Pressure Control System (CPCS) failure	PRESSURE CMPTR FAIL CAS message +  light on

After procedure complete

FIGURE 02-21-15-19 MANUAL PRESSURIZATION CONTROL KNOB ADJUSTED

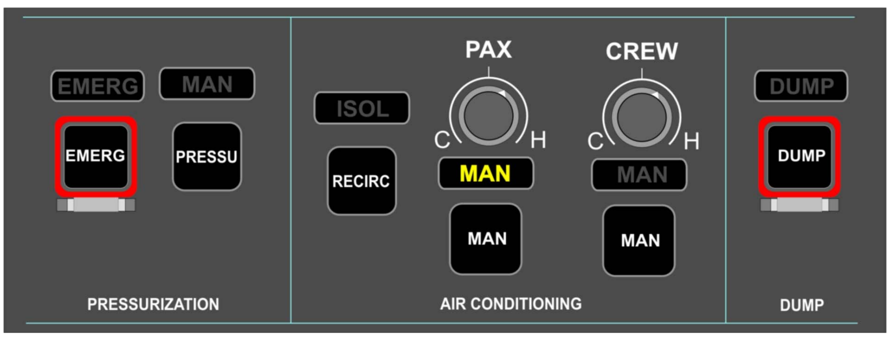


FIGURE 02-21-15-20 PRESSURIZATION OVERHEAD PANEL WITH PRESSU IN MAN MODE

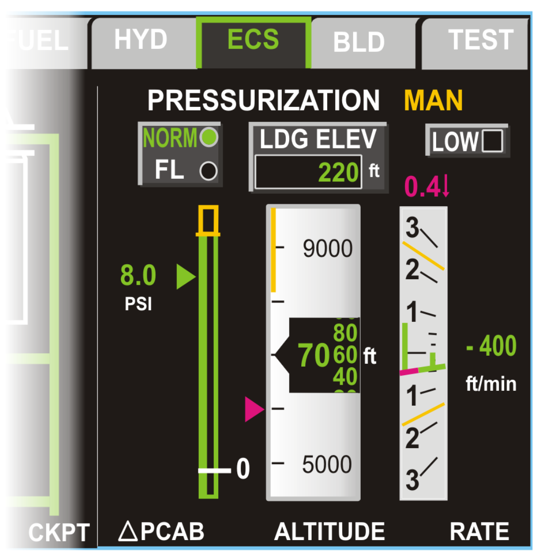


FIGURE 02-21-15-21 ECS SYNOPTIC WITH PRESSURIZATION IN MANUAL MODE

ACTION	RESULT
- Manual pressurization control knob set to the white area - PRESSU pushbutton in MAN mode	- Pressurization in manual mode - Emergency outflow valve becomes the master valve - MAN status light in amber
Manual pressurization control knob adjusted to reach target rate (turned counterclockwise to decrease cabin altitude)	- Target rate is displayed in magenta above the variometer scale (digital readout) and on the left-hand side of the scale (pointer) - Target altitude is pointed in magenta on the left side of the altitude scale - Effective cabin altitude rate is indicated on rate display

CAS MESSAGES

CAS MESSAGE	DEFINITION
CABIN ALTITUDE	Cabin altitude above 9,700 ft (or landing field elevation +1,700 ft limited to 14,500 ft in case of T/O or landing above 8,000 ft)
CABIN PRESSURE TOO HIGH	ΔP cabin above 9.44 psi (651 mb)
CABIN SELECT LAND ELEV	No landing field elevation selected when starting descent
CHECK CABIN ALTITUDE	Cabin altitude above 8,200 ft
PRESSURE CMPTR FAIL	Cabin Pressure Controller failure
CHECK CABIN RATE	Cabin pressure rate of change lower than - 1,200 ft/min or above + 1,200 ft/min

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