SECTION 6-12

AIR CONDITIONING AND PRESSURIZATION

Index

GENERAL DESCRIPTION

The EMB-120 BRASILIA is equipped with a foil air bearing, air-cycle machine air conditioning system that employs air bled from the engine compressors or APU (if installed).
The air conditioning is integrated by the bleed air, environmental control unit, temperature control and air distribution sub-system.
The air conditioning system provides cabin pressurization and temperature control for the comfort of passengers and crew members. The pressurization level is controlled by means of the pressurization control selector which commands the outflow valves in order to maintain the airplane differential pressure within structural limits.
On the ground, conditioned air may be supplied by a ground service air conditioning unit through the external ground connection located at the lower surface of the fuselage.
In case of a failure in both air conditioning packs, the airplane may be ventilated by the impact air by opening the ram air inlet.
In addition, a ventilation system is provided in order to cool the avionics installed in the electronic bay located in the nose compartment.

BLEED AIR SYSTEM

Pressurized air to the air-cycle machine is bled from the engines or APU (if installed).
The engine air bleed is performed through two ports at the $P_{2.5}$ and P_3 engine compressor stages. However, only one port provides bleed air to the air conditioning packs at a time.
In each engine bleed air port is installed a restrictor in order to limit the airflow bled from the engine, in case of a downstream duct failure.
A check valve that is installed in the low pressure port outlet keeps the $P_{2.5}$ port closed when the high pressure port (P_3) is enabled.
The high pressure stage is normally open during ground operations and low speed descents. In all other operation conditions the air conditioning system is supplied by the low pressure stage.
A high stage bleed shutoff valve is installed in the high pressure port.
With the BLEED switch set to LOW, the high stage bleed shutoff valve is kept closed and the bleed air is supplied by the low pressure stage.
With the BLEED switch set to AUTO position, the high stage bleed shutoff valve is controlled by an upstream installed pressure switch. The pressure switch commands the valve to close when the high stage pressure reaches 58 psi.
Downstream of the low/high pressure port junction is installed the engine bleed shutoff valve which is, in normal condition, controlled by the BLEED switch. If a bleed overheat condition occurs, an overheat sensor will close the respective engine bleed shutoff valve. This valve is also shut off when the fire extinguishing handle is pulled.
Each bleed duct, including the APU bleed duct, is provided with a check valve to avoid reverse flow to the compressors. The bleed system is provided with a crossbleed line that allows just one engine and/or the APU to feed both air conditioning packs.

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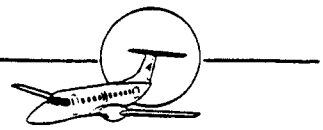
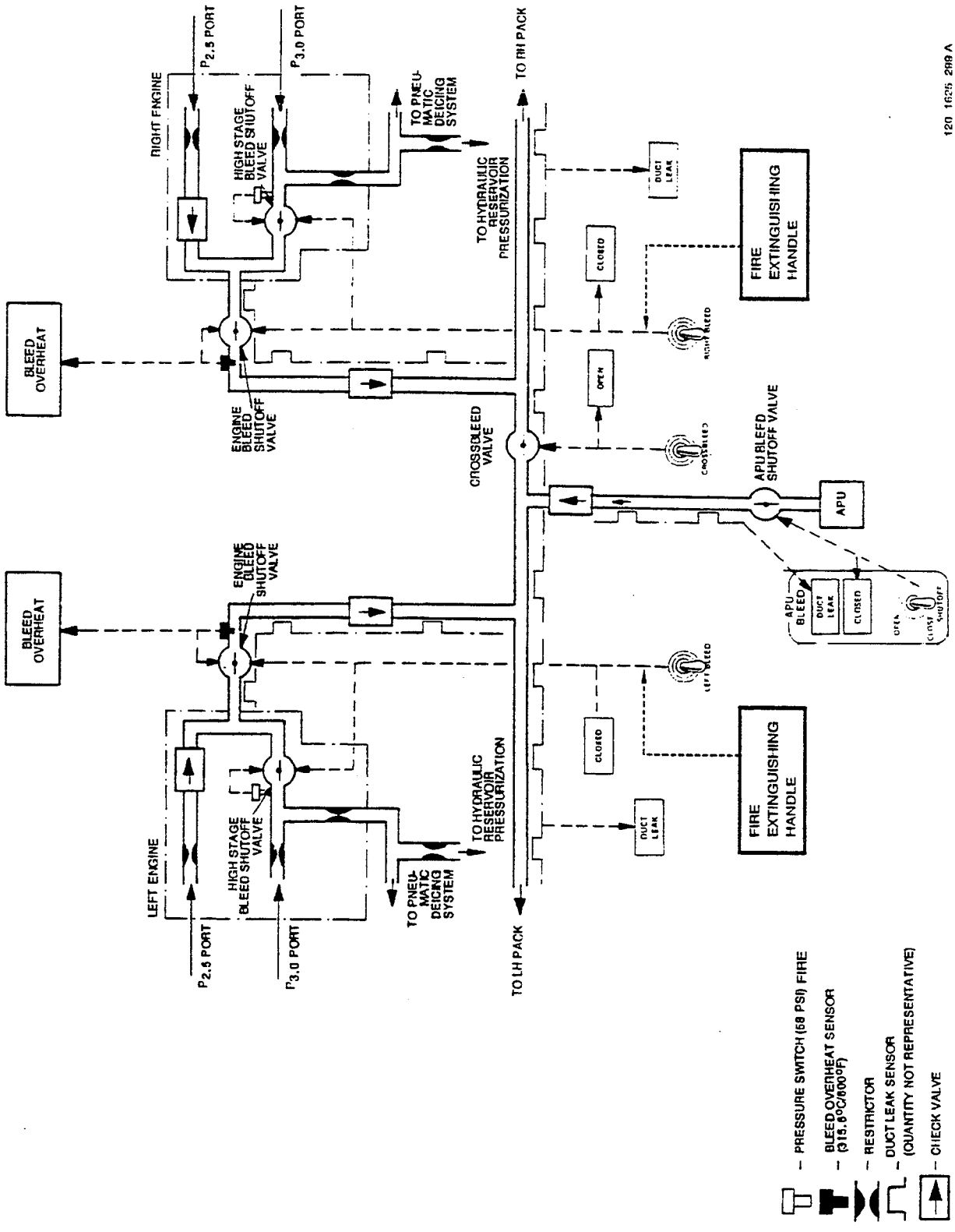


A crossbleed shutoff valve, controlled by the CROSSBLEED switch, is installed in the crossbleed duct.
The APU bleed duct is connected to the crossbleed line at the left-hand side of the crossbleed shutoff valve. Therefore, with the crossbleed valve closed, the APU will feed the left pack. In order to supply the right pack, it is necessary that the crossbleed shutoff valve be opened.
An APU bleed shutoff valve is installed in the APU bleed duct and is controlled by the APU BLEED switch in normal condition. The APU bleed shutoff valve may also be actuated when the APU fire extinguishing switch is positioned at CLOSE position. In addition, the APU bleed shutoff valve receives information from the APU electronic control concerning the EGT indication and the starter-generator condition. Should an APU abnormal operation condition exist, the APU electronic control closes the APU bleed automatically.
An electrical circuit prevents the APU bleed from being opened if the left engine bleed is open and the crossbleed is closed. Moreover, with the crossbleed open, the APU bleed can only be opened if the right engine bleed is closed. Engine exhaust smell may be felt in the cabin when APU bleed air is supplying the air conditioning packs and wind conditions are such that engine exhaust gases are blown into the APU air inlet. To avoid this, the APU bleed should be closed.
The bleed valves are electropneumatically actuated. Should either the electric power or pneumatic power be cut off, the valves remain closed, regardless of the position of the relevant switches.

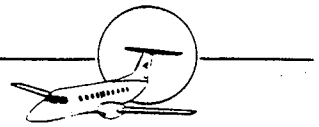
BLEED AIR ALARMS AND INDICATING LIGHTS

Each engine bleed shutoff valve, the APU bleed shutoff valve and the crossbleed valve have indicating white lights, located on the overhead panel, that confirm the actual valve condition, regardless of the switch position.
To monitor the bleed air, two alarms are provided:

The duct leak warning, which has sensors installed close to each duct interconnection. Besides monitoring the air conditioning bleed ducts, the duct leak warning also monitors the pneumatic lines of the deicing system and the air conditioning packs. The sensors are activated if the temperature in the bleed duct routing region reaches 71°C (160°F).
Once activated, the duct leak warning is presented by the DUCT LEAK red light flashing on the multiple alarm panel; by the DUCT LEAK red light illuminated on the overhead panel; and the three-chime aural warning activation followed by the DUCT LEAK voice message.
The bleed overheat warning is activated by a sensor installed in the bleed duct just after each engine bleed shutoff valve.
When the temperature in the duct reaches 315.6°C (600°F) the respective engine bleed shutoff valve and the high-stage bleed shutoff valve is closed automatically, the BLEED OVERHEAT amber light on the overhead panel will come on and the AIR COND amber light on the multiple alarm panel will flash. The aural warning will sound.



BLEED AIR SCHEMATIC



ENVIRONMENTAL CONTROL UNIT (PACK) SYSTEM

The pressurized air from the bleed lines is conditioned by two environmental control units (packs), both located at the fuselage trailing edge fairings, on each side of the airplane. The air conditioning pack consists of a two-section heat exchanger, a foil air bearing air-cycle machine, a condenser and a water separator.

The bleed hot air enters the pack through the pack pressure regulator/shutoff valve that is controlled by the pack control selector, which is the four-position type, located on the air conditioning panel.

The pack pressure regulator shutoff valve is the torque motored butterfly-type, electropneumatically actuated. It regulates the pressure of air to enter the air-cycle machine. Should either the electrical power or the pneumatic power be cut off, the valve remains closed, regardless of the pack control selector position. A flow control venturi is provided just downstream of the pack pressure regulator/shutoff valve to limit the airflow to the pack as a safety device to the air conditioning lines.

Then, the airflow enters the primary heat exchanger where it is cooled, and goes through the compressor inlet valve, entering the compressor section. The cooled bleed air coming from the primary heat exchanger is pressurized to a level suitable to enter the turbine side of the air-cycle machine.

The air-cycle machine is a turbine-compressor spool that employs only the pressurized bleed air to supply the cabin.

The heat acquired by the air in the compression phase is removed in the secondary heat exchanger, where its temperature drops to approximately half its value.

The airflow passing through the heat exchangers is cooled by either outside air through the NACA inlets during flight or by the ground cooling fans during ground operations.

The ground cooling fan is an electric motor-driven fan that is energized whenever the pack control selector is out of the OFF position with the airplane on the ground. A ground cooling fan malfunction causes poor cooling of the primary heat exchanger, which will cause a pack failure condition. The ground cooling fans are installed near the heat exchangers of each pack.

After that, the high pressure cooled air is condensed and the water is extracted in the water separator.

The water obtained in the water separator is routed through a water drain pipe and is sprayed on the heat exchanger unit in order to improve heat exchange efficiency.

Then the high pressure dry cooled airflow is routed to the expansion turbine where its pressure and temperature is drastically decreased.

NOTE: The temperature of the air coming from the water separator sometimes tends to be lower than the recommended temperature for turbine operation. On airplanes Post-Mod. SB 120-21-0047 or S/N 120.219, 120.251, 120.270, 120.271, 120.282 and on, a control valve is installed in the turbine inlet line in order to supply hot air (derived from the compressor outlet), thereby allowing the air temperature to be controlled so as to prevent a turbine ice formation.

The work generated in the turbine is transmitted to the compressor through a shaft, thus starting the normal cycle of the pack operation.

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The low pressure cold air from the turbine combines with the hot bleed air coming from the hot air bypass line, thereby reaching a suitable level of temperature and pressurization for the cabin. The conditioned air is directed to the low pressure section of the condenser, passing through a check valve, and is delivered to the distribution ducts.

PACK FAIL ALARM

The pack fail alarm is activated by a 218.3°C (425°F) set point thermostat which is installed at the compressor outlet in order to monitor the outlet air temperature after compression.
During flight a pack fail indication may be eventually caused by a failure in the primary heat exchanger or by a bleed overheating condition.
On the ground, the activation of the pack fail alarm indicates a probable failure in the air ground cooling fan.
The pack fail alarm is presented by illumination of the amber PACK FAIL light on the overhead panel; amber AIR COND light flashing on the multiple alarm panel and aural warning sounding.
Simultaneously with the pack fail alarm, the thermostat will command the pack pressure regulator/ shutoff valve to close, turning off the ground cooling fan.
After the occurrence of a pack fail alarm, the system can only be restarted by turning the pack control selector off.

TEMPERATURE CONTROL SYSTEM

The conditioned air that feeds the cabin is a hot-cold air mixture, composed of the cold airflow coming from the expansion turbine and the hot airflow modulated from the hot bleed air.
The temperature control is achieved by regulating the hot and cold airflows through two valves, one located in the hot airflow bypass line and the other in the cold air flow line.
After going through the pressure regulator/shutoff valve, the airflow is divided into two lines:

- One line is directed to the air-cycle machine, thus becoming the cold air line.
- The other line is derived downstream of the valve, thus becoming the hot airflow line.

Both lines are gathered at the expansion turbine outlet.
Two valves accomplish temperature control:

- The temperature control valve, that is a normally closed electropneumatic shutoff valve, located in the hot air bypass line.
  This valve receives information either from the electronic temperature control in the automatic operating mode, or directly from the temperature adjusting knob in the manual operating mode.
- The compressor inlet valve, that is a normally open pneumatic valve, located upstream of the compressor inlet and slaved to the temperature control valve.

Operation of the valves is interdependent, the valves being pneumatically interconnected. Only the temperature control valve is electrically controlled. When the temperature control valve is closed, the compressor inlet valve is opened, and vice-versa, although the compressor inlet valve is never fully closed.
A double temperature indicator is installed on the overhead panel and indicates the pax cabin and the cockpit temperatures.
Separate temperature control devices are provided to the pax cabin and to the cockpit for crew use.
The temperature control mode selector allows selecting the automatic or manual mode of operation.
The temperature adjusting knob allows the crew to control the environmental temperature value.
The Cockpit Temperature Control devices (temperature adjusting knob and temperature control

mode selector) command the left pack and the Cabin Temperature Control devices command the right pack.

A pax cabin temperature adjusting knob is also provided on the attendant's panel, and controls the right pack temperature controller in auto mode, provided the cabin temperature control mode selector, on the air conditioning panel, is set to the CAB AT position.

The temperature control is achieved by either of these modes:

AUTO MODE: With the temperature control mode selector in the AUTO position, the temperature in the cabin and in the cockpit is controlled by the relevant electronic temperature controller, that receives information from the temperature sensors.

When in AUTO mode, the temperature range is kept between 15.5°C (60°F) and 32.2°C (90°F). The pilot can vary the temperature within this range at his discretion, just by setting the temperature adjusting knob.

When in normal condition of operation, the air conditioning system should be set to AUTO.

MANUAL MODE: With the temperature control mode selector in the MAN position, the pax cabin and cockpit temperature control (which is applicable) is performed by setting the relevant temperature adjusting knob to the desired temperature as shown on the temperature indicator.

The manual mode should be set only if a failure occurs in the automatic control. It is not advisable to select manual mode to assist in the cabin temperature pull-up or pull-down.

An automatic control failure may be noticed when the temperature is not maintained within the auto mode temperature limits.

Once in manual mode, the pilot should continuously monitor the temperature and act on the temperature adjusting knob. Avoiding full hot or full cold selection is recommended, as this would lead to a duct overheat condition or cause ice formation at the turbine outlet.

NOTE: Use the temperature controller whenever a temperature change is desired. If the air conditioning system does not maintain the minimum cabin temperature of 19°C, even with bleeds in AUTO and packs in NORM, the pack switches HI position can be selected. This position is allowed during cruise only, to improve air conditioning heating.

OVERHEAT ALARM AND PROTECTION DEVICE

The Duct Temperature Limiter is a thermopneumatic device that actuates to close the temperature control valve when the temperature in the conditioned air duct reaches 107°C (225°F). No indication in the cockpit is provided on the limiter actuation. A thermostat located just before the mixing chamber provides a duct overheat alarm to the pilots when the duct internal temperature reaches 118°C (245°F). The duct overheat alarm is presented by the DUCT OVERHEAT amber light illuminating on the overhead panel, the AIR COND amber light flashing on the multiple alarm panel and the aural warning sounding.

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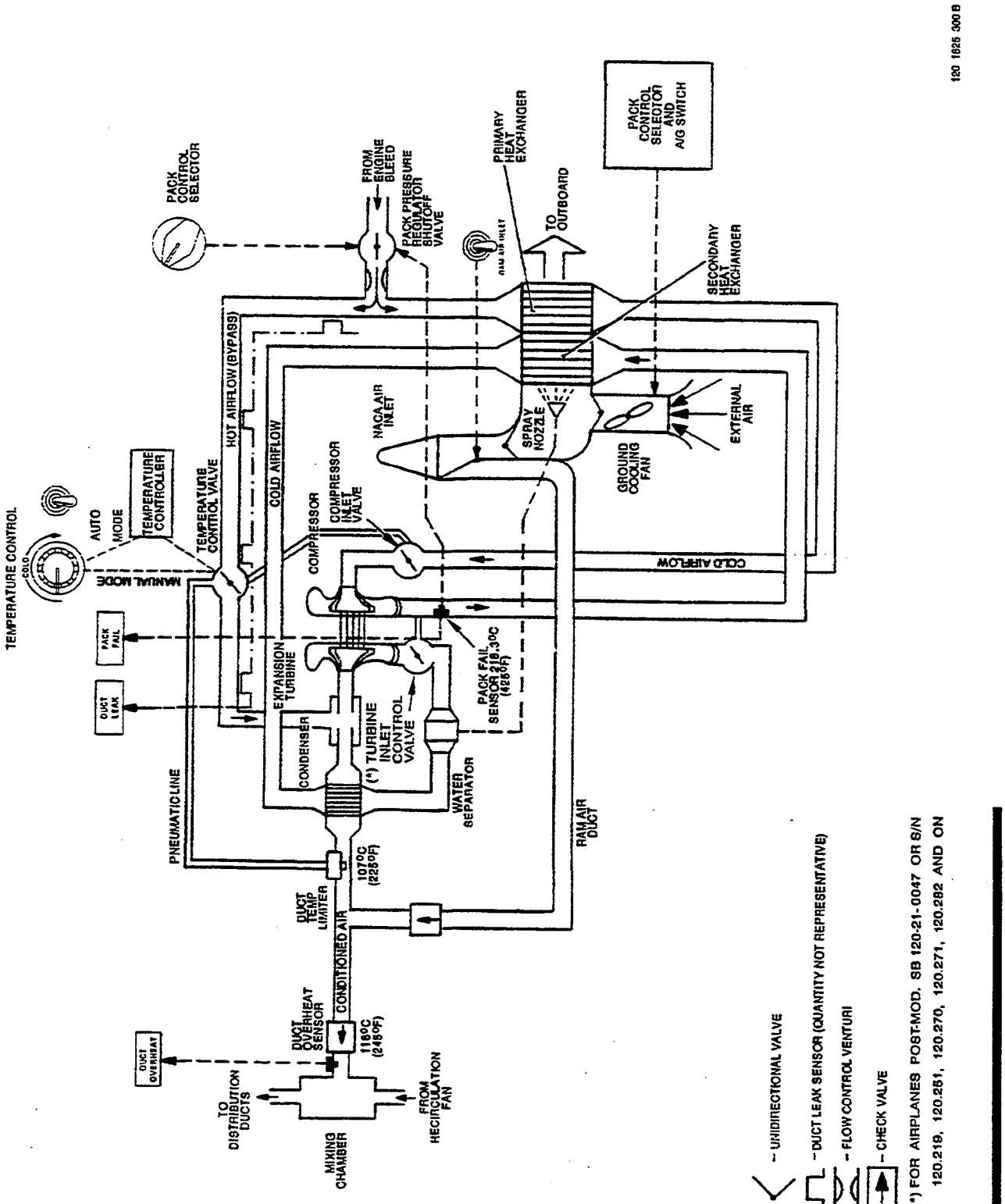

AIR CONDITIONING PACK SCHEMATIC

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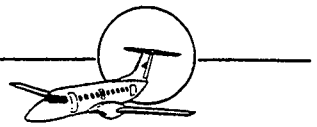


AIR DISTRIBUTION SYSTEM

The air delivered from the pack is routed to the noise absorber and mixing chamber and then directed into the different distribution ducts.
The mixing chamber is a junction box that provides a suitable mixture between the conditioned air coming from the pack and the fresh air coming from the recirculation fan, besides promoting noise absorption.
The air flows to the airplane interior through the general outlets located at the floor level (lower outlets) or at the overhead level (upper outlets) and at the console level (in the cockpit).
As an additional device to deliver air to the passengers and crew members, gasper outlets are provided along the cabin and in the cockpit.
The distribution ducts are shaped in such a manner to provide different airflow quantity to the pax cabin and the cockpit. The airflow demanding is 60% to the pax cabin, and 40% to the cockpit, regardless of the arrangement of the operating packs.

PAX CABIN AIR DISTRIBUTION

The air to be distributed to the pax cabin is delivered to the cabin interior through the upper and lower general outlets, with the warmer air being directed to the lower general outlets and the cool air being directed to the upper general outlets, thus providing a good air circulation by profiting from the natural airflow motion.
The airflow deflection (warmer air down and cool air up) is automatically performed by a three-way valve that is actuated at 24°C (75°F) by a temperature sensor.

COCKPIT AIR DISTRIBUTION

The air delivered to the cockpit is continuously directed to the windshield diffusers and to the general outlets located at the console level.
Airflow to the windshield defogging is controlled by the W/S DEFOG switch on the overhead panel that commands a butterfly-type deflection valve. Once actuated, this valve increases the airflow to the windshield diffusers. However, a little airflow is kept to the general outlets.
The windshield diffusers are distributed behind the glareshield panel, providing full windshield defogging.
In addition, air outlets located in the pilot's feet region are provided.
The airplanes Post-Mod. SB 120-21-0032 or S/N 120.135 and on are provided with two push-pull handles that allow each pilot to individually shut off the airflow directed to his feet. Each handle is installed under the instrument panel, near the rudder pedal adjusting mechanism.

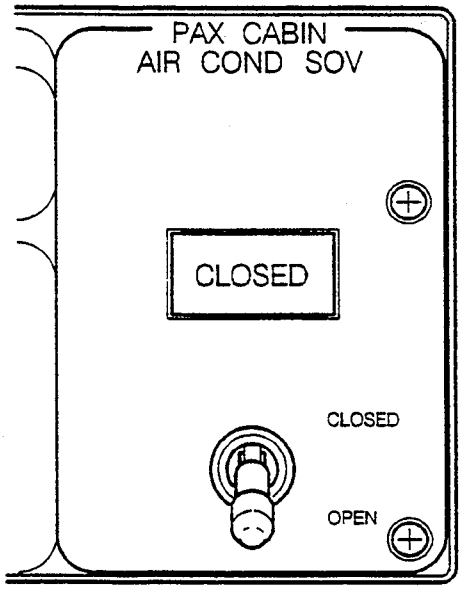
RECIRCULATION SYSTEM

To increase the airflow to the cabin, two recirculation fans are provided. They draw the fresh air from

under the floor and add it to the mixing chamber.
Each recirculation fan is controlled by the relevant RECIRC switch on the overhead panel and operates in high or low rpm, as selected.
The recirculation system is usually operated on the ground to save the engine bleed.
In flight, the recirculation fans may be turned on in conjunction with the packs, in order to improve the refrigeration level in the cabin, as the recirculation fans draw the cool air from under the floor.
In the event of the occurrence of smoke in the cabin, the recirculation fans must be kept off.
On hot days, while on the ground, the recirculation fans should be kept off to reduce the cool-down period.

PASSENGER CABIN AIR CONDITIONING SHUTOFF VALVE (IF INSTALLED)

The airplane may be equipped with means of closing air conditioning to the passenger cabin. This is carried out by a switch with CLOSED and OPEN positions, and an additional actuator installed in the air conditioning distribution three-way valve.
When the switch is moved to the CLOSED position, the three-way valve is signaled to close the warm airflow duct, and the additional actuator is signaled to close the cool airflow duct, thus closing both air passages to the cabin.
Airflow is then directed only to the cockpit.
When the switch is set to the CLOSED position, a white CLOSED light illuminates in the associated panel.
When the switch is moved to OPEN, the air conditioning flows normally to the passenger cabin.



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PASSENGER CABIN AIR CONDITIONING SHUTOFF VALVE SWITCH
(OVERHEAD PANEL)

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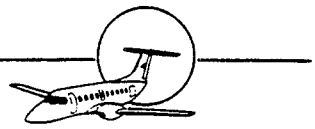

GASPER SYSTEM

With a view to enhancing the feeling of comfort of passengers and crew members, gasper outlets in the cabin provide individual air supply to the passengers and four gasper outlets, two for each pilot, provide air supply in the cockpit.

Each gasper outlet may be closed or opened by turning the relevant gasper socket located over each seat. The socket is movable, which allows the passenger to direct the airflow to his body.

The gasper duct is derived from the interconnection airflow duct and is fed by both airflow delivered from the mixing chamber and by the airflow generated by the gasper fan. The gasper fan is installed adjacent to the gasper duct and draws the fresh air from under the floor.

A shutoff valve is installed at the gasper duct entrance. Both the gasper fan and the shutoff valve are controlled by the GASPER switch on the overhead panel and by a temperature sensor located in the interconnection duct.

In the event of the occurrence of cabin smoke, the gasper fan must be kept off. Gasper fan should also be kept off, if a pulsating air flow appears, which may occur if most of the gasper outlets are closed.

In hot days, while on the ground, the gasper fan should be kept off to reduce the pull-down period.

The gasper system operates as follows:

OFF position:
- Airplanes Pre-mod. SB 120-021-0031.
  The gasper shutoff valve is open and the gasper fan is off. The air to the gasper outlets is provided from the mixing chamber.
- Airplanes Post-mod. SB 120-021-0031 or S/N 120.110 and on.
  The gasper shutoff valve is closed and the gasper fan is off. No air flow is provided to the gasper outlets.

AUTO position: Depending on the interconnection duct temperature (T)

- $T < 24°C$ (75°F) – gasper fan off and gasper shutoff valve open.
  The air to the gasper outlets is provided from the mixing chamber only.
- $T > 24°C$ (75°F) – gasper fan on (high rpm) and gasper shutoff valve closed.
  The air to the gasper outlets is provided by the gasper fan only.

MIX position: Gasper fan is on (low rpm), and gasper shutoff valve is open, regardless of the interconnection duct temperature.
The airflow coming from the mixing chamber is increased by the airflow generated by the gasper fan, and then is delivered through the gasper outlets.

NOTE: The MIX position is recommended during the beginning of the cool-down period.
It should not be used during flight because it can deliver warm air to the passenger head.

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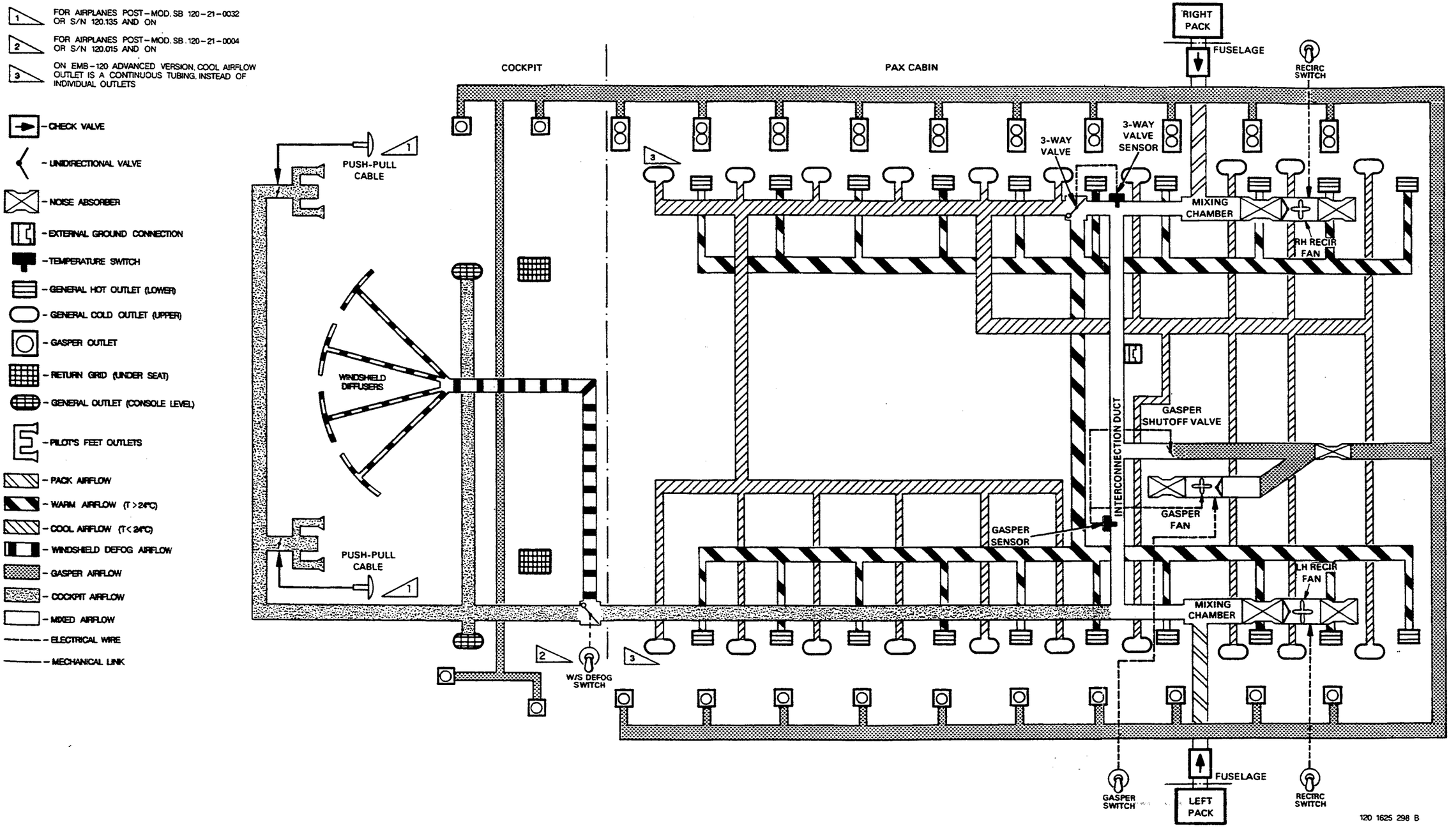
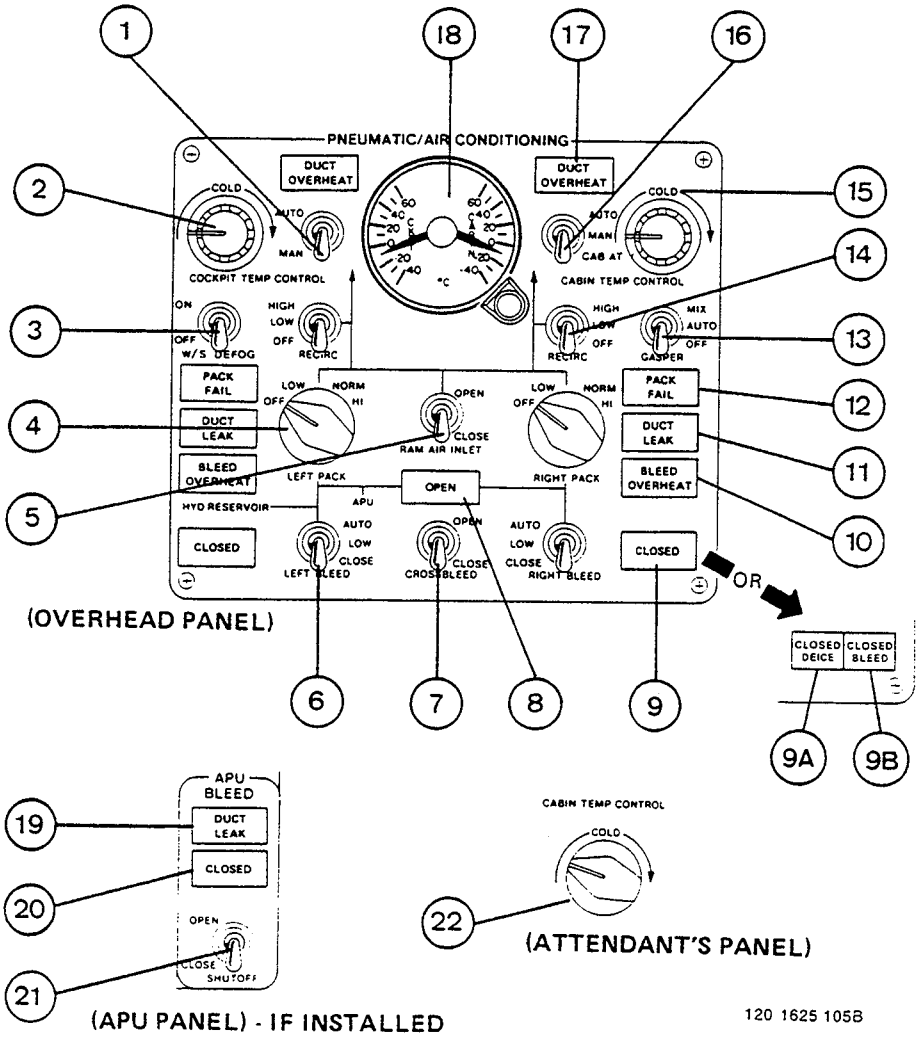


COCKPIT/PAX CABIN AIR DISTRIBUTION SCHEMATIC

CABIN VENTILATION BY RAM AIR

The airplane is equipped with a ventilation system as an alternative means to allow outside air to enter the cabin.
The impact air is drawn through the same NACA inlets used to cool the heat exchangers.
A flapper valve controlled by the RAM AIR INLET switch deflects the airflow directed to cool the heat exchangers and re-routes it to the distribution ducts just upstream of the mixing chamber.
The RAM AIR INLET switch controls both the right and the left flapper valves simultaneously. No indicating light is provided to the crew on ram air inlet actuation.

NOTE:
- The ram air is to be used to ventilate the airplane interior for cabin smoke evacuation purposes with the airplane depressurized and packs off.
- The ram air system should be operative for an approved unpressurized flight with packs off.
- Only the ram air is not sufficient to pressurize the cabin.
- Opening the ram air inlet with the pack on will cause a pack fail condition, as the airflow to the heat exchanger is shut off.



AIR CONDITIONING CONTROL PANEL

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1. **COCKPIT TEMPERATURE CONTROL MODE SELECTOR**

   AUTO – The left pack temperature control is performed by the electronic temperature controller that receives inputs from the cockpit, skin, and duct temperature sensors.

   MAN – The left pack temperature control valve is commanded directly through the cockpit temperature adjusting knob. No temperature range is enabled.

2. **COCKPIT TEMPERATURE ADJUSTING KNOB**

   Allows the pilot to set a desired temperature to the cockpit by actuating the left pack temperature control in either manual or automatic modes.

3. **WINDSHIELD DEFOG SWITCH (AIRPLANES POST-MOD. SB 120-21-0004 OR S/N 120.015 AND ON)**

   ON – The airflow to the windshield diffusers is increased. Continuous airflow is still delivered to the general outlets in the cockpit.

   OFF – The airflows directed to the general outlets in the cockpit only.

4. **LEFT PACK CONTROL SELECTOR (AIRPLANES PRE-MOD. SB 120-21-0015)**

   OFF – The pack pressure regulator/shutoff valve is closed.

   LOW – The pack pressure regulator/shutoff valve delivers low air bleed pressure to the pack.

   NORM – The pack pressure regulator/shutoff valve delivers mean air bleed pressure to the pack.

   HIGH – The pack pressure regulator/shutoff valve delivers high air bleed pressure to the pack.

4. **LEFT PACK CONTROL SELECTOR (AIRPLANES POST-MOD. SB 120-21-0015 OR S/N 120.025 AND ON)**

   OFF – The pack pressure regulator/shutoff valve is closed.

   LOW – The pack pressure regulator/shutoff valve delivers low pressure to the pack.

   NORM – The pack pressure regulator/shutoff valve delivers high pressure to the pack.

   HIGH – The pack pressure regulator/shutoff valve delivers medium pressure to the pack. In addition, the high-stage bleed shutoff valve is kept open, regardless of the high stage pressure and provided the BLEED switch is at switch is at AUTO position.

5. **RAM AIR INLET SWITCH**

   OPEN – Opens both flapper valves allowing the outside air to be drawn through the NACA inlets. Then the impact air is directed to the distribution ducts.

   CLOSE – The airflow is directed to the pack heat exchangers.

6. **LEFT BLEED SWITCH**

   AUTO – The engine bleed shutoff valve is kept open. The high-stage bleed shutoff valve may be open or closed depending on the high stage pressure as sensed by the high stage pressure switch.

   NOTE: For airplanes Post-Mod. SB 120-21-0015 or S/N 120.025 and on, the high stage bleed shutoff is kept open if the pack control selector is at HI position.

   LOW – The engine bleed shutoff valve is kept open and the high stage bleed shutoff valve is closed. Engine bleed from low stage port only.

   CLOSE – Both, the engine bleed shutoff valve and the high stage bleed shutoff valve are closed.

   NOTE: Airplanes operated in Canada have shutoff valves installed in each pneumatic deicing bleed line. These valves will be open when the bleed switches are positioned in AUTO or LOW, and will be closed when the bleed switches are positioned in CLOSE.

7. **CROSSBLEED SWITCH**

   OPEN – Opens the crossbleed valve, connecting the left and right bleed systems.

   CLOSE – Closes the crossbleed valve, isolating the left and right bleed systems.

8. **CROSSBLEED OPEN LIGHT (WHITE)**

   ILLUMINATED – Indicates crossbleed valve open.

9. **RIGHT BLEED CLOSED LIGHT (WHITE)**

   ILLUMINATED – Indicates the relevant engine bleed shutoff valve is closed.

9A. **RIGHT PNEUMATIC DEICING BLEED CLOSED LIGHT (WHITE)**

   ILLUMINATED – Indicates the relevant pneumatic deicing bleed shutoff valve is closed.

9B. **RIGHT BLEED CLOSED LIGHT (WHITE)**

   ILLUMINATED – Indicates the relevant engine bleed shutoff valve is closed.

10. **RIGHT BLEED OVERHEAT LIGHT (AMBER)**

   ILLUMINATED – Indicates an overheat condition in the right bleed duct. The engine-bleed shutoff valve and high stage bleed shutoff valve are closed simultaneously.

11. **RIGHT DUCT LEAK LIGHT (RED)**

   ILLUMINATED – Indicates leakage through the right bleed ducts.

12. **RIGHT PACK FAIL LIGHT (AMBER)**

   ILLUMINATED – Indicates high temperature at the compressor outlet. The pack pressure regulator/shutoff is closed simultaneously.

13. **GASPER SWITCH**

   MIX – The gasper fan is turned on (low rpm) and the gasper shutoff valve is open.

   AUTO – The gasper fan is either on or off, depending on the interconnection duct temperature. The gasper shutoff valve may be open or closed, depending on the gasper fan condition.

   OFF – The gasper fan is off and the gasper shutoff valve is open.

14. **RIGHT RECIRCULATION SWITCH**

   HIGH – Turns on the right recirculation fan in high rpm.

   LOW – Turns on the right recirculation fan in low rpm.

   OFF – Turns off the right recirculation fan.

15. **CABIN TEMPERATURE ADJUSTING KNOB**

   Allows the pilot to set a desired temperature to the pax cabin, by actuating the right pack temperature control in either manual or automatic modes.

16. **CABIN TEMPERATURE CONTROL MODE SELECTOR**

   AUTO – The right pack temperature control is performed by the electronic temperature controller, that receives inputs from the pax cabin, skin and duct temperature sensors.

   MAN – The right pack temperature control valve is commanded directly through the cabin temperature adjusting knob. No temperature range is established.

   CAB AT – Enables the right pack temperature control to be commanded by the cabin temperature adjusting knob located on the attendant's panel. In this condition, the right pack temperature control operates in automatic mode only.

17. **RIGHT DUCT OVERHEAT LIGHT (AMBER)**

   ILLUMINATED – Indicates overheating in the right pack airflow supply.

18. **TEMPERATURE INDICATOR**

   Indicates the cockpit and the pax cabin temperatures in degrees centigrade.

19. **APU DUCT LEAK LIGHT (RED) (IF INSTALLED)**

   ILLUMINATED – Indicates leakage through the APU bleed ducts. Illuminates in conjunction with the DUCT LEAK on the multiple alarm panel.

20. **APU BLEED CLOSED LIGHT (WHITE) (IF INSTALLED)**

   ILLUMINATED – Indicates the APU bleed shutoff valve, closed.

21. **APU BLEED SHUTOFF VALVE SWITCH (IF INSTALLED)**

   OPEN – Opens the APU bleed shutoff valve, allowing the APU to provide bleed air.

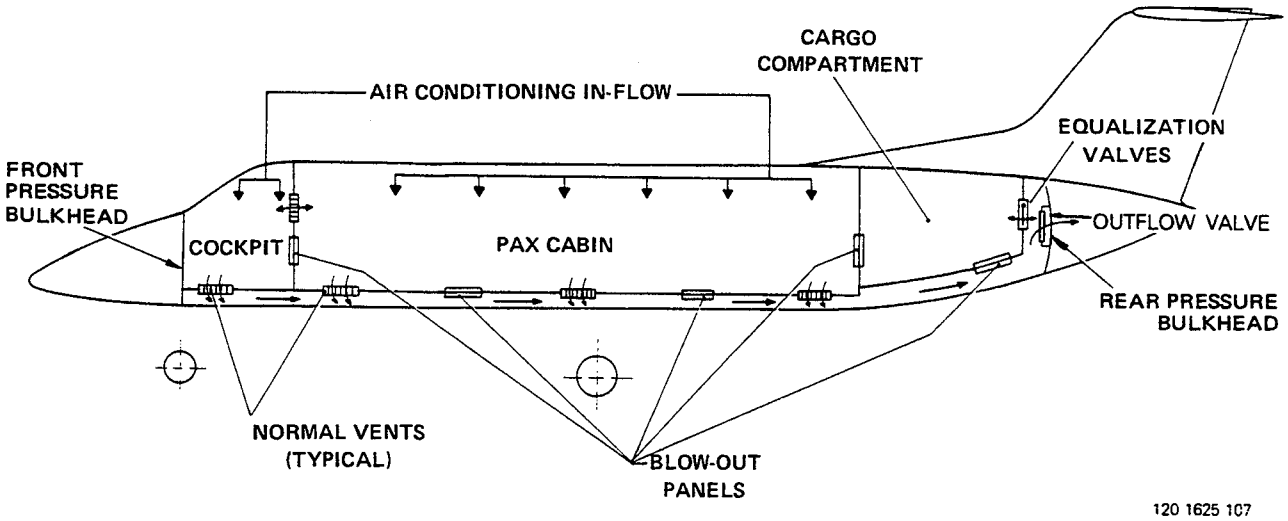
   CLOSE – Closes the APU bleed shutoff valve.

22. **ATTENDANT'S CABIN TEMPERATURE ADJUSTING KNOB**

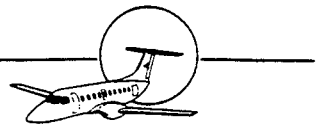
   Allows the attendant to actuate the right pack temperature controller, thus controlling the pax cabin temperature. The knob is effective only in automatic mode and is enabled when the cabin temperature control mode selector is set to CAB AT position.

PRESSURIZATION OUTFLOW

Cabin air outflow is controlled by the electropneumatic outflow valve and by the pneumatic outflow valve. When the AUTO mode is in operation, the pneumatic outflow valve is pneumatically slaved to the electropneumatic outflow valve. If the MANUAL mode is in operation, the electropneumatic outflow valve is closed and cabin outlet flow is controlled only by the pneumatic outflow valve.
Both outflow valves are located at the center of the rear pressure bulkhead inside the pressurized cabin, and have no communication but with the cabin underfloor flow.
Air circulated into the cockpit through the air distribution system is used to cool the instrument panel. It is then directed through the air dump exhaust in the cockpit floor, producing an underfloor flow, which is partly recirculated by recirculation fans and partly exhausted overboard through the outflow valves.
The passenger cabin air is drawn through the foot-level grills down around the passenger cabin underfloor also producing an underfloor flow which is also partly recirculated by recirculation fans, and partly exhausted overboard through the outflow valves.



OUTFLOW DIAGRAM



CABIN PRESSURE CONTROL SYSTEM

GENERAL

The pressurization system controls cabin altitude in either one of the two modes, as selected by the pilot:

- AUTO – Automatic; the normal mode of operation by the means of electronic controller.
- MAN – Manual control of the system in the event of AUTO mode failure.

Control for the automatic pressurization system comes from the electronic controller. The electronic controller senses cabin pressure for the selected cabin rate of climb, cabin altitude, and barometric correction. The electronic controller also senses the position of the mode selector switch, the power levers switch and the landing gear switch.

The electronic controller then controls the torque motor box to open or close the electropneumatic outflow valve by varying the pressure in it as a function of vacuum and cabin pressure. In AUTO mode the pneumatic outflow valve is slaved to the electropneumatic outflow valve by a simple interconnection line.

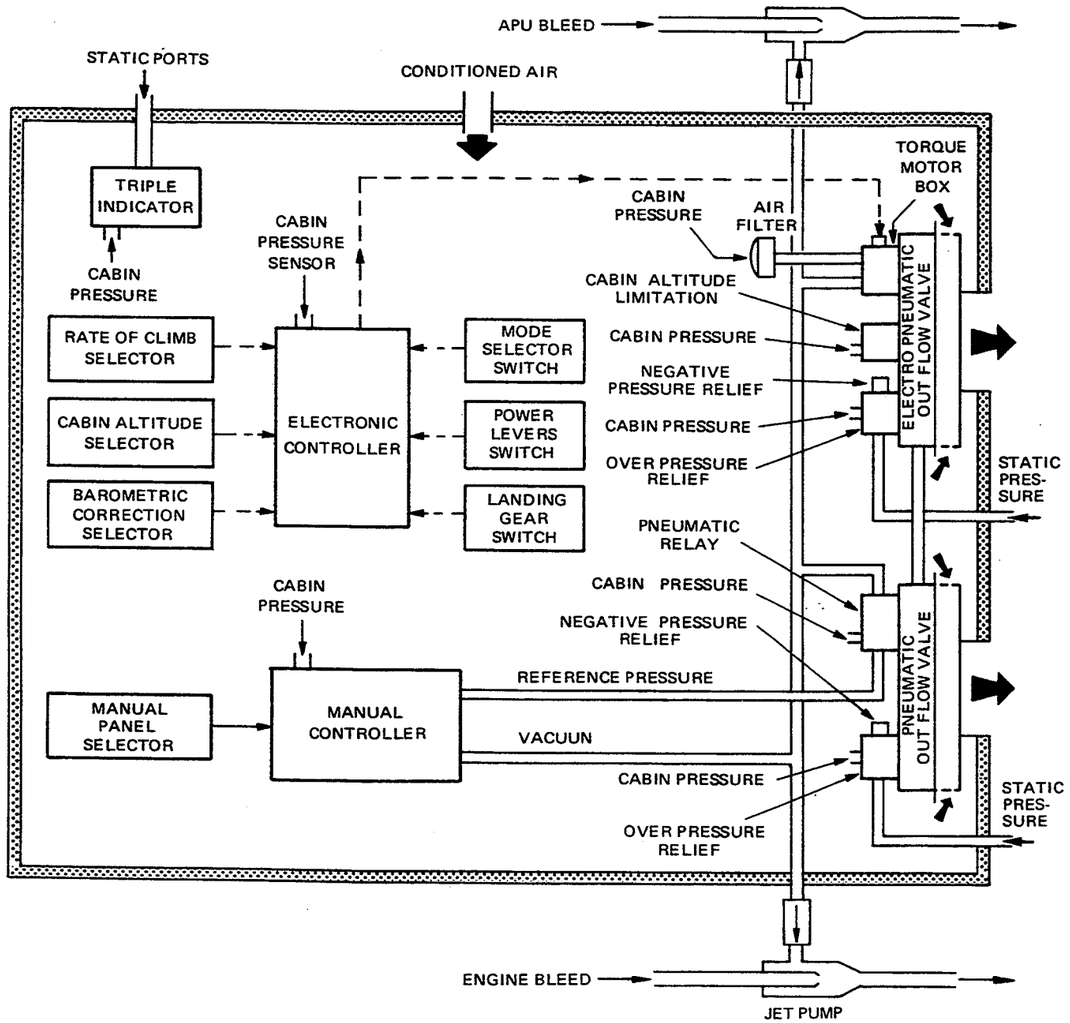
The manual pressurization system is controlled by the manual controller which senses cabin pressure and the manual controller selector position that delivers vacuum or reference pressure to open or close the pneumatic outflow valve. When the manual system is in operation, the electropneumatic outflow valve is closed and the cabin outlet flow is controlled only by the pneumatic outflow valve.

An independent triple indicator is provided by the pressurization system to indicate cabin altitude, cabin rate of climb, and differential pressure.

A cabin altitude switch turns on the red CABIN ALT light in the multiple alarm panel, if the cabin altitude exceeds 10000 ft.

Each outflow valve ensures overpressure relief to a maximum positive set differential pressure of 7.2 ± 0.1 psi.

Also, negative pressure relief is ensured by each outflow valve, to the negative set differential pressure of – 0.30 psi.



PRESSURIZATION SCHEMATIC

MODE SELECTOR SWITCH

AUTO - Selects the automatic mode of operation (normal condition).
MAN - Selects the manual mode of operation.
DUMP - (Safety guard must be lifted). Selects cabin depressurization with cabin altitude limitation at 13000 ft ± 1500 ft. In this condition the cabin rate of climb is approximately 14400 ft/min.

CABIN CLIMB NEEDLE

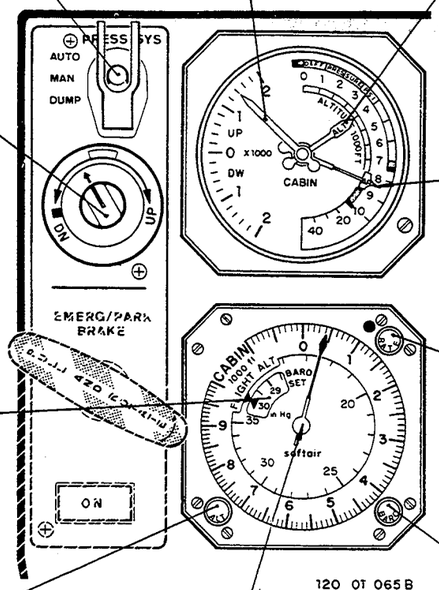
Indicates the cabin rate of climb independently of the mode of operation.

CABIN ALTITUDE NEEDLE

Indicates the cabin pressure altitude, independently of the mode of operation.

MANUAL CONTROLLER SELECTOR

Selects any cabin rate of change between — 1500 ft/min at DN position and + 2500 ft/min at clockwise stope, when the manual mode is operating.



CABIN ΔP NEEDLE

Indicates the differential pressure between cabin pressure and outside air, independently of the mode of operation.

RATE KNOB

Marked and notched position selects 650 ft/min for cabin climb and 450 ft/min for cabin descent. Other positions select cabin climb between:
+ 200 / — 150 ft/min and + 1450 / — 1000 ft/min.

BARO SET SCALE

Indicates the barometric setting.

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ALT KNOB

Selects cabin altitude between — 1500 ft and + 10000 ft or the airplane flight altitude.

ELECTRONIC CONTROLLER NEEDLE

Indicates the selected cabin altitude on the outer scale or the selected flight altitude on the inner scale.

BARO KNOB

Sets barometric correction between 29 and 31 inches of mercury.

PRESSURIZATION CONTROL PANEL (AFT PANEL)

AUTO MODE

In AUTO, the electronic controller is used to preset cabin or flight altitude, cabin rate of climb and barometric correction as follows:

- ALT knob — Selects cabin altitude between — 1500 ft and + 10000 ft on the outer scale or airplane flight altitude on the inner scale; indicated by the electronic controller needle maintaining a 7 psi cabin/ambient pressure differential.
  A ± 200 ft oscillation in cabin altitude is acceptable.
- RATE knob — Selects cabin rate of climb. This knob has a marked and notched position corresponding to 650 ft/min for climb and 450 ft/min for descent.

  Any value of cabin rate of change can, however, be selected between the following values:

  Climb: 200 ↔ 1450 ft/min

  Descent: — 150 ↔ —1000 ft/min
- BARO knob — Provides barometric correction between 29 and 31 inches of mercury.

With engines and electrical system switched off, the outflow valves are closed. In this condition, the mode selector switch is at AUTO position, the manual controller selector at DN position and the electronic controller with cabin altitude selected 0 ft, the RATE knob on marked position, as well as BARO knob set QNE. Also, the throttles at idle position and air conditioning valve closed.
When the engines are operating, vacuum is applied by the air jet pump to the system, but the outflow valves remain closed.
On ground, with power levers at idle position, the outflow valves are fully open when electrical power is switched on.
Opening the air conditioning valve causes a pressure drop between cabin and outside, due to the cabin airflow. After having opened the air conditioning valve, the BARO knob is set and flight altitude is selected by means of the ALT knob.
For take-off, with the air conditioning operating, the electronic controller provides an automatic prepressurization by the full throttle position switch signal. The system controls a constant pressurization at cabin rate of climb of —450 ft/min to pressurize the cabin in order to avoid a cabin bump, due to the aerodynamic overpressure on the outflow valves, during the aircraft rotation for take-off.
If the aircraft takes off without cabin airflow, valves are closed during the automatic prepressurization phase to avoid that bump.
The following pneumatic safeties override the AUTO mode operation:

- Overpressure relief (7.2 psi)
- Negative pressure relief (—0.3 psi)
- Cabin altitude limitation (13000 ± 1500 ft)

RAPID DEPRESSURIZATION

Rapid depressurization is commanded by lifting the mode selector switch safety guard and positioning the switch at DUMP.
This function is achieved by the torque motor box of the electropneumatic outflow valve. A quick cabin depressurization is performed with cabin altitude limited to 13000 ft + 1500 ft.

MAN MODE

The MAN mode is only used in case of electrical supply failure or in case of AUTO mode failure. In case of the automatic system failure, the manual controller selector must be placed at 1 o'clock position prior to switching off the automatic system.
The manual controller selector is placed as a function of the desired cabin rate of change. The control features of the manual system permit to take-off with a failed normal system and to control cabin altitude during the flight, without increasing the crew work load. The crew should watch the triple indicator to monitor the system as desired.
The selection of any cabin rate of change is achieved between − 1500 ft/min (DN position of manual controller selector) and + 2500 ft/min (clockwise stop of the manual controller selector).
Rapid cabin depressurization (with + 2500 ft/min maximum rate of climb) is provided by the manual controller selector to the clockwise stop position (UP).
The following pneumatic safeties override the MAN mode operation:

- Overpressure relief (7.2 psi)
- Negative pressure relief (−0.3 psi)

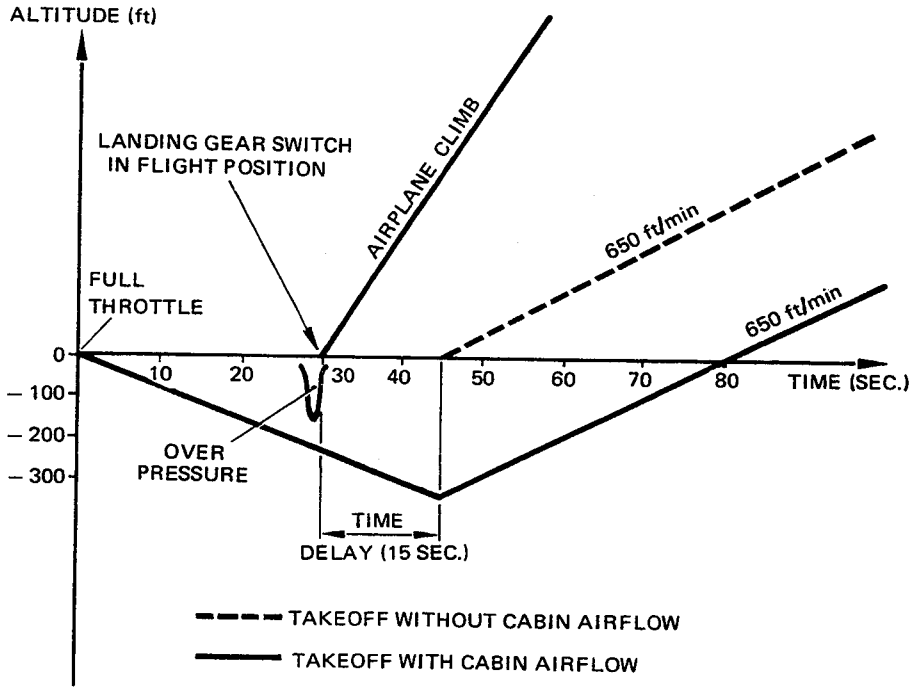
AUTOMATIC PREPRESSURIZATION

DURING TAKE-OFF

The landing gear switch signal for UP position provides a 15-second time delay to the electronic controller, at the end of which the automatic prepressurization will stop, then allowing the cabin rate of climb to be controlled at 650 ft/min up to the cabin level selected before take-off.
When cabin altitude is equal to the selected cabin altitude (cruise), the system controls a cabin rate of change equal to zero.

DURING DESCENT

Cabin altitude must be adjusted to 300 ft below the landing field elevation by the ALT knob and the corrected landing field pressure (QNH) set by the BARO knob. The system then controls a cabin rate of climb at −450 ft/min.



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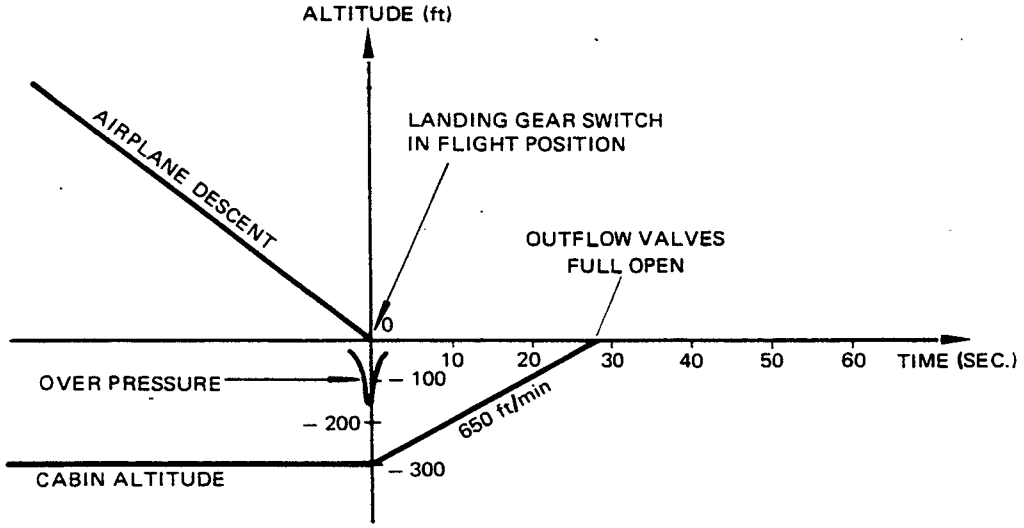
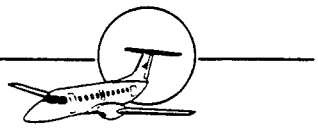
AUTOMATIC PRESSURIZATION DURING TAKEOFF

AUTOMATIC DEPRESSURIZATION AFTER LANDING

For landing, the power levers are not in the full power position and the landing gear is in the down position. These two conditions lead the system to control the automatic depressurization at a cabin rate of climb of 650 ft/min.
The outflow valves are fully open when cabin altitude is equal to the outside altitude.



AUTOMATIC DEPRESSURIZATION AFTER TOUCH DOWN



ELECTRONIC BAY VENTILATION SYSTEM

Most of the avionics are installed in the electronic bay located in the nose section of the airplane. In order to keep the compartment temperature within operational limits, the airplane is provided with an automatic ventilation system.

On airplanes Pre-Mod. SB 120-053-0011, the electronic bay ventilation system comprised of two NACA air inlets and their relevant shutoff valves, and six fans (two for air circulation and four for exhaustion). The system operates as follows: as soon as the DC buses 1 and 3 are energized, all fans are turned on. The two shutoff valves are commandes to open on ground only. During flight, the valves are closed in order to avoid cold air from entering into the electronic compartment, which would cause water condensation. Should a failure occur and at least one valve remains open in flight or closed on ground the ELEC BAY VALVE FAIL caution light the multiple alarm panel will illuminate.

On airplanes Post-Mod. SB 120-053-0011 or S/N 120.021 and on, the system is comprised of two NACA air inlets provided with water separators and shutoff valves, four fans (two for air circulation and two for exhaustion), four control thermostats and two overtemperature sensors. Whenever the DC buses 1 and 3 are energized, the circulation fans are turned on. When the electronic bay internal temperature exceeds 25°C (77°F), the control thermostats open the shutoff valves and turn the exhaustion fans on. As soon as the temperature drops below 20°C (68°F), the shutoff valves are closed and the exhaustion fans are turned off. Should an overtemperature occur (70°C/158°F), the ELEC BAY OVERTEMP caution light in the multiple alarm panel will illuminate.