



## 1. GENERAL.

Pneumatic power is used to operate the following aircraft systems:

- Air conditioning;
- Pressurization;
- Boot de-icing.

Engines alternately supply high and low pressure bleed air to the pneumatic system. Low pressure bleed air is normally supplied. High pressure bleed air is automatically supplied whenever the low pressure bleed is insufficient to maintain pneumatic pressure.

A precooler in each nacelle lowers the high pressure bleed air temperature to a suitable level before the air is ducted into a pneumatic manifold. A manifold connects the two engine bleed systems. A cross valve in the manifold makes it possible to interconnect the two bleed systems. The valve may only be open on the ground.

## 2. MAIN COMPONENTS AND SUBSYSTEMS.

### 2. 1. Engine bleed air.

Low pressure (LP) air is bled off the engine at a point behind the 5th compressor stage. A check valve prevents reverse flow into the engine.

High pressure (HP) air is bled from a point behind the radial compressor (6th compressor stage) and has about three times greater pressure than the low pressure air. The HP air is only supplied if the gas generator speed drops below approximately 80 percent Ng.

Right engine operating in propeller brake mode can supply sufficient bleed air to power the two air conditioning packs by opening the XVALVE. In flight, however, the XVALVE shall be closed.

### 2. 2. Precooler.

The precooler, or heat exchanger, is mainly used to lower the temperature of the high pressure bleed air. A small section of the unit is also used for cooling the air to the boot de-icing system.

Air is used as the cooling medium. In flight ram air is taken from a scoop on the engine nacelle. On the

ground, controlled by the WOW switch, this airflow is augmented by a jet pump. The jet pump creates an underpressure behind the precooler which in turn sucks air through the cooler.

### 2. 3. High Pressure valve.

The HP valve is controlled by a 3-position HP VALVE switch on the AIR COND panel. With the switch in AUTO the valve opens below an Ng of approximately 80 percent (76 psi bleed pressure) and closes when Ng exceeds this value. It also closes under the following conditions:

- If the bleed air temperature, after the precooler, exceeds 288°C (550°F);
- If the fire handle is pulled,
- If the HP VALVE switch is set to OFF

In each case, when the triggering condition has ceased to exist, the valve can be reopened by moving the HP VALVE switch to RESET then AUTO.

Should a HP valve fail to close after a "close" signal, HP HIGH light in the AIR COND panel will come on together with AIRCOND master caution.

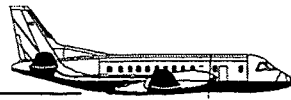
The valve is pneumatically actuated and requires a bleed pressure of min. 10 psi for operation. In case of loss of electrical control power the valve fails closed.

### 2. 4. Bleed valve.

The bleed valve is controlled by a 3-position BLD VALVE switch on the AIR COND panel. With the switch in AUTO the valve automatically regulates pneumatic air pressure to the manifold as a function of altitude.

The valve closes under the following conditions:

- If the bleed air temperature exceeds 288°C (550°F);
- If the fire handle is pulled,
- If the regulated pressure exceeds 43,5 psi,
- If the air conditioning pack (ACP) compressor discharge temperature exceeds 225° (440°F);
- If the distribution duct temperature exceeds 82°C (180°F);
- If the BLD VALVE switch is set to OFF.



In each case when the triggering condition has ceased to exist, the valve can be reopened by moving the BLD VALVE switch to RESET then AUTO.

As a confirmation of a closed valve, BLD CLOSED light in the AIR COND panel will come on together with AIRCOND master caution.

Should the valve fail to close after a close signal the BLD FAULT light in the AIR COND panel will come on together with AIRCOND master caution. The BLD FAULT light will also come on if the bleed air temperature is too high or the regulated pressure exceeds its allowable value.

When the temperature or pressure goes down after the valve has closed the BLD FAULT light will go out.

The valve is pneumatically actuated and requires a bleed pressure of min. 10 psi for operation. In case of loss of electrical control power the valve fails open.

### 2. 5. Cross manifold and Cross valve.

The cross manifold connects the left and right engine bleed systems.

A cross valve in the manifold makes it possible to interconnect the two bleed systems. The valve may only be opened on the ground. The valve is controlled by a 2-position switch on the AIR COND panel. To open the valve requires one BLD VALVE to be closed. If, when the X VALVE is open, both BLD VALVES are set in AUTO the X VALVE will automatically close.

As a confirmation of an opened valve X VALVE OPEN light in the AIR COND panel will come on.

The valve is pneumatically actuated and requires a bleed pressure of min. 10 psi for operation. In case of loss of electrical control power the valve fails closed.

### 2. 6. Tailcompartment air shut-off valve. (Mod No. 1991)

The shut-off valve is fully automated in its function. There is no control switch nor an indication in the cockpit.

The valve is normally open and closes, thereby stopping the air supply to the tail compartment, under the following conditions:

- when a Bleed valve is closed; (It closes under any of the Bleed valve closing conditions, see item 2.4.)
- after an engine failure. (It closes when one DC generator goes off line, power is lost to the UTILITY BUS).

The valve is pneumatically actuated and requires a bleed pressure of about 2 psi for operation. In case of loss of electrical control power the valve fails closed.

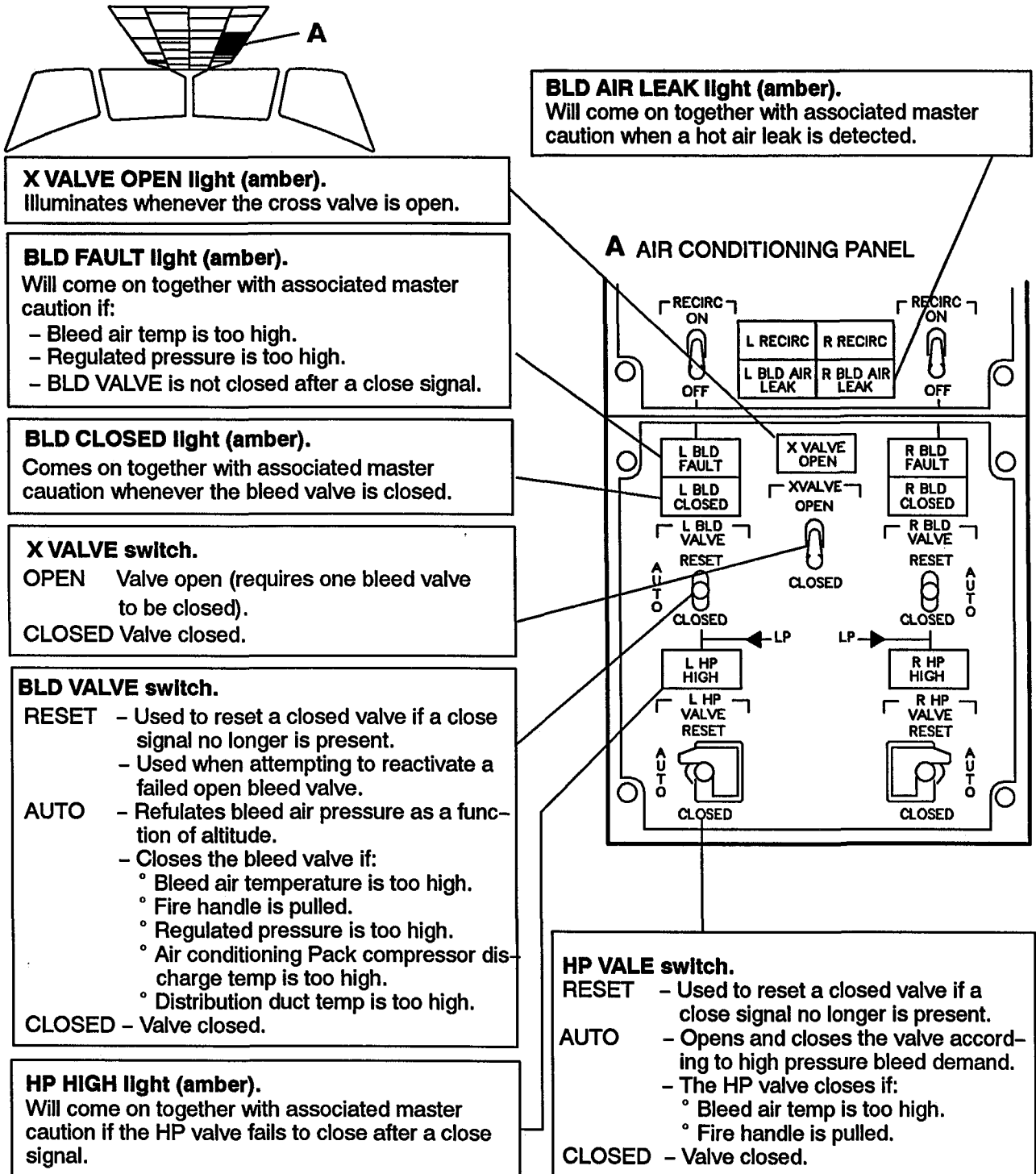
### 2. 7. Hot air leak detection.

A temperature variable resistance continuous loop hot air leak detector system is installed. The loop is routed alongside the bleed ducting between the engine nacelle and the cross valve on each side of the aircraft. The loop terminates at a control unit. If the control unit senses a temperature of 205° (400°F), the affected side's BLD AIR LEAK light in the AIR COND panel will come on together with AIRCOND master caution.



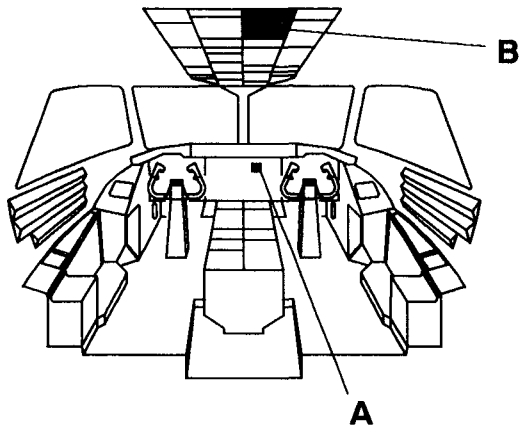


### 3. CONTROLS AND INDICATORS.

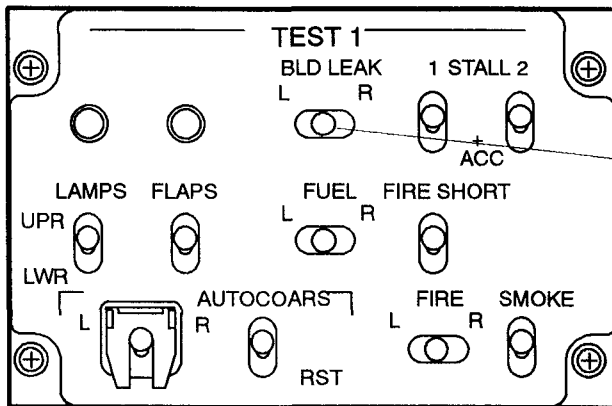


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FIG. 2. Pneumatic system – controls and indicators.

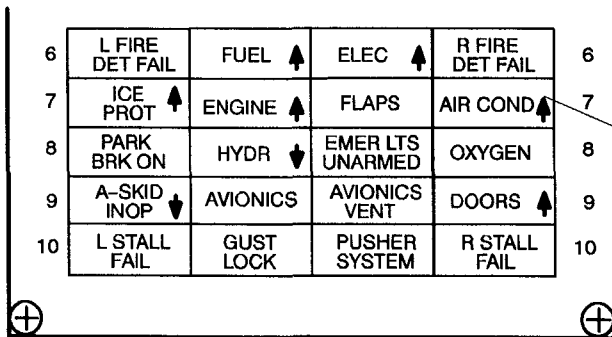


**B TEST 1 PANEL**



**BLD LEAK test switch.**  
L/R Tests continuity of the respective side's bleed leak detection loop.  
Center Off.

**B CENTRAL WARNING PANEL**



**AIRCOND light (amber).**  
The AIRCOND light will come on flashing together with associated master caution for:

- Bleed air leak.
- Bled air temp is too high.
- BLD VALVE is closed.
- BLD VALVE is not closed after a close signal.
- HP VALVE is not closed after a close signal.

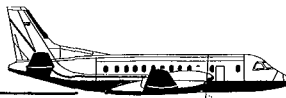
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FIG. 3. Pneumatic system – controls and indicators.



#### 4. ELECTRICAL POWER SUPPLY.

High press control right (MANUAL) .....	R MAIN BUS	P-19 R HP MAN CTL
High press control right (AUTO) .....	R MAIN BUS	P-18 R HP AUTO
High press control left (MANUAL) .....	L MAIN BUS	H-19 L HP MAN CTL
High press control left (AUTO) .....	L MAIN BUS	H-18 L HP AUTO
Bleed valve control left .....	R BAT BUS	P-17 L BLD VALVE
Bleed valve control right .....	L BAT BUS	H-17 R BLD VALVE
Cross valve control .....	R MAIN BUS	P-16 XVALVE
Tailcompartment air shut-off valve .....	UTILITY BUS	P-20 TAIL COMPT AIR (WITH MOD NO 1991 INSTALLED)
Bleed air leak ind. right .....	R MAIN BUS	P-13 R BLD AIR LEAK
Bleed air leak ind. left .....	L MAIN BUS	H-13 L BLD AIR LEAK

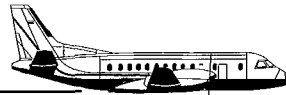


**1. LIMITATIONS.**

Not applicable.

**2. NORMAL OPERATION.**

CONDITIONS	NORMAL PROCEDURES
<p><b>2. 1. OPERATION OF PNEUMATIC SYSTEM.</b></p>	<p><b>HP bleed during ground operation.</b></p> <ul style="list-style-type: none"> <li>– HP bleed may be necessary to check the BOOT DE-ICE system or for cabin comfort in hot or cold climate. However, if there is no need, keep the HP VALVE switches in CLOSED position. This is due to a significant ITT raise, especially with PL's at GND IDLE.</li> </ul> <p>AVOID TO USE HP BLEED AT GND IDLE.</p> <p><b>Before engine start.</b></p> <ol style="list-style-type: none"> <li>1. X VALVE switch ..... CLOSED</li> <li>2. BLD VALVE switches ..... RESET/AUTO</li> <li>3. HP VALVE switches ..... CLOSED</li> </ol> <p><b>After engine start.</b></p> <ol style="list-style-type: none"> <li>4. BLD VALVE switches ..... AS REQUIRED</li> <li>5. HP VALVE switches ..... AS REQUIRED</li> </ol> <p><b>Line up.</b></p> <ol style="list-style-type: none"> <li>6. BLD VALVE switches ..... AS REQUIRED</li> <li>– Performance is affected with bleed valves open.</li> <li>7. HP VALVE switches ..... AS REQUIRED</li> <li>– With the switches in AUTO the HP valves will close automatically when PL's are advanced to takeoff power.</li> </ol> <p><b>Climb.</b></p> <ol style="list-style-type: none"> <li>8. BLD VALVE switches ..... AUTO</li> <li>– If taking off with the BLD VALVE's off, wait a few seconds between switching on the first and second pack to reduce the pressure bump.</li> </ol>



CONDITIONS	NORMAL PROCEDURES
	<p><b>Approach.</b></p> <p>9. HP VALVE switches ..... AS REQUIRED</p> <ul style="list-style-type: none"> <li>– In hot conditions set HP VALVE's to CLOSED to avoid high transient ITT during reverse thrust application after touch down.</li> <li>– In icing conditions leave HP VALVE's in AUTO. HP bleed may be required for operation of the boot de-icer system.</li> </ul> <p><b>On ground.</b></p> <p>10. HP VALVE switches ..... AS REQUIRED</p> <p><b>Parking.</b></p> <p>11. HP VALVE switches ..... CLOSED</p> <p>12. BLD VALVE switches ..... CLOSED</p> <ul style="list-style-type: none"> <li>– Set the switches to CLOSED before engine shut down.</li> </ul>