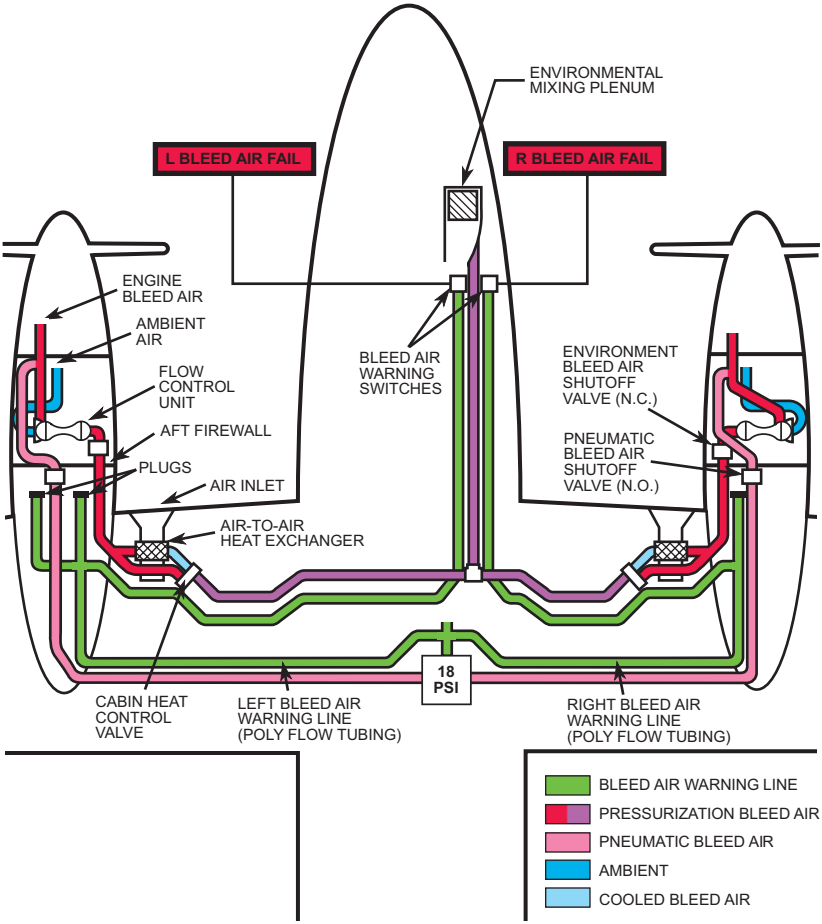
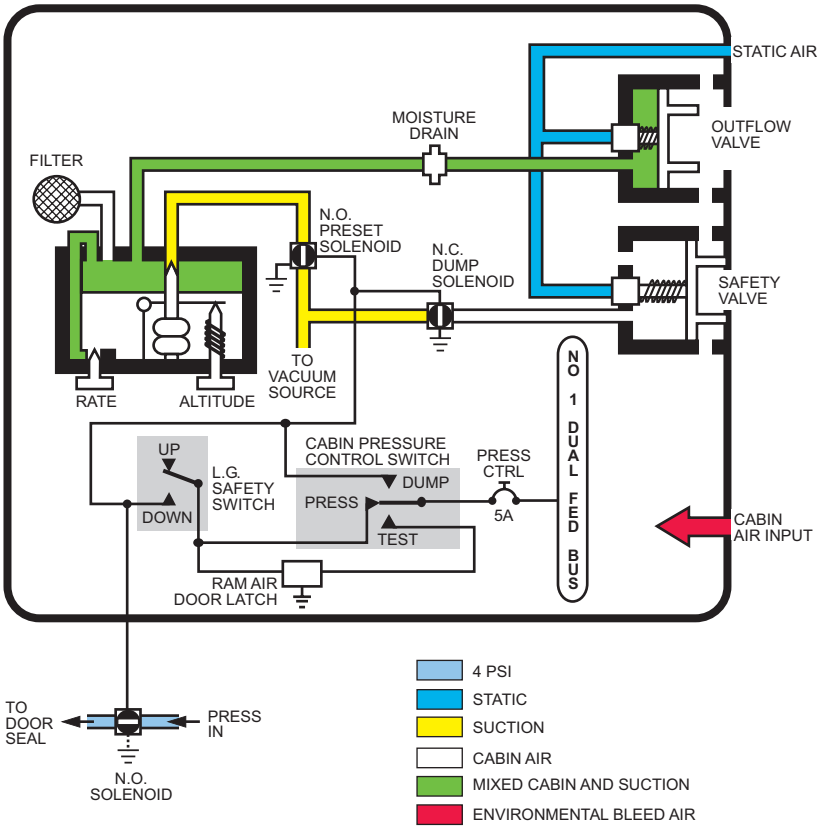
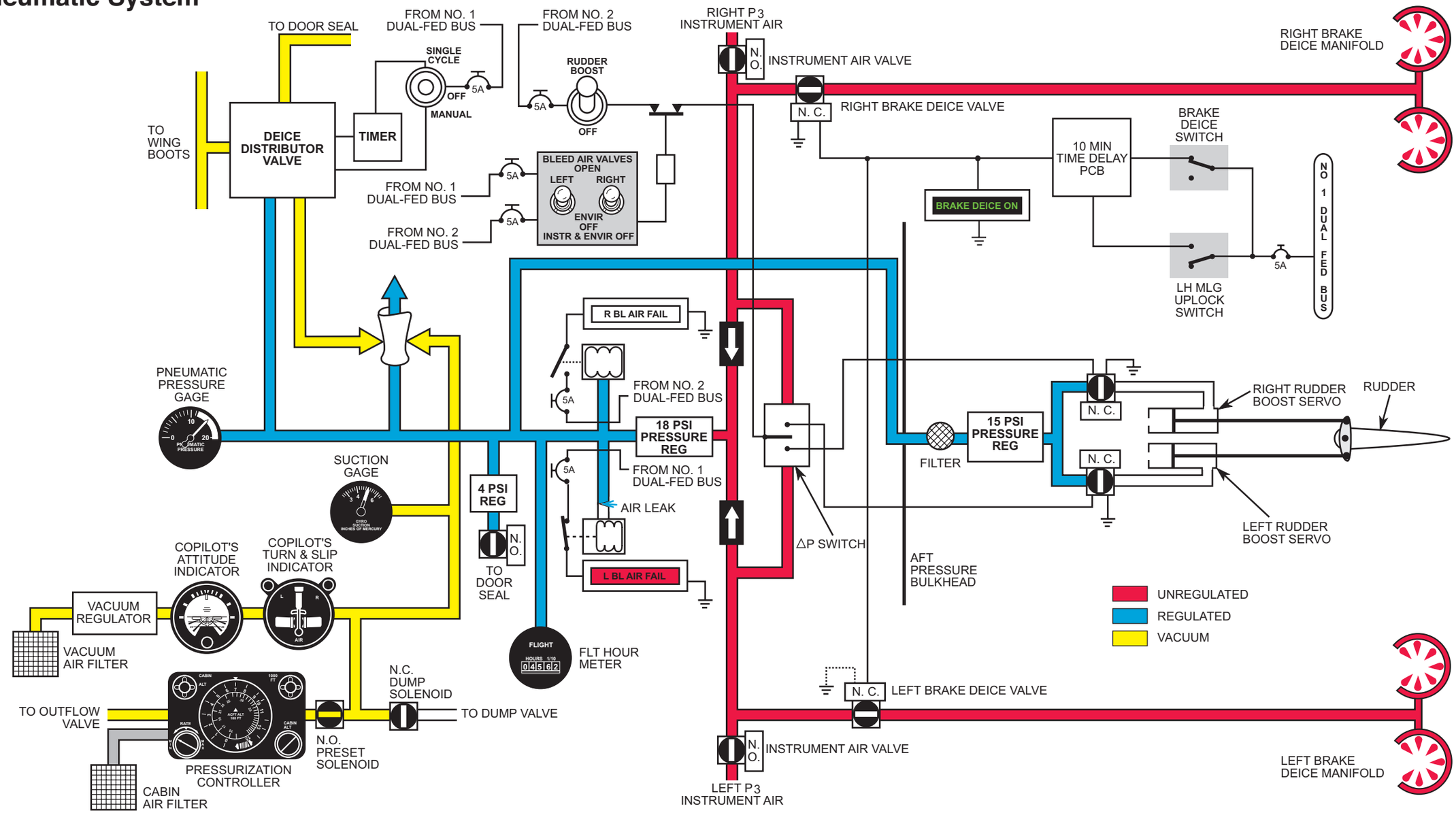
Bleed Air Warning System



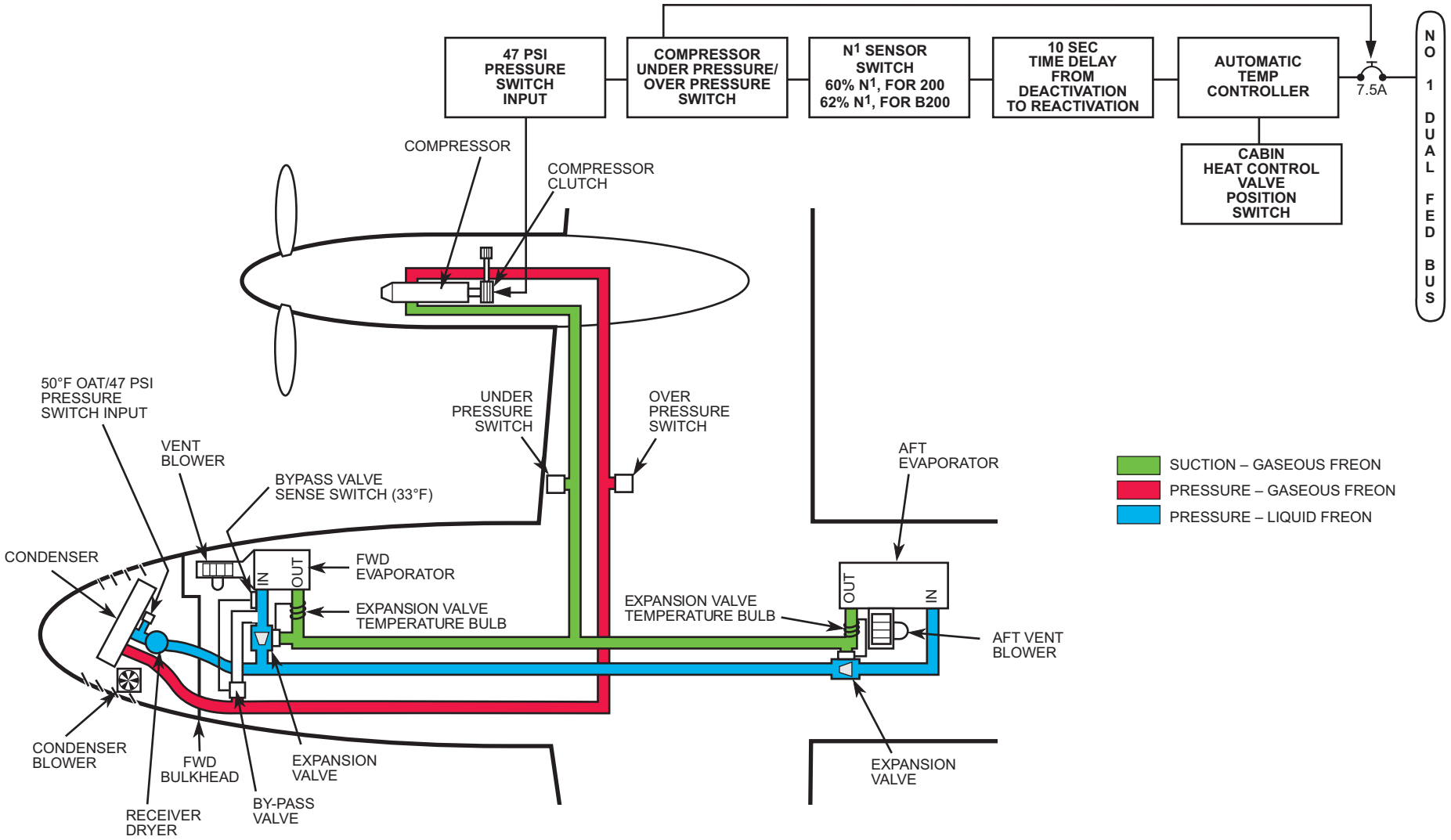
Pressurization System



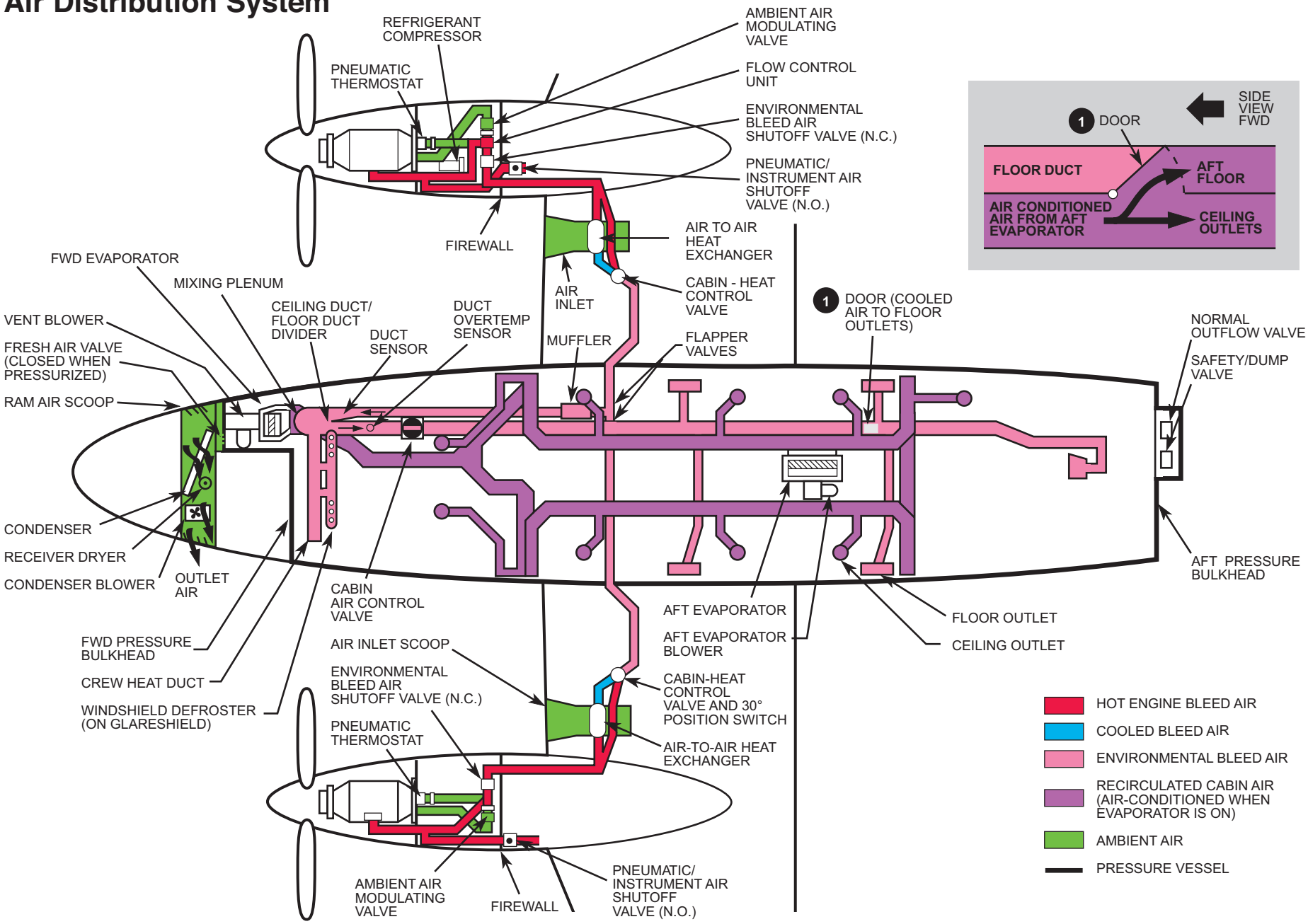
Pneumatic System



Air Conditioning System

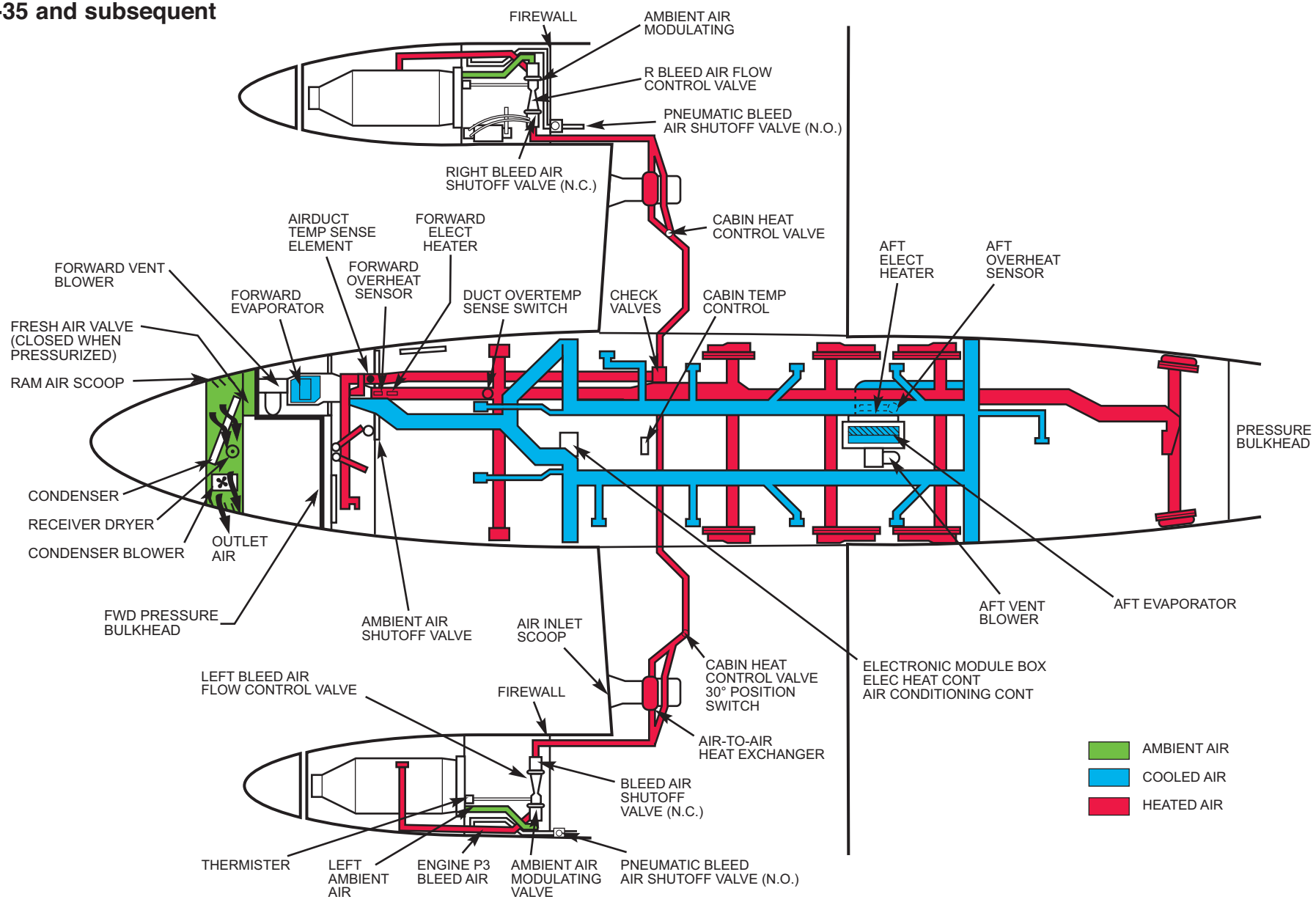


Air Distribution System



Air Distribution System

BB-1439, 1444 and subsequent; BT-35 and subsequent



Environmental Systems

This environmental section includes the following systems:

- bleed air supply (pneumatic system)
- heating system
- air conditioning system
- pressurization system

Bleed Air Supply

The bleed air system extracts bleed air from the engine's compressor section (P_3) and transfers it to various aircraft systems. The pneumatic side of the supply is for surface deice, rudder boost, brake deice, and door seal. In addition, a venturi-ejector in the system creates a vacuum source for the air-driven gyros, pressurization control, and deflation of the deice boots. The environmental supply is for air conditioning and pressurization.

A pair of BLEED AIR VALVES switches controls bleed air supply. With the switches in the OPEN position, both the ENVIR and INSTR shutoff valves open to supply engine bleed air. Placing the switches in ENVIR OFF stops bleed air flow to the environmental system (air conditioning and pressurization) by closing the environmental shutoff valve. Placing the switches in INSTR & ENVIR OFF stops bleed air flow completely by closing both environmental and pneumatic shutoff valves for the selected side. The ENVIR valve is a normally closed valve while the INSTR valve is a normally open valve.

The pneumatic instrument bleed air flows from the shutoff valve to a tee-fitting where the left and right engine bleed air supplies combine. Check valves in each supply line prevent reverse bleed air flow when an engine is not operating. The combined bleed air supply then flows through a 18 PSI pressure regulator. Bleed air from the 18 PSI regulator produces the vacuum.

The environmental system bleed air supply flows through a flow control unit (FCU). Based on atmospheric pressure and temperature, the FCU maintains the required bleed air flow by mixing bleed and ambient air in an ejector.

On **BB-2 to 1179; BL-1 to 69**, with weight-on-wheels, the ambient air modulating valve closes so that only bleed air flows through the FCU to ensure rapid cabin warmup during low ambient temperature operating conditions.

Once airborne, the modulating valve opens to admit ambient air into the FCU. To prevent a pressure surge caused by simultaneously opening of the left and right modulating valves, a time delay circuit delays right valve opening for six seconds. As ambient temperature decreases, the flow control valve gradually closes the modulating valve until at approximately -30°F ambient air flow ceases.

On **BB-1180 and subsequent; BL-70 and subsequent; earlier aircraft with Kit 101-5065-1 S**, placing the BLEED AIR SWITCHES in OPEN energizes the flow control unit's (FCU) electronic controller. The controller closes the bleed air modulating valve and opens the firewall shutoff valve so bleed air flows through the FCU. After the modulating valve closes completely, it slowly cycles open to provide the desired bleed air flow. With weight-on-wheels the ambient air modulating valve remains closed and only bleed air flows through the FCU.

Once airborne, the ambient air modulating valve opens to admit ambient air into the FCU. As aircraft altitude increases or ambient air temperature decreases, the controller drives the ambient air modulating valve toward the closed position until at approximately -30°F, the valve closes completely. The FCU's bleed air bypass valve opens to increase bleed air flow.

Heating and Air Conditioning

The air conditioning system provides conditioned air to the cabin and cockpit. In addition, the right engine drives a freon system for cooling. During unpressurized flight, a ram air scoop provides fresh air ventilation.

At maximum takeoff power, bleed air from the engine compressor section flows to the environmental flow control unit (FCU) at approximately 650°F and 120 PSI. The FCU directs the regulated and mixed bleed air to the cabin-heat control valve, which determines the amount of air that passes through the air-to-air heat exchanger. As the valve closes, more of the air mass passes through the exchanger to decrease the temperature of the air directed to the cabin.

With the CABIN TEMP MODE selector in AUTO, the heating and air conditioning systems operate automatically as the CABIN TEMP knob modulates the cabin heat control valve to maintain the proper temperature.. A temperature-sensing unit in the cabin along with the requested setting initiates a heat or cool command to the temperature controller. A duct anticipator temperature probe provides for constant temperature control.

Selecting a warmer cabin (toward INCR) signals the automatic temperature control to modulate the cabin heat control valves one at a time to allow bleed air to bypass the heat exchangers. Selecting a cooler cabin (toward DECR) signals the cabin heat control valves to pass bleed air through the air-to-air heat exchanger. If necessary, the freon air conditioning system is activated to reach the desired temperature.

When the evaporative-type freon air conditioning system is necessary, high pressure high temperature freon gas flows to a condenser coil where it is cooled to a liquid. The condensed liquid then flows through a receiver/dryer before being metered to flow through an evaporator to be cooled.

With the CABIN TEMP MODE selector in MAN HEAT or MAN COOL , manual control of the cabin temperature can be made with the MANUAL TEMP switch. Momentarily holding the MANUAL TEMP spring-loaded center return switch to INCR (hot) or DECR (cold) modulates the cabin heat control valves. Only one valve moves at a time. Allow approximately 30 seconds per valve (one minute total) for the valves to move to the full heat or full cold position. Cool air comes out of the overheat vents while the majority of warm air comes out of the floor vents. MAN COOL directs the air conditioner system to operate if the right engine speed is above 60% (**200**) to 62% (**B200**) N_1.

High and low pressure switches protect the air conditioning system. If a refrigerant over or under pressure condition occurs, the appropriate pressure switch actuates. Switch actuation that cuts power to the compressor clutch. The system also has temperature protection to prevent evaporator freezing. If evaporator temperature falls to approximately 33°F, the thermal switch actuates a bypass valve that routes hot refrigerant past the system's expansion valve.

Supplemental Heating

Optional radiant heating panels provide increased heating. The RADIANT HEAT switch controls the radiant heat panels usually located above the cabin windows and on the cargo door. Depending on the installation, thermal fuses or thermostats provide overheat protection for the panels.

On **aircraft BB-1439, 1444 and subsequent; BL-139 and subsequent**, an optional electric heating system warms the cabin during ground operations. With weight-on-wheels, place the CABIN TEMP MODE in MAN HEAT and the ELEC HEAT and AFT BLOWER switches on. When the electric heat system is turned on, the ELEC HEAT ON annunciator must extinguish before turning the AFT BLOWER switch off. If duct temperature reaches 118°F (48°C), overheat sensors shut the system down by de-energizing heater power relays and control switch.

Pressurization

The pressurization system controls cabin altitude, climb rate, and descent rate by operating outflow valves that vent conditioned air to the atmosphere.

The pressurization controller regulates the outflow valve opening to maintain the desired cabin rate-of-change during climb and descent and cabin pressure altitude during cruise. If a negative cabin pressure differential occurs, a negative pressure relief diaphragm opens to allow ambient air inflow into the cabin. This prevents cabin altitude being lower than aircraft altitude.

Aircraft with PT6-41 engines have a 6.1 PSI maximum cabin pressure differential while aircraft with PT6A-42 engines have a 6.6 PSI maximum cabin pressure differential. The pressurization system maintains approximately a 10,000 ft cabin altitude at 31,000 (PT6A-41) or 35,000 ft pressure altitude (PT6A-42). If the system malfunctions and cabin pressure differential exceeds the system's maximum value, a safety valve dumps excess pressure to atmosphere. Place the CABIN PRESS switch in DUMP to releases cabin pressure regardless of weight-on-wheels status.

Placing the CABIN PRESS switch in TEST bypassing the landing gear squat switch to test the system, which enables the aircraft to be pressurized on the ground.

Environmental Systems

Air Conditioning/Heating System

Power Source	Engine bleed air – heating Right engine – Freon system
Distribution	Engine compressor bleed air Environmental control unit Cabin Cockpit
Control	Switches BLEED AIR VALVES MANUAL TEMP VENT BLOWER AFT BLOWER RADIANT HEAT (prior to BB 1439) ELEC HEAT (BB 1439 and subsequent) CABIN TEMP MODE selector CABIN TEMP control selector Right engine RPM above 60%
Monitor	CABIN AIR gage Thermostat AIR CND_1 LOW annunciator
Protection	High and low pressure switches N_1 speed switch 47 PSI pressure switch

Bleed Air System

Power Source	Bleed air (each engine – station P_3)
Distribution	Prior to 18 PSI regulator Brake deice Rudder boost P switch After 18 PSI regulator Bleed air warning system Rudder boost servos Flight hour meter Door seal (if installed) Vacuum Deice boots
Control	BLEED AIR VALVE switches
Monitor	PNEUMATIC PRESSURE gage GYRO SUCTION gage
Protection	BL AIR FAIL annunciators Bleed air shutoff valves Relief valves Check valves

Pressurization System

Power Source	Bleed air (each engine – station P_3)
Distribution	Flow control unit Air-to-air heat exchangers Cockpit Cabin
Control	Switches BLEED AIR VALVES CABIN PRESS Pressurization controller
Monitor	Cabin altitude and differential pressure gage Cabin VSI
Protection	BL AIR FAIL annunciators Bleed air shutoff valves CABIN ALT annunciator Squat switch Outflow/safety valves (negative/maximum differential relief) Passenger oxygen mask auto deployment system