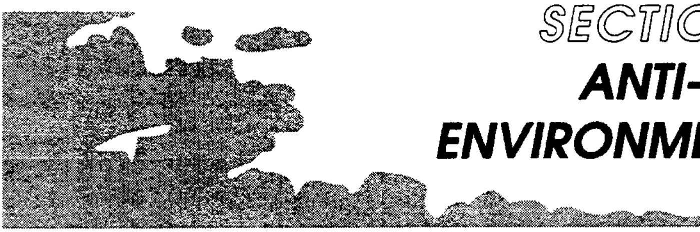

SECTION VI
ANTI-ICE & ENVIRONMENTAL

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SECTION VI
ANTI-ICE & ENVIRONMENTAL

ANTI-ICE SYSTEMS

Aircraft anti-ice protection is provided through the use of electrically heated anti-ice systems, engine bleed air heated anti-ice systems, and an alcohol anti-ice system. Electrically heated systems include the pitot-static probes, total air temperature probe, engine inlet air temperature and pressure sensors, stall warning vanes, and horizontal stabilizer leading edge. Electrically heated windshields provide windshield defogging. Engine bleed air is utilized to heat the wing leading edge, windshield, and nacelle inlets. The alcohol system is installed to provide anti-icing for the nose radome and back-up anti-ice protection for the pilot's windshield in event of normal anti-icing system malfunction.

ICE DETECT LIGHTS

Two ice detect lights are installed on the forward glareshield to indicate ice or moisture formation on the windshield during night operations. These lights are illuminated whenever the BATTERY switches are On. When particles of ice or moisture form, light refraction results in the appearance of two red areas, approximately 1-1/2 inches (38 mm) in diameter, on the windshield. The light on the pilot's side is located in a position covered by the windshield anti-ice airstream. The copilot's light is positioned outside the anti-ice airstream; therefore, the copilot's windshield must be monitored whenever windshield anti-ice system is in operation. The red areas indicate ice encounters when the OAT is below freezing and moisture encounters when the OAT is above freezing. The lights are supplied 28 VDC through the 2-amp L and R ICE DET circuit breakers on the pilot's and copilot's circuit breaker panels respectively.

WING INSPECTION LIGHT

The wing inspection light, located on the right forward fuselage, may be used to visually inspect the right wing leading edge for ice accumulation during night operations. The light is illuminated by depressing the WING INSP LIGHT momentary button on the copilot's dimmer panel. The light illuminates a black dot on the outboard wing leading edge to enhance visual detection of ice accumulation. Power is supplied through the 5-amp WING INSP LT circuit breaker on the copilot's circuit breaker panel.

ENGINE AND NACELLE INLET ANTI-ICE

The engine and nacelle inlet anti-ice system provides anti-ice protection for the nacelle inlets and the engine inlet air temperature and pressure sensor masts. The engine inlets are anti-iced by directing engine bleed air through diffuser tubes to the inner surfaces of the nacelle inlet lip. The engine air temperature (T_{T2}) and pressure (P_{T2}) sensor masts are anti-iced by electrical heating elements installed in the base of the masts. Each engine anti-ice system is independently operated and consists of a P_{T2}/T_{T2} mast heating element, a nacelle anti-ice control valve, a pressure switch, a control switch, an amber NAC HT light, and associated aircraft wiring and bleed-air plumbing. Control circuits are powered by 28 VDC supplied through the 7.5-amp L and R NAC HT circuit breakers on the pilot's and copilot's circuit breaker panels respectively.

NAC HEAT SWITCHES

The left and right engine and nacelle inlet anti-ice systems are independently controlled through the NAC HEAT switches in the ANTI-ICE group on the center switch panel. Each NAC HEAT switch has two positions: On (L or R) and OFF. When a NAC HEAT switch is placed in the On (L or R) position, the associated P_{T2}/T_{T2} sensor element is energized, the associated solenoid-operated nacelle anti-ice control valve opens, and the green NAC HT ON annunciator will illuminate. Engine bleed air flows through the open valve to diffuser tubes which distribute the heated air on the inner surface of the nacelle inlet lip. Since the solenoid-operated control valve is energized closed, nacelle inlet anti-ice protection is operational in the event of an electrical system failure.

NAC HT ON LIGHT

The green NAC HT ON light, on the glareshield annunciator panel, provides the crew with visual indication that one or both nacelle heat systems are on. The NAC HT ON light will illuminate anytime a NAC HEAT Switch is in the On position.

L AND R NAC HT LIGHTS

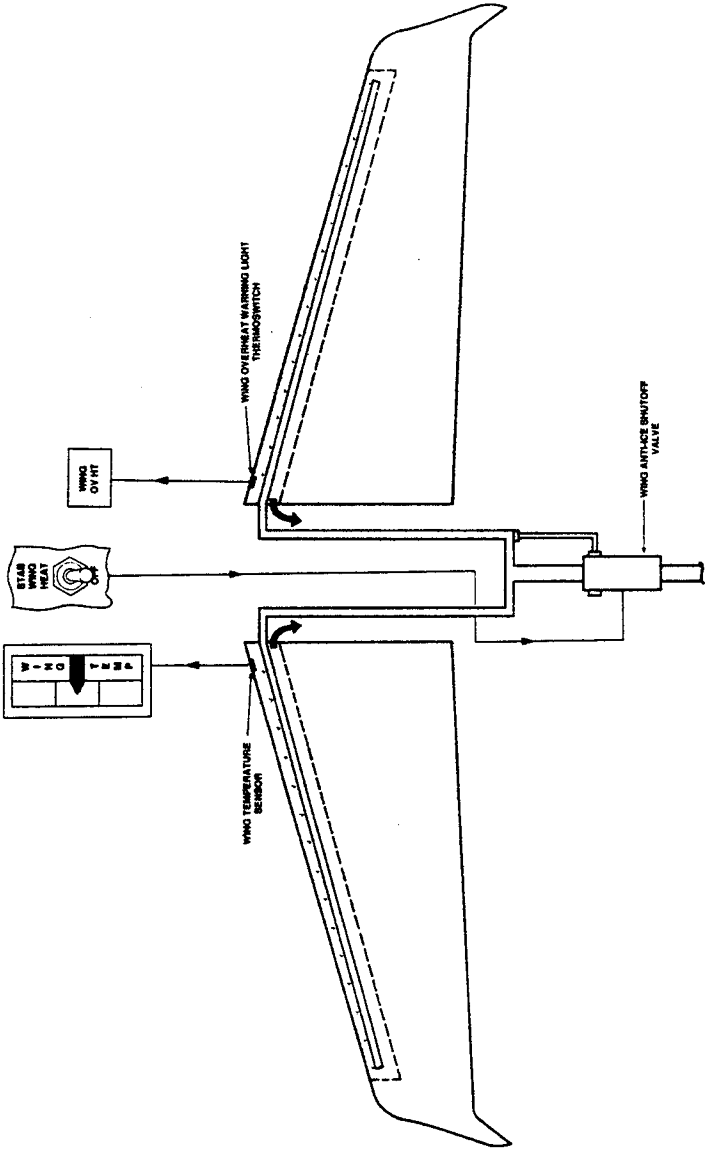
The amber L and R NAC HT lights on the glareshield annunciator panel provide the crew with visual indication of a nacelle inlet anti-ice system malfunction. The lights are operated by pressure switches in the associated nacelle inlet bleed air plumbing. Illumination of a NAC HT light when the associated NAC HEAT switch is in the On position, indicates that insufficient pressure is being applied to the engine anti-ice system due to a malfunction of a nacelle anti-ice control valve. Illumination of a NAC HT light when the associated NAC HEAT switch is in the OFF position, indicates that bleed air pressure is being applied to the engine anti-ice system due to a malfunction of a nacelle anti-ice control valve.

WING ANTI-ICE

The wing anti-ice systems utilize engine bleed air directed through diffuser tubes in each wing leading edge. The heated air is distributed to the wing root and leading edge and then allowed to exit into the center wing/wheel well area. The system consists of wing diffuser tubes, an overheat warning light, a thermoswitch, a wing temperature sensor, an anti-ice shutoff valve, a wing temperature indicator, a system switch, and associated aircraft wiring. Electrical power for system operation is 28 VDC supplied through the 7.5-amp WING HT circuit breaker on the copilot's circuit breaker panel.

STAB WING HEAT SWITCH — WING HEAT FUNCTION

The wing anti-ice system is controlled through the STAB WING HEAT switch located in the ANTI-ICE group on the center switch panel. The switch has two positions: On (STAB WING HEAT) and OFF. When the STAB WING HEAT switch is set On, the anti-ice shutoff valve control solenoid will close allowing pressure to build within the valve reference chambers. The building pressure will open a valve in the bleed-air airstream and allow heated air to flow through the ducting into the wing diffuser tubes. In the event of an electrical system failure, the valve will shut off the bleed air flow and wing anti-ice protection will not be available.



WING ANTI-ICE SYSTEM
Figure 6-1

WING TEMP INDICATOR

The WING TEMP indicator, located in the ANTI-ICE group on the center switch panel, is installed to provide a visual indication of the wing leading edge temperature. The indicator receives input signals from the wing temperature sensor installed on the inner surface of the left wing leading edge. The indicator face is divided into three colored segments: blue, green, and red. If the indicator pointer is in the blue segment, wing leading edge temperature is below approximately 40°F (4°C). If the indicator pointer is in the blue segment and the STAB WING HEAT switch is On, a system malfunction is indicated. If the indicator pointer is in the green segment, wing leading edge temperature is above 40°F (4°C). If the indicator pointer is in the red segment, the wing leading edge is approaching an overheat condition and corrective action must be taken. The wing anti-ice system should be energized whenever flying through visible moisture and the WING TEMP indicator pointer is in the blue segment.

WING OV HT LIGHT

The red WING OV HT light, on the glareshield annunciator panel, will illuminate in the event that the wing leading edge heats to 215°F (102°C). The light is energized by the overheat warning light thermoswitch located on the inner surface of the right wing leading edge.

HORIZONTAL STABILIZER ANTI-ICE

The horizontal stabilizer anti-ice system utilizes sequenced electrical heating elements along the horizontal stabilizer leading edge. The system consists of an electrically heated blanket bonded to each half of the horizontal stabilizer leading edge, a sequence timer, a caution light, a system switch, and associated aircraft wiring. Control circuits operate on 28 VDC supplied through the 7.5-amp STAB HT circuit breaker on the copilot's circuit breaker panel. Electrical power for the heating elements is 28 VDC supplied through a 130-amp current limiter.

STAB WING HEAT SWITCH — STABILIZER HEAT FUNCTION

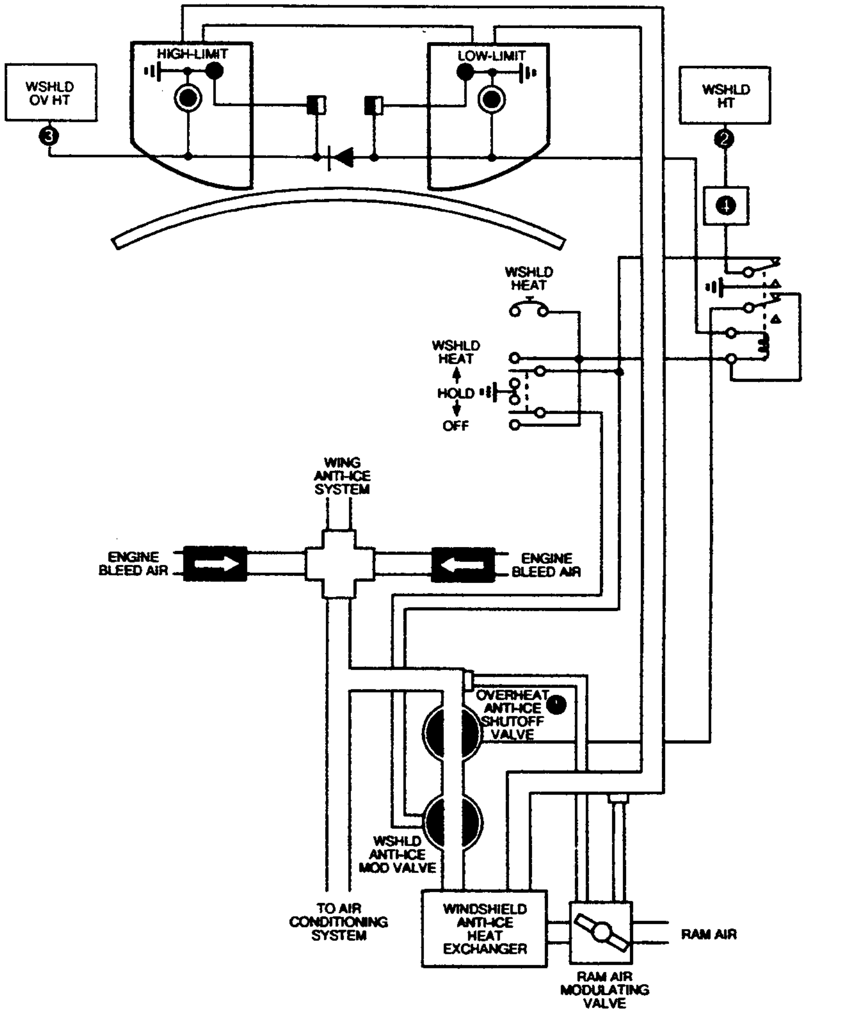
The horizontal stabilizer anti-ice system is controlled through the STAB WING HEAT switch on the center switch panel. The switch has two positions: On (STAB WING HEAT) and OFF. When the aircraft is in flight and the STAB WING HEAT switch is On, 28 VDC is supplied through the stab heat relay box to the sequence timer. The timer distributes intermittent electrical power to the individual heating elements in a forward-to-aft sequence of 15 seconds duration each. Approximately 3 minutes are required to complete a full cycle. The center, or parting elements, are supplied with continuous electrical power. During normal stabilizer heat operation, the aircraft DC AMPS readout will reflect a pulsating current drain of approximately 60-amps in 15 second cycles. At least one engine generator must be operating to energize the stab heat control circuits. The control circuits are routed through a start cutout relay and the right squat switch; therefore, the system is inoperative when the squat switch is in the ground mode and during engine start.

STAB HEAT LIGHT

The amber STAB HT light, located on the glareshield annunciator panel will illuminate whenever the STAB WING HEAT switch is On and the heating blanket parting elements are not receiving electrical power. During flight, illumination of the STAB HT light indicates system failure. During ground operation, the STAB HT light should illuminate whenever the STAB WING HEAT switch is ON.

WINDSHIELD ANTI-ICE

Primary windshield anti-icing is accomplished by directing conditioned engine bleed air through ducting and control valves to external outlet nozzles forward of the windshield. The windshield anti-ice system consists of an anti-ice overheat shutoff valve, a windshield anti-ice modulating valve, one low-limit (215°F [102°C]) and one high-limit (250°F [121°C]) thermoswitch for ground operations, one low-limit (250°F [121°C]) and one high-limit (270°F [132°C]) thermoswitch for flight operations, a green WSHLD HT light, a red WSHLD OV HT warning light, a ram air modulating valve, an anti-ice duct temperature sensor, an anti-ice heat exchanger, two outlet nozzle assemblies, a system control switch, and associated aircraft wiring and bleed air ducting. Electrical power to the control circuits is 28 VDC supplied through the 7.5-amp WSHLD HT circuit breaker on the pilot's circuit breaker panel.



- INFLIGHT TEMPERATURE LIMIT THERMOSWITCH
- GROUND TEMPERATURE LIMIT THERMOSWITCH
- SQUAT SWITCH RELAY (makes connection when aircraft is on the ground)

1. Overheat Anti-Ice Shutoff Valve is normally closed (must be energized open)
2. Electrical ground on this wire turns WSHLD HT light **on**
3. Electrical ground on this wire turns WSHLD OV HT light **on**
4. If input is power or open circuit, the output is an electrical ground

NOTE: This figure is intended to reflect the system logic and not necessarily all of the actual components used to accomplish that logic.

WINDSHIELD ANTI-ICE SYSTEM
Figure 6-2

WSHLD HEAT SWITCH

The windshield anti-ice system is controlled through the WSHLD HEAT switch in the ANTI-ICE group on the center switch panel. The switch has three positions: On (WSHLD HEAT), HOLD, and OFF. When the BATTERY switches are set ON, the windshield anti-ice overheat shutoff valve is energized to the open position. When open, the overheat shutoff valve allows engine bleed air to flow downstream to the anti-ice modulating valve. When the WSHLD HEAT switch is placed in the On position, a circuit is completed to the anti-ice modulating valve and WSHLD HT indicator light. The anti-ice modulating valve will move toward full open until the valve is fully open or the WSHLD HEAT switch is set to HOLD. When the switch is in the HOLD position, the anti-ice modulating valve will remain in its last attained position, and allow bleed air to the anti-ice heat exchanger. When the WSHLD HEAT switch is set to OFF, the anti-ice modulating valve will move towards the closed position until the valve is fully closed or the WSHLD HEAT switch is set to HOLD. The anti-ice modulating valve will fully open or close in approximately 15 seconds. The anti-ice heat exchanger cools the bleed air with ram air regulated by a ram air modulating valve. This valve is controlled by the downstream anti-ice duct temperature sensor and regulates the anti-ice bleed air temperature by varying the amount of ram air allowed into the heat exchanger.

WSHLD HT LIGHT

The green WSHLD HT light, located on the glareshield annunciator panel, provides the crew with a visual indication of windshield heat operation. The light will illuminate when the anti-ice modulating valve is in any position except fully closed and remain illuminated until the applicable (ground or inflight) low-limit thermoswitch trips or the WSHLD HEAT switch is set to OFF.

WSHLD OV HT LIGHT

Illumination of the red WSHLD OV HT warning light, on the glareshield annunciator panel, indicates that the bleed air temperature in the windshield outlet nozzles has reached the applicable (ground or inflight) high-limit thermoswitch setting and the windshield anti-ice system has been shut down. If the outlet nozzle bleed air temperature reaches 250°F (121°C) during ground operation, the ground high-limit overheat thermoswitch will close the anti-ice overheat shutoff valve and illuminate the WSHLD OV HT warning light. If the outlet nozzle bleed air temperature reaches 270°F (132°C) in flight, the inflight high-limit overheat thermoswitch will perform the same function. When the nozzle bleed air temperature cools sufficiently, the overheat thermoswitches will reset and allow the anti-ice overheat shutoff valve to open, extinguishing the WSHLD OV HT warning light. To avoid a false WSHLD OV HT indication upon landing, the ground overheat thermoswitch circuitry is disabled for 10 seconds after touchdown, after which normal functioning will resume.

WINDSHIELD DEFOG

Windshield internal defogging is accomplished using electrically heated windshield panels. The system is designed to be activated before takeoff and remain on until shutdown. The system consists of two windshield panels with integral heaters, windshield heat control unit, system switch, L and R WS DEFOG annunciators, and associated aircraft wiring. The system utilizes a 163 VAC output from the inverter system to power the integral heaters. The control circuit receives 28 VDC through the 5-amp L WSHLD DEFOG and R WSHLD DEFOG circuit breakers on the pilot's and copilot's circuit breaker panels.

WSHLD DEFOG SWITCH

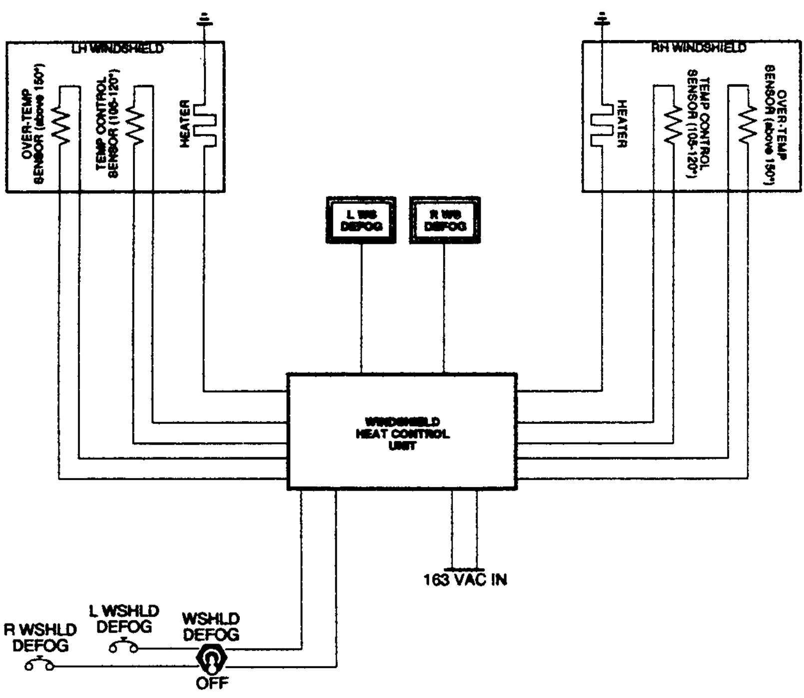
The windshield defog system is controlled through the WSHLD DEFOG switch in the ANTI-ICE group on the center switch panel. The switch has two positions: OFF and On (WSHLD DEFOG). When the WSHLD DEFOG switch is set to the On position, the integral heaters will be supplied 163 volts AC power from the inverter system via the windshield heat control unit.

NOTE: The inverter powering the left AC bus will power the left windshield panel while the inverter powering the right AC bus will power the right windshield panel.

Normal system operation is indicated by illumination of the L and R WS DEFOG annunciators when the system is activated (windshield temperature below 80°F [27°C]). When the windshield is heated above 80°F (27°C), the annunciators will extinguish.

L AND R WS DEFOG ANNUNCIATORS

Illumination of a WS DEFOG annunciator, located on the glareshield annunciator panel, indicates an over-temperature condition, under-temperature condition or loss of AC or DC power. Normal operating temperature of the windshield is between 105°F (41°C) and 120°F (49°C). Temperature sensors are attached to each windshield panel which provide temperature data to the windshield heat control unit. Should the temperature of the windshield drop below 80°F (27°C), the applicable WS DEFOG annunciator will illuminate to alert the crew. Should the temperature of the windshield increase above 150°F (66°C), the applicable WS DEFOG annunciator will illuminate and the affected windshield will be deactivated. When the windshield cools to the normal operating range, the system will reactivate and the WS DEFOG annunciator will extinguish. Electrical faults detected by the system monitor will cause the affected WS DEFOG annunciator to illuminate.



WINDSHIELD DEFOG SYSTEM
Figure 6-3

WINDSHIELD AND RADOME ANTI-ICE — ALCOHOL SYSTEM

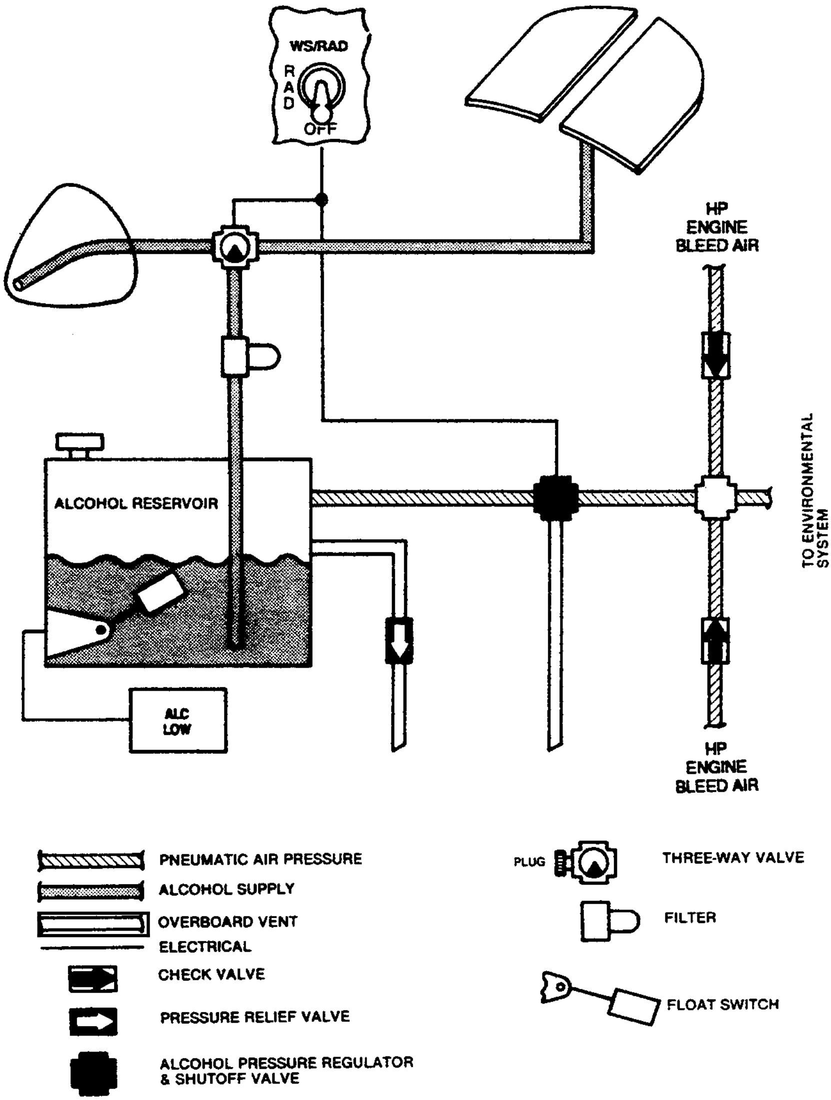
The alcohol anti-ice system is utilized for radome anti-ice protection and for windshield anti-icing in the event of a windshield heating system malfunction. Alcohol anti-icing is accomplished by directing methyl alcohol over the pilot's windshield surface through an external outlet in the windshield heat outlet nozzle assembly and through an outlet nozzle assembly on the radome. The system consists of a 1.75 gallon (6.6 liter) alcohol reservoir, a float switch, a filter, a relief valve, a three-way control valve, a bleed air shutoff and pressure regulator valve, a system switch, an amber ALC LOW caution light, and associated aircraft wiring. The pressure relief valve is installed to prevent system overpressurization by venting system pressure greater than 2.6 psi (17.9 kPa) above ambient, and bleed system pressure when the system is off. The system control circuits operate on 28 VDC supplied through the 5-amp ALC SYS circuit breaker on the copilot's circuit breaker panel.

ALCOHOL SWITCH

The alcohol anti-ice system is controlled by the three position ALCOHOL switch on the center switch panel. When the switch is set to WS/RAD, circuits are completed to open the shutoff and pressure regulator valve and position the three-way control valve for alcohol flow to the windshield and radome. The alcohol reservoir, pressurized to approximately 2.4 psi (16.5 kPa) above ambient through the shutoff and pressure regulator valve, supplies alcohol to the windshield outlet and radome nozzles through a filter and the three-way control valve. When the switch is set to RAD, the three-way valve will position to supply alcohol flow to the radome only. When the switch is set to OFF, the shutoff and pressure regulator valve will close, the three-way valve will reposition to cut off flow and system pressure will bleed off through the pressure relief valve.

ALC LOW CAUTION LIGHT

Illumination of the amber ALC LOW light, located on the glareshield annunciator panel, indicates the alcohol supply in the reservoir is low. The reservoir float switch will illuminate the light through a relay when in the full down position. When the relay is energized, a holding circuit is also energized to prevent the light from flickering due to the bobbing motion of the float. The holding circuit is deenergized when the BATTERY switches are set to OFF and the alcohol reservoir is filled. A completely filled reservoir will supply the alcohol anti-ice system with approximately 45 minutes of alcohol flow when providing protection for both the windshield and radome or approximately 2 hours for radome only.



ALCOHOL ANTI-ICE SYSTEM
Figure 6-4

PITOT-STATIC AND STALL WARNING ANTI-ICE

Anti-ice protection for the pitot-static probes, total temperature probe, and stall warning vanes, is accomplished by energizing integral electrical heating elements in each component. The independent pitot-static probe, total temperature probe, and stall warning vane anti-ice systems consist of control switches, probe heaters, vane heaters, and pitot heat monitors. Both left and right systems utilize the same PITOT HT light. The pitot-static probe heating elements receive 28 VDC through the respective 15-amp L and R PITOT HT circuit breakers on the pilot's and copilot's circuit breaker panels. Pitot heat system is operative during EMER BUS mode. The total temperature probe heating element receives 28 VDC through the 15-amp TAT PROBE HT circuit breaker on the pilot's circuit breaker panel. The stall warning vane heating elements receive 28 VDC through the respective 10-amp L and R STALL VANE HT circuit breakers on the pilot's and copilot's circuit breaker panels.

PITOT HEAT SWITCHES

The pitot-static heat systems are individually controlled through the PITOT HEAT switches in the ANTI-ICE group on the center switch panel. Each switch has two positions: On (L or R) and OFF. When the L and R PITOT HEAT switches are set to On (L and R), power is supplied to each pitot-static probe heater, each stall warning vane heater, and the total temperature probe heater.

PITOT HT LIGHT

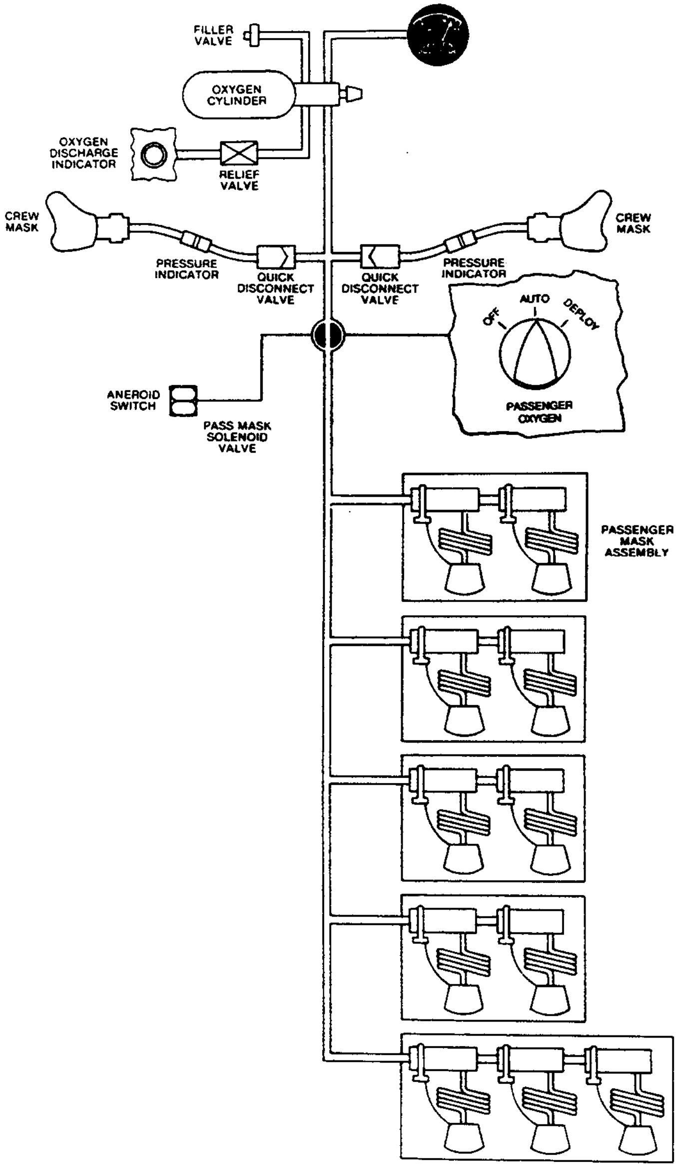
A dual pitot heat monitor system is installed to alert the pilot if insufficient current is being applied to the pitot-static probe heating elements. The monitors are wired to the ground side of the pitot-static probe heating elements. Each monitor is basically a relay which maintains an open circuit for the PITOT HT light as long as sufficient current is being applied to the associated pitot-static probe heating element. In the event of a malfunction in or loss of power to the associated pitot-static probe heating element, the relay will release and complete the PITOT HT light circuit. Illumination of the amber PITOT HT light, in the glareshield annunciator panel, indicates a malfunction in either the left or right pitot-static heat system or that at least one PITOT HEAT switch is OFF.

OXYGEN SYSTEM

The aircraft oxygen system provides oxygen service for the crew and passengers. The system consists of the crew and passenger distribution systems, a high-pressure oxygen storage cylinder, a shutoff valve and pressure regulator assembly, an oxygen pressure gage, an overboard discharge relief valve and indicator, an oxygen aneroid switch, a passenger oxygen control valve, lanyard actuated passenger mask oxygen valves, and crew and passenger oxygen masks. Electrical power to operate the passenger oxygen control valve is supplied through the 7.5-amp OXY VALVE circuit breaker on the pilot's circuit breaker panel. Oxygen is available to the crew at all times and can be made available to the passengers either automatically above 14,000 (±750) feet cabin altitude, or manually at any altitude through the use of the cockpit controls on the pilot's sidewall. The oxygen system is designed for use during emergency descent to a cabin altitude not requiring oxygen and is not to be used for extended periods of flight at cabin altitudes requiring oxygen or as a substitute for the normal pressurization system. Passenger masks will not provide sufficient oxygen for prolonged operation above 34,000 feet cabin altitude. Prolonged operation above 25,000 feet cabin altitude with passengers on board is not recommended. Smoking is prohibited when oxygen is in use. Refer to the FAA Approved Airplane Flight Manual for limitations and operating procedures.

OXYGEN STORAGE AND PRESSURE REGULATOR

The oxygen storage cylinder has a storage capacity of 40 cubic feet (1.13 cubic meters) at 1800 psi (12,411 kPa). The cylinder is located in the dorsal fin or the right side of the nose compartment. The shutoff and pressure regulator assembly forms an integral part of the storage cylinder and provides for pressure regulation, pressure indication, and servicing. Oxygen pressure is available to the passenger and crew distribution systems and is regulated to a pressure of 60 to 80 psi (418 to 552 kPa) when the oxygen cylinder shutoff valve is open. The shutoff and pressure regulator assembly also incorporates a burst disc pressure relief valve to discharge the oxygen cylinder contents overboard in the event that cylinder pressure reaches 2700 to 3000 psi (18,617 to 20,685 kPa). Should the cylinder contents be discharged overboard, the green overboard discharge indicator, on the outside surface of the aircraft near the storage cylinder, will be ruptured or missing.



20-25B-1

OXYGEN SYSTEM SCHEMATIC
Figure 6-5

OXYGEN PRESSURE GAGE

The oxygen pressure gage is located on the pilot's sidewall. The gage is calibrated from 0 to 2000 psi. The gage is a direct-reading type that is plumbed to the high-pressure side of the regulator and indicates oxygen cylinder pressure only.

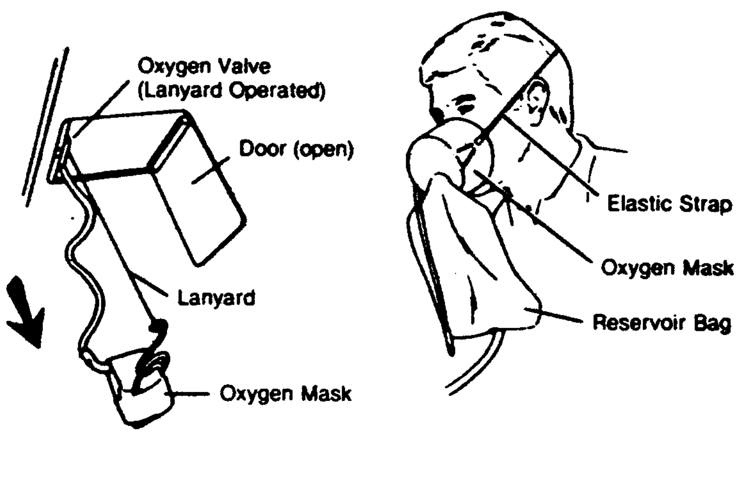
OXYGEN SYSTEM COCKPIT CONTROLS

The oxygen system cockpit controls consist of one control valve, labeled PASSENGER OXYGEN OFF-AUTO-DEPLOY, located on the pilot's sidewall above the armrest. The control valve controls oxygen availability to the passenger oxygen distribution system and provides automatic or manual mode selection. Oxygen is available to the crew oxygen distribution system at all times when the oxygen cylinder shutoff valve is open. Control positions and system functions are as follows:

1. With the PASSENGER OXYGEN valve in the AUTO position, oxygen is available to the passenger distribution system and the aneroid-controlled solenoid valve will deploy the masks automatically. Should the cabin altitude reach 14,000 (±750) feet, the aneroid switch will open the solenoid valve, the passenger oxygen masks will deploy, and the upper center panel lights will illuminate to provide maximum visibility for donning masks. Normally, the control should be in this position.
2. With the PASSENGER OXYGEN valve in the DEPLOY position, oxygen is available to the passenger distribution system and the passenger masks will deploy. The solenoid valve will be bypassed and allow oxygen system pressure to deploy the passenger masks. This position can be used to deploy the passenger masks at any cabin altitude and must be used if electrical power is unavailable.
3. With the PASSENGER OXYGEN valve in the OFF position, oxygen is not available to the passenger distribution system regardless of cabin altitude. This position can be used when oxygen is required for the crew only.

PASSENGER MASKS

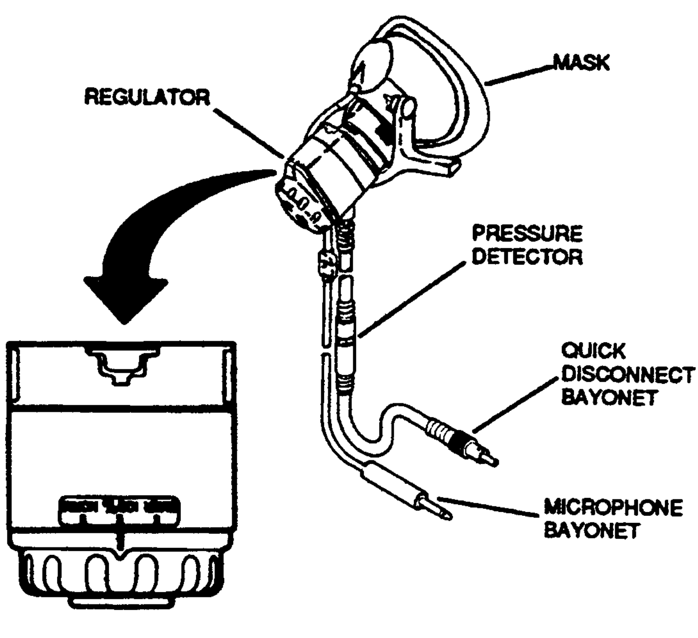
Passenger oxygen masks are stowed in compartments in the cabin ceiling upper-center panel. Whenever the compartment doors open automatically (PASSENGER OXYGEN-AUTO) or manually (PASSENGER OXYGEN-DEPLOY), oxygen is available for passenger use. Passengers should don masks and must pull lanyard to initiate oxygen flow. An orifice is incorporated in the mask to provide a constant flow of 4.1 liters per minute. The rebreather bag will inflate at a seemingly slow rate when oxygen is flowing. This is normal. Should the compartment door be inadvertently opened from the cockpit, pressure must be bled from the system by pulling one of the lanyards before the masks can be restowed. The compartment doors can be opened manually for mask cleaning and servicing by releasing the latch labeled OXYGEN adjacent to each door. When the doors are opened using this method, no oxygen flow is available to the masks.



PASSENGER MASK
Figure 6 - 6

CREW MASKS

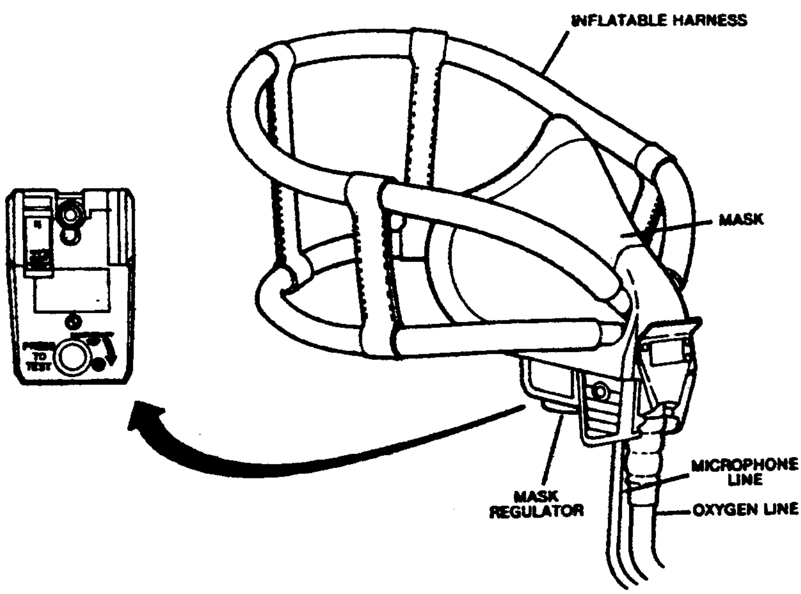
The standard (6600214 series) flight crew masks are stowed on straps behind the pilot's and copilot's seats. Optional (Scott ATO MC 10-15-01) flight crew masks, stowed in accessible storage receptacles on the pilot's and copilot's sidewalls, may replace the standard crew masks. The pressure demand mask regulators provide for normal, 100% oxygen and emergency operation (refer to the FAA Approved Airplane Flight Manual for detailed operational procedures). Each mask incorporates a microphone controlled by the MIC SELECT switch on the audio control panels. An electrical cord extends from each mask and is plugged into the OXY MIC jack on the jack panel. Communication between crew members can be accomplished by using the OXY function of the MIC SELECT switch on the audio control panels. A pressure detector is installed in each mask oxygen supply line to show visible verification of oxygen pressure to the mask. A quick-disconnect is provided for each crew member. When the mask bayonet is inserted into the quick-disconnect, a spring loaded poppet moves off its seat and allows oxygen flow into the mask supply line.



CREW MASK — 6600214 SERIES
Figure 6-7

PRESSURIZATION SYSTEM

Cabin pressurization is provided by conditioned air entering the cabin through the air distribution ducts and controlled by modulating the amount of air exhausted from the cabin. The pressurization system consists of a cabin primary outflow valve, a cabin safety valve, differential pressure relief valves, cabin altitude limiters, a vacuum shutoff solenoid valve, a pressurization vacuum regulator, a pressurization module, two bleed-air shutoff valves, two emergency pressurization valves, cabin altitude warning and emergency pressurization aneroid switches, two emergency pressurization override switches, an amber CAB ALT caution light, and an aural warning system. All system controls are located on the pressurization and copilot's switch panel. All system annunciators are located on the glareshield annunciator panel. Power for the control circuits is 28 VDC supplied through the 7.5-amp PRESS CONT circuit breaker on the copilot's circuit breaker panel, and the 2-amp CABIN AIR circuit breaker located on the pilot's circuit breaker panel.



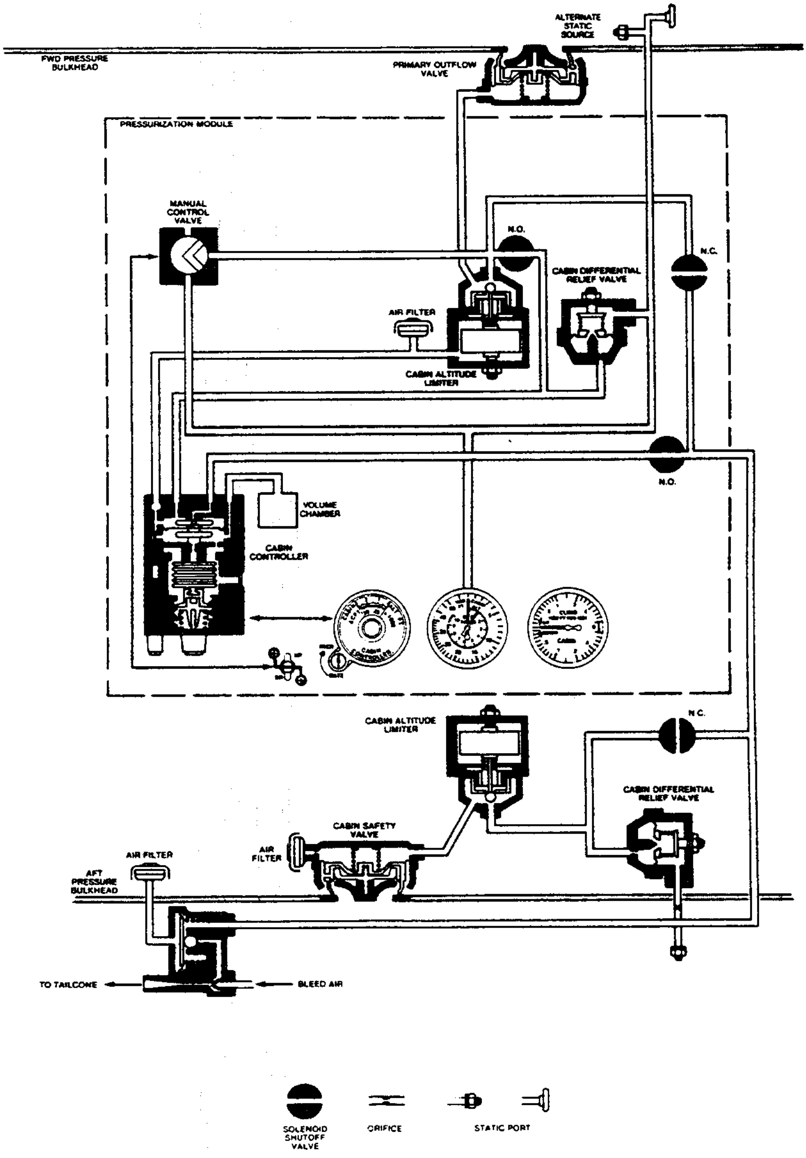
CREW MASK—SCOTT ATO MC 10-15-01
Figure 6-8

NORMAL PRESSURIZATION

Normal pressurization is controlled by regulating control pressure to the cabin primary outflow valve. The control pressure may be regulated automatically by the CABIN CONTROLLER or manually by the manual UP-DN control lever. A pressurization vacuum regulator in the tailcone provides regulated vacuum (servo pressure) to operate the valve. With the squat switch in air mode, and the pressurization AUTO-MAN switch in AUTO, the aircraft pressurization system is completely independent of the aircraft electrical system. If the aircraft is inadvertently allowed to ascend and exceed the controlling limits of the pressurization controls, the normal differential pressure relief valve will cause the primary outflow valve to open and maintain a 9.4 psi (64.8 kPa) differential. Should the normal differential pressure relief valve fail, the maximum differential pressure relief valve will modulate the cabin safety valve to maintain a 9.7 psi (67 kPa) differential. Cabin altitude limiters are installed in the servo pressure vacuum lines to the primary outflow valve and cabin safety valve to limit cabin altitude to 11,500 feet should a differential relief valve fail and allow the primary outflow valve or cabin safety valve to remain open. Should the cabin altitude reach 11,500 feet, the altitude limiters will vent cabin pressure to the primary outflow valve and cabin safety valve control chambers causing the valves to close. Should a rapid descent cause a negative pressure in the cabin, both the primary outflow valve and cabin safety valve will open to vent ambient atmospheric pressure to the cabin.

EMERGENCY PRESSURIZATION

In the event of normal cabin airflow malfunction, emergency pressurization is provided by routing engine bleed air directly into the cabin through the emergency pressurization valves. Emergency pressurization is accomplished automatically by pressurization aneroid switches when the cabin altitude increases to 9500 (±250) feet or manually by setting the BLEED AIR switches to EMER. The emergency pressurization valves will open, the bleed-air shutoff/pressure regulator valve will go to the low-pressure setting ducting engine low-pressure bleed air directly into the cabin air sidewall and floor diffusers. This bypasses the conditioned air plumbing in the tailcone area to maximize the inflow of bleed air to the cabin. The emergency pressurization valves are deenergized to the open position for emergency air flow, and energized closed for normal bleed-air flow. Each valve is independent of the other and, whenever both valves are open, temperature control and bleed air for wing, and windshield anti-ice will be unavailable. Operating power for emergency valve actuation is 28 VDC supplied through either the 7.5-amp L and R EMER PRESS circuit breakers on the pilot's and copilot's circuit breaker panels. Power for emergency valve actuation is available during EMER BUS mode.



PRESSURIZATION SYSTEM SCHEMATIC
Figure 6-9

PRESSURIZATION CONTROLS AND INDICATORS

BLEED AIR SWITCHES

The L and R BLEED AIR switches, located on the copilot's switch panel, control the respective left and right bleed-air shutoff/pressure regulator valves on the engine and left and right emergency pressurization valves in the bleed air ducting. Each BLEED AIR switch has three positions: EMER, ON, and OFF. When a BLEED AIR switch is in the ON position, the respective bleed-air shutoff/pressure regulator valve will open and the emergency pressurization valve will remain closed unless the 9500-foot emergency pressurization aneroid switches are activated. When a BLEED AIR switch is set to OFF, the respective bleed-air shutoff/pressure regulator valve will be energized to the closed position. When a BLEED AIR switch is set to EMER, the respective bleed-air shutoff/pressure regulator valve will supply low-pressure bleed air and emergency pressurization valve will be de-energized open. The bleed-air shutoff/pressure regulator valves control bleed air flow to the cabin air distribution and temperature control system, wing anti-ice system, and windshield anti-ice system. The bleed-air shutoff/pressure regulator valves will close automatically whenever the respective ENG FIRE PULL T-handle is pulled. Bleed-air for windshield alcohol tank pressurization is still available with the shutoff/pressure regulator valves closed. The BLEED AIR switches remain effective during EMER BUS mode.

BLEED AIR WARNING LIGHTS

Red BLEED AIR L and BLEED AIR R warning lights on the glareshield annunciator panel, provide the crew with visual indication of a pylon overheat condition or pylon bleed air ducting overheat condition. Each light is operated by a thermal switch in the associated pylon bleed-air ducting or a thermal switch in the associated pylon just aft of the forward engine mount. The ducting thermal switches close if the duct temperature should reach 645 (±10)°F (341 [±5.5]°C). The pylon thermal switches will illuminate the respective light if the temperature in a pylon exceeds 250 (±5)°F (121 [±2.7]°C). The switches will open and the affected BLEED AIR Light will extinguish as the pylon cools.

CAB AIR SWITCH

The CAB AIR switch, on the pressurization control panel, controls the cabin-air flow control valve and the pressurization system cabin safety valve. During ground operation, when the CAB AIR switch is in the OFF position, the normally closed vacuum shutoff solenoid is energized open through relays in the squat switch relay panel and regulated vacuum from the pressurization vacuum regulator will open the cabin safety valve. When the CAB AIR switch is set ON, the vacuum shutoff solenoid is de-energized, allowing the safety valve to drive closed under increasing cabin pressure.

CAB AIR LIGHT (OPTIONAL)

An amber CAB AIR light may be installed on the glareshield annunciator panel which illuminates when the CAB AIR switch is in the OFF position. This light serves to remind crew members to switch CAB AIR on prior to takeoff.

PRESSURIZATION AUTO-MAN SWITCH

The AUTO-MAN switch, on the pressurization control panel, provides automatic and manual mode selection for normal pressurization. When the switch is set to MAN, solenoid valves in the regulated vacuum lines are energized to remove regulated vacuum from the CABIN CONTROLLER and apply regulated vacuum to the manual control valve. The control valve is manually operated by the red UP-DN control lever. When the AUTO-MAN switch is set to AUTO, the solenoid valves de-energize and allow regulated vacuum to the CABIN CONTROLLER for automatic pressurization control. Normally, the AUTO-MAN switch remains in the AUTO position.

CABIN CONTROLLER

With the CAB AIR switch ON and the pressurization AUTO-MAN switch AUTO, the CABIN CONTROLLER, located on the pressurization control panel, will automatically control cabin altitude. The controller senses cabin altitude and rate-of-climb and automatically modulates the primary outflow valve by regulating control servo vacuum pressure. Prior to takeoff, the altitude selector knob, on the face of the controller, should be set to selected cruising altitude or desired cabin altitude. The RATE knob may be rotated to select and maintain a comfortable pressurization rate for ascent or descent. For descent and landing, the altitude selector should be set to landing field elevation.

PRESSURIZATION MANUAL CONTROL LEVER (UP-DN)

With the CAB AIR switch ON and the pressurization AUTO-MAN switch in MAN, cabin pressurization is controlled by the red UP-DN manual control lever on the pressurization control panel. The lever controls servo vacuum pressure to the primary outflow valve through a manual control valve. As the lever is moved towards UP, outside static air pressure is vented to the outflow valve control chamber causing the valve to open. When the lever is moved towards DN, cabin pressure is vented to the outflow valve control chamber causing the valve to close.

CABIN ALT/DIFF PRESS GAGE

The cabin altimeter/differential pressure gage, on the pressurization control panel, is vented to both outside air pressure and cabin air pressure. The indicator has two pointers, each travels over a separate calibrated scale. The large pointer sweeps over the outside scale to indicate cabin altitude. The CABIN ALT scale is marked from 0 to 50,000 feet in 1000-foot increments. The small pointer sweeps over the inside scale to indicate differential pressure in psi. The DIFF PRESS scale is marked from 0 to 10 psi in 0.2-psi increments.

CABIN CLIMB INDICATOR

The rate of change in cabin pressure altitude is indicated in feet per minute on the CABIN CLIMB indicator located on the pressurization control panel. The indicator face is marked from 0 to 6000 feet per minute in both UP and DOWN directions. The instrument functions similarly to the aircraft vertical speed indicator but is vented to cabin pressure only.

EMER PRESS OVERRIDE SWITCHES

Emergency pressurization override switches are provided to allow takeoffs and landings at field elevations higher than the emergency pressurization aneroid switch settings (9500 [±250] feet). The switches are located on the copilot's switch panel and are labeled EMER PRESS OVERRIDE - NORMAL L and R. With the switches in OVERRIDE position, the emergency pressurization aneroid switches are electrically isolated from the emergency pressurization valves; thus preventing the valves from opening when the aneroid switches activate. When the override switches are in the NORMAL position, actuation of the aneroid switches will open the emergency pressurization valves. The switches will have no effect if the BLEED AIR switches are in the OFF or EMER position.

CAB ALT LIGHT

Should the cabin altitude exceed 8750 (±250) feet, an aneroid switch will close to illuminate the amber CAB ALT light on the glareshield annunciator panel. The aneroid switch will also deactivate the AUTO pressurization mode to stop the cabin altitude from rising any higher if the malfunction was in that control system. The aneroid switch will reset at a lower cabin altitude, reenergizing the automatic control system and extinguishing the CAB ALT light.

CABIN ALTITUDE WARNING HORN

A cabin altitude aural warning horn will sound to alert the crew should the cabin altitude reach 10,100 (±250) feet. The horn is controlled by an aneroid switch which will apply a ground to the warning horn circuit when actuated. The cabin altitude warning horn circuit is tested through the system test switch on the pilot's instrument panel. The MUTE switch on the right thrust lever may be used to interrupt the horn for approximately 60 seconds in the event the horn sounds. The cabin altitude warning horn is operative during EMER BUS mode.

SYSTEM TEST SWITCH — CABIN ALT FUNCTION

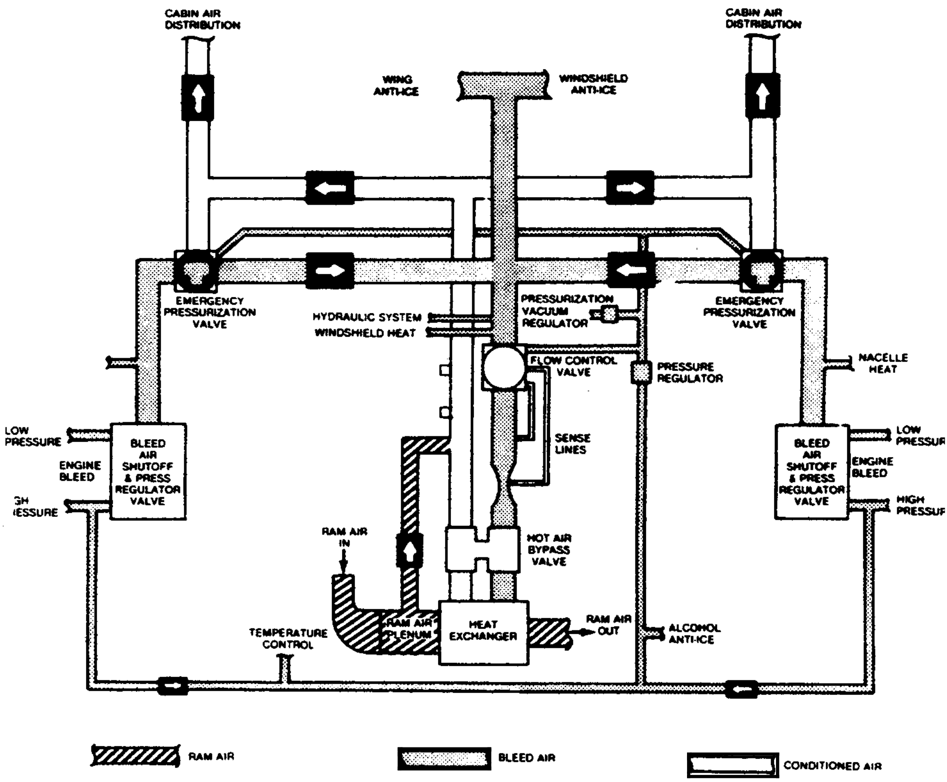
The rotary-type system test switch on the pilot's instrument panel is used to test the cabin altitude warning system. Rotating the switch to CABIN ALT and depressing the switch PRESS TEST button will provide a ground simulating the 10,100-foot aneroid switch actuation. During the test sequence, MUTE switch operation may also be checked.

AIR CONDITIONING AND HEATING

Primary heating and cooling is accomplished by controlling the temperature of the bleed air entering the cabin air distribution systems. *On aircraft 31-035 thru 31-190,* an R12 freon-based cooling system is installed to provide additional cooling at altitudes below 35,000 feet and during ground operations. *On aircraft 31-191 and subsequent,* an R134A refrigerant-type cooling system is installed to provide additional cooling. An auxiliary (electrical) cabin heating system is installed to provide additional cabin heating, if required.

PRIMARY HEATING AND COOLING — BLEED AIR

Cockpit and cabin temperature is regulated by controlling the temperature of the pressurization bleed air entering the cabin air distribution system. With the BLEED AIR switches ON and the CAB AIR switch ON, engine bleed air is admitted to the ram air heat exchanger through a flow control valve. The bleed air is cooled in the heat exchanger by ram air entering the dorsal inlet, passing through the exchanger, and then exiting into the tailcone. The conditioned bleed air then passes out of the exchanger into the cabin air distribution ducts. The temperature of the conditioned air is controlled by the hot air bypass (H) valve. This valve bypasses some of the bleed air around the heat exchanger and mixes it directly with the conditioned air exiting the heat exchanger. H-valve position, thus, temperature regulation, is controlled by the pneumatically operated temperature control system. Whenever the cabin temperature AUTO-MAN selector knob is rotated to AUTO, the temperature controller will automatically maintain the temperature set with the temperature selector. With the mode selector in AUTO and the HOT-COLD temperature selector knob set to COLD the temperature selector needle valve opens and reduces the pressure to the cabin temperature sensor. The decreased pressure causes the cabin temperature sensor bleed path to open and allows the sensor to vent more of the pressure to ambient. The decreased pressure allows the H-valve to close and routes bleed air through the heat exchanger, then into the cabin at a lower temperature. When the temperature selector is set to HOT the temperature selector needle valve closes and raises the pressure to the cabin temperature sensor. The increased pressure causes the cabin temperature sensor bleed path to close and increases pressure to the H-valve. The increased pressure allows the H-valve to open and bypass more hot air into the cabin distribution system. The cabin temperature sensor's fan blows cabin air across the sensor, and causes the sensor to meter more or less pressure, depending on the temperature of the cabin air and the selected temperature. The temperature sensor fan is inoperative when the COOL-OFF switch is set to COOL. When the mode selector is set to MAN, the cabin temperature sensor and duct temperature sensor are removed from the system, and the pressure to the H-valve is controlled directly by the HOT-COLD temperature selector. Setting the temperature selector to COLD, bleeds off a greater amount of the regulated pressure and allows the H-valve to route more bleed air through the heat exchanger. Setting the temperature selector to HOT closes the bleed path and increases the pressure at the H-valve. The valve opens and bypasses more bleed air directly into the cabin air distribution ducts.



TAILCONE BLEED-AIR DISTRIBUTION
Figure 6-10

CAB AIR SWITCH

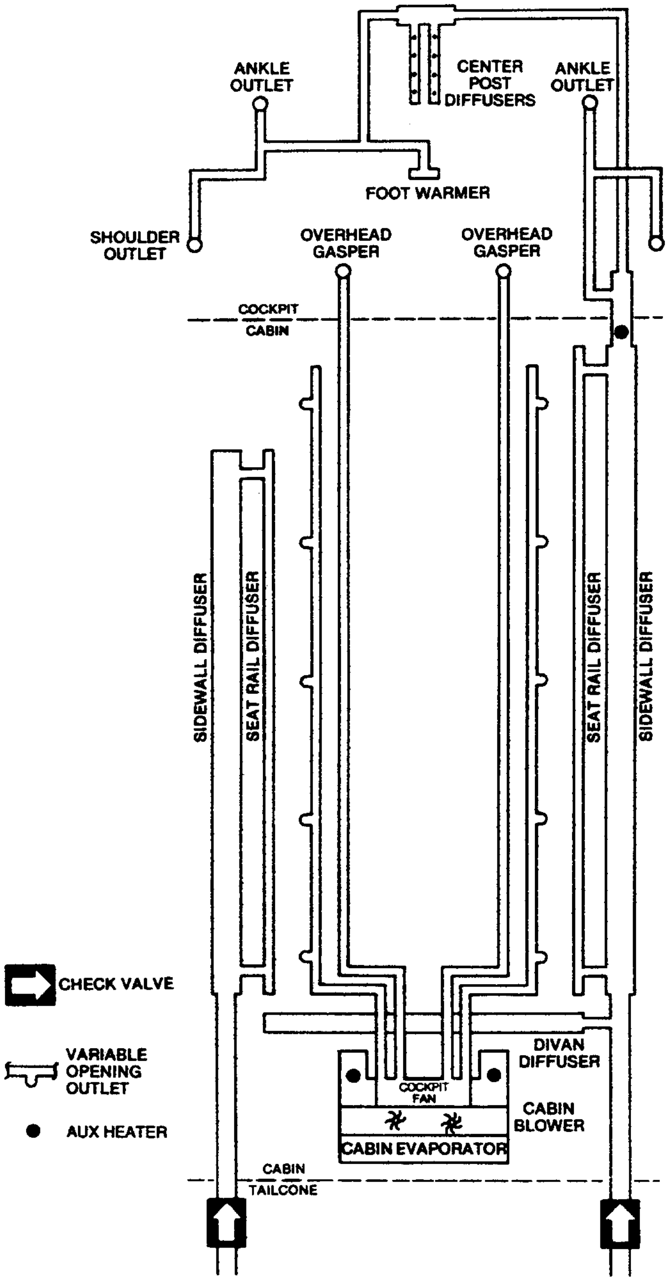
The CAB AIR switch, located on the pressurization control panel, controls the flow control valve. With the BLEED AIR switches ON, setting the CAB AIR switch ON will de-energize the flow control valve controlling solenoid and allow system pressure to the valve's controlling chambers. Internal pressures will position the valve butterfly, controlling bleed air flow to the heat exchanger. Setting the CAB AIR switch ON also energizes the cabin temperature sensor blower. Setting the CAB AIR switch OFF will energize the valve control solenoid which will shutoff control pressure and allow the valve butterfly to block bleed air flow.

AUTO-MAN SELECTOR

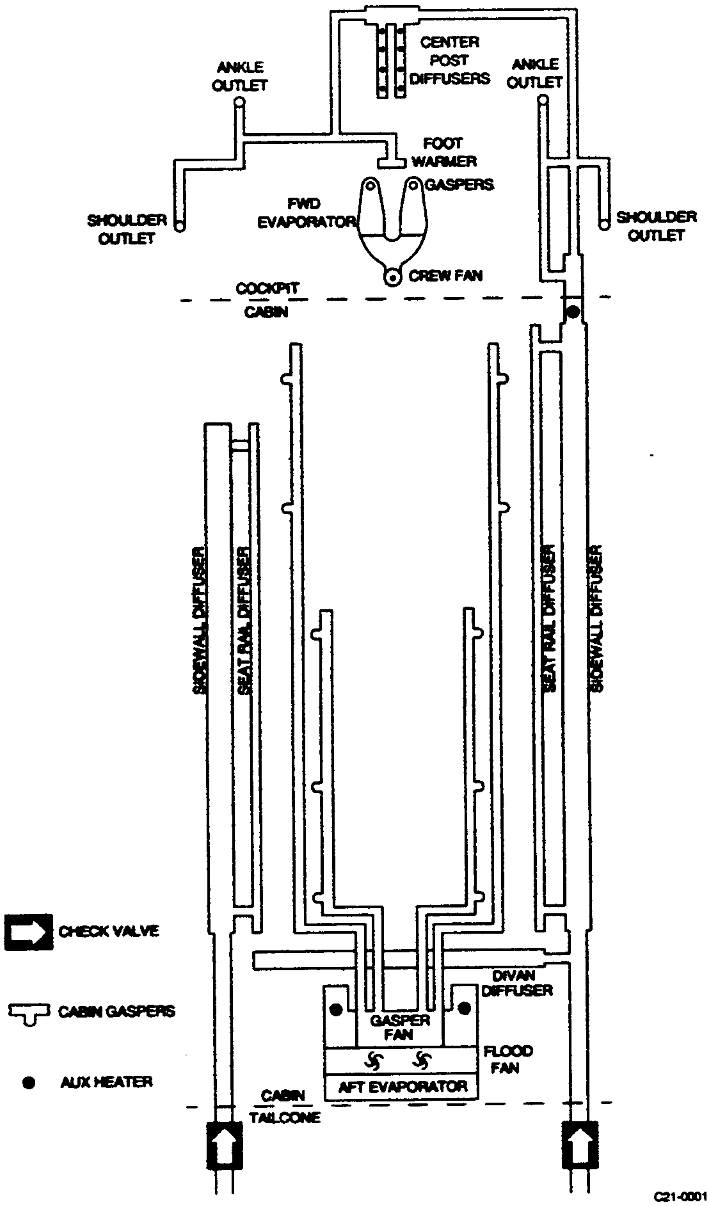
An AUTO-MAN mode selector, located on the copilot's switch panel, provides for automatic or manual mode operation of the cabin temperature control system. When in AUTO mode, the system temperature controllers automatically position the H-valve butterfly. In the MAN mode, the HOT-COLD selector directly regulates the H-valve controlling pressure.

HOT-COLD TEMPERATURE SELECTOR

The HOT-COLD temperature selector is located on the copilot's switch panel. In system AUTO mode, the temperature selector is used to select the desired cabin temperature to be maintained automatically by the temperature control system. In MAN mode, the temperature selector directly varies the regulating pressure to position the H-valve. In AUTO mode, rotating the knob clockwise from COLD to HOT is equivalent to selecting temperatures ranging from 60°F (16°C) to 90°F (32°C).



AIR DISTRIBUTION SCHEMATIC
(With R12 Freon Cooling System)
Figure 6-11



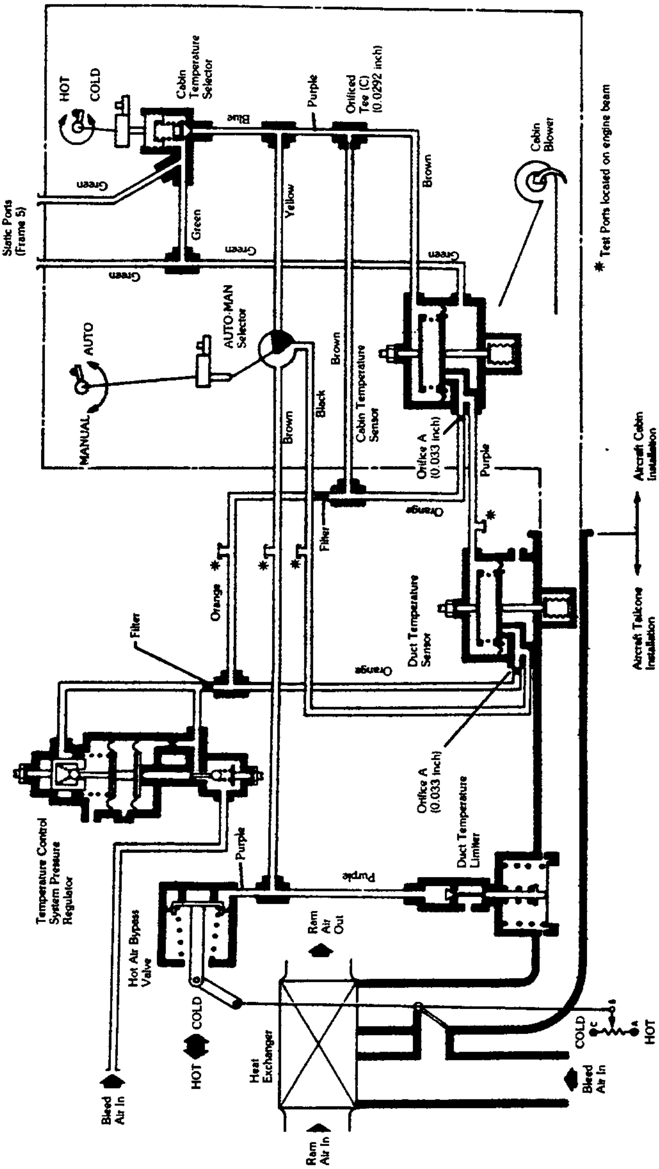
AIR DISTRIBUTION SCHEMATIC
(With R134A Cooling System)
Figure 6-12

TEMP CONT INDICATOR

The TEMP CONT indicator is a vertical scale instrument incorporated into a combination CABIN TEMP/TEMP CONT unit. The unit is located on the copilot's instrument panel and provides the crew with a visual indication of the H-valve position. The indicator face consists of a scale reading from COLD to HOT and a single pointer. The increments on the scale represent the H-valve position from full closed (COLD) to full open (HOT). The pointer is electrically controlled by an externally mounted potentiometer on the H-valve. The potentiometer is mechanically linked to the H-valve butterfly. The indicator operates on 28 VDC supplied through the 2-amp CAB TEMP & CONT IND circuit breaker on the copilot's circuit breaker panel.

CABIN TEMP INDICATOR

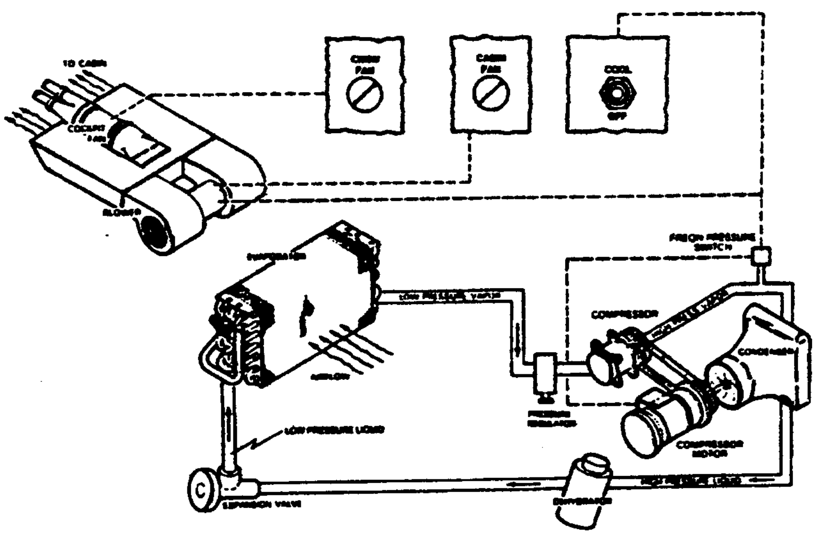
The CABIN TEMP indicator is a vertical scale instrument incorporated into a combination CABIN TEMP/TEMP CONT unit. The unit is located on the copilot's instrument panel and provides the crew with visual indication of cabin temperature. The indicator is calibrated from 60°F to 90°F in three colored segments as follows: 60°F to 70°F, blue; 70°F to 80°F, green; 80°F to 90°F, red. The indicator operates on 28 VDC supplied through the 2-amp CAB TEMP & CONT IND circuit breaker on the copilot's circuit breaker panel.



TEMPERATURE CONTROL SCHEMATIC
Figure 6-13

R12 FREON COOLING SYSTEM (Aircraft without Forward Evaporator and Blower Unit)

The refrigerant-type (freon) cooling system is installed for cockpit and cabin cooling during ground operations, inflight cooling below 35,000 feet, and cabin dehumidification. Power must be supplied by an engine generator or ground power unit. When the COOL-OFF switch is set to COOL, power is supplied to the freon compressor motor and the system refrigerant is compressed and circulated under high pressure through a receiver/dehydrator (dryer) to the system evaporator. A cockpit fan and cabin blower, located in the aft cabin overhead unit, circulate air through the system evaporator to provide cooling. Freon system overpressurization protection is provided by a pressure switch downstream of the compressor. The switch will open to break the motor power circuit should system pressure exceed limits and reset when pressure drops to within limits. The refrigeration system is automatically cutout during engine start. The compressor motor is powered by 28 VDC supplied through a 150-amp current limiter. System control circuits are powered by 28 VDC supplied through the 7.5-amp FREON circuit breaker on the pilot's circuit breaker panel. The cockpit fan and cabin blower are powered by 28 VDC supplied through the 15-amp CREW & CAB FAN circuit breaker on the pilot's circuit breaker panel.



R12 FREON COOLING SYSTEM — STANDARD EVAPORATOR
Figure 6-14

COOL-OFF SWITCH

The COOL-OFF switch, located on the copilot's switch panel, controls the freon cooling system. When set to COOL, the switch allows power to the freon compressor motor and cabin blower circuits.

CABIN FAN SWITCH

The CABIN FAN switch, located on the copilot's switch panel is used to control the cabin blower in the evaporator duct housing. To provide supplemental air circulation, the CABIN FAN switch is rotated clockwise out of the off detent position until the desired fan speed is attained. Cabin fan speed is not variable when the freon cooling or auxiliary cabin heat system is operating.

CABIN BLOWER DIVERTER CONTROL

Airflow from the cabin blowers is controlled by positioning the cabin blower diverter control switch on the evaporator duct housing in the aft cabin. When the switch is set to the ON position, diverter doors in the evaporator duct will open and airflow from the cabin blowers will be directed forward. When the switch is set to the OFF position, the doors will close and airflow from the cabin blowers will be diverted into the area above the interior headliner. If the auxiliary cabin heater is operating, this switch is overridden and diverting air above the interior headliner is not possible.

CREW FAN SWITCH

The CREW FAN switch located, on the copilot's switch panel is used to control the cockpit fan in the evaporator duct housing. To provide supplemental air circulation, the CREW FAN switch is rotated clockwise out of the off detent position until the desired fan speed is attained. The fan will force air through the cockpit and cabin overhead distribution ducts to provide cooling or circulate air when the air circulation mode is selected. Air circulated by the cockpit fan is exhausted through the cockpit and cabin overhead eyeball outlets when they are rotated to the open position.

R12 FREON COOLING SYSTEM (Aircraft with Forward Evaporator and Blower Unit)

The refrigerant-type (freon) cooling system is installed for cockpit and cabin cooling during ground operations, inflight cooling below 35,000 feet, and cabin dehumidification. Power must be supplied by an engine generator or ground power unit. When the COOL-OFF switch is set to COOL, power is supplied to the freon compressor motor and the system refrigerant is compressed and circulated under high pressure through a receiver/dehydrator (dryer) to the system forward and aft evaporators. A cockpit fan and cabin blower, located in the aft evaporator and blower unit, circulate air through the system aft evaporator to provide cooling. A separate cockpit fan, located in the forward evaporator and blower unit, circulates air through the system forward evaporator to provide cooling. Freon system overpressurization protection is provided by a pressure switch downstream of the compressor. The high pressure switch will open to break the motor power circuit should system pressure exceed limits and reset when pressure drops to within limits. *On aircraft modified per ECR 3658, "Forward Air Conditioner Improvement"*, the low pressure switch will open to break the motor power circuit should system pressure be discharged or if atmospheric temperature is too low. If there is a partial refrigerant loss, the crew will notice a jump in amperage when the system cycles on and off. The refrigeration system is automatically cutout during engine start. The compressor motor is powered by 28 VDC supplied through a 150-amp current limiter. System control circuits are powered by 28 VDC supplied through the 7.5-amp FREON circuit breaker on the pilot's circuit breaker panel. The cockpit fan and cabin blower, located in the aft evaporator and blower unit, are powered by 28 VDC supplied through the 15-amp CREW & CAB FAN circuit breaker on the pilot's circuit breaker panel. The cockpit fan, located in the forward evaporator and blower unit, is powered by 28 VDC supplied through the 7.5-amp CREW BLOWER circuit breaker on the CABIN PWR BUS.

COOL-OFF SWITCH

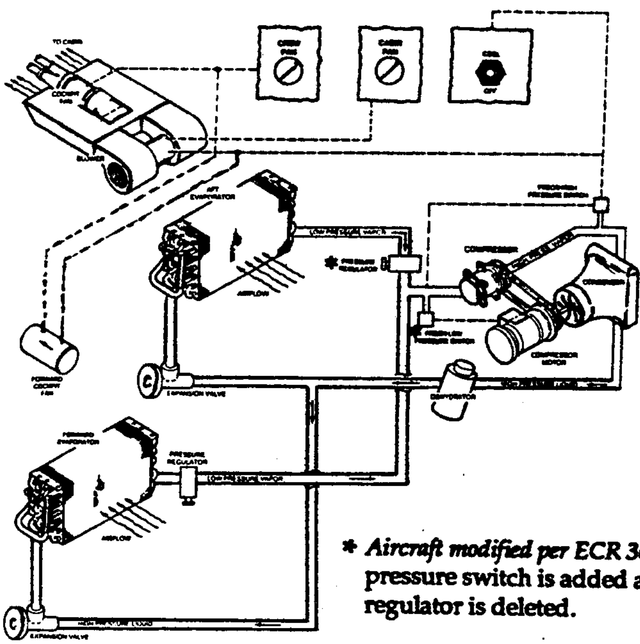
The COOL-OFF switch, located on the copilot's switch panel, controls the freon cooling system. When set to COOL, the switch allows power to the freon compressor motor, cabin blower and cockpit fan (forward evaporator and blower unit) circuits.

CABIN FAN SWITCH

The CABIN FAN switch, located on the copilot's switch panel is used to control the cabin blower and diverter doors in the aft evaporator and blower duct housing. When the COOL-OFF switch is set to COOL and the CABIN FAN switch is in the off detent, the cabin blower will operate on high speed. Rotating the CABIN FAN switch clockwise out of the off detent position will vary the speed of the cabin blower. To provide supplemental air circulation, the COOL-OFF switch is set to OFF and the CABIN FAN switch is rotated clockwise out of the off detent position until the desired fan speed is attained. Cabin fan speed is not variable when the auxiliary cabin heat system is operating.

CABIN BLOWER DIVERTER CONTROL

Airflow from the cabin blowers is controlled by the position of the COOL-OFF and CABIN FAN switches. When the COOL-OFF switch is set to the COOL position and the CABIN FAN switch is in the off detent, the diverter doors in the evaporator duct will close and airflow from the cabin blowers will be diverted into the area above the interior headliner. When the CABIN FAN switch is rotated clockwise out of the off detent position, the diverter doors will open and airflow from the cabin blowers will be directed forward. Whenever the COOL-OFF switch is set to the OFF position, the diverter doors will remain open.



* *Aircraft modified per ECR 3658,* freon low pressure switch is added and pressure regulator is deleted.

20-123C-1

R12 FREON COOLING SYSTEM — OPTIONAL FORWARD EVAPORATOR
Figure 6-15

CREW FAN SWITCH

The CREW FAN switch, located on the copilot's switch panel, is used to control the cockpit fans in both the forward and aft evaporator and blower units. When the COOL-OFF switch is set to COOL and the CREW FAN switch is in the off detent, the cockpit fan (forward evaporator and blower unit) will operate on low speed. Rotating the CREW FAN switch clockwise out of the off detent position will activate the aft cockpit fan and vary the speed of both the forward and aft cockpit fans. To provide supplemental air circulation, the CREW FAN switch is rotated clockwise out of the off detent position until the desired fan speed is attained. The aft fan will force air through the cockpit and cabin overhead distribution ducts to provide cooling or circulate air when the air circulation mode is selected. Air circulated by the aft cockpit fan is exhausted through the cockpit and cabin overhead eyeball outlets when they are rotated to the open position. Air circulated by the forward cockpit fan is exhausted through two louvered outlets in the cabinet behind the copilot's seat.

R134A COOLING SYSTEM

The refrigerant-type (R134A) cooling system is installed for cockpit and cabin cooling during ground operations, inflight cooling, and cabin dehumidification. On the ground, power must be supplied by either aircraft electrical system generator providing 28 VDC, or ground power unit. In flight, the air conditioning system must be operated by both aircraft generators on line. When the COOL-OFF switch is set to COOL, power is supplied to the R134A compressor motor and the system refrigerant is compressed and circulated under high pressure through a receiver/dehydrator (dryer) to the system forward and aft evaporators.

The foward evaporator/blower unit is located above the cockpit headliner. It provides airflow for the cockpit, as well as windshield defog. Cabin air is drawn into the evaporator coil and the fan then delivers the conditioned air to individual gaspers and an "eyebrow" outlet duct. The evaporator blower can be operated in the "FAN" position to recirculate cockpit air without cooling.

The cabin evaporator/blower unit is located in the aft section of the cabin ceiling. It contains an evaporator, two separate blowers and two heating elements that provide auxiliary heating. The first blower provides cooling airflow to the cabin gaspers and the second blower provides flood duct cooling to the aft cabin. This blower is also used in the auxiliary heat mode. The evaporator blowers can be operated in the "FAN" position to recirculate cabin air without cooling.

Refrigerant system is protected against overpressure conditions by two separate safety devices. The first is a binary high/low pressure switch located on the compressor discharge port. This switch will open at approximately 350 psig and will interrupt power to the compressor control circuit. This in turn will de-energize the compressor motor relay and remove power to the compressor motor. The refrigerant system pressure will then drop. The switch will also interrupt power to the compressor control circuit under low pressure conditions. This low pressure switch may also shut down the compressor if the average refrigerant temperature between the cabin and tailcone is 35°F (1.7°C) or less. The second overpressure safety device is a fuse plug located on the receiver/dryer bottle. This plug will vent the system refrigerant safely overboard in the event of a system pressure in excess of 425 psig. The refrigerant system is automatically cutout during engine start. System safety features also include electrical interlocking and load shedding. In flight, the air conditioning system can be operated from the aircraft electrical system only with both generators on-line. Loss of either generator will automatically shed the air conditioning system electrical loads, except for the minimal loads of the evaporator fans. The compressor drive/condensor fan motor is powered by 28 VDC supplied through a 175-amp current limiter. System control circuits are powered by 28 VDC supplied through the 7.5-amp COOL-CREW FAN circuit breaker on the pilot's circuit breaker panel. The gasper fan, located in the aft evaporator, is powered by 28 VDC supplied through the 15-amp GASPER FAN circuit breaker on the co-pilot's circuit breaker panel. The cockpit fan, located in the forward evaporator and blower unit, is powered by 28 VDC supplied through the 7.5-amp COOL-CREW FAN circuit breaker on the pilot's circuit breaker panel. The flood fan, located in the aft evaporator, is powered by 28 VDC supplied through a 15-amp FLOOD FAN circuit breaker on the pilot's circuit breaker panel.

COOL-OFF SWITCH

The COOL-OFF switch , located on the copilot's switch panel, controls the R134A cooling system. When set to COOL, the switch allows power to the compressor motor, flood fan, gasper fan and crew fan circuits.

GASPER FAN CONTROL

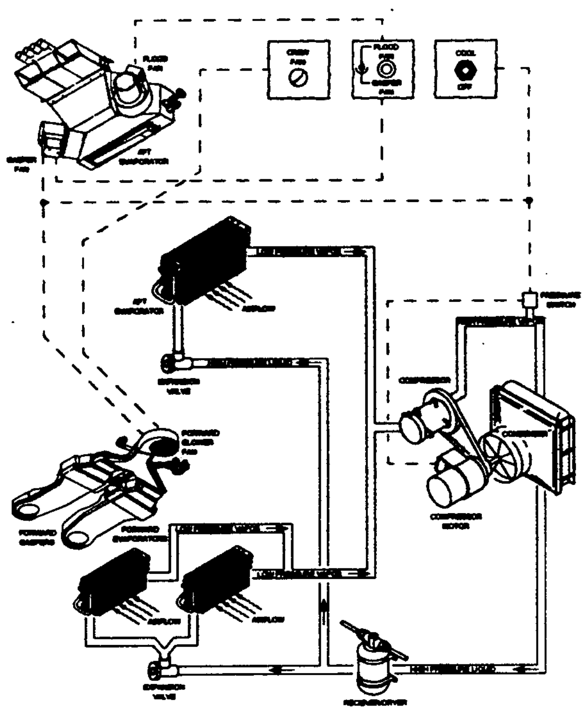
The GASPER FAN control, located on the copilot's switch panel is used to control the gasper fan in the aft evaporator and blower duct housing. When the COOL-OFF switch is set to COOL and the GASPER FAN control is in the off detent, the gasper fan will operate on low speed. Rotating the GASPER FAN control counterclockwise out of the off detent position will vary the speed of the gasper fan. For supplemental air circulation set the COOL-OFF switch to OFF and rotate the GASPER FAN control counterclockwise out of the off detent.

FLOOD FAN CONTROL

The FLOOD FAN control, located on the copilot's switch panel is used to control the flood fan in the aft evaporator and blower duct housing. When the COOL-OFF switch is set to COOL and the FLOOD FAN control is in the off detent, the flood fan will not operate. Rotating the FLOOD FAN control clockwise out of the off detent position will vary the speed of the flood fan. When the COOL-OFF switch is in the OFF position the flood fan will not operate.

CREW FAN CONTROL

The CREW FAN control, located on the copilot's switch panel, is used to control the cockpit fan in the forward evaporator and blower unit. When the COOL-OFF switch is set to COOL and the CREW FAN control is in the off detent, the cockpit fan will operate on low speed. When the CREW FAN control is in any position but the off detent the cockpit fan speed will vary with the position of the control. When the COOL-OFF switch is in the OFF position and the CREW FAN control is in any position but the off detent, supplemental air circulation is provided from the foward blower unit.



R134A COOLING SYSTEM
Figure 6-16

AUXILIARY HEATING SYSTEM

An auxiliary heating system is installed to provide additional cabin and cockpit heating when required. Power for the auxiliary heaters must be supplied by an engine generator or ground power unit. The system is divided into two separate heating systems: crew and cabin. The crew system consists of an inline heater located in the RH cabin air duct, a temperature sensor, a cockpit heater control box, and associated aircraft wiring. The cabin system consists of two heater coil assemblies located in the evaporator duct housing in the aft cabin, an auxiliary heat relay panel, and associated aircraft wiring. The AUX HT control switch on the copilot's switch panel is used to control both the crew and cabin systems.

CREW HEATER

The cockpit inline heater consists of two heater elements, a thermal switch and thermal fuse. The thermal switch located at the front of the heater outlet will actuate at 295°F (146.1°C) to de-energize the heating elements. In the event of a malfunction, a thermal fuse is incorporated which will melt at approximately 415°F (212°C) and disable the heater. Air circulation is provided by the RH cabin air distribution system (CAB AIR ON and bleed air available to RH cabin air distribution system). The heated air is exhausted through the shoulder and ankle outlets, foot warmer, and windshield center post diffuser. A temperature sensor at the base of the center post diffuser senses the air temperature and provides this data to the cockpit heater control box to control the air temperature to approximately 180°F (82°C). To preclude heater burnout, the inline heater should not be activated unless air flow is available in the RH air distribution duct. To help ensure airflow, operation of the heater is inhibited when the CAB AIR switch is OFF. Additionally, *on aircraft 31-046 thru 31-119,* heater operation will be inhibited until an engine is running and the associated bleed air shutoff valve is open. If only the left engine is providing bleed air flow, the left emergency pressurization valve must be in the normal position. *On aircraft 31-120 and subsequent,* an internal sensor is installed within the crew heater to monitor heater temperature and to cycle the heater between two pre-determined temperatures. The system control circuits operate on 28 VDC supplied through the 7.5-amp AUX CREW HT circuit breaker on the pilot's circuit breaker panel. The heater elements are powered by 28 VDC supplied through two 20-amp current limiters.

CABIN HEATER

• *Aircraft 31-035 thru 31-174*

Each heater coil assembly consists of two heater coils, and a thermoswitch. The heater coil assemblies are provided overheat protection by the thermoswitches which are wired into the control circuit for the heater coil assemblies. The thermoswitches cycle the heating elements to maintain a constant 125°F (52°C) to 150°F (66°C) airflow temperature. The system utilizes the cabin blower to provide heated air circulation. To ensure airflow over the heating elements the cabin blower is activated whenever AUX HT switch is set to CAB & CREW. Cabin blower speed is limited to 10% maximum until air temperature reaches 150°F (66°C), at which time cabin blower speed automatically increases to maximum. Cabin heater control circuits are wired through start and cooling system cutout relays; therefore, the cabin auxiliary heating system is inoperable during engine start and during cooling system operation. The system control circuits operate on 28 VDC supplied through the 7.5-amp AUX CAB HT circuit breaker on the pilot's circuit breaker panel. The heater elements are powered by 28 VDC supplied through two 50-amp current limiters wired to a single 150-amp current limiter on the battery charging bus.

The cabin auxiliary heat may be used to heat the cabin before starting the engines provided power is supplied by a GPU. When using the system in this fashion, ensure the CAB AIR switch is set to OFF. This will preclude the possibility of operating the cockpit inline heater when no air circulation is available.

• *Aircraft 31-175 & subsequent*

Each heater coil assembly consists of two heater coils, two thermoswitches and a thermal sensor. The heater coil assemblies are provided overheat protection by the thermoswitches which are wired into the control circuit for the heater coil assemblies. Should any coil element become overheated, the foward thermoswitch will open at 350°F (177°C) and power will be disconnected from both coil assemblies. The aft thermoswitch cycles the heating elements to maintain a constant 125°F (52°C) to 150°F (66°C) airflow temperature. The system utilizes the cabin blower (*31-175 thru 31-190*), or flood fan blower (*31-191 & subsequent*), to provide heated air circulation. To ensure airflow over the heating elements, the cabin blower/flood fan blower is activated whenever AUX HT switch is set to CAB & CREW. When air temperature reaches 150°F (66°C), the cabin blower/flood fan blower speed automatically increases to maximum. Cabin heater control circuits are wired through start and cooling system cutout relays; therefore, the cabin auxiliary heating system is inoperable during engine start and during cooling system operation. The system control circuits operate on 28 VDC supplied through the 7.5-amp AUX CAB HT circuit breaker on the pilot's circuit breaker panel. The heater elements are powered by 28 VDC supplied through two 50-amp current limiters wired to a single 150-amp current limiter on the battery charging bus.

The cabin auxiliary heat may be used to heat the cabin before starting the engines provided power is supplied by a GPU. When using the system in this fashion, ensure the CAB AIR switch is set to OFF. This will preclude the possibility of operating the cockpit inline heater when no air circulation is available.

AUX HT SWITCH

The auxiliary heating system is controlled through the AUX HT switch on the copilot's switch panel. The switch has three positions: OFF, CREW and CAB & CREW. When the switch is in the CREW position, the cockpit inline heater will energize if all the prerequisite conditions are met. With the switch in the CAB & CREW position, the cockpit heater will operate as described, and the cabin heating elements will energize to provide cockpit and cabin heat.