R134A AIR CONDITIONING SYSTEM - DESCRIPTION AND OPERATION
(Airplanes 20800274 And On, and 208B0655 And On)

1. General

A. The air conditioning system provides cool air for cockpit and cabin area. This system uses a compressor in conjunction with three evaporators to distribute R134a cooled air through overhead ducts.

(1) The compressor is mounted on the engine accessory section and driven by a V-belt from a drive unit assembly.

(2) Two evaporator units with integral blowers are located in the wing root areas (left and right). The third evaporator unit is located in the tailcone behind the aft cabin bulkhead.

B. An air conditioning schematic is provided to aid maintenance technicians in system understanding. Refer to Figure 1.

2. Description

A. Component Descriptions are as follows:

(1) Compressor - The air conditioning compressor is mounted on the aft left side of engine and driven by a V-belt from a drive unit mounted on engine accessory section. Service valves are located on the suction and discharge ports labeled SUC and DIS respectively on the compressor. The compressor has a dual function. It is a means of moving refrigerant through the system and compresses gaseous refrigerant, raising pressure and temperature simultaneously. A temperature rise is desired outcome and is accomplished with a corresponding rise in pressure.

(2) Condenser - The condenser is a flat tube fin coil located in the lower left section of the engine compartment. The condenser receives hot, high pressure gaseous refrigerant and converts it to a cooler, high pressure liquid. Ambient air is blown across the condenser coil. Heat from hot gas passes into the cooler air stream, and changes, back to a liquid. The liquid refrigerant is routed to the receiver/dryer for recycling.

(3) Receiver/Dryer - The receiver/dryer is installed in the lower right side of the engine compartment.The receiver/dryer is a canister type using a desiccant to remove moisture and a filter to remove larger particles of impurities and hold desiccant in place. The unit also stores liquid refrigerant during the operation cycle.

(4) Pressure Switch - A binary High/Low pressure safety switch is threaded into the top of the receiver/dryer. This switch disengages the compressor clutch and stops system operation should the system become overloaded. Compressor damage could occur if the system pressure becomes either too high or too low. The system will cycle on again when the pressure returns to a safe operating condition.

(5) Evaporators - There are three evaporators in the system, one in each wing root and a third in the tailcone. Each evaporator consists of the evaporator coil with an expansion valve and an electrically powered squirrel cage blower. The two wing-mounted evaporators are connected into the ventilation system duct in the wing root. Air for these evaporators may be fresh air from the outside when the ventilation duct valves are closed. The rear evaporator operates on recirculated air only. Refrigerant to each of the evaporators is metered through the expansion valves.

(6) Service Valves - Quick disconnect service valves in low the pressure (vapor) and high pressure (liquid) lines are located beneath the floorboard between pilot and copilot seats.

(7) Controls - Controls for the air conditioning system consist of a air conditioning switch and three fan switches. located at the lower edge of the instrument panel directly above control pedestal, and two ventilation system controls in the overhead console. Figure 1 shows the cockpit control panel.

(a) The air conditioner control switch has three positions, OFF, VENTILATE and COOL. All electrical operations of the air conditioning system are controlled by this switch.The OFF position prevents power from going to any component in the system. The COOL position starts the evaporator fans and makes power available to the remaining components in the system. Placing the switch in the VENTILATE position provides power only to the evaporator blowers. The AC FAN switches are two position toggle switches providing only a high or low speed operation of the fan motors.

(b) The ventilation system controls in the overhead console operate control valves in the ventilation ducts located in the wing to cause either fresh air to be drawn across the wing mounted evaporators when the valve is open, or cabin air to be recirculated across the evaporators when the valves are closed.

(8) Circuit Breakers - Four pull-off circuit breakers are provided and located on the left sidewall circuit breaker panel. They are labeled LEFT VENT BLWR, RIGHT VENT BLWR, AFT VENT BLWR and AIR COND CONT.

(9) Refrigerant Lines - Refrigerant lines in the engine compartment, under floorboards and fuselage side walls, interconnect the compressor, condenser, receiver/dryer and evaporators. The fittings shall follow the SAE standard guidelines for special fitting to avoid cross contamination with refrigerant R12.

(10) Air Distribution System - The air distribution system is the same as the standard 10 outlet, 13 outlet for 208B, ventilation air distribution system except for an added outlet outboard of the two forward seats. The wing mounted evaporators are connected to this system.

(a) A separate distribution system is provided for the tailcone mounted evaporator.When the air conditioning is operating, cooled air is supplied to the cabin through 16 overhead adjustable outlets (two each above the pilot and front passenger, one above each rear passenger seat and two directing air forward and two directing air downward from the aft cabin bulkhead area), or 19 outlets for 208B.

(b) The pilot&#65533;s, front passenger&#65533;s and the 8 rear passenger seat outlets (11 for 208B) are the swivel type for optimum positioning. Airflow volume is controlled by rotating the outlet nozzle which controls an internal valve. Air flow volume and direction may be controlled through the 4 aft cabin outlets via the air outlet grills

(11) Return Air Check Valve - A check valve is installed in the fuselage root rib and ties into the ducting feeding into the wing mounted evaporators. The check valve allows air to exit cabin for recirculation over the evaporator but prevents air from entering the cabin through the return air duct and forces all air into the plenum distribution system.

3. Operation

A. R134a refrigerant is pumped through a system that alternately evaporates and condenses the refrigerant to move heat from one location to another. In this case, heat is removed from the cabin through evaporators and is expelled to the outside air through the condenser.

(1) On both the 208 and 208B system, the compressor is driven by a V-belt from a drive unit mounted on the engine accessory section. The compressor compresses the low pressure gas to a hot high pressure gas. Hot high pressure gas is then passed through the condenser where it rejects heat picked up from the cabin along with the heat of compression and then condenses the gas into a warm high pressure liquid. This liquid is then passed through a receiver/dryer where the remaining gas is separated from the liquid and any moisture is removed by a desiccant.

(2) The receiver/dryer also acts as a reservoir for the liquid refrigerant. The warm high pressure liquid then travels to the constant pressure expansion valves where warm high pressure liquid is expanded to a low pressure, low temperature liquid/vapor mixture. This mixture then travels through the evaportaors and absorbs heat from the cabin air which evaporates the remaining liquid refrigerant. The low pressure gas then returns to the compressor to repeat the process. Refer to Figure I.

Figure 1 : Sheet 1 : R134a Air Conditioning System Schematic

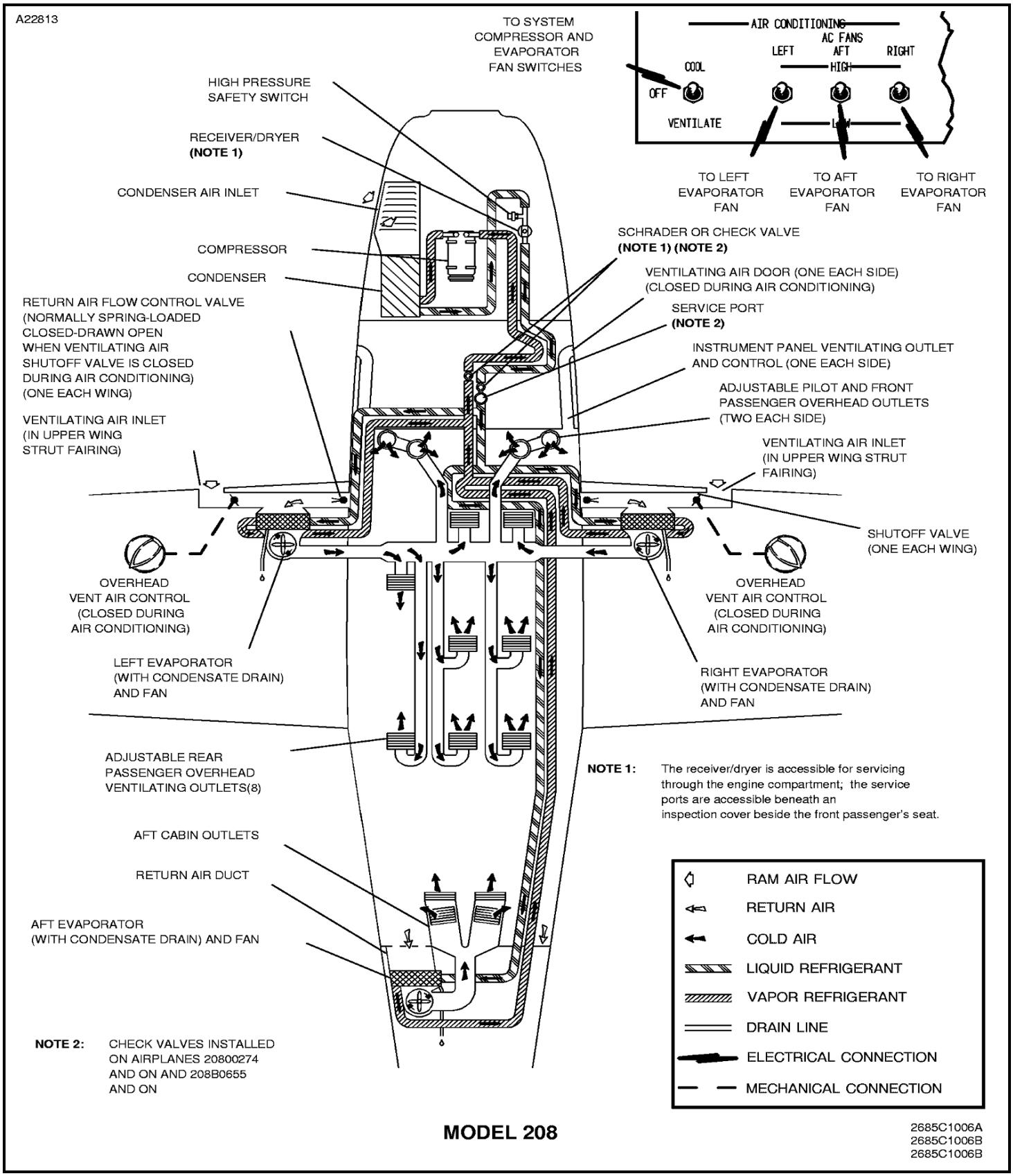

Figure 1 : Sheet 2 : R134a Air Conditioning System Schematic