ENVIRONMENTAL SYSTEMS

1. GENERAL

This section covers those systems and components used to furnish a means of heating, cooling, and treating the air used to ventilate the areas of the fuselage within the pressure seals. Includes equipment cooling, heater, valves, and ducts.
(See Figure 21-001)

The cabin air distribution system consists of fresh air inlets in each wing, a heat exchanger around the RH engine exhaust muffler, an air mixing chamber, air ducting for distribution, a windshield diffuser, and crew and passenger air vents.

Fresh air enters the cabin air distribution system through inlets located in each wing leading edge and is ducted to the crew and passenger air vents. Screens in the wing inlet ducts prevent large objects from entering the cabin air system. Fresh air also enters the upper RH cowl inlet, flows through the upper cowl, and is ducted to a heat exchanger surrounding the RH engine exhaust muffler. The heated air is then routed to the hot air valve, mounted to the forward side of the firewall, that allows the heated air to enter the cabin air distribution system.

The heated air from the hot air valve and the fresh air from the wing inlets are allowed to mix in the air mixing chamber mounted to the rear side of the firewall behind the instrument panel. The mixed air is then distributed by ram air to the passenger outlets and/or to the windshield diffuser. Airflow is ducted directly to all panel air vents.

The crew panel air vents are chest high outlets mounted in the RH and LH bolster panels. The crew floor air vents are mounted to the bottom of each kick plate. The passenger panel air vents are chest high outlets mounted in the armrests integral to the LH and RH cabin wall trim panels. The passenger floor air vents are mounted to the bottom portion of the LH and RH cabin wall trim panels. The windshield diffuser, located in the glareshield assembly, directs conditioned air to the base of the windshield.

Temperature, volume, and flow selection are regulated by manipulation of the cabin temperature and cabin air selector knobs on the lower RH side of the instrument panel.
Figure 21-001
Heating and Ventilation System - Serials 22-0002 thru 22-1862


CABIN HEAT/DEFROST SELECT
WINDSHIELD DEFROST DIFFUSER
FOOT-WARMER DIFFUSER
AIR MIXING CHAMBER
HEAT EXCHANGER
HEAT OFF
TEMP. CONTROL
COLD
FRESH AIR INTAKE
CONDITIONED AIR
FRESH AIR
MECHANICAL CONNECTION
B. Cabin Air System - Serials 22-1602, 22-1821, 22-1840, 22-1863 thru 22-2437 (See Figure 21-002)

The cabin air distribution system consists of a fresh air inlet in the RH wing, a heat exchanger around the RH engine exhaust muffler, an air mixing chamber, air ducting for distribution, a distribution manifold, a windshield diffuser, and crew and passenger air vents. An optional blower fan may also be installed.

Fresh air enters the cabin air distribution system through an inlet on the inboard, leading edge of the RH wing and is ducted to the air mixing chamber. A screen in the wing inlet duct prevents large objects from entering the cabin air system. Fresh air also enters the upper RH cowl inlet, flows through the upper cowl, and is ducted to a heat exchanger surrounding the RH engine exhaust muffler. The heated air is then routed to the hot air valve, mounted to the forward side of the firewall, that allows the heated air to enter the cabin air distribution system.

The heated air from the hot air valve and the fresh air from the wing inlet are allowed to mix in the air mixing chamber located under the RH crew seat. The mixed air is then distributed by either ram air or by optional blower fan to the distribution manifold mounted to the center, aft side of the firewall. The distribution manifold uses butterfly valves to control airflow to the floor and defrost vents. Airflow is ducted directly to all panel air vents.

The crew panel air vents are chest high outlets mounted in the RH and LH bolster panels. The crew floor air vents are mounted to the bottom of each kick plate. The passenger panel air vents are chest high outlets mounted in the armrests integral to the LH and RH cabin wall trim panels. The passenger floor air vents are mounted to the bottom portion of the LH and RH cabin wall trim panels. The windshield diffuser, located in the glareshield assembly, directs conditioned air to the base of the windshield.

Temperature, volume, and flow selection are regulated by manipulation of the cabin airflow, cabin vents, and cabin temperature selector knobs on the lower RH side of the instrument panel.

An optional air conditioning system is available on these airplanes. Refer to the Air Condition section below for additional information on this system. (Refer to 21-00)
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Serials 22-1863 thru 22-2333, 22-2335 thru 22-2419, 22-2421 thru 22-2437 w/o Fan.

Figure 21-002
Heating and Ventilation System - Serials 22-1863 thru 22-2437 w/o Fan (Sheet 1 of 3)
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Figure 21-002
Heating and Ventilation System - Serials 22-1863 thru 22-2437 w/ Fan (Sheet 2 of 3)
Figure 21-002
Heating and Ventilation System - Serials 22-1863 thru 22-2437 w/ Air Conditioning (Sheet 3 of 3)

NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Serials 22-1602, 22-1840, 22-1863 thru 22-2333, 22-2335 thru 22-2419, 22-2421 thru 22-2437 w/ Air Conditioning.

EFFECTIVITY:
Serials 22-1863 thru 22-2437 w/ Air Conditioning

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C. Cabin Air System - **Serials 22-2438 & subs** (See Figure 21-003)

The cabin air distribution system consists of a fresh air inlet in the lower RH cowl, a heat exchanger around the RH engine exhaust muffler, an air mixing chamber, air ducting for distribution, a distribution manifold, a windshield diffuser, and crew and passenger air vents. An optional blower fan may also be installed.

Fresh air enters the cabin air distribution system through a NACA vent on the RH lower cowl and is ducted to the air mixing chamber mounted to the forward side of the firewall. Fresh air also enters the upper RH cowl inlet, flows through the upper cowl, and is ducted to a heat exchanger surrounding the RH engine exhaust muffler. The heated air is routed to the air mixing chamber to be mixed with the fresh air. The mixed air is then distributed by either ram air or by optional blower fan to the distribution manifold mounted to the center, aft side of the firewall. The distribution manifold uses butterfly valves to control airflow to the floor and defrost vents. Airflow is ducted directly to all panel air vents.

The crew panel air vents are chest high outlets mounted in the RH and LH bolster panels. The crew floor air vents are mounted to the bottom of each kick plate. The passenger panel air vents are chest high outlets mounted in the armrests integral to the LH and RH cabin wall trim panels. The passenger floor air vents are mounted to the bottom portion of the LH and RH cabin wall trim panels. The windshield diffuser, located in the glareshield assembly, directs conditioned air to the base of the windshield.

Serials w/ Perspective Avionics: Additional crew vents are located at LH and RH display panels.

Temperature, volume, and flow selection are regulated by manipulation of the cabin airflow, cabin vents, and cabin temperature selector controls on the lower RH side of the instrument panel.

An optional air conditioning system is available on these airplanes. Refer to the Air Condition section below for additional information on this system. *(Refer to 21-00)*
Figure 21-003
Heating and Ventilation System - Serials 22-2438 & subs w/o Fan, w/o Perspective Avionics (Sheet 1 of 3)

NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Serials 22-2334, 22-2420, 22-2438 thru 22-3025, 22-3026 & subs w/o Fan & w/o Perspective Avionics.
Figure 21-003

Heating and Ventilation System - Serials 22-2438 & subs w/ Fan, w/o Perspective Avionics (Sheet 2 of 3)

NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

SERIES 22-2334, 22-2420, 22-2438 thru 22-3025, 22-3026 & subs w/ Fan & w/o Perspective Avionics.

EFFECTIVITY:
Serials 22-2438 & subs w/ Fan, w/o Perspective Avionics
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Figure 21-003
Heating and Ventilation System - Serials 22-2334, 22-2420, 22-2438 thru 22-3025, 22-3026 & subs w/ Air Conditioning & w/o Perspective Avionics.

EFFECTIVITY:
Serials 22-2438 & subs w/ Air Conditioning, w/o Perspective Avionics

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D. Cabin Air System - *Serials 22-3026 & subs* (See Figure 21-004)

An optional air conditioning system is available on these airplanes. Refer to the Air Condition section below for additional information on this system. *(Refer to 21-00)*
Figure 21-004
Heating and Ventilation System - Serials 22-3026 & subs w/o Fan, w/ Perspective Avionics (Sheet 1 of 3)

NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.
EFFECTIVITY:
Serials 22-3026 & subs w/ Air Conditioning & w/ Perspective Avionics.

Figure 21-004
Heating and Ventilation System - Serials 22-3026 & subs w/ Air Conditioning & Perspective Avionics (Sheet 3 of 3)

NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Serials 22-3026 & subs w/ Air Conditioning & w/ Perspective Avionics.

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E. Cabin Air System - Serials 22T-0001 & subs (See Figure 21-005)

The cabin air distribution system consists of a fresh air inlet in the lower RH cowl, a heat exchanger around the crossover exhaust pipe, an air mixing chamber, air ducting for distribution, a distribution manifold, a windshield diffuser, and crew and passenger air vents. An optional blower fan may also be installed.

Fresh air enters the cabin air distribution system through a NACA vent on the RH lower cowl and is ducted to the air mixing chamber mounted to the forward side of the firewall. Fresh air also enters the cabin air distribution system through a NACA vent on the LH lower cowl and a second NACA vent on the RH lower cowl. This air is ducted through the turbochargers to the intercoolers. Ducts on the rear port of the intercoolers direct the air to a heat exchanger on the crossover exhaust pipe. The heated air is routed to the air mixing chamber to be mixed with the fresh air. A temperature sensor, located in the cabin air coupler duct, prevents system overheating by monitoring duct temperature. If the temperature becomes too hot, the sensor sends a signal to the actuator to adjust the amount of cold air entering the system. The mixed air is then distributed by either ram air or by optional blower fan to the distribution manifold mounted to the center, aft side of the firewall. The distribution manifold uses butterfly valves to control airflow to the floor and defrost vents. Airflow is ducted directly to all panel air vents.

For over-temperature protection (the turbocharger bleed air is further heated, under some conditions the hot air source temperature may be in excess of 300°F), the controller monitors mixed air temperature through a sensor downstream of the mixing chamber. If mixed air temperature exceeds duct temperature limit, the hot air flow is reduced and fresh airflow increased until temperature is reduced. Valves are automatically cycled to ensure supply temperature is maintained below duct temperature limits. The crew panel air vents are chest high outlets mounted in the RH and LH bolster panels. The crew floor air vents are mounted to the bottom of each kick plate. The passenger panel air vents are chest high outlets mounted in the armrests integral to the LH and RH cabin wall trim panels. The passenger floor air vents are mounted to the bottom portion of the LH and RH cabin wall trim panels. The windshield diffuser, located in the glareshield assembly, directs conditioned air to the base of the windshield. Additional crew vents are located at LH and RH display panels.

Temperature, volume, and flow selection are regulated by manipulation of the cabin airflow, cabin vents, and cabin temperature selector controls on the lower RH side of the instrument panel.
F. Air Conditioning System - Serials 22-1602, 22-1821, 22-1840, 22-1863 & subs, 22T-0001 & subs
(See Figure 21-002), (See Figure 21-003), (See Figure 21-004), (See Figure 21-005)

The air conditioning system consists of an engine driven compressor, condenser assembly with integral blower fan and receiver-drier, evaporator assembly with integral expansion valve assembly, and all associated plumbing and control mechanisms.

The R134A refrigerant enters the engine mounted compressor as a vapor and is pressurized until the heat-laden vapor reaches a point much hotter than the outside air. The compressor then pumps the vapor to the condenser where it cools, changes to a liquid, and passes to the receiver-drier. The receiver-drier's function is to filter, remove moisture, and ensure a steady flow of liquid refrigerant into the evaporator through the expansion valve - a temperature controlled metering valve which regulates the flow of liquid refrigerant to the evaporator. Inside the evaporator, the liquid refrigerant changes state to a gas and in doing so, absorbs heat. The evaporator then absorbs the heat from the air passing over the coils and the moisture from the air condenses and is drained overboard through the belly of the aircraft. From the evaporator, the refrigerant vapor returns to the compressor where the cycle is repeated. During normal air-conditioning operation, ram air from the fresh air intake flows into the evaporator assembly, is cooled as it passes through the evaporator coils, and is then ducted forward to the distribution manifold. During maximum air-conditioning operation - or recirculation mode - the fresh air valve closes and valves in the evaporator assembly open allowing cabin air to be recirculated and further cooled as the air passes through the evaporator coils and ducted forward to the distribution manifold. Conditioned air is circulated through the system by ram air or by the blower fan mounted adjacent to the evaporator.
EFFECTIVITY:
Serials 22T-0001 & subs w/o Fan
CROSSOVER TUBE
RAM AIR
FRESH AIR VALVE
MIXING CHAMBER
HOT AIR VALVE
FLOOR AIRFLOW
DISTRIBUTION MANIFOLD
WINDSHIELD DIFFUSER
FLOOR AIRFLOW
MANIFOLD
PANEL AIRFLOW
AIR GASPER
FOOT-WARMER DIFFUSERS
RAM AIR
CROSSOVER TUBE
HOT AIR VALVE
SERVO MOTOR
CONTROL PANEL
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Serials 22T-0001 & subs w/ Fan.

Figure 21-005
Heating and Ventilation System - Serials 22T-0001 & subs w/ Fan (Sheet 2 of 3)
NOTE: Illustration depicts maximum cabin cooling airflows and selector settings.

Figure 21-005
Heating and Ventilation System - Serials 22T-0001 & subs w/ Air Conditioning (Sheet 3 of 3)