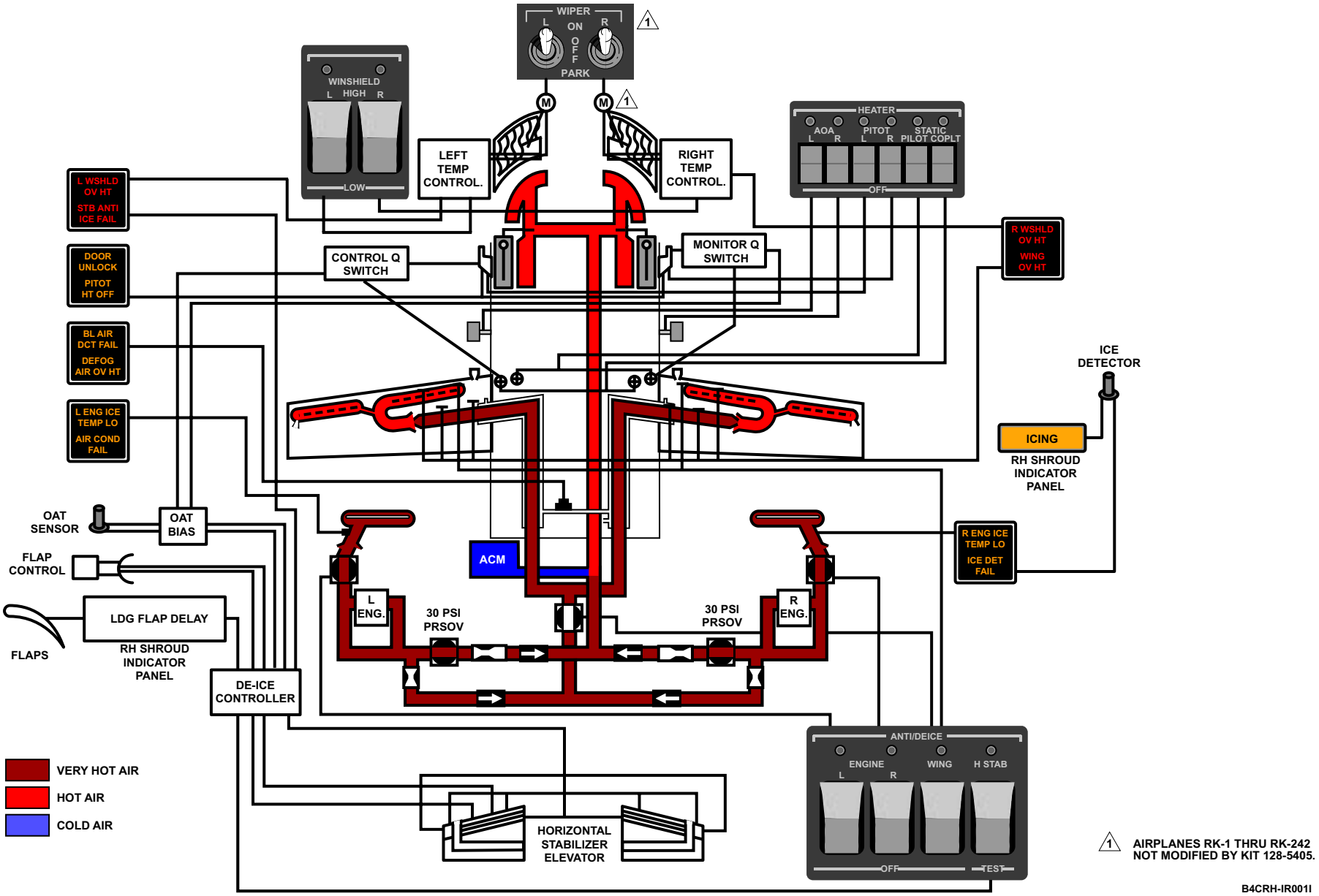
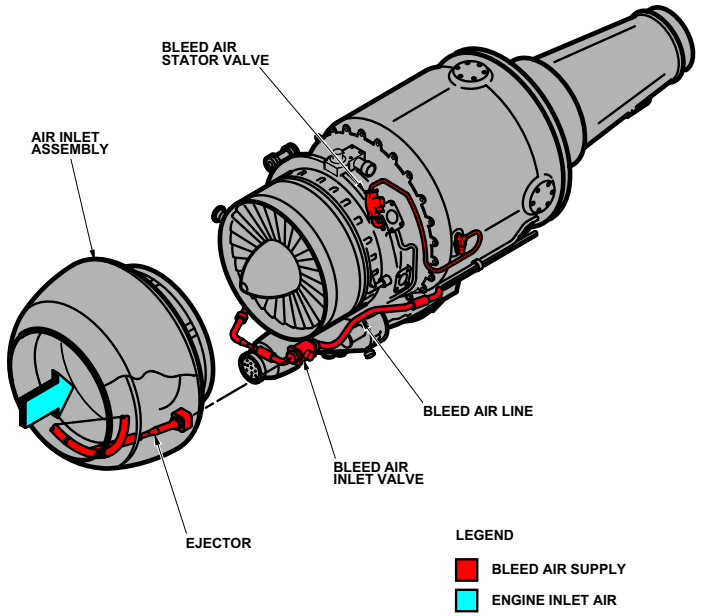
Ice and Rain Protection System



Air Inlet Anti-Ice and Stator Anti-Ice Systems



B4CRH-IR002I

Ice and Rain Protection System

The ice and rain protection system prevents, or disposes of, ice or rain on the following areas of the airplane:

- wing leading edges
- engine inlet ducts, nose cone, stators, T_1 probes and T_0 probes
- horizontal stabilizer
- pitot tubes
- True Air Temperature (TAT) Sensors
- static ports
- AOA transmitters, and
- pilot's and copilot's windshields.

Anti-ice/deice, defogging and rain protection subsystems are divided into three types:

- Bleed air – Engine bleed air is utilized for the thermal source:
  - Engine Air Intake Anti-ice System
  - Wing Leading Edge Anti-ice System
  - Windshield Defog System
- Electrical – Electrical power is utilized for the thermal source:
  - Heated Windshield
  - Horizontal Stabilizer Deice System
  - Pitot-static And AOA Anti-ice Systems
- Rain Protection – Windshield wiper system (if installed) or surface seal.

Wing Leading Edge Anti-Ice System

The WING ANTI-ICE switch on the overhead switch panel controls the wing leading edge anti-icing system. When the switch is in the ON position, the pressure regulator and shutoff valve are energized and open. When the leading edge temperature exceeds a predetermined value, the WING ANTI-ICE operation light located on the overhead switch panel will illuminate.

One temperature switch and three over temperature switches are installed in each wing leading edge. One temperature switch activates when the air temperature in the duct is approximately 140°F (60°C) causing the WING ANTI-ICE operation light to illuminate. Two over temperature switches installed on the front spar activate when the temperature of the front spar is above 212°F (100°C). One over temperature switch, installed on the leading edge skin, activates at 350°F (176°C). In either case, the WING OVHT annunciator will illuminate.

The warning system for bleed air rupture protection is composed of four thermal switches in the aft fuselage and a pressure switch in the cabin air duct shield. Two thermal switches are installed at the aft pressure bulkhead and two above the bleed air ducting. The thermal switches are set to close at 350°F (176°C) and open at 320°F (160°C). Should one of these thermal switches activate, a BL AIR DCT FAIL annunciator will illuminate. The overpressure switch is installed forward of the aft pressure bulkhead. This pressure switch is set to close at 3.5 ±0.5 PSI and open at 2 PSI minimum. When the switch is closed, a BL AIR DCT FAIL annunciator will illuminate.

Horizontal Stabilizer Deice System

Ice protection for the horizontal stabilizer and elevator is accomplished by heater mats bonded to the left and right leading edges of the stabilizer and the left and right elevator horns. The mats consist of five independent heating elements molded to each leading edge and four elements molded to each elevator horn.

Deice Operation

Deicing of the horizontal stabilizer leading edges and elevator horns is accomplished by a cyclic supply of 28V DC power to the heater elements. When the H STAB DEICE switch on the overhead switch panel is turned ON, a white light adjacent to the switch illuminates and 28V DC power is directed from the H STAB CONT circuit breaker (ICE RAIN) to a controller located in the aft fuselage. The controller will not supply power to the heater elements if the RAT is greater than approximately 21°C, or if the aircraft is on the ground. With the system turned ON and the RAT below approximately 21°C, the controller processes RAT, airspeed and flap position from the temperature sensor, Q-switches and flap lever respectively and follows a predetermined cyclic sequence of powering the heating elements.

NOTE: During normal operation the stabilizer deice system may increase generator load by up to approximately 163 amperes/generator depending on OAT.

During flight in icing conditions, wait at least 15 seconds after selecting 10° flaps before selecting 30° flaps. This delay provides the stabilizer deice system the time required to remove any ice accumulation from the stabilizer leading edge. During this delay, the white LDG FLAP DELAY annunciator (copilot's shroud panel) will illuminate and the system will limit flap travel to approximately 10 degrees.

If a system failure occurs, the H STAB DEICE FAIL annunciator will illuminate and the glareshield-mounted WARNING flasher switches will flash.

When the H STAB DEICE switch on the overhead panel is turned OFF, and the RAT is below approximately 21°C, the controller will complete its active cycle before shutting down.

Ice Detector

The ice detector, mounted on the upper left side of the nose, senses ice accretion and causes the ICING annunciator in the copilot's shroud panel to illuminate. The illumination of the annunciator is the ice detector's only function. If the ice detector fails, an ICE DETECT FAIL caution annunciator illuminates and the glareshield-mounted MASTER CAUTION RESET switches will flash.

Engine Anti-Ice

Each engine has two anti-ice systems installed to prevent the buildup of ice in the engine intake. One system circulates high pressure compressor bleed air in a jacket around the nacelle air inlet duct leading edge and the other system extracts high pressure compressor bleed air and routes it into the engine low pressure compressor inner stators. Additional high-pressure compressor air is tapped off and supplies a small amount of air for anti-ice protection for the T_1 temperature probe and the inlet cone. The nacelle inlet anti-ice control valve is located on the lower part of the engine inlet case and the inner stator anti-ice control valve is located at the 10 o'clock position on the engine intermediate case.

The L or R ENGINE ANTI-ICE switches located on the overhead switch panel, control the engine anti-ice systems. When the ENGINE ANTI-ICE switch is ON, the pressure regulator shutoff valve opens to regulate the bleed air pressure for the engine anti-ice system at 16 PSI. At the same time, the L or R ENGINE ANTI-ICE operation light will illuminate. When the engine inlet bleed air temperature is below 120°F the L or R ENG ICE TEMP LO annunciator will illuminate.

Pitot-Static and Angle-of-Attack Anti-Ice System

The pitot tubes, static ports and angle-of-attack (AOA) probes are electrically heated. Each component incorporates a heating element operated by 28V DC power and controlled by the PITOT, STATIC and AOA HEATER switches located on the overhead switch panel. The heating elements are high resistance wires bonded to the interior surface of the component. The operation lights are incorporated in each switch.

Two pitot tubes are installed on the external surface of the nose electronics compartment structure: one on the left and one on the right. Two pairs of static ports are flush mounted on each side of the cabin lower skin surface. Four switches are provided for operation of the heaters. The L PITOT HEATER switch controls the heater element in the left pitot tube and the R PITOT HEATER switch controls the heater element for the right pitot tube. A PITOT HT OFF annunciator will illuminate when the pitot heat is off. The PILOT STATIC HEATER switch controls the heater elements in the pilot's static ports on each side and the COPLT STATIC HEATER switch controls the heat to the copilot's static ports.

The angle-of-attack (AOA) transmitters are installed on each side of the forward fuselage just below the side window. The angle-of-attack probe heater circuit is protected and controlled by the AOA HEATER switch. The probe heater uses 28V DC power and is regulated by a thermostat to prevent overheating. The thermostat will open if the probe heater exceeds 280°F (137°C). An operation light, incorporated in the AOA HEATER switch, is illuminated when the heater is powered. The AOA transmitter case is also equipped with a heater that is protected and controlled by the AOA HEATER switch and a thermostat. This thermostat will remove power when the case temperature exceeds 120°F (48°C) and return power when the temperature decreases below 90°F (32°C). The AOA HEATER operation light continuously monitors input electrical power.

Heated Windshield

Heating the windshield not only prevents the formation of ice, but also aids its bird strike resistance. For this reason, windshield low heat should always be used during flight. Electrical power is applied to the windshield by the L or R WINDSHIELD ANTI-ICE switch through the respective temperature controller which uses a sensing element to monitor the heating element temperature. The control unit incorporates overheat warning circuitry which supplies a signal to the L or R WSHLD OVHT light annunciator. The windshield heat system has two separate modes of operation: high and low. Electrical power is supplied to the heating elements through the windshield anti-ice (high power relays or windshield anti-ice low power relays. The temperature controller automatically regulates the heating cycle to maintain the temperature between 95°F and 104°F (35°C and 40°C) by utilizing the sensing element embedded in the windshield.

The high and low relays and temperature controller are located in the left junction box. When the windshield anti-ice system is placed in operation by placing the WINDSHIELD ANTI-ICE switch in the HIGH or LOW position, the operation light incorporated near the switch will illuminate and remain on until the controller cycles or the switch is turned OFF. Should a malfunction occur in the system, such as an open sensor or windshield overheat condition, the L or R WSHLD OVHT annunciator will illuminate.

Windshield Defog System

Defogging air is supplied by the air-conditioning system to both windshields and the cockpit side windows. The windshield air is regulated by the defog select valve, which is actuated by the DEFOG SELECT lever located on each side panel. The lever directs air to the windshields or the floor depending on position. A thermal switch, located at a side window defog outlet, will illuminate the DEFOG AIR OVHT annunciator if the duct temperature exceeds 200°F (93°C).

Additional defogging capability for the cockpit side windows is provided by an electrically powered heater/blower mounted at the side window. The blower is activated by a L or R DEFOG BLOWER CONT push button located near the DEFOG SELECT LEVER.

Windshield Wiper System Thru RK-242

Dual windshield wipers are provided for rain removal. An independent motor drives each wiper. Each motor is operated by a WIPER control switch, located on the overhead switch panel, that has three positions: PARK, OFF and ON. The PARK position automatically brings the wipers to a stowed position thus, keeping the windshield area unobstructed when the wipers are not operating. When the switch is turned to the OFF position, the wiper stops immediately. When the switch is in the OFF position, setting the PARK position allows the wiper to operate one cycle and stop at the parked position. In the ON position, each wiper cleans a triangle-shaped area equal to approximately a 60 inch segment of a circle. Moving the wiper switch from ON to PARK with the wipers operating can result in damage to the wiper system.

RK-243 and After and Those Airplanes Modified by KIT 128-5405

Rain protection is provided by Surface Seal^{TM} coated windshields.

Approved Deicing and Anti-Icing Fluids

Only the following fluids have been approved for deicing and anti-icing:.

NOTE: When using deicing/anti-icing fluids, takeoff speeds (V_R) should be increased by 10 kt to stop ingestion of the solution into the engine.

- SAE AMS 1424 Type I
- ISO 11075 Type I
- SAE AMS 1428 Type II
- ISO 11078 Type II
- SAE AMS 1428 Type IV

Only the follow Type IV anti-icing fluids are approved:

- Clariant Safewing MP IV 1957
- Clariant Safewing MP IV 2001
- UCAR ULTRA+ (Approved for use down to -15ºC)
- Octagon Max Flight Type IV

NOTE: Only 10 degree flap operation is permitted when using Type II or Type IV deicing/anti-icing fluid.