



OPERATIONS MANUAL
SECTION 6-14

ICE AND RAIN PROTECTION

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GENERAL DESCRIPTION

The Ice and Rain protection system consists of:

- PNEUMATIC DE-ICING on:
 - Wings
 - Horizontal Stabilizer
 - Vertical Stabilizer

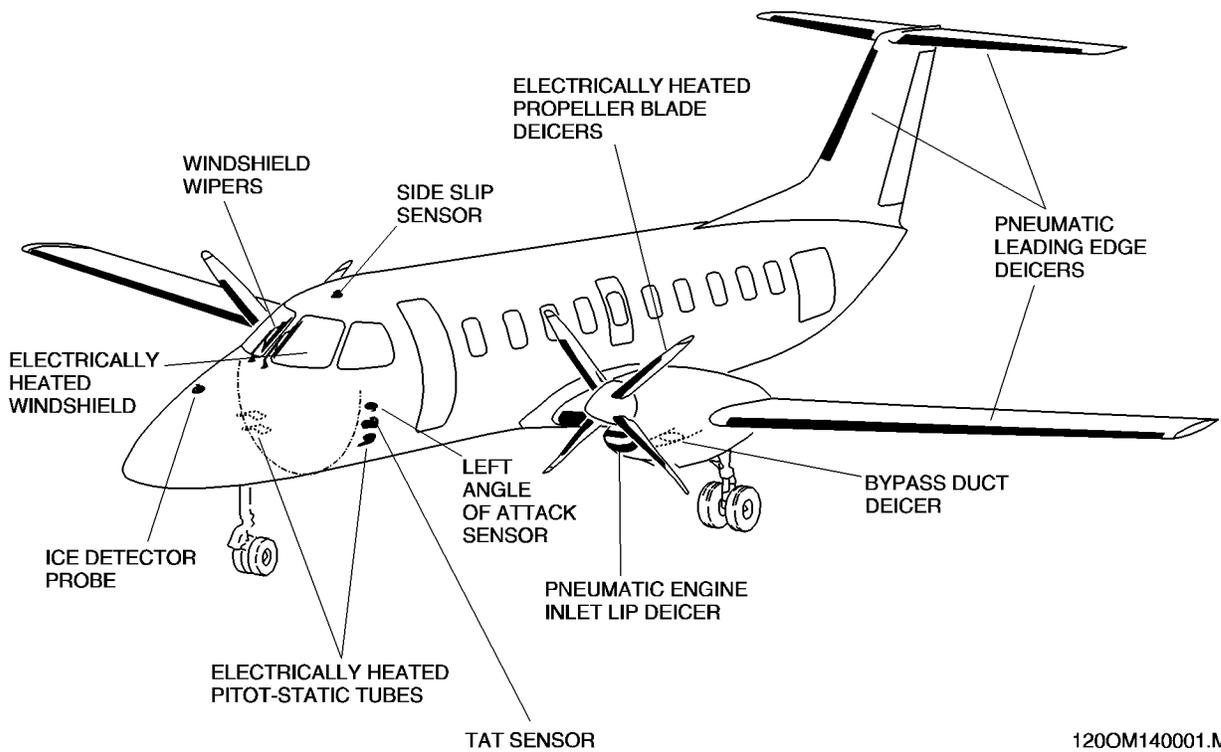
- PROPELLER DE-ICING on:
 - The leading edge of the propeller blades

- ELECTRICAL ANTI-ICING on:
 - Windshield
 - AOA, SIDE SLIP, TAT Sensors
 - Pitot tubes & Static Ports

- WINDSHIELD WIPERS on:
 - Left Windshield
 - Right Windshield

- WINDSHIELD DEFOG

- ICE DETECTION SYSTEM



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ICE AND RAIN PROTECTION SYSTEMS

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PNEUMATIC DEICING SYSTEM

The pneumatic de-icing system consists of inflatable rubber boots installed on the wings, horizontal and vertical stabilizers leading edges, on the engine air inlet lips and engine air bypass duct.

The boots, inflated by engine bleed air, break the accreted ice on the leading edges and the air-stream carries away the broken ice.

The engine bleed air flows through a manifold, is distributed to six ejector flow control valves and from the valves to the boots.

- These valves are electrically actuated and electronically controlled by timers, thereby providing inflation cycles for the leading edges and engine air inlet lip deicers.
- Engine air inlet deicers are controlled independently by individual timers. Leading edge deicers are controlled by one timer only, having a second one as a standby.

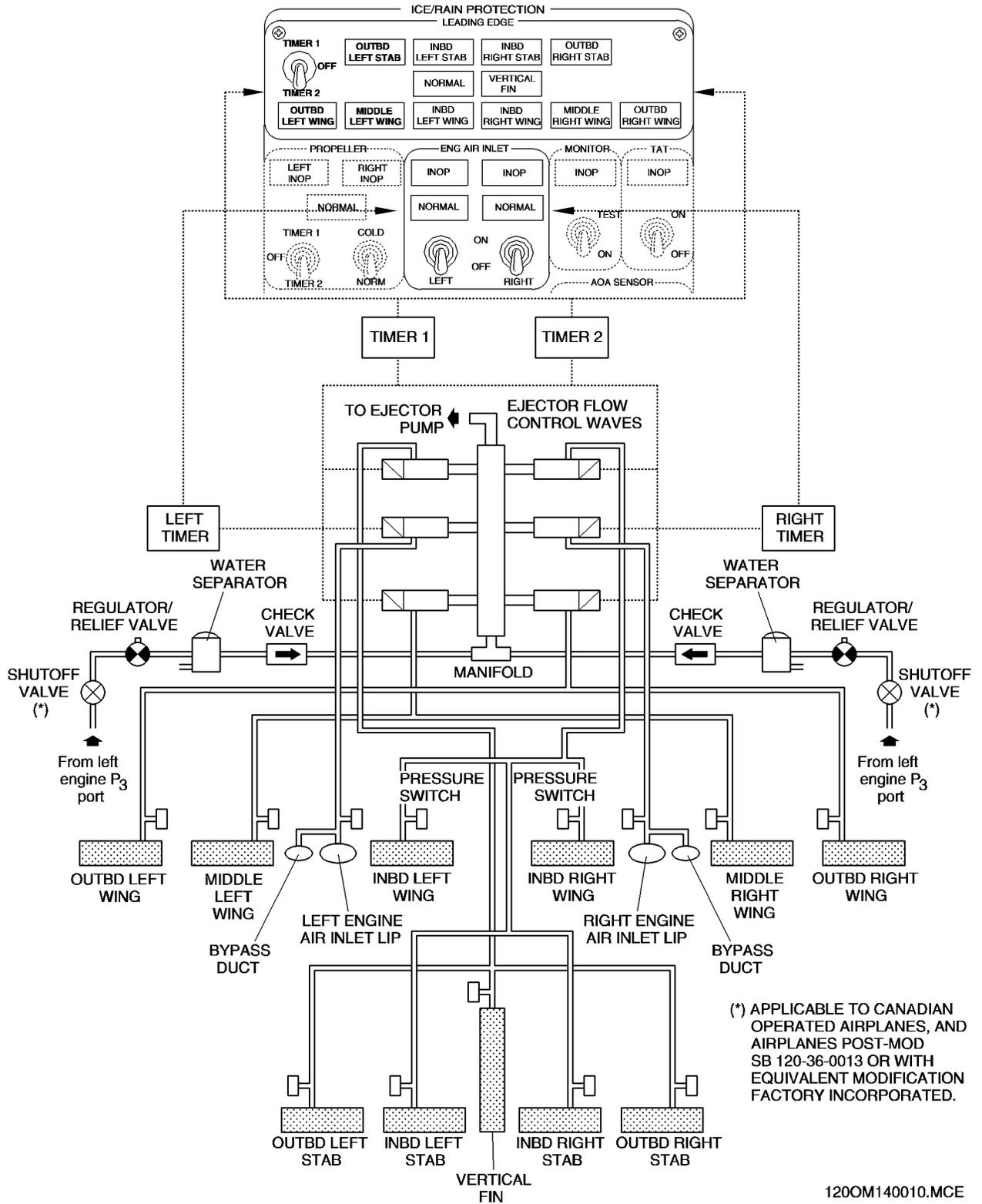
Engine bleed air flows from both engines to the manifold, therefore in case of an engine failure, the remaining engine is capable of supplying engine bleed air to the pneumatic de-icing system.

- When the pneumatic de-icing system is working properly the green NORMAL lights illuminate. If a failure is detected in any boot, the respective amber light illuminates and the normal light extinguishes.
- Inspection lights located on either side of the fuselage illuminate the leading edge of the wings and engine air intakes, allowing the crew to visually detect accreted ice at night. Inspection lights are controlled by the INSP switch, located on the Overhead Panel.

NOTE: Airplanes Post-Mod. SB 120-36-0013 or with equivalent modification factory incorporated have shutoff valves installed in each pneumatic deicing bleed line. These valves allow to shut off the air supply to the deicing system in case of leakage in the line and are actuated through the BLEED switches (left and right) located on the air conditioning control panel.

With the BLEED switch positioned in AUTO or LOW, the shutoff valve is opened (valve deenergized); with the BLEED switch positioned in CLOSE, the shutoff valve is closed (valve energized).

The CLOSED DEICE lights, on the air conditioning control panel will illuminate whenever the shutoff valve is closed.



PNEUMATIC DEICING SYSTEM SCHEMATIC

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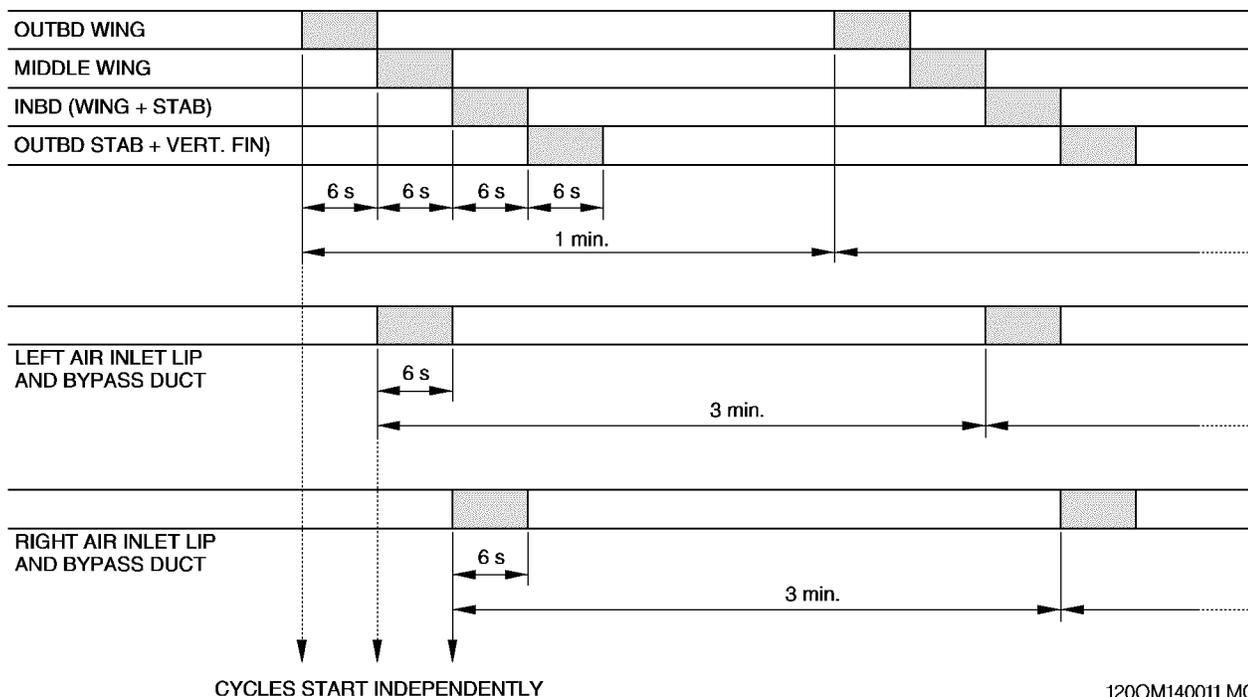
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PNEUMATIC DEICING SYSTEM CYCLES

For engine air inlet lips and bypass ducts protection, a 3-minute cycle is provided. There is no synchronization between the boots timers, therefore simultaneous operation of two and even three ejector flow control valves is possible.

NOTE: If the pneumatic deicing system is turned off, it cannot be turned on again, for at least 5 seconds to avoid failure indication.

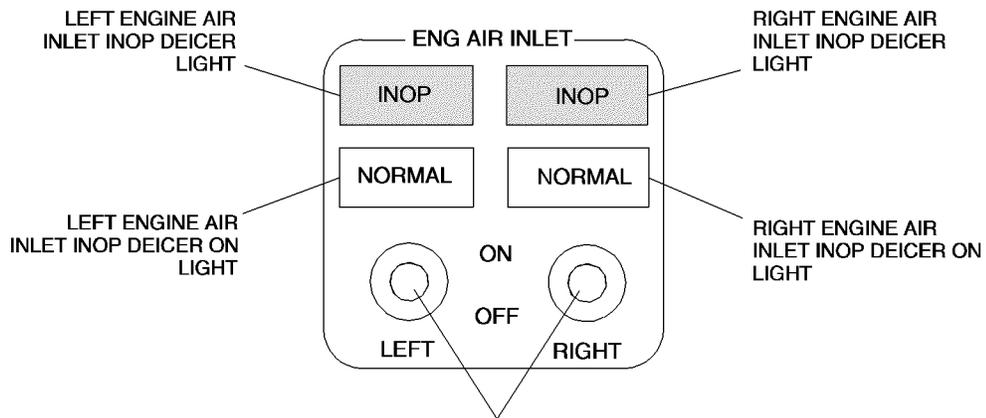
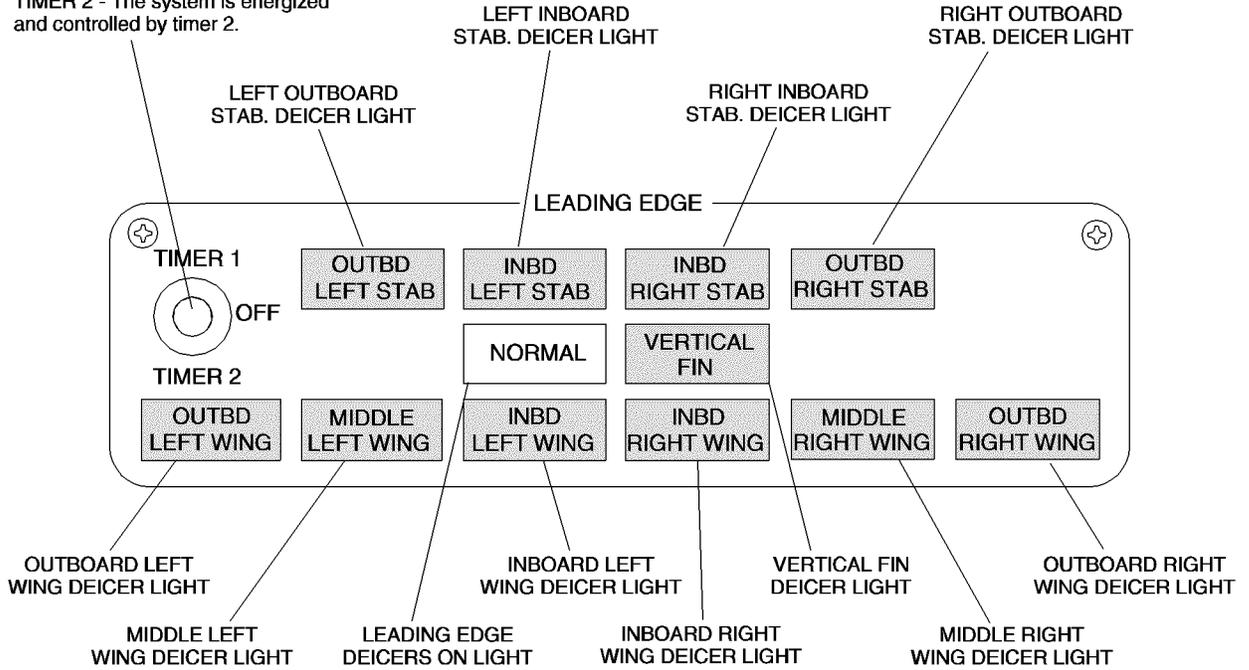
For leading edges protection, each ejector control valve will be energized for 6 seconds, cycling automatically every minute.



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LEADING EDGE DEICERS SWITCH
TIMER 1 - The system is energized and is controlled by timer 1.
OFF - The complete system remains off.
TIMER 2 - The system is energized and controlled by timer 2.



ENGINE AIR INLET LIP AND BYPASS DUCT DEICERS SWITCH

ON - System energized and operating under three-minute cycle.
OFF - System is deenergized.

- AMBER LIGHTS - ILLUMINATED** - When any failure is detected.
- GREEN LIGHTS - ILLUMINATED** - When the system is energized and normally operating.

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PNEUMATIC DEICING PANELS (OVERHEAD PANEL)



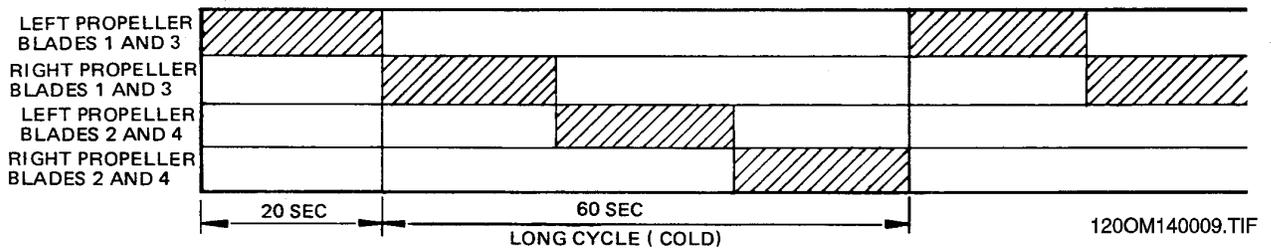
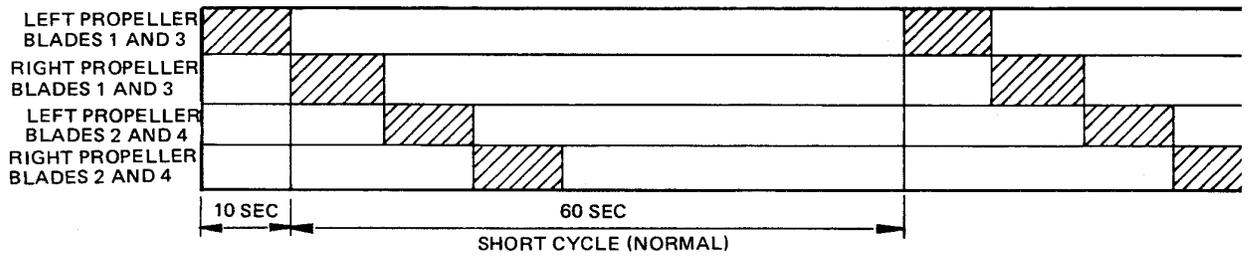
PROPELLER DEICING

The leading edge of the propeller blades incorporates electrical resistances for ice protection. The system incorporates two redundant timers which control the heating cycles. Each timer energizes two opposed propeller blades simultaneously, according to the following sequence:

SEQUENCE SEGMENT	HEATED BLADES
1	Left propeller/blades 1 & 3
2	Right propeller/blades 1 & 3
3	Left propeller/blades 2 & 4
4	Right propeller/blades 2 & 4

Each propeller and timer is supplied by a independent 28 V DC bus. The system will not be powered when engine oil pressure is below 40 psid. Short and long heating cycles are provided for propeller ice protection. In the short cycle, each blades heater is energized during 10 seconds, and deenergized during 60 seconds. In the long cycle, heaters are energized during 20 seconds and deenergized during 60 seconds. The short cycle is recommended when the true outside air temperature (TOAT) is above -10°C , and the long cycle is recommended below -10°C . Long and short cycles are selected by the cycles selection switch, located on the propeller deicing panel. A test switch is incorporated on the side panels, for maintenance purposes only.

NOTE: Refer to section 5, "Correction to the Indicated Outside Air Temperature" Chart, in order to obtain the TOAT, entering the respective indicated outside air temperature read or the OAT indicator.

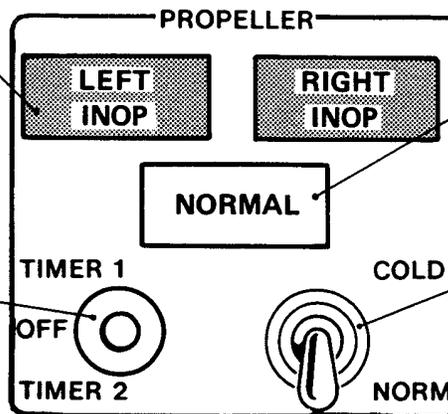


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LEFT PROPELLER DEICING SYSTEM INOPERATIVE LIGHT (AMBER) ILLUMINATED - Fault detected on the left propeller deicing circuit.

PROPELLER DEICING SYSTEM NORMAL LIGHT (GREEN) ILLUMINATED - When system is functioning properly.

PROPELLERS DEICING SYSTEM SWITCH
TIMER 1 - System energized and controlled by timer 1.
OFF - System deenergized
TIMER 2 - System energized and controlled by timer 2.



CYCLES SELECTION SWITCH
COLD - Selects 20 SEC - ON/60 SEC - OFF Cycle (Long Cycle).
NORM - Selects 10 SEC - ON/60 SEC - OFF Cycle (Short Cycle).

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PROPELLER DEICING PANEL (OVERHEAD PANEL)



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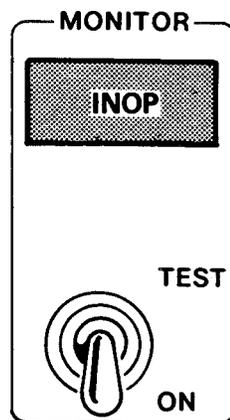
DEICING SYSTEMS MONITOR

A monitor unit checks the operation (duty cycles, time periods, sequence, and level of signals) of all inflatable boots, propeller ice protection system, caution lights associated with these systems, as well as its own operation. It is powered by two independent buses, DC bus 1 and DC bus 2.

When the Ice and Rain protection system is energized, the monitor illuminates the respective witness light (green light), indicating that the system is functioning properly. In case of a failure, the monitor illuminates the respective failure caution light (amber light) and simultaneously extinguishes the witness light. Even when the monitored system is not energized and a fault exists, the respective failure caution light illuminates.

An INOP amber light on the monitor panel illuminates when any fault develops in the monitor. A TEST/ON switch is also provided in the monitor panel. The TEST position checks all of the deicing system lights and the monitor (it does not check the operation of the deicing systems). When set to TEST position and no failure is detected, all lights illuminated in the deicing panels, including the monitor panel, extinguishes. In the next 2 seconds the INOP light on the monitor panel and the DEICE light on the multiple alarm panel illuminates. During the next 3 seconds all lights on the deicing panels illuminate. In the next 2 seconds all lights extinguishes.

After the test time (7 seconds), the equipment will revalidate all deicing systems. If a failure is detected in the monitor, only the monitor INOP light and multiple alarm panel DEICE light illuminates and remains illuminated until the failure ceases.



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ELECTRICAL ANTI-ICING SYSTEMS

WINDSHIELDS HEATING SYSTEM

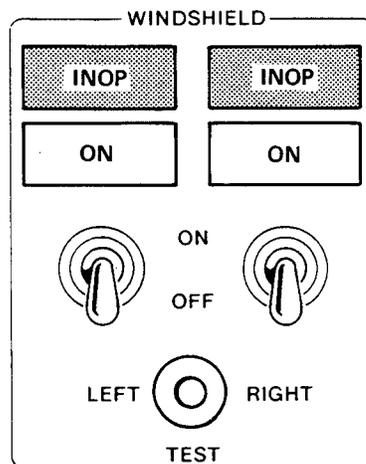
Independent power supplies are provided for each windshield heating element and its control circuit. One switch (ON-OFF type) for each windshield maintains the windshield temperature within safe values. Temperature cycles between 40°C and 45°C, with an overheat limit of 55°C. When the windshield is being heated, the ON green light illuminates on the windshield anti-icing control panel. If the windshield is not being heated, the INOP amber light illuminates and the green light extinguishes.

When a windshield overheat (temperature above 55°C) condition is detected the red RW/S OVERHEAT or LW/S OVERHEAT light illuminates on the multiple alarm panel.

The overheat circuit is checked by a switch which can be selected to test the left or to the right windshields. The INOP light on the overhead panel, the DEICE and the respective RW/S or LW/S OVERHEAT red light on the multiple alarm panel, illuminate and the aural warning sounds until the test switch is set to its normal position.

NOTE: On airplanes Post-Mod. S.B. 120-030-0022 or S/N 120.216 and on, a proper circuit functioning is indicated by the illumination of the respective ON green light on the overhead panel, and the respective RW/S or LW/S OVERHEAT red light on the multiple alarm panel, triggering the aural warning while the test switch is actuated.

When the circuit is being tested but is not working properly the lights remain illuminated as they were before the test.



(OVERHEAD PANEL)



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Conductive copper wires on the windshields interlayer permits electric heating to prevent ice buildup and fogging.



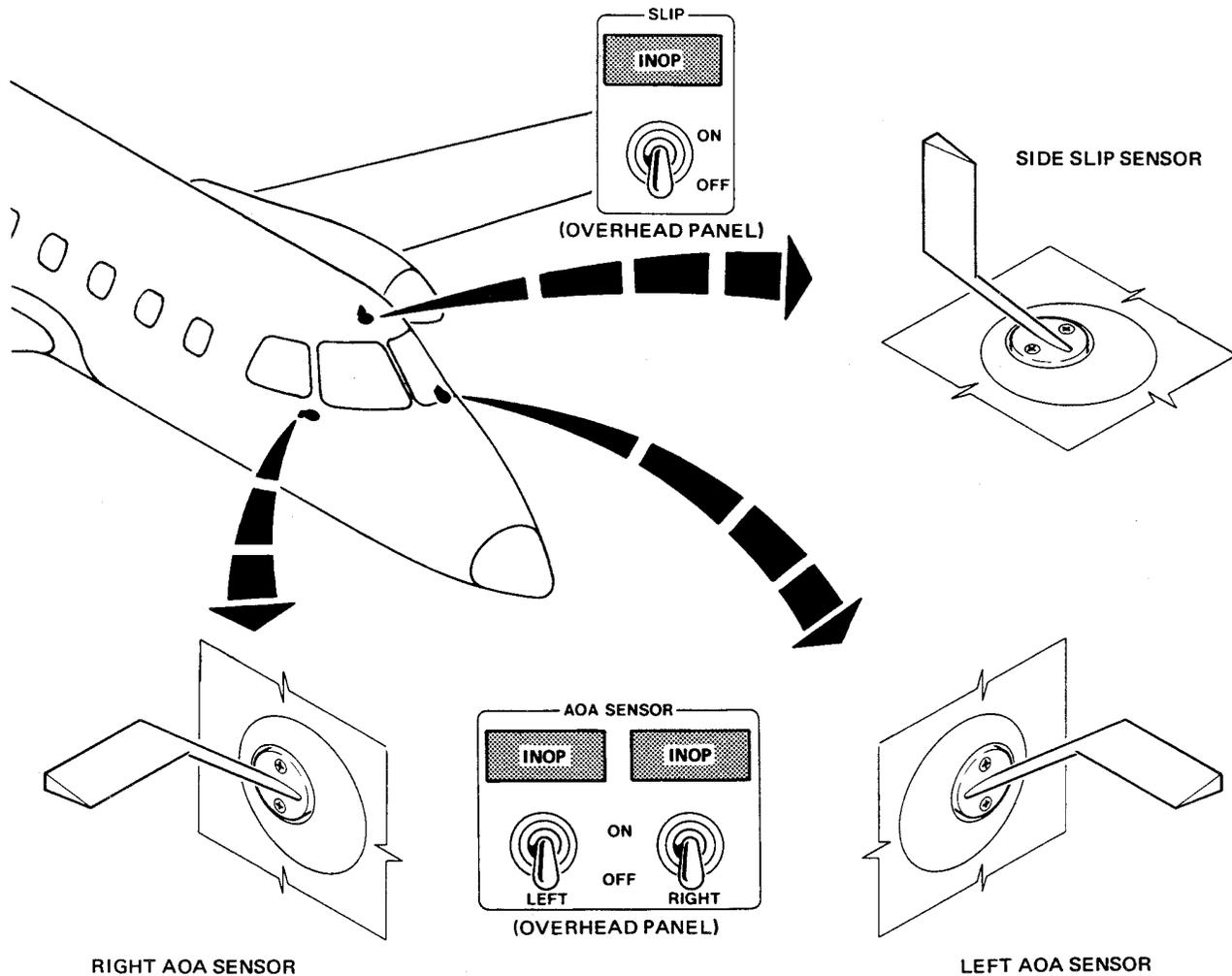
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ANGLE OF ATTACK AND SIDE SLIP SENSORS HEATING SYSTEMS

The angle of attack and side slip sensors are electrically heated by independent buses, DC Bus 1, (left AOA sensor), and DC Bus 2, (right AOA and slip sensors).

The amber INOP light illuminates on the slip panel and the DEICE light illuminates on the Multiple Alarm Panel if the slip sensor is not being heated and the slip switch is ON.

The related amber INOP light illuminates on the AOA sensor panel and the DEICE light illuminates on the Multiple Alarm Panel if any AOA sensor is not being heated and the related switch is ON.



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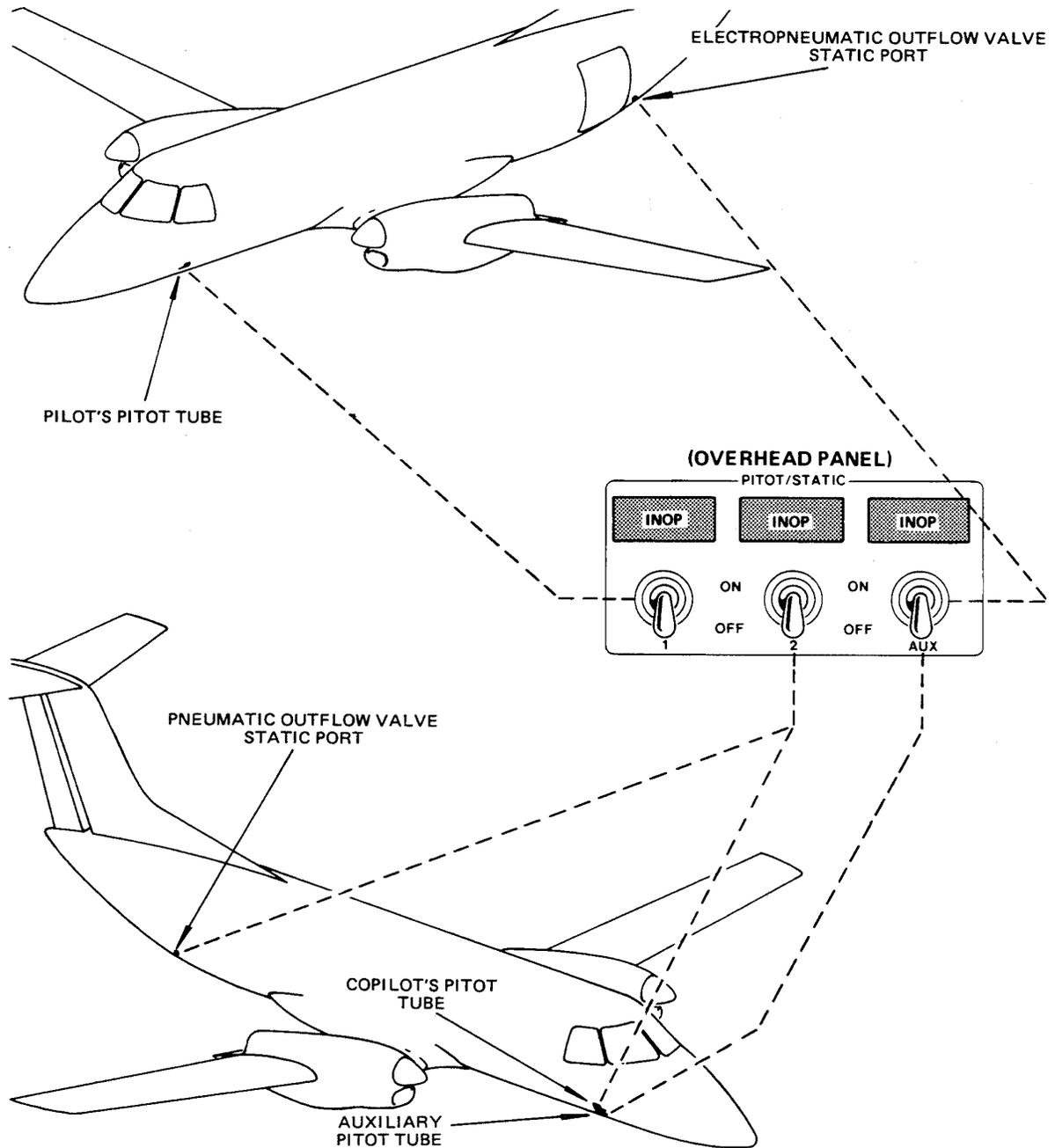
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PITOT/STATIC AND OUTFLOW VALVES STATIC PORTS HEATING SYSTEM

The pitot/static tubes and static ports are electrically heated by independent power supplies. System switched OFF (causing heater element to become inoperative) is indicated by illuminating the INOP amber lights on the pitot/static panel. INOP lights also illuminate, should the associated supply fail. DEICE light on the multiple alarm panel always illuminates in conjunction with pitot/static INOP lights.



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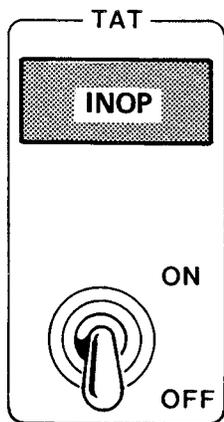
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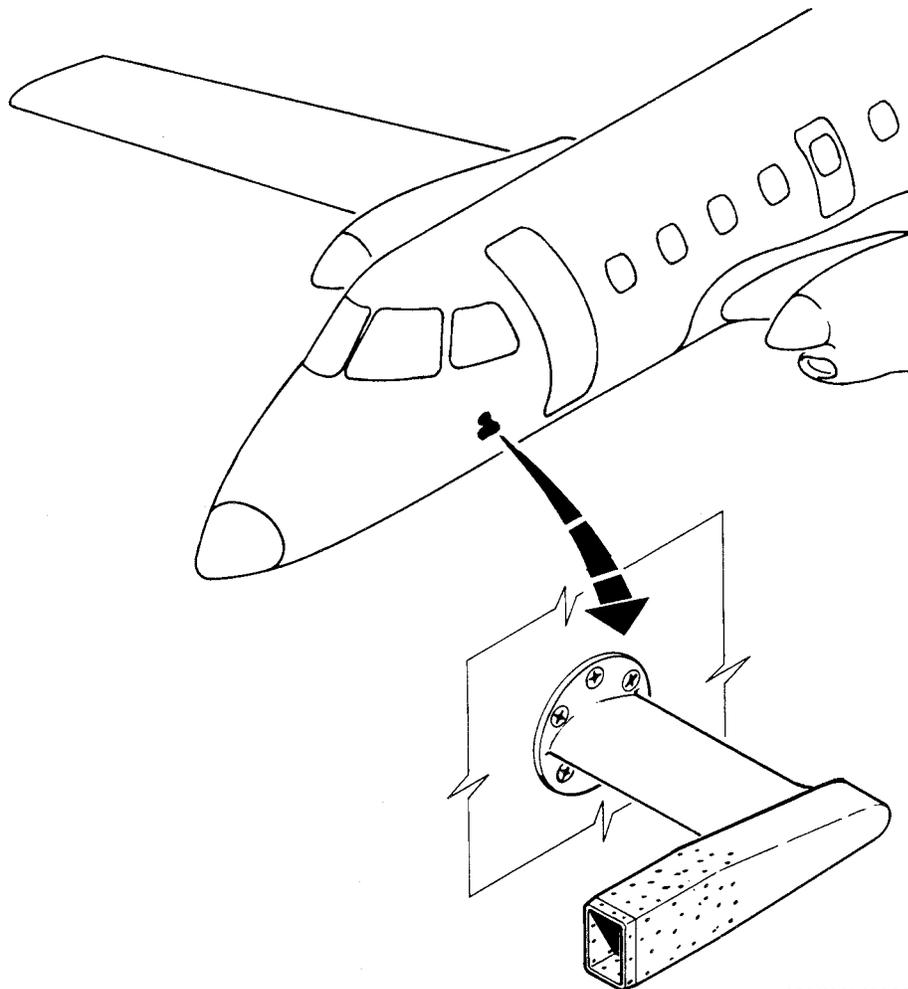
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TOTAL AIR TEMPERATURE SENSOR HEATING

The total air temperature (TAT) sensor is electrically heated and the heater is controlled by an ON/OFF switch. A current detector is provided to monitor the current after the power is switched ON and if the sensor is not heated the amber INOP light illuminates on the TAT Panel and the DEICE light illuminates on the Multiple Alarm Panel.



(OVERHEAD PANEL)



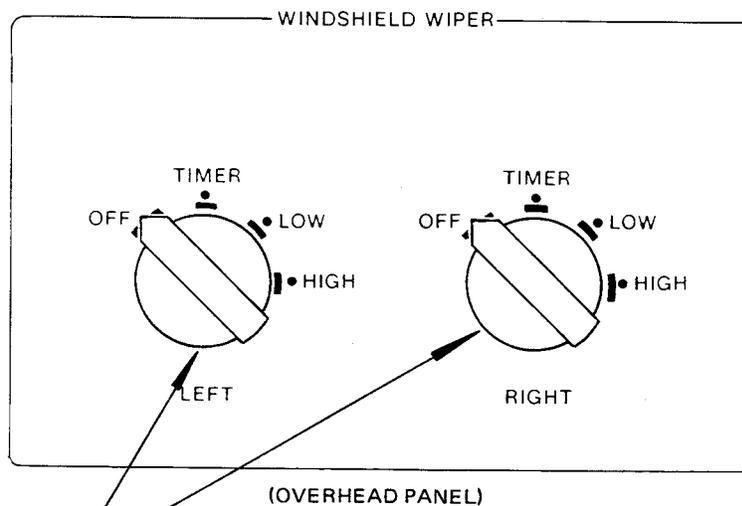
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WINDSHIELD WIPERS

The airplane is equipped with two-speed, independently winds wipers, the left and the right one.



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WINDSHIELD WIPER CONTROL SWITCHES

- OFF – Blades are parked on the windshield mounting brackets
- TIMER – Provides intermittent operation in single cycles (2 strokes) with a 8-second time interval between two cycles
- LOW – Wiper operates at approximately 80 strokes per minute
- HIGH – Wiper operates at approximately 140 strokes per minute



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ICE DETECTION SYSTEM

The ice detection system consists of an ICE DETECTION PANEL and an ice detector installed on the airplane nose.

The ice detector is a vibrating probe.

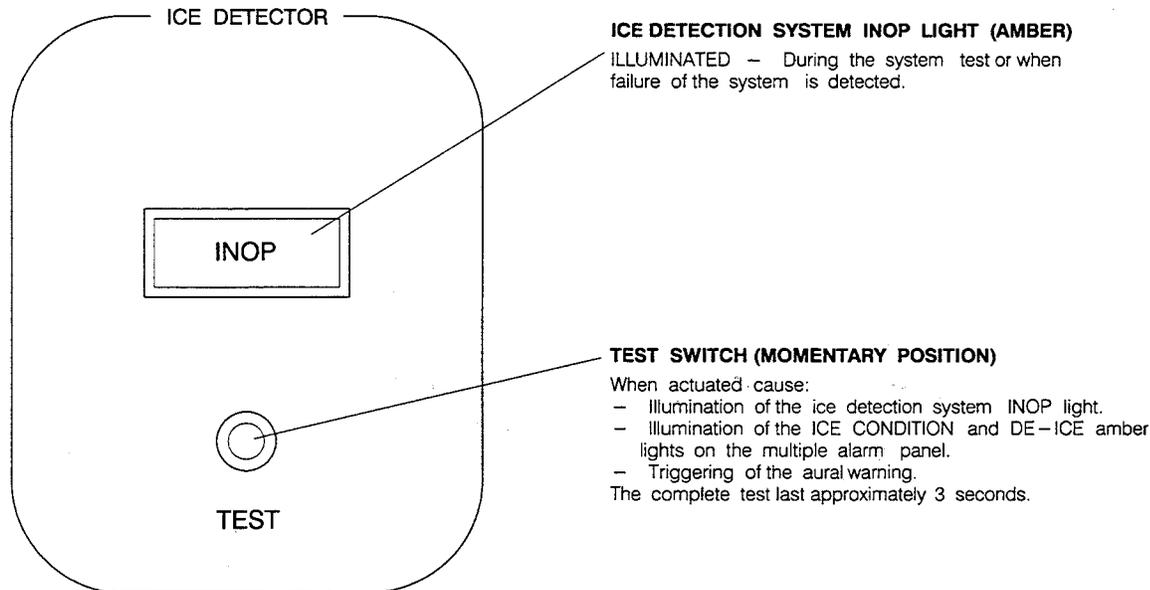
The airplane enters an icing environment, the ice collected on the probe causes the frequency of the probe to decrease, generating a signal that activates the ICE CONDITION amber light on the multiple alarm panel.

The ice detector detects ice accretion little as 0.5 mm (0.020 inch) of ice.

The icing signal remains activated for 60 seconds. After 60 seconds, the ice detector heater is activated to deice the probe. When the probe natural frequency is recovered, the heater is deenergized and a new detection cycle is initiated. When operating in icing conditions, the probe signal will be continuously activated and the ICE CONDITION light will remain illuminated as long as icing condition persists.

The ice detection system is powered by the DC bus 2. The system is automatically turned on during airplane energization, and remains activated during the entire flight.

- NOTE:**
- The system performs a self-test whenever the airplane is energized.
 - The DEICE amber light illuminates on the multiple alarm panel simultaneously with ICE CONDITION.



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ICE DETECTION SYSTEM PANEL
(OVERHEAD PANEL)

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