

**canadair
challenger**

OPERATING MANUAL
PSP 601A-6

SECTION 14

ICE/RAIN PROTECTION

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SECTION 14

ICE/RAIN PROTECTION

1. GENERAL (Figures 1 and 3)

Ice and rain protection is provided by thermal and electrical anti-icing systems. Thermal anti-icing, using 14th stage engine bleed air, protects the wing leading edges and the engine cowlings. Electrical anti-icing is provided for the windshield and the various sensors of the air data system (ADS), including the stall protection system angle-of-attack sensors.

2. ICE DETECTION (Figure 2)

Icing conditions are detected by two externally mounted ice detectors. The ice detectors consist of aerodynamic struts which hold sensing probes into the airstream. The sensing probe vibrates at a set frequency until ice accumulates to a point where the frequency starts to decrease. When the frequency decreases to a value which indicates the ice has reached a certain thickness, the ice detector sends a signal to the ice detector panel in the flight compartment.

3. WING ANTI-ICING (Figures 4 and 5)

A. General

The wing anti-icing system monitors the temperature of the wing leading edges and automatically controls, through an electronic wing anti-icing controller, the flow of engine bleed air to the wing leading edges to prevent icing.

Left and right wing anti-icing modulating/shutoff valves direct 14th stage bleed air into wing anti-icing ducts running along each side of the underfloor area of the fuselage to the wing leading edges. Piccolo tubes, running the full length of each leading edge, discharge the air against the inside of the leading edge skin. The air then exhausts through louvers along the underside of the wing leading edge.

The left and right sides of the wing anti-icing system are separated by a normally closed isolation valve.

A control temperature sensor, a standby temperature switch and a sufficient heat/overheat sensor are fitted to the inside of each wing leading edge. These sensors monitor the leading edge skin temperature as required for automatic or standby control as well as for sufficient heat and overheat indications.

B. Operating Modes

In the NORMAL mode, the wing anti-icing controller uses the higher of the two temperatures sensed by the control temperature sensors and modulates both wing anti-icing valves to maintain the leading edge temperature at its optimum value for anti-icing.

In the STANDBY mode, each standby temperature switch cycles its respective wing anti-icing valve open or closed to maintain the leading edge temperature within the maximum and minimum limits for anti-icing.

4. ENGINE ANTI-ICING (Figures 4 and 5)

Engine anti-icing is obtained by heating the leading edge of the nacelle nose cowl with 14th stage bleed air. The bleed air is ducted to each engine via left and right pressure regulating/shutoff valves and enters a ring-shaped piccolo tube inside the nacelle nose cowl. The air discharges from the piccolo tube against the inside surface of the nose cowl leading edge, then exhausts through a louver in the nose cowl lower access panel.

A pressure relief valve protects the engine cowl against bleed air overpressure. An engine anti-ice blowout plug, which is normally flush with the engine nacelle skin, extends when the valve operates to indicate that an overpressure relief has occurred and that maintenance action is required before the next flight. (Refer to Volume 1, WALKAROUND CHECK LIST for location.)

The pressure regulating/shutoff valves are de-energized open. This feature causes the valves to fail open following an electrical failure.

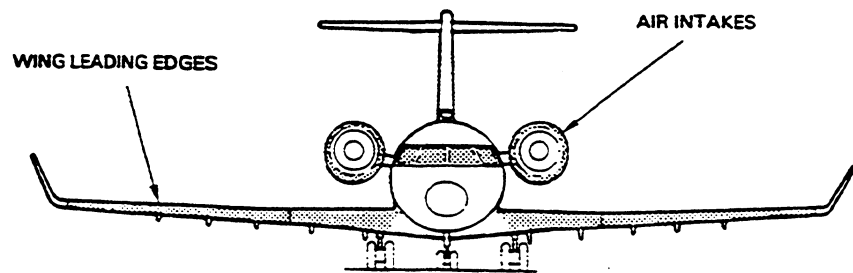
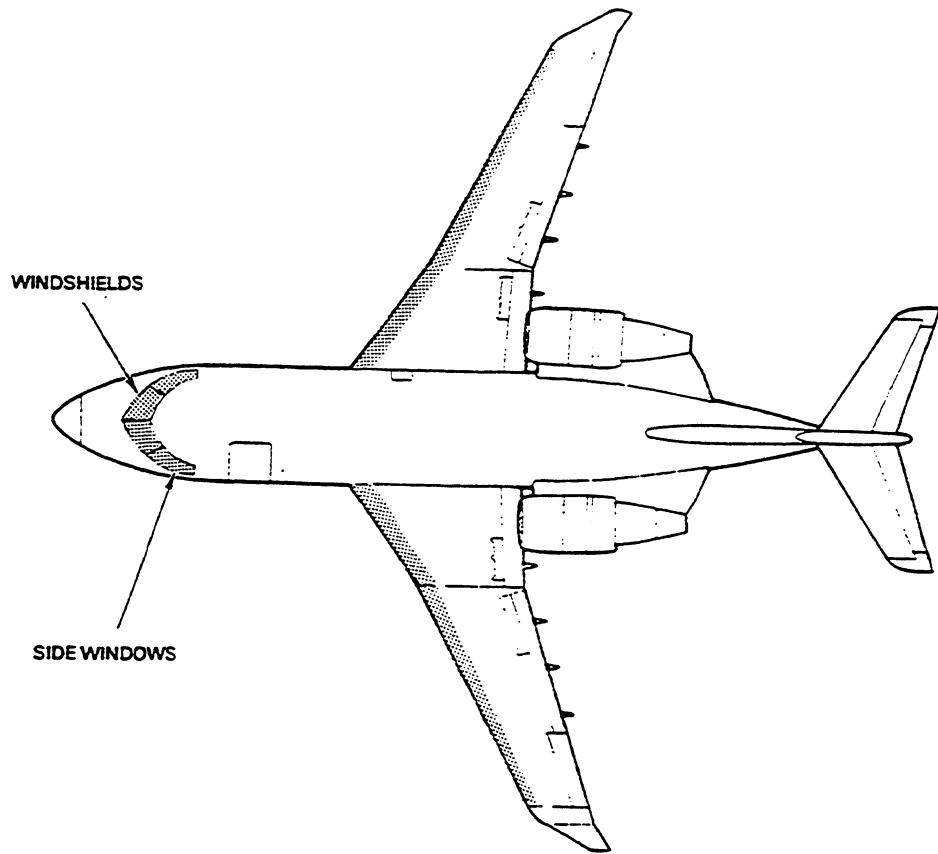
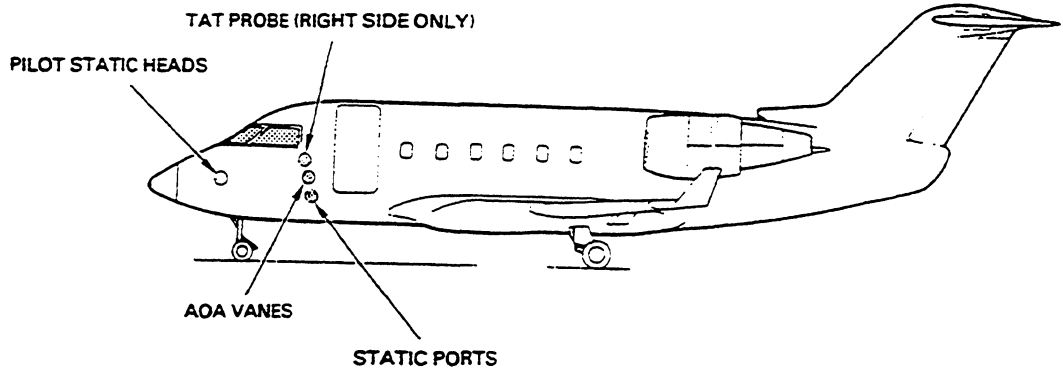
5. WINDSHIELD AND SIDE WINDOW ANTI-ICING (Figure 5)

The windshields and side windows are of laminated construction and each has a thin heating element between the two outer laminations. The windshield and side window anti-icing system consists of the heating elements, temperature sensors, dual-channel temperature control units, and controls and indicators on the ANTI-ICE panel.

The left and right sides of the system operate independently. Each side of the system has a dual-channel temperature control unit. Each unit monitors temperature signals from the same side windshield and side window. Two temperature sensors are provided for each windshield and side window, one for normal operation and one spare.

6. ADS SENSOR ANTI-ICING (Figure 6)

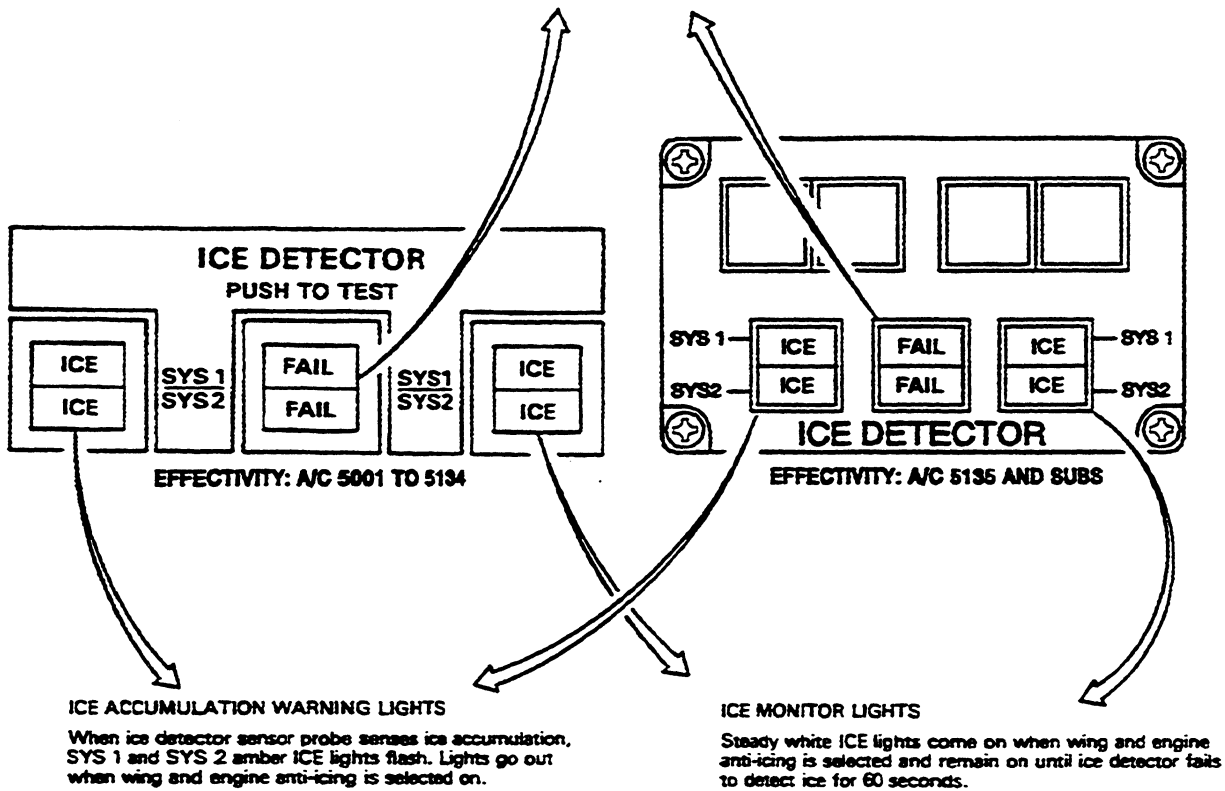
The ADS sensor anti-icing consists of heating elements in the left and right pitot heads, left and right static ports, left and right angle-of-attack (AOA) vanes, and in the total air temperature (TAT) probe. Power to the elements is controlled by the ADS HEATER CONT panel in the flight compartment.



**Anti-Iced Areas
Figure 1**

SYS 1 AND SYS 2 FAIL LIGHTS

Steady amber FAIL lights come on when built-in-test circuit detects fault in ice detection system 1 and/or 2. FAIL lights are also used as a press-to-test indication.

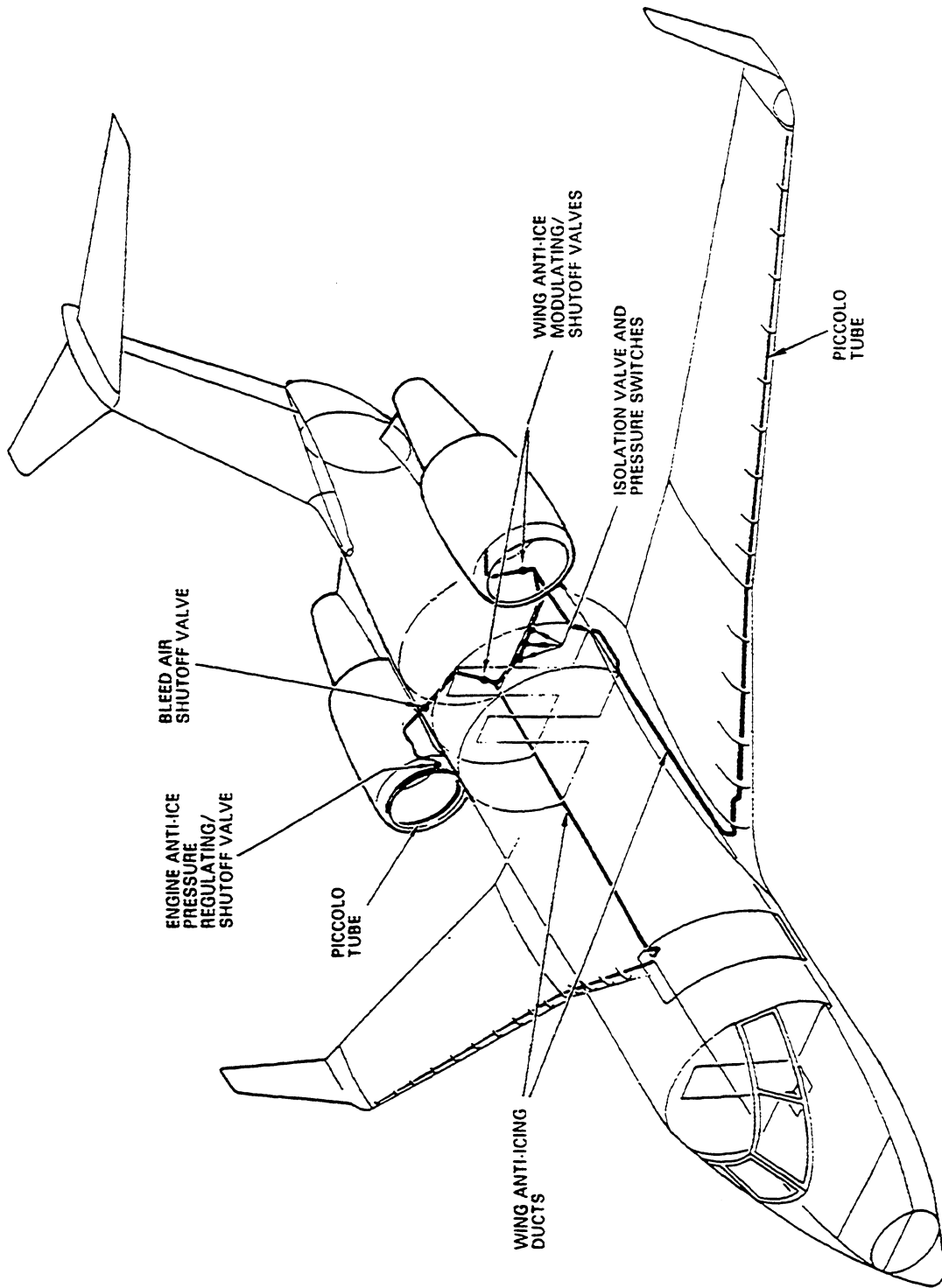


ICE ACCUMULATION WARNING LIGHTS
When ice detector sensor probe senses ice accumulation, SYS 1 and SYS 2 amber ICE lights flash. Lights go out when wing and engine anti-icing is selected on.

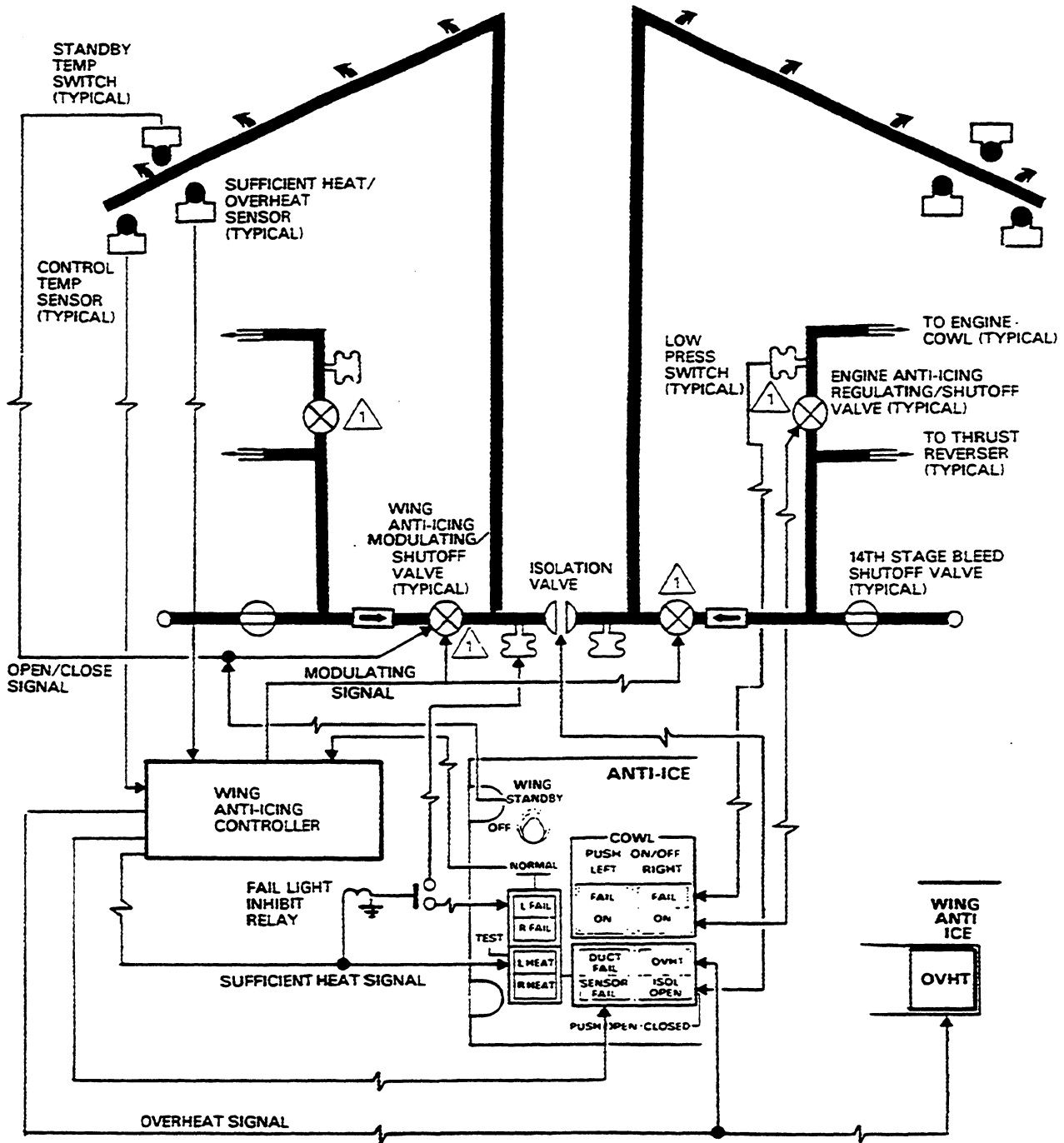
ICE MONITOR LIGHTS
Steady white ICE lights come on when wing and engine anti-icing is selected and remain on until ice detector fails to detect ice for 60 seconds.

CENTRE INSTRUMENT PANEL


Ice Detector Panel
Figure 2



Anti-Icing Ducts and Components
Figure 3



NOTE

 If open, valves are closed by thrust reverser operation (refer to Section 17).

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COWL-LEFT AND RIGHT SWITCH/LIGHTS (2)

Control operation of pressure regulating/shutoff valves of engine anti-icing system.

When switch/lights are pressed in, valves de-energize and open. When pressed out, valves are energized and close.

ON light - white light comes on when switch/light is pressed in or when associated pressure regulating/shutoff valve fails open.

FAIL light - amber light comes on when switch/light is pressed in and bleed air pressure is low or when switch/light is pressed out and associated pressure regulating/shutoff valve fails open.

WSHLD SWITCHES (2)

Three-position switches control same side windshield and side window heating elements

HIGH or LOW - Temperature control units maintain windshield and side window at constant temperature. At HIGH setting, controlled temperature of windshield is higher than controlled temperature at LOW setting. Controlled temperature of side window is the same at HIGH or LOW.

WING SWITCH

Three-position switch controls mode of operation of left and right wing anti-icing modulating/shutoff valves.

STANDBY - Modulating/shutoff valves cycle open or close to maintain wing leading edge within the minimum and maximum allowable temperatures.

OFF - Modulating/shutoff valves closed.

NORMAL - Anti-icing controller operates modulating/shutoff valves to maintain a constant wing leading edge temperature.

L FAIL AND R FAIL LIGHTS

Amber L FAIL or R FAIL light comes on if WING switch is set to STANDBY or NORMAL and low pressure condition is detected in the associated wing anti-icing manifolds. Each light is inhibited when its associated HEAT light is on.

L HEAT AND R HEAT SWITCH LIGHTS

White L HEAT or R HEAT light comes on to indicate that temperature of associated leading edge is sufficient for effective anti-icing.

When switch/light is pressed to test, correct operation of system control and monitoring circuits is indicated when flashing WING ANTI-ICE, OVHT light on centre instrument panel and L HEAT, R HEAT, L FAIL, R FAIL and OVHT lights on ANTI-ICE panel all come on.

DUCT FAIL AND SENSOR FAIL LIGHTS

Red DUCT FAIL light: Refer to Section 16

Amber SENSOR FAIL light comes on when controller detects an open temperature sensor in one of the overheat detection circuits.

OVHT AND ISOL OPEN SWITCH/LIGHTS

When pressed in, anti-ice isolation valve opens and white ISOL OPEN light comes on. When pressed out, valve closes and light goes out.

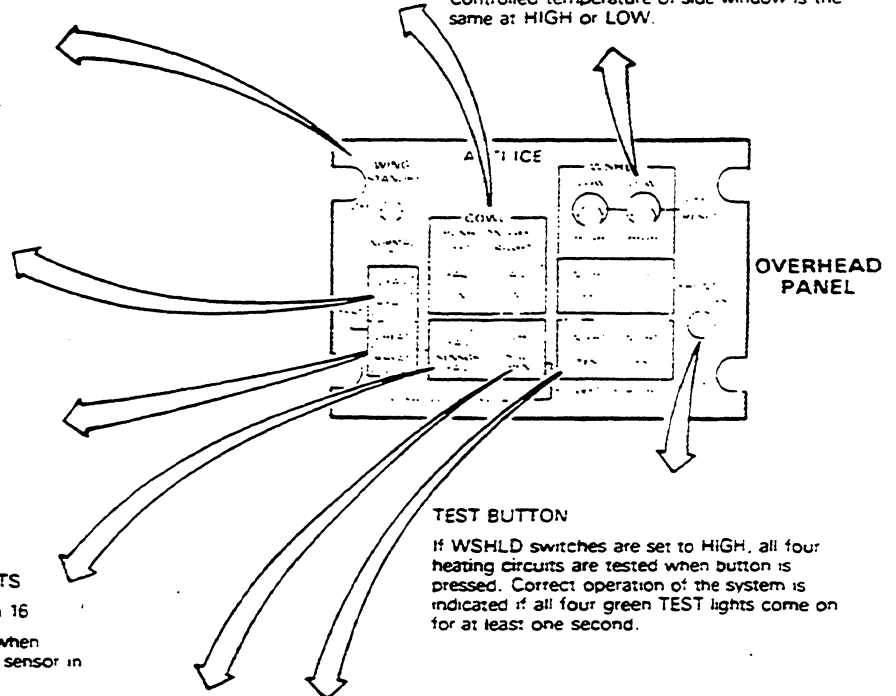
Red OVHT light comes on when an overheat condition is detected in the left or right wing leading edge.

NO HT LIGHTS (4)

Amber NO HT light comes on if associated temperature control unit detects an electrical fault in heating circuit.

TEST LIGHTS (4)

Green TEST lights come on during system test to indicated correct operation of associated heating circuit.

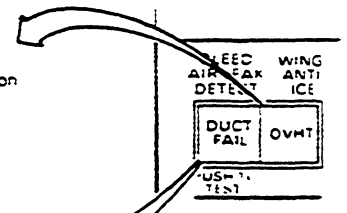


WING ANTI-ICE/OVHT LIGHT

Flashing red OVHT light comes on with OVHT light on ANTI-ICE panel when overheat condition exists on left or right leading edge.

When pushed to test, light comes on flashing.

DUCT FAIL LIGHT
Refer to Section 17.



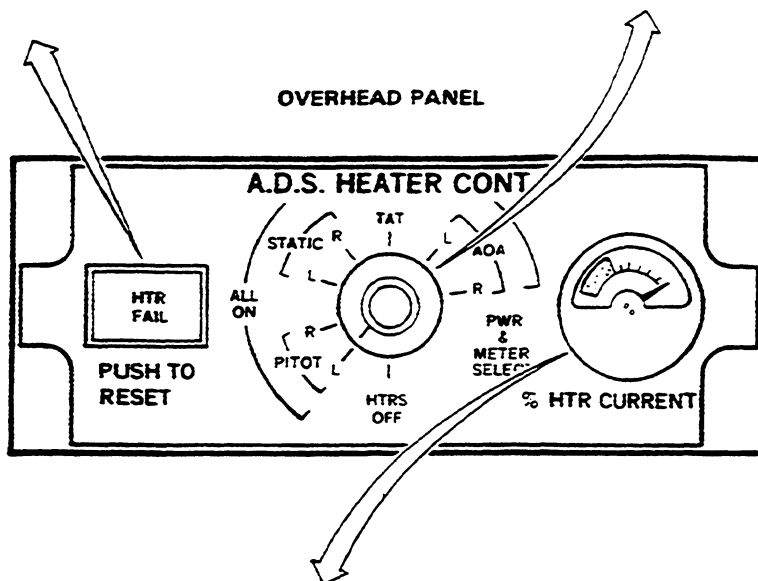
CENTRE INSTRUMENT PANEL

HTR FAIL SWITCH/LIGHT

Amber HTR FAIL light comes on if a heater fails in the left or right AOA vane, left or right static port, or the TAT probe. When pressed in, light goes out and system is reset to receive any further failures.

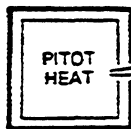
PWR & METER SELECT SWITCH

Controls power to heating elements in the left and right pitot heads, left and right static ports, left and right AOA vanes, and the TAT probe. When set away from HTRS OFF, all heating elements are supplied. Also used to test individual heater elements.



% HTR CURRENT INDICATOR

Indicates heater current in terms of percentage. Red zone indicates failed system.



PITOT HEAT LIGHTS (2)

Amber PITOT HEAT lights come on to indicate failure of associated pitot static head heater. Pilot's light signals failure of left heater; copilot's light signals failure of right heater.

PILOTS AND COPILOT'S INSTRUMENT PANELS