

# Gulfstream G150

## AIRPLANE FLIGHT MANUAL

Section VII  
Systems

### ICE AND RAIN PROTECTION

#### DESCRIPTION

The aircraft is equipped with ice and rain protection systems as follows:

- De-ice - Remove ice from wings and horizontal stabilizer.
- Anti-ice - Prevent formation of ice on engine nacelles, pitot and static ports, angle of attack probe, ambient temperature sensor and windshields.
- Rain repellent coating on the windshields.

#### SURFACE DE-ICING

Pneumatic surface de-icing system, utilizing engine bleed air, provides air pressure and vacuum to de-icing boots. The boots are fabric reinforced rubber sheets, containing built-in inflatable tubes, installed on the leading edges of the wings (fixed and slatted) and horizontal stabilizer.

Air from the engines is supplied through two lines, each incorporating a check valve, to allow system operation with one engine inoperative. A test connection is provided downstream of the check valves for connection of external air source for ground system check.

The air is regulated to a pressure of 18 psi in a pressure regulator which also incorporates a relief valve, to prevent over-pressure. Regulated air is fed to a distributor valve and to an ejector. The ejector provides suction which is also fed to the distributor valve.

Two supply ports connect the distributor valve to the wing boots and to the horizontal stabilizer boots, respectively. The distributor valve is controlled by a timer, so that suction and pressure can be alternately provided to the wings and to the horizontal stabilizer boots. With the system off, both wings and horizontal stabilizer boots are connected through the distributor valve to the suction source.

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With the system turned to either the normal or alternate mode, the timer continuously cycles the distributor valve to provide 6 seconds of inflation to the wings followed by 4 seconds of inflation to the tail. Complete cycle lasts one minute.

A high pressure switch is installed downstream the pressure regulator to warn of a pressure regulator failure. The switch is set to operate at a pressure between the nominal regulated pressure and the relief pressure of the relief valve. A low vacuum switch is also incorporated in the suction line to indicate a malfunction which may result in loss of suction.

A pressure switch is installed on the boots supply lines at each of the connecting tubes between the distributor valve outlets to the wing and horizontal stabilizer boots, to give an indication of boots inflation when the system is operating.

A heated (thermostat controlled) drain valve is installed in the wings supply line, at its lowest point.

When the de-icing system is off, vacuum is applied to the boots which makes them adhere to the leading edges profiles. Such action, together with boots chordwise tapers at their edges, maintains the aerodynamic profile of the leading edges.

### **NOTE**

System operation is recommended when ice formation on leading edge is 1/3 to 1/2 inch thick.

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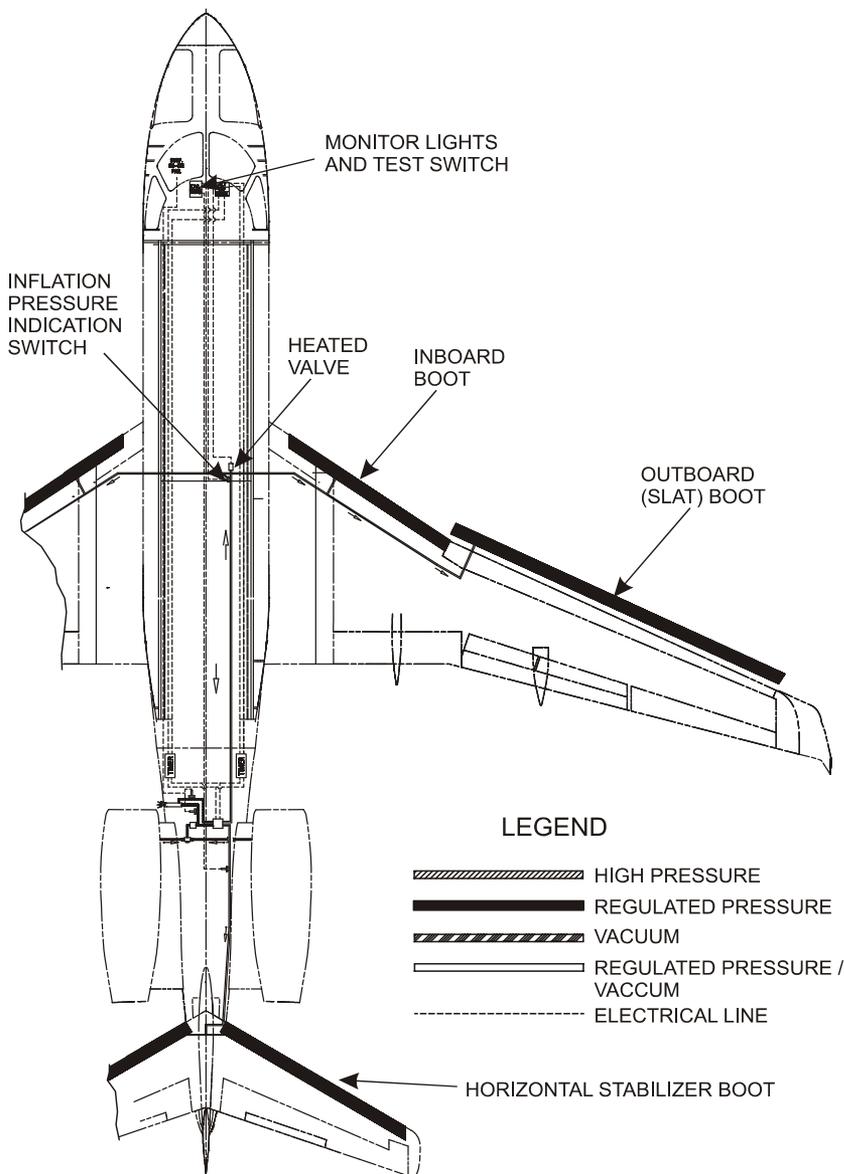


Figure 7-30-1. Airframe Ice Protection - Schematic

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#### ENGINE/NACELLE ANTI-ICE SYSTEM

The system includes nacelle inlet, inlet air temperature and pressure/temperature probe anti-icing systems. Nacelle inlet lip is heated by hot, pressurized engine bleed air, supplied through electrically-operated valves. The inlet air probe is electrically heated. System for each engine is controlled by the respective ENG PROBE & NACELLE, L or R ANTI-ICE pushbutton located on the overhead panel. Electrical power for entire system is supplied by No. 1 and No. 2 distribution buses, for left and right systems respectively, through circuit breakers on overhead panel (NACELLE ANTI-ICE L and R). Each anti-ice pushbutton incorporates two separate indicator lights: NAC and P2T2. Pressure switch in the nacelle is preset to illuminate the respective lights when sufficient air pressure exists for anti-icing. Nacelle anti-ice valve is spring-loaded, normally open, fail-safe valve which opens when electrical power fails or is removed, thus enabling continuous heat supply to nacelle. However, electrical circuit is completed through oil pressure switch (to prevent overheating when engine is off). Therefore, a failure of the P2T2 light to illuminate could mean no heat to P<sub>1</sub>2/T<sub>1</sub>2 probe.

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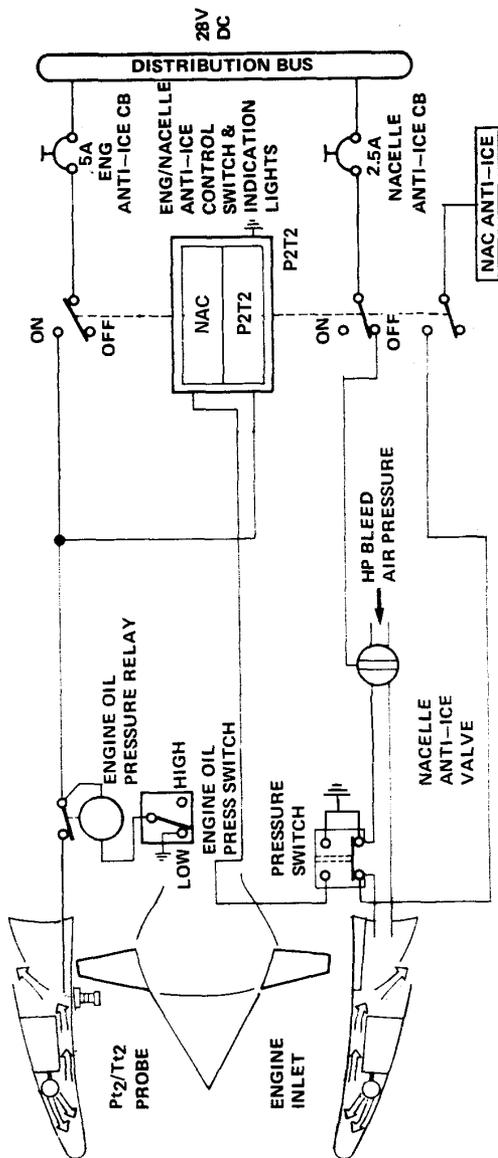


Figure 7-30-2. Engine / Nacelle Anti-ice - Schematic

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#### PROBES HEATING

##### **Pitot-Static**

Left and right pitot tubes and three static source ports on each side of fuselage are electrically heated. System is controlled by PROBES HEAT switch, on overhead panel.

**PITOT HEAT FAIL (L/R)** message comes on if the respective probe heat has failed in flight, or, unheated on ground.

##### **Angle of Attack**

The angle of attack (AOA) probe, on aircraft right side, is electrically heated. The system is controlled by PROBES HEAT switch, on overhead panel.

Whenever No. 2 distribution bus is powered, aircraft on ground and PROBES HEAT switch is in AUTO position, the AOA probe is heated with low current (preheat). If this heating fails **AOA PREHEAT FAIL** message comes on. If AOA probe heat fails in flight, **AOA HEAT FAIL** message comes on. On ground, the message is inhibited.

##### **SAT/TAS Probe**

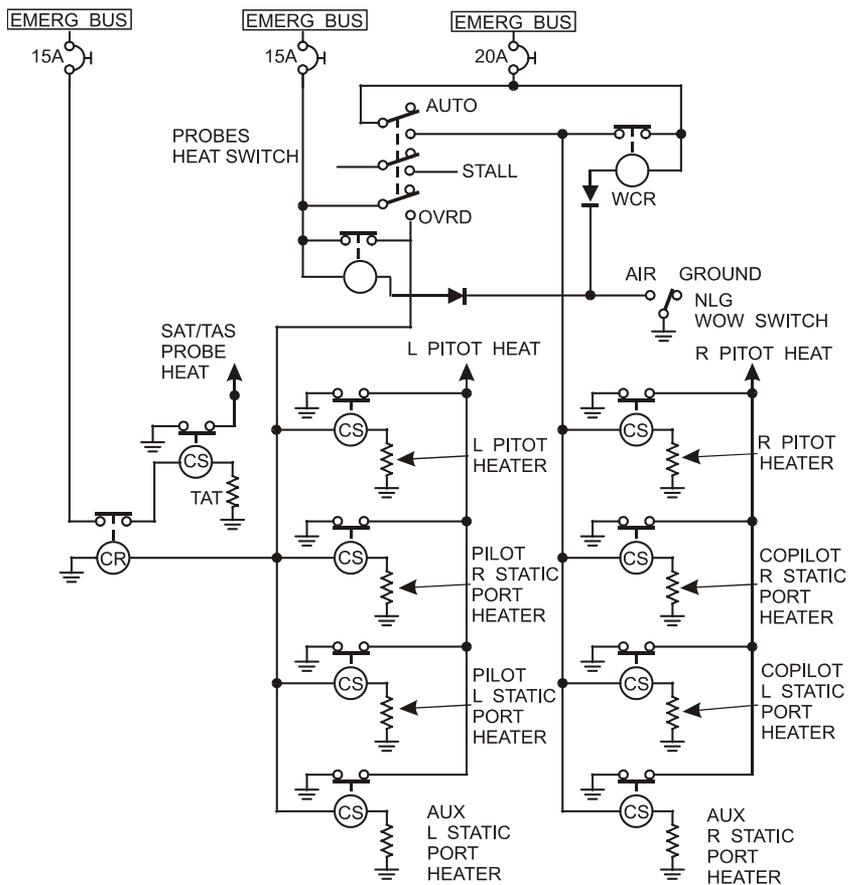
The SAT/TAS probe is electrically heated in flight. The system is controlled by PROBES HEAT switch, on overhead panel.

If the heat fails in flight, **SAT/TAS HEAT FAIL** message comes on.

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**LEGEND:**

- CS - CURRENT SENSITIVE RELAY
- WCR - WOW SWITCH CONTROLLED RELAY
- CR - CURRENT RELAY

Figure 7-30-3. Probes Heat System - Schematic

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#### WINDSHIELD HEAT

Left and right windshield heat systems prevent ice accumulation, are independently controlled and operated electrically. Front part of pilot side window is also heated to prevent residual ice accumulation. Both cockpit side windows are heated for defogging. Each system includes following major components: windshield temperature sensor and control unit, relays and WINDSHIELD HEAT switches (L and R) on overhead panel.

Temperature control unit monitors windshield temperature, through sensors embedded in the windshield, and automatically regulate and maintain constant temperature.

The system is tested by pressing W/S TEST pushbutton, on overhead panel, with both WINDSHIELD HEAT switches in ON position. **WNSHLD HEAT FAIL (L/R)** and **SIDE WDO HEAT FAIL (L/R)** messages come on, together with lights inside the W/S TEST pushbutton.

If one generator fails, both windshield heat systems are automatically disconnected by integral load-shedding circuitry, to prevent overloading remaining generator. If windshield heat is required, with one generator off line, system operation may be restored by placing BATT POWER switch in OVRRD LOAD REDUCT position.

If one temperature control unit fails, **WNSHLD HEAT FAIL (L/R)** message comes on.

WINDSHIELD HEAT switch controls three zones on left and right windshields. In the LOW position all three zones are powered by a fixed current. In the HIGH position only the central zone is powered to provide a high heat.

On ground, when BATT POWER switch is in ON position and WINDSHIELD HEAT switches are in LO or HI position both side windows are electrically heated.

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### ICE AND RAIN PROTECTION SYSTEM - CONTROLS AND INDICATORS

#### ANTI-ICE ENG PROBE & NACELLE (L and R) Pushbuttons and Indicating Lights:

P2T2 / NAC - When pressed, nacelle anti-ice air supply valve opens, energizes electrical power to heat inlet air P<sub>t</sub>2/T<sub>t</sub>2 probe.

Disengaged (out) position closes nacelle anti-icing air supply valves and deenergizes electrical power to inlet air P<sub>t</sub>2/T<sub>t</sub>2 probe.

NAC light comes on when sufficient pressure is available for anti-ice operations.

NAC ANTI-ICE caution light - Comes on when left or right nacelle anti-ice pushbutton is activated and the respective NAC light is not on.

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DE-ICE switch - Controls operation of wing and tail de-ice boots according to the following positions:

OFF - System is off.

NORMAL - System operates according to timer program; six seconds pressure pulse to wing boots followed by four seconds pressure pulse to tail boots, then fifty seconds suction dwell before next cycle.

ALT - Same operation as NORMAL position; system alternate timer.

WING/TAIL annunciators/test pushbutton - WING or TAIL light comes on whenever the respective surface boots inflate beyond 13 psi pressure. Test function of the annunciators is as follows:

With DE-ICE switch in either OFF, NORMAL or ALT position, pressing the pushbutton lights up TAIL annunciator to indicate that heating element of de-icing system drain is operating.

### NOTE

Avoid holding WING/TAIL pushbutton pressed for more than few seconds, to avoid overheating of heating elements.

PROBES heat switch - Controls heat of pitot tubes, AOA transmitter, and SAT/TAS probes according to the following positions:

AUTO - AOA probe is heated with low current on ground and high current in flight.

OVRD - Probes are heated with high current on ground and in flight.

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WINDSHIELD HEAT (L and R) switch has three positions:

HI - Current is supplied to the center zone heating elements for use during ice accumulation and to the respective side window.

LO - Normal operation. Current is supplied to all three zones heating elements during low ice accumulation and to the respective side window.

OFF - Windshield heat is off.

W/S HEAT TEST button - pressed to test windshield heat system when W/S HEAT switches are in HI or LO position. all WNDSHLD HEAT FAIL (L/R) and SIDE WDO HEAT FAIL (L/R) messages come on if test is successful.

### Caution Messages

AOA HEAT FAIL - Discontinuity in power line

AOA PREHEAT FAIL - Discontinuity in power line to AOA transmitter / transmitter case

DE ICE LOW VACUUM - Insufficient de ice boots suction

DE ICE HI PRESSURE - Overpressure in de ice boots system

NAC ANTI ICE FAIL (L/R) - Engine bleed pressure insufficient for anti icing or engine/nacelle anti-ice control has failed

PITOT HEAT FAIL (L/R) - Power supply failure

SAT/TAS HEAT FAIL - Power supply failure

SIDE WDO HEAT FAIL (L/R) - Failure in one side window heat system

WNDSHLD HEAT FAIL (L/R) - Failure in one windshield heat system

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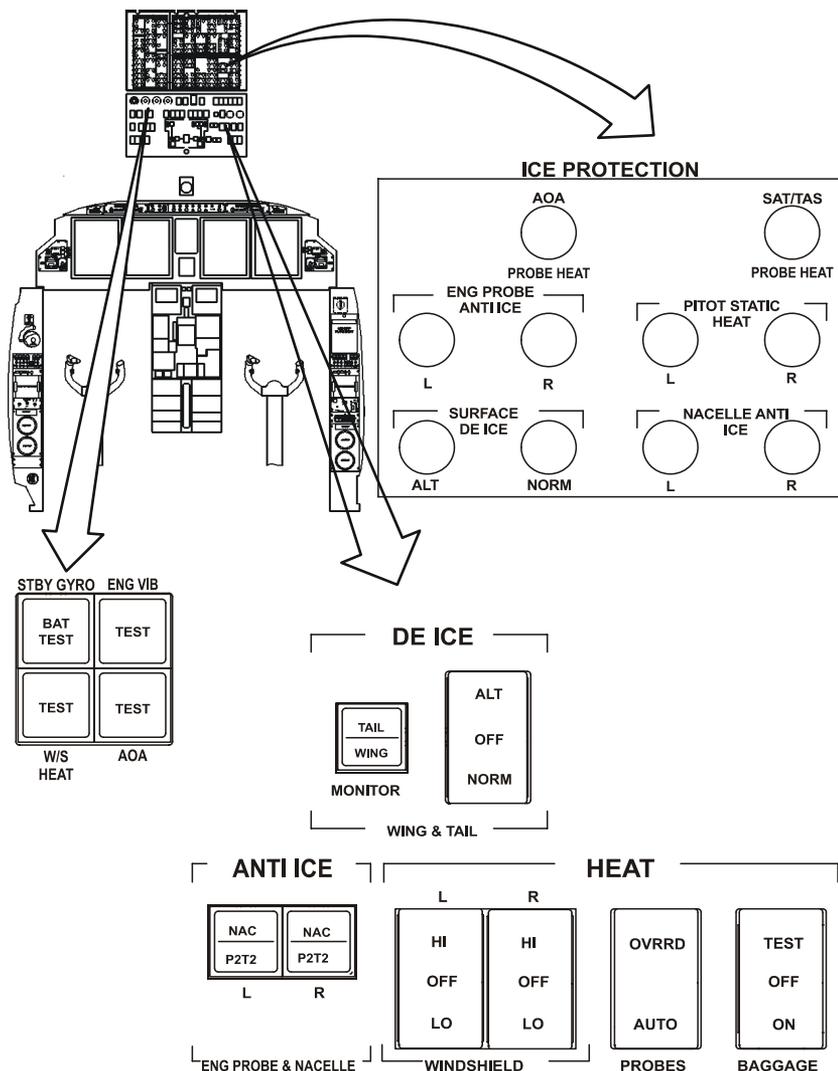


Figure 7-30-4. Ice and Rain Protection System Controls and Indicators