WING AND STABILIZER DE-ICE SYSTEM

The wing and stabilizer de-ice system removes the ice formed on the wing and the horizontal stabilizer leading edges. The de-ice system supplies bleed air to two leading edge de-icers on each wing, and two leading edge de-icers on the horizontal stabilizer.

The wing pneumatic de-icers consisting of a smooth rubber boot containing small expandable de-icing tubes. Each wing de-icer is a single boot with separate inflatable chambers, one for the inboard wing section and another for the outboard. Each section of the de-icer has an air connection to the corresponding other side de-icer. Thus, the left and right inboard de-icers inflate simultaneously and the left and right outboard de-icers also inflate simultaneously.

The horizontal stabilizer de-icers consist of a smooth rubber containing small expandable de-icing tubes. A single air bleed connects to the de-icers on both sides, thus all tubes are inflated simultaneously.

During normal operation both engines supply bleed air to a common manifold at the pressure regulator valve inlet. The bleed air goes through a heat exchanger before get into the de-ice system in order to get warmed. Refer to the Pneumatic System description for more detailed information.

The left and right lines are equipped with a check valve that provide a positive seal against engine bleed air backflow in the event of loss of bleed air from one engine, ensuring that pressure to the de-ice system is maintained.

The pressure regulator is designed to receive inlet air pressure from an engine bleed air source and to provide a constant outlet pressure for de-icer inflation, over a wide range of flow rates and inlet pressures.

The water separator eliminates the majority of liquid water in the air line in order to minimize the potential for valve freeze-up.

There is a low pressure switch located on the water separator outlet manifold and it is monitored by the system controller. In the event of insufficient bleed air pressure for proper system operation, the low pressure switch will close.

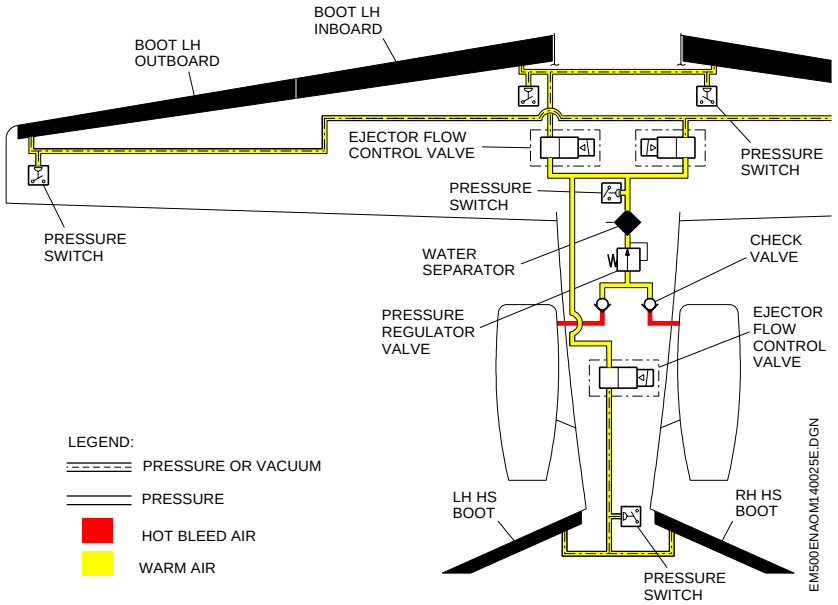
From the manifold, pressure is supplied to each of the three Ejector Flow Control Valves (EFCVs).

There are two EFCVs for the wings de-ice system, and one EFCV for the horizontal stabilizer de-ice system. The EFCV controls the flow of air to and from the de-icer boots. It is a two-position, solenoid-operated poppet valve that provides system pressure (energized position) or vacuum to the pneumatic de-icers.

There is also a pressure switch near each de-icer inlet:

- There are two pressure switches per wing, one for each wing de-icer inflatable zone;
- One pressure switch located at the inlet of the horizontal stabilizer de-icers.

They ensure a minimum pressure is being supplied to the de-icers in a specific timing window and monitor the proper operation of the respective de-icer boot.

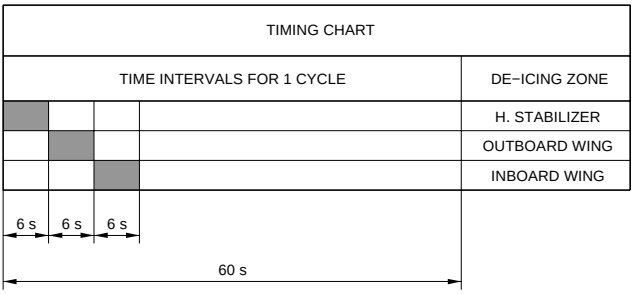


WING AND STABILIZER DE-ICE SYSTEM SCHEMATIC

When the system is activated (WINGSTB Switch to ON position), the wing and stabilizer de-ice system cycle automatically every minute, according to system's logic described below.

When the de-ice cycle starts, the horizontal stabilizer EFCV is energized initiating the de-icer inflation. After the six second inflation time, the EFCV is de-energized and a vacuum is applied to deicer. This sequence repeats for the outboard wing section de-icer and after that to the inboard wing section de-icer. At the end of the inboard wing six second inflation cycle, all EFCVs are de-energized and vacuum is applied to all de-icers for the remaining forty two seconds of the de-ice system cycle. At the end of one minute cycle, if the WINGSTB Switch remains in the ON position, the cycle repeats. This continues until the wing and stabilizer de-ice system is turned to OFF.

If the ice protection system WINGSTB Switch is momentarily operated from the "OFF" to "ON" position, the controller will operate in single cycle mode. The controller will cycle through all EFCVs plus a six second dwell time and then shut off.



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WING AND STABILIZER DE-ICE SYSTEM CYCLE

OPERATION

When flying in icing conditions, the pilot must activate the ice protection system and operate the airplane according to the recommendations given in the Airplane Flight Manual (Section 2 – Limitations and Section 3 – Normal Procedures).

When the WINGSTB Switch is placed to the ON position, the stall warning system activation angles are anticipated. The effect in the airplane is higher stall warning speeds and the CAS message SWPS ICE SPEED is displayed on MFD.

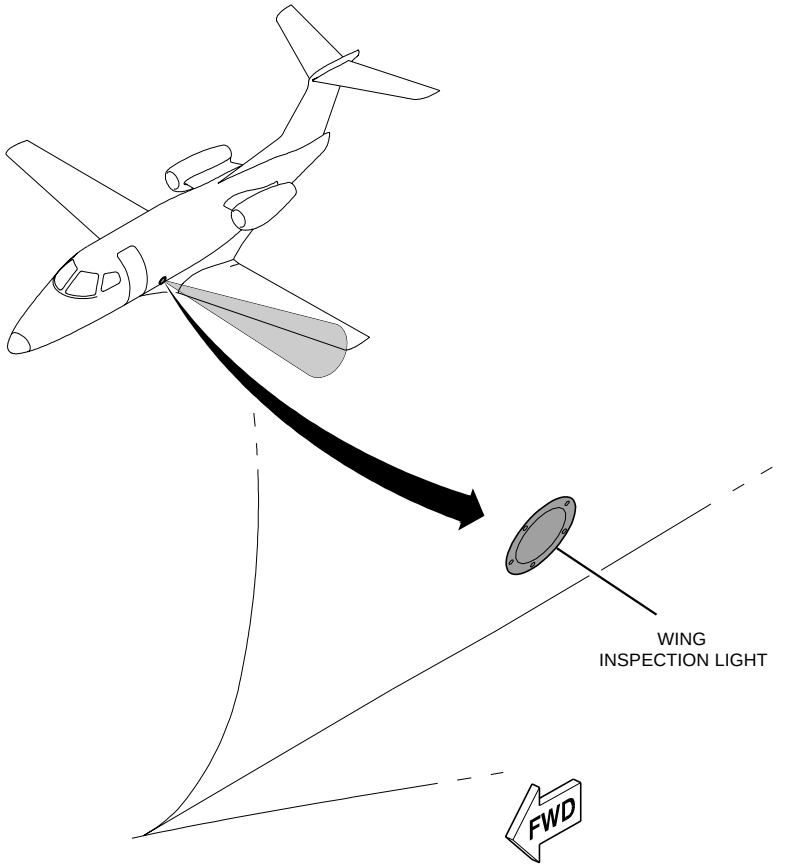
Because of that stall speed increase, before turn the system ON, it is important to comply with the AFM limitation minimum airspeed for WINGSTB Switch activation, in order to guarantee the airplane is faster than the increased stall warning speeds.

The pilot must also follow the AFM limitation regarding minimum airspeed for operation in icing conditions (AEO, FLAP ZERO and Gear UP). This speed allows the airplane to perform a coordinated turn of 40 degrees bank without the stall warning activation. This is especially helpful when performing holding procedures.

If a driftdown is required (OEI), the pilot must follow the driftdown speed schedules for ice protection ON or OPERA software. The driftdown speed schedule allows the airplane to perform a coordinated turn of 30 degrees bank without the stall warning activation.

WING INSPECTION LIGHT

A wing inspection light installed only on the left side provides visual means for crew to verify ice formation at night on wing leading edges. The wing inspection light is activated through Ice Protection Panel.



WING INSPECTION LIGHT

ENGINE ANTI-ICE SYSTEM

The Engine Anti-Ice System removes or prevents ice formation around the engine inlet cowls (lip), using hot bleed air from the related engine compressor (dedicated bleed port).

The bleed air supply is always available to the system when the engine is running, but each Engine Anti-Ice system is independent of the other engine and the bleed air supply cannot be shared between engines.

The Engine Anti-Ice System components are:

- Supply duct;
- Shutoff valve (EAI valve);
- Flow limiter (venturi);
- Pressure transducer;
- Piccolo tube and;
- Exhaust vent.

The engine anti-ice system operates continuously when the respective ENG 1 (2) switches are set to ON position. When the EAI System is turned ON, the engine inlet temperature sensor heater (TT0 probe heater) is also turned ON.

The system is activated via an electrically controlled, pneumatically actuated pressure regulating shutoff valve (Engine Anti-Ice Valve). The valve controls the bleed airflow from the engine to the engine anti-ice system. The EAI shutoff valve actuating solenoid must be energized in order to drive the valve closed. In the absence of an electrical signal, the engine bleed valve will fail safe open. The valve may be locked in the open position, thus allowing dispatch the airplane in ice conditions. The procedures are described in the dispatch documents.

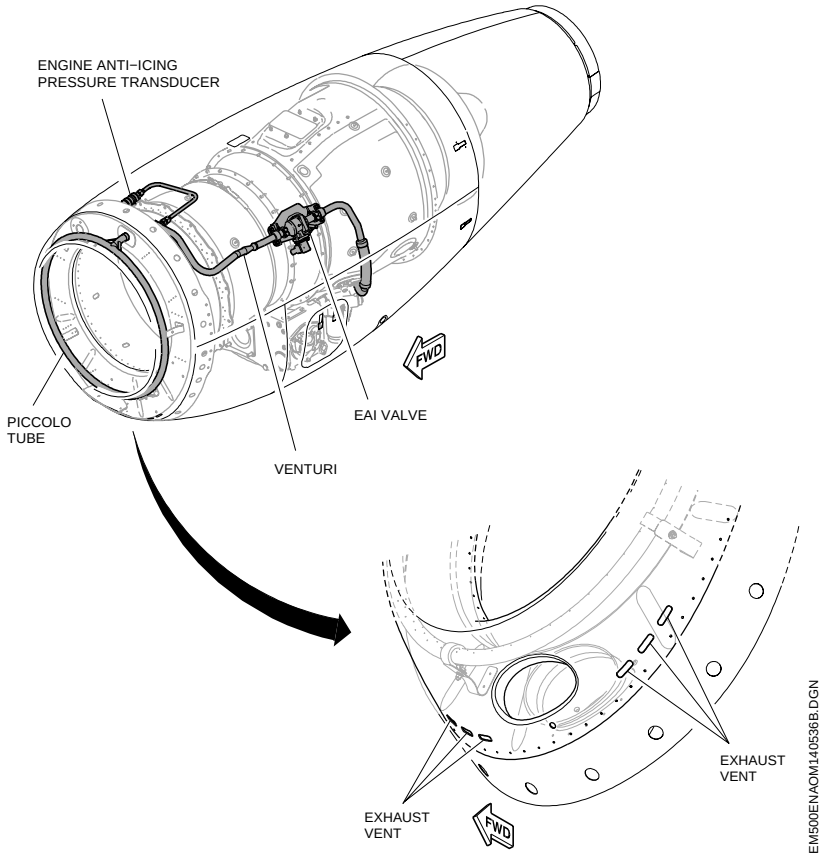
Next, the air flow passes through a flow limiter (venturi), which has the purpose of limiting the mass air flow entering the forward D-chamber in the event of a burst duct.

The D-chamber is the space formed by the inner surface of the engine inlet lip skin and the forward bulkhead.

The pressure transducer is connected to the anti-ice air supply duct and monitors the anti-ice system pressure.

At the inlet connection, the air passes into the circular piccolo tube mounted inside the D-chamber. The anti-ice air fills the piccolo tube and exits through holes distributing the air over the inner surface of the inlet lip skin and heats it up to prevent ice formation on the outer surface.

After that, the air flows toward the bottom where it exits the D-chamber through an exhaust vent to the atmosphere.



ENGINE ANTI-ICE SYSTEM