CIRCUIT BREAKERS

Push-to-reset, pull-off type circuit breakers, with the amperage rating marked on each breaker, are installed in panels located on both sides of the cockpit. The panels are readily accessible to the flight crew during flight. Panel configurations may vary from airplane to airplane due to differences in installed equipment; therefore, the panels shown are typical installations. Additional circuit breakers to which flight crew access is not essential, are located in the tailcone junction box.

ICE AND RAIN PROTECTION

ANTI-ICE/DEICE SYSTEMS

The ice protection systems are divided into two classes: anti-ice and deice. Anti-ice systems act to deter the formation of ice and require the pilot to anticipate possible icing conditions and put the system into operation before icing conditions are encountered. Anti-ice systems are not designed to remove ice which has already accumulated. Deice systems are designed to remove ice which has already formed. The only deice system on the Citation 525A is the horizontal stabilizer system which is operated from the 23 PSI service air system.

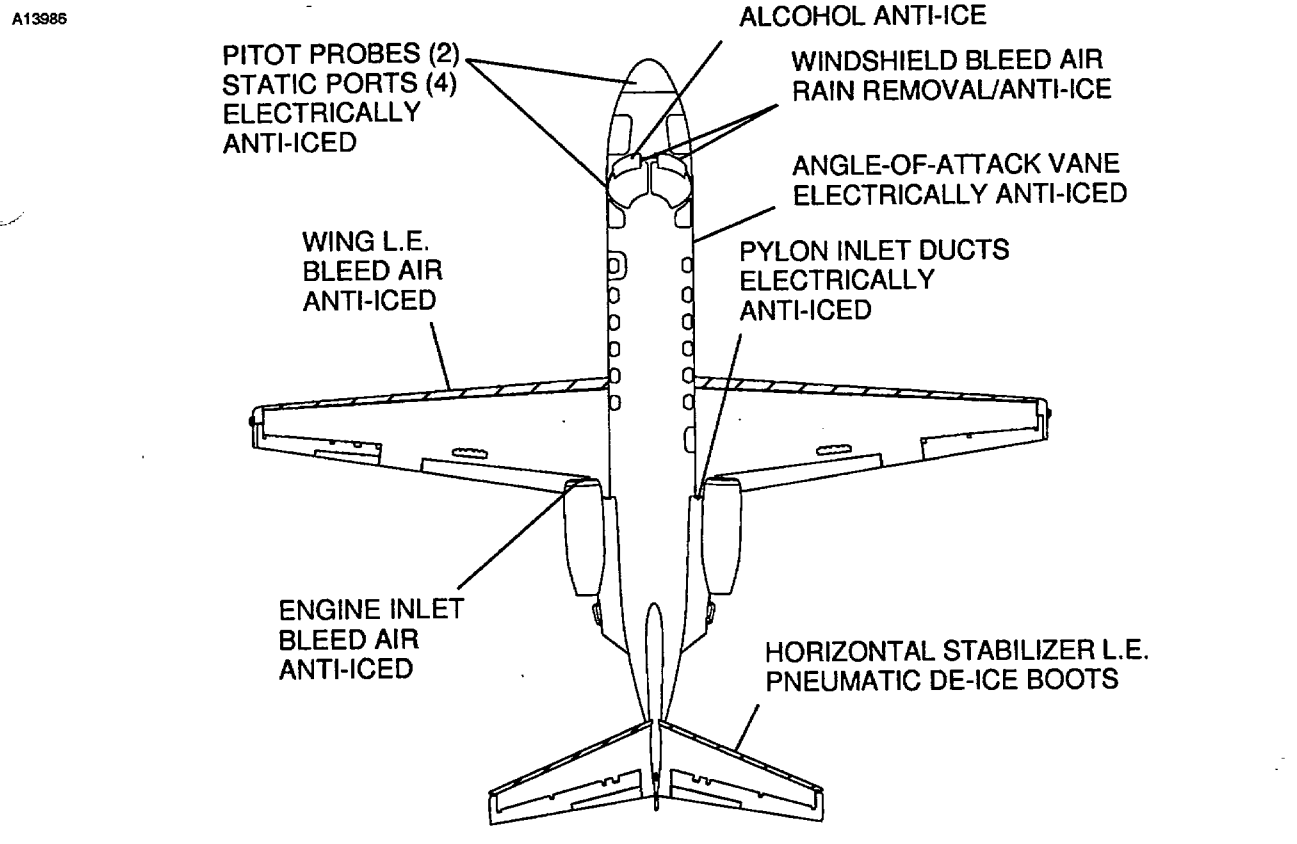

Figure 2-17 Airplane Anti-Ice/Deice Systems

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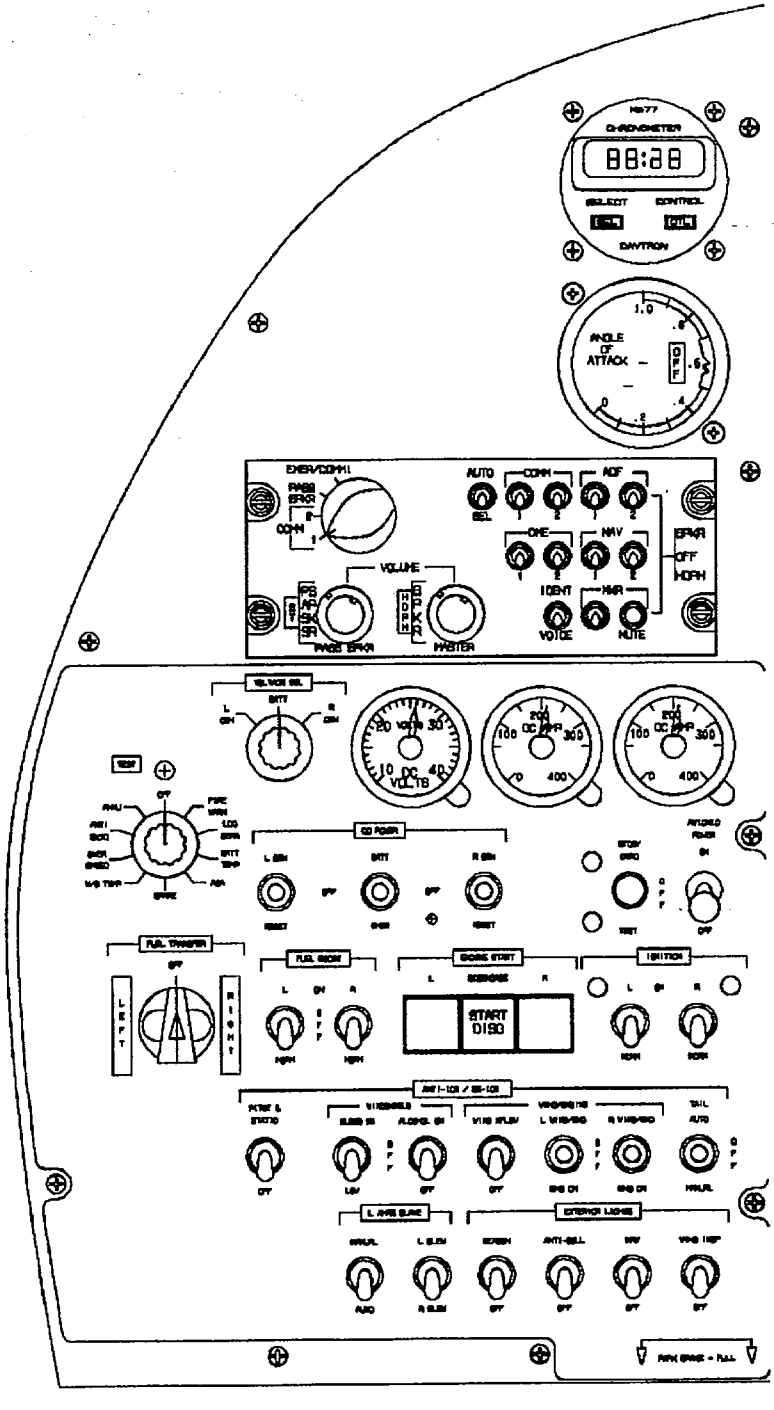

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Figure 2-18. Pilot's Switch Panel with Anti-Ice and Deice System Controls.

The Citation 525A anti-ice systems operate from electrical power or hot engine bleed air. The hot air for engine anti-ice is bled directly from the engines, passed through the engine inlet pressure regulating shutoff valves and sprayed into the engine cowl and around the generator inlets. There is no crossfeed for engine anti-ice; if an engine fails or is shut down there is no longer any anti-ice capability for that engine. The wing, pylon inlet and windshield anti-ice/rain removal systems receive high pressure engine bleed air from the left and right engines which has been passed through a precooler located in each engine pylon. The precooler drops the bleed air temperature by approximately 300°F before it proceeds into either the wing anti-ice system, through the left and right wing anti-ice pressure regulating shutoff valves, or into the windshield anti-ice/rain removal system through the windshield anti-ice heat exchanger. A crossover system is provided for the wing anti-ice system, and an alcohol spray backup is provided for the pilot's windshield only.

The pitot-static system, the angle-of-attack vane, the pylon inlet ducts, and the TT_2 probes (which are located on the bottom of the engine just forward of the fluid drains) are electrically anti-iced from the DC electrical system.

The various anti-icing and de-icing functions are actuated by switches on the pilot's switch panel and control knobs on the lower left side of the pilot's instrument panel. Anti-ice systems and the stabilizer deice system should be turned on when operating in visible moisture with an indicated RAT of +10°C or below. The wing/engine anti-ice systems may be operated in the ENG/ON position and the windshield anti-ice and the tail deice may be OFF provided it can be visually verified that no ice is accumulating. Selecting engine anti-ice also initiates continuous ignition.

ENGINE ANTI-ICE SYSTEM

The engine anti-ice system consists of bleed air heated engine inlet leading edges. The engine is anti-iced by directing hot bleed air through the engine inlet and the generator cooling air inlet. Electrically actuated but servo/pneumatically powered valves in each engine bleed air system control the bleed air flow. In case of loss of electrical power these valves are designed to open automatically, causing engine anti-ice to be provided. The engine fan, stators and spinner are aerodynamically deiced. Ice will build up on the spinner and shed due to centrifugal and aerodynamic forces. As the ice builds and sheds some minor acoustical vibrations may be evident at some power settings. Bleed air from the engines for engine anti-ice is temperature controlled only by throttle setting and the system is so designed that high temperatures do not present a problem, however, low temperature sensors constantly monitor the system; if the temperature in the hot air supply duct should fall below 220°F (104°C), the respective ENG ANTI-ICE L or R will illuminate, usually followed in approximately one minute by the MASTER CAUTION annunciator.

The engine anti-ice is controlled by three-position WING/ENGINE ANTI-ICE switches (L WING/ENG/OFF/ENG ON and R WING/ENG/OFF/ENG ON) on the pilot's switch panel. Activation of either anti-ice switch to ENG ON will activate only the corresponding engine anti-ice. The switch position WING/ENG will activate both engine anti-ice and wing anti-ice on the respective side.

When the WING/ENGINE ANTI-ICE switches are placed to the WING/ENG position, bleed air is supplied to pylon air inlet ducts. These blankets are heated to prevent ice from blocking cooling air supply to the cabin and windshield air heat exchangers. Blockage of these ducts will result in loss of cabin temperature control and windshield bleed air temperature control. Electrical power is also supplied by the WING/ENGINE ANTI-ICE switches, under the same conditions, to the TT_2 probes located on the bottom of the engines.

Cockpit indications of system function are obtained from the N_1, N_2, ITT and the amber LH and RH ENG ANTI-ICE annunciator panel lights. Opening of the valves will be shown by an ITT rise and a slight N_1 and N_2 RPM decrease which indicates bleed air extraction is taking place.

Upon initiating system operation, the L and R ENG ANTI-ICE annunciators will illuminate, indicating operating temperature has not been achieved. The time for the lights to extinguish after initiating operation will vary with outside air temperature and engine power setting. Normally, no more than two minutes are required at cruise or climb thrust settings. During descent into anticipated icing conditions, due to the normally associated low power settings, it is advisable to turn on the system well before entering the visible moisture environment. Once the inlets have warmed after being turned on, subsequent illumination of the ENG ANTI-ICE annunciator(s) will be accompanied by the MASTER CAUTION light. Engine anti-ice shall be ENG ON (or ENG/WING) for operations with an indicated RAT of +10°C or below when flight free of visible moisture cannot be assured.

Engine anti-ice is, as the name implies, designed as a preventive system. Its use should be anticipated and the system actuated any time flight in visible moisture with indicated RAT of +10°C or below is imminent. Failure to turn on the system before ice accumulation has begun may result in engine damage due to ice ingestion. Because of engine bleed air extraction with system operation, maximum allowable power settings are reduced as shown in Section IV of the FAA Approved Airplane Flight Manual.

As previously stated, loss of electrical power to the engine anti-ice valves will cause them to move to the open position, ensuring anti-ice capability. This fact must be considered when setting engine power if a complete electrical failure, or failure of electrical power to the engine anti-ice system, should be experienced.

WING ANTI-ICE SYSTEM

Wing anti-icing is accomplished by routing hot engine bleed air through the leading edge of the wings. The bleed air, which exits the engine at up to 800°F, is first cooled to a temperature range between approximately 420°F to 500°F, by passing through air-to-air heat exchangers mounted in the engine pylons - one for each side. Additional heat loss occurs as the air passes through the supply ducts before it enters the wing leading edge. After passing through the wing leading edge the air exits through louvers on the lower side of each wing tip.

Wing anti-ice is controlled by the L and R three-position WING/ENG/OFF/ENG/ON switches on the pilot's switch panel. Placing the switch to WING/ENG will activate the respective wing anti-ice system by removing electrical power from the pressure regulating and shutoff valve. These valves are electrically controlled but servo/pneumatically powered. The valves open when power is removed, in order to enable anti-ice air to be automatically supplied to the wings in case of electrical power failure. In the event of an engine failure WING XFLOW must be selected on the WING XFLOW/OFF switch in order to continue to supply engine bleed air to both wings. The operating engine power must remain above 75% N_2 RPM.

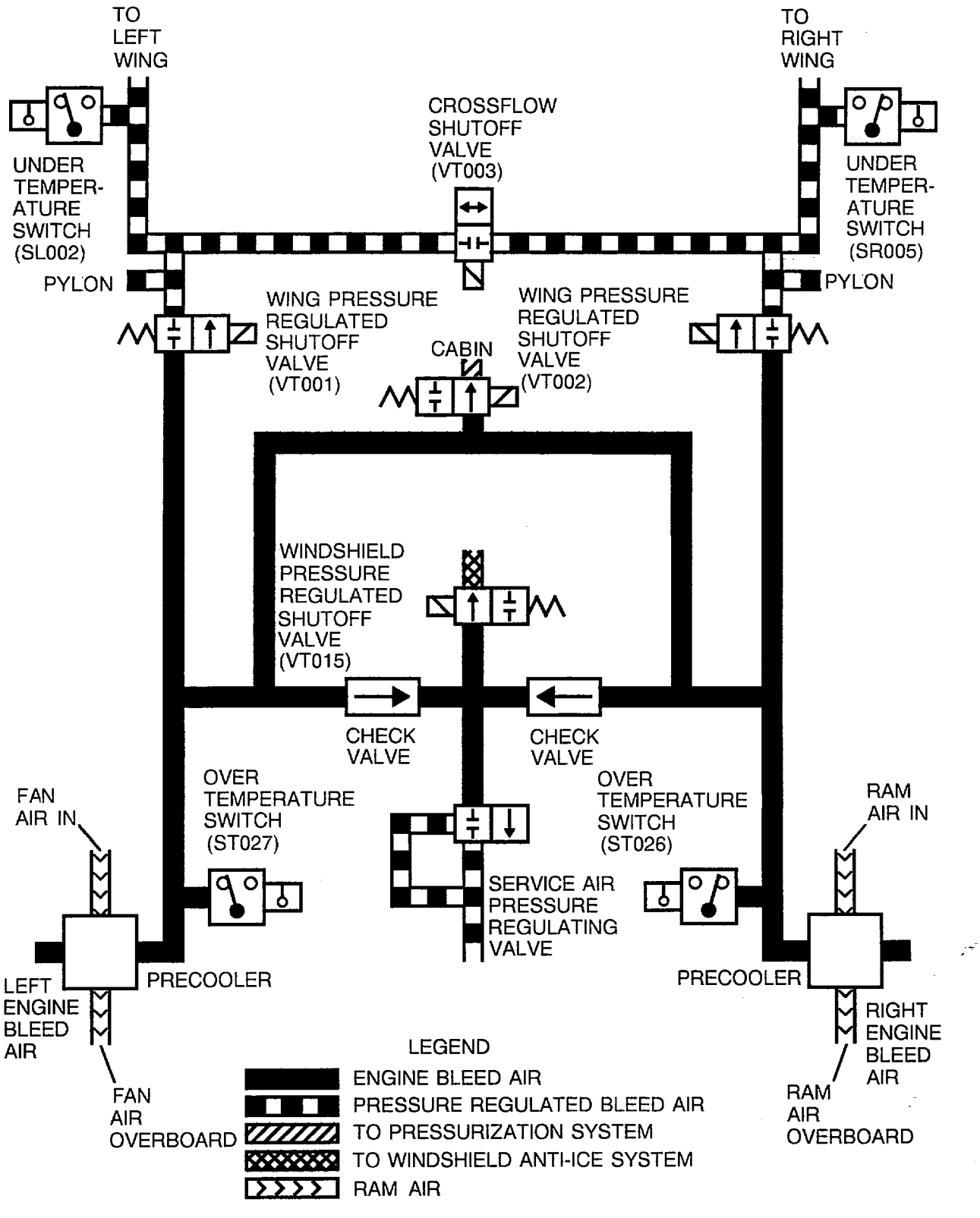

Figure 2-19. Wing Bleed Air Anti-ice Flow Schematic

Before the air passes into the wing anti-ice system it passes a temperature probe set at 540°F, which will illuminate the BLD AIR O'HEAT L or R annunciator to inform the pilot if the bleed air entering the cabin pressurization, the windshield anti-ice/rain removal system, and the wing anti-ice system is too hot. High bleed air temperature will also shut off the wing anti-ice pressure regulating shut off valve on the side of the overheat, until the system cools.

Temperature sensors are located in each wing root to monitor wing anti-ice air for minimum temperature. If the air entering the leading edges is below 230°F (110°C) the switch will close, illuminating the respective amber L or R WING ANTI-ICE annunciator. If the WING ANTI-ICE annunciator illuminates, increasing engine power on the respective engine to above approximately 75% N_2 RPM should extinguish the light in approximately 2 minutes. A 145°F (71°C) switch mounted on the wing leading edge root rib monitors wing structural temperature and will shut off the respective wing anti-ice system and illuminate the respective WING ANTI-ICE L/R annunciator should a wing overheat condition occur. This condition will occur during sustained ground operation at high engine thrust, but should not occur in flight.

The WING ANTI-ICE L/R annunciators will also illuminate approximately one minute after the respective engine N_2 RPM is reduced below 75%, unless the 230°F (110°C) switch causes earlier illumination. In any case the MASTER CAUTION will illuminate approximately one minute after illumination of the WING ANTI-ICE annunciator. The MASTER CAUTION is disabled when the system is initially turned on, until the WING ANTI-ICE annunciators extinguish. Bleed air for the pylon inlet anti-ice is provided by the wing anti-ice system.

Each wing anti-ice system is separate and fed by its respective engine, however, a crossfeed valve is provided for use during single-engine operation. The two-position valve is controlled by a switch marked WING XFLOW/OFF on the anti-ice/deice section of the pilot's switch panel. The crossfeed valve remains normally closed when power is removed from the valve in the off position. If the wing anti-ice is not operating on one side due to the fact that an engine has been shut down, for instance, WING XFLOW is selected on the crossfeed switch; power is supplied to the valve, opening it and providing heated air from the operating engine through the crossflow line to anti-ice both wings. Higher N_2 (75% to 80%) will normally be required to prevent the operating engine side WING ANTI-ICE from illuminating. The WING and ENG ANTI-ICE annunciators on the affected engine side will be ON continuously after one minute. Use the operating engine side WING ANTI-ICE annunciator to monitor the system.

HORIZONTAL STABILIZER DEICE SYSTEM

The horizontal stabilizer surface deice system is driven by the service air system. Service air is engine bleed air which has been regulated to 23 ± 1 PSI by the service air pressure regulating and relief valve. The regulating and relief valve (regulator) is located downstream of the precooler in the bleed air manifold through which it receives conditioned bleed air.

The deice system consists of pneumatic boots on the leading edges of both horizontal stabilizers, a pressure regulator, two control valves, two horizontal stabilizer pressure switches, a system timer, a control switch and a white TAIL DEICE L/R annunciator. The respective LH or RH TAIL DEICE annunciator will illuminate any time a horizontal stabilizer deice pressure switch senses a minimum of 16 PSI in the corresponding pneumatic system. The system is protected by a five-ampere circuit breaker marked TAIL DEICE on the left circuit breaker panel.

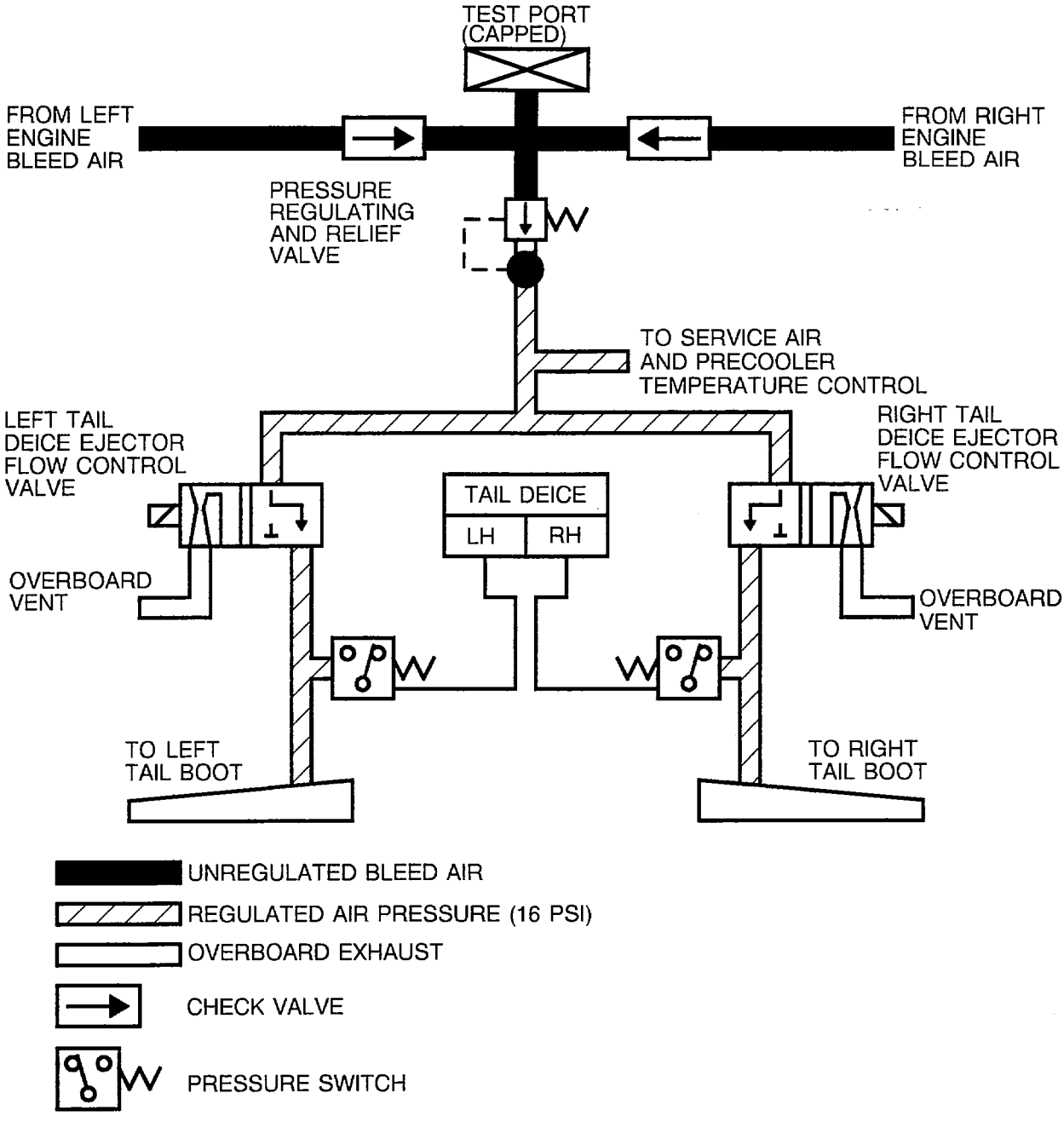

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Figure 2-20. Horizontal Stabilizer Surface Deice System

The deice boots are controlled by a three-position switch which is labeled AUTO/OFF/MANUAL. In OFF, power is removed from the system. TAIL AUTO is the normal mode of system operation. When the switch is in the TAIL AUTO position it provides one six-second cycle for each boot followed by approximately three minutes of rest counting from the time the system was initialized. Boot cycling is controlled by the two control valves. On the first cycle, the left valve opens to inflate the left boot on the empennage for six seconds, followed by a delay of 6 seconds and a six-second inflation of the right boot by the right valve. In MANUAL the deice boots will remain inflated as long as the switch is held in the MANUAL position. The MANUAL position will override TAIL AUTO and inflate the boots. The boots deflate by bleeding the air back through the control valve and dumping it overboard. They are held deflated by a vacuum produced ejector pump.

In the event the boots remain inflated or it is desirable to stop boot inflation and terminate the automatic cycle, place the tail deice switch to the OFF position. This overrides the timer circuit and immediately deactivates the control valves. Returning the switch to the OFF position prepares the system for the next actuation. Satisfactory operation of the deice boot cycle is verified by illumination of the TAIL DEICE L/R annunciator lights. Illumination of the TAIL DEICE lights indicates there is bleed air pressure to the respective boot for inflation. The light will extinguish momentarily between each cycle of the left and right boots. Operation of the boots should be functionally checked prior to icing encounters while on the ground or in flight with the RAT above -35°C (-31°F).

It is possible to see the ends of the horizontal stabilizer from the cockpit, however it will be very difficult to judge the amount of ice buildup. For that reason the "auto" cycle has been provided. A wing inspection light is provided to illuminate the left wing to observe wing ice buildup during night flight. If wing ice is observed it is probable that the horizontal stabilizer is also icing.

During icing encounters, the crew should attempt to monitor the outboard end of the stabilizer as much as possible for any evidence of a failed deice boot. During normal operation, some ice may form on unprotected areas which cannot be seen from the cockpit. This is normal and does not present a problem. Should deice boot(s) be, or become, inoperative and it is suspected that ice may be on the stabilizer, refer to FAA Approved Flight Manual, Section 3, Abnormal Procedures. Ice on the horizontal stabilizer can result in unexpected pitch transients if flaps are extended.

The deice boots should not be operated when indicated outside air temperature or ram air temperature (RAT) is below -35°C (-31°F) since cracking of the boots may occur below that temperature and the boots may not fully deflate.

WINDSHIELD ANTI-ICE

The windshield bleed air system provides windshield anti-ice under all normal operating conditions. This system also provides external windshield defog and rain removal. The system supplies engine bleed air through an electrically actuated pressure regulating shutoff (bleed air control) valve located in the tailcone of the airplane, and manually positioned valves which regulate air to each windshield. Windshield air is taken from the same line which provides emergency pressurization. The manual valves are located at each windshield bleed air nozzle and are left in the OFF position for all normal operation. A check should be made to ensure that the rain removal knob is pushed down prior to turning the WINDSHIELD BLEED switch ON. When windshield anti-icing is required, the W/S bleed manual valves are turned to MAX and the WINDSHIELD BLEED switch is turned to LOW if the indicated ram air temperature (RAT) is above -18°C or to HI if the indicated RAT is -18°C or below. Normal system operation is indicated by an increase in air noise as the bleed air discharges from the nozzles. A temperature sensor is located near the discharge nozzles. A temperature controller provides inputs to the ram air control valve in order to automatically control the windshield bleed air to approximately 260°F in LOW setting and approximately 280°F in HI, by modulating crossflow air through the heat exchanger in the tailcone.

An additional temperature sensor, located in the windshield bleed air line, automatically actuates the electrical shutoff valve and illuminates the windshield air overheat annunciator light (W/S AIR O'HEAT) should the bleed air temperature exceed 300°F while the windshield anti-ice bleed switch is in LOW or HI. This condition should not occur unless a sustained high power, low airspeed condition is maintained or a system malfunction occurs. If the W/S AIR O'HEAT annunciator illuminates when the windshield bleed air switch is selected to OFF it means that the bleed air control valve has failed open. Control through the manual valves is still possible.

In the event of a complete electrical system failure, the bleed air control valve would open and the overheat annunciator would be inoperative. If the manual bleed air valves are open, they should be closed as soon as practical, subject to icing conditions. Damage to the windshield could result from continued operation without electrical control.

Self-test of the temperature monitor system is normally accomplished during the preflight warning systems check by selecting the W/S TEMP position on the rotary test switch and turning the windshield bleed air switch to either the HI or LOW position. Proper system function is verified by illumination of the windshield air overheat annunciator light. Self-tests may also be accomplished in flight, if desired.

If the windshield bleed air anti-ice system fails, a backup alcohol anti-ice system is provided for the left windshield only. The system is controlled by a two-position windshield ALCOHOL ON/OFF switch which, when moved to the ON position, activates an electric pump which sprays alcohol on the pilot's windshield. Sufficient alcohol is provided for approximately 10 minutes of continuous operation with a fully serviced reservoir.

RAIN REMOVAL

This system utilizes the normal windshield bleed air anti-ice system for rain removal, with augmenter doors to provide increased airflow over each windshield in heavy rain. These doors are manually operated by pulling the PULL RAIN handle located below the WINDSHIELD BLEED AIR knobs on the pilot's instrument panel. For rain removal, the manual windshield bleed air controls on the pilot's subpanel should be turned to the MAX position, the PULL RAIN handle pulled out and the WINDSHIELD BLEED switch positioned to LOW. Augmenter door opening will be difficult should the WINDSHIELD BLEED switch be turned on first. It may also be difficult to open above 175 KIAS.

WINDSHIELD ICE DETECTION

Icing can be detected during night operation by the windshield ice detection lights. These lights show an accumulation of ice on the windshield by a circular red glow illuminating on the pilot's and copilot's windshields. The pilot's windshield ice detect light is located approximately in the center of the pilot's clear vision area and the copilot's ice detect light is located just inboard of the clear vision area. When the anti-ice systems are operating the pilot's detector will remain clear while the copilot's, which is in an non-protected area, will show ice and then remain iced over.

The windshield ice detection lights are turned on by the panel lights NIGHT DIM switch. Satisfactory operation of the ice detection lights is verified by placing the palm of the hand over the lights and observing a red glow from the lights. The system is designed to detect windshield icing only at night, when icing could form on the windshield and not be noticed.

PITOT-STATIC AND ANGLE-OF-ATTACK VANE ANTI-ICE

Electric elements heat the pilot's and copilot's pitot tubes, the static ports and the angle-of-attack (AOA) vane. The PITOT & STATIC anti-ice switch on the lower left panel controls these elements. Annunciator lights (P/S HTR OFF, LH or RH) will come on when power is removed from the heaters or when a heater fails. The right pitot static anti-ice receives its