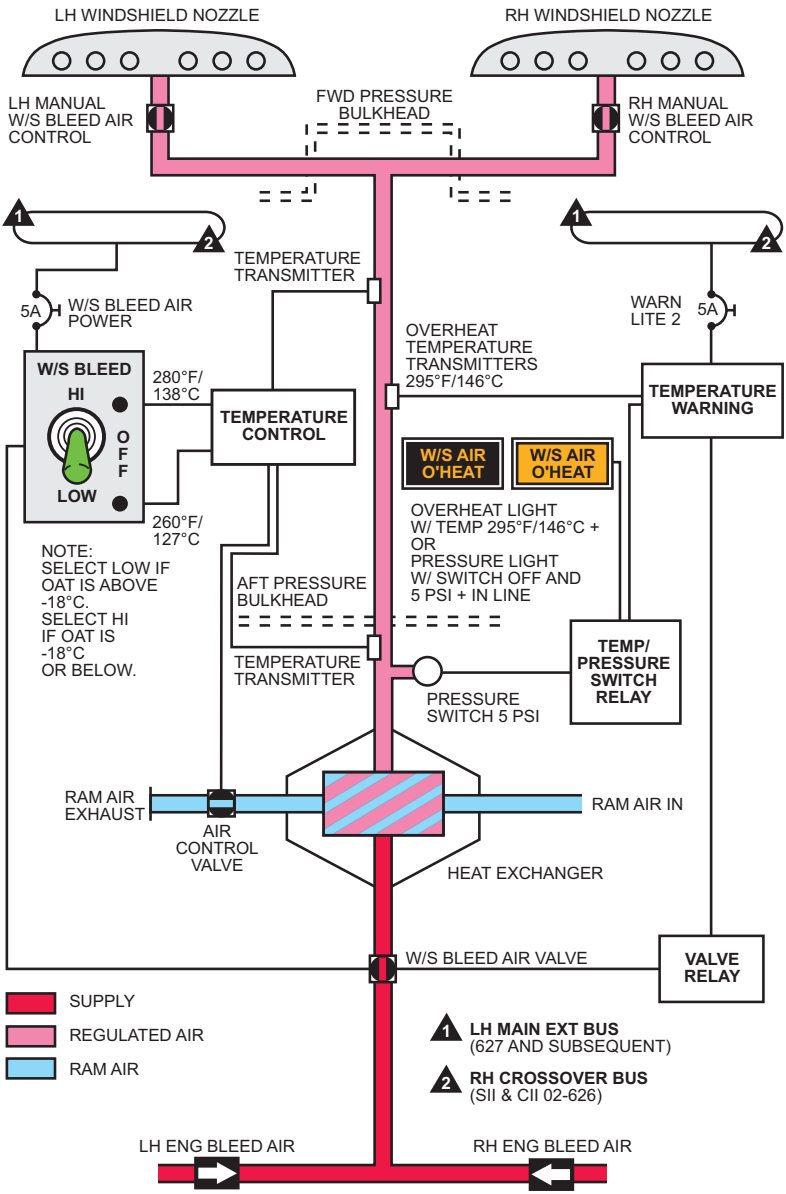
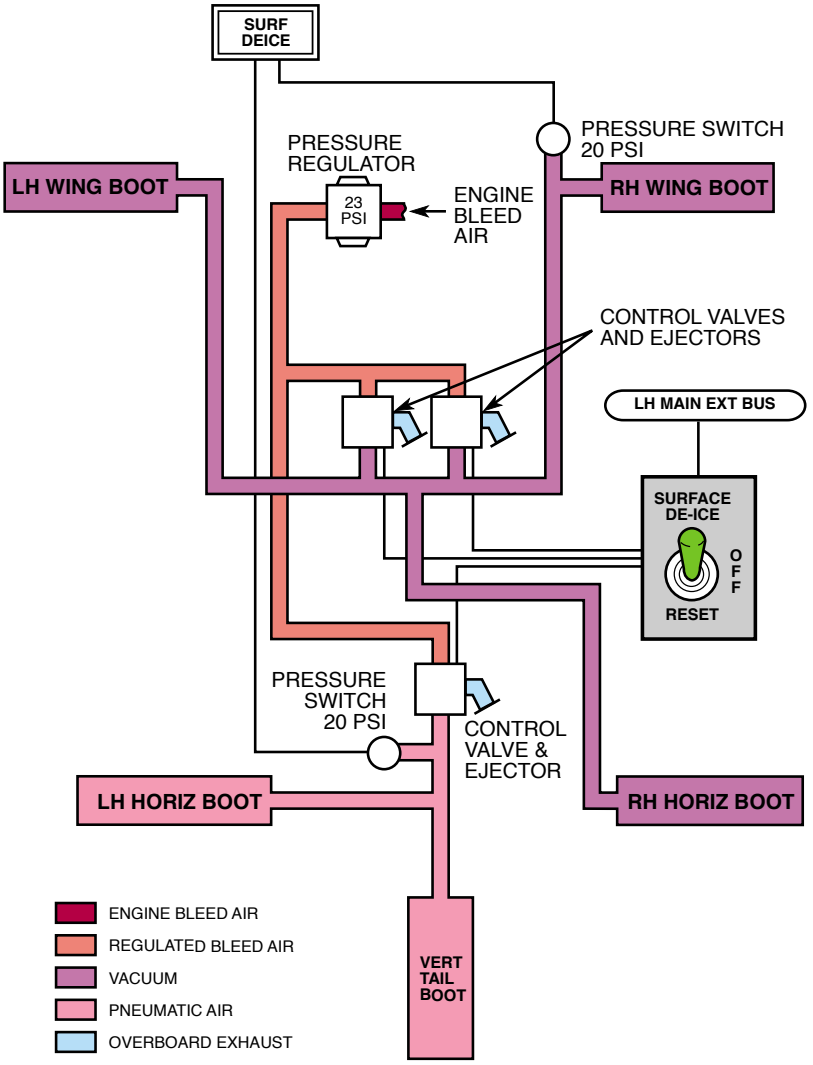
Windshield Bleed Air Anti-Ice System

(All Citations)



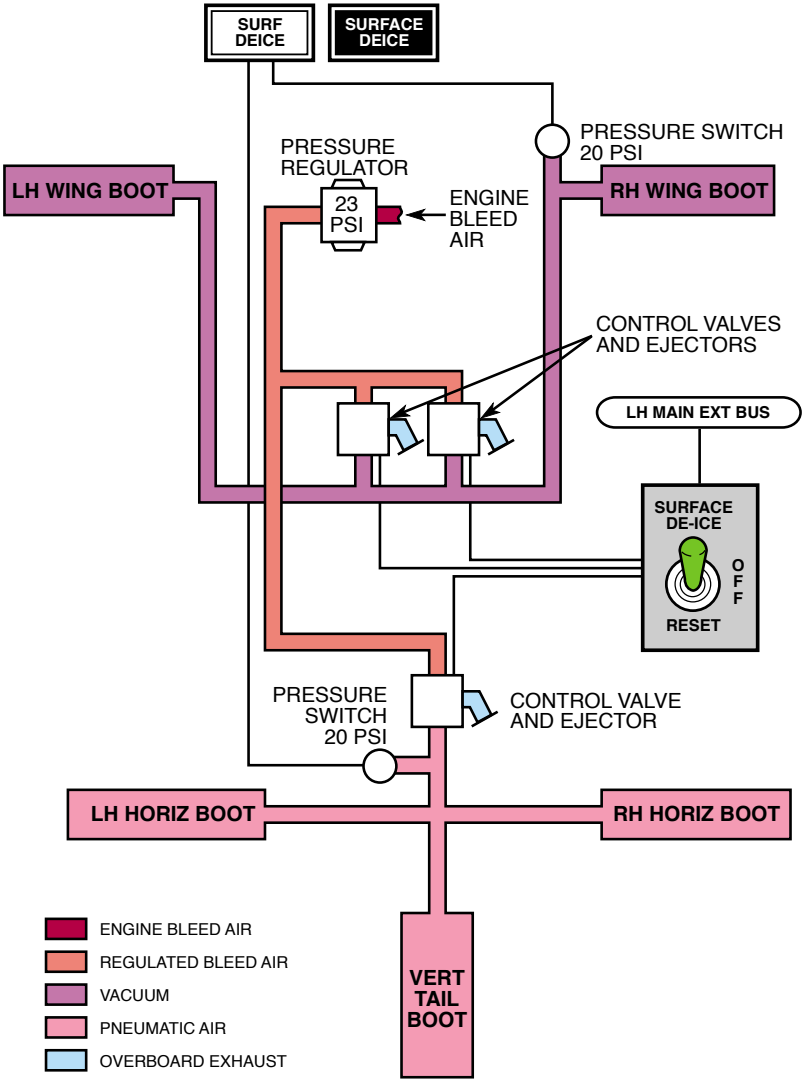
Surface Deice System

Citation; Citation I



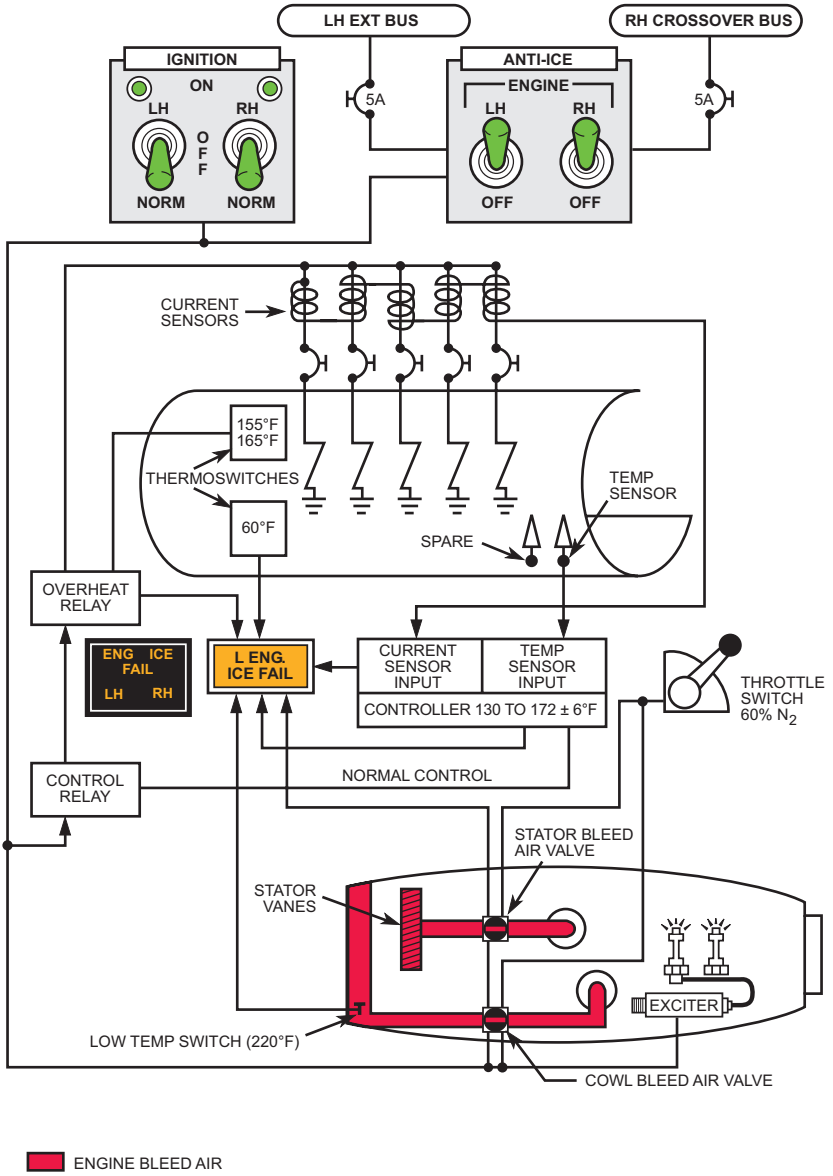
Surface Deice System

Citation II; CII-627



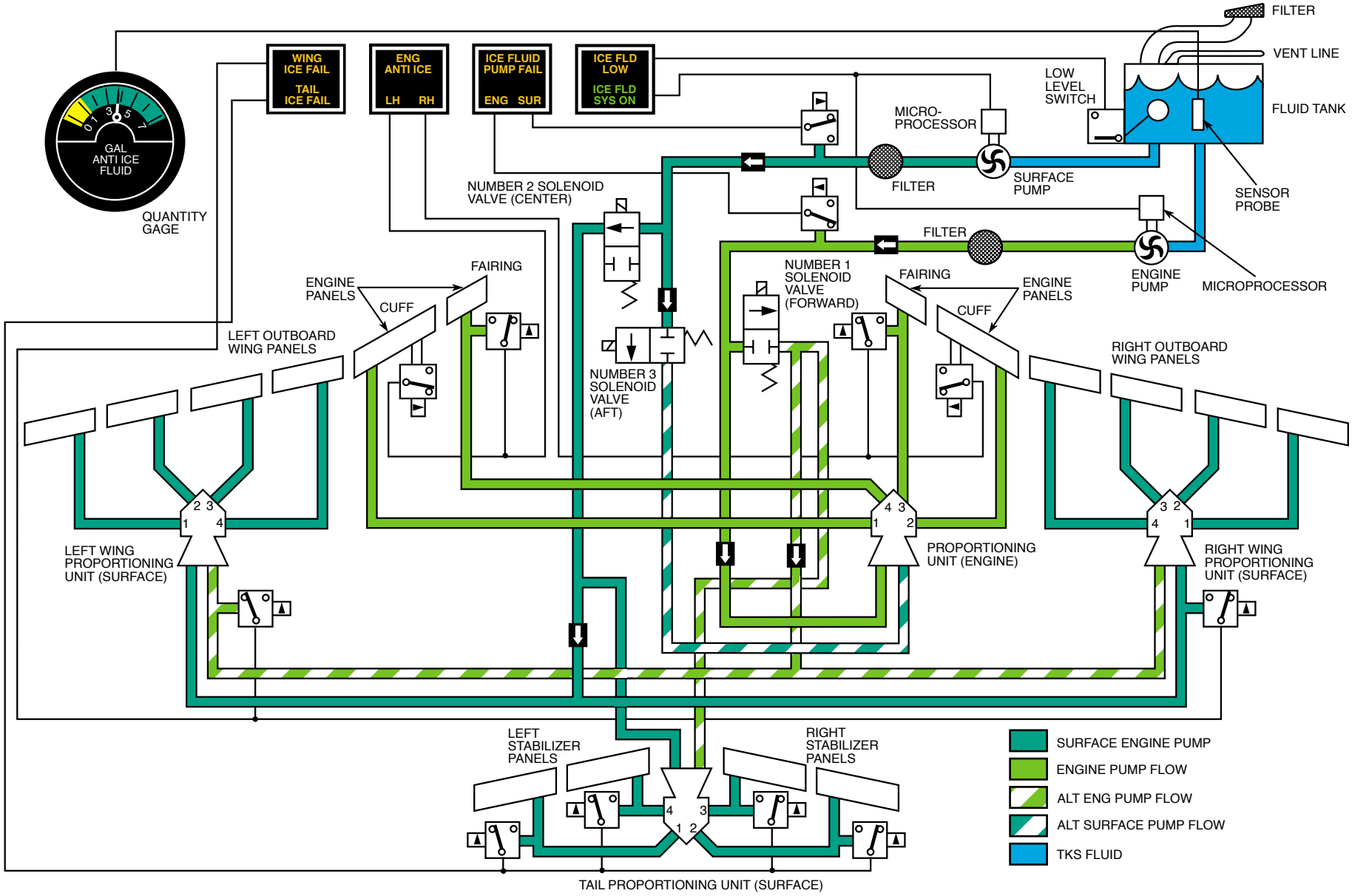
Engine Anti-Ice System

(except Citation SII)



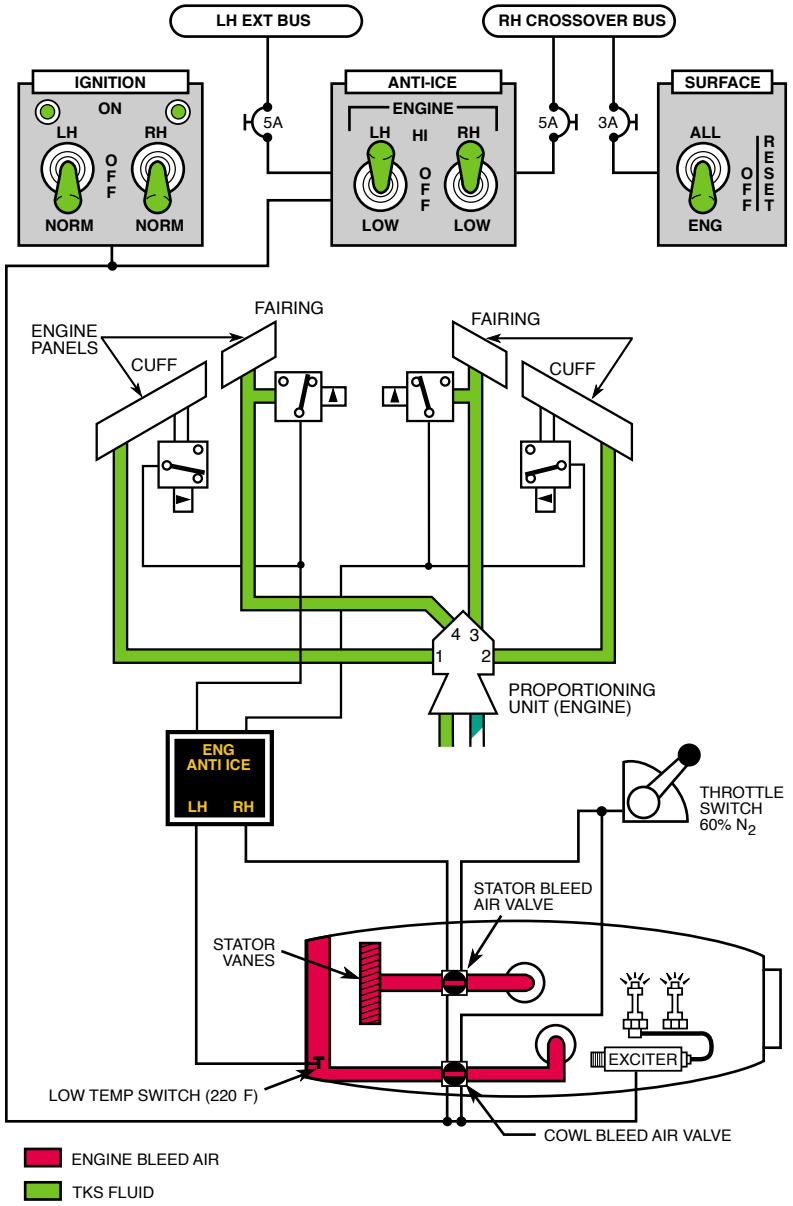
TKS Anti-Ice System

Citation SII



Engine Anti-Ice System

Citation SII



Ice and Rain Protection

Anti-icing protection is provided for the:

- engine spinner, temperature probe, inlet lip, and stator vanes
- inboard and outboard wing leading edges
- horizontal stabilizer leading edges
- vertical stabilizer leading edge (**except SII)**
- windshield
- pitot tubes, static ports, angle-of-attack (AOA) probe, and drain masts.

Ice Detection

On the **Citation SII**, a detector and interpreter unit continuously monitors outside air conditions to provide a visual warning of icing conditions. The system operates on the principle that ice accumulation affects the thermal characteristics and resistance of the system's probe. When icing accumulation occurs on the probe, the system illuminates the ICING DETECTED annunciator.

Engine

During engine operation, hot bleed air flowing to the engine T_1 probes and bullet nose cone provides continuous anti-icing protection. Placing the ENGINE ANTI ICE switches in ON, LOW, or HI (**SII only**) removes power from the inlet and stator vane anti-ice valves. The valves do not open until power is above 60% N_2 RPM and bleed air pressure reaches a minimum of 8 PSIG or 4 PSIG (**SII only**). After the valves open, hot bleed air flows to warm the engine air inlet and stator vanes. When supplied with a 60 to 130 PSIG bleed air supply, the anti-ice valves regulate pressure to 14 to 18 PSIG or 11 to 14 PSIG (**SII only**). At power settings below 60% N_2 RPM, the valves close to prevent excessive engine power loss.

With the ENGINE ANTI ICE switches ON or HI/LOW (**SII only**), the engine ignition system provides continuous ignition system operation and the inboard wing heating elements receive power (**except SII**).

During engine anti-icing operation, the respective ENG ICE FAIL or ENGINE ANTI-ICE annunciator illuminates when:

- leading edge temperature is below 60°F (16°C)
- heating element or circuit breaker opens
- overheat relay opens because of system malfunction or overheat condition
- shorted or open temperature sensor
- stator valve not open with engine power below 60% N2 or valve failure
- engine inlet temperature below 170°F (77°C).

Surface Anti-Icing and Deicing

On the **Citation, Citation I, and Citation II aircraft**, turning the ENGINE ANTI ICE switches ON supplies 28V DC to the inboard wing leading edge heating elements.

Turning the SURFACE DE-ICE switch on starts a 12 second timer that supplies low pressure bleed air to inflate the outboard wing, horizontal stabilizer, and vertical stabilizer deice boots. As the system cycles and supplies inflation pressure to the boots, two pressure switches illuminate the SURF DE-ICE annunciator.

On the **Citation and Citation I**, during the first six seconds the left horizontal stabilizer and vertical stabilizer boots inflate and during the last six seconds the wing and right horizontal stabilizer boots inflate. On the **Citation II**, during the first six seconds the horizontal and vertical stabilizer boots inflate and during the last six seconds the wing boots inflate.

When not inflated, 5.5 In Hg vacuum holds the deice boots tight against the leading edges.

On the **Citation SII**, a TKS fluid-based anti-icing system protects the wings and horizontal stabilizer from ice accumulation. The system has two separate delivery subsystems that obtain fluid from common 7.5 gallon capacity reservoir. The engine subsystem delivers fluid to the cuff and fairing panels and the surface

subsystem supplies the outboard wing and horizontal stabilizer leading edges. The ENG ANTI-ICE and SURFACE ANTI-ICE switches control system operation (see **Table 4H-1**).

With the system operating (ICE FLD SYS annunciator illuminated), two electric pumps draw fluid from the reservoir and provide it under pressure to their respective systems through a filter, check valves, and solenoid valves to proportioning units for the engine, left and right wing, and tail. The proportioning units ensure equal fluid delivery to the various panels. If pressure drops to one of the delivery systems, pressure switches illuminate the associated ENG ANTI ICE, WING ICE FAIL, or TAIL ICE FAIL annunciator. If the pressure downstream of a pump drops, the associated ENG/SUR ICE FLUID PUMP FAIL annunciator illuminates.

When reservoir fluid level drops and the low level switch actuates, the ICE FLD LOW annunciator illuminates to indicate approximately 20 minutes of fluid left.

Engine		Surface	Results
LH	RH		
LOW	LOW	ENG	TKS to inboard leading edge, wing cuff, and fairing panels at reduced rate (above 22,000 ft); bleed air on.
HI	HI	ENG	TKS to inboard leading edge, wing cuff, and fairing panels at normal rate; bleed air on.
HI	HI	ALL	TKS to inboard leading edge, wing cuff, fairing, and all other panels at normal rate; bleed air on.

Table 4H-1; TKS Operation

Windshield Anti-Icing

Selecting LOW or HI on the W/S BLEED switch supplies power to the windshield temperature controller. The controller then removes power to the windshield bleed air valve. The valve opens and bleed air flows through a heat exchanger before it reaches the manually operated shutoff valve. By regulating ram air flow through a heat exchanger, the system regulates bleed air temperature to approximately 127°C (261°F) with the W/S BLEED switch in the LOW position or 138°C (280°F) with the switch in the HI position.

With temperature data supplied by two sensors, the controller opens the air control valve to increase ram air flow and decrease bleed air temperature or closes the control valve to increase ram air flow and decrease bleed air temperature. If bleed air temperature exceeds 146°C (295°F) or duct pressure exceeds 5 PSI with the bleed air valve closed, the W/S AIR O'HEAT annunciator illuminates.

Rotating the WINDSHIELD BLEED AIR control knobs from the OFF position opens the manually operated shutoff valves to regulate windshield air flow.

With the WINDSHIELD BLEED AIR knobs in MAX and the W/S BLEED switch in LOW, pulling the PULL RAIN knob out opens augmenter doors to change the windshield anti-icing system airflow for rain removal.

An isopropyl alcohol-based fluid system supplements the bleed air windshield anti-icing system. Placing the W/S ALCOHOL switch in ON supplies approximately 10 minutes of deicing alcohol to the pilot's windshield.

Pitot/Static Anti-Icing

Turning the PITOT & STATIC switch on supplies 28V DC to the pitot tube, static port, and angle-of-attack probe (if installed) heating elements. If a pitot tube or static port heating element fails, current sensors illuminate the appropriate LH/RH P/S HTR OFF annunciator. The annunciators also illuminate if the PITOT & STATIC switch is in OFF. The AOA HTR FAIL annunciator illuminates if the AOA probe (if installed) heater fails.

In addition, heating elements in the water drain masts prevent ice accumulation when electrical power is available.

Surface Deice System

Citation; Citation I; Citation II

Power Source	Engine bleed air Main DC buses L/R
Distribution	Wing boots L/R Horizontal stabilizer boots L/R Vertical stabilizer boot
Control	SURFACE DE-ICE switch
Monitor	SURFACE DE-ICE annunciator (illuminates in two 6-second cycles when SURFACE DE-ICE switch is activated)
Protection	Circuit breakers Surface deice switch (reset)

Engine Anti-Ice System

Citation; Citation I; Citation II

Power Source	Engine bleed air Main DC buses L/R
Distribution	Bleed air from each engine to: Engine inlet First stage stator vanes Nose cone, T_1 probe Engine ignitors Electrically heated inboard wing leading edge
Control	ENGINE anti-ice switches L/R Throttle microswitches: >60% N_2
Monitor	ENG ANTI-ICE FAIL L/R annunciators DC ammeters L/R Stall strip – WING INSP light Engine ITT/RPM Engine ignition lights
Protection	Circuit breakers Back up temp sensors Engine inlet/stator fail safe valves

Engine Anti-Ice System

Citation SII

Power Source	Engine bleed air Main DC buses L/R
Distribution	Bleed air from each engine to: Engine inlet First stage stator vanes Nose cone, T_1 probe Engine ignitors TKS fluid manifolds to inboard wing fairing/cuff
Control	ENGINE anti-ice switches L/R Throttle microswitches: >60% N_2
Monitor	Annunciators ENG ANTI-ICE FAIL L/R ICE FLUID PUMP FAIL – ENG/SUR ICE FLD LOW ICE FLD SYS ON ICING DETECTED Engine ITT/RPM IGNITION L/R lights TKS quantity gage
Protection	Circuit breakers Proportioning valves

Windshield Anti-Ice Systems

Power Source	Engine bleed air Main DC buses L/R
Distribution	Windshield bleed nozzles L/R Left side alcohol manifold
Control	W/S BLEED AIR switch W/S Temperature controller W/S ALC switch Manual bleed air control valves Rain removal door handle
Monitor	W/S AIR O'HEAT annunciator Bleed air noise
Protection	Circuit breakers Windshield bleed air valve – fail safe Overtemp transmitter

TKS Surface Anti-Ice System

Citation SII

WARNING: The surface TKS system is not a deice system and does not remove significant accumulations of ice. When ice is detected, turn on the system immediately. If more than 1/8 inch of ice accumulates prior to system activation, leave the icing environment.

Power Source	RH Crossover bus (engine anti-ice)
Distribution	Wing Wing fairing/cuff Horizontal stabilizer
Control	SURFACE anti-ice switch
Monitor	Annunciators ICE FLUID PUMP FAIL – ENG/SUR WING ICE FAIL TAIL ICE FAIL ICE FLD LOW ICE FLD SYS ON ICING DETECTED Windshield ice detection lights TKS quantity gage DC ammeters L/R
Protection	Circuit breakers Check valves Surface anti-ice warning

NOTE: TKS fluid (monoethyleneglycol/isopropyl alcohol/ deionized water solution) prevents ice accumulation. However, TKS fluid may freeze if allowed to flow into dry, cold air.

NOTE: The TKS reservoir provides 1.5 to 7.5 hours of anti-icing.