Systems

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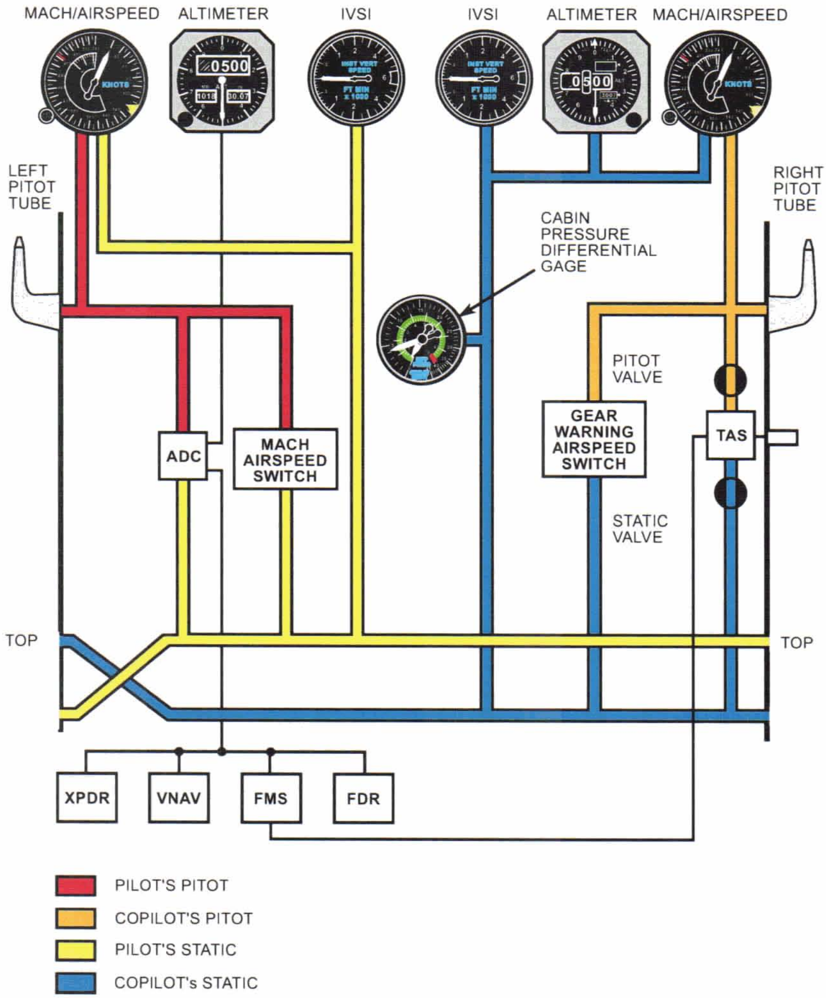
Pitot Static System



Pitot/Static System

An electrically heated pitot tube on each side of the aircraft nose supplies ram air pressure to the flight instruments.

The left pitot tube supplies the:

- pilot's Mach/airspeed indicator
- Mach/airspeed switch
- air data computer

The right pitot tube supplies the:

- copilot's Mach/airspeed indicator
- true airspeed (TAS) computer
- landing gear airspeed warning switch.

Static air sources include a static port on each side of the aircraft nose for the pilot's and copilot's static systems. The pilot and copilot static lines do not connect, but they do cross over within the aircraft so that the pilot's and copilot's static sources are on both sides of the aircraft.

The pilot's static system supplies the pilot's:

- Mach/airspeed indicator
- instantaneous vertical speed indicator (IVSI)
- Mach/airspeed switch
- air data computer.

The copilot's static system supplies the copilot's:

- Mach/airspeed indicator
- altimeter
- instantaneous vertical speed indicator (IVSI)
- landing gear airspeed warning switch
- cabin differential pressure gage
- true airspeed (TAS) computer.

Air Data Computer

The air data computer (ADC) receives pitot pressure (P_T) and static pressure (P_S) inputs from the pitot/static system and temperature data from a probe on the lower forward fuselage. The ADC converts and processes these inputs and then provides electrical driving signals for the:

- pilot's altimeter
- transponder (altitude reporting)
- altitude alerting system
- vertical navigation system
- optional flight data recorder (FDR)
- flight management system (FMS).

SPZ-500

The Honeywell SPZ-500 automatic flight control system (AFCS) combines the functions of an autopilot, flight director, yaw damper, and elevator trim system to provide automatic flight path and attitude control through the pitch, roll, and yaw axes. Various subsystems of the SPZ-500 AFCS include:

- air data system
- autopilot system
- flight director system
- flight instrumentation
- attitude and heading reference system.

Supplied with these inputs, the AFCS generates the appropriate pitch, roll, and yaw commands or cues to fly the aircraft from its actual attitude to a desired attitude.

EFIS

The standard electronic flight instrumentation system (EFIS) consists of:

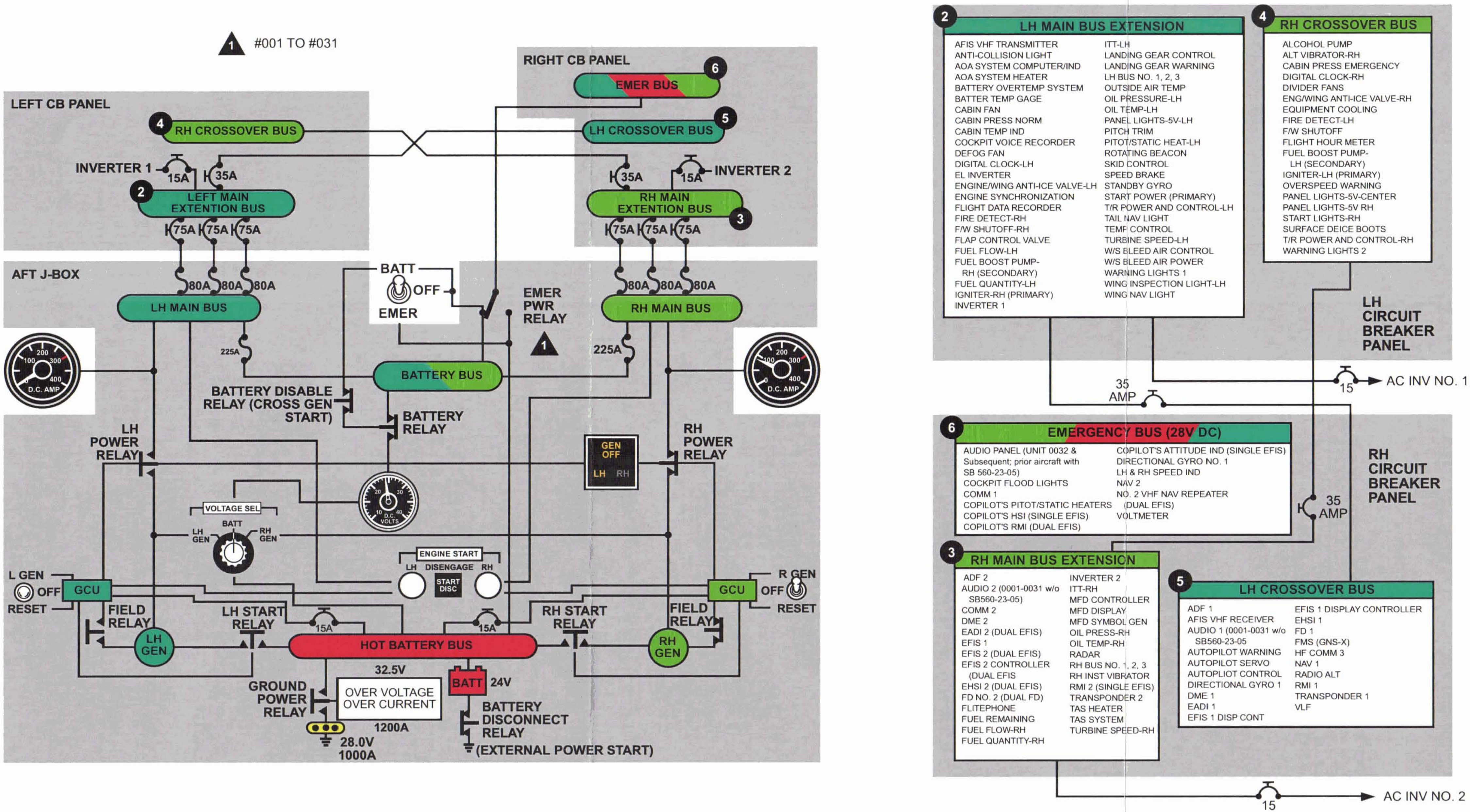
- pilot's electronic attitude director indicator (EADI) and horizontal situation indicator (EHSI)
- symbol generator (SG)
- display controller
- instrument remote controller.

One option adds a multifunction display (MFD) that has the capability to display radar and/or navigation information. The MFD can also display EHSI information if that display fails. The MFD symbol controller can also replace a failed EFIS symbol generator.

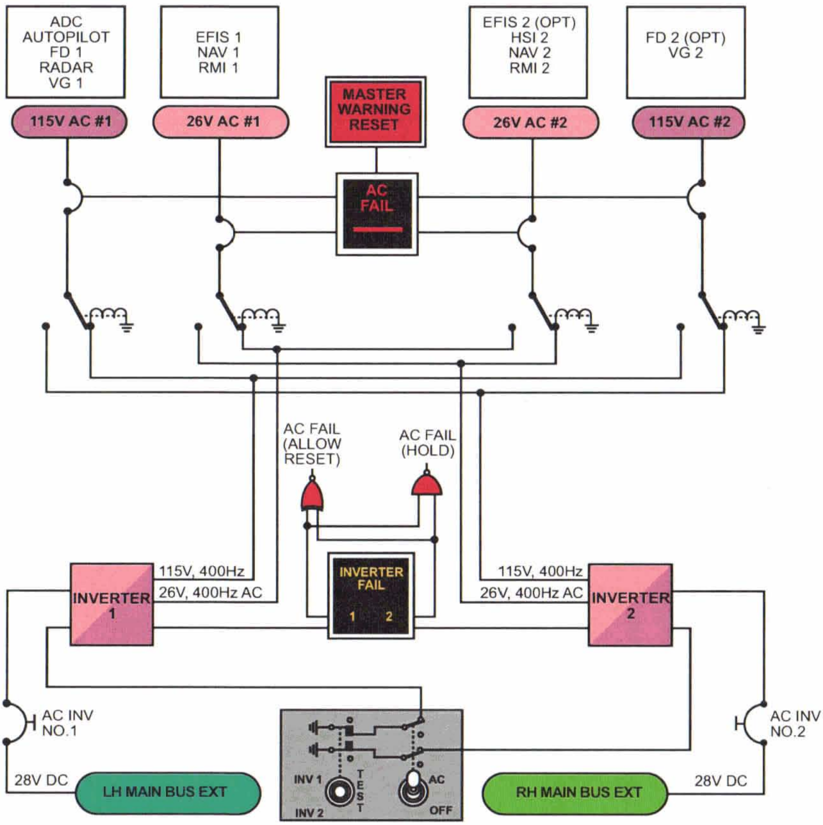
Another option is a five tube EFIS that consists of:

- pilot's EADI and EHSI
- copilot's EADI and EHSI
- MFD
- pilot's, copilot's, and MFD symbol generators
- two display controllers.

DC Electrical System

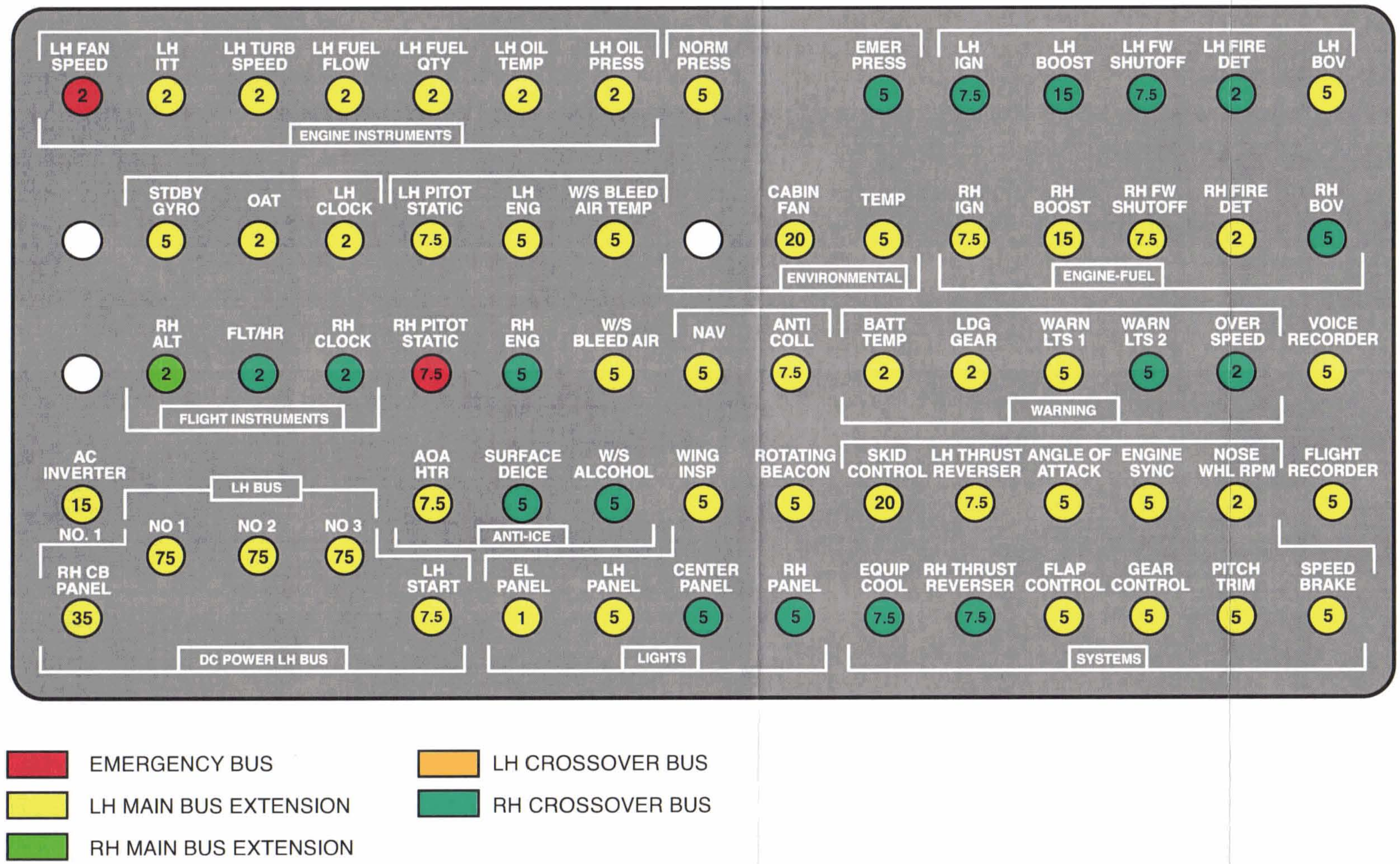


AC Electrical System



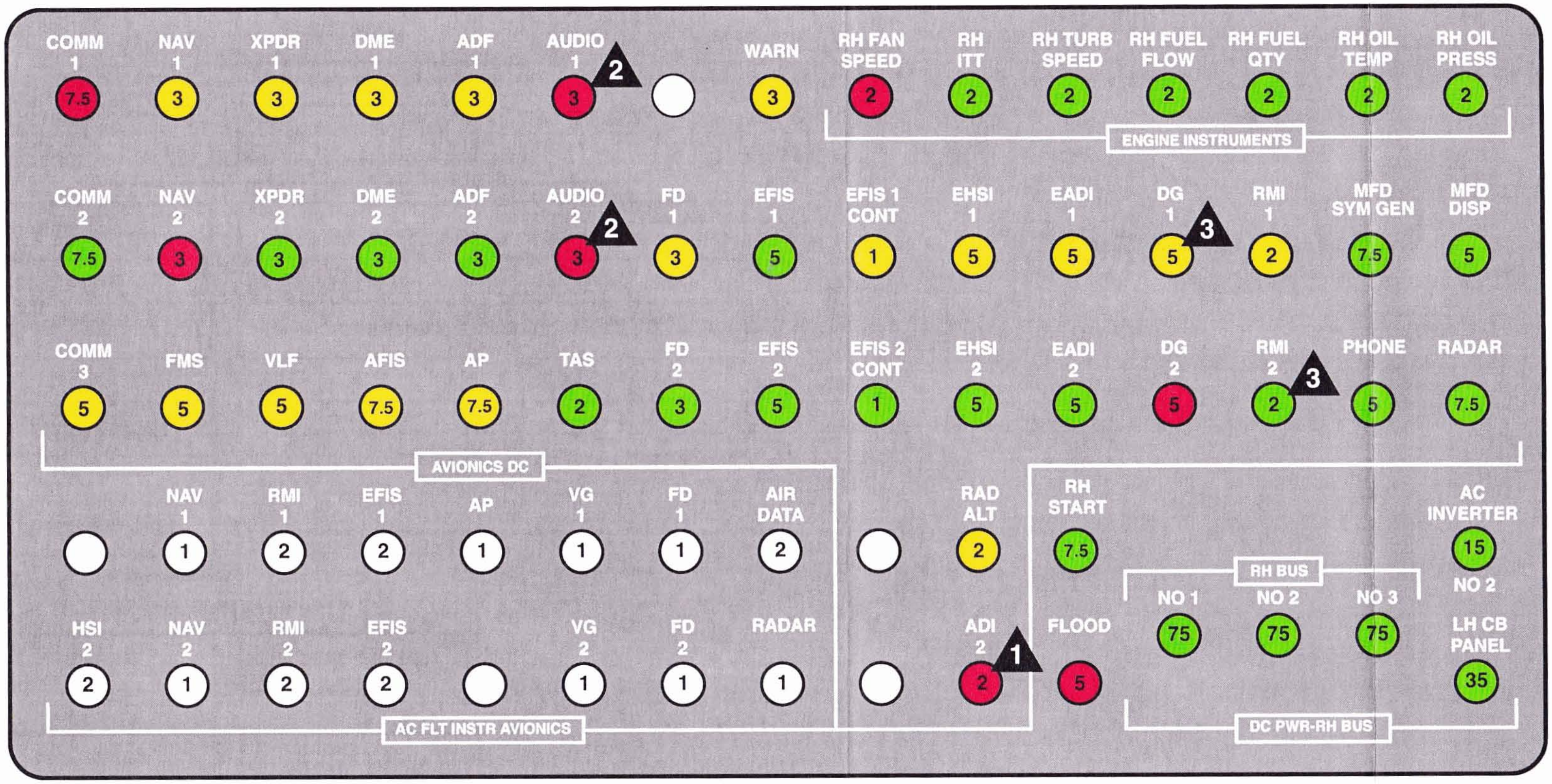
Circuit Breakers

Left CB Panel



Circuit Breakers

Right CB Panel



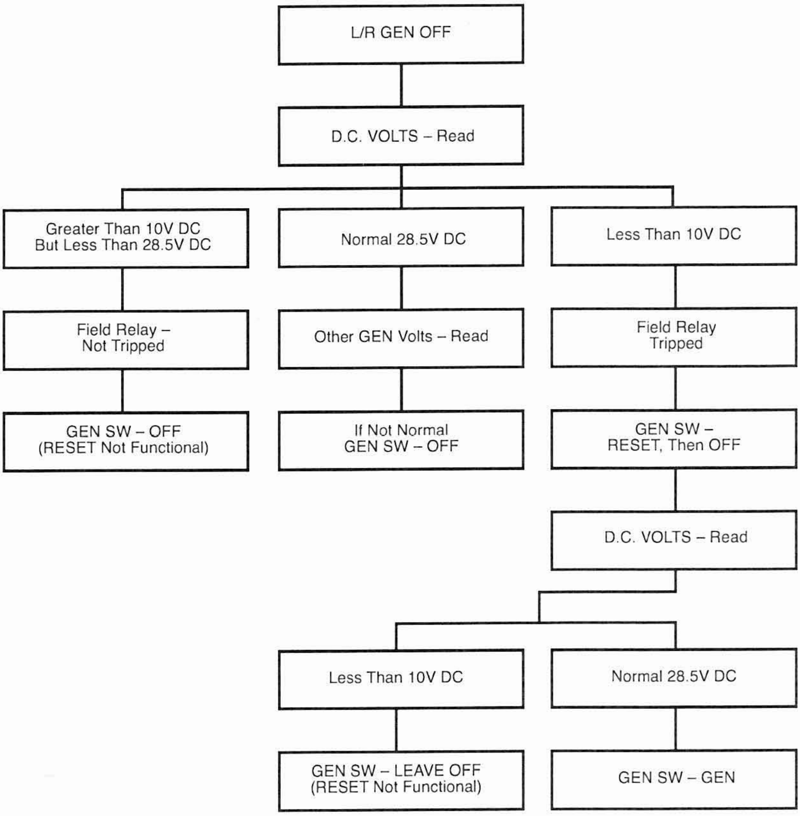
EMERGENCY BUS	LH CROSSOVER BUS
LH MAIN BUS EXTENSION	RH CROSSOVER BUS
RH MAIN BUS EXTENSION	

1. NOT INSTALLED WITH DUAL EFIS

2. 0001-0031 w/o SB 560-23-05
   AUDIO 1 - LH CROSSOVER BUS
   AUDIO 2 - RH MAIN BUS EXTENSION

3. DUAL EFIS INSTALLED
   DG 1 - EMER BUS
   RMI 2 - EMER BUS

Generator Reset Decision Procedure



DC System

Aircraft electrical system power sources include:

- one 24V DC, 44 amp-hour nickel-cadmium battery
- two 28.5V DC, 300 amp engine-driven starter/generators
- external power system.

Nine buses distribute power from the various DC power sources: Hot Battery, Battery, Emergency, Left and Right Main, Left and Right Main Bus Extension, and Left and Right Crossover.

Battery

On all aircraft, with the battery switch in BATT, the battery relay closes to supply power from the Hot Battery bus to the Battery bus. From the Battery bus, power flows to the Left and Right Main buses. The Left and Right Main buses, in turn, power their Main Bus Extensions and Crossover buses.

The battery disconnect relay automatically opens during a ground power unit start to remove the battery from the electrical system and avoid cycling of the battery. The relay closes automatically at the end of the start cycle.

On **units 001 to 031 without SB560-23-05**, placing the battery switch in the OFF position opens the emergency relay. Selecting the EMER position closes the emergency battery relay and power flows from the Hot Battery bus to the Emergency bus only.

On **units 001 to 031 with SB560-23-05 and units 032 and subsequent**, placing the battery switch in the OFF or BATT position allows power from the Left Main DC or Right Main DC bus to power the emergency bus through the Battery bus and relaxed emergency power relay.

Selecting the EMER position energizes the emergency battery relay to the other position. Power flows from the Hot Battery bus to the Emergency bus only.

If battery temperature exceeds 145°F (63°C), a temperature sensor in the battery case illuminates the BATT O'HEAT annunciator steadily; above 160°F (71°C), the annunciator flashes. A battery temperature gage provides continuous indication of battery temperature.

Starter/Generators

Two engine-driven starter/generators are the primary source of DC electrical power. During engine starting they function as starters. At the end of the start cycle, the generator control units (GCUs) enable the transition from starter to generator.

Each GCU provides:

- field weakening during engine start
- automatic starter shutoff
- voltage regulation at 28.5V DC
- generator load sharing (paralleling)
- overvoltage and ground fault protection
- reverse current protection.

With the generator switch in GEN, regulation, protection, and Main bus connection are automatic. When generator output is correct, the power relay closes to connect the generator to its Main bus. The Main buses, in turn, cross tie through the Battery bus so that if one generator fails, the operating generator continues to power the entire electrical system.

If an overvoltage condition or feeder fault occurs or an ENG FIRE switch is pressed, the GCU opens the generator field relay to de-energize the generator and the power relay to disconnect the generator from its Main bus. The associated GEN OFF annunciator illuminates. Placing the generator switch in OFF also opens the power relay to disconnect the generator from its Main bus.

Momentarily holding the switch in RESET resets a generator field relay tripped from overvoltage, feeder fault, or when the ENG FIRE switch is pushed. Selecting RESET may also be necessary following a windmilling airstart.

External Power

With a 28V DC 1,000A GPU connected, external power supplies the Hot Battery bus through the closed external power relay.

When a generator comes on-line and begins supplying power to the DC buses, the external power relay opens to disconnect external power.

An external power overvoltage/overcurrent sensor protects the aircraft electrical system from overvoltage and overcurrent conditions. If GPU voltage exceeds 32.5V DC or current exceeds 1,200A, the sensor opens the external power disable relays to disconnect external power. Before external power can be reapplied, the overvoltage/overcurrent sensor must be reset by disconnecting the GPU from the aircraft.

AC Power

Two 375VA static inverters convert 28V DC into 115V AC, 400 Hz three-phase power and 26V AC, 400 Hz, single-phase power for avionic equipment and other equipment requiring AC power.

With the AC/OFF switch in the AC position, 28V DC from the Left and Right Main Bus Extension buses powers the No. 1 and No. 2 inverters respectively. The No. 1 inverter supplies its 115V and 26V AC buses and the No. 2 inverter supplies its 115V and 26V AC buses.

The No. 1 115V AC bus powers the autopilot, radar, air data computer (ADC), and the pilot's vertical gyro and flight director. The No. 2 115V AC bus powers the copilot's vertical gyro and flight director (dual EFIS aircraft). The No. 1 26V AC bus supplies the No. 1 navigation radio, remote magnetic indicator (RMI), and EFIS and the No. 2 26V AC bus supplies the No. 2 navigation radio, RMI, horizontal situation indicator (HSI), and optional copilot's EFIS.

Four AC BUS circuit breakers provide AC bus protection for the 115V and 26V AC buses. If a bus fault occurs, the associated CB opens to disconnect inverter output to the bus. An open AC bus CB illuminates the AC FAIL annunciator and triggers the Master Warning lights. Resetting the Master Warning light does not extinguish the AC FAIL annunciator.

If an inverter fails, the failed inverter's switching relays relax with loss of power and route AC power from the operating inverter to the failed inverter's buses. During an inverter failure, the associated INV FAIL annunciator and AC FAIL annunciator illuminate. Illumination of the AC FAIL annunciator also triggers the Master Warning lights. Resetting the Master Warning lights extinguishes the AC FAIL annunciator. The INV FAIL annunciator remains illuminated.

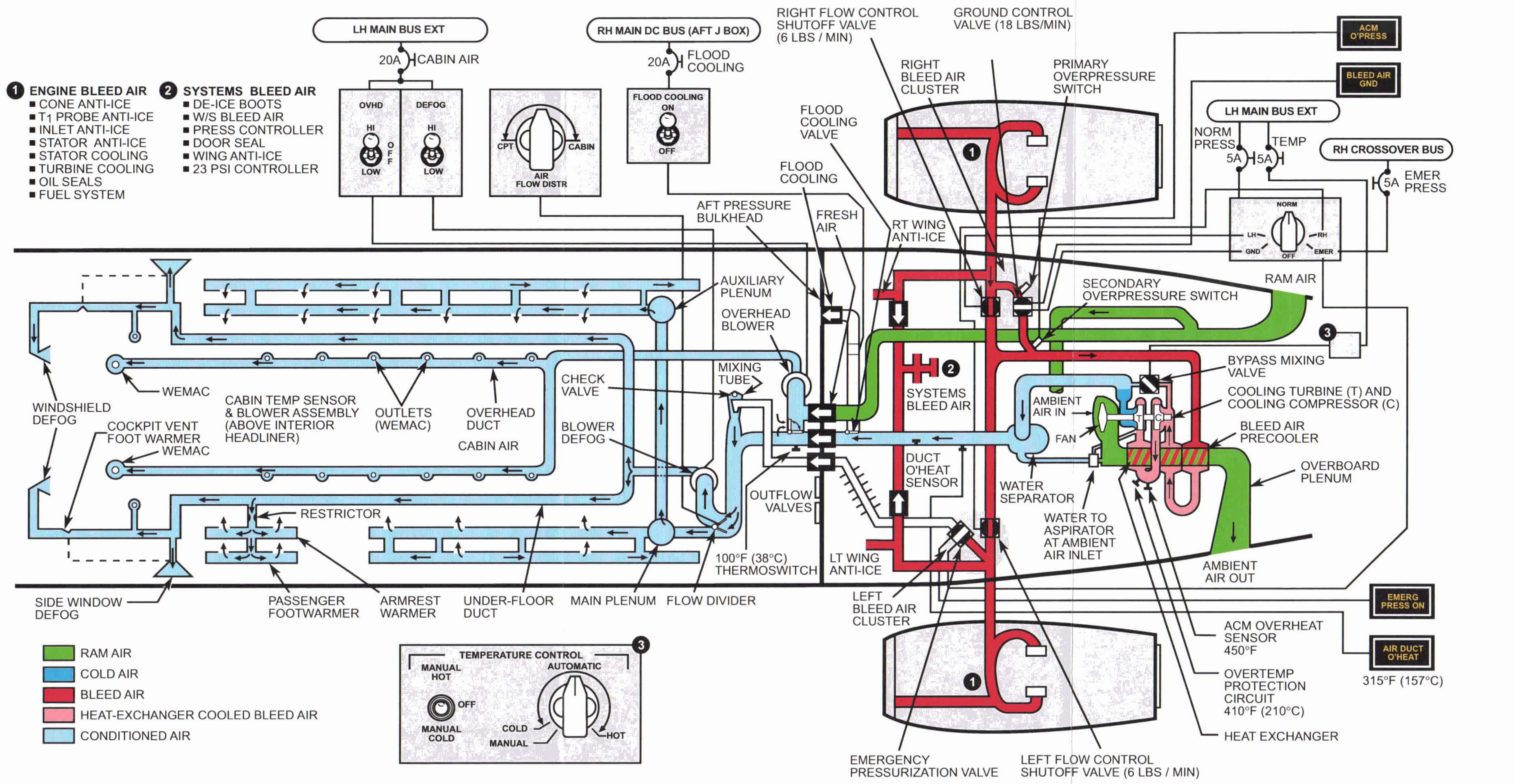
Loss of both inverters illuminates both INV FAIL annunciators, the AC FAIL annunciator, and triggers the Master Warning lights. Resetting the Master Warning lights does not extinguish the AC FAIL annunciator.

The spring-loaded inverter test switch allows preflight testing of the inverter switching system. Placing the switch in INV 1 or INV 2 interrupts the DC input to the selected inverter. The inverter loses power and its switching relays relax to route power from the operating inverter to the failed inverter's buses. Selecting the second inverter position after testing the first, fails the entire AC system.

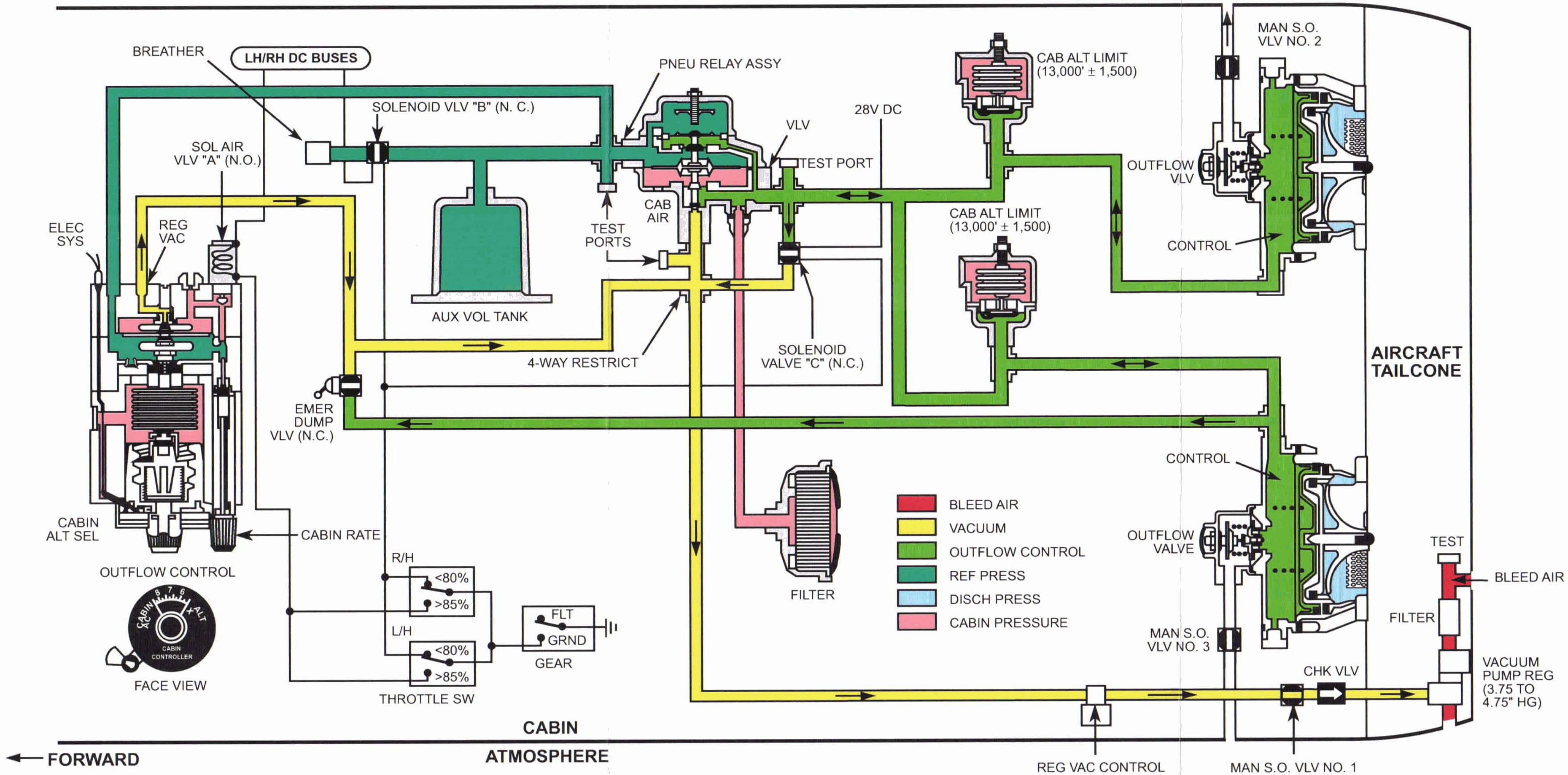
Electrical System

Power Source	Battery (1) – 24V DC, 20-cell, 44 amp-hour Starter/generators (2 engine-driven) – 28.5V DC, 300A AC inverters (2) – 26V and 115V AC, 400 Hz GPU – 28V DC, 600 to 1,000A
Distribution	DC buses Hot Battery Battery Emergency LH/RH Main LH/RH Main Extension LH/RH Crossover AC buses 115V AC Nos. 1/2 26V AC Nos. 1/2
Control	DC switches L GEN/R GEN BATT/OFF/EMER AVIONIC POWER ON/OFF (master) AC switches AVIONIC POWER AC/OFF (DC power to to inverters) AVIONIC POWER INV 1/TEST/INV 2
Monitor	DC Voltmeters and ammeter L/R GEN OFF annunciators BATT O'TEMP annunciator Master Warning AC AC FAIL annunciator INVERTER FAIL 1/2 annunciators Master Warning
Protection	Circuit breakers Current limiters Relays Generator control units

Pneumatic/Air Conditioning System



Pressurization System



Bleed Air Sources

Bleed air from each engine's centrifugal compressor flows through transfer tubes and elbow assemblies before entering the bleed air cluster. At the bleed air cluster, the bleed air flow splits to supply the:

- air conditioning and pressurization systems through flow control and shutoff valves
- emergency pressurization (left engine) through emergency pressurization valve
- ground air conditioning system (right engine) through ground shutoff valve
- airframe anti-icing and deicing systems (see Ice and Rain Protection).

The six-position PRESS SOURCE selector controls the flow control and shutoff, ground shutoff, and emergency pressurization valves (see **Table 4C-A**).

Position	Function
OFF	All flow control and shutoff valves closed.
GND	L/R flow control and shutoff valves closed; ground shutoff valve open with right engine operating and left squat switch in on ground mode. Ground air conditioning system operation.
LH	Left flow control and shutoff valve opened and right flow control and shutoff valve closed. Left engine supplies bleed air for air conditioning system.
NORM	L/R flow control and shutoff valves open and both engines supply bleed air for air conditioning system. Normal operating position.
RH	Right flow control and shutoff valve open and left flow control and shutoff valve closed. Right engine supplies bleed air for air conditioning system.
EMER	Emergency pressurization valve open and left and right flow control and shutoff valves closed. All bleed air routed into cabin for emergency pressurization.

Table 4C-A; PRESS SOURCE Switch Selection

Air Conditioning

On the ground with the PRESS SOURCE selector in the GND position, the left and right flow control and shutoff valves close and the ground shutoff valve opens. Bleed air from the right engine then flows through the open ground shutoff valve to the air cycle machine (ACM) precooler. If bleed air pressure exceeds 32 to 38 PSIG (right engine 72% N_2 RPM), the primary overpressure switch closes the ground shutoff valve to prevent system overpressurization. If the primary switch fails, the secondary overpressure switch closes the shutoff valve at 36 to 42 PSIG (right engine 74% N_2 RPM) and illuminates the AC OVERPRESS annunciator.

With both engines operating and the PRESS SOURCE selector in the NORMAL position, the electrically controlled and pneumatically operated left and right flow control and shutoff valves open. Bleed air then flows through each valve at a flow rate of 6.0 PPM.

Hot bleed air flows through a ram air cooled precooler that provides the initial bleed air cooling. With the air conditioning system operating, a fan driven by the ACM forces air past the precooler and heat exchangers.

After flowing through the precooler, bleed air flows through the primary heat exchanger before reaching the ACM compressor. Compression of bleed air pressurizes it resulting in a temperature rise. An electrically controlled bypass valve downstream of the ACM compressor regulates bleed air flow through the rest of the ACM. The bypass valve, responding to commands from the temperature controller or crew inputs, opens or closes to decrease or increase bleed air flow through the ACM (see Temperature Control). Bleed air bypassed from the ACM mixes with cold conditioned air upstream of the water separator.

Air then flows through the secondary heat exchanger for additional cooling before it reaches the ACM turbine. Compressed bleed air expands across the turbine. The energy extracted drives the trubine and expansion cools the bleed air.

Conditioned air leaving the ACM enters the water separator where a coalescer removes water from the moisture-laden air. An ejector collects this water and sprays it on the heat exchangers to assist cooling.

Finally, conditioned air from the water separator enters the cabin through a check valve in~the aft pressure bulkhead. A temperature switch in the air duct illuminates the AIR DUCT O'HEAT annunciator if temperature reaches approximately 31 5°F.

After passing through the aft pressure bulkhead, overhead and underfloor ducts distribute conditioned air through the cabin and cockpit. The overhead ducts supply conditioned air through adjustable WEMAC ducts in the cabin and cockpit.

The underfloor ducting supplies the cockpit armrest, foot warmer, side window, and windshield defog outlets.

Temperature Control

With the TEMPERATURE CONTROL knob in the AUTOMATIC range, the temperature controller responds to temperature data provided by a sensor in the air conditioning duct and the cabin. In response to TEMPERATURE CONTROL knob setting, the controller opens or closes the bypass valve to increase or decrease cabin air temperature.

In the automatic mode, a 410°F temperature sensor monitors ACM compressor discharge temperature to prevent the ACM from overheating. If discharge temperature reaches 410°F, the sensor biases the temperature controller to provide a warmer cabin temperature than selected until the ACM cools. Selecting manual full cold when flying above 31,000 ft can result in an ACM overheat and shutdown because the 410°F sensor does not function in manual mode.

Placing the TEMPERATURE CONTROL knob in the MANUAL position allows the crew to manually control cabin temperature by directly opening or closing the bypass valve with the MANUAL HOT/MANUAL COLD switch. Holding the switch in the MANUAL HOT position for eleven seconds opens the bypass valve to increase cabin temperature; holding it in the MANUAL COLD position for eleven seconds closes the bypass valve to decrease cabin temperature. When released, the switch spring-loads to the OFF position with the bypass valve remaining in its last position.

Adjusting the AIR FLOW DISTR knob between the CKPT and CABIN positions operates a motor-driven flow divider that controls air flow from the underfloor supply duct into the cabin armrest and foot warmer manifolds.

Placing the DEFOG switch in HI or LOW activates a blower that increases airflow through the ducts to the cockpit foot warmers and windshield and side window defog outlets.

Flood Cooling (Optional)

Placing the FLOOD COOLING switch in the ON position energizes a blower fan and closes the normal air conditioning supply duct. Most of the conditioned air from the air conditioning system then flows through a grill in the aft pressure bulkhead. This system allows rapid cooling of the cabin on the ground and below 10,000 ft.

Freon Air Conditioning (Optional)

A Freon air conditioning system provides supplemental cabin cooling on the ground and in flight to 18,000 ft. With the MODE switch in the AC position, the compressor and forward blower run to cool the cabin. During air conditioning operation, the COMP ON light illuminates.

On the ground, only one operating generator is necessary to operate the system. In flight, both generators must be on-line. If one generator goes off-line, the compressor automatically shuts down.

Ram Air Supply

A ram air scoop in the vertical stabilizer fin supplies fresh air through a check valve to the air conditioning system and cabin. The check valve prevents cabin pressurization loss through the ram air ventilation system.

Pressurization

With the air conditioning system operating, a constant supply of pressurized air enters the cabin. The pressurization system then maintains a selected cabin altitude, climb rate, and descent rate by opening and closing two outflow valves on the aft pressure bulkhead. The system's 8.9 ± 0.1 PSID maximum cabin pressure differential provides an 8,000 ft cabin altitude at the aircraft's 45,000 ft maximum operating altitude.

Normal Operation

With an engine operating, bleed air directed through a pressure regulator and ejector supplies vacuum for operation of the pressurization system. After setting the CABIN RATE knob within the white band and the ACFT knob to the planned cruising altitude plus 1,000 ft, the pressurization controller governs cabin pressurization without further crew inputs.

With the throttles above 85% N_2 RPM and the squat switch in the ground mode, three solenoid valves actuate to supply ambient pressure and regulated vacuum to the pressurization system for pre-pressurization during takeoff.

As the aircraft climbs to altitude, the pressurization controller regulates cabin climb rate by opening and closing the outflow valves with control air amplified through a pneumatic relay.

If the pressurization system fails to control the outflow valves and cabin altitude increases to 13,500 ± 1,500 ft, two cabin altitude limit valves open to supply ambient pressure to the outflow valves. The decreasing vacuum to the outflow valves forces the outflow valves to the closed position.

During descent with the pressurization controller set to 500 ft above the landing field altitude, the system gradually bleeds cabin pressure to atmosphere to provide a comfortable descent rate. When the aircraft passes through the altitude setting, the system unpressurizes the cabin. At touchdown, the squat switch signals the pressurization controller to completely dump cabin pressure by fully opening the outflow valves.

Emergency Dump

Lifting the guard then moving the EMER DUMP lever up supplies vacuum to both outflow valves to open them and depressurize the cabin. With the PRESS SOURCE switch in any other position than OFF, the cabin altitude limit valves prevent cabin altitude from exceeding 13,000 ± 1,500 ft. Placing the PRESS SOURCE switch in OFF stops the pressurized air supply to allow the cabin to dump to ambient pressure.

Emergency Pressurization

If ACM compressor discharge temperature reaches 435°F, the left and right control and shutoff valves and the ground shutoff valve close to shutdown the ACM. The emergency pressurization valve then opens to supply hot bleed air from the left engine to the distribution system for cabin pressurization.

If cabin altitude climbs to 10,000 ± 350 ft, the CABIN ALT annunciator illuminates and the Master Warning lights flash.

If cabin altitude continues climbing, placing the PRESS SOURCE selector in the EMER position closes the left and right flow control and shutoff valves, opens the emergency pressurization valve and illuminates the EMERG PRESS ON annunciator. Hot bleed air obtained directly from the left engine flows into the distribution ducts to pressurize the cabin.

Air Conditioning System

Power Source	HP bleed air from either/both engine(s) Ram air
Distribution	Emergency pressurization duct Flood cooling duct Fresh air duct Overhead ducts Under-floor ducts
Control	Air cycle machine TEMPERATURE CONTROL rheostat MANUAL HOT/COLD switch Mixing valve (bypass modulating and shutoff valve) CPT/CABIN FLOW DISTR selector DEFOG fan OVHD fan PRESS SOURCE selector Bleed air shutoff/flow control valves
Monitor	Cabin temperature indicator Annunciators AIR DUCT O'HEAT BLD AIR GND EMERG PRESS ON ACM O'PRESS
Protection	Circuit breakers ACM O'PRESS ACM O'HEAT

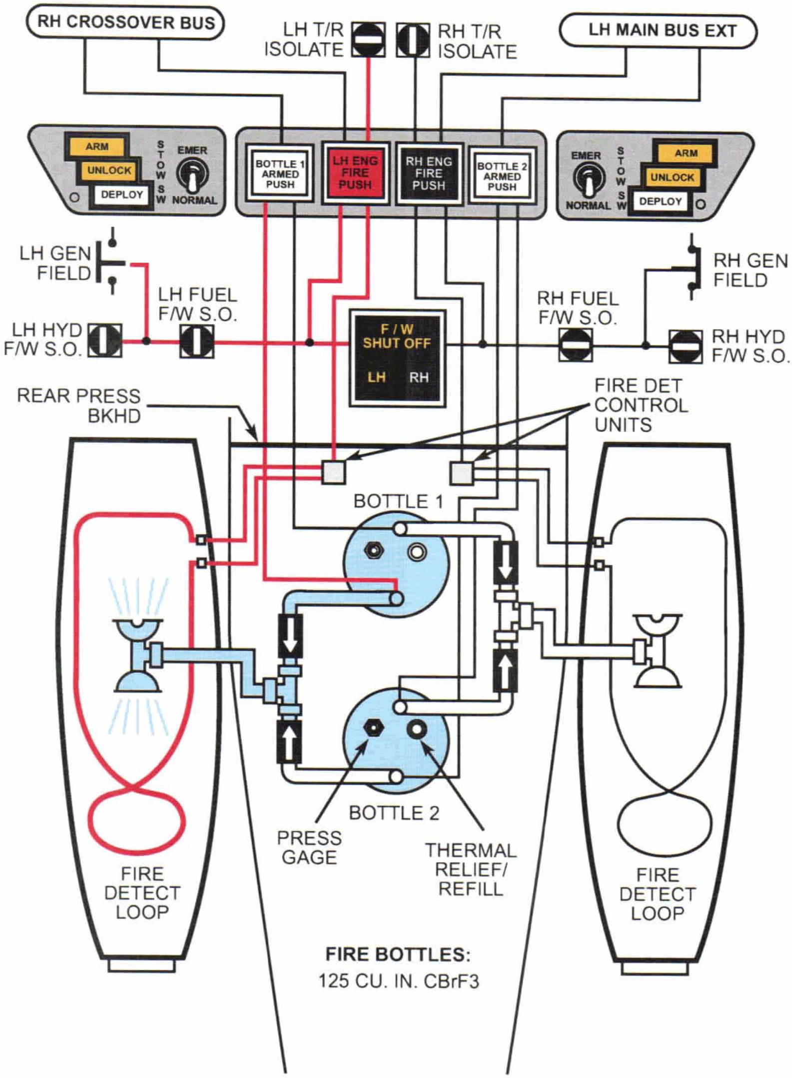
Bleed Air System

Power Source	HP bleed air from either/both engine(s)
Distribution	Door seal Engine anti-ice system Fuel System Left engine to cabin (EMER position) Pressurization controller Windshield bleed air Wing deice system
Control	Bleed air cluster valves Bleed air pressure regulator ENGINE ANTI ICE switches Lower forward door latch pin PRESS SOURCE selector SURFACE DEICE switch/ejectors W/S BLEED HI/LOW switch W/S BLEED AIR manual shutoff valvles
Monitor	Annunciators BLD AIR GND EMERG PRESS ON ENG ANTI-ICE LH/RH SURFACE DEICE W/S AIR O'HEAT
Protection	Circuit breakers

Pressurization System

Power Source	Emergency pressurization from left engine HP bleed air from either/both engine(s)
Distribution	Emergency pressurization duct Overhead ducts Under-floor ducts
Control	Aircraft pressurization controller CABIN RATE knob Control power (28V DC and vacuum) Landing gear squat switch (left) Outflow valves PRESS SOURCE rotary selector Pressure regulator Thottles
Monitor	Annunciators CABIN ALT 10,000 FT BLD AIR GND EMERG PRESS ON CABIN ALT/DIFF PRESS indicator Cabin rate-of-change indicator
Protection	Cabin altitude limit switches Circuit breakers Emergency dump valve Oxygen system Passenger oxygen system baro-sensor 10,000 ft cabin sensor

Fire Protection System



Fire Detection

The closed-loop engine fire detection system consists of a detector control unit connected to a stainless steel sensor tube that wraps around the engine combustion and accessory sections. The sensor tube contains a 28V DC energized wire centered in a semi-conductor material. At normal operating temperatures, the material's resistance is high and current does not flow from the center wire to the outer casing.

As temperature increases, the material's resistance decreases until current flowing from the center wire to the outer casing energizes the detector control unit fire relay. The relay closes and the associated ENG FIRE warning switchlight illuminates.

Lifting the plastic guard and then pressing the illuminated ENG FIRE warning switchlight closes the fuel and hydraulic firewall shutoff valves, de-energizes the generator field relay and thrust reverser isolation valve, and arms the fire extinguishing system (BOTTLE ARMED PUSH switchlight).

Fire Extinguishing

Two 125 cubic-inch, dual-head, single-shot fire extinguisher bottles contain Halon 1301 (bromotrifluoromethane) pressurized to 600 ± 75 PSI at 70°F (21°C) with nitrogen. Each bottle also has a pressure gage and combination fill and pressure release valve. Abnormally high temperatures in the tailcone melts the pressure release valve's fusible check valve to release bottle contents into the tailcone.

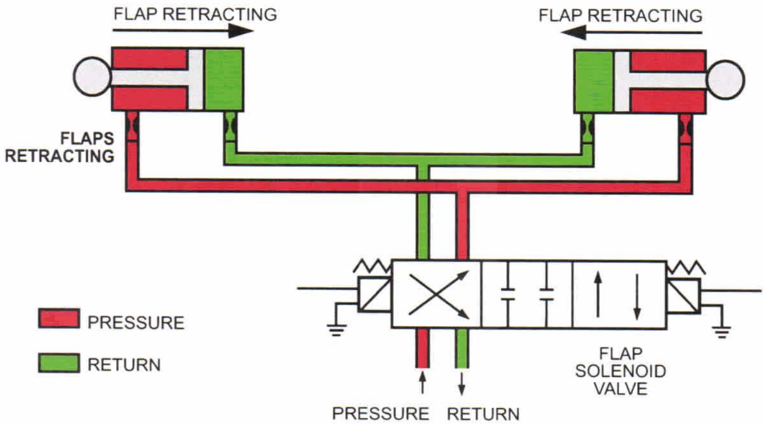
Pressing the illuminated ENG FIRE warning switchlight arms the fire extinguishing system and illuminates the BOTTLE 1/2 ARMED PUSH switchlights. Pressing an illuminated BOTTLE 1/2 ARMED PUSH switchlight supplies 28V DC to fire the selected bottle's explosive cartridge for the affected engine. Pressurized nitrogen then carries the fire extinguishing agent from the bottle through distribution lines to the engine nacelle. After the bottle discharges, the respective BOTTLE 1/2 ARMED PUSH switchlight extinguishes.

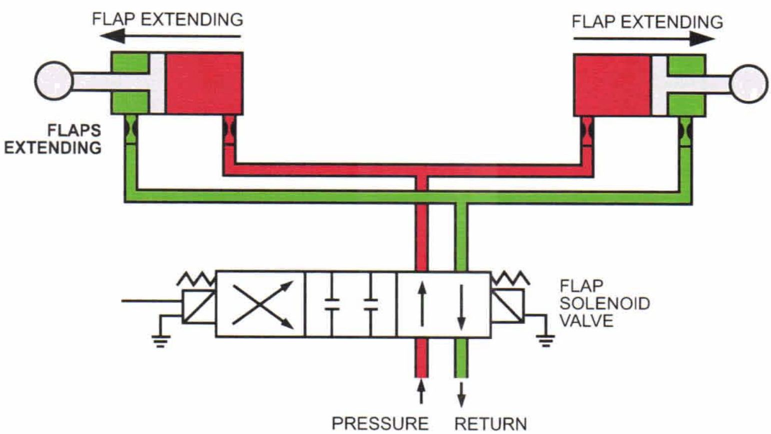
If the ENG FIRE warning switchlight remains illuminated after 30 seconds, pressing the other BOTTLE ARMED PUSH switchlight discharges the remaining bottle into the same engine nacelle.

Fire Protection System

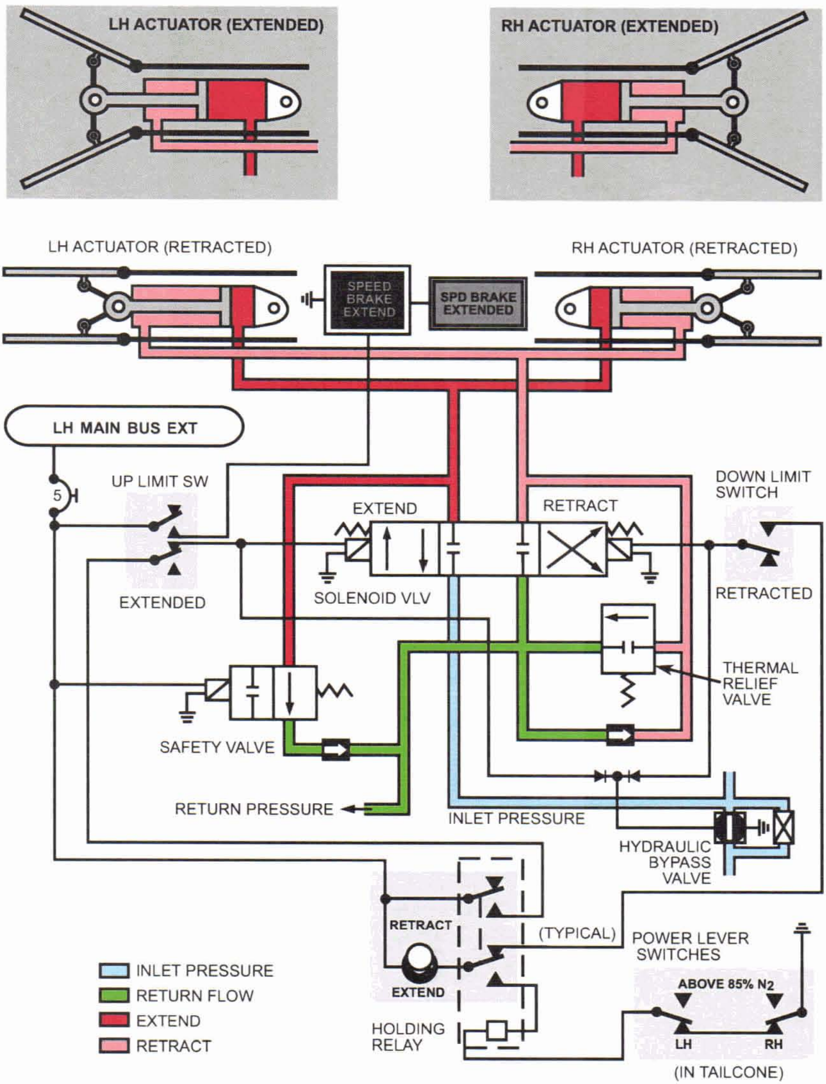
Source	$CBrF_3$
Distribution	Each $CBrF_3$ bottle to either engine via manifolds and spreader bar
Control	BOTTLE ARMED switchlights (1/2) ENG FIRE warning switchlights (L/R) Left Main Extension bus Right Crossover bus
Monitor	BOTTLE ARMED PUSH switchlights (1/2) $CBrF_3$ bottle gages ENG FIRE warning switchlights (L/R) FIREWALL SHUTOFF annunciators (L/R)
Protection	Field relay trip Fire detect control units (L/R) Fire detection loops (L/R) Firewall shutoff valves (closed) Fuel Hydraulic Thrust reverser isolation valve (closed)

Flaps System





Speedbrakes System



Primary Flight Controls

The mechanically controlled primary flight controls include the ailerons, elevators, and rudder. Pilot or autopilot inputs to the primary flight controls command the aircraft through the roll, pitch, and yaw axes.

Ailerons

Movement of either control wheel left or right from neutral transmits control inputs by cables to the aileron sector assembly. The aileron sector assembly, in turn, moves the ailerons through cables and aileron actuator assemblies.

Aileron Trim

Rotating the aileron trim wheel left or right from the neutral position mechanically positions the left aileron trim tab with cables connected to the tab's actuator.

Elevators

Moving either control column forward or aft from neutral operates cables connected to the elevator bellcrank. Movement of the bellcrank operates pushrods connected to the elevators.

Elevator Trim

Rotating the elevator trim wheel forward or aft mechanically drives the elevator trim tabs through cables connected to the trim tab actuators. Pressing the split elevator trim switch on the pilot's or copilot's control wheel drives the elevator trim tabs up or down through an electric motor connected to the control cables. Operation of the pilot's split elevator trim switch overrides the copilot's switch.

If the system malfunctions, pressing the AP/TRIM DISC switch disconnects electrical power from the trim motor. The manual elevator trim wheel also overrides the electric pitch trim system.

Rudder

The rudder moves in response to rudder pedal and yaw damper inputs to provide yaw control. Movement of the rudder pedals moves the rudder through cables and a bellcrank.

Rudder Trim

Rotating the rudder trim wheel left or right from neutral mechanically positions the servo-type rudder trim tab to reduce pedal forces. An indicator shows trim tab position NOSE L or NOSE R from neutral. The rudder trim tab also functions as a servo tab in that it moves in the opposite direction of rudder deflection.

Control Lock

With ailerons, elevator, and rudder in the neutral position and throttles in the cutoff position, pulling the CONTROL LOCK T-handle out and rotating it 45° clockwise locks the flight controls and throttles. With the control lock engaged, maximum nosewheel tow limit angle is 60°.

Rotating the CONTROL LOCK T-handle counterclockwise and then pushing it in releases the control lock.

Secondary Flight Controls

Secondary flight controls include electrically controlled and hydraulically operated flaps and speedbrakes.

Flaps

The flaps have a 0 to 35° range of travel with FLAP handle detents at the UP (0°), T.O. (7°), T.O. & APPR (15°), and LAND (35°) positions. During flap operation between 15 and 25° (extension or retraction), the elevator trim flap/trim interconnect compensates for rapid pitch changes. Flap trim interconnect may be stopped by pressing the AP/TRIM DISC switch.

Moving the FLAP handle to extend or retract the flaps actuates a down-switch or up-switch. The appropriate switch closes and 28V DC power flows to the hydraulic system bypass valve and the flap solenoid valve. The bypass valve closes, hydraulic pressure builds to 1,500 PSI, and the flap solenoid valve shifts to direct hydraulic pressure to the appropriate side of the flap actuators. Under pressure the flap actuators position the flaps through a bellcrank on each flap's inboard end. Pushrods transmit bellcrank movement to the remaining flap bellcranks.

When flaps reach the position selected with the FLAP handle, a preselect cable assembly connected to the flap indicator deactuates the respective up or down switch. Then the flap solenoid valve closes, the hydraulic system bypass valve opens, and flap movement stops.

Speedbrakes

Placing the spring-loaded SPEED BRAKE switch in the EXTEND position energizes a holding relay that supplies 28V DC to energize the hydraulic system bypass, speedbrake solenoid, and speedbrake safety valves. The bypass valve closes and hydraulic pressure builds. When the solenoid valve energizes, it shifts to route hydraulic pressure to the speedbrake actuators that extend the speedbrakes. When the speedbrakes reach the extended position, up limit switches actuate to illuminate the SPEED BRAKE EXTEND annunciator, close the solenoid valve, and open the bypass valve. When the solenoid valve closes, it traps hydraulic fluid in the actuating system to hold the speedbrakes in the extended position.

Loss of electrical power with the speedbrakes extended opens the safety valve to release hydraulic pressure and allow the speedbrakes to blow down to the trail position.

Placing the SPEED BRAKE switch in the RETRACT position de-energizes the holding relay that supplies 28V DC power to shift the solenoid valve to the retract position and close the bypass valve. The hydraulic system pressurizes; hydraulic pressure flows through the solenoid valve to the speedbrake actuator retract ports to retract the speedbrakes. When the speedbrakes retract, the SPEED BRAKE EXTEND annunciator extinguishes, the bypass valve opens, and the solenoid valve closes to block hydraulic pressure to the actuators.

With the speedbrakes extended, advancing the throttles above approximately 85% N_2 automatically retracts the speedbrakes by releasing the SPEED BRAKE switch's holding relay. The holding relay then releases to the RETRACT position and the speedbrakes retract.

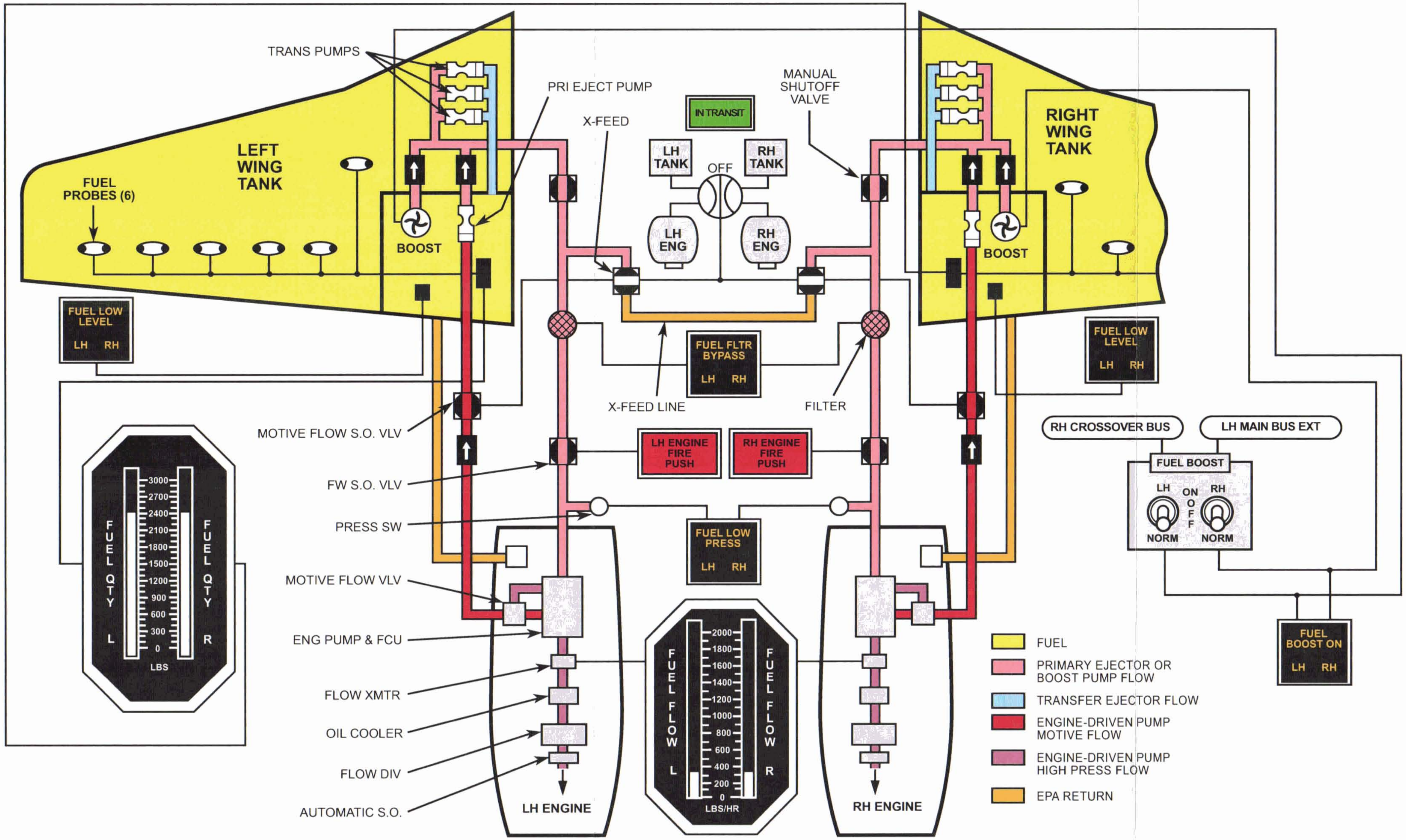
Flaps

Power Source	Hydraulic system Left Main Extension bus
Control	Flap selector handle Flap/trim interconnect
Monitor	Flap position indicator HYD PRESS ON annunciator Trim Wheel
Protection	Blow-up/trail capacity Circuit breakers

Speedbrakes

Power Source	Hydraulic system Left Main Extension bus
Control	Speedbrake switches 85% N_2 microswitch
Monitor	HYD PRESS ON annunciator SPEED BRAKE EXTEND annunciator
Protection	Auto-retract with throttles above 85% N_2 Circuit breakers Safety valve Thermal relief valve

Fuel System


TRANS PUMPS
PRI EJECT PUMP
MANUAL SHUTOFF VALVE
X-FEED
IN TRANSIT
LH TANK
OFF
RH TANK
LH ENG
RH ENG
LEFT WING TANK
RIGHT WING TANK
FUEL PROBES (6)
BOOST
BOOST
FUEL LOW LEVEL
LH RH
FUEL FLTR BYPASS
LH RH
FUEL LOW LEVEL
LH RH
X-FEED LINE
FILTER
MOTIVE FLOW S.O. VLV
RH CROSSOVER BUS
LH MAIN BUS EXT
LH ENGINE FIRE PUSH
RH ENGINE FIRE PUSH
FUEL BOOST
LH ON RH
OFF
NORM NORM
FW S.O. VLV
PRESS SW
FUEL LOW PRESS
LH RH
MOTIVE FLOW VLV
FUEL QTY
L R
3000 2700 2400 2100 1800 1500 1200 900 600 300 0
LBS
ENG PUMP & FCU
FUEL BOOST ON
LH RH
FLOW XMTR
OIL COOLER
FLOW DIV
AUTOMATIC S.O.
FUEL FLOW
L R
2000 1800 1600 1400 1200 1000 800 600 400 200 0
LBS/HR
LH ENGINE
RH ENGINE
FUEL
PRIMARY EJECTOR OR BOOST PUMP FLOW
TRANSFER EJECTOR FLOW
ENGINE-DRIVEN PUMP MOTIVE FLOW
ENGINE-DRIVEN PUMP HIGH PRESS FLOW
EPA RETURN

Fuel Storage

Each wing tank extends from the wing root to the wing tip. The tanks include all internal wing area forward of the rear spar except for the inboard leading edge and the area above the wheel wells. Gaps in the forward wing spar and ribs allow fuel to flow inboard. One-way flapper valves restrict fuel flow to prevent sudden weight and balance shifts during maneuvering. An overwing filler cap near each wing tip allows gravity fueling of the tanks.

Each tank holds 431 U.S. gallons of usable fuel for a total capacity of 862 U.S. gallons or 5,816 lbs at 6.75 lbs/gallon.

Each tank's venting system consists of a non-icing underwing air scoop, float valve, check valves, surge tank, and a vent line that extends from the inboard tank area to the surge tank.

An internal sump area in each wing tank's inboard section contains an electric boost pump, primary ejector pump, and six water drains. Each wing tank also has three transfer pumps that move fuel from the tank area into the sump area.

Fuel Indicating

Six capacitance-type fuel probes and a temperature compensator for each wing tank drive the vertical tape FUEL QTY indicators. The system, operating on 28V DC from the LH Main and RH Main DC buses, show tank quantity from 0 to 3,000 lbs.

A float switch in each wing tank sump illuminates its respective FUEL LOW LEVEL annunciator when fuel quantity drops to 185 lbs.

Fuel Distribution

During engine start with the boost pump switch in NORM or OFF, the electric boost pump supplies positive fuel feed to the engine-driven pump. Fuel flows from the sump area through a check valve, manual shutoff valve, fuel filter, and firewall shutoff valve. If the fuel filter begins clogging, a differential pressure switch closes at 3.75 PSID to illuminate the FUEL FILT BYPASS annunciator. At 4.75 PSID, the fuel filter bypass valve opens to route fuel around the filter.

After the engine starts, the generator control unit (GCU) de-energizes the electric boost pump. The primary ejector pump then supplies fuel from the sump area to the engine-driven pump. With the engine-driven pump operating, the primary ejector pump receives motive flow fuel through the motive flow valve and open motive flow shutoff valve.

If fuel pressure in the supply line drops below approximately 5 PSIG with the boost pump in NORM and the throttle out of cutoff, a pressure switch illuminates the LOW FUEL PRESS annunciator. The electric boost pump then energizes to supply fuel from the sump area to the engine-driven fuel pump. If the annunciator remains illuminated, the electric boost pump is inoperative.

Placing the boost pump switch in ON, regardless of throttle lever position and fuel pressure, supplies power to the electric boost pump from the Left Main Bus Extension and Right Crossover buses.

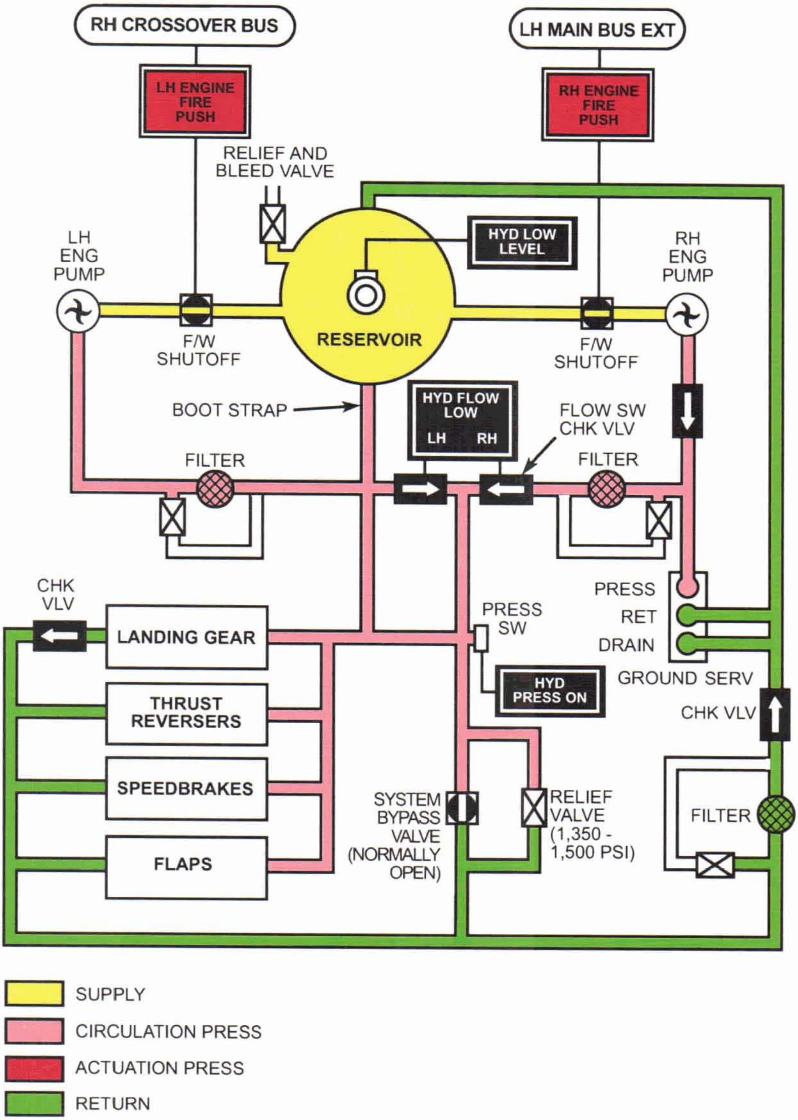
Placing the crossfeed switch in LH TANK or RH TANK cross feeds fuel from one tank to both engines. The selected tank's electric boost pump operates and both crossfeed valves open. After three seconds of operation, the opposite motive flow shutoff valve closes and fuel flows from the selected tank to both engines.

The green INTRANSIT light illuminates during crossfeed valve operation and when valve position does not agree with crossfeed switch position after power is supplied to the valves.

Fuel System

Power Source	Motive flow ejector pump Motive flow fuel
Distribution	Crossfeed manifold Fuel transfer motive flow Motive flow manifold Wing tank to respective engine (L/R) via engine manifold
Control	ENGINE START (L/R) switches ENG FIRE switchlights (L/R) FUEL BOOST switches (L/R) LH TANK/RH TANK crossfeed selector STARTER DISENGAGE switches (L/R) Throttles Fuel control unit (fuel cutoff)
Monitor	Annunciators FIREWALL SHUTOFF (L/R) FUEL BOOST ON (L/R) FUEL FILTER BYPASS (L/R) FUEL LOW LEVEL (L/R) FUEL LOW PRESS (L/R) Crossfeed INTRANSIT light FUEL FLOW gage FUEL QTY gage
Protection	Circuit breakers Prist Fuel filters Fuel firewall shutoff valves Motive flow shutoff valve .07 emergency cutoff

Hydraulic System



Hydraulic System

An open-center hydraulic system supplies 1,500 PSI pressure for operation of the:

- landing gear
- thrust reversers
- speedbrakes
- flaps.

With the engines running, each constant-displacement engine-driven hydraulic pump draws fluid from the self-pressurizing reservoir through an electrically operated firewall shutoff valve.

If reservoir fluid level drops to approximately the REFILL mark, the reservoir's low fluid level warning switch illuminates the HYD LOW LEVEL annunciator.

From each pump, pressurized fluid flows through a filter before reaching its flow switch check valve. If a pump's output drops to less than 0.45 GPM, the flow switch closes to illuminate the HYD FLOW LOW annunciator. Check valves prevent reverse flow from an operating pump to an inoperative pump.

After the flow check switch valve, the two engine-driven pump outputs combine at the normally open bypass valve. Fluid continues through the bypass valve and flows at approximately 60 PSI back to the reservoir through a filter.

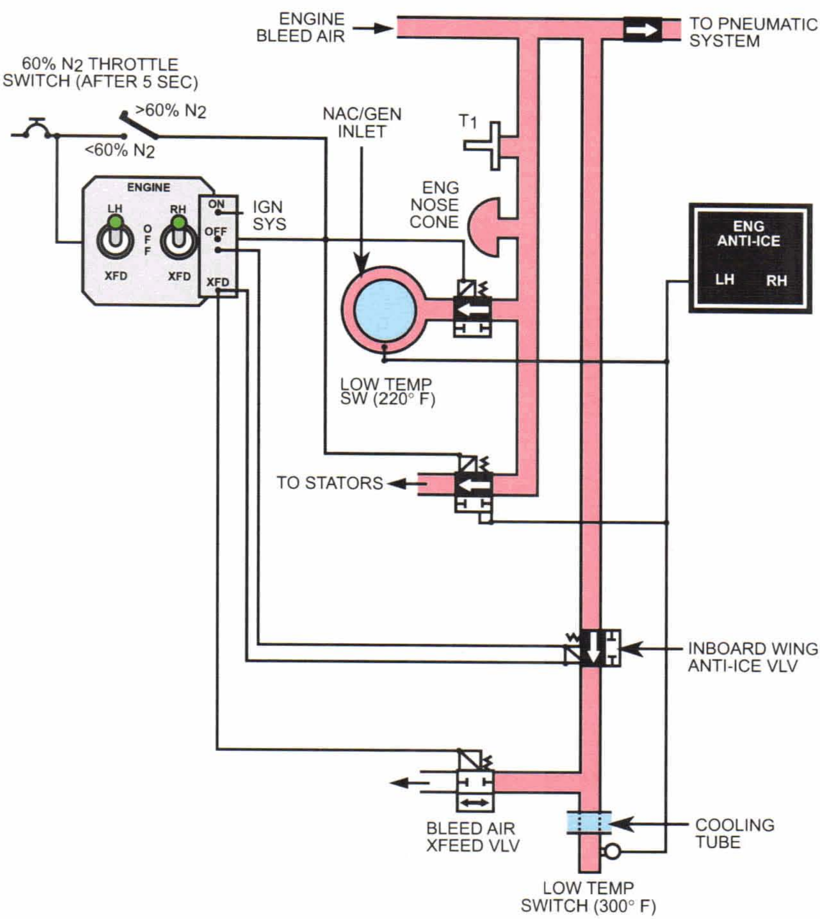
During landing gear, thrust reverser, or speedbrake operation, the electrically controlled bypass valve closes to pressurize the hydraulic system. When the pressure exceeds approximately 125 to 165 PSI, a pressure switch closes to illuminate the HYD PRESS ON annunciator. A pressure relief valve in-line with the bypass begins opening at 1,350 PSI and fully opens at 1,500 PSI to maintain system operating pressure.

After the landing gear, speedbrakes, or flaps cycle or the thrust reversers stow, electrical power is removed from the bypass valve returning the system to low pressure.

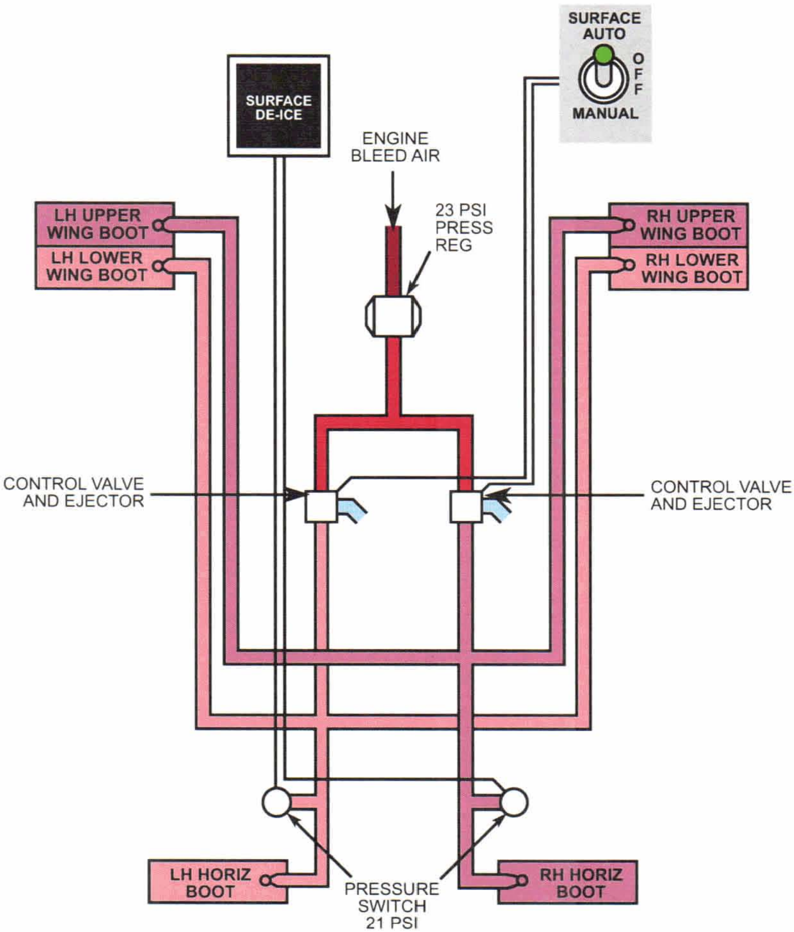
Hydraulic System

Power Source	Hydraulic reservoir fluid Engine-driven hydraulic pumps L/R (pressure)
Distribution	Hydraulic manifolds
Control	ENGINE FIRE PUSH L/R switchlights Landing gear handle Speedbrake switch Thrust reverser levers Flaps lever
Monitor	Annunciators HYD FLOW LOW SPEED BRAKE EXTEND HYD LOW LEVEL HYD PRESS ON F/W SHUT OFF LH/RH ARM/UNLOCK/DEPLOY (T/Rs) Flap position indicator Trim wheel
Protection	Bypass relief valve Bypass valve Circuit breakers Firewall shutoff valves Flaps (blow-up protection) Reservoir pressure relief valve Thermal relief Thrust reverser isolation valve

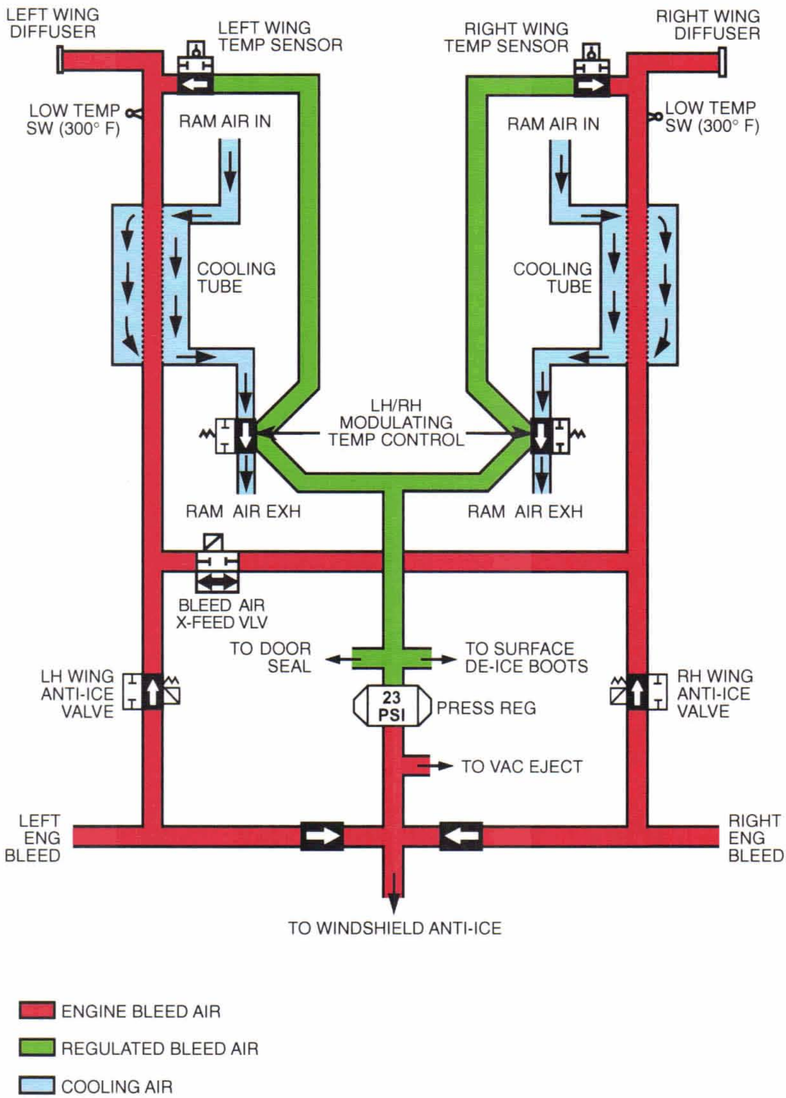
Engine Anti-Ice System



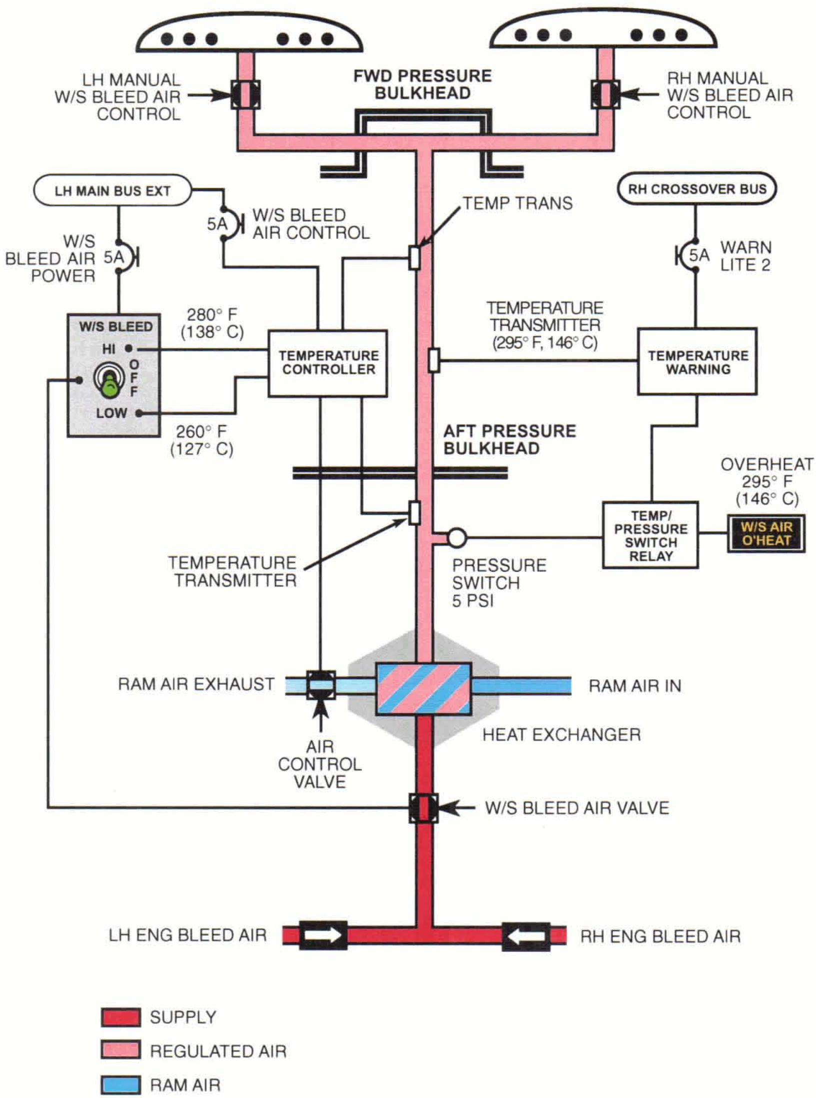
Surface Deice System



Wing Anti-Ice System

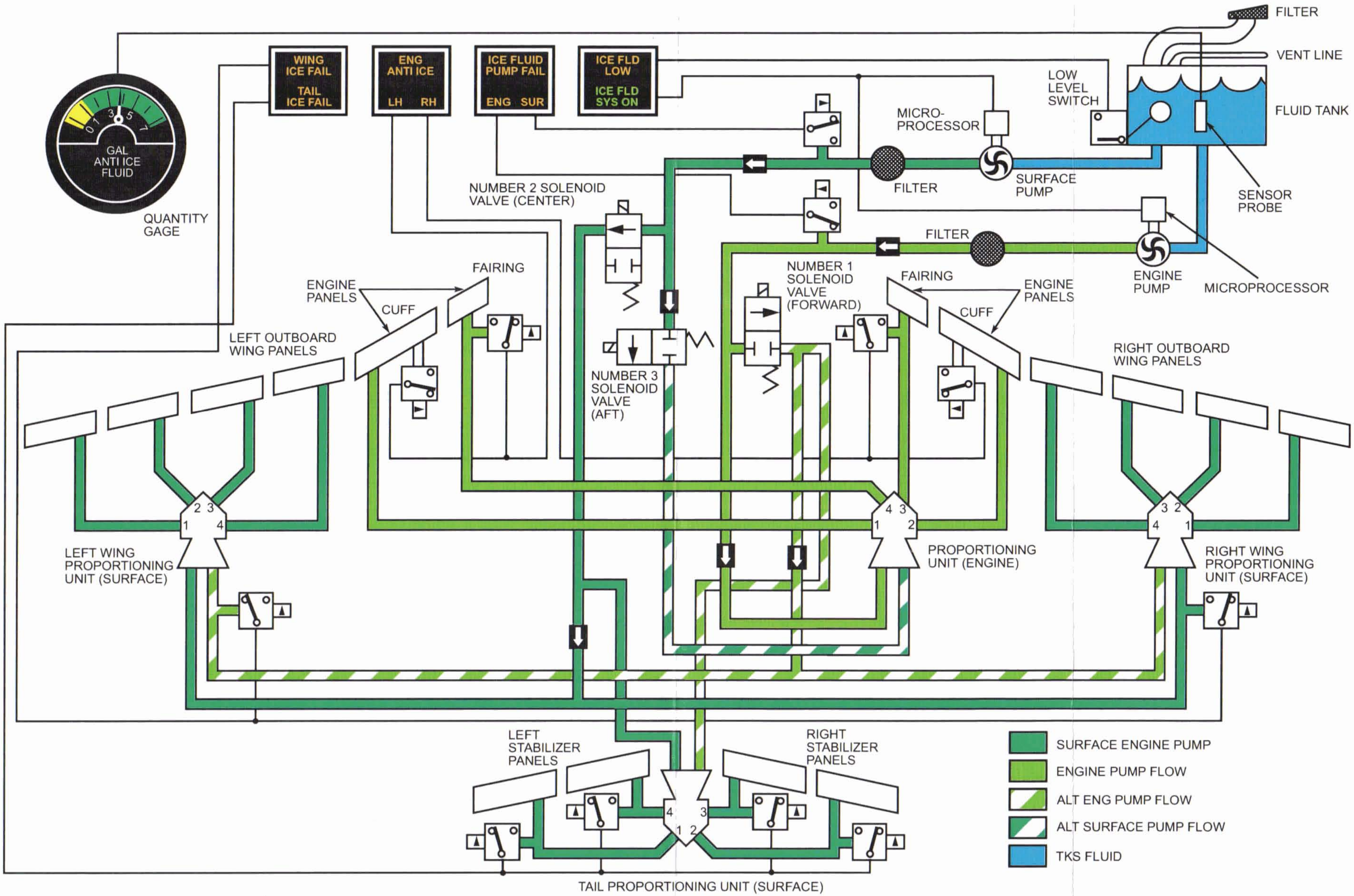


Windshield Bleed Air Anti-Ice System



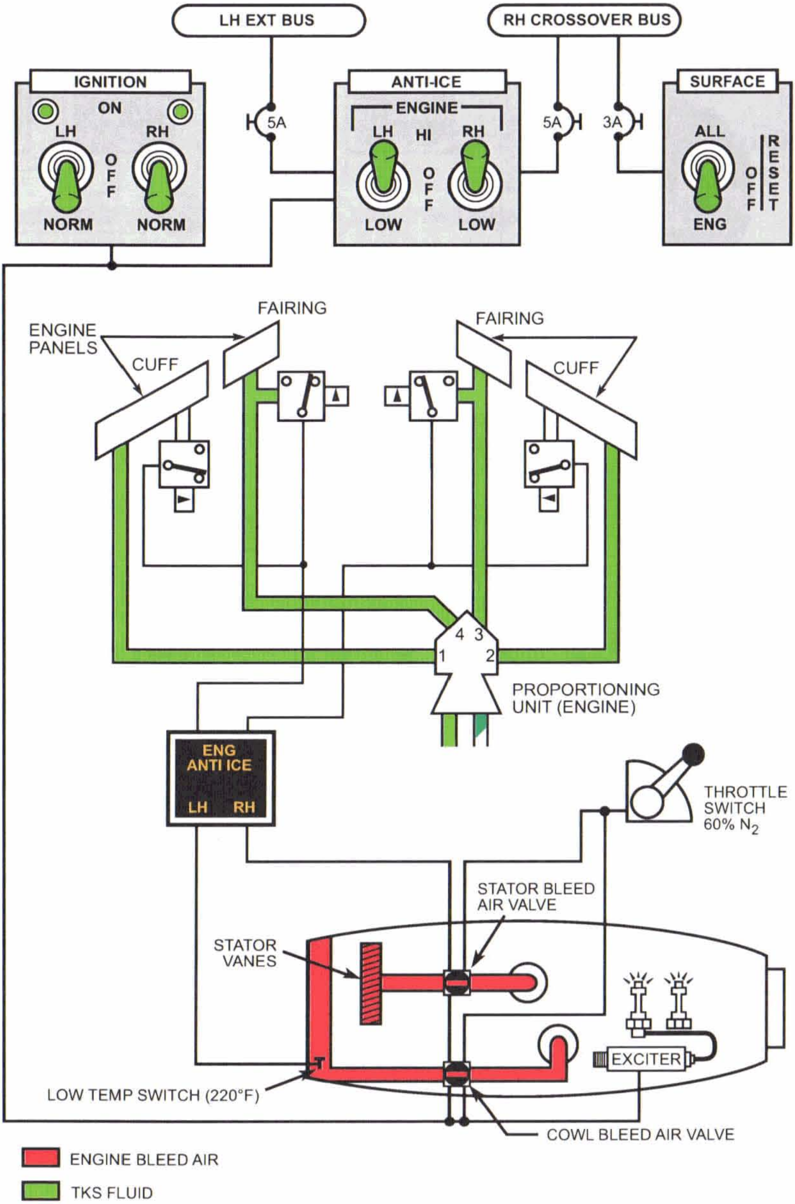
TKS Anti-Ice System

Citation SII



Engine Anti-Ice System

Citation SII



Ice and Rain Protection

Anti-icing protection is provided for the:

- engine bullet nose, temperature probe, inlet lip, and stator vanes
- inboard wing leading edges
- windshield
- pitot tubes, static ports, and angle-of-attack (AOA) probe.

Anti-icing systems must be operating before encountering icing conditions.

Pneumatically operated deicing boots remove ice accumulations from the outboard wing and horizontal stabilizer leading edges.

Engine

During engine operation, hot bleed air flowing to the engine T_1 probes and bullet nose cone provides continuous anti-icing. Turning the ENGINE ANTI ICE switches on removes power from the wing anti-ice valves (see Wing Anti-Icing). With the switches on, power set above 60% N_2 RPM, and bleed air pressure at or above 4 PSIG, after a five second delay the inlet bleed and inner stator bleed valves open and hot bleed air flows to warm the engine. 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 engine power loss.

With the ENGINE ANTI ICE switches on, the engine ignition activates to provide continuous ignition. 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, the appropriate ENGINE ANTI-ICE annunciators illuminate when engine inlet temperature is below approximately 220°F, the stator vane bleed air valve fails to open, or wing bleed air temperature is below 300°F.

Inboard Wing Anti-Icing

With the ENGINE ANTI ICE switches on, the wing anti-ice valves admit hot bleed air into the inboard wing leading edge ducting. From the anti-ice valve, bleed air travels through a ram air shroud before reaching the inboard leading edge. A temperature sensor in the ducting regulates bleed air temperature by opening and closing a temperature controller modulating valve.

If an engine fails, selecting XFD with the inoperative engine's ENGINE ANTI ICE switch opens a crossfeed valve that supplies bleed air from the operating engine to the opposite inboard wing leading edge and disables the cowling temperature and stator valve sensors on the selected side.

If bleed air temperature is too high, the sensor opens the modulating valve to admit more ram air through the shroud. If the bleed air leaving the shroud is too cool, the temperature sensor closes the modulating valve to reduce cooling air through the shroud. If the bleed air temperature in the leading edge fails to reach 300°F with the ENGINE ANTI ICE switches in ON, the appropriate ENG ANTI-ICE annunciator illuminates.

A piccolo tube in the inboard leading edge distributes bleed air to warm the leading edge. The air then exhausts through two scuppers. Three overtemperature switches in the leading edge provide overheat protection. If temperature reaches 160°F at any switch, the appropriate WING O'HEAT annunciator illuminates; the wing anti-ice valve closes. When temperature drops, the annunciator extinguishes and the valve opens. Ram air flows through the space separating the heated leading edge and the fuel tank. The ram air escapes through a small outboard scupper.

Surface Anti-Icing and Deicing

Placing the SURFACE DEICE switch in the AUTO position begins an 18 second timer that cycles bleed air to inflate outboard wing and horizontal stabilizer deice boots. During the first 6 seconds, the timer opens the control valve that supplies bleed air to the lower wing and left horizontal stabilizer deice boots. For the next 6 seconds the system is inactive. For the last 6 seconds, the timer opens the control valve that supplies bleed air to the upper wing and right horizontal stabilizer deice boots. During system operation, the SURFACE DEICE annunciator illuminates when bleed air pressure reaches 21 PSI.

Holding the SURFACE DEICE switch in MANUAL opens both control valves to inflate the deice boots for the upper and lower wing and left and right horizontal stabilizer.

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**).

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

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.

Windshield Anti-Icing/Rain Removal

Selecting LOW or HI on the W/S BLEED switch supplies power to the windshield temperature controller. The controller then removes power from 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 the heat exchanger, the system regulates bleed air temperature to approximately 127°C (LOW) or 138°C (HIGH).

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 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 increase the windshield anti-icing system airflow for rain removal.

An isopropyl alcohol-based fluid system provides a backup for the bleed air windshield anti-icing system. Placing the W/S ALCOHOL switch in ON supplies approximately 10 minutes of 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 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 heater fails.

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

Engine Anti-Ice System

Power Source	Engine bleed air LH/RH Main Extension bus
Distribution	Each engine cowl (ring) Bleed air to inboard wing leading edge Bleed air to compressor stator vanes Bleed air to nose cone, T_1 probe
Control	ENG ANTI-ICE LH/RH switches
Monitor	WING O'HEAT annunciator ENG ANTI-ICE LH/RH annunciators Engine ITT/RPM Lights Engine ignition Wing inspection
Protection	Automatic bleed air valve closure below 60% N_2 Automatic 5-second thermal relay delay on acceleration above 60% N_2

Windshield Bleed Air System

Power Source	Bleed air (LH/RH bleed air clusters) Alcohol reservoir LH Main Extension bus
Distribution	Windshield nozzles
Control	Switches W/S BLEED W/S ALCOHOL Manual bleed air control valves Rain augmenter door handles
Monitor	Bleed air noise
Protection	Circuit breakers

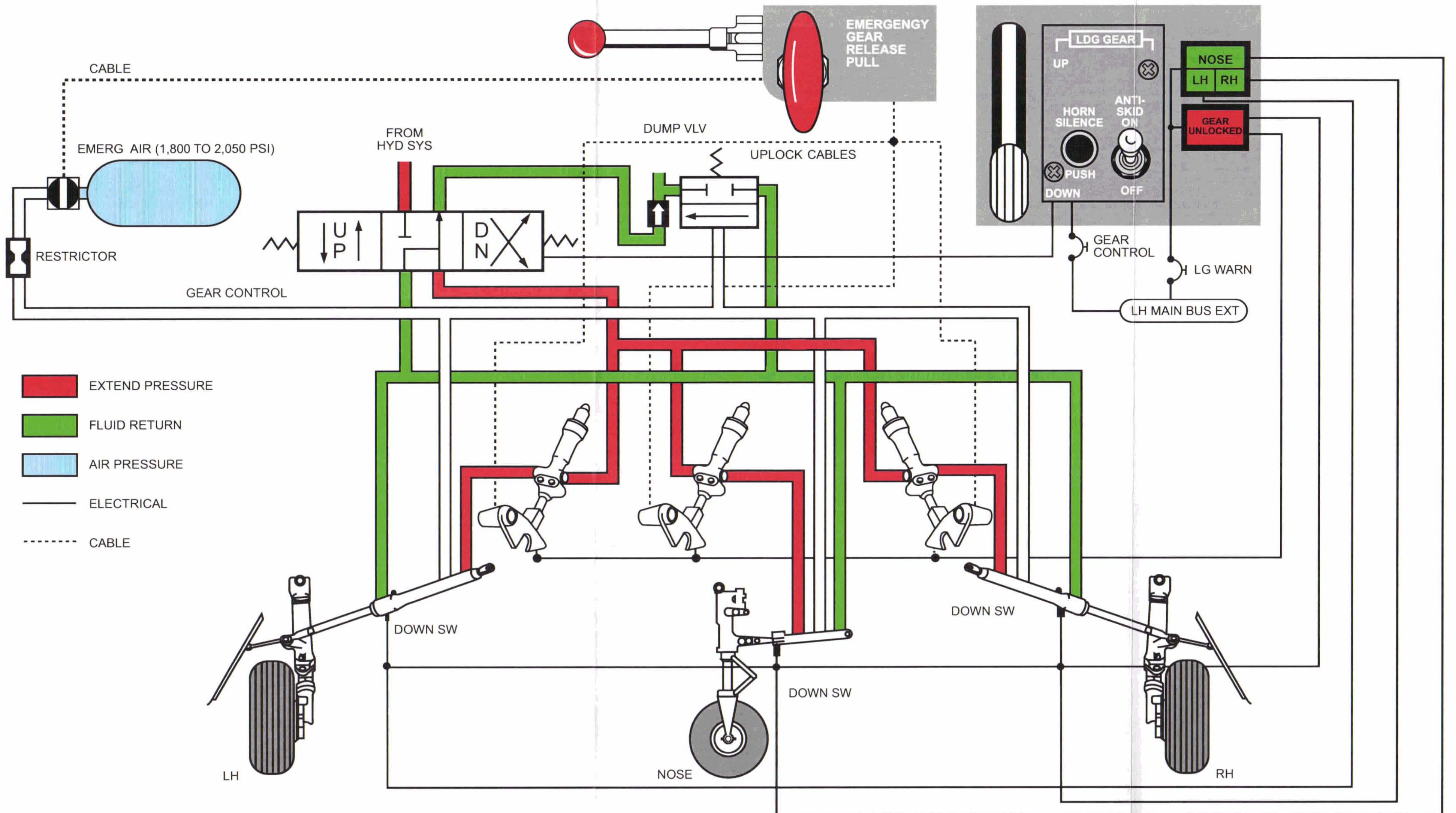
Surface Deice System

Power Source	Bleed air (L/R bleed air clusters) RH Crossover bus
Distribution	Wing boots (upper/lower) Horizontal stabilizer boots LH/RH
Control	SURFACE DEICE switch
Monitor	SURFACE DEICE annunciator Visual scan
Protection	Circuit breakers

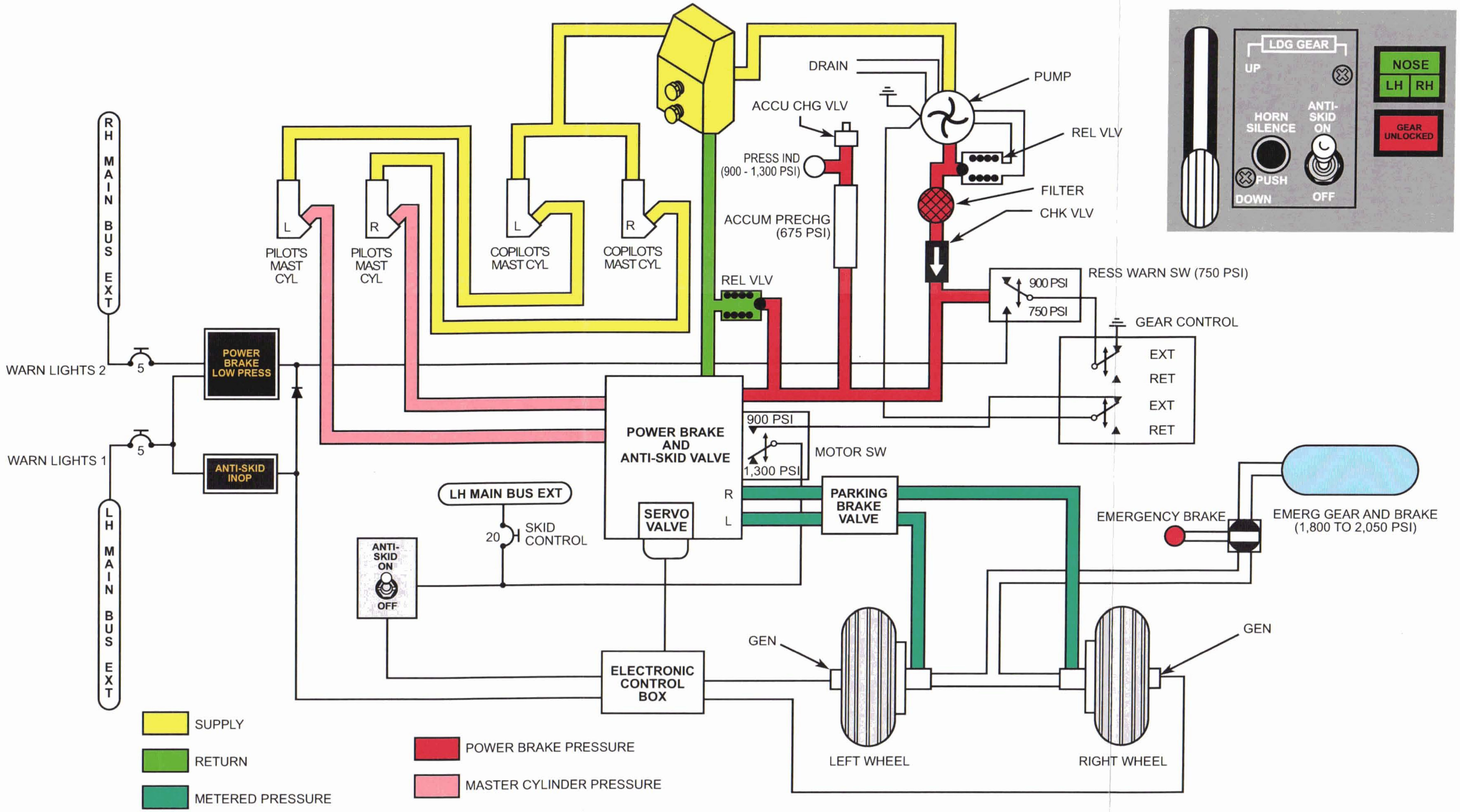
Pitot/Static Deice System

Power Source	LH Main Extension bus (pilot side) Emergency DC bus (copilot side)
Distribution	AOA heater LH/RH pitot tube LH/RH static ports
Control	PITOT & STATIC ANTI-ICE switch
Monitor	Annunciators P/S HTR OFF AOA HTR FAIL
Protection	Circuit breakers

Landing Gear System



Brake System



Landing Gear and Brakes

The aircraft has a tricycle-type landing gear consisting of a single wheel nose gear and single wheel main gear. A chined nosewheel tire deflects slush and rain away from the engine intakes. Each landing gear strut is an air/oil type that absorbs taxiing and landing shocks. Hydraulic pressure normally retracts and extends the landing gear. If the hydraulic system fails, free fall and pneumatic pressure extend the landing gear.

A mechanically operated nosewheel steering system positions the nose gear in response to rudder pedal movement.

The main gear has hydraulically operated disc brakes with an electrically operated anti-skid system. The anti-skid system provides maximum braking efficiency on all runway surfaces while minimizing wheel skid.

Landing Gear

Squat switches on the left and right main landing gear supply on-ground and in-air signals to various aircraft systems (**Table 4I-A**). Down-and-lock switches on the landing gear actuators and up-and-lock switches in the wheel wells control the gear indicating system and the landing gear system during retraction and extension.

Left Main Gear	Right Main Gear
Ground Idle Radar forced standby Outflow valves ground mode Emergency pressurization Bleed air ground Cross generator start disable Flight hour meter/digital clocks Landing gear handle solenoid lock Anti-skid system Stick shaker Thrust reversers	Stick shaker test Thrust reversers

Table 4I-A; Squat Switches

Retraction

After the aircraft leaves the ground and the landing gear struts extend, the left main gear squat switch opens to release the landing gear handle locking solenoid.

Pulling the landing gear handle out releases it from the detent. Moving the handle to the UP position begins the retraction sequence by actuating the landing gear retract switch. Then the red GEAR UNLOCK light illuminates, the hydraulic system bypass valve closes to increase hydraulic pressure to 1,500 PSI, and the landing gear control valve shifts to route hydraulic pressure to the landing gear actuator retract ports. Initial movement of the actuators unlocks the internal downlocks; the green LH, NOSE, and RH lights extinguish.

When the landing gear reaches the fully retracted position, mechanical uplocks engage the gear and hold it in the retracted position. The nose gear doors close when the nose gear completely retracts. The main gear doors follow the main gear as it retracts.

When the landing gear is up-and-locked, the nose and main gear up-and-lock switches actuate to extinguish the red GEAR UNLOCK light, de-energize the landing gear control valve, and open the hydraulic system bypass valve returning the system to open-center operation.

Extension

Pulling the landing gear control handle out to unlock it and moving it to the DOWN position begins the landing gear extension sequence by actuating the landing gear down switch. The red GEAR UNLOCK light illuminates, the hydraulic system bypass valve closes to pressurize the hydraulic system to 1,500 PSI, and the landing gear control valve shifts to the extend position. Hydraulic pressure then flows through the landing gear control valve to the uplock actuators. The uplocks release then direct pressure to the extend side of the landing gear actuators. The gear begins extending.

As the landing gear reaches the down-and-locked position, hydraulic pressure locks the landing gear with its internal downlocks. The down and lock switches actuate to extinguish the GEAR UNLOCK light, illuminate the LH, NOSE, RH gear lights, and open the hydraulic system bypass valve.

Abnormal Extension

Pulling the red AUX GEAR CONTROL T-handle below the pilot's instrument panel and rotating it 45° clockwise mechanically releases the landing gear uplocks to allow the landing gear to free-fall to the down-and-locked position. Yawing the aircraft assists gear extension and locking by exerting pressure on the landing gear through the gear doors. With the gear handle in the DOWN position, the green LH, NOSE, and RH gear position lights illuminate when the gear is down-and-locked.

Pulling the emergency gear blow down knob mechanically opens the emergency air bottle to direct pressurized nitrogen to the landing gear actuator pneumatic extend ports. It also shifts the dump valve to route hydraulic fluid to the reservoir. After abnormal gear extension, the landing gear system must be serviced and the bottle must be recharged to 1,800 to 2,050 PSI.

Nosewheel Steering

With the nose gear extended, the nosewheel steering system positions the nosewheel up to 20° left or right of center through rudder pedal movement. Deflecting a rudder positions a bellcrank between the pedals that connects through a bungee to a steering arm. Movement of the steering arm then moves the nosewheel through a universal joint and steering gears.

As the nose gear retracts, the universal joint pivots to center the nosewheel. When the nose gear fully retracts, the joint swivels to allow normal rudder pedal movement.

Wheels and Brakes

Inflate the nosewheel tire to 120 ± 5 PSI and the main wheel tires to 130 ± 5 PSI with dry nitrogen only.

Normal Braking

An independent hydraulic system supplies pressure to operate the brakes. With the landing gear handle in the down position and electrical power available, an electric motor-driven hydraulic pump, controlled by a pressure switch, pressurizes the system to 1,300 PSI. An accumulator, precharged to 675 PSI with nitrogen, maintains system pressure when the pump is not operating. If system pressure falls below 900 PSI, the pump motor energizes until system pressure builds to 1,300 PSI. If system pressure falls to 750 PSI, a pressure warning switch illuminates the PWR BRK PRESS LO annunciator.

Pressing on the toe brake of each rudder pedal mechanically operates a master cylinder that hydraulically controls braking effort supplied through the power brake and anti-skid valve. The power brake and anti-skid valve, in turn, supplies pressure proportional to braking effort to the brake assemblies. Under pressure, the braking assembly piston then extends against the pressure plate to force the stationary and rotating discs together.

With the ANTI-SKID switch ON, a transducer in each main wheel axle provides wheel speed signals to the anti-skid system control box. If the control box senses an excessive wheel deceleration indicative of an impending skid, it commands the anti-skid valve to reduce braking pressure to the wheels. When the wheel spins up to match the other wheel, the system restores normal braking pressure to both wheel brakes.

The anti-skid system also provides touchdown and locked wheel crossover protection. If the brakes are applied before touchdown, the system dumps pressure until the left squat switch actuates on touchdown. Above 40 kts groundspeed, locked wheel crossover protection compares left and right wheel speeds and dumps pressure when the slow wheel's speed is 50% or slower than the fast wheel.

If an anti-skid component fails, the ANTI-SKID INOP annunciator illuminates. After a system failure, the ANTI-SKID switch should be placed in OFF. Normal braking without anti-skid protection is still available.

Emergency Braking

Pulling the EMER BRAKE PULL handle below the pilot's instrument panel mechanically opens the brake valve assembly to release pressurized nitrogen into the supply lines. Pressure in the supply lines shifts a shuttle valve at each wheel brake assembly to stop normal hydraulic system pressure and to admit pressurized nitrogen into the brake assemblies. Braking pressure is proportional to handle extension. Anti-skid protection is not available.

Pulling the handle out completely supplies full pressure from the bottle for maximum braking. Releasing the handle shifts the brake valve assembly to vent pressure to atmosphere and release the brakes.

Parking Brakes

With the aircraft on the ground, the hydraulic system pressurized, and the the parking brake handle pulled out, applying toe pressure applies the brakes. Pulling the parking brake handle out shifts the parking brake valve to trap pressure and hold the brakes. Pushing the handle in releases the brakes.

Landing Gear System

Power Source	Hydraulic system fluid Left Main Extension bus
Distribution	Gear actuators
Control	Gear control handle Hydraulic bypass valve Landing gear control valve Landing gear horn silence Squat switch Test switch LDG GEAR position
Monitor	Emergency air pressure gage (preflight) GEAR UNLOCKED light (red) HYD PRESS ON annunciator Landing gear down lights (green) Landing gear horn
Protection	Circuit breakers Emergency air bottle (blow-down knob) Gear/flap warning horn Gear uplocks manual release (T-handle) Mechanical downlock

Brake/Anti-Skid System

Power Source	Independent hydraulic system Emergency air bottle LH Main Extension bus
Distribution	Brake actuators
Control	Brake pedals ANTI-SKID switch Parking brake handle Test switch ANTI-SKID position
Monitor	POWER BRAKE LOW PRESS annunciator ANTI-SKID INOP annunciator Emergency air pressure gage (preflight) Brake accumulator pressure gage (preflight) Brake pedal feel
Protection	Circuit breakers Emergency braking Filter and check valve in anti-skid electro-hydraulic pump

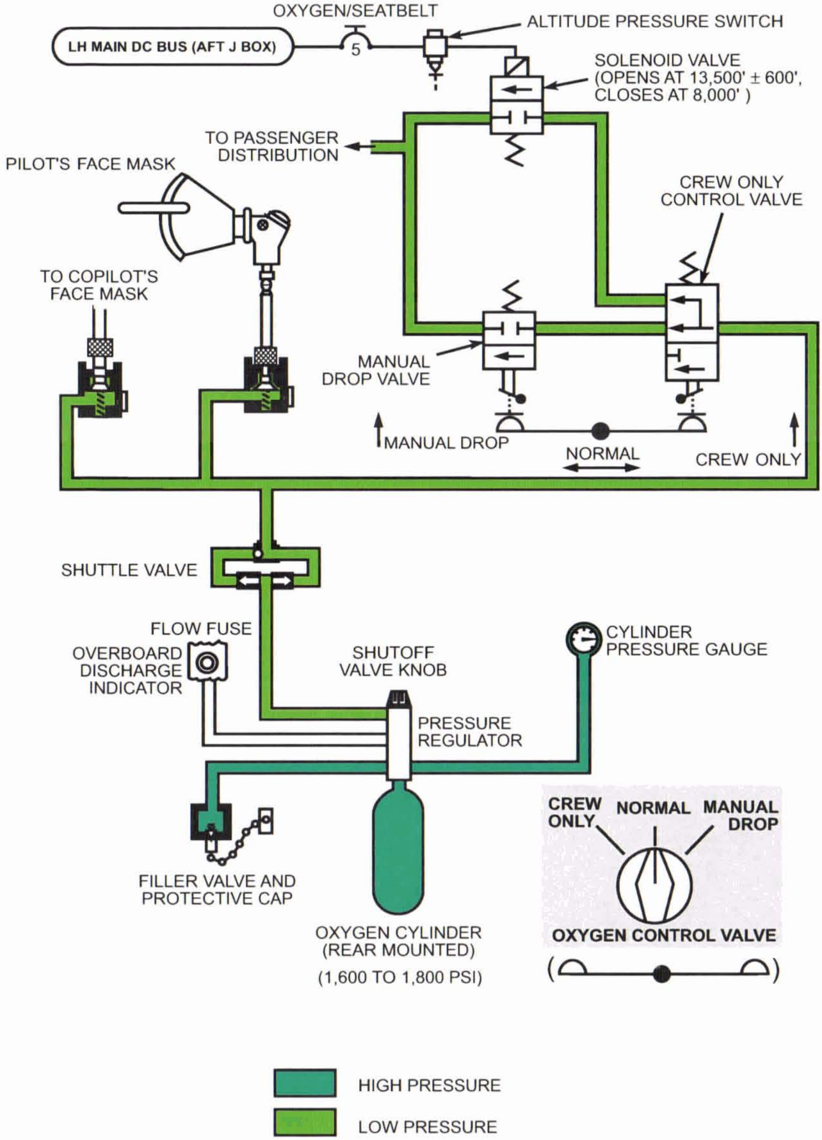
CAUTION: There is no anti-skid during emergency braking.

Nosewheel Steering

Power Source	Rudder pedals
Distribution	Rudder pedal cables Bellcrank in wheel well Spring-loaded bungee rod Steering arm to universal joint For nose gear centering and disconnection of rudder pedals from steering gears during landing gear retraction
Control	Rudder pedal deflection
Protection	Optional nosewheel spin-up system: gravel spray reduction

CAUTION: Do not attempt flight with sheared nosewheel bolts; violent nosewheel shimmy may occur and the nose gear may not center when retracted after takeoff.

Oxygen System



Oxygen Supply

From the 76 cubic foot oxygen bottle in the tailcone compartment, oxygen flows through a regulator assembly before it reaches the crew and passenger oxygen distribution systems. The regulator assembly has a shutoff valve, pressure regulator, and separate lines for oxygen pressure gage, filler valve, and overpressure rupture disc.

When the bottle supplies oxygen between 1,600 and 1,800 PSI, the pressure regulator reduces bottle pressure to approximately 70 PSI. If bottle pressure reaches 2,850 ± 150 PSI at 70°F or 2,600 ± 100 PSI at 160°F, the rupture disc bursts to release bottle contents overboard. When the disc ruptures, it dislodges a green indicator disc on the lower left rear fuselage to provide a visual indicator of bottle discharge. The filler valve and pressure gage allows normal servicing of the bottle without removal.

Distribution

After the regulator assembly, oxygen flows through redundant supply lines to the pilot and copilot oxygen outlets. If a supply line ruptures and excessive flow occurs, the line's flow fuse closes to prevent oxygen loss. Oxygen continues to flow through the opposite supply line and shuttle valve.

Crew System

The standard quick-donning diluter-demand crew oxygen mask has a built-in regulator and microphone. With the mask regulator in the NORM position, the regulator dilutes oxygen with cabin air according to cabin altitude. As cabin altitude increases, the regulator increases the oxygen to cabin air ratio until it provides 100% oxygen. Placing the regulator in the 100% position provides 100% oxygen regardless of cabin altitude. Placing the regulator in the EMER position supplies 100% oxygen at positive pressure. Each mask stores next to the crew member's seat when not in use.

The optional EROS mask operates similarly. The major difference is the EROS's inflatable harness. During donning, the harness inflates to assist in placement over the head, then deflates to make it snug against the user's face. When not required, the mask stores in a cup on the cabin divider behind each crewmember's head.

With the regulator set to N (normal), the regulator dilutes oxygen with cabin air according to cabin altitude. In the 100% position, it supplies 100% oxygen at positive pressure.

Passenger System

With the OXYGEN CONTROL VALVE in the NORMAL position, oxygen flows to the normally closed solenoid valve. If cabin altitude reaches 13,500 ± 600 ft, the altitude pressure switch closes to energize the passenger solenoid valve. The valve opens and oxygen flows to the passenger oxygen masks. The initial pressure surge actuates door release mechanisms to deploy the passenger oxygen masks. The masks fall and hang by their lanyards. Pulling on the lanyard releases a pin that allows oxygen flow.

When cabin altitude drops to approximately 8,000 ft, the altitude pressure switch opens and the solenoid valve closes. Oxygen flow to the passenger distribution system stops.

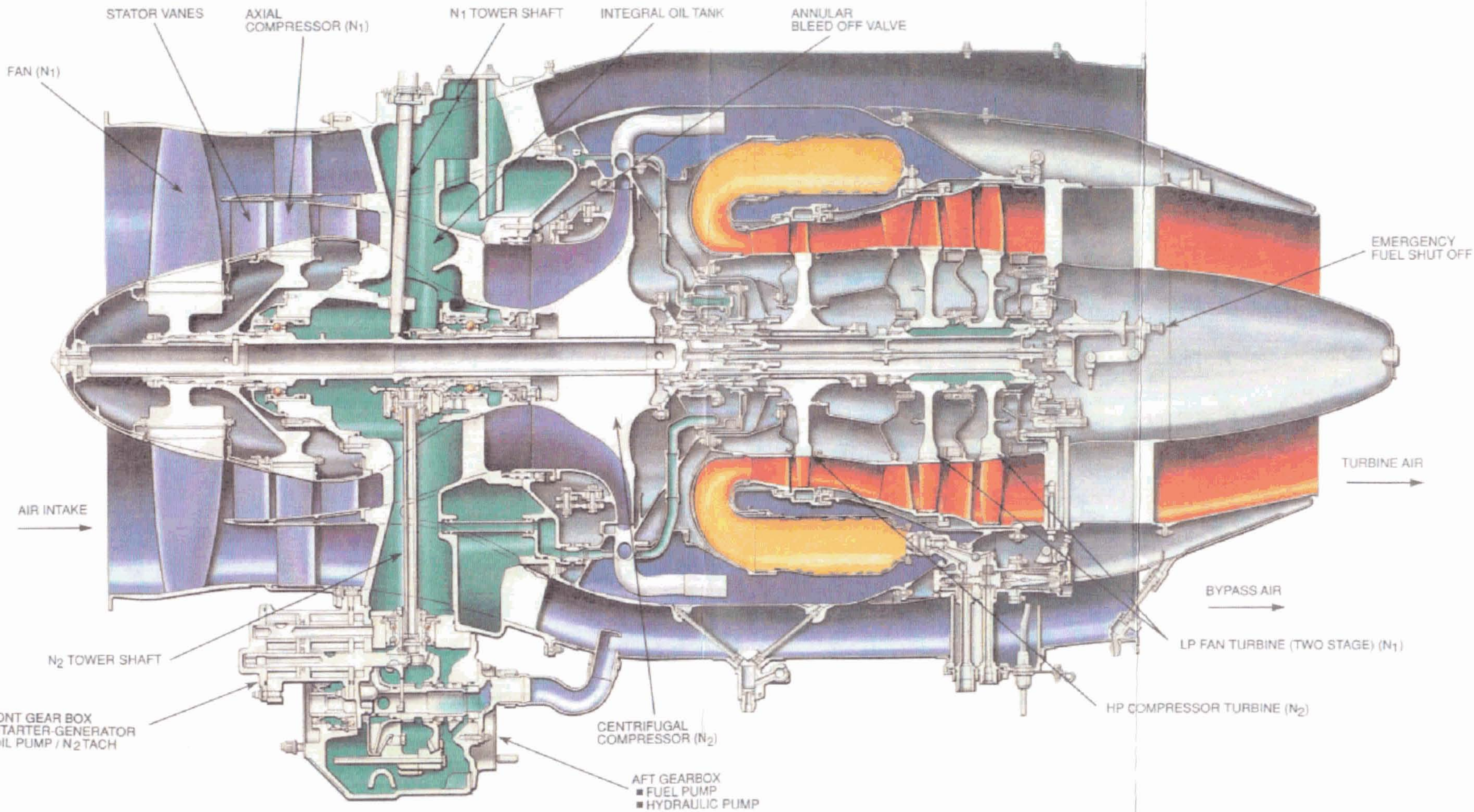
Placing the OXYGEN CONTROL VALVE in MANUAL DROP opens the manual drop valve; oxygen flows to the passenger masks regardless of cabin altitude.

Placing the OXYGEN CONTROL VALVE in the CREW ONLY position closes the valve to prevent flow to the passenger oxygen system regardless of cabin altitude.

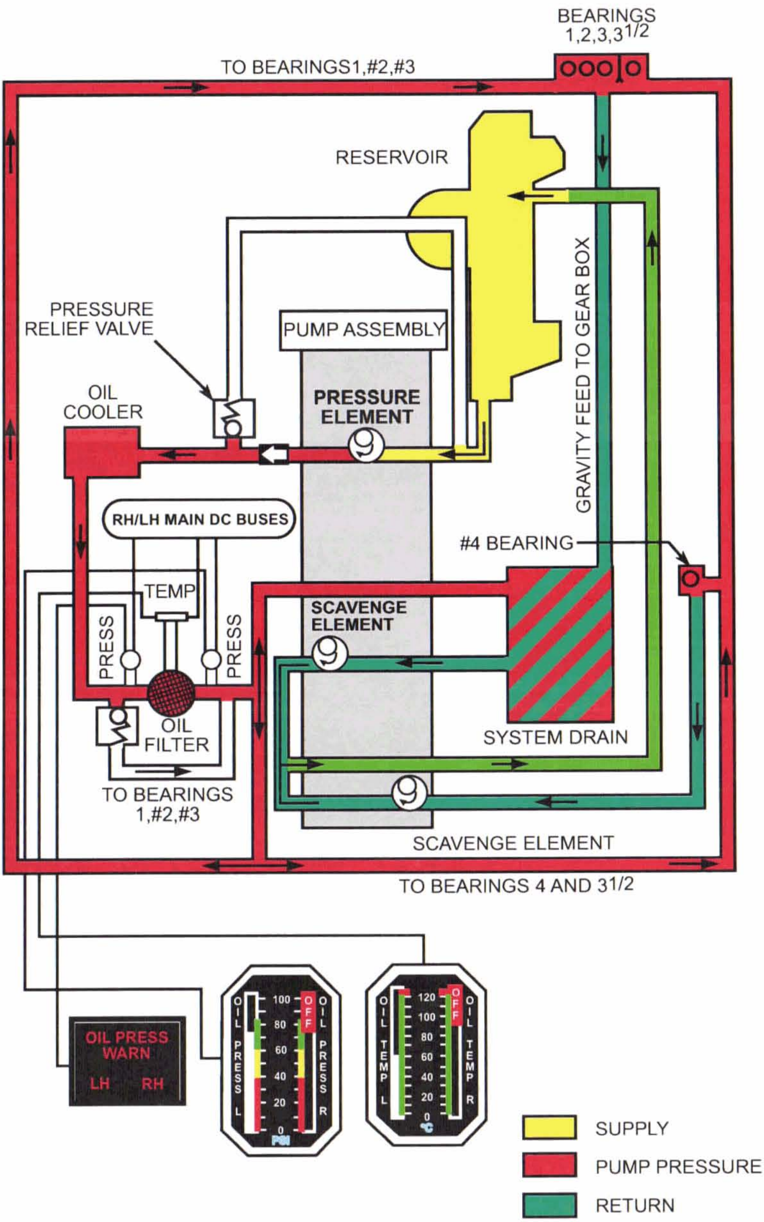
Oxygen System

Power Source	Left Main DC bus Pressurized oxygen in storage bottle
Distribution	Crew oxygen masks Passenger oxygen masks
Control	Altitude pressure switch/solenoid valve Oxygen control valve Oxygen cylinder shutoff valve Oxygen mask pressure regulator
Monitor	Crew oxygen flow indicator (in line to mask) Oxygen pressure gage
Protection	Circuit breaker Overpressure/overtemperature relief – overboard discharge disc

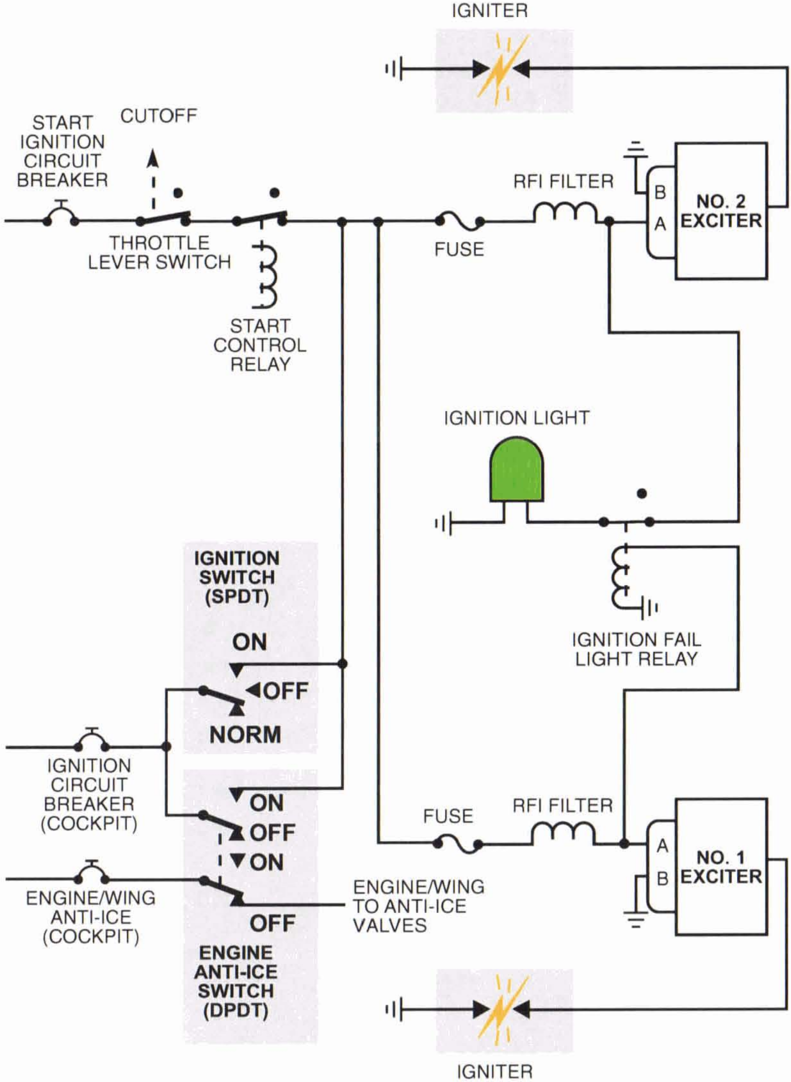
Pratt & Whitney JT15D-5A



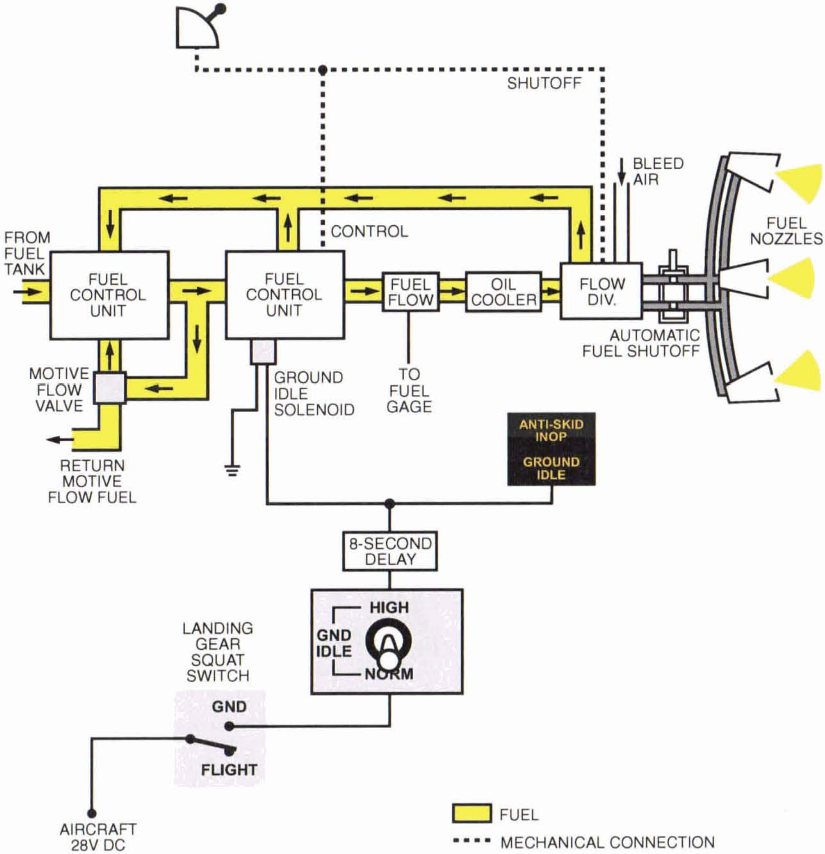
Lubrication System



Ignition System



Engine Fuel Control System



Powerplant

Two Pratt & Whitney of Canada JT15D-5A engines power the Citation V aircraft. The JT15D-5A is a lightweight, two-spool, medium bypass turbofan that produces 2,900 lbs of static take-off thrust at sea level.

Two Pratt & Whitney of Canada JT15D-4B engines power the Citation SII aircraft. The JT15D-4B is a lightweight, two-spool, medium bypass turbofan that produces 2,500 lbs of static take-off thrust at sea level.

After air enters the engine inlet, a front fan driven by the low pressure (LP) turbine accelerates the air rearward toward the axial and centrifugal compressors and the full-length, annular bypass duct. Approximately two-thirds of the total air flows around the engine core through the bypass duct.

After the air passes through the fan, a one-stage axial compressor, driven by the low pressure turbine, accelerates the air before passing it to the centrifugal compressor. The compressor, driven by the high-pressure (HP) turbine, slings air outward to accelerate it to a high-velocity centrifugal flow. The diffuser converts this high-velocity flow into a low-velocity axial flow before it reaches the combustion section.

A compressor bleed off valve prevents engine stalling and surging caused by rapid engine acceleration and deceleration. In response to N_2 speed, altitude, and engine acceleration and deceleration rates, a bleed off valve control opens and closes the annular bleed off valve through an actuator to bleed excess compressor air into the bypass duct to smooth air flow through the engine.

After entering the annular, reverse-flow combustion section, the airflow makes a 180° turn forward, then mixes with fuel introduced by the fuel nozzles. Initially ignited by two igniter plugs, the air/fuel mixture burns and expands. The hot combustion gases then flow to the exit duct where they make a 180° turn before reaching the HP turbine. As the high velocity gas stream passes through the turbine, the turbine rotates to extract energy to drive the centrifugal compressor and accessory gearbox. The combustion gases then flow through the two-stage LP turbine to rotate it. The LP turbine, in turn, drives the axial compressor and front fan. After exiting the turbine section, the gas stream enters the exhaust duct where it mixes with bypass air as forward thrust.

Lubrication System

The engine-driven oil pump draws oil from a 2.03 U.S. gallon tank and provides it under pressure through a fuel/oil cooler and filter to the engine bearings, bevel and spur gears, and accessory gearbox.

After lubricating, cooling, and cleaning the engine, oil drains from the bearings into the accessory gearbox. Oil from the No. 4 bearing drains into a sump where a separate scavenge element draws oil into the accessory gearbox. The oil pump's scavenge element then draws oil from the accessory gearbox and pumps it to the oil tank.

A breather system relieves excess air pressure from the lubrication system to prevent pump cavitation and excess system pressure.

Pressure and temperature transmitters in the lubrication system drive the vertical tape OIL PRESS and OIL TEMP gages and the OIL PRESS WARN annunciators. Below approximately 40 PSI, the respective OIL PRESS WARN annunciator illuminates.

Fuel and Fuel Control

Under pressure from the wing fuel system, fuel flows through the firewall shutoff valve to the engine-driven fuel pump at approximately 20 to 30 PSI. A pressure switch between the shutoff valve and pump illuminates the FUEL LOW PRESS annunciator if fuel pressure drops below approximately 5 PSI. If the boost pump switch is in the NORM position, low fuel pressure automatically turns the electric fuel boost pump on. The engine-driven fuel pump then delivers fuel at approximately 500 to 700 PSI through a filter to the hydromechanical fuel control unit (FCU). A motive flow valve downstream of the fuel pump supplies low pressure, high-flow motive flow fuel to the airframe fuel system's primary ejector pump.

Movement of the associated throttle lever controls the FCU. Each throttle lever has a mechanical stop that prevents inadvertent selection of CUTOFF and a latch that must be released to advance the throttle from CUTOFF to IDLE. In response to throttle movement, the FCU meters fuel based on engine N_2 speed, ambient pressure and temperature, compressor inlet temperature, and throttle position to provide efficient engine operation during starting, acceleration, and shutdown.

Metered fuel from the FCU flows through the fuel/oil cooler to the flow divider valve. A fuel flow transmitter between the FCU and cooler drives the vertical tape FUEL FLOW gage. The gage shows fuel flow from 0 to 2,000 pounds-per-hour (PPH).

In the flow divider valve, the fuel flow splits to supply the primary and secondary manifolds. The divider valve also controls fuel pressure to the primary manifold during engine start and ensures fuel does not reach the manifolds until it reaches a minimum pressure.

From the flow divider valve, fuel flows to the fuel manifold assembly. The assembly then distributes fuel to the twelve fuel nozzle primary and secondary passages. The fuel nozzles deliver a finely atomized spray of fuel into the engine's combustion chamber.

An emergency fuel shutoff system prevents engine overspeed by cutting fuel flow to the engine. Axial displacement of the low pressure turbine shaft 0.07 inches activates a trigger that closes the emergency fuel cutoff valve. Fuel flow stops and the engine shuts down.

Ignition

With the IGNITION switch in the NORM position during the engine start cycle, advancing a throttle above the cutoff position supplies power from the Hot Battery bus to two ignition exciters. Each exciter provides high-voltage electrical pulses to an ignition plug. The plug, extending into the combustion chamber, fires to ignite the fuel/air mixture. When the engine start cycle terminates, the ignition system deactivates.

Placing an IGNITION switch in ON supplies power for continuous ignition system operation. During ignition system operation, a green light above each switch illuminates. Placing an ENGINE ANTI-ICE switch on also provides ignition operation.

Engine Synchronizer

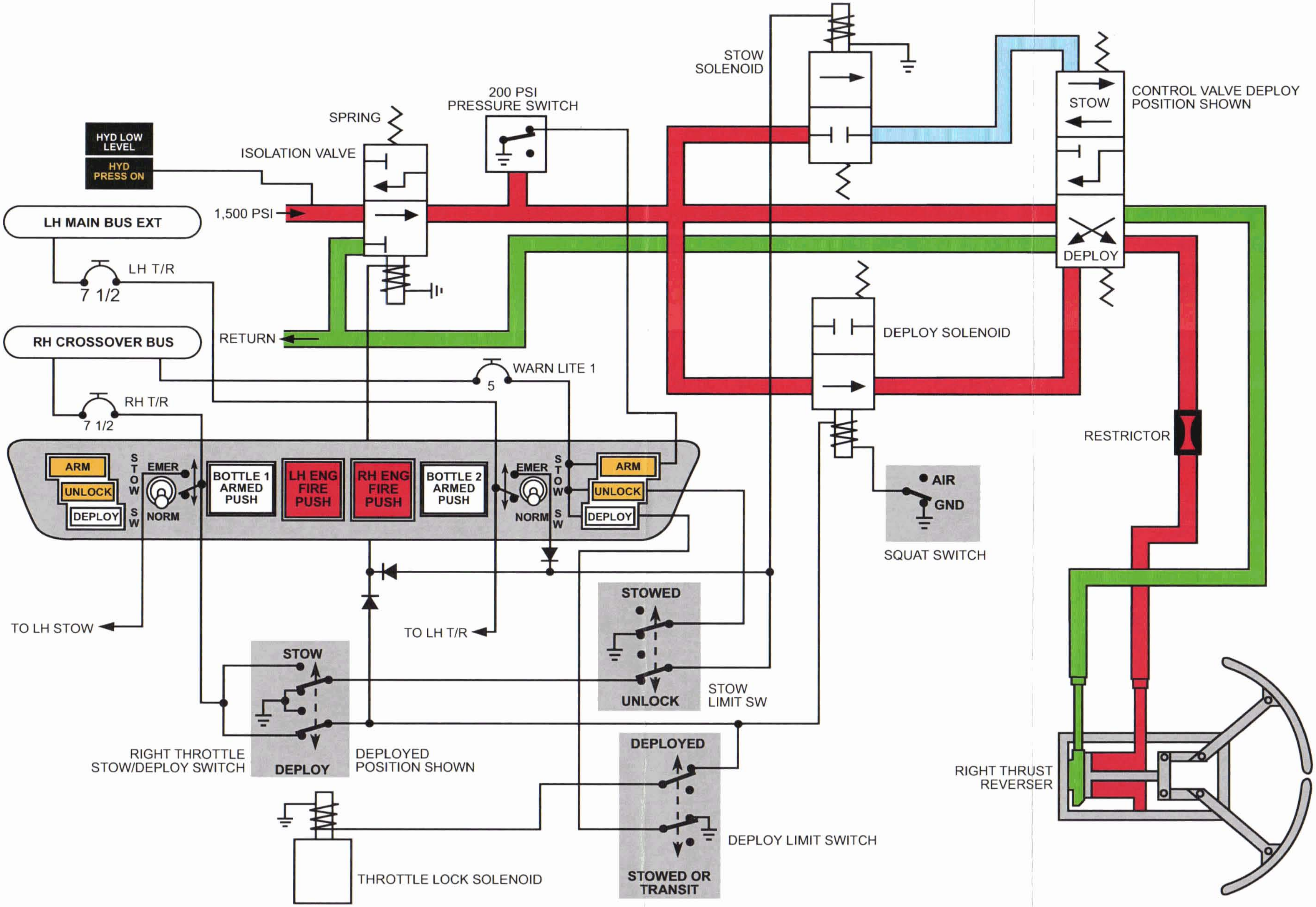
When operating, the engine synchronizer provides automatic N_1 or N_2 synchronization between the left (master) and right (slave) engines. With the ENGINE SYNC switch in FAN or TURB, the system compares the right engine's N_1 or N_2 speed (whichever is selected) to the left engine. If there is a speed mismatch, the system trims the right engine's FCU through an actuator to either increase or decrease engine speed. The system has a 1.5% N_1 or 1.0% N_2 RPM authority range. The system does not operate if slave engine speed, compared to the master, is out of this range. This prevents the right engine from synchronizing with a failing left engine.

Ground Idle

A ground idle system reduces engine idle speed on the ground to slow taxi speed and reduce brake wear. With the aircraft on the ground and the GND IDLE switch in NORM, the system reduces engine idle speed from 52% N_2 RPM to 46% N_2 RPM after an eight second delay. With the switch in NORM, the GROUND IDLE annunciator illuminates.

When the aircraft leaves the ground or the switch is in HIGH, the system deactivates.

Thrust Reverser System



Hydraulic System

An open-center hydraulic system supplies 1,500 PSI pressure for operation of the:

- landing gear
- thrust reversers
- speedbrakes
- flaps.

With the engines running, each constant-displacement engine-driven hydraulic pump draws fluid from the self-pressurizing reservoir through an electrically operated firewall shutoff valve.

If reservoir fluid level drops to approximately the REFILL mark, the reservoir's low fluid level warning switch illuminates the HYD LOW LEVEL annunciator.

From each pump, pressurized fluid flows through a filter before reaching its flow switch check valve. If a pump's output drops to less than 0.45 GPM, the flow switch closes to illuminate the HYD FLOW LOW annunciator. Check valves prevent reverse flow from an operating pump to an inoperative pump.

After the flow check switch valve, the two engine-driven pump outputs combine at the normally open bypass valve. Fluid continues through the bypass valve and flows at approximately 60 PSI back to the reservoir through a filter.

During landing gear, thrust reverser, or speedbrake operation, the electrically controlled bypass valve closes to pressurize the hydraulic system. When the pressure exceeds approximately 125 to 165 PSI, a pressure switch closes to illuminate the HYD PRESS ON annunciator. A pressure relief valve in-line with the bypass begins opening at 1,350 PSI and fully opens at 1,500 PSI to maintain system operating pressure.

After the landing gear, speedbrakes, or flaps cycle or the thrust reversers stow, electrical power is removed from the bypass valve returning the system to low pressure.

Hydraulic System

Power Source	Hydraulic reservoir fluid Engine-driven hydraulic pumps L/R (pressure)
Distribution	Hydraulic manifolds
Control	ENGINE FIRE PUSH L/R switchlights Landing gear handle Speedbrake switch Thrust reverser levers Flaps lever
Monitor	Annunciators HYD FLOW LOW SPEED BRAKE EXTEND HYD LOW LEVEL HYD PRESS ON F/W SHUT OFF LH/RH ARM/UNLOCK/DEPLOY (T/Rs) Flap position indicator Trim wheel
Protection	Bypass relief valve Bypass valve Circuit breakers Firewall shutoff valves Flaps (blow-up protection) Reservoir pressure relief valve Thermal relief Thrust reverser isolation valve

Thrust Reverser System

When deployed, the hydraulically operated and electrically controlled thrust reversers deflect engine thrust forward to decrease landing roll and brake wear.

Deploy

Before thrust reverser deployment can begin, the throttle levers must be in the idle position.

Pulling the thrust reversers levers up begins the deploy sequence by actuating the stow/deploy switches. The hydraulic system bypass valve then closes, hydraulic system pressure builds, and the HYD PRESS ON annunciator illuminates. The isolation valve then opens to admit pressurized fluid into the thrust reverser system hydraulic lines; the ARM lights illuminate once hydraulic pressure reaches 200 PSI. If one squat switch is in the on ground mode, the control valve then shifts to admit hydraulic pressure to the thrust reverser actuator deploy ports.

Initial movement of the thrust reverser actuators from the stowed position actuates the stow limit switches to the unlocked position and the UNLOCK lights illuminate. Under hydraulic pressure, the actuators continue moving to drive the thrust reverser doors to the deployed position. When the doors reach the fully deployed position, deploy limit switches actuate to illuminate the DEPLOY lights and release the throttle lock solenoid. Full range of reverse thrust is now available.

Stow

Moving the thrust reverser levers forward and down begins the stow sequence by actuating the stow/deploy switches. The control valves then shift to route hydraulic pressure to the thrust reverser actuator stow ports. As the thrust reversers begin stowing, the deploy limit switches de-actuate to extinguish the DEPLOY lights. When the reverser mechanism stows and locks, the stow limit switch de-actuates to extinguish the UNLOCK lights, close the isolation valve, and open the hydraulic system bypass valve. The ARM light extinguishes after the isolation valve closes and pressure in the thrust reverser system drops below 100 PSI.

Emergency Stow

If a thrust reverser unlocks or begins deploying in flight, the associated UNLOCK light illuminates, an automatic throttle retarding device between the thrust reverser mechanism and the throttle levers retards the throttle lever to the idle position.

Placing the associated EMER STOW SW switch in the EMER position supplies 28V DC from the opposite thrust reverser's CB to close the hydraulic system bypass valve, open the isolation valve, and shift the control valve to the stow position. Hydraulic pressure then forces the unlocked thrust reverser to the stowed position. During an emergency stow the ARM light remains illuminated and the bypass valve remains closed as long as the EMER STOW SW is in the EMER position.

Thrust Reverser System

Power Source	Engine thrust Target-type reverser doors
Distribution	Hydraulic system and control valves
Control	Left Main Extension bus Right Crossover bus Squat switch (either main gear) Thrust reverser levers
Monitor	ARM/DEPLY/UNLOCK T/R indicator lights HYD PRESS ON annunciator Rotary TEST switch, THRU REV position MASTER WARNING annunciators
Protection	Automatic throttle-retarding to idle thrust upon inadvertent deployment Circuit breakers EMER STOW switches Isolation valves Mechanical overcenter lock