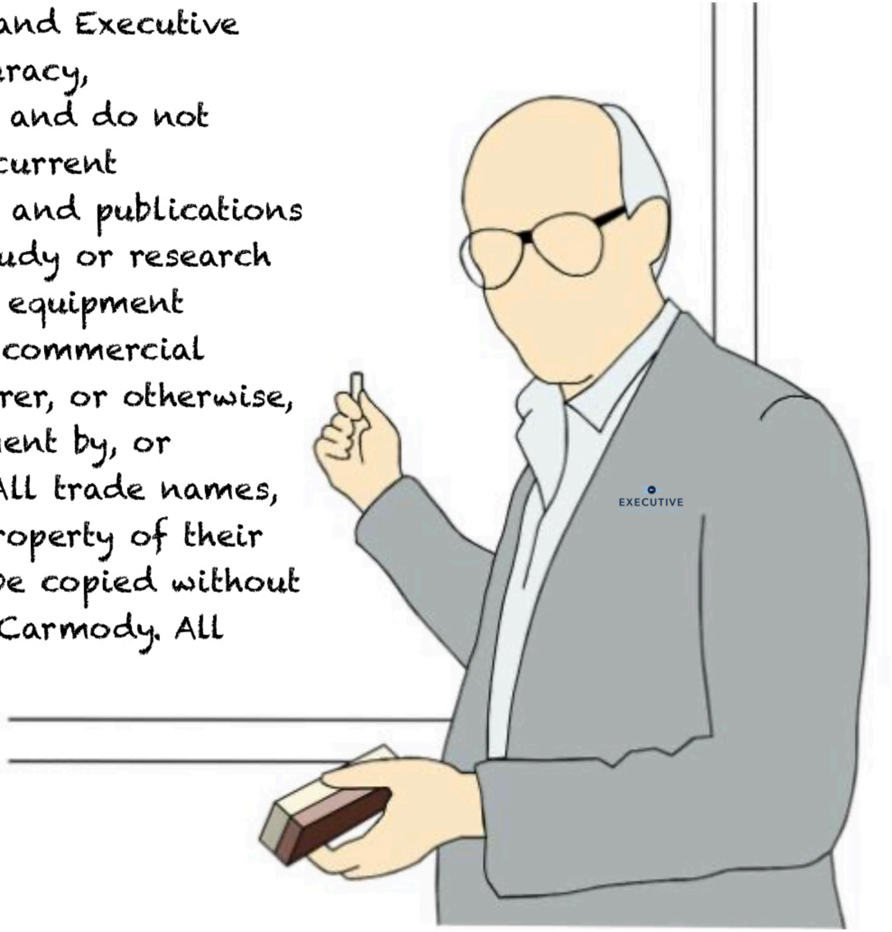
Cessna CJ3+

Workbook


EXECUTIVE

PLEASE NOTE!

THE INFORMATION IN THIS TRAINING MODULE HAS BEEN ACCUMULATED FROM NUMEROUS FAA-APPROVED SOURCES INCLUDING THE CESSNA CITATION AIRPLANE FLIGHT MANUAL. SINCE THE INFORMATION FROM THESE SOURCES MAY NOT BE CURRENT, THIS TRAINING MODULE CANNOT BE USED FOR FLIGHT OPERATIONS.

IT IS NOT A SUBSTITUTE FOR THE OFFICIAL FAA-APPROVED PILOT'S OPERATING HANDBOOK AND AIRPLANE FLIGHT MANUAL. *IT IS FOR TRAINING PURPOSES ONLY.*

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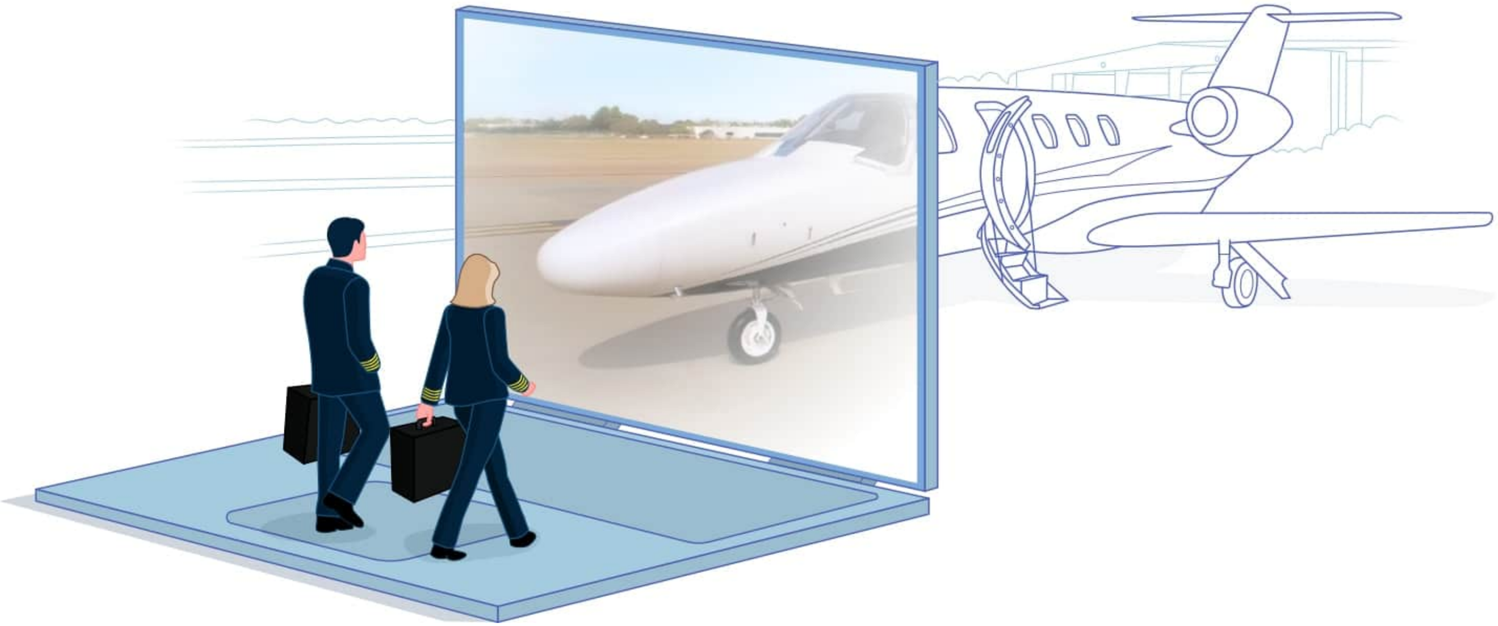


GENERAL SYSTEMS

GENERAL

The Citation CJ3+ is certified in accordance with Part 23 Commuter Category and Part 36 (noise).

Takeoff and landing performance and other special condition certification requirements are equivalent to Part 25.

Medium bypass turbofan engines contribute to overall operating efficiency and performance.

Configuration Code	Effectivity by Serial Number
AA	Airplanes 525B-0001 and On.
AB	Airplanes 525B-0042 thru 525B-0095.
AC	Airplanes 525B-0001 thru 525B-0041.
AD	Airplanes 525B-0001 thru 525B-0095 and 525B-0096 thru 525B-0134 incorporating SB525B-23-01 and 525B-0135 and On.
AE	Airplanes 525B-0096 thru 525B-0134 not incorporating SB525B-23-01.
AF	Airplanes 525B-0096 and On.
AG	Airplanes 525-0001 thru -0305 not incorporating SL525B-73-02.
AH	Airplanes 525-001 thru -0305 incorporating SL525B-73-02 and -036 and on.

List of Airplane Configuration Codes that appear at the bottom of each page of the basic FAA Approved Airplane Flight Manual,

TO RECEIVE CREDIT FOR THIS COURSE, YOU MUST PASS THE FINAL EXAM LOCATED ON THE LAST PAGE OF THIS STUDY GUIDE.

WEIGHT LIMITS

Ramp	14,070 lbs.
Takeoff	13,870 lbs.
Landing	12,750 lbs.
Zero Fuel	10,675 lbs.
Baggage, Nose	400 lbs.
Baggage, Tail	600 lbs.

SPEED LIMITS

VMO to 8,000	260K
VMO 8,000 to FL293	278K
MMO	0.737M
VA 8,500 lbs. @ SL	165K
Turbulent Air	180K
Flaps 15 (TO & APR)	200K
Flaps 35 (Land)	161K
Flaps failed to Ground	140K
Gear (ALL)	200K
VMCG	89K
VMCA (Flaps 0)	81K
VMCA (Flaps 15)	89K
Autopilot	275K/0.72M

TAKEOFF AND LANDING LIMITS

Max Altitude	14,000 ft.
Max Water or Slush	0.75"
Max Temp (SL)	AFM ° C
Min Temp	-54° C
Max Tailwind	10 kts.
Max Crosswind	25 kts.
Starter	3 Starts in 30 mins.
Battery	3 Starts/hr.
Max Generator Load	250 amps.
P/S heat on ground	2 mins.

ENROUTE LIMITS

Max Altitude	FL 450
Max Temp	ISA +39 C
Max Generator Load: Up to FL410 Above FL410	 300 amps. 250 amps.
Min A/P takeoff	350' ABV RW
Min A/P cruise	1000' AGL
Min A/P on ILS GS	160' ABV RW
Min A/P non-precision	160' SBV RW

POWERPLANT LIMITS

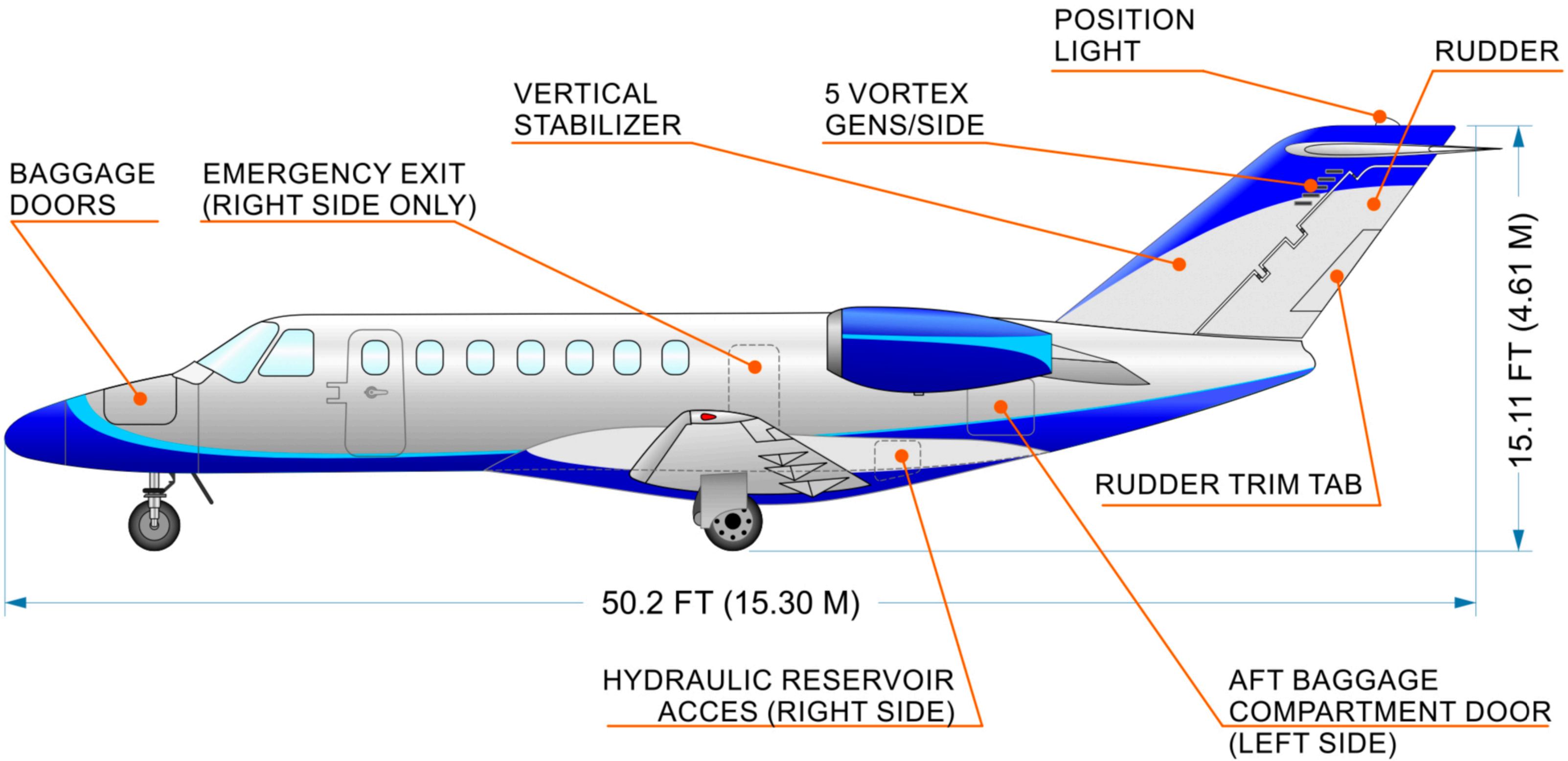
FJ44	2C
N1	105.2%
N2	98.8%
N2 Icing	75%
ITT (Start)	1,000° C
ITT Take-off (5 min)	820° C
ITT Continuous	805° C
ITT Idle	580° C
Bypass Ratio	3.3 to 1
Max Thrust	2,780 lbs.
Starting:	
Max Tailwind Component	10 kts.
Max Crosswind Component	10 kts.
Min Volts for Starting	24V

FUEL LIMITS

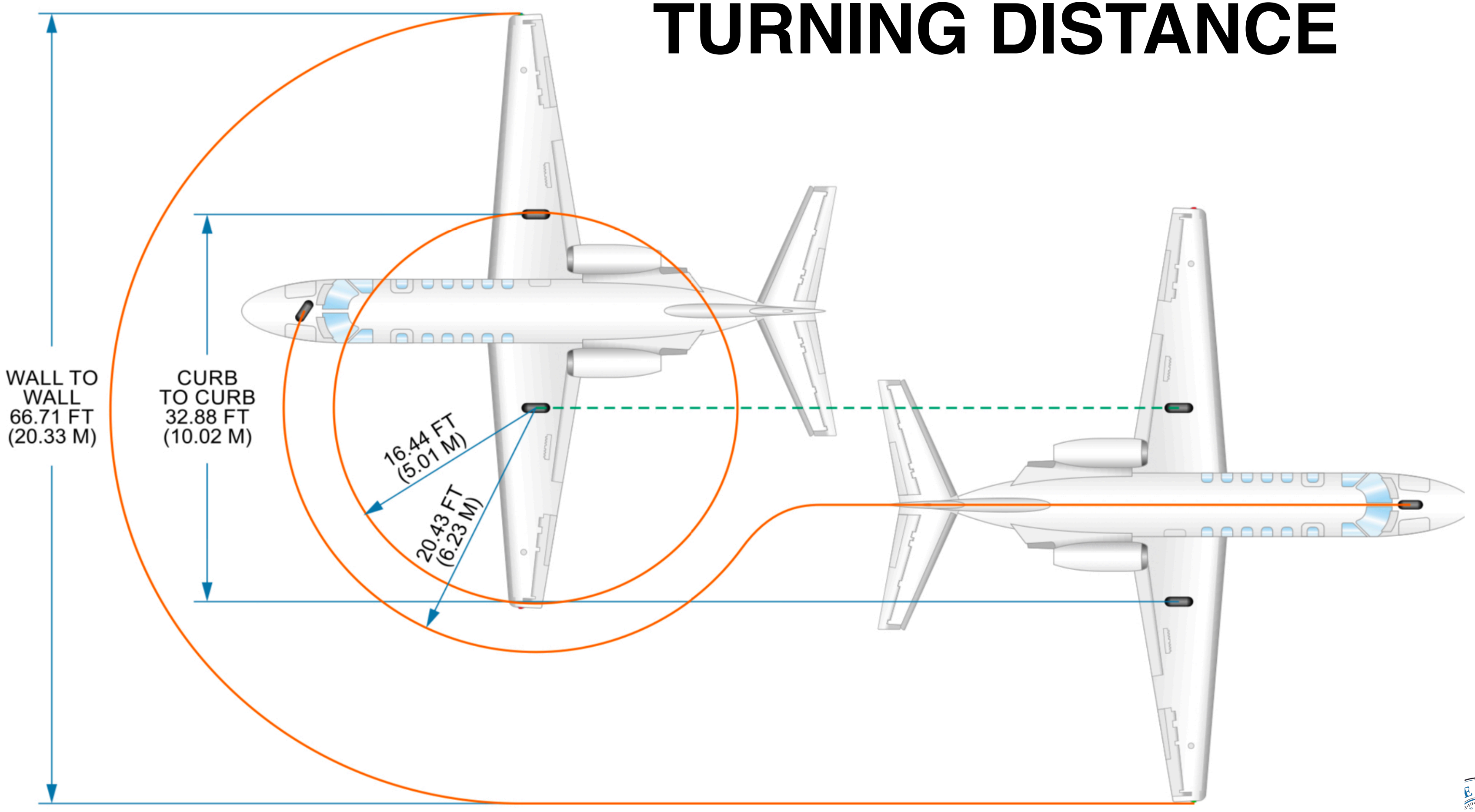
Quantity	3,960 lbs.
LO Fuel Level	190 lbs.
LO Fuel Press	5 psi
Max Fuel Imbalance	200 lbs.

ENVIRONMENTAL LIMITS

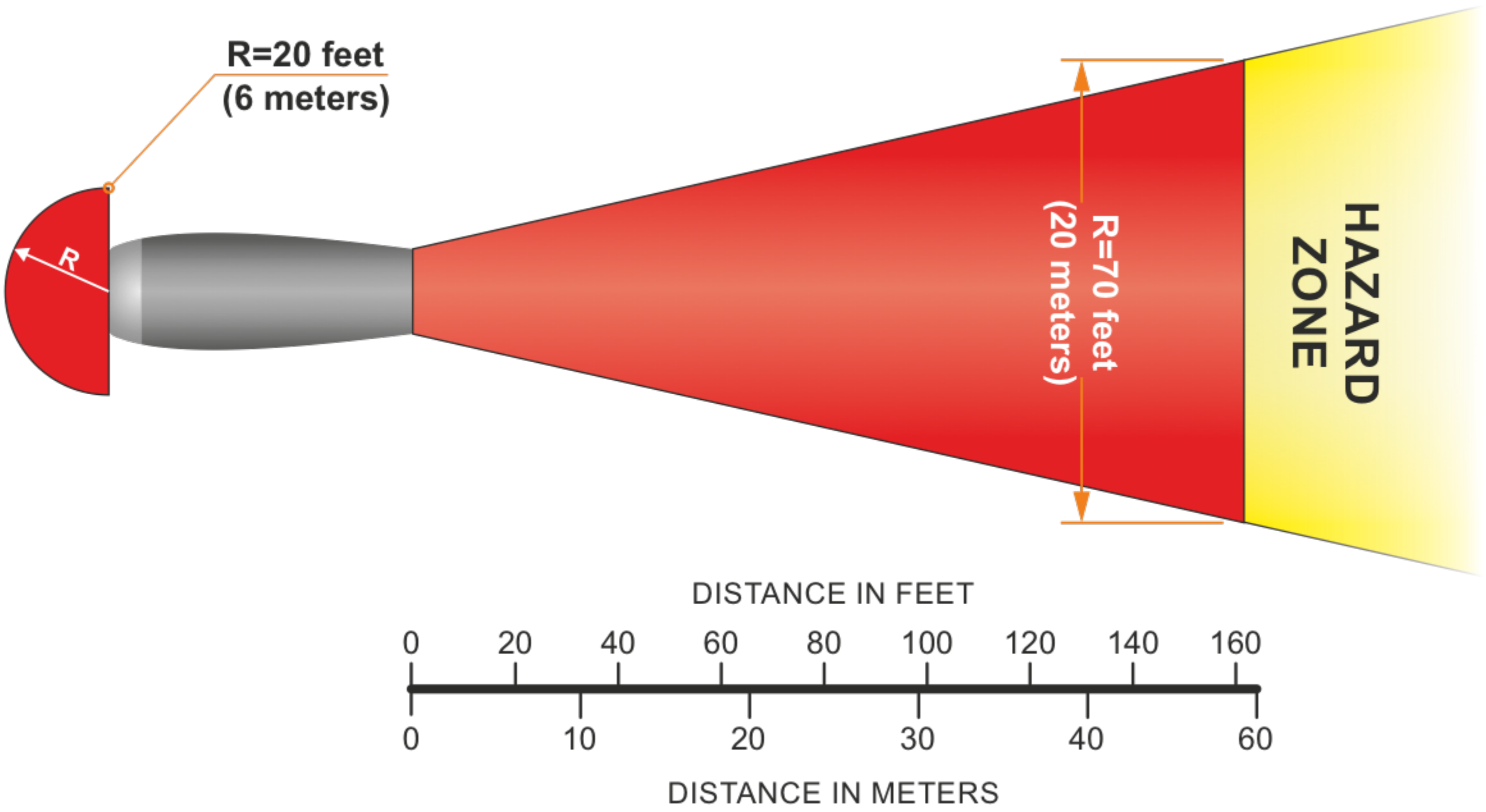
Max Design Cabin Alt.	8,000'
CAB ALT Light	10,000' or 14,500'
Altitude Limiter	14,500' (+/- 500)
Masks Auto-Drop	14,500' (+/- 500)
Max Cabin Differential	9.0
Min Speed Sustained Icing	180K


POSITION
LIGHT
RUDDER
VERTICAL
STABILIZER
5 VORTEX
GENS/SIDE
BAGGAGE
DOORS
EMERGENCY EXIT
(RIGHT SIDE ONLY)
15.11 FT (4.61 M)
RUDDER TRIM TAB
50.2 FT (15.30 M)
HYDRAULIC RESERVOIR
ACCES (RIGHT SIDE)
AFT BAGGAGE
COMPARTMENT DOOR
(LEFT SIDE)

TURNING DISTANCE



ENGINE HAZARD AREAS



NOSE SECTION

The nose section is an unpressurized, unheated area containing:

On the left-hand bulkhead:
1. The avionics compartment
2. An equipment area
3. A 20-cu. ft. baggage storage area which holds 400 pounds of storage.

On the right-hand bulkhead:

4. The windshield alcohol
5. Brake reservoirs,
6. The power brake accumulator,
7. A pneumatic nitrogen bottle

NOSE SECTION (CONT'D)

A swing up door, one on each side of the nose section are key-locked and latched at the bottom. When either nose compartment door is fully open, a gas cylinder on the aft door hinge holds the door in the open position. The baggage door lock incorporates a microswitch in the key lock assembly which illuminates the BAGGAGE DOOR FWD warning light annunciator if the baggage door is not latched and locked. The nose compartment door key-locks connect to the BAGGAGE DOOR FWD annunciator light.

NOSE SECTION (CONT'D)

The amber BAGGAGE SMOKE light will illuminate if the nose or tailcone baggage smoke detector activates in either area.

ENTRANCE DOOR

The entrance door is located on the left side of the fuselage forward of the wing. The door is secured in the closed position by 12 locking pins attached to a handle.

The door handle is secured with a key lock.

CABIN DOOR WARNING

A microswitch in the door illuminates the CABIN DOOR OPEN CAS message (crew alerting system) light if the door is not secured. The MASTER CAUTION RESET annunciator will also be activated. Five visual indicator windows in the door verify the door is closed and latched. When the door is closed, the bottom forward locking pin opens a valve allowing bleed air to inflate a pneumatic cabin door seal installed in the door perimeter.

ENTRANCE DOOR (CONT'D)

If the primary door seal loses pressure below 5 PSI, the DOOR SEAL CAS message illuminates. The cabin will not depressurize because a non- inflatable, rigid secondary seal will hold the cabin pressure.

CABIN DOOR SEAL

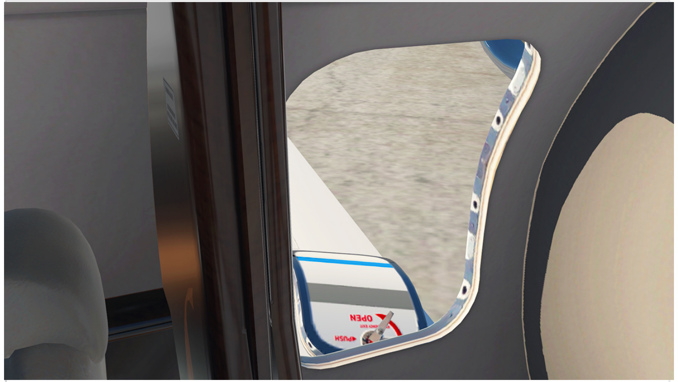
EMERGENCY EXIT

An EMERGENCY EXIT is located on the aft right-hand side of the cabin fuselage. The exit opens inward. It is a plug door and has a locking pin with a red flag to prevent opening from the outside while the airplane is on the ground. The pin is removed prior to flight.

EMERGENCY EXIT (CONT'D)

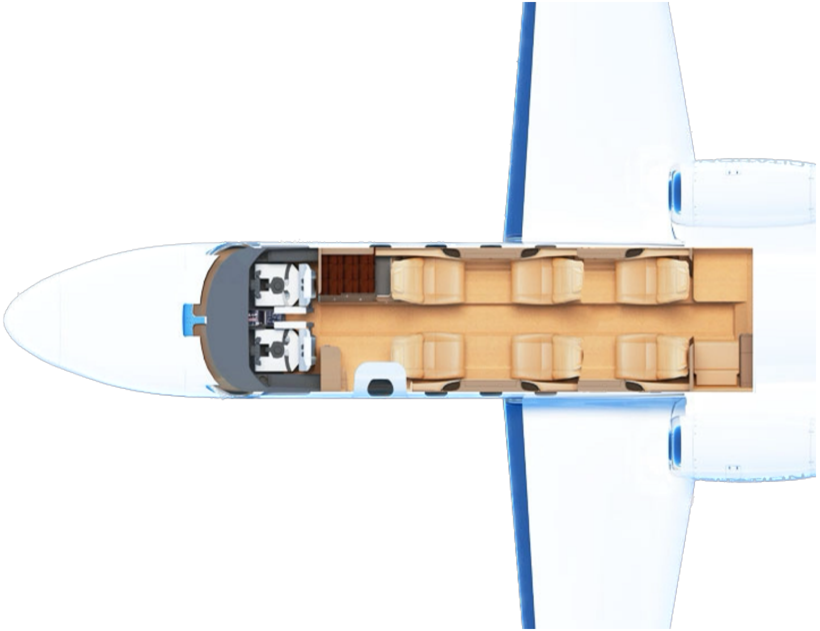
The cabin entrance door and emergency exit door can both be opened from outside or inside the airplane. This exit is an alternate to the cabin door in an evacuation and is the primary exit in a ditching situation.

The emergency exit is connected to the warning circuit and will illuminate the EMERGENCY EXIT OPEN CAS message if the emergency exit is not in the proper position.



EMERGENCY EXIT OPEN

CABIN



The standard passenger seating configuration is a six-place center club arrangement with a refreshment bar across from the entry door. The cabin extends from the forward pressure bulkhead to the aft pressure bulkhead and is 20.8 ft. long by 4.9 ft. wide and is 4.9 ft. high.

CABIN (CONT'D)

The passenger cabin is equipped with drop-down, constant-flow oxygen masks for emergency use.

The cabin overhead panels contain individual air outlets and seat lighting for passenger comfort.

Indirect lighting for the cabin is provided by two rows of LED lights running the length of the cabin, controlled by a switch near the cabin entrance.

The aluminum wing is a one-piece, natural laminar flow airfoil, that attaches to the bottom of the fuselage.

TAIL CONE COMPARTMENT

The unpressurized tail cone compartment contains the major components of the:

1. Hydraulic System
2. Environmental System
3. Electrical Distribution System
4. Flight Controls
5. Engine Fire Extinguishing System

Access is through a baggage door on the left-hand side of the fuselage below the engine. It holds 600 lbs. in 50 cubic feet of space.

AFT BAGGAGE COMPARTMENT

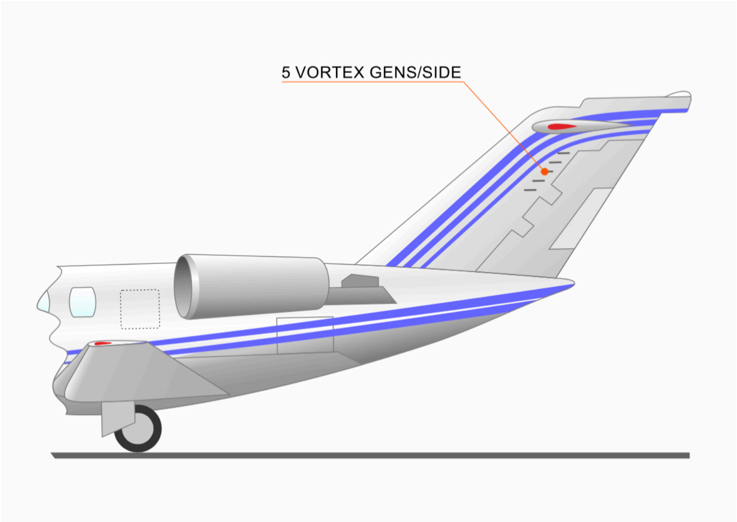
The tail cone compartment is unpressurized. The area is equipped with a smoke detector but has no fire suppression capability. The door is held in the opened position by a gas spring. It is secured by mechanical latches and a key lock. A microswitch, operated by the key lock, is connected to the AFT DOOR OPEN warning circuit.

AFT DOOR OPEN

EMPENNAGE

The empennage consists of a vertical stabilizer with the horizontal stabilizers mounted on a T tail.

Five vortex generators are mounted on each side of the vertical stabilizer. They function to stabilize the airflow over the elevators.



SYSTEMS

ELECTRICAL SYSTEM

The CJ3+ is an all-DC aircraft. The airplane's 28V DC buses are supplied from two starter-generators. Engine starting and secondary DC power is available from either the battery or an GPU. Permanent magnetic alternators (PMA) on the powerplant provide power for full-authority digital engine controls (FADECs). Inverters supply AC power, however, there are no cockpit controls or indications for AC power. Three 110 VAC power outlets are located in the cabin.

SYSTEMS (CONT'D)

FUEL SYSTEM

The fuel system is comprised of two identical halves. Each wing tank stores fuel and supplies it to its engine. Fuel can be transferred between tanks with all fuel controls and indicators located in the cockpit.

SYSTEMS (CONT'D)

ENGINES

Two Williams-Rolls FJ-44-3A turbofan engines are mounted on pylons at the rear of the fuselage. Each engine produces 2820 pounds of thrust. The engines are controlled by dual channel FADEC systems.

SYSTEMS (CONT'D)

ICE PROTECTION

1. Hot bleed air protects the wing's leading edge from ice accumulation.
2. Bleed air also heats the nacelle and the generator air inlets.
3. The horizontal stabilizer is deiced by inflatable boots.
4. Engine bleed air is used to deice the windshield.
5. Isopropyl alcohol is available to anti ice the left windshield in the event that bleed air is not available.
6. Electrical heaters anti-ice the pitot-static systems, the angle-of-attack vane, along with the T2 and pylon air inlet ducts.

SYSTEMS (CONT'D)

HYDRAULIC SYSTEM

Two engine-driven hydraulic pumps supply pressure through an open center system for operation of:

1. The landing gear
2. Speedbrakes
3. Flaps

The main brakes are equipped with anti-skid protection and utilize, a separate hydraulic system. Pneumatic backup is available for landing gear extension and emergency braking.

SYSTEMS (CONT'D)

FLIGHT CONTROLS

The flight controls are conventional, and cable operated. Manual trim is provided for the aileron and rudder tabs. The elevator trim is both mechanically and electrically actuated.
Hydraulic speedbrakes are installed on the upper and lower wing surfaces. The flaps are hydraulic.
The nosewheel steering is mechanically controlled by the rudder pedals

SYSTEMS (CONT'D)

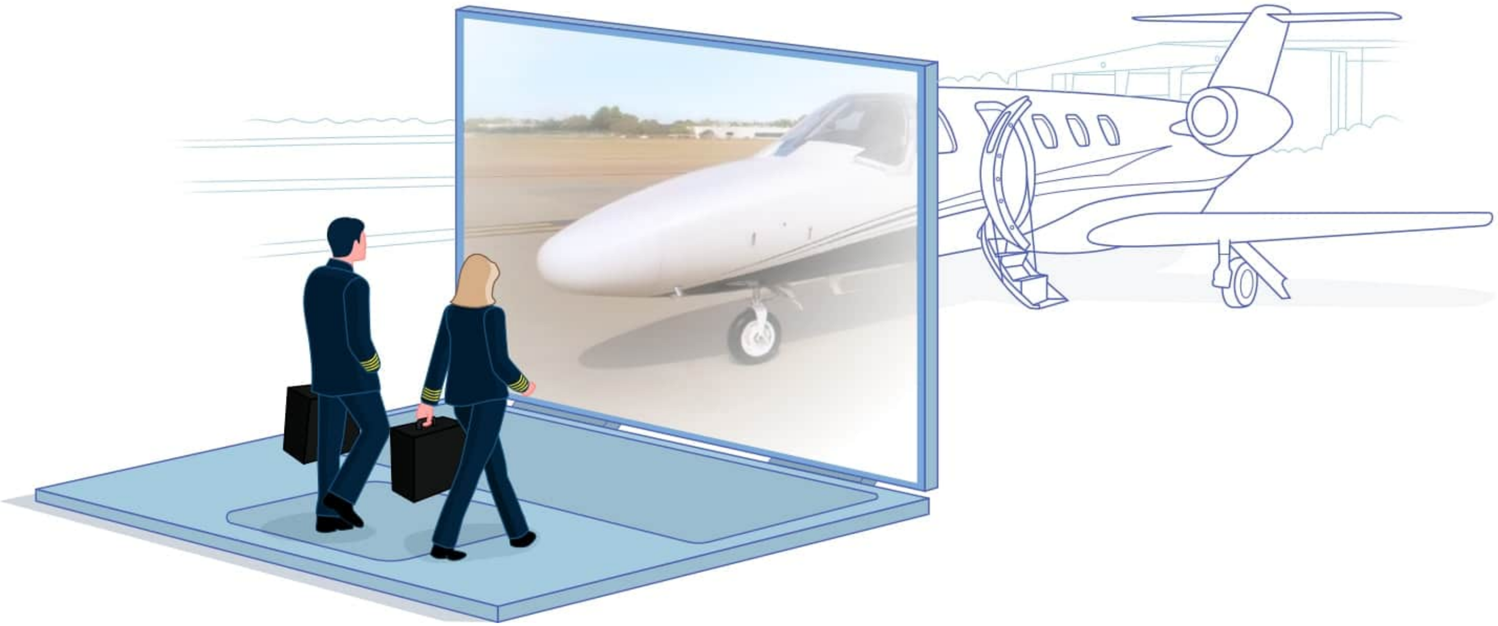
ENVIRONMENTAL CONTROLS

Cabin pressurization is automatic and utilizes bleed air from the engines. The bleed air is conditioned by ram air and/or the vapor cycle A/C. Temperature is controllable, and the system can maintain a sea level cabin up to 23,000 ft, and an 8,000' ft cabin at 45,000 feet. These pressures are based on a differential of 9.0 psi.

OXYGEN SYSTEM

The oxygen system supplies quick-donning masks in the cockpit and the cabin through dropout masks automatically deployed in the event of excessive cabin altitude. Continuous use of the supplemental oxygen system is prohibited above the following cabin altitudes:

Passengers	25,000 Ft.
Crew Only: EROS oxygen mask	40,000 Ft.



ELECTRICAL SYSTEM

ELECTRICAL SYSTEMS

The DC system consists of:

1. Storage
2. Generation
3. Distribution
4. System monitoring

AC ELECTRICAL SYSTEM

An AC inverter is used to convert 28 VDC to 40 to 60 volts, 400 Hz AC. AC power is used for electroluminescent panels and in the cabin areas for 110 VAC or 230 VAC for passenger conveniences. The inverter supplies 110 VAC or 230 VAC, depending on the installed configuration, to wall outlets while suppling up to 1,200 watts of power. The wall outlets are normally located in the co-pilot's cockpit sidewall and in the passenger cabin sidewall. The AC system is protected by a 60 amps current limiter that is located in the aft junction box. The ON/OFF switch is located in the wall outlet. When an electrical plug is inserted into the wall outlet, the inverter turns ON. When the plug is removed, the the inverter turns off. The inverter will not function with the battery switch in the EMER position.

GENERAL

Direct current (DC) is used for electrical power.

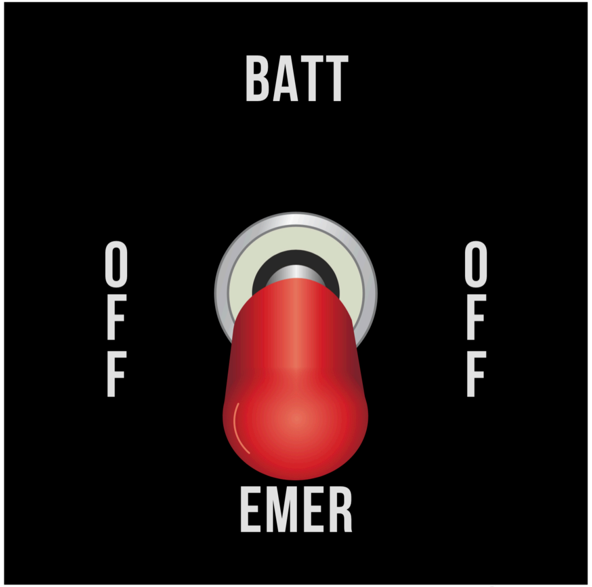
Sources:

- The two generators are the primary sources of power, however one generator is capable of supplying all standard requirements.
- The secondary sources are the battery or external power.

Distribution:

- The left generator powers the left main DC bus, and the right generator powers the right main DC bus. Both generators operate in parallel, but if a generator fails or is off line, the crossfeed bus ties the remaining generator to the main DC buses. The crossfeed bus is protected by a 225 amps fuse.

An emergency DC bus powers those items of equipment which are required in an emergency. Placing the DC POWER switch to EMER will enable this equipment to be powered by the battery. The hot battery bus, which allows power to some items at all times when the battery is installed, completes the bus system.



DC POWER

BATTERY

The standard battery is a nickel-cadmium rated at 25 volts and 28 amperes. An optional 25-volt 44 ampere-hour battery is available. The battery is the secondary source of DC power available and is used prior to start, during battery starts, and in the event of dual generator failure. The battery is located in the tail cone compartment and has a manual quick-disconnect feature. The battery is accessible through the tail cone door.

DC POWER - BATTERY

The battery is limited to three engine starts per hour.

During an external power start, the battery is separated from its ground by the battery disconnect relay to prevent battery discharge during the EPU start cycle.

Using an external power unit is not considered a battery start.

A battery in good condition should supply power to all buses for a minimum of 10 minutes while under a maximum load.
If only the hot battery and emergency buses are powered, battery should last a minimum of 30 minutes.

A standby battery is a 5-amp/hour pack installed in the nose of the aircraft. This provides power to the standby flight instrument after loss of the generators. An auxiliary battery in the nose of the aircraft provides 14-amp/hour power. A battery-disconnect relay provides an electrical disconnect for both batteries during certain conditions, including a battery overheat or stuck start relay.

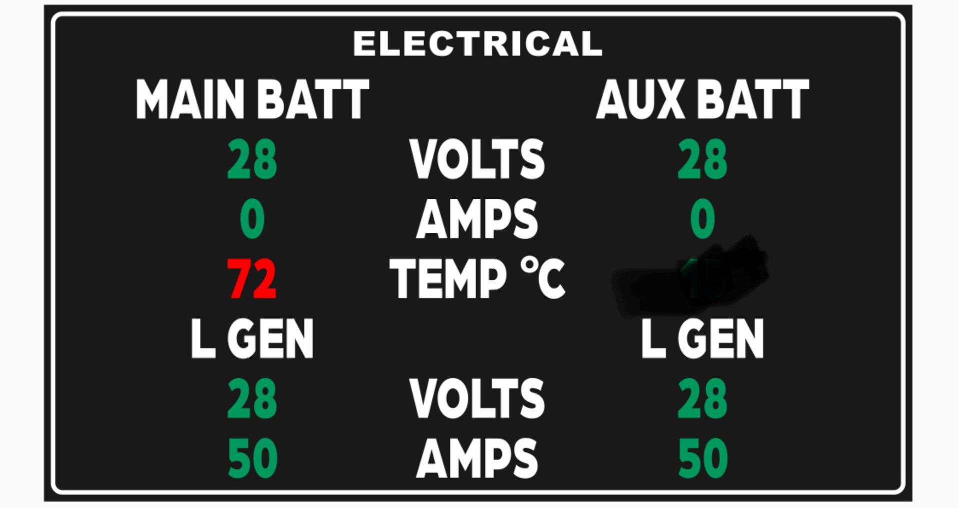
DC POWER - BATTERY DISCONNECT

A red guarded battery disconnect switch is located above the pilot armrest on the left side console panel. It is used to disconnect the battery in the event of a stuck starter relay, or a battery overheat. Activating this switch uses battery power to open the battery disconnect relay. If the battery disconnect switch is open, the battery cannot supply electrical power to the aircraft or be charged from the generators.

NOTE: In order for the battery disconnect switch to operate, the aircraft battery switch must be in the BATT position.

BATTERY OVERHEAT

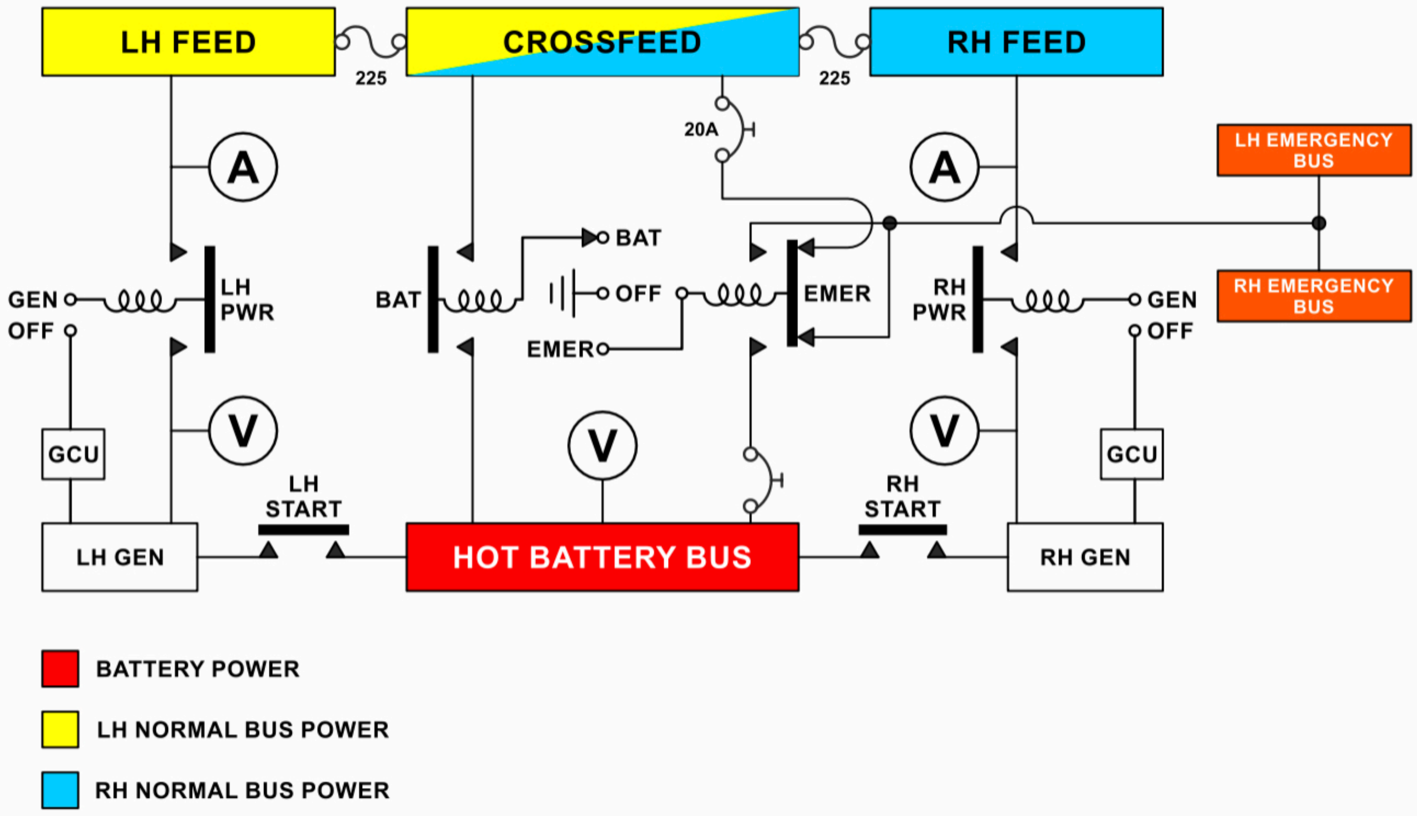
Battery overheat is normally the result of an excessive rate of charge, a discharge or internal battery damage. A BATTERY OVERTEMP CAS message warns of abnormally high battery temperatures. Additionally, the battery temperature digits on the MFD turn red. Battery overheat is possible with both NiCad and lead-acid batteries. Thermal runaway is possible with a NiCad battery.



DC POWER-STARTER GENERATORS

The two engine-driven DC starter-generators are the primary sources of electrical power.
Each air-cooled generator is mounted on the respective engine accessory gearbox, rated at 30 volts DC, regulated to 29 volts, 300 amperes, and is capable of 50% overload of 450 amperes for two minutes. The generators share loads equally (within 10% of total load) during normal operation via a crossfeed bus between the generator control units(GCUs). The starter/generator is driven by the accessory gearbox. If the starter/generator mechanically fails, the drive shaft will shear to prevent damage to the engine accessory gearbox. An internal fan cools the unit on the ground, while ram air cools the starter/generator in flight.

DC POWER-GENERATOR CIRCUIT



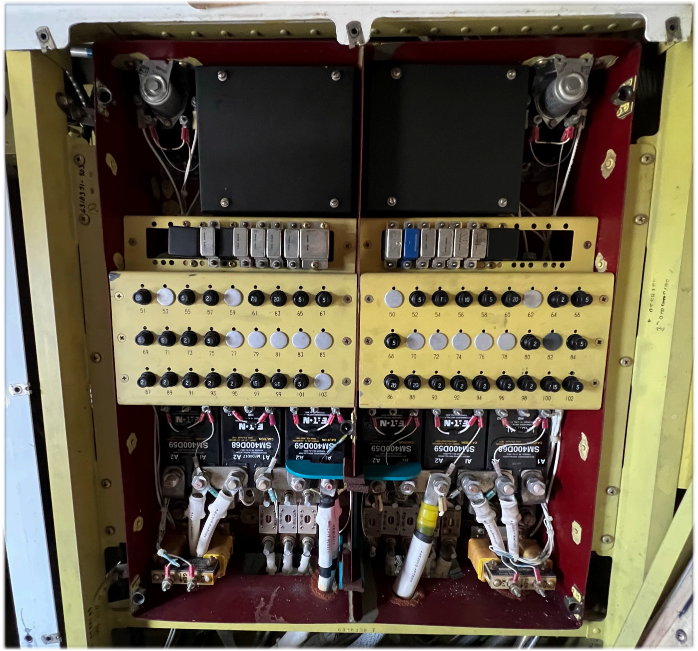
DISTRIBUTION

Direct current is distributed throughout the airplane by 10 buses. The main junction box (J-BOX) in the tailcone compartment contains:

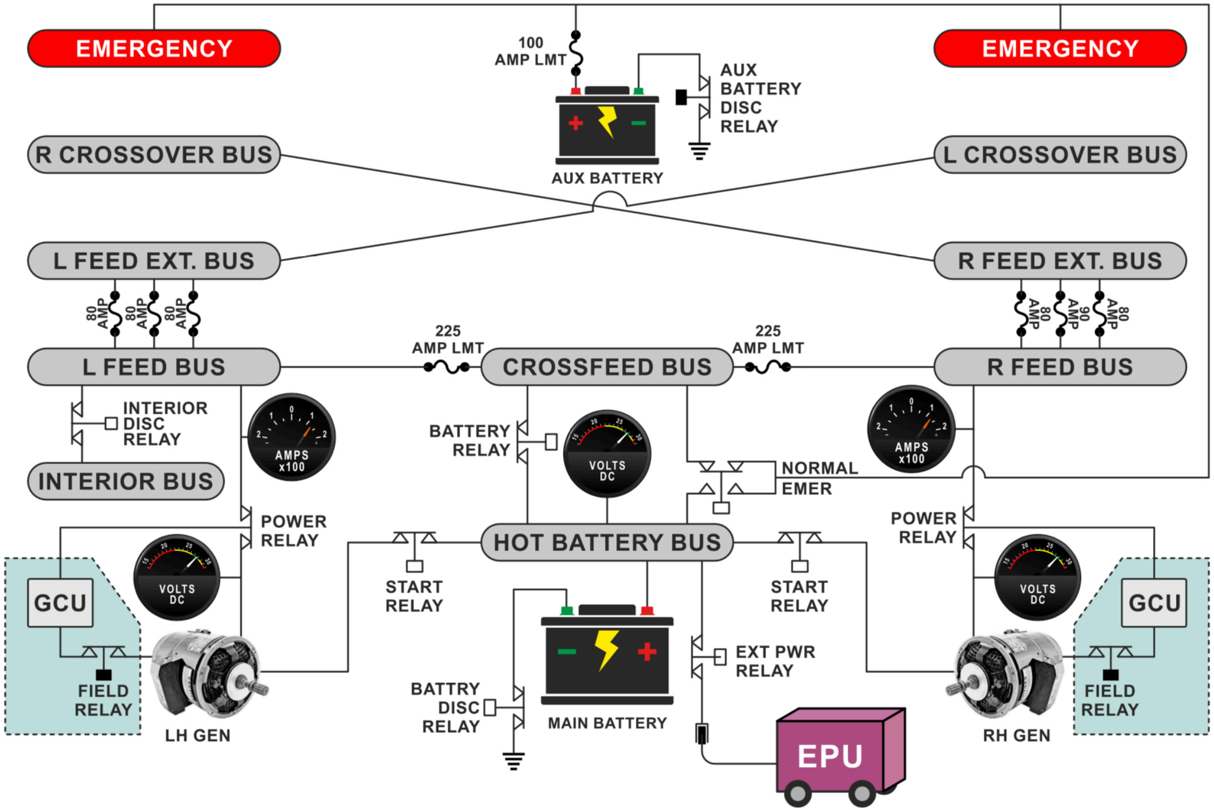
- Two feed buses. (Left and Right)
- The crossfeed bus.
- The hot battery bus.

The cockpit buses include:

- Two feed extension buses.
- Two crossover buses.
- The emergency buses.

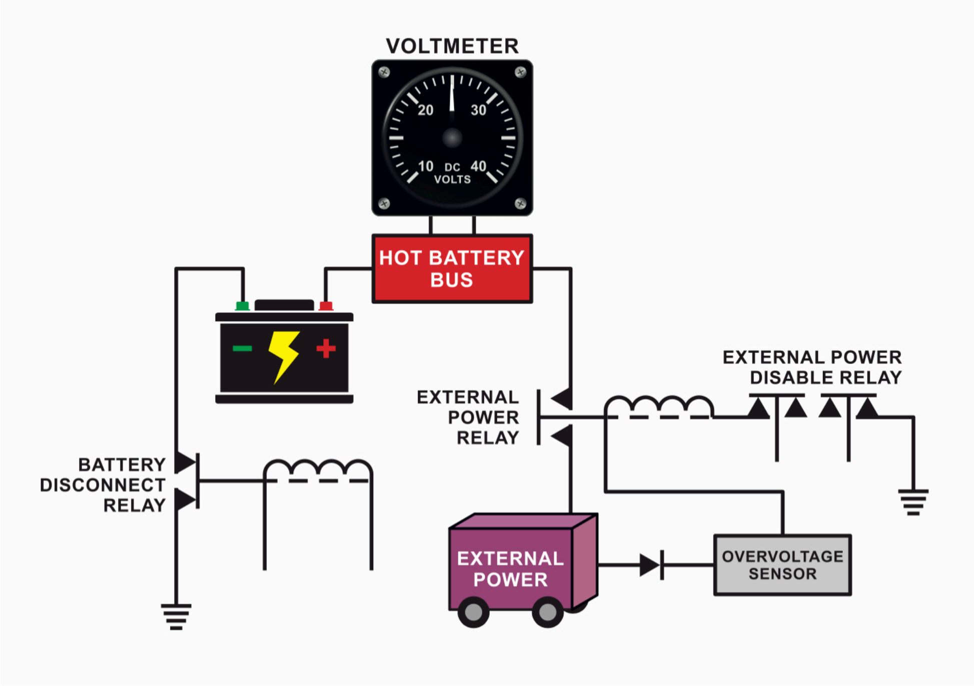


DISTRIBUTION - ELECTRICAL SYSTEM SCHEMATIC



DISTRIBUTION (CONT'D)

The hot battery bus is connected directly to the battery. It can also receive power from an external power unit. During normal operation, it is powered from the generators.

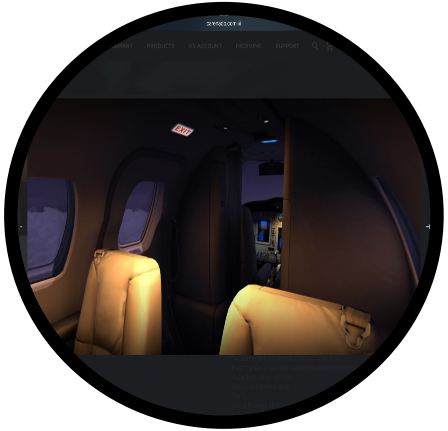


HOT BATTERY BUS

The HOT battery Bus items include:

LIGHTS

- Nose compartment light,
- Cabin entry door “EXIT” and white light,
- Emergency exit door “EXIT” and white lights,
- The two right wing walkway lights,
- The optional LH/RH footwell strip lights,
- The aft baggage compartment light.



HOT BATTERY BUS (CONT'D)

ELT

If activated by the 5-G switch, the 3-second pushbutton uses hot battery bus power to turn the ELT off.

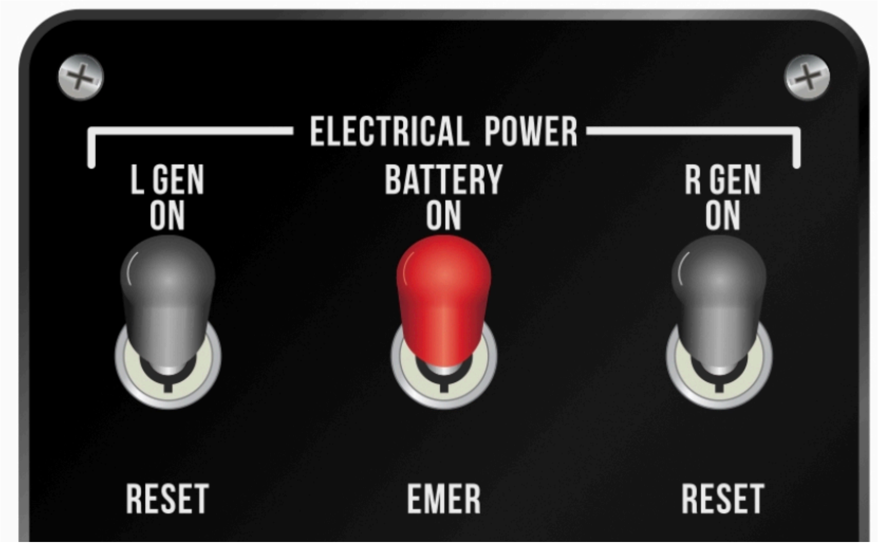
Emergency Battery Pack:

1. Powers the engine instrument and cockpit floodlights during the start sequence.
2. A 5-G force or greater activates a switch that powers the cabin entry door white light and "EXIT" light, the emergency exit door "EXIT" light and white light, the two right wing walkway lights, and the optional LH/RH footwell strip lights.

If the optional footwell strip lights are installed a second emergency battery pack is installed.

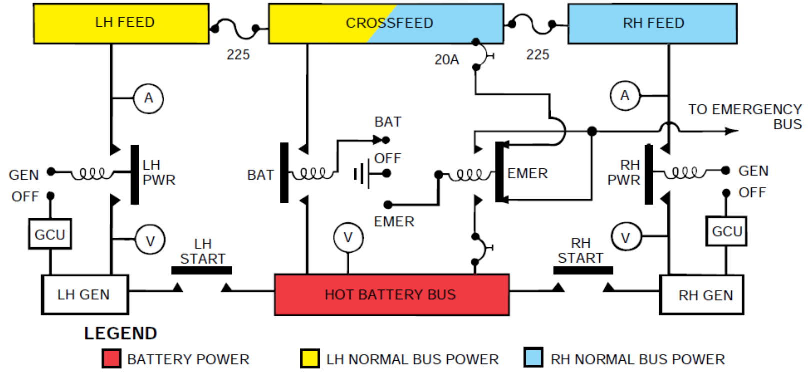
CONTROL

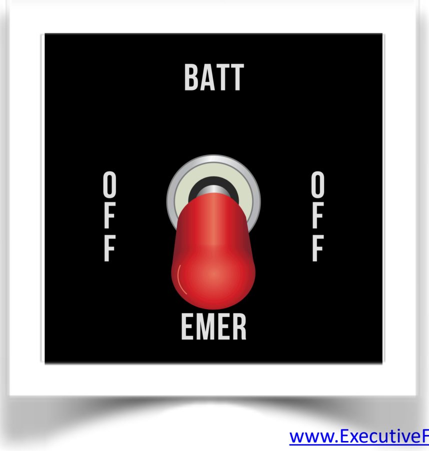
DC power is controlled by a battery switch and two generator switches. The battery switch has three positions:
BATT, OFF, and EMER.



BATTERY SWITCH

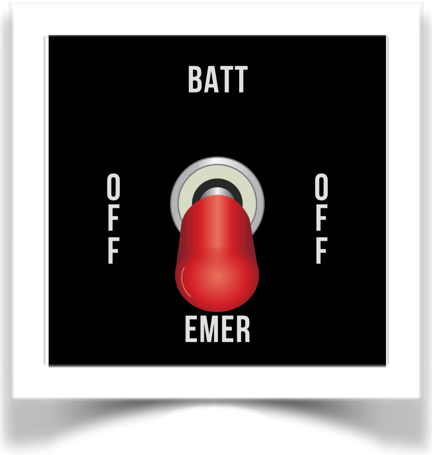
- When the Battery S/W is OFF: The Hot battery bus is isolated, and the Emergency bus is connected to the crossfeed bus.
- When the Battery S/W is selected to BATT: The Battery relay closes and powers the crossfeed bus. The Emergency relay is deenergized and Power to the emergency bus is through the crossfeed bus.
- Placing the battery S/W in EMER will power the emergency relay connecting the Emergency bus to the hot battery bus.
- With the generators operating and the EPU off, selecting the battery switch to EMER or OFF will isolate the battery from any charging source without losing power to any bus.





EMERGENCY BUS

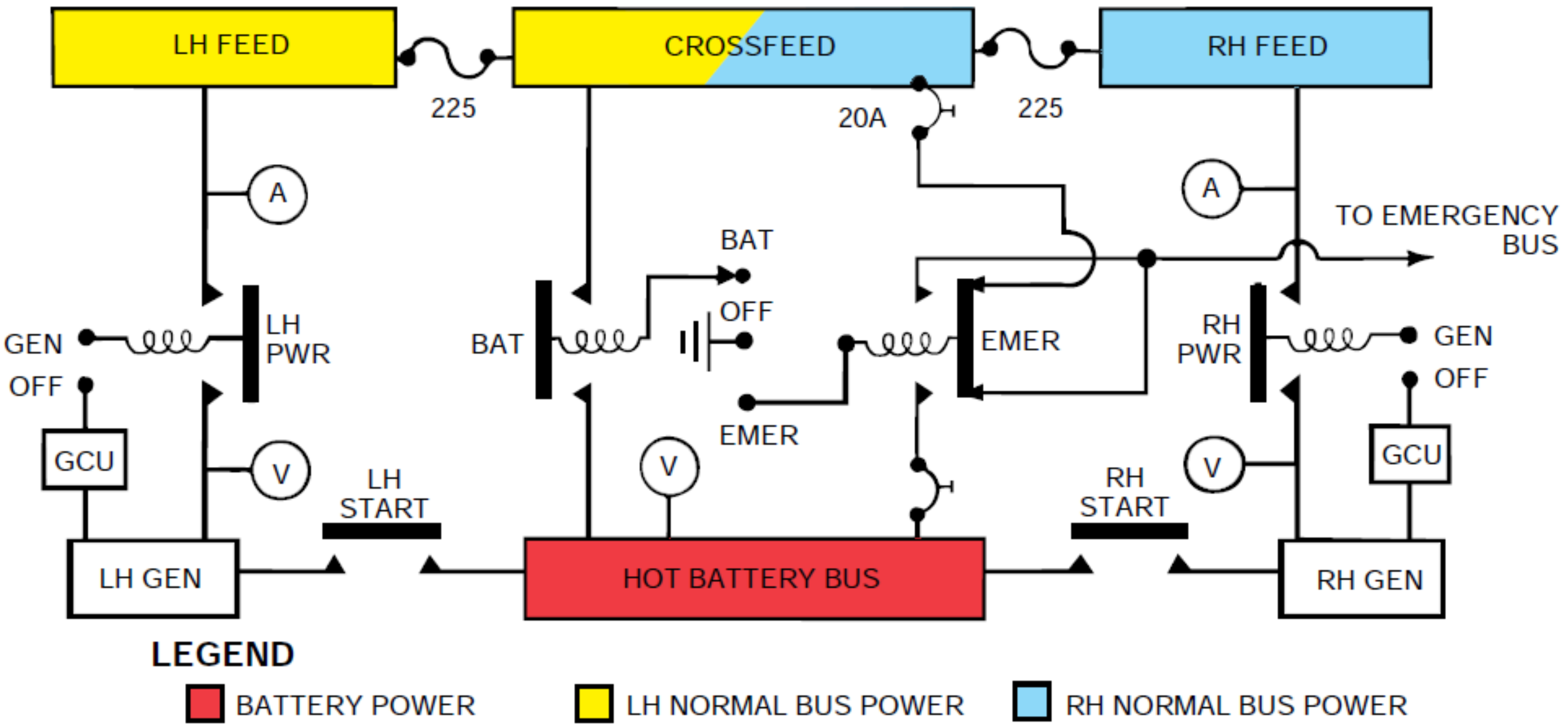
If both generators fail, selecting the battery switch to EMER sheds electrical loads to only the essential items of the hot battery bus and the emergency buses. This reduces the draw on the battery.



The following are powered from the CJ3 emergency bus:

COMM 1	Pilot's and Co-pilot's Audio Panels
Standby Pitot Heat	Landing Gear Control
NAV 1	Standby HSI (Co-pilot's AHRS)
Co-pilot's Pitot Heat	Landing Gear Monitor
RTU 1	Standby Engine N_1 indicators
Co-pilot's Air Data Computer	Overhead Floodlights
RIU L-R	Standby Flight Display
Flap Control	Voltmeter (internal battery)
Garmin 500 (optional)	RTU2

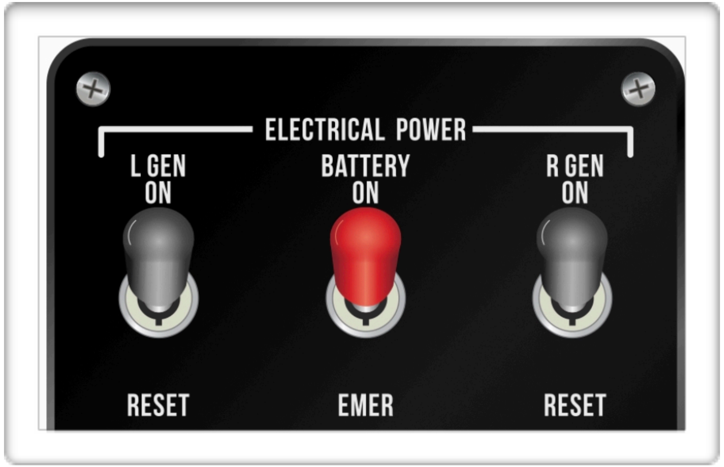
CONTROL
BATT S/W AND GEN S/W



GENERATOR SWITCH

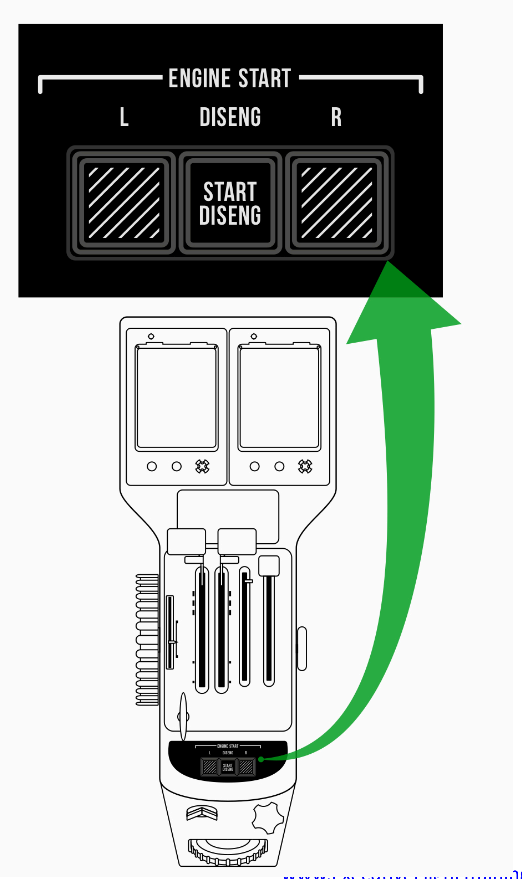
The generator switches are three-position switches: GEN, OFF, and RESET.

- **S/W to GEN** → The GCU closes the power relay, and the generator connects to its feed bus. The ammeter indicates the generator output to the feed buses.
- **S/W to OFF** → The power relay opens. The ammeter shows no generator load to the feed buses.
- **S/W to RESET** → The generator field relay will close, if no faults exists.



ENGINE START PANEL

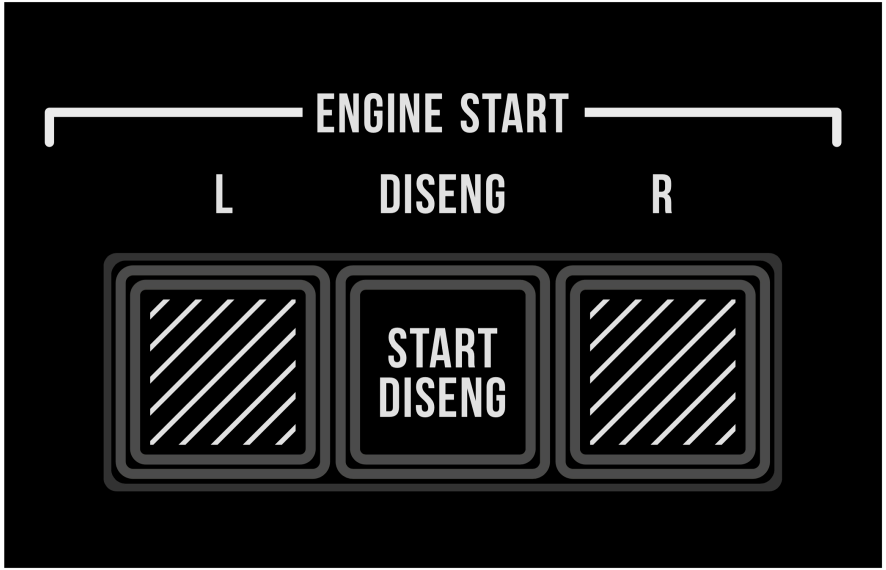
The Engine Start Buttons connects the starter relay to the Hot Battery Bus and then to the starter. The start switches are located on the center console. Illumination of the white cross-hatched pattern on the starter button is a direct indication that the starter relay has closed. The START DISENG button is used for a manual termination of the start sequence. Minimum battery voltage for engine start is 24 VDC.



MONITORING STARTER

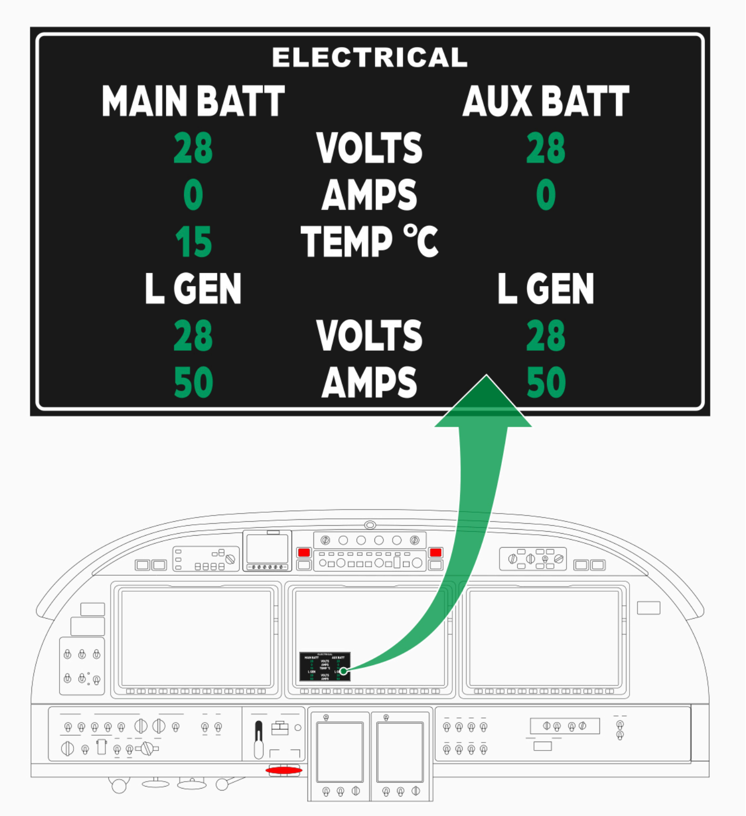
Pushing the engine start button illuminates the starter button white light as a direct indication the start relay closed.

The light inside the STARTER DISENGAGE button is a courtesy light. It is activated when the panel lights master switch is turned on for night operations.



MONITORING

The electrical system indications are located on the engine indicating system (EIS) as shown. Voltage and amperage for the main battery, the auxiliary battery, and the generators are displayed. Additionally, the temperature of the main battery is indicated. The numbers change colors based on their value relative to the applicable limits.



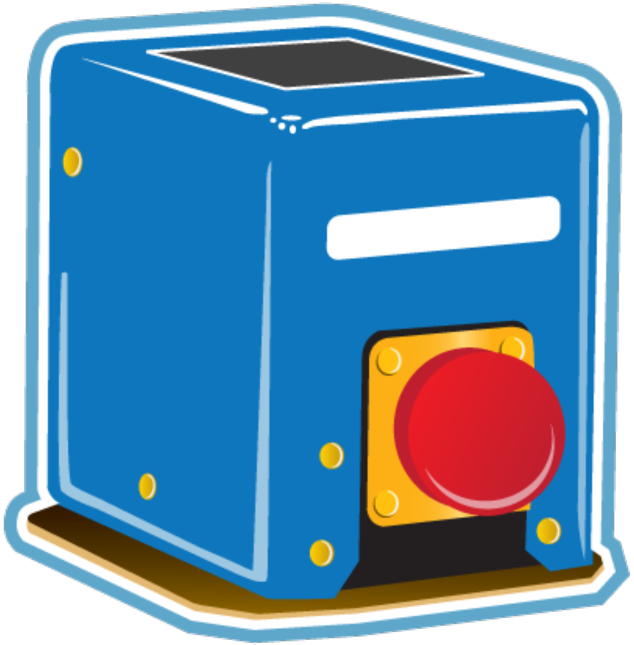
MONITORING (CONT'D)

Cockpit indicators integrated into the engine indication and crew alerting system (EICAS) monitor electrical system status and performance.

MESSAGE	DESCRIPTION
BATTERY OVERTEMP	Battery temperature is greater than +62°C. This message will repost when battery temperature exceeds +71°C.
GENERATOR OFF L-R	Both generator contacts are open AND the aircraft is in the air. This message has a three-second time delay before displaying.
GENERATOR OFF L-R	Loss of a single generator. This message is inhibited when the same-side start contact is closed and has a three-second time delay before displaying.
J-BOX LIMITER OPEN	Failure of a 225-amp current limiter.
J-BOX REMOTE CB TRIP	Left or right start circuit breaker on the aft J-Box has opened.

GENERATOR CONTROL UNIT

A Generator Control Unit (GCU) provides starter regulation, overvoltage protection, feeder fault and ground fault protection for each generator.



DC POWER - EXTERNAL POWER

External power is routed to the hot battery bus. The battery is charged from the external power unit (EPU) regardless of the battery switch position. The EPU voltage should be set to 28- 29 volts, with the amperage output between 800 and 1,100 amperes. When using the external power for prolonged ground operation, the battery should be physically disconnected to prevent overheating the battery.

EXTERNAL POWER OPERATION

BEFORE START

The generator switches should be selected to GEN for a battery start or OFF if using an external power cart.

Place the battery switch to BATT and check the voltmeter for 24 volts minimum on the EIS.

The battery should be visually checked for signs of deterioration or corrosion.

External power should not be connected until these checks are complete.

OPERATION EPU START

Checked the EPU voltage regulation (28 to 29 volts maximum) and an availability of 800 to 1,100 amperes maximum.

During an EPU start, the GEN S/W should be OFF for both engine's start.

Starting an engine on the ground above 10,000' MSL must be an EPU start. Maximum airport elevation for EPU starts is 14,000 MSL.

EXTERNAL POWER PROTECTION

Pressing the starter button for EPU starts, first opens the battery disconnect relay to prevent NICAD battery cycles, then closes the start relay. There is no reverse current protection between the hot battery bus and the EPU. Some external power units do not have reverse current protection. If the EPU is turned off or shuts down while connected to the airplane, rapid discharge and damage to the battery can result.

Always disconnect the EPU from the airplane when not in use.

ABNORMAL NICAD BATTERY

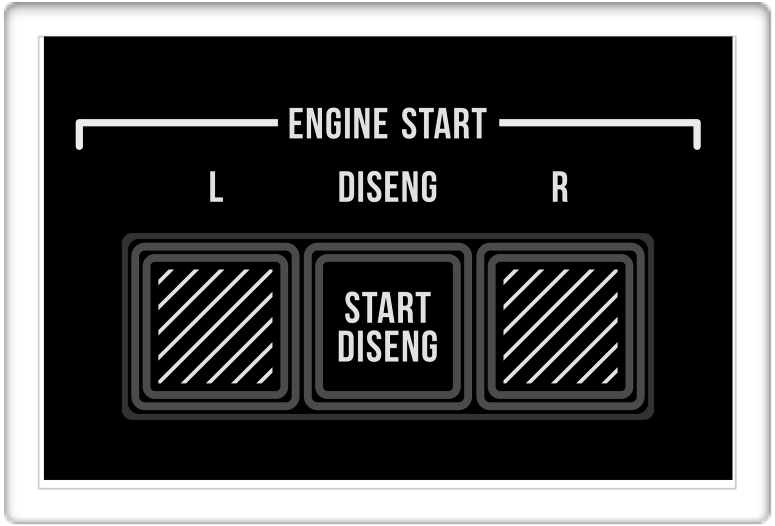
BATTERY OVERTEMP

A NICAD Battery overheat can result from an excessive amount and rate of charge or internal battery damage. A battery over-temperature warning system is provided to warn the pilot of abnormally high battery temperatures. An internal temperature of 62°C (145°F) will illuminate a red BATT OVERTEMP CAS message. If the temperature reaches 71°C (160°F) the red BATT OVERTEMP light will flash.

ABNORMAL START

If the speed-sensing switch fails to terminate the start sequence, pressing the STARTER DISENGAGE button will terminate the start.

The ammeters provide an indication of impending generator problems. Ampere readings that differ by more than 10% of the total load indicate unparalleled operation.



ABNORMAL START

GENERATOR OFF L-R

If a GEN OFF LH/RH CAS light illuminates, check the voltmeter to determine if the field relay or the power relay has opened. The field relay in the GCU controls field excitation within the generator. When open, the field relay opens the power ground, which causes the power relay to open. Loss of a single generator is annunciated by an amber GEN OFF/LH or RH CAS light and MASTER CAUTION light.

GENERATOR OFF L-R

Dual generator failure is annunciated with a red GEN OFF LH/RH CAS message and a flashing red MASTER WARNING.

J-BOX REMOTE CB TRIP

J-BOX REMOTE CB TRIP

If the J BOX REMOTE CB TRIP CAS message illuminates, the left or right start control circuit breaker has tripped. This deenergizes the starting PC board starting the engine is not possible.

J-BOX LIMITER OPEN

J-BOX LIMITER OPEN

Illumination of the CAS message indicates a blown 225-amp current limiter. Although normal generated power is still available, the cross-tie bus will not supply power to the respective bus from the battery or from the opposite generator in the event of a generator failure. on the ground, the engines cannot be started.

MESSAGE	DESCRIPTION
BATTERY OVERTEMP	Battery temperature is greater than +62°C. This message will repost when battery temperature exceeds +71°C.
GENERATOR OFF L-R	Both generator contacts are open AND the aircraft is in the air. This message has a three-second time delay before displaying.
GENERATOR OFF L-R	Loss of a single generator. This message is inhibited when the same-side start contact is closed and has a three-second time delay before displaying.
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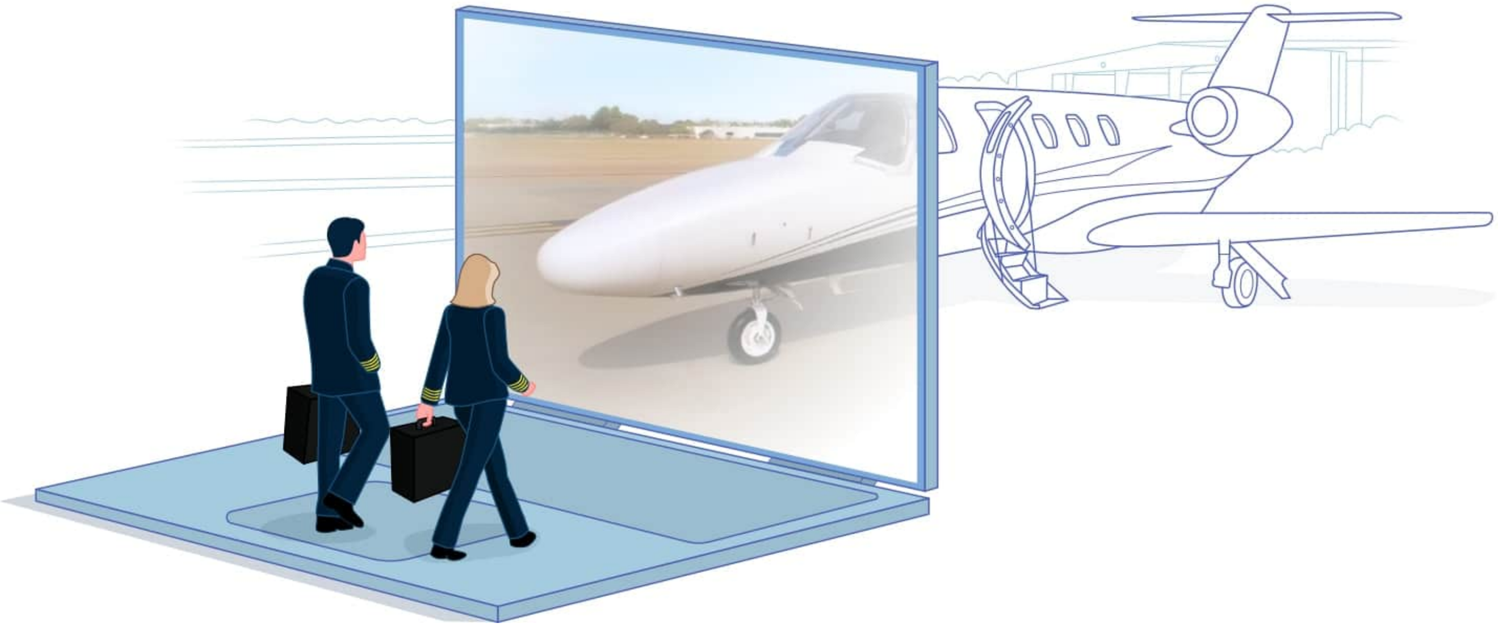


LIGHTING

TO RECEIVE CREDIT FOR THIS COURSE, YOU MUST PASS THE FINAL EXAM LOCATED ON THE LAST PAGE OF THIS STUDY GUIDE.

GENERAL LIGHTING

The airplane lighting is divided into:

INTERIOR LIGHTING:

1. Cockpit lighting which includes the instrument panel lights, floodlights, electroluminescent panels, and map lights.

2. Cabin lighting which is the passenger reading lights, floodlights for the main cabin door and emergency exit, an aft compartment light, lighted signs, and optional indirect fluorescent lights.

3. Emergency lighting.

GENERAL LIGHTING (CONT'D)

EXTERIOR LIGHTING:

1. Navigation
2. Landing/recognition/taxi
3. Anti-collision
4. Flashing red beacon
5. Wing inspection light

INTERIOR LIGHTING

All lights except the overhead and instrument floodlights are controlled by a night dim switch and are adjusted by rheostats. All lights except the overhead and instrument floodlights are controlled by a PANEL LIGHT CONTROL master switch (NIGHT DIM/ON/OFF) and are adjusted by rheostats. When the instrument panel lights are on, a dimmer is activated in the annunciator panel to dim the light intensity during night flying.

COCKPIT LIGHTING

COCKPIT FLOODLIGHTS

The battery switch must be in BATT or EMER for operation.

MAP LIGHTS

Map lights are located on the left and right forward overhead panel.

COCKPIT LIGHTING (CONT'D)

CONTROL PANEL LIGHTS

The control of panel lighting is provided by electroluminescent light panels. Control is accomplished with the lighting rheostat labeled EL.

INSTRUMENT LIGHTS

Instruments are internally lighted. The instrument panel lights are dimmed by appropriate control panel or on the instrument itself. (LEFT/RIGHT/CENTER)

PASSENGER INTERIOR LIGHTING

The passenger compartment lighting includes all cabin lights, utility lights and lighted signs. Indirect fluorescent lights (optional), passenger reading lights.

LIGHTING-PASS SAFETY/SEAT BELT

With the switch in the PASS SAFETY position, the no smoking/ fasten seat belt signs and the interior and exterior emergency exit lights are illuminated. Placing the switch in the SEAT BELT position will illuminate only the fasten seat belt sign.

EMERGENCY LIGHTING

If normal DC power fails, the emergency lighting system will illuminate the interior of the aircraft. The emergency lighting system is powered by moving the passenger safety switch to PASS SAFETY or by pressing the white push-button switch near the main cabin door. The third method to activate emergency lighting is to expose the aircraft to a force of 5G's or more. Two lights are installed over the right wing for emergency egress.

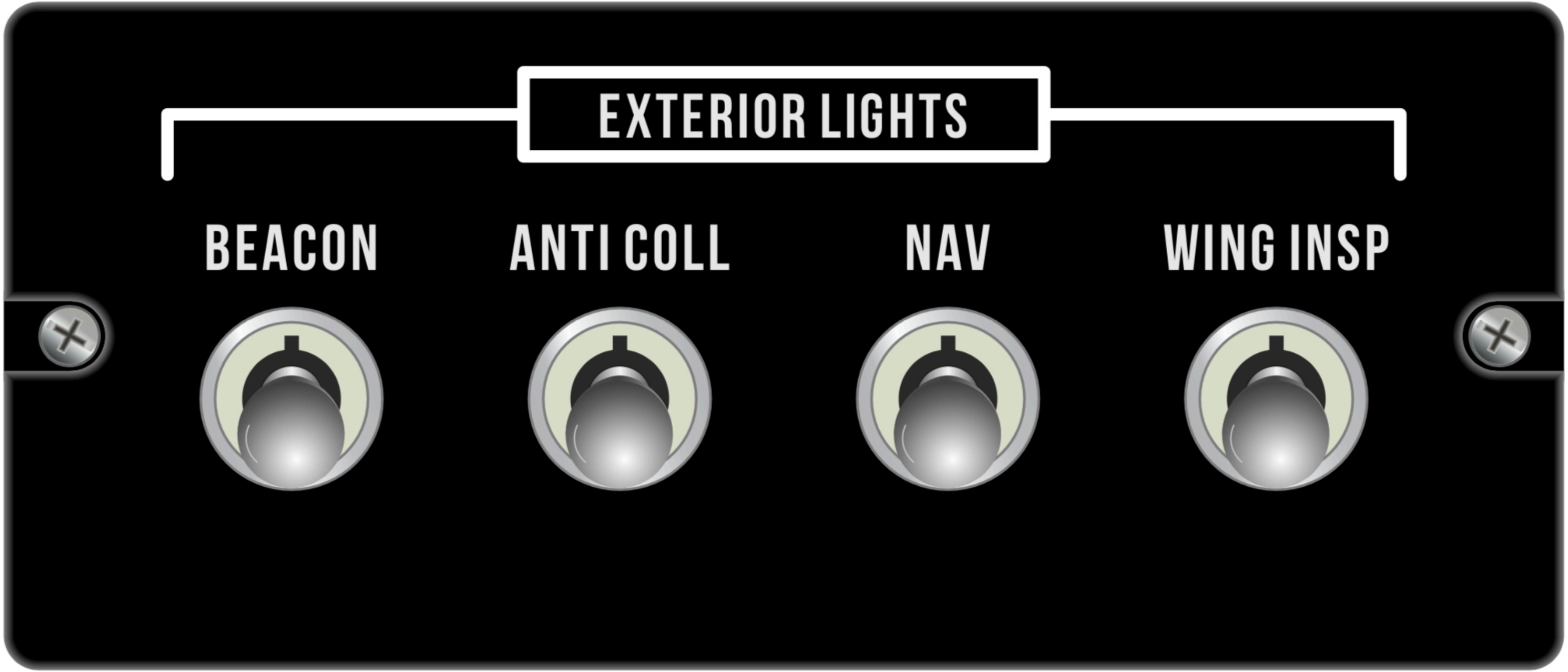
BAGGAGE COMPARTMENT LIGHTING

The baggage compartments are illuminated by a light in the tail cone compartment light and one in the nose baggage area. The lights are wired directly to the Hot Battery Bus. Closing the baggage doors will extinguish the light, regardless of switch position.

EXTERIOR LIGHTING

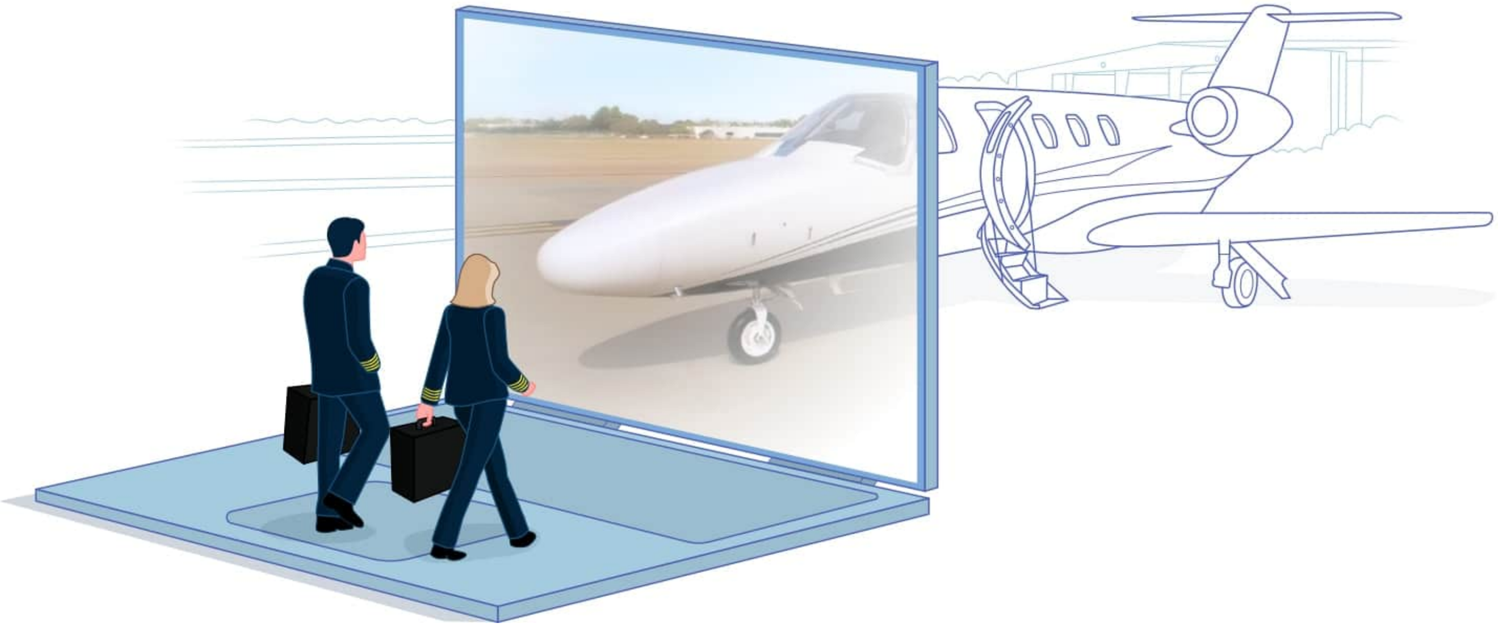
The landing/recognition/taxi lights are combined LED lights. The LANDING position produces the highest intensity and is used for takeoff and landing. The RECOG/TAXI position produces a lower intensity light for taxi operations and in-flight collision avoidance.

EXTERIOR LIGHTING (CONT'D)



EXTERIOR LIGHTING - NAV LIGHT

EXTERIOR LIGHTING - WING INSPECTION LIGHT



CAS WARNING SYSTEMS

MASTER WARNING SYSTEM

The master warning system uses cockpit indications, both visual and aural, to alert the crew to warnings, cautions, and advisory information about the status of the aircraft.
CAS messages are classified as WARNING (Red), CAUTION (Amber), and ADVISORY (White).

MASTER WARNING LIGHTS

WARNING LIGHTS are RED and Require Immediate Corrective Action. The red warning lights in the CAS panel will cause the MASTER WARNING RESET lights to flash. A fire or overheat condition will activate the engine fire sensor closing its sensor switch. This powers and illuminates the red L or R ENG FIRE switchlight and includes an aural warning of “left (or right) engine fire”. The ENGINE FIRE L-R CAS message also displays on the PFD.

MASTER WARNING LIGHTS

CAUTION lights are AMBER.
Amber lights indicate:

1. A malfunction that requires immediate attention, but not necessarily immediate action.
2. Abnormal system operation.

The amber MASTER CAUTION RESET light will flash whenever an amber CAS panel light illuminates. When the MASTER CAUTION is reset, the amber lights remain on until the condition is solved. If the problem is solved, the annunciator light automatically extinguishes. Resetting the master caution light is accomplished by pressing either of the master caution reset lights.

MASTER WARNING SYSTEM

ADVISORY LIGHTS

ADVISORY lights are white and DO NOT TRIGGER a MASTER WARNING or MASTER CAUTION. When an advisory light illuminates, the checklist may require an action. If required, the action will be found in the “Abnormal Procedures” check list or in the AFM.

CAS MESSAGE PANEL

CAS Messages operate in conjunction with the MASTER WARNING and MASTER CAUTION lights. If a system malfunctions, the associated CAS message illuminates until the malfunction is corrected.

ENGINE CNTRL FAULT L-R

Sample CAS Message

TEST FUNCTION

The System Tests page is used to preflight the following airplane systems:

- Fire Warning
- Landing Gear
- Angle of Attack
- Windshield Temperature
- Overspeed Sensing
- Anti-Skid
- Annunciators
- Terrain Avoidance and Warning System (TAWS)
- Traffic Collision and Avoidance System (TCAS)
- Radar Altimeter
- Rudder Bias

CAS PANEL TEST INDICATIONS

SYSTEM TESTED	ADDITIONAL PILOT ACTIONS	INDICATIONS
Fire Warning	None	Red ENGINE FIRE buttons illuminate. ENGINE FIRE L-R CAS message appears. "Left Engine Fire" and "Right Engine Fire" aural warning plays. BAGGAGE SMOKE AFT-FWD CAS message is displayed and "Aft Baggage Smoke" and "Forward Baggage Smoke" aural warning plays.
Landing Gear	None	Red and green landing gear indicators illuminate. "Landing Gear" aural warning plays.
Angle of Attack	None	AOA pointer goes to 1, stick shaker activates, and indexer lights illuminate.
Windshield Temp	Select WINDSHIELD ANTI-ICE BLEED switch to HI or LOW. Select OFF after message appears.	After four seconds, the W/S AIR O'TEMP CAS message appears.
Overspeed	None	Overspeed warning tone plays.
Anti-Skid	None	ANTISKID FAIL CAS message appears.
Annunciators	None	MASTER WARNING RESET, MASTER CAUTION RESET, autopilot controls, Bottle Armed, and START-DISENG, ENGINE START buttons illuminate.
TAWS	None	TAWS TEST CAS message is displayed. Audio "TAWS System Test OK" is heard if the test passes.
TCAS	None	TCAS TEST CAS message is displayed. PFD resolution advisory indications and traffic symbols on the maps display, and audio "TCAS System Test OK" plays. If the test fails, the TCAS FAIL CAS message is displayed and a "TCAS II System Test Failed" aural message is heard.
Radio Altimeter	None	Radio altimeter indicates 50 feet and RA TEST appears and a rising runway.
Rudder Bias	None	RUDDER BIAS FAIL CAS message is displayed.

DOOR CAS MESSAGE

MESSAGE	DESCRIPTION
AFT DOOR OPEN	Aft baggage door is not locked.
CABIN DOOR OPEN	Cabin door is open.
CABIN DOOR SEAL	The primary door seal pressure is too low to maintain door seal integrity. This message is inhibited if aircraft is on the ground and the cabin door is open or if both engines are not running while on the ground.
NOSE DOOR OPEN L-R	Nose baggage door is not locked.
EMERGENCY EXIT OPEN	Emergency exit is not secure.

ELECTRICAL CAS MESSAGES

MESSAGE	DESCRIPTION
BATTERY OVERTEMP	Battery temperature is greater than +62°C. This message will repost when battery temperature exceeds +71°C.
GENERATOR OFF L-R	Both generator contacts are open AND the aircraft is in the air. This message has a three-second time delay before displaying.
GENERATOR OFF L-R	Loss of a single generator. This message is inhibited when the same-side start contact is closed and has a three-second time delay before displaying.
J-BOX LIMITER OPEN	Failure of a 225-amp current limiter.
J-BOX REMOTE CB TRIP	Left or right start circuit breaker on the aft J-Box has opened.

LIGHTING CAS MESSAGES

MESSAGE	DESCRIPTION
EMER LTS NOT ARMED	EMER LIGHTS switch is not in the ARMED position.

FUEL CAS MESSAGES

MESSAGE	DESCRIPTION
FUEL BOOST ON L-R	Boost pump is on due to low fuel pressure.
FUEL FLTR BYPASS L-R	This message indicates an impending bypass of the fuel filter.
FUEL LEVEL LOW L-R	Fuel low level switch tripped. Signal must be true for 30 seconds to turn the message on, and false for 90 seconds to turn the message off.
FUEL PRESS LOW L-R	The fuel pressure switch has sensed low pressure for two seconds or greater.
FUEL TRANSFER ON	This message is amber when transfer valve is active and if fuel is being transferred from the side with lower fuel quantity (boost pump is active on the side with the lower fuel quantity). This message is also amber if the transfer system has been active for more than 10 minutes. Otherwise, it is white.
FIREWALL SHUTOFF L-R	Either the fuel or hydraulic shutoff valves are closed. This message is amber if there is a mismatch between fuel and hydraulic. There is a two-second delay before the message changes to amber.
FUEL BOOST ON L-R	This message signifies that the fuel boost pump is on.
FUEL TRANSFER ON	This message is white if the fuel transfer is active and the active FUEL BOOST input side matches the fuel tank side with a higher quantity OR the fuel transfer for less than 10 min.
FIREWALL SHUTOFF L-R	This message is white if both the fuel and hydraulic shutoff valves are closed. There is a two-second delay before the message changes to amber.

ENGINE CAS MESSAGES

MESSAGE	DESCRIPTION
ENGINE FAIL L-R	This message posts when an engine fails and does not appear to the FADEC to be a normal shutdown.
OIL PRESSURE LOW L-R	Engine is running and the oil pressure is below limits.
ENG CNTRL FAULT L-R	Indicates a fault in the FADEC. This message is inhibited for 10 seconds after initial aircraft power-up.
ENGINE SHUTDOWN L-R	Engine has been intentionally shut down with the throttle in cutoff.

FIRE CAS MESSAGES

MESSAGE	DESCRIPTION
BAGGAGE SMOKE FWD	Smoke has been detected in the nose baggage compartment. This message will remain for the rest of the flight even if the smoke has dissipated.
BAGGAGE SMOKE AFT	Smoke has been detected in the tail cone baggage compartment. This message will remain for the rest of the flight even if the smoke has dissipated.
ENGINE FAIL L-R	An engine has failed.
ENGINE FIRE L-R	Engine fire detection system has sensed an engine fire or overheat condition.

PNEUMATIC CAS MESSAGES

MESSAGE	DESCRIPTION
CABIN DOOR SEAL	There is a door seal fault. The message is inhibited if the aircraft is on the ground and the cabin door is open. It is also inhibited if either engine is not running while on the ground.
EMERGENCY PRESS ON	Emergency pressurization has turned on. Normally, the emergency pressurization only turns on if manually activated by the AIR SOURCE selector or automatically activated due to high cabin altitude.
FRESH AIR ON	AIR SOURCE selector switch is in the FRESH AIR position and the aircraft is in the air or the throttles are advanced to the CRU detent or higher. The aircraft will not pressurize in the FRESH AIR mode.
FRESH AIR ON	AIR SOURCE selector switch is in the FRESH AIR position. The message will be amber if the aircraft is in the air or the throttles are advanced to the CRU detent or higher.

ICE & RAIN CAS MESSAGES

WING A/I COLD L-R	This message is amber any time the onside wing bleed-air switch is ON for 120 seconds but the surface did not reach the required temperature OR if the switches are mismatched for more than 10 seconds. On the ground there is a white message preceding the amber message.
WING A/I O'TEMP L-R	Wing leading edge exceeds the overtemperature sensor setting.
ENGINE A/I COLD L-R	The white message only appears on the ground and is removed after 120 seconds to be replaced with an amber message.
ENGINE A/I ON	This message will post when either engine bleed-air switch is in the ENG ONLY position.
P/S COLD L-R-STBY	Pitot static heater is off. White message is active only when the aircraft is on the ground and either thrust lever is less than cruise power.
TAIL DE-ICE FAIL	This message statically posts when the EMER inhibit logic has been satisfied to remind the pilot that the tail deice is failed when in emergency power.
TAIL DE-ICE ON	Tail deice is on.
WING A/I COLD L-R	The white message only appears on the ground and is removed after 120 seconds to be replaced with an amber message.
WING/ENG A/I ON	This message will post when either bleed-air switch is in the WING/ENG position.

ICE & RAIN CAS MESSAGES (CONT'D)

MESSAGE	DESCRIPTION
BLEED AIR O'TEMP L-R	Bleed air leaving the precooler is too hot.
ENGINE A/I COLD L-R	This message is amber any time the onside engine bleed-air switch is ON for 120 seconds but the surface did not reach the required temperature OR if the switches are mismatched for more than 10 seconds. On the ground there is a white message preceding the amber message.
P/S COLD L-R-STBY	Pitot static heater is off or inoperative. Amber message is active only when the aircraft is in the air or both thrust levers are greater than cruise power.
P/S HEAT ON	The pitot-static heat has been on for two minutes while on the ground.
TAIL DE-ICE FAIL	Tail deice has failed.
T2 HEATER FAIL L-R	T2 heater has failed.
TAIL DE-ICE ON	RAT is less than –35°C and the tail deice system is on or the tail deice system is off and the boots are inflated.
W/S AIR O'TEMP	This CAS message indicates a windshield air overtemperature or the shutoff valve has failed open.

AIR-CONDITIONING CAS MESSAGES

MESSAGE	DESCRIPTION
AIR DUCT OVERTEMP	The air duct has exceeded a temperature of 300°F.
BLEED AIR O'TEMP L-R	Bleed air overheat.
EMERGENCY PRESS ON	The emergency pressurization has turned on. Normally, the emergency pressurization only turns on if manually activated by the AIR SOURCE selector or automatically activated due to high cabin altitude.
FRESH AIR ON	FRESH AIR is selected on AND aircraft is in the air OR THROTTLE levers are near cruise power settings or above.
FRESH AIR ON	FRESH AIR is selected on AND aircraft is on the ground AND THROTTLE levers are below cruise power settings.

PRESSURIZATION CAS MESSAGES

MESSAGE	DESCRIPTION	INHIBITS
CABIN ALTITUDE	Indicates that the cabin altitude is above approximately 9,500 feet during normal operations and 14,500 feet in High Elevation mode.	LOPI, TOPI
EMERGENCY DESCENT	Indicates the emergency descent mode of the autopilot is active. This mode will activate when the autopilot is on, the airplane altitude is above FL300 and, the cabin altitude exceeds approximately 14,500 feet.	LOPI, TOPI
EMERGENCY PRESS ON	Indicates the emergency pressurization system has been turned on at the AIR SOURCE selector or automatically activated due to high cabin altitude.	EMER, LOPI, TOPI
HIGH ELEVATION MODE	This message is active if the pressurization controller is in the High Elevation mode AND the airplane is in the air with the CABIN ALT at exceeding 9,500 feet for more than 30 minutes.	EMER, LOPI
PRESSURIZATION CNTRL	This message indicates the pressurization controller is unable to automatically control cabin pressure. This may be due to a failure in the pressurization system or the PRESSURIZATION switch was selected to STBY position.	EMER, LOPI, TOPI
HIGH ELEVATION MODE	Indicates that the pressurization controller High Elevation mode is active.	EMER, LOPI
PRESSURIZATION CNTRL	This message is displayed when the BATTERY switch is selected to EMER in emergency as a reminder that the pressurization controller is inoperative.	

HYDRAULIC CAS MESSAGES

MESSAGE	DESCRIPTION
FIREWALL SHUTOFF L-R	Either the fuel or hydraulic shutoff valves are closed. This message is amber if there is a mismatch between fuel and hydraulic. There is a two-second delay before the message changes to amber.
HYD FLOW LOW L-R	This message indicates that the flow sensor in the hydraulic line is not sensing any flow of fluid. If message is displayed for one side, it indicates a faulty pump. If message is displayed for both sides, it could indicate loss of fluid.
HYD PRESS ON	Hydraulic pressure has been on at least 40 seconds.
FIREWALL SHUTOFF L-R	This message is white if both fuel and hydraulic shutoff valves are closed. There is a two-second delay before the message changes to amber.
HYD PRESS ON	Hydraulic pressure is on.

GEAR & BRAKES CAS MESSAGES

MESSAGE	DESCRIPTION
NO TAKEOFF	Indicates the airplane is not in a safe takeoff configuration. Takeoff must be aborted.
ANTISKID FAIL	This message posts when ANTISKID is inoperative and has an 8 second delay in the air.
BRAKE PRESSURE LOW	Hydraulic pressure in the power brake system is insufficient. On the ground, this message cannot be acknowledged using the MASTER CAUTION RESET switches. Both CAS messages will stay on and the message continues to flash until the issue is corrected. This message also incorporates a 20-second delay in flight.
PARK BRAKE HANDLE	This message indicates the parking brake handle is not in the fully released position.
WOW MISCOMPARE	Indicates the main gear squat switches do not agree.
BRAKE PRESSURE LOW	The power brake system has failed when in emergency power.
PARK BRAKE HANDLE	This message indicates the parking brake handle is not in the fully released position. If the airplane is in the air, the message is amber.
NO TAKEOFF	Indicates the airplane is not in a safe takeoff configuration. This message will turn red if throttles are advanced. One of the following items is not in the takeoff position: • Flaps - 0° or 15° • Elevator Trim - In takeoff band • Speed Brakes - Retracted • Parking Brake - Released

HYDRAULIC CAS MESSAGES

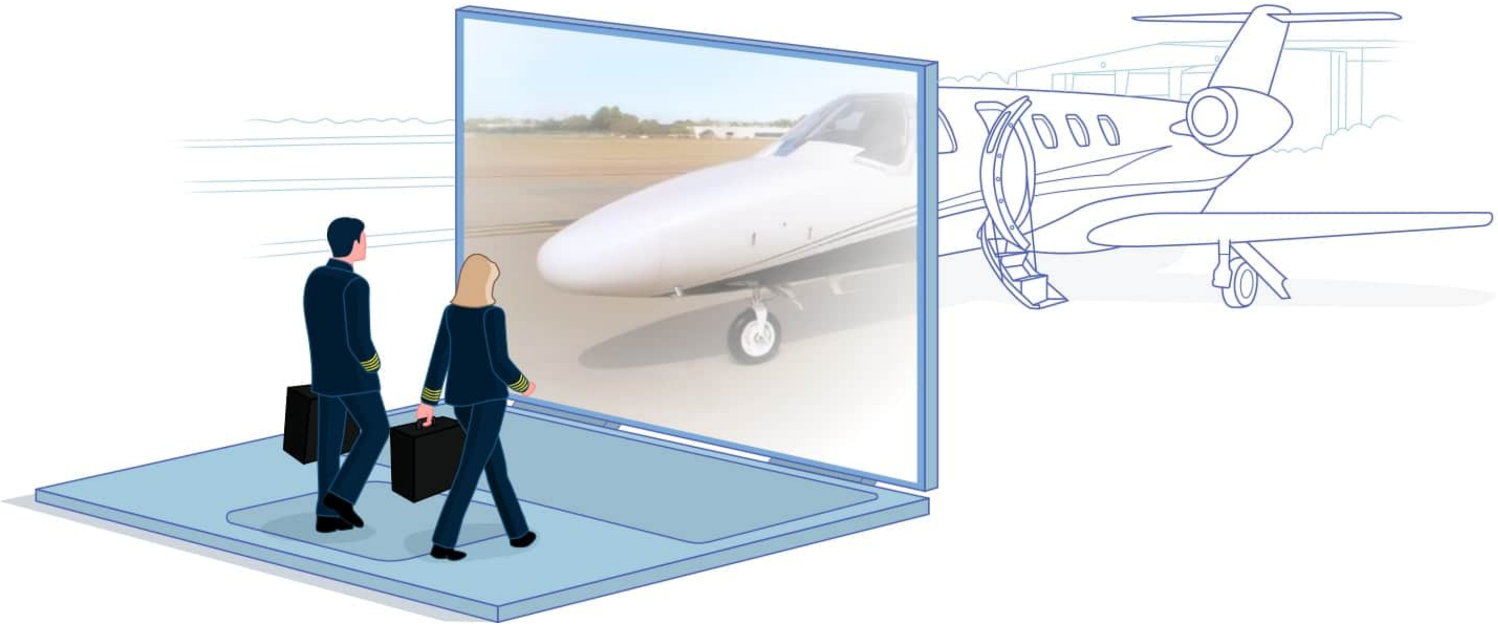
MESSAGE	DESCRIPTION
NO TAKEOFF	Indicates the airplane is not in a safe takeoff configuration. Takeoff must be aborted. If flaps are greater than 20°, speedbrake not retracted, the parking brake handle is set, or trim not in takeoff signals are received, the flight controls are not set correctly. This message occurs near CRU detent at approximately 85% N_2.
ELEC PIT TRIM FAIL	This message posts when any of the following has occurred: • Either Trim switch is stuck • PITCH TRIM circuit breaker is not powered • Pitch servo has lost power or has internally failed
FLAPS > 35	This message is active if the airplane is in the air AND the flaps are extended beyond 35°.
HYD FLOW LOW L-R	Indicates inoperative or cavitated hydraulic pump(s) or other hydraulic problem. If the airplane is on the ground, this message is inhibited when the same side engine is not running. If the airplane is in the air: • If hydraulic flow is low on one side, message is inhibited by same-side engine shutdown. • If both sides are low, message has no inhibits.
HYD PRESS ON	Indicates hydraulic system has been pressurized for more than 40 seconds.

HYDRAULIC CAS MESSAGES (CONT'D)

RETRIM L-R WING DOWN	This message indicates the autopilot is using a larger than normal roll force. Large wheel forces will be present if the autopilot disengages. L/R indicates direction to trim to relieve force.
RETRIM NOSE UP-DOWN	This message indicates there will be major control column forces if the AP is disengaged at this time. Up/down indicates the direction to trim to relieve the force.
RUDDER BIAS FAIL	Indicates that the rudder bias system valve is closed.
FLAPS > 35	Indicates the flaps are extended beyond 35° when the airplane is on the ground. If the airplane is in the air, the message will be amber.
HYD PRESS ON	Indicates hydraulic system has been pressurized.
NO TAKEOFF	Indicates the airplane is not in a safe takeoff configuration. Takeoff must be aborted. If flaps are greater than 20°, speedbrake not retracted, the parking brake handle is set, or trim not in takeoff signals are received, the flight controls are not set correctly. This message is white if both throttles are less than 85% N_2.
SPEED BRAKES EXTEND	Indicates both speedbrake panels have deployed.

AUDIO WARNING SYSTEM

Various audio warnings are incorporated into airplane systems that warn of specific conditions and malfunctions.



FUEL SYSTEM

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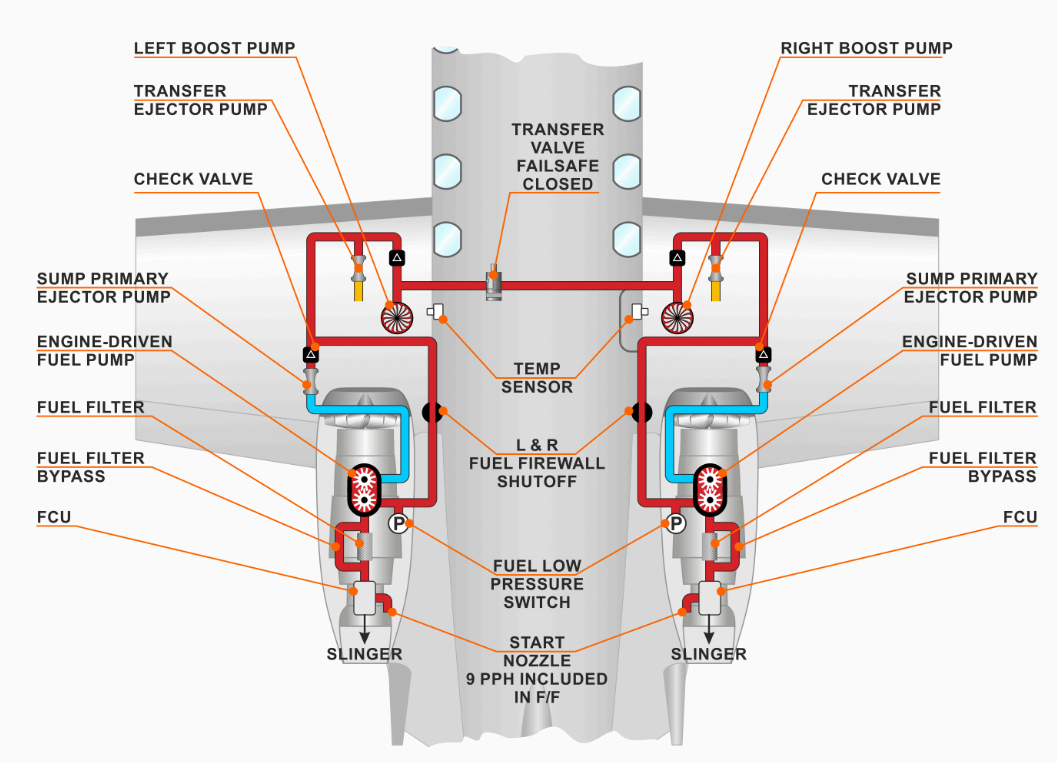
The engine is limited to 10 seconds of continuous flight at zero- or negative-g.

GENERAL

Each wing tank holds a combined fuel quantity of 2,355 lbs per side (351 gallons), or 4,710 lb total. Fuel flow to the engines is accomplished with electrically driven boost pumps and an ejector pump, one in each tank.



FUEL TANKS

Fuel is stored in each wing in a sealed wing structure.

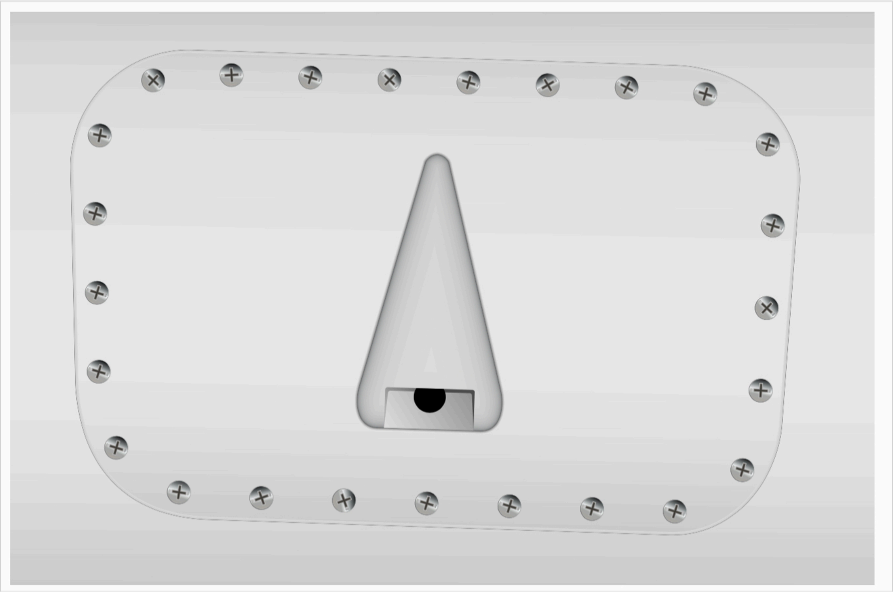
Each tank includes:

- A vent system
- Fuel quantity probes
- A filler cap
- Sump drains
- Ejector pumps
- An electrically driven boost pump.

FUEL TANK VENT

TANK VENTS

A fuel venting system is installed in each wing to maintain a positive pressure on the fuel within the wing. It also serves as an overflow drain and equalizes the pressure within the tank as fuel is consumed. The vent uses a NACA design to prevent icing.



FUEL FILLER

TANK FILLER

The aircraft is refueled by a single over the wing fuel cap. A variety of fuels can be used in the airplane, including Commercial kerosene Jet A, Jet A-1, Jet B, JP-4, JP-5, and JP-8. Do not use Avgas. The fuel is heated as it circulates through the oil/fuel heat exchanger. This eliminates the need for adding a Prist.

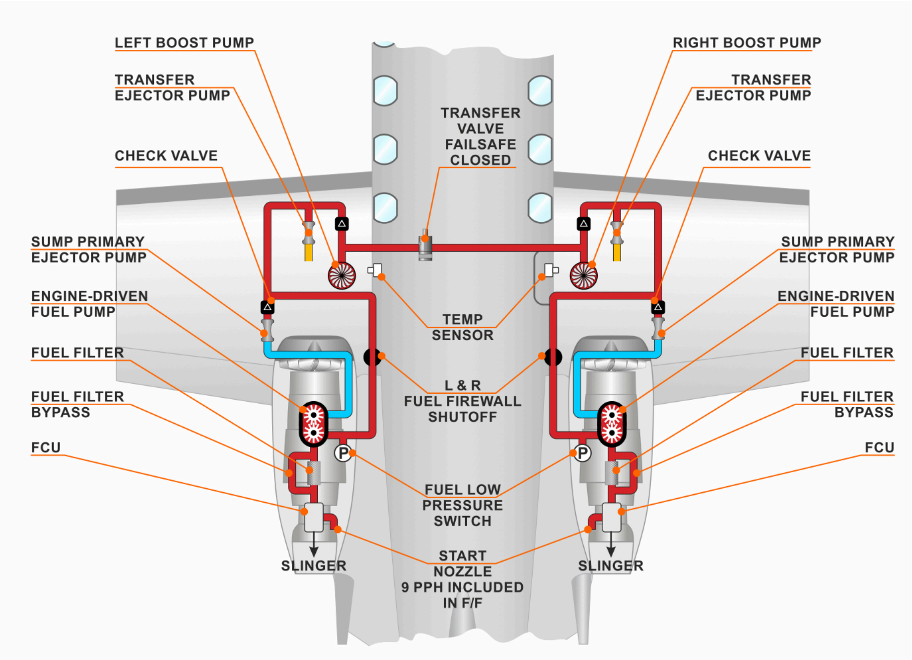
DRAIN VALVES

There are ten total fuel quick drains. Three drains are located in the lower surface of each wing and two are positioned outside of each main gear. Jet fuel absorb moisture from the air and also contains water. Drain the sumps before the first flight of the day and after each refueling.

MAJOR COMPONENTS FUEL TRANSFER SYSTEM

BOOST PUMPS

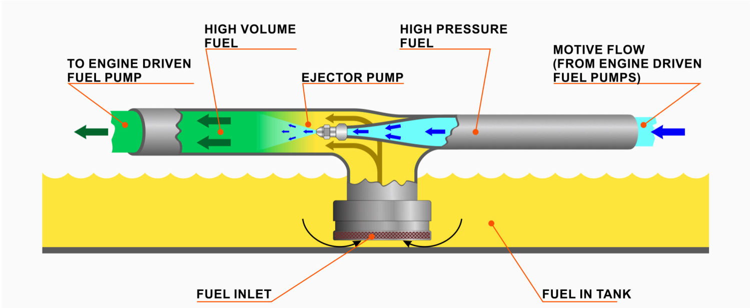
A low-pressure boost pump is located in each fuel tank sump. The DC powered pump supplies fuel to the high-pressure engine-driven fuel pump, and the scavenge ejector pumps. The boost pump can supply fuel to the on-side engine, both engines, or to the fuel transfer system.



MAJOR COMPONENTS FUEL TRANSFER SYSTEM (CONT'D)

EJECTOR PUMPS

There are 3 ejector pumps in each wing. The primary ejector pump receives motive flow from the engine-driven fuel pump and is the primary source of pressurized fuel flow to the engine-driven fuel pump and the scavenge ejector pumps. The scavenge pumps move fuel from the lowest point in the fuel tank to the sump.



MAJOR COMPONENTS FUEL TRANSFER SYSTEM (CONT'D)

FUEL TRANSFER VALVE

When the transfer valve is energized, the white FUEL TRANSFER CAS illuminates. It is an electrically operated valve and is spring-loaded (fail-safe) closed if there is a loss of normal DC power. The white FUEL TRANSFER ON CAS will change to amber if the receiving tank has 60 pounds more fuel than the sending tank. It will also change to amber if the transfer switch is left on for longer than 10 minutes.

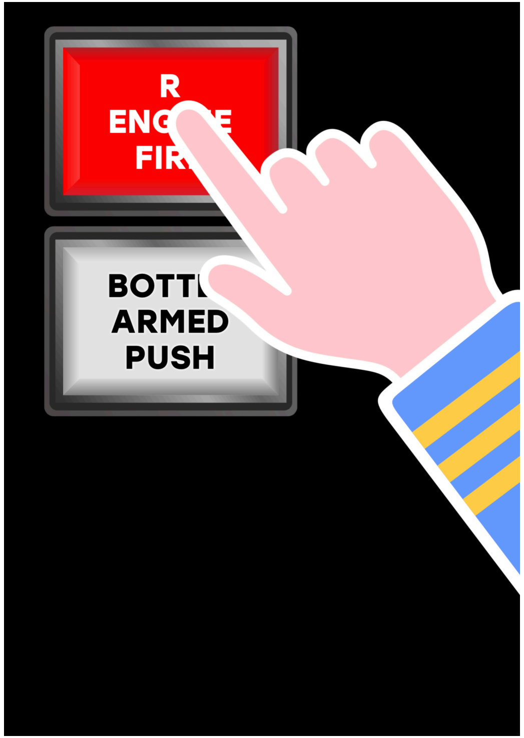
FUEL SHUTOFF VALVES

SHUTOFF VALVES

- The electrically driven fuel firewall shutoff valves are operated by red LH or RH ENG FIRE switchlights located on the glareshield.
- Normally the valves are closed only in the event of engine fire or test.

When both the fuel and hydraulic firewall shutoff valves are closed on an engine, the applicable amber LH or RH F/W SHUTOFF amber CAS light will illuminate. Pushing the ENG FIRE lights a second time opens the shutoff valves and extinguishes the F/W SHUTOFF CAS message.

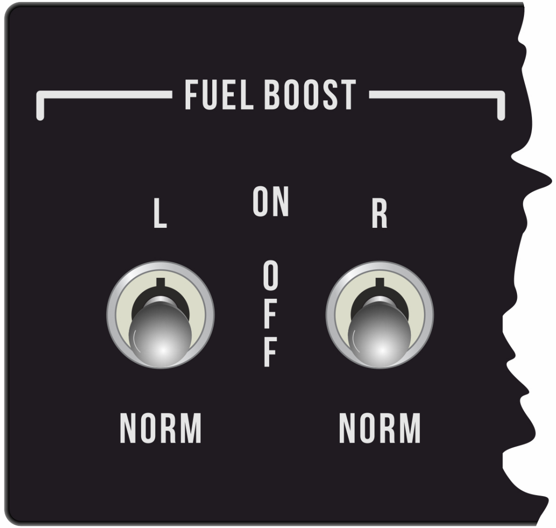
NOTE:
If an engine is shut down in flight for reasons other than fire, the firewall shutoff valves must be open, and the boost pump operated to prevent damage to the engine-driven fuel pump.



FUEL SYSTEM CONTROLS

CONTROLS

The LH or RH FUEL BOOST pump switches control the electrically driven boost pumps. It has three positions labeled "ON–OFF–NORM." The switch should be in NORM during flight. If the throttle is in CUTOFF, the pumps are disabled in NORM. The pumps will operate continuously with the switch in ON, regardless of throttle position.



In the NORM position: The boost pump operates automatically during:

1. Engine start.
2. Transfer operation.
3. If low fuel pressure is sensed in the engine fuel supply line.

(If the throttle is in cutoff, the boost pump will not come on automatically, even though the switch is in NORM.)

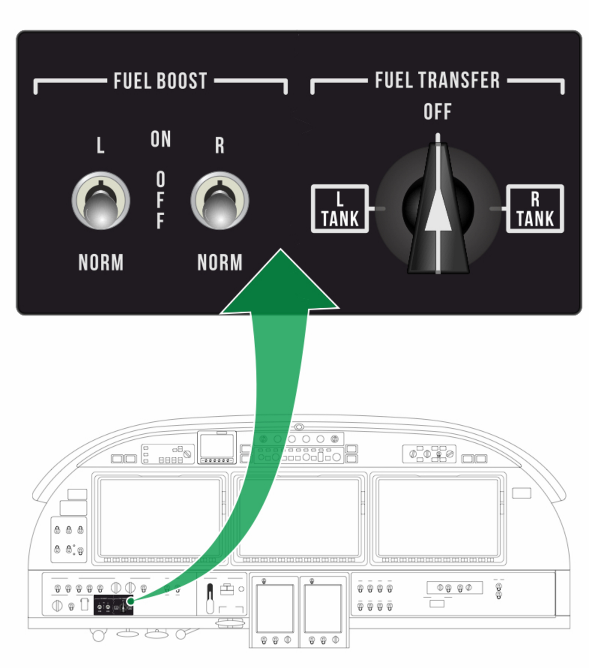
In the **OFF** position, the boost pump will not operate.

FUEL HEATER AND SUMP TEMPERATURE

The left and right fuel temperature sensors in each sump measure and display sump temperature. Fuel temperature appears just below the FUEL totalizer on the engine section of the MFD. All motive flow fuel is heated as it circulates through the oil/fuel heat exchanger. Oil flows through the engine to the fuel heat exchanger heating the fuel to eliminate suspended water icing. The heated fuel eliminates the need for a fuel anti-icing additive. Heated fuel is routed to the primary ejector pump, the engine fuel pump, the scavenge ejector pumps, and helps warm the sump fuel. The maximum allowable fuel temperature is 57°C for all fuels. Refer to the AFM for minimum temperature limits for each approved fuel.

MAJOR COMPONENTS FUEL TRANSFER SYSTEM (CONT'D)

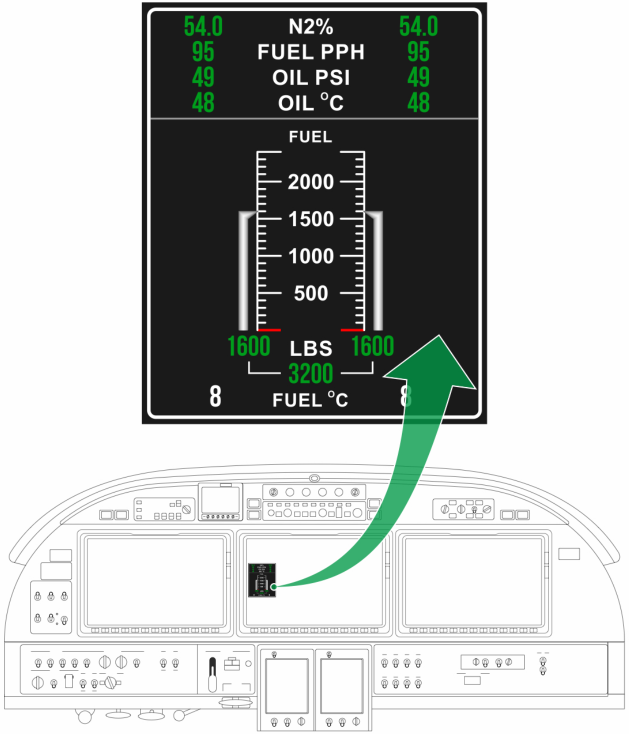
The TRANSFER selector has three positions LH TANK–OFF–RH TANK. The arrow on the switch points to the wing sump receiving fuel. Verify fuel transfer by monitoring the fuel quantity indicators. Fuel transfers to the selected tank at approximately 600 pounds per hour. Maximum fuel imbalance for normal operation is 200 pounds. Maximum demonstrated fuel imbalance for emergency return to the airfield is 600 pounds.



MAJOR COMPONENTS FUEL SYSTEM

INDICATING SYSTEM

QUANTITY INDICATION
The fuel system has 14 capacitance probes, 7 in each wing tank. These probes provide input to dual indicating FUEL QTY indicators. If the MFD fuel quantity has failed, the white tape is removed, and the boxed readout is replaced by four yellow dashes.



FUEL SYSTEM CAS MESSAGES

MESSAGE	DESCRIPTION
FUEL BOOST ON L-R	Boost pump is on due to low fuel pressure.
FUEL FLTR BYPASS L-R	This message indicates an impending bypass of the fuel filter.
FUEL LEVEL LOW L-R	Fuel low level switch tripped. Signal must be true for 30 seconds to turn the message on, and false for 90 seconds to turn the message off.
FUEL PRESS LOW L-R	The fuel pressure switch has sensed low pressure for two seconds or greater.
FUEL TRANSFER ON	This message is amber when transfer valve is active and if fuel is being transferred from the side with lower fuel quantity (boost pump is active on the side with the lower fuel quantity). This message is also amber if the transfer system has been active for more than 10 minutes. Otherwise, it is white.
FIREWALL SHUTOFF L-R	Either the fuel or hydraulic shutoff valves are closed. This message is amber if there is a mismatch between fuel and hydraulic. There is a two-second delay before the message changes to amber.
FUEL BOOST ON L-R	This message signifies that the fuel boost pump is on.
FUEL TRANSFER ON	This message is white if the fuel transfer is active and the active FUEL BOOST input side matches the fuel tank side with a higher quantity OR the fuel transfer for less than 10 min.
FIREWALL SHUTOFF L-R	This message is white if both the fuel and hydraulic shutoff valves are closed. There is a two-second delay before the message changes to amber.

FUEL SYSTEM OPERATION

1. The FUEL BOOST pump switch is in the NORM position.
2. The engine START button is depressed.
3. The Fuel boost pump starts automatically.
4. Once the engine start terminates, the boost pump is deenergized and the FUEL BOOST ON light extinguishes.

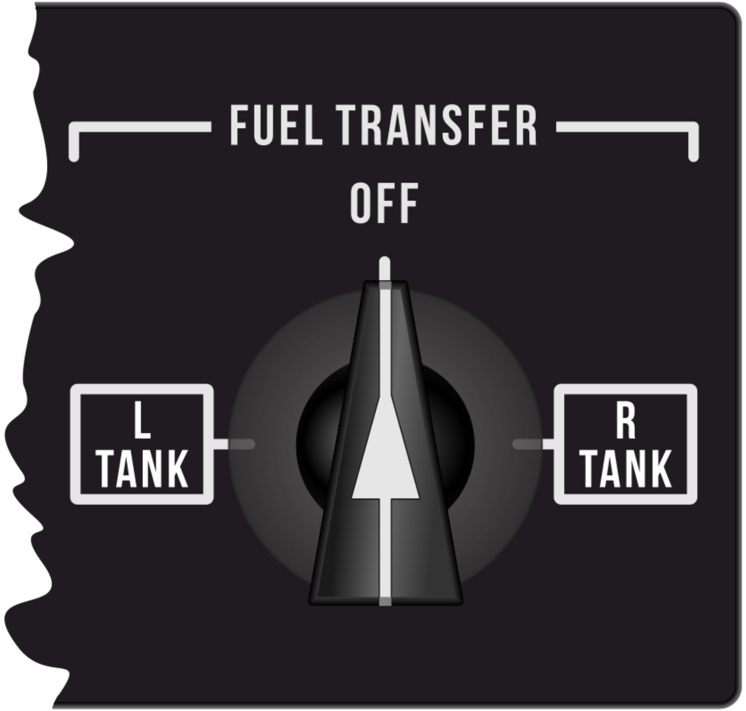
Additionally, the firewall shutoff valves are normally open. They can be closed by pressing the LH or RH ENG FIRE switchlight in the event of an engine fire. Illumination of the amber LH or RH F/W SHUTOFF CAS message verifies that the fuel and hydraulic firewall shutoff valves have closed.

FUEL TRANSFER SYSTEM

To stop fuel transfer and return the system to norn operation:

1. Transfer switch to OFF.
2. FUEL BOOST ON CAS should extinguish.
3. FUEL TRANSFER CAS should extinguish.

If the electrical power fails during crossfeed operation, t transfer valve FAILS to the CLOSED position. If the boo pump switch is OFF, the transfer circuit will not function.



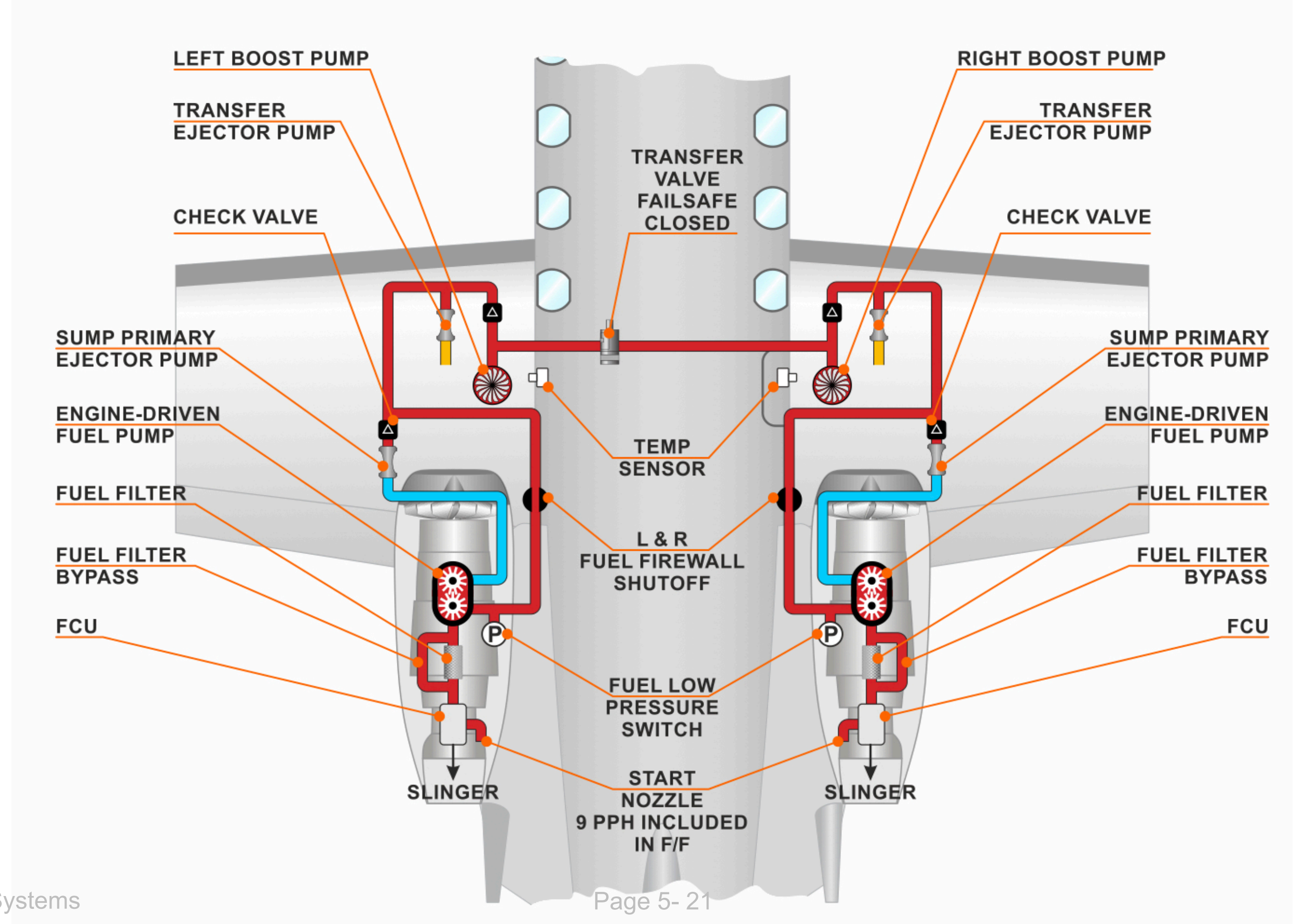
OPERATING THE FUEL TRANSFER SYSTEM

TIP:

- If both FUEL BOOST ON CAS light illuminate when transfer is selected, it indicates that both boost pumps are operating, and fuel transfer cannot occur.
- Cycle the FUEL BOOST pump switch for the non-selected tank to ON, then back to NORM. This will de-energize the pump in the tank not selected and allow crossfeeding to begin.

TIP:

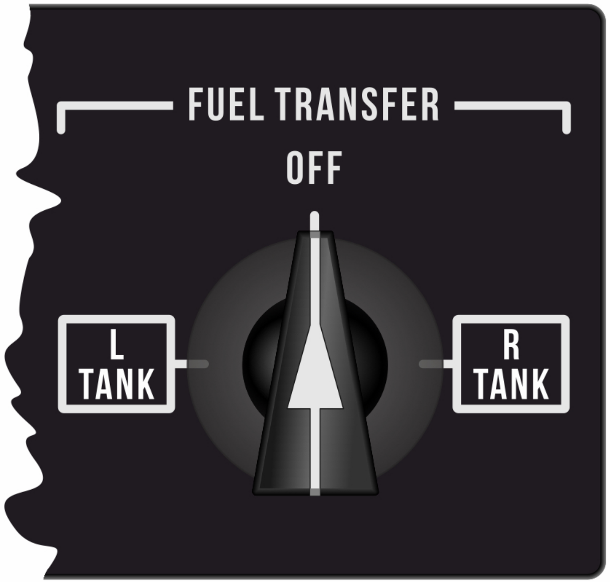
- If the FUEL CROSSFEED CAS light illuminates when fuel transfer has not been selected, turn both boost pumps on to prevent crossfeeding.


LEFT BOOST PUMP
TRANSFER EJECTOR PUMP
CHECK VALVE
SUMP PRIMARY EJECTOR PUMP
ENGINE-DRIVEN FUEL PUMP
FUEL FILTER
FUEL FILTER BYPASS
FCU
SLINGER
TRANSFER VALVE FAILSAFE CLOSED
TEMP SENSOR
L & R FUEL FIREWALL SHUTOFF
FUEL LOW PRESSURE SWITCH
START NOZZLE 9 PPH INCLUDED IN F/F
RIGHT BOOST PUMP
TRANSFER EJECTOR PUMP
CHECK VALVE
SUMP PRIMARY EJECTOR PUMP
ENGINE-DRIVEN FUEL PUMP
FUEL FILTER
FUEL FILTER BYPASS
FCU
SLINGER
P
P

MAJOR COMPONENTS FUEL TRANSFER SYSTEM (CONT'D)

FUEL TRANSFER SELECTOR

The FUEL TRANSFER selector has three positions, LH TANK – OFF – RH TANK. The tail of the arrow shows tank fuel is being drawn from while the arrow points to the tank to be filled.



FUEL TRANSFER SYSTEM

FUEL TRANSFER ON

The transfer valve is electrically opened and spring-loaded closed.

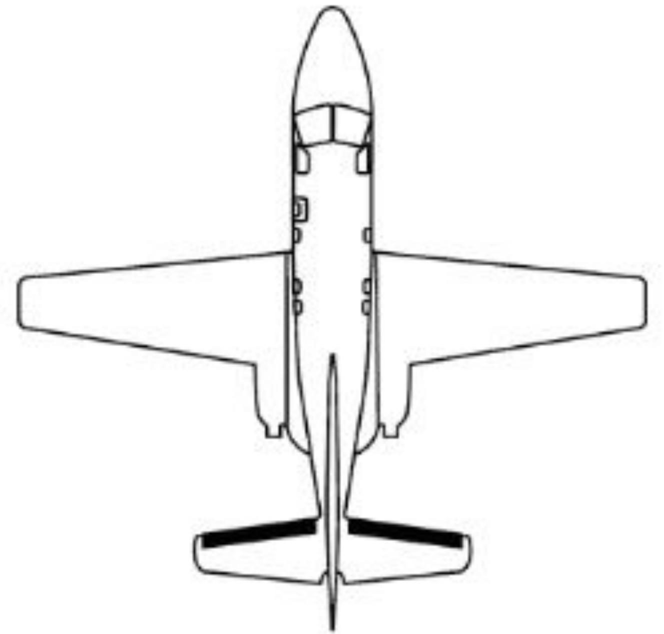
Selecting LH TANK to RH TANK on the fuel transfer switch will activate the left-wing electric boost pump and open the crossfeed valve. Fuel is delivered from the left-wing sump through the open crossfeed valve and into the right-wing sump.

The arrow on the fuel transfer switch points the direction the fuel is flowing. When the crossfeed valve is energized, the FUEL TRANSFER white CAS light illuminates.

FUEL SERVICING

GENERAL

Fuel servicing includes those procedures necessary for fueling, adding anti-icing additives, and checking for contaminants and condensation in the fuel. Fuel servicing is accomplished through a filler cap on the outboard section of each wing. Normally, refuel to the screen at the bottom the filler standpipe for maximum usable fuel for flight planning.



FUEL SERVICING (CONT'D)

The following procedures, warnings, and cautions must be followed when using DIEGME (MIL-I-85470). Current precautions for EGME (MIL-I-27686) still apply.

Diethylene Glycol Monomethyl Ether (DIEGME) is harmful if inhaled, swallowed, or absorbed through the skin and will cause eye irritation. It is also combustible. Before using this material, refer to all safety information on the container.

Diethylene Glycol Monomethyl Ether (DIEGME) (MIL-I-85470) has been approved as an additional fuel anti-ice additive, and concentration for Ethylene Glycol Monomethyl Ether (EGME) (MIL-I-27686) has been changed for consistent mixing of additives.

Don't use less than 20 fluid ounces of additive per 156 gallons of fuel or more than 20 fluid ounces of additive per 104 gallons of fuel.

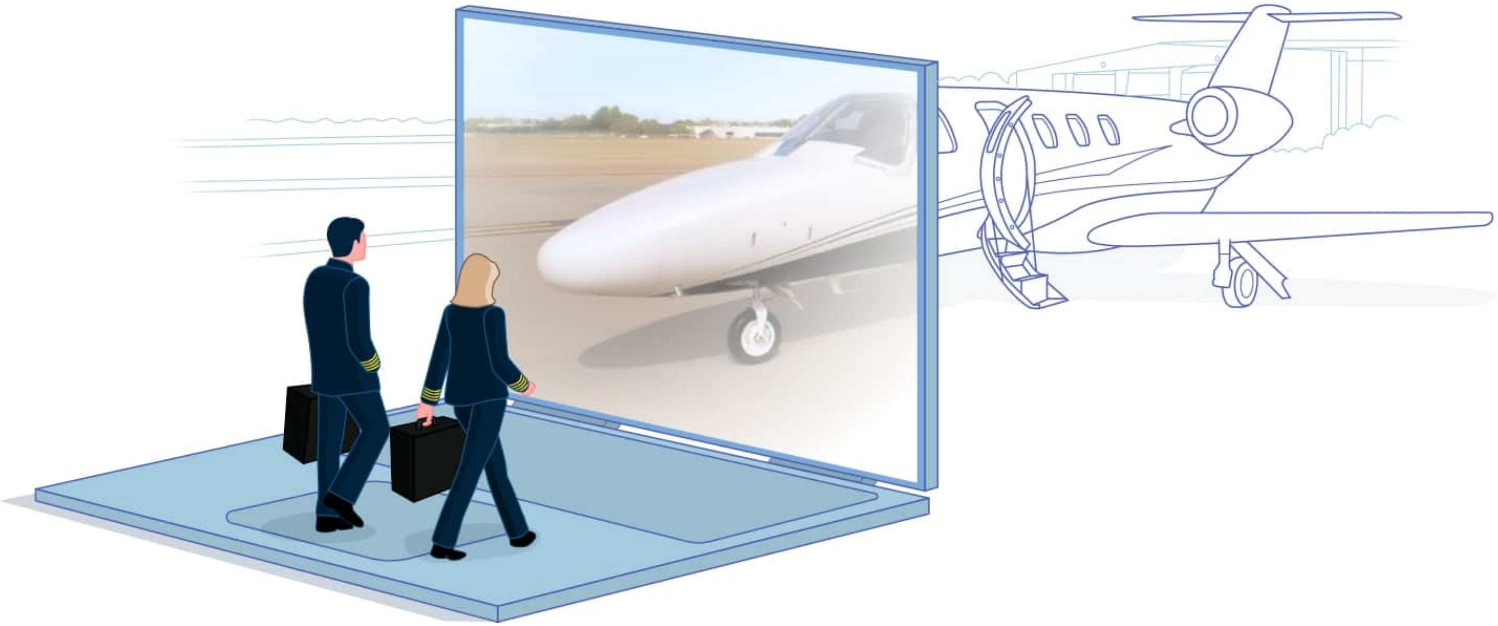
FUEL SERVICING (CONT'D)

REFUELING

All approved fuels for operation are listed in the limitations and specifications section of the AFM. Avgas is not approved.

DEFUELING

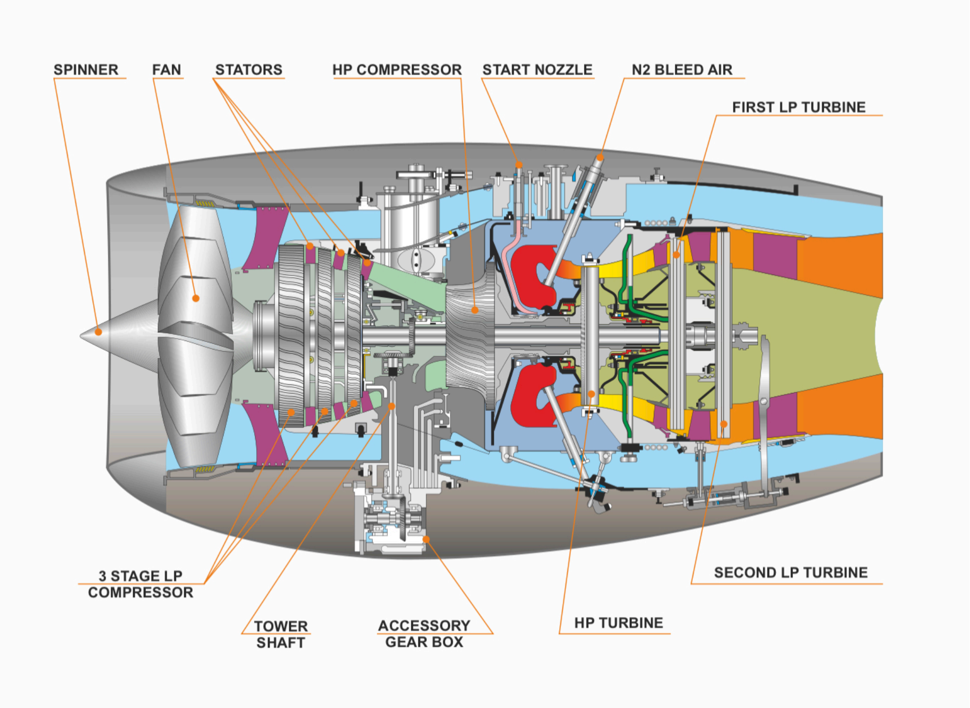
Defueling is accomplished by removing the engine cowling and disconnecting the FCU supply line. Connect an EPU and activate the fuel boost pump to defuel to the desired fuel quantity. Do not run the boost pumps dry. Fuel cannot be offloaded through the wing fuel caps due to the filler neck and screen.



POWERPLANT

GENERAL

Thrust is provided by two aft fuselage-mounted turbofan engines manufactured by Williams-Rolls. The engines are lightweight, twin-spool, medium bypass ratio FJ44-3A-24. Each engine develops 2,780 pounds of thrust at sea level. Engine control and operation is performed by a FADEC system.



OPERATING CONDITIONS	OPERATING LIMITS					
THRUST SETTING	TIME LIMIT (MINUTES)	ITT TEMPERATURE °C	N_2% TURBINE RPM	N_1% FAN RPM	OIL PRESSURE PSIG	OIL TEMPERATURE °C
START	---	REFER TO FIGURE 2-38	---	---	---	-40 TO 135 (NOTE 7)
GND IDLE	CONTINUOUS	---	53.4 (MIN.)	---	35 MIN. 100 MAX. (NOTE 6)	-40 TO 135 (NOTE 7)
FLT IDLE	CONTINUOUS	---	60.7	---	35 MIN. 100 MAX. (NOTE 6)	-40 TO 135 (NOTE 7)
TAKEOFF	5 (NOTE 1)	877 MAX.	100	102.8 (NOTE 1)	45 - 90 (NOTE 3)	0 TO 135
MAXIMUM CONTINUOUS	CONTINUOUS	840 MAX.	100	102.8 (NOTE 2)	45 - 90 (NOTE 3)	10 TO 135
TRANSIENT	---	REFER TO FIGURE 2-35	100.7 (20 SEC. MAX.)	103.9 (20 SEC. MAX.)	23 MIN. (NOTE 4) 100 MAX. (NOTE 5)	149 (NOTE 8)

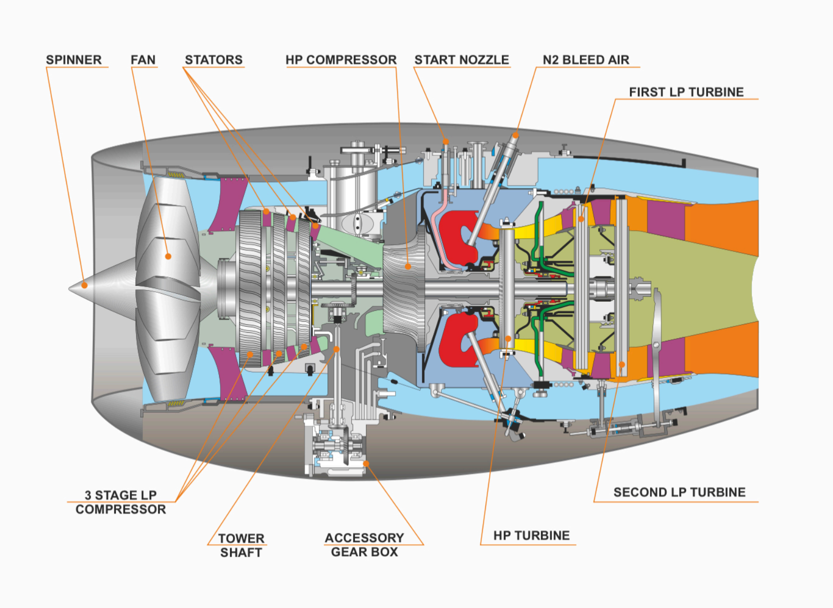
NOTE:

1. Takeoff thrust settings that are nominally limited to 5 minutes duration may be used for up to 10 minutes for One Engine Inoperative operations. Time limit begins when throttle lever is advanced for takeoff thrust. The takeoff thrust (N_1) for the airplane is defined in Figures 2-17 and 2-20, and is more limiting than engine rotational limits and must be observed. Performance data, including V_{MCA} and V_{MCG} in section IV, is based on use of the takeoff thrust setting.
2. Maximum Continuous Thrust (MCT) for the airplane is defined by Figures 2-23 and 2-26 (single engine), and Figures 2-29 and 2-32 (multi-engine). These thrust settings (N_1) are more limiting than engine rotational limits and must be observed. Performance data in section IV is based on the use of the appropriate MCT setting.
3. Minimum oil pressure is 45 PSIG when operating at or above 80% N_2, 35 PSIG when operating below 80% N_2.
4. Minimum allowable oil pressure is 23 PSIG for up to 5 minutes when operating below 80% N_2.
5. Maximum allowable oil pressure is 100 PSIG for up to 5 minutes, when operating at or above 80% N_2.
6. Maximum allowable oil pressure is 100 PSIG for up to 5 minutes, with oil pressure returning to normal range.
7. The engine should not be operated above 80% N_2 until oil temperature is above 10°C (+50°F).
8. Maximum oil temperature is 149°C (+300°F) for up to 5 minutes when operating below 80% N_2.

MAJOR ENGINE SECTIONS

The engine is divided into six major sections:

1. Intake and Fan
2. Compressor
3. Combustion
4. Turbine
5. Exhaust
6. Accessories

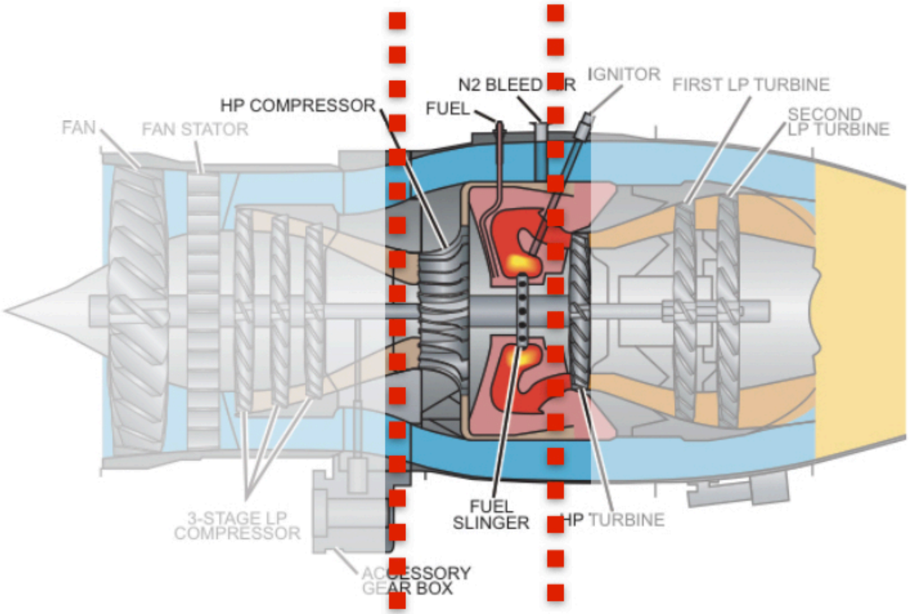


MAJOR ENGINE SECTIONS (CONT'D)

COMPRESSOR
- HP Compressor
- Compressor cover

DIFFUSER
- Fuel Manifold

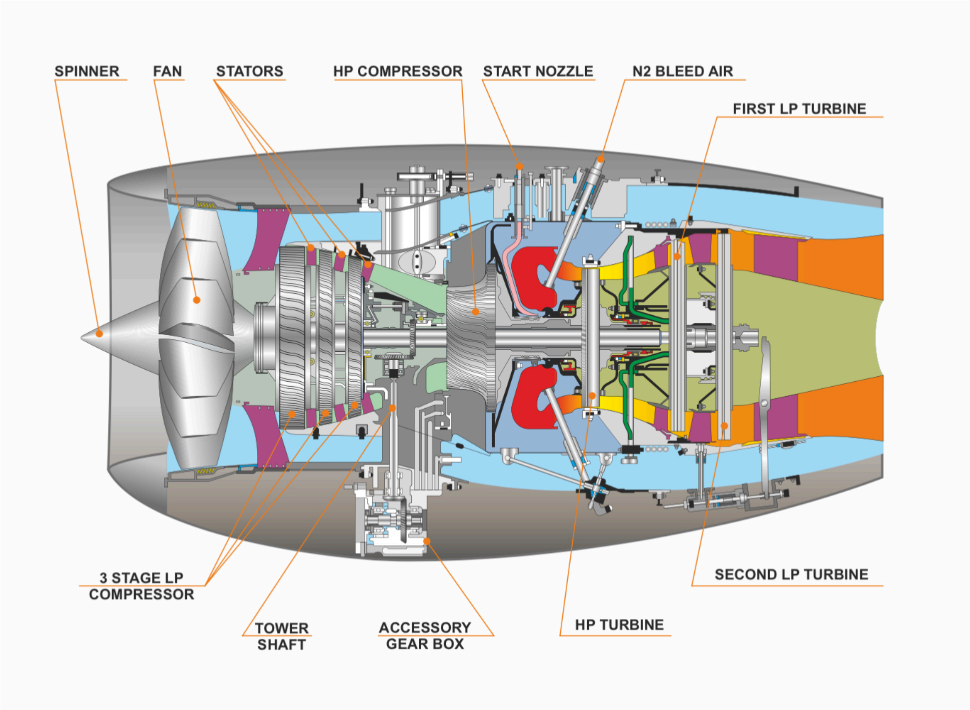
COMBUSTION
- Fuel Slinger



MAJOR ENGINE SECTIONS (CONT'D)

TURBINES

- HP Turbine
- 1st LP Turbine Nozzle
- 1st LP Turbine
- 2nd LP Turbine Nozzle
- 2nd LP Turbine



DESCRIPTION OF THE ENGINE SECTIONS

INTAKE AND FAN SECTION

This section includes the air intake and the fan assembly. The air intake divides into two concentric ducts aft of the fan assembly.(Bypass and Core)

The Fan Assembly consists of the nose cone, the fan stage, the single axial compression stage, and two sets of stator vanes.

DESCRIPTION OF THE ENGINE SECTIONS (CONT'D)

INTAKE AND FAN SECTION

1. Low-pressure compressor:
The bypass ratio is approximately 3.3:1. The fan contributes 68% of the total thrust at sea level. For every pound of air flowing through the engine core, 3.3 pounds of air flows through the bypass duct.

2. High-pressure compressor:
The high-pressure compressor is a single stage centrifugal compressor which receives airflow under pressure from the booster stage. It further increases the pressure and directs the airflow rearward.

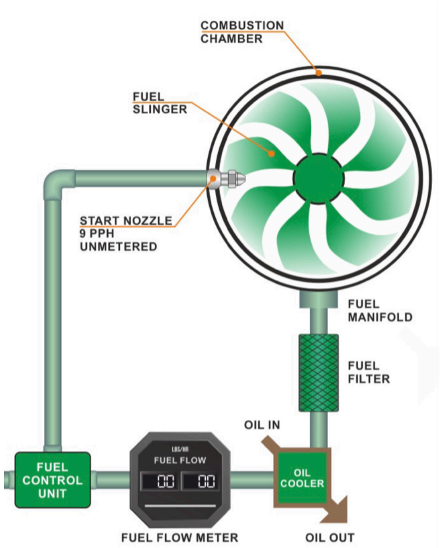
DESCRIPTION OF THE ENGINE SECTIONS (CONT'D)

COMBUSTION SECTION

The combustion section is a single annular-style combustor consisting of a combustor cover and a nozzle assembly. Fuel is added by a rotating slinger that atomizes the fuel and delivers it uniformly to the primary combustion zone.

START FUEL NOZZLE

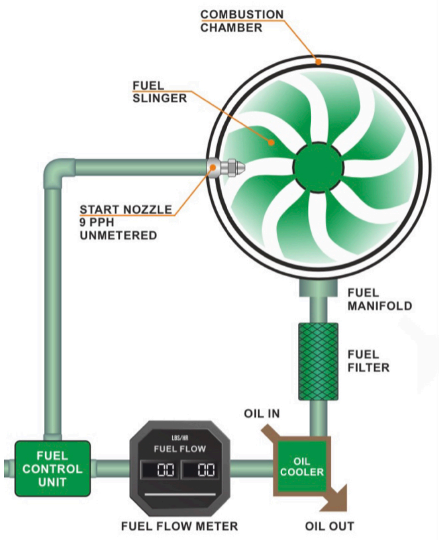
A single fuel nozzle provides enhanced altitude restart capability. This nozzle receives high pressure metered fuel from the Fuel Control Unit (FCU), and delivers approximately 9 pounds per hour of continuous flow anytime the engine is running. The 9 pounds per hour fuel consumption is not monitored by the fuel flow indicating system. The start nozzle delivers fuel anytime the engine is running. Selecting the throttle to off will shutoff the start nozzle.



DESCRIPTION OF THE ENGINE SECTIONS (CONT'D)

FUEL SLINGER

The fuel slinger assembly is a part of the HP rotary group. Fuel is sent to the underside of the slinger by the fuel manifold. As the slinger spins, centrifugal force causes atomized fuel to enter the combustion chamber through a series of small holes in the slinger.



DESCRIPTION OF THE ENGINE SECTIONS (CONT’D)

TURBINE SECTION

The turbine section has one high-pressure and two low-pressure turbines.

- The high-pressure turbine's (“N2” or “turbine”) job is to extract energy from the expanding combustion gases to drive the high-pressure compressor and the accessory section.
- The low-pressure turbine(“N1”, or “fan”) has two-stages. It is connected to the low-pressure compressor and fan.

DESCRIPTION OF THE ENGINE SECTIONS (CONT'D)

EXHAUST SECTION

This section consists of the primary exhaust duct and the bypass air duct. The combination of primary exhaust and bypass airflow produces the total thrust of the engine.

ACCESSORY SECTION

The accessory gear is driven by the high-pressure rotor shaft through a tower shaft and bevel gear. It functions to drive the following accessories:

- Oil pump
- Hydraulic pump
- Fuel pump and fuel control unit
- Starter-generator

ENGINE SYSTEMS

The engine systems include the following:

- Oil system
- Fuel system
- Ignition system
- Instrumentation
- FADEC control
- Synchronization

ENGINE OIL SYSTEM

GENERAL

The oil system cools and lubricates the engine bearings and the accessory section. The only approved oils are Mobil Jet II or Mobil 254. Mixing of approved oils is permissible. All oils are MIL-L-23699.

OIL TANK

The 4.5-quart oil reservoir incorporates a filler port used for servicing and checking quantity.

ENGINE OIL SYSTEM (CONT'D)

Check the oil within 10 minutes after engine shutdown. The engine cowlings include an access door to a sight glass with FULL and ADD marks to check the oil level. If it becomes necessary to add oil, ensure the engine oil cap is secured after servicing. The engine is equipped with a check valve that prevents oil loss if the cap is not seated properly.

ENGINE OIL SYSTEM (CONT'D)

OIL PUMP

An engine-driven oil pump with one pressure and two scavenge elements provides pressure, lubrication and oil scavenging. It is mounted on the accessory section.

OIL TANK

The oil cooler is an oil-to-fuel heat exchanger mounted on the engine gearbox. Output fuel from the fuel control unit is used to cool the engine oil. This also heats the fuel reducing the chance of icing forming from water in the fuel.

OIL FILTER

The oil filter has a disposable cartridge and is used to remove solid contaminants from the oil. The filter will bypass oil if it becomes clogged. There is no cockpit indication that the filter is bypassing. The bypass warning indicator is a pop out button that on is checked during the exterior preflight through an access panel on the lower engine nacelle.

ENGINE OIL SYSTEM (CONT'D)

OIL PRESSURE

The engine oil pressure is maintained within limits by a mechanical relief valve located on the oil pump housing.

INDICATION

The oil pressure is sensed by dual transmitters utilizing a pressure transducer that sends the input to the EIS display. The indicator is calibrated in pounds per square inch.

If the oil pressure sensors fail, three amber dashes are displayed in the digital readout.

Oil Pressure EIS Display

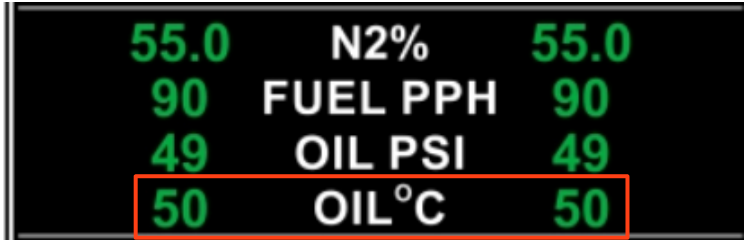
ENGINE OIL SYSTEM (CONT'D)

Starting in cold weather conditions:
Starting an engine that has been cold-soaked in below freezing temperatures, can lead to high oil pressure. As the oil temperature rises while the engine is at idle, the oil pressure will fall. The engine should not be run above 80% N2 until oil temperature is above 10°C (50°F). The relief valve opens if oil pressure rises over 100 psi to speed oil warmup.

ENGINE OIL SYSTEM (CONT'D)

Oil temperature is sensed by a resistance bulb, then transmitted as a signal to a digital display on the EIS. If the oil temperature data fails, three amber dashes will be displayed. display.

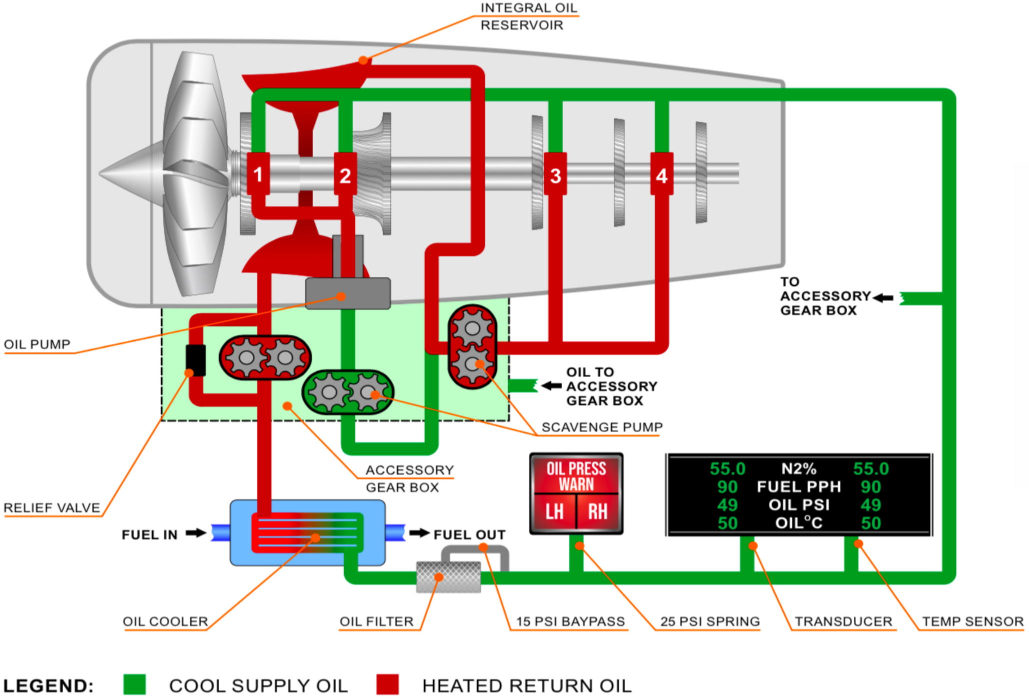
NOTE:
Mixing of approved oils is permissible.
Maximum oil consumption 0.1 quart per hour.

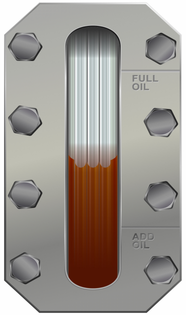


ENGINE OIL SYSTEM (CONT'D)

The maximum permissible normal operating oil consumption is approximately 0.1 quart per hour. Inflight shutdown windmilling oil consumption is approximately 0.8 quart per hour.

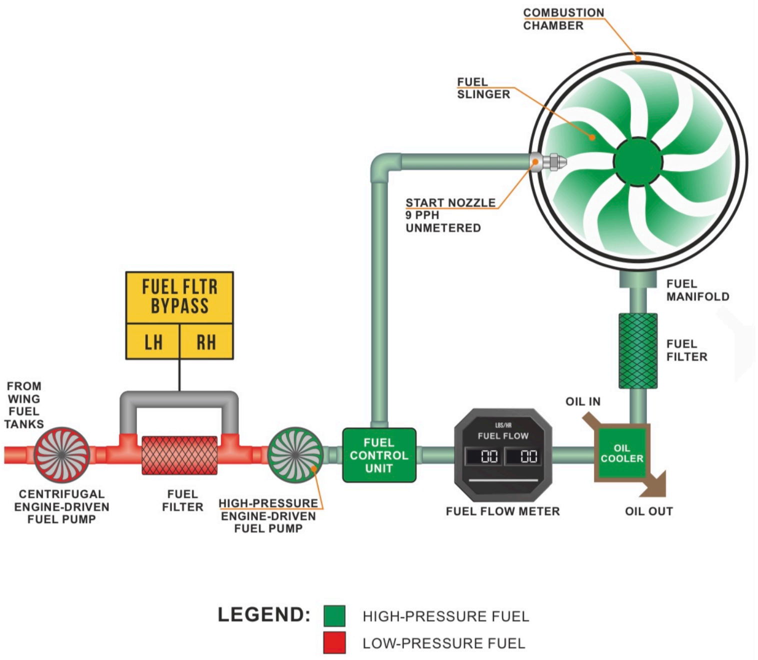
OIL SYSTEM


INTEGRAL OIL
RESERVOIR
1
2
3
4
TO
ACCESSORY
GEAR BOX
OIL PUMP
OIL TO
ACCESSORY
GEAR BOX
SCAVENGE PUMP
ACCESSORY
GEAR BOX
RELIEF VALVE
OIL PRESS
WARN
LH
RH
55.0
N2%
55.0
90
FUEL PPH
90
49
OIL PSI
49
50
OIL°C
50
FUEL IN
FUEL OUT
OIL COOLER
OIL FILTER
15 PSI BAYPASS
25 PSI SPRING
TRANSDUCER
TEMP SENSOR
LEGEND:
COOL SUPPLY OIL
HEATED RETURN OIL


FULL
OIL
ADD
OIL

ENGINE FUEL SYSTEM

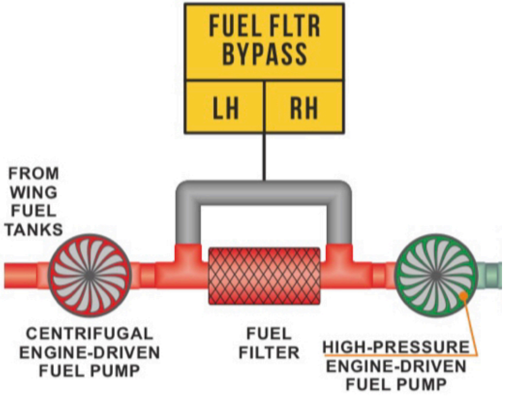
The FADEC-controlled engine-driven fuel delivery unit (FDU) is driven through a gearbox attachment. The FDU includes the main engine fuel pump, main engine fuel filter, metering components, and a permanent magnet alternator (PMA). The FDU supplies fuel to a manifold leading to the fuel slinger, a fuel shutoff valve, and a start nozzle. The fuel slinger rotates and ejects fuel radially through a series of holes into the combustion chamber.



ENGINE FUEL SYSTEM (CONT'D)

FUEL PUMP

The dual-stage fuel pump receives 6 to 8 psi high-volume fuel supply and delivers high pressure 110 to 150 psi fuel to the FCU. This pump is not a suction pump and receives fuel under pressure from the wing tank. If this pump fails, the engine flames out since there is no other source of high-pressure fuel available to the engine.



FUEL FILTER

A disposable fuel filter removes any solid contaminants from the fuel. If the fuel filter becomes blocked, a filter bypass valve will bypass total fuel flow around the filter. A FUEL FLTR BYPASS annunciator and a MASTER CAUTION light will illuminate if fuel pressure drops to approximately 4.5 psid across the fuel filter.

If the FUEL FILTER BYPASS caution light illuminates,
it indicates impending or actual bypass. Land as soon as Practical.

ENGINE FUEL SYSTEM (CONT'D)

ACCELERATION BLEED VALVE

A fuel control unit (FCU) moves a cable connected to a butterfly bleed valve on top of the engine in the interstage housing. The acceleration bleed valve is open at start, closes over 85% N2 during engine acceleration, and reopens at approximately 85% N2 during deceleration. The bleed valve unloads the HP compressor, allowing improved acceleration response by venting bleed air into the bypass duct.

EMERGENCY FUEL SHUTOFF

An N1 shaft separation detection device detects N1 shaft movement. This prevents N1 rotor overspeed if N1 shaft separation occurs. If N1 shaft moves more than .050 inches, the FCU fuel shutoff lever automatically closes and terminates fuel flow.

ENGINE FUEL SYSTEM (CONT'D)

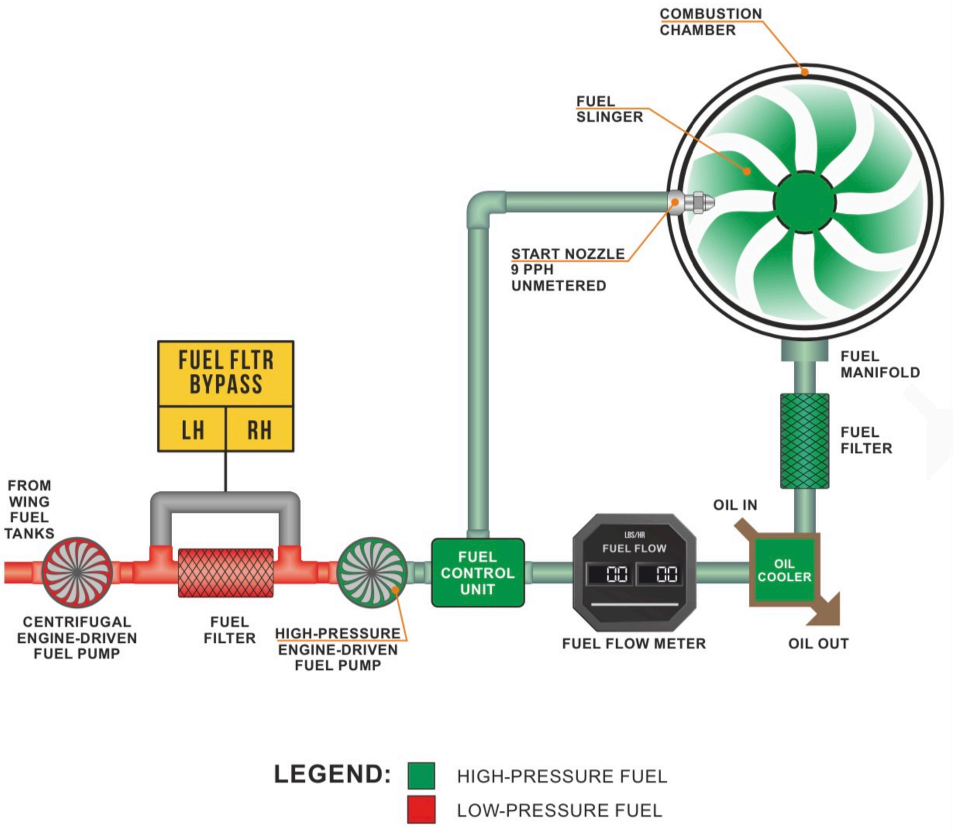
INDICATION

A flow meter measures fuel flow down stream from the FCU and displays fuel flow in pounds per hour digitally on the center instrument panel. A red OFF flag appears at the top of the indicator scale when DC power is not available. The 9 pounds per hour to the start nozzle is not metered.

NOTE:

Fuel-flow indication is disabled when the associated throttle is moved to cutoff. This prevents erratic fuel flow indications when rpm decreases below 10%.

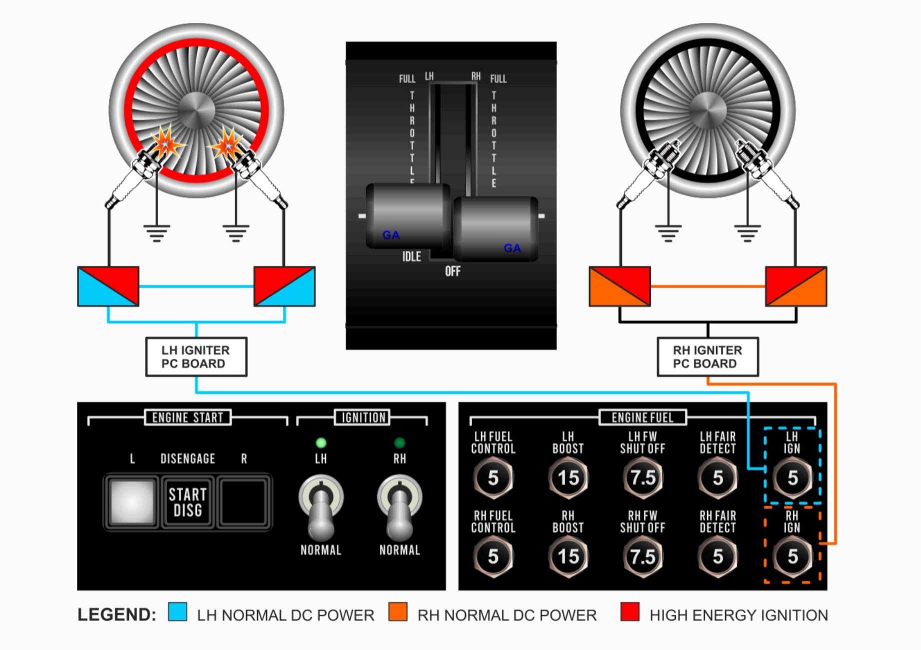
ENGINE FUEL SYSTEM (CONT'D)



ENGINE IGNITION SYSTEM

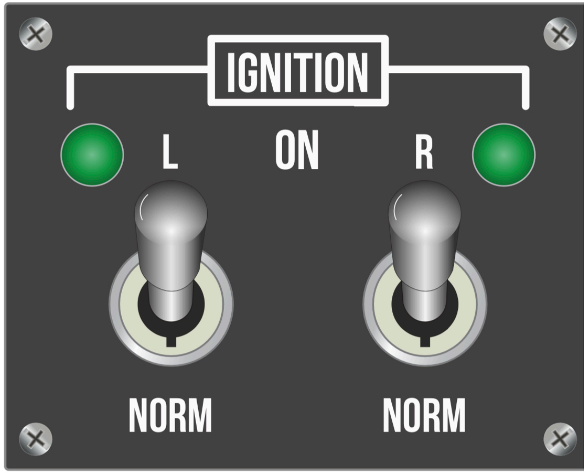
GENERAL

The ignition system incorporates a dual high energy ignition system on each engine consisting of two, side by side, exciter boxes mounted at the one o'clock position. Dual plugs(5 & 7 O'clock) are provided for redundancy only. One plug is sufficient to start or sustain the engine. With one igniter inoperative, the start will not be slower or hotter. Ignition operation is divided into automatic or manual phases.



ENGINE IGNITION SYSTEM (CONT'D)

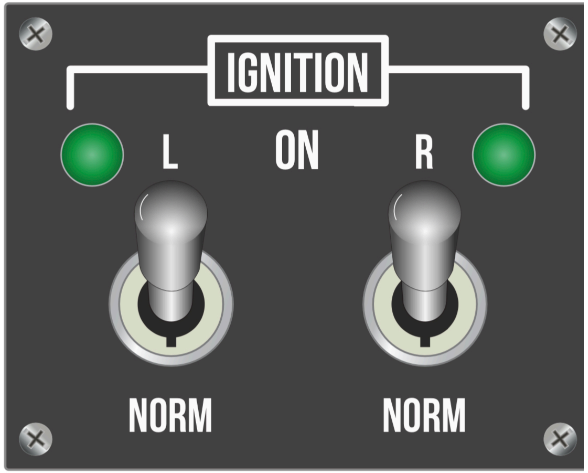
The ignition system is controlled by the FADEC, or by an ignition switch for each engine. The IGNITION switch has two positions: ON and NORM. When the IGNITION switch is in NORM, automatic ignition occurs during engine start and as determined by the FADEC. During normal ground engine starts, the FADEC alternates between the left and right igniter for each start. Both the left and right igniters are automatically selected for in flight restarts and during FADEC-detected flameout recovery.



ENGINE IGNITION SYSTEM (CONT'D)

Selecting the IGNITION switch to ON provides continuous ignition regardless of the position of the throttle. When the ANTI-ICE bleed-air switches are selected to ENG or WING/ENG, the igniters are not activated. The igniters are only activated by FADEC or when the IGNITION switch is turned ON. There is no time limit for ignition operation, but continuous use will reduce igniter life.

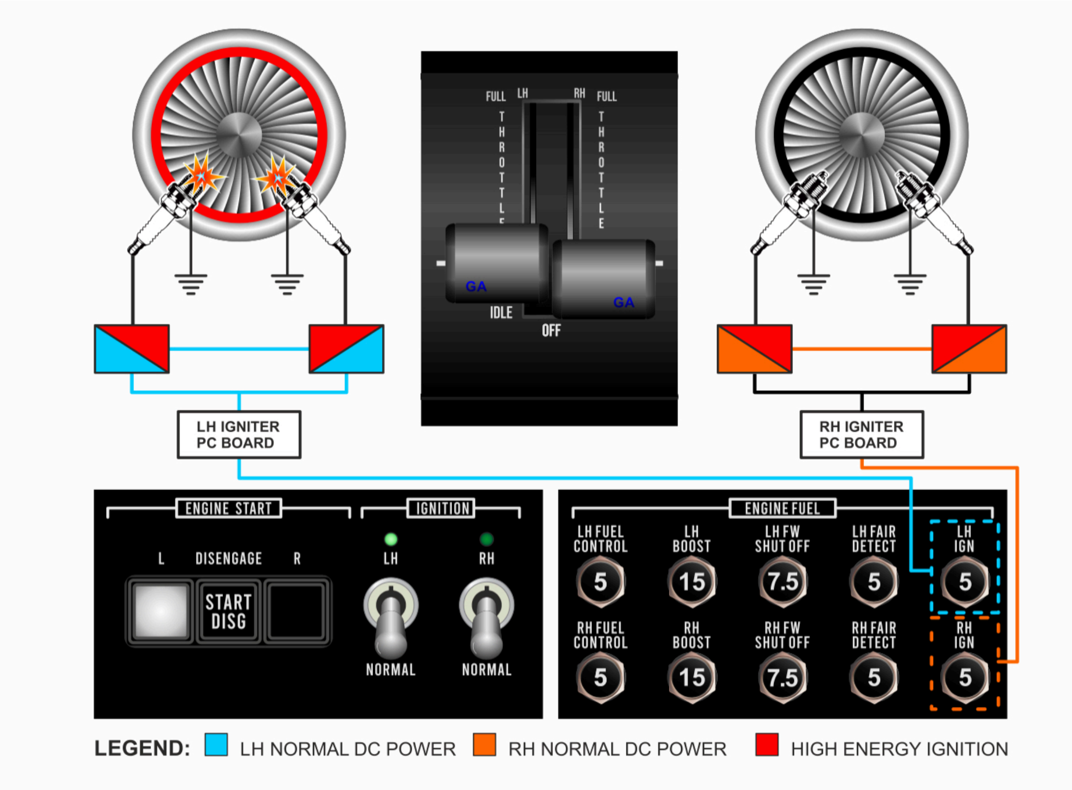
NOTE:
It is not necessary to select ignition to ON during takeoff or when in hail, rain, or runway slush.



ENGINE IGNITION SYSTEM (CONT'D)

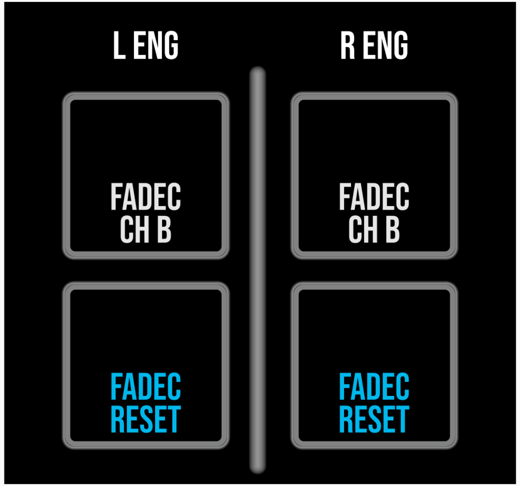
INDICATION

A green light illuminates above the IGNITION switch whenever power is available to one or both exciters.



FADEC CONTROL SYSTEM

The FADEC system uses the airplane's electrical system for starting. Although FADEC does not control the engine starter, it does control the ignition sequencing. The FADEC system utilizes only one igniter for ground starts, and alternates between igniters during subsequent starts. The FADEC uses both igniters for in-flight restarts and flameout protection.



Each FADEC system has two channels. Channel A and Channel B. If a failure occurs, the system will automatically switch to the opposite channel. They can also be manually switched by the crew. The channels automatically switch at engine shut-down in preparation for the next engine start.

FADEC CONTROL SYSTEM (CONT'D)

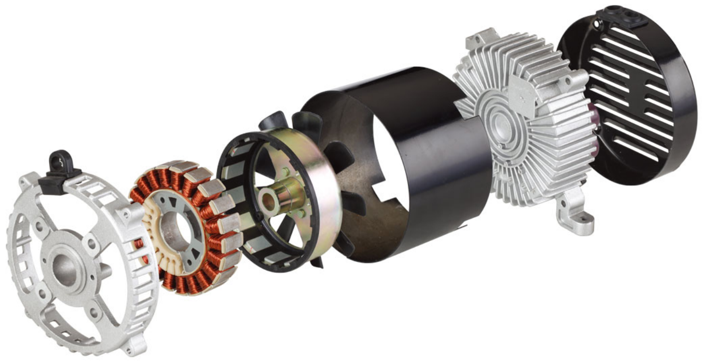
- FADEC provides automatic control of the engine power settings, transient control, and fuel delivery during starts.
- The FADEC controls fuel valve position to modulate fuel flow, controls the solenoid fuel shutoff valve, and control of engine bleed state.
- The FADEC limits critical parameters of N1, N2, and ITT. N1 is governed at high power and N2 at low power.
- Overspeed function limits for both N1 and N2 are governed by FADEC.

FADEC CONTROL SYSTEM (CONT'D)

Each engine has an independent FADEC system which incorporates two channels. (Channel A and Channel B) Each FADEC box is installed in the airframe near its respective engine. Either channel can operate as the primary engine control and is incorporated with an automatic switchover to the opposite channel in the event of a channel failure***. If both FADEC channels fail on one engine, the engine will shut down.*** There is no connection between the left and right engine FADECs to continue operating both engines from only one FADEC. Channel switchover occurs at engine shutdown in preparation for the next engine start.

PERMANENT MAGNET ALTERNATOR

Each engine has a permanent magnet alternator installed as part of the FDU. After engine start, the PMA becomes the primary power source for the FADEC system. Aircraft power is the secondary or standby power source. Even with a complete loss of airframe electrical power, the FADEC(s) will maintain engine operation utilizing the PMA.

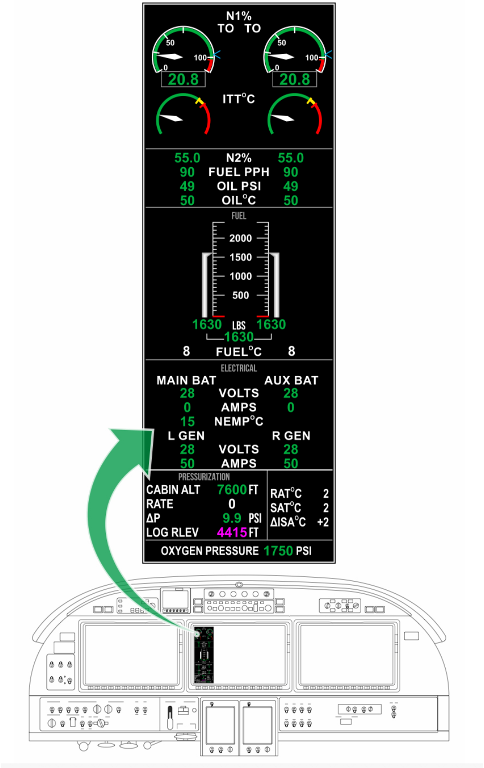


ENGINE INSTRUMENTATION

The Garmin 3000 uses two indicating systems for the engine:
1. (EIS) engine indicating system indications
2. Garmin Touchscreen Controllers (GTCs).

The EIS displays the powerplant indications on the multi-function display. (MFD). They include N1, ITT, N2, fuel flow, oil pressure and temperature. The data sources for N1, N2, and ITT are the FADECs.

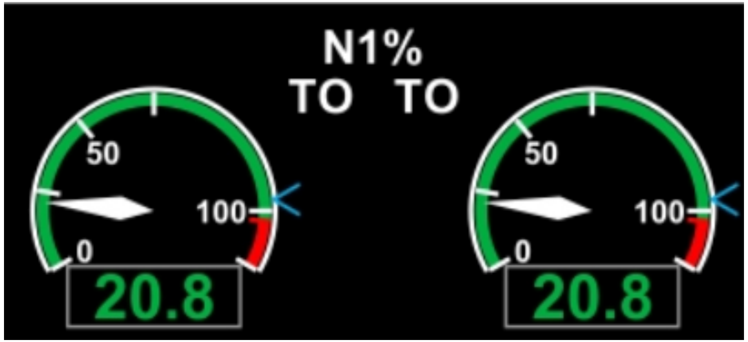
- Normal status, alerts, and warnings on the EIS are color coded:
- Green indicates within normal limits.
- Amber indicates a deviation from normal limits. An amber indication may need corrective action.
- Red color indicates absolute limits and indicates a need for immediate corrective action.



ENGINE INSTRUMENTATION (CONT'D)

N1 (FAN) RPM

N1 or fan rpm is supplied from a monopole pickup located in the compressor case next to the oil filler. The N1% EIS display has both analog and digital indications located the top of the EIS on the MFD. The display includes an N1 target bug and thrust command indication,



N1 is the primary thrust indicator, and all engine power settings are made with reference to N1.

N1 TARGET BUG AND THRUST COMMAND INDICATIONS

ENGINE CNTRL FAULT L-R

The N1 target bug is automatically set by the FADEC, and changes color based on the throttle position or FADEC status. During start, a blue target bug appears when the engines are at idle. This indicates the maximum available N1 speed that can be selected. After the engine reaches maximum FADEC calculated takeoff power, the bug turns green. If one of the two FADEC channels fails, the bug turns yellow in color and is accompanied by the ENGINE CNTRL FAULT L-R CAS message. After setting the throttles to the takeoff (TO), climb (CLB), or cruise (CRU) detents, the thrust command indication (TCI) will display the selected throttle position in green letters.

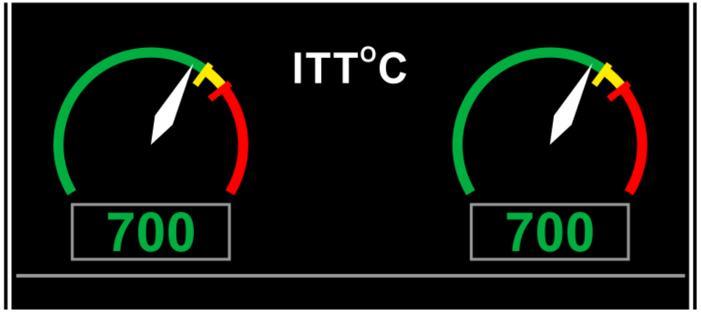
N1 DATA FAILURE

N1, N2, and ITT receive data from the FADEC system, with the left FADEC channel suppling data to the left EIS indications, and the right FADEC supplies data for the right indications. The N1 pointer is removed from the EIS if no FADEC N1 data is available. System redundancy is provided by automatic switchover to the opposite channel in the event of active channel failure.

If both sources of N1 fail for an engine, four amber dashes and a decimal point display on the N1% digital readout on the MFD/ PFD display

INTER-TURBINE TEMPERATURE DISPLAY

The inter-turbine temperature (ITT) gauge indicates the temperature between the first and second turbine stages in degrees Celsius. The temperature is displayed by an analog pointer or by a digital readout when the engine is off, during engine starts , or if the ITT exceeds normal limits. If desired, the ITT digital readout can be continuously displayed by selecting the Display Engine Digits button in the Propulsion page of either GTC. If the engine exceeds maximum ITT limits, the analog pointer turns red. During engine start, a yellow caution band appears on the ITT scale.



TURBINE N2 RPM

Turbine rpm is displayed as a percentage of N2 rpm on the MFD. A monopole pickup produces a signal proportional to N2 speed based on the fuel pump gear shaft speed. If a signal failure occurs, four amber dashes and a decimal point are displayed on the failed side's MFD. DC power failure will cause the MFD and EIS displays to fail, with no backup engine instrumentation displayed.

ENGINE POWER LEVERS

The throttles control engine power. A cutoff stop prevents inadvertent selection of cutoff. A latch on the throttle must be raised before the cutoff position throttle can be moved to, or from, the cutoff position.

Throttle Positions:

- **TO** - Takeoff thrust is produced when the throttle is in the TO position. Takeoff thrust is limited to 5 minutes duration but may be increased for 10 minutes for an engine failure.
- **MCT** - Maximum continuous thrust is produced when the throttle is in the MCT position.
- **CRU** - Maximum cruise thrust is produced when the throttle is in the CRU position.

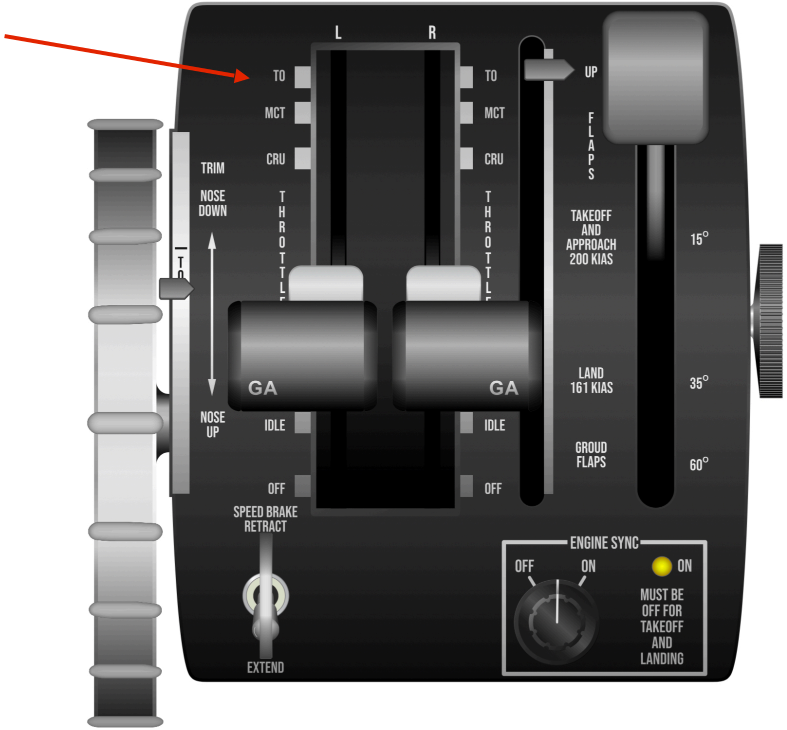
START SEQUENCE

During the start sequence, lift up the throttle latch and advance the throttle to the idle position. This activates the automatic ignition. During the start, the ITT must increase within 10 seconds and N1 fan rotation must be observed before reaching 25% N2. At 45% N2 the start sequence terminates, and the engine rpm increases to the ground idle rpm of approximately 51–54% N2.

THRUST CONTROL SYSTEM

The FADEC has five positioned power settings:

- Shutdown (OFF)
- IDLE position
- Maximum cruise thrust (CRU position)
- Maximum continuous thrust (climb) (MCT position)
- Takeoff thrust (TO position)



ENGINE STARTING

Abort the engine start starts for any of the following conditions:

- **FALSE START** - No ITT or fuel flow within 10 seconds after advancing the throttle to idle detent.
- **HOT START** - ITT rapidly approaching 1000°C.
- **NO N1** - rotation by 12% N2.
- **HUNG START** - slow or no rotation after ITT increases and prior to reaching idle rpm.

To abort a start:

1. Position the throttle to OFF.
2. Motor the engine for 15 seconds.
3. Push the starter disengage button.

ENGINE CYCLES

Engine operating life limits are determined by mechanical and thermal stresses which occur during engine operation making it imperative to record flight cycles (both partial and full). Total cycles is the sum of full and partial cycles accrued during each flight and must be recorded in the airplane logbook, for each individual engine at the completion of each flight as follows:

Full Cycle:

a. Engine start, takeoff power setting, followed by engine shutdown, regardless of duration
b. Inflight start

Partial Cycle:

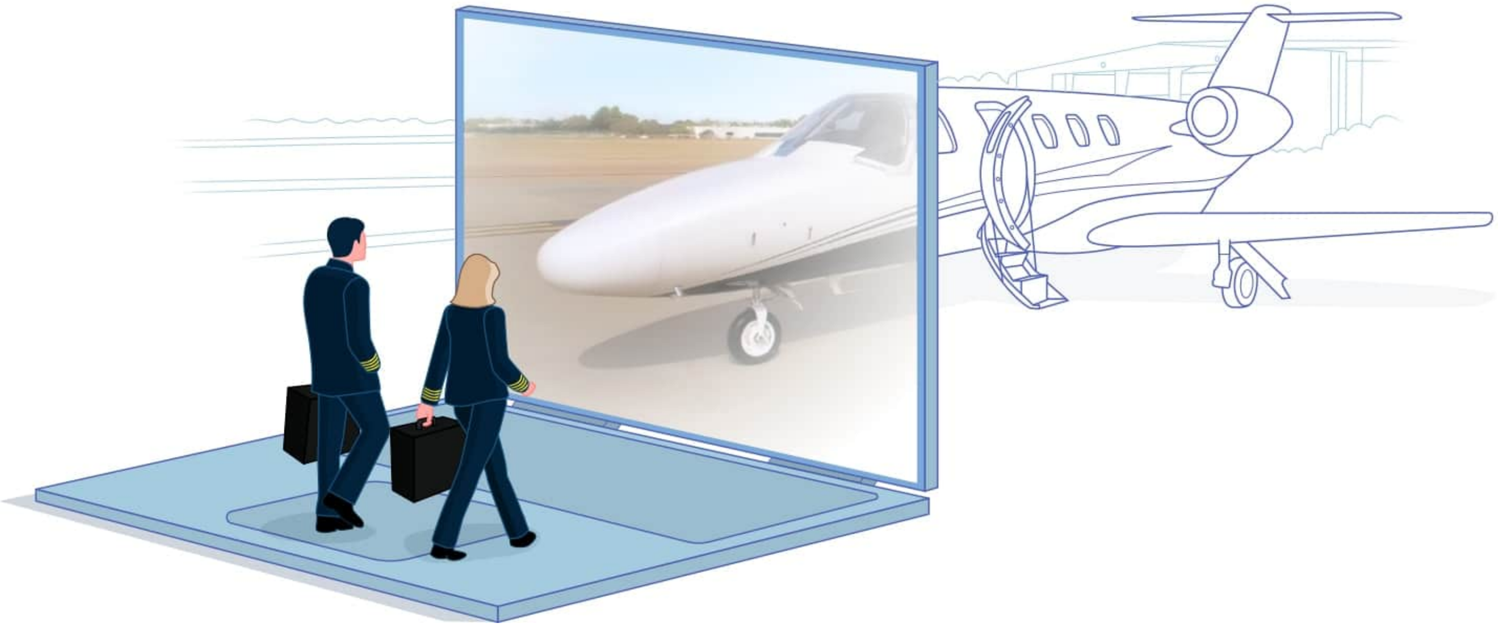
a. A touch-and-go landing—0.50 cycle
b. A full stop landing without engine shutdown—0.50 cycle
c. Ground running: Idle to maximum continuous thrust—0.50 cycle

ENGINE SYNCHRONIZATION

A synchronizer reduces the out-of-sync thrum of the turbine engines. The left engine is the master engine, and the right engine is the slave. The slave engine FADEC receives the fan or turbine speed requested from the master engine FADEC and schedules fuel flow to achieve the desired engine rotational speed. The system functions by adjusting the RPM of the right engine to match the left engine. Prior to using the synchronizer, the engines should be manually synchronized with the throttle to within ±1.5%. The system must be off during takeoff, approach and landing, and single-engine operation. Synchronization is not active at throttle settings above MCT, regardless of synchronization switch position.

SYNCHRONIZING CONTROL

The engine synchronizer is controlled by a two-position rotary switch labeled ENGINE SYNC: ON – OFF. To operate, select the ON position when the engines are within the capture band. The fan or turbine will synchronize depending on throttle angle. When the ENGINE SYNC switch is ON, the amber ENGINE SYNC light will illuminate.



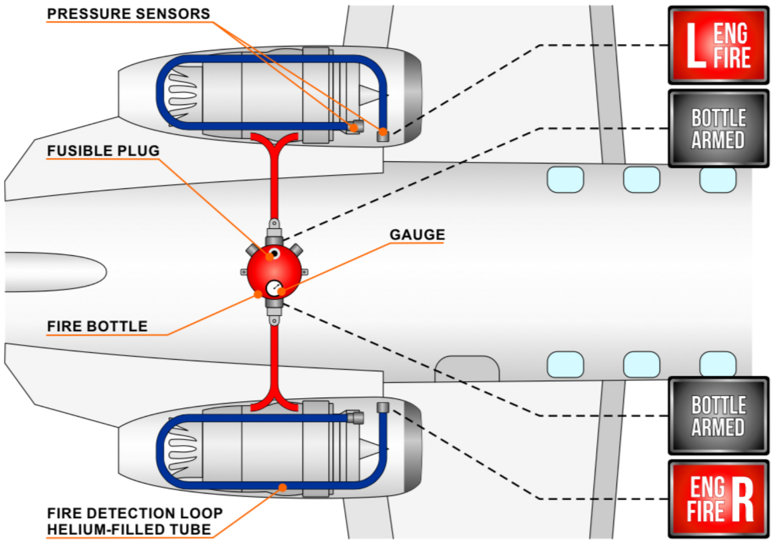
FIRE PROTECTION

GENERAL

The engine fire and overheat detection system consists of:

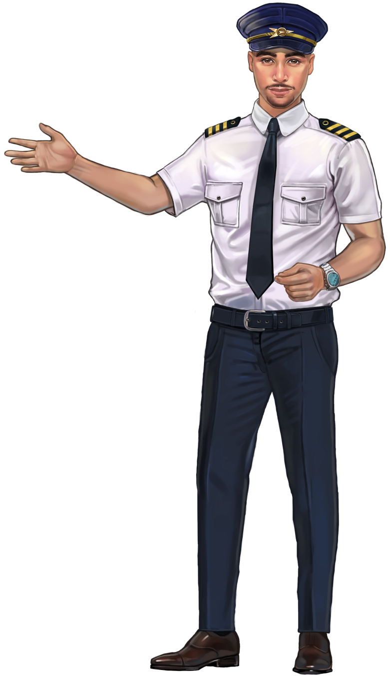
1. A detector/sensor
2. Detection control unit
3. A fire warning light
4. Aural warning - left or right engine fire.

The engine-extinguishing system consists of one fire bottle charged with an extinguishing agent. It is pressurized with nitrogen and discharged by an electrically activated squib. The bottle is armed and activated manually from the cockpit. In addition, the bottle is guarded against overpressure.



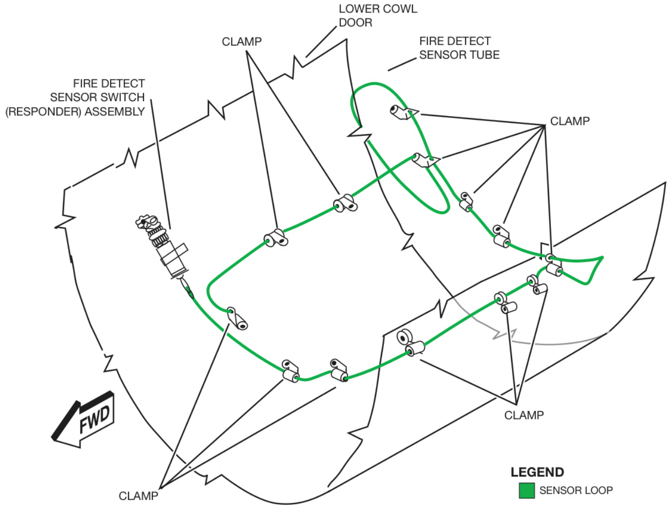
ENGINE FIRE SYSTEM COMPONENTS

The engine fire-detection system consists of:
- Engine fire sensors
- Detection control units
- ENG FIRE switch-lights
- Aural warning



ENGINE FIRE DETECTION SENSOR

Each engine fire sensor is a flexible stainless-steel tube filled with helium. A fire or overheat condition will cause the gas pressure to increase in the tube setting off the fire warning. This illuminates the red ENG FIRE switchlight in the cockpit. When the pressure decreases, the alarm switch opens and deactivates the ENG FIRE switchlight. Mechanical damage to the detector tube will not give a false alarm. Damage to the unit will result in a "NO TEST" rather than a false alarm.



NOTE:
Illumination of the ENG FIRE Switchlight does not activate the MASTER WARNING lights.

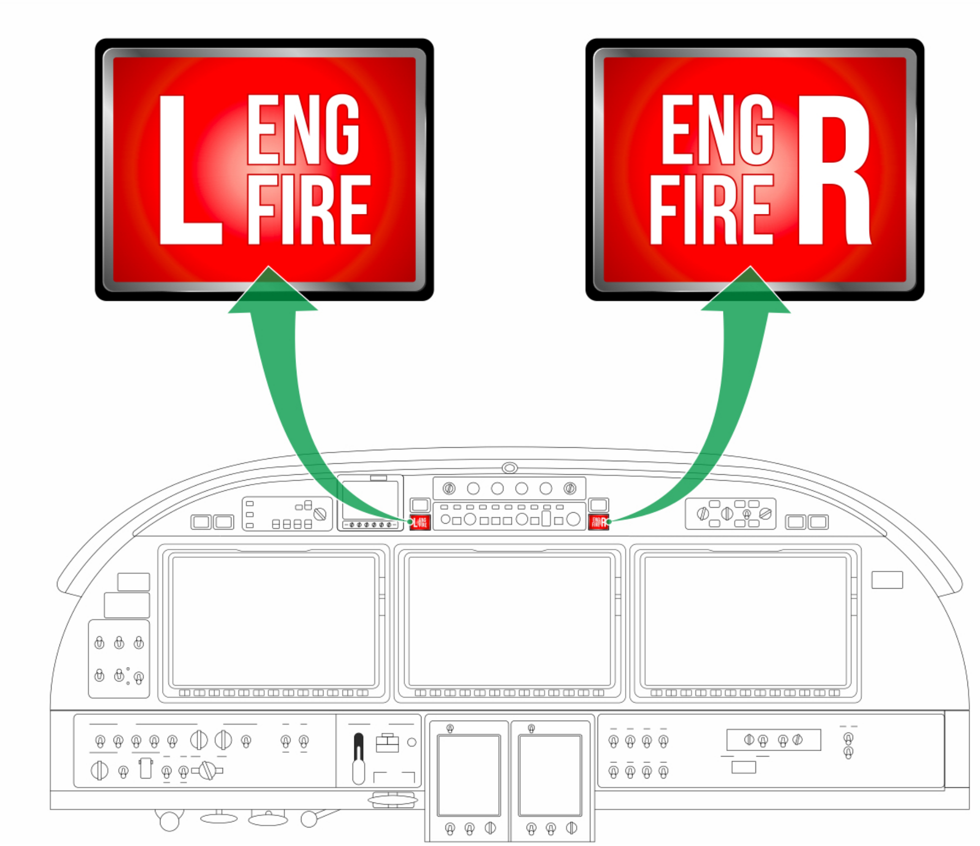
ENGINE FIRE SWITCHLIGHTS

The red, guarded ENG FIRE switchlights are located in the center of the cockpit glareshield and are labeled "LH ENG FIRE" or "RH ENG FIRE."

When the guard is lifted and the red switchlight is depressed, the following actions occur:

- The fuel and hydraulic firewall shutoff valves close.
- The field relay on the generator trips.
- The fire bottle is armed, and the white lights illuminate.

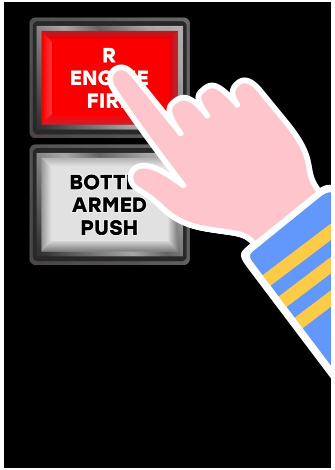
ENGINE FIRE LIGHTS



ENGINE FIRE SWITCHLIGHTS

Pushing the fire switchlight can be confirmed by the illumination of the following annunciator panel lights:

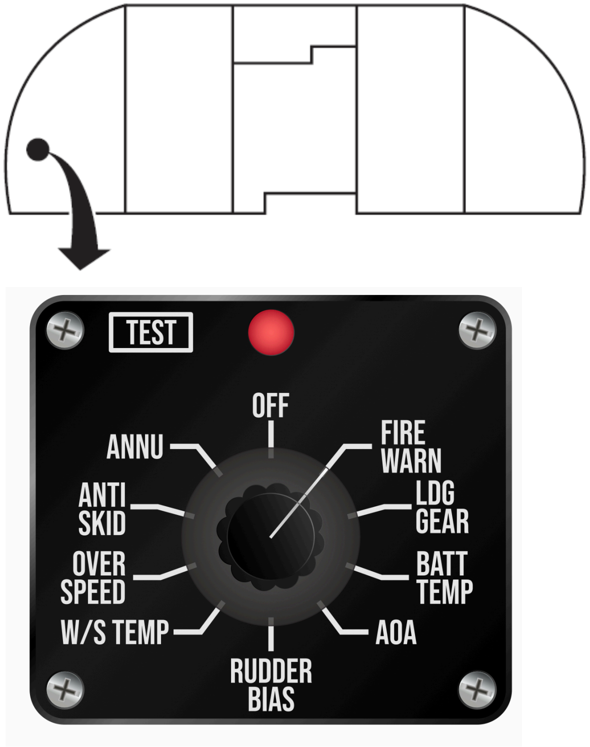
- BOTTLE 1/2 ARMED
- LH or RH F/W SHUTOFF
- LH or RH FUEL LOW PRESS
- LH or RH FUEL BOOST ON
- LH or RH HYD FLOW LOW
- LH or RH GEN OFF
- LH or RH OIL PRESS WARN (BELOW 25 PSI OIL PRESS)
- MASTER CAUTION/WARNING



If the fire switchlight has been activated, depressing the switchlight a second time reopens the appropriate valves and extinguishes the respective annunciator lights.
It does reset the generator field relay.

ENGINE FIRE DETECTION TEST

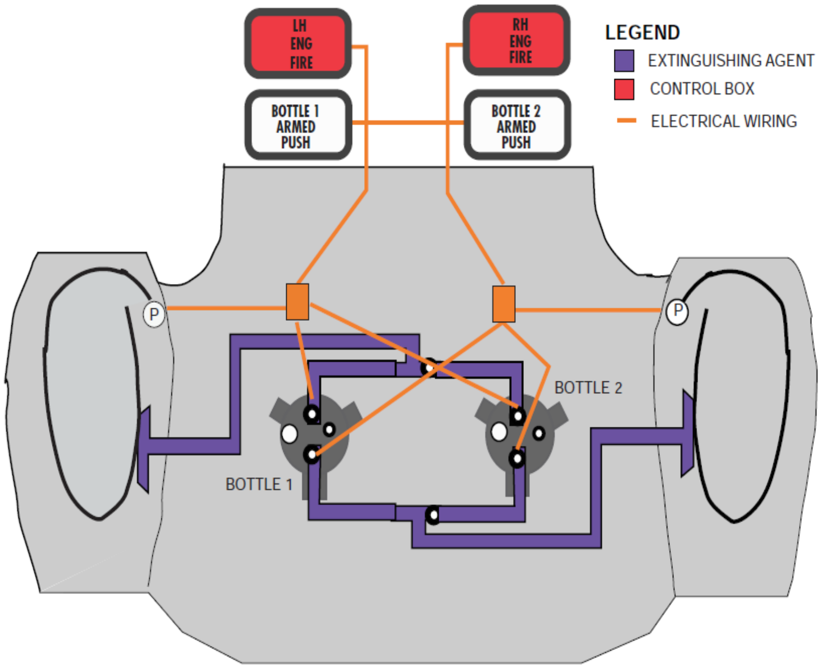
- The engine fire-detection system requires DC power to operate.
- The rotary test switch is used to test the fire-detection system. When FIRE WARN is selected, both ENG FIRE switch lights will illuminate.



ENGINE FIRE EXTINGUISHING

EXTINGUISHING BOTTLES

- The engine fire-extinguishing system consists of two fire bottles of Halon 1301 located in the tailcone area. If the temperature of the bottle exceeds 210°F, the pressure is expelled by a thermal relief valve.



ENGINE FIRE EXTINGUISHING SYSTEM OPERATION

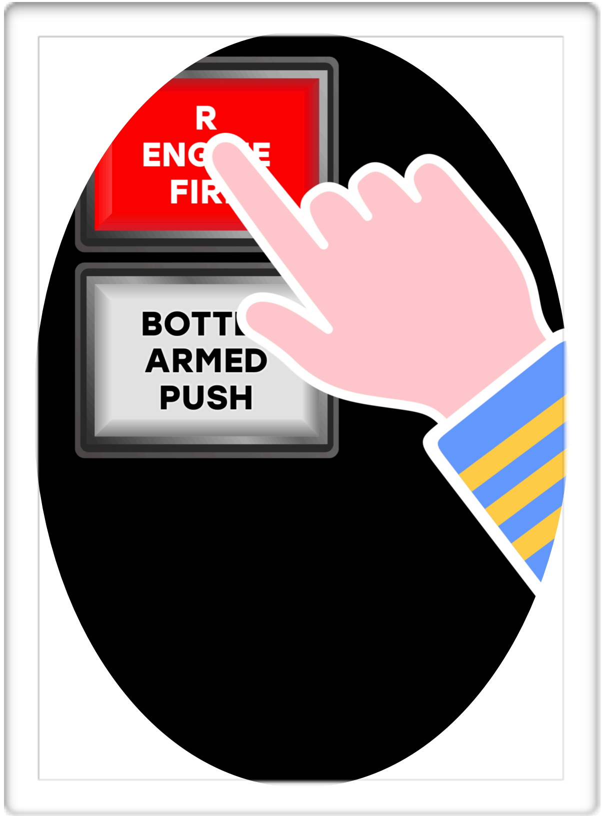
If the ENG FIRE light Illuminates:

1. Retard the throttle to idle.
2. Verify fire exists.
3. Push Engine Fire switchlight.
4. Push the white BOTTLE ARMED light.

If the ENG FIRE light remains illuminated, push the remaining BOTTLE ARMED switchlight. This will release the Halon in the remaining bottle into the same nacelle. The BOTTLE ARMED switchlight does not confirm the bottle is serviced. This can only be confirmed by visual check of the bottle gages at 600 psi on a 70°F day. A placard in the tail compartment can be used to adjust for different temperatures.

ENGINE FIRE EXTINGUISHING

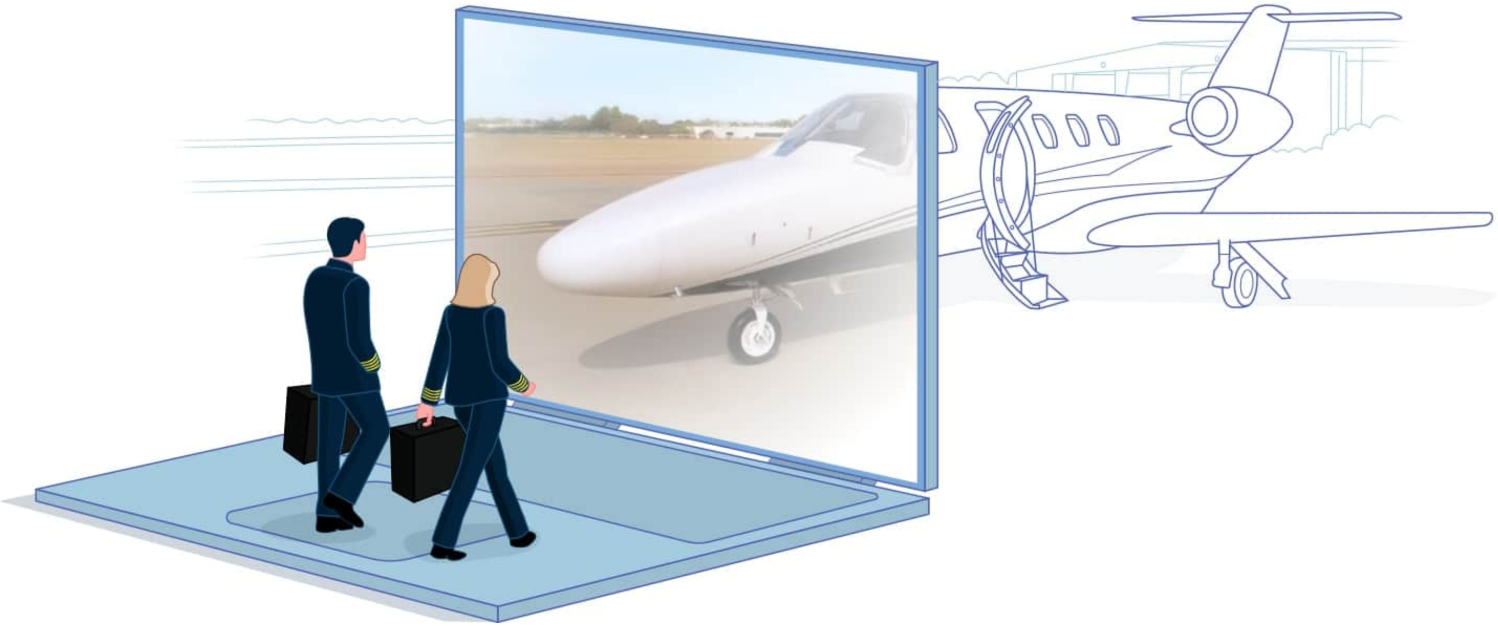
To reopen the fuel and hydraulic shutoff valves, push the ENGINE FIRE switch a second time. Hold the generator switch to reset to reenergize the generator field.



PORTABLE FIRE EXTINGUISHER

A portable hand-held fire-extinguisher is installed in the cockpit and is accessible from either the pilot or copilot positions. The portable 2 1⁄2-pound hand-held fire-extinguisher is mounted to the floor to the left side of the copilot's seat in a quick-release mounting bracket.

The portable extinguisher is a pressurized bottle containing Halon Type 1211 extinguishing agent. The extinguisher is rated for class A, B, and C fires. Check that the pressure is in the green arc during the preflight check.



PNEUMATICS

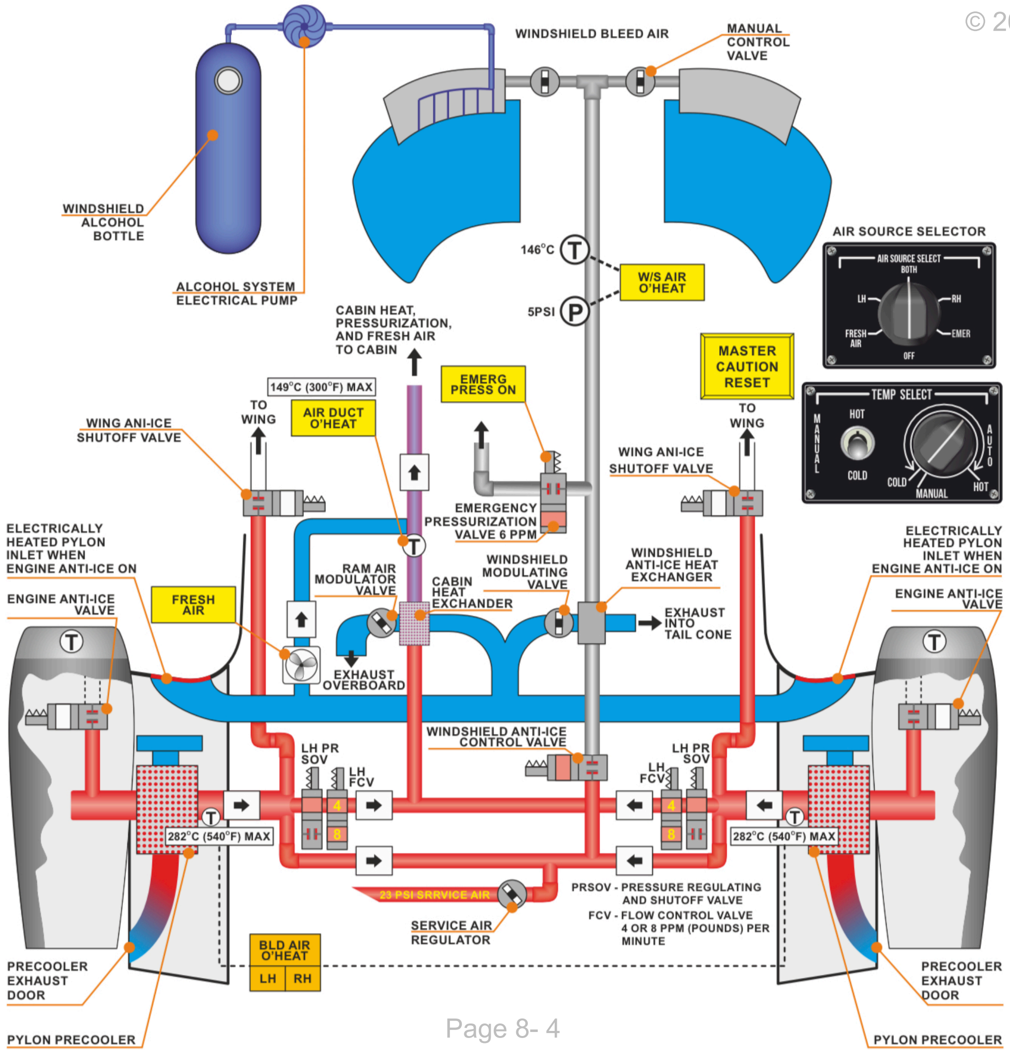
TO RECEIVE CREDIT FOR THIS COURSE, YOU MUST PASS THE FINAL EXAM LOCATED ON THE LAST PAGE OF THIS STUDY GUIDE.

GENERAL

High Pressure bleed air from each engine is used for the following systems:

1. Cabin pressurization.
2. Rudder bias system.
3. Left- and right-wing anti-ice system.
4. Windshield rain removal and anti-ice system.
5. Service air (23 psi)

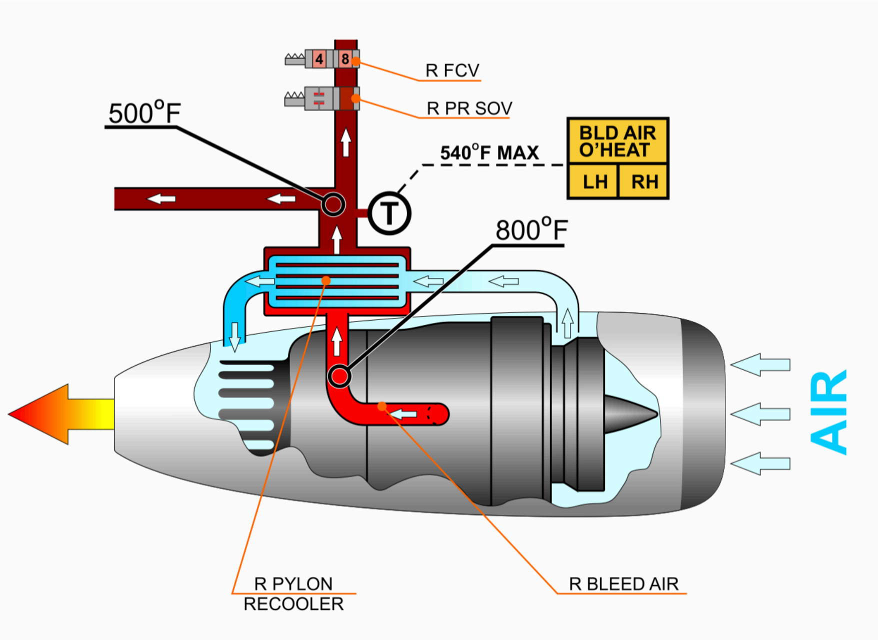
- Hydraulic reservoir
- Cabin Door Seal
- Horizontal tail deice boots
- Precooler temperature control
- Flood Cooling Vent
- Pressurization dive solenoid for pressure
- Pressurization ejectors (vacuum)


WINDSHIELD BLEED AIR
MANUAL CONTROL VALVE
WINDSHIELD ALCOHOL BOTTLE
ALCOHOL SYSTEM ELECTRICAL PUMP
146°C
W/S AIR O'HEAT
5PSI
AIR SOURCE SELECTOR
AIR SOURCE SELECT
BOTH
LH
RH
FRESH AIR
EMER
OFF
CABIN HEAT, PRESSURIZATION, AND FRESH AIR TO CABIN
MASTER CAUTION RESET
TEMP SELECT
HOT
MANUAL
COLD
AUTO
COLD
MANUAL
HOT
149°C (300°F) MAX
EMERG PRESS ON
TO WING
WING ANI-ICE SHUTOFF VALVE
AIR DUCT O'HEAT
TO WING
WING ANI-ICE SHUTOFF VALVE
EMERGENCY PRESSURIZATION VALVE 6 PPM
ELECTRICALLY HEATED PYLON INLET WHEN ENGINE ANTI-ICE ON
ELECTRICALLY HEATED PYLON INLET WHEN ENGINE ANTI-ICE ON
RAM AIR MODULATOR VALVE
CABIN HEAT EXCHANGER
WINDSHIELD MODULATING VALVE
WINDSHIELD ANTI-ICE HEAT EXCHANGER
ENGINE ANTI-ICE VALVE
FRESH AIR
EXHAUST INTO TAIL CONE
ENGINE ANTI-ICE VALVE
EXHAUST OVERBOARD
WINDSHIELD ANTI-ICE CONTROL VALVE
LH PR SOV
LH FCV
LH PR SOV
LH FCV
282°C (540°F) MAX
282°C (540°F) MAX
23 PSI SRRVICE AIR
SERVICE AIR REGULATOR
PRSOV - PRESSURE REGULATING AND SHUTOFF VALVE
FCV - FLOW CONTROL VALVE 4 OR 8 PPM (POUNDS) PER MINUTE
BLD AIR O'HEAT
LH
RH
PRECOOLER EXHAUST DOOR
PRECOOLER EXHAUST DOOR
PYLON PRECOOLER
PYLON PRECOOLER

SYSTEM DESCRIPTION

PRECOOLER

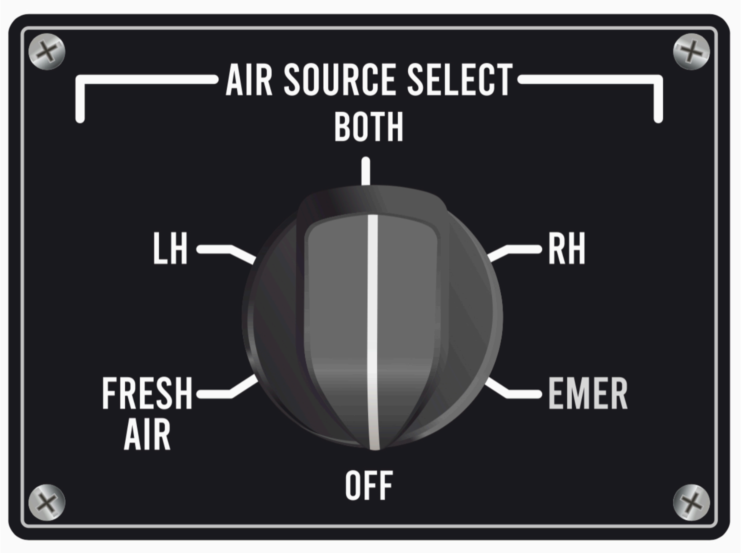
The precoolers are stainless steel, heat exchangers mounted in the engine pylons. 900°F bleed air enters the heat exchanger from the engine and is cooled to 475°F. This temperature is acceptable to use in the airplane anti-ice, environment and pneumatic systems. If bleed air is too hot to use, (>540°F) the BLD AIR O'HEAT annunciator and MASTER CAUTION lights will illuminate.



CONTROL OF THE BLEED AIR

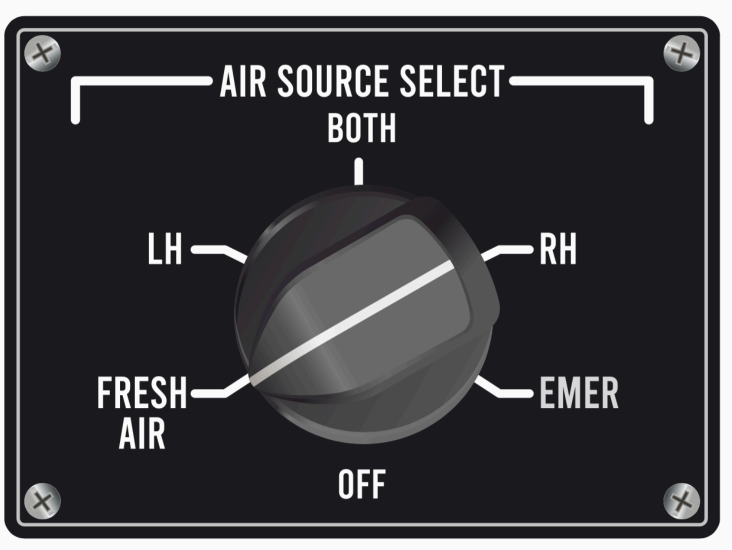
The **AIR SOURCE SELECTOR** determines the amount of air that enters the cabin and from what source it is supplied. The control switch has positions labeled:
OFF – FRESH AIR – LH – BOTH – RH – EMER.

The OFF position closes all environmental bleed-air valves and the EMER valve is deenergized closed. Bleed air is still available to the service air system, but no air enters the pressure vessel from the engines.



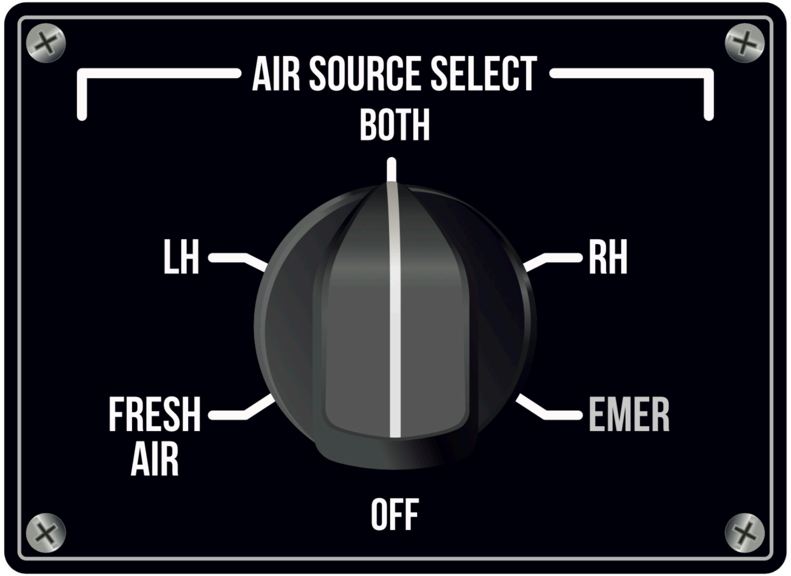
CONTROL OF THE BLEED AIR (CONT'D)

The **FRESH AIR** position of the AIR SOURCE selector will not allow the airplane to pressurize and is intended for ground use or at low altitudes. During unpressurized flight, outside air is obtained at the forward edge of the pylons.



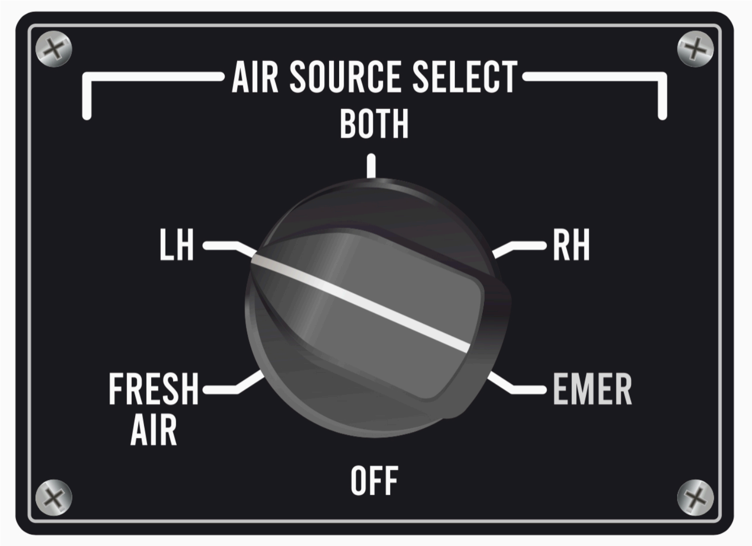
CONTROL OF THE BLEED AIR (CONT'D)

The **BOTH** position opens the LH and RH bleed-air shutoff and flow control and shutoff valves. This closes the W/S bleed-air shutoff valve and closes the EMER valve. Bleed air from both engines is allowed to pass through the bleed-air manifold to the cabin heat exchanger. The bleed air valves fail to the BOTH Position if normal DC power is lost. All takeoff performance data is based on the source selector being in the BOTH position.



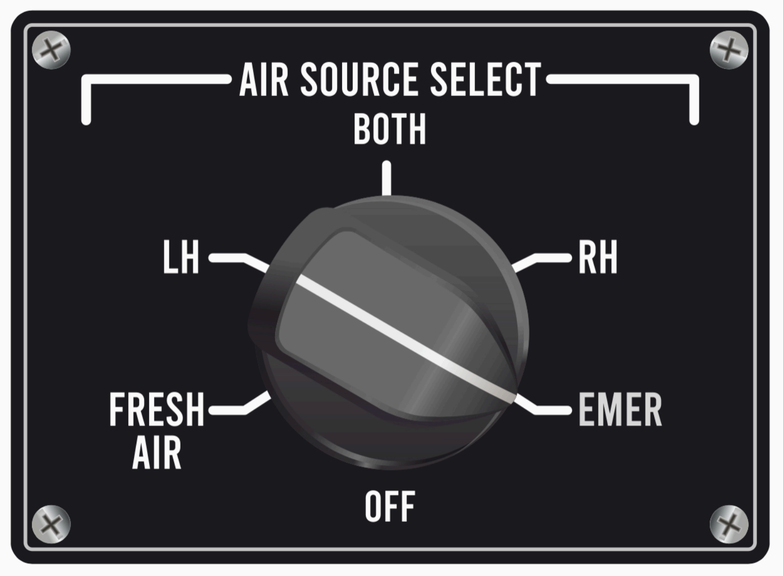
CONTROL OF THE BLEED AIR (CONT'D)

The **LH or RH** positions limit pneumatic bleed-air from the engine associated with the selected switch position. The amount of airflow entering the cabin is 8 pounds per minute (ppm) using LH, RH, or BOTH.



CONTROL OF THE EMERGENCY BLEED AIR

When the **EMER** position is selected inflight, bleed air from both engines is routed directly into the cabin through the windshield bleed-air system ducting. In EMER, the LH and RH bleed-air shutoff, flow control, and shutoff valves are energized closed and the EMER valve energized open allowing 6 ppm flow. On the ground the EMER pressurization valve cannot open by the left squat switch logic.



CONTROL OF THE EMERGENCY BLEED AIR

EMERGENCY PRESS ON

Positioning the source select knob to EMER in flight or on the ground will cause the EMERG PRESS ON CAS and the MASTER CAUTION lights to illuminate. The CAS message will also display if the emergency pressurization valve opens automatically above a cabin altitude of 14,200'. When this mode is selected with windshield anti-ice OFF, the W/S AIR O'HEAT CAS message and 5-psi pressure switch are deactivated. 120°F air from the windshield heat exchanger is regulated to 6 ppm of flow through the emergency valve to heat and pressurize the cabin.

DC ELECTRICAL POWER FAILURE DESCRIPTION

In the event of a DC electrical power failure, the pneumatic air is supplied as if the source selector switch is positioned to BOTH, regardless of where the PRESS SOURCE selector is positioned.

Additionally:

1. The emergency pressurization valve fails closed.
2. LH and RH bleed-air shutoff, flow control, and shutoff valves fail open.
3. The windshield bleed-air shutoff valve fails open, directing air to the two-windshield bleed air manual valves.
4. The wing anti-ice valves also fail open.

SOURCE SELECTIONS, VALVE POSITIONS, AND FLOW RATES

CONDITION	SOURCE SELECTOR POSITION	LH FCV/PPM	RH FCV/PPM	EMER VALVE/PPM	NET FLOW TO CABIN PPM/TEMP/PRESS
2 Engines Operating	BOTH	Open 4	Open 4	Closed 0	8 ppm 65–85 F
2 Engines Operating	LH	Open 8	Closed 0	Closed 0	8 ppm 65–85 F
2 Engines Operating	RH	Closed 0	Open 8	Closed 0	8 ppm 65–85 F
2 Engines Operating	EMER	Closed 0	Closed 0	Open 6	6 ppm 120 F*
2 Engines Operating	FRESH AIR	Closed 0	Closed 0	Closed 0	0 Depress to Ambient
2 Engines Operating	OFF	Closed 0	Closed 0	Closed 0	0 Leak Rate till Depressurized
LH Throttle OFF, RH Engine Operating	BOTH/RH	Closed 0	Open 8	Closed 0	8 ppm 65–85 F
LH Engine Operating, RH Throttle OFF	LH/BOTH	Open 8	Closed 0	Closed 0	8 ppm 65–85 F
LH Engine OFF and Lost DC Power	Any Position	Closed 0	Open 4	Closed 0	4 ppm Cabin May Rise
RH Engine OFF and Lost DC Power	Any Position	Open 4	Closed 0	Closed 0	4 ppm Cabin May Rise

* Windshield Bleed Air: OFF=49°C (120°F), HI=138°C (280°F), LOW=127°C (260°F)

NEED TO KNOW INFORMATION

- The flow control valve (FCV) (4 or 8 ppm) failsafes to the 4-ppm position with lost DC power, and the PRSOV (pressure regulating and shutoff valve) which normally regulates 16 psi is a failsafe open valve.

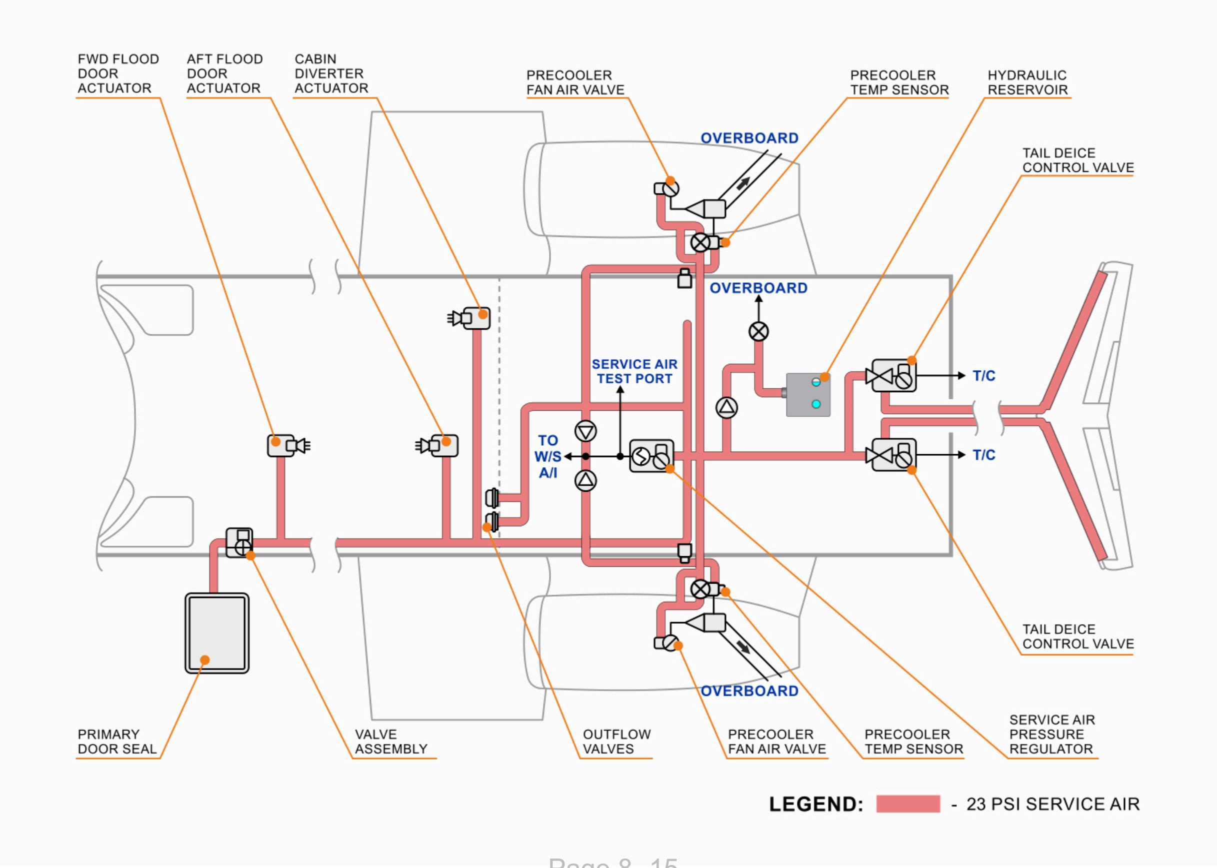
- With both engines operating in BOTH. Flow rate is: 4+4=8 ppm flow into the cabin.

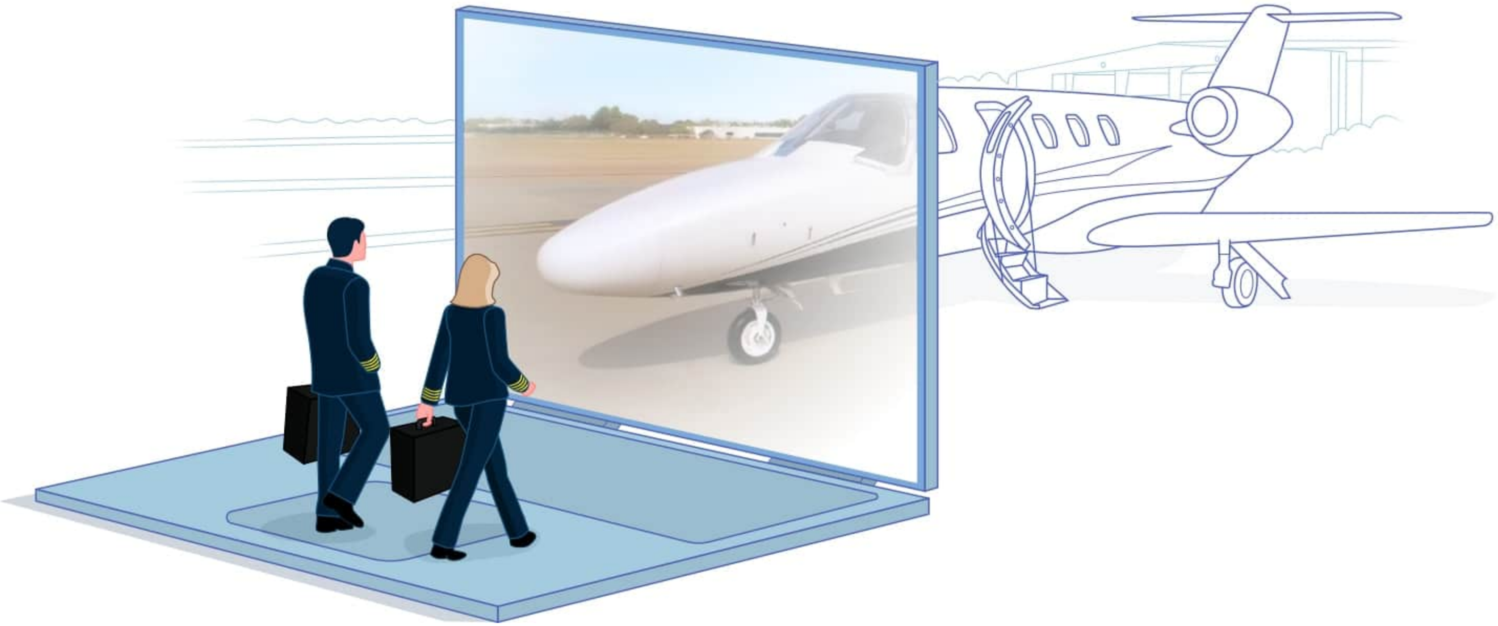
- With LH or RH selected, the selected FCV is energized the full 8 ppm flow rate into the cabin while the non selected FCV is closed by logic.

- If a throttle is selected OFF, the remaining engine FCV is energized to 8 ppm flow rate into the cabin by logic.

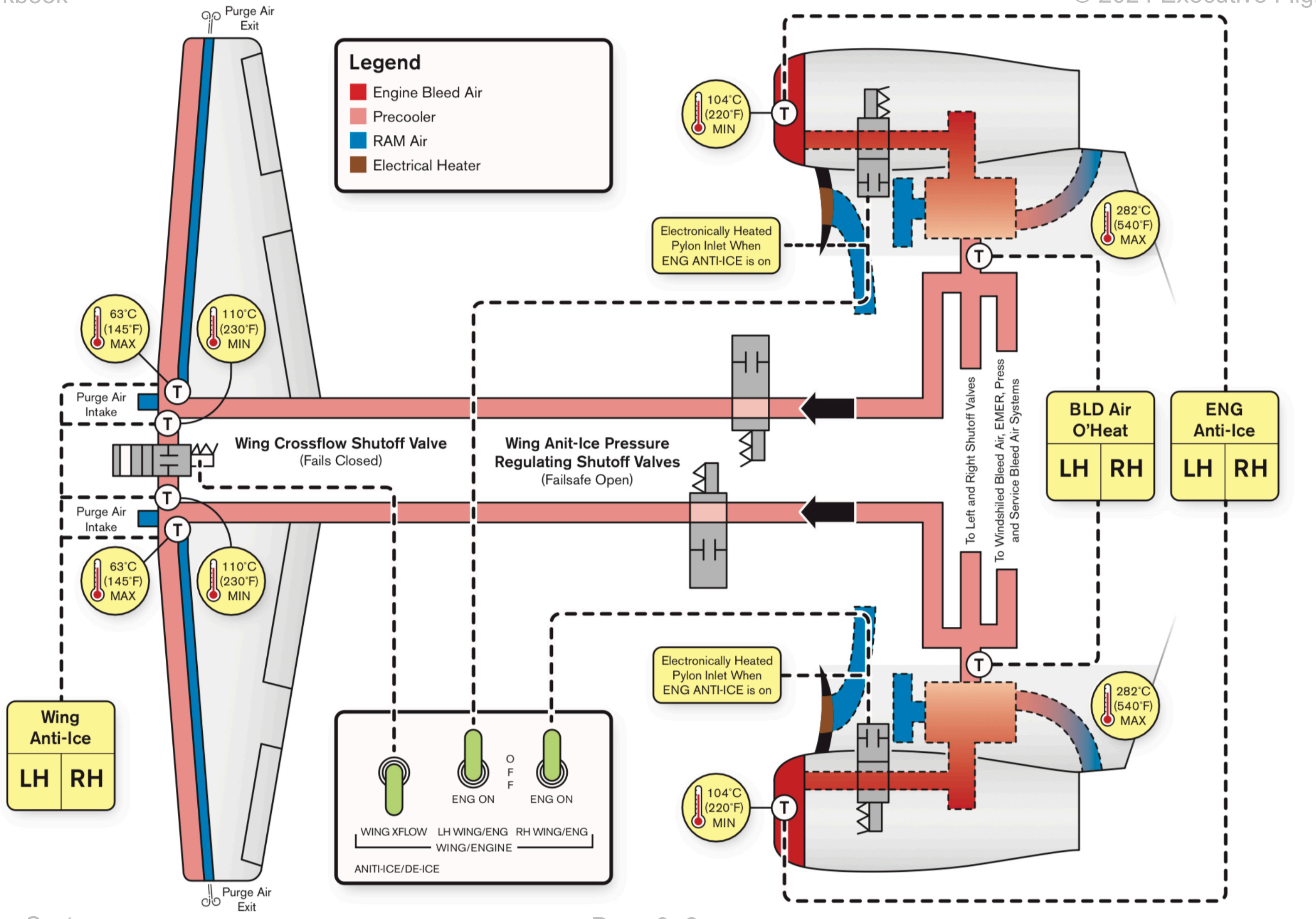
- In the event of engine failure and the loss of normal DC power, the operating engine FCV failsafes open to 4 ppm flow to the cabin. At half the normal flow rate to the cabin, the cabin pressure may rise, and the differential pressure reduce.

SERVICE AIR


FWD FLOOD DOOR ACTUATOR
AFT FLOOD DOOR ACTUATOR
CABIN DIVERTER ACTUATOR
PRECOOLER FAN AIR VALVE
PRECOOLER TEMP SENSOR
HYDRAULIC RESERVOIR
TAIL DEICE CONTROL VALVE
OVERBOARD
OVERBOARD
SERVICE AIR TEST PORT
TO W/S A/I
T/C
T/C
TAIL DEICE CONTROL VALVE
OVERBOARD
PRIMARY DOOR SEAL
VALVE ASSEMBLY
OUTFLOW VALVES
PRECOOLER FAN AIR VALVE
PRECOOLER TEMP SENSOR
SERVICE AIR PRESSURE REGULATOR
LEGEND: - 23 PSI SERVICE AIR



ANTI-ICING SYSTEM


Legend
Engine Bleed Air
Precooler
RAM Air
Electrical Heater
Purge Air Exit
Purge Air Intake
63°C (145°F) MAX
110°C (230°F) MIN
Wing Crossflow Shutoff Valve
(Fails Closed)
Wing Anit-Ice Pressure Regulating Shutoff Valves
(Failsafe Open)
104°C (220°F) MIN
282°C (540°F) MAX
Electronically Heated Pylon Inlet When ENG ANTI-ICE is on
To Left and Right Shutoff Valves
To Windshiled Bleed Air, EMER, Press and Service Bleed Air Systems
BLD Air O'Heat
LH RH
ENG Anti-Ice
LH RH
Wing Anti-Ice
LH RH
ENG ON
OFF
ENG ON
WING XFLOW
LH WING/ENG
RH WING/ENG
WING/ENGINE
ANITI-ICE/DE-ICE
T

INTRODUCTION

The Citation is approved for flight into known icing.
The anti-ice protection systems utilize:

- Hot bleed air from the engines to deice the wing, engine and windshield.
- Isopropyl alcohol to backup the bleed air system for anti-icing the left windshield.
- Electric heat for the pitot-static, angle-of-attack systems and pylon inlets.

The tail deice system uses pneumatic boots on the horizontal stabilizers.

The engine fan, stators, and spinner are deiced aerodynamically. As ice builds on the spinner, it is shed by centrifugal and aerodynamic forces.

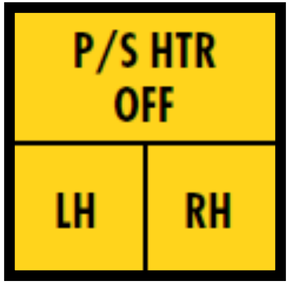
PITOT AND STATIC ANTI-ICE SYSTEM SWITCHES

The two pitot tubes, four static ports, and the angle-of-attack vane are all heated electrically.

Power to operate the left-hand pitot and static system is from the normal DC bus. Limit ground operation of the pitot-static heater system to 2 minutes.

PITOT AND STATIC ANTI-ICE ANNUNCIATOR LIGHTS

The **P/S HTR OFF** light will illuminate if either pitot tube or any static port heater fails. It will also illuminate if the switch is in the off position.



The **AOA HTR FAIL** annunciator light will illuminate if the angle of attack vane
heater has failed.

ICE LIGHTS

The windshield ice detection lights are located on the glareshield.

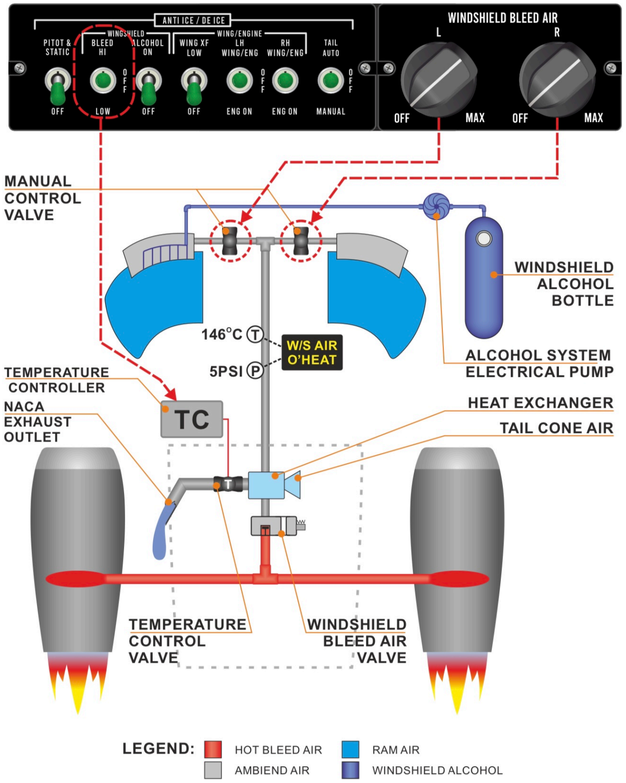
NOTE:
Monitor the copilot's windshield ice detection light whenever the anti-ice systems are operating at night.

ICE LIGHT

A wing inspection light is a fixed-position light located forward of the left-wing leading edge and mounted on the left side of the fuselage

WINDSHIELD ANTI-ICE

Both windshields may be anti-iced by use of engine bleed air or by alcohol (pilot's side only) in the event that the bleed-air system fails.



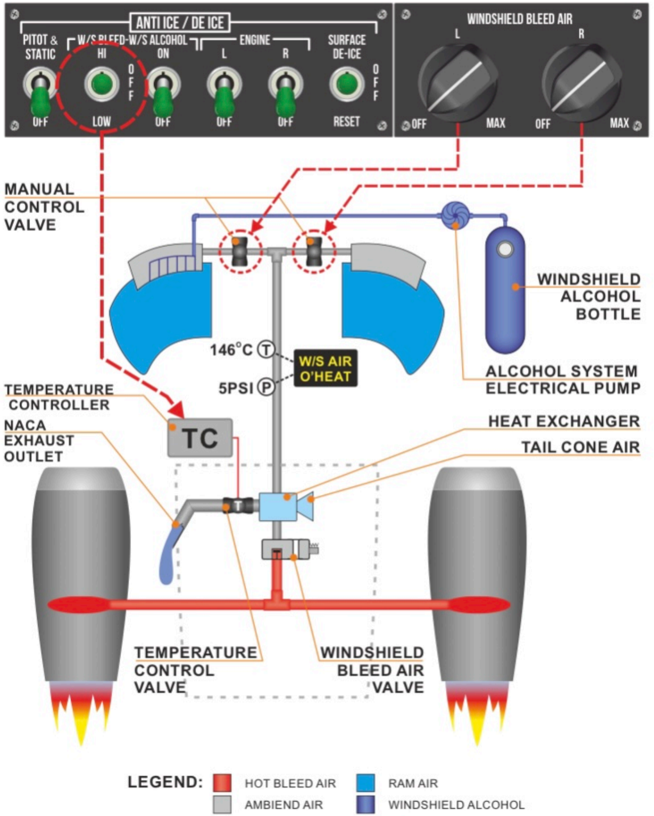
WINDSHIELD ANTI-ICE SYSTEM

Selecting the W/S BLEED switch to HI or LOW will open the windshield bleed-air shutoff valve allowing hot bleed air to flow to the automatic temperature controller. The automatic temperature controller maintains windshield bleed-air temperature position by regulating pylon ram cooling air through a heat exchanger:

138±6°C (280±10°F) HI.
127±6°C (260±10°F) LOW.

WINDSHIELD ANTI-ICE (CONT'D)

If windshield anti-icing is required, twist the manual WINDSHIELD BLEED AIR valves open and select LOW on the W/S BLEED switch if the indicated RAT is warmer than –18°C (0°F) or select HI if the indicated RAT is –18°C (0°F) or below.



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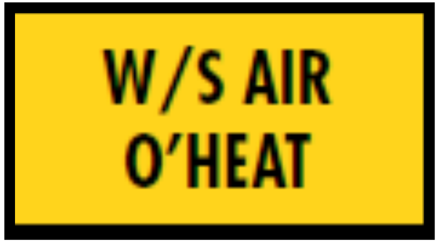
WINDSHIELD ANTI-ICE ANNUNCIATOR LIGHTS

The W/S AIR O'HEAT will illuminate:

- If the over-temperature sensor exceeds 149°C (300°F).
- The overheat sensor will automatically close the windshield bleed-air solenoid valve and illuminate the W/S AIR O'HEAT light.
- If the overheat light illuminates, the WINDSHIELD BLEED AIR valves should be partially closed to reduce the airflow.



WINDSHIELD ANTI-ICE SYSTEM

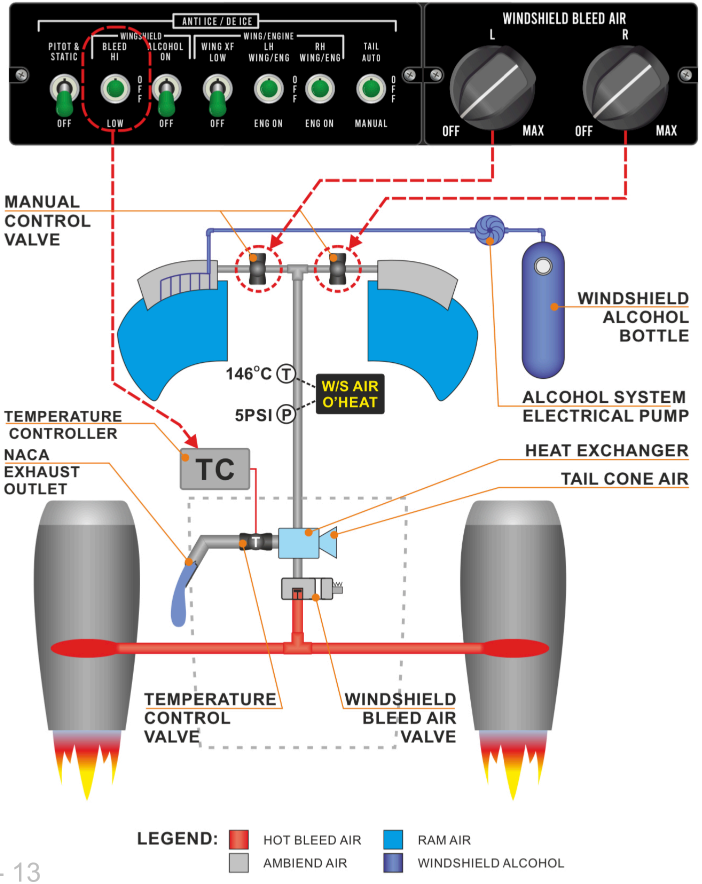
The W/S AIR O'HEAT light will also illuminate if the duct pressure exceeds 5 psi with the W/S BLEED switch in the OFF position.

If an electrical failure occurs, the windshield bleed-air solenoid valve will fail open. This allows hot engine bleed air to be available to the manual windshield bleed-air valves. If this happens, the automatic temperature control and overheat warning become inoperative.

The manual valves are opened only when bleed air to the windshields is desired. This procedure protects the windshields from possible hot bleed-air damage in the event of an electrical power failure of the bleed-air solenoid valve.

Bleed Air Damaged Windshield

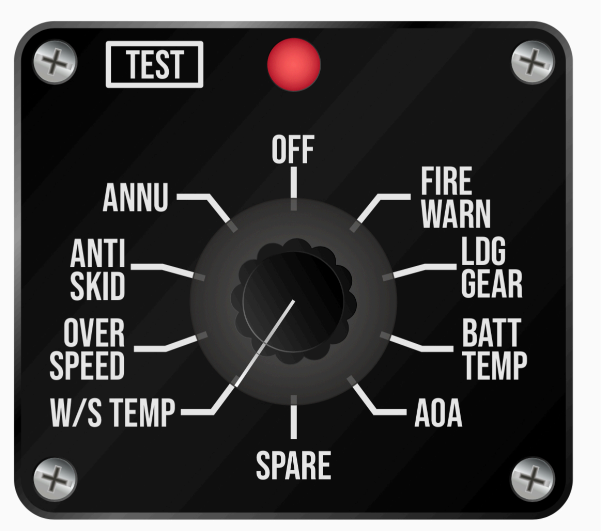
WINDSHIELD ANTI-ICE SYSTEM (CONT'D)



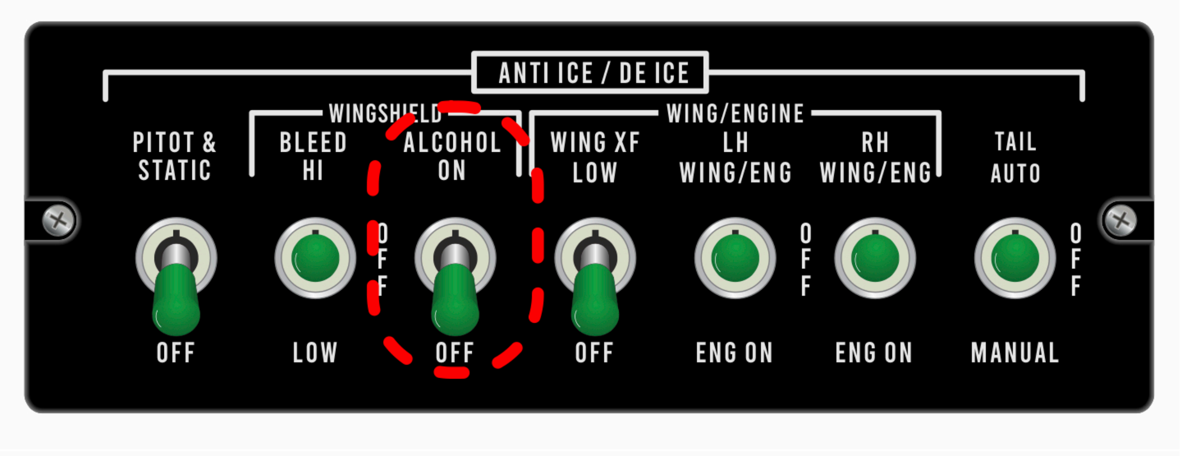
WINDSHIELD ANTI-ICE

SYSTEM TEST

The windshield anti-ice test is performed by the rotary test switch. A windshield overheat condition is simulated and the WS AIR O'HEAT annunciator light illuminates.



WINDSHIELD ALCOHOL SYSTEM



If the windshield bleed air system fails, a reserve isopropyl alcohol reservoir provides 2 quarts (ten minutes) of continuous alcohol anti-ice capability for the pilot's windshield. It is controlled by the 2 position W/S ALCOHOL switch.

WINDSHIELD ALCOHOL SYSTEM

PREFLIGHT CHECK

Windshield Alcohol Reservoir Sight Gage......... FLUID VISIBLE
The ball should be at the top of the sight gage.

Example of empty alcohol tank during preflight

RAIN REMOVAL SYSTEM

The rain removal system uses the normal windshield anti-ice system for rain removal. Mechanically actuated rain doors deflect airflow over each windshield to remove rain. The doors are operated by pulling the PULL RAIN handle located under the WINDSHIELD BLEED-AIR knobs on the pilot's panel.

For rain removal:

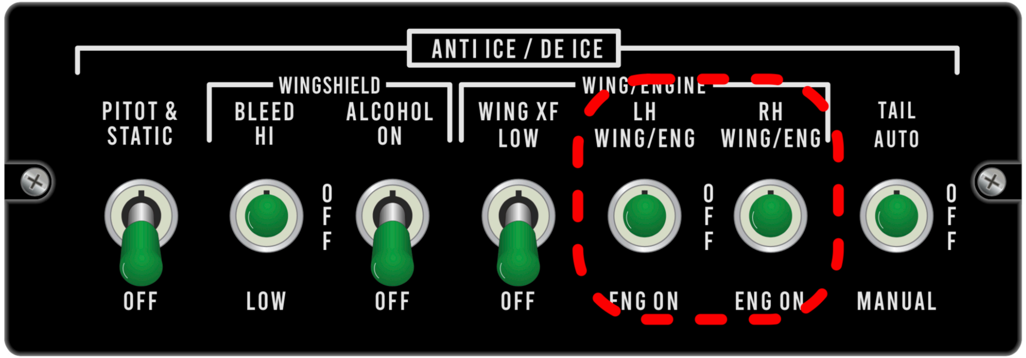
- PULL RAIN handle.
- Rotate the WINDSHIELD BLEED-AIR knobs to the MAX position.
- Position the W/S BLEED switch to LOW.

OPERATING THE RAIN REMOVAL SYSTEM

TIPS

- Because it's mechanical, opening the rain door is difficult above 175 KIAS.
- Rotating the copilot's WINDSHIELD BLEED-AIR knob to the OFF position will increase the bleed air to the pilot's windshield.
- Applying rain repellent will increase the effectiveness of the rain removal system.
- The nosewheel chine deflects water and slush away from the engine inlets to prevent engine compressor stalls or flameout. Avoid slush or water more than 3/4” deep.

ENGINE ANTI-ICE SYSTEM



The engine fan, spinner, and stators are all deiced aerodynamically. Ice that builds on the spinner is shed by centrifugal and aerodynamic forces. Minor engine vibrations may occur as the ice is shed. Selecting the LH and RH WING/ENG anti-ice switches to the ENG ON position, sends hot bleed air to the engine inlet and generator cooling air inlets. When operating at altitudes below FL300, selection of any bleed air anti-ice system ON will result in the engine idle speed increasing to approximately 70.4% N2. The anti-ice idle speed improves the engines ability to supply bleed air and also increases idle thrust. The engine idle speed will reset from anti-ice idle back to normal flight idle when the landing gear is extended, or all bleed air anti-ice systems are turned OFF.

ENGINE ANTI-ICE SYSTEM

Illumination of the amber L–R ENG ANTI-ICE annunciator light indicates the engine inlet temperature is too cold for satisfactory ice protection with the engine anti-ice system on. The annunciator light will illuminate if inlet temperature drops below 10°C (50°F). The MASTER CAUTION will illuminate approximately 1 minute after the ENG ANTI-ICE L/R annunciator illuminates.. The MASTER CAUTION is disabled when the system is initially turned on, until the ENG ANTI-ICE annunciators extinguish.

TESTING THE ANTI-ICE SYSTEM

1. Do not test in actual icing conditions.
2. Select ENG ON.
3. The L/R ENG ANTI-ICE light will illuminate for under-temperature and will extinguishes quickly on the ground or after 2 minutes in flight.
4. Turn the switches OFF and retard the throttles to IDLE.
5. The test is complete.

NOTE:
The ITT may rise slightly and N1 and N2 drop slightly as the engine anti-ice valve opens.

USING THE ANTI-ICE SYSTEM

GROUND OPERATION IN ICING CONDITIONS:

- Advance the throttles above 80% N2
- Select ENG ON.
- The ENG ANTI-ICE lights illuminate briefly indicating under-temperature.
- The ENG ANTI-ICE lights extinguish.
- The nacelle and generator inlets are now warmer than 10°C.
- With the switches in the ENG ON position, pull the throttles to IDLE.
- If the ENG ANTI-ICE lights illuminate for under-temperature, cycle the throttles to keep the ENG–ANTI-ICE lights extinguished.

GROUND OPERATION (WING)

Selecting WING/ENG switch during ground operations deenergizes the left- and right-wing anti-ice shutoff valves open. This feeds pre-cooled, hot engine bleed air to the wing leading edges and pylon ram-air inlets. Hot bleed air travels by the under-temperature sensors at the wing root outward through the wing leading edge and exits through louvers on the lower surface of the wingtips.

USING THE ANTI-ICE SYSTEM (CONT'D)

FLIGHTS IN ICING CONDITIONS

In icing conditions, avoid reducing power below 80% N2. This will facilitate keeping the engine anti-ice valves open. Selecting power settings below approximately 80% N2 may not provide enough hot bleed air to keep the ENG ANTI-ICE and WING ANTI-ICE annunciator lights extinguished. Additionally, low power settings may not provide sufficient air flow to inflate the tail deice boots.

Preheating the inlets and wings expedites extinguishing the ENG ANTI-ICE and WING ANTI-ICE lights prior to takeoff.

USING THE ANTI-ICE SYSTEM (CONT'D)

During ground or flight operations, if bleed-air temperature at the wing root drops below the 110°C (230°F) under-temperature sensor, the amber L or R WING ANTI-ICE annunciator illuminates. The WING ANTI-ICE annunciator also illuminates for any wing root overheat over the 104°C (220°F) over-temperature sensor setting.

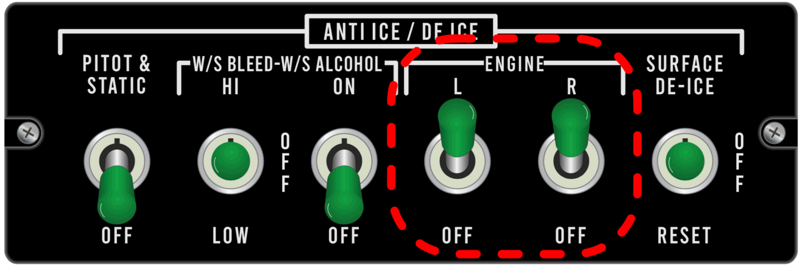
Exercise caution in high-speed descents in icing conditions not to reduce the power below 70%. Below 75 to 80% N2 may cause an under-temperature light to illuminate or prevent the tail deice boots from cycling.

USING THE ANTI-ICE SYSTEM (CONT'D)

To pre-heat the wing and engine system while on the ground requires the throttles to be above 80% N2 power setting. It may take up to two (2) minutes to reheat and extinguish the WING/ENG ANTI-ICE lights. Preheat as often as necessary. During high-speed descents from above 15,000 feet, the throttles should be kept in the 80% N2 range. This setting will provide sufficient heat to prevent illumination of the WING/ENG ANTI-ICE lights.

PYLON RAM-AIR INLET DUCT HEAT

The engine anti-ice switches supply to the electrically heated blankets on the pylon ram air inlet ducts. This prevents ice from blocking ram cooling air to the cabin and windshield heat exchangers.



PYLON RAM-AIR INLET DUCT INSPECTION

PREFLIGHT INSPECTION

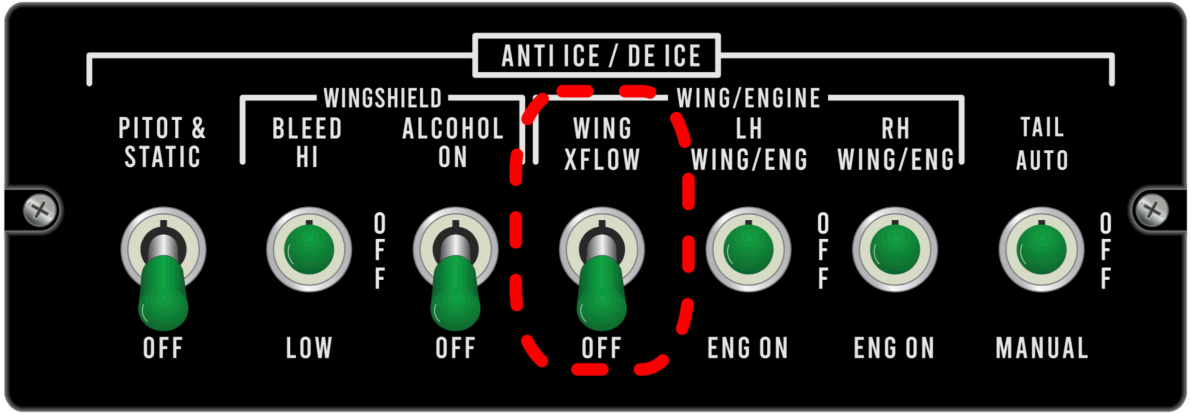
During the preflight inspection, turn on the pitot and engine anti-ice switches for 30 seconds. The pitots, static ports, AOA, and pylon ram-air inlet heater blankets should be warm to the touch during the preflight check.

USING THE ANTI-ICE SYSTEM

While operating icing conditions, the wing heat must be on. If no ice is accumulating, the wing/ engine switch may be operated in the ENG ON position. The WINDSHIELD–BLEED HI–LOW switch and TAIL–AUTO/MANUAL switch may be selected OFF.

On the ground, if ice is observed accumulating on the wings, preheating is required. The wings must be heated at all times during flight, if icing conditions are expected

WING ANTI-ICE SYSTEM



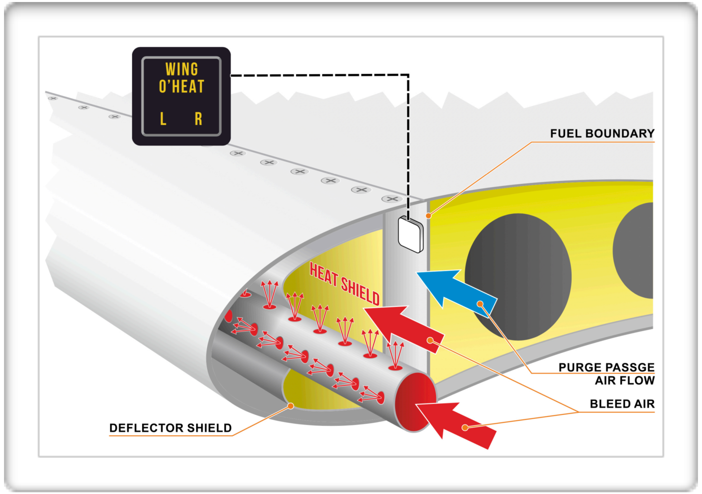
The LH and RH wing and engine anti-ice switches are selected to WING/ENG for a ground test of the system or for ground and/or flight icing conditions. Hot engine bleed air move through the wing leading edges and exit through louvers under the surface of the wings and warm up the leading edge. During the preflight, check that the louvers are unobstructed.

A crossflow valve (XFLOW–OFF switch) provides anti-ice capability to both wings if one engine is shut down.

WING ANTI-ICE SYSTEM

During flight, ambient air is directed through a small hole located just under the root of each wing leading edge to the purge passage.

Confirm the holes are unobstructed during the walk-around. The purge passage is installed between the heated wing leading edge and the forward portion of the fuel cell. Cool ambient air is directed through this passageway and exits at the wing tip to provide a cool air barrier between the hot air at the wing leading edge and the fuel tank. Hot bleed air and purge passage bleed air do not mix.



WING ANTI-ICE SYSTEM (CONT'D)

During ground operations engine bleed air is available to the wing and engine anti-ice system. However, heating the wings is limited to one (1) minute after the WING ANTI-ICE lights extinguish or structural damage to the wing's leading edge may result. Once the WING ANTI-ICE lights extinguished, switch the system off or to ENG ON if in icing conditions and reduce the power to idle.

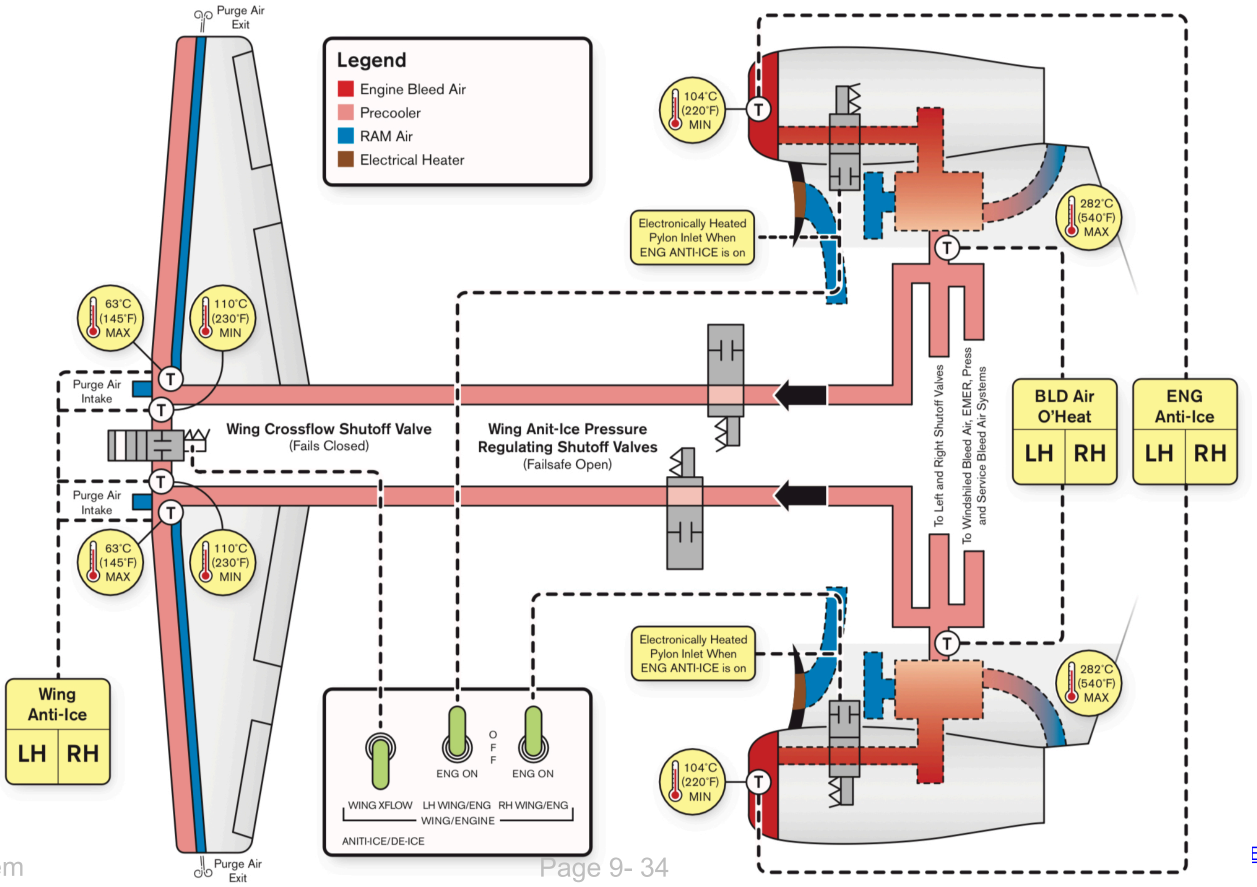
This is a description of how the amber WING and ENG ANTI-ICE lights and MASTER CAUTION lights operate.

ON GROUND (After Heated and Lights Go Out)

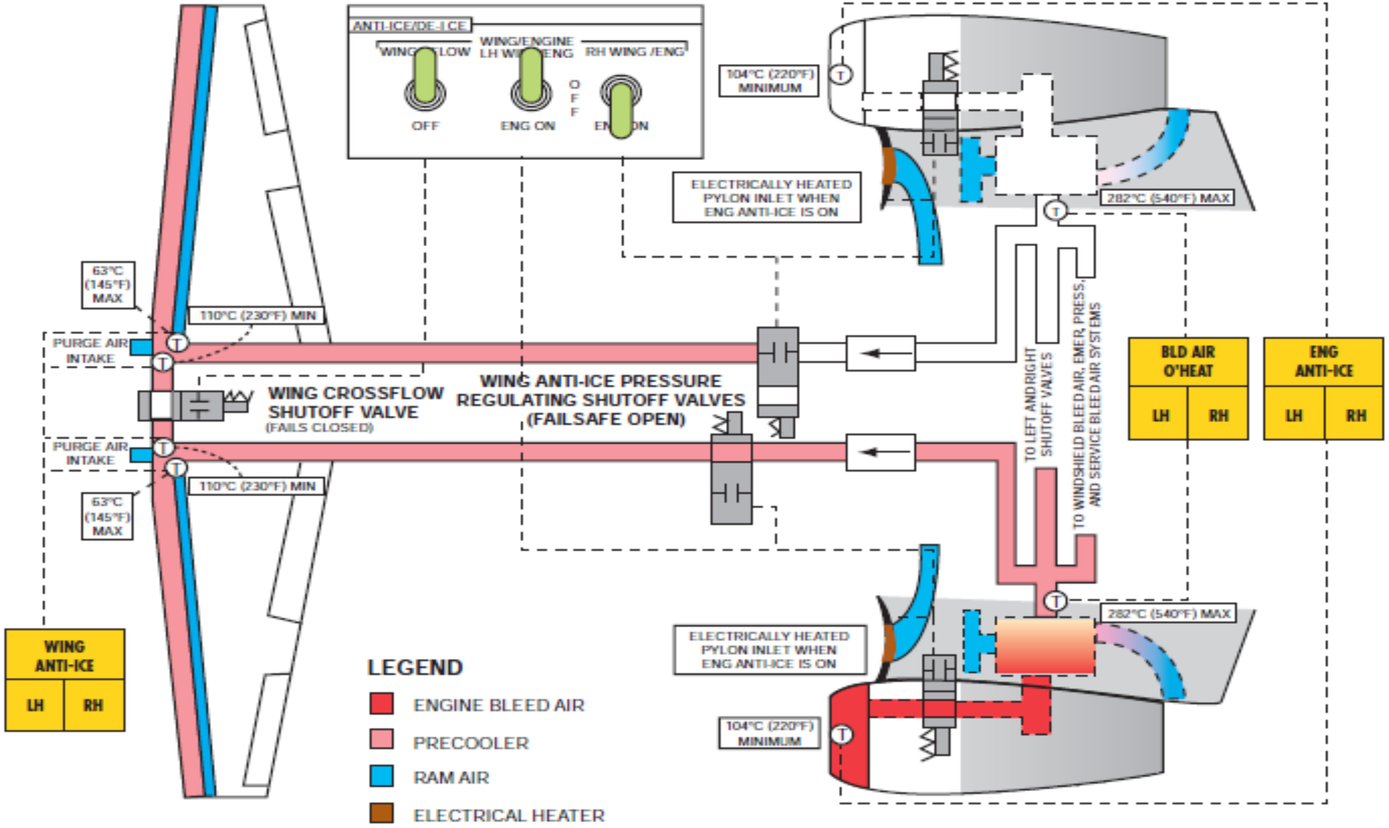
GROUND EVENT	CAUTION LIGHTS DURING THE 1st MINUTE	CAUTION LIGHTS DURING THE 2nd MINUTE	CAUTION LIGHTS DURING THE 3rd MINUTE AND BEYOND
UNDERTEMP	No Lights	ENG ANTI-ICE Steady Lights & No MASTER CAUTION Lights	ENG ANTI-ICE Flashing Lights & Steady MASTER CAUTION Lights
OVERTEMP	WING ANTI-ICE Lights Immediately On Steady & No MASTER CAUTION Lights 1 Minute Limit	WING ANTI-ICE Lights Flashing/Cycling & MASTER CAUTION Lights On Steady Wing May Already Be Damaged	WING ANTI-ICE Lights Flashing/Cycling & MASTER CAUTION Lights On Steady Wing May Already Be Damaged

INFLIGHT (80% N2 Minimum)			
FLIGHT EVENT	CAUTION LIGHTS DURING THE 1st MINUTE	CAUTION LIGHTS DURING THE 2nd MINUTE	CAUTION LIGHTS DURING THE 3rd MINUTE AND BEYOND
UNDERTEMP	No Lights Pilot Corrects Avoids Lights	WING & ENG ANTI-ICE Steady Lights & No MASTER CAUTION Lights	WING & ENG ANTI-ICE Flashing Lights And Steady MASTER CAUTION Lights
UNDERSPEED	No Lights Pilot Corrects Avoids Lights	WING & ENG ANTI-ICE Steady Lights & No MASTER CAUTION Lights	WING & ENG ANTI-ICE Flashing Lights And Steady MASTER CAUTION Lights
OVERTEMP (All WING/ENG ANTI-ICE Switch Positions)	WING ANTI-ICE Lights Immediately On Flashing & No MASTER CAUTION Lights	WING ANTI-ICE Lights Flashing/Cycling & MASTER CAUTION Lights On Steady	WING ANTI-ICE Lights Flashing/Cycling & MASTER CAUTION Lights On Steady

ENGINE/WING ANTI-ICE SYSTEM - BOTH ENGINES



ENGINE/WING ANTI-ICE SYSTEM - ONE ENGINE



WING ANTI-ICE SYSTEM

If the throttles are reduced below the under-speed sensor, both the engine and wing anti-ice valves will immediately close, and a one-minute timer is activated. The WING ANTI-ICE amber annunciator light illuminate one minute after the throttle is retarded to an under-speed or an under-temperature condition, whichever occurred first. If the throttle is not advanced above 80% N2 by the end of the second minute, the MASTER CAUTION lights illuminate steady and the amber WING and ENG ANTI-ICE lights flash. The 80% N2 minimum rpm setting must be maintained during flight icing. It may take up to two minutes at 80% N2 , to extinguish under-temperature lights or provide sufficient bleed-air flow to inflate the horizontal tail deice boots.

WING ANTI-ICE SYSTEM (CONT'D)

To ground test the wing and engine anti-ice systems:

1. Set throttles above 80% N2
2. Select WING/ENG switch on.
3. The WING ANTI-ICE and ENGINE ANTI-ICE annunciator lights will initially illuminate steady for under-temperature and extinguish in approximately 30 seconds.
4. The system test is complete when the wing anti-ice lights extinguish.
5. Select both switches OFF and reduce the throttles to IDLE.

During ground operation, either during a test of the system or in icing conditions, turn the WING/ENG switch OFF immediately when the WING ANTI-ICE lights go out to prevent wing overheat damage.

WING ANTI-ICE SYSTEM (CONT'D)

Don't forget to check the wings for icing five minutes prior to takeoff. When cleared into position, line-up with the nose-wheel centered and brakes on. Set the throttles to TO and wait for the WING ANTI-ICE annunciator to extinguish. This procedure assures the anti-ice equipment operates correctly. If ice has accumulated behind the heated wing leading edge, deicing is required prior to takeoff. Icing will also be present on the tail.

WING ANTI-ICE SYSTEM (CONT'D)

How to MONITOR wing temperature WITH ONE ENGINE INOPERATIVE.

When an engine is shutdown during flight in icing conditions, under-temperature wing monitoring on the inoperative side may not be possible. In fact, no wing under-temperature monitoring is possible in OFF or ENG ON. If an engine is shutdown, select both switches to WING/ENG to monitor for under-temperature on both the operating engine wing and the inoperative engine wing. If either WING ANTI-ICE light illuminates, it is a wing under temperature and the operating engine throttle should be advanced to produce more heat.

WING ANTI-ICE X-FLOW SYSTEM

The X-FLOW selection is used:

1. To anti-ice the inoperative engine wing.
2. To heat a wing if the operating engine wing anti-ice valve has failed closed.
3. During an over-temperature in non-icing flight conditions with the switches OFF.

With the wing anti-ice switches OFF, an OVER-TEMPERATURE of the wings is very unlikely during flight. However, if a WING ANTI-ICE light illuminates, a wing over-temperature is indicated. This could mean a wing anti-ice valve has failed open allowing hot bleed air to flow into a wing. Reducing power and selecting XFLOW directs half of the bleed air to the overheating wing and half to the opposite wing to help reduce excess heat.

WING ANTI-ICE SYSTEM

Wing over temperature:

Wing over-temperature is rarely problematic during flight; however, it can be a concern during ground operations. Wing over-temperature above 63°C (145°F) or a BLD AIR O'HEAT (precooler discharge air over 282°C (540°F) could damage the wing leading edge. This can occur during sustained ground operation at high RPM.

WING ANTI-ICE SYSTEM (CONT'D)

Wing structural over-temperature protection is active in any switch position i.e., WING/ENG, OFF, and ENG ON.

If a wing over-temperature occurs:

- WING ANTI-ICE light(s) immediately begin to flash.
- The wing anti-ice valves immediately close to protect the overheated wing.
- The MASTER CAUTION lights are armed to come on in approximately one minute.
- The affected wing anti-ice valve and light may cycle until the over-temperature is corrected. During prolonged ground test there is a one (1) minute limit to heat the wings after the WING ANTI-ICE lights extinguish.

WING ANTI-ICE SYSTEM FAILURES

- If the N2 speed display fails in icing conditions and indicates rpms below 80% N2, the wing and engine anti-ice valves will energize closed terminating bleed air to the wings and engines.
- If normal DC fails, the engine and wing anti-ice valves fail open, and the wings and engines are heated.
- If the engine anti-ice circuit breakers pop and cannot be reset, the wing and engine anti-ice valves are deenergized open.

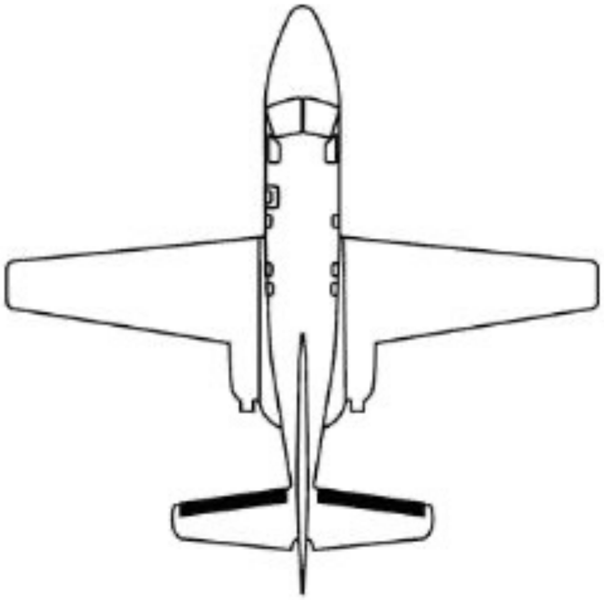
TAIL DEICE

The horizontal stabilizer leading edges is deiced by inflatable boots controlled by the tail deice AUTO–OFF–MANUAL switch. The boots utilize the service bleed air system when the engines are operating. A timer controls the automatic sequencing of the boots.

TAIL DEICE (CONT'D)

If electrical power is lost, the tail deice system is inoperative, and icing conditions must be avoided.

The tail boots should not be activated if the indicated RAT is below –35°C (–31°F). Permanent boot damage could result.



TAIL BOOT OPERATION

AUTO is the normal system mode.

When the switch is in the AUTO position it provides one six-second cycle for each boot followed by approximately three minutes of rest starting from the time the system was initialized. Boot cycling is controlled by two control valves.
The MANUAL position overrides AUTO and inflates the boots as long as the switch is held in the manual position. When the tail deice switch is OFF, both horizontal stabilizer boot control valves are deenergized open, and a bleed air ejector creates a vacuum to hold the boots deflated.

NOTE:
If the BATTERY switch is in the EMER position, the TAIL DE-ICE FAIL CAS message indicates that the tail deice is inoperative.

TAIL DE-ICE FAIL

TAIL DEICE SYSTEM

As each set of boots is inflated, a 16-psi pressure switch illuminates the white TAIL DE-ICE CAS message to indicate actuating pressure has been applied.

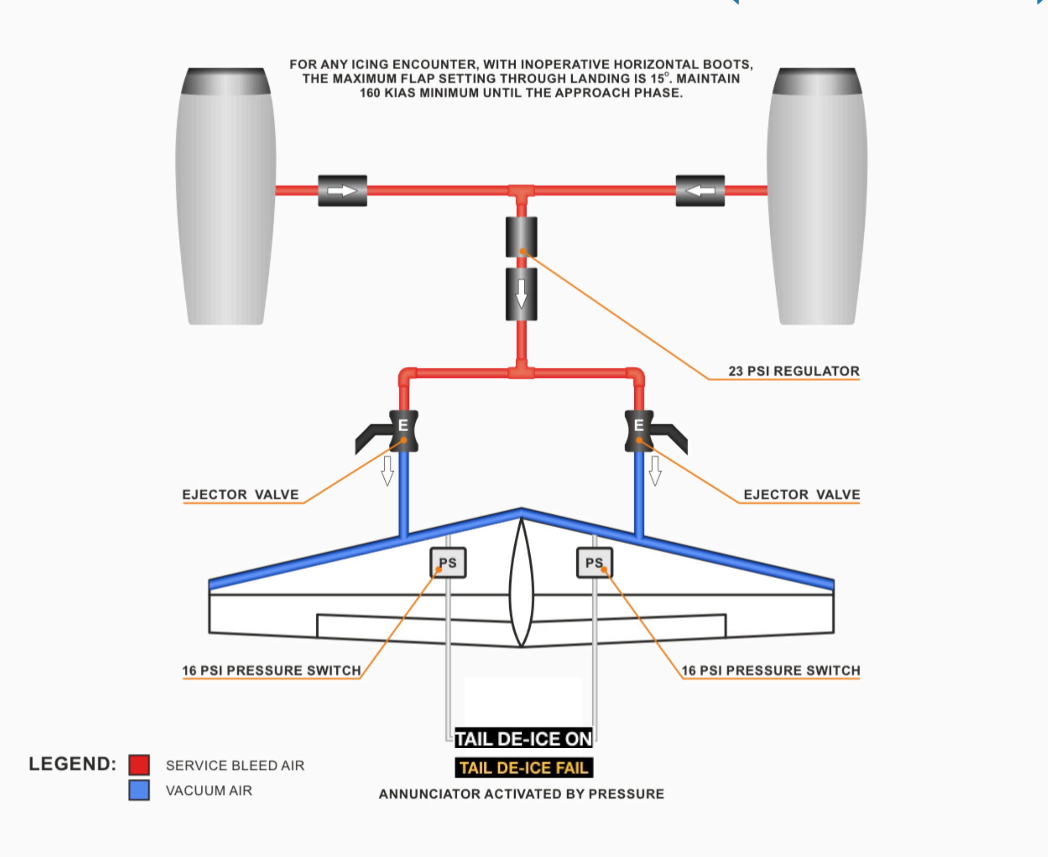
TAIL DE-ICE ON

If the tail deice boot(s) fail, monitor the tips of the horizontal stabilizer for ice accumulation. If ice has formed on the tail, limit the flap selection to 15° maximum.

TAIL DE-ICE FAIL

Maintain a minimum airspeed of 160 KIAS while in icing conditions until it is necessary to slow down for the approach and landing.

TAIL DEICE SYSTEM (CONT'D)



OPERATIONS IN SEVERE ICING CONDITIONS

The aircraft is not approved for flight in severe icing conditions. Severe icing may result from environmental conditions outside of those for which the airplane is certified. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system or may result in ice forming aft of the protected surfaces. This ice may not shed when the ice protection systems are used and may seriously degrade the performance and controllability of the airplane.

All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night.

NOTE:
This supersedes relief provided by the master minimum equipment list.

OPERATIONS IN SEVERE ICING CONDITIONS (CONT'D)

Severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues:

1. Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.
2. Accumulation of ice on the upper surface of the wing aft of the protected area.

If one or more of these visual cues exist:

1. Use of the autopilot is prohibited.
2. Immediately request priority handling from Air Traffic Control to facilitate a route or altitude change to exit the icing conditions.
3. Leave flaps in current position, do not extend or retract.
4. Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
5. If unusual or uncommanded roll control movement is observed, reduce angle-of- attack.

OPERATIONS IN SEVERE ICING CONDITIONS (CONT'D)

Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when:

1. Unusual lateral trim is required while the airplane is in icing conditions.
2. Autopilot trim warnings are encountered while the airplane is in icing conditions

SEVERE ICING ENCOUNTER

Severe icing may be encountered at temperatures as cold as –18°C. Increased vigilance is required at temperatures around 0°C ambient air temperature with visible moisture present.

NOTE:

The following weather conditions may be conducive to severe in-flight icing:

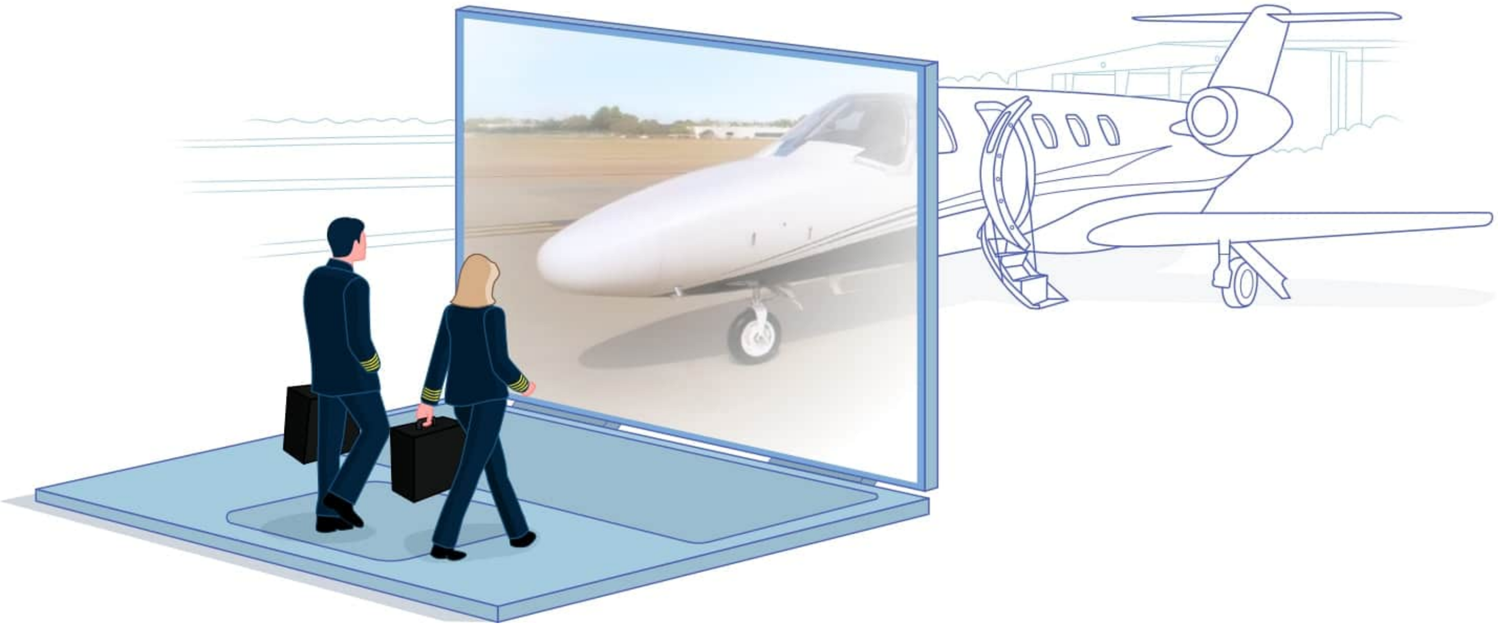
- Visible rain at temperatures colder than 0°C (32°F) ambient air temperature.
- Droplets that splash or splatter at temperatures colder than 0°C (32°F) ambient air temperature.

SEVERE ICING IS PRESENT

Severe icing conditions are indicated by one or more of the following visual cues:

- Unusually extensive ice accumulations on the airframe and windshield in areas not normally observed to collect ice.
- Accumulation of ice on the upper surface of the wing aft of the protected area.

1. Immediately request priority handling from Air Traffic Control to facilitate exiting the severe icing conditions.
2. Flaps—Leave in current position. Do not extend or retract.
3. Autopilot—Disengage. Be prepared for control wheel force required to maintain desired flight path.
4. Avoid abrupt and excessive maneuvering that may aggravate control problems.
5. If unusual or uncommanded roll is encountered—Reduce angle-of-attack.



AIR CONDITIONING

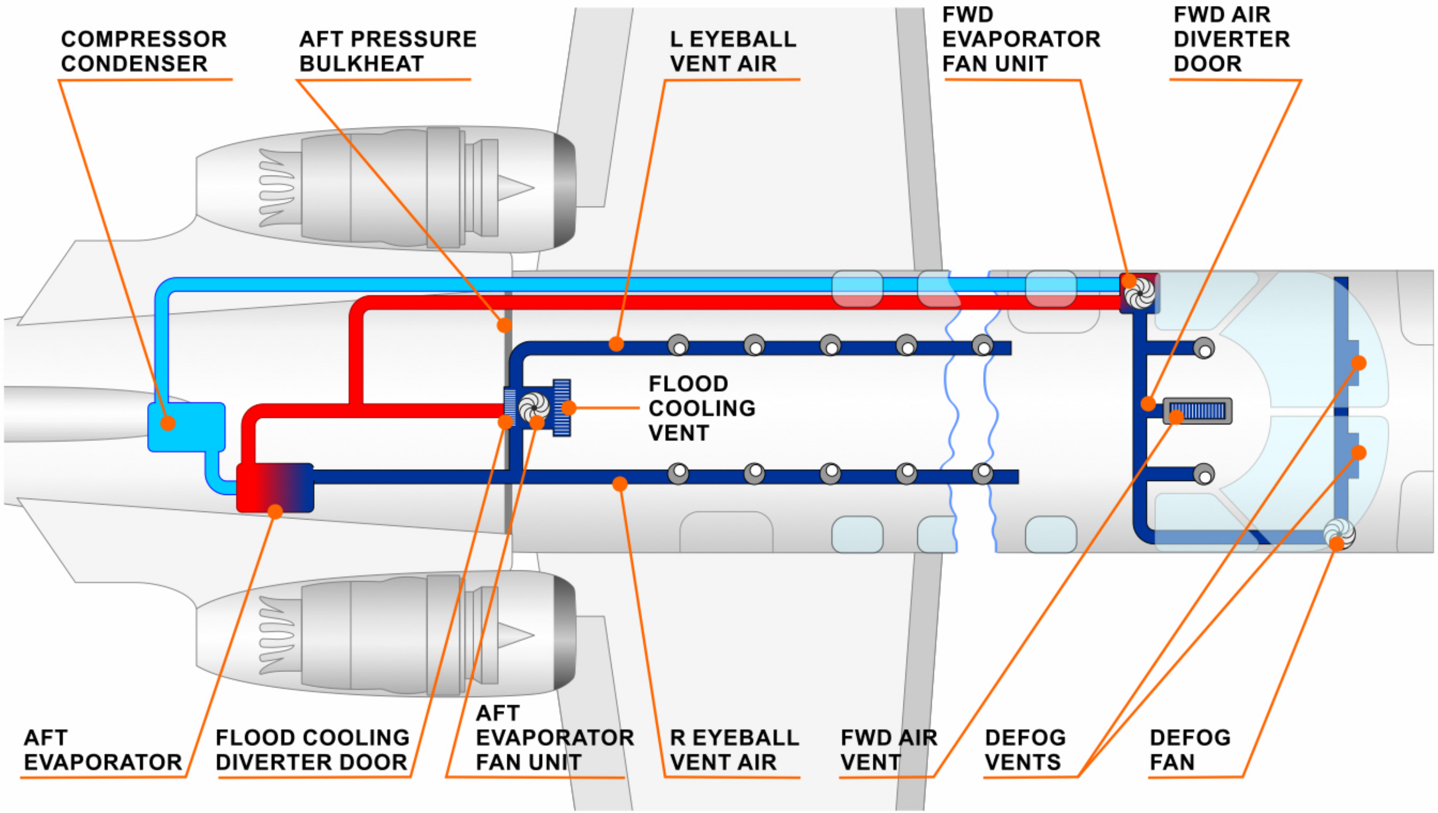
AIR CONDITIONING

The airplane's interior is conditioned with automatic and manual temperature control. Engine bleed air is used to heat, cool, and pressurize the cabin and cockpit. Bleed Air is extracted from the engine and enters the pre-cooler, then the heat exchanger before entering the cabin.

To increase cooling, two vapor-cycle evaporators are connected to a compressor and condenser located in the tail cone.

Either engines can supply bleed air for system operation on the ground or in the air.

The cabin can be supplied with fresh air during ground operations.
Emergency pressurization is also available in flight from either engine.

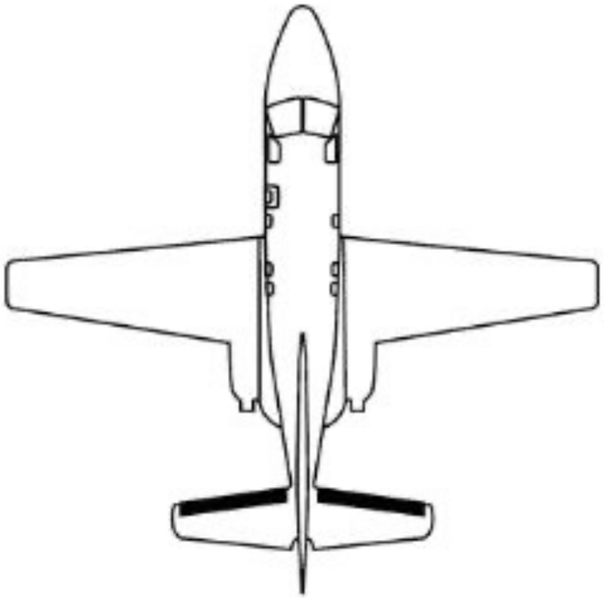


COMPRESSOR CONDENSER
AFT PRESSURE BULKHEAT
L EYEBALL VENT AIR
FWD EVAPORATOR FAN UNIT
FWD AIR DIVERTER DOOR
FLOOD COOLING VENT
AFT EVAPORATOR
FLOOD COOLING DIVERTER DOOR
AFT EVAPORATOR FAN UNIT
R EYEBALL VENT AIR
FWD AIR VENT
DEFOG VENTS
DEFOG FAN

PYLON PRECOOLERS

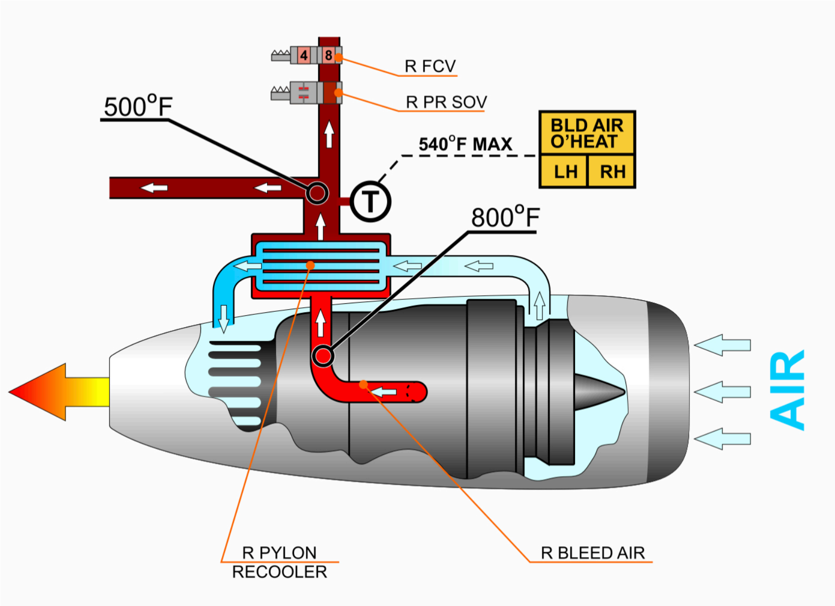
If electrical power is lost, the tail deice system is inoperative, and icing conditions must be avoided.

The tail boots should not be activated if the indicated RAT is below –35°C (–31°F). Permanent boot damage could result.



PYLON PRECOOLERS (CONT'D)

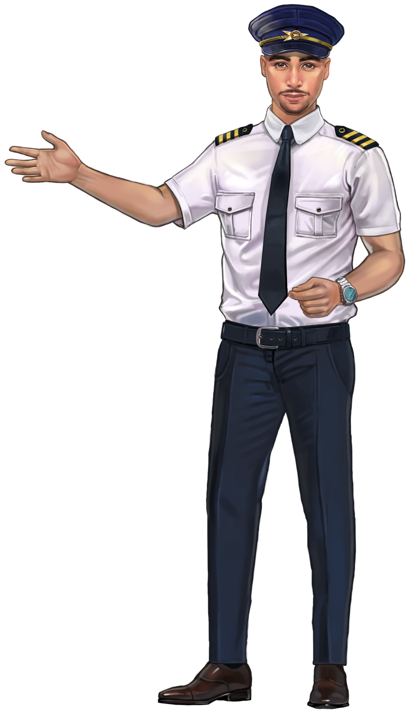
Engine bleed air exits the engine at approximately 900°F as it enters the pre-cooler. It drops to 500°F as it exits the unit as a result of the ambient air passing over the pre-cooler.



PYLON PRECOOLERS (CONT'D)

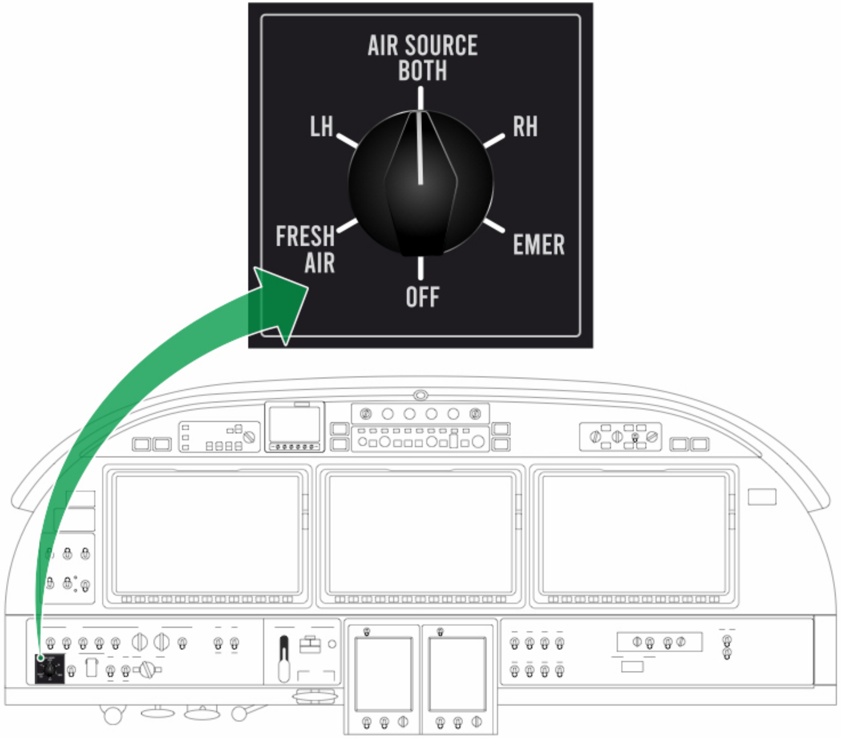
BLEED AIR O'TEMP L-R

When the cooled bleed air exits the pre-cooler, it passes an over-temperature sensor. If the bleed air is above 560°F, the BLD AIR O'TEMP L-R CAS messages illuminates. Reducing power should extinguish the message.



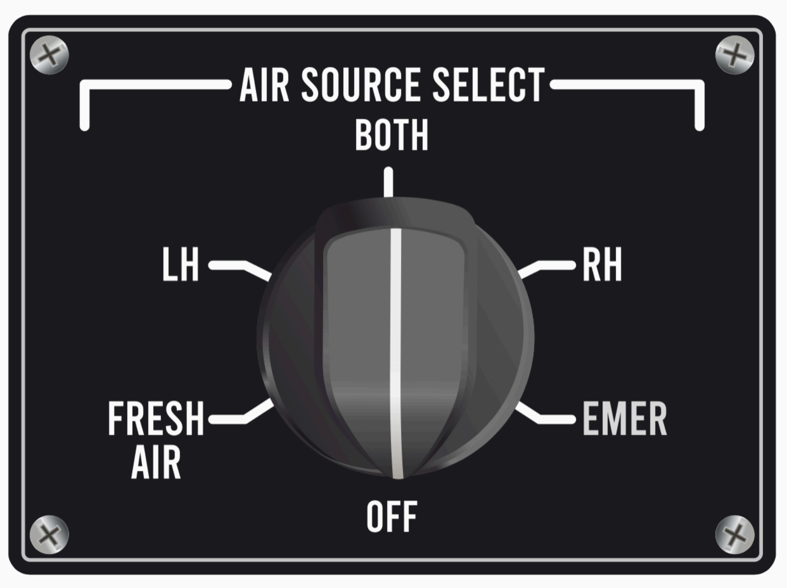
BLEED AIR SOURCE CONTROL

The AIR SOURCE SELECTOR determines the sources and amount of bleed air that enters the cabin.



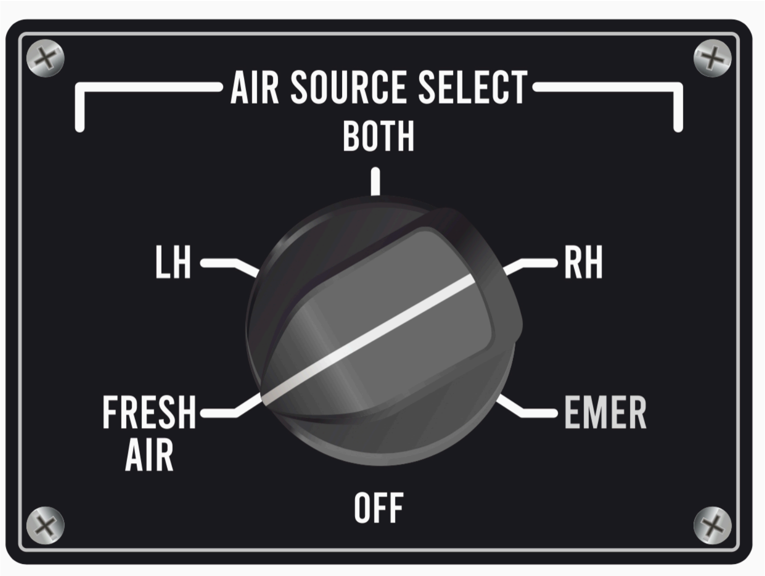
BLEED AIR SOURCE CONTROL (CONT'D)

The AIR SOURCE SELECTOR determines the sources and amount of bleed air that enters the cabin. The OFF position energizes the LH and RH bleed-air shutoff valves, the flow control and shutoff valve, and the W/S bleed-air shutoff valve closed. The EMER valve is de-energized closed. Bleed air is still available to the service air system, but no bleed air enters the pressure vessel from the engines. The airplane will fully depressurize at its leak rate.



BLEED AIR SOURCE CONTROL (CONT'D)

The FRESH AIR position will not pressurize the airplane and is intended for ground and unpressurized low altitude operation only. The LH and RH bleed air shutoff valves, the flow control and shutoff valve, and the windshield.



The source of air entering the cabin in FRESH AIR is ram air from intakes on the forward edge of the pylons with an axial fan boosting airflow.
If pressurized at the time of selection, no air will flow until internal pressure leaks out to equal pylon ram inlet pressure. One-way check valves then unseat, and the fan ventilates the cabin.

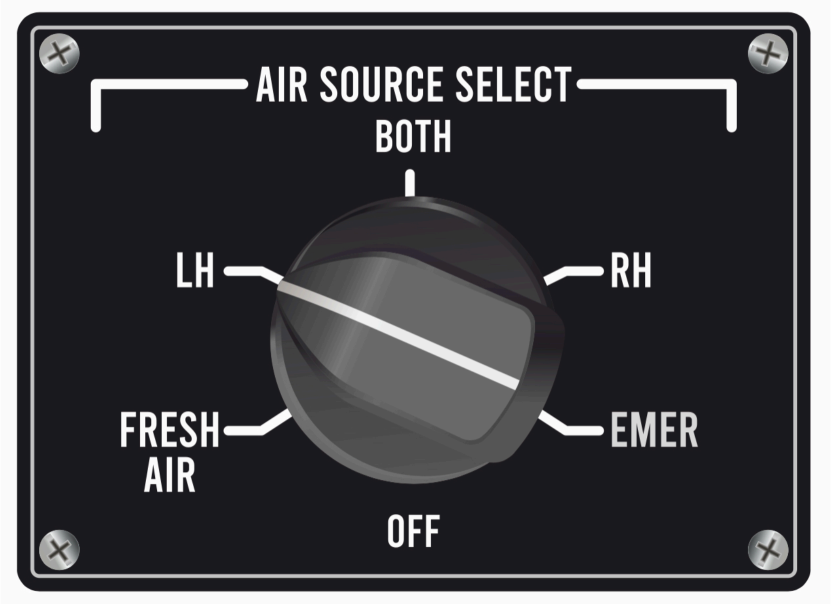
BLEED AIR SOURCE CONTROL CAS MESSAGE

FRESH AIR ON	FRESH AIR is selected on AND aircraft is in the air OR THROTTLE levers are near cruise power settings or above.
FRESH AIR ON	FRESH AIR is selected on AND aircraft is on the ground AND THROTTLE levers are below cruise power settings.

The FRESH AIR ON CAS message and the MASTER CAUTION lights illuminate when the fresh air source is selected, and the aircraft is inflight. The LH and RH bleed air shutoff valves, the flow control and shutoff valve, and the windshield bleed-air shutoff valve are all energized closed. The EMER valve is de-energized closed. The source of air entering the cabin in FRESH AIR is ram air from intakes on the forward edge of the pylons with a fan boosting airflow.

BLEED AIR SOURCE CONTROL (CONT'D)

The LH position allows left engine air to enter the cabin and shuts off right engine air. The selected bleed-air valve is open, and the non-selected engine bleed-air valve is closed. The windshield bleed-air shutoff valve is energized closed and the EMER valve is de-energized closed. With the RH position selected, the process is reversed. The amount of airflow entering the cabin is regulated to 8 ppm in either the LH or RH position.



EMERGENCY BLEED AIR

The EMER position provides bleed air at 49°C (120°F). It is regulated by the emergency valve to enter the cabin at 6 ppm. Air from the EMER valve, located under the floor of the copilot seat, is directed into the cabin bleed air distribution ducting. EMER provides an alternate source of bleed air from one or both engines to continue pressurization should the normal source fail.
In the EMER position:

The windshield anti-ice valve is de-energized OPEN.

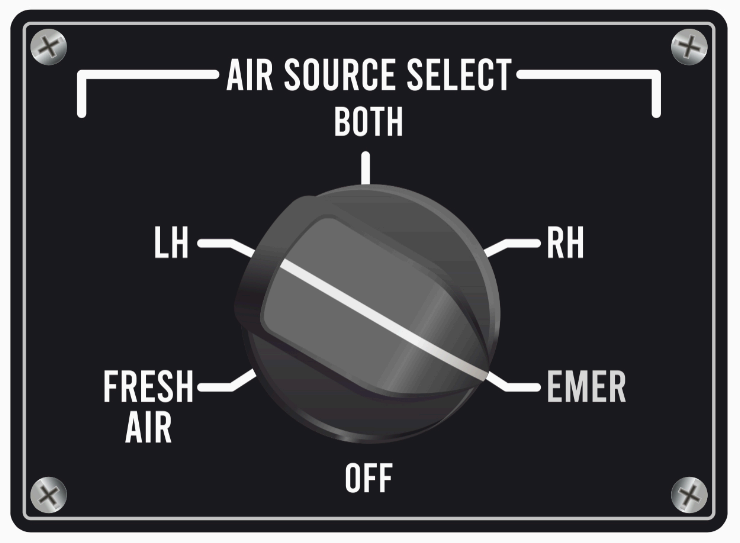
- The emergency valve is energized OPEN.
- The LH and RH bleed-air shutoff and flow control and shutoff valves are energized closed.

***It is not intended for normal use*.**

BLEED AIR SOURCE CONTROL (CONT'D)

Selecting EMER in flight or on the ground will cause the EMERG PRESS ON CAS message and the MASTER CAUTION lights to illuminate.

Selecting EMER opens the valve in flight but not on the ground. The emergency valve fails closed with the loss of normal DC. Selecting the windshield anti-ice system ON greatly impacts EMER operations reducing source air volume and increasing source air temperature from the Windshield Anti-Ice heat exchanger to 138°C (280°F) in HI or 127°C (260°F) in LOW.



EMERGENCY PRESS ON

BLEED AIR SOURCE CONTROL (CONT'D)

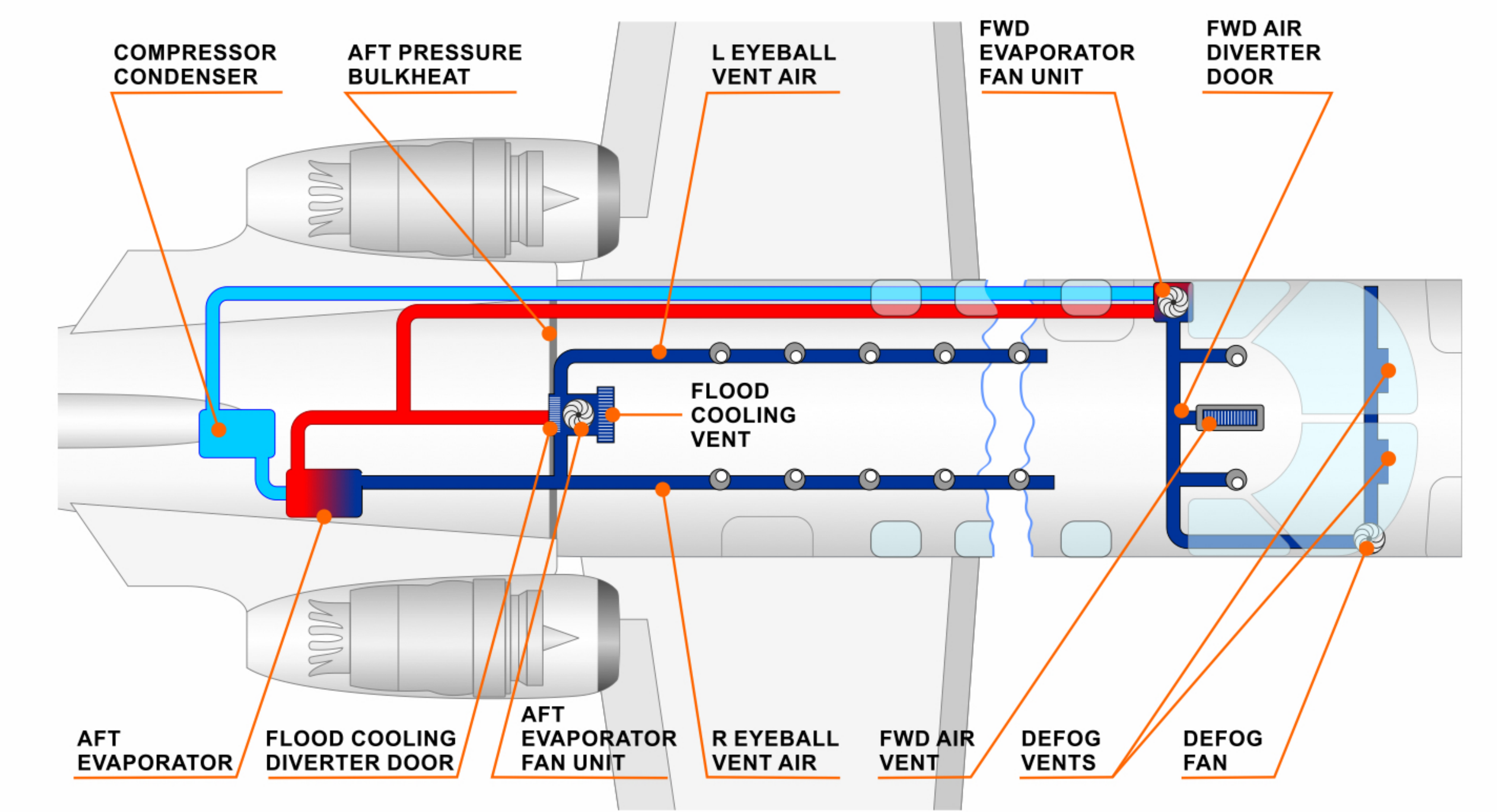
If DC electrical failure occurs, regardless of the AIR SOURCE SELECT position, air is supplied to the cabin as if the source selector switch were positioned to BOTH.

Without electrical power, the emergency pressurization valve fails closed, and the left and right bleed-air shutoff and flow control and shutoff valves fail open supplying the cabin with 8 ppm regulated airflow.

The windshield bleed-air shutoff valve fails open, delivering air to the two-windshield bleed-air manual valves which are normally closed except
in icing conditions.

TEMPERATURE CONTROL

The cabin temperature is controlled automatically by a TEMPERATURE slide rheostat or a MANUAL HOT/COLD switch.


COMPRESSOR
CONDENSER
AFT PRESSURE
BULKHEAT
L EYEBALL
VENT AIR
FWD
EVAPORATOR
FAN UNIT
FWD AIR
DIVERTER
DOOR
FLOOD
COOLING
VENT
AFT
EVAPORATOR
FLOOD COOLING
DIVERTER DOOR
AFT
EVAPORATOR
FAN UNIT
R EYEBALL
VENT AIR
FWD AIR
VENT
DEFOG
VENTS
DEFOG
FAN

AUTOMATIC TEMPERATURE CONTROL

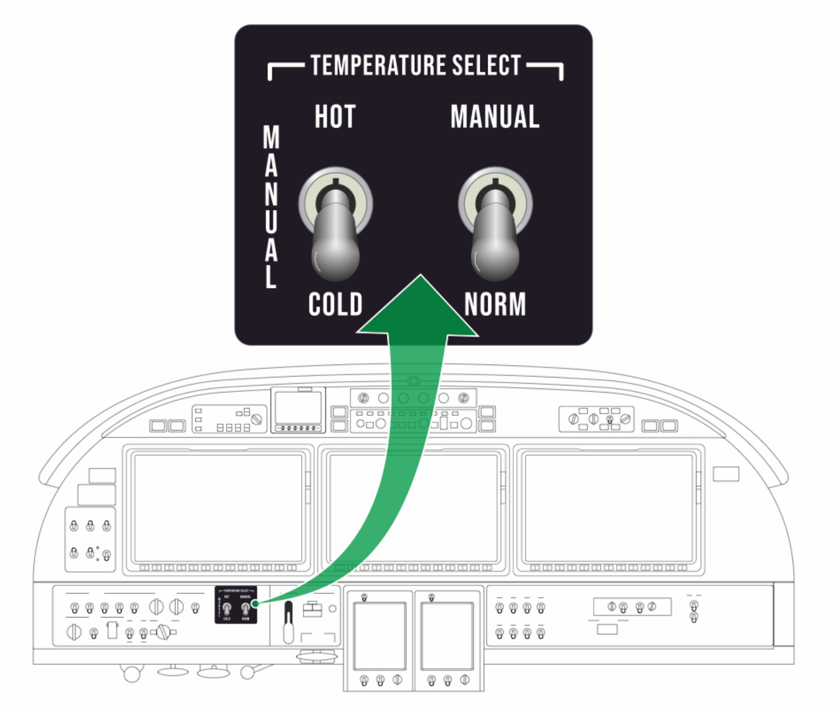
In **AUTO**, temperature is sensed by a thermometer located in the aft cabin.
The automatic temperature selection is approximately 18 to 29°C (65 to 85°F).
Usually, the most comfortable results are obtained by setting the auto selector in the 1 o'clock position.

Hot engine bleed air to the cabin is automatically shutoff during ground taxi or less than 85% N2 when the cabin temperature is warmer than 18°C (65°F) and when no pylon ram inlet cooling air is available to cool the main cabin heat exchanger.

MANUAL TEMPERATURE CONTROL

Placing the TEMPERATURE SELECT switch in MANUAL enables the MANUAL HOT–COLD toggle switch to control the cabin temperature. In MANUAL it takes approximately 15 seconds for the ram-air modulating valve to transverse from stop to stop.

- The manual switch does not select temperature. In only moves the ram-air modulating valve.
- The manual switch does not directly affect the position of the precooler exhaust doors. The precooler exhaust doors will be repositioned if the ram-air modulating valve is more than 30% open and the wing anti-ice is off.



SYSTEM PROTECTION

In **MANUAL** or **AUTO**, a signal is sent the temperature controller, then to the ram-air modulating valve to modulate the amount of ram airflow across the cabin heat exchanger.

A duct temperature anticipator is installed between the heat exchanger and aft pressure bulkhead. The anticipator senses the temperature of incoming conditioned air to the cabin and sends a signal to the temperature controller to maintain desired cabin temperature.

The cabin temperature sensor is installed on the inlet of the aft evaporator, immediately forward of the aft pressure bulkhead. It senses actual cabin temperature and sends a signal to the temperature controller to maintain the desired cabin temperature

SYSTEM PROTECTION (CONT'D)

A duct overheat temperature sensor is mounted between the cabin heat exchanger and aft pressure bulkhead. When cabin supply air temperatures exceed 157°C (315°F) downstream of the cabin air-to-air heat exchanger, the temperature sensor illuminates an AIR DUCT O'HEAT annunciator and the MASTER CAUTION light. In the automatic temperature mode, AIR DUCT O'HEAT protection should be provided by the system.

The TEMPERATURE SELECT AUTO knob provides a signal to the cabin temperature controller. The cabin temperature controller limits the high and low temperature adjustments received from the ram-air modulating valve. The cabin temperature controller does a comparison between desired temperature and actual temperature and signals the actuator to move the ram-air modulating valve to adjust the cabin air supply temperature. Automatic air duct overheat protection is disabled while using manual temperature control, but the AIR DUCT O'HEAT annunciator will continue to function.

SYSTEM PROTECTION (CONT'D)

The TEMPERATURE SELECT AUTO knob provides a signal to the cabin temperature controller. The cabin temperature controller limits the high and low temperature adjustments received from the ram-air modulating valve. The cabin temperature controller does a comparison between desired temperature and actual temperature and signals the actuator to move the ram-air modulating valve to adjust the cabin air supply temperature.

Automatic air duct overheat protection is disabled while using manual temperature control, but the AIR DUCT O'HEAT annunciator will continue to function.

VAPOR-CYCLE AIRCONDITIONING

INTRODUCTION

The air-conditioning system provides conditioned air to both cockpit and cabin areas. The vapor-cycle system functions in conjunction with temperature-controlled bleed air.

- The compressor can operate from the right generator or EPU on the ground.
- It must have both generators operating when airborne.

The compressor is automatically load shed if a generator fails while airborne.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

GENERAL

Cabin air is circulated through two evaporators, one in the aft bulkhead and one in the forward cabin under the side-facing seat. The aft evaporator provides conditioned air to overhead rotatable WEMACs or the flood-cooling door.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

The green COMPRESSOR ON light on the PRESSURIZATION–ENVIRONMENTAL control panel indicates that the air conditioning compressor is operating. The compressor is located in the tail cone.

VAPOR-CYCLE AIRCONDITIONING

EVAPORATORS

There are two evaporators in the vapor-cycle system.

- The forward evaporator is mounted on the left side, forward of the cabin entry door.
- The rear evaporator is mounted at the rear of the cabin.

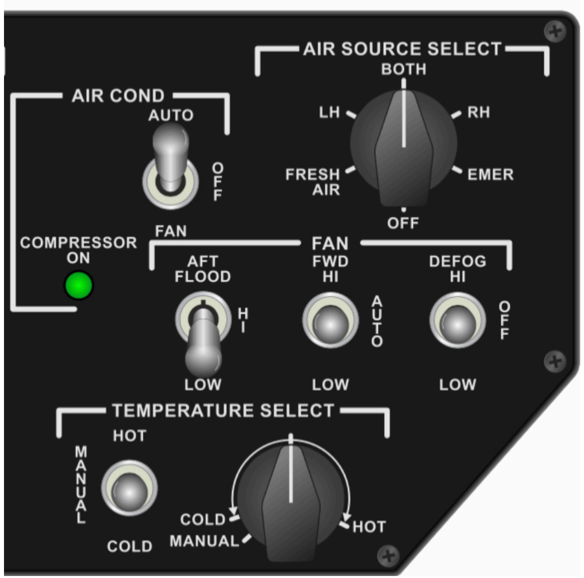
The aft evaporator is connected to the overhead wemac system as well as a flood-cooling outlet located on the rear bulkhead. Do not block the evaporator inlets.

Cabin air is driven across the evaporator coils by electrically powered blowers.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

CONTROLS

A three-position compressor control switch
Two, three-position fan switches.
The aft fan switch controls the flood-cooling diverter door.
Additionally, the system is controlled by the cabin temperature control system The airplane is also equipped with automatic load shedding. In flight, both generators must be operating in order for the compressor drive motor to operate. In the event of a generator failure, the compressor is automatically disconnected from the power source. The fans are energized anytime the air-conditioning select switch is placed in the AUTO or FAN positions. A COMPRESSOR ON green light will illuminate when there is power applied to the compressor.



VAPOR-CYCLE AIRCONDITIONING

TEMPERATURE CONTROL OF THE VAPOR-CYCLE SYSTEM IN FLIGHT AND ON THE GROUND

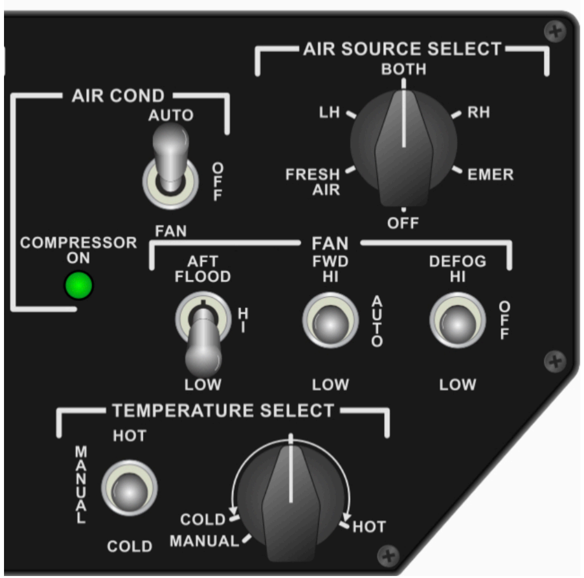
In the AUTO position, the blowers and the cabin temperature control system are energized. Power is also applied to the ram-air modulating valve which controls the amount of pylon ram air used for the cabin air heat exchanger and operates the compressor limit switches.

In flight with warm cabin conditions, the ram-air modulating valve will drive full open (asking for maximum cooling of the bleed air) and the limit switch on. This will power the compressor.
The cabin is provided with refrigerant cooling while the ram-air modulating valve controls bleed-air temperature to the cabin. As conditions change and the ram air modulating valve drives 70% closed, a second limit switch will remove power from the compressor. The compressor will automatically shutoff above 18,000 feet.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

On the ground when no ram air is available, the ram-air valve will drive full open any time the cabin temperature is above the cabin temperature control set point engaging the compressor. The ram-air modulating valve will drive toward closed anytime the cabin temperature is below the selected temperature removing power from the compressor.

This provides temperature control of the vapor-cycle system in flight and on the ground.



VAPOR-CYCLE AIR CONDITIONING (CONT'D)

FAN CONTROLS

The forward (FWD) evaporator fan switch, labeled LOW–AUTO– HI, controls the forward evaporator fan. In the AUTO position, the forward fan will operate at a low speed only while the compressor is activated. The LOW and HI positions will continuously run the fan with or without compressor operation.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

The AFT fan switch, labeled LOW–HI– FLOOD, controls a two-speed aft fan and the flood-cooling door.

- The LOW and HI positions provide airflow through the aft evaporator and circulate it to the cabin through the overhead distribution system.
- In the FLOOD position, all of the air is distributed from a large vent near the top of the aft pressure bulkhead. This will bypass the overhead distribution system.

VAPOR-CYCLE AIR CONDITIONING (CONT'D)

FLOOD-COOLING DOOR

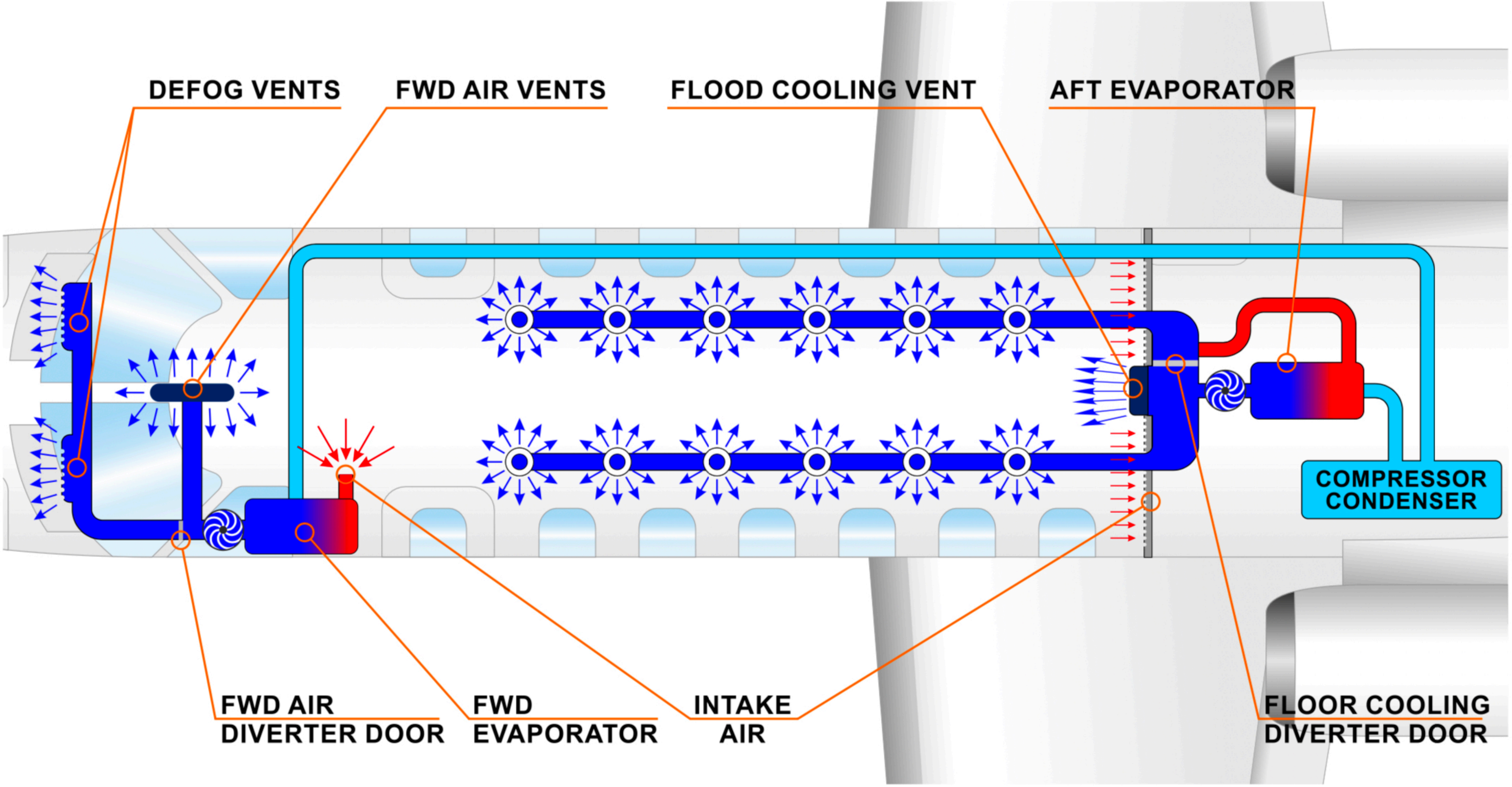
The flood-cooling vent is located behind the interior panel near the top of the aft pressure bulkhead. The door is spring-loaded to the flood position in the absence of 23 psi service air pressure, i.e. no engine running.

AIR DISTRIBUTION DESCRIPTION

The cabin bleed-air distribution system delivers air throughout the cabin and cockpit. The system components include:

1. cockpit foot warmer outlets.
2. passenger foot warmer outlets.
3. passenger armrest outlets.
4. windshield defog outlets.
5. flow divider.
6. windshield defog fan.
7. fresh air fan.

Fresh air is available directly to the cabin for ground or unpressurized low altitude ventilation in lieu of bleed air. A fresh air blower, located aft of the aft pressure bulkhead, delivers fresh air through the bleed-air distribution system.


DEFOG VENTS
FWD AIR VENTS
FLOOD COOLING VENT
AFT EVAPORATOR
COMPRESSOR CONDENSER
FWD AIR DIVERTER DOOR
FWD EVAPORATOR
INTAKE AIR
FLOOR COOLING DIVERTER DOOR

AIR DISTRIBUTION

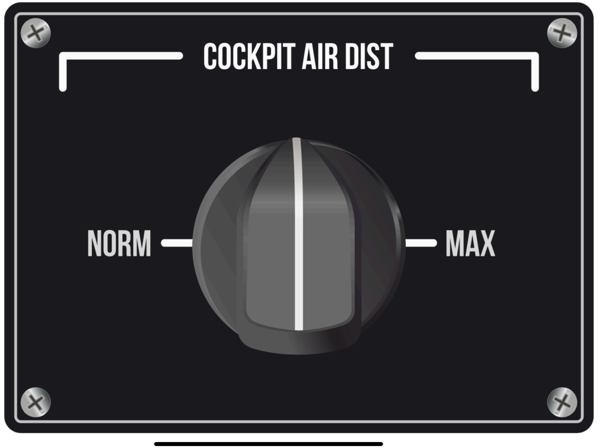
OPERATION

The overhead ventilation system is routed along the ceiling forward of the aft pressure bulkhead. The system recirculates cabin air through the aft evaporator and operates only when the AIR COND switch is set to FAN or AUTO. The overhead ducting system incorporates the aft evaporator flood-cooling door and conditioned air ducting and outlets.

The flood-cooling door is pneumatically actuated and controlled by the AFT fan switch in the FLOOD position.

COCKPIT AIR DISTRIBUTION

The COCKPIT AIR DIST knob adjusts the distribution of incoming air between the cabin air duct and cockpit/ emergency air duct.



"AT" COCKPIT AIR DISTRIBUTION

The four detents of the COCKPIT AIR DIST knob electrically controls and pneumatically actuates the two spring-loaded (retracted) valves, using 23 psi service air. This provides the crew a more comfortable environment and better windshield moisture control.

The COCKPIT AIR DIST knob is kept in NORM for climb and cruise and is selected to MAX for descent and approach.

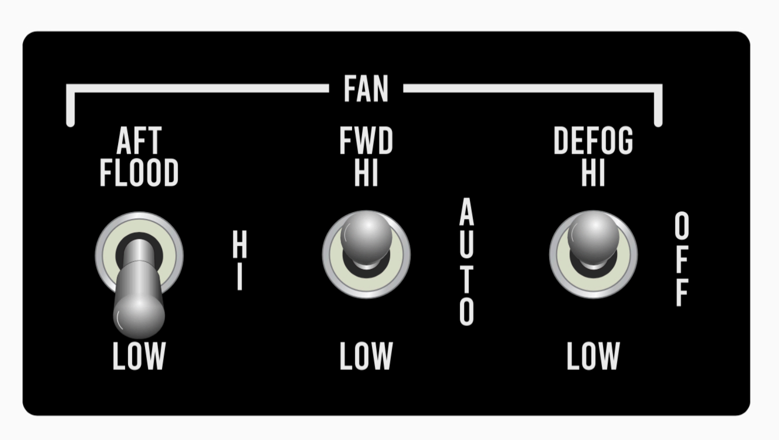
SWITCH DETENTS	CREW AIR	PASSENGER AIR
NORM (9 O'CLOCK)	50%	50%
11 O'CLOCK	60%	40%
1 O'CLOCK	70%	30%
MAX (3 O'CLOCK)	80%	20%

AIR DISTRIBUTION

DEFOG FAN

The DEFOG fan is located in the right cockpit sidewall. When the DEFOG fan is in the HI or LOW position, it recirculates cockpit air from behind the instrument panel to the inner windshield. The DEFOG fan switches are normally left OFF for climb and cruise and selected to HI prior to:

- Normal descent
- Approach
- Descent after cold soak



DEFOG FAN

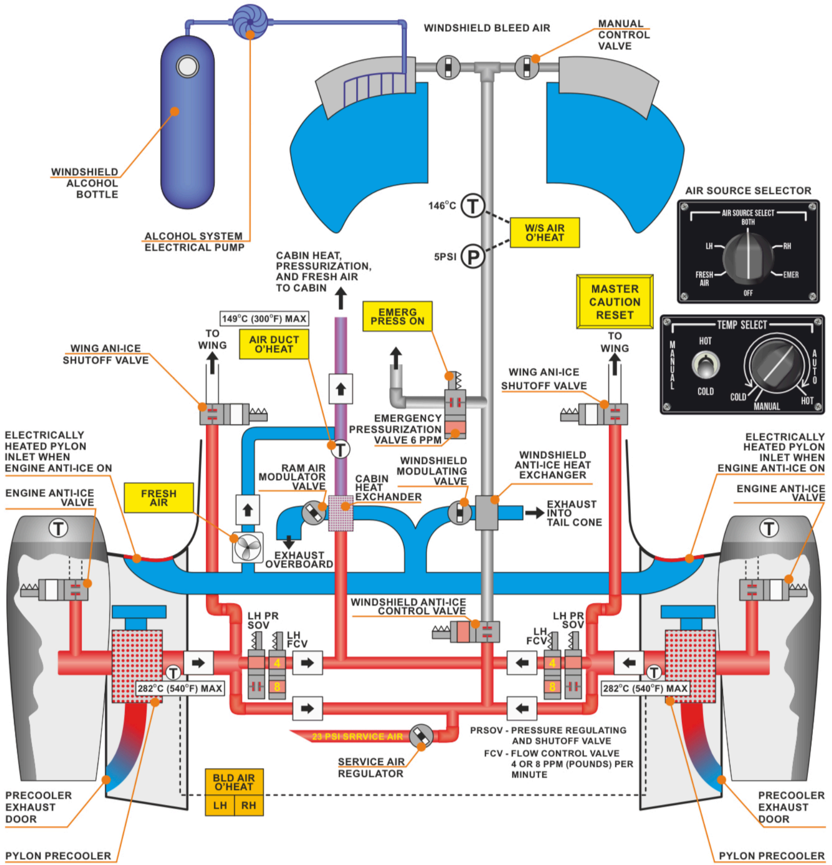
Selecting HI or LO operates the vapor-cycle air-conditioning system below 18,000 feet MSL (by aneroid) if the refrigerant is sufficiently warm regardless of switch position (even OFF).

Selecting HI or LO automatically turns on the vapor-cycle compressor, the FWD evaporator fan speed to HI, sends 23 psi service air to the diverter valve pneumatic actuator. This overcomes the spring moving the diverter door to direct the majority of air from the floor grill (register) to the DEFOG fan inlet. The DEFOG fan at HI or LO fan speed boosts the dry evaporator air to the inside windshield surface. Condensation is routed overboard through two heat vents under the fuselage, one near the forward evaporator and the other near the aft evaporator.

RECOMMENDED COMFORT SETTINGS

FOR DESCENT AFTER BEING COLD SOAKED AT ALTITUDE:

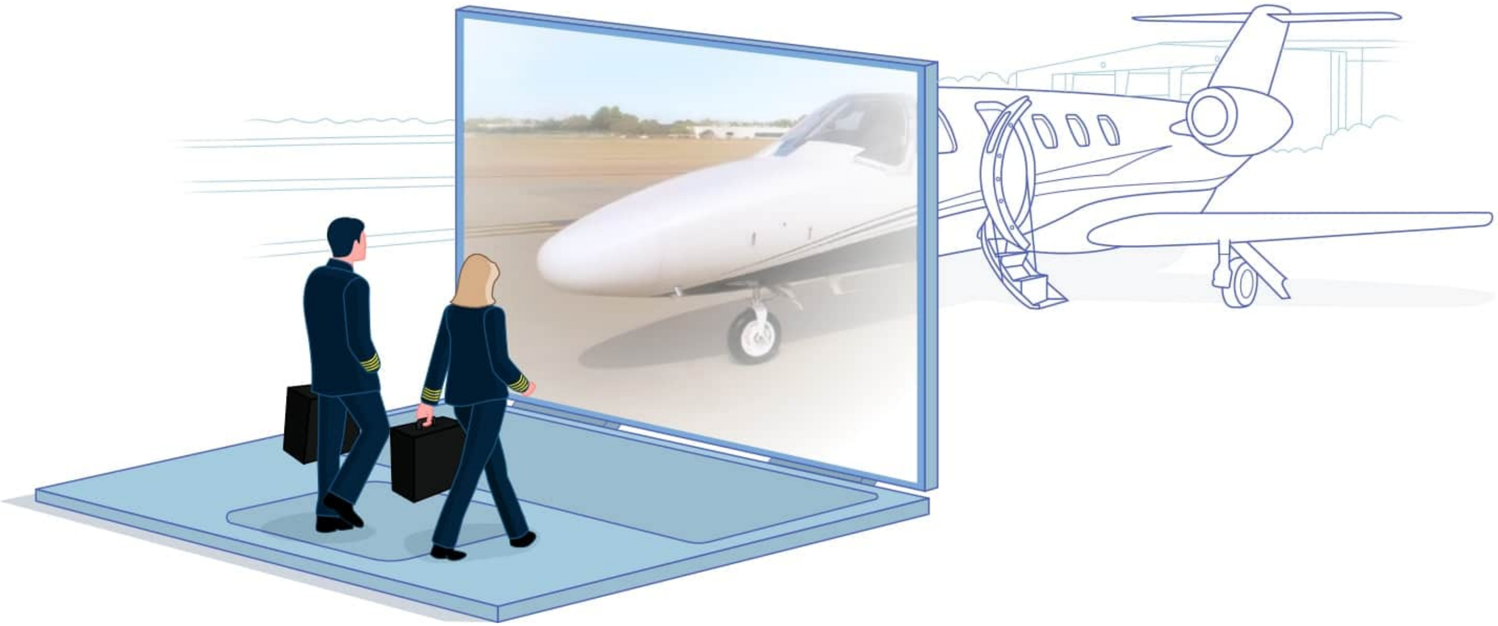
- FWD evaporator fan speed “HI.”
- Select the DEFOG fan switch to “HI” prior to descent and approach.
- COCKPIT AIR DIST to MAX routes additional warm air forward for crew comfort and windshield warm up (MAX=80% air to crew and 20% air to passengers).
- Select windshield anti-ice bleed air to LOW and open valves.
- Use cruise descent with its higher N1s for warmer bleed-air temperatures to better heat the cabin and cockpit.


WINDSHIELD BLEED AIR
MANUAL CONTROL VALVE
WINDSHIELD ALCOHOL BOTTLE
ALCOHOL SYSTEM ELECTRICAL PUMP
146°C
5PSI
W/S AIR O'HEAT
AIR SOURCE SELECTOR
AIR SOURCE SELECT
BOTH
LH
RH
FRESH AIR
EMER
OFF
MASTER CAUTION RESET
TEMP SELECT
HOT
COLD
MANUAL
AUTO
CABIN HEAT, PRESSURIZATION, AND FRESH AIR TO CABIN
149°C (300°F) MAX
EMERG PRESS ON
TO WING
AIR DUCT O'HEAT
WING ANI-ICE SHUTOFF VALVE
EMERGENCY PRESSURIZATION VALVE 6 PPM
ELECTRICALLY HEATED PYLON INLET WHEN ENGINE ANTI-ICE ON
RAM AIR MODULATOR VALVE
WINDSHIELD MODULATING VALVE
WINDSHIELD ANTI-ICE HEAT EXCHANGER
CABIN HEAT EXCHANDER
ENGINE ANTI-ICE VALVE
FRESH AIR
EXHAUST INTO TAIL CONE
EXHAUST OVERBOARD
WINDSHIELD ANTI-ICE CONTROL VALVE
LH PR SOV
LH FCV
282°C (540°F) MAX
23 PSI SRRVICE AIR
SERVICE AIR REGULATOR
PRSOV - PRESSURE REGULATING AND SHUTOFF VALVE
FCV - FLOW CONTROL VALVE 4 OR 8 PPM (POUNDS) PER MINUTE
BLD AIR O'HEAT
LH
RH
PRECOOLER EXHAUST DOOR
PYLON PRECOOLER

CONDITION	SOURCE SELECTOR POSITION	LH FCV/PPM	RH FCV/PPM	EMER VALVE/PPM	NET FLOW TO CABIN PPM/TEMP/PRESS
2 Engines Operating	BOTH	Open 4	Open 4	Closed 0	8 ppm 65–85 F
2 Engines Operating	LH	Open 8	Closed 0	Closed 0	8 ppm 65–85 F
2 Engines Operating	RH	Closed 0	Open 8	Closed 0	8 ppm 65–85 F
2 Engines Operating	EMER	Closed 0	Closed 0	Open 6	6 ppm 120 F
2 Engines Operating	FRESH AIR	Closed 0	Closed 0	Closed 0	0 Depress to Ambient
2 Engines Operating	OFF	Closed 0	Closed 0	Closed 0	0 Leak Rate till Depressurized
LH Throttle OFF, RH Engine Operating	BOTH/RH	Closed 0	Open 8	Closed 0	8 ppm 65–85 F
LH Engine Operating, RH Throttle OFF	LH/BOTH	Open 8	Closed 0	Closed 0	8 ppm 65–85 F
LH Engine OFF and Lost DC Power	Any Position	Closed 0	Open 4	Closed 0	4 ppm Cabin May Rise
RH Engine OFF and Lost DC Power	Any position	Open 4	Closed 0	Closed 0	4 ppm Cabin May Rise

SOURCE SELECTIONS, VALVE POSITIONS, AND FLOW RATES

- The FVC (4 or 8 ppm) (flow control valve) failsafes to the 4-ppm position if DC power is lost, and the PRSOV (pressure regulating and shutoff valve) which normally regulates 16 psi is a failsafe open valve.
- BOTH engines operating in “both” result in 4 + 4= 8 ppm flow to the cabin
- With LH or RH selected, the selected FCV is energized to a full 8 ppm to cabin while the non-selected FCV is closed by logic.
- Anytime a throttle is selected OFF, the remaining engine FCV is energized to 8 ppm flow to the cabin logic.
- In the unlikely event of engine failure and the loss of normal DC power, the operating engine FCV failsafes open to 4 ppm flow to the cabin. At half the normal flow rate to the cabin, cabin pressure may rise, and differential pressure reduce.

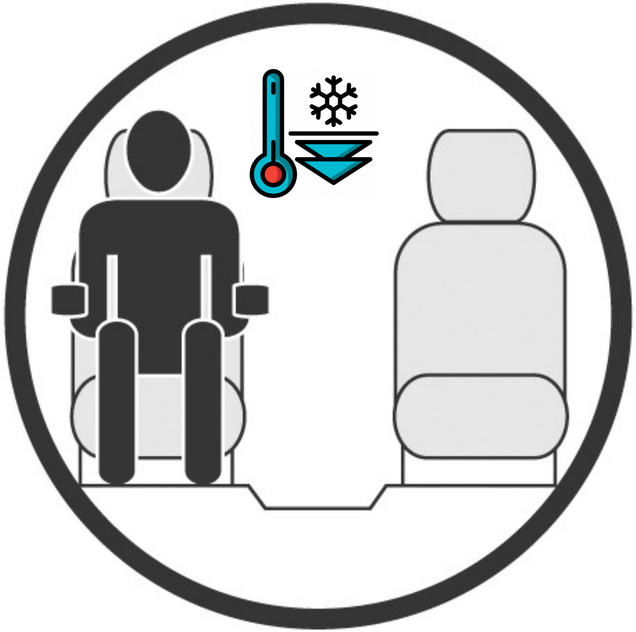


PRESSURIZATION

PRESSURIZATION

INTRODUCTION

The pressurization system maintains a lower cabin altitude than the actual airplane altitude. This is accomplished by introducing bleed air into the cabin and controlling the amount of air vented overboard. The pressurization and air-conditioning system incorporate a common airflow resulting in cabin pressurization being accomplished with conditioned air.



PRESSURIZATION (CONT'D)

GENERAL

Two elements are required to provide cabin pressurization.

1. One is a constant source of air.
2. The other is a method of controlling the outflow of air to achieve the desired cabin altitude.

The airflow into the cabin is fairly constant (through a wide range of engine power settings), while the outflow of air is controlled by the two outflow valves located on the aft pressure bulkhead.

PRESSURIZATION SYSTEM

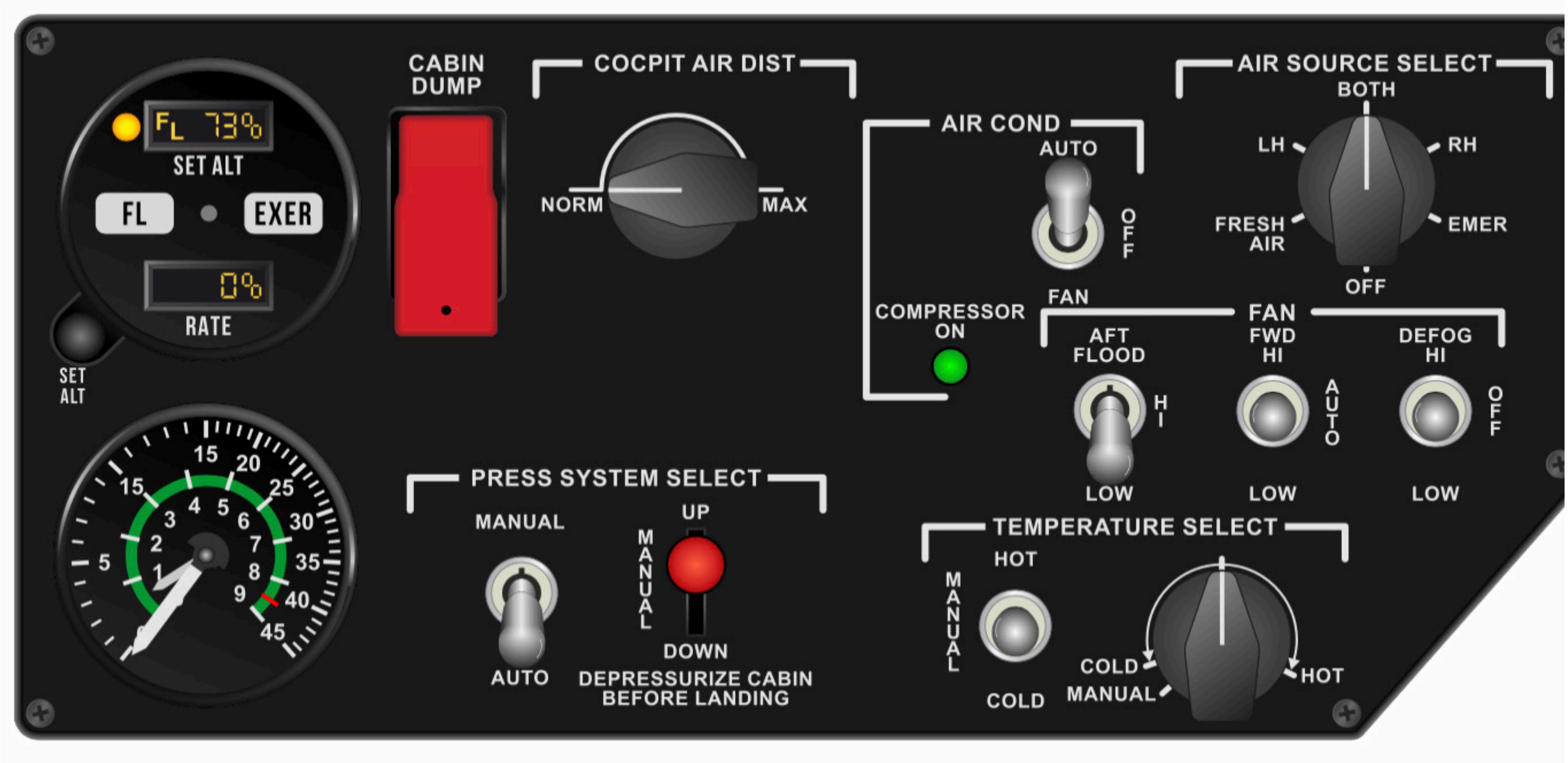
The outflow valves can be controlled automatically or manually. Automatic control requires DC power and is not available during emergency electrical power operations.
Selecting AUTO mode with the air data sensor operating, generates an auto-schedule based on the departure field elevation, the maximum altitude reached, and the pilot input of landing field pressure altitude plus 200 feet.
Maximum cabin differential pressure is 9.0 psid.

SYSTEM DESCRIPTION

The components of the pressurization control system are:

1. The primary and secondary outflow valves.
2. Pressurization controller.
3. Manual toggle valve
4. The cabin dump switch.

Both outflow valves contain maximum differential safety valves, and maximum cabin altitude safety valves. The cabin altitude safety valves are capable of overriding the controller inputs to the outflow valves avoiding the possibility of under- or over-pressurization.


FL 73%
SET ALT
FL
EXER
0%
RATE
SET ALT
CABIN DUMP
COCPIT AIR DIST
NORM
MAX
AIR COND
AUTO
OFF
COMPRESSOR ON
AIR SOURCE SELECT
BOTH
LH
RH
FRESH AIR
EMER
OFF
FAN
FAN
AFT FLOOD
HI
LOW
FWD HI
AUTO
LOW
DEFOG HI
OFF
LOW
PRESS SYSTEM SELECT
MANUAL
AUTO
UP
MANUAL
DOWN
DEPRESSURIZE CABIN BEFORE LANDING
TEMPERATURE SELECT
HOT
MANUAL
COLD
COLD
MANUAL
HOT

SETTING THE DIGITAL PRESSURE CONTROLLER

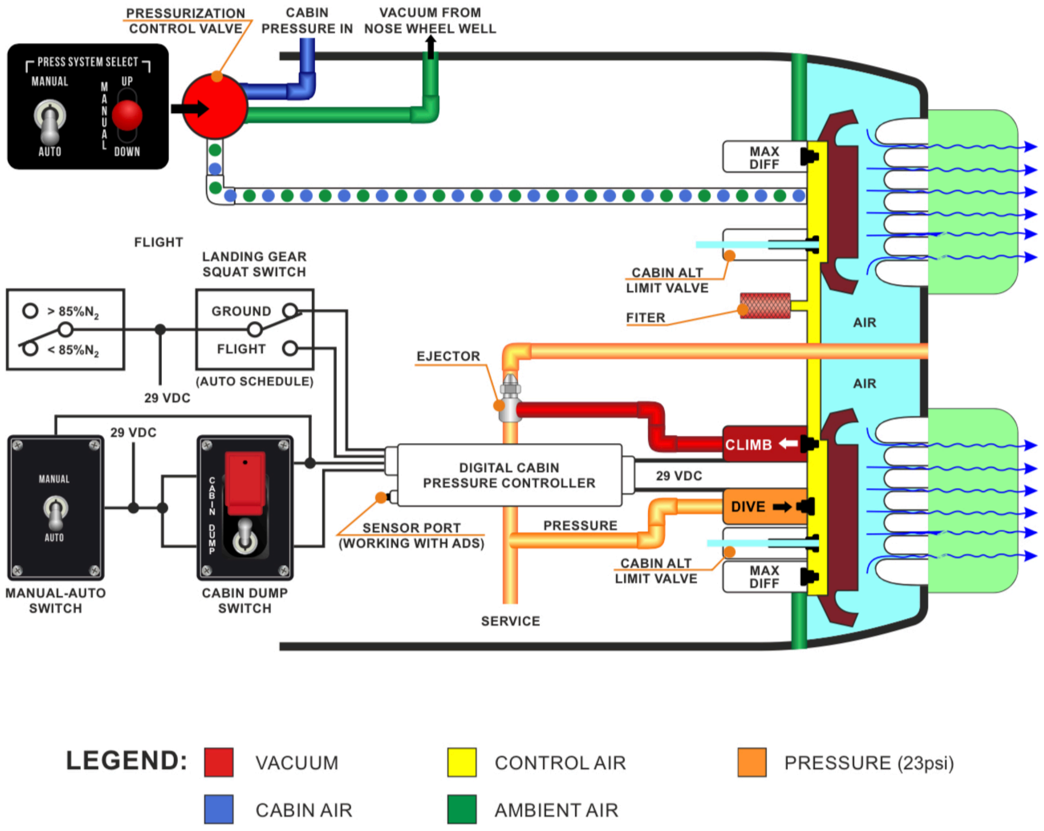
The digital pressure controller is set to maintain an 8.9 psid maximum cabin differential.

To get 9.0 psid, it is necessary to use the RED knob or cherry picker to drive onto the MAX DIFF valve. The controller will maintain an 8,000-foot cabin pressure at FL450. The system can be adjusted to hold Sea Level pressure to 23,586 feet. An automatic schedule built into the controller maintains proper cabin pressurization and rate-of-climb in accordance to the automatic altitude inputs from the air data sensor/ computer and what the pilot sets for takeoff, normally destination field elevation plus 200 feet.

OUTFLOW VALVES

The primary and secondary outflow valves are identical to each other with the exception that the primary valve has a vacuum ejector and cabin altitude climb and dive solenoids mounted on it. The primary and secondary outflow valves are connected through a port which allows equal pressure or negative pressure to be applied to both valves.

PRESSURIZATION SYSTEM



OUTFLOW VALVES (CONT'D)

The climb and dive solenoids respond to commands from the pressurization controller. If the controller opens the dive solenoid, 23 psi service air is used to apply pressure on the back side of both outflow valves and drive them to the closed position.
If the controller opens the climb solenoid, a vacuum created by 23 psi service air opens the outflow valves.
If electrical power is lost, the air chamber will remain at a fixed position and cabin altitude will be dependent upon the relative psid sensed in the outflow valve diaphragms.

In the event that control vacuum should exceed limits due to a malfunction, cabin altitude limit valves are provided to prevent cabin altitude from exceeding 14,500 ±500 feet.

PRESSURIZATION CONTROL

GENERAL

Throttle settings combined with squat switches are used to select the outflow valve operating modes.

1. On the ground with either engine operating below 85% N2 (ground taxi mode), both outflow valves are kept fully open.
2. When both throttles are set greater than 85% N2 on the ground (pre-pressurization mode) both outflow valves slowly close to bring cabin delta pressure to a maximum of 200 feet below field altitude during takeoff roll.
3. At liftoff, the right squat switch puts the system into the flight mode.

PRESSURIZATION CONTROL (CONT'D)

- The primary outflow valve has two normally closed solenoids which let air into and out of the valve control chambers.

- When the cabin dive solenoid is energized open, it allows 23 psi service air or cabin air to pressurize both valve control chambers and push the valves toward closed.

- When the cabin climb solenoid is energized open, it allows vacuum from the 23-psi service air ejector to move both valves toward open.

PRESSURIZATION CONTROL (CONT'D)

The solenoid airflow is designed so it cannot overpower:

- The maximum cabin altitude limit valves,
- The maximum differential pressure valves,
- The manual toggle valve.

Audible clicks are produced when the solenoids pop open. The clicks can be heard when the engines are off. The system is designed to respond rapidly to small cabin pressure variations and correct them before passengers and crew detect any discomfort.

SETTING THE DIGITAL PRESSURE CONTROLLER

AUTOMATIC MODE

The pressurization controller contains two digital windows marked SET ALT and RATE. Additionally, it includes a FL button, an EXER button and a SET ALT knob.

When the AUTO–MANUAL switch is in the AUTO position, the pilot uses the SET ALT knob to select the destination field elevation plus 200 feet. Descent and landing are made by setting the controller to destination field pressure altitude plus 200 feet.

PRESSURIZATION CONTROL (CONT'D)

In flight, the controller continuously generates an AUTO-SCHEDULE based on the departure field elevation, the maximum altitude reached in the current flight (per the air data sensor/Computer), and the operator input destination field pressure altitude plus 200 feet. The controller determines the pressure rate of change and the cabin pressure altitude based on the AUTO SCHEDULE and the air data sensor/computer pressure altitude. The controller sends DC pulses through the primary outflow valve climb and dive solenoids to obtain a specific cabin pressure. The AUTO-SCHEDULE will have the cabin completely depressurized at the set landing pressure altitude (±200 feet) before touchdown.

PRESSURIZATION CONTROL (CONT'D)

ISOBARIC MODE

If the air data sensor/computer information is interrupted, the controller will automatically switch to the ISOBARIC mode.
A yellow caution light appears on the upper LH corner of the pressurization controller display face to advise of this malfunction.

The previously selected destination field pressure altitude will be replaced with flight level (FL). This allows the pilot to set the cruising altitude.

PRESSURIZATION CONTROL (CONT'D)

The controller uses the flight level selection to control the cabin pressure rate of change and the cabin pressure altitude to maintain near maximum differential pressure. The selected destination field altitude can be recalled by pressing the FL pushbutton on the controller. The selected flight level on the controller display will be replaced with cabin altitude (CA), allowing the pilot to set the desired cabin altitude prior to landing. The controller then controls the cabin pressure rate of change to maintain the displayed cabin altitude. The pilot may view the FL and CA displays at any time by pressing the FL pushbutton on the controller.

PRESSURIZATION CONTROL (CONT'D)

If the air data sensor/computer information resumes, the controller automatically removes the FL indication, and the yellow caution light extinguishes to normal operation.

Complete cabin pressure controller FAILURE is indicated by A Steady Red Light in the upper LH corner of the controller. The digits go blank, and the outflow valves capture and hold current cabin pressure.

The red knob must then be used to manually control cabin pressure.

MANUAL CONTROL OF THE PRESSURIZATION SYSTEM

When the AUTO–MANUAL switch is in the MANUAL position, electric power to open the climb and dive solenoids is removed. Cabin pressure altitude must be controlled by moving the MANUAL toggle valve. Cabin altitude can be increased or decreased by holding the red knob (cherry picker) in the UP or DOWN positions. Manual control uses cabin air for positive pressure to stop outflows, and it uses nose wheel compartment air, through a regulator, for vacuum to open both outflow valves. This system is independent of airplane vacuum or electrical power. The UP position allows outflow valve control chamber air to be vented into the nose wheel well. The DOWN position allows cabin air pressure into the outflow valve control chamber, closing the outflow valve causing cabin pressure altitude to dive.

PRESSURIZATION CONTROL (CONT'D)

The cabin altitude pressure switch illuminates the CAB ALT annunciator warning if cabin altitude exceeds 10,000 ± 350 feet cabin pressure, in the normal mode. If set for high altitude landing mode above 8,000 feet, the CABIN ALT illuminates at 14,500 ± 500 feet cabin pressure. Illumination of the CAB ALT light causes the MASTER WARNING lights to flash. An optional voice annunciation advises "cabin pressure."

PRESSURIZATION CONTROL (CONT'D)

EXERCISE TEST BUTTON

The EXER test button is used to preflight the pressurization system. Test the system with an engine running and the entrance door closed and locked. Press and hold the system exercise (EXER) button on the pressurization controller. The cabin will slowly pressurize to 200 feet below field elevation. Releasing the button terminates the exercise. Pushing the EXER button in flight only tests the light, it does not effect pressurization.

PRESSURIZATION CONTROL (CONT'D)

Pushing the EXER button inflight is a light test and does not effect pressurization. The light test consists of pressing the EXER button for approximately one second and releasing the button.

The SET ALT and RATE displayed numbers disappear and the four LEDs illuminate in sequence. First the SET ALT LEDs and yellow light (upper LH corner) come on briefly then the SET ALT goes blank (yellow light still on). Then the RATE LEDs come on with the yellow light (upper LH corner) still on. The test ends as the former numbers reappear to set destination field elevation plus 200 feet for takeoff in the SET ALT window from (–) 1000 feet to 10,000 feet.

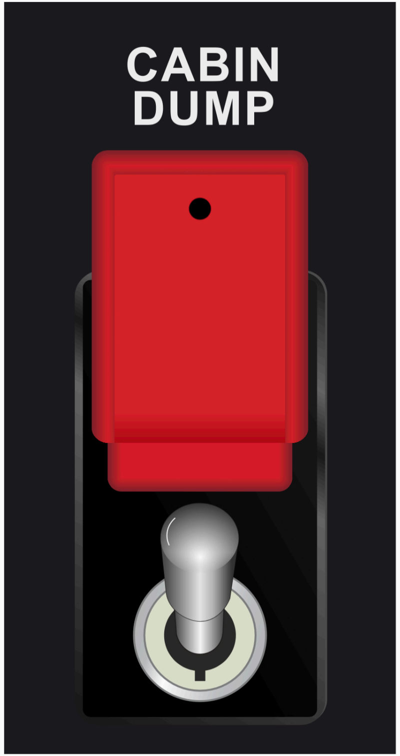
PRESSURIZATION CONTROL (CONT'D)

EMERGENCY CABIN DUMP

An emergency cabin pressure dump switch may be manually actuated at any time to reduce cabin pressure.

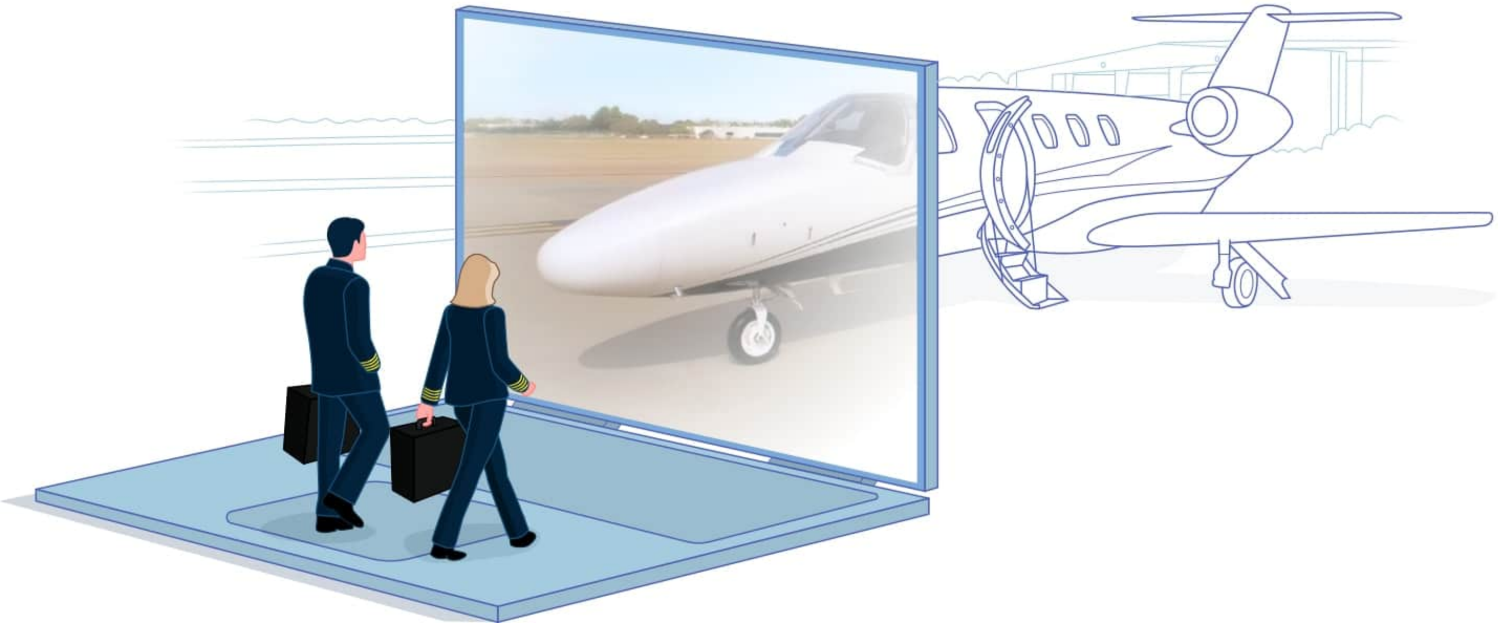
The CABIN DUMP switch activates the climb solenoid to remove air from the outflow valve control chamber.

The maximum altitude limit valves will prevent complete cabin depressurization above 14,500 ±500 feet altitude. The switch requires normal DC and is protected from accidental operation by a red guard.



PRESSURIZATION CAS MESSAGES

MESSAGE	DESCRIPTION
CABIN ALTITUDE	Indicates that the cabin altitude is above approximately 9,500 feet during normal operations and 14,500 feet in High Elevation mode.
EMERGENCY DESCENT	Indicates the emergency descent mode of the autopilot is active. This mode will activate when the autopilot is on, the airplane altitude is above FL300 and, the cabin altitude exceeds approximately 14,500 feet.
EMERGENCY PRESS ON	Indicates the emergency pressurization system has been turned on at the AIR SOURCE selector or automatically activated due to high cabin altitude.
HIGH ELEVATION MODE	This message is active if the pressurization controller is in the High Elevation mode AND the airplane is in the air with the CABIN ALT at exceeding 9,500 feet for more than 30 minutes.
PRESSURIZATION CNTRL	This message indicates the pressurization controller is unable to automatically control cabin pressure. This may be due to a failure in the pressurization system or the PRESSURIZATION switch was selected to STBY position.
HIGH ELEVATION MODE	Indicates that the pressurization controller High Elevation mode is active.
PRESSURIZATION CNTRL	This message is displayed when the BATTERY switch is selected to EMER in emergency as a reminder that the pressurization controller is inoperative.



HYDRAULIC SYSTEM

HYDRAULIC SYSTEM

The hydraulic system is an open center system pressurized by a hydraulic pump on each engine.

The hydraulic system operates 3 subsystems:

- Landing gear
- Speed brakes
- Flaps

The system operation is monitored by annunciator lights.

HYDRAULIC SYSTEM (CONT'D)

The hydraulic system is classified as an open center system. With the engines running, the hydraulic pumps generate low pressure flow and direct it through an open bypass valve. The hydraulic fluid returns to the reservoir tank. The tank is pressurized by the 23-psi service bleed-air system to reduce foaming of the returning fluid. When one of the hydraulic systems is operated, the by-pass valve closes, and the hydraulic flow is directed toward the system being operated. This creates a load and pressure is created. Once the pressure exceeds the load, the system moves, and the hydraulic work is executed. This also explains why airspeed limitations exist on the landing gear and flaps.

HYDRAULIC SYSTEM (CONT'D)

- The reservoir is pressurized to provide an adequate supp operating conditions.
- The hydraulic fluid is filtered prior to entering a subsystem.
- Annunciator lights warn of low flow and indicate when the sys
- The wheel brake system is powered by a separate, completel
- Approved hydraulic fluid for both systems is red MIL-PRF-832

HYDRAULIC SYSTEM OPERATION

After engine start, the hydraulic pump draws hydraulic fluid from the reservoir. As the fluid begins to circulates through the system, the hydraulic pressure increases to 60 psi and the LH or RH HYD FLOW LOW lights extinguish. With the hydraulic system not operating, the bypass valve remains open, and the hydraulic fluid returns to the reservoir. If a hydraulic system is activated, the bypass valve closes to increase the pressure to 1500 psi. This illuminates the HYD PRESS ON annunciator. The system pressure is limited to 1,500 psi by the system relief valve. When system operation is completed, the system bypass valve opens, and the hydraulic fluid returns to the reservoir.

HYD PRESS ON

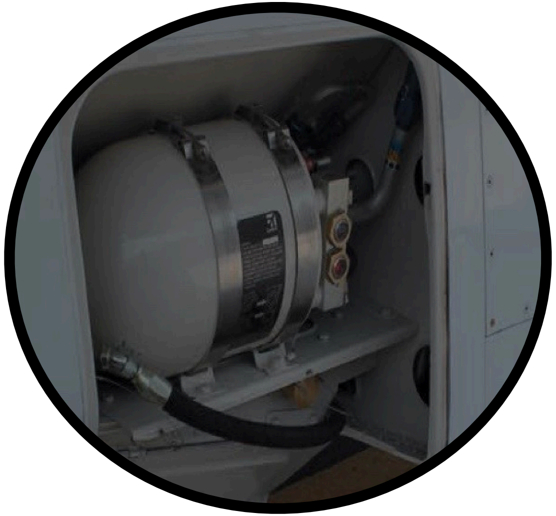
HYDRAULIC SYSTEM COMPONENTS

The major components include:

- Reservoir
- Pumps
- System bypass valve
- Firewall shutoff valves
- Filters
- Flow switches

RESERVOIR

The reservoir is located on the right side of the fuselage under the right engine. It is pressurized by the 23-psi service bleed-air system to reduce foaming and assure positive flow. A pressure relief valve on top of the reservoir opens at approximately 30 psi to prevent over-pressurization. A sight gage is marked at FULL and ADD levels.

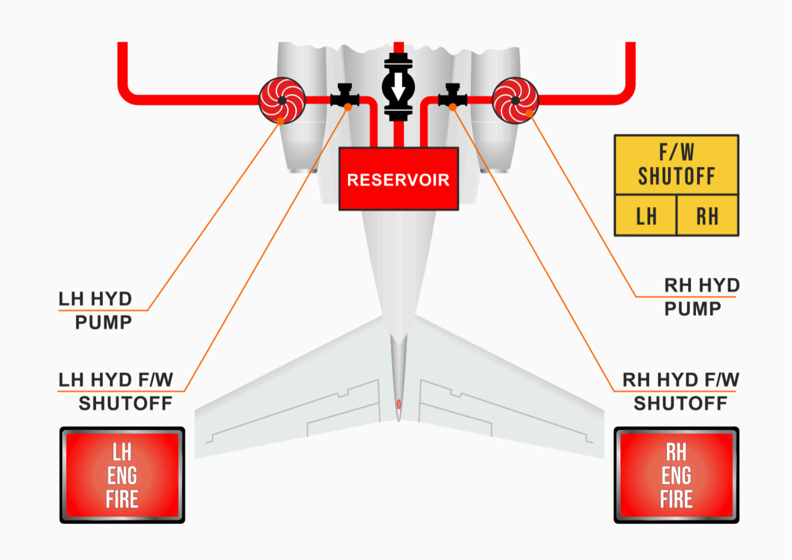


RESERVOIR (CONT'D)

The hydraulic reservoir can be serviced by setting the flaps to zero or 15°. Retract the speedbrakes and thrust attenuators. Pour in clean, RED, MIL-H-83282 fluid to the FULL mark and recap.

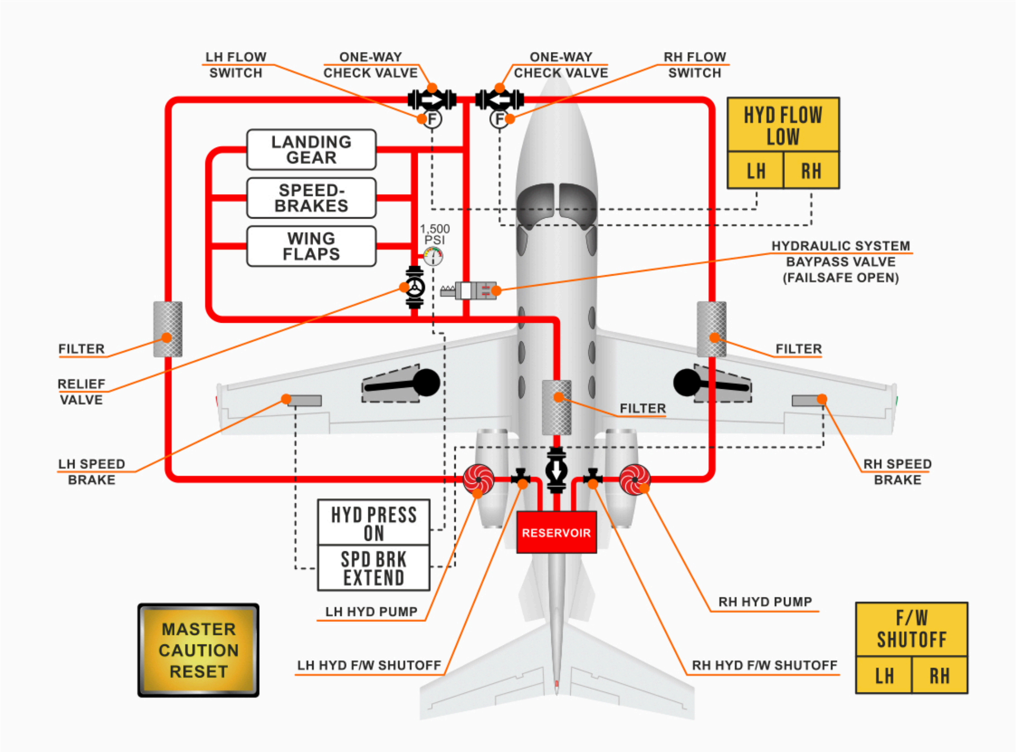
HYDRAULIC PUMPS

The constant volume hydraulic pumps are driven by the accessory section of the engines. Each pump is capable of pumping 3.25 GPM and either pump can operate the entire hydraulic system.



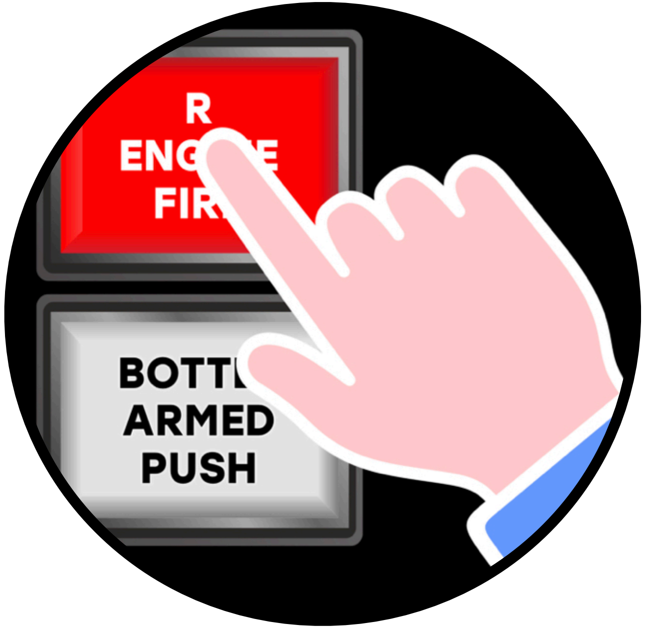
HYDRAULIC BYPASS VALVE

The solenoid-operated hydraulic bypass valve is spring-loaded open allowing the hydraulic fluid to constantly return to the reservoir tank. During hydraulic system operation, this valve closes to increase hydraulic pressure. A mechanical relief valve works in parallel with the bypass valve to maintain a system pressure of 1,500 psi. If electrical power is lost, the hydraulic bypass valve fails to the open position.



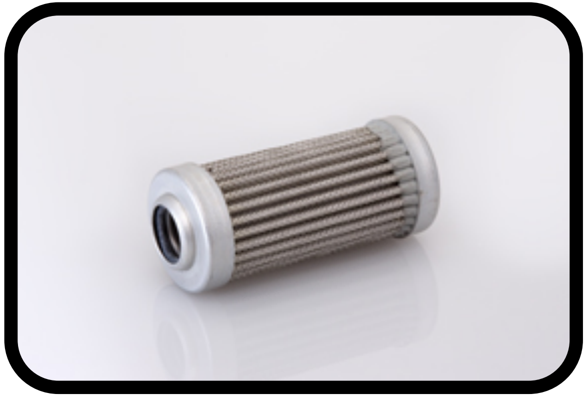
FIREWALL SHUTOFF VALVES

A hydraulic firewall shutoff valve is installed in the supply line to each hydraulic pump. The valves are motorized and are controlled by ENG FIRE switches on the glareshield. The valves are normally open and are to be closed only in the event of an engine fire or for perform maintenance. The hydraulic F/W SHUTOFF LH/RH lights come on when a FIRE switch light is pressed.



HYDRAULIC FILTERS

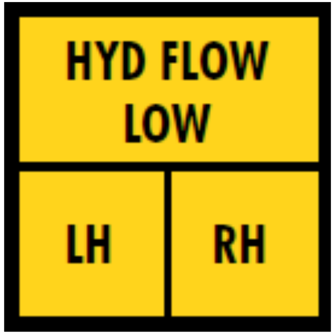
The hydraulic system incorporates three filters. Two filter fluid leaving the pumps and one filters fluid returning to the reservoir. Each filter has a bypass valve that opens if the filter element clogs, but there is no indication of a filter bypassing.

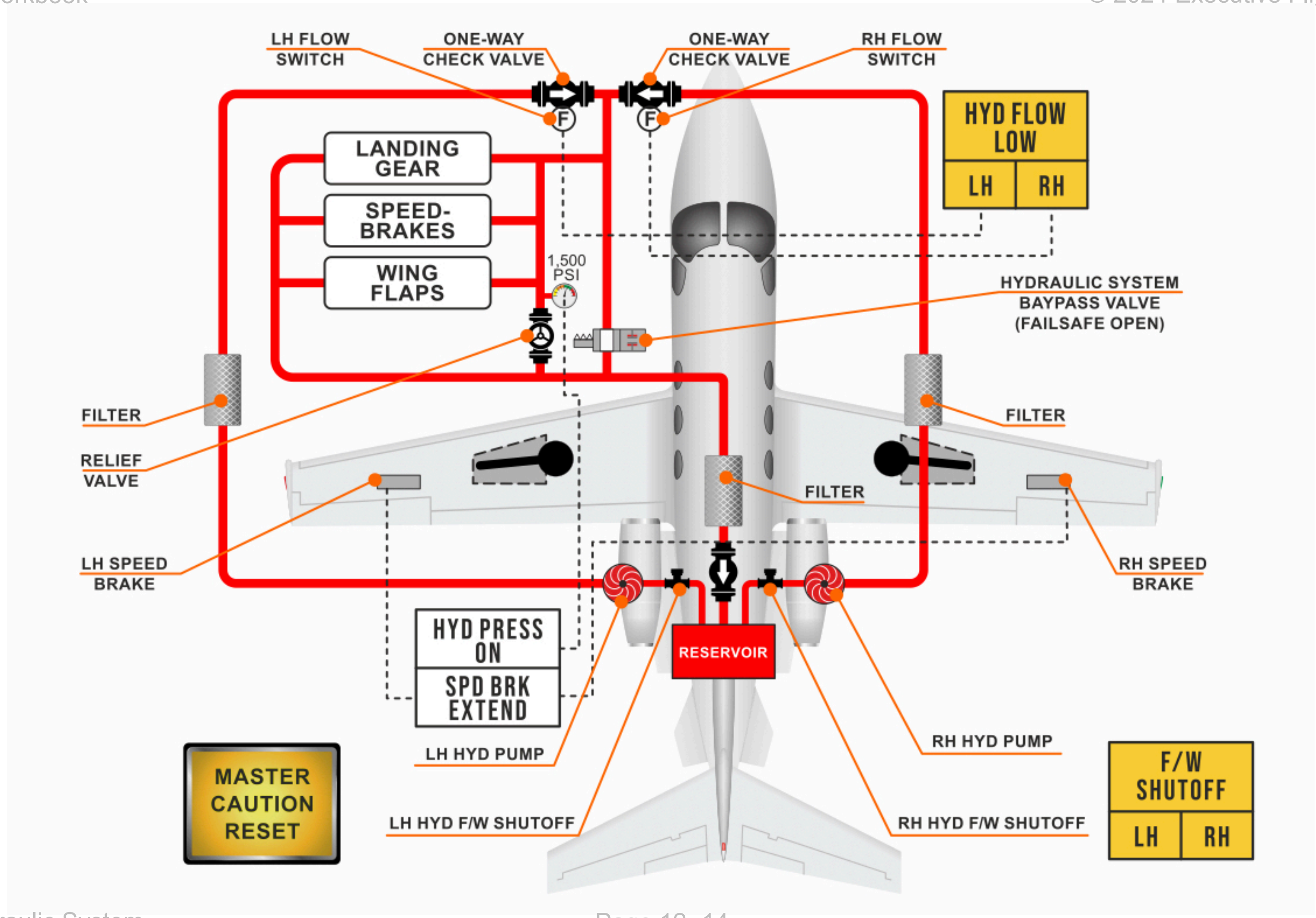


Filter Element

FLOW SWITCHES

A flow switch is installed in each hydraulic's pump pressure line to control the HYD FLOW LOW LH/RH annunciator light. As hydraulic fluid flow from a pump increases to approximately 1.3 gpm, the LH or RH indicator of the annunciator extinguishes. If the flow decreases below approximately .40 gpm, the HYD FLOW LOW annunciator and the MASTER CAUTION lights will illuminate. A one-way check valve in the flow switch prevents reverse flow into the pump.

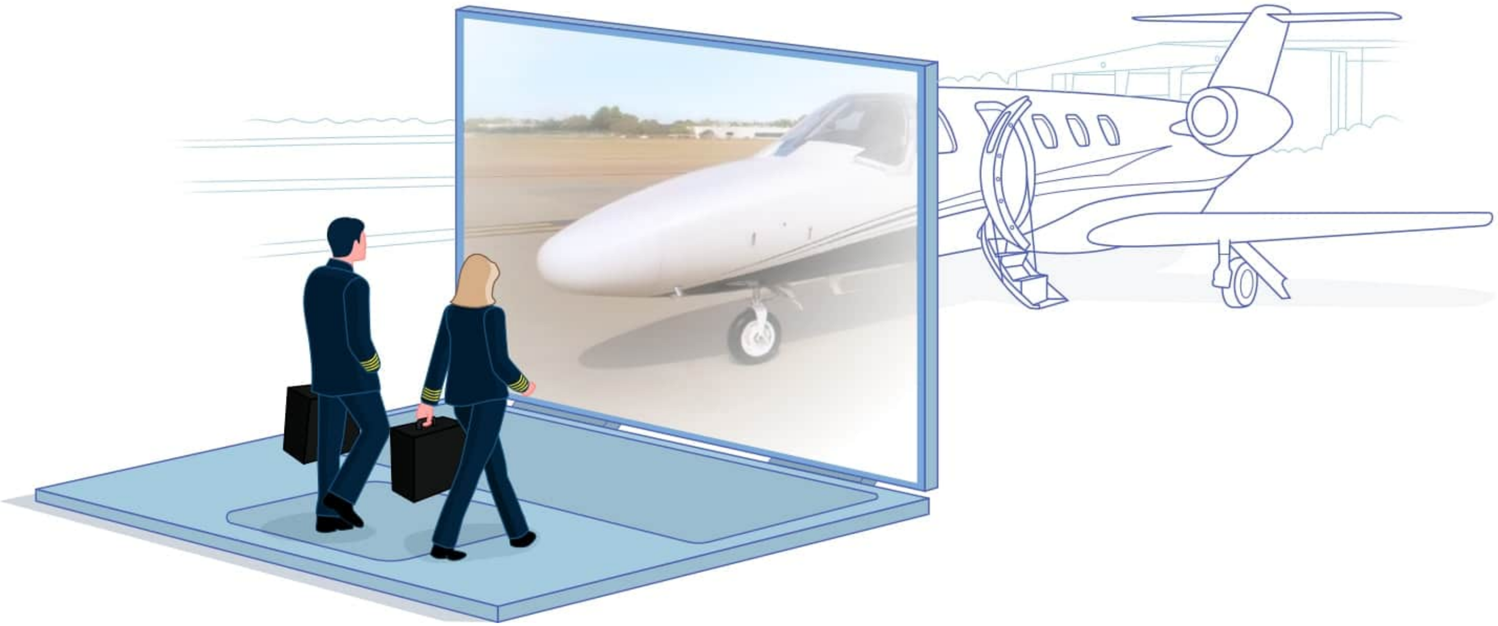



LH FLOW SWITCH
ONE-WAY CHECK VALVE
ONE-WAY CHECK VALVE
RH FLOW SWITCH
F
F
LANDING GEAR
SPEED-BRAKES
WING FLAPS
1,500 PSI
HYD FLOW LOW
LH
RH
HYDRAULIC SYSTEM BAYPASS VALVE (FAILSAFE OPEN)
FILTER
RELIEF VALVE
FILTER
FILTER
LH SPEED BRAKE
RH SPEED BRAKE
HYD PRESS ON
SPD BRK EXTEND
RESERVOIR
LH HYD PUMP
RH HYD PUMP
MASTER CAUTION RESET
LH HYD F/W SHUTOFF
RH HYD F/W SHUTOFF
F/W SHUTOFF
LH
RH

HYDRAULIC SUBSYSTEMS

The hydraulically powered systems include:

- landing gear
- speedbrakes
- flaps



LANDING GEAR AND BRAKES

TO RECEIVE CREDIT FOR THIS COURSE, YOU MUST PASS THE FINAL EXAM LOCATED ON THE LAST PAGE OF THIS STUDY GUIDE.

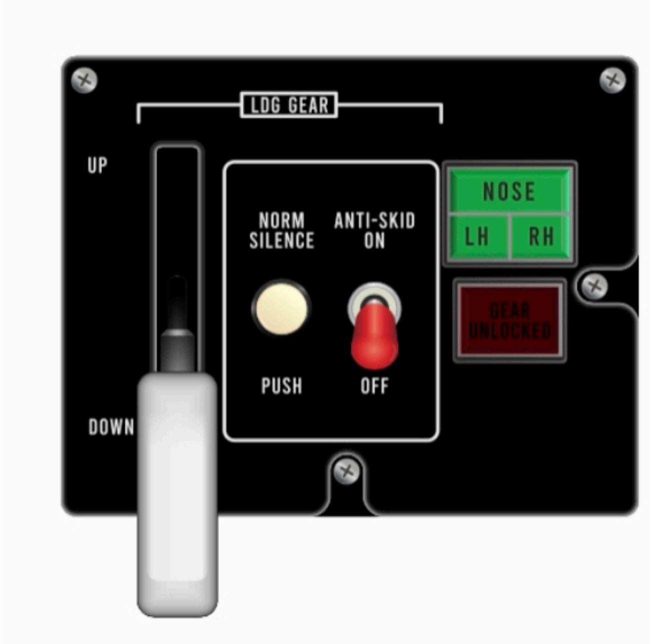
INTRODUCTION

The landing gear is electrically controlled and hydraulically actuated. When retracted, the nose gear and the struts of the main gear are enclosed by mechanically actuated doors. The trailing link main gear wheels remain uncovered in the wheel wells. Gear position and warning are provided by indicator lights and an aural warning system. Nosewheel steering is mechanically actuated through linkage from the rudder pedals. A shimmy damper is located on top of the nose gear strut. Power braking is provided with or without antiskid. Emergency braking is also available.

GENERAL

Each inboard-retracting main gear uses two hydraulic actuators—one for gear actuation and one for uplock release. Two hydraulic actuators perform identical duties for the forward retracting nose gear.

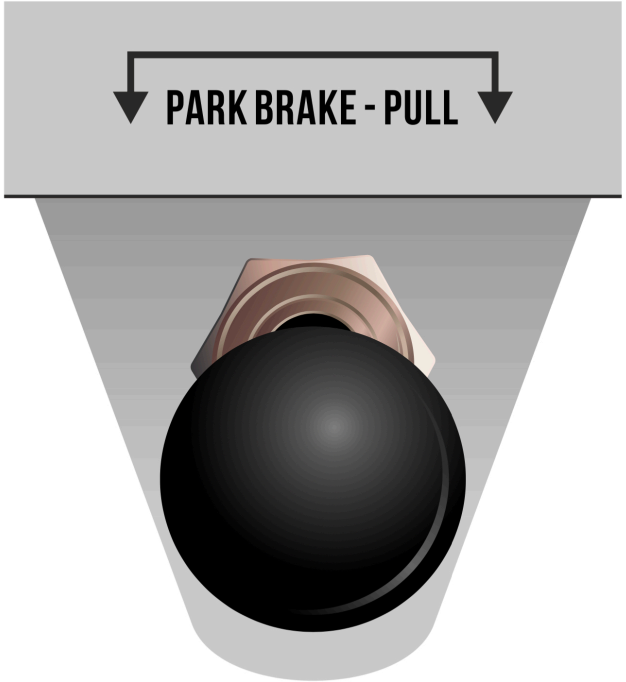
Gear position indication is provided by one red and three green position indicator lights on the landing gear control panel. In addition, an aural warning sounds when throttle or flap and gear position are not compatible when the airspeed is less than 130 KIAS at <85% N2.



GENERAL (CONT’D)

The NOSEWHEEL steering system is mechanically actuated by cable linkage from the rudder pedals.

The POWER BRAKE system uses a separate hydraulic system powered by an electrically driven pump. Each main gear wheel houses a multiple disc brake assembly that can be actuated by pressure from an electrically driven pump or stored nitrogen pressure during emergency braking.
A parking brake is provided for parking the airplane.



LANDING GEAR

GENERAL

The main and nose landing gear struts are conventional air-oil struts.

The landing gear is normally hydraulically actuated but can be mechanically and pneumatically released and extended if the normal gear actuation system fails. The gear can be extended and retracted (VLO) and operated with the gear extended (VLE) at airspeeds up to 200 KIAS.

It takes less than six seconds to extend or retract the landing gear.

MAIN LANDING GEAR

The main gear assembly includes:

- A trunnion,
- Oleo struts,
- Actuators, trailing link,
- A single wheel with
- A multiple disc brake, and
- A squat switch that senses in flight/on-ground conditions.

LANDING GEAR (CONT'D)

The main gear assembly includes:

- A trunnion,
- Oleo struts,
- Actuators, trailing link,
- A single wheel with
- A multiple disc brake, and
- A squat switch that senses in flight/on-ground conditions.

LANDING GEAR (CONT'D)

UPLOCK MECHANISM

The main landing gear struts are mechanically locked in the retracted position by the uplock cylinder.

To release any strut from its uplock, fluid is first sequenced to the uplock piston, pushing the piston against spring tension fully inside the cylinder.

The uplock can also be unlocked by the T-handle mechanical cable or by the round concentric knob releasing high pressure nitrogen from the bottle in the right nose compartment to push the piston to its unlocked position.

LANDING GEAR (CONT'D)

DOWNLOCK MECHANISM

The downlock mechanism consists of a spring-loaded slider ring which is pushed along the piston shaft till it spring-loads down into a slot at the fully extended position. A second locking ring is hydraulically moved over the slider ring contacting a microswitch that illuminates the down-and-locked green indicating light. The downlocks can only be released by applying hydraulic pressure to the retract side of the actuator; therefore, no over center or external downlock pins are required.

LANDING GEAR (CONT'D)

A door actuated by the landing gear movement covers the main gear strut when retracted. The exposed wheels fair into the wheel well.

Each main gear wheel incorporates a fusible plug that melts to deflate the tire if excessive temperature is generated by an overheated brake. Maximum tire ground speed is 165 knots.

LANDING GEAR (CONT'D)

NOSE GEAR

The nose gear assembly includes:

- A strut
- Two hydraulic actuators
- Torque links
- A single wheel
- A self-contained shimmy damper
- The tire must be inflated to 125 ± 5 psi

NOSE LANDING GEAR

The nose gear is held up by a spring-loaded uplock mechanism that is released by a hydraulic actuator prior to gear extension.

When the nose gear strut goes to the down-and-locked position, the heads-up angle-of-attack indicator is activated.

Three doors are actuated by nose gear movement to completely enclose the nose gear and wheel at retraction. The two forward doors are closed with the gear extended or retracted, and are open only during gear transit. The aft spade door remains open with the gear extended.

NOSE LANDING GEAR (CONT'D)

Three doors are actuated by nose gear movement to completely enclose the nose gear and wheel at retraction. The two forward doors are closed with the gear extended or retracted and are open only during gear transit. The aft spade door remains open with the gear extended. The nosewheel deflects with rudder pedal movement any time the gear is extended. During a crosswind landing, center the rudder pedals immediately before nosewheel touchdown.

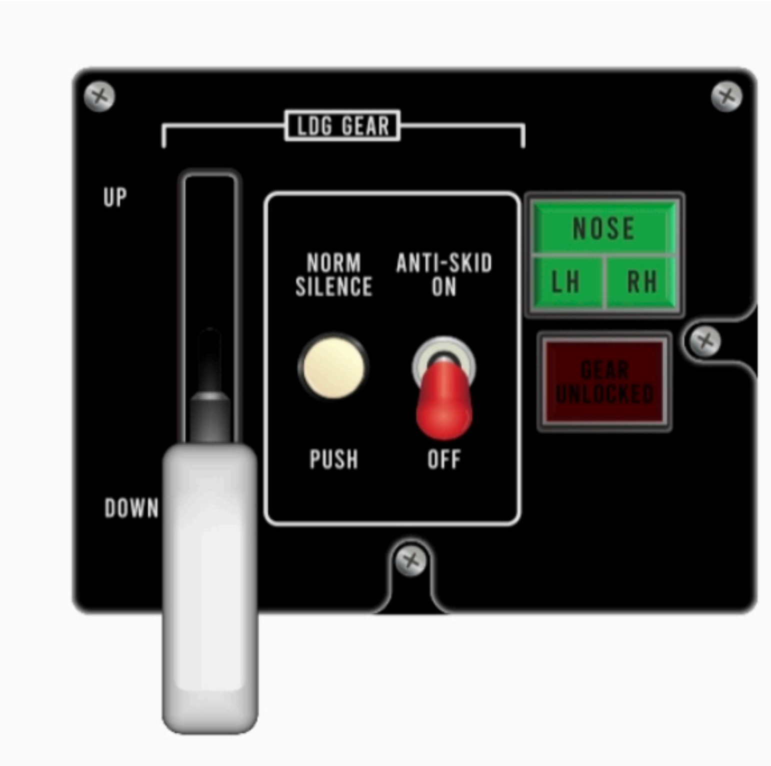
LANDING GEAR (CONT'D)

CONTROLS AND INDICATORS

The landing gear is controlled by the LDG GEAR control handle to the left side of the center panel.

Gear position is shown by one red and three green indicator lights on the gear control panel.

A warning horn provides warning of abnormal conditions.



LANDING GEAR (CONT'D)

CONTROLS

The LDG GEAR control handle actuates switches to complete circuits to the extend or retract solenoid of the gear control valve.

On the ground, the solenoid spring-loaded plunger holds the handle in the DOWN position, preventing inadvertent movement of the handle to the UP position.

LANDING GEAR (CONT'D)

Never attempt to pull the gear handle up on the ground. Check the gear handle is in the down position before pushing the start button to prevent inadvertent nose gear retraction.

Airborne, with the left main gear squat switch in the in-flight position, the locking solenoid is energized to retract the plunger. This frees the handle for movement to the UP position. This safety feature cannot be overridden. If the solenoid fails or electrical power is lost, the gear handle cannot be moved to the UP position.

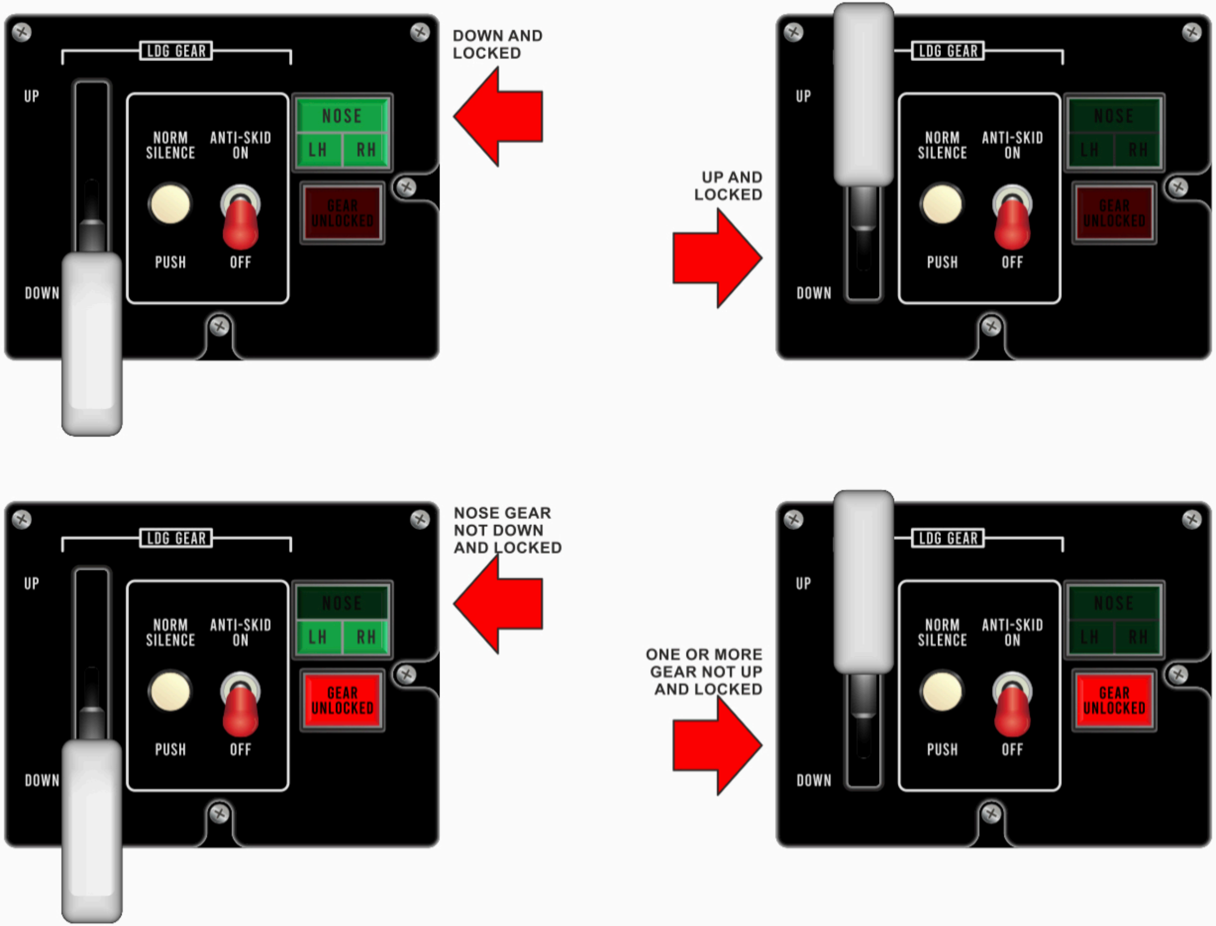
The gear handle must be pulled out of a detent prior to movement to either the UP or DOWN position.

LANDING GEAR INDICATORS

The lights on the gear control panel indicates the gear is down and locked. As each gear locks down, its respective green light is illuminated.

The red GEAR UNLOCKED light indicates an unsafe gear condition. It illuminates when the gear handle is moved out of the UP detent and remains on until all three gear are down and locked. At retraction, the light comes on when any downlock is released and remains on until all three gear are up and locked.

The GEAR UNLOCKED light and warning horn can both be tested by positioning the rotary TEST switch to LDG GEAR.

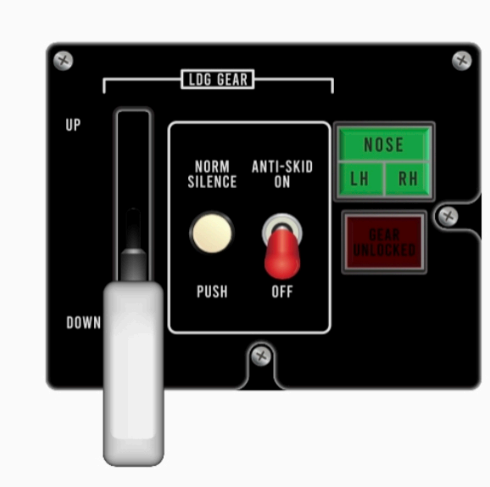


DOWN AND LOCKED
UP AND LOCKED
NOSE GEAR NOT DOWN AND LOCKED
ONE OR MORE GEAR NOT UP AND LOCKED
LDG GEAR
UP
DOWN
NORM SILENCE
ANTI-SKID ON
PUSH
OFF
NOSE
LH
RH
GEAR UNLOCKED

LANDING GEAR WARNINGS

A LANDING GEAR aural warning is provided by the warning/ caution advisory system if:

1. One or more gear are not locked down.
2. One or both throttles are retarded below 85% N2 rpm, and airspeed is below 130KIAS. The warning can be silenced by pressing the HORN SILENCE pushbutton on the gear control panel.
3. The aural warning also sounds if flaps are extended beyond TAKE OFF AND APPROACH (15) with one or more gear not down-and-locked regardless of any other condition. Under these conditions, the aural warning cannot be silenced with the pushbutton.



RETRACTION

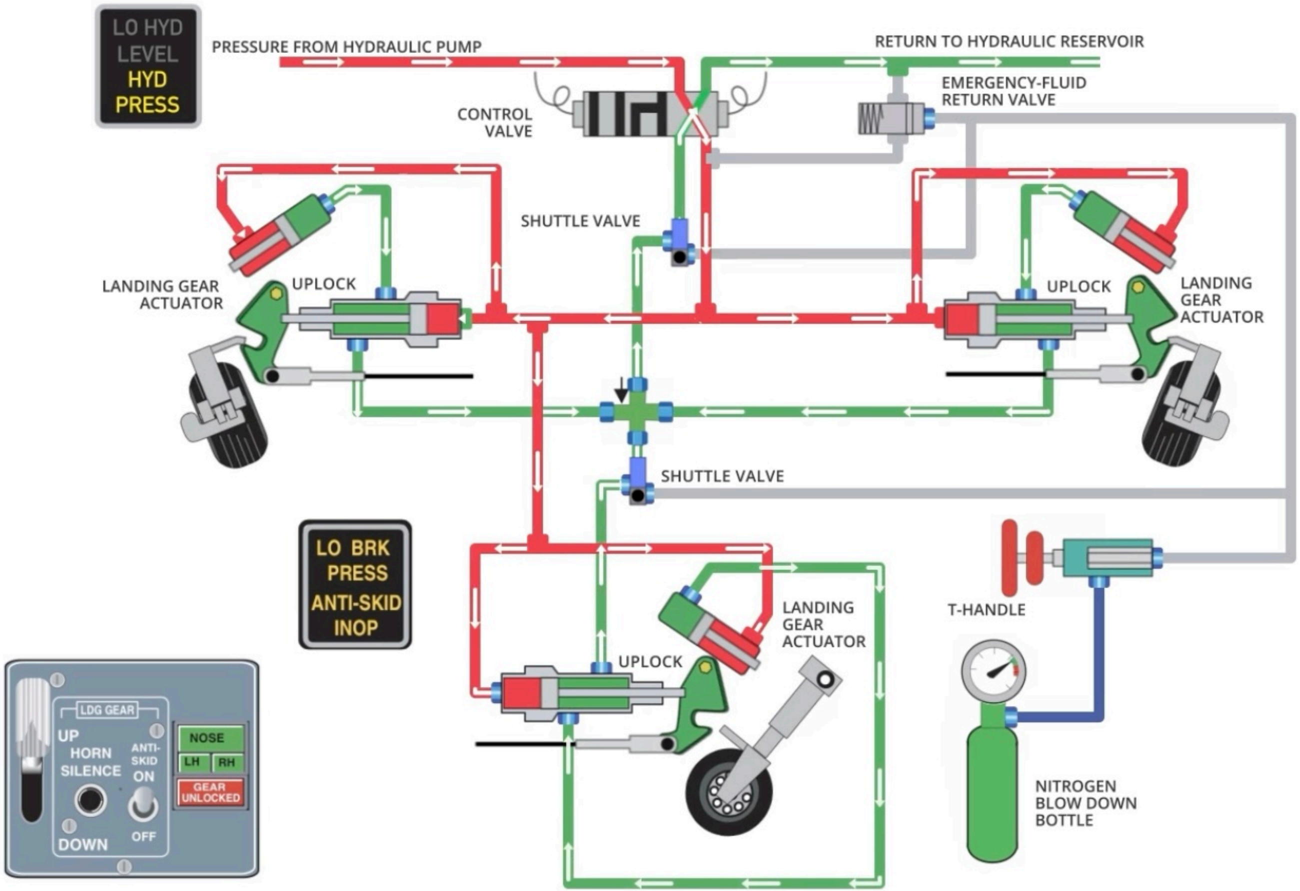
When the LDG GEAR handle is placed in the UP position:

1. The retract solenoid energizes.
2. Pressure is directed to the retract side of actuators to position the up- locks.
3. The downlock mechanism in each actuator unlocks and retraction begins.

As each gear reaches the fully retracted position, it is engaged by a spring-loaded uplock mechanism, and an uplock microswitch is actuated.

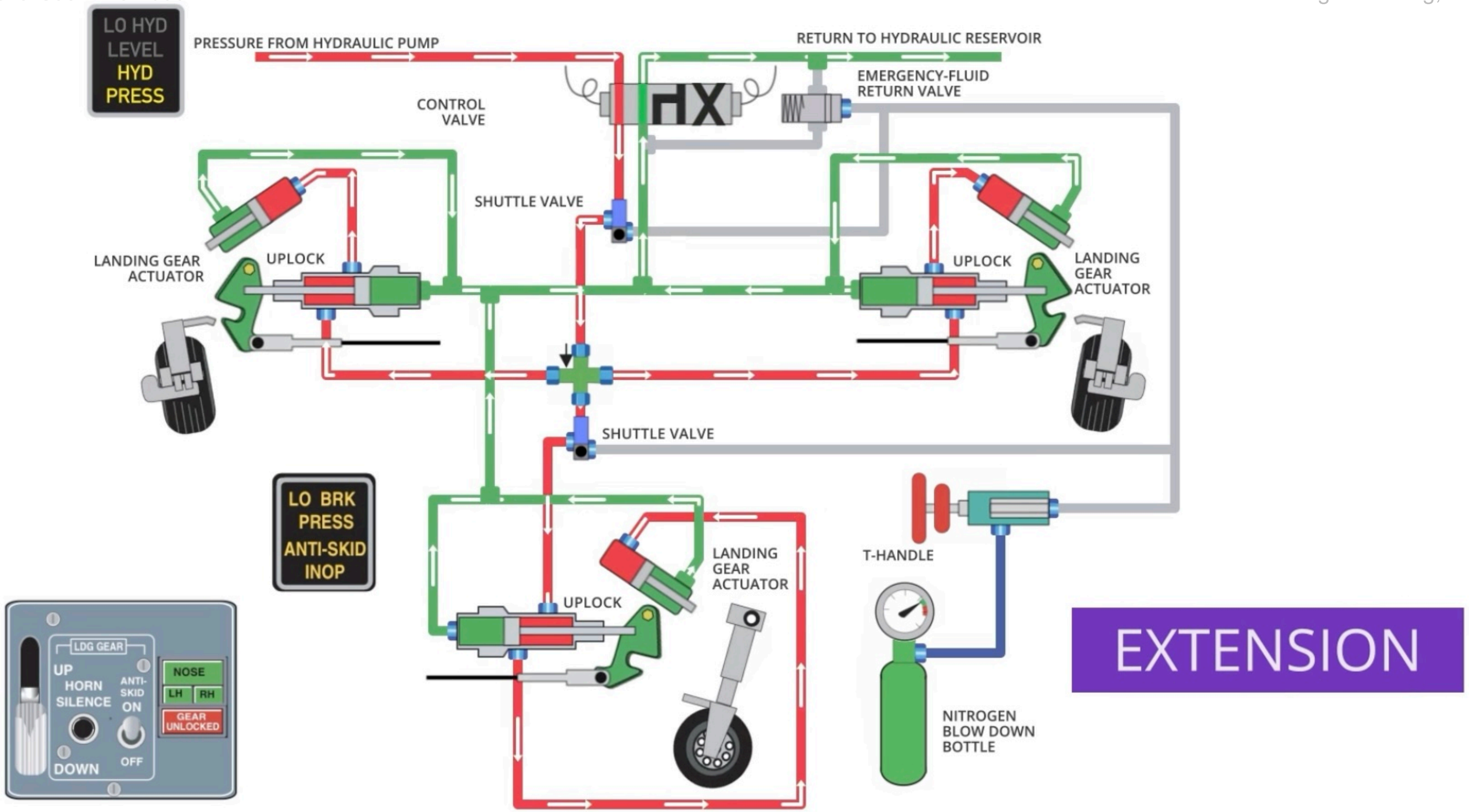
When all three uplock microswitches have been actuated, the gear control valve circuit is interrupted, and the valve returns to the neutral position.

All position indicator lights on the control panel extinguish.


LO HYD LEVEL
HYD PRESS
PRESSURE FROM HYDRAULIC PUMP
RETURN TO HYDRAULIC RESERVOIR
EMERGENCY-FLUID RETURN VALVE
CONTROL VALVE
SHUTTLE VALVE
LANDING GEAR ACTUATOR
UPLOCK
UPLOCK
LANDING GEAR ACTUATOR
SHUTTLE VALVE
LO BRK PRESS
ANTI-SKID INOP
T-HANDLE
LANDING GEAR ACTUATOR
UPLOCK
LDG GEAR
UP
HORN SILENCE
ANTI-SKID
ON
OFF
DOWN
NOSE
LH
RH
GEAR UNLOCKED
NITROGEN BLOW DOWN BOTTLE

EXTENSION

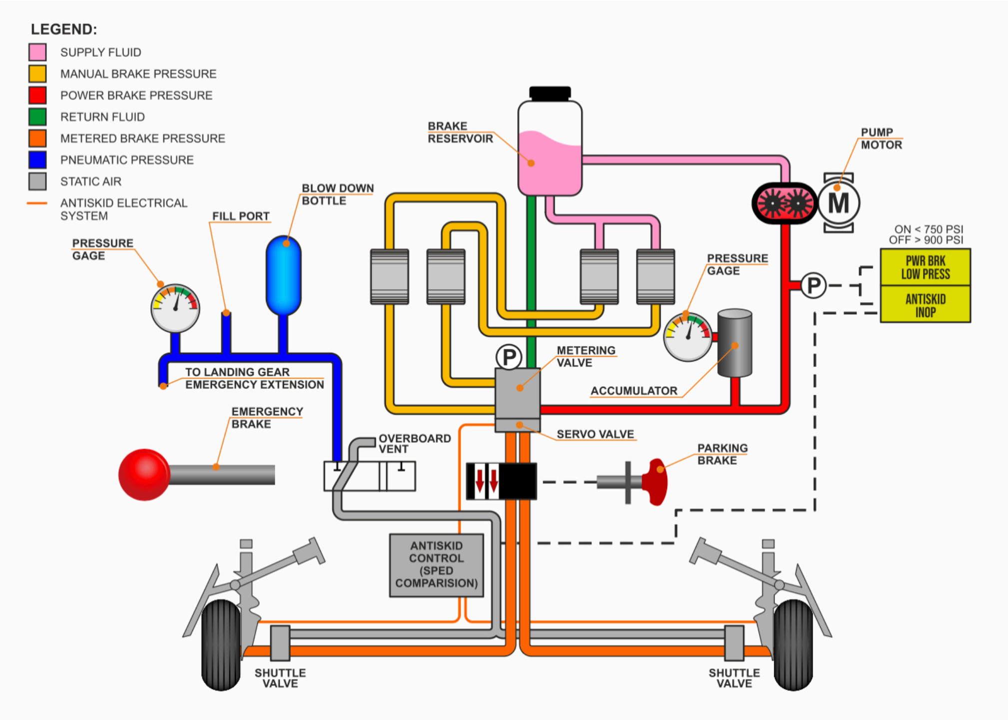
1. The LDG GEAR handle is selected DOWN.
2. The extend solenoid energizes.
3. Hydraulic pressure is directed to the uplock actuators and releases the gear uplock, then the pressure continues to the gear actuators.
4. As three downlock switches are actuated, the control valve will stop the hydraulic flow.
5. Landing gears internal locking mechanism will lock the LDG and send a signal to illuminate the gear position indicator.

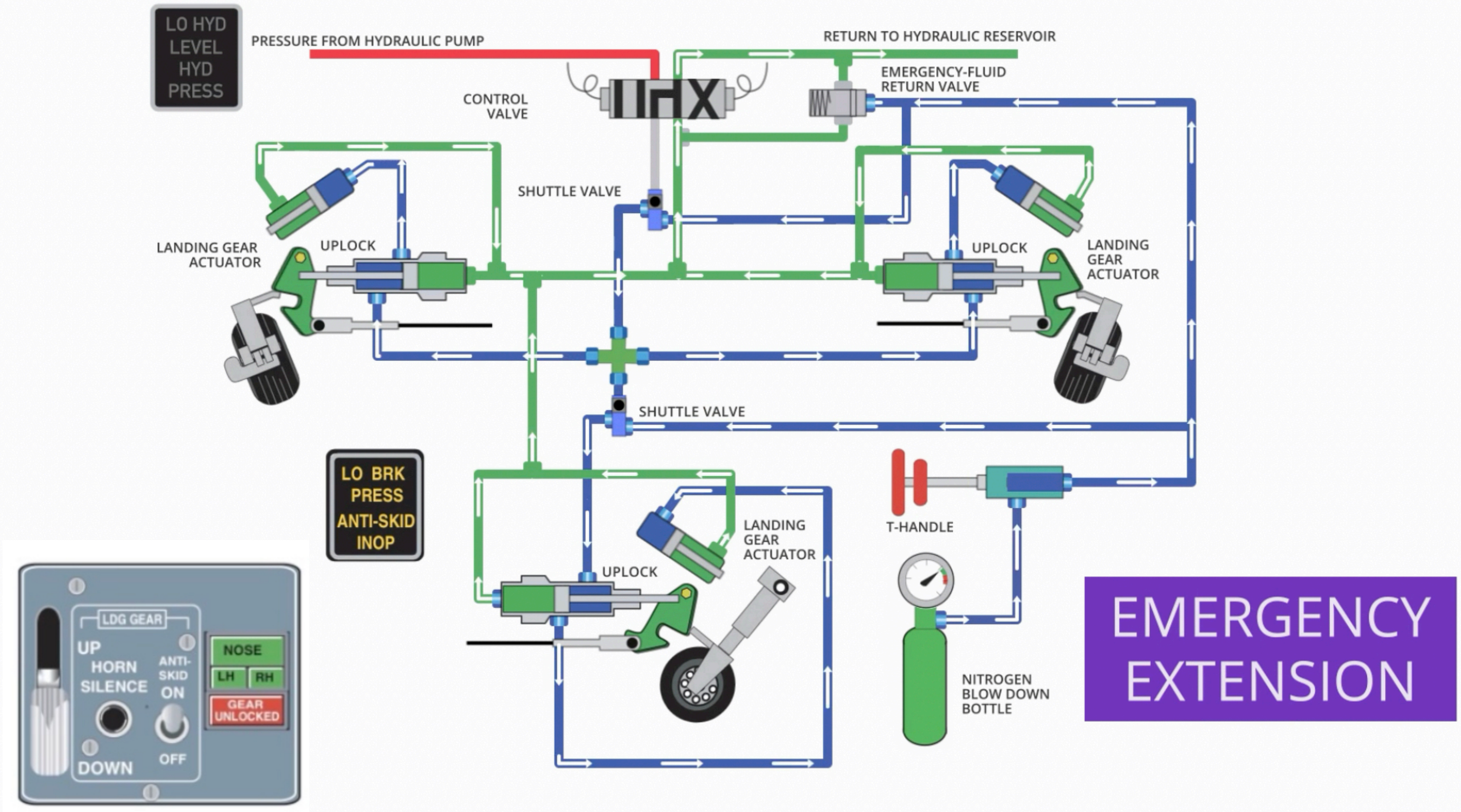

LO HYD LEVEL
HYD PRESS
PRESSURE FROM HYDRAULIC PUMP
RETURN TO HYDRAULIC RESERVOIR
EMERGENCY-FLUID RETURN VALVE
CONTROL VALVE
SHUTTLE VALVE
LANDING GEAR ACTUATOR
UPLOCK
UPLOCK
LANDING GEAR ACTUATOR
SHUTTLE VALVE
LO BRK PRESS
ANTI-SKID INOP
T-HANDLE
LANDING GEAR ACTUATOR
UPLOCK
EXTENSION
LDG GEAR
UP
HORN SILENCE
ANTI-SKID ON
OFF
DOWN
NOSE
LH
RH
GEAR UNLOCKED
NITROGEN BLOW DOWN BOTTLE

EMERGENCY EXTENSION

If the hydraulic system fails or an electrical malfunction exists in the landing gear system, the gear up-locks can be manually released for gear free-fall.

An air bottle (Nitrogen), which is charged to 1,800 to 2,050 psi, is located in the right nose storage compartment. This bottle is used for positive gear uplock release and locking the landing gear down.




LO HYD LEVEL HYD PRESS
PRESSURE FROM HYDRAULIC PUMP
RETURN TO HYDRAULIC RESERVOIR
EMERGENCY-FLUID RETURN VALVE
CONTROL VALVE
SHUTTLE VALVE
LANDING GEAR ACTUATOR
UPLOCK
UPLOCK
LANDING GEAR ACTUATOR
SHUTTLE VALVE
LO BRK PRESS ANTI-SKID INOP
T-HANDLE
LANDING GEAR ACTUATOR
UPLOCK
NITROGEN BLOW DOWN BOTTLE
EMERGENCY EXTENSION
LDG GEAR
UP
HORN SILENCE
ANTI-SKID
ON
OFF
DOWN
NOSE
LH
RH
GEAR UNLOCKED

EMERGENCY EXTENSION (CONT'D)

An emergency gear extension is initiated by pulling the AUX GEAR CONTROL T-handle and rotating it clockwise 45° to lock. This mechanically releases the gear up-locks, allowing the landing gear to free-fall. If necessary, yaw the airplane, in each direction to fully extend the main gear actuators. Next pull the round knob behind the T-handle. Pneumatic pressure should be used to assure positive locking of all three gear actuators. This releases air pressure to drive the gear actuators to the fully extended position where they are maintained by the internal lock mechanism in each actuator. Once the air bottle has been actuated, hydraulic operation of the gear is not possible.

EMERGENCY EXTENSION (CONT'D)

Maintenance action is required after an emergency extension to restore normal operation of the landing gear.

The optimum speed for this procedure is 150 KIAS with flaps up.

NOSEWHEEL STEERING

FOR TOWING:

- ***Disengage the flight control lock.***
- ***Do not exceed 95° nose wheel deflection.***

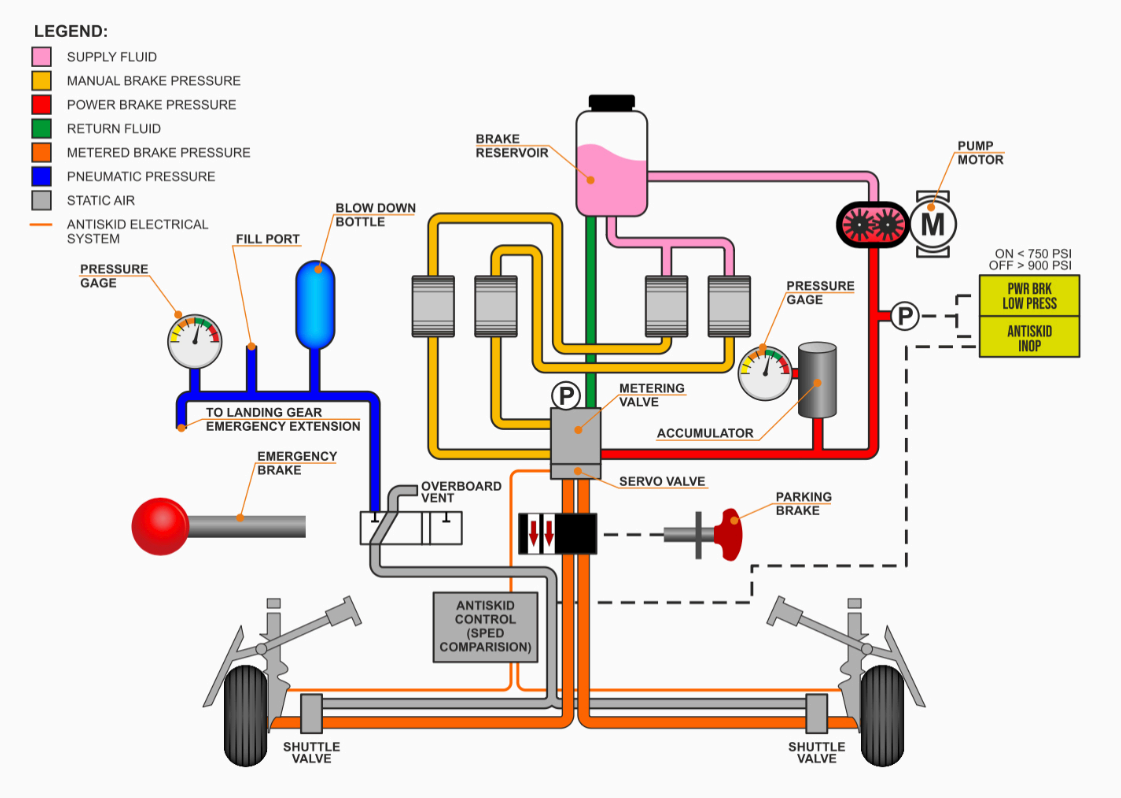
If 95° is exceeded, the steering attachment bolts will shear resulting in a loss of steering capability.
If the control lock is engaged, towing beyond 60° may cause structural damage.
Flying the airplane with inoperative nosewheel steering can result in violent nosewheel shimmy.
The pedals should be centered just prior to nosewheel touchdown during a crosswind landing.

BRAKES

System components include:

1. A hydraulic accumulator
2. A reservoir pressurized by cabin air.

Reservoir fluid level and accumulator air precharge are exterior inspection items in the right nose baggage compartment area.



BRAKES (CONT'D)

The antiskid system has touch-down protection that prevents touching down with locked brakes. The skid control CB provides touch-down system protection.

For normal operation of the power-brake and antiskid system:

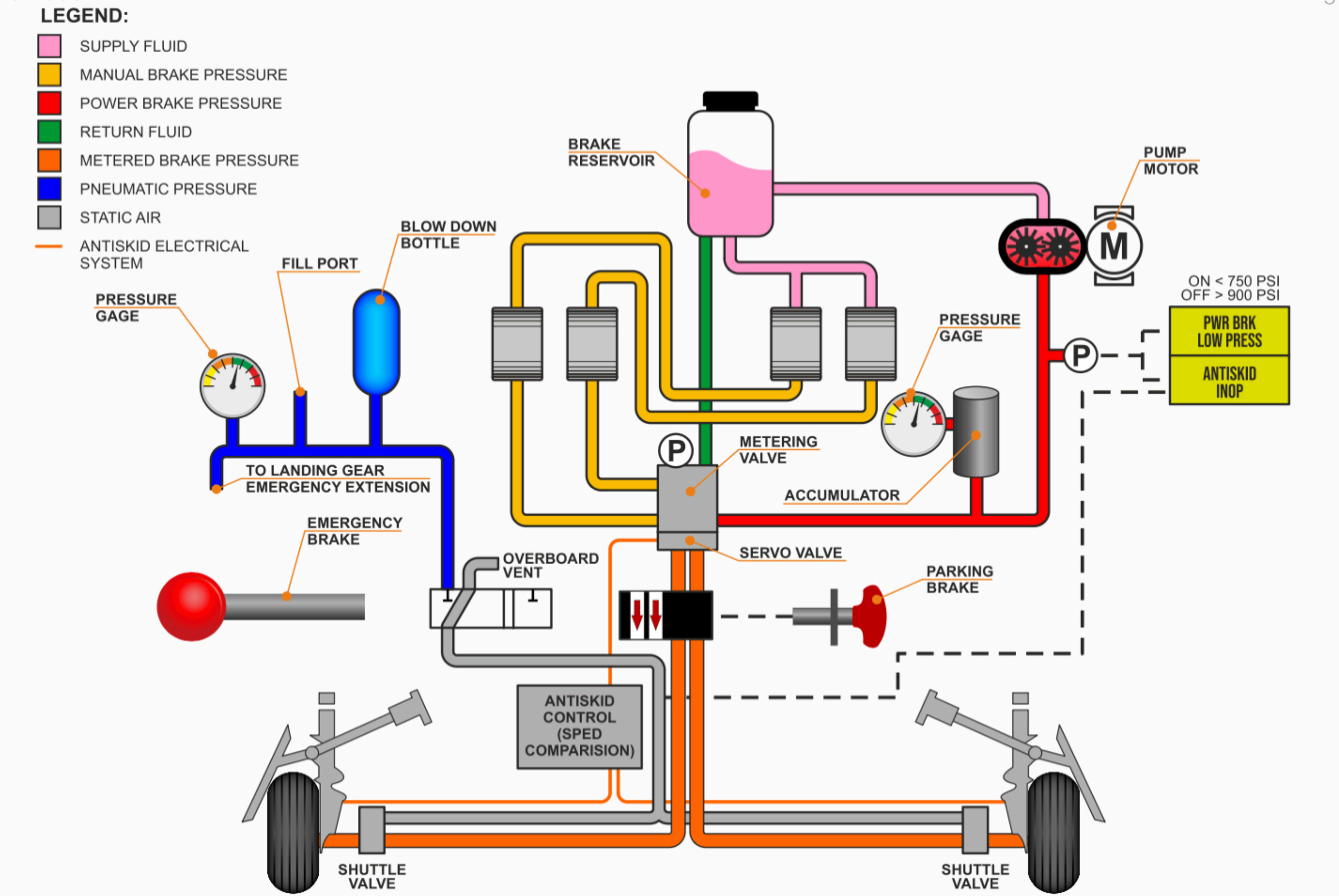
1. The wheels must be rotating.
2. Weight-on-wheels from both squat switches.

Optimum braking technique is obtained by lowering the nose to the ground, applying brakes, and then selecting the ground flap position which automatically extends the speedbrakes. Firmly applying and holding the brakes until the desired speed has been reached.

Do not pump the brakes.
The antiskid system is not operative with the parking brake set.

BRAKES (CONT'D)

With the ANTI-SKID switch on the LDG GEAR panel in the ON position and a ground speed of at least 12 knots, maximum braking without wheel skid is available. Any tendency of a wheel to rapidly decelerate (skid) is detected by the wheel speed transducer, and the antiskid valve is signaled to momentarily dump pressure from both brakes. As wheel speed returns to normal, dumping ceases and pressure is once again increased in the brake assemblies. When wheel speed drops below approximately 12 knots, the antiskid function disengages.


LEGEND:
SUPPLY FLUID
MANUAL BRAKE PRESSURE
POWER BRAKE PRESSURE
RETURN FLUID
METERED BRAKE PRESSURE
PNEUMATIC PRESSURE
STATIC AIR
ANTISKID ELECTRICAL SYSTEM
BRAKE RESERVOIR
PUMP MOTOR
M
BLOW DOWN BOTTLE
FILL PORT
PRESSURE GAGE
ON < 750 PSI
OFF > 900 PSI
PWR BRK LOW PRESS
ANTISKID INOP
PRESSURE GAGE
P
P
METERING VALVE
TO LANDING GEAR EMERGENCY EXTENSION
ACCUMULATOR
EMERGENCY BRAKE
OVERBOARD VENT
SERVO VALVE
PARKING BRAKE
ANTISKID CONTROL (SPED COMPARISION)
SHUTTLE VALVE
SHUTTLE VALVE

BRAKES (CONT'D)

With the ANTI-SKID switch on the LDG GEAR panel in the ON position and a ground speed of at least 12 knots, maximum braking without wheel skid is available.
When wheel speed drops below approximately 12 knots, the antiskid function disengages.
Differential braking is available. Manual braking is possible if the power-brake system fails, but pneumatic braking is recommended. The ANTI-SKID switch, located on the LDG GEAR control panel, is normally in the ON position. In the OFF position, the antiskid system is deactivated and the ANTI-SKID INOP annunciator is on.

BRAKES (CONT'D)

If a fault develops in the antiskid system, the ANTI-SKID INOP annunciator light comes on, and the system should be switched off. Brake operation remains the same except that antiskid protection is not available. Care should be taken to ensure that brake pressure is released prior to turning the antiskid system off, and that the airplane is not moving prior to turning the antiskid system on.

When brake system pressure drops below 750 psi, the ANTISKID INOP and POWER BRAKE LOW PRESS annunciators will illuminate.

BRAKES SYSTEM TEST

A ground test of the antiskid system is accomplished by selecting the ANTI-SKID position on the rotary test. The ANTI-SKID INOP light should flash and the ANTI-SKID INOP light should extinguish when the rotary test OFF position is selected.

The antiskid system test is failed if the ANTI-SKID INOP light remains on in rotary test OFF position.

ANTISKID IN-FLIGHT TEST

This model 525 aircraft initiates a dynamic self-test upon extension of the landing gear.

To initiate a self-test:

1. Select ANTI SKID on the rotary TEST knob or
2. Turn the ANTI-SKID switch OFF and then back ON.
3. In flight, the ANTISKID INOP annunciator is delayed for 8 seconds.

Any time the system is powered ON, even upon restoration of electrical power following a power failure, the anti-skid system performs a self-test.

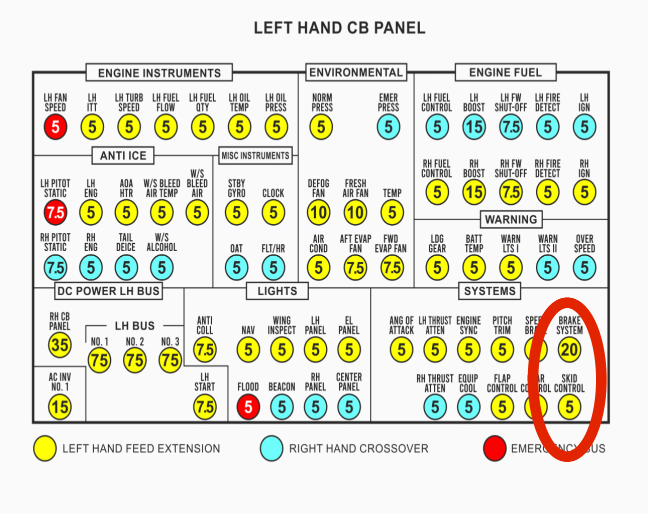
BRAKES (CONT'D)

SYSTEM TEST

When the aircraft is inflight with the ANTI-SKID switch on, the antiskid control unit is constantly monitoring for shorts and opens in the transducer and servo-valve circuits. This is the self test function. If an open or short occurs with the gear handle up or down in flight, the ANTI-SKID INOP light will illuminate.

Two circuit breakers located in the systems section of the pilot's circuit breaker panel. The first is a 20-amp brake system CB. Disengaging the brake system CB electrically deenergizes the antiskid system and the power brake system.

The second is a 5-amp skid control CB, disengaging the skid control CB does not turn the antiskid system off, it only eliminates touchdown protection.



WHEEL FUSIBLE PLUG CONSIDERATIONS

Brake application reduces the speed of an airplane by means of friction between the brake components. The friction generates heat, which increases the temperature of the brake and wheel assembly, resulting in an increased tire pressure. Each main wheel incorporates fuseplugs, which melt at a pre-determined temperature, to prevent a possible tire explosion due to excessively high tire pressure. Repetitive traffic patterns with multiple landings and/or multiple rejected takeoffs, could melt the fuseplugs and cause loss of all tire pressure and possible tire and wheel damage.

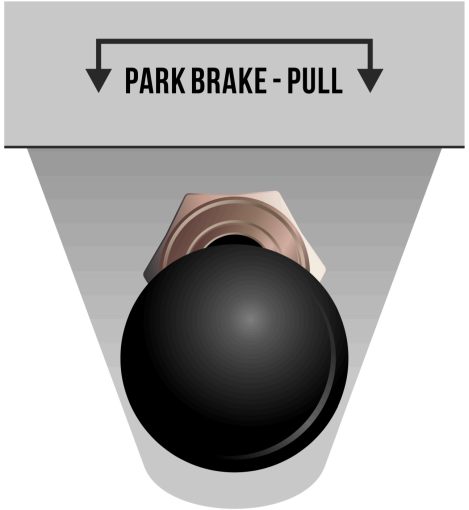
PARKING BRAKES

The parking brakes is set by trapping fluid in the brake lines.

To Set:
Apply the brakes and then pull out the PARK BRAKE handle.

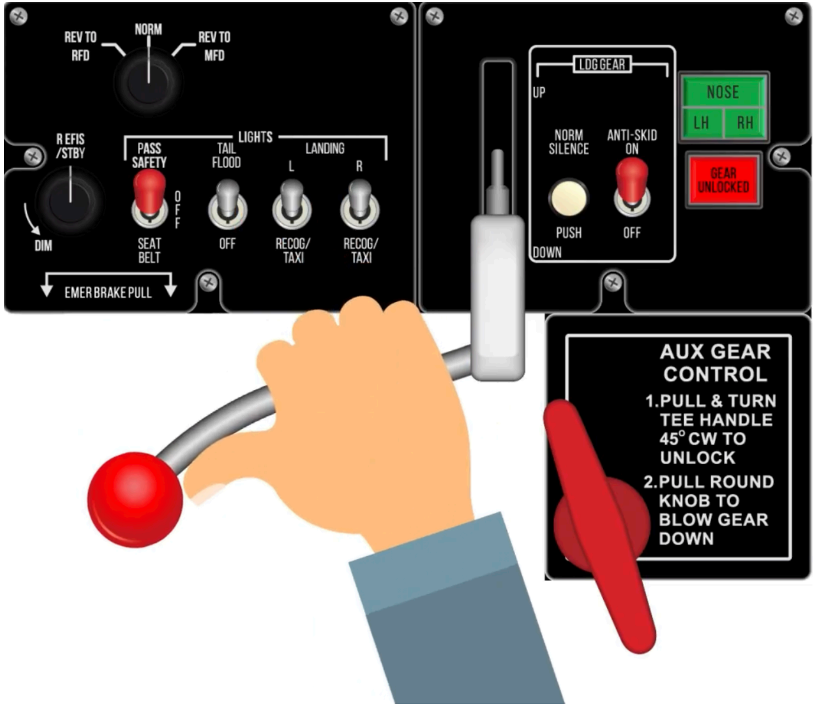
To Release:

- While pressing the brake pedals, push in on the PARK BRAKE handle.
- One-way check valves allow setting increased, trapped pressure once the brakes are set by simply depressing the brake pedals harder.
- Do not set the brakes subsequent to a maximum effort stop.
- A 1,000 psi thermal relief valve is incorporated in the parking brake valve.



EMERGENCY BRAKES

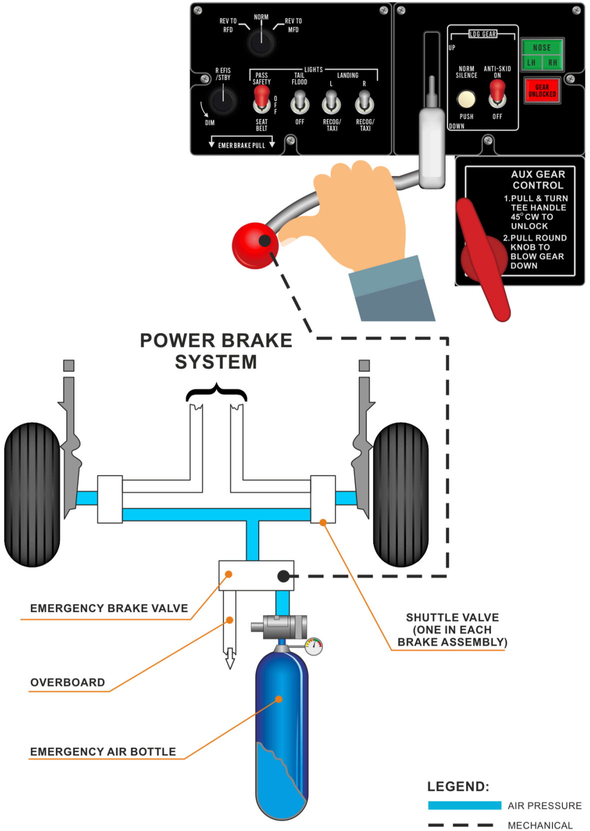
In the event of a hydraulic brake system failure, a pneumatic brake system is available. A pneumatic bottle provides pressure for alternate brakes and for emergency landing gear extension. The bottle has adequate pressure for emergency brakes and pneumatically extending the landing gear.



EMERGENCY BRAKES

OPERATION

Pulling the red EMER BRAKE PULL lever aft mechanically actuates the emergency brake valve. The valve meters air pressure through shuttle valves to the brake assemblies in direct proportion to the amount of lever movement. Since air pressure is applied to both brakes simultaneously, differential braking is not possible. Returning the lever to its original position releases pressure from the brakes and vents it overboard, releasing the brakes. The emergency brakes should be applied only enough to obtain the desired rate of deceleration, then held until the airplane stops. Repeated applications waste air pressure. Antiskid protection is not available while using emergency brakes.



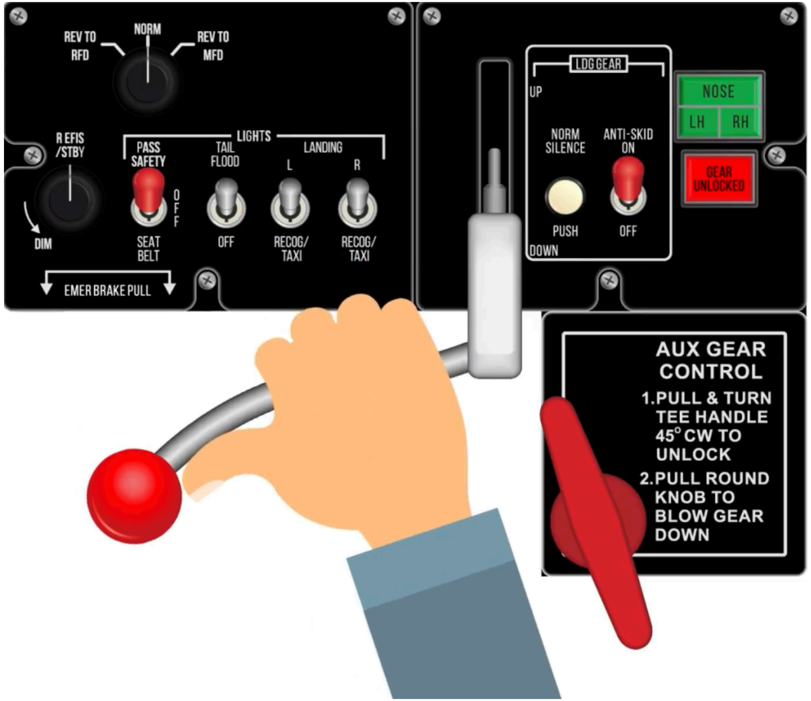
EMERGENCY BRAKES

The emergency brakes should be applied judiciously. Pull the handle slowly to obtain the desired rate of deceleration, then hold until the airplane stops. Do not pump the handle as this wastes air pressure. Antiskid protection is not available during emergency braking. Differential braking in not available. Do not attempt to taxi after clearing the runway using the emergency brakes. Ten applications are available for emergency braking if the emergency air bottle is full.
Five applications may be available if the system has also been used for emergency gear extension.

APPLYING EMERGENCY BRAKES

- Use a smooth, steady, continuous pull of the handle to obtain the desired deceleration rate.
- Multiple pulls and releases of the handle will deplete the nitrogen charge.

Do not depress the brake pedals while applying emergency airbrakes. Shuttle valve action may be disrupted, allowing air pressure to enter the hydraulic lines and rupture the brake reservoir leading to a total loss of the brakes.



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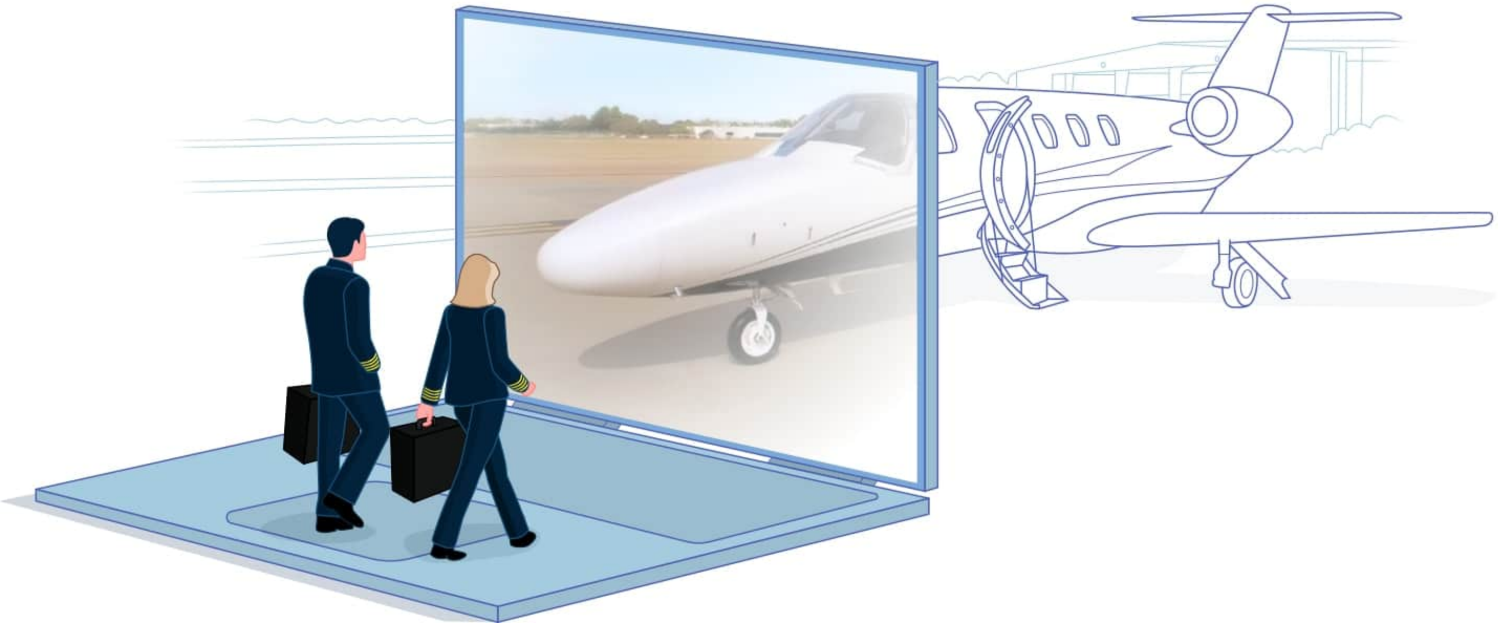


FLIGHT CONTROLS

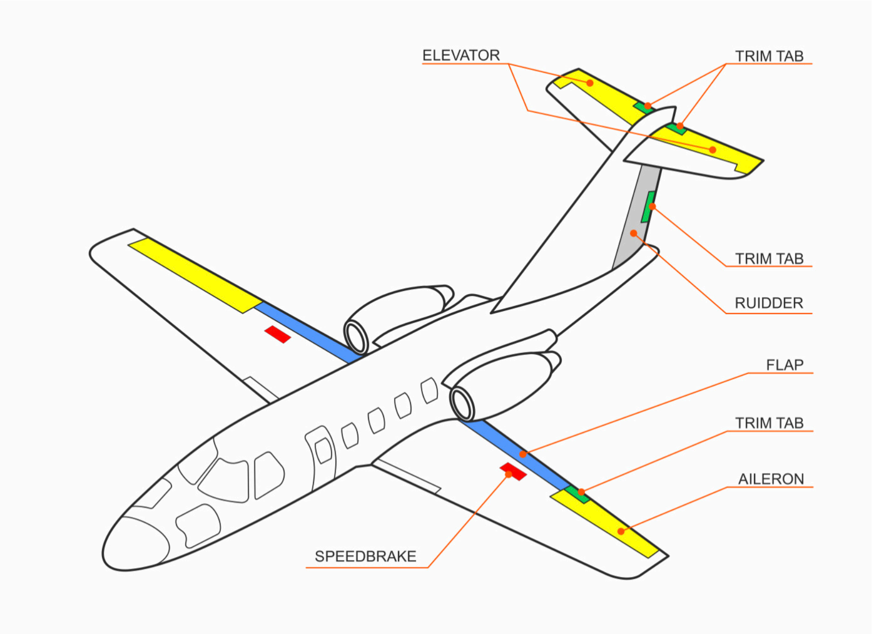
INTRODUCTION TO FLIGHT CONTROLS

The primary flight controls are the:

- Ailerons
- Rudder
- Elevators

The trim is mechanical in all three axes, with electrical elevator trim available.

Secondary flight controls consist of hydraulically actuated flaps and speed brakes.



PRIMARY FLIGHT CONTROLS

GENERAL

The ailerons, rudder, and elevators are manually operated by the control column and rudder pedals. Control surfaces are operated by cables and bellcranks. The rudder, elevators, and the left aileron are each equipped with a trim tab which is mechanically actuated from the cockpit. The elevator tabs can also be electrically positioned by pitch trim switches on the control wheels. The pilot's switch has priority.

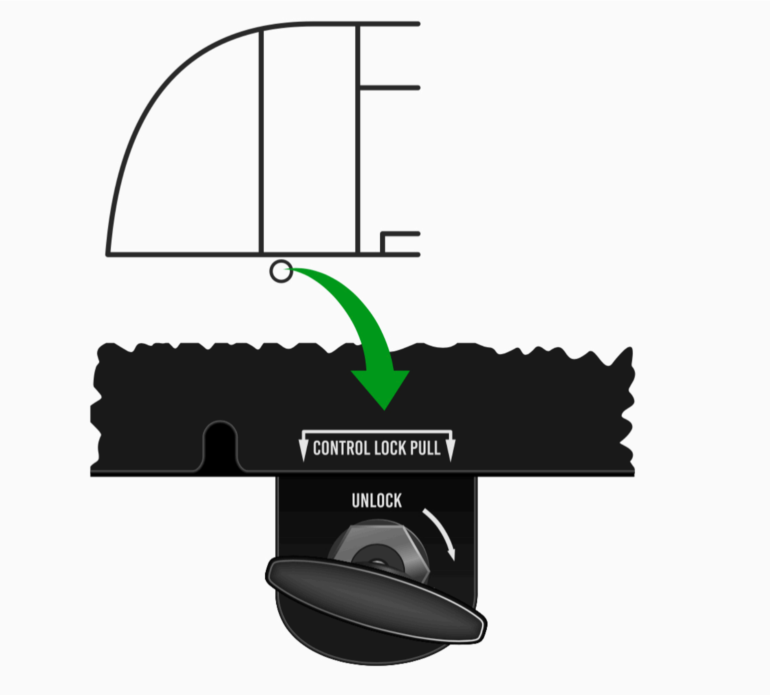
CONTROL LOCK SYSTEM

Control locks, when engaged, restrain the primary flight controls and lock both throttles off.

Prior to engaging the control lock:

1. Move both throttles to CUTOFF
2. Neutralize the flight controls.
3. Rotate the CONTROL LOCK handle 90° clockwise and pull out until the handle returns to the horizontal position and locks the flight controls in neutral and the throttles in CUTOFF.

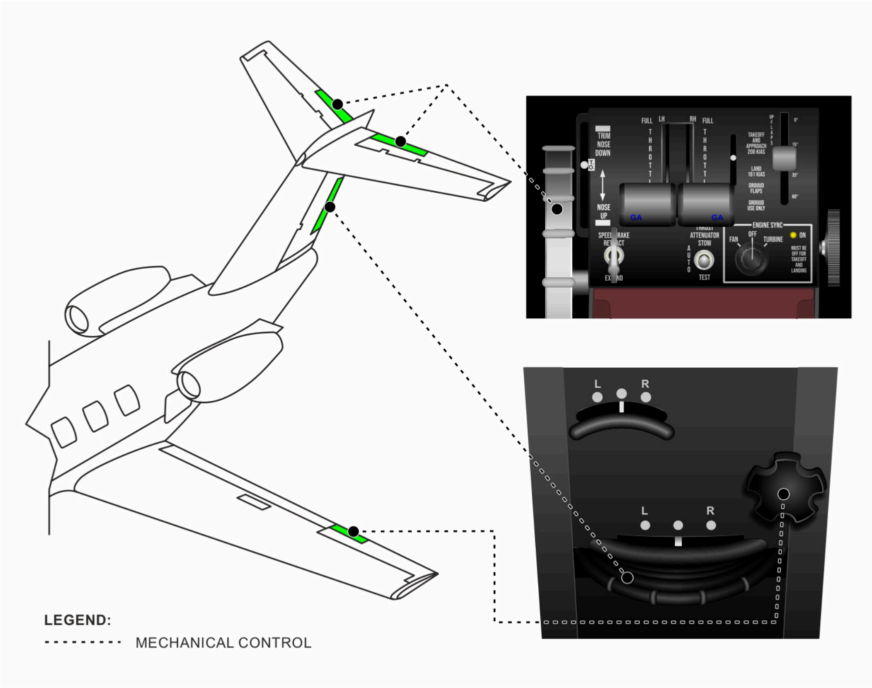
To unlock the flight controls and throttles, rotate the handle 90° clockwise and push in until it returns to the horizontal position.



TRIM SYSTEMS

RUDDER AND AILERON TRIM

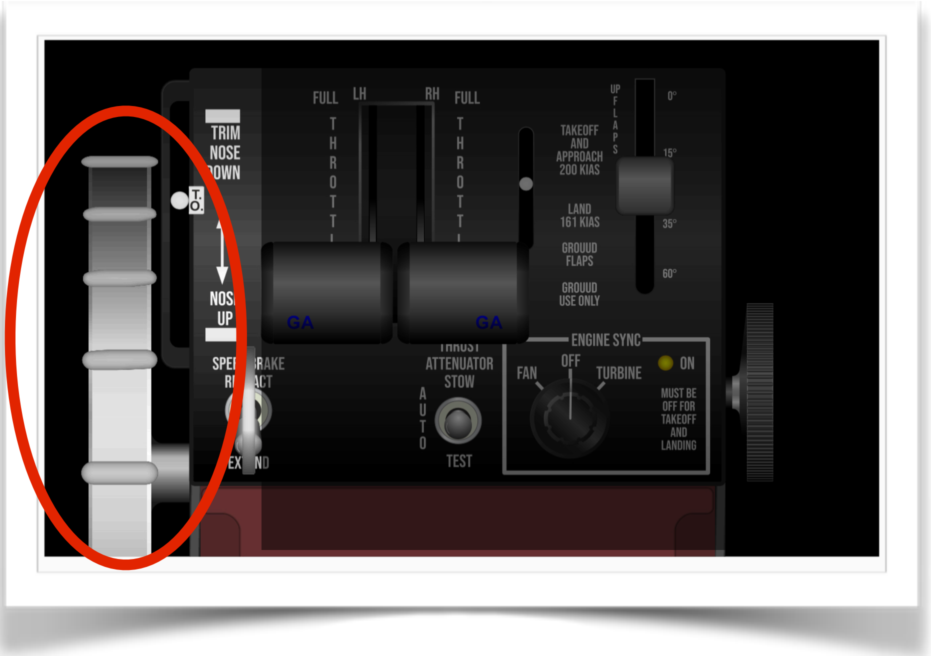
Rudder or aileron trim is controlled by the rudder trim wheel or aileron trim knob on the pedestal. Cable systems position the rudder and aileron trim tabs. A mechanical indicator adjacent to the trim wheel or knob indicates trim position. The rudder servo tab deflects 1⁄3° in the opposite direction for each degree of rudder deflection to aid the pilot in rudder deflection. It is the only servo tab on the airplane.



ELEVATOR TRIM

MANUAL TRIM

Manual elevator trim is operated by rotating the elevator trim wheel fore and aft. As the tabs move, a pointer on the elevator TRIM indicator moves toward the NOSE UP or NOSE DOWN position.



ELEVATOR TRIM

The electric elevator trim is controlled by a split-element trim switch on the outboard side of each control wheel.
The pilot's pitch trim inputs will override those made by the copilot.
As the trim switch is moved to the UP or DOWN position, the elevator tabs are repositioned as indicated by the elevator TRIM indicator.

ELEVATOR TRIM TEST

Prior to flight, the electrical trim system can be tested for proper operation by holding both elements of the switch full forward and full aft and observing that the trim moves in the appropriate directions. Next, push only one side of the trim switch in each direction. No trimming should occur.

Runaway or malfunctioning trim can be interrupted by depressing the red AP/TRIM DISC switch on the control wheel and pulling the PITCH TRIM circuit breaker on the left circuit breaker panel.

Do not engage the autopilot with electric trim inoperable.

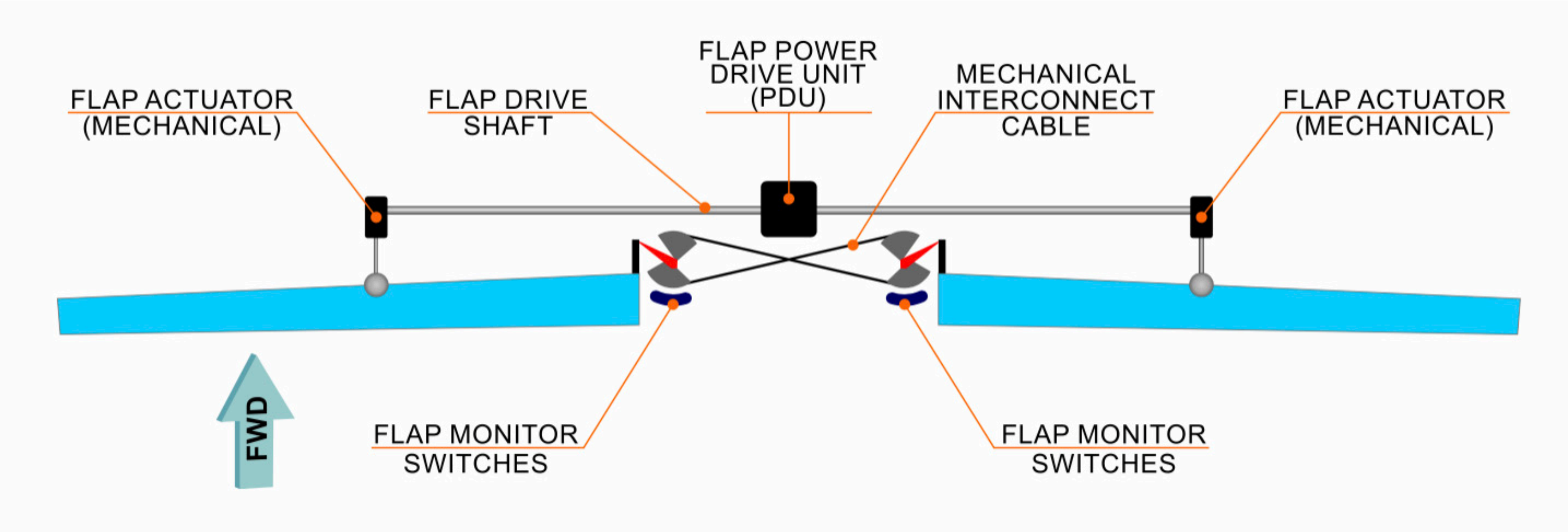
SECONDARY FLIGHT CONTROLS

The secondary flight controls consist of the:

1. Wing flaps
2. Speedbrakes

Both systems are electrically controlled and hydraulically actuated.

SECONDARY FLIGHT CONTROLS (CONT'D)



A single FLAP section on each wing can be hydraulically positioned from 0° to 60°.
A mechanical interconnection of the left- and right-wing flap segments prevents asymmetrical flap operation and permits flap operation with only one hydraulic actuator.

SECONDARY FLIGHT CONTROLS (CONT'D)

The SPEEDBRAKES consist of smooth panels on top and panels with holes on the bottom of the wing forward of the flaps. They provide increased descent rates and increased drag to aid braking during landing rollout.

SECONDARY FLIGHT CONTROLS (CONT'D)

FLAPS

The flap selections are:
UP ………………………………………….. 0°
TAKEOFF AND APPROACH ……… 15°
LAND ……………………………………… 35°
GROUND FLAPS ……………………… 60°
Maximum altitude to extend flaps and/or landing gear ……………………………….. FL180

SECONDARY FLIGHT CONTROLS - FLAPS

The GROUND FLAPS (60°) flap position provides increased aerodynamic drag for landing rollout. Landing performance data is based on touchdown, nose down, brakes on, then selecting the GROUND FLAPS position.

Selecting the GROUND FLAPS position closes the 60° flap position switch in the quadrant, automatically extending the speedbrakes, and directs the flaps from 35 to 60°.

Selecting the FLAPS handle from 60 to 35° opens the 60° flap position switch, retracting the speedbrakes, and moving the flaps from 60 to 35°.

Avoid cycling the throttles above and below 85% N2 while in the ground flap position.

FLYING WITH FLAPS 60°

Intentional selection of GROUND FLAPS 60° in flight is prohibited.
If an inflight malfunction results in 60° flaps and can not be corrected, consider carrying power to touchdown. Reducing power to idle at 50 feet could result in high sink rate.

Even though the ground flap position is prohibited in flight, it has been demonstrated that the airplane can be safely flown at the 60° position whether caused by malfunction or inadvertent selection. Do not exceed 140 KIAS.

SECONDARY FLIGHT CONTROLS - FLAPS

INDICATION

The FLAPS > 35° annunciator and MASTER CAUTION lights illuminate immediately on the ground if the flaps are beyond 35° and both throttles are above 85% N2. On the ground with throttles below 85% N2, no annunciator lights come on.

In flight, with the throttles below 85% N2, the MASTER CAUTION and FLAPS >35° lights illuminate after an 8-second delay anytime flaps are beyond 35°. The lights illuminate immediately if the throttles are above 85% N2.

Go-around should not be attempted once GROUND FLAPS have been selected.

OPERATION OF THE FLAPS

Moving the flap lever to any position causes the hydraulic system bypass valve to close for pressure buildup as indicated by illumination of the HYD PRESS ON annunciator. It also energizes the flap solenoid valve, routing pressure for flap movement.

SECONDARY FLIGHT CONTROLS – FLAPS (CONT'D)

SYSTEM FAILURE

In the event of electrical failure, the flap solenoid valve remains in the neutral position, and the flap position cannot be changed.

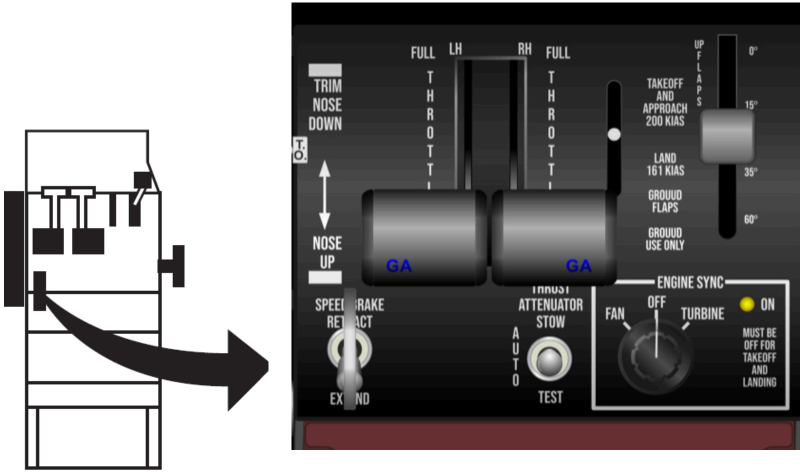
If hydraulic system failure occurs with the flaps retracted, they cannot be extended.
With the flaps in an extended position, the flaps will remain in the selected position unless the handle is moved. Once the solenoid valve is energized, the flaps may "blow upward" to a deflection proportionate to air loads.

SECONDARY FLIGHT CONTROLS - SPEEDBRAKES

SPEEDBRAKES

Two speedbrake panels on each wing, one on top and one on the bottom surface of the wing, are operated by hydraulic actuators.

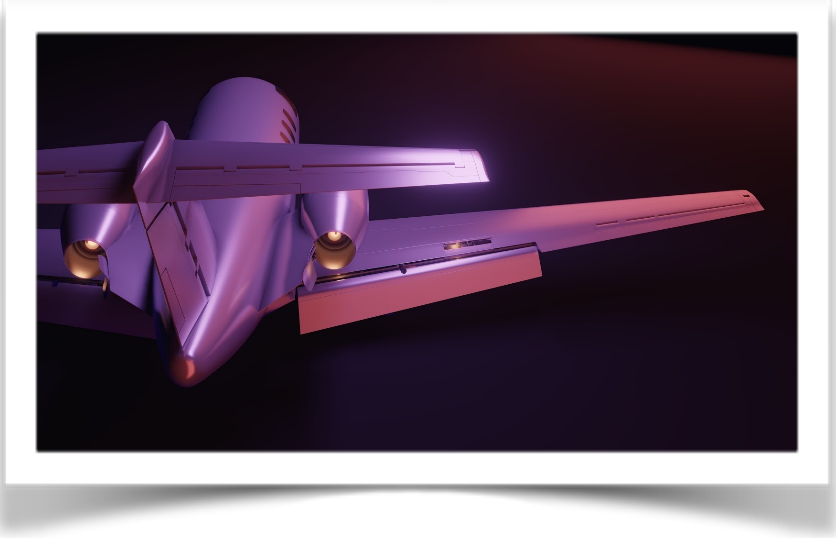
They provide increased descent rates and increased drag.



EXTENDING THE SPEEDBRAKES

Selecting the speedbrake switch to the EXTEND position illuminates the HYD PRESS ON annunciator and directs hydraulic pressure to move the speedbrakes out of their mechanical locks and extend them.

Upon full extension, the white SPEED BRAKE EXTEND annunciator illuminates and the hydraulic system bypass valve opens to relieve pressure, extinguishing the HYD PRESS ON annunciator. The solenoid valve traps fluid to the actuator and hydraulically locks the speedbrakes in the extended position.



RETRACTING THE SPEEDBRAKES

RETRACTING SPEEDBRAKES

Selecting the speedbrake switch the RETRACT position pressurizes the hydraulic system and the speedbrake solenoid valve is positioned to direct pressure for retraction. The SPEED BRAKE EXTEND annunciator extinguishes as the speedbrakes retract. The hydraulic system locks the speedbrakes in the retract position, and the hydraulic system depressurizes.

SECONDARY FLIGHT CONTROLS - SPEEDBRAKES

The speedbrakes can be extended with the SPEED BRAKE switch or by moving the FLAPS handle to the GROUND FLAPS position. The speedbrakes retract with the SPEED BRAKE switch, or either throttle above 85% N2, or if FLAPS are selected to FLAPS 35°. If electrical failure occurs with the speedbrakes extended, the safety valve opens, allowing the speedbrakes to blow down. If electrical failure occurs with the speedbrakes retracted, they cannot be extended.

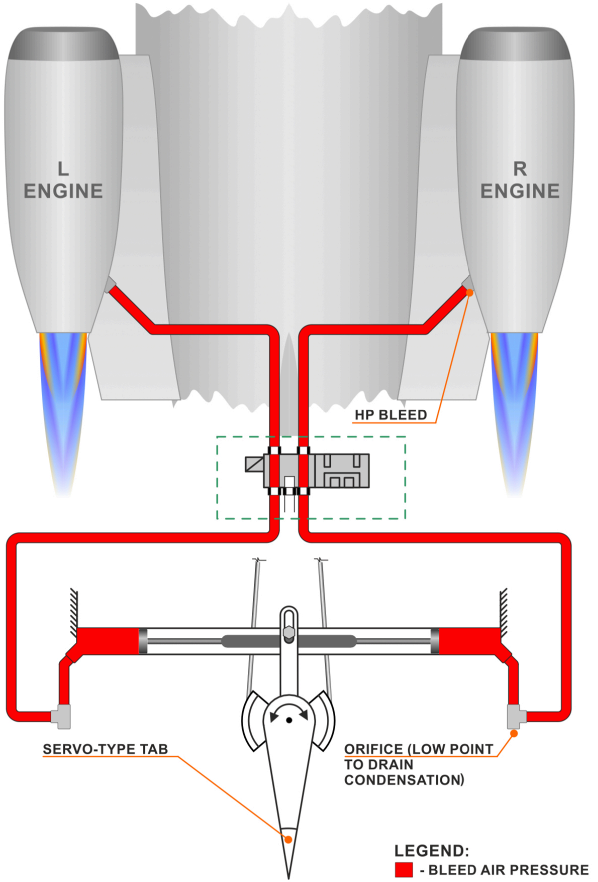
RUDDER BIAS

The rudder bias system assists the pilot in maintaining directional control in the event of loss of thrust from one engine. The bias system is pneumatically powered from engine bleed air. When active, the system automatically assists the pilot in positioning the rudder to compensate for asymmetric thrust. The system consists of the following major components:

- Solenoid-operated control valve
- Balanced pneumatic actuator
- Separate engine bleed-air plumbing for left and right engine

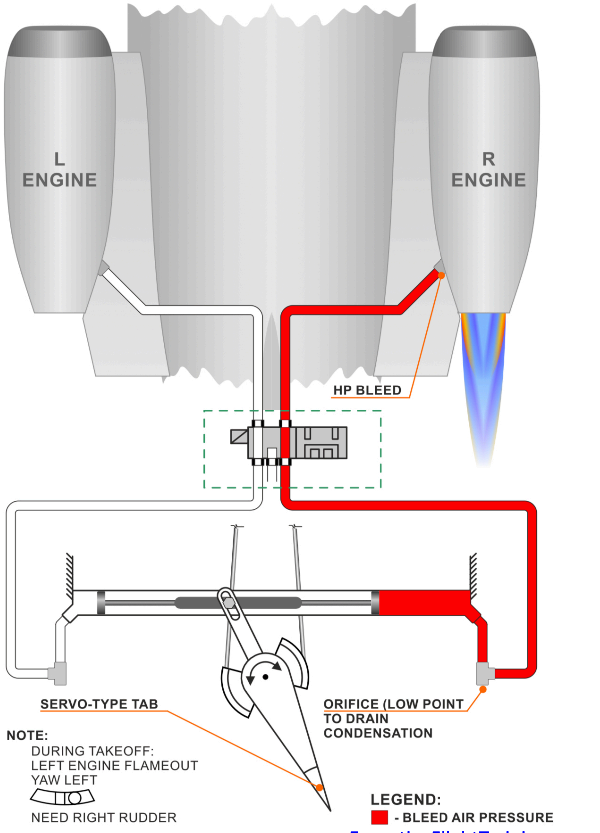
Failure of the rudder bias system is indicated by:

- Illumination of the RUDDER BIAS annunciator.
- Illumination of the MASTER CAUTION light.
- Uncommanded motion of a rudder pedal moved forward



RUDDER BIAS (CONT’D)

Equal bleed air pressure on both sides of the rudder bias actuator allows the rudder to move normally. With the bias valve in the bypass position, the rudder is allowed to move without interference from the bias system (fail-safe). In the event of an engine failure, the resulting imbalance in bleed air pressure to the bias actuator applies rudder pressure to assist the pilot in compensating for the asymmetric thrust.



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STALL WARNING

A stall strip on the leading edge of each wing and a stick shaker operated by the angle-of-attack system provide adequate stall warning. The stall strips create turbulent airflow at high angles of attack, causing airflow buffet to warn of an approaching stall.

NOTE

The stall strips are critical items for favorable stall characteristics and should be replaced if damaged.

TAKEOFF AND LANDING OPERATIONAL LIMITS

Maximum Altitude Limit………………………………………………… 14,000 Feet
(Refer to high altitude procedures.)

Maximum Tailwind Component ……………………………………………..10 Knots

Maximum Crosswind Component …………………………………………..20 Knots
(Not a limit)

Maximum Ambient Temperature …………………………………………. Refer to AFM

Minimum Ambient Temperature …………………………………………. –53° C

The maximum intentional asymmetric fuel differential is 200 pounds; however, controllability for safe return and landing has been demonstrated with an emergency asymmetrical difference of 600 pounds.

TAKEOFF/LANDING/ENROUTE LIMITATIONS

- The autopilot and yaw damper must be OFF for takeoff and landing.
- Engine synchronizer must be OFF for takeoff and landing.
- Cabin must be depressurized for takeoff and landing.
- Speed brakes must be retracted prior to 50 feet on landing.
- Touch and go landing utilizing ground flaps are prohibited.
- Extending ground flaps during touch-and-go landings is prohibited

PUSH THE BUTTON TO DOWNLOAD THE TEST

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