Learjet 24/25

Cockpit Reference Handbook

CAE SimuFlite

August 2010

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CAE SimuFlite

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Introduction

CAE SimuFlite created this reference handbook for cockpit use. It is an abbreviated version of the SimuFlite Initial Pilot Training Manual and includes international flight planning information. Please refer to the front of each chapter for a table of contents.

The **Procedures** chapter contains four elements: Preflight Inspection, Expanded Normal Procedures, a sample Standard Operating Procedure (SOP), and Maneuvers.

The **Limitations** chapter contains general, operational, and aircraft system limitations.

The alphabetically arranged **Systems** chapter includes text for particular systems and relevant color schematics.

The **Flight Planning** chapter includes maximum allowable takeoff and landing weight flow charts and a sample weight and balance form. International flight planning information includes a checklist, a glossary of frequently used international flight operation terms, and sample flight plan forms (ICAO and FAA) with completion instructions.

The **Servicing** chapter contains servicing specifications and checklists for fueling, defueling, and other servicing procedures.

The **Emergency Information** chapter provides basic first aid instructions.

Information in the **Conversion Tables** chapter may facilitate your flight planning and servicing computations.

Operating Procedures

This chapter contains four sections: Preflight Inspection, Expanded Normal Procedures, a sample Standard Operating Procedure (SOP), and Maneuvers. Although these procedures are addressed individually, their smooth integration is critical to ensuring safe, efficient operations.

Preflight Inspection contains an abbreviated checklist for the exterior inspection as well as preflight cockpit and cabin checks.

Expanded Normal Procedures presents checklists for normal phases of flight. Each item, when appropriate, is expanded to include cautions, warnings, and light indications.

Standard Operating Procedures details Pilot Flying/Pilot Monitoring callouts and verbal or physical responses.

Maneuvers contains pictorial representations of specific maneuvers.

Preflight Inspection

Table of Contents

General

Before starting the exterior inspection, obtain the following:

- flashlight
- standard screwdriver
- fuel sampler
- step stool
- container for fuel sample disposal.

The following is a generalized exterior inspection.

All Surfaces . . . . FREE FROM SNOW/ICE/FROST

Protective Covers/Plugs . . . . REMOVE/STOW

Remove safety covers from the engines, static ports, stall warning vents, pitot probes, starter/generator inlets, and APU inlets.

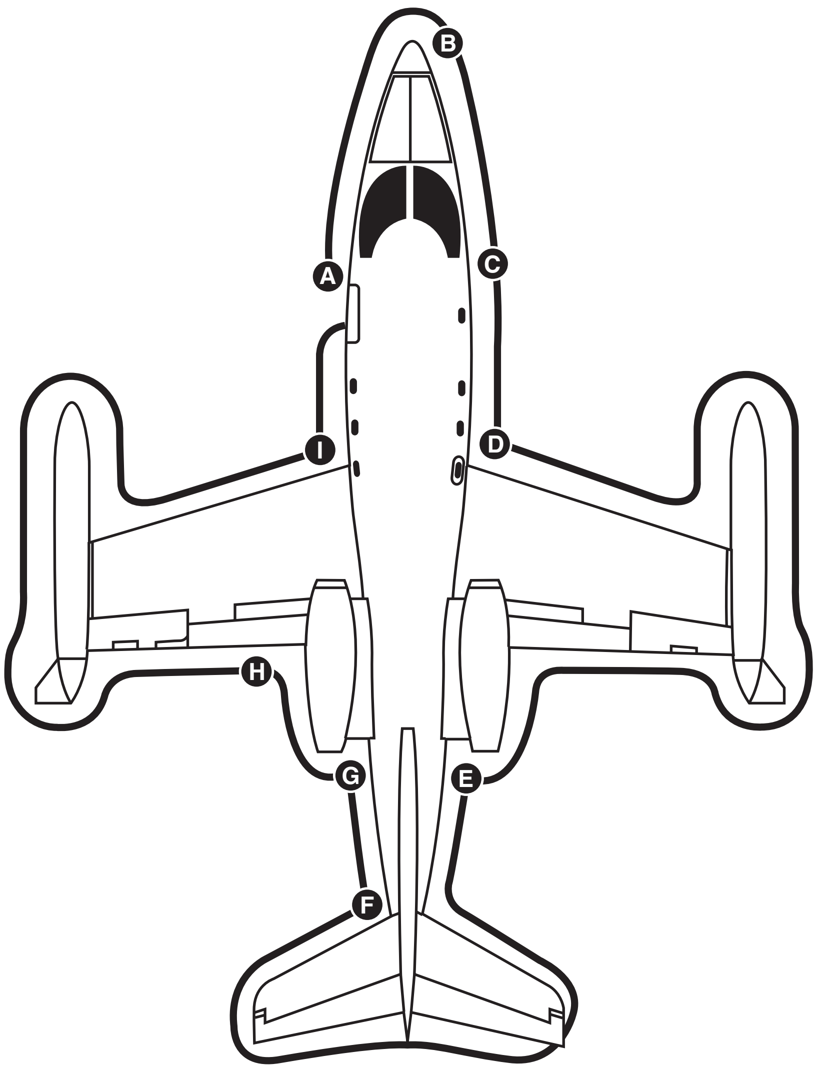
All Intakes/Exhausts . . . . CLEAR

General Condition . . . . UNDAMAGED

Perform a general condition check of the entire aircraft. Note any fuel, oil or hydraulic leaks. Determine cause and have corrected before flight.

NOTE: If night flight is anticipated, check actual operation of navigation and strobe lights.

Preflight Inspection Walkaround Path



Power Off

NOTE: Procedures marked with this symbol (◗) denote through-flight checklist items.

Before performing the Power Off checks, remove and stow the controls lock.

A Left Nose/Radome

Pilot's Windshield . . . . CHECK/CLEAN

Alcohol Discharge/Defog Outlet . . . . . CHECK/CLEAR

◗ Left Shoulder Static Port . . . . CHECK/CLEAR

◗ Left Stall Warning Vane . . . . CHECK FREEDOM OF MOVEMENT

Leave the vane in full down position to prevent an inadvertent stick shaker when the stall warning system is activated later.

◗ Left Static Ports . . . . CHECK/CLEAR

Pitot/Static Drain Valves . . . . DRAIN

Open only if moisture in pitot static system is suspected.

◗ Left Pitot Probe Opening . . . . CHECK/CLEAR

Left Avionic Cowling . . . . SECURE

Wheel Well . . . . INSPECT

Hydraulic Lines . . . . SECURE/NO LEAKS

Nose Gear Door/Linkage . . . . . SECURE/UNDAMAGED

Strut Extension . . . . MINIMUM 5-1/2 INCHES

◗ Nose Wheel/Tire . . . . CONDITION/TREAD

Chine . . . . MINIMUM 3/4 INCH FROM GROUND

Radome . . . . INSPECT

Alcohol Discharge Port . . . . CHECK/CLEAR

Erosion Shoe/Grounding Strips . . . . CONDITION

B Right Nose

Right Avionic Cowling . . . . SECURE

◗ Right Pitot Probe . . . . CHECK/CLEAR

◗ Right Static Port . . . . CHECK/CLEAR

◗ Right Stall Warning Vane . . . . . CHECK FREEDOM OF/ MOVEMENT

Leave the vane in full down position to prevent an inadvertent stick shaker when the stall warning system is activated later.

Total Temperature Probe (**if installed**) . . . CHECK/CLEAR

Pitot/Static Drain Valves . . . . DRAIN

Open only if moisture in pitot static system is suspected.

◗ Right Shoulder Static Port . . . . CHECK/CLEAR

Copilot's Windshield . . . . CHECK/CLEAN

Defog Outlet . . . . CHECK/CLEAR

Wing Inspection Light (**if installed**) . . CHECK CONDITION

Oxygen Bottle Valve
(**Learjet 24D/E/F**) . . . . . .OFF ARROW POINTS INWARD

Oxygen Bottle Access Door . . . . CLOSE/SECURE

Green Oxygen Blowout Disc . . . . INTACT

Lower Antennae . . . . CHECK CONDITION

C Right Fuselage

Rotating Beacons . . . . CHECK CONDITION

Cabin Windows . . . . CLEAN/UNDAMAGED

Emergency Exit Window Seal . . . VISIBLE/UNDISTORTED/ SECURE

Window/Handle . . . . FLUSH WITH FUSELAGE

Upper Antennae . . . . CHECK CONDITION

Engine Inlet Area . . . . CLEAR/CONDITION

Compressor Blades/Guide Vanes . . . . UNDAMAGED

Dorsal Inlet . . . . CHECK/CLEAR

Right Landing Gear/Wheel Well . . . . INSPECT

Strut Inflation . . . . MINIMUM 3-1/4 INCHES

Outboard Gear Door . . . . . . CONNECTED TO STRUT/ SECURE

Inboard Door . . . . CLOSED/SECURE

Hydraulic Lines . . . . CONDITION/NO LEAKS

Landing Light . . . . UNDAMAGED/SECURE

NOTE: Installing the landing light lamp with the filament in vertical position prolongs the life of the light.

- Wheels/Tires . . . . CHECK CONDITION
- Brake Discs (parking brake set) . . . . . . MINIMUM WEAR

Disc to Brake Housing Clearance (maximum):

Learjet 24D/E/F

Standard Brakes . . . . . . LESS THAN 0.20 INCHES

Optional Brakes . . . . . . LESS THAN 0.33 INCHES

Learjet 25B/C/D/F

Brakes . . . . LESS THAN 0.33 INCHES

CAUTION: If clearance is greater than the above, ensure maintenance removes discs for inspection and overhaul.

Fwd Fuel System Drains (5) . . . . CLEAR/CONDITION

D Right Wing and Tip Tank

Original/Century III Wing . . . . INSPECT TOP/ LEADING EDGE

Original With Softflite 1 Wing . . . . INSPECT TOP/ LEADING EDGE

Boundary Layer Control Devices . . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

Century III With Softflite Wing . . . . INSPECT TOP/ LEADING EDGE

Stall Strip . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

Mark II Wing . . . . INSPECT TOP/LEADING EDGE

Triangular Stall Strip . . . . UNDAMAGED

XR Modification Wing . . INSPECT TOP/LEADING EDGE

Stall Strip . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

Fuel Vent Ram Air Scoop . . . . CHECK/CLEAR

Wing Strake . . . . SECURE

Anti-Ice Exhaust Scupper . . . . CHECK/CLEAR

Recognition Light . . . . CHECK CONDITION

Right Tip Tank Sump Drain . . . . DRAIN

CAUTION: Insert fuel tester probe in the slot of the tip tank sump drain, push up to drain, and release upward pressure to stop draining. Do not turn the valve or continuous draining can occur.

- Fuel Cap . . . . SECURE/LOCKING TAB TO REAR

Fuel Overboard Vent . . . . CHECK/CLEAR

Navigation/Strobe Lights . . . . CHECK CONDITION

Tip Tank Fin and Wicks . . . . CHECK CONDITION

Fuel Jettison Dump Tube (**if installed**) . . . CHECK/CLEAR

Aileron . . . . INSPECT

Balance Tab Linkage . . . . INSPECT

Aileron Drain Holes . . . . CHECK/CLEAR

Brush Seals . . . . CHECK

Original/Century III Wing
Vortex Generators . . . . CHECK CONDITION

> **CAUTION:** No more than three vortex generators on each wing (a total of six) may be missing.

Original Wing with Softflite 1; Century III Wing With Softflite; XR Modification
Boundary Layer Energizers . . . . CHECK CONDITION

> **CAUTION:** With any missing BLEs, the limiting Mach is reduced to 0.78.

Spoilers/Flaps . . . . CHECK CONDITION

> **NOTE**: After prolonged storage, flap droop and slight spoiler extension is normal.

E Right Nacelle

Engine Oil . . . . CHECK

Oil Access Door . . . . CLOSE/SECURE

> **NOTE**: Engine oil level indications are most accurate when checked immediately after engine shutdown. If pre-flight oil level checks low, motor engine for 30 seconds and recheck oil level. If there is no oil level indication, add enough oil to obtain an indication before motoring engine to recheck oil level.

Nacelle Latches . . . . . SECURE/FLUSH WITH NACELLE

After each third engine shutdown:

EPA Tank . . . . DRAIN

Thrust Reverser (**if installed**) . . . . INSPECT

Buckets . . . . STOWED/FLUSH WITH NACELLE

◗ Engine Exhaust/Turbine Blades . . . . INSPECT

F Rear Fuselage/Tailcone Interior

Oxygen Bottle Valve
(**Learjet 25B/C/D/F**) . . . . OFF ARROW POINTS INWARD

Dorsal Access Door . . . . SECURE

Green Oxygen Blowout Disc . . . . . CHECK CONDITION

Right ELT Antenna (**if installed**) . . . CHECK CONDITION

VOR Localizer Right and
Left Antennae . . . . CHECK CONDITION

Empennage

Vertical Stabilizer, Rudder, Horizontal
Stabilizer, and Elevator . . . . CONDITION/
DRAIN HOLES CLEAR

Static Wicks (8) . . . . CHECK CONDITION

Nav and Strobe Lights . . . . CHECK CONDITION

VLF H-Field Antenna (**if installed**) . . CHECK CONDITION

Drag Chute Lid (**if installed**) . . . . UNDAMAGED/
FLUSH WITH FUSELAGE

Tailcone Access Door . . . . OPEN

Tailcone Interior . . . . INSPECT

Batteries/Drains . . . . CHECK

Air Conditioning Belt . . . . CHECK

When aircraft and T/R hydraulic systems are zero:

Hydraulic Accumulator . . . . 750 PSI

T/R Accumulator (**if installed**) . . . . . 600 TO 650 PSI

Current Limiters/
Electrical Connections . . . . . . CHECK CONDITION

Hydraulic Reservoir
Quantity Gage . . . FLUID LINE JUST VISIBLE WITHIN 1/8" OF TOP/BALL AT TOP OF SIGHT GLASS

System pressure must be zero for accurate indication.

Drag Chute . . . . PROPER INSTALLATION

Riser Attaching Loop . . . . INSERTED IN HOOK

Riser Attachment Hook . . . . UNLOCKED

Riser . . . . PROPER ROUTING/STOWAGE

Fire Extinguisher Bottles Charge . . . . 600 PSI

Tailcone Access Door . . . . CLOSE/SECURE

Aft Fuel System Drains (4) . . . . CLEAR/CONDITION

NOTE: Fuel vent drain valve must be drained completely.

G Left Nacelle

Left VOR/LOC Antenna . . . . CHECK CONDITION

Left ELT Antenna (**if installed**) . . . . CHECK CONDITION

◗ Engine Exhaust/Turbine Blades . . . . INSPECT

Thrust Reverser (**if installed**) . . . . INSPECT

Buckets . . . . STOWED/FLUSH WITH NACELLE

Left Engine Oil . . . . CHECK

Oil Access Door . . . . CLOSE/SECURE

NOTE: Engine oil level indications are most accurate when checked immediately after engine shutdown. If preflight oil level checks low, motor engine for 30 seconds and recheck oil level. If there is no oil level indication, add enough oil to obtain an indication before motoring engine to recheck oil level.

After each third engine shutdown:

EPA Tank . . . . DRAIN

Nacelle Latches . . . . . SECURE/FLUSH WITH NACELLE

Fire Bottle Blow-Out Disk . . . . INTACT

H Left Wing and Tip Tank

Spoilers/Flaps . . . . CHECK CONDITION

NOTE: After prolonged storage, flap droop and slight spoiler extension is normal.

Original/Century III Wing
Vortex Generators . . . . CHECK CONDITION

CAUTION: No more than three vortex generators on each wing (a total of six) may be missing.

Original Wing With Softflite 1;
Century III Wing With Softflite;
XR Modification
Boundary Layer Energizers . . . . CHECK CONDITION

CAUTION: With any missing BLEs, the limiting Mach is reduced to 0.78.

Aileron . . . . INSPECT

- Aileron Drain Holes . . . . CHECK/CLEAR
- Brush Seals . . . . CHECK

Left Tip Tank . . . . CHECK CONDITION

Fuel Jettison Dump Tube (**if installed**) . . . . CLEAR

Tip Tank Fin and Wicks . . . . CHECK CONDITION

Fuel Overboard Vent . . . . CHECK/CLEAR

◗ Fuel Cap . . . . SECURE/LOCKING TAB TO REAR

Left Tip Tank Sump Drain . . . . DRAIN

CAUTION: Insert fuel tester probe in the slot of the tip tank sump drain, push up to drain, and release upward pressure to stop draining. Do not turn the valve or continuous draining can occur.

Navigation/Strobe Lights . . . . CHECK CONDITION

Anti-Ice Exhaust Scupper . . . . CHECK/CLEAR

Wing Strake . . . . SECURE

Fuel Vent Ram Air Scoop . . . . CHECK CLEAR

Original/Century III Wing . . . . INSPECT TOP/ LEADING EDGE

Original With Softflite 1 Wing . . . . INSPECT TOP/ LEADING EDGE

Boundary Layer Control Devices . . . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

Century III Wing With Softflite . . . . INSPECT TOP/ LEADING EDGE

Stall Strip . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

Mark II Wing . . . . INSPECT TOP/LEADING EDGE

Triangular Stall Strip . . . . UNDAMAGED

XR Modification Wing . . INSPECT TOP/LEADING EDGE

Stall Strip . . . . UNDAMAGED

Wing Fence . . . . SECURE/NOT BENT

I Left Fuselage

Left Landing Gear/Wheel Well . . . . INSPECT

Minimum Strut Inflation . . . . 3-1/4 INCHES

Outboard Gear Door CONNECTED TO STRUT/SECURE

Inboard Door . . . . CLOSED/SECURE

Hydraulic Lines . . . . SECURE/NO LEAKS

Landing Light . . . . UNDAMAGED/SECURE

> **NOTE**: Installing the landing light lamp with the filament in vertical position prolongs the life of the light.

◗ Wheels/Tires . . . . INSPECT

◗ Brake Discs
(parking brake set) . . . . TIGHT/MINIMUM WEAR

Disk to Brake Housing Clearance (**maximum**):

Learjet 24D/E/F

Standard Brakes . . . . LESS THAN 0.20 INCHES

Optional Brakes . . . . LESS THAN 0.33 INCHES

Learjet 25B/C/D/F

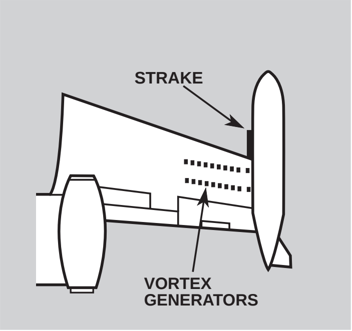
Brakes . . . . LESS THAN 0.33 INCHES

> **CAUTION:** If clearance is greater than the above, ensure maintenance removes discs for inspection and overhaul.

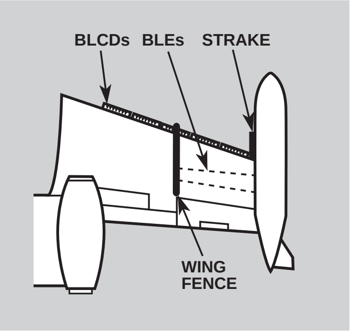
◗ Engine Inlet Area . . . . CLEAR/CONDITION

Compressor Blades/Guide Vanes . . . . UNDAMAGED

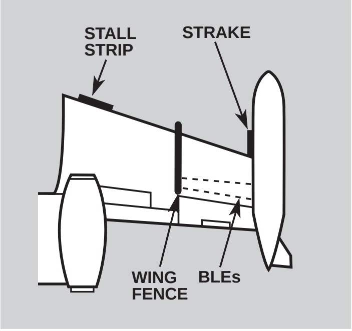
Cabin Windows . . . . CLEAN/UNDAMAGED



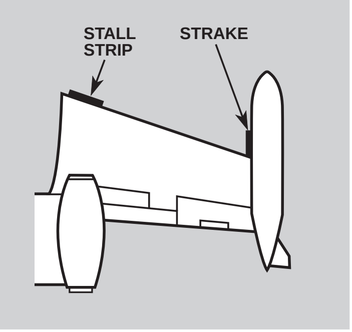
Original/Century III Wing



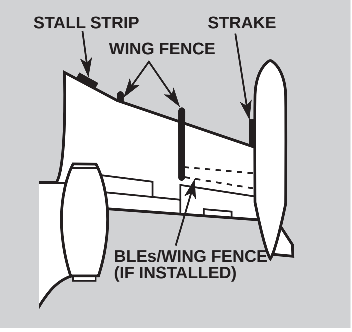
Original Wing with Softflite 1



Century III Wing with Softflite 1



Mark II Wing



XR Wing

Power On Inspection

Battery Switches . . . . ON

NOTE: If batteries are low, use GPU power.

Pitot Heat Switches . . . . ON/OFF

CAUTION: Use caution when touching pitot/static ports, pitot tubes, and stall warning vanes to check heat.

Exterior Light Switches . . ON/CHECK ILLUMINATION/OFF

Battery Switches . . . . OFF

Stall Warning System Test . . . . PERFORM

NOTE: Power must be on before beginning Stall Warning System Test. For aircraft prior to Century III/ RAS Wing Mod., go to AFM for expanded instructions on the Stall Warning System Test.

Cabin Inspection

FAA Approved Flight Manual . . . ON BOARD/AVAILABLE

Documents . . . . DISPLAYED

- airworthiness certificate
- registration certificate
- radio station license

➧ Baggage . . . . SECURED

➧ Emergency Exit . . . . CLEAR/UNOBSTRUCTED

➧ Passenger Briefing . . . . COMPLETE

According to Part 91.519 requirements, the pilot-in-command or a crewmember briefs the passengers on smoking, use of safety belts, location and operation of the passenger entry door and emergency exits, location and use of survival equipment, and normal and emergency use of oxygen equipment.

For flights over water, the briefing should include ditching procedures and use of flotation equipment. An exception to the oral briefing rule is if the pilot-in-command determines the passengers are familiar with the briefing content. A printed card with the above information should be available to each passenger to supplement the oral briefing.

Auxiliary Heater (**if installed**):

Power Source . . . . . . ENGINE-DRIVEN GENERATOR OR APU

Damper Control . . . . CLOSE POSITION

NOTE: The auxiliary heater does not operate with the damper control in open position. The cooling system fan activates automatically when the auxiliary heater is operating.

Expanded Normals

Table of Contents

Pressurization			
Aircraft	**S/N**	**System**	**Switches**
25D/F	206 through 226	450	
25D/F	227 through 256	510	BLEED AIR switches on temperature control panel
25D/F	257 and subsequent	510	BLEED AIR switches on pressure panel
25B/C	061, 070 through 205	450	
24E/F	329 through 349	450	
24E/F	350 and subsequent	510	BLEED AIR switches on temperature control panel
24D	230 through 328	450	

Table 2B-A; Pressurization System Differences

Anti-Skid				
Aircraft	**S/Ns**	**System**	**Lights**	**Test**
25D/F	206 and subsequent	modulating system	4 red lights	self-test
25B/C	*061, 070 through 196, 198 through 204 without approach speed system AMK 75-4 and 197, 205	modulating system	4 red lights	self-test
25B/C	061, 070 through 196, 198 through 204 without approach speed system AMK 75-4	modulating system	4 red lights	3-position test switch
25B/C	197 and 205	modulating system	4 red lights	self-test
24E/F	329 and subsequent	non-modulating system	4 green lights 1 white test light	2-position test switch
24D	230 through 257, 259, 261 through 263, 328	non-modulating system	4 green lights 1 white test light	2-position switch
* Learjet 25B/C 061, 070 through 193 not modified by AAK 75-1 must have the ANTI-SKID switch OFF except for during testing and before takeoff; those modified with AAK 75-1 may leave the ANTI-SKID switch ON.				

Table 2B-B; Anti-Skid Systems Differences

Yaw Damper				
Aircraft	**S/N**	**System**	**Disengage Tone**	
25D/F	206 through 326, 338 through 341 with AMK 81-7A	dual yaw dampers	yes	wheel master disengage
25D/F	337, 342 and subsequent	dual yaw dampers	yes	wheel master disengage
25B/C	with AMK 81-9A	dual yaw dampers	yes	wheel master disengage
24E/F	with AMK 81-13	single yaw damper	yes	wheel master disengage
24D	with AMK 81-18	single yaw damper	yes	wheel master disengage
AAK 83-4 disconnects the yaw damper at touchdown and adds force sensors.				

Table 2B-C; Yaw Damper Differences

Trim				
Aircraft	**S/N**	**System**	**Lights**	**Audio Clicker**
25D/F	337, 342 and subsequent and 206 through 341 except 337 with **AMK 81-7A**	two-speed with overspeed test switch	PITCH TRIM OVSP and TAKEOFF TRIM	yes
25B/C	061 through 205 with **AMK 81-9A**	two-speed with overspeed test switch	PITCH TRIM OVSP and TAKEOFF TRIM	yes
24E/F	329 and subsequent with **AMK 81-13**	two-speed with overspeed test switch	PITCH TRIM OVSP and TAKEOFF TRIM	yes
24D	230 and subsequent with **AMK 81-18**	two-speed with overspeed test switch	PITCH TRIM OVSP and TAKEOFF TRIM	yes
With flaps above 3° bias, the two-speed system operates at less than one-half normal speed and sounds clicker; with flaps greater than 3°, the normal pitch trim speed and emergency pitch trim speed are unchanged. The wheel master switch (MSW), when depressed and held, disconnects all pitch inputs (AFC/SS, pusher/nudger, puller) and all pitch trim.				

Table 2B-D; Trim Systems AMK Modifications

Checklist Usage

Tasks are executed in one of two ways:

- as a sequence that uses the layout of the cockpit controls and indicators as cues (i.e., “flow pattern”)
- as a sequence of tasks organized by event rather than panel location (e.g., After Takeoff, Gear – RETRACT, Yaw Damper – ENGAGE).

Placing items in a flow pattern or series provides organization and serves as a memory aid.

A challenge-response review of the checklist follows execution of the tasks; the PNF calls the item, and the appropriate pilot responds by verifying its condition (e.g., Engine Anti-Ice (challenge) – ON (response)).

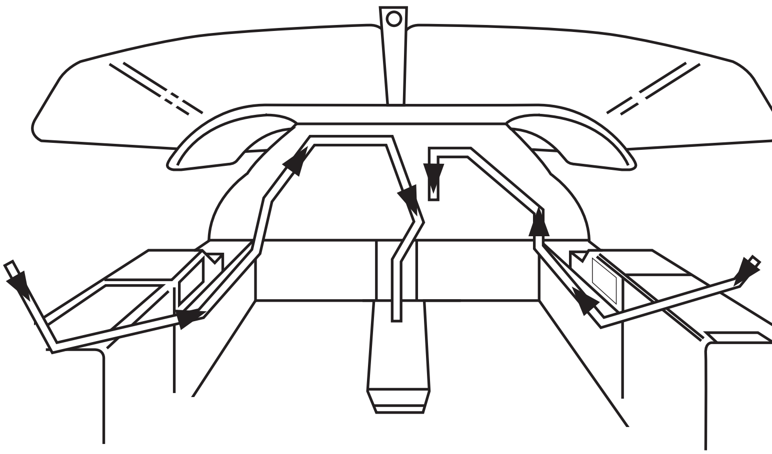
Two elements are inherent in execution of normal procedures:

- use of either the cockpit layout or event cues to prompt correct switch and/or control positions
- use of normal checklists as “done” lists.

The following checklists are considered first flight of day checklists. The following symbol may also appear next to individual items:

➧ through flight only.

Cockpit Flow Pattern



Normal Procedures

The following Expanded Normal Chapter is based upon a Learjet 25D/F aircraft. These procedures may not agree totally with AFMs for other 20 series models. Important differences on the basic AFM are covered; however, minor differences such as Air Bleed or Bleed Air switches and Air Bleed OFF/NORMAL/MAX or Cabin Air are stated only as Bleed Air and Cabin Air switches. Our goal is to present these procedures in a logical sequence that, with minor changes, fits the **24D/E/F and 25B/C/D/F Learjet models**.

Before Starting Engines (Power Off)

> **NOTE:** For aircraft with combination of Mark II Wing, XR modification, pre-select flaps, and Teledyne AOA system, refer to individual AFM for aircraft specific expanded normals.

- **Safety Belts/Shoulder Harness . . . . SECURED**

  Adjust the seat belt for a snug fit. Ensure the shoulder harnesses are latched to the buckle.

- **Seat . . . . ADJUSTED**

  Ensure the seat is adjusted so that full travel can be obtained on all controls, and that maximum height affords HSI scan.

- **Control Lock . . . . REMOVED**

  Remove and stow.

- **Flight Controls . . . . CHECKED**

  Ensure that shoes do not hinder movement of pedals during full rudder pedal movements.

Oxygen Masks/Valves/Pressure . . . . CHECKED

Crew Masks . . . . FLOW CHECKED/100% SELECTED

PASS MASK Valve . . . . AUTO

PASS OXY Valve . . . . NORM

➧ OXYGEN PRESSURE Gage . . . . CHECKED

➧ **Emergency Air Pressure . . . . CHECKED**

➧ **Circuit Breakers . . . . IN**

The left and right circuit breaker panels should be checked visually and not by rubbing the hand across the row of breakers. Always use a flashlight at night.

Alternate Instrument Static Valve . . . . CLOSED

➧ **Panel Switches/Avionics . . . . OFF/SET AS INDICATED BELOW**

ANTI-SKID Switch . . . . ON

(**25B/C 061, 070 to 193 without AAK 75-1**, ANTI-SKID switch must be OFF)

NOTE: AAK-75-1; Anti-Skid Transducer Drive Assembly Improvement (**25-003 to 193**).

P TRIM Selector Switch . . . . NORM

JET PUMP Switches . . . . ON

Bleed Air Switches (**510 System**) . . . . ON/NORM

For Takeoff Below 8,500 ft Field Elevation:

EMER PRESS Switch
(**if installed**) . . . . .NORM (GUARDS DOWN)

NOTE: If EMER PRESS switch installed, refer to AFM for takeoff at field elevations above 8,500 ft pressure altitude.

Shutoff Valve (SOV) Lights . . . . EXTINGUISHED

Gear Handle . . . . DOWN

Check that the landing gear handle is down.

Temperature Controls . . . . SET

510 Pressurization

For automatic mode operation:

AUTO/MAN Switch . . . . AUTO

COLD/HOT Knob . . . ROTATE TO DESIRED TEMP

After takeoff, the cabin temperature control system automatically maintains cabin at desired setting.

For manual mode operation:

AUTO/MAN Switch . . . . MAN

COLD/HOT Knob . . ROTATE TO DESIRED SETTING

450 Pressurization

For automatic mode operation:

MAN/AUTO/HOT Knob . . . . ROTATE TO AUTO

Set desired cabin temperature. After takeoff, cabin temperature control system automatically maintains cabin at desired setting.

For manual mode operation:

MAN/AUTO/HOT Knob . . . . ROTATE TO MAN

MAN/HOT/COLD Switch . . HOLD IN HOT OR COLD

Hold in needed position until desired setting achieved.

Pressurization Controls . . . . SET

510 Pressurization

AUTO MAN Switch . . . . AUTO

CAB AIR Switch . . . . OFF

➧ CABIN CONTROLLER . . . . SET CRUISE ALT

Cabin RATE Selector . . . . POSITION AS DESIRED

450 Pressurization System

Air Bleed Switch . . . . OFF

AUTO MAN Switch . . . . AUTO

➧ CABIN ALT Controller Knob . . ROTATE TO CRUISE ALTITUDE

Cabin RATE Selector . . . . POSITION AS DESIRED

IN NORMAL/OUT DEFOG Knob . . . . PUSH IN

Thrust Levers . . . . CUT OFF

Drag Chute Handle (if installed) . . . . STOWED

➧ **TOLD Card/Bugs . . . . CHECKED/SET**

EPR, V_1, V_R, V_2, V_{FS} takeoff distance computed and initial altitude in ALT SET.

Before Starting Engines (Power On – Batteries or GPU)

Batteries . . . . CHECKED/ON

Setting battery switches to ON energizes windshield ice detect lights and static port heaters.

L BAT Switch . . . . ON

Check for minimum voltage.

L BAT Switch . . . . OFF

R BAT Switch . . . . ON

Check for minimum voltage.

L BAT Switch . . . . ON

◗ For Through Flight, Battery Switches . . . . ON

NOTE: With **lead acid batteries**, do not attempt a battery start with less than 24V DC on each battery at 70°F (21°C) or below, or less than 25V DC on each battery at 110°F (43°C) or above. Interpolate for temperatures between 70°F (21°C) and 110°F (43°C).

With **nickel-cadmium batteries**, do not attempt a battery start with less than 23V DC on each battery.

Emergency Power . . . . CHECKED/ON

Single Emergency Battery

EMERGENCY Power Switch . . . . STBY

Check attitude gyro for starting and erection. On some aircraft, the emergency battery only has two positions: ON/OFF.

Battery Switches . . . . OFF

Check attitude gyro for operation; amber EMER PWR light illuminates.

Dual Emergency Batteries

EMERGENCY/STBY/ON Power Switch . . . . . STBY

Check attitude gyro for starting and erection.

EMERGENCY/ON/OFF Power Switch . . . . ON

Battery Switches . . . . OFF

Check attitude gyro and equipment powered by second emergency battery for operation; both amber EMER PWR lights illuminate.

EMERGENCY/STBY/ON Power Switch . . . . . . ON

Check attitude gyro operation; both amber EMER PWR lights illuminate. Check that three green gear locked down lights are illuminated. These lights indicate gear, flap, and spoiler relays are operational.

Battery Switches . . . . ON

Check that both EMER PWR lights extinguish. Leave both emergency power switches on.

◗ For Through Flights, Emergency Power Switches . . . ON

Check attitude gyro for starting and erection.

Ground Power Unit (if desired to conserve batteries)

Battery Switches . . . . OFF

GPU . . . . CONNECT

Ensure unit is regulated to 28V DC and limited to 1,000A maximum.

Battery Switches . . . . ON

Inverters . . . . CHECKED/ON

Two Inverters

SEC Inverter Switch . . . . ON

Ensure the red SEC INV light is extinguished.

AC Bus Switch . . . . SEC/THEN PRI

Check AC voltmeter is within green arc when switch in both positions.

PRI Inverter Switch . . . . ON

Ensure the red PRI INV light is extinguished.

SEC Inverter Switch . . . . OFF

The red SEC INV light illuminates.

AC Bus Switch . . . . PRI/THEN SEC

Check AC voltmeter is within green arc when switch in both positions.

◗ For Through Flight, PRI Inverter Switch . . . . ON

Three Inverters (if installed)

AUX Inverter Switch . . . . ON

Check that the amber AUX INV light is extinguished.

AUX Inverter Bus Switch . . . . L/THEN R BUS

Check AC voltmeter is within green arc when switch in both positions.

SEC Inverter Switch . . . . ON

AUX Inverter Switch . . . . OFF

AC Bus Switch . . . . SEC/THEN PRI

Check AC voltmeter is within green arc when switch in both positions.

PRI Inverter Switch . . . . ON

Ensure the red PRI INV light is extinguished.

SEC Inverter Switch . . . . OFF

The red SEC INV light illuminates.

AC Bus Switch . . . . PRI/THEN SEC

Check AC voltmeter is within green arc when switch in both positions.

Ice Detect Lights . . . . CHECKED

Check by placing a light colored object between ice detect light and windshield.

Annunciators . . . . CHECKED

Readout Panel Test Switch . . . . DEPRESS

With the switch under the glareshield, check all warning lights illuminate except gear unsafe, thrust reverser, autopilot, and EMER PWR. Cover both photoelectric cells inboard of each FIRE indicator; they should go full dim. Uncover each alternately and check for dim/bright difference. At night, shine a flashlight on the photoelectric cells to check that the annunciators go to bright.

◗ **Hydraulic Pressure . . . . CHECKED**

If pressure is below 1,000 PSI:

With Auxiliary Hydraulic Pump

HYD PUMP Switch . . . . ON

Operate pump until sufficient pressure obtained.

HYD PUMP Switch . . . . OFF

Without Auxiliary Hydraulic Pump

START-GEN Switch . . . . START

Motor engine until sufficient pressure obtained; this may require 11% to 12% RPM.

◗ **Parking Brake . . . . SET**

Landing Gear Lights/Horn . . . . TESTED

Ensure three green lights illuminated.

TEST-MUTE Switch . . . . TEST/HOLD

Check that the horn and three red UNSAFE lights illuminate.

TEST-MUTE Switch . . . . RELEASE

Warning Systems . . . . TESTED

➧ No Smoking/Seat Belt Sign . . . . ON

FIRE DET Test Switch . . . . TEST

Both FIRE warning lights flash to indicate system continuity.

CAB ALT/MACH TEST Switch . . . . PUSH FWD/HOLD

Check that the cabin altitude warning horn sounds.

Horn Silence Switch . . . . . MOMENTARILY ENGAGE

Cabin altitude warning ceases for one minute.

CAB ALT/MACH TEST Switch . . . . RELEASE

L/R STALL WARNING Switches . . . . ON

Ensure STALL WARNING annunciators extinguished.

STICK PULLER/Horn . . . . TEST

Pitch Trim . . . . SET WITHIN T.O. SEGMENT ON NOSE TRIM INDICATOR

CAB ALT/MACH TEST Switch . . . . . PULL AFT/HOLD

Control column moves aft with approximately 18 lbs force; aural overspeed warning sounds.

Control Wheel Master Switch (MSW) . . . . . DEPRESS

Stick puller disengages; aural overspeed warning continues to sound.

CAB ALT/MACH TEST Switch/MSW . . . . . RELEASE

Stall Warning System . . . . CHECKED

During heavy wind conditions, it may be necessary to head aircraft into the wind to prevent wind from blowing the stall warning vanes up.

Century III Wings with AAK 76-4 (Reduced Approach Speed Kit), AAK 79-10, or AMK 83-5

Flaps . . . . UP

Stall Warning Test Switch . . . . . . HOLD TO L STALL POSITION UNTIL NEEDLE STOPS MOVING

The pilot AOA needle sweeps from green to red segment. At the green/yellow margin, the shaker and nudger actuate; the red L STALL annunciator flashes. High-frequency vibration of the control column announces shaker actuation; low frequency forward movement of the control column if not opposed announces nudger actuation.

As the needle passes from the yellow segment to red segment, pusher activates briefly and then stops; the red L STALL annunciator illuminates steadily at, or just prior to, pusher actuation.

After the pusher stops, the AOA needle sweeps back and remains in the yellow with the shaker and nudger still operating, or it returns to the green segment.

> **NOTE: Learjet 24D and 25B/C with Mark II wings/no Teledyne AOA System and 24D and 25B/C original wing/with or without Softflite 1** conduct a stall warning system check during the Power On check as part of the preflight inspection (see Preflight chapter).

> **WARNING:** The action of the nudger verifies operation of the pitch torquer prior to pusher actuation. During ground test, if shaker is not accompanied by the nudger, DO NOT DISPATCH. During flight, if the shaker is not accompanied by the nudger, DO NOT DECELERATE FURTHER.

Stall Warning Test Switch . . . . RELEASE

Stall Warning Test Switch . . . . . . HOLD TO R STALL POSITION UNTIL NEEDLE STOPS MOVING

Test operation is identical to L STALL position except copilot AOA and red R STALL annunciator are involved.

Stall Warning Test Switch . . . . RELEASE

With STALL WARNING switches on, steady illumination of the L or R STALL warning light indicates a malfunction except during pusher actuation or system test.

Either MSW . . . . DEPRESS

Stall Warning Test Switch . . . . . . HOLD TO R STALL

Verify AOA needle moves through the band; check that pusher and nudger do not actuate.

Stall Bias . . . . TEST

With flaps down, watch pilot AOA needle for three shifts. With flaps up, watch copilot AOA needle for three shifts.

STALL WARNING Switches . . . . OFF

Emergency Pitch/Normal Trims . . . . CHECKED

> **NOTE:** Throughout the following check, verify that the trim-in-motion audio clicker sounds approximately one second after initiating pitch trim with flaps up. The trim-in-motion audio clicker does not sound when the flaps are lowered beyond 3°. The trim-in-motion audio clicker indicates movement of the horizontal stabilizer. The clicker may also sound during autopilot pitch trim.

The following procedure is the complete three-axis trim systems operational check that must be accomplished once every 10 hours of flight operations.

✦ indicates items that should be accomplished daily.

✦ Flaps . . . . UP

✦ P TRIM Selector Switch . . . . EMER

✦ Emergency Pitch Trim Switch (pedestal) . . CHECK

NOSE UP and NOSE DOWN Switch . . OPERATE

Trim should occur in both directions. Check that depressing either control wheel master switch (MSW) while trimming NOSE UP or NOSE DOWN stops trim motion. With arming button (CTR) depressed, operate pilot control wheel trim switch in nose up/nose down positions. No trim motion should occur. Repeat same steps using copilot's 4-way switch.

P TRIM Selector Switch . . . . OFF

Emergency Pitch Trim Switch (pedestal) . . . CHECK

No motion should occur.

NOSE UP and NOSE DOWN Switch . . OPERATE

Operate pilot control wheel trim switch nose up/nose down positions. Trim motion should not occur. Repeat using copilot switch in nose up/nose down positions with CTR depressed.

➧ ✦ P TRIM Selector Switch . . . . NORMAL

Emergency Pitch Trim Switch (pedestal) . . . CHECK

NOSE UP and NOSE DOWN Switch . . OPERATE

No trim motion should occur.

➧ ✦ Pilot Control Wheel Trim Switch . . . . CHECK

Without CTR, ensure trim motion does not occur while trimming. Depress CTR without displacing 4-way switch; ensure trim does not occur. Next, depress CTR and move 4-way switch NOSE UP and NOSE DOWN. Ensure trim motion occurs in selected direction. Finally, ensure trim motion stops when MWS depressed while trimming.

➧ ✦ Copilot Control Wheel Trim Switch . . .CHECK

Check same items as pilot control wheel above, and then check override functions.

➧ Override . . . . CHECK

With copilot trim and arming button, trim in NOSE UP or DOWN. Verify that the pilot can override copilot's inputs (i.e., reverse direction of copilot).

✦ Trim Speed . . . . CHECK

Trim . . . . INITIATE

PITCH TRIM OVSP TEST Switch . . . . HOLD ON

Flaps . . . . LOWER

As flaps pass 3°, check that (1) trim indicator rate increases; (2) clicker ceases; (3) PITCH TRIM OVSPD light illuminates.

PITCH TRIM OVSP TEST Switch . . . . RELEASE

Either 4-Way Trim Switch . . . TOWARD NOSE DOWN AND NOSE UP LIMIT CHECK

Ensure illumination of amber TAKEOFF TRIM annunciator at both NOSE DOWN and NOSE UP limits.

◗ ✦ Pitch Trim . . . . SET FOR TAKEOFF

✦ Roll Trim . . . . TEST

Pilot 4-way
(**without Arming Button**) . . . . . . NO MOVEMENT

Arming Button Only . . . . NO MOVEMENT

4-way
(**with Arming Button**) . . . MOVE LWD OR RWD

Repeat above steps with copilot 4-way.

Override Check: copilot 4-way trim, one direction; pilot 4-way, opposite direction.

◗ ✦ Roll Trim . . . . . SET FOR TAKEOFF (LEVEL)

Yaw Trim Switch (split rocker) . . . . CHECK

Each of Four Corners . . . DEPRESS SEPARATELY

Ensure no trim occurs.

✦ Both Corners on One Side . . . . DEPRESS

Ensure trim motion occurs to that side. Check other side in same manner.

- ◗ ✦ Yaw Trim . . . . . SET FOR TAKEOFF (CENTERED)

  Accomplish final clean up check of three axes set, pitch trim normal.

- ◗ Flaps . . . . SET FOR TAKEOFF

Fuel Panel . . . . SET/CHECKED

- ◗ Fuel Quantities . . . . CHECK
- ◗ Fuel Counter . . . . ZERO

  L STANDBY PUMP . . . . ON

  Ensure L FUEL PRESS light is extinguished.

  L STANDBY PUMP . . . . OFF

  R STANDBY PUMP . . . . ON

  Ensure R FUEL PRESS light is extinguished.

  R STANDBY PUMP . . . . OFF

- ◗ CROSSFLOW Switch . . . . CLOSE
- ◗ FUS TANK XFER-FILL Switch . . . . OFF
- ◗ FUS VALVE Switch (**if installed**) . . . . CLOSE
- ◗ FUEL JTSN Switch (**if installed**) . . . . OFF

Autopilot . . . . CHECKED

> **NOTE:** If a GPU is not being used, the autopilot and yaw damper checks may be accomplished with the Before Taxi checklist to conserve battery power for engine starting.
>
> The autopilot will not engage if Turn Command knob is not in detent of either vertical or directional gyro OFF flag is in view. Allow 90 (±20) seconds after inverters are turned on for gyro spool-up.
>
> The autopilot procedure accomplishes minimum check. For complete check, refer to AFM Supplement.

Gyro/Hdg Flags . . . . PULLED

Turn Knob/Pitch Wheel . . . . . . DETENT/CENTERED

AFC/SS Test Switch . . . . HOLD ON

Overspeed warning sounds.

AFC/SS Engage Button . . . . DEPRESS

Overspeed warning silences.

A/P TEST-ROLL MON Button . . . . . DEPRESS/HOLD

Autopilot disengages within eight seconds; disengage tone sounds.

A/P TEST-ROLL MON Button . . . . RELEASE

AFC/SS Engage Button . . . . DEPRESS

A/P TEST TRIM MON Switch . . . . PUSH FWD

Autopilot disengages within five seconds; disengage tone sounds.

AFC/SS Engage Button . . . . DEPRESS

A/P TEST TRIM MON Switch . . . . PULL AFT

Autopilot disengages within five seconds; disengage tone sounds.

AFC/SS Engage Button . . . . DEPRESS

Turn Knob . . . . TWIST

Yoke follow deflection right and left.

Pitch Trim Wheel . . . . PUSH/THEN PULL

Control column moves forward, then aft.

AFC/SS Disengagements . . . . CHECKED

Check that each of the following disengages with disengage tone sounding. After each disengagement, reengage.

- Pilot or Copilot 4-way Trim
- Pilot or Copilot MSW
- EMERGENCY Pitch Trim Switch

Yaw Dampers . . . . CHECKED

Yaw Damper Selector Switch . . . SEC YAW DAMPER

SEC YAW DAMPER Switch . . . . ENGAGE

Alternately depress left and right rudder pedals. Verify resistance to movement in each direction.

Pilot or Copilot MSW . . . . DEPRESS

The secondary yaw damper disengages; the yaw damper disengage tone sounds.

Yaw Damper Selector Switch . . . . PRI YAW DAMPER

PRI YAW DAMPER Button . . . . DEPRESS

Alternately depress left and right rudder pedals. Verify resistance to movement in each direction.

Pilot or Copilot MSW . . . . DEPRESS

The primary yaw damper disengages; on modified aircraft, the yaw damper disengage tone sounds.

YAW DAMPER ON Button . . . . DEPRESS

YAW DAMPER OFF Button . . . . DEPRESS

Primary yaw damper disengages and disengage tone sounds.

Flight Instruments . . . . CHECKED

- Airspeed Indicator – check for zero indication.
- Attitude Indicator – check that indicator is erect and no flags are in view. Select go-around mode.
- Altimeter – check that setting agrees with airport elevation and no flags in view. Select Normal Mode.
- Vertical Speed Indicator (VSI) – check for zero indication and that there is no flag (**if applicable**).
- Horizontal Situation Indicator (HSI) – check heading and that there are no flags in view.
- Radio Magnetic Indicator (RMI) – check there are no flags in view. Compare the headings of the two indicators. Compare RMI and HSI on copilot side. Finally compare all four headings with the standby compass. Set the ADF/VOR as required.
- Standby Gyro – check that the indicator is uncaged and erect and no flags are in view.
- Clock – set and check operation.

When flight instrument check is complete, pilot should call, “(heading in degrees), 1, 2, and 3, no flags, emergency gyro on and uncaged, altimeter is “____.” Copilot repeats headings and then calls, “4 and 5 agree and altimeter set.”

Starting Engines

The Starting Engines checklist should be completed prior to engine start. Both engines are normally started prior to taxi during training.

A GPU is recommended for start when ambient temperature is 32°F (0°C) or below. Ensure GPU power supply is regulated to 28V DC, it has adequate capacity for engine starting, and it is limited to 1000 amps maximum.

While starting the engines, the pilot checks engine indications such as oil pressure, EGT, and RPM. All appropriate items should be accomplished. If a GPU is used, position the generator switch in OFF after the engines stabilize at idle. The generator switch is placed in the ON position for a battery start.

After starting both engines, complete an evaluation of their operation. If satisfactory, disconnect the GPU and turn generators on. Check amperage and current limiters.

CAUTION: With **nickel-cadmium batteries** do not dispatch if red BAT 140 or BAT 160 annunciator illuminates any time prior to takeoff. Both batteries should be checked per Gates Learjet Maintenance Manual.

Passengers/Baggage . . . . BRIEFED/SECURED

According to Part 91.519 requirements, the pilot-in-command or a crewmember briefs the passengers on smoking, use of safety belts; location and operation of the passenger entry door and emergency exits, location and use of survival equipment, and normal and emergency use of oxygen equipment. For flights over water, the briefing should include ditching procedures and use of flotation equipment. An exception to the oral briefing rule is if the pilot-in-command determines the passengers are familiar with the briefing content. A printed card with the above information should be available to each passenger to supplement the oral briefing.

Cabin Door . . . . TWO HANDLES FORWARD/LIGHT OUT

Air Conditioner/Aux Heat . . . . OFF/FAN

Electrical Panel . . . . SET

If battery start, check for minimum voltage of 24V for lead-acid batteries or 23V for Nicad batteries.

Batteries . . . . CHECK FOR MINIMUM VOLTAGE

Primary Inverter Switches . . . . CHECK ON

Thrust Levers . . . . CUTOFF

Beacon . . . . ON

PRI Inverter Switch . . . . ON

Ensure the red PRI INV light is extinguished.

Engine . . . . START

- **GPU Start**

  START-GEN Switch . . . . START

  Ensure LOW FUEL PRESS light is extinguished.

Thrust Lever . . . . IDLE AT 10% RPM

AIR IGN light illuminates. Monitor:

- fuel flow
- EGT (within limits)
- oil pressure

START-GEN Switch . . . . OFF

AIR IGN light extinguishes.

- **Battery Start**

START-GEN Switch . . . . START

Ensure FUEL PRESS annunciator is extinguished.

Thrust Lever . . . . IDLE AT 10% RPM

AIR IGN light illuminates. Monitor:

- fuel flow
- EGT (within limits)
- oil pressure

START-GEN Switch . . . . GEN

AIR IGN and GEN lights extinguish. Check DC VOLTS and AMPS for generator output.

AUX HYD PUMP Switch . . . . OFF

Check hydraulic pressure. Ensure LOW HYD light is extinguished.

Second Engine . . . . START

Repeat previous steps for second engine.

GPU (if applicable) . . . . DISCONNECT

START-GEN Switches . . . . GEN

If a GPU start, position switches to GEN and check that GEN annunciators extinguished. Check 28V and even load on ammeters.

Before Taxi (Two Engines)

Inverters . . . . ALL/ON

Check SEC and AUX INV (**if installed**) annunciators are extinguished.

> **NOTE:** On aircraft with auxiliary inverter, it is recommended that all three inverters be on during normal operations for maximum life.

Engine Instruments . . . . NORMAL

- Check that red FUEL PRESS annunciator(s) is extinguished; this indicates jet pumps are operating
- Check that red low oil pressure annunciator(s) is extinguished
- Check hydraulic pressure gage is indicating proper pressure
- Check engine instruments for normal indications.

Current Limiters . . . . CHECKED

MAIN BUS TIE Circuit Breaker . . . . PULL

Learjet 25D/F 368 and subsequent and prior with AMK 85-1; 24E/F with AMK 85-1

ESS BUS TIE Circuit Breaker . . . . PULL

Either START-GEN Switch . . . . OFF

Check that ammeter reading on opposite generator increases; it should approximately double.

START-GEN Switch . . . . GEN

GEN annunciator extinguishes and both generators share load.

Opposite START-GEN Switch . . . . OFF

Check that ammeter reading on opposite generator increases; it should approximately double.

START-GEN Switch . . . . GEN

GEN annunciator extinguishes and both generators share load.

MAIN BUS TIE Circuit Breaker . . . . RESET

Learjet 25D/F 368 and subsequent and prior with AMK 85-1; 24E/F with AMK 85-1

ESS BUS TIE Circuit Breaker . . . . RESET

CAUTION: Failure to successfully complete the current limiter check indicates a malfunction. Replace 275 amp current limiter(s) prior to takeoff.

NOTE: If a failure of a current limiter occurs at this point, the illumination of the GEN annunciator will be accompanied by illumination of an INV annunciator and the sound of emergency air flow.

Radar/Avionics . . . . STANDBY/SET

Place radar in standby mode; set avionics as desired. Tilt antenna up to 10°.

External Lights . . . . ON/OFF

Ensure lights as required are on. Do not use strobe lights when taxiing in vicinity of other aircraft. Position lights should be turned on for all night operations.

Spoilers . . . . CHECKED/RETRACTED/LIGHT OUT

SPOILER Switch . . . . EXT

Check that spoilers extend fully and symmetrically in approximately one to two seconds; SPOILER annunciator illuminates.

SPOILER Switch . . . . RET

Check that spoilers retract fully and symmetrically in approximately six seconds; SPOILER annunciator extinguishes.

Emergency Lights (if installed) . . . . . . TESTED/ARMED

EMER LT Switch . . . . TEST

Check for illumination.

EMER LT Switch . . . . OFF

EMER LT Switch . . . . ARM

Door Light Switch . . . . NORM

STAB & WING HEAT Switch
(Cabin Air on or normal) . . . . . . CHECKED/ON OR OFF

STAB & WING HEAT Switch . . . . ON

Check for cabin fluctuation (cabin air must be on) in direction of switch movement. Check that the STAB HEAT light is illuminated and there is no additional DC ampere increase.

STAB & WING HEAT Switch . . . . AS REQUIRED
BELOW 70% RPM

Monitor WING TEMP indicator for overheat condition.

CAUTION: With aircraft sitting statically, do not perform extended engine operation above 70% RPM with cabin air on. There is no ram airflow through the heat exchanger and possible damage to air conditioning components may occur.

Nacelle Heat . . . . CHECKED/ON OR OFF

NAC HEAT Switches . . . . ON

Check left and right amps for indication rise of approximately 50 amps each. Check that the ENG ICE lights are illuminated.

Left Thrust Lever . . . . ADVANCE THEN IDLE

Check that the left ENG ICE ice light extinguished between 65% and 80% RPM.

L NAC HEAT Switch . . . . OFF

Ensure the left ENG ICE light remains extinguished.

Right Thrust Lever . . . . ADVANCE THEN IDLE

Check that right ENG ICE light extinguished between 65% and 80% RPM.

R NAC HEAT Switch . . . . OFF

Ensure the right ENG ICE light remains extinguished.

Windshield Heat . . . . CHECKED/PURGED

Purge on the first flight, or if exposed to moisture. This procedure clears the windshield heat system of moisture and precludes water from freezing on the windshield if the system is turned on at altitude.

IN NORMAL/OUT DEFOG Knob . . . . PULL OUT

WSHLD HEAT Switch . . . . AUTO

Check that green WSHLD HEAT light illuminates; note audible airflow. Check for water blowing out of external defog nozzles.

WSHLD HEAT Switch . . . . MAN

WSHLD HEAT ON/OFF Switch . . . . OFF

Hold in OFF until airflow stops.

IN NORMAL/OUT DEFOG Knob . . . . .PUSH IN

Cabin Air . . . . OFF/ON OR NORMAL IF DESIRED

Learjet 24D/E/F Anti-Skid . . . . CHECKED

Place the anti-skid test switch to TEST. Watch for white light to illuminate on anti-skid panel. The remaining portion of the check will occur during taxi. Ensure green light flash.

Parking Brake . . . . RELEASED

Anti-Skid . . . . ON/LIGHTS EXTINGUISHED

Anti-Skid . . . . CHECK/LIGHTS OUT

Learjet 25B/C, 25-197 and 205 with AMK 75-4 Reduced Airspeed Kit; Learjet 25D/F, 25-206 and subsequent

Learjet 25B/C, 25-061, 70 through 196, 198 through 204 without AMK 75-4 Reduced Airspeed Kit

Anti-Skid Switch (**not modified with AAK 75-1**) . . . OFF

Anti-Skid Switch (**modified with AAK 75-1**) . . . . ON

Learjet 25B/C, 25-061, 70 through 196, 198 through 204 without AAK 76-4 Reduced Airspeed Kit:

Anti-Skid Switch . . . . ON

Switch should be on for at least four seconds before testing.

TEST Switch . . . . HOLD TO OUTBD

Hold to OUTBD for a minimum of four seconds and a maximum of 20 seconds (holding switch longer than 20 seconds may result in damage to the test circuit). Outboard lights should illuminate. Release switch and ensure lights extinguish.

TEST Switch . . . . HOLD TO INBD

Hold to INBD for a minimum of four seconds and a maximum of 20 seconds. Inboard lights should illuminate. Release switch and ensure lights extinguish.

If one or more of the anti-skid lights remain illuminated after check is completed, set ANTI-SKID switch off and then back on. If the light or lights do not illuminate, wait a minimum of four seconds and re-check the system as outlined above.

After lift-off, one or more of the anti-skid lights may illuminate during gear retraction depending on brake condition and/or differential brake snubbing. The light or lights will then be illuminated when gear is lowered. Set the ANTI-SKID switch off and then back on to clear the system. Wait a minimum of four seconds and proceed with Anti-Skid check.

Anti-Skid Switch (**not modified with AAK 75-1**) . . . OFF

Anti-Skid Switch (**modified with AAK 75-1**) . . . . . . ON

NOTE: If a light remains illuminated after setting the ANTI-SKID switch on, assume the system is inoperative and refer to the appropriate section for anti-skid inoperative takeoff and landing distance in the AFM.

Taxi

Brakes/Steering . . . . CHECKED

Depress brakes gently at slow taxi speed. When taxiing through slush or snow, use the brakes to create some friction heat in the brake discs to prevent brakes from freezing. Both pilot and copilot brakes should be tested.

Wheel Master Switch . . . . DEPRESS

Begin taxiing with Wheel Master Switch depressed. Check that green STEER ON light is illuminated. Check steering in both directions.

On aircraft with PRI STEER, hold the PRI STEER button while exiting the parking area where tight turns are required. Low priority steering may be locked in by setting the STEER LOCK switch to ON or by holding the wheel master.

STEER LOCK Switch . . . . AS REQUIRED

Disengage steering by pushing the wheel master. Ensure the STEER ON light extinguishes.

Flight Controls . . . . FREE

Thrust Reversers . . . . CHECKED

The following functional checks are required prior to each flight and may be accomplished either before or after starting engines. If an auxiliary hydraulic pump is installed and operating, it is recommended that the checks be accomplished before engine start.

Head aircraft into the wind when conducting this check with engines running.

T/R Lights (8) . . . . TEST

All thrust reverser function lights illuminate. If any lights do not illuminate, pull the circuit breakers for both thrust reversers and safety pin the reversers prior to flight.

T/R Fault Switch . . . . TEST

All thrust reverser function lights remain extinguished.

T/R Levers . . . . REVERSE IDLE/DEPLOY

Check that engine RPM increases; all thrust reverser function lights should remain extinguished.

T/R Levers . . . . STOW

T/R Arming Switches . . . . ARM

Check that the thrust reverser ARM lights illuminates.

Thrust Levers . . . . ADVANCE ONE AT A TIME

Check that the thrust reverser ARM lights extinguish at approximately 65% RPM.

Thrust Levers . . . . IDLE

Check that the thrust reverser ARM lights illuminate.

T/R Levers . . . . REVERSE IDLE/DEPLOY

Ensure that the thrust reverser UNSAFE lights illuminate and then extinguish; the DEPLOY lights should illuminate.

T/R Arming Switches . . . . OFF

Check that the thrust reverser ARM lights extinguish.

NORMAL-EMER STOW Switches . . . . . . EMER STOW

Check that the DEPLOY lights extinguish and that the UNSAFE lights illuminate and then extinguish; the yellow emergency stow lights should blink.

T/R Levers . . . . STOW

NORMAL-EMER STOW Switches . . . . NORMAL

Check that the yellow emergency stow lights extinguish.

T/R Arming Switches . . . . ARM

Ensure that the thrust reverser ARM lights illuminate.

T/R Levers . . . . REVERSE IDLE/DEPLOY

Check that the UNSAFE lights illuminate and then extinguish; the DEPLOY lights should illuminate.

T/R Levers . . . . STOW

Ensure the DEPLOY lights extinguish; the UNSAFE lights should illuminate and then extinguish.

T/R Arming Switches . . . . OFF

Check that the thrust reverser ARM lights are extinguished.

Before Takeoff

Cabin . . . . SET

Passengers . . . . BRIEFED

Swivel Seats . . . . FORWARD/PLACARDED

Work Table/Toilet Door . . . . STOWED

Emergency Exit . . . . CHECKED

Ensure aisle clear and handle unobstructed.

NO SMOKING/FASTEN SEAT BELT Switch . . . . ON

Circuit Breakers . . . . IN L/IN R

Anti-Ice Systems . . . . OFF

WSHLD HEAT . . . . OFF

NAC HEAT Switches . . . . OFF

STAB & WING HEAT Switch . . . . OFF

Cabin Air . . . . NORM/ON

External Lights (Recognition/Strobe/Landing) . . . . . . ON

Nav Equipment/Transponder/Radar . . . . SET

Check all radios on and set for proper frequencies and courses required for departure. Check transponder altitude reporting is on; switch from standby to on. Ensure VLF engaged. Radar to ON/WX.

Flight Instruments . . . . CHECKED

Check instruments for normal indications.

Spoilers/Flaps/Trim . . . . RETRACTED/SET___/ 3 SET/NORMAL

- Ensure the red SPOILER light is extinguished.
- Set flaps for takeoff.

P TRIM Selector Switch . . . . NORM

Check Pitch Trim indicator needle is set for takeoff; check aileron trim indicator and that wings are level. Ensure the Rudder Trim indicator is centered. Check that the TAKE-OFF TRIM light is extinguished.

Fuel Balance . . . . CHECKED

Check total fuel weight in each wing, tip tank, and fuselage tank. If out of balance, balance fuel by transferring.

Coffee/Oven Switches . . . . AS REQUIRED

Crew Briefing . . . . COMPLETED

Steer Lock Switch . . . . OFF

Use Control Wheel Master switch (MSW) during takeoff to approximately 45 KIAS (airspeed alive).

NOTE: For takeoff, an initial rotation attitude of 8° to 10° at V_R is recommended.

Parking Brake . . . . OFF

Anti-Skid Switch (Learjet 25B/C without AAK 75-1) . . ON

AIR IGN Switch . . . . ON

Stall Warning Switches . . . . ON

Turn both Stall Warning switches on and check that the red L/R STALL WARN lights are extinguished.

Pitot Heat . . . . CHECKED/ON

Dual PITOT HT lights:

L PITOT HT Switch . . . . ON

L PITOT HT light extinguishes.

R PITOT HT Switch . . . . ON

R PITOT HT light extinguishes.

Check left and right amps for slight increase.

Single PITOT HT light:

L PITOT HEAT Switch . . . . ON

Ensure PITOT HT light remains illuminated. Check amps for slight increase.

L PITOT HEAT Switch . . . . OFF

R PITOT HEAT Switch . . . . ON

Ensure PITOT HT light remains illuminated. Check amps for slight increase.

L PITOT HEAT Switch . . . . ON

PITOT HT light should extinguish.

Thrust Reversers . . . . ARMED

Warning Lights . . . . OUT

Monitor during takeoff. All lights should be extinguished except green STEER ON and WSHD HT.

Recognition/Strobe/Landing Lights . . . . ON

Turn on if desired and/or necessary.

After Takeoff

After Takeoff procedures are not accomplished until the aircraft is safely airborne and the crew has had time to clear the area for traffic—usually at least 3,000 ft AGL. The first five steps are accomplished as flow on taking off. This checklist is usually call and response by PNF.

WARNING When fuel quantity gage indicates 600 pounds or less remaining in either wing tank, prolonged nose up attitude of 10° or more may cause fuel to be trapped in the aft area of the wing tank outboard of the wheel well. Fuel starvation and engine flameout may occur. Reducing pitch attitude and thrust to a minimum required prevents this situation.

Landing Gear . . . . UP

Retract gear at a positive rate of climb. Landing gear should be fully retracted prior to retracting flaps.

Yaw Damper . . . . ON

To engage primary yaw damper:

Yaw Damper Selector Switch . . . . . PRI YAW DAMPER

YAW DAMPER ON Button . . . . DEPRESS

To engage secondary yaw damper:

Yaw Damper Selector Switch . . . . . SEC YAW DAMPER

SEC YAW DAMPER Switch . . . . ENGAGE

Anti-Ice . . . . **ON/OFF**

Turn on or off as required.

WARNING Even small accumulations of ice on the wing leading edge can cause aerodynamic stall prior to activation of the stick shaker and/or pusher. These ice accumulations can also cause angle-of-attack indicator information to be unreliable.

NOTE: If taxi and/or takeoff were on ice, snow, or slush, allow the wheels to spin down for approximately one minute prior to gear retraction to throw off as much slush as possible.

During gear retraction after liftoff, one or more of the ANTI-SKID lights may illuminate depending upon brake condition and differential brake snubbing.

NOTE: Anti-ice systems should be turned on prior to flight into visible moisture and ram air temperature of 10°C or below.

During periods of heavy precipitation, set AIR IGN switches to ON to prevent possible engine flameout due to large quantities of water entering the engine.

Flaps . . . . **UP**

Retract flaps at V_2 + 30.

Air Ignition . . . . **OFF**

Turn switches to OFF unless ambient conditions require ignition to remain on.

Thrust Reversers . . . . OFF

Cabin Pressurization . . . . CHECKED

Monitor cabin pressurization rates throughout climb. Recommended rate is 500 to 600 fpm. Observe cabin vertical speed indicator.

Landing Lights . . . . OFF

Angle-of-Attack . . . . CROSS CHECKED

Check both pilot's instruments for relative agreement.

Seat Belts/No Smoke Signs . . . . OFF

Climb

Altimeters (Transition Level) . . . . 29.92 L/R

Pressurization . . . . MONITORED

Air Conditioner . . . . OFF

Do not operate cooling system above 18,000 ft, unless modified per service letter for operation to 35,000 ft.

Recognition Lights . . . . OFF

Windshield Heat . . . . AS DESIRED

Crew Masks . . . . QUICK DONNING POSITION

See AFM limitation section for mask requirements.

At Flight Level 410,
450 Pressurization System (25-206 through 25-226):

Crew/Passenger O_2 Masks . . . . DON

Ensure lanyards have been pulled.

> **NOTE:** Observe applicable operating rules for additional oxygen requirements.

Cruise

Windshield Heat . . . . ON/OFF

Use AUTO or MAN position as desired.

Engine Instruments . . . . MONITORED

Pressurization . . . . MONITORED

450 Pressurization: If pressurization system is operating satisfactorily in either the automatic or manual mode, do not select maximum airflow above 90% RPM; this prevents an uncomfortable pressure “bump.”

Fuel Panel . . . . MONITORED

Monitor fuel distribution and initiate fuel transfer/management as required.

AFC/SS . . . . ENGAGED

Learjet 25B/C/D/F, engage prior to 0.78; **Learjet 24D/E/F**, engage prior to 0.79.

NOTE: For high altitude, low airspeed operations at high power settings, set AIR IGN switches to ON. Refer to Ignition System Limits, AFM Section I.

Descent

Windshield Heat . . . . **AS REQUIRED**

Pressurization . . . . **LANDING ELEVATION**

Adjust Cabin Rate Selector as desired during descent. Recommended "down" rate is 500 to 600 fpm.

Anti-Ice . . . . **ON/OFF**

Before entering possible icing conditions, turn NAC, WING & STAB HEAT, and radome alcohol on. Maintain 80% RPM minimum to ensure adequate bleed air for anti-ice and to maintain cabin pressurization.

WARNING Even small accumulations of ice on the wing leading edge can cause aerodynamic stall prior to activation of the stick shaker and/or pusher. These ice accumulations can also cause angle-of-attack indicator information to be unreliable.

NOTE: Anti-ice systems should be turned on prior to flight into visible moisture and ram air temperature of 10°C or below.

The manufacturer recommends that approach speed be increased if turbulence is anticipated due to gusty winds, wake turbulence, or wind shear. For gusty wind conditions, an increase in approach speed of one half the gust factor is recommended.

Fuel Quantity . . . . CHECKED

Check fuel balance and total for VREF computations.

Hydraulic Pressure . . . . CHECKED

TOLD Card/Bugs . . . . CHECKED/SET

Complete TOLD card computations; set bugs.

Crew Briefing . . . . COMPLETED

See SOP section.

Leaving Flight Level 180

Altimeters . . . . SET XX.XX L/R

Set both to current altimeter setting and call complete four-number setting.

Air Conditioner . . . . ON

For additional cooling or to decrease cabin humidity, set cooling system as required.

Recognition Lights . . . . ON

Approach

Fuel Balance . . . . CHECKED

Check fuel total and balance. Refine V_{REF} and wind factor speeds if necessary.

TOLD Card/Bugs . . . . CHECKED/SET

Circuit Breakers . . . . IN L/IN R

Ensure all circuit breakers are in on both sides.

Thrust Reversers . . . . CHECKED/ARMED

Ensure NORMAL-EMER STOW switch is in NORMAL.

T/R Arming Switch . . . . OFF

T/R Fault Switch . . . . TEST

Check that all function lights are extinguished.

T/R Arming Switches . . . . ARM

Ensure all function lights are extinguished.

T/R Arming Fault Switch . . . . TEST

All function lights should be extinguished.

Hydraulic/Emergency Air . . . . CHECKED

Check for normal pressure on gages.

Baro/Rad Alt/Radios . . . . SET

Set at 1,500 ft. Below 1,500 ft, set to DA/MDA.

Seat Belt/No Smoke Sign . . . . ON

Cabin Pressurization . . . . CHECKED

Engine Sync . . . . OFF

The ENG SYNC light illuminates whenever the nose gear cycled to down and the ENG SYNC switch is in ENG SYNC.

Spoilers . . . . RETRACTED

Ensure Spoiler switch is in RET position and SPOILER light is extinguished.

Crew Briefing . . . . COMPLETED

Before Landing

Position gear to DN at V_{LO} or less. Check for three green lights.

NOTE: If taxi and/or takeoff were on ice, snow or slush, place ANTI-SKID switch to OFF and pump brakes six to ten times. Then place ANTI-SKID switch to ON. Brake applications tend to crack any ice between brake discs and between the discs and wheels.

The ENG SYNC light will illuminate whenever the nose gear is down and ENG SYNC switch is in the ENG SYNC position.

Landing Gear . . . . DOWN

Landing/Taxi Lights . . . . ON

During daytime, use taxi lights only.

Parking Brake/Anti-Skid . . . . OFF/ON/LIGHTS OUT

NOTE: The left landing light will not illuminate unless the left main gear is down and locked. The right landing light will not illuminate unless the right main gear is down and locked.

NOTE: If anti-skid light(s) are illuminated after gear is lowered, place ANTI-SKID switch to OFF and then to ON to clear the system. If the light(s) remain illuminated, assume the system is inoperative and leave switch in the ON position. Refer to the appropriate section of the AFM for increased landing distance.

Learjet 25B/C, 25-197 and 205 with AMK 75-4 Reduced Airspeed Kit; Learjet 25D/F, 25-206 and subsequent:

Parking Brake/Anti-Skid . . . . OFF/ON/LIGHTS OUT

Learjet 25B/C, 25-061, 70 through 196, 198 through 204 without AMK 75-4 Reduced Airspeed Kit:

Parking Brake/Anti-Skid . . . . OFF/ON/LIGHTS OUT

Test INBD and OUTBD systems are performed during Before Taxi checklist.

Learjet 24D/E/F:

Parking Brake/Anti-Skid . . . . OFF/ON/LIGHTS OUT

TEST Switch . . . . HOLD IN TEST ONE SECOND

White light illuminates momentarily to indicate continuity of system.

Flaps . . . . DOWN

Hydraulic Pressure . . . . CHECKED

Check for normal pressure.

Air Ignition . . . . ON

Yaw Damper . . . . OFF DURING LANDING FLARE

Learjet 25D/F, 25-363 and subsequent, Learjet 25B/C, 25-061, 70 through 205 and Learjet 25D/F, 25-206 through 362 with AAK 83-4 may land with yaw damper engaged: the yaw damper automatically disengages on landing.

Go Around/Missed Approach (Two Engines)

Autopilot . . . . DISENGAGED

Thrust Levers . . . . SET TO TAKEOFF POWER OR AS REQUIRED

Select go-around mode.

Spoiler Switch . . . . RETRACTED

Flaps 20

Landing Gear . . . . UP

Check gear up when positive rate-of-climb established.

Yaw Damper . . . . ON

Check yaw damper on (PRI or SEC) at pilots' discretion.

At Approach Climb Speeds (approx. V_{REF} + 5) . . . CLIMB

When clear of obstacles:

Airspeed . . . . ACCELERATE TO V_{REF} +30

Flaps . . . . RETRACT

Go to After Takeoff checklist.

WARNING: When fuel quantity gage indicates 600 lbs or less remaining in either wing tank, prolonged nose up attitude of 10° or more may cause fuel to be trapped in the aft area of the wing tank outboard of the wheel well. Fuel starvation and engine flameout may occur.

For go around conditions with LOW FUEL warning light, reduce climb attitude to a minimum required.

After Landing

SPOILER Switch . . . . EXT

Brakes . . . . AS REQUIRED

Nosewheel Steering . . . . AS REQUIRED BELOW 45 KTS

During moderate to heavy braking action on patchy snow or ice, avoid use of nosewheel steering above 10 kts.

CAUTION: If upon touchdown, one or more ANTI-SKID GEN lights illuminate, anti-skid protection for the associated wheel is inoperative and has reverted to manual brake control.

If not already operating, do not turn on cooling system during landing with anti-skid system operating. Initial voltage drops may cause false signals in the anti-skid system and dump pressure for 2-3 seconds.

After Clearing Runway

Thrust Reversers . . . . OFF

Air Ignition . . . . OFF

Landing/Taxi Lights . . . . TAXI or OFF

After clearing runway, set switch to TAXI position as required.

Recognition/Strobe Lights . . . . OFF

Do not use strobe lights when taxiing in the vicinity of other aircraft. Position lights must be turned on for all night operations.

Radar . . . . OFF

Stall Warning . . . . OFF

Anti-Ice . . . . OFF

After clearing runway, set the anti-ice systems as follows:

Pitot Heat Switches . . . . OFF

Windshield and Radome Alcohol . . . . OFF

Windshield Heat . . . . AS REQUIRED BELOW 70% RPM

NAC HEAT Switches . . . . AS REQUIRED

STAB & WING HEAT Switch . . . . AS REQUIRED BELOW 70% RPM

Monitor the WING TEMP indicator to prevent overheat condition.

Emergency Lights . . . . OFF

Unnecessary Avionics . . . . OFF

Cabin Air . . . . OFF

Spoilers . . . . RETRACTED

Flaps . . . . UP

Trims . . . . RESET

Hydraulic Pressure (after one engine off) . . . CHECKED

Fuel Transfer . . . . AS REQUIRED

Coffee and Oven Switches . . . . OFF

Shutdown

Chocks/Parking Brake . . . . AS REQUIRED

Emergency Power/Standby Gyro . . . . OFF/CAGED

Panel Switches/Avionics . . . . OFF

Thrust Levers . . . . CUTOFF

When shutting down the engines, check the hydraulic pumps. Operate a hydraulic load (spoilers or flaps) after shutting down one engine. If operating pressure is maintained, the pump on the operating engine is functioning.

Inverters . . . . OFF

Generators . . . . OFF

Cross Flow . . . . CLOSED

Close the crossflow valve. If the valve is left open, the fuel may gravity flow to the lowest wing and cause the airplane to tip over on the ramp.

Fuel Transfer/Fuse Valve . . . . OFF/CLOSED

Always stop the fuel transfer process while the battery switches are on. If the battery switches are turned off before the fuel transfer switch is placed in off, it is possible that the crossflow valve will remain open.

Hydraulic Pressure . . . . BLEED TO ZERO

If the parking brake is set, use of flaps to bleed hydraulic system pressure will not affect parking brake pressure.

Batteries . . . . OFF

Controls . . . . LOCKED

CAUTION: On aircraft without SB 23/24/25-34D, failure to bleed hydraulic pressure from the system before setting the Battery switch(es) to OFF could result in nose gear retraction if the landing gear selector valve malfunctions.

Quick Turnaround (One or No Engine Shutdown)

The After Landing checklist must be accomplished prior to this procedure. After completing this checklist, make a normal takeoff starting with the beginning of the Before Takeoff checklist.

TOLD Card/Bugs . . . . SET

Pressurization . . . . SET

Fuel Panel . . . . CHECKED

Cabin Door . . . . TWO HANDLES FORWARD/
. . . . . .LIGHT OUT

Go to Second Engine Start or Before Takeoff.

Before Taxi (One Engine)

Engine Instruments . . . . CHECK

Oil Pressure . . . . CHECK

Fuel Pressure . . . . CHECK

Ensure the L or R FUEL PRESS annunciator is not illuminated; this indicates jet pump is operating.

Hydraulic Pressure . . . . CHECK

Check that the LOW HYD annunciator (if installed) is extinguished.

> **NOTE:** On aircraft with only a red LO OIL PRESS annunciator, the light remains illuminated until both engines are operating; on aircraft with red L or R LO OIL annunciators, the applicable light extinguishes.

GPU (if applicable) . . . . DISCONNECTED

Check that DC voltmeter dropped to indicate ground power is disconnected.

START-GEN Switch . . . . GEN

Check that GEN annunciator extinguished. Check generator output.

Lights . . . . ON/OFF

Ensure lights as required are on. Do not use strobe lights when taxiing in vicinity of other aircraft.

Spoilers . . . . CHECKED/RETRACTED/LIGHT OUT

SPOILER Switch . . . . EXT

Check that spoilers extend fully and symmetrically in approximately one to two seconds; SPOILER annunciator illuminates.

SPOILER Switch . . . . RET

Check that spoilers retract fully and symmetrically in approximately six seconds; SPOILER annunciator extinguishes.

Emergency Lights (if installed) . . . . . . TESTED/ARMED

EMER LT Switch . . . . TEST

Check for illumination.

EMER LT Switch . . . . ARM

Door Light Switch . . . . NORM

Parking Brake . . . . RELEASED

Learjet 25B/C, 25-197 and 205 with AAK 76-4 Reduced Airspeed Kit; Learjet 25D/F, 25-206 and subsequent:

Anti-Skid . . . . CHECKED/LIGHTS OUT

If a light remains on after setting the ANTI-SKID switch to ON, assume anti-skid system is inoperative. Leave the switch in ON and refer to the appropriate section of the AFM for increased takeoff distance.

Learjet 24D/E/F:

Anti-Skid Switch . . . . ON

TEST Switch . . . . HOLD IN TEST ONE SECOND

The white light below the four green lights illuminates momentarily to indicate proper system operation. Wheel brakes are inoperative when switch held in TEST. If any green light is not illuminated during taxi above 5 knots, assume the associated wheel has reverted to manual control.

Learjet 25B/C, 25-061, 70 through 196, 198 through 204 without AAK 76-4 Reduced Airspeed Kit:

Anti-Skid Switch . . . . ON

Switch should be on for at least four seconds before testing.

TEST Switch . . . . HOLD TO OUTBD

Hold to OUTBD for a minimum of four seconds and a maximum of 20 seconds (holding switch longer than 20 seconds may result in damage to the test circuit). Outboard lights should illuminate. Release switch and ensure lights extinguish.

TEST Switch . . . . HOLD TO INBD

Hold to INBD for a minimum of four seconds and a maximum of 20 seconds. Inboard lights should illuminate. Release switch and ensure lights extinguish.

If one or more of the anti-skid lights remain illuminated after check is completed, set ANTI-SKID switch off and then back on. If the light or lights do not illuminate, wait a minimum of four seconds and re-check the system as outlined above.

After lift-off, one or more of the anti-skid lights may illuminate during gear retraction depending on brake condition and/or differential brake snubbing. The light or lights will then be illuminated when gear is lowered. Set the ANTI-SKID switch off and then back on to clear the system. Wait a minimum of four seconds and proceed with Anti-Skid check.

Anti-Skid Switch (**not modified with AAK 75-1**) . . . OFF

Anti-Skid Switch (**modified with AAK 75-1**) . . . . . . ON

NOTE: If a light remains illuminated after setting the ANTI-SKID switch on, assume the system is inoperative and refer to the appropriate section for anti-skid inoperative takeoff and landing distance in the AFM.

Second Engine Start

Second Engine . . . . STARTED

START-GEN Switch . . . . START

Thrust Lever . . . . IDLE AT 10% RPM

AIR IGN light illuminates. Monitor that the EGT is within limits, fuel flow and oil pressure have indications.

START-GEN Switch . . . . GEN

AIR IGN and GEN lights extinguish. Check DC VOLTS and AMPS for generator output.

Engine Instruments . . . . CHECK

Oil Pressure . . . . CHECK

On aircraft with a red LO OIL PRESS annunciator, the light remains illuminated until both engines are operating; on aircraft with red L or R LO OIL annunciators, the applicable light extinguishes.

Fuel Pressure . . . . CHECK

Ensure the L or R FUEL PRESS annunciator is not illuminated; this indicates jet pumps is operating.

Hydraulic Pressure . . . . CHECK

Check that the LOW HYD annunciator (**if installed**) is extinguished.

START-GEN Switch . . . . GEN

Check that GEN annunciators extinguished. Check generator output.

Engine Instruments . . . . NORMAL

Check engine instruments for normal indications.

Current Limiters . . . . CHECKED

MAIN BUS TIE Circuit Breaker . . . . PULL

Learjet 25D/F 368 and subsequent and prior with AMK 85-1; 24E/F with 85-1

ESS BUS TIE Circuit Breaker . . . . PULL

Either START-GEN Switch . . . . OFF

Check that ammeter reading on opposite generator increases; it should approximately double.

START-GEN Switch . . . . GEN

GEN annunciator extinguishes and both generators share load.

Opposite START-GEN Switch . . . . OFF

Check that ammeter reading on opposite generator increases; it should approximately double.

START-GEN Switch . . . . GEN

GEN annunciator extinguishes and both generators share load.

MAIN BUS TIE Circuit Breaker . . . . RESET

Learjet 25D/F 368 and subsequent and prior with AMK 85-1; 24E/F with 85-1

ESS BUS TIE Circuit Breaker . . . . RESET

CAUTION: Failure to successfully complete the current limiter check indicates a malfunction. Replace 275 amp current limiter(s) prior to takeoff.

STAB & WING HEAT Switch
(Cabin Air on or normal) . . . . CHECKED

STAB & WING HEAT Switch . . . . ON

Check that the STAB HEAT light is illuminated and there is no additional DC ampere increase. Check for cabin fluctuation (cabin air must be on).

STAB & WING HEAT Switch . . . . AS REQUIRED BELOW 70% RPM

Monitor WING TEMP temperature indicator for overheat condition.

Nacelle Heat . . . . CHECKED

NAC HEAT Switches . . . . ON

Check left and right amps for indication rise of approximately 50 amps each. Check that the ENG ICE ice lights are illuminated.

Left Thrust Lever . . . . ADVANCE THEN IDLE

Check that the left ENG ICE light extinguished between 65% and 80% RPM.

L NAC HEAT Switch . . . . OFF

Ensure the left ENG ICE light remains extinguished.

Right Thrust Lever . . . . ADVANCE THEN IDLE

Check that right ENG ICE light extinguished between 65% and 80% PRM.

R NAC HEAT Switch . . . . OFF

Ensure the right ENG ICE light remains extinguished.

CAUTION: With aircraft sitting statically, do not perform extended engine operation above 70% RPM with cabin air on. There is no ram airflow through the heat exchanger and possible damage to air conditioning components may occur.

Windshield Heat . . . . CHECKED/PURGED

Purge on first flight or if exposed to moisture. This procedure clears the windshield heat system of moisture and precludes water from freezing on the windshield if the system is turned on at altitude. This purge should be done the first flight of the day and anytime aircraft is exposed to moisture.

IN NORMAL/OUT DEFOG Knob . . . . PULL OUT

WSHLD HEAT Switch . . . . AUTO

Check that green WSHLD HEAT light illuminates; note audible airflow. Check for water blowing out of external defog nozzles.

WSHLD HEAT Switch . . . . MAN

WSHLD HEAT ON/OFF Switch . . . . OFF

Hold in OFF until airflow stops.

IN NORMAL/OUT DEFOG Knob . . . . PUSH IN

Parking

Under normal weather conditions, the aircraft may be parked and headed in a direction to facilitate servicing without regard to prevailing winds. For extended parking, head aircraft into the wind.

Aircraft . . . . PARKED ON HARD, LEVEL SURFACE

Nose Wheel . . . . CENTERED

Main Gear Wheels . . . . CHOCKED

Parking Brake . . . . OFF

Flaps and Spoilers . . . . RETRACTED

Static Ground Cables . . . . CONNECTED

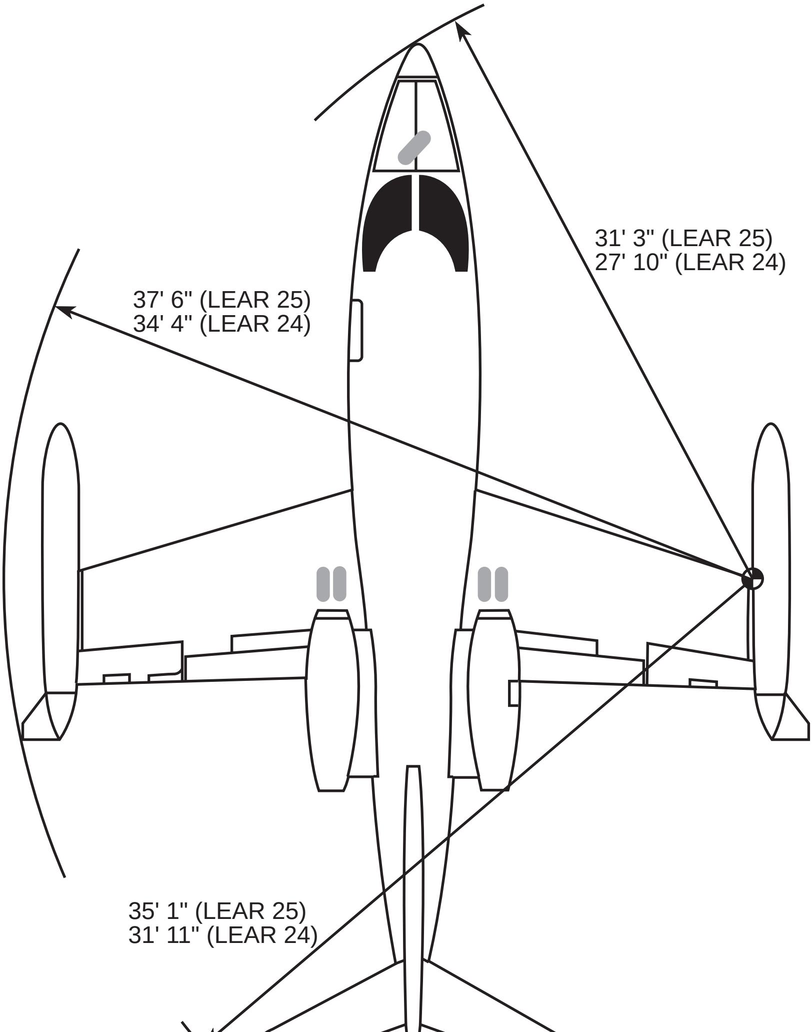
Protective Covers . . . . INSTALLED

Gust Lock . . . . INSTALLED

Tail Stand . . . . INSTALLED

Cabin Door . . . . CLOSED AND LOCKED

Nose Steer Turning Radius



2B-1

Mooring

If extended parking plans or impending weather necessitates mooring the aircraft, 7/16 inch polypropylene ropes (or equivalent) are attached to the nose gear and the main gear struts. This procedure requires that tie-down eyelets be set into the apron; there is no procedure for mooring at unprepared facilities.

Parking Procedure . . . . PERFORMED

Ropes . . . . ATTACHED TO NOSE GEAR AND MAIN GEAR/SECURE TO PARKING APRON

Towing/Taxiing

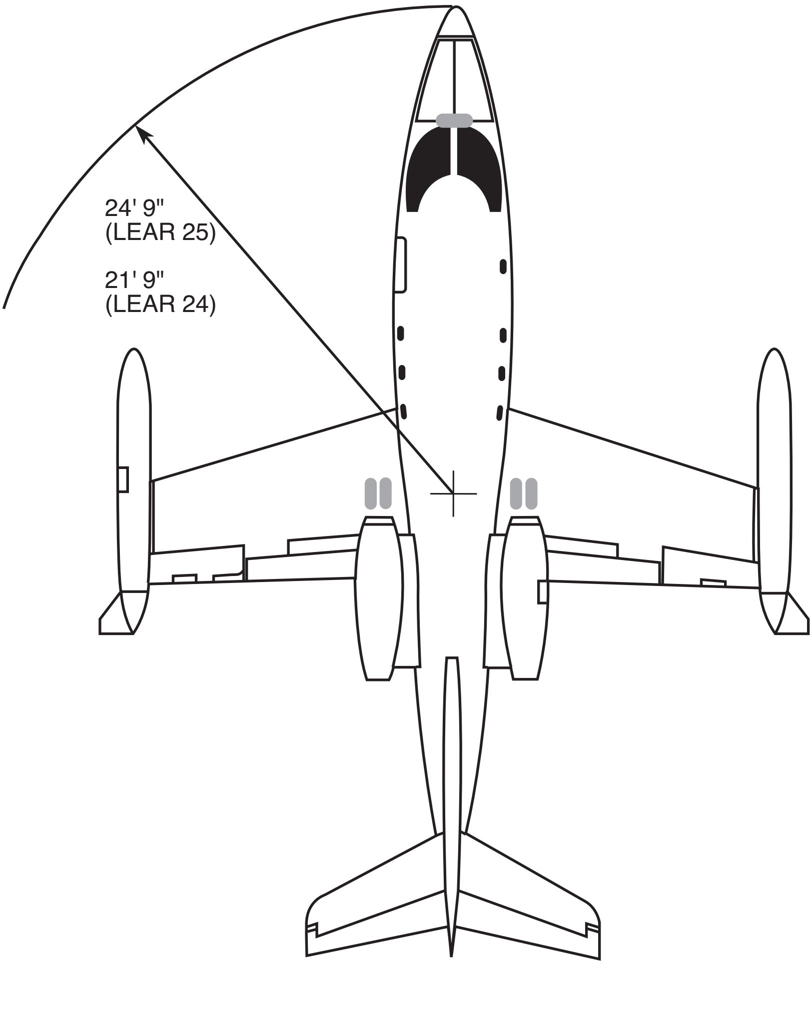
On hard surfaces, the aircraft can be towed or pushed backwards using a tow bar attached to the nose wheel. The turning angle of the nose wheel with tow bar is 90°, either side of center. When the aircraft is not on a hard surface, (such as sand, soft ground, or mud), cables or ropes must be attached to each main gear for towing; in such an event, steering is accomplished with the rudder pedals.

For taxi operations, directional control is accomplished utilizing the nosewheel steering system. The maximum turning radius for the nosewheel steering system is 45° either side of center.

Observe the aircraft turning distances depicted on pages 2B-63 and 2B-65, (**Figures 2B-1 and 2B-2**).

CAUTION: If aircraft is off runway and mired in soft ground, do not attempt nose wheel towing. Cables or ropes attached to the main gear must be used to prevent damage to the aircraft. See Main Gear Towing section this chapter.

Towing Radius
Learjet 24/25



2B-2

Nose Gear Towing

Tow Bar . . . . ATTACHED TO NOSE WHEEL

Insert tow bar into nose wheel axle and secure.

Wheel Chocks/Mooring Ropes . . . . REMOVED

Control Gust Lock . . . . REMOVED

Grounding Cables . . . . REMOVED

Tow Bar . . . . ATTACHED TO TOWING VEHICLE

Parking Brakes . . . . RELEASED

Wing/Tail Walkers . . . . STATIONED (OPTIONAL)

Aircraft . . . . TOW

Use smooth starts and stops.

CAUTION: When pushing aircraft backward with a towing vehicle, perform all braking with the towing vehicle. Brake application while the aircraft is being pushed backward, other than by hand, may cause damage to the brake components. Ensure that battery switches are set to OFF while towing to avoid damage to the electric nose gear steering actuator. If it is necessary to tow with power on the aircraft, pull both AC and DC NOSE STEER CBs on the pilot's CB panel.

When Towing Operation Completed

Nose Wheel . . . . CENTERED

Parking Brake . . . . SET

Controls Gust Lock . . . . INSTALLED

Wheels . . . . CHOCKED

Grounding Cables . . . . ATTACHED

Tow Bar . . . . REMOVED

Main Gear Towing

Pilot's Seat . . . . OCCUPIED

Main Gear . . . . ATTACH ROPES OR CABLES

Position large ropes or belt straps on main gear strut as low as possible.

Wheel Chocks/Mooring Ropes . . . . REMOVED

Control Gust Lock . . . . REMOVED

Grounding Cables . . . . REMOVED

Ropes, Chains or Cables . . . . ATTACHED TO TOWING VEHICLE

Towing ropes, chains or cables should be of sufficient length to allow towing vehicle to be at least 50 to 100 ft from aircraft.

Parking Brakes . . . . RELEASED

Wing/Tail Walkers . . . . STATIONED (OPTIONAL)

Aircraft . . . . TOW

Use smooth starts and stops.

When Towing Operation Completed

Nose Wheel . . . . CENTERED

Wheels . . . . CHOCKED

Parking Brake . . . . SET

Controls Gust Lock . . . . INSTALLED

Grounding Cables . . . . ATTACHED

Ropes, Chains or Cables . . . . REMOVED

Taxiing (Ground Movement)

During taxi, the aircraft is controlled by rudder pedal steering. Taxiing can be accomplished with one or both engines operating.

Pilot Stations . . . . BOTH OCCUPIED

Wheel Chocks/Mooring Ropes . . . . REMOVED

Control Gust Lock . . . . REMOVED

Grounding Cables . . . . REMOVED

Engine Inlet and Exhaust Covers . . . . REMOVED

Area . . . . . . CLEAR OF PERSONNEL AND EQUIPMENT

Engine . . . . STARTED

Start one engine according to engine starting procedure.

Parking Brakes . . . . RELEASED

Release the parking brake and start taxi roll using only sufficient thrust to start roll.

After Taxiing:

Parking Brake . . . . SET

Engine . . . . SHUT DOWN

Shut the engine down according to engine shutdown procedure. After the engine has cooled, install engine inlet and exhaust covers.

Parking Procedure . . . . PERFORMED

WARNING: Ensure personnel and equipment are clear of engine inlet and exhaust when engine is operating.

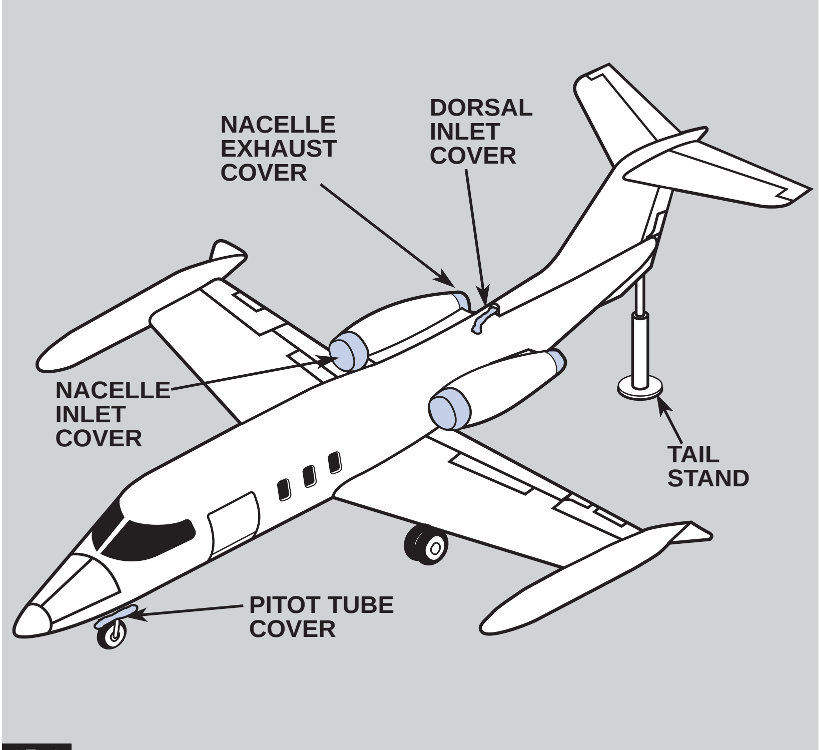
Storage and Restoring

Storage

Aircraft storage practices vary depending upon the length of the storage period. There are, however, several general policies to observe. If the aircraft is to be stored outside, adhere to parking and mooring requirements. All protective covers should be installed (**Figure 2B-3**). Do not set the parking brake. In all other cases, the following are generally performed:

Parking (0 to 7 Days)

If the engines are in a sheltered environment (i.e., not exposed to excessive humidity or temperature changes), no action need be taken beyond installing protective covers.



2B-3

Flyable Storage (7 to 30 Days)

Parking

Aircraft . . . . PARKED

Park aircraft in hangar, if possible. If aircraft is parked outside, position on flat surface, facing into the prevailing wind.

Main Gear Wheels . . . . CHOCKED

Nose Wheel . . . . CENTERED

Parking Brake . . . . RELEASED

Moor aircraft if necessary.

Fuel System

Aircraft . . . . FUELED

Fuel aircraft to capacity using approved fuel with anti-ice additive mixed in normal proportions.

Flight Control System

Controls Gust Lock . . . . INSTALLED

Flaps and Spoilers . . . . RETRACTED

Engines

Protective Covers . . . . INSTALLED

Electrical System

Grounding Cables . . . . ATTACHED

Batteries . . . . LEADS DISCONNECTED

Exterior Fuselage

Protective Covers . . . . . INSTALLED ON PITOT TUBES AND DORSAL FIN INLET

Tail Stand . . . . INSTALLED

Access Doors and Panels . . . CLOSED AND SECURED

Cabin Door . . . . CLOSED AND LOCKED

Attach red tag to cabin door handle with the following notation: AIRCRAFT PREPARED FOR FLYABLE STORAGE (7 to 30 days) (date of storage).

Prolonged Storage (31 Days to 6 Months)

Aircraft . . . . WASHED AND WAXED

Interior

Interior . . . . CLEANED

Seat Covers . . . . INSTALLED

Install protective seat covers on all seats.

Parking Procedure . . . . PERFORMED

Perform parking procedure as described for Flyable Storage.

Engines

Engines . . . . PRESERVED

Preserve engines in accordance with the General Electric CJ610 Maintenance Manual. When preserving engines, follow the special environmental preservation instructions, if applicable.

Protective Covers . . . . INSTALLED

Fuel System

Fuel System Procedure . . . . PERFORMED

Perform fuel system procedure as described for Flyable Storage.

Fuel Vents . . . . COVERED

Cover fuel vents with barrier material; secure with tape. Make a 0.10 inch diameter hole in barrier material to allow venting.

Electrical System

Batteries . . . . REMOVED AND STORED

Standby Battery . . . . REMOVED AND STORED

Emer. Power Supply Battery . . REMOVED AND STORED

Nav/Avionic Emer. Batt. Supply Packs . . . . . . STORED

Store all battery packs in accordance with manufacturer's procedures.

Oxygen System . . . . DEPLETED

Deplete oxygen from oxygen supply cylinder and aircraft oxygen lines (refer to Maintenance Manual for details). Ensure that oxygen supply valve is closed.

Alcohol Anti-Ice System . . . . TANK EMPTIED

Refrigeration System . . . . OPERATED

Connect an external power source and operate refrigeration system every 30 days.

Hydraulic System . . . . CHECKED

Fill hydraulic system to operational level and check for leaks. Repair all leaks prior to storage.

Windshield and Windows . . . . CLEANED

LH Windshield Cover . . . . INSTALLED

Place LH windshield cover over LH windshield. Using black tape, secure and seal protective cover to fuselage. Do not tape center of windshield.

RH Windshield Cover . . . . INSTALLED

Place RH windshield cover over RH windshield. Using black tape, secure and seal protective cover to fuselage and LH windshield cover.

Cabin Window Covers . . . . INSTALLED

Place a window protective cover over each of the cabin windows; secure and seal the covers around the edges with black tape.

CAUTION: Use extreme care not to scratch or gouge windshield or windows.

Avionic Equipment . . . . REMOVED AND STORED

Remove and store avionic equipment in accordance with manufacturers' recommended procedures.

Pitot/Static System

Pitot Tube . . . . SECURED

Tape a small piece of barrier material around pitot tube and install pitot tube cover.

Static Ports . . . . SECURED

Cut small pieces of barrier material and place them over the static ports. Secure and seal them from the atmosphere by taping around the perimeter of barrier material.

Landing Gear

Tires . . . . REPLACED

Replace unserviceable tires with serviceable tires.

Brakes . . . . REMOVED AND PRESERVED

Remove brakes and preserve in brake preservative according to procedure outlined in Maintenance Manual.

Anti-Skid Wheel Transducer . . . . SERVICED

Remove anti-skid wheel transducer and apply brake preservative inside the hub. Re-install anti-skid wheel transducer.

Landing Gear Strut . . . . LUBRICATED

Main and Nose Gear Shock Struts . . . CHECKED EVERY 30 DAYS

Main and Nose Gear Tire Pressure . . CHECKED EVERY 30 DAYS

Wheel Wells . . . . SECURED

Install barrier material over wheel wells; secure and seal from atmosphere with black tape.

Toilet . . . . SANITIZED

Emergency Air Bottle . . . . DEPLETED

Deplete emergency air bottle air charge; ensure that charging valve is turned off.

Engine Fire Extinguisher System

Fire Extinguisher Container . . . . SERVICED

Gain access to fire extinguisher container and install a wire jumper between the ground stud and cartridge insulated terminal. Attach a red tag to the jumper wire with the notation: REMOVE JUMPER WIRE BEFORE STARTING ENGINE.

Flight Control System

Flight Control System . . . . LUBRICATED

Lubricate flight control system in accordance with maintenance manual.

Controls Gust Lock . . . . INSTALLED

Flaps and Spoilers . . . . RETRACTED

Exterior Fuselage

Tail Stand . . . . INSTALLED

Dorsal Fin Inlet Cover . . . . INSTALLED

Access Doors and Panels . . . . CHECK CLOSED AND SECURED

Cabin Door . . . . CLOSED AND LOCKED

Attach red tag to cabin door handle with the following notation: AIRCRAFT PREPARED FOR PROLONGED STORAGE (31 days to 6 months) (date of storage).

Indefinite Storage (More than 6 months)

Prepare aircraft for storage as described under Prolonged Storage (31 Days to 6 Months). The following areas require additional preparation:

Engines

Engines . . . . PRESERVED

Preserve engines in accordance with the General Electric CJ610 Maintenance Manual.

Protective Covers . . . . INSTALLED

Ensure that protective covers are installed after the engines have been preserved. When preserving engines, follow the special environmental preservation instructions, if applicable.

Engine Fire Extinguisher System

Engine Fire Extinguisher . . . . REMOVED AND STORED

Remove engine fire extinguisher containers and cartridges. Store in accordance with the manufacturer's recommended procedures.

Fuel System

Sumps . . . . DRAINED

Anti-Ice Additive . . . . CHECKED

Remove a pint of fuel from the wing filler and check that anti-ice additive concentration in fuel meets minimum Airplane Flight Manual requirements (see FAA Approved Airplane Flight Manual). If anti-ice additive concentration does not meet minimum requirements, defuel the aircraft and fuel aircraft with fuel and anti-ice additive in proper proportions. Anti-ice additive concentration should be checked every six months; more often if the aircraft is stored outside in high temperature and high humidity environment.

Fuel Systems . . . . TOPPED OFF AS REQUIRED

Cabin Door . . . . CLOSED AND LOCKED

Attach red tag to cabin door handle with the following notation: AIRCRAFT PREPARED FOR INDEFINITE STORAGE (more than six months) (date of storage).

Landing Gear

Struts and Actuators . . . . SERVICED

After aircraft has been stored for 12 months, remove barrier material from landing gear struts and actuators. Wipe hydraulic fluid off struts and actuators and apply a fresh light coating of hydraulic fluid. Wrap struts and actuators with new barrier material. Secure and seal with black tape. Replace tape that attaches barrier material to aircraft every six months.

Windshield and Windows . . . . REPLACE TAPE

Every Six Months:

Replace tape that attaches protective covers to the aircraft every six months. Use care when servicing not to gouge or scratch the windshield or windows.

Restoring After Storage

After an aircraft has been stored for a period, it must be restored to an airworthy state. Based on the length of storage, the following are generally performed.

Restoring from Flyable Storage (7 to 30 Days)

Aircraft Exterior . . . . CLEANED, IF REQUIRED

Protective Covers . . . . REMOVED

Tail Stand . . . . REMOVED

Controls Gust Locks . . . . REMOVED

Batteries . . . . SERVICED AND CONNECTED

Servicing . . . . CHECKED

Check the following items and service if required:

- hydraulic accumulator
- hydraulic reservoir
- nose and main landing gear and struts
- tires
- refrigeration system
- emergency air bottles
- alcohol anti-ice system
- oxygen system
- engine oil system.

Preflight Inspection . . . . PERFORMED

Restoring from Prolonged Storage (31 Days to 6 Months)

In addition to procedures required for restoring from Flyable Storage, the following are performed:

Engines . . . . PREPARED FOR SERVICE

Prepare the engines for service in accordance with the General Electric CJ610 Maintenance Manual.

Fuel System . . . . SERVICED

Electrical System . . . . SERVICED

Oxygen System . . . . SERVICED AND CHECKED FOR LEAKS

Alcohol Anti-Ice System . . . . SERVICED

Environmental Systems . . . . . OPERATIONAL CHECKS PERFORMED

Hydraulic System . . . . CHECKED FOR LEAKS

Repair any leaks prior to flight.

Windshield and Windows . . . . . PROTECTIVE COVERS REMOVED AND STORED

Avionic Equipment . . . . SERVICED

Install all avionic equipment removed for storage. Prepare for service in accordance with manufacturer’s recommended procedures.

Pitot/Static System . . . . COVERS AND BARRIER MATERIAL REMOVED

Landing Gear . . . . SERVICED

Toilet . . . . SERVICED

Service toilet in accordance with manufacturer’s recommended procedures.

Emergency Air Bottle . . . . SERVICED

Engine Fire Extinguisher System . . . . SERVICED

Remove electrical power from the aircraft. Remove red tag and jumper between ground stud and fire extinguisher cartridge insulated terminal. Restore electrical power to aircraft.

Flight Controls . . . . SERVICED

Remove controls gust locks, lubricate flight control system, and perform operational systems checks. See Maintenance Manual for details.

Exterior Fuselage . . . . CHECKED

Interior . . . . CLEANED, IF REQUIRED

Preflight Inspection . . . . PERFORMED

Restoring from Indefinite Storage (More than 6 Months)

In addition to procedures required for restoring from Prolonged Storage, the following are performed:

Engine Fire Extinguisher System . . . . CHECKED

Hydrostatically test and service engine fire extinguisher containers and install engine fire extinguisher containers and cartridges (see Maintenance Manual for details).

400-Hour Inspection . . . . PERFORMED

Perform 400-hour inspection as described in Maintenance Manual.

Cold Weather Operations

Preflight Inspection

Aircraft Surface . . . . CHECKED FREE OF SNOW, ICE AND FROST

Failure to remove snow, ice, or frost accumulation on the aircraft prior to flight may result in serious aerodynamic disturbances and unbalanced flight loads that may cause structural damage in flight. Takeoff distance and climb performance also can be adversely affected to a hazardous level.

- Ice may be removed by spraying with suitable deice fluid such as isopropyl alcohol. Do not spray deicing fluid in areas where spray or fluid may enter the engine air inlets. Deicing fluid may be used to clean these areas providing it is thoroughly wiped clean before starting.
- Remove ice, snow, and dirt from landing gear shock struts and wheel wells. Check gear doors, position switches, squat switches, wheels, and tires.
- Carefully inspect the engine inlet, outlet, and variable inlet guide vanes for ice buildup from freezing precipitation.

Control Surfaces . . . . CHECKED FREE OF SNOW, ICE AND FROST

Snow removal from the control surfaces must be completed to ensure proper travel. Special attention must be given to control the refreezing of water resulting from deicing with heated air.

Pitot/Static Ports . . . . CLEARED OF ICE

Ice formations in the proximity of the static ports or on the pitot tube can cause erroneous instrument indications.

Landing Gear/Hydraulics . . . . CHECKED

Check for fluid leaks and for proper inflation of struts and tires.

Ramp . . . . CHECKED

Check the ramp area around the engines for loose encrusted snow or ice that could be ingested during engine start or blown at personnel or other aircraft when taxiing.

Preheating . . . . PERFORMED

Interior – The cabin and cockpit should be preheated for crew and passenger comfort and for proper operation of the instruments.

Engines – The engines should be preheated prior to starting when the engines have been cold soaked at temperatures below -40°F (-40°C). Two 850 watt electric blowers can be used; one in the inlet and one in outlet duct, or a BT-400 ground heater unit (NSN 4520-00-219-7969) or equivalent is recommended. If the temperature is between -40°F and -65°F, direct warm air into each engine for a minimum of 30 minutes prior to engine start.

Starting

Use of a GPU for an engine start is recommended at temperatures of 32°F (0°C) or below. Ensure the GPU is regulated to 28V DC and has an amperage rating between 500 and 1,000 amps.

Engine acceleration is much slower than normal. The EGT increases rapidly due to the slower engine spool up. If EGT is rising rapidly and appears likely to exceed the start limit, abort the start.

Oil pressure can be expected to exceed the maximum allowable transients. Do not exceed idle power with oil temperature below 30°C. If the outside temperature prevents the oil temperature from reaching 30°C, however, idle power may be exceeded as required to further warm the oil to normal operating limits prior to takeoff.

If the outside temperature is below -13°C, operate the engines for at least three minutes to bring the hydraulic system up to normal operating temperature prior to takeoff.

Taxi

If Airport Surfaces Are Contaminated with Ice, Wet Snow or Slush:

Engines . . . . BOTH STARTED FOR TAXI

Use the brakes to build up the temperature of the disks to prevent them from freezing when the aircraft is stopped. Allow greater stopping distances on the ramp and taxiways.

Anti-Ice Systems . . . . AS REQUIRED

Flaps . . . . RETRACTED UNTIL REACHING THE RUNWAY

Avoid the exhaust wake or propwash of other aircraft and be alert for loose ice or crusted snow that can be ingested into the engines.

Many pilots use thrust reversers to aid directional control while taxiing on slick surfaces. This is very risky and can easily cause foreign object damage to the engine.

Slick surfaces can cause nosewheel steering to be marginal. Differential braking can be used to aid directional control. Be careful not to make turns too sharp; this could damage the steering system. Also, be alert for slick spots causing the nose wheel to spin, possibly coming 180° out of alignment with the direction of travel.

Takeoff

Check takeoff distances carefully; the distances in the Performance section do not account for runway contamination for takeoff.

Parking Brake . . . . CHECK RELEASED

Air Ignition . . . . ON

If the use of anti-ice systems is planned for takeoff, turn them on prior to setting takeoff thrust. Windshield heat is rarely used on takeoff because of the noise.

CAUTION: Do not take off with runway water or slush accumulation of 3/4 inch or more.

After Takeoff

After takeoff, accelerate to 200 KIAS and leave the gear extended for approximately 60 seconds to allow slush and wet snow to blow and spin off. Retract the gear before exceeding 200 KIAS.

Before Landing

If taxi or takeoff was accomplished on an ice, slush or snow covered runway, use the following procedure to crack any ice that may have formed between the brake disks and wheels.

Landing Gear . . . . EXTENDED NORMALLY

Anti-Skid Switch . . . . OFF

Brakes . . . . PUMPED HEAVILY 6 TO 10 TIMES

Anti-Skid Switch . . . . ON

Anti-Skid Lights . . . . OUT

Landing Distance . . . . INCREASED

Multiply the dry runway landing distance by 1.4 for a wet runway; 1.7 for freezing runway.

If operating under FAR 135, multiply the 135 landing distance by 1.15 for a wet runway. For an icy runway, multiply the FAR 91 distance by 1.7 and divide the result by 0.6 to obtain the factored 135 distance.

Landing

Slick Runway Landing Procedure:

Approach Speed . . . . V_{REF}

Touchdown . . . . FIRM

Spoilers . . . . EXTENDED

Nosewheel . . . . ON THE RUNWAY

Brakes . . . . REQUIRED BRAKING APPLIED

Thrust Reversers . . . . DEPLOYED AND APPLIED

Drag chute may be used in place of reversers.

The nose wheel on the runway improves directional control. Spoilers should be deployed immediately after touchdown. The anti-skid system automatically controls the brakes to prevent skids and provides maximum braking for the runway condition. Consider the use of the drag chute, if installed. High reverse thrust can result in directional control difficulties. Be prepared to reduce power to idle reverse if directional control is adversely affected. If snow or ice is present while applying moderate to heavy braking, do not use nosewheel steering above 10 knots ground speed.

Crosswind Consideration

On a slick runway, directional control can become a problem in crosswinds much lower than the maximum demonstrated. The thrust reversers may be preferable to the drag chute. Nosewheel steering is more effective if forward control pressure is applied; the brakes, however, are more effective if the controls are held more aft.

After Clearing Runway

After landing on slush or snow, retract the flaps to 20°. Do not retract the flaps fully. Ice or snow can build up on the flap structure and damage the airplane on retraction.

Shutdown and Postflight

If the airplane is to be left outside in cold conditions, perform the following in addition to the normal securing procedures.

Park . . . . INTO THE WIND IF POSSIBLE

Main Wheels . . . . CHOCKED

- Do not set the parking brake.
- If a large accumulation of snow fall is possible, do not leave the aircraft with a full fuselage tank, particularly if the wings are not full. Snow accumulation on the tail can cause the aircraft to fall back on its tail.
- Remove ice and snow from the flap structure and retract flaps.
- Remove ice, snow, and dirt from the landing gear struts, inboard doors, gear microswitches, and wheel assemblies.
- Remove water and beverages from the aircraft. Remove the flushing toilet tank or add ethylene glycol base anti-freeze containing an antifoam agent.
- If temperature is below 0°F (-17.8°C), remove aircraft batteries and store in a warm location.

Protective Covers . . . . INSTALLED

Deicing Supplemental Information

This section provides supplementary information on aircraft deicing, anti-icing/deicing fluids, deicing procedures, and aircraft operating procedures. Consult the AFM, Maintenance Manual Chapter 12 – Servicing, and FAA Advisory Circulars for deicing procedures, fluid specifications, recommendations, and hazards.

Federal Aviation Regulations (FARs) prohibit takeoff with snow, ice, or frost adhering to the wings and control surfaces of the aircraft. It is the responsibility of the pilot-in-command to ensure the aircraft is free of snow, ice, or frost before takeoff.

Failure to adequately deice the aircraft can result in seriously degraded aircraft performance, loss of lift, and erratic engine and flight instrument indications.

Following extended high-altitude flight, frost can form at ambient temperatures above freezing on the wing's underside in the fuel tank areas. Refueling the aircraft with warmer fuel usually melts the frost.

Deicing

When necessary, use the following methods to deice the aircraft:

- placing the aircraft in a warm hangar until the ice melts
- mechanically brushing the snow or ice off with brooms, brushes, or other means
- applying a heated water/glycol solution (one-step procedure)
- applying heated water followed by an undiluted glycol-based fluid (two-step procedure).

Two types of anti-icing/deicing fluids are in commercial use: SAE/ISO Types I and II. Type I fluids are used generally in North America. Type II fluids, also referred to as AEA Type II, are used generally in Europe.

Type I fluids are unthickened glycol-based fluids that are usually diluted with water and applied hot; they provide limited holdover time.

Type II fluids are thickened glycol-based fluids that are usually applied cold on a deiced aircraft; they provide longer holdover times than Type I fluids.

> **NOTE**: Holdover time is the estimated time that an anti-icing/deicing fluid protects a treated surface from ice or frost formation.

Many factors influence snow, ice, and frost accumulation and the effectiveness of deicing fluids. These factors include:

- ambient temperature and aircraft surface temperature
- relative humidity, precipitation type, and rate
- wind velocity and direction
- operation on snow, slush, or wet surfaces
- operation near other aircraft, equipment, and buildings
- presence of deicing fluid and its type, dilution strength, and application method.

CAUTION: Type II FPD generally should not be applied forward of the wing leading edges. If used for deicing, do not apply forward of cockpit windows. Ensure that radome and cockpit windows are clean.

CAUTION: If engines are running when spraying of deicing fluids is in progress, turn bleed air and air conditioning packs off.

One-step deicing involves spraying the aircraft with a heated, diluted deicing/anti-icing fluid to remove ice, snow, or frost. The fluid coating then provides limited protection from further accumulation.

Two-step deicing involves spraying the aircraft with hot water or a hot water/deicing fluid mixture to remove any ice, snow, or frost accumulation followed immediately by treatment with anti-icing fluid (usually Type II FPD fluid).

Deice the aircraft from top to bottom. Avoid flushing snow, ice, or frost onto treated areas. Start the deicing process by treating the horizontal stabilizer followed by the vertical stabilizer. Continue by treating the fuselage top and sides. Finally, apply deicing fluid to the wings.

Deicing fluid should not be applied to:

- pitot/static tubes, static ports, temperature probes, AOA vanes, or TAT probe
- gaps between control surfaces and airfoil
- cockpit windows
- passenger windows
- air and engine inlets and exhausts
- vents and drains
- wing and control surface trailing edges
- brakes.

> **CAUTION:** Do not use deicing fluid for engines. After deicing engine, start engine(s) immediately to prevent any reicing condition Select engine anti-ice on after engine start.

Do not use deicing fluid to deice engines. Mechanically remove snow and ice from the engine inlet. Check the first stage fan blades for freedom of movement. If engine does not rotate freely, deice engine with hot air.

After aircraft deicing and anti-icing, visually inspect the following areas to ensure that they are free from ice, snow, and frost accumulations:

- wing leading edges, upper and lower surfaces
- vertical and horizontal stabilizer leading edges, side panels, and upper and lower surfaces
- ailerons, elevator, and rudder

- flaps, flap tracks, and flap drive mechanisms
- ground and flight spoilers
- engine inlets and exhausts
- cockpit windows
- communication and navigation antennas
- fuselage
- AOA probes, pitot tubes, static ports, and SAT/TAS probe
- fuel tank vents
- cooling air inlets and exhausts
- landing gear including brakes, wheels, tires, struts, and doors.

When unsure of wing cleanliness, perform a “hands on” inspection to verify that all wing surfaces are clean of ice, snow, and frost.

Hot Weather and Desert Operations

Observe airplane performance limitations computed from Section V of the AFM. Temperature affects engine thrust, braking, takeoff distance, and climb performance.

In areas of high humidity, non-metallic materials are subject to moisture absorption and increase the weight of the aircraft.

In very dry areas, protect the airplane from dust and sand.

Exterior Inspection

Preflight Inspection . . . . PERFORMED

Protective Covers . . . . REMOVED

- Clean dust and dirt from landing gear shock struts. Check gear doors, position switches, and squat switches for condition and operation. Check tires and struts for proper inflation.
- Check and remove dust and sand from engine inlet duct, tail pipe, and the visible components of the thrust reversers.

During the inspection, be particularly conscious of dust and sand accumulation on components lubricated with oily or greasy lubricants.

Be careful of other personnel and equipment behind the airplane during engine starts.

Engine Start

During engine starts at high outside temperatures, engine EPR is higher than normal but should remain within limits.

Taxi

If the airport surfaces are sandy or dust covered, avoid exhaust wake and propwash of other airplanes.

Takeoff

Ensure takeoff performance is adequate for the conditions and runway length.

Shutdown and Postflight

Install all aircraft protective covers.

Do not allow sand or dust to enter fuel tanks while refueling.

Do not leave reflective objects in the cockpit or on the glareshield; reflected heat can distort the windshield optical properties.

Standard Operating Procedures

Table of Contents

General Information

CAE SimuFlite strongly supports the premise that the disciplined use of well-developed Standard Operating Procedures (SOP) is central to safe, professional aircraft operations, especially in multi-crew, complex, or high performance aircraft.

If your flight department has an FAA-accepted or approved SOP document, we encourage you to use it during your training. If your flight department does not already have one, we welcome your use of the CAE SimuFlite SOP.

Corporate pilots carefully developed this SOP. A product of their experience, it is the way CAE SimuFlite conducts its flight operations.

The procedures described herein are specific to the Learjet models 25, 35, 55, and apply to specified phases of flight. The flight crew member designated for each step accomplishes it as indicated.

Definitions

LH/RH: Pilot Station. Designation of seat position for accomplishing a given task because of proximity to the respective control/indicator. Regardless of PF or PM role, the pilot in that seat performs tasks and responds to checklist challenges accordingly.

PF: Pilot Flying. The pilot responsible for controlling the flight of the aircraft.

PIC: Pilot-in-Command. The pilot responsible for the operation and safety of an aircraft during flight time.

PM: Pilot Monitoring. The pilot who is not controlling the flight of the aircraft.

Flow Patterns

Flow patterns are an integral part of the SOP. Accomplish the cockpit setup for each phase of flight with a flow pattern, then refer to the checklist to verify the setup. Use normal checklists as “done lists” rather than “do lists.”

Flow patterns are disciplined procedures; they require pilots who understand the aircraft systems/controls and who methodically accomplish the flow pattern.

Checklists

Use a challenge-response method to execute any checklist. After the PF initiates the checklist, the PM challenges by reading the checklist item aloud. The PF is responsible for verifying that the items designated as PF or his seat position (i.e., LH or RH) are accomplished and for responding orally to the challenge. Items designated on the checklist as PM or by his seat position are the PM's responsibility. The PM accomplishes an item, then responds orally to his own challenge. In all cases, the response by either pilot is confirmed by the other and any disagreement is resolved prior to continuing the checklist.

After the completion of any checklist, the PM states “_______ checklist is complete.” This allows the PF to maintain situational awareness during checklist phases and prompts the PF to continue to the next checklist, if required.

Effective checklists are pertinent and concise. Use them the way they are written: verbatim, smartly, and professionally.

Omission of Checklists

While the PF is responsible for initiating checklists, the PM should ask the PF whether a checklist should be started if, in his opinion, a checklist is overlooked. As an expression of good crew resource management, such prompting is appropriate for any flight situation: training, operations, or checkrides.

Challenge/No Response

If the PM observes and challenges a flight deviation or critical situation, the PF should respond immediately. If the PF does not respond by oral communication or action, the PM must issue a second challenge that is loud and clear. If the PF does not respond after the second challenge, the PM must ensure the safety of the aircraft. The PM must announce that he is assuming control and then take the necessary actions to return the aircraft to a safe operating envelope.

Abnormal/Emergency Procedures

When any crewmember recognizes an abnormal or emergency condition, the PIC designates who controls the aircraft, who performs the tasks, and any items to be monitored. Following these designations, the PIC calls for the appropriate checklist. The crewmember designated on the checklist accomplishes the checklist items with the appropriate challenge/response.

> ***NOTE:*** *“*Control” means responsibility for flight control of the aircraft, whether manual or automatic.

The pilot designated to fly the aircraft (i.e., PF) does not perform tasks that compromise this primary responsibility, regardless of whether he uses the autopilot or flies manually.

Both pilots must be able to respond to an emergency situation that requires immediate corrective action without reference to a checklist. The elements of an emergency procedure that must be performed without reference to the appropriate checklist are called memory or recall items. Accomplish all other abnormal and emergency procedures while referring to the printed checklist.

Accomplishing abnormal and emergency checklists differs from accomplishing normal procedural checklists in that the pilot reading the checklist states both the challenge and the response when challenging each item.

When a checklist procedure calls for the movement or manipulation of controls or switches critical to safety of flight (e.g., throttles, engine fire switches, fire bottle discharge switches), the pilot performing the action obtains verification from the other pilot that he is moving the correct control or switch prior to initiating the action.

Any checklist action pertaining to a specific control, switch, or piece of equipment that is duplicated in the cockpit is read to include its relative position and the action required (e.g., “Left Throttle – IDLE; Left Boost Pump – OFF”).

Time Critical Situations

When the aircraft, passengers, and/or crew are in jeopardy, remember three things:

- FLY THE AIRCRAFT – Maintain aircraft control.
- RECOGNIZE CHALLENGE – Analyze the situation.
- RESPOND – Take appropriate action.

Aborted Takeoffs

The aborted takeoff procedure is a pre-planned maneuver; both crewmembers must be aware of and briefed on the types of malfunctions that mandate an abort. Assuming that the crew trains to a firmly established SOP, either crewmember may call for an abort.

The PF normally commands and executes the takeoff abort for directional control problems or catastrophic malfunctions. Additionally, any indication of one of the following malfunctions prior to V_1 is cause for an abort:

- engine failure
- engine fire
- thrust reverser deployment

In addition to the above, the PF usually executes an abort prior to 80 KIAS for any abnormality observed.

When the PM calls an abort, the PF announces “Abort” or “Continue” and executes the appropriate procedure.

Critical Malfunctions in Flight

In flight, the observing crewmember positively announces a malfunction. As time permits, the other crewmember makes every effort to confirm/identify the malfunction before initiating any emergency action.

If the PM is the first to observe any indication of a critical failure, he announces it and simultaneously identifies the malfunction to the PF by pointing to the indicator/annunciator.

After verifying the malfunction, the PF announces his decision and commands accomplishment of any checklist memory items. The PF monitors the PM during the accomplishment of those tasks assigned to him.

Non-Critical Malfunctions in Flight

Procedures for recognizing and verifying a noncritical malfunction or impending malfunction are the same as those used for time-critical situations: use positive oral and graphic communication to identify and direct the proper response. Time, however, is not as critical and allows a more deliberate response to the malfunction. Always use the appropriate checklist to accomplish the corrective action.

Radio Tuning and Communication

The PM accomplishes navigation and communication radio tuning, identification, and ground communication.

For navigation radios, the PM tunes and identifies all navigation aids. Before tuning the PF's radios, he announces the NAVAID to be set. In tuning the primary NAVAID, in particular, the PM coordinates with the PF to ensure proper selection sequencing with the autopilot mode. After tuning and identifying the PF's NAVAID, the PM announces “(Facility) tuned and identified.”

Monitor NDB audio output at any time that the NDB is in use as the NAVAID. Use the marker beacon audio as backup to visual annunciation for marker passage confirmation.

In tuning the VHF radios for ATC communication, the PM places the newly assigned frequency in the head not in use (i.e., preselected) at the time of receipt. After contact on the new frequency, the PM retains the previously assigned frequency for a reasonable time period.

Altitude Assignment

The PM sets the assigned altitude in the altitude alerter and points to the alerter while orally repeating the altitude. The PM continues to point to the altitude alerter until the PF confirms the altitude assignment and alerter setting.

Pre-Departure Briefings

The PIC should conduct a pre-departure briefing prior to each flight to address potential problems, weather delays, safety considerations, and operational issues.

Pre-departure briefings should include all crewmembers to enhance team-building and set the tone for the flight. The briefing may be formal or informal, but should include some standard items. The acronym AWARE works well to ensure that no points are missed. This is also an opportunity to brief the crew on any takeoff or departure deviations from the SOP that are due to weather or runway conditions.

NOTE: The acronym AWARE stands for the following:

- Aircraft status
- Weather
- Airport information
- Route of flight
- Extra

Advising of Aircraft Configuration Change

If the PF is about to make a change to aircraft control or configuration, he alerts the PM to the forthcoming change (e.g., gear, speedbrake, and flap selections). If time permits, he also announces any abrupt flight path changes so there is always mutual understanding of the intended flight path.

Time permitting, a PA announcement to the passengers precedes maneuvers involving unusual deck or roll angles.

Transitioning from Instruments to Visual Conditions

If visual meteorological conditions (VMC) are encountered during an instrument approach, the PM normally continues to make callouts for the instrument approach being conducted. However, the PF may request a changeover to visual traffic pattern callouts.

Phase of Flight SOP

Holding Short

PF	PM
CALL: "Before Takeoff checklist"	
	ACTION: Complete Before Takeoff checklist
	CALL: "Before Takeoff checklist complete"

Takeoff Briefing

ACTION: Brief the following:

- Assigned Runway for Takeoff
- Initial Heading/Course
- Type of Takeoff (Rolling or Standing)
- Initial Altitude
- Airspeed Limit (If Applicable)
- Clearance Limit
- Emergency Return Plan
- SOP Deviations

Consider the following:

- Impaired Runway Conditions
- Weather
- Obstacle Clearance
- Instrument Departures Procedures
- Abort

Holding Short (continued)

PF	PM
Cleared for Takeoff	
	ACTION: Confirm Assigned Runway for Takeoff and Check Heading Indicator Agreement **CALL:** "Assigned Runway Confirmed, Heading Checked"
ACTION: Confirm Assigned Runway for Takeoff and Check Heading Indicator Agreement **CALL:** "Assigned Runway Confirmed, Heading Checked" **CALL:** "Runway Line-Up/ Before Takeoff Checklist"	
	ACTION: Complete Runway Line-Up/Before Takeoff Checklist **CALL:** "Runway Line-Up/ Before Takeoff Checklist Complete

Takeoff Roll

PF	PM
Setting Takeoff Power	
CALL: "Max power."	**CALL:** "Max power."
Initial Airspeed Indication	
ACTION: Visually confirm positive IAS indication. NWS released.	**CALL:** "Airspeed alive."
At 80 KIAS	
	CALL: "80 knots crosscheck."
At V_1	
ACTION: Move hand from throttles to yoke.	**CALL:** "V_1."
At V_R - V_2	
ACTION: Rotate to a approx. 9° pitch attitude for takeoff (Go-around position on V-Bars).	**CALL:** "Rotate."

Climb

PF	PM
At Positive Rate of Climb	
	CALL: "Positive rate."
Only after PM's call, **CALL:** "Gear up. Yaw Damper - engaged."	
	CALL: "Gear selected up." When gear indicates up, "Gear indicates up, yaw damper - engaged."
After Gear Retraction	
	ACTION: Immediately accomplish attitude correlation check. ▪ PF's and PM's ADI displays agree. ▪ Pitch and bank angles are acceptable. **CALL:** "Attitudes check." Or, if a fault exists, give a concise statement of the discrepancy.
At V_{REF} + 30 KIAS and 400 Ft Above Airport Surface (Minimum)	
	CALL: "V_2 + 30 KIAS."
CALL: "Flaps up."	
	CALL: "Flaps selected up." When indicator shows UP, "Flaps indicate UP."

Climb (continued)

PF	PM
At V_{ENR} (Minimum)	
CALL: "Climb power."	
	CALL: "Climb power set."
At 1,500 Ft (Minimum) Above Airport Surface and Workload Permitting	
CALL: "After Takeoff checklist."	
	ACTION: Complete After Takeoff checklist.
	CALL: "After Takeoff checklist complete."
At 10,000 ft.	
CALL: "10,000 feet."	
	ACTION: No Smoke / Fasten Seat Belt lights, as required
At Transition Altitude	
CALL: "29.92 set." "Climb checklist."	**CALL:** "29.92 set."
	ACTION: Complete Climb checklist.
	CALL: "Climb checklist complete."
At 1,000 ft. Below Assigned Altitude	
	CALL: "_____ (altitude) for_____ (altitude)." (e.g., "9,000 for 10,000.")
CALL: "_____ (altitude) for _____ (altitude)." (e.g., "9,000 for 10,000.")	

Cruise

PF	PM
At Cruise Altitude	
CALL: "Cruise checklist."	
	ACTION: Complete Cruise checklist.
	CALL: "Cruise checklist complete."
Altitude Deviation in Excess of 100 Ft	
	CALL: "Altitude."
CALL: "Correcting."	
Course Deviation in Excess of One Half Dot	
	CALL: "Course."
CALL: "Correcting."	

Descent

PF	PM
Upon Intial Descent From Cruise	
CALL: "Descent checklist."	
	ACTION: Complete Descent checklist.
	CALL: "Descent checklist complete.
At 1,000 Ft Above Assigned Altitude	
	CALL: " ____ (altitude) for ____ (altitude)." (e.g., "10,000 for 9,000.")
CALL: " ____ (altitude) for ____ (altitude)." (e.g., "10,000 for 9,000.")	
At Transition Level	
CALL: "Altimeter set ________	**CALL:** "Altimeter set ____ ."
	ACTION: Complete Transition checklist.
	CALL: "Transition checklist complete."
At 10,000 Ft	
	CALL: "10,000 ft."
CALL: "Check." Speed 250 kts."	

Maintain sterile cockpit below 10,000 ft above airport surface.

Descent (continued)

PF	PM
At Appropriate Workload Time	
REVIEW	**REVIEW**

Review the following:

- approach to be executed
- field elevation
- appropriate minimum sector altitude(s)
- inbound leg to FAF, procedure turn direction and altitude
- final approach course heading and intercept altitude
- timing required
- DA/MDA
- MAP (non-precision)
- VDP
- special procedures (DME step-down, arc, etc.)
- type of approach lights in use (and radio keying procedures, if required)
- missed approach procedures
- runway information conditions

ACTION: Brief the following:

- configuration
- approach speed
- minimum safe altitude
- approach course
- FAF altitude
- DA/MDA altitude
- field elevation
- VDP
- missed approach
  - heading
  - altitude
  - intentions
- abnormal
- implications

Accomplish as many checklist items as possible. The Approach checklist must be completed prior to the initial approach fix.

Precision Approach

PF	PM
Prior to Initial Approach Fix	
CALL: "Approach checklist."	
	ACTION: Complete Approach checklist.
	CALL: "Approach checklist compete."
After Level-Off on Intermediate Approach Segment	
CALL: "Flaps 8." or "Flaps 20."	
	CALL: "Flaps selected 8 or 20." When flaps indicate 8° or 20°, "Flaps indicate 8 or 20."
After Initial Convergence of Course Deflection Bar	
CALL: "Localizer/ course alive."	**CALL:** "Localizer/ course alive."
At initial Downward Movement of Glideslope Raw Data Indicator	
CALL: "Glideslope alive."	**CALL:** "Glideslope alive."
When Annunciators Indicate Localizer Capture	
CALL: "Localizer captured."	**CALL:** "Localizer captured."

Precision Approach (continued)

PF	PM
At One Dot from Glideslope Intercept	
	CALL: "One dot to go."
CALL: "Gear down. Before Landing checklist"	**CALL:** Gear selected down." When gear indicates down, "Gear indicates down."
	ACTION: Complete Landing checklist except for full flaps, autopilot and yaw damper.
When Annunciator Indicates Glideslope Capture	
CALL: "Glideslope captured."	**CALL:** "Glideslope captured."
CALL: "Flaps DOWN."	**CALL:** "Flaps selected DOWN." When Flaps indicate DOWN, "Flaps indicate DOWN."

If the VOR on the PM's side is used for crosschecks on the intermediate segment, the PM's localizer and glideslope status calls are accomplished at the time when the PM changes to the ILS frequency. This should be no later than at completion of the FAF crosscheck, if required. The PM should tune and identify his NAV radios to the specific approach and monitor.

Precision Approach (continued)

PF	PM
At FAF	
CALL: "Outer marker." or "Final fix."	
	ACTION: ■ Start timing ■ Visually crosscheck that both altimeters agree with crossing altitude. ■ Set missed approach (MA) altitude in the altitude alerter. ■ Check PF and PM instruments. ■ Call FAF inbound.
	CALL: "Outer marker." or "Final fix." "Altitude checks."
At 1,000 Ft Above DA(H)	
	CALL: "1,000 ft to minimums."
CALL: "Check."	

Precision Approach (continued)

PF	PM
At 500 Ft Above DA(H)	
	CALL: "500 ft to minimums."
CALL: "Check."	

NOTE: An approach window has the following parameters:

- within one dot deflection, both LOC and GS
- IVSI less than 1,000 fpm
- IAS within V_{AP} ± 10 kt (no less than V_{REF} or 0.6 AOA, whichever is less)
- no flight instrument flags with the landing runway or visual references not in sight
- landing configuration, except for full flaps (circling or single engine approaches).

When within 500 ft above touchdown, the aircraft must be within the approach window. If the aircraft is not within this window, a missed approach must be executed.

PF	PM
At 200 Ft Above DA(H)	
	CALL: "200 ft to minimums."
CALL: "Check."	
At 100 Ft Above DA(H)	
	CALL: "100 ft to minimums."
CALL: "Check."	

Precision Approach (continued)

PF	PM
At Point Where PM Sights Runway or Visual References	
	CALL: "Runway (or visual reference) ____ o'clock."
CALL: "Going visual. Land." or "Missed approach."	
	ACTION: As PF goes visual, PM transitions to instruments.
At DA(H)	
	CALL: "Minimums. Runway (or visual reference) ____ o'clock."
ACTION: Announce intentions. **CALL:** "Going visual. Land." or "Missed approach."	
	ACTION: As PF goes visual, PM transitions to instruments. **CALL:** "100 ft. AGL." **CALL:** "50 ft. AGL."

Precision Missed Approach

PF	PM
At DA(H)	
	CALL: "Minimums. Missed approach."
CALL: "Missed approach."	
ACTION: Apply power firmly and positively. Activate go-around mode and initially rotate the nose to the flight director go-around attitude.	**ACTION:** Assist PF in setting power for go-around.
CALL: "Flaps 8." or "Flaps 20."	**CALL:** "Flaps selected 8 or 20." When flaps indicate 8° or 20°, "Flaps indicate 8 or 20."
At Positive Rate of Climb	
	CALL: "Positive rate."
CALL: "Gear up. Yaw Damper - engaged."	
	CALL: "Gear selected up." When gear indicates up, "Gear indicates up, yaw damper - engaged."
	ACTION: Announce heading and altitude for missed approach.

Precision Missed Approach (continued)

PF	PM
At V_{REF} +30 KIAS and 400 ft. Above Airport Surface (Minimum)	
CALL: "Flaps UP."	
	CALL: "Flaps selected UP." When flaps indicate UP, "Flaps indicate UP."
To ATC	
	CALL: "Missed approach."
At 3,000 ft. Above Airport Surface or Level - Off, which ever is lower	
CALL: "After Takeoff/ Climb checklist."	**ACTION:** Complete After Takeoff checklist. **CALL:** "After Takeoff checklist complete."

Precision Approach Deviations

PF	PM
± One Half Dot – Glideslope	
	CALL: "One half dot (high, low) and (increasing, holding, decreasing)."
CALL: "Correcting."	
± One Half Dot – Localizer	
	CALL: "One half dot (*right, left*) and (*increasing, holding, decreasing*)."
CALL: "Correcting."	
V_{TGT} ±__________	
	CALL: "Speed (*plus or minus*) _____(knots) and (*increasing, holding, decreasing*)."
CALL: "Correcting."	
At or Below V_{REF}	
	CALL: "V_{REF}." or "V_{REF} minus _____ (knots below V_{REF})."
CALL: "Correcting."	
Rate of Descent Exceeds 1,000 FPM	
	CALL: "Sink ____ (amount) hundred and (*increasing, holding, decreasing*)."
CALL: "Correcting."	

Non-Precision Approach

PF	PM
Prior to Initial Approach Fix	
CALL: "Approach checklist."	
	ACTION: Complete "Approach checklist."
	CALL: "Approach checklist complete."
After Level-Off on Intermediate Approach Segment	
CALL: "Flaps 8." or "Flaps 20."	
	CALL: "Flaps selected 8 or 20." When flaps indicate 8° or 20°, "Flaps indicate 8 or 20."
At Initial Convergence of Course Deviation Bar	
CALL: "Localizer/ course alive."	**CALL:** "Localizer/ course alive."
When Annunciators Indicate Course Capture	
CALL: "Localizer/course captured."	**CALL:** "Localizer/course captured."

Non-Precision Approach (continued)

PF	PM
Prior to FAF	
	CALL: " ____(number) miles/ minutes from FAF."
CALL: "Gear down."	
	CALL: "Gear selected down." When gear indicates down, "Gear indicates down."
	ACTION: Complete Before Landing checklist except for full flaps. autopilot, and yaw damper.
CALL: "Landing checklist."	

Non-Precision Approach (continued)

PF	PM
At FAF	
CALL: "Outer marker." or "Final fix."	**CALL:** "Outer marker." or "Final fix."
	ACTION: Start timing. ▪ Visually crosscheck that both altimeters agree. ▪ Set MDA (or nearest 100 ft above) in altitude alerter. ▪ Check PF and PM instruments. ▪ Call "FAF inbound."
CALL: "Flaps DOWN."	
	CALL: "Flaps selected DOWN." When Flaps indicate DOWN, "Flaps indicate DOWN."
	CALL: "Altimeters check."
At 1,000 Ft Above MDA	
	CALL: "1,000 ft to minimums."
CALL: "Check."	

Non-Precision Approach (continued)

PF	PM
At 500 Ft Above MDA	
	CALL: "500 ft to minimums."
CALL: "Check."	

NOTE: An approach window has the following parameters:

- within one dot CDI deflection or 5° bearing
- IVSI less than 1,000 fpm
- IAS within V_{AP} ±10 kt (no less than V_{REF} or 0.6 AOA, whichever is less)
- no flight instrument flags with the landing runway or visual references not in sight
- landing configuration, except for full flaps (circling or single engine approaches).

When within 500 ft above touchdown, the aircraft must be within the approach window. If the aircraft is not within this window, a missed approach must be executed.

PF	PM
At 200 Ft Above MDA	
	CALL: "200 ft to minimums."
CALL: "Check."	
At 100 Ft Above MDA	
	CALL: "100 ft to minimums."
CALL: "Check."	
At MDA	
	CALL: "Minimums. ____ (time) to go." or "Minimums. ____ (distance) to go."
CALL: "Check."	

Non-Precision Approach (continued)

PF	PM
At Point Where PM Sights Runway or Visual References	
	CALL: "Runway (or visual reference) ____ o'clock."
CALL: "Going visual. Land." or "Missed approach."	
	CALL: "200 ft. AGL."
	CALL: "100 ft. AGL."
	CALL: "50 ft. AGL."

Non-Precision Missed Approach

PF	PM
At MAP	
	CALL: "Missed approach point. Missed approach."
CALL: "Missed approach."	
ACTION: Apply power firmly and positively. Activate go-around mode and initially rotate the nose to the flight director go around attitude.	**ACTION:** Assist PF in setting power for go-around.
CALL: "Flaps 8." or "Flaps 20."	
	CALL: "Flaps selected 8 or 20." When flaps indicate 8° or 20°, "Flaps indicate 8 or 20."
At Positive Rate of Climb	
	CALL: "Positive rate."
CALL: "Gear up. Yaw Damper - engaged."	
	CALL: "Gear selected up." When gear indicates up, "Gear indicates up, yaw damper - engaged."
	ACTION: Announce heading and altitude for missed approach.

Non-Precision Missed Approach (continued)

PF	PM
At V_{REF} +30 and 400 ft. Above Airport Surface (Minimum)	
CALL: “Flaps UP.”	
	CALL: “Flaps selected UP.” When flaps indicate UP, “Flaps indicate UP.”
At 1,500 ft. (Minimum) Above Airport Surface and Workload Permitting	
CALL: “After Takeoff checklist.”	
	ACTION: Complete After Takeoff checklist
	ACTION: “After Takeoff/Climb checklist complete.”

Non-Precision Approach Deviations

PF	PM
± One Dot – Localizer/VOR	
	CALL: "One dot (*right, left*) and (*increasing, holding, decreasing*)."
CALL: "Correcting."	
± 5 Degrees At or Beyond Midpoint for NDB Approach	
	CALL: " ____ (degrees off course) (*right, left*) and (*increasing, holding, decreasing*)."
CALL: "Correcting."	
V_{TGT} ± ________	
CALL: "Correcting."	**CALL:** "Speed (*plus or minus*) _____(knots) and (*increasing, holding, decreasing*)."
At or Below V_{REF}	
	CALL: "V_{REF}." or "V_{REF} minus ____ (knots below V_{REF})."
CALL: "Correcting."	
Rate of Descent Exceeds 1,000 FPM of Briefed Rate	
	CALL: "Sink ____ (amount) hundred and (*increasing, holding, decreasing*)."
CALL: "Correcting."	

Visual Traffic Patterns

PF	PM
Before Pattern Entry/Downwind (1,500 ft Above Airport Surface)	
CALL: "Approach checklist."	
	ACTION: Complete Approach checklist to slats and flaps.
Downwind	
CALL: "Flaps 8." or "Flaps 20."	
	CALL: "Flaps selected 8 or 20." When flaps indicate 8° or 20°, "Flaps indicate 8 or 20."
CALL: "Gear down."	**CALL:** "Gear selected down." When gear indicates down, "Gear indicates down."
	ACTION: Complete Before Landing checklist except for full flaps. autopilot, and yaw damper.

Visual Traffic Patterns (continued)

PF	PM
At 1,000 Ft Above Airport Surface	
	CALL: “1,000 ft AGL.”
CALL: “Check.”	
At 500 ft Above Airport Surface	
	CALL: “500 ft AGL.”
CALL: “Check.”	
At 200 ft Above Airport Surface	
	CALL: “200 ft AGL.”
CALL: “Check.”	
	CALL: “100 ft. AGL.”
	CALL: “50 ft. AGL.”

Landing

PF	PM
Landing Assured (At Point on Approach When PF Sights Runway and Normal Landing Can be Made)	
CALL: "Going visual. Land.Flaps DOWN or Flaps 40."	
	CALL: "Flaps DOWN or Flaps 40." When flaps indicate DOWN or 40°, "Flaps indicate DOWN or 40."
ACTION: Disconnect autopilot prior to landing, if on.	**ACTION:** Continue with: ▪ speed check ▪ vertical speed check ▪ callouts ▪ gear down verification ▪ flap verification.
	CALL: "Final gear and flaps recheck. Before Landing checklist complete."
At 100 ft Above Touchdown	
	CALL: "100 ft."
At 50 ft Above Touchdown	
	CALL: "50 ft."
At Landing Flare (L2/L3)	
ACTION: Yaw damper off with WMS.	**CALL:** "Yaw damper off."

Landing (continued)

PF	PM
At Touchdown	
ACTION: "Extend spoilers." **CALL:** "Spoilers extended."	
	CALL: "Spoilers extended."
At Thrust Reverser Deployment	
	CALL: "Two unlocked. Two deployed."
At Thrust Reverser Idle Speed (60 / 70 KIAS) CALL "60	
	CALL: "60 knots (L3/L5) or 70 kts (L2)."

Maneuvers

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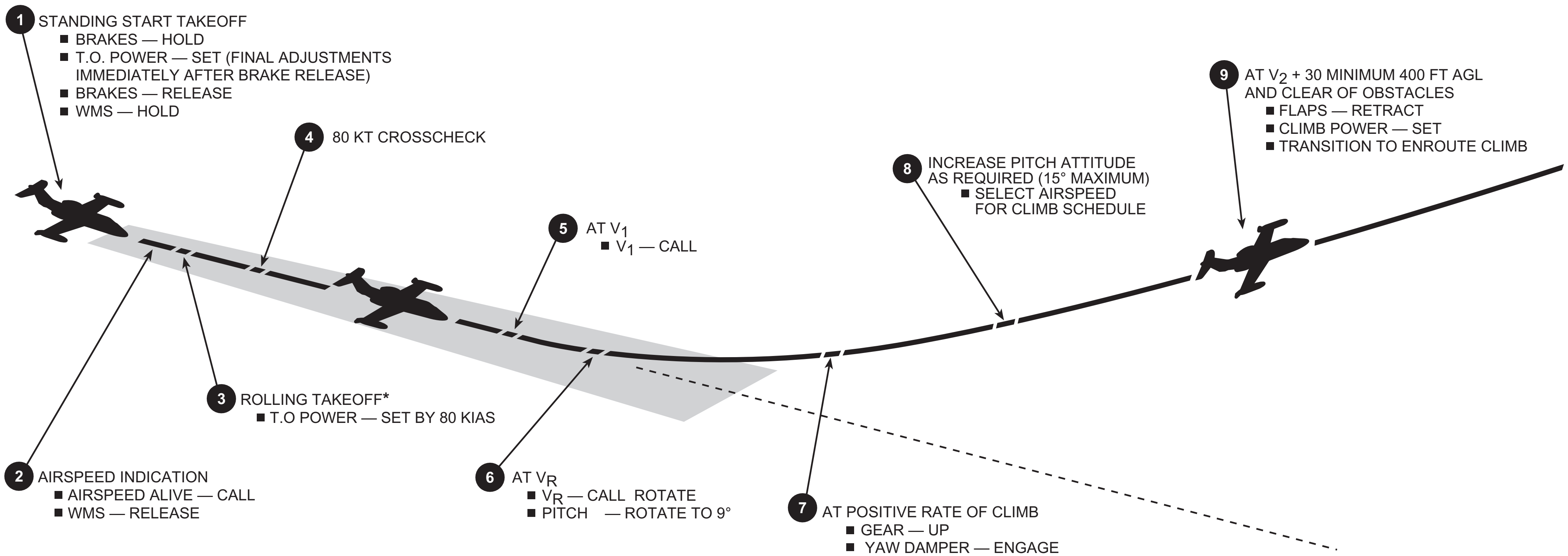
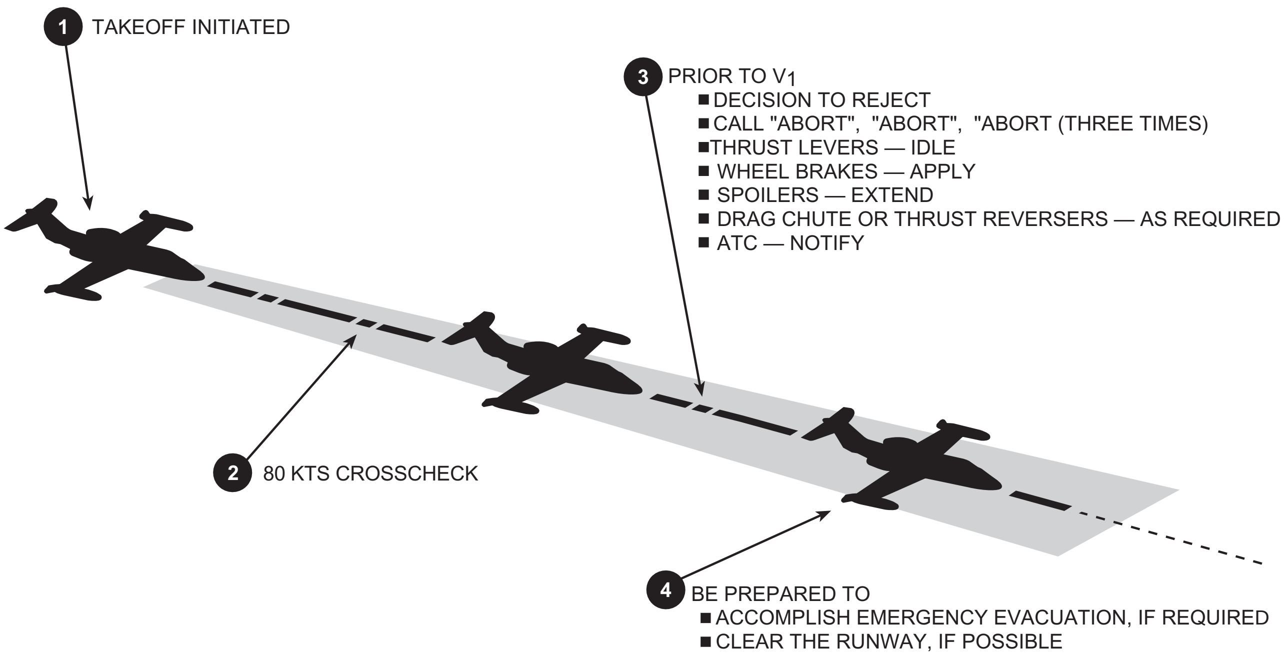
Takeoff

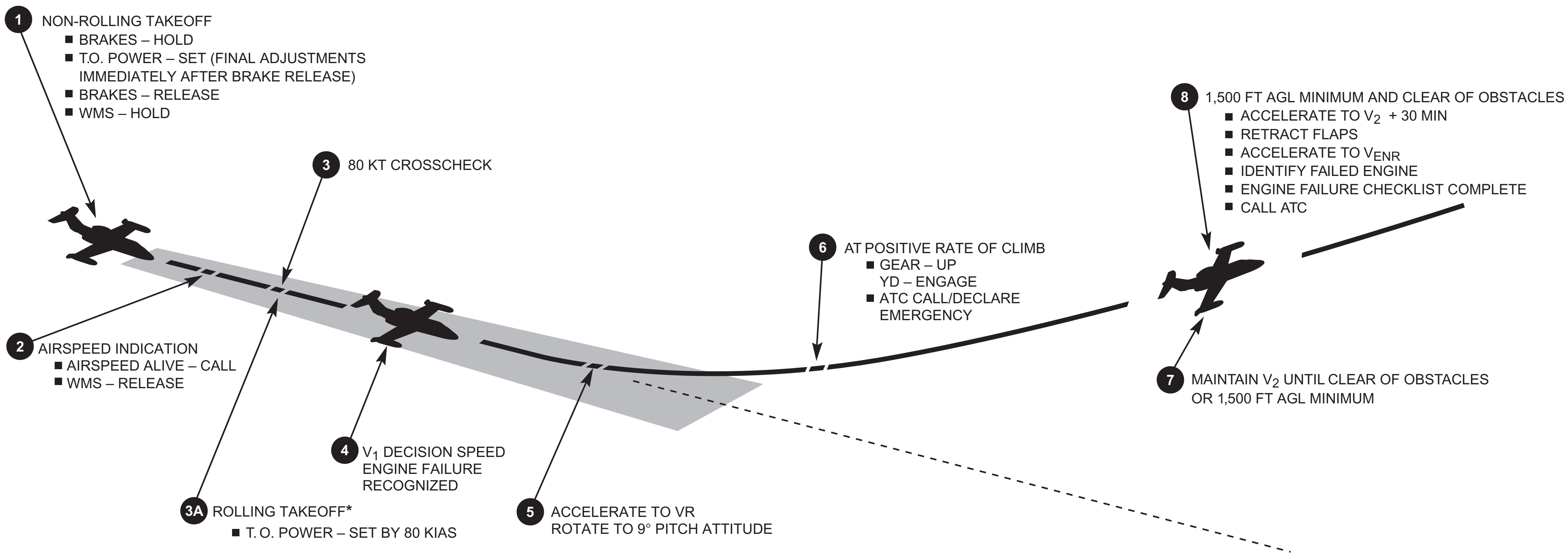


* The more comfortable rolling takeoff is accomplished when actual runway length is at least 10% longer than computed takeoff distance and obstacle clearance is not a factor. On a rolling takeoff if power is set beyond the computed takeoff distance then **the takeoff data is no longer valid**.

Rejected Takeoff



Engine Failure After V_1/Takeoff Continued

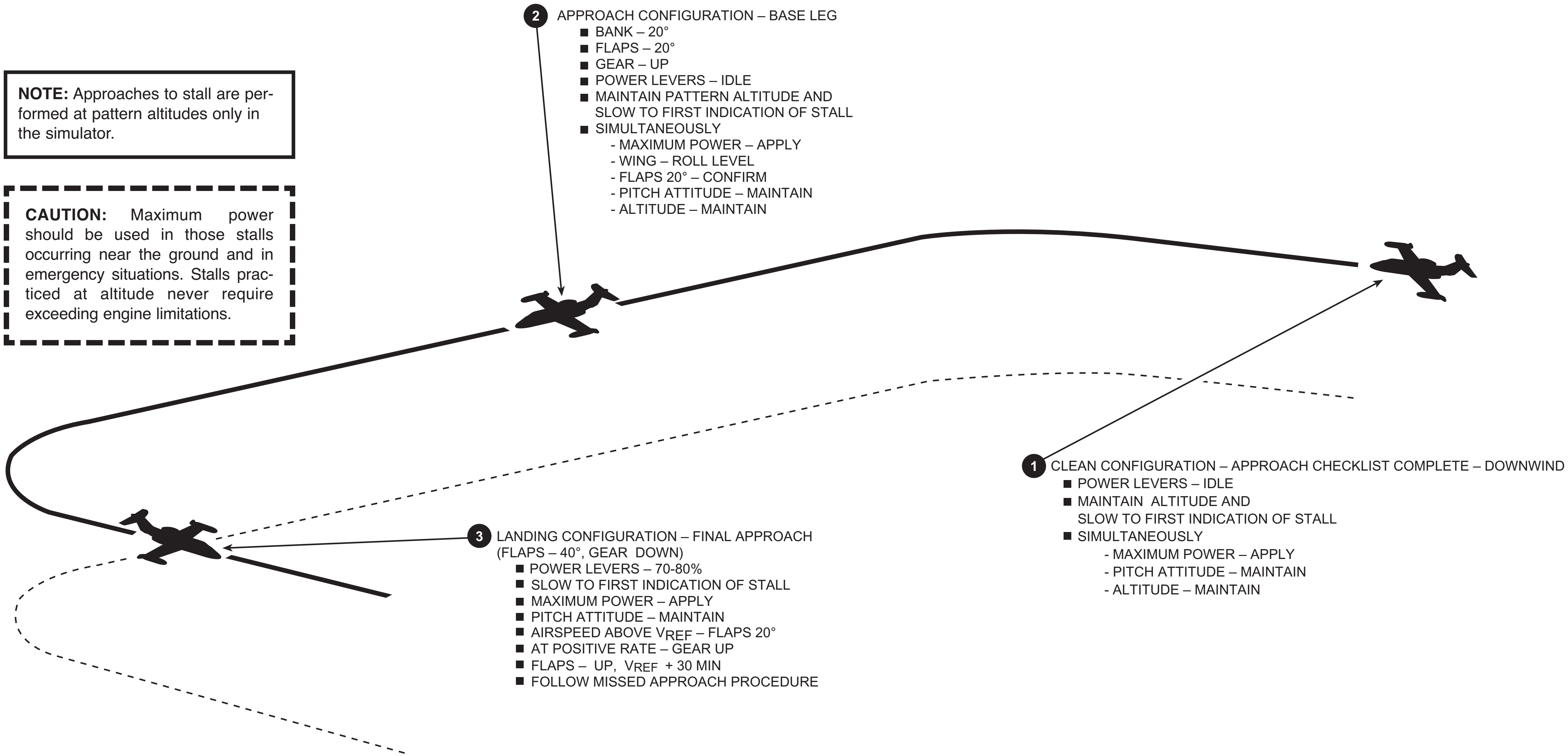


* The more comfortable rolling takeoff is accomplished when actual runway length is at least 10% longer than computed takeoff distance and obstacle clearance is not a factor. On a rolling takeoff if power is set beyond the computed takeoff distance then **the takeoff data is no longer valid**.

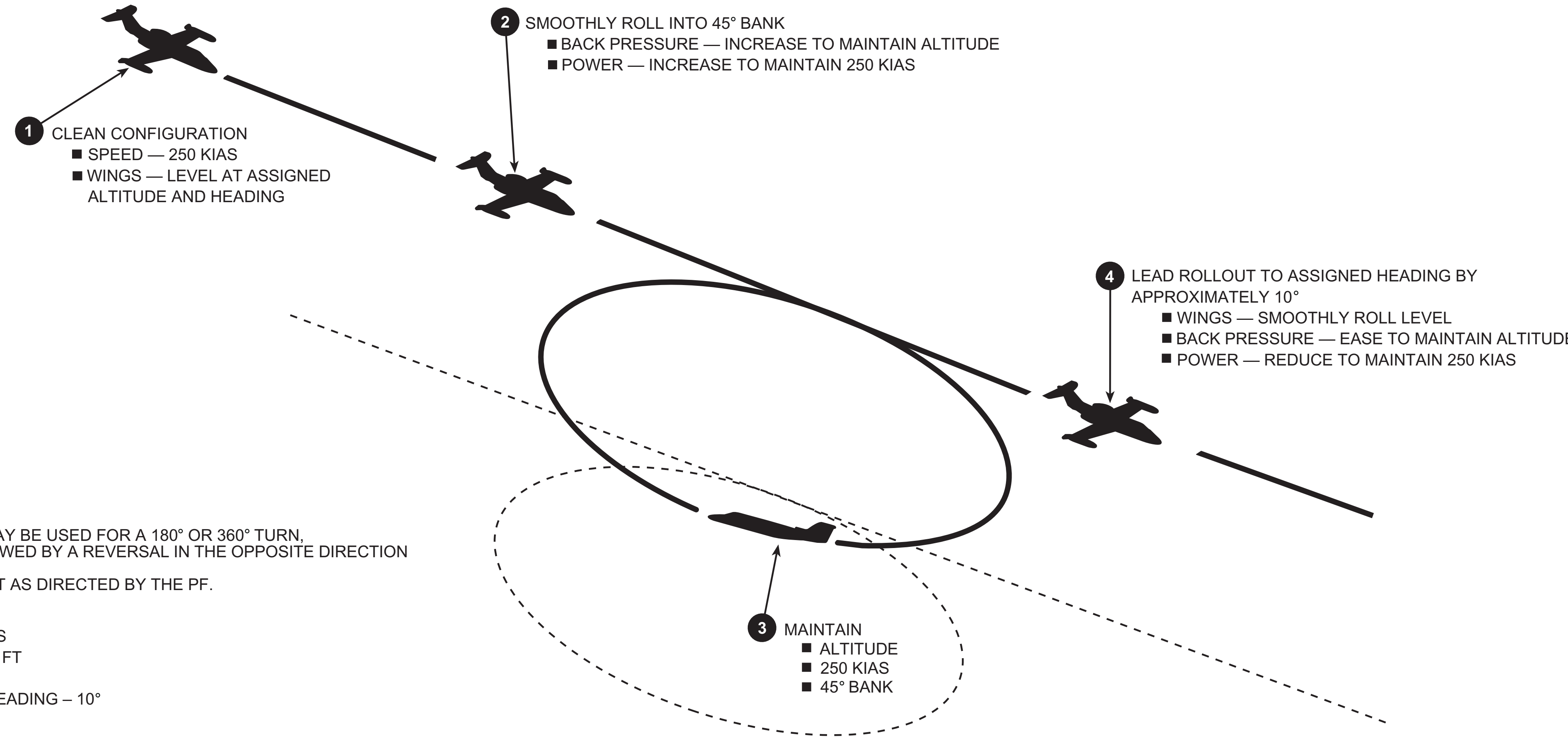
Approach to Stalls

NOTE: Approaches to stall are performed at pattern altitudes only in the simulator.

CAUTION: Maximum power should be used in those stalls occurring near the ground and in emergency situations. Stalls practiced at altitude never require exceeding engine limitations.



Steep Turns



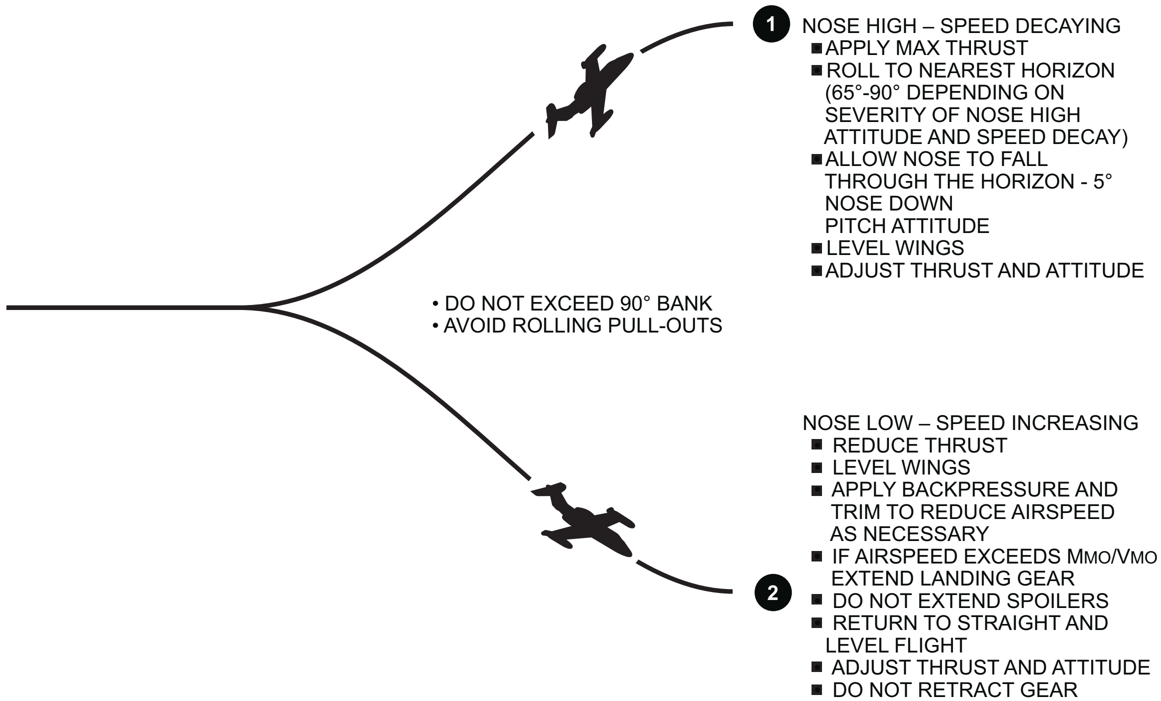
THIS MANEUVER MAY BE USED FOR A 180° OR 360° TURN, AND MAY BE FOLLOWED BY A REVERSAL IN THE OPPOSITE DIRECTION

THE PM MAY ASSIST AS DIRECTED BY THE PF.

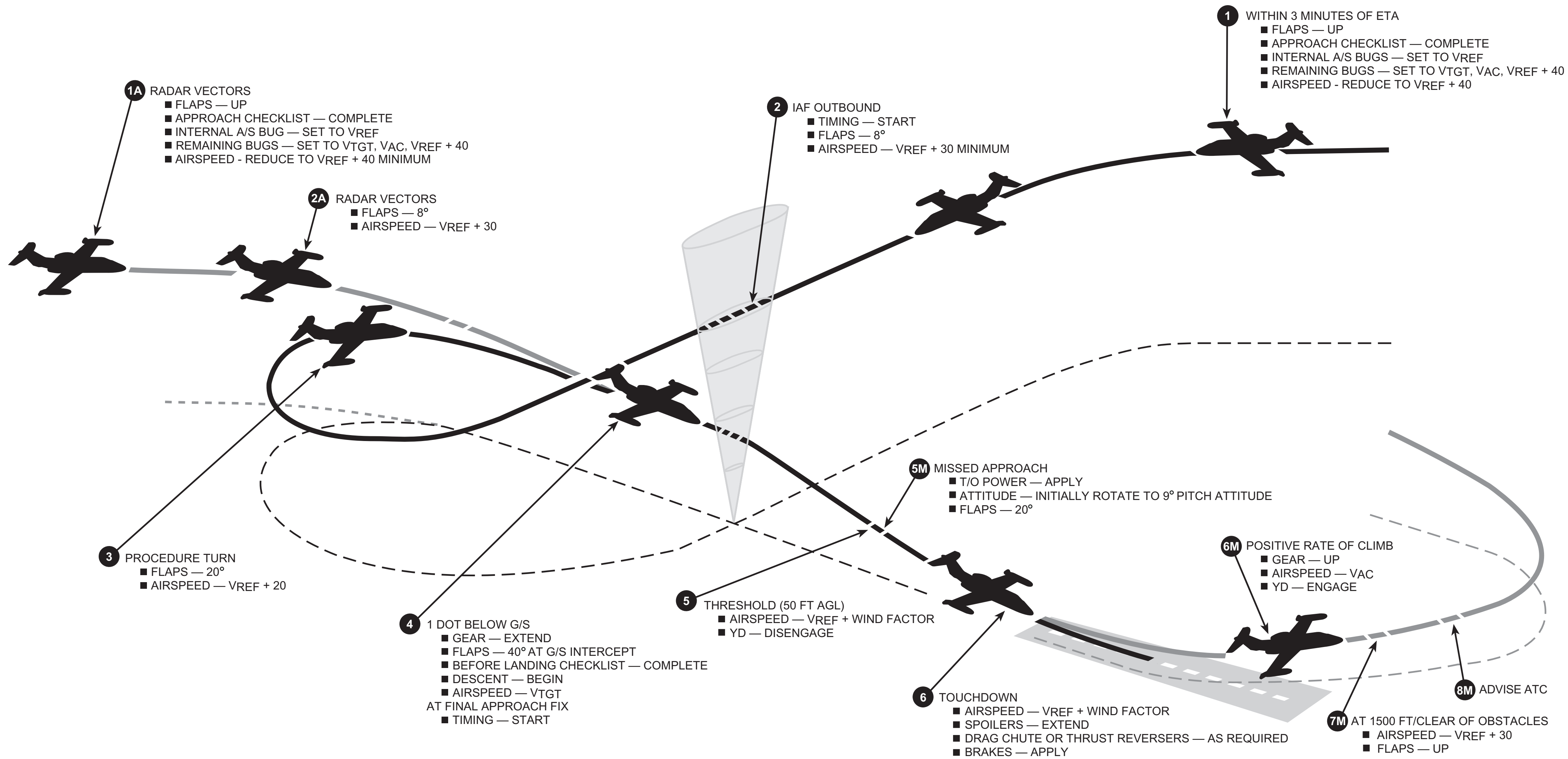
TOLERANCES ARE:

- SPEED – 10 KIAS
- ALTITUDE – 100 FT
- BANK – 5°
- ROLLOUT ON HEADING – 10°

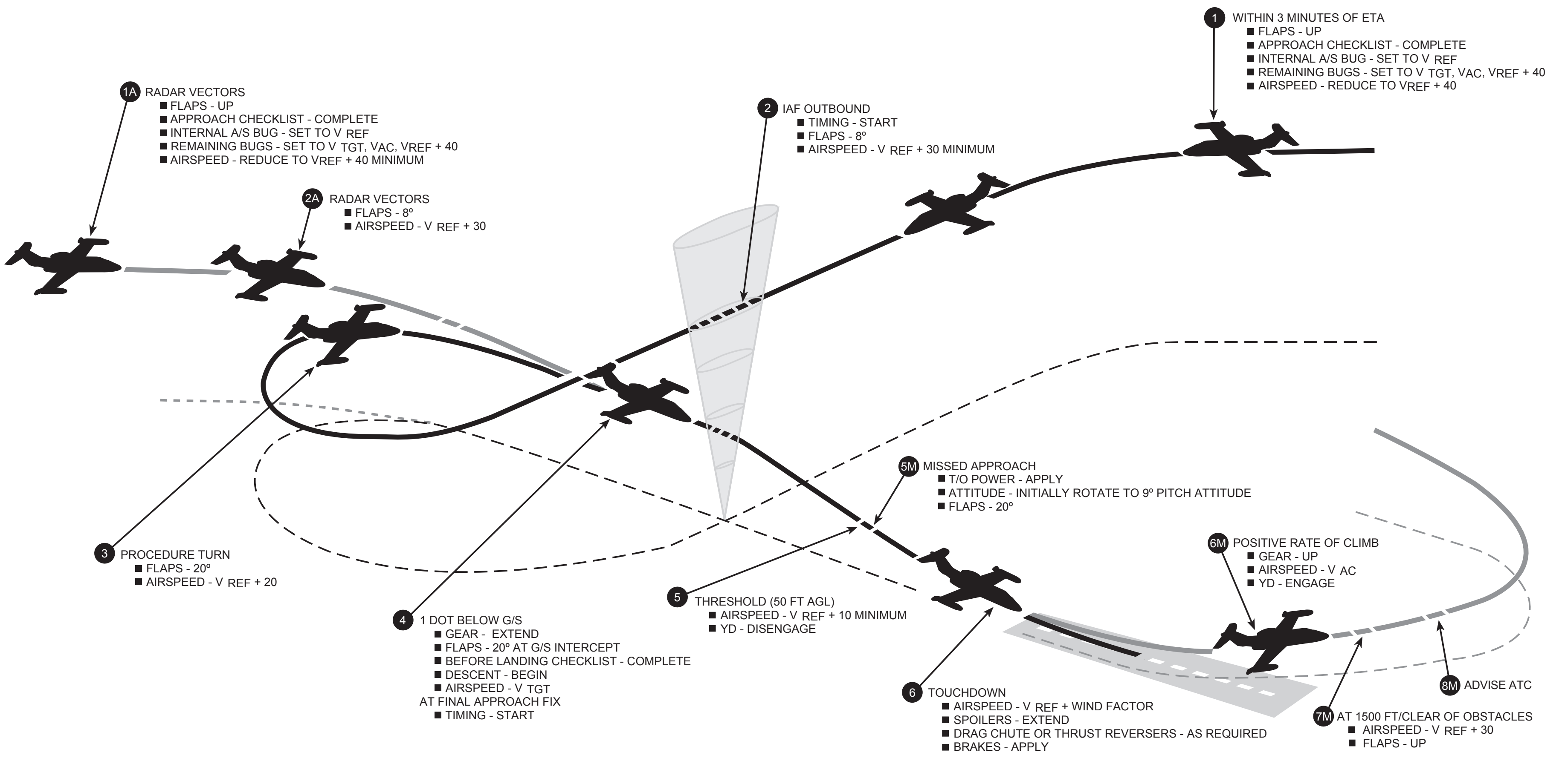
Unusual Attitude Recovery



Precision Approach/Missed Approach and Landing



Single Engine Precision Approach/Missed Approach and Landing



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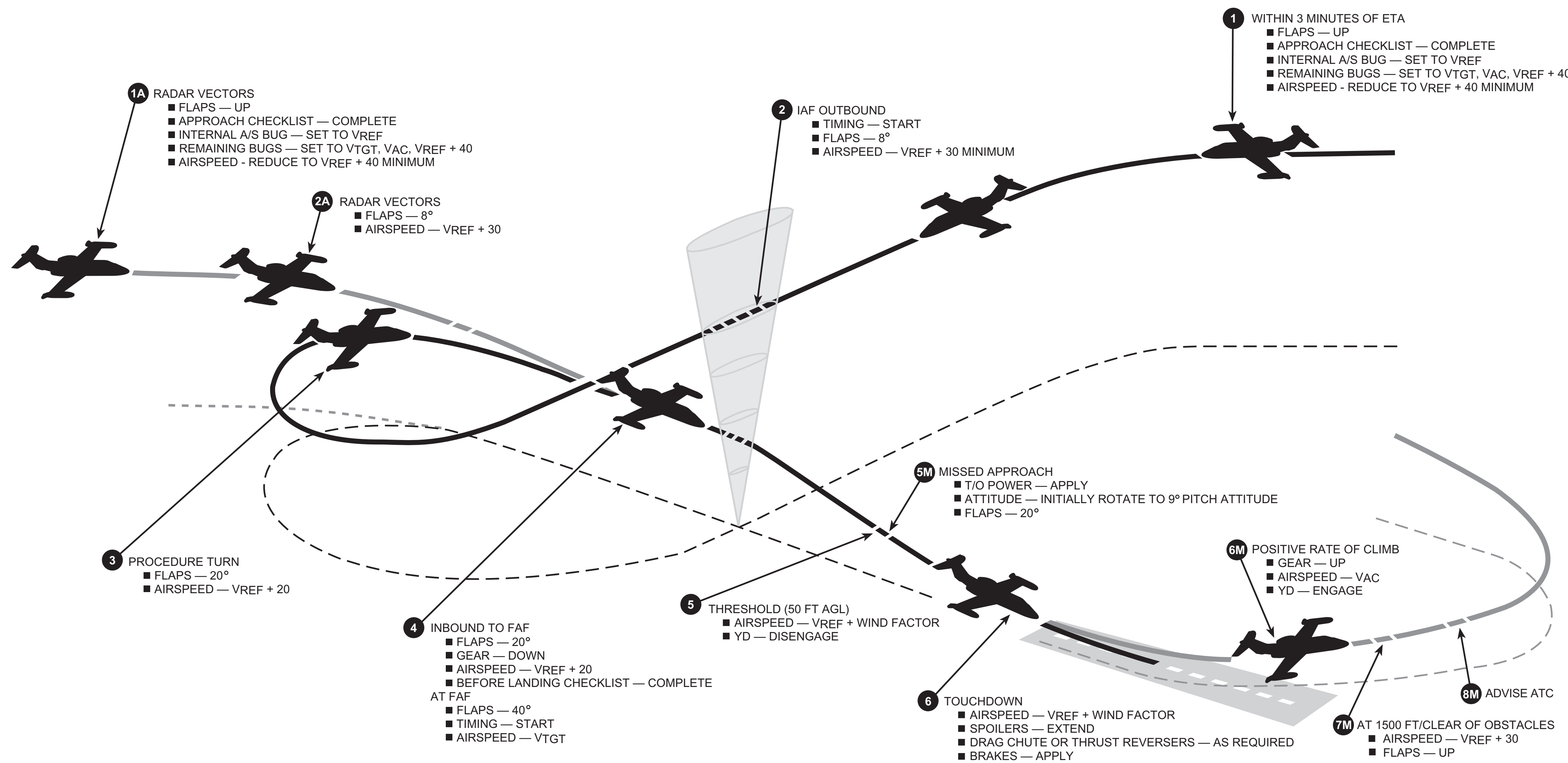
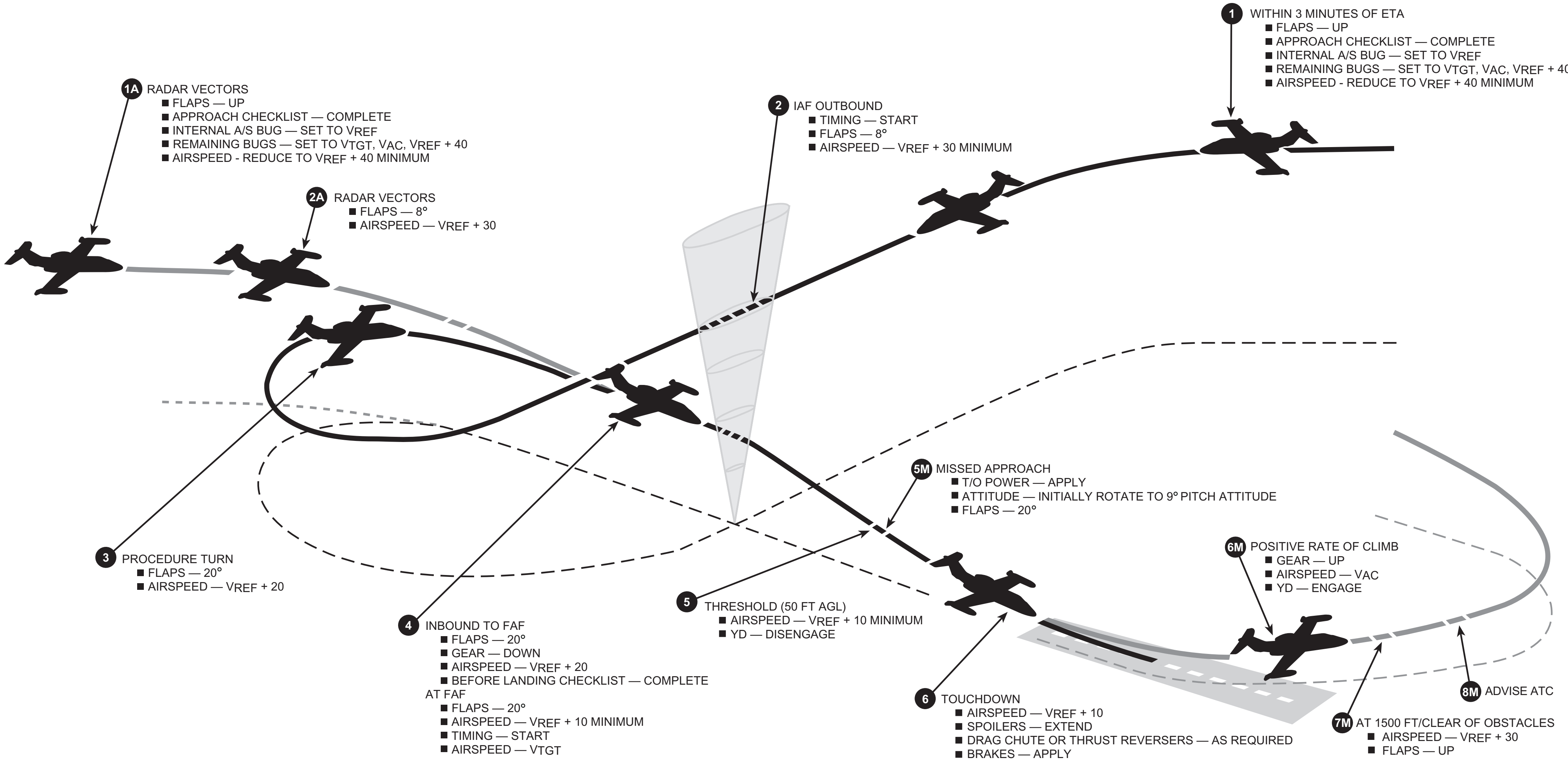
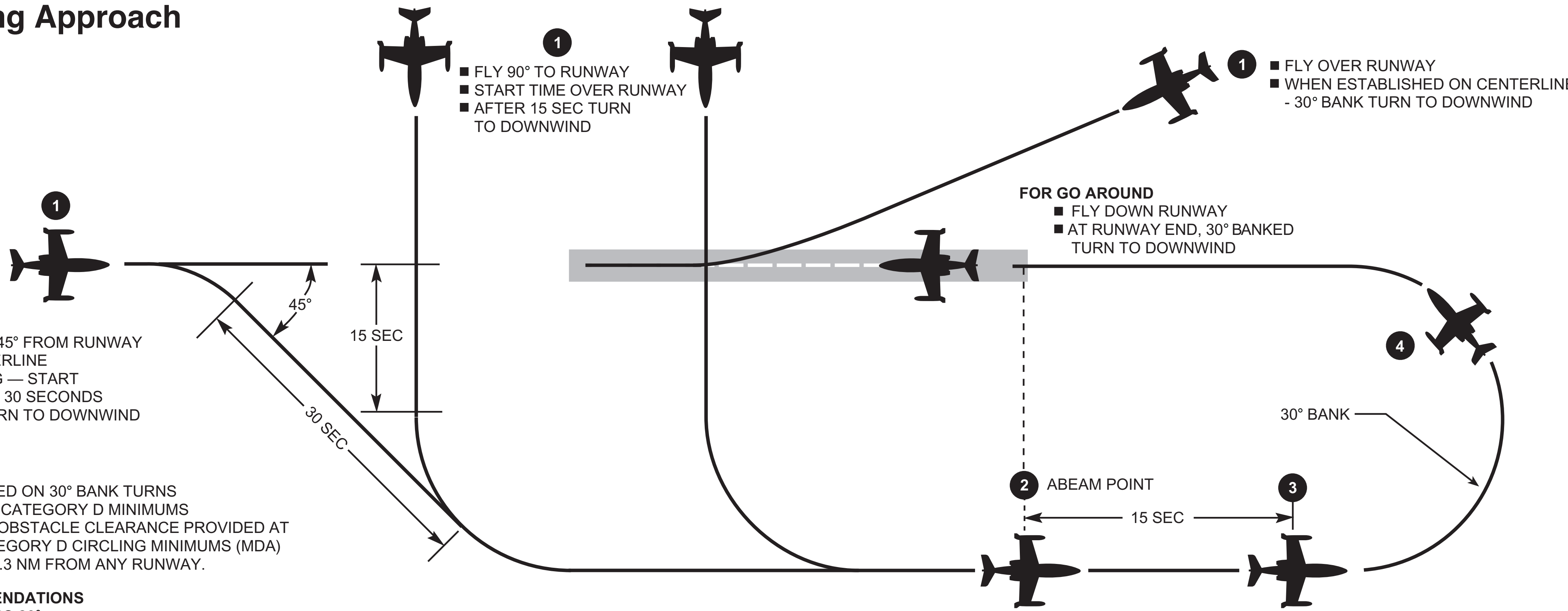
Non-Precision Approach/Missed Approach and Landing



Single Engine Non-Precision Approach/Missed Approach and Landing



Circling Approach



NOTES
- BASED ON 30° BANK TURNS
- USE CATEGORY D MINIMUMS
- 300' OBSTACLE CLEARANCE PROVIDED AT CATEGORY D CIRCLING MINIMUMS (MDA) TO 2.3 NM FROM ANY RUNWAY.

RECOMMENDATIONS
- FLAPS 20°
- GEAR DOWN
- SPEED V_{REF} + 20 MIN (MAINTAIN CONSTANT SPEED FOR TIMING)
- F/D ALTITUDE HOLD SELECT
- F/D HEADING SELECT
- SLIGHT ADJUSTMENTS TO TIME MAY BE USED TO ADJUST FOR HEADWINDS OR TAILWINDS.

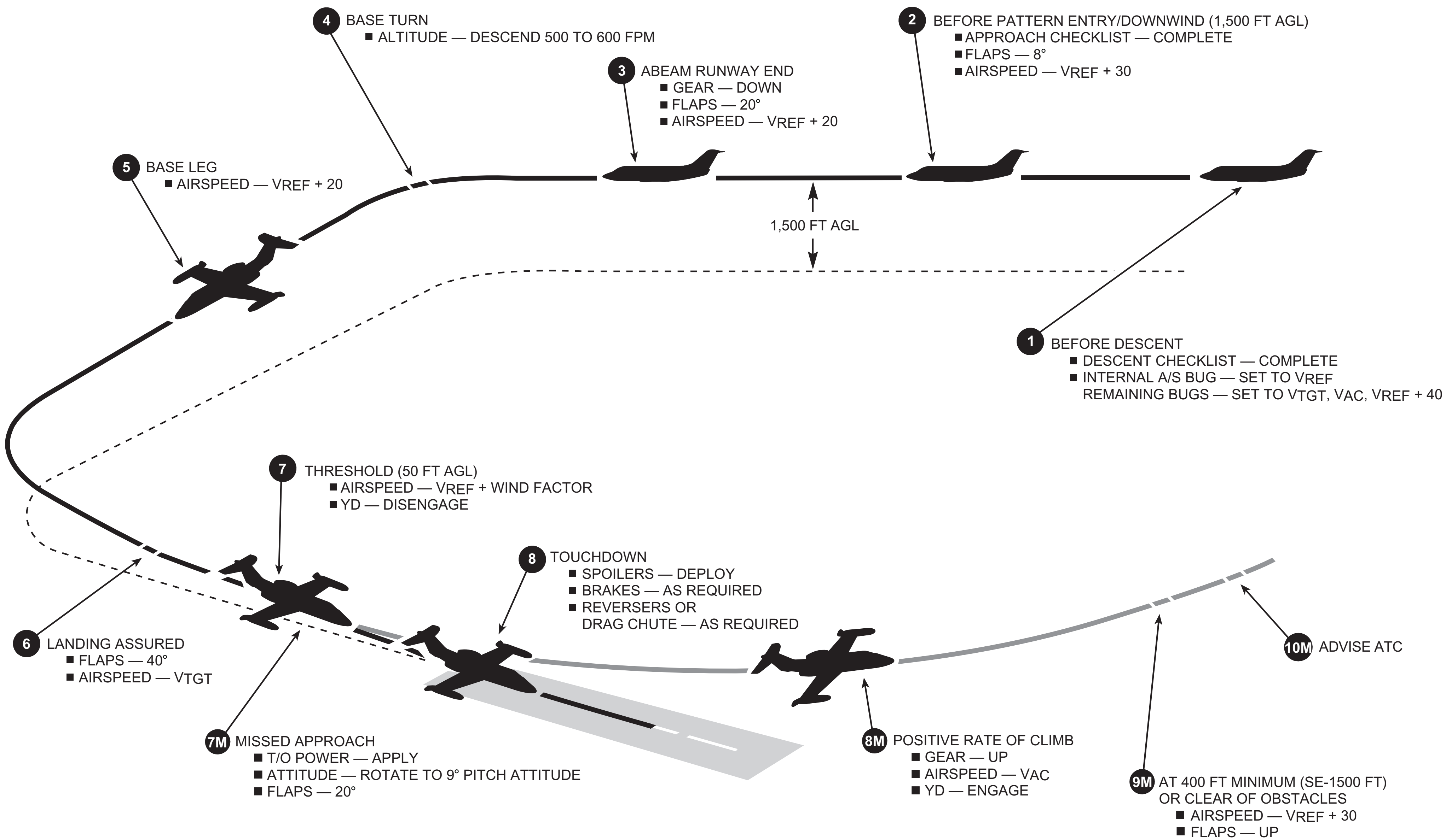
IF SIGHT OF RUNWAY IS LOST
- CLIMBING TURN TOWARD RUNWAY, THEN
- EXECUTE THE MISSED APPROACH PROCEDURE FOR THE APPROACH FLOWN

> **CAUTION:** FAR 91.175 re-quires immediate execution of the missed approach procedure when an identifiable part of the airport is not distinctly visible unless due to nor-mal banking during approach.

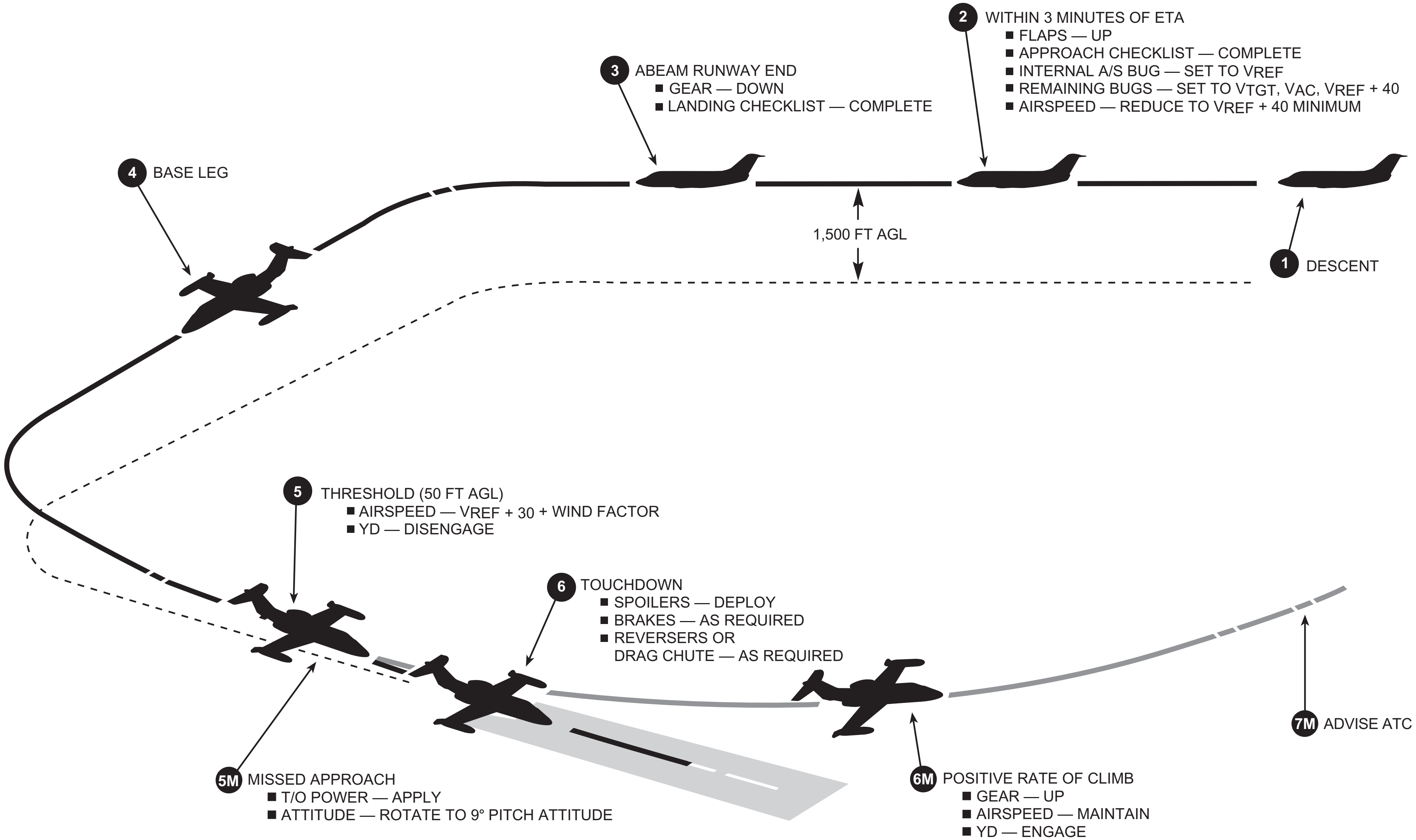
BASIC CIRCLING PATTERN

1. ENTER BASIC PATTERN AS APPROPRIATE FOR AIRCRAFT POSITION
2. START TIMING ABEAM APPROACH END OF RUNWAY
3. START TURN TO FINAL, 30° BANK
4. WITH RUNWAY IN SIGHT AND IN POSITION TO MAKE A NORMAL APPROACH TO LANDING
   - BEFORE LANDING CHECKLIST — COMPLETE
   - FLAPS 40°
   - DESCENT FROM MDA — BEGIN
   - SPEED — V_{TGT}
   - IF NOT IN A POSITION TO MAKE A NORMAL LANDING
     - GO-AROUND — PERFORM
   - AT THRESHOLD
     - SPEED — V_{REF} + WIND FACTOR
     - 50 FT AGL
   - YD — DISENGAGE

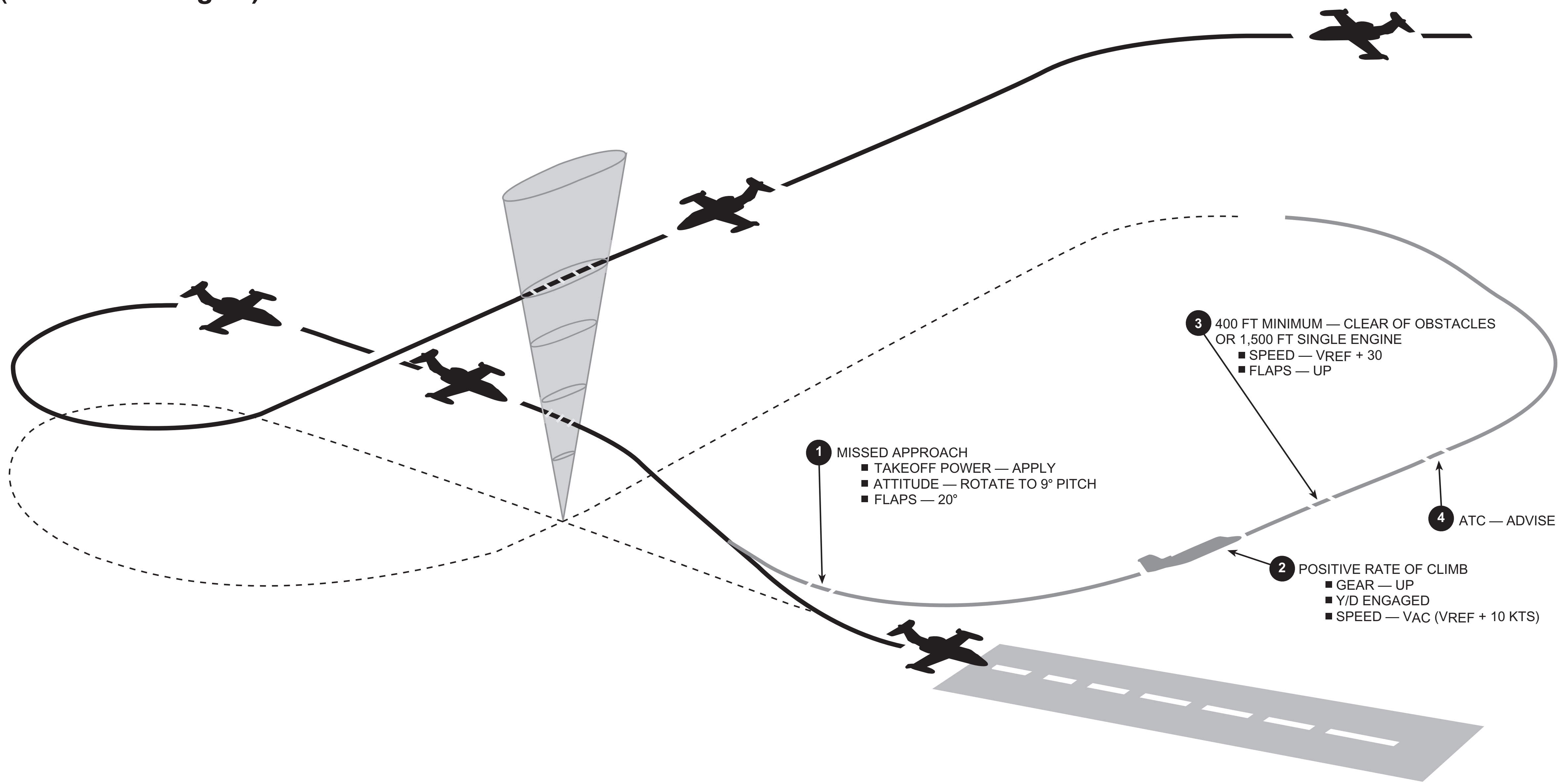
Visual Approach/Balked Landing



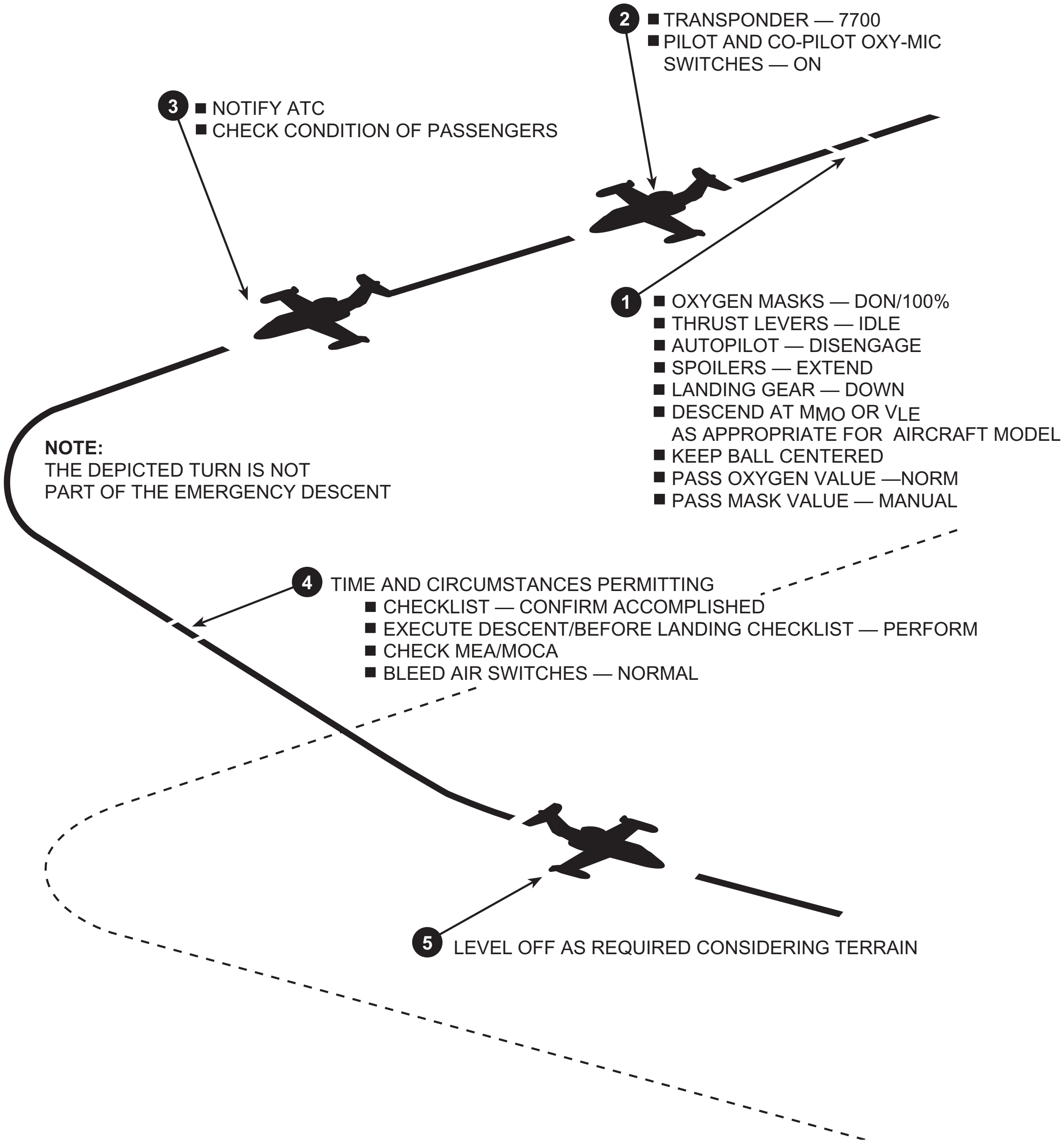
No Flap
Visual Approach/Balked Landing



Go-Around/Missed Approach/Balked Landing (One or Two Engine)



Emergency Descent



Limitations

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General Limitations

Authorized Operations

- The aircraft is certified for operations under the following conditions: VFR, IFR, day, night, and icing.
- On **Models 24D, 25B/C, and 25D/F with the XR Modification but without SB 44-10**, flight into known icing conditions is prohibited.

Certification Status

- FAR 25

Cabin Fixtures – Models 24D/E/F and 25B/C

- Swivel seats must face forward and be in the full outboard position (if applicable). The right rear seat must be in forward position during takeoff and landing.
- The card table, if installed, must be stowed during takeoff and landing.
- On **aircraft with a toilet**, the right forward seat must be full aft during takeoff and landing.
- On **aircraft with a toilet**, the door(s) must be stowed during takeoff and landing.
- On **Model 25C with one or more divans**, these must be in the most aft position for takeoff and landing.

Maneuvers

- No aerobatic maneuvers, including spins, are approved.
- On **Model 24E/F**, intentional stalls are prohibited above 18,000 ft with flaps and/or landing gear extended.

Minimum Flight Crew

- Pilot and Copilot

Noise Levels – Models 24D/E/F and 25D/F

The requirements of FAR 36 are equal to or more severe than the requirements outlined in ICAO Annex 16.

No determination has been made by the FAA that the noise levels in the AFM are or should be acceptable or unacceptable for operation at, into, or out of any airport.

The noise levels shown in **Table 3-A** represent reference conditions of standard atmospheric pressure at sea level, 77°F (25°C) ambient temperature, 70% relative humidity, and zero wind.

Takeoff and sideline noise levels were obtained at the maximum takeoff weight, climb speed, flap setting, anti-ice setting, engine setting, thrust cutback initiation, and cutback EPR shown in **Table 3-B**.

- Landing approach noise levels were established at the glideslope, gear setting, maximum landing weight, approach speed, and flap setting shown in **Table 3-C**. No special noise abatement procedures were used.

NOTE: Noise level data is not available for **Model 25B/C**.

Condition	24D with Original Wing[1]	24D with RAS Kit[2]	24E	24F	25D/F
Sideline	**104.0**	**103.7**	**103.9**	**103.7**	**103.7**
Takeoff	**91.9**	**85.8**	**84.3**	**85.8**	**90.1**
Approach	**96.7**	**95.3**	**95.3**	**95.3**	**95.2**

Table 3-A; Effective Perceived Noise Decibels (EPNdb)

[1] With or without Softflite

[2] With or without Softflite

Condition	24D	24E	24F	25D/F
Maximum Takeoff Weight (Lbs)	13,500	12,900	13,500	15,000
Climb Speed	V_2 + 10	V_2 + 27	V_2 + 27	V_2 + 27
Flap Setting	20	8	8	8
Anti-Ice	Off	Off	Off	Off
Engine Setting (all)	Takeoff	Takeoff	Takeoff	Takeoff
Thrust Cutback (Ft AGL)	3,988	4,600	4,275	3,400
Cutback EPR	1.91	1.78	1.72	1.78

Table 3-B; Takeoff Noise Level Determination Conditions

Condition	24D/E/F	25D/F
Glideslope	3°	3°
Gear	Down	Down
Maximum Landing Weight (Lbs)	11,880	13,300
Approach Speed	V_{REF} + 10	V_{REF} + 10
Flaps	40	40

Table 3-C; Approach/Landing Noise Level Determination Conditions

Maximum Number of Occupants (Models 24F and 25D/F)

- On **Model 24F S/N 24-350, 352 to 354, 356, and 357 with AMK 82-6**, the maximum number of occupants is limited to the pilot, copilot, and seven passengers.
- On **Model 25D/F**, the maximum number of occupants is limited to the pilot, copilot, and seven passengers for flights above 45,000 ft.

> **NOTE:** AMK 82-6; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 24F, 24-350, 352, 356, and 357**). Applies only to FL510 aircraft.

Smoking

- Smoking in the lavatory area with the privacy curtains closed is prohibited.
- Smoking is prohibited while the oxygen system is in use.

Aircraft/Wing/ XR Modification	Other Modifications	V_{MO} – Sea Level to 14,000 ft	V_{MO} – Above 14,000 ft	M_{MO}	M_{MO}, AFC/SS Inoperative	M_{MO}, Stick Puller Inoperative	M_{MO}, With Any BLEs Missing (if installed)	V_{LO}	V_{LE}	V_{FE}		
										10°	T.O./APPR or 20°	DN (40°)
24D – Original Wing	—	306	306	0.82	0.79	30,000 ft	0.78	201	264	—	193	151
24D – RAS Kit	—	308	306	0.82	0.79	0.74	0.78	202	266	—	193	153
24D – Mark II Wing	With 350 Kit With Preselect	306	358	0.82	0.79	0.74	—	202	264	258	204	151
	With 350 Kit Without Preselect	306	358	0.82	0.79	0.74	—	201	264	192	193	151
	Without 350 Kit With Preselect	306	306	0.82	0.79	0.74	—	201	264	258	204	151
	Without 350 Kit Without Preselect	306	306	0.82	0.79	0.74	—	201	264	192	193	151
24D – XR Modification	With 350 Kit With Preselect	308	360	0.82	0.79	0.74	0.78	202	265	258	208	153
	Without 350 Kit With Preselect	308	308	0.82	0.79	0.74	0.78	202	265	258	208	153
24E – Century III Wing	—	308	308	0.82	0.79	0.74	0.78	202	266	—	193	153
24F – Century III Wing	—	308	360	0.82	0.79	0.74	0.78	202	266	—	193	153
25B/C – Original Wing	—	306	306	0.82	0.78	30,000 ft	0.78	200	265	—	202	153
25B/C – RAS Kit	—	306	359	0.82	0.78	0.74	0.78	201	264	—	204	152
25B/C – Mark II Wing	With 350 Kit With Preselect	306	358	0.82	0.78	0.74	—	200	265	258	202	153
	With 350 Kit Without Preselect	306	358	0.82	0.78	0.74	—	200	265	201	202	153
	Without 350 Kit With Preselect	306	306	0.82	0.78	0.74	—	200	265	258	202	153
	Without 350 Kit Without Preselect	306	306	0.82	0.78	0.74	—	200	265	201	202	153
25B/C – XR Modification	With 350 Kit With Preselect	306	358	0.82	0.78	0.74	0.78	200	264	256	203	152
	Without 350 Kit With Preselect	306	306	0.82	0.78	0.74	0.78	200	264	256	203	152
25D/F – Century III Wing	—	306	359	0.82	0.78	0.74	0.78	201	264	—	204	152
25D/F – XR Modification	With 350 Kit With Preselect	306	358	0.82	0.78	0.74	0.78	200	264	256	203	152

NOTE: Turbulent Air Penetration Speeds – 0.73/250 for all aircraft; Single Engine Climb Speeds or Driftdown – 170K.0,54M/200 kts for all aircraft except Models B/C, which is 220 kts.

Table 3-D; Airspeed Limits, All Aircraft

Operational Limitations

Center-of-Gravity

- The center-of-gravity for all flight conditions must be maintained within the applicable Center-of-Gravity envelope (**Figure 3-1**, following page) in AFM Section I (or applicable supplement).
- On **Models 25B/C and 25D/F**, the normal empty weight center-of-gravity may be aft of the flight limit.

> **NOTE:** The Center-of-Gravity envelope in **Figure 3-1** is typical; it does not apply to all Learjet 24/25 aircraft. For the chart that applies to a specific aircraft, refer to the AFM for that aircraft.

Load Limits

Flaps Up . . . . +3.0 TO -1.0 G

Flaps Down . . . . +2.0 TO 0.0 G

These acceleration values limit the bank angle in a level coordinated turn to 70° (flaps up) and 60° (flaps down). In addition, limit pullups and pushovers to these values.

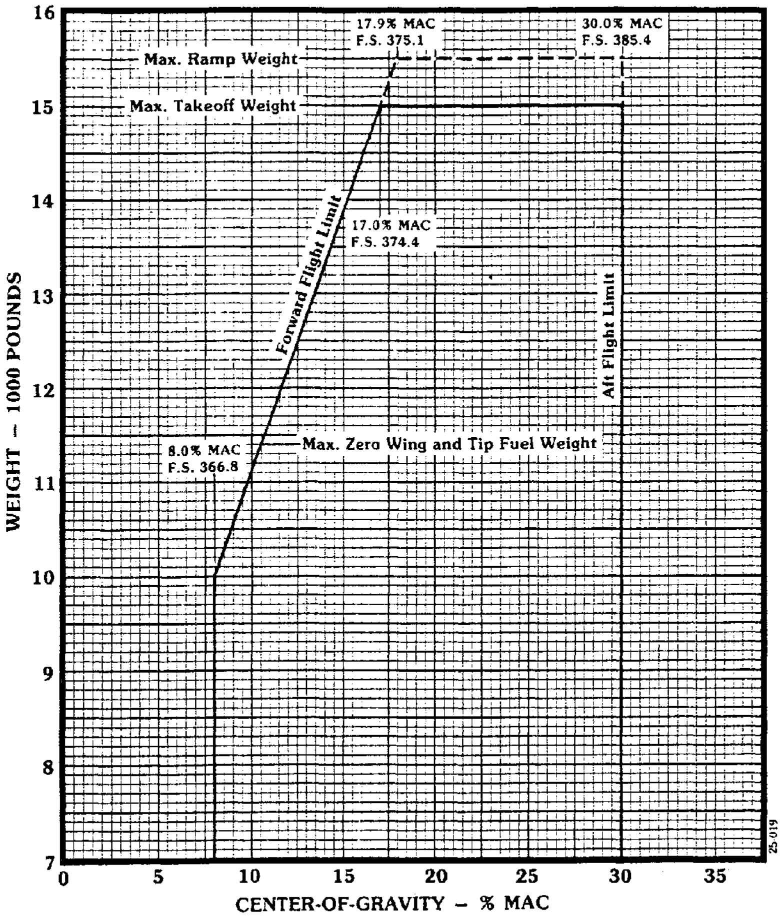
Speed Limitations

For a summary of all speed limitations, see **Table 3-D**.

V_1, Critical Engine Failure

- Refer to the applicable Critical Engine Failure Speed V_1 figure in AFM Section IV (**Models 24D, 24E/F, and 25B/C**), Section V (**Model 25D/F**), or supplement, as appropriate.

Center-of-Gravity – Learjet 25D/F



Forward Flight Limit: F.S. 366.8 (8.0% MAC) for all weights up to and including 10,000 lbs (4,536 kg) and tapers to F.S. 374.4 (17% MAC) at 15,000 lbs (6,804 kg).

Aft Flight Limit: F.S. 385.4 (30.0% MAC) for all weights up to and including 15,000 lbs (6,804 kg).

3-1

V_2, Takeoff Safety

- For **Model 25D/F**, refer to the applicable Engine Out Safety Speed V_2 figure in AFM Section V.
- For **Models 24D, 24E/F, and 25B/C**, refer to the applicable Takeoff Safety Speed V_2 figure in AFM Section IV.
- For **aircraft with the XR modification**, refer to the applicable Takeoff Speed Schedules in Section IV of the AFM supplement.

V_A, Maneuvering

- Refer to the applicable Airspeed/Mach Limits (or Airspeed Limits) in AFM Section I.
- For **aircraft with the XR modification or Mark II Wing**, refer to the applicable Airspeed Limitations in Section I of the applicable AFM supplement.

V_{FE}, Maximum Flap Extended

Refer to **Table 3-D**.

V_{LE}, Maximum Landing Gear Extended

Refer to **Table 3-D**.

V_{LO}, Maximum Landing Gear Operating

Refer to **Table 3-D**.

V_{MCA}, Minimum Control – Air

Model 25D/F:

Without XR Modification . . . . 102 KIAS

With XR Modification. . . . . 97 KIAS

Model 25B/C:

Original Wing
(**With or Without 350K V_{MO} Kit**) . . . . 102 KIAS

Mark II Wing
(**With or Without 350K V_{MO} Kit**) . . . . 102 KIAS

XR Modification. . . . . 97 KIAS

Model 24D:

Original Wing (**With or Without Softflite 1**) . . . . . 108 KIAS

RAS Kit (**With or Without Softflite**) . . . . 103 KIAS

Mark II Wing
(**With or Without 350K V_{MO} Kit**) . . . . .85.5 KIAS

XR Modification. . . . . 83 KIAS

Model 24E/F With Century III Wing. . . . . 103 KIAS

- For **Model 25D/F with the XR Modification (S/Ns 25-230 to 341, 343 to 362 with AMK 81-12; 25-342, 363 and subsequent**), the minimum speed above 31,000 ft is defined by the Engine Stall Warning line on the applicable Airspeed Limitations figure in Section I of the AFM supplement.
- On **Model 25B/C with Mark II Wing and 350K V_{MO} kit**, the air minimum control speed is not greater than stall speed at the minimum takeoff gross weight scheduled in the AFM. V_{MCA} is not a limitation on V_R or V_2.
- Each of the above speeds is a maximum, which occurs at sea level and -18°C (0°F). On **Models 24D/E/F, 25B/C**, see AFM Section IV for appropriate values. On **Model 25D/F**, see AFM Section V for appropriate values.

> **NOTE:** The Center-of-Gravity envelope in **Figure 3-1** is typical; it does not apply to all Learjet 24/25 aircraft. For the chart that applies to a specific aircraft, refer to the AFM for that aircraft.

V_{MCG}, Minimum Control – Ground

Model 25D/F . . . . 100 KIAS

XR Modification . . . . SEE BELOW

Model 25B/C:

Original Wing. . . . . 100 KIAS

Mark II Wing . . . . SEE BELOW

XR Modification . . . . SEE BELOW

Model 24E/F . . . . 104 KIAS

Model 24D:

Original Wing (**With or Without Softflite 1**) . . . . . 109 KIAS

RAS Kit (**With or Without Softflite**) . . . . 104 KIAS

Mark II Wing . . . . SEE BELOW

XR Modification . . . . SEE BELOW

On **Models 24D, 25B/C, and 25D/F with the XR Modification**, see the Minimum Control Speed Ground V_{MCG} figure in Section I of the AFM supplement.

On **Models 24D and 25B/C with Mark II wings**, see the Minimum Control Speed, Ground V_{MCG} figure in AFM Section I.

Each of the above speeds is a maximum, which occurs at sea level and -18°C (0°F). On **Models 24D/E/F**, see AFM Section IV for appropriate values. On **Model 25D/F**, see AFM Section V for appropriate values.

V_{MO}/M_{MO}, Maximum Operating

- See **Table 3-D**.
- Do not deliberately exceed V_{MO}/M_{MO} in any flight condition except where specifically authorized for flight test or in approved emergency procedures.
- See the applicable Airspeed/Mach Limits (or Airspeed Limits) figure in AFM Section I.
- Observe the Warning at left.

> **WARNING:** Do not Extend spoilers or operate with spoilers deployed at speeds above V_{MO}/M_{MO} due to significant nose-down pitching moment associated with spoiler deployment.

V_R, Rotation

Refer to the applicable Rotation Speed V_R figure in AFM Section IV or V, as appropriate.

Minimum Speed – Model 24E/F and 25D/F S/N 230 and subsequent

On **Models 24E/F and 25D/F with AMK 81-12 or AMK 82-6** (as applicable), engine stall limit defines the minimum speed above 31,000 ft; see the Airspeed Limits figure in AFM Section I.

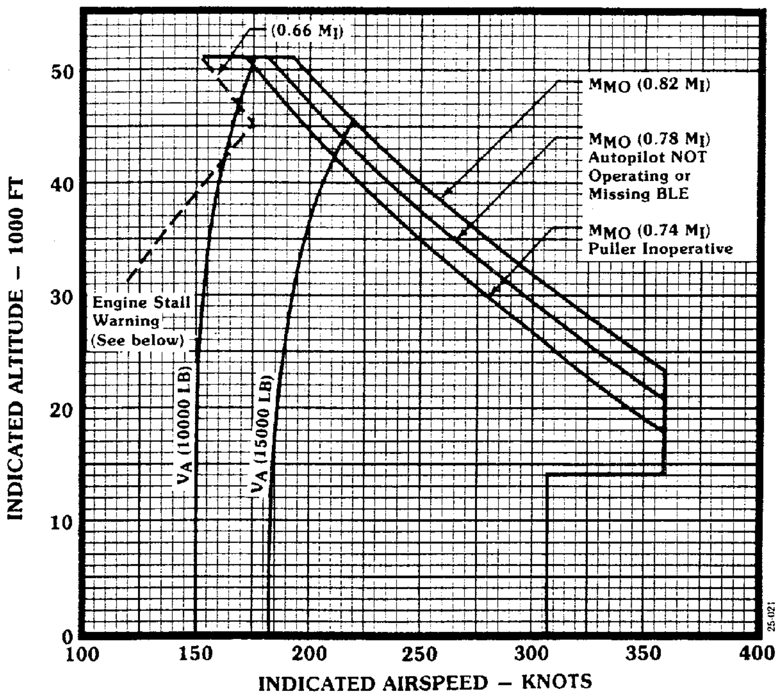
> **NOTE:** AMK 81-12; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 25, 25-230 to 25-341; 25-343 to 25-362, except 25-337**).
>
> AMK 82-6; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 24F, 24-350, 352, 353, 354, 356, 357**).

Tire Limiting Groundspeed

Main Tires . . . . 182 KTS

Airspeed/Mach Limits – Learjet 25D/F

Aircraft Certified for 51,000 ft Maximum Altitude



Engine stall warning defines minimum airspeed above 31,000 ft.
At lower altitudes, shaker and pusher operation determines minimum airspeed.

3-2

> **NOTE:** The Airspeed/Mach Limits chart is typical; it does not apply to all Learjet 24/25 aircraft. For the chart that applies to a specific aircraft, refer to the AFM for that aircraft.

Weights

Maximum Ramp Weight

Models 25B/C and 25D/F:

Without XR Modification . . . . 15,500 LBS

With XR Modification. . . . . 16,800 LBS

Model 24F . . . . 13,800 LBS

Model 24E:

Without AAK 85-4 . . . . 13,200 LBS

With AAK 85-4 . . . . 13,800 LBS

> **NOTE:** AAK 85-4; Addition of Fuselage Fuel Tank and Increase T.O.G.W. (**Model 24E**).

Model 24D:

Without XR Modification . . . . 13,800 LBS

With XR Modification. . . . . 15,300 LBS

- On **Model 25B/C/D/F without the XR Modification**, ramp weight shall not exceed maximum allowable takeoff weight by more than 500 lbs.
- On **Model 25B/C/D/F with the XR Modification**, the maximum ramp weight shall not exceed the maximum allowable takeoff weight by more than 500 lbs (or 300 lbs when operating as a small aircraft under FAR 135).
- On **Model 24D/E/F**, ramp weight shall not exceed maximum allowable takeoff weight by more than 300 lbs.

Maximum Certified Takeoff Weight

Model 25B/C/D/F:

Without XR Modification . . . . 15,000 LBS

With XR Modification. . . . . 16,300 LBS

Model 24F . . . . 13,500 LBS

Model 24E:

Without AAK 85-4 . . . . 12,900 LBS

With AAK 85-4. . . . . 13,500 LBS

Model 24D:

Without XR Modification . . . . .13,500 LBS

With XR Modification. . . . . 15,000 LBS

- The takeoff weight is limited by the most restrictive of the following:
  - maximum certified takeoff weight
  - maximum takeoff weight for altitude and temperature to observe climb and brake energy limits identified in AFM Section IV (or V, as appropriate)
  - takeoff field length as determined from the applicable figure in AFM Section IV (or V, as appropriate)
  - maximum takeoff weight for obstacle clearance as determined from the applicable figures in AFM Section IV (or V, as appropriate) to observe FARs 121 and 135 (U.S.-registered aircraft).

Maximum Certified Landing Weight

Model 25B/C/D/F:

Without XR Modification . . . . 13,300 LBS

With XR Modification. . . . . 13,700 LBS

Model 24E/F . . . . 11,880 LBS

Model 24D:

Without XR Modification . . . . 11,880 LBS

With XR Modification. . . . . 12,630 LBS

- The landing weight is limited by the most restrictive of the following:
  - maximum certified landing weight
  - maximum approach, balked landing climb, and landing weight for altitude and temperature as determined from the respective figures in AFM Section IV (or V, as appropriate).

On **aircraft with the XR modification**, brake energy is not limiting.

Perform a Hard or Overweight Landing inspection per the Maintenance Manual if the maximum certified landing weight is exceeded.

Maximum Zero Wing and Tip Fuel Weight – Maximum Wing Bending Weight

All Aircraft . . . . 11,400 LBS

- All weights in excess of 11,400 lbs must consist of wing and tip tank fuel.

Takeoff and Landing Operational Limits

Demonstrated Crosswind Component

Model 25 D/F:

Without XR Modification . . . . 30.5 KTS

With XR Modification. . . . . 28.5 KTS

Model 25B/C:

Original Wing (**With or Without Softflite 1**) . . . . . 28.5 KTS

Mark II Wing . . . . 28.5 KTS

RAS Kit (**With or Without Softflite**) . . . . 30.5 KTS

XR Modification. . . . . 28.5 KTS

Model 24E/F . . . . 25.9 KTS

Model 24D:

Original Wing (**With or Without Softflite 1**) . . . . . 28.5 KTS

RAS Kit (**With or Without Softflite**) . . . . 25.9 KTS

Mark II Wing . . . . 28.5 KTS

XR Modification. . . . . 28.5 KTS

Engine Synchronizer

- On **Models 24D (24-273 and subsequent), 24E/F, 25B/C (25-134 and subsequent), and 25D/F**, the engine synchronizer, **if installed**, must be off for takeoff,8 landing, single-engine operation, and below 70% RPM.
- On **Models 24D (prior to 24-273) and 25B/C (prior to 25-134)**, the engine synchronizer, **if installed**, must be off for takeoff, landing, descent, single-engine operation, and below 70% RPM.

Maximum Pressure Altitude for Takeoff

All Aircraft . . . . 10,000 FT

Maximum Nosewheel Steering Speed

Models 24D/E/F and 25B/C/D/F with Variable Authority Nosewheel Steering:

Maximum . . . . 45 KTS

Model 24D With Both Inboard Anti-Skid Generators Inoperative . . . . 10 KTS

Model 25B/C/D/F With Any Two of the Following Three Anti-Skid System Lights Illuminated: Two Inboard and Right Outboard . . . . 10 KTS

Models 24D and 25B/C with PRI STEER Switch:

Pri Steer . . . . 10 KTS

Wheel Master . . . . 45 KTS

Maximum Tailwind Component

All Aircraft . . . . 10 KTS

Minimum Fuel Load for Takeoff/ Intentional Go-Around

- A minimum fuel load of 600 lbs in each wing is required for takeoff and intentional go-around.
- On **aircraft with the XR Modification**, takeoffs are prohibited with less than 1,000 lbs of wing fuel per side. Engine-driven motive-flow transfer jet pumps pump the lower half of the tip tank fuel into the wing fuel sumps; the upper half of the tip tank fuel gravity flows into the wing tanks. Engine fuel consumption during takeoffs can exceed the output of the tip tank transfer pumps; a low fuel quantity light and engine fuel starvation may result if wing tank quantities are less than 1,000 lbs.

Pressurization

Do not take off or land with the cabin pressurized.

Runway Conditions

Do not operate if water and/or slush accumulation on the runway exceeds 3/4 inch (19 mm).

Seat Belts/Shoulder Harnesses

Seat belts and shoulder harnesses must be worn during takeoff and landing.

System Temperature

- For **Models 24D/E/F and 25B/C**, use the performance for the lowest temperature shown if OAT is below the lowest temperature on the performance charts.
- When OAT is below -25°C (-13°F), operate the engines for three minutes prior to takeoff to bring the hydraulic system up to normal operating temperature.

Temperature Limits (At Sea Level)

All Aircraft . . . . -54°C AND +50°C (-65°F AND +122°F)

- On the following aircraft, maintain an indicated RAT of -31°C or warmer above 45,000 ft
  - **Model 25D/F (25-230 to 254 and 262) without SB 24/25-287**
  - **Model 24F (24-350 to 356 except 351 and 355) without SB 24/25-287**

Tip Tank Fuel for Landing

- Maximum tip tank fuel for landing is 800 lbs (363 kg) each tip tank.

Enroute Operational Limits

Maximum Operating Altitude

MODEL	DIFFERENCES	Altitude (ft)
25D/F	25-206 to 229; 25-230 to 336; 338 to 341, 343 to 362 without AMK 81-12	45,000
	25-230 to 336, 338 to 341, 343 to 362 with AMK 81-12 25-337, 342, 363 and subsequent	51,000
25B/C	Stick Puller Operative Stick Puller Inoperative	45,000 30,000
24E/F	24-329 to 349, 351, and 355; 24-350, 352 to 354, 356, and 357 without AMK 82-6	45,000
	24-350, 352 to 354, 356, and 357 with AMK 82-6	51,000
24D	Stick Puller Operative Stick Puller Inoperative	45,000 30,000

Table 3-E; Maximum Operating Altitude

NOTE: AMK 81-12; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 25D/F, 25-230 to 341, 343 to 336, 338 to 362**).

AMK 82-6: Installation of Engine Stall Warning Box and Air Data Sensor (**Model 24F, 24-350, 352 to 354, 356, and 357**).

SB 24/25-287; Increase Engine Stall Margin at High Altitudes (**Model 24E/F, 24-350, 352, 353, 354, 356; Model 25D/F, 25-230 to 254, 262**).

Systems Limitations

Avionics

Autopilot Monitor Checks

- On **Model 25D/F**, the Before Starting Engines Autopilot Monitors check must be accomplished according to AFM Section II to assure proper autopilot operation if autopilot use is intended.
- On the following **Model 25D/F with the XR Modification**, the Autopilot Pitch Monitor checks in the Before Taxiing procedures of AFM Section II must be completed successfully before each flight if autopilot use is intended.
  - **25D/F, 25-230 to 362 (except 342) with AMK 81-12 and Teledyne AOA**
  - **25D/F, 25-342, 363 and subsequent when equipped with Teledyne AOA**
- On **Models 24D/E/F and 25B/C**, the Before Taxiing Autopilot Monitor check(s) of AFM Section II must be successfully completed prior to each flight if autopilot use is intended.

> **NOTE:** AMK 81-12; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 25D/F, 25-230 to 341, 343 to 336, 338 to 362**).

J.E.T. FC-110 Automatic Flight Control Stability System (AFC/SS) for Models 24D/E/F

- Maximum speed is V_{MO}/M_{MO}.
- The autopilot system is approved for Category I ILS approaches.
- Minimum altitude for use of AFC/SS with aircraft configured for cruise is 1,000 ft AGL.
- Minimum altitude for use of AFC/SS with aircraft configured for approach is 200 ft AGL.

- Do not use AFC/SS pitch and roll axes for takeoff or landing.
- Do not extend spoilers with AFC/SS engaged.
- When using AFC/SS, the pilot or copilot must be in the respective seat with seat belt fastened.
- On **Model 25D/F**, disengage AFC/SS ALT and SPD hold functions if icing, heavy precipitation, or moderate or severe turbulence is encountered.
- On **Model 24D (original or Softflite 1 wing)**, disengage ALT hold function if icing, heavy precipitation, or moderate or severe turbulence is encountered.

J.E.T. FC-110 Automatic Flight Control Stability System (AFC/SS) for Model 25B/C/D/F

- Maximum speed is V_{MO}/M_{MO}.
- The autopilot system is approved for Category I ILS approaches.
- AFC/SS pitch and roll axes must not be used for takeoff or landing.
- The AFC/SS must be engaged at speeds faster than 0.78 M_I.
- Do not extend spoilers with AFC/SS engaged.
- When using AFC/SS, the pilot or copilot must be in the respective seat with seat belt fastened.
- Disengage AFC/SS ALT and SPD hold functions if icing, heavy precipitation, or moderate or severe turbulence is encountered.

Drag Chute

- Do not deploy drag chute in flight.
- Do not deploy drag chute at speeds in excess of 150 KIAS.
- Do not deploy drag chute with thrust reversers deployed.

> **NOTE:** Deploy the drag chute on landing at least once during each six-month interval. Then inspect and repack the drag chute according to Maintenance Manual instructions.

Electrical System

Battery Condition Prior to Start (Model 25D/F)

- On **aircraft with lead-acid batteries**, do not attempt a battery start with less than 24V DC each battery at 70°F (21°C) or below, or less than 25V DC each battery at 110°F (43°C) or above. Interpolate for temperature between 70°F (21°C) and 110°F (43°C).
- On **aircraft with ni-cad batteries**, do not attempt a battery start with less than 23V DC.
- On **aircraft with ni-cad batteries**, do not dispatch if the red BAT 140 or BAT 160 warning light illuminates any time prior to takeoff, including engine start. Check batteries per the Maintenance Manual.

External Power

The maximum amperage from an external power source must be limited to 1,000A (28V DC).

Generator Output

OAT 60°F (15.5°C) or Above 300A

Under Any Circumstance. 400A

Aircraft With XR Modification:
Maximum Load Each Generator . . . . . REFER TO **TABLE 3-F**

MODEL	ALTITUDE (FT)	Generator Load (Amps)
25D/F, 25-230 to 362 (except 342) with Teledyne AOA and AMK 81-12; 25-342, 363 and subsequent with Teledyne	Sea Level to 26,000 26,000 to 45,000 45,000 to 51,000	400 300[1] 200
25B/C and D/F, 25-070 to 362 (except 342) with Teledyne AOA without AMK 81-12	Sea Level to 26,000 26,000 to 45,000	400 300[1]
24D	Sea Level to 26,000 26,000 to 45,000	400 300

Table 3-F; Maximum Generator Load (Aircraft with XR Modification)

[1] Maximum generator load is 200A for 0.76M_I to 0.82 M_I

> **NOTE:** AMK 81-12; Installation of Engine Stall Warning Box and Air Data Sensor (**Model 25D/F, 25-230 to 341, 343 to 336, 338 to 362**).

Inverters (Models 25D/F and 24D/E)

On **aircraft with an auxiliary inverte**r, it is recommended that all three inverters be on during normal operations for maximum inverter life.

Lighting Recommendations

- Do not use strobe lights when taxiing in the vicinity of other aircraft.
- Position lights must be on for all night operations.
- Navigation lights should be on for all night operations.
- Do not use strobe lights during flight through fog or clouds.

Environmental System

Heating and Cooling Systems

AIR BLEED Switch – Extended Ground Operation

CAUTION: On **Model 25D/F S/Ns 25-206 to 226 and aircraft with the 450 pressurization system**, do not select the AIR BLEED switch to MAX while sitting on the ground. With the aircraft sitting statically on the ground, do not perform extended engine operation above 70% RPM with the AIR BLEED switch in NORM. Because there is no ram air flow through the heat exchanger, overheating can damage air conditioning components and cabin furnishings.

CAUTION: On **Model 25D/F S/Ns 25-227 and subsequent**, with the aircraft sitting statically on the ground, do not perform extended engine operation above 70% RPM with the cabin air on. Because there is no ram air flow through the heat exchanger, overheating can damage air conditioning components.

Cockpit Blower

- If the overhead air outlets in the cockpit are closed, turn off the cockpit blower to prevent overheating the blower motor.

Cooling System Operation During Landing

> **CAUTION:** If the cooling system is not already operating, do not turn it on during landing with the anti-skid system operating. Initial voltage drop may cause false signals in the anti-skid system, which then dumps brake pressure for two to three seconds.

Freon Air Conditioning System

- Do not operate the Freon cooling system at altitudes above 18,000 ft.
- Power for the auxiliary heater must be supplied by an engine generator or GPU.
- Power for the Freon cooling system must be supplied by an engine generator or GPU.
- On **aircraft without the Freon air conditioning system**, observe the Caution below.
- For **aircraft with the 450 pressurization system**, observe the topmost Caution on page 3-29.

> **CAUTION:** On **Model 25B/C without Freon air conditioning system**, do not select the AIR BLEED switch to MAX position while operating on the ground; to do so causes cabin overheating, which may damage cabin furnishings.

Pressurization

- On **Model 25D/F S/N 25-227 and subsequent**, the automatic pressurization mode deactivates and the amber CAB ALT annunciator illuminates if cabin altitude increases to 8,750 ±250 ft and remains deactivated until cabin altitude decreases to extinguish the CAB ALT light (7,200 ft).
- Do not take off or land with the cabin pressurized.
- On **Model 25D/F S/Ns 25-206 to 226**, the automatic pressurization mode deactivates if the cabin altitude increases to 10,000 ±500 ft and remains deactivated until cabin altitude decreases to 7,500 ft or below.

> **NOTE:** To prevent uncomfortable pressure bumps during cruise on **Models 24D; 24E/F S/N 329 to 349; and 25B/C**, do not select MAX airflow above 90% if the pressurization system is operating satisfactorily in either the automatic or manual mode.

Flight Controls

Ice Accumulations

WARNING: Even small accumulations of ice on the wing leading edge can cause aerodynamic stall prior to activation of the stick shaker and/or pusher. These ice accumulations can also cause angle-of-attack indicator information to be unreliable.

Spoilers

- Do not extend spoilers with autopilot engaged.
- Do not extend spoilers with flaps extended while airborne.
- Do not extend spoilers, or operate with spoilers deployed, at speeds above V_{MO}/M_{MO}.

Stall Warning System

- On **Model 25D/F**, both stall warning systems must be on and operating and remain on throughout flight. The systems may be turned off per emergency and abnormal procedures in AFM Sections III and IV, respectively, and for stall warning maintenance per Maintenance Manual procedures.
- On **Models 24E/F and 25D/F**, the Before Starting Engines and After Takeoff stall warning system operation and comparison checks must be accomplished according to AFM Section II to assure proper stall warning system operation.
- On **Models 24D/E/F and 25B/C**, both stall warning systems must be on and operating for all normal flight operations. The systems may be turned off for emergency operations per emergency procedures in AFM Section III and for stall warning system maintenance per the Maintenance (or Service) Manual.

- On **Models 24D/E/F and 25B/C**, warning lights for both stall warning systems are inoperative when the generator and battery switches are off.
- On **Models 24D and 25B/C**, the Exterior Inspection (Power On) and After Takeoff stall warning system operation and comparison checks in AFM Section II must be completed on each flight to assure proper stall warning system operation.

> **WARNING:** The action of the nudger verifies operation of the pitch torquer prior to pusher activation. If, during ground test, the nudger does not accompany the shaker, do not dispatch. If, during flight, the nudger does not accompany the shaker, do not decelerate further.

> **WARNING:** On **Models 24D and 25B/C**, do not intentionally fly the aircraft slower than initial stall warning (shaker) onset.

Takeoff Trim

Takeoff trim is not required to be set within the green band for takeoff. Use trim settings forward of the green band for takeoff at aft CG loadings; use trim settings near the aft portion of the green band for takeoff at forward CG loadings. However, do not attempt a takeoff with the TAKE-OFF TRIM light illuminated under any circumstance.

Trim Systems – Model 25D/F

- To assure proper trim systems operation, successfully complete the Before Starting Engines Trim Systems checks according to AFM Section II.
- Successfully perform the complete trim systems operational check in AFM Section II a minimum of once every 10 hours of aircraft flight operation.

> **WARNING:** On **Model 25D/F**, failure to conduct a pitch trim preflight check prior to each flight increases the probability of an undetected system failure. An additional single failure in the trim system could result in a trim runaway.

Trim Systems – Model 24D/E/F With XR Modification

- On **aircraft without AMK 81-18**, the following apply.
  - If the system fails to shift to low rate when flaps are up, do not take off.
  - If trim interrupt fails to stop trim motion, do not take off.
  - If amber TRIM FAULT/aural trim-in-motion warning fails, do not take off and limit maximum cruise speed to 275 KIAS.
  - If green CRUISE TRIM light is inoperative, use normal trim flaps down and emergency trim flaps up.

> **NOTE:** AMK 81-9; Horizontal Stabilizer Trim and Autopilot Improvement (**Model 25B/C, 25-061, 067 to 205**).
>
> AMK 81-13; Horizontal Stabilizer Trim and Autopilot Improvement (**Model 24E/F, 24-329 to 357**).
>
> AMK 81-19; Horizontal Stabilizer Trim and Autopilot Improvement (**Model 24D, 24-230 to 328**).

Trim Systems – Models 24D/F and 25B/C

- On **aircraft with AMK 81-9 or 81-18**, the following apply.
  - To assure proper trim systems operation, the Before Starting Engines Trim checks of AFM Section II must be successfully completed before each flight.
  - The complete Trim Systems Operational check of AFM Section II shall be completed a minimum of once every 10 hours of aircraft flight operation.
- On **aircraft without AMK 81-9 or 81-18**, the following apply.
  - Pitch trim system runaway training that actually involves running the trim in flight to simulate malfunctions is prohibited.
  - To assure proper trim systems operation, the Before Starting Engines Trim checks of AFM Section II must be successfully completed before each flight.

> **WARNING:** For **Models 24D/E/F and 25B/C**, the following apply:
>
> - Failure to conduct the prescribed pitch trim preflight check prior to each flight increases the probability of an undetected system failure.
> - On **aircraft without AMK 81-9, 81-13, or 81-18**, an additional single failure could result in a trim runaway. In certain critical flight conditions, an unrestrained pitch trim runaway could result in high speeds, severe buffet, wing roll off, loads in excess of structural limit, and extremely high forces necessary for recovery.

Yaw Damper – Model 25D/F

- To assure proper yaw damper operation, the Before Starting Engines Yaw Damper Operational check must be successfully completed according to AFM Section II.
- On **Model 25D/F S/Ns 25-206 to 336, 338 to 362 without AAK 83-4**, one yaw damper must be on and operative for all flight conditions except takeoff, trimming rudder, and landing touchdown. For trimming rudder, disengage yaw damper, accomplish rudder trim, then re-engage yaw damper.
- For a normal landing, the following apply.
  - The aircraft shall be configured for landing at least 500 ft AGL.
  - The yaw damper shall be disengaged during the flare.
- On **Model 25D/F S/N 25-337, 363 and subsequent; prior aircraft with AAK 83-4**, one yaw damper must be on and operative for all flight conditions except takeoff and trimming rudder. For trimming rudder, disengage yaw damper, accomplish rudder trim, then re-engage yaw damper.
- On **aircraft with the XR Modification (25D/F, 25-337, 363 and subsequent; prior aircraft with AAK 83-4)**, observe Note below.

> **NOTE:** AAK 83-4; Installation of Yaw Damper Force Sensor (**Models 25B/C and D/f, 25-070 to 362**).

> **NOTE:** Yaw damping authority falls below that normally available when using rudder pedal forces to maneuver air conditions. Remove crew-applied rudder pedal force to restore normal yaw damping.

CAUTION: If landings are attempted in turbulent air conditions with the yaw damper OFF, the aircraft may exhibit undesirable lateral-directional (Dutch-roll) characteristics. These characteristics are improved as the wing/tip fuel is consumed.

Yaw Damper – Model 25B/C

- Both yaw dampers must be operative.
- To assure proper yaw damper operation, successfully complete the Yaw Damper Operational check in AFM Section II before each flight.
- On **aircraft without AAK 83-4**, observe the following.
  - One yaw damper must be on and operating for all flight conditions except takeoff, trimming rudder, and landing touchdown. For trimming rudder, disengage yaw damper, accomplish rudder trim, then re-engage the yaw damper.
  - The aircraft shall be configured for landing at least 500 ft AGL.
  - The yaw damper shall be disengaged during the flare.
- On **aircraft with AAK 83-4**, one yaw damper must be on and operating for all flight conditions except takeoff and trimming rudder. For trimming rudder, disengage yaw damper, accomplish rudder trim, then re-engage yaw damper.
- On **aircraft with the XR Modification (25B/C, 25-337, 363 and subsequent; prior aircraft with AAK 83-4)**.

NOTE: Yaw damping authority falls below that normally available when using rudder pedal forces to maneuver air conditions. Remove crew-applied rudder pedal force to restore normal yaw damping.

Yaw Damper – Model 24D/E/F

- The yaw damper must be on and operative for all flight conditions except takeoff, landing touchdown, and trimming rudder.
- For landing, the following apply.
  - The aircraft shall be configured for landing at least 500 ft AGL.
  - The yaw damper shall be disengaged during the flare.

NOTE: It is recommended that if turbulence is anticipated due to gusty winds, wake turbulence, or wind shear, the approach speed be increased. For gusty wind conditions, an increase in approach speed of one half the gust factor is recommended.

CAUTION: If landings are attempted in turbulent air conditions with the yaw damper OFF, the aircraft may exhibit undesirable lateral-directional (Dutch-roll) characteristics. These characteristics are improved as the wing/tip fuel is consumed.

Fuel System

Anti-Icing Additive

- Military JP4-type fuel refined in the U.S. has anti-icing additive conforming to MIL-I-27686 blended at the refinery, and no additional treatment is necessary. However, some non-military JP4-type fuel does not have anti-icing additive meeting the requirements of MIL-I-27686 blended at the refinery. Any approved (or emergency fuels on **Models 24E, 25B/C, and 25D/F**) not containing the additive must have it blended during refueling. Prior to refueling, check with the fuel supplier to determine if the fuel contains anti-icing additive meeting the requirements of MIL-I-27686.
- Refer to AFM for anti-icing procedures.

WARNING: Fuel anti-icing additive may be harmful if inhaled or swallowed. Use adequate ventilation. Avoid contact with skin and eyes. If sprayed into eyes, flush with large amounts of water and contact a physician immediately.

CAUTION: Ensure that anti-icing additive is directed into the fuel stream and that additive flow starts after fuel flow starts and stops before fuel flow stops. Do not allow concentrated additive to contact interior of fuel tank or aircraft painted surfaces.

CAUTION: Lack of anti-icing additive may cause fuel filter icing and subsequent engine flameout.

NOTE: Refer to the applicable AFM for manufacturer approved fuels.

Auxiliary Fuselage Fuel Transfer
(Aircraft with FUS VALVE Switch)

Activation of standby pumps overrides gravity transfer and causes the right transfer and crossflow valves to close.

If the crossflow valve fails to open, fuselage fuel gravity flows into the right wing tank until heads are equal. A right wing heavy condition occurs.

On **Model 25D/F**, some fuel recirculates into the fuselage tank through the right transfer line if the right fuselage transfer valve (FUS VALVE) remains open during normal transfer activation.

Aviation Gasoline

- On **Models 24E/F and 25B/C/D/F**, the use of aviation gasoline (i.e., avgas, lowest octane available) is permitted as an emergency fuel only when JP-4, JP-5, or other approved jet fuels are not available. Set the fuel density adjustment knob according to **Table 3-K** depending on the mixture of avgas and JP-4/JP-5.
- On **Model 24D**, aviation gasoline (i.e., avgas, lowest octane available) may be used as an emergency fuel. When using avgas, adjust the density adjustment on the front of the fuel control unit to 0.69.
- On **Model 24E/F**, accomplish switch fueling according to FAA Order 8110.34.
- Limit use of avgas to no more than 25 hours between engine overhauls.
- Keep an accurate record of engine operation time when using avgas.
- Mixing aviation gasoline with jet fuels is allowed.
- All operations with aviation gasoline in excess of 50% by volume must be recorded in the Engine Log.

% Aviation Gsoline (by volume)	Density Setting	
	Type A	Type B
Below 20 (JP-4)	7|8 (JP-4)	-2
Below 20 (JP-5)	81|3 (JP-5)	-3
20 to 35	7|5	-1
35 to 50	7|2	▲
Above 50	6|9	+1

Table 3-A; Aviation Gasoline Fuel Density Adjustments (Models 24E/F, 25B/C, and 25D/F)

CAUTION: When using any aviation gasoline in the fuel mixture, operation is limited.

- Do not take off with fuel temperature lower than -54°C (-65°F).
- Restrict aircraft flight to below 15,000 ft.
- On **Model 24D**, both electric standby fuel pump switches must be on, and the pumps must be operating when using aviation gasoline.
- On **Models 24E/F and 25B/C/D/F**, both jet pump and both standby pump switches must be on and the pumps must be operating.

Biocide Additive

- Biobor JF is approved for use as a biocide additive when pre-mixed in the fuel supply facility. The concentration must not exceed 270 ppm.
- On **Model 25B/C**, over-the-wing mixing of Biobor is not approved.
- Biobor JF can be used concurrently with the anti-icing agent; however, Biobor JF itself is not an anti-icing agent.

CAUTION: Drain all sumps prior to refueling with fuel containing Biobar JF.

Fuel Crossflow

CAUTION: Do not crossfeed with the main jet pump(s) inoperative. Engine starvation may occur when fuel is pumped through the open crossflow valve into the opposite wing.

Fuel Density Adjustments – Models 24E and 25B/C/D/F

- Either of two types of fuel control units may be on the engines. The fuel control density adjustment knobs, which differ on each of these units, are designated Type A and Type B.
- If optimum engine acceleration is desired, adjust the density adjustment knob on the front of the fuel control unit to the fuel density setting for the fuel type in use.
- Recommended fuel control adjustment knob positions (i.e., density settings) for fuel types are shown in **Table 3-H**.

CAUTION: Engine stall margin may be reduced during high-altitude operation if the fuel control density adjustment knob is set to a lower density setting than that recommended for the type of fuel in use.

Fuel Density Adjustments – Model 24D

The following are density adjustments for approved fuels.

JP-4 . . . . 0.78

JP-5 . . . . 0.813

Kerosene 0.80

Aviation Gasoline. 0.69

<table>
<tr><th rowspan="2">Fuel Type</th><th colspan="2">Density Setting</th></tr>
<tr><th>Type A</th><th>Type B</th></tr>
<tr><td>JP-4</td><td>7 | 8</td><td>-2</td></tr>
<tr><td>JP-5</td><td>81 | 3</td><td>-3</td></tr>
</table>

Table 3-B; Fuel Density Adjustments (Models 24E, 25B/C, and 25D/F)

Fuselage Fuel Transfer

On **Model 25D (with the FUS VALVE switch) and Model 25F**, fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. However, fuselage fuel gravity flows into the left wing tank until the heads are equal. A left wing heavy condition occurs.

CAUTION: Do not energize the fuselage fuel transfer system when wing and tip tanks are full.

On **Model 25B**, fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. However, fuselage fuel gravity flows into the left wing tank until heads are equal. A left wing heavy condition occurs.

On **Models 24E/F, 25B, and 25D (without the FUS VALVE switch)**, fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. However, fuselage fuel gravity flows into the right wing tank until the heads are equal. A right wing heavy condition occurs. Plan fuel requirements to ensure return to the takeoff point or to an alternate if the fuselage tank fails to transfer.

Low Fuel/10° Nose-Up Limit

WARNING: When the fuel quantity gage indicates 600 lbs or less remaining in either wing tank, a prolonged nose-up wing attitude of 10° or more may cause fuel to be trapped in the aft area of the wing tank outboard of the wheel well. Fuel starvation and engine flameout may occur. Reducing pitch attitude and thrust to a minimum required prevents this situation.

For go-around conditions with low fuel, on first LOW FUEL warning light steady indication, reduce climb attitude and thrust to the minimum required.

Refueling Operations (Models 24D/E and 25D/F)

WARNING: Do not completely fill one tank before adding fuel to the opposite tank. Fill both tanks simultaneously or alternately add 125 gallons (473.2 liters) of fuel to each tank until obtaining the desired amount. Failure to follow this procedure results in excessive lateral unbalance.

Temperature Limits

- Do not take off with kerosene or JP-5 type fuel at fuel temperatures below -29°C (-20°F).
- Do not take off with JP-4 type fuel at fuel temperatures below -54°C (-65°F).

Unusable Fuel

- The fuel remaining in the fuel tanks when the fuel quantity indicator reads zero is not usable in flight.

Hydraulic System

Approved Fluid

- Use only hydraulic fluid conforming to MIL-H-5606.

Auxiliary Hydraulic Pump Duty Cycle

- Do not exceed the auxiliary hydraulic pump duty cycle of three minutes on, then 20 minutes off.

Hydraulic Pressure at Shutdown (Model 24E and 25D/F)

CAUTION: Failure to bleed hydraulic pressure from the system before setting the battery switches off during shutdown may result in nosegear retraction if the landing gear selector valve malfunctions.

NOTE: If the parking brake is set, using the flaps to bleed hydraulic system pressure does not affect parking brake pressure.

NOTE: When OAT is below -25°C (-13°F), operate the engines for three minutes prior to takeoff to bring the hydraulic system up to normal operating temperature.

Ice and Rain Protection

Anti-Ice Operation

Turn on anti-ice systems prior to flight into visible moisture and ram air temperatures of 10°C or below.

Horizontal Stabilizer Anti-Ice

- During ground operation, ensure that the amber STAB HEAT annunciator is on and that there is no additional DC ammeter increase; this prevents overheating of the horizontal stabilizer heating elements.

> **CAUTION:** Do not use stabilizer heat and Freon cooling system simultaneously.

Ice Accumulations

> **WARNING:** Even small accumulations of ice on the wing leading edge can cause aerodynamic stall prior to activation of the stick shaker and/or pusher. These ice accumulations can also cause angle-of-attack indicator information to be unreliable.

Nacelle Heat – Models 24D/E/F and 25B/C

- Use nacelle heat to prevent ice accumulations in the engine air intake; do not consider it for ice removal. Ice ingestion could cause engine flameout or compressor damage.
- During ground operation only, set the nacelle heat switches off if the INLET HTR annunciator illuminates.

Nacelle Heat – Model 25D/F

- Illumination of the L or R ENG ICE annunciators with the NAC HEAT switches on and engine RPM at 80% or above indicates that bleed air pressure is not being applied to the nacelle heat anti-ice system due to a malfunction.

> **CAUTION:** Illumination of the INLET HTR annunciator during ground operation indicates an inlet duct overheat condition.

Windshield and Radome Anti-Ice Fluid

Methyl alcohol (methanol) per Federal Specification O-M-232, Grade A, is required.

Windshield Anti-Ice

- On **Models 24D, 24E/F S/Ns 24-329 to 349, and 25B/C**, use the WSHLD & RADOME switch position only if the bleed air for windshield anti-ice fails.
- On **Model 24E/F S/Ns 24-350 to 357**, use the WSHLD/ RADOME switch position if bleed air for the windshield anti-ice fails.

Windshield Defog

CAUTION: During ground operation, do not defog the windshield above 70% RPM; the bleed air may damage the windshield.

Wing Anti-Ice

On Model 25D/F S/Ns 25-206 to 259, if the WING TEMP gage pointer is in the yellow arc, the wing structure is approaching an overheat condition, and the wing temperature limit switch has failed. On Model 25D/F S/N 25-260 and subsequent, if the WING TEMP gage pointer is in the red arc, the wing structure is approaching an overheat condition, and the wing temperature limit switch has failed.

On **Model 24F and Model 25D/F S/Ns 25-206 to 259**, if the system is on and the WING TEMP gage pointer is in the red arc, a wing heat system failure is indicated. On **Model 25D/F S/N 25-260 and subsequent**, if the system is on and the WING TEMP gage pointer is in the blue arc, a wing heat system failure is indicated.

NOTE: AAK 76-4; Reduced Approach Speed System Kit (**Model 24D, 24-230 to 328; Models 25B/C, 25-070 to 205**).

AAK 82-8; Handling Qualities Improvement for Aircraft Not Equipped with Reduced Approach Speed System (Cancelled and Superseeded by AMK 83-4) (**25-111 and 176**).

AMK 83-4; Handling, Qualities Improvement (Softflite 1) for Aircraft Not Equipped with Reduced Approach Speed System (**Model 24D, 24-230 to 328, Model 25B/C, 25-070 to 205, except when modified by AAK 76-4 or Mark II Wing.**).

On **Models 24D with AMK 83-4 and 25B/C with AAK 82-8 or AMK 83-4**, ice buildup may occur on the outboard wing leading edge at reduced power (e.g., holding) in icing conditions below -18°C (0°F) OAT. Satisfactory handling qualities were demonstrated by adding power to above 85% RPM (spoilers may be required for added drag). If it is necessary to land with ice or suspected ice on the wing leading edge, perform the landing procedure for Wing Heat Failure in AFM Section III. Suspect ice on the wing leading edge any time icing conditions are encountered below -18°C (0°F) OAT and it cannot be confirmed that the wing leading edge is clear (e.g., during night operation).

In extreme icing conditions above approximately 15,000 ft, a small ice buildup may occur at the junction of the wings and tip tanks at reduced power (e.g., holding). Satisfactory handling qualities were demonstrated by deflecting the flaps and adding power to above 85% RPM. Below approximately 15,000 ft and at a minimum 80% RPM, all wing leading edge ice was removed using normal descent procedures.

For ground operation, limit RPM to 70% and monitor WING TEMP gage to prevent wing overheating.

Wing Leading Edge Ice

On **Model 25D/F S/N 25-342 and subsequent**, increase the normal approach speeds per the Wing Heat Failure procedure in AFM Section IV if the presence of ice on the wing leading edge is detected.

On **Model 25D/F S/Ns 25-206 to 341**, increase the normal approach speeds per the Wing Heat Failure procedure in AFM Section IV if the presence of ice on the wing leading edge is suspected during night operations in atmospheric conditions conducive to icing.

On **Models 24D/E/F and 25B/C**, increase the normal approach speeds per the Wing Heat Failure procedure in AFM Section III if the presence of ice on the wing leading edge is suspected during night operations in atmospheric conditions conducive to icing.

On **Models 24D/E/F and 25B/C**, the wing inspection light, in itself, is inadequate for detecting the presence of ice near the wing tips.

Landing Gear

Cooling System Operation During Landing with Anti-Skid System Operating

CAUTION: If the cooling system is not already operating, do not turn it on during landing with the anti-skid system operating. Initial voltage drop may cause false signals in the anti-skid system and dump brake pressure for two or three seconds.

Snow-Covered or Icy Runway Operations

When taxiing through slush or snow, use the brakes to create some friction heat in the brake discs to prevent the brakes from freezing.

If taxi and/or takeoff were on ice, snow, or slush, allow the wheels to spin down for approximately one minute prior to gear retraction to throw off as much slush as possible.

If taxi and/or takeoff were on ice, snow, or slush, turn the anti-skid switch off, pump the brakes six to ten times, then turn the anti-skid switch on during the before landing phase of flight. These brake applications tend to crack any ice between the brake discs and between the discs and wheels.

During moderate to heavy braking action on patchy snow or ice, avoid use of nosewheel steering above 10 kts.

Oxygen System

Manual Oxygen Mask Deployment

If the generator and battery switches are off, automatic deployment of passenger oxygen masks does not occur. In this event, turn the PASS MASK valve to MAN to deploy the masks if passenger oxygen is required.

> **NOTE:** Passenger masks do not provide sufficient oxygen for prolonged operation above 34,000 ft cabin altitude. Prolonged operation above 25,000 ft cabin altitude with passengers on board is not recommended.

Oxygen Duration

Oxygen duration is as shown in **Tables 3-I** and **3-J**. Bold face numbers indicate 100% oxygen. Light face numbers indicate diluter demand (NORMAL position on regulator).

Prior to overwater flights, plan flights so that enough oxygen is available for all occupants if pressurization fails.

For cabin altitudes of 10,000 ft and above, oxygen duration time includes cabin altitude ascent time from 8,000 ft to final stabilized cabin altitude.

The oxygen duration time for the 7,000 ft and 8,000 ft cabin altitude provides information for flight planning when supplemental oxygen is required.

To calculate oxygen duration for a less than fully charged system, use the following formula.

$$\textit{Duration} = \textit{Duration from Chart} \quad X \quad \frac{\textit{System Pressure}}{\textit{1,850}}$$

Cabin Alt	Oxygen Duration (minutes)						
	2 Crew	2 Crew 2 Pass.	2 Crew 4 Pass.	2 Crew 6 Pass.	2 Crew 8 Pass.	2 Crew 9 Pass.	2 Crew 11 Pass.
40,000	**251**	**80**	**48**	**35**	**28**	**25**	**22**
35,000	**182**	**71**	**45**	**33**	**23**	**24**	**20**
30,000	**135**	**63**	**42**	**32**	**26**	**23**	**20**
25,000	**105**	**56**	**39**	**30**	**25**	**23**	**20**
20,000	175 **84**	73 **51**	47 **37**	35 **29**	29 **25**	26 **23**	23 **20**
15,000	124 **67**	63 **45**	44 **34**	34 **28**	28 **24**	26 **23**	23 **20**
10,000	91 **54**	Passenger Oxygen Not Required					
8,000	82 **50**	49 **35**	35 **27**	27 **22**	22 **19**	20 **17**	17 **15**
7,000	78 **48**	47 **34**	34 **27**	27 **22**	22 **18**	20 **17**	17 **15**

Table 3-C; Oxygen Duration – ZMR 100 Series Crew Masks with Fully Charged System

Cabin Alt	Oxygen Duration (minutes)						
	2 Crew	2 Crew 2 Pass.	2 Crew 4 Pass.	2 Crew 6 Pass.	2 Crew 8 Pass.	2 Crew 9 Pass.	2 Crew 11 Pass.
40,000	267 **251**	84 **79**	51 **47**	36 **34**	29 **27**	26 **24**	22 **21**
35,000	195 **182**	76 **71**	48 **45**	35 **33**	28 **26**	26 **24**	22 **21**
30,000	219 **135**	79 **64**	49 **42**	36 **32**	29 **26**	26 **23**	22 **20**
25,000	252 **105**	83 **56**	50 **39**	37 **30**	29 **25**	26 **23**	22 **20**
20,000	220 **84**	81 **51**	51 **37**	37 **29**	30 **25**	27 **23**	24 **20**
15,000	192 **67**	77 **45**	50 **34**	37 **28**	31 **24**	28 **23**	24 **20**
10,000	163 **54**	Passenger Oxygen Not Required					
8,000	153 **50**	67 **35**	43 **27**	32 **22**	25 **19**	23 **17**	19 **15**
7,000	148 **48**	67 **34**	43 **27**	32 **22**	25 **18**	23 **17**	19 **15**

Table 3-D; Oxygen Duration – 6600214 Series Crew Masks with Fully Charged System

Oxygen Mask Availability Requirements

- The aircraft certification requirements in **Table 3-O** are in addition to the requirements of applicable operating rules. Observe the most restrictive requirement (certification or operating).
- Headsets, eyeglasses, or hats worn by crewmembers may interfere with donning capabilities.

Model	Differences	Limit
24D **24E/F** **25B/C** **25D/F**	ALL 24-329 to 349 without optional 6600214 Series Masks All 25-206 to 226 with ZMR Series Masks	Above FL250, one crewmember must wear mask around his neck. Above FL410, pilot, copilot, and passengers must wear masks.
24E/F **25D/F**	24-329 to 349 without optional 6600214 Series Masks 25-206 to 226 with optional 6600214 Series Masks	Above FL250, crew masks must be suspended from quick release hooks to permit donning within five seconds. Above FL410, pilot, copilot, and passengers must wear masks.
24E/F **25D/F**	24-350 and subsequent 25-227 and subsequent	Crew masks must be suspended from quick release hooks to permit donning within five seconds.

Table 3-E; Oxygen Mask Availability

Powerplant

Approved Oils (Models 24D/E/F and 25B/C)

- The oils shown in **Table 3-L** are approved for use when filtered through a 10-micron filter.
- Type 1 oils 2389 Turbo Oil, RM 184A, and Shell Aircraft Oil 307 are approved for all models.
- On **Model 24D/E**, it is recommended that the engine lubrication system be serviced only with the approved Type 2 oils because they are capable of withstanding higher operating temperatures than Type 1 oils and have improved anti-coking characteristics.
- Type 1 oils have a lower viscosity than Type 2 oils. Therefore, stabilized oil pressure under similar RPM and oil temperature conditions can be expected to indicate 5 to 10 PSI lower when using Type 1 oils than when using Type 2 oils.

Approved Oils (Model 25D/F)

- Oils conforming to GE Specification D50TF1 (current revision) filtered through a 10-micron filter are approved for use. The oils in **Table 3-L** are those oils specifically approved by the engine manufacturer.
- Type 1 oils 2389 Turbo Oil, RM 184A, and Shell Aircraft Oil 307 are approved for all models.

> **CAUTION:** The intermixing of different brands of the same type oil is authorized. The intermixing of types is not authorized. In the event of the nonavailability or inadvertent mixing of approved oil types, the engine oil system should be drained, flushed, and refilled at the earliest opportunity. The change from a Type 1 to a Type 2 oil during an engine TBO may result in a marked change in oil color (sometimes to black). This condition is caused by carbon particles in suspension and will be influenced by engine TBO at the time of the oil change. Should this occur, the system should be drained, flushed, and closely monitored.

Oil	24D	24E/F	25B/C	25D/F
Aeroshell Turbine Oil 550	X	X	X	X
Aeroshell Turbine Oil 555	X	X	X	X
Aeroshell Turbine Oil 560		X		
AVTUR Oil Synthetic	X	X	X	X
Castrol 205	X	X	X	X
Caltex RPM Jet Engine Oil 5	X	X	X	X
Caltex Starjet 5	X	X	X	X
Caltex 7388	X	X	X	X
Chevron Jet Engine Oil 5	X	X	X	X
Enco Turbo Oil 2380	X	X	X	X
Esso Turbo Oil 2380	X	X	X	X
Exxon Turbo Oil 2380	X	X	X	X
Mobil Jet Engine Oil II	X	X	X	X
Mobil Oil 254		X		X
Sinclair Turbo-S Type 2	X	X	X	X
Stauffer Jet II	X	X	X	X
Texaco SATO 7388	X	X	X	X
Texaco Starjet 5	X	X	X	X

Table 3-F; Approved Type II Oils

NOTE:

- Stauffer Jet II, AVTUR Oil Synthetic, and Castrol 205 are identical oils.
- Texaco SATO 7388 and Caltex 7388 are identical oils.
- Chevron Jet Engine Oil 5 and Caltex RPM Jet Engine Oil 5 are identical oils.
- Enco Turbo Oil 2389, Esso Turbo Oil 2380, and Exxon Turbo Oil 2380 are identical oils.
- Texaco Starjet 5 and Caltex Starjet 5 are identical oils.

Engine Pressure Ratio

- On **Model 24D/E/F**, refer to the applicable Engine Pressure Ratio vs. Compressor Inlet Temperature figure in AFM Section IV.
- On **Model 25D/F**, refer to the applicable Takeoff Power Setting or Maximum Continuous Power Setting figure in AFM Section V.

Engine RPM Recommendations

- Maintain sufficient engine RPM, especially at high altitudes, to maintain cabin pressurization.
- Maintain a minimum of 80% RPM when anti-ice systems are on.

Engine Speeds

- Refer to the applicable Engine Speed Limits figure in AFM Section I.
- On **Models 24E/F and 25D/F**, an appreciable permanent change in engine vibrations (even though within limits) requires inspection of the engine rotor.
- On some **Model 24F** aircraft (specifically, **24-350, 352 to 354, 356, and 357**), do not exceed the maximum continuous EGT limit of 724°C or engine speed limit of 100% at FL450.

> **CAUTION:** On **Model 24F S/N 24-350, 352 to 354, 356, and 357**, at FL510, do not advance thrust levers if airspeed/Mach falls below 149 KIAS/0.65 M_I; this prevents flameout. Regain minimum airspeed/Mach with loss of altitude until above minimum airspeed/Mach, then readvance thrust levers.

Engine Temperatures

- Refer to **Table 3-M**.
- Refer to the applicable Exhaust Gas Temperature Limits figure in AFM Section I.
- Start temperatures should never exceed the solid line temperature curve on the applicable Exhaust Gas Temperature Limits figure in AFM Section I. At ambient temperatures of approximately 86°F (30°C) and above, normal start temperatures may exceed 800°C but should be less than 820°C.

Model	Differences	Limit	Max. Temp. Limit (°C)
CJ 610		Momentary	1000
		5 Minutes	716
		Max. Continuous	702
CJ 610-6	800	0 to 2 Seconds	910
	800	5 Seconds	854
	782	10 Seconds	782
	716	5 Minutes (Takeoff)	716
	702	Max. Continuous	702
CJ 610-8A	800	0 to 2 Seconds	910
	800	5 Seconds	854
	782	10 Seconds	782
	735	5 Minutes (Takeoff)	735
	724	Max. Continuous	724

Table 3-G; Engine Operating Limits

Ignition System

- Time limits for operating the engine ignition system are either of the following:
  - 2 minutes on, 3 minutes off, 2 minutes on, 23 minutes off
  - 5 minutes on, 25 minutes off.

When flight conditions dictate, the ignition system may be operated continuously as required; however, if the ignition system time limits are exceeded, the igniter plugs must be removed, inspected, and tested per the GE Accessory Overhaul Manual, SEI-154, prior to reinstallation.

Each engine has an ignition exciter and two igniter plugs; either plug is capable of starting the engine.

For high-altitude, low-airspeed operations at high power settings, set AIR IGN switches on.

- During periods of heavy precipitation, set AIR IGN switches on to prevent possible engine flameout due to large quantities of water entering the engine.
- Set ignition switches on if landing is to be made on a wet and/or slushy runway.

Oil Pressures

- Refer to the Oil Pressure Limits figure in AFM Section I.
- Establish the oil pressure for each engine at normal continuous engine speeds; use this as a basis for determining the pressure changes discussed below.
- Continually monitor engine oil pressure. If pressures change more than ±10 PSI from normal, inspect the lubrication system prior to the next flight for possible malfunction.
- Type 1 oils have a lower viscosity than Type 2 oils. Therefore, stabilized oil pressure under similar RPM and oil temperature conditions can be expected to indicate 5 to 10 PSI lower when using Type 1 oils than when using Type 2 oils.

Oil Temperature Limits

Maximum Oil Temperature. . . . . 185°C

Minimum Oil Temperature for Starting:

Type 1 Oils . . . . -54°C (-65°F)

Type 2 Oils . . . . -40°C (-40°F)

Turbine Engine Vibration Indicator

- On **Models 24D/E/F and 25B/C with turbine engine vibration indicator**, the indicator displays the vibration amplitude of the turbine section of the engine and is for maintenance use only. This instrument is not to be used to supersede engine operating limitations or procedures contained under normal and emergency operating procedures.

XR Modification Engine Limits (Models 24D, 25B/C, and 25D/F)

- For **aircraft with the XR Modification**, refer to the applicable Engine Pressure Ratio vs. Compressor Inlet Temperature figure in Section 4 of the AFM supplement. For maximum RPM, EGT, and EPR limits, refer to the applicable figures in Section I of the basic AFM.

Thrust Reversers

- Use the thrust reverser system only on prepared surfaces.
- The maximum engine speed in reverse thrust is 85%, usable at 70 KIAS or above. At 70 KIAS, smoothly and deliberately return the reverse levers to the reverse idle/deploy position.
- Do not operate the engine in reverse thrust for a period greater than 30 seconds at power settings above reverse idle.
- Do not attempt engine starts with thrust reversers deployed.
- Align aircraft into the wind for functional checks (engine operating). Do not exceed 55% RPM in reverse during functional tests. With engines idling, do not deploy thrust reverser for more than five seconds when static or taxiing downwind, nor more than ten seconds at taxi speeds upwind.
- Simultaneous use of the thrust reversers and drag chute is prohibited.
- Arming lights are limited to three minutes due to the solenoid duty cycle limit.

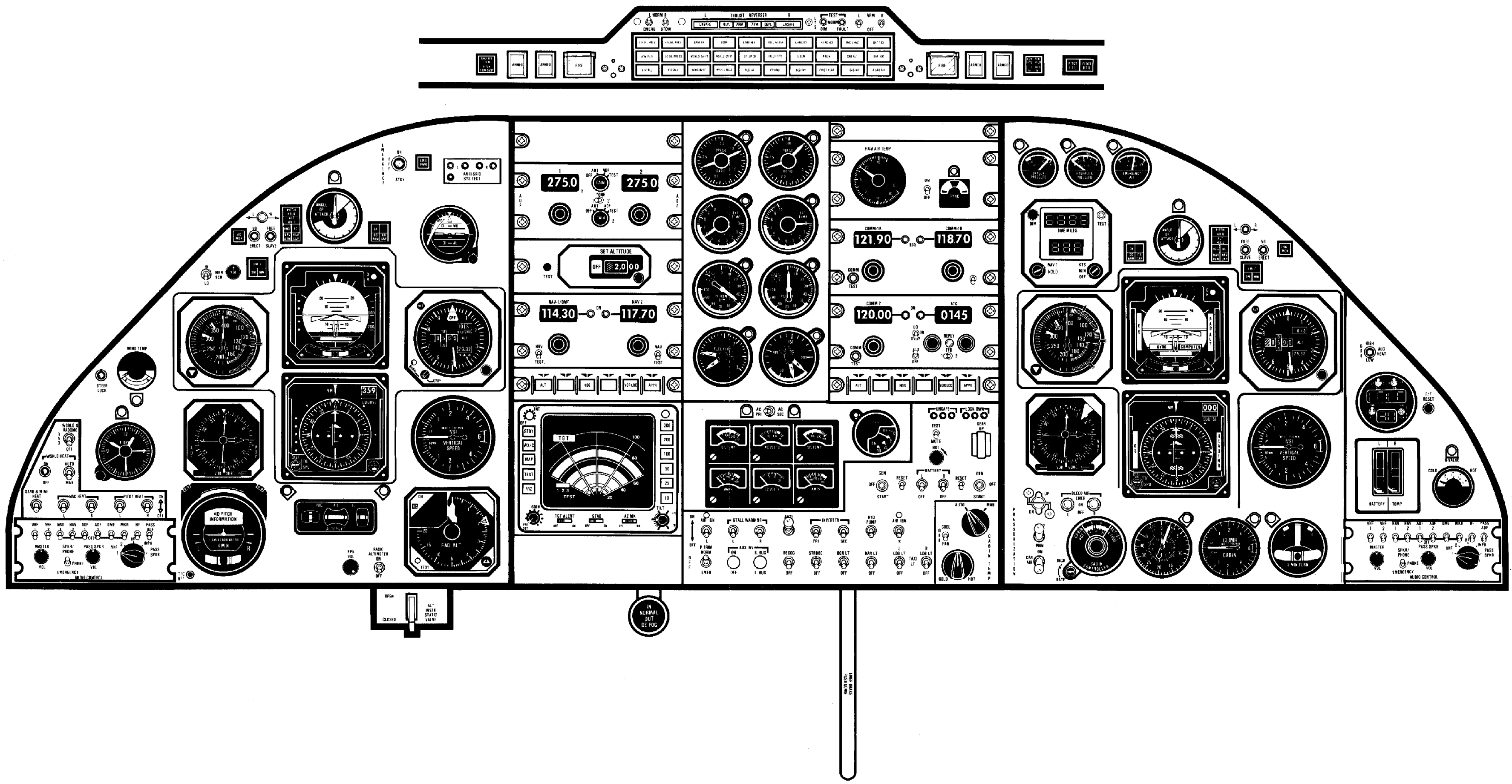
NOTE: The AFM supplement for thrust reversers, revision C, is applicable only to:

- **Model 24** aircraft with thrust reverser kit serial number 474 and subsequent.
- **Model 25** aircraft with thrust reverser kit serial number 237 and subsequent.
- aircraft modified according to Service Letter SL 25-6.

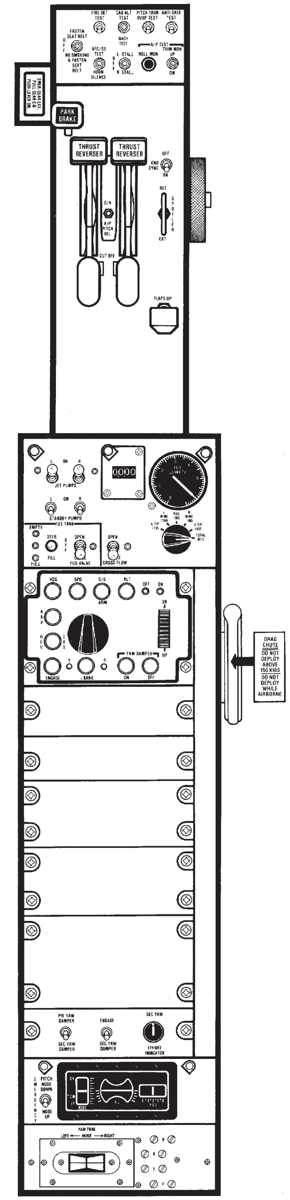
Systems

Table of Contents

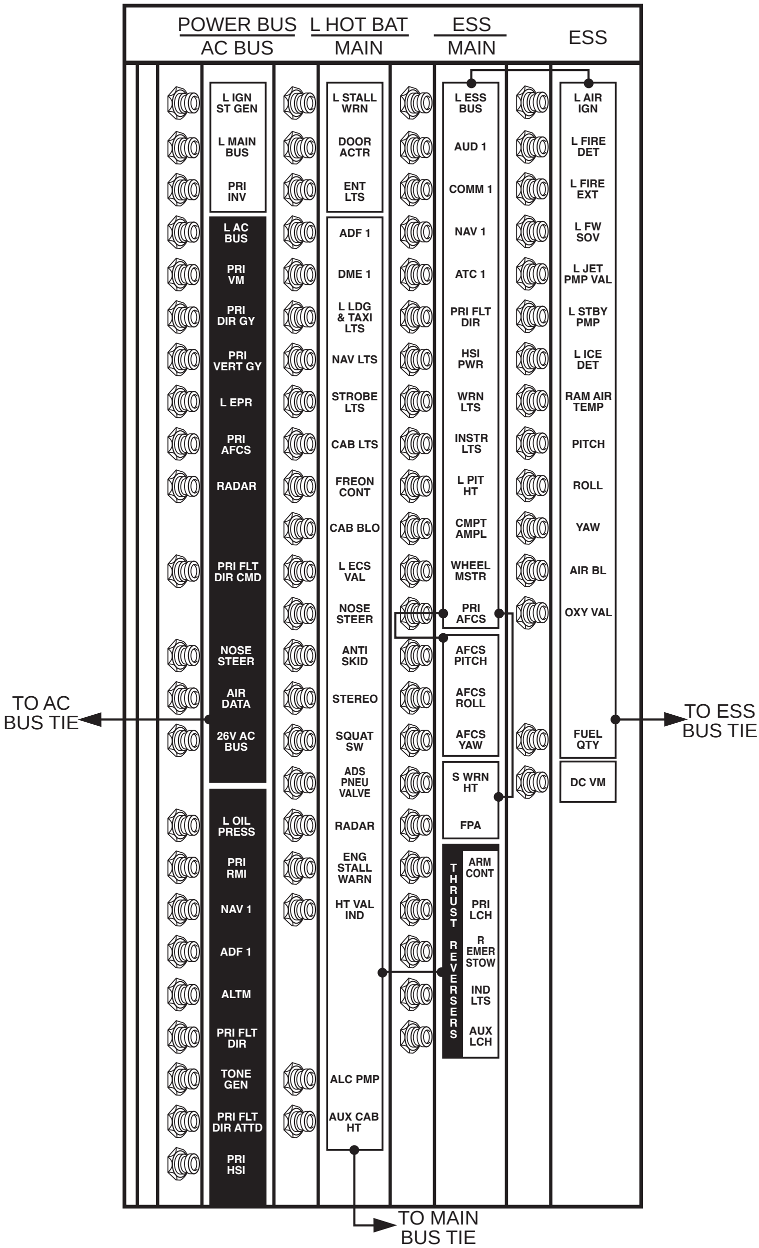
Cockpit Instrument Panel



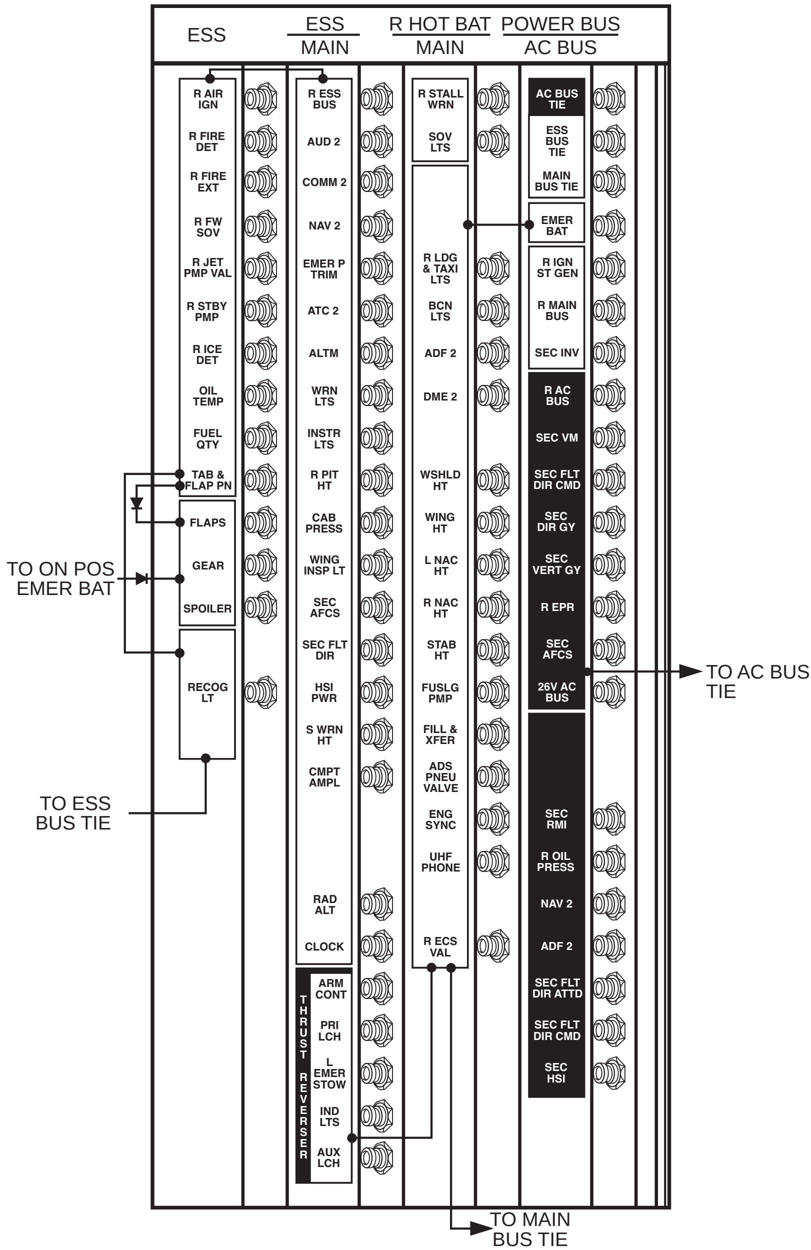
Pedestal


PARK BRAKE
THRUST REVERSER
THRUST REVERSER
DRAG CHUTE
DO NOT DEPLOY ABOVE 150 KIAS
DO NOT DEPLOY WHILE AIRBORNE

Pilot's Circuit Breaker Panel

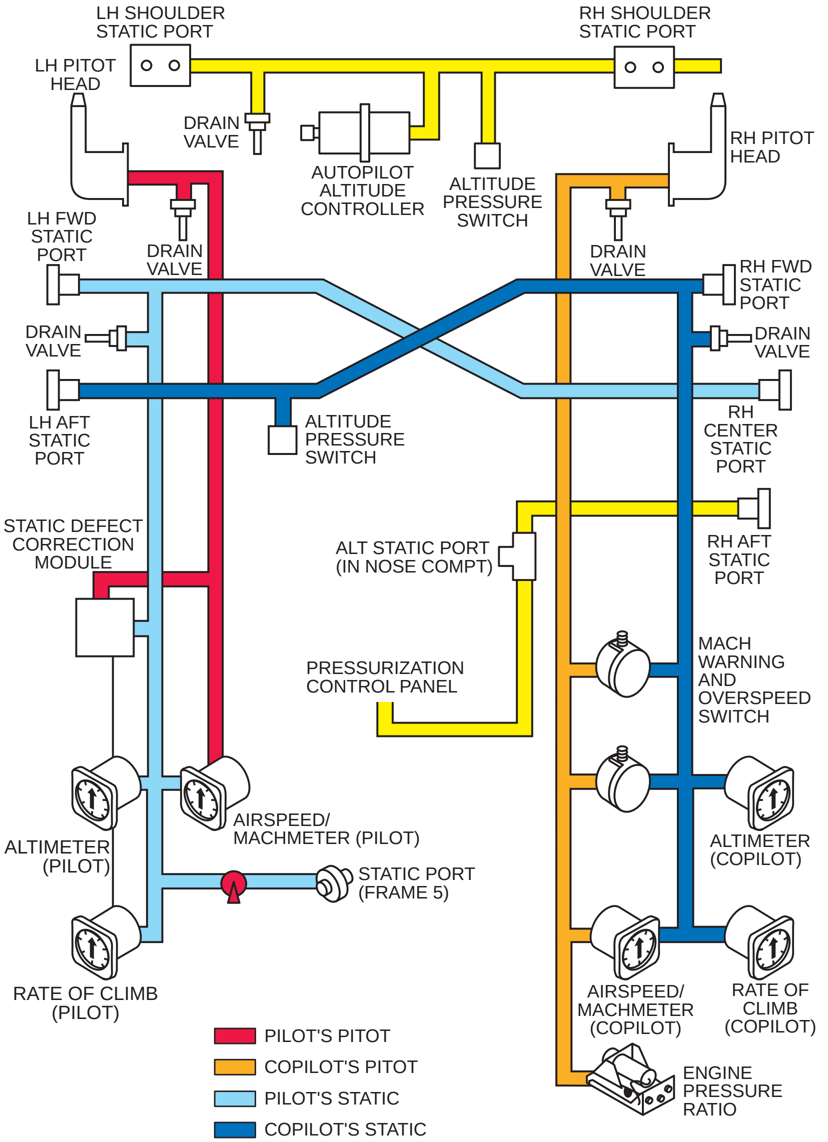


Copilot's Circuit Breaker Panel



Pitot/Static System

25D/F, 25-227 and subsequent; 24E/F, 350 and subsequent; 24D, 24-230 to 238; 24E/F, 24-329 to 349; 25B/C, 25-061, 070 to 205; 25D/F, 25-206 to 226



Avionics

Depending on customer preference, modifications, and system upgrades, avionics systems on the Learjet 24/25 vary widely. This section provides a brief overview of common equipment installations.

- pitot/static system and air data instruments
- communication equipment
- navigation equipment
- flight control systems.

For a complete description of and operating procedures for avionics systems in the Learjet 24/25, refer to the applicable Aircraft Flight Manual supplements and avionics equipment pilot's guides.

Pitot/Static System

Two electrically heated pitot tubes on either side of the aircraft nose supply ram air pressure. Drain valves in the pitot lines permit the removal of accumulated moisture from the system. The PITOT HEAT switches control electrical power to the pitot tube heating elements.

The left pitot tube supplies the static defect correction (SDC) module and the pilot's Mach/airspeed indicator. The right pitot tube supplies the copilot's Mach/airspeed indicator, Mach warning and overspeed switches, and inlet pressure for the exhaust pressure ratio (EPR) indicating system.

Static ports supply static pressure data to the pilot's and copilot's instruments, the cabin pressurization system, and the autopilot altitude controller or air data sensor. Static system drains on either side of the nose landing gear doors permit the removal of accumulated moisture from the static system.

Two static ports on each side of the nose supply static pressure to the pilot's and copilot's air data instruments. The LH forward and RH center ports interconnect to supply the pilot's instruments. The RH forward and LH aft ports interconnect to supply the copilot's instruments. Electrical heating elements prevent the formation of ice.

On **Learjet 24E/F aircraft and 24D aircraft with AAK 76-4**, the RH forward and LH aft ports interconnect to supply the copilot's instruments and one of the stall warning altitude pressure switches.

An unheated static port on the forward pressure bulkhead provides an alternate static source if the pilot's static system clogs. The ALT INSTR STATIC VALVE switch below the left instrument panel selects the alternate static source. When using the alternate static source, the pilot's flight instruments require correction. Refer to the Aircraft Flight Manual (AFM) for the correction charts.

A third static port (unheated) is on the right nose aft of the forward right static ports. This port supplies static pressure to the cabin pressurization module through one of the differential pressure relief valves. It also connects to the manual altitude controller (cherry picker).

An additional static port is on the aft bulkhead. This port connects to the cabin safety valve through the second cabin differential pressure relief valve and the cabin altitude limiter (see Pressurization chapter).

Two shoulder static ports forward of the windshield supply static pressure to the autopilot altitude controller or air data sensor.

Air Data Instruments

Air data instruments include:

- Mach/airspeed indicator
- altimeter
- instantaneous vertical speed indicator (IVSI)
- Mach/overspeed warning
- altitude alerter
- ram air temperature system.

This discussion also includes the radio altimeter and the optional flight advisory system.

Mach/Airspeed Indicator

Typical Mach/airspeed indicators for the pilot and copilot provide aircraft airspeed and Mach number. Each indicator receives pitot and static pressure information from its respective pitot tubes and static ports. Typically, each indicator displays airspeed from 60 to 400 kts and Mach number from 0.3 to 1.0 with a single pointer moving over two scales.

An aneroid moves the Mach scale to compensate for changes in pressure altitude. A Mach Limit Push knob on the face of the instrument sets an airspeed reference marker (bug).

Altimeters

Typical altimeters found in the Learjet 24/25 include barometric and altitude encoding instruments.

Barometric altimeters use two aneroid diaphragms to sense changes in atmospheric pressure. A system of gears and mechanical linkages drive a pointer and a drum display. The pointer makes a complete revolution every 1,000 ft. The drum display indicates altitude in ten thousands, thousands, and hundreds of feet.

The pilot's altimeter is a barometric encoding altimeter that provides altitude information to the transponder. The system uses a rotating wheel with an optical sensor that converts altitude information into an electrical signal to drive the pointer and drum.

All altimeters contain provisions for adjusting the unit to local barometric pressure in either millibars or inches of mercury (In Hg). On encoding altimeters, adjusting to local barometric pressure has no effect on the encoded altitude information; it is always relative to standard pressure (29.92 In Hg/1013 millibars).

The altimeter also includes a bezel that is capable of setting MDA/DH reference. A yellow triangle, located at the bottom of pictured altimeter, rotates freely around the instrument. The tapered end of the triangle marks the beginning of 200 ft above decision; the top end of the triangle marks 100 ft above decision. The attached index (located near "9" in the picture) marks 500 ft above decision.

Instantaneous Vertical Speed Indicator

Vertical speed indicators for the pilot and copilot use accelerometers to provide an instantaneous display of aircraft vertical speed (up or down). Both indicators have a pointer moving over a fixed scale that indicates aircraft vertical velocity from 0 to 6,000 feet-per-minute up or down. The instruments receive static air pressure information from their respective static systems.

On most aircraft, a static defect correction (SDC) module receives pitot and static pressure information from the pilot's pitot/static system. The module provides electrical driving signals for the pilot's altimeter and instantaneous vertical speed indicator (IVSI).

Mach/Overspeed Warning System

The Mach warning/overspeed system provides an aural warning and/or activates the stick puller system if the aircraft exceeds a preset speed. Two Mach warning/overspeed switches in the pitot static system activate the overspeed warningsystems. One switch is for high Mach (tone and stick puller) and low V_{MO} (tone). The other is for low Mach (tone) with the autopilot inoperative or off and high V_{MO} (tone). The autopilot system activates the stick puller function of the warning system.

Altitude Alerter

The altitude alerter provides visual and aural indications when the aircraft approaches or deviates from a selected altitude; these systems receive altitude information from the static defect module through the pilot's altimeter. An altitude alerting unit contains controls for setting a desired altitude, selected altitude display, and a visual warning light. Usually, the system allows the setting of a desired altitude from 0 to 55,000 ft.

Once the aircraft reaches the set altitude, the unit provides visuals warnings through a light on the unit and aural warnings through the cockpit speakers and headsets.

Once the aircraft altitude is within 1,000 ft of the desired altitude, the altitude alerting light illuminates and the alert horn sounds for one second. The light extinguishes once the aircraft is within 300 ft of selected altitude. The light illuminates and the horn sounds if altitude deviates more than 300 ft; correcting the altitude or selecting a new altitude extinguishes the light.

Ram Air Temperature

The ram air temperature (RAT) system consists of a temperature bulb in the dorsal air inlet and a RAM AIR TEMP indicator on the center instrument panel. The indicator displays temperature from -70 to 50°C.

The Left Essential bus supplies 28V DC through the 7.5 amp RAM AIR TEMP circuit breaker to the bulb and indicator.

Radar/Radio Altimeter

The radar/radio altimeter provides precise radio altitude from 0 to 2,500 ft during approach and landing. The system consists of a transceiver, transmit and receive antennas, and an indicator. The transceiver transmits a signal toward the ground, receives the bounced signal, and computes altitude by measuring the time difference between signal transmission and reception.

As the aircraft descends to 2,500 ft, the system begins providing altitude information to the RAD ALT indicator on the pilot's instrument panel and the flight instrument system. From 0 to 500 ft the indicator provides altitude in 10 foot increments; from 500 to 2,500 ft, 100 foot increments. The radio altimeter may fluctuate as much as 50 ft when taxiing over ice or snow due to the radio signal reflective properties of these surfaces.

Through a knob on the lower right edge of the indicator, the pilot can set a decision height (DH). Once the aircraft reaches this preselected altitude, an amber DH light illuminates on the indicator.

Flight Profile Advisory System

An **optional** flight profile advisory system works with the radio altimeter, nose gear relay panel, and the flight director to provide a verbal warning of unsafe flight conditions.

If the aircraft descends to 2,000 ft, the system provides a “RADIO ALTITUDE” warning. As the aircraft continues to descend past 1,000 ft radio altitude, the system announces “ONE THOUSAND” and provides a verbal announcement of radio altitude every 100 ft. Setting a decision height on the radio altimeter provides a “MINIMUM” announcement once the aircraft reaches the preselected radio altitude.

If the aircraft deviates more than one dot from the localizer, the system announces “LOCALIZER” three times; for a deviation of more than one dot from the glideslope the system announces “GLIDESLOPE” three times. The “LOCALIZER” and “GLIDESLOPE” warnings continue until the crew corrects the deviation from the localizer or glideslope path.

If the aircraft descends below a 500 ft with the landing retracted, the system announces “CHECK GEAR” three times. These warnings repeat every 100 ft until gear extension.

Communications

Communications equipment includes:

- audio control panels
- VHF communications
- HF communications
- Flitefone
- cockpit voice recorder (CVR)
- static discharging.

Audio Control Panels

A typical audio control panel contains controls for audio source and microphone output selection. Each unit has inputs for a handset, oxygen mask microphone, and headset microphone, and outputs for cockpit loudspeakers and headset. Volume controls vary the loudness of the audio sources fed to the headset and cockpit and cabin speakers.

The volume control knob that varies the loudness fed to the cabin speakers is in the center of the panel labeled PASSSPKR. The MASTER volume control knob on the left controls loudness to the headset and cockpit speakers. The SPKR/PHONE/EMERGENCY switch between the volume knobs selects the headset phone, cockpit speakers and headset phone, or emergency. The EMERGENCY position bypasses the positions of the audio select switches and volume knobs providing the pilot all radio signals at once.

The control knob at the right of the audio panel selects the transmission radio with positions for VHF 1 or 2, HFN, INPN (interphone), PASSSPKR. That selector knob provides audio from the selected radio. The white switches across the top of the audio panel provide monitoring capability for these selected radios. The up position selects the audio source with the down position off.

The switches can select VHF or HF radio transmissions, NAV 1 or 2, DME, ADF 1 or 2, or MKR to allow the pilot to listen to navigation code identifiers. The PASSADF switch allows a selected ADF to be broadcast in the cabin.

VHF Communications

Typical VHF transceivers provide air-to-air, air-to-ground, and ground-to-ground communications. The transceivers operate in the 117.000 to 135.975 MHZ frequency range with a frequency spacing of 25 kHz that provides 720 discrete channels. Optional transceivers have an extended frequency range of 116.000 to 151.975 that provides 1,440 discrete channels.

Depending on the equipment installed, there is either a dual or triple VHF transceiver system. Dual VHF communication systems utilize two separate radios. Each radio has its own control head and antenna. A common installation of dual radios uses a dual control head (COMM 1A/ COMM 1B) that controls a single transceiver. A second control head (COMM 2) controls its own transceiver. Triple VHF communication systems have three independent systems: COMM 1A, COMM 1B, and COMM 2. The COMM 1A and 1B systems have separate transceivers and control heads but share an antenna. The COMM 2 system is for emergency use if either the COMM 1A or COMM 1B system fails.

HF Communications

High frequency (HF) communications equipment allows very long range communications in the short wave frequency band. Typical systems operate in the 2.0000 to 29.9999 MHZ range with frequency spacing of 100 Hz; this provides 280,000 distinct channels. Most HF transceivers provide amplitude modulation (AM), single sideband (SSB), upper sideband (USB), and lower sideband (LSB) modes. The control head has a frequency display, volume and squelch controls, mode selector switches, and channel/ frequency select buttons and switches. Some systems allow the presetting and storing of commonly used frequencies.

Flitefone

A Flitefone radio-telephone allows the crew or passengers to communicate with ground stations through the public telephone system, with mobile telephones, or with other aircraft radio telephones over the high frequency (HF) and ultra-high frequency (UHF) radio frequencies. The system also allows communication between the cockpit and passenger cabin.

Cockpit Voice Recorder

A cockpit voice recorder (CVR) records cockpit and radio conversations. The CVR consists of a recorder unit, control unit, and a voice recorder cutout box. The control unit in the cockpit has a microphone that records cockpit conversations, test and erase switches, and a headphone jack. The erase switch only works with the parking brake set. Through the headphone jack, the crew can monitor and test system operation.

The parking brake and squat switches control the CVR when the aircraft is on the ground. With the battery switch(es) ON, the CVR operates in the bulk erase mode. If the aircraft crashes and the recorder continues receiving power, the low oil pressure switches interrupt power to the CVR after a time delay. This allows the recorder to retain the last 20 minutes of recordings.

The recorder unit is in an international orange-colored, fire and shock resistant container in the tailcone or baggage compartment. If the aircraft ditches, an underwater locator beacon on the unit assists in locating the CVR.

Flight Data Recorder

A flight data recorder (FDR) records aircraft flight data on foil or magnetic tape. The FDR consists of a remotely mounted recorder unit and an accelerometer. The FDR in the tailcone is in an international orange painted steel container built to withstand impact and fire.

An underwater locating beacon on the recorder assists in locating the recorder if the aircraft ditches. The battery-powered beacon begins transmitting once the beacon submerses in either salt or fresh water. The design of the beacon allows it to continue transmitting for approximately 30 days at depths up to 20,000 ft.

Emergency Locator Transmitter

The optional emergency locator transmitter (ELT) transmits a downward sweeping tone on 121.5 MHZ and 243.0 MHZ as an aid in locating a downed aircraft. The ELT consists of a battery-powered transmitter, antenna(s), and a system switch on the instrument panel. An impact switch in the transmitter activates the system with the application of a force of approximately five Gs along the longitudinal axis of the aircraft.

The system switch either arms, activates, or turns off the ELT. Some systems employ a switch that can reset the force-activated switch in the transmitter.

Navigation

Typical navigation equipment on the Learjet 24/25 includes very high frequency (VHF) receivers, an instrument landing system (ILS), automatic direction finding (ADF), and long range navigation equipment. This discussion also includes flight management and area navigation systems.

Please refer to Attitude and Direction for a discussion on the navigation gyro systems.

VHF Navigation

VHF navigation receivers provide very high frequency omnirange (VOR), localizer (LOC), glideslope (GS), and marker beacon navigation information to the flight crew through various indicating equipment.

Typically, each system receives 200 VHF frequencies from 108.00 to 117.95 with 50 MHZ spacing, 40 paired glideslope frequencies from 329.15 to 335.00 MHZ spaced at 150 kHz, and 40 LOC frequencies from 108.10 to 111.95 MHZ. Automatic DME channeling is through the navigation receiver. Multiple outputs from the receivers drive the flight director, radio magnetic indicators (RMIs), autopilot, course deviation indicators (CDIs), and area navigation equipment (RNAV). The receiver supplies audio output to the audio control units.

Receiver control, frequency selection, and frequency display are through control heads on the center instrument panel. As part of the VHF navigation receiver, a marker beacon receiver provides visual and aural indications of beacon passage. The system receives on 75 MHZ and provides electrical outputs to two sets of three indicating lights on the instrument panel. The receiver also provides audio output to the audio control units for beacon passage notification.

Instrument Landing System

Instrument landing systems (ILS) combine outputs from the VHF navigation, UHF glideslope and marker beacon receivers to display instrument approach path guidance information on the attitude director indicator and the horizontal situation indicator (HSI).

The system consists of a glideslope receiver operating in the 329.15 to 335.00 MHZ frequency range, the VHF receiver in LOC mode operating in the 118.10 to 111.95 MHZ frequency range, a glideslope antenna in the nose, and a LOC antenna on each side of the vertical stabilizer.

Automatic Direction Finder

Automatic direction finder (ADF) systems consist of a receiver, control head, and a combined loop and sensing antenna. Most aircraft have a pair of systems. The receiver operates in the 190.0 to 1749.5 kHz frequency range with 0.5 kHz spacing that provides 3,120 distinct frequencies.

Typical ADF systems provide three basic modes of operation: antenna (ANT), automatic direction finding (ADF), and tone (TONE). In antenna mode, the radio magnetic indicator (RMI) pointer parks and the system provides only audio output.

ADF mode provides continuous relative bearing readings to low frequency homing stations, radio beacons, and AM broadcast stations and audio outputs to the audio control panels. Tone mode provides a 1000 Hz tone for identification of morse code station identifiers.

Radio Magnetic Indicators

Two radio magnetic indicators display aircraft heading information on a calibrated servo-driven compass card. A pointer and compass card provides bearing indication to either VOR or ADF stations.

The indicators receive magnetic heading information from the directional gyros, and navigation station bearing information from the VHF and ADF receivers.

Area Navigation Systems

Area navigation systems (RNAV) allow point-to-point navigation within the coverage of VHF navigation facilities (VOR/VORTAC/DME). Most systems allow the storage of flight plans containing multiple waypoints for frequently flown routes.

These systems utilize data provided by the VHF, DME, and localizer receivers to compute and display waypoint information.

Flight Management Systems

Flight management systems (FMS) utilize position information from various navigation equipment to provide an integrated navigation display and control system. The FMS receives inputs from the VHF navigation equipment, computes the aircraft position, and provides outputs for the autopilot, flight director, radio magnetic indicators (RMIs), and HSIs.

Typical systems receive and process information from the DME, VOR, and VLF/Omega receivers, directional compass system, and autopilot computer to provide automatic navigation radio tuning, and course, bearing, and roll commands to the autopilot system. Some systems utilize a database of navigation waypoints and facilities to automate aircraft navigation.

VLF Navigation

Very low frequency (VLF) navigation systems provide great circle, point-to-point navigation on a world-wide basis. These systems utilize very low frequency transmissions from Omega and U.S. Navy facilities.

The receiver-computer unit processes all inputs and provides position coordinates, distance and deviation information, drift and track angle deviation, wind direction and speed, and ground speed to the control display unit. The receiver-computer also provides inputs to the HSIs, autopilot, and flight director system. Loss of navigation facility signals causes the system to revert to dead reckoning based on aircraft heading, true airspeed, and last computed winds.

Pulse Equipment

Pulse equipment includes avionics that employ pulses of radio signals to provide aircraft altitude, distance, and location, and identification of weather hazards ahead of the aircraft. This includes:

- distance measuring equipment (DME)
- transponders
- weather radar.

Distance Measuring Equipment

Distance measuring equipment (DME) computes and provides slant range distance between the aircraft and a VORTAC facility. The system transmits in the 1025 to 1150 MHZ range, and receives in the 962 to 1213 MHZ range. Pairing of DME channels with VHF navigation frequencies allows the automatic selection of DME channels by the VHF receiver.

The DME system provides distance, speed, and time information to the DME display(s) and horizontal situation indicator(s).

Transponder

Typical transponder systems with Mode C or Mode S capability provide identification and altitude reporting to surveillance radar installations. The system consists of a transceiver, control head, and a transmit/receive antenna. The pilot's encoding altimeter provides aircraft altitude information to the transponder system for transmission to ATC radar facilities.

Weather Radar

Weather radar systems consist of an antenna, receiver-transmitter, display, and system controls. The vertical gyro system provides aircraft attitude information to the radar system to stabilize the antenna. The system operates by transmitting a high frequency radio signal (X band), receiving the bounced signal, and displaying the received signals on the display. Controls on and below the indicator select system mode, scan range, antenna tilt, and receiver gain (sensitivity).

Typical systems provide:

- selectable scanning range
- ground mapping
- weather cell contouring
- adjustable antenna tilt and scan
- target alerting.

Hazard areas presented here come from various aircraft and component maintenance manuals and FAA Advisory Circular AC 2068B. Personnel hazard areas are the maximum recommended hazard area for radar operation on the ground. When operating radar on the ground, precautions should be taken to avoid injury to personnel, fuel ignition, or radar equipment damage. Avoid operating the radar during refueling or within 300 ft of refueling aircraft. Caution personnel to remain outside an area within 270° and 15 ft forward of the radome. Direct the nose of the aircraft so a 240° sector forward of the aircraft is free for a distance of 100 ft of large obstructions, hangars, and other buildings. Tilt the antenna up to its maximum angle.

Attitude and Direction Equipment

Attitude and direction equipment includes:

- magnetic compass
- turn and bank indicator
- standby gyro horizon
- directional gyros
- vertical gyros.

Magnetic Compass

A conventional, liquid filled magnetic compass on the windshield center post provides aircraft heading information. The compass contains provisions for maintenance personnel to adjust the unit to compensate for aircraft generated magnetic fields. A correction card near the unit provides a record of recent adjustments to the compass and compass deviation errors.

Turn and Bank Indicator

The turn and bank indicator and the turn coordinator are basic flight instruments that provide aircraft rate-of-turn and slip information. An electrically driven gyro moves a pointer or aircraft symbol in the direction and in proportion to the rate of turn of 90° per minute. A fluid-damped inclinometer on the bottom of the instrument consists of a ball riding in a curved tube. The relationship of the ball to a wire on either side of the tube's center indicates the lateral attitude of the aircraft.

Auxiliary Attitude Gyro

An auxiliary standby attitude gyro on the pilot's instrument panel to provide aircraft roll and pitch information during a complete electrical failure or system malfunction. The unit consists of an indicator on the center instrument panel and a remote emergency power supply. The power supply contains an inverter and nickel-cadmium batteries; the aircraft electrical system maintains battery charge.

Directional Gyros

Two directional gyros provide 360° of magnetic heading information to the HSIs, RMIs, autopilot, flight director(s), and pictorial navigation system (if installed). Each directional gyro consists of a directional gyro, a flux valve, and control switches.

A SLAVE/FREE switch for each directional gyro system allows the selection of either slaved or free gyro operation. In SLAVE, the directional gyro follows signals provided by the flux valve. In FREE, the directional gyro operates independently from the flux valve; manual correction of the gyro is through the L/R switch next to SLAVE/FREE switch.

Vertical Gyros

Two vertical gyros provide aircraft ±82° of pitch and 360° of roll information to the autopilot, flight instruments, flight director(s), and radar antenna stabilization system.

If one of the gyro-motors fail, the operating motor speeds up to compensate for the loss. Each vertical gyro also has pitch and roll synchros, torquer motors, and monitoring circuits. The torquer motors are part of the gyro erection system. The erection system keeps the gyros aligned on their vertical axis.

A VG ERECT switch for each vertical gyro controls voltage to the gyro erection system. When used, the VG ERECT switch provides a higher voltage to the erection system; the gyro aligns at a faster rate.

Attitude Indicator

The copilot's attitude indication, on aircraft with a single flight director, is an electrically driven instrument that receives pitch and roll information from the aircraft's vertical gyro system. The instruments displays aircraft pitch and roll on a servo-driven sphere-type display. The attitude indicator provides 360° of roll and ±90° of pitch information. The brown-earth, blue-sky sphere has pitch attitude reference marks above and below the horizon line. Roll angle marks are to the left and right of the wings level mark (12 o'clock position).

If the instrument loses power, an OFF flag appears.

Horizontal Situation Indicator

A typical horizontal situation indicator displays:

- aircraft position and heading in relation to magnetic north
- selected heading (through lower left knob) and selected course through lower right with readout in upper right
- distance to or from a DME station or waypoint in the upper left LED readout panel

- deviation from selected VOR, localizer (LOC), or other navigation aid (optional)
- vertical deviation from glideslope, and TO/FROM and bearing/track pointer information
- ground speed or time-to-go may override distance when lower left outer knob is rotated.

An aircraft symbol on the horizontal situation indicator (HSI) shows airplane position and heading in relation to an azimuth card, lateral deviation bar, and selected heading. The azimuth card displays heading information from a gyro-stabilized magnetic compass. Heading is read on the card beneath the lubber line at the top center of the indicator.

The heading (HDG) knob allows the crew to set a marker to a desired heading as read on the azimuth card. This allows the crew to set a heading on the azimuth card for display as a steering command on the ADI. A course knob rotates the course arrow on the indicator to a bearing as read on the azimuth card.

Red warning flags appear in the indicator to alert the crew to invalid data and system and component failures. A HEADING or HDG flag appears if the directional gyro providing heading information fails or is unusable. A GS flag appears if the glideslope receiver malfunctions or the signal is unusable or unreliable.

Collins PN-101

The Collins PN-101 is a self-contained system that presents magnetic heading and navigation information on a single course indicator. The system consists of:

- course indicator
- directional gyro
- flux detector
- slaving accessory.

The PN-101 receives VOR, ILS, and glideslope information from a VHF navigation radio; it receives magnetic heading information from a directional gyro. A flux detector coupled to the directional gyro through the slaving accessory aligns the directional gyro with magnetic north. The course indicator includes:

- aircraft symbol
- azimuth card and lubber line
- course bar, course arrow, and course knob
- TO/FROM arrow
- heading marker and knob
- glideslope pointer
- heading and navigation warning flags
- gyro caging knob.

With the Collins PN-101, the flight crew can perform:

- VOR approach
- VOR holding pattern
- ILS holding pattern
- ILS approach
- ILS final approach and go-around
- ILS back course approach
- radar vectoring.

Please refer to the Collins PN-101 Pilot's Guide for specific operating procedures.

The heading (HDG) flag appears when the course indicator loses valid directional gyro inputs; the navigation (NAV) flag appears if the indicator loses navigation radio information.

Attitude Deviation Indicator

A typical attitude deviation indicator provides a three-dimensional display of aircraft attitude and flight control system commands. The attitude deviation indicator (ADI) displays:

- pitch and roll commands
- flight director steering commands
- localizer and glideslope deviation
- rate-of-turn
- radio altitude (some installations)
- decision height (some installations)
- inclinometer (i.e., ball).

A rate-of-turn sensor detects aircraft lateral turn rate and drives the ADI rate-of-turn display (if installed).

Two bars flanking the aircraft symbol display steering commands from the flight director. The bars are servo-driven for combined pitch and roll commands. Numerous warning flags within the indicator alert the crew to invalid information received by the ADI.

Red warning flags appear on the ADI if there is a failure in the systems supplying information to the flight director system. These include:

GS – glideslope receiver malfunction or unreliable signal
GYRO – vertical gyro or attitude system failure
COMPUTER – director receiving invalid inputs; command bars disappear
RAD ALT – radio altimeter system failure; invalid altitude information.

Flight Director

A flight director system generates vertical and lateral steering commands for an attitude director indicator (ADI) and horizontal situation indicator (HSI). The ADI displays these steering commands as command bars.

Depending on the equipment installed, the Learjet 24/25 has a single flight director system for the pilot and an attitude indicator and course indicator for the copilot, or a dual flight director system. The flight director system(s) and autopilot are independent systems; they are not integrated.

Flight Director Computer

The flight director computer provides pitch and roll commands to the attitude director indicator. The computer uses signals supplied by the navigation receivers, pitot/static system, vertical gyros, and directional gyros to generate the pitch and roll commands.

The computer also supplies flight director system status warnings to the flight crew.

Mode Selector Panel

The mode selector panel allows the selection of operating modes for the flight director computer. Separate vertical and lateral modes are selectable on the flight guidance panel. Vertical modes include altitude hold and go-around. Lateral modes include heading select, VOR-LOC, and APPR (approach). A lateral mode must be selected before altitude hold is operable.

Automatic Flight Control System

Flight control systems include the autopilot, yaw damper, and flight director systems. The autopilot and flight director are not integrated; each is an independent system.

The Learjet 24/25 has a J.E.T. FC-110A automatic flight control stability system (AFC/SS). A single (**Learjet 24**) or dual (**Learjet 25**) yaw damper system provides lateral (yaw) control of the aircraft.

Please refer to the applicable pilot's manuals, Aircraft Flight Manual and component maintenance manuals for a thorough discussion of these systems and operating procedures for the particular components of autopilot.

Autopilot

The J.E.T. FC-110A AFC/SS provides automatic control and stabilization of the aircraft about the pitch, roll, and yaw axes. It positions the elevator, ailerons, and rudder in response to autopilot computer/amplifier steering commands. Selectable operating modes provide the ability to maintain a desired altitude, pitch attitude, heading, and to capture and track localizer, glideslope, and VOR/ ILS signals.

The FC-110A consists of:

- autopilot controller
- autopilot computer/amplifier
- force indicator
- autopilot electrical box
- yaw rate gyro
- lateral accelerometer
- autopilot altitude controller or air data sensor
- servo actuators.

Please refer to the Aircraft Flight Manual Supplements and applicable pilot guides for system specific operating procedures and system limitations.

Autopilot Controller

The autopilot controller is on the center pedestal. The controller contains:

- autopilot engage and yaw damper ON/OFF buttons
- roll turn knob and pitch command wheel
- autopilot on/off annunciators
- navigation, heading, glideslope, and altitude mode selector buttons (SPD, REV CRS, BANK).

Pressing the autopilot engage button engages the autopilot pitch and/or roll axes. With no other autopilot mode active, the autopilot activates the heading hold function and maintains the aircraft at a wings level attitude and a pitch attitude.

Use of any of the following disengages the autopilot:

- the trim or trim arming switch
- pitch trim selector switch
- a wheel master switch
- emergency pitch trim switch
- pilot's vertical gyro VG ERECT switch
- pilot's directional gyro FREE/SLAVE switch.

Moving the roll turn knob left or right out of its center detent initiates a bank (30° maximum) in the direction of and in proportion to knob movement. Moving the knob in either direction releases the heading (HDG), navigation (NAV), and glideslope (G/S) buttons. The autopilot will not engage with the roll knob out of the center detent.

Moving the pitch command wheel up or down initiates a pitch change in the direction of and in proportion to wheel movement. Moving the wheel up to its maximum movement initiates a 20° pitch up; moving it down to its maximum movement initiates a 10° pitch down. Either action disables the G/S, altitude (ALT) hold, and speed (SPD) functions.

The amber OFF annunciator illuminates when DC power is available to the autopilot controller but the autopilot is not engaged. The blue ON annunciator illuminates once the autopilot pitch and/or roll axes activate.

Autopilot Switches and Indicators

Additional controls for the autopilot are on the control wheels and pedestal. A force indicator for the aileron, rudder, and elevator servo actuators is on the pilot's instrument panel. On the horns of each control wheel is a:

- master switch
- maneuver roll and pitch control switch
- pitch sync switch
- four-way trim switch.

The wheel master switch on the outboard control horn acts as a complete AFC/SS disengagement switch. The maneuver roll and pitch (MANU R/P) and the pitch sync switches are on the inboard control horn. Pressing and holding the MANU R/P switch places the autopilot in standby mode enabling the pilot to manually fly the aircraft. After releasing the switch, the autopilot assumes basic attitude control by bringing the aircraft to a wings level attitude; it erases all previously programmed pitch and roll functions. Pressing the pitch sync button clears any pitch function (SPD, ALT, or GS when engaged) and syncs the ADI V bars to the aircraft delta on the ADI.

Between the throttle levers is the A/P PITCH REL switch. Depressing and holding the switch temporarily disables the autopilot pitch axis; the roll axis remains engaged. The crew then can manually fly the aircraft to a new pitch attitude. Once released, the autopilot maintains the new pitch attitude.

Upon pitch release, depressing the go-around button disengages the autopilot pitch and roll functions and commands a go-around attitude of 9° nose-up and wings level.

Yaw Damper

The **Learjet 24** has a single yaw damper system that is part of the autopilot. The **Learjet 25** has a dual yaw damper system (primary and secondary). The secondary system is independent of the autopilot.

Single Yaw Damper – Learjet 24

The autopilot computer/amplifier receives yaw rate information from a lateral accelerometer and a yaw rate gyro. The computer/amplifier processes this information and provides driving signals for a servo actuator connected to the rudder through servo cables and a rudder servo sector. A follow-up on the servo actuator provides rudder position information to the computer/amplifier.

Dual Yaw Damper – Learjet 25

The dual yaw damper system consists of:

- two servo actuators (primary and secondary)
- secondary yaw damper controller
- yaw damper follow-ups
- two yaw rate gyros
- lateral accelerometer
- yaw damper control box
- rudder servo sector and servo cables.

Yaw Damper Force Sensors

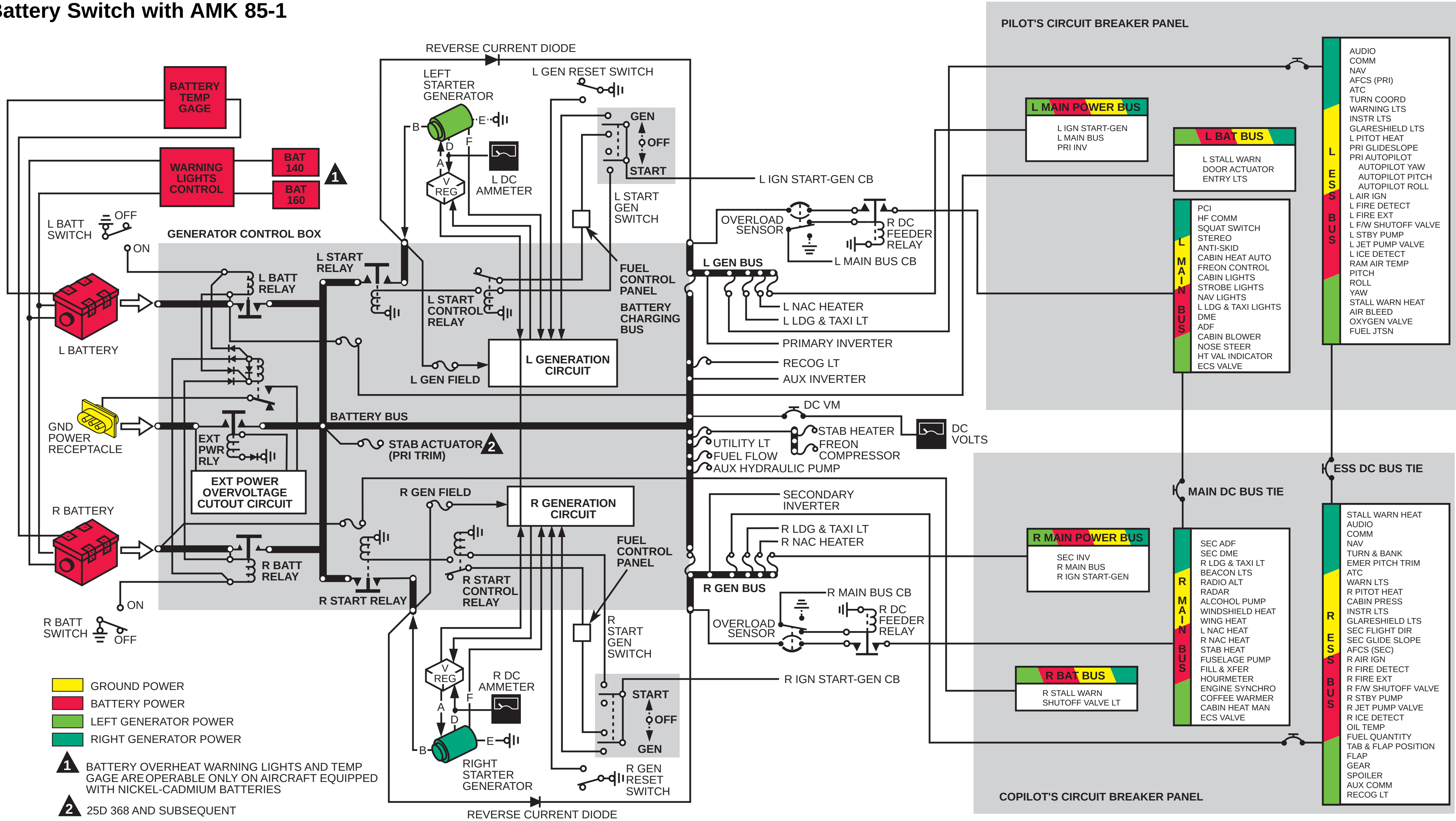
On **Learjet 25D/F, 25-363 and subsequent; earlier aircraft with AAK 83-4**, the yaw damper force sensor system consists of two yaw damper force sensors and one yaw damper force detector box. The yaw damper force sensors (one for pilot and copilot) attach between the respective pilot's rudder pedal bellcrank and the forward rudder bellcrank.

The pilot and copilot must resist rudder pedal movement or initiate an override load on the rudder pedals to provide a load on the yaw damper force sensors. When a force of 30 lbs is applied to the rudder pedals, the force sensors supply an electrical signal to the yaw damper force detector box. The force detector box then switches the yaw damper system to a low override torque configuration.

The yaw damper system automatically switches into normal operating mode after reduction of force on the rudder pedals.

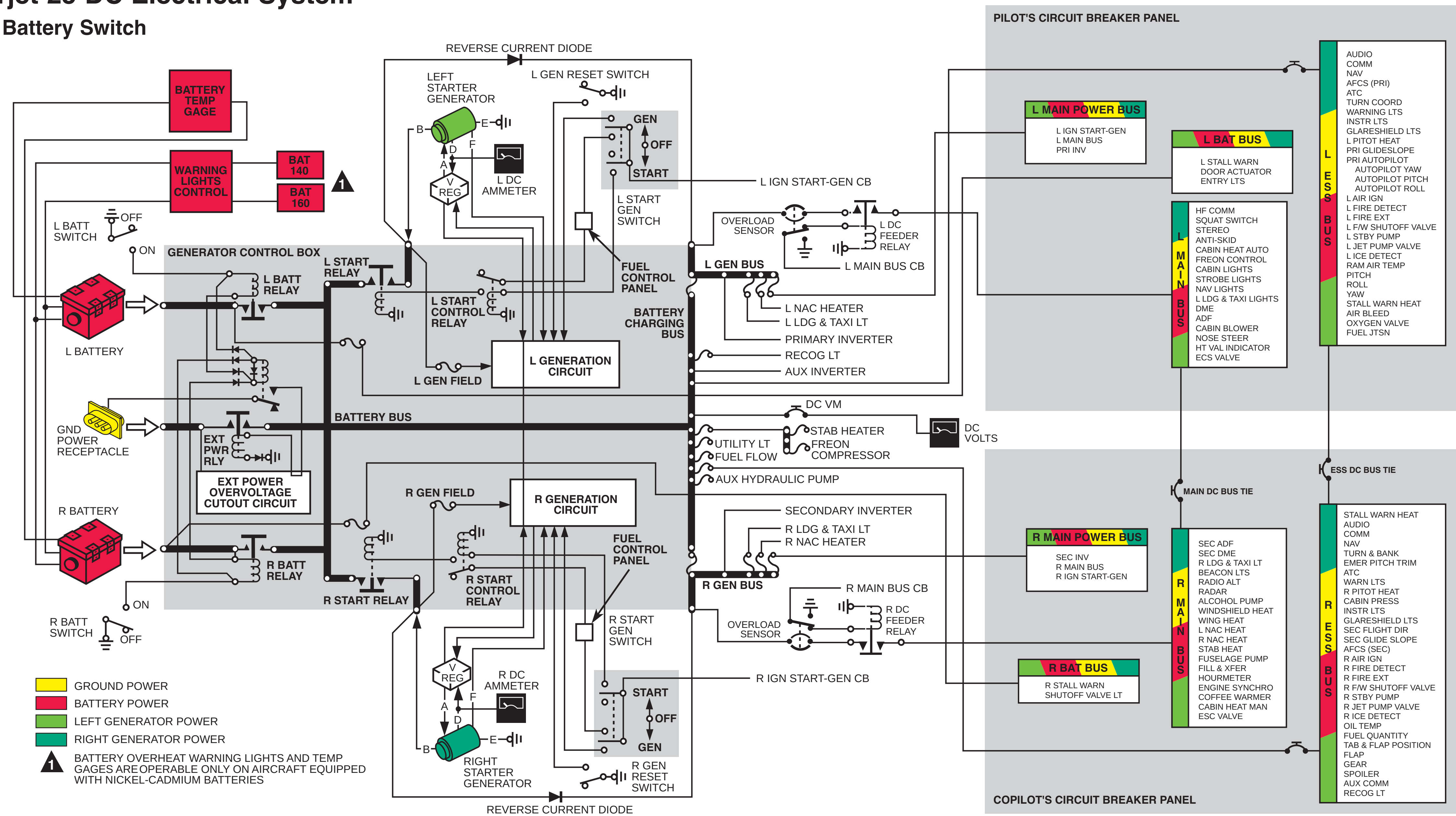
Learjet 25 DC Electrical System

Dual Battery Switch with AMK 85-1



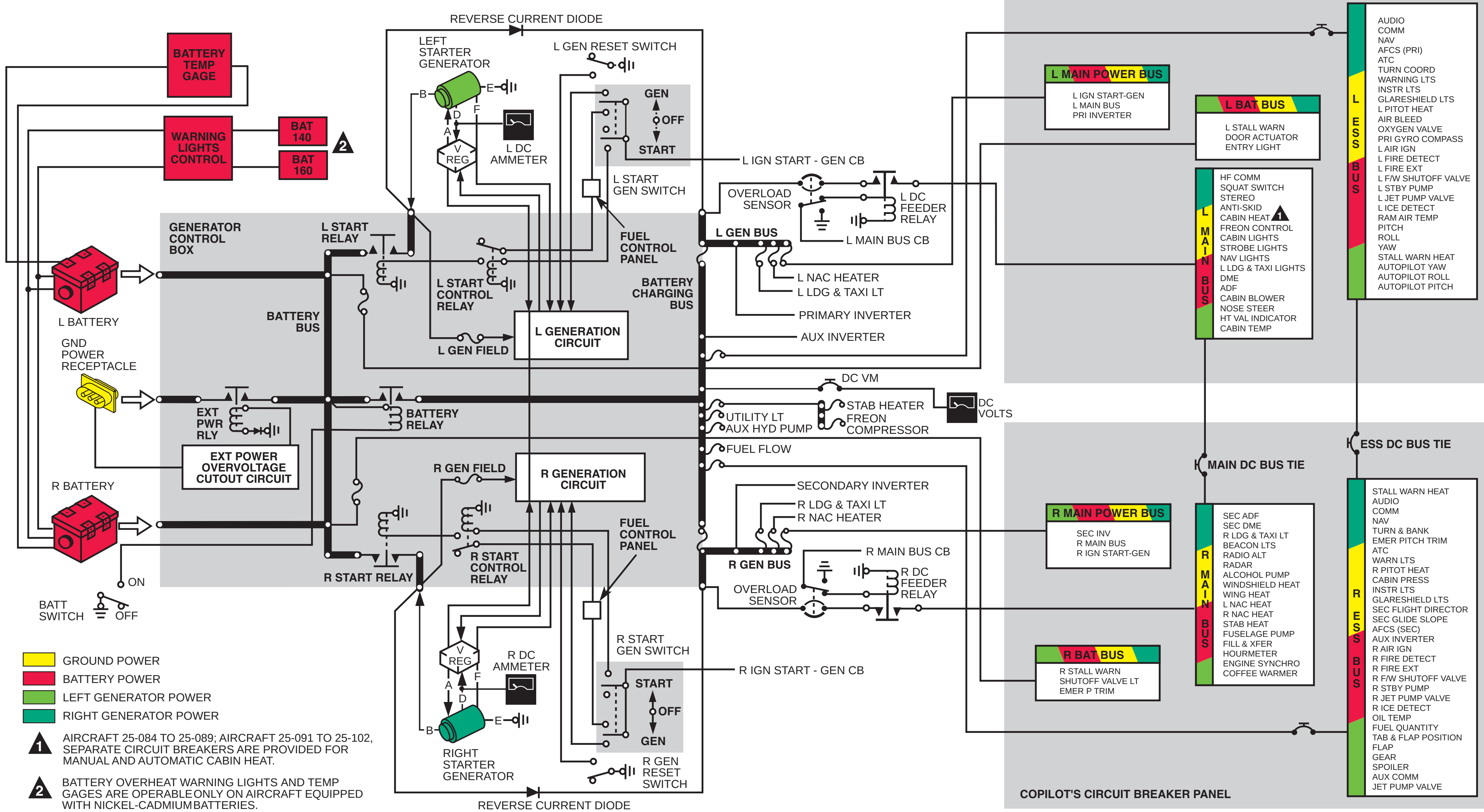
Learjet 25 DC Electrical System

Dual Battery Switch



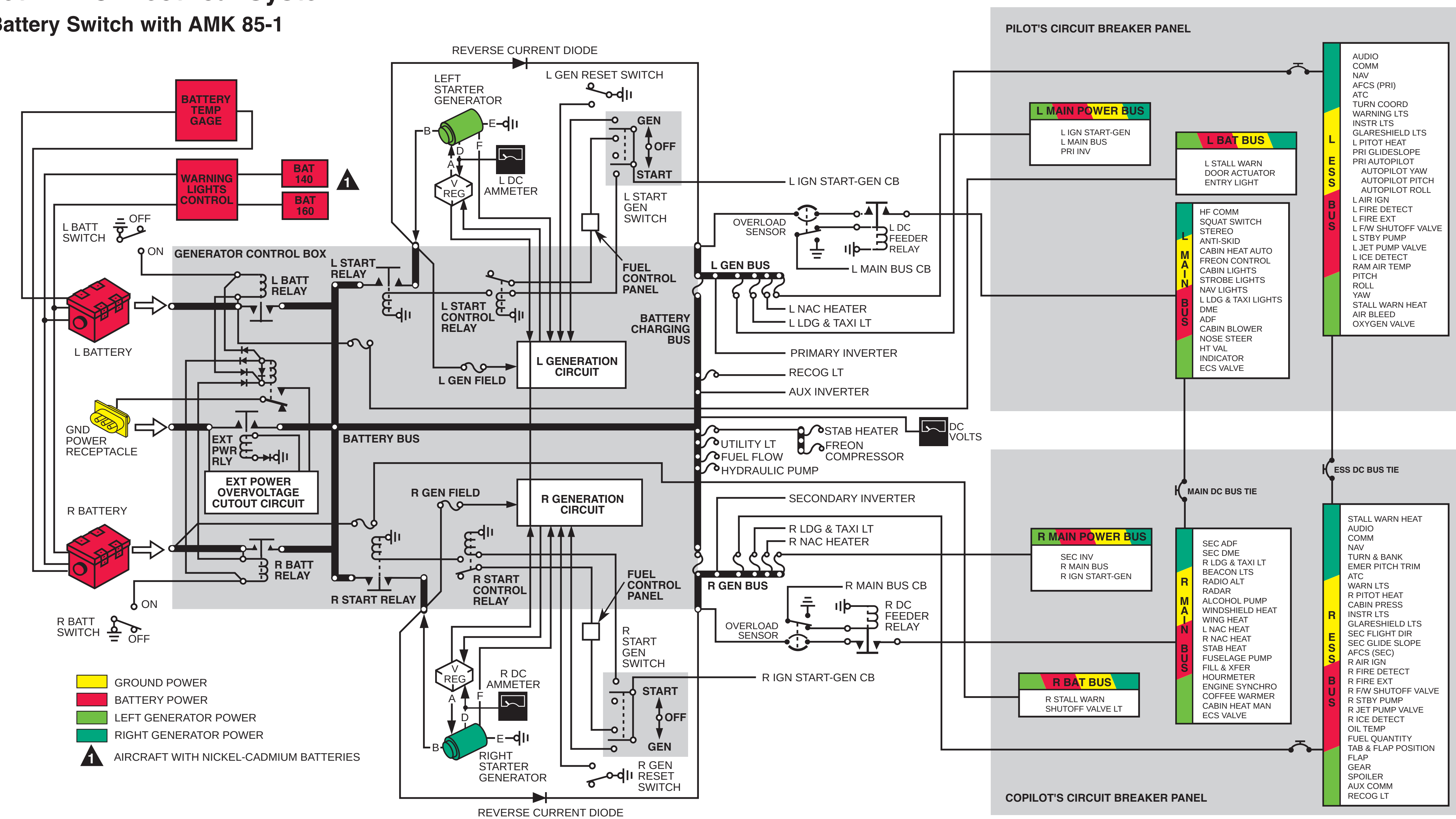
Learjet 25 DC Electrical System

Single Battery Switch



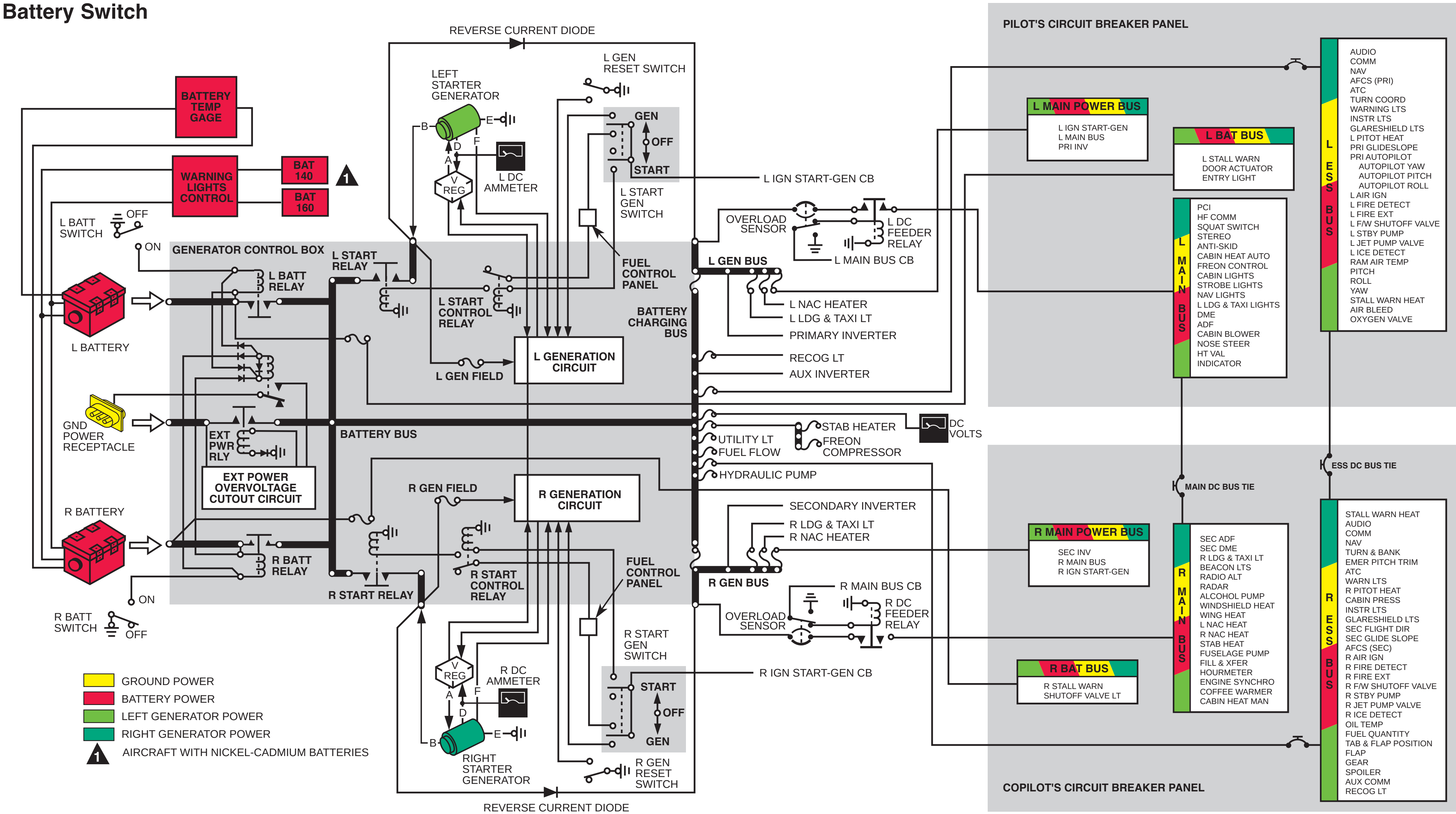
Learjet 24 DC Electrical System

Dual Battery Switch with AMK 85-1



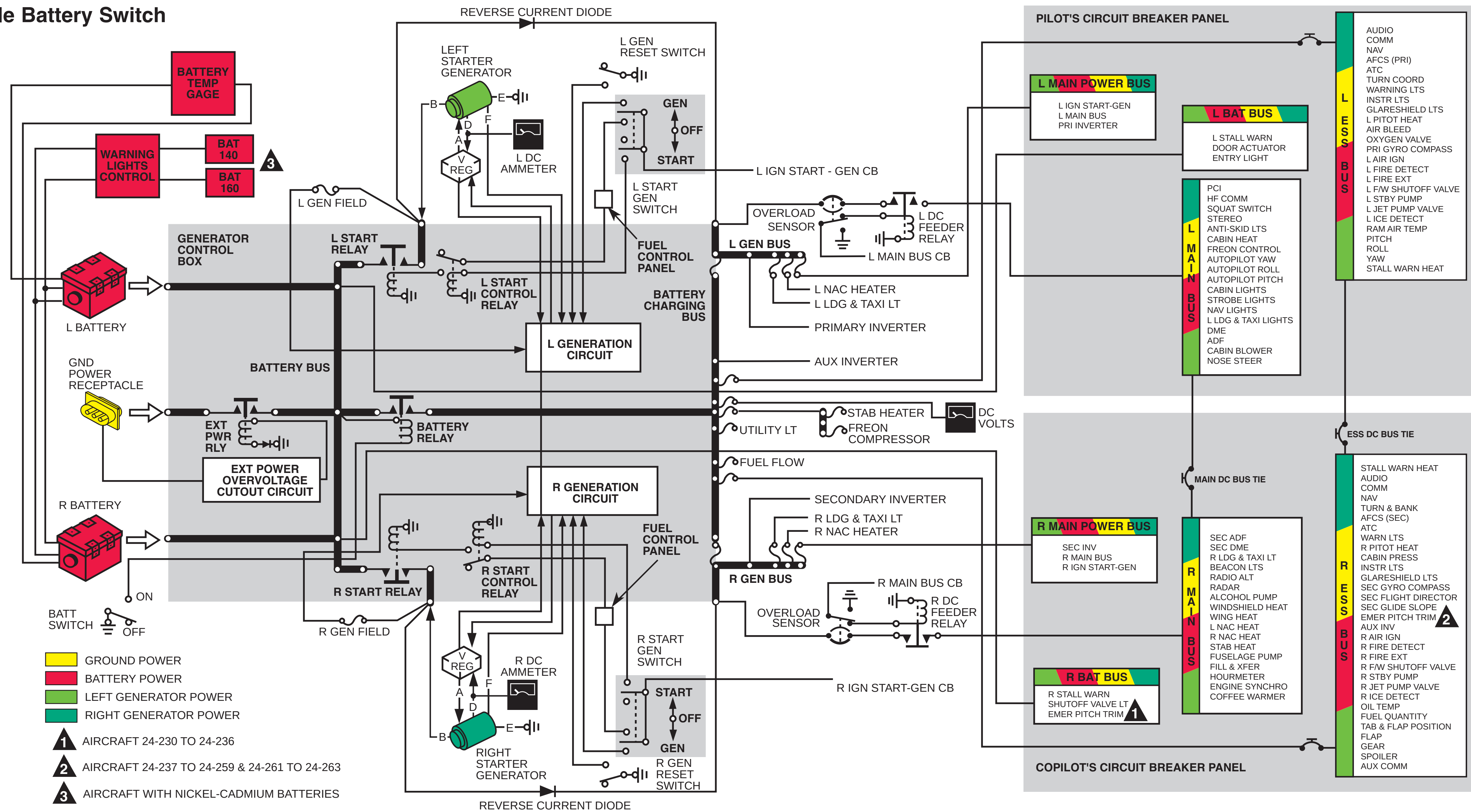
Learjet 24 DC Electrical System

Dual Battery Switch



Learjet 24 DC Electrical System

Single Battery Switch



Electrical Systems

This section describes the electrical and lighting systems.

The Learjet 24/25 electrical system includes direct current (DC) that powers the majority of the aircraft systems, and alternating current (AC) that powers avionics equipment.

Two engine-driven starter/generators provide DC to their respective distribution buses for primary aircraft electrical power. Two batteries, with one or two control switches depending on configuration, supply secondary DC power for engine starting and emergencies. An external power system allows connection of a GPU for engine starting, maintenance, and ground operations. A single or dual emergency battery system provides limited AC and DC power during complete electrical system failures.

Two solid-state static inverters provide 115V, 400Hz, 1,000 volt-amp (VA) power to a distribution system. Some aircraft have an optional third inverter.

Lighting on the Learjet 24/25 includes cockpit, passenger cabin, exterior and emergency lights.

Model		One Switch	Two Switches
25D/F	25-206 and subsequent		X
25B/C	25-061, 070-089, 091-102	X	
	25-090, 103-205		X
24E/F	24-329 and subsequent		X
24D	24-230 to 259, 261 to 163	X	
	24-260, 264 and subs.		X

Table 4B-A; Battery Switch Differences

Model		250 Watt	600 Watt
25D/F	25-206 and subsequent		X
25B/C	25-061 to 138	X	
	25-139 to 205		X
24E/F	24-328 and subsequent		X
24D	24-258 to 271	X	
	24-272 to 328		X

Table 4B-B; Recognition Light Differences

DC Electrical System

Two 30V DC, 400 ampere starter/generators are the primary source of DC power for the aircraft. Two 24V batteries supply power for engine starting and emergencies. A receptacle on the left side of the fuselage near the tailcone access door allows the connection of a 28V DC ground power unit (GPU). Single or dual emergency batteries supply 25V DC and 115V, 400 Hz AC power during complete electrical failures.

Major DC system components include:

- two starter/generators with associated voltage regulators, generator control
- box, control systems and switches
- two batteries with associated gages, switches, warning systems, and annunciators
- external power system
- one or two emergency batteries
- eight DC buses in the cockpit
- relays, current limiters, and circuit breakers.

Generator System

The generator system consists of:

- two starter/generators
- two voltage regulators
- generator control box
- two reverse current diodes
- generator reset switches
- DC feeder bus relays
- bus control circuits
- indication and warning systems.

Starter/Generators

The starter/generators serve a dual function: as motors during the engine start cycle, and as generators once the engine reaches idle speed. Ram air supplied by a flexible cooling duct from a scoop on the lower nacelle cools each starter/generator.

Voltage Regulators

If a generator's output voltage exceeds 32 ±1V DC, circuits within the voltage regulator energize a generation circuit over-voltage relay. The relay opens to remove the generator field ground. If the fault corrects itself, selecting RESET on the respective generator reset switch re-establishes the generator field ground; the generator comes on-line.

Generator Control Box

The generator control box in the tailcone contains relays that control the starter/generators and the DC electrical system. The box contains the:

- battery relay(s)
- external power relay
- left and right start/generator control relays
- over-voltage control relay
- equalizer circuit relay.

Reverse Current Diodes

A reverse current diode for each starter/generator protects each generator system by preventing the reverse flow of current to a generator. These diodes effectively isolate each generator from its opposite. If the reverse current exceeds 2V, the generator drops off-line.

Generator Switches

Each generator system has a three position (GEN/OFF/START) generator control switch and a generator reset switch. Placing the switch in START closes the motive flow valve, turns on the standby pump and arms the ignition system. Once the engine reaches idle speed, placing the switch in GEN de-energizes the starter control relay and energizes generation circuit relays. The starter/generator begins supplying power to the aircraft DC electrical system. The center OFF position de-energizes the starter/generator.

If an over-voltage control relay opens, thus breaking a generator field current ground, momentarily selecting RESET with the respective generator reset switch re-establishes the ground.

Generator Warning System

An amber GEN annunciator for each generator is on the annunciator panel. If a generator drops off-line, malfunctions, experiences a over-voltage condition, or a reverse current condition occurs, the respective GEN annunciator illuminates. The L/R GEN annunciators also illuminate if the respective generator's switch is OFF or in START.

Voltmeter and Ammeters

Two ammeters on the center instrument panel indicate the output of the generators from 0 to 400 amps. A yellow arc covering 300 to 400 amps denotes the maximum operating output range of the generator. A red radial line at 400 amps denotes the maximum output under any condition.

A single voltmeter between the ammeters indicates the Battery Charging bus voltage. The voltmeter, scaled from 0 to 35 volts, has a red radial line at 35 volts to denote the maximum allowable bus voltage. Over-voltage circuits for the generators limit generator output to 32 volts.

Batteries

Two batteries are in the tailcone provide 24 volt DC power to the aircraft electrical system for engine starting and emergencies. Battery installation varies considerably; the aircraft can have nickel-cadmium or lead-acid batteries.

Typical installations include:

- 22 amp-hour, 24V, 19-cell nickel-cadmium batteries
- 40 amp-hour, 24V, 19-cell nickel-cadmium batteries
- 45 amp-hour, 24V lead-acid batteries.

Aircraft with nickel-cadmium batteries have a battery temperature warning system that has low and high limit thermoswitches and warning lights. In addition to the lights, some aircraft also have a battery temperature sensor(s) and a battery temperature indicator.

Battery Switch(es)

The battery switch or battery switches are on the center instrument panel below the landing gear handle (**Table 4B-A**).

On **aircraft with a single battery switch**, turning the BATTERY switch on energizes (closes) the battery relay. Battery voltage must be at least 16V to close the battery relay. The batteries supply power from the Battery bus through the closed relay to the Battery Charging bus. If a nickel-cadmium battery overheats, isolate it by turning the BATTERY switch OFF; this opens the relay and removes battery power from the Battery Charging bus. The batteries remain connected to the Battery bus and the Hot Battery buses.

On **aircraft with two battery switches**, turning one or both BATTERY switches ON closes the respective battery relay if the battery voltage is at least 16V. Turning one of the BATTERY switches OFF does not remove battery power from the aircraft; the remaining battery continues to provide power to the electrical system.

External Power

Where available, a 28V DC ground power unit (GPU) can provide power to the aircraft electrical system for engine starting, systems operation, and battery charging. The external power system consists of:

- power receptacle
- external power relay
- external power control relay (two battery switch installation)
- external power over-voltage lockout circuit.

The external power receptacle is on the left side of the fuselage near the tailcone access door. The external power relay and over-voltage lockout circuit are in the generator control box.

Emergency Batteries

The optional emergency battery system supplies 25V DC and 4.6/115V, 400 Hz AC power for operation of select essential equipment. The system contains nickel-cadmium or lead-acid batteries and an inverter. The inverter converts battery power into AC for a standby attitude gyro. Installation of an optional second emergency battery varies with aircraft serial number and equipment installed; please check your aircraft configuration.

On **aircraft with one emergency battery**, there is an EMERGENCY power switch and an amber EMR PWR light on the top of the pilot's instrument panel. Later aircraft have a three-position (ON/OFF/STBY) switch while early aircraft have a two-position switch (ON/OFF) to control battery operation

On **aircraft with two emergency batteries**, the second battery usually supplies power for the radio, transponder, and No. 1 hdg gyro. The No. 2 battery has a two-position (ON/ OFF) switch and an amber EMR PWR light. The EMR PWR light illuminates once the No. 2 battery begins supplying power during an electrical system failure.

DC Distribution

Buses provide connection and distribution points for the DC and AC power. Wiring, current limiters, and circuit breakers carry power from the generators, batteries, and external power system to the DC-powered aircraft systems.

All references to power sources for aircraft systems were derived from a typical **Learjet 25B/C/D/F** and **Learjet 24D/E/F** aircraft electrical system definition.

The DC bus system consists of:

- Battery bus
- Left and Right Hot Battery buses
- Battery Charging bus
- Left and Right Generator buses
- Left and Right Main Power buses
- Left and Right Main buses
- Left and Right Essential buses.

The left and right circuit breaker panels in the cockpit contain individual circuit breakers that supply aircraft equipment. Each panel contains:

- ESS BUS (Essential)
- MAIN BUS (Main)
- AC BUS
- BAT BUS (Battery)
- MAIN POWER BUS (Main Power).

The left circuit breaker panel contains the primary (i.e., pilot) systems circuit breakers; the right panel contains the secondary (i.e., copilot) systems circuit breakers.

Battery Bus

The battery bus receives power from the batteries, external power system, or operating generators.

On **aircraft with two battery switches**, the batteries supply power to the Battery bus through the respective closed battery relay; the Battery bus supplies the Battery Charging bus directly. The Battery bus also receives power from the external power system through the closed external power relay if one battery is on.

On **aircraft with a single battery switch**, the Battery bus receives power from the batteries. The Battery bus also receives power from the external power receptacle with a GPU connected through the closed external power relay. From the Battery bus, the closed battery relay connects the Battery bus to the Battery Charging bus.

The Battery bus also supplies engine starting power through the respective start relay.

Left and Right Hot Battery Buses

The Left Hot Battery bus is on the pilot's circuit breaker panel (left side) and the Right Hot Battery bus is on the copilot's circuit breaker panel (right side). Typically, the Left Hot Battery bus powers the left stall warning system, door actuator, and the entry lights. The Right Hot Battery bus powers the right stall warning system and both firewall shutoff valve lights

Battery Charging Bus

The Battery Charging bus receives power from the batteries through closed battery relay (single battery switch) or from the Battery bus (dual battery switches).

The Battery Charging bus supplies the:

- auxiliary hydraulic pump (i**f installed**)
- auxiliary inverter (**if installed**)
- Freon compressor (**if installed**)

- fuel flow indicating system
- Left and Right Essential buses (**without AMK 85-1**)
- recognition light (**if installed**)
- stabilizer heater
- utility light.

Generator Buses

The Left and Right Generator buses supply power from the generators to:

- Battery Charging bus
- Left and Right Essential buses (**with AMK 85-1**)
- Left and Right Main Power buses
- Left and Right Main buses.

The Left Generator bus powers the:

- left landing and taxi lights
- primary AC inverter
- Left Main Power bus
- Left Main bus
- L ESS bus (**with AMK 85-1**).

The Right Generator bus powers the:

- right taxi and landing lights
- secondary AC inverter
- Right Main Power bus
- Right Main bus
- R ESS BUS (**with AMK 85-1**).

Left and Right Main Power Buses

The Left Generator bus powers the Left Main Power bus; the Right Generator bus powers the Right Main Power bus.

The Left Main Power bus supplies the:

- primary AC inverter switch
- Left Main bus feeder relay
- left ignition starter/generator switch.

The Right Main Power bus supplies the:

- secondary AC inverter switch
- Right Main bus feeder relay
- right ignition starter/generator switch.

Left and Right Main Buses

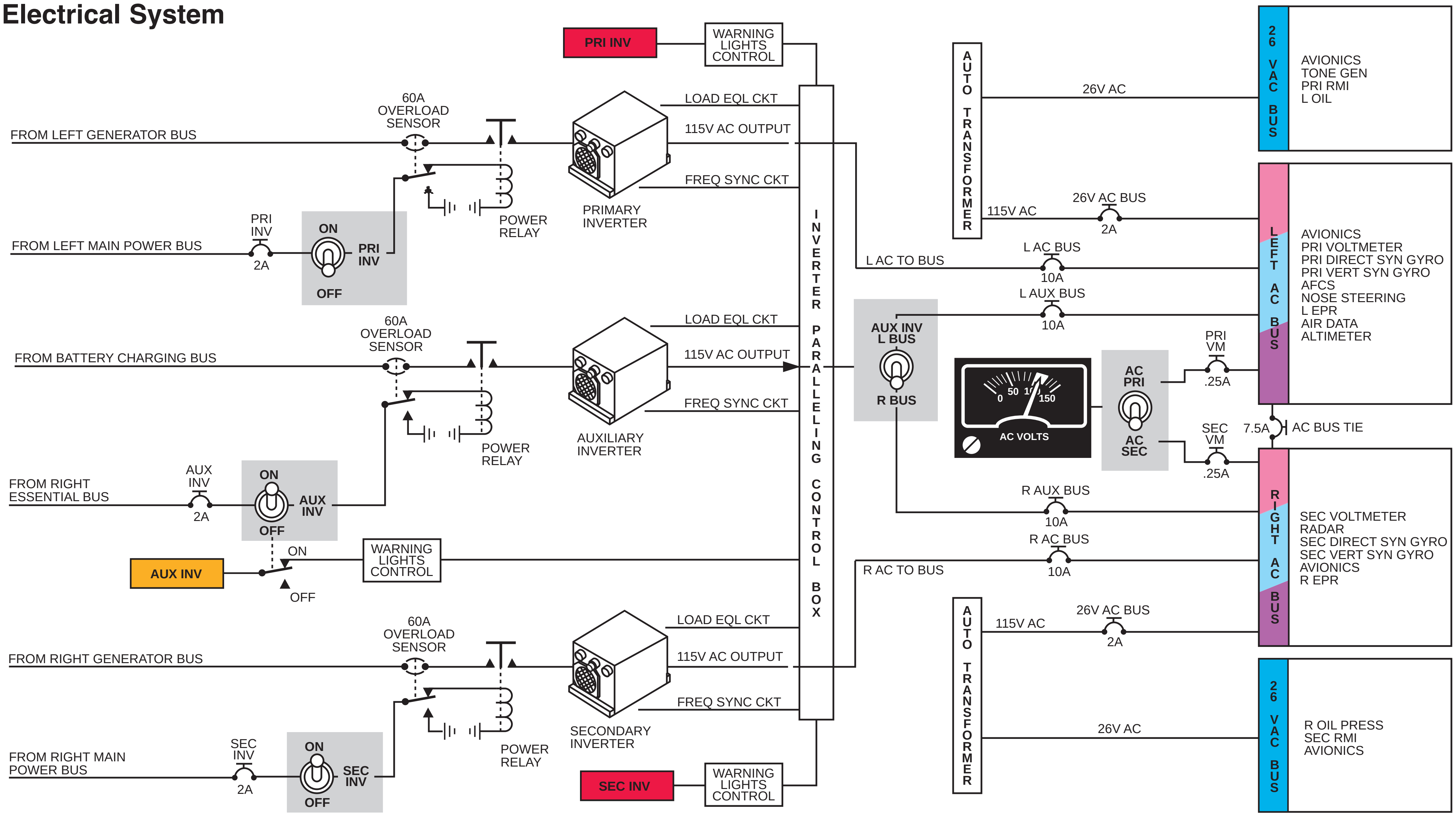
The Left and Right Main buses provide power for non-essential communications equipment, lighting, and navigation equipment. The Left and Right Main buses receive power from their respective Generator bus. The MAIN DC BUS TIE circuit breaker connects the Left and Right Main buses and serves as automatic bus separation in case of a short on one main DC Buses and not the other.

Left and Right Essential Buses

The Left and Right Essential buses supply power for audio panels, communications radios, flight instruments, fire protection and extinguishing systems, landing gear, spoiler, and flaps.

In the three-position emergency battery system, there is a diode within the Right Essential bus that separates the flaps, spoilers, landing gear, and optional auxiliary communications radio from the rest of the bus. Normally, these items receive power from the Right Essential bus. If an electrical failure occurs, the emergency battery provides power to these items; the diode prevents the power flow to the rest of the bus.

AC Electrical System



AC Electrical System

The **Learjet 25B/C/D/F** and **Learjet 24D/E/F** AC electrical system uses inverters to convert 28V DC into 115V AC power for flight instruments and selected engine indicating equipment. Auto-transformers convert 115V AC into 26V AC power.

Inverter System

A typical AC system consists of:

- overload sensors
- power relays
- primary and secondary inverters
- paralleling control box
- distribution buses
- auto-transformers
- control and indication system
- AC voltmeter and source selector switch.

Some aircraft have an optional auxiliary inverter. This inverter has its own overload sensor, power relay, inverter switch, and warning light.

Inverter

The primary, secondary, and auxiliary inverters provide 115V, 400 Hz AC single phase power; all three have a 1,000 volt-ampere rating. The primary inverter receives 28V DC power from the Left Generator bus; the secondary inverter receives power from the Right Generator bus. The optional auxiliary inverter receives power from the Battery Charging bus.

AC Buses

The AC bus system consists of a Left AC bus and a Right AC bus. The AC BUS TIE circuit breaker connects the Left and Right AC buses. An auto-transformer on each AC bus converts 115V AC into 26V AC.

Control and Indication

Control and indication for the inverter system includes:

- primary and secondary inverter switches
- auxiliary inverter ON/OFF and bus selector switches (**if installed**)
- AC voltmeter
- AC voltmeter source selector switch.

Inverter Switches

The PRI (primary) and SEC (secondary) INVERTER control switches control the inverter power relays that supply DC power to the inverters.

The optional auxiliary inverter has two switches: AUX INV and R BUS/L BUS. The two-position (ON/OFF) AUX INV switch controls the auxiliary inverter power relay. The two-position R BUS/L BUS selects the AC bus that the inverter supplies.

AC Voltmeter

A source-selectable AC voltmeter is below the engine instruments. Above the voltmeter is a two-position (AC PRI/AC SEC) switch that selects the Left AC (AC PRI) or Right AC (AC SEC) bus.

Inverter Warning Lights

Two red inverter lights are on the glareshield. The PRI INV and SEC INV lights illuminate if the respective inverter fails. The lights also illuminate if the inverter is not supplying power to its bus (e.g., inverter failed or AC bus CB open) or its switch is OFF.

On **aircraft with an auxiliary inverter**, the amber AUX INV light illuminates if the auxiliary inverter fails with the AUX INV switch ON. The light does not illuminate with the AUX INV switch in OFF.

Lighting

Lighting on the Learjet 24/25 includes cockpit, cabin, and exterior lighting.

See the Data Summary at the end of this chapter for a listing of cockpit, cabin and exterior lighting system switches, power sources and circuit breakers.

This description represents a typical aircraft delivered from the factory.

Cockpit Lighting

Cockpit lighting includes instrument, glareshield flood, and map lights. These systems employ post, eyebrow, edge, and flood lights. Cockpit lighting control is through separate system rheostats on the pilot's and copilot's side panels and near the light (map).

Instrument Lighting

Instrument lighting includes internal lighting of individual instruments, post lights, eyebrow lights, and panel edge lighting. These lighting systems also illuminate the communication and navigation radio control heads, autopilot controller, and pedestal.

There are three separate systems; pilot's, copilot's, and center panel. Each system has a light dimmer that receives 28V DC and converts it into a variable low voltage for light bulb illumination.

Glareshield Flood Lights

Two sets of glareshield flood lights shine down to illuminate the instrument panel. Each set of lights consists of multiple incandescent bulbs controlled by a rheostat. The pilot's FLOOD rheostats control these lights.

Some installations employ cold-cathode tubes instead of incandescent bulbs. The operation of the lights is essentially similar.

Map Lights

A map light above the pilot's and copilot's stations shines down to illuminate work areas. These lights also illuminate the circuit breaker panels on each side of the cockpit. Each light has a rheostat next to it that controls lighting intensity from OFF to full brightness.

The El Panel rheostats power electro-luminescence panels on the circuit breaker panels.

Cabin Lighting

Cabin lighting includes:

- passenger reading
- entry (left service cabinet)
- forward and aft upper center panel
- baggage compartment
- No Smoking/Fasten Seat Belt.

All cabin lighting systems operate on 28V DC supplied by the aircraft electrical system. The entry, upper center panel, and baggage compartment lights are also part of the emergency lighting system (see Emergency Lights).

Passenger Reading Lights

Individual reading lights on the close out panel between the windows and the upper center panel illuminate the passenger seats. Each light has an ON/OFF switch next to it.

Entry Light

A light in the left service cabinet illuminates the entry area. A switch in the service cabinet supplies 28V DC supplied through the ENTRY LTS CB from the Left Hot Battery bus.

Upper Center Panel Lights

Two lights in the forward upper center panel and one light in the aft upper center panel provide general passenger compartment lighting. The switch that controls the entry lights also controls the forward upper center panel lights. A switch in the aft cabin controls the single aft light.

Baggage Compartment

Two lights illuminate the baggage compartment in the aft cabin. Both lights receive power from the Left Hot Battery bus through the ENTRY LTS or ENT LTS CB. The same switch that operates the entry and forward upper center panel lights also controls the baggage compartment lights.

No Smoking/Fasten Seat Belt Sign

A NO SMOKING/FASTEN SEAT BELT sign is on the left service cabinet or the forward part of the upper center panel. The NO SMOKING & SEAT BELT LIGHT switch on the upper edge of the pedestal controls the sign. Placing the switch in either FASTEN SEAT BELT or FASTEN SEAT BELT & NO SMOKING also sounds a chime through the passenger cabin speaker.

Exterior Lighting

Exterior lighting includes:

- navigation lights (4)
- strobe lights (3)
- rotating beacon (2)
- landing and taxi lights (2)
- optional recognition light (1 or 2)
- optional wing inspection light.

Controls for the exterior lighting system are on the bottom of the center instrument panel.

Navigation Lights

The navigation lights consist of a green light in the right wing tip, a red light in the left wing tip, and two white lights in the tail. The NAV LTS switch controls these lights.

Use the navigation lights for all night operations.

Avoid prolonged operation of the navigation lights in a hangar. Lack of cooling air for the tail navigation light may cause lens distortion due to heat build-up.

Strobe Lights

The **optional** strobe light system places a flashing high-intensity strobe light adjacent to each navigation light. A timing circuit module controls the simultaneous flashing of all three lights at approximately 50 flashes per minute. The STROBE LIGHT switch controls 28V DC supplied by the Left Main bus through the STROBE LTS CB.

Rotating Beacon

A red, two bulb oscillating rotating beacon (anti-collision light) is on the top of the vertical stabilizer and the bottom of the fuselage. The BCN LT switch supplies 28V DC from the Right Main bus through the BEACON LTS CB to both lights.

Landing and Taxi Lights

The landing and taxi lights consist of a 450-watt lamp on each main landing gear. The two (left and right) three-position LDG LT-TAXI LT-OFF switches together with the landing gear down-and-locked switches control relays that supply power to the lights.

When the landing gear retracts, the lights extinguish.

Recognition Light

A single 250 or **optional** 600 watt recognition light (depending on the aircraft) is in the right tip tank nose. The RECOG LT switch controls a relay that supplies 28V DC through a current limiter from the Battery Charging bus (**Table 4B-B**).

Wing Inspection Light

An **optional** wing inspection light on the right side of the aircraft illuminates the right wing for ice detection and provides escape path lighting for the emergency exit.

Normally, the wing inspection light receives power from the Right Main bus through the WING INSP LTS CB and WING INSP push button on the copilot's dimmer panel.

During an emergency, the baggage compartment emergency lighting system battery supplies this light (see Emergency Lights).

Emergency Lights

The **optional** emergency lighting system uses nickel-cadmium battery packs to illuminate select passenger cabin lights, optional door light, and the wing inspection light during an emergency. The depressurization lighting system is also part of the emergency lighting system.

Cabin Emergency Lights

The cabin emergency lighting system uses two power supplies with 12V DC nickel-cadmium batteries to illuminate the upper center panel, emergency exit, and wing inspection lights during an electrical system failure.

Emergency lighting control and operation is through the three-position (DISARM/ARM/TEST) emergency light switch on the pedestal and the two-position (EMER LT/NORM) cabin emergency light switch in the left hand service cabinet.

Normally, the DISARM/ARM/TEST switch is in the ARM position and the EMER LT/NORM switch is in the NORM position. Placing the EMER LT/NORM switch in EMER LT, the DISARM/ARM/TEST switch in TEST, or loss of 28V DC to the control circuit module illuminates the emergency lights.

Depressurization Lighting

On the **Learjet 25B/C/D/F; 25-090 and subsequent**, and the **Learjet 24D/E/F; 24-247 and subsequent**, the oxygen system aneroid switch also controls the depressurization lighting system. Once cabin altitude reaches 14,000 ±750 ft, the aneroid switch closes to complete a circuit to the depressurization relay. Once the depressurization relay closes, the upper center panel lights illuminate as warning to don oxygen masks.

DC Electrical Systems

Power Source	Two 24V batteries (lead-acid or ni-cad) Two engine-driven 30V, 400A starter-generators One or two 25V DC and 4.6/115V AC, 400 Hz emergency batteries (lead-acid or ni-cad) 28V DC ground power unit
Distribution	Tailcone buses Battery Battery Charging Generator L/R Cockpit buses Hot Battery L/R Main Power L/R Main L/R Essential L/R
Control	Switches START/GEN L/R Generator RESET L/R Battery switches BATTERY (L/R or single) EMERGENCY ON/OFF/STBY (with one optional emergency battery) ON/OFF (with second optional emergency battery)
Monitor	DC voltmeter/ammeters Battery temperature indicator (ni-cad batteries) Annunciators L GEN/R GEN BAT 140/BAT 160 (ni-cad batteries) EMR PWR (one for each optional emer gency battery)
Protection	Circuit breakers Current limiters Overload control sensors and relays Overvoltage protection circuit (external power)

AC Electrical System

Power Source	Two 115V, 400 Hz, 1,000VA static inverters One 115V, 400 Hz, 1,000VA auxiliary static inverter (**optional**) Two 26V AC autotransformers
Distribution	Cockpit buses 115V AC L/R 26V AC L/R
Control	Switches PRI/SEC INVERTER AUX INV (**optional**) R BUS/L BUS (with optional auxiliary inverter switch) AC voltmeter source selector
Monitor	AC voltmeter PRI INV/SEC INV annunciators AUX INV annunciator (**if installed**)
Protection	Circuit breakers Overvoltage sensor relay on each inverter

Lighting System

Cockpit Lighting Data

Light	Switch	Distribution Bus	Circuit Breaker Current Limiter (FL)
Instrument (post, panel and instrument)	INSTR (pilot's)	Left Essential	INSTR LTS 7.5A (left)
	INSTR (copilot's)	Right Essential	INSTR LTS 7.5A (right)
	CTR PNL	Left Essential	INSTR LTS 7.5A (left)
Glareshield Flood	FLOOD (pilot's)	Right Essential	INSTR LTS 7.5A (right)
	FLOOD (copilot's)	Left Essential	INSTR LTS 7.5A (left)
Map	Map Light Rheostat	Left Essential	INSTR LTS 7.5A (left)
	Map Light Rheostat	Right Essential	INSTR LTS 7.5A (right)

Passenger Cabin Lighting Data

Light	Switch	Distribution Bus	Circuit Breaker Current Limiter (FL)
Passenger Reading	INSTR (pilot's)	Left Main	CABIN LTS 7.5A
Forward Upper Center Panel	INSTR (copilot's)	Left Hot Battery	ENTRY LTS 7.5A
Aft Upper Center Panel	CTR PNL	Left Main	CABIN LTS 7.5A
Entry (left service cabinet)	FLOOD (pilot's)	Left Hot Battery	ENTRY LTS 7.5A
Baggage Compartment	FLOOD (copilot's)	Left Hot Battery	ENTRY LTS 7.5A
No Smoking/ Fasten Seat Belt	Map Light rheostat	Left Main	CABIN LTS 7.5A
Emergency	Map Light rheostat	Right Main	EMER LTS 7.5A
Depressurization	Aneroid switch	Left Main	CABIN LTS 7.5A

Exterior Lighting Data

Light	Switch	Distribution Bus	Circuit Breaker Current Limiter (FL)
Navigation	INSTR (pilot’s)	Left Main	NAV LTS 7.5A
Strobe	INSTR (copilot’s)	Left Main	STROBE LTS 7.5A
Rotating Beacon	CTR PNL	Right Main	BEACON LIGHTS 7.5A
Landing and Taxi	L LDG – TAXI-OFF	Left Generator	L LDG and TAXI 7.5A
		Left Main	FL 13 20A
	L LDG – TAXI-OFF	Right Generator	R LDG and TAXI 7.5A
		Right Main	FL 14 20A
Recognition	RECOG LT	Right Essential	RECOG LT 7.5A
		Battery Charging	FL 16 20 or 30A
Wing Inspection	WING INSP	Right Main	WING INSP LT 5A

Environmental Systems

This chapter describes the systems that extract, distribute, and control engine bleed air for pressurization, cooling and heating, and anti-ice protection.

The **pneumatic system** extracts bleed air from the engine's eighth stage of compression and supplies this air to a common bleed air manifold. The bleed air manifold supplies air to the environmental pressurization system, the wing heat system and the windshield heat system. In addition, bleed air pressurizes the hydraulic reservoirs and on some models the alcohol reservoir.

The **air conditioning system** provides cabin heating by regulating engine bleed air temperatures. Additional cabin cooling, when required, utilizes an automotive-type Freon system. During unpressurized flight, a ram air scoop provides fresh air ventilation.

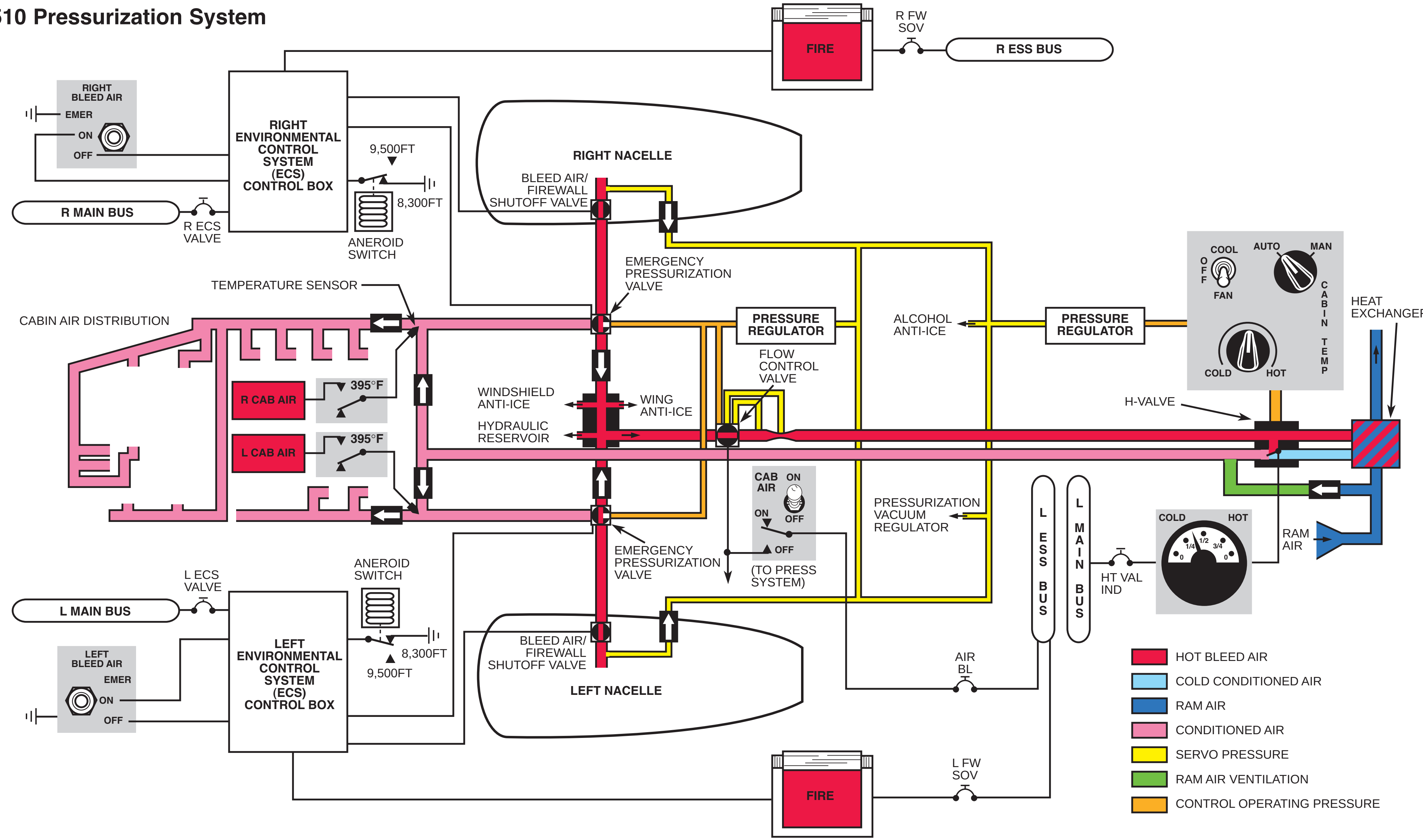
Conditioned air entering the cabin through the air distribution duct provides **cabin pressurization**. Modulating the amount of air exhausted through the cabin air exhaust control valve regulates pressurization.

S/Ns	Pressurization System	Differences
Learjet 24D/F, 25-257 and subsequent	FL510 Pressurization	Bleed Air switches moved to the pressurization control panel
Learjet 24E/F, 24-350 and subsequent Learjet 25D/F, 25-227 to 256	FL510 Pressurization	Cabin Air switch (ON/OFF) Two Bleed Air switches on Cabin Temperature Control panel Emergency bleed air valves Pneumatically controlled H-valve Cabin altitude warning light set at 8,750 ft Two emergency bleed air aneroids set at 9,500 ft Cabin altitude warning horn set at 10,000 ft Cabin altitude limiter set at 11,500 ft 9.4 maximum cabin PSID
Learjet 24D, 24-230 to 328; 24E/F, 24-329 to 349; 25B/C, 25-061, 070 to 205; 25D/F, 25-206 to 226	FL450 Pressurization	One Air Bleed switch with OFF/NORM/MAX positions Cabin RATE knob/Cabin Altitude Controller Electrically controlled H-valve Cabin altitude warning horn set at 10,000 ft Cabin altitude limiter set at 11,500 ft 8.9 maximum cabin PSID

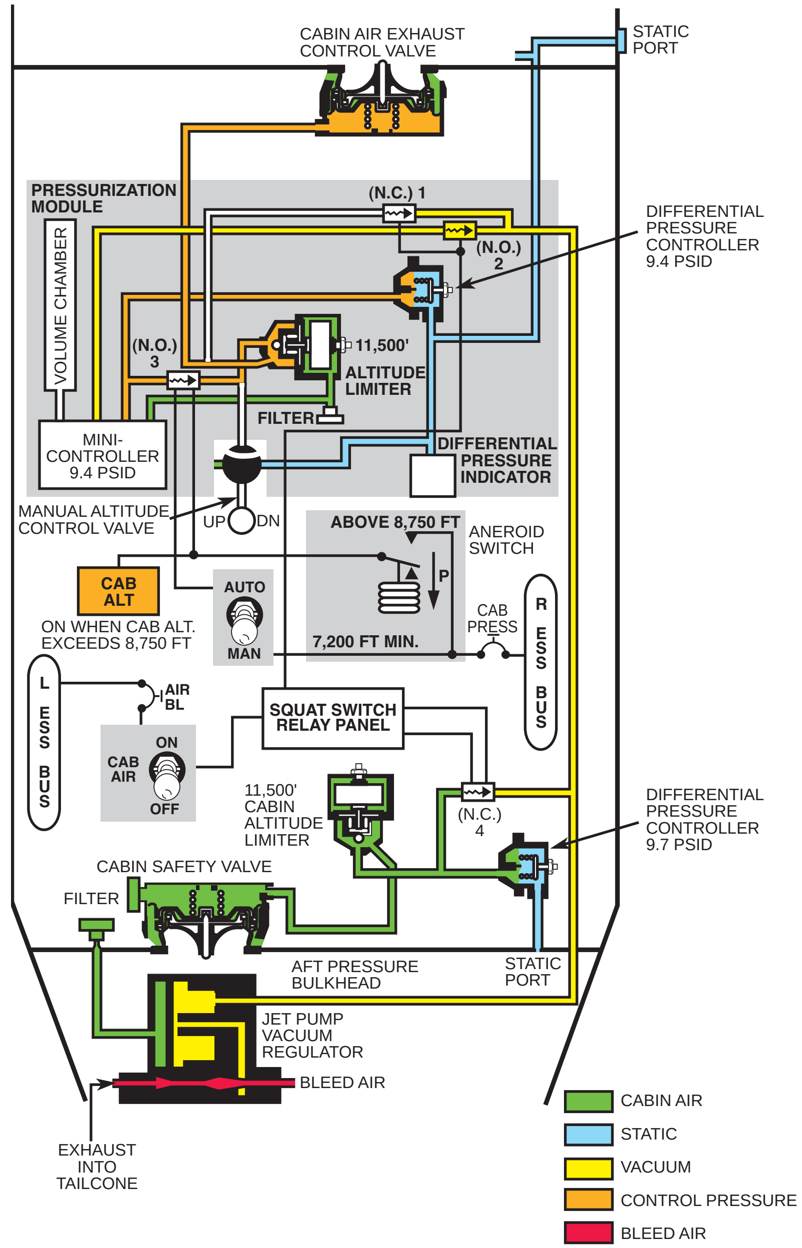
Table 4C-A; Air Conditioning and Pressurization Differences

Pneumatic System

510 Pressurization System



510 Pressurization System



Pneumatic Systems – 510 Pressurization

The pneumatic distribution system consists of two basically independent systems, one for each engine, connected to a common distribution point, the bleed air manifold.

From the source of eighth stage bleed air, the air flows through environmental control system (ECS) valves. Next, it flows through a bleed air check valve that prevents loss of bleed air if one engine is shut down, and then to the bleed air manifold. From the bleed air manifold, the air continues through the flow control valve, hot air bypass valve (H-valve) and heat exchanger to the cabin.

The bleed air manifold distributes air to the following systems:

- heating/cooling and pressurization
- windshield anti-icing
- wing leading edge anti-icing
- hydraulic reservoir pressurization
- the vacuum pressure regulator
- alcohol supply tank pressurization.

Each distribution system contains an emergency pressurization valve and an engine bleed air shutoff valve, which constitute the ECS control valves. The LH and RH Bleed Air switch controls the ECS control valves. The respective Main bus powers the Bleed Air switches labeled OFF/ON/EMERG. The Bleed Air switches are normally left in the ON position.

With a Bleed Air switch in the OFF position and engines not running, the respective bleed air shutoff valve is energized closed and the emergency pressurization valve is spring-loaded to the emergency position.

With both Bleed Air switches in the ON position, the shutoff valves are open and the emergency valves are spring loaded to the emergency position.

Placing a Bleed Air switch to the EMERG position de-energizes the solenoid in the ECS valve; the spring repositions the emergency valve to the emergency position.

The shutoff valve also closes if the FIRE switchlight is depressed.

The flow control valve receives power from the L ESS Bus through the CABIN AIR switch labeled OFF/ON. When the CABIN AIR switch is in the ON position, the solenoid valve is de-energized; the flow control valve is open and regulated air enters the cabin. The OFF position closes the flow control valve, stopping the flow of air into the cabin.

The hot air bypass valve (H-valve) controls cabin temperature by allowing bleed air to bypass the heat exchanger to mix with the air flowing through the heat exchanger. The H-valve consists of three ducts. One duct directs engine bleed air to the heat exchanger while the second duct directs precooled air to the distribution system, which incorporates a pressure-actuated butterfly valve. The third duct connects the other two ducts.

When a higher temperature is called for, the butterfly valve opens and higher temperature bleed air flows directly into the air distribution system and bypasses the heat exchanger.

Temperature Control System

The temperature control system consists of the following:

- temperature control unit
- cabin temperature sensor
- duct temperature sensor
- skin temperature sensor
- duct temperature limiter
- hot air bypass valve (H-valve) and indicator
- temperature pressure regulator.

The amount of bleed air cooling accomplished by the heat exchanger is dependent upon the position of the H-valve.

The cabin temperature sensor monitors the temperature of the air entering the cabin.

A duct temperature limiter limits the duct temperature by venting the regulated pressure in the actuator housing of the hot air H-valve to ambient.

Temperature Control Operations

The temperature sensor, the COLD/ HOT temperature selector, the duct temperature sensor, and the duct temperature limiter control the regulated pressure. Pressure in the temperature control system positions the H-valve to obtain the desired air flow temperature.

The COLD/HOT temperature selector varies pressure in the system. With the AUTO/MAN temperature mode selector set to MAN, the cabin temperature sensor is removed from the system, and the temperature selector directly controls pressure to the bypass valve. Setting the temperature to COLD bleeds off a greater amount of the regulated pressure and allows the hot air bypass valve to route more bleed air through the heat exchanger.

Setting the temperature to HOT closes the bleed-off path and increases the pressure at the H-valve. The valve opens and bypasses more bleed air directly into the cabin air distribution ducts. The position of the H-valve may be monitored on the H-valve indicator in MAN or AUTO mode.

With the AUTO/MAN temperature mode selector set to AUTO and temperature selector to COLD, the bypass valve closes and routes bleed air through the heat exchanger, and then into the cabin at a lower temperature.

When the temperature selector is placed in HOT, the bypass valve opens and more hot air bypasses into the cabin distribution system.

The temperature control system also includes two overtemperature switches, one in the LH and one in the RH air distribution ducts. If the temperature of the bleed air routed to the cabin reaches 395 ±5°F, the red CAB AIR annunciator illuminates. If the duct temperature cools to 370°F, the light extinguishes.

510 Pressurization System

The cabin pressurization control system provides cabin pressurization at a constant (isobaric) altitude selectable from sea level to 10,000 ft. Conditioned air entering the cabin through the air distribution ducts provides cabin pressurization. Modulating the amount of air exhausted from the cabin through the outflow valve controls the pressurization. The pressurization control system may be operated either automatically or manually.

Components of the pressurization system include the following:

- cabin pressure controller
- air filters
- differential pressure controllers
- cabin altitude limiters
- cabin pressurization aneroid switch
- cabin air exhaust control (outflow) valve
- cabin safety valve
- cabin altitude warning.

Control Panel

The control panel on the copilot's lower panel consists of:

- CABIN AIR switch (see Pneumatic section)
- manual control valve lever (cherry picker)
- AUTO/MAN switch
- BLEED AIR switches (see Pneumatic section)
- rate selector/controller
- cabin altitude controller

- cabin altitude and differential pressure indicator
- cabin rate-of-climb indicator.

The manual cabin altitude control valve provides manual control of cabin pressurization. By manipulating the manual UP/DN control knob (cherry picker). The cherry picker is quite sensitive and functions in either the automatic or manual mode since it requires no electric power.

The AUTO/MAN switch on the pressurization control panel requires DC power to select manual mode. Setting the switch to MAN isolates the mini-controller from the system and the cherry picker is used to regulate the outflow valve. Setting the switch to AUTO returns the mini-controller to the system. Control pressure then regulates the outflow valve. With the loss of DC power, manual cannot be selected.

With the Bleed Air switch on and the engine(s) running, the bleed air shutoff valve(s) are open and the emergency valves are in the normal position. Placing the CABIN AIR switch on opens the flow control valve and conditioned air flows into the cabin.

The cabin altitude and differential pressure gage contains two pointers, each traveling over a separate arc of calibrations. The outside (large) pointer shows cabin pressure altitude. The smaller pointer indicates differential pressure between the cabin and outside air in pounds per square inch.

The rate-of-climb indicator displays the rate of change in cabin pressure altitude. The indicator reacts similar to the flight instantaneous vertical speed indicator (IVSI).

Ground Operation

With the AUTO/MAN switch in AUTO and the CABIN AIR switch in ON, the two normally open solenoids (#2 and #3) in the pressurization module are electrically held closed; the normally closed solenoid (#1) is held open through the squat switch relay panel.

When the aircraft is on the ground and the CABIN AIR switch is in OFF, the normally closed vacuum shutoff solenoid valve (#4) is electrically held open through a de-energized relay contact in the squat switch relay panel.

When the CABIN AIR switch is then set to ON, power is applied to the de-energized relay and to a 15-second delay timer. After 15 seconds, the relay energizes to open the power and ground circuits to the vacuum shutoff solenoid; this allows the shutoff solenoids to move to the normally closed position. Increasing cabin pressure in the cabin safety valve control chambers allows the cabin safety valve to close.

Flight Operation

When the squat switch control box re-configures to the air mode, power is removed from solenoids 1, 2, and 3; they then move to their normal positions to make the pressurization system completely independent of the electrical system.

With the AUTO/MAN switch in AUTO, CABIN AIR switch set to ON, and both bleed air switches in ON/NORMAL, power is removed once the squat switch relay box goes to air mode. Desired cabin pressurization is selected using the auto controller and rate knob, providing system limitations of 9.4 PSID and maximum cabin altitude of 8,750 ft are met.

With the AUTO/MAN switch in MAN, the CABIN AIR switch set to ON, and both bleed air switches in ON/NORMAL, or with the CABIN ALT annunciator on, the system is in manual mode and the auto press and rate knob are inoperative. The cherry picker is used to manually control cabin altitude. If the cabin is inadvertently allowed to ascend, the differential pressure controller will limit the cabin pressure differential to 9.7 PSI through the cabin safety outflow valve and the cabin altitude limiter limits cabin altitude to a maximum of 11,500 ±1,500 ft.

During descent, the cabin air exhaust control valve modulates toward the open position as the aircraft reaches the preselected cabin altitude. As the aircraft descends below the preselected altitude, the cabin becomes unpressurized and parallels the aircraft rate of descent until touchdown.

Normal settings for the mini-controller are enroute flight level and landing field elevation. To attain the nominal rate of cabin climb and descent (approximately 600 fpm), set the rate knob at the 9 o'clock position.

Emergency Pressurization

If normal cabin air flow malfunctions and the cabin altitude reaches 8,750 ±250 ft, an aneroid switch causes power to be applied to a normally open solenoid (#3) so that it then closes. This action places the system in the manual mode and the cherry picker is used to control cabin altitude.

The routing of engine bleed air directly into the cabin through the emergency pressurization valves automatically provides emergency pressurization for the aircraft when cabin altitude increases to 9,500 ±250 ft or when the BLEED AIR switches are set to EMER.

With the emergency pressurization valves in the emergency position, engine bleed air is routed directly from the engines into the air distribution ducts. Since this bypasses all bleed air plumbing in the tailcone area, it stabilizes cabin altitude even if a failure has occurred in that area. The solenoids on the emergency pressurization valves are de-energized and the valve goes to its emergency position.

During emergency mode of operation, temperature control, wing, windshield bleed air anti-ice, and hydraulic reservoir pressurization are not available.

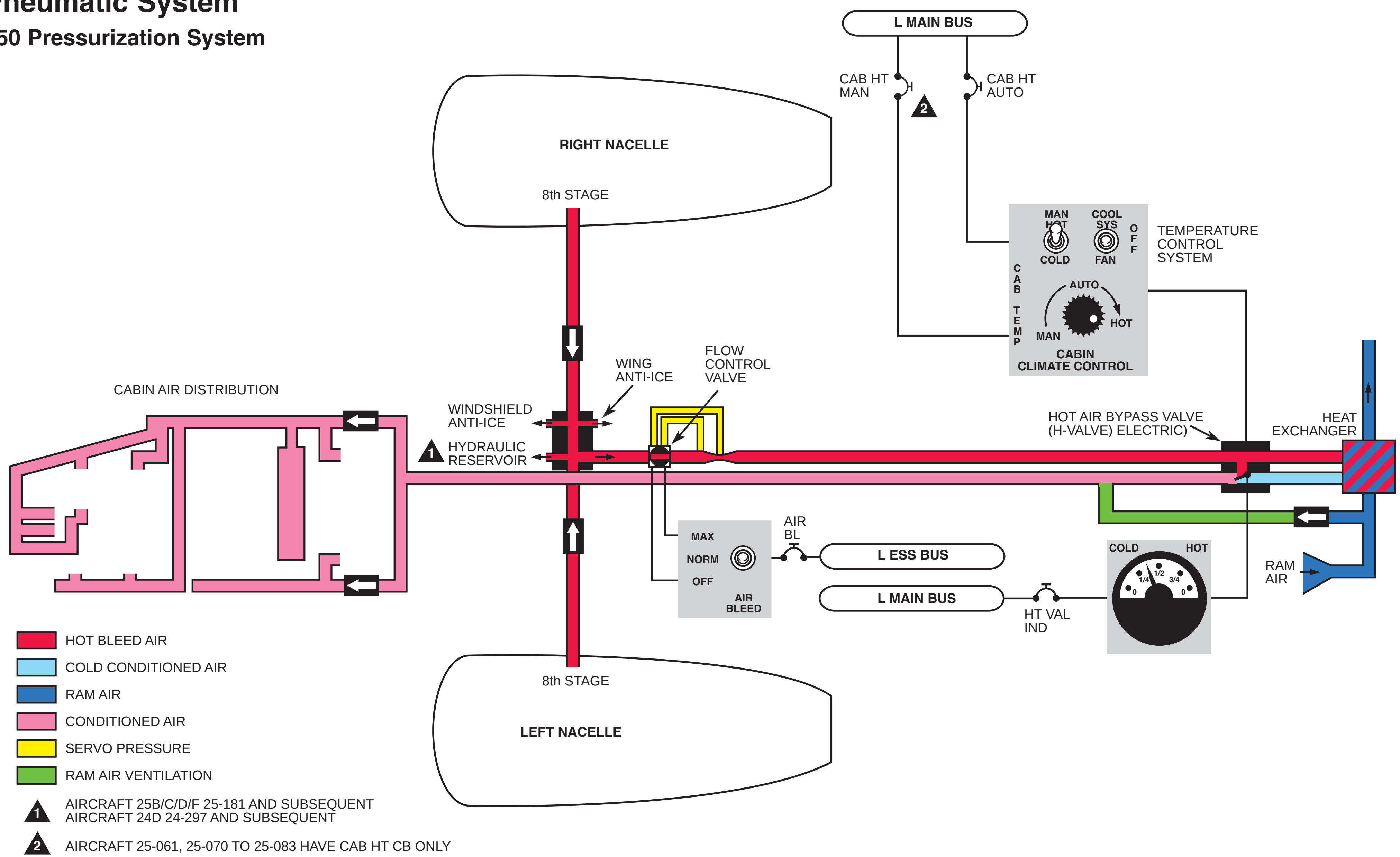
Cabin Pressurization Warning System

If the cabin altitude exceeds 8,750 ±250 ft, the aneroid switch controlling the outflow valve completes a power circuit to a relay in the squat switch relay panel. When the relay energizes, completed ground circuits illuminate the CAB ALT annunciation.

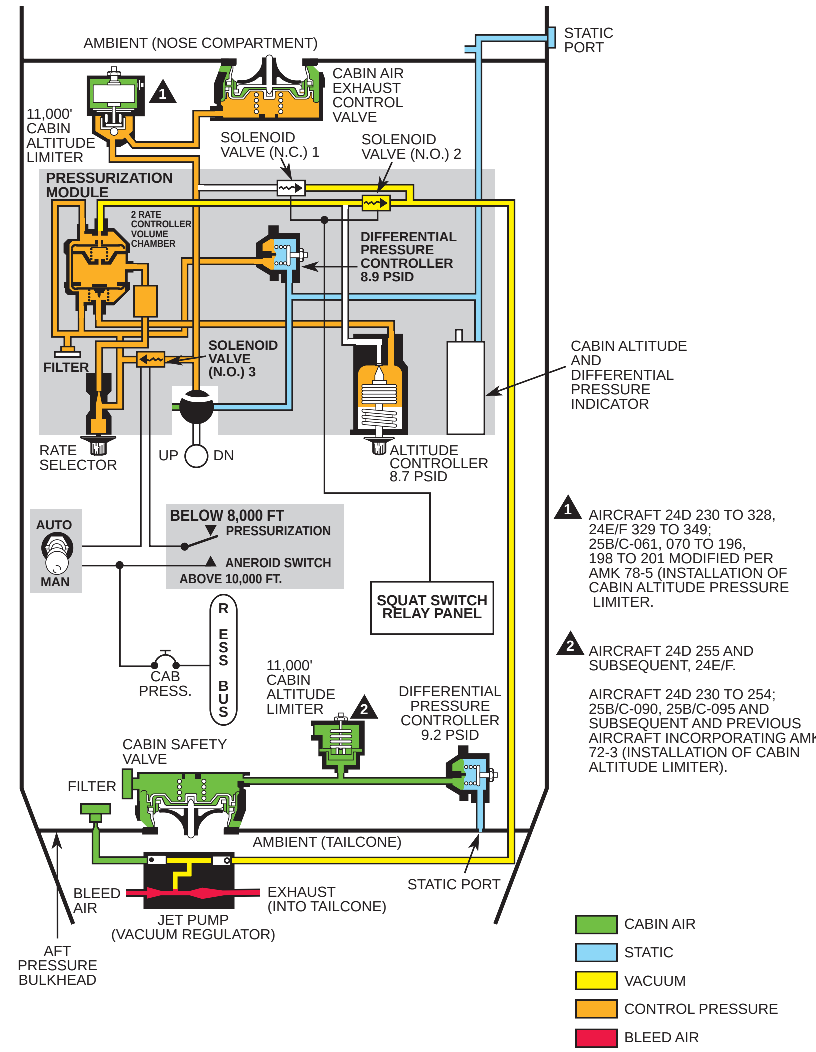
If the cabin altitude exceeds 10,100 ±250 ft, an aneroid completes a ground circuit to the aural warning unit. A CAB ALT TEST switch and a horn silence switch are on the pedestal. The horn silence switch only silences the horn for 30 to 50 seconds.

Pneumatic System

450 Pressurization System



450 Pressurization System



Pneumatic Systems – 450 Pressurization

The pneumatic distribution system consists of two basically independent systems, one for each engine, connected to a common distribution point, the bleed air manifold.

From the source of eighth stage bleed air, the air passes through a bleed air check valve to prevent loss of bleed air if one engine is shut down.

The bleed air manifold is the common distribution point for the following:

- the flow control valve
- a shutoff valve and pressure regulator for windshield anti-icing
- a shutoff valve for wing leading edge anti-icing
- hydraulic reservoir pressurization
- jet pump/vacuum pressure regulator
- the pressurization system.

The flow control valve is the regulating and shutoff device that controls the source of environmental and pressurization air. The flow control valve receives power from the L ESS bus through a three-position switch labeled OFF/NORMAL/MAX.

With the switch in the OFF position, the valve is spring-loaded to the closed position. In the NORMAL position, differential pressure in the reference chambers changes and the valve moves to an open position. In the MAX position, the valve moves to full open; this allows full bleed air flow to the cabin.

Controlled air is directed to the hot air bypass valve to condition the temperature. The L Main bus powers the hot air bypass valve (H-valve) through the AUTO/MAN and TEMP controls on the instrument panel.

Temperature Control System

The temperature control system controls the position of the H-valve and consists of the following:

- temperature control unit
- cabin temperature sensor
- duct temperature sensor
- high limit thermostat
- hot air bypass valve (H-valve) and indicator
- cabin skin temperature sensor (**Learjet S/Ns 24D, 24-255 to 328; S/Ns 24E/F, 24-329 and subsequent; S/Ns 25B/C, 25-090, 095 to 205; S/Ns 25D/F, 25-206 to 226**).

The amount of bleed air cooling accomplished by the heat exchanger is dependent upon the position of the H-valve. The temperature control unit positions the H-valve through a balance bridge circuit. The MAN/AUTO/HOT temperature selector, cabin temperature sensor, duct temperature sensor, skin temperature sensor (**if installed**), and the H-valve form the bridge circuit.

With the MAN/AUTO/HOT selector knob rotated counter clockwise into the detent, the system is in manual mode. Holding the MAN/HOT/COLD spring-loaded switched in the HOT or COLD positions controls the H-valve; monitor position indicator to determine H-valve position.

With the selector knob rotated clockwise out of the detent, the system is in the automatic mode. In the auto mode, the MAN/AUTO knob controls the temperature. Use the position indicator to monitor the position of the H-valve in either AUTO or MAN. The valve takes from 35 to 55 seconds to fully open or close.

450 Pressurization System

The cabin pressurization control system provides cabin pressurization at a constant (isobaric) altitude selectable from sea level to 10,000 ft. Conditioned air entering the cabin through the air distribution ducts provides cabin pressurization. Modulating the amount of air exhausted from the cabin through the cabin air exhaust control valve (outflow valve) controls the pressurization. The pressurization control system may be operated either automatically or manually.

Components of the pressurization system include the following:

- pressurization module and additional controls
- air filters
- differential pressure controllers
- cabin altitude limiter(s)
- cabin pressurization aneroid switch
- cabin air exhaust control (outflow) valve
- cabin safety valve
- cabin altitude warning.

Control Panel

The control panel on the copilot's lower panel consists of:

- air bleed switch (see Pneumatic section)
- manual control valve lever (cherry picker)
- AUTO/MAN switch
- rate selector/controller
- cabin altitude controller
- cabin altitude and differential pressure indicator
- cabin rate-of-climb indicator.

The manual cabin altitude control valve provides manual control of cabin pressurization. By manipulating the manual UP/DN control knob (cherry picker). The cherry picker is quite sensitive and functions in either the automatic or manual mode since it requires no electric power.

The AUTO/MAN switch on the pressurization control panel requires DC power to select manual mode operation. Setting the switch to MAN closes a normally open solenoid valve (#3). With this solenoid closed, the mini-controller is removed from the system; the cherry picker then regulates the outflow valve. Setting the switch to AUTO de-energizes the solenoid, which allows the solenoid to return to its normally open position; this returns the mini-controller to the system. Control pressure then regulates the outflow valve. With a loss of DC power, manual mode is not available.

The rate selector operates as a needle valve used as a variable orifice. The RATE knob manually positions the needle valve to meter control pressure to the rate reference chamber of the rate controller. The rate controller regulates the rate of change in the cabin pressurization system as established by the rate selector. To achieve a normal rate of cabin climb or descent (approximately 600 fpm), set the rate selector at the 8 to 9 o'clock position.

The cabin altitude controller consists of an evacuated bellows connected to a metering valve. A select knob adjusts the spring tension on the bellows' shaft to establish the desired altitude from 0 to 10,000 ft.

The cabin altitude and differential pressure gage contains two pointers, each traveling over a separate arc of calibrations. The outside (large) pointer shows cabin pressure altitude. The smaller pointer indicates differential pressure between the cabin and outside air in pounds per square inch.

The rate-of-climb indicator displays the rate of change in cabin pressure altitude. The indicator reacts similar to the flight instantaneous vertical speed indicator (IVSI).

Ground Operation

With the AUTO/MAN switch in AUTO and the bleed air switch in NORM, the two normally open solenoids (#3 and #2) in the pressurization module are electrically held closed and the normally closed solenoid (#1) is held open through the squat switch relay panel.

The outflow valve opens and vents cabin pressure to ambient to maintain a maximum of 0.25 PSI differential. The 0.25 PSI differential allows the door and emergency exit seals to inflate. The safety valve is spring loaded closed.

Flight Operation

With the AUTO/MAN switch in AUTO, the bleed air switch in NORM, and the squat switch control box in the air mode, power is removed from the electrically closed solenoids (#2 and #3) and electrically opened solenoid (#1). An aneroid switch limits cabin altitude to 10,000 ft.

With the AUTO/MAN switch in MAN, the cherry picker is used to manually control cabin altitude. If the aircraft is inadvertently allowed to ascend and exceeds controlling limits of the differential pressure controller for the cabin safety valve, the differential pressure controller modulates the cabin safety valve outflow to maintain a 9.2 PSI differential. The cabin altitude limiter limits cabin pressure and allows the cabin safety valve to open if the differential pressure controller fails. The limiter controls the cabin safety valve rate-of-modulation to maintain a cabin altitude of approximately 11,000 ft. If rapid descent causes a negative pressure in the cabin, both the cabin air exhaust control valve and the cabin safety valve open to admit atmospheric pressure to the cabin.

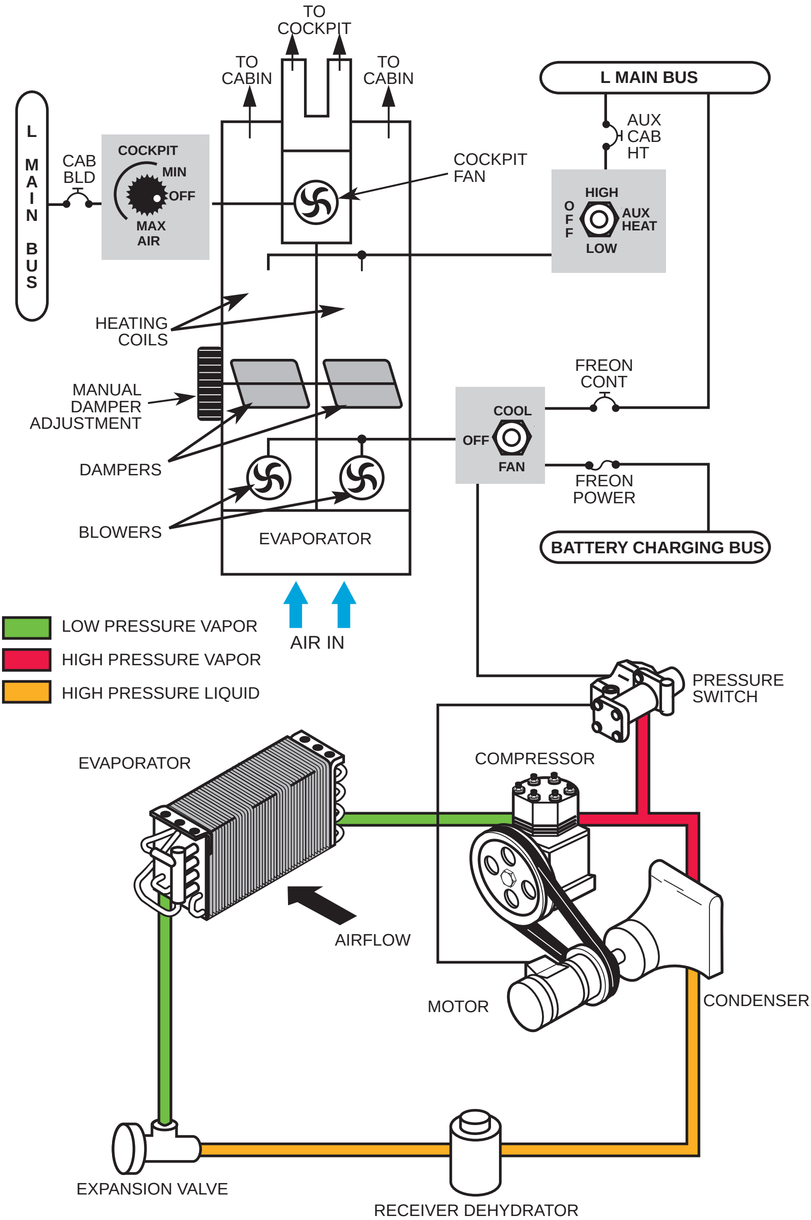
Upon landing, the cabin air exhaust control valve modulates toward the open position as the aircraft descends and reaches the preselected cabin altitude. As the aircraft descends below the preselected altitude, the cabin becomes unpressurized and follows the aircraft rate of descent to touchdown.

Normal settings for the cabin altitude controller are enroute flight level and landing field elevation. To attain the desired rate of cabin climb and descent, approximately 600 fpm, set the rate knob at the 9 o'clock position.

Cabin Pressurization Warning System

If the cabin altitude reaches 10,000 ±500 ft, an aneroid switch completes a ground circuit to the aural warning unit. A CAB ALT TEST switch and a horn silence switch are on the pedestal. The test position tests the circuit during preflight checks. The horn silence switch only silences the horn for 30 to 60 seconds.

Freon Air Conditioning/ Auxiliary Heating System



Air Conditioning/Heating

A Freon refrigeration system and auxiliary cabin heater system supplement the normal air conditioning system. These systems are independent of the bleed air system and require the operation of a GPU or one engine operating with the generator on line.

Refrigeration System

The refrigeration system provides ground cooling, inflight cooling at lower altitudes, and cabin dehumidification. The cooling system consists of the following major components:

- compressor
- compressor motor
- condenser
- dehydrator
- evaporator, blower, and expansion valve
- pressure switch
- cockpit cooling fan
- COOL/OFF/FAN switch.

A 28V DC motor and compressor are in the tailcone. The compressor draws fluid from the low pressure side of the system and compresses it to create a high pressure side. The compressor then pumps Freon under pressure to the system.

The refrigerant condenser connects to the compressor's discharge port through a flexible high pressure hose. High pressure vapor Freon leaves the compressor and enters the condenser. The fan removes heat from the condenser to cool the vapor; this causes the vapor to return to a liquid state.

The dehydrator removes small traces of moisture that may remain. At temperatures above 70°F, the sight glass indicates whether the refrigerant level is sufficient for operation; bubbles or an interrupted stream of refrigerant indicates servicing is required.

An expansion valve, prior to the evaporator, sprays high pressure Freon into the evaporator where it expands and cools. This reduces the pressure of the Freon and allows it to absorb heat from the cabin.

The evaporator and blower cool, dry, and clean the air in the cabin. A pressure regulator in the low pressure line provides back pressure to the evaporator to prevent condensation from freezing.

Cabin Air Distribution

The blower housing is overhead in the aft cabin. The blower assembly incorporates the cabin, cockpit fan, blowers, cabin Freon cooling system evaporator, and the auxiliary cabin heating elements.

Placing the COOL/OFF/FAN switch in the COOL position applies 28V DC to the Freon control relay through the energized generator relay and the de-energized start relay. With the compressor running, Freon compresses and recirculates throughout the system while the blower circulates cabin air through the evaporator for cooling.

Air ducted down both sides of the upper center panel provides cockpit cooling for the crew. Individual outlets are in the cockpit headliner. A rheostat-type COCKPIT AIR CONTROL knob on the copilot's side panel controls a fan in the blower assembly to force air to the cockpit. With the switch in the FAN position, the cabin blower operates independently of the compressor to recirculate cabin air.

The COOL/OFF/FAN switch is placed in the OFF or FAN position at 18,000 ft to prevent motor brush arcing.

Auxiliary Cabin Heater (Optional)

An **optional** auxiliary cabin heater, independent of the engine bleed air system, utilizes the Freon cooling system ducting and blower to provide additional heating for the cabin. Ground operation requires a GPU or an engine running with the generator on line.

The heater assembly, which is attached to the evaporator and blower assembly, consists of four heater elements wired in parallel, a three-position switch with HIGH/LOW/OFF positions, a thermal switch, thermal fuse, and a safety switch. When the damper doors on the cabin blower duct are closed, the heater safety switch completes the heater control relay circuit to allow the coils to operate.

With the AUX HEAT switch set to HIGH, all four heating elements in the ducts energize. With the switch set to LOW, only two heater elements energize. Each heating unit has a thermal switch that cycles the elements on at 125°F and off at 150°F. The system operates on 28V DC from the 7.5A AUX CAB HT circuit breaker on the Right Main bus panel.

On **Learjet 24D, 24-230 to 270 and Learjet 25B/C, 25-070 to 125**, the blower motor runs at full RPM with the AUX HEAT switch set to HIGH or LOW and the diverter doors closed; this allows full air flow across the heater elements.

On **Learjet 24D, 24-271 to 328, 24E/F, 24-329 and subsequent, 25B/C, 25-126 to 205, and 25D/F, 25-206 and subsequent**, when the AUX HEAT switch is set to HIGH or LOW and the diverter doors are closed, two circuits are completed. The first circuit connects to the heater low control relay through the diverter door switch, the heater fuses, and the thermoswitches; the second is a ground through the heat switch to energize the heater low control relay. This relay energizes and applies 28V DC power to the heating elements. The blower motor then applies a locking voltage to the coil. This allows the blower motor to run at approximately 10% of the motor's full speed until the elements reach 150. The voltage-dropping resistor is then bypassed and full 28V DC power allows the blower motor to run at normal speed.

Pneumatic System

Power Source	Bleed air – L/R engines (8th stage) Main DC buses (L/R) ESS DC buses (L/R)
Distribution	Air conditioning/heating system Windshield defog Wing anti-ice Engine anti-ice Hydraulic reservoir pressurization (**early 450 system** indirectly from cabin pressure) **510 system (servo air)** Flow control valve H-valve Emergency pressurization (three-way valves) Vacuum jet pump Alcohol anti-ice reservoir
Control	CAB AIR switch **510 system** BLEED AIR switches L/R FIRE switchlights
Monitor	Pressurization system **510 system**: L/R CAB AIR annunciator
Protection	**510 system** L/R FW SOV CB (Essential bus) L/R ECS valve CB (Main bus) **450 system** AIR BL CB

Pressurization System

Power Source	Pneumatic system Jet pump/vacuum pressure regulator – automatic operation Cabin air/outside static air – manual operation Right Essential DC bus – manual mode selection Left Essential DC bus – flow control valve switch or CABIN AIR switch
Distribution	Cabin safety valve – negative/positive relief Cabin air exhaust control valve Automatic cabin altitude controller Cabin altitude limiter/differential pressure controller
Control	AUTO/MAN switch UP/DN manual control valve lever (i.e., cherry picker) Cabin altitude controller select knob RATE knob **510 system**: CABIN AIR ON/OFF (flow control valve) switch **450 system**: MAX/NORM/OFF air bleed (flow control valve) switch
Monitor	CABIN CLIMB indicator Cabin altitude/differential pressure gage Cabin altitude warning horn **510 system**: 10,100 ft **450 system**: 10,000 ft CAB ALT annunciator – 8,750 ft (**510 system**)

Pressurization System (cont.)

Protection	Differential pressure relief Auto controller – 8.7 PSID (**450**), 9.4 PSID (**510**) Forward backup – 8.9 PSID (**450**), 9.4 PSID (**510**) Safety valve – 9.2 PSID (**450**) 9.7 PSID (**510**) Cabin altitude limiter(s) **510 system**: 11,500 ft max **450 system**: 11,000 ft max

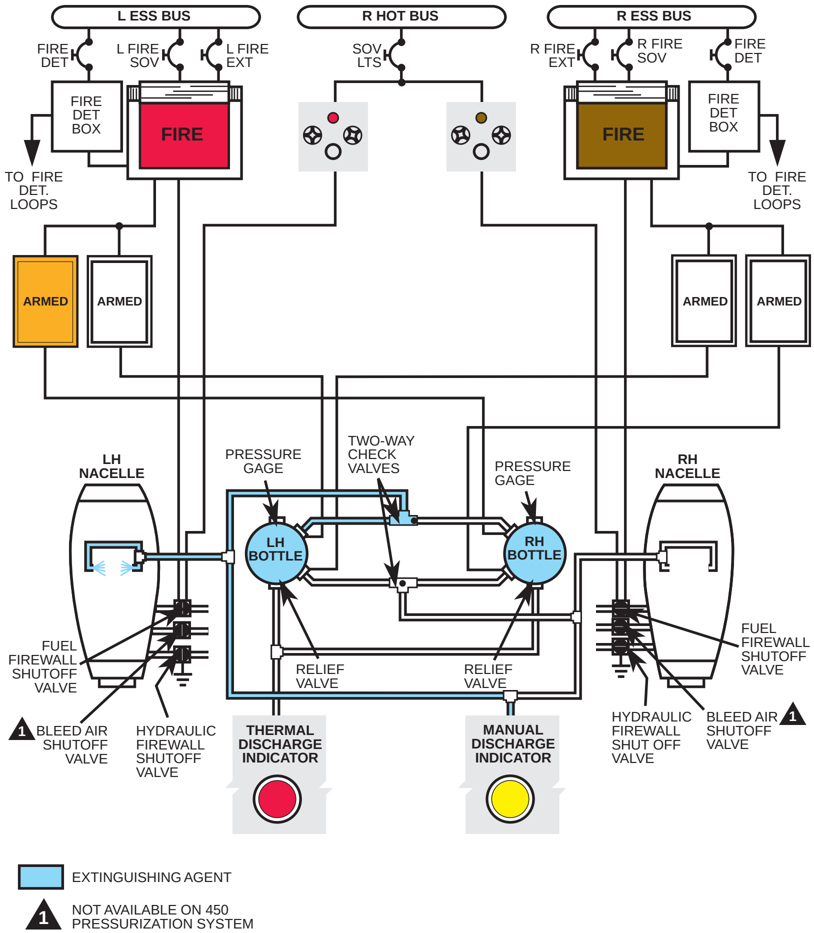
Freon Cooling System

Power Source	Battery Charging bus (28V DC) (power) L Main bus (control)
Distribution	Freon compressor Aft evaporation unit cools recirculated cabin air
Control	Switches COOL/OFF/FAN Cockpit fan
Protection	Freon control CB Freon stab heat relay box

Auxiliary Heating System

Power Source	Left Main bus (28V DC)
Distribution	Electric heating elements in aft cabin blower ducts heat recirculated cabin air
Control	Switches AUX HEAT Cockpit fan
Protection	Circuit breaker

Fire Protection System



Fire Protection

This chapter describes the Learjet 24/25 fire protection system, consisting of engine fire detection/extinguishing systems and a manually operated fire extinguisher in the cockpit for use inside the pressure vessel.

The fire detection system senses and indicates the presence of an engine overheat condition or fire and provides a visual warning in the cockpit.

The engine fire extinguishing system includes two fire extinguisher bottles in the tailcone. Both bottles can be discharged to either engine.

A portable fire extinguisher is in the pressure section, mounted either on the cabin floor under the copilot's seat or in the cabin for passenger and crew access.

Engine Fire Detection System

The DC-powered fire detection system identifies a fire or overheat condition in either the left or right engine nacelle and provides a visual warning in the cockpit.

Components of the detection system include:

- a fire detection sensor cable (loop) for each engine
- a control box for each engine
- left and right guarded engine FIRE switchlights, which have both a warning and extinguishing function
- a fire detection test switch.

A continuous fire detection sensor loop in each engine nacelle consists of two elements attached to the nacelle by hinge-type connectors. The upper element loops across the top of the nacelle at forward and aft points and runs the length of the nacelle on the inboard and outboard sides. The aft element encircles the inner nacelle exhaust opening.

If temperatures exceed 510°F at the aft nacelle area or 480°F at the nacelle forward area, the loop directs a signal to the affected engine's control box.

Each control box monitors the resistance of the detection loop in its engine. A signal from the loop causes the control box to activate the flashing red lights in the associated engine FIRE switchlight.

When set to the TEST position, the FIRE DET TEST switch on the forward center pedestal checks the detection system operation by simulating an engine fire in both engines. The control boxes illuminate the flashing red lights in both engine FIRE switchlights.

Engine Fire Extinguishing System

The DC-powered engine fire extinguishing system components consist of the following:

- two fire extinguisher bottles housed in the tailcone
- a guarded red engine FIRE switchlight for each engine
- discharge indicators
- two amber ARMED switchlights for each engine.

Two fire extinguisher bottles in the tailcone equipment section are cross-plumbed so that either bottle can be discharged to either engine, or both bottles to the same engine, as required. Each bottle contains CF_3Br (monobromotrifluormethane) pressurized to 600 PSI at 70°F. Each fire bottle has two fire extinguisher cartridges.

On **aircraft with Walter Kidde fire extinguishers**, the exploding cartridge ruptures the bottle seal and releases the charge of extinguishing agent to the affected engine nacelle.

On **aircraft with HTL (formerly American Standard) fire extinguishers**, the exploding cartridge breaks a housing that mechanically holds a piston-type seal. Bottle pressure blows out the seal to release extinguishing agent to the affected engine nacelle.

When the detection loop senses a fire condition in its nacelle and signals the control box, the corresponding red engine FIRE switchlight flashes. In respnse, moving the throttle lever to CUT-OFF, lifting the cover guard over the engine FIRE switchlight, and pressing the switchlight accomplishes the following:

- close the affected engine's main fuel and hydraulic shutoff valves to stop combustible fluid flow
- arm the appropriate cartridge on both fire extinguisher bottles
- illuminate the two amber ARMED switchlights
- illuminate the shutoff valve indicator, a tiny red pinhead light adjacent to the engine FIRE switchlight.

On **aircraft with the 510 pressurization system**, pressing the flashing engine FIRE switchlight also closes the affected engine's bleed air shutoff valve.

Once the engine FIRE switchlight is pressed, the ARMED switchlights illuminate, even if the fire extinguisher bottles are inoperative or have been discharged previously.

Pressing the ARMED switchlight causes extinguishing agent to empty into the affected engine, and the ARMED switchlight to extinguish.

If a second charge of extinguishing agent is needed for the same engine (i.e., the engine FIRE switchlight continues to flash), press the remaining illuminated ARMED switchlight to release extinguishing agent into the affected engine from the remaining bottle.

However, if the engine FIRE switchlight extinguishes after the first fire extinguisher bottle is discharged, the remaining bottle is still available for either engine.

Portable Fire Extinguisher

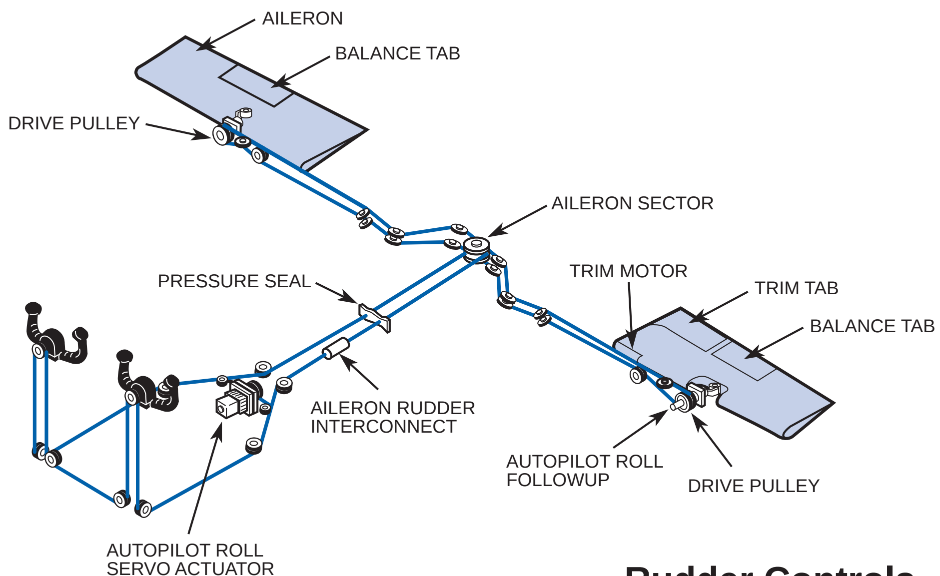
A portable, chemical-type extinguisher is in the pressurized section of the aircraft, mounted either on the cockpit floor under the copilot's seat in quick-release brackets or in the cabin for passenger and crew access.

Fire Protection System

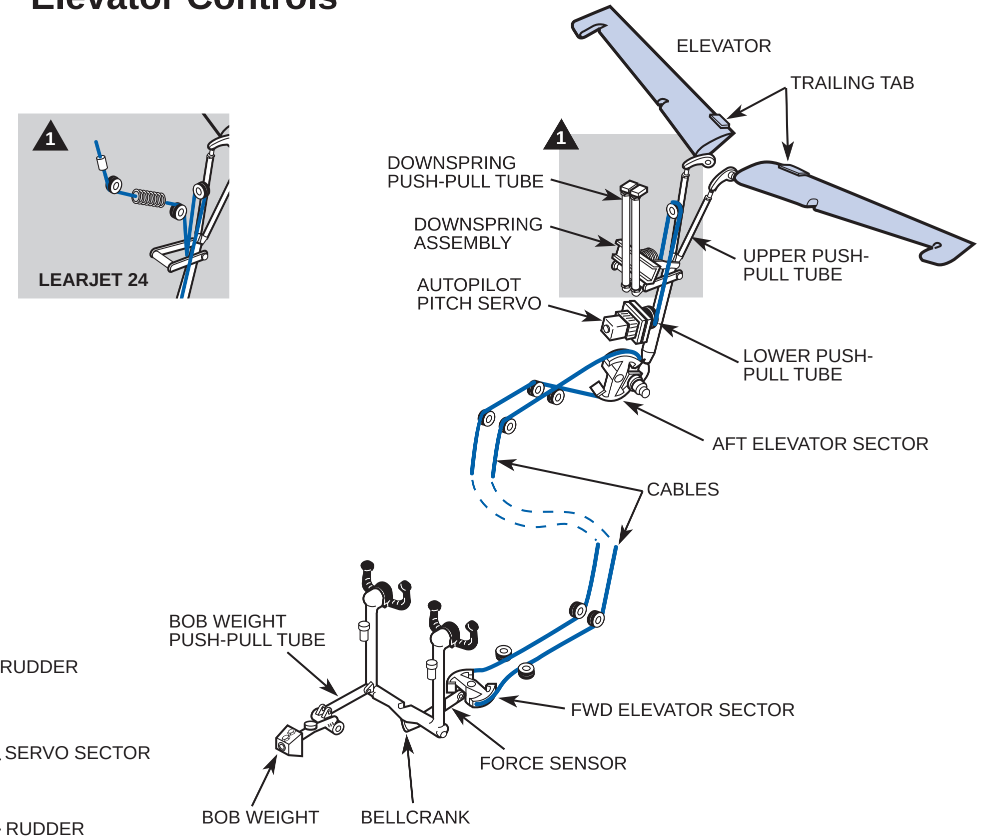
Power Source	Left Essential bus Left FIRE and ARMED switchlights Right Essential bus Right FIRE and ARMED switchlights Right Battery bus Shutoff valve indicators
Distribution	Cross-plumbing: each extinguisher bottle to either engine
Control	Switchlights FIRE L/R ARMED L/R (two on each side)
Monitor	Switchlights FIRE L/R ARMED L/R Firewall shutoff valve indicators Fire bottle pressure gages Yellow manual discharge disc Red thermal discharge disc
Protection	Circuit breakers (Essential L/R buses) L/R FIRE DET L/R FIRE EXT L/R FW SOV Overpressure discharge port on fire extinguisher bottles

Ailerons, Elevator and Rudder Controls

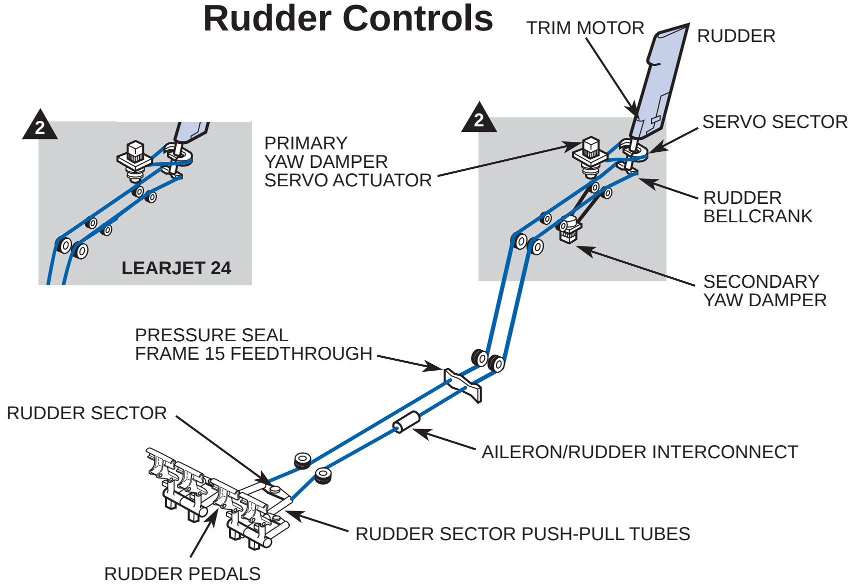
Ailerons Controls



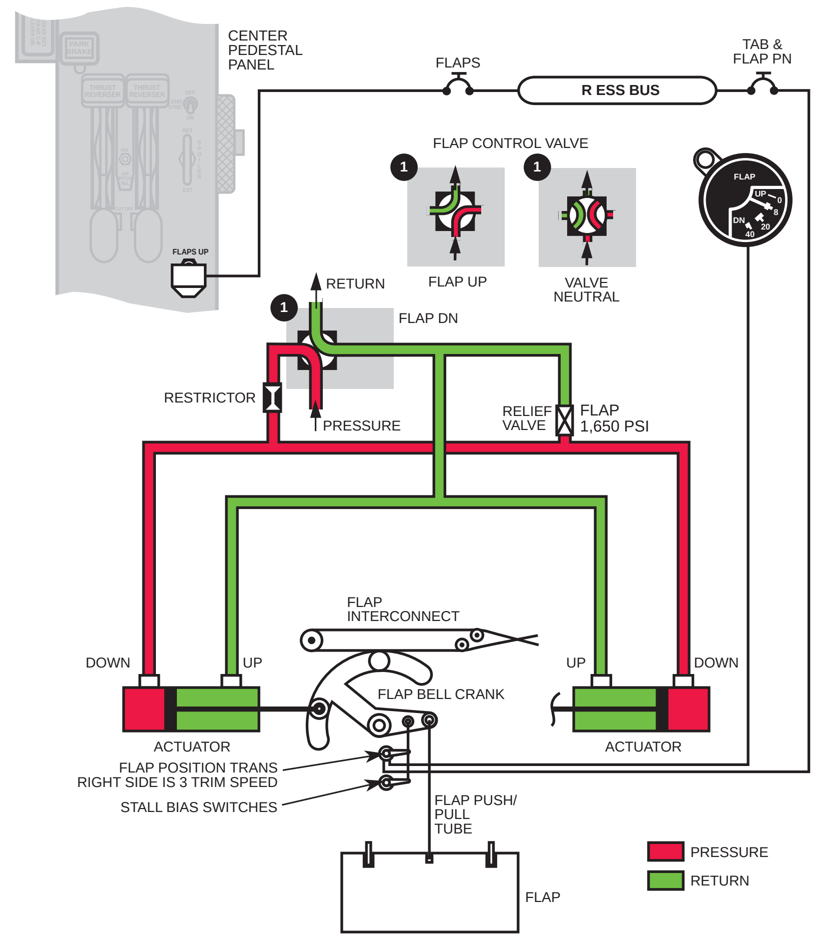
Elevator Controls



Rudder Controls



Flap System


CENTER
PEDESTAL
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DN
RETURN
FLAP DN
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PRESSURE
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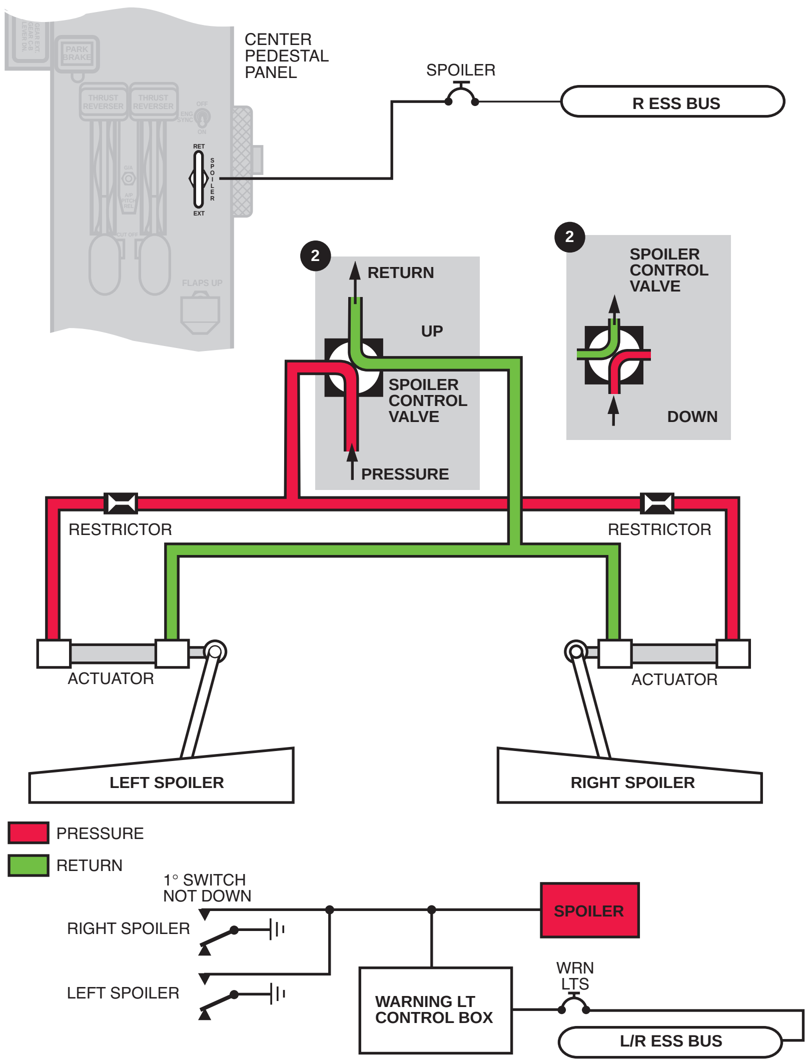
VALVE
FLAP
1,650 PSI
FLAP
INTERCONNECT
DOWN
UP
UP
DOWN
FLAP BELL CRANK
ACTUATOR
ACTUATOR
FLAP POSITION TRANS
RIGHT SIDE IS 3 TRIM SPEED
STALL BIAS SWITCHES
FLAP PUSH/
PULL
TUBE
FLAP
PRESSURE
RETURN

Spoiler System



Flight Controls

The primary flight controls, which are driven mechanically by a direct cable connection to a cockpit control, consist of the ailerons, elevators, and rudder.

The electrically controlled and hydraulically operated secondary flight controls consist of the flaps and spoilers.

The rudder and left aileron have trim tabs; electric trim actuators position these tabs to provide roll and yaw trim. Positioning the horizontal stabilizer provides pitch trim.

In addition to the primary and secondary flight controls, the flight controls system includes the following:

- stall warning system
- Mach overspeed devices
- pitch trim systems
- autopilot (see Avionics chapter).

Primary Flight Controls

Primary flight controls permit command of the aircraft through the roll, pitch, and yaw axes. The ailerons, elevators, and rudder receive inputs from the control wheels, control columns, and pedals in the cockpit via cables and bellcranks.

Ailerons

The ailerons, on the outboard trailing edge of each wing, provide roll control of the aircraft. They are controlled mechanically through the control wheel or electronically through the autopilot roll servo. Balance tabs on the ailerons reduce the forces required to position the control surface. The ailerons move inversely to one another (i.e., the aileron on one wing moves up and the aileron on the opposite wing moves down). Full range of travel for the ailerons is 18° (±1°) up and 18° (±2°) down.

Roll Trim

A trim tab on the left aileron's inboard trailing edge provides lateral trim. A push-pull rod connects the rotary-type electric actuator and the tab. The Left Essential bus supplies 28V DC to the roll trim tab through the 7.5 amp ROLL CB on the pilot's CB panel. The trim tab travels both up and down 8° (±1°).

A trim switch on the outboard horn of each control wheel governs the actuator. The dual-function trim switch (i.e., trim and trim arming) has four positions: LWD (left wing down), RWD (right wing down), NOSE UP, and NOSE DN. Actuation of the pilot's switch overrides the actuation of the copilot's switch. If the autopilot MANUV R/P switch has not been pressed, the autopilot disengages with the actuation of either the pilot or copilot switch.

The AIL indicator, on the center pedestal, displays trim tab position using information from a potentiometer in the actuator.

Aileron Balance Tab System

An aileron balance tab on each aileron decreases control column force. With aileron movement, each balance tab moves proportionately in the opposite direction. Moving the aileron full up extends the aileron balance tab full down to 15° (±2°); moving the aileron full down extends the tab full up to 15°.

Elevators

The elevators on the trailing edge of the horizontal stabilizer provide pitch control of the aircraft either mechanically through fore and aft movement of the control column or electrically through the autopilot pitch servo.

A closed loop cable assembly from the control column to the tail section drives the elevators through a trailing edge travel range of 15° (+1°, -0°) up and 15° (+1°, -0°) down.

Rudder

The rudder at the trailing edge of the vertical stabilizer provides directional control of the aircraft about the vertical axis. Rudder pedals control the rudder; a direct-connect cable system from both sets of rudder pedals to the tail section drives the aircraft rudder. The yaw damper servos can also control the rudder. Full range of motion is 30° (+2°, -1°), left and right of center.

Rudder Trim

The rudder trim system reduces pilot input forces to aid him in maintaining yaw control. Trim tab travel is 15° (±1°) left and right.

The YAW TRIM switch on the center pedestal positions the rudder trim tab. Moving the rocker-type switch from the spring-loaded NOSE position to the right or left electrically operates the tab. The switch assembly has a power switch above a ground switch for each side (i.e., left and right); both switches for either direction must move simultaneously for trim actuation.

The rudder trim indicator on the center pedestal shows the position of the rudder trim tab. The Right Essential bus supplies 28V DC to the indicator through the TAB & FLAP PN CB on the copilot's CB panel.

Horizontal Stabilizer

The horizontal stabilizer on the rear of the fuselage provides pitch stability. A dual motor, screw-jack actuator positions the entire horizontal stabilizer to provide pitch trim. Normal trim utilizes the primary trim motor while emergency trim uses the emergency motor. The emergency trim motor also provides autopilot trim.

Horizontal Stabilizer Control System (Modified Aircraft)

The horizontal stabilizer control system consists of the following:

- two-speed actuator
- stabilizer trim position indicator
- normal pitch trim speed controller
- pitch trim and emergency pitch trim selector switch
- pitch trim monitor test switch
- pilot and copilot trim and trim arming switches
- pitch trim disable terminal board
- overload sensor and relay assembly
- TAKE-OFF TRIM and PITCH TRIM OVSP warning lights
- squat switch
- flap switches and relays.

Normal Pitch Trim

Selecting the P TRIM (pitch trim) switch to NORMAL completes a standby circuit that de-energizes the trim control relay; the Left Essential bus supplies 28V DC to the pilot's trim and trim arming switch through the PITCH CB. The trim switch on the outboard horn of each control wheel allows either pilot to control normal pitch trim. During normal trim operation, the autopilot disengages.

The pilot's trim switch has priority over the copilot's trim switch. The control wheel master (MSW) switch, which is below the trim switch on the control wheel and labeled WHEEL MASTER, interrupts normal pitch trim system operation.

The normal system operates at a high rate with the flaps extended beyond 3° and at low rate with flaps fully retracted.

Emergency Pitch Trim

The emergency trim system provides a backup to the normal pitch trim system. Setting the P TRIM switch to EMER renders the pilot and copilot trim and trim arming switches inoperative. Selecting the EMERGENCY PITCH switch to NOSE DOWN or NOSE UP supplies 28V DC through the EMERGENCY PITCH trim switch to the secondary pitch trim motor, which moves the horizontal stabilizer.

Pressing the MSW interrupts emergency pitch trim operation for the duration of switch actuation.

Trim-in-Motion Audio Clicker

A trim-in-motion audio clicker alerts the crew to horizontal stabilizer movement with flaps retracted. After approximately one second of continuous stabilizer movement, a detector box produces a series of audible clicks through the headsets and cockpit speakers. The clicker may or may not sound during autopilot trim due to the duration of the trim inputs. The clicker does not sound with the right flap beyond 3°; therefore, the flaps must be retracted to verify clicker operation during the pitch trim check before flight.

Pitch Trim Indications

The NOSE DN/TO/UP pitch trim indicator on the center pedestal displays the degree of horizontal stabilizer trim. A linear potentiometer on the actuator supplies the signals to the indicator and the clicker system. The Right Essential bus supplies 28V DC through the TAB & FLAP PN CB.

With the squat switches in ground mode, an amber TAKE-OFF TRIM light illuminates if the horizontal stabilizer pitch angle is beyond prescribed takeoff limits. The actual takeoff range, however, is wider than the green band on the indicator. An extinguished TAKE-OFF TRIM light verifies takeoff trim positioning.

Control Wheel Master Switches

A control wheel master (MSW) switch (i.e., MASTER SWITCH) is beneath the trim switch on each control wheel's outboard horn. In addition to other functions, either MSW interrupts normal or emergency pitch trim when pressed and held. Upon release of the MSW, the pitch trim system in operation when the MSW was pressed resumes operation.

Yaw Damper

Learjet 25

The **Learjet 25** uses a dual (i.e, primary and secondary) yaw damper system. Each system consists of a computer, a yaw servo and capstan, a yaw follow-up, a yaw rate gyro, a lateral accelerometer, and associated aircraft wiring.

The yaw damper systems require 28V DC and 115V AC of power. The primary yaw damper receives power from the Left Essential bus and Left AC bus; the secondary yaw damper receives power from the Right Essential bus and Right AC bus.

The systems operate independently, and only one damper can operate at a time. Engage and operate one yaw damper constantly except when trimming the rudder. Disengage the yaw damper prior to touchdown.

For an operational description of the yaw damper, see the Avionics chapter.

Learjet 24

A single yaw damper system on the **Learjet 24** controls transient yaw motion for automatic stabilization about the yaw axis. The system consists of a computer, a yaw servo and capstan, a yaw follow-up, a yaw rate gyro, a lateral accelerometer, and associated aircraft wiring; one box contains the yaw damper computer and control panel.

The system requires 28V DC and 115V AC from the Left Essential bus and Left AC bus, respectively.

Engage and operate the yaw damper constantly except when trimming rudder. Disengage the yaw damper prior to touchdown; pressing the MSW disengages the yaw damper.

Controls Gust Lock

A controls gust lock secures movable control surfaces. When installed, the lock holds full left rudder, full down elevator, and left aileron full up. Check controls for proper movement prior to flight.

Secondary Flight Controls

The flaps and spoilers comprise the electrically controlled and hydraulically actuated secondary flight control system.

Flaps

The single-slotted flaps on the trailing edge of each wing inboard of the ailerons attach to the rear wing spar with tracks, rollers, and hinges. The flaps aid in reducing airspeed and landing distance or aid in increasing the rate of descent. With flaps partially extended, the lift of the wing increases while the stalling speed decreases. At full extension (40°), drag increases due to the increase in lift.

The three-position (UP/off/DOWN) flap switch on the right side of the center pedestal operates the flaps. Moving the airfoil-shaped switch to UP or DOWN delivers 28V DC to the respective up or down solenoid of the flap control valve, which moves the flaps in the desired direction.

Extending the flaps beyond 25° to 30° with the gear retracted sounds the warning horn. Extending the gear to the down and locked position or retracting the flaps above 25° silences the horn.

A 1,650 PSI pressure relief valve in the flap extension line allows the flaps to retract if flight loads become too high for the structure.

Mark II Wing with Preselect Flaps

Aircraft with the **optional** preselect flap system have a flap lever on the right side of the thrust lever quadrant. The lever glides in a slot controlling the flap preselect operation.

The four-position (UP/10/20/DN 40) switch on the right side of the center pedestal operates the flaps. The selection of 10, 20, or 40 delivers 28V DC to the respective up or down solenoid of the flap control valve.

An alternate system employs two toggle switches below the pre-select lever. When the NORM/FLAP/ALT switch is set to ALT, the flap system functions like a non-preselect system using the UP/off/DN switch; the center position of the switch (i.e., off) stops the flaps in their current position.

Flap Position Indicator

A flap position indicator is on the center instrument panel.

On **Learjet 24Ds and Learjet 25B/Cs with an original wing**, the indicator has DN and UP markings. A white T.O. & APP bar corresponds to approximately 20° flaps. The initial portion of the pointer's range only indicates aft travel of the flaps without extension. The two amp TAB & FLAP PN CB on the copilot's CB panel supplies the indicator with 28V DC from the Right Essential bus.

Flap gage is a voltmeter-type gage with zero volts indicated at the 40° flap position. With loss of power, gage reads 40.

On **Learjet 24Ds and 25B/Cs with the RAS Kit, all Learjet 24E/Fs, and all Learjet 25D/Fs**, the indicator has UP, 8°, 20°, and DN (40°) markings. The two amp TAB & FLAP PN CB on the copilot's CB panel supplies the indicator with 28V DC from the Right Essential bus.

On Learjet 24Ds and 25B/Cs with Mark II wing or aircraft with Extended Range (XR) modification, the FLAP indicator has UP, 10°, 20°, and DN (40°) markings. The two amp TAB & FLAP PN CB on the copilot's CB panel supplies the indicator with 28V DC from the Right Essential bus.

Spoilers

The spoilers are on the upper surfaces of the wings forward of the flaps. The spoilers aid in reducing lift, airspeed, and landing distance or aid in increasing the rate of descent.

A hydraulic actuator that attaches to the spoiler control arm and wing structure extends and retracts the spoilers; at least one engine-driven hydraulic pump or the auxiliary pump must provide hydraulic pressure for spoiler operations. The spoilers have a maximum extension of 47° and a maximum travel differential of 1°.

Control and Indication Devices

The guarded SPOILER (EXT or RET) switch on the center pedestal controls the spoilers. Selecting EXT or RET energizes an electrically actuated hydraulic control valve that directs hydraulic pressure to both spoiler actuators.

Microswitches adjacent to each spoiler actuator illuminate the red SPOILER annunciator on the glareshield upon spoiler extension or if the spoilers do not fully retract; the annunciator extinguishes only on full retraction.

The SPOILER switch receives 28V DC from the Right Essential bus through the SPOILER CB on the copilot's CB panel.

Stall Warning System

The stall warning system provides flight control visual and tactile warning information relative to a stall and, in some cases, automatically forces the aircraft nose-down to prevent aerodynamic stall.

Century III, Reduced Approach Speed Kit (RAS), or Softflite

A dual stall warning system provides the crew with an indication of an impending stall and, if necessary, commands the aircraft to a nose-down attitude. The force diminishes linearly through the normal accelerometer to maintain G downward force on the control column. The system consists of:

- two AOA transducers on the forward fuselage
- a stall warning computer
- a stall warning bias box
- two control column shakers (one on each control column)
- a normal accelerometer in the nose
- two AOA indicators on the instrument panel
- two ON/OFF control switches
- a stall warning test switch
- two altitude switches
- two stall warning annunciators (L and R STALL) on the glareshield also function as Power ON.

The AOA transducers receive constant voltage from the Hot Battery bus through the L and R STALL CBs. Three bias switches (i.e., 3°, 13°, and 25°) on each flap provide flap position information.

The altitude switches close at 22,500 ±750 ft; this increases the shaker and pusher actuation speeds by 15 kts for the **Learjet 24** and 10 kts for the **Learjet 25**.

At an AOA sufficient to produce a speed of 7% above stall speed on both AOA transducers, the stall warning computer-amplifier energizes the control column shaker/nudger. The shaker produces a low-frequency/high amplitude buffet to the control column. The nudger uses the autopilot pitch servo to pulse the control column forward (nose-down) 1-1/2 to 2-1/2 times a second. The AOA needles enter the yellow arc on the indicators concurrently with shaker/nudger actuation. In addition, the L and R STALL warning annunciators illuminate and flash.

If the impending stall condition continues until speed reaches approximately 1 knot above stall speed, the AOA indicator reaches the red arc. At this point, the computer commands a nose down attitude to the pitch servo. The amount of nose down force is 80 lbs at the control wheel. As the angle-of-attack decreases, the accelerometer senses and limits the down force to 1/2 G and the pusher is released. If the condition continues the pusher fires again; this results in a pumping motion on the control wheel.

On Learjet 25D/F (25-290 to 336 and 338 to 341 with AAK 79-10 or AMK 83-5) and Learjet 25B/C (25-061, 070 to 206 with RAS Kit and AAK 79-10 or AMK 83-5 Softflite), the pusher operates as described above except it activates when the AOA increases to within ±3 kts of stall speed in any flap configuration. Shaker/nudger occurs 7 kts above pusher.

The stall warning computer incorporates a stall rate function (Alpha Dot) that alters the shaker, nudger, and pusher up to four kts prior to stall.

The stall warning test switch on the pedestal allows for system testing only while the aircraft is on the ground (i.e., squat switch closed). Holding the switch to RH TEST simulates an increase in AOA. As the indicator needle crosses the yellow band, the right control column shaker/nudger actuates and the R STALL warning annunciator flashes.

As the needles cross the red line, the pusher actuates. The selection of LH TEST initiates the left stall system test.

XR Modification/Mark II Modified Aircraft with Teledyne AOA and Pre-Select Flaps

The Mark II/Teledyne angle-of-attack indicating and stall warning system, which replaces the original equipment, provides AOA indication normalized to a scale of 0 (zero lift) to 1.0 (stall) over the full operational envelope. It also provides stall warning and stall prevention for all flap settings.

Except for stick pusher components, two completely independent systems comprise the modification. Either left or right system drives the pusher independently.

The probe is heated for de-icing, and is ported and shielded to prevent ingestion of moisture in use or on the ground. When the PITOT HEAT switch is ON for ground use, taxi, and pre-takeoff, a low heat mode is provided to the probe. When both the STALL WARNING and PITOT HEAT switches are ON, high heat, which is the in-flight de-icing mode, is provided. High heat is used from start of takeoff roll to completion of flight; low heat is used for all ground operations where anti-icing is required. The high heat mode must not be used for more than two minutes without airflow over the probe; the heating element could be destroyed. On the ground, high heat makes the probe hot enough to cause serious burns; use caution when touching the probes.

Flap Position Switches

The Mark II Pre-Select 9°, 19°, and 36° position feedback switches in the wing also transmit flap position data to the AOA/Stall Warning computers.

Stall Warning Computer

Stall Warning Test switches are mounted together with the Landing Light and Engine Sync switches on the switch panel assembly on the lower right side of the control pedestal. The computer provides a system check in the TEST mode; it uses the AOA indicator to simulate an angle-of-attack signal for shaker, nudger, and pusher. In the RESET mode, the computer checks the AOA transmitter monitoring circuits by introducing open circuit and ground faults in the AOA transmitter potentiometer circuit. When held, the wheel master deactivates the nudger and pusher.

AOA Indicator

The normalized AOA indicator provides a convenient reference for all phases for the flight regime; it does not, however, replace the airspeed indicator as a primary instrument. The indicator's continuous display on a scale of 0 (zero lift) to 1.0 (stall) of stall margin regardless of aircraft configuration, gross weight or bank angle can considerably enhance pilot performance.

The indicator can also drive the speed deviation FAST/SLOW pointer of a flight director and a heads-up indicator display. These outputs are referenced to a manually adjustable reference index set by turning the knob REF SET on the front of the AOA indicator.

Optional Indexer

The indexer on the glareshield presents a heads-up, discrete indicator of fast/slow deviation from the reference set by the adjustable indices on the AOA indicator. A red chevron pointed down, a green circle and a yellow chevron pointed up combine to give five indications:

- top (red) chevron illuminated – AOA too high; lower nose
- top (red) chevron and green circle illuminated – AOA slightly high; lower nose
- green circle illuminated – on reference
- bottom (yellow) chevron and green circle illuminated – AOA slightly low; raise nose
- bottom (yellow) chevron illuminated – AOA low; raise nose.

Learjet 24D and 25B/C with Original or Mark II Wings/Softflite 1

A dual stall warning system provides the crew with an indication of an impending stall and, if necessary, commands the aircraft to a nose-down attitude. The system receives power from the Battery bus through the L and R STALL WRN CBs and consists of:

- two AOA transducers on the forward fuselage
- a stall warning computer-amplifier
- a stall warning bias box in the nose
- two control column shakers (one on each control column)
- a normal accelerometer in nose
- two AOA indicators
- two ON/OFF control switches
- a stall warning accelerometer cutout box (**models modified with AAK 76-4 or later Learjet models**)
- two stall warning annunciators (L and R STALL) on the glareshield also function as Power ON.

Mach/Overspeed Warning and Puller Control System

The system consists of a Mach/overspeed warning switch on the right side of the fuselage forward of the instrument panel, a pitot and static source, and a stick puller adjustment potentiometer.

A Mach overspeed warning occurs when the aircraft exceeds M_{MO}. The overspeed horn sounds while the stick puller (i.e., autopilot pitch servo) applies 18 lbs of force at the control column; this raises the aircraft's nose to reduce airspeed. While held, the MSW deactivates the puller; upon release, the puller reactivates. The pilot may override the stick puller force anytime.

A CAB ALT TEST/MACH TEST switch on the pedestal allows a system operation check. To test the puller system, place the BATTERY switch(es) and L STALL WARNING switch to ON and position the pitch trim within the T.O. segment on the indicator. Holding the spring-loaded switch in MACH causes the warning horn to sound and the stick puller to actuate (i.e., the control columns move aft from neutral). Press the control wheel master switch and the puller disengages while the warning horn continues to sound. Release the CAB ALT/MACH TEST switch and the control wheel master switch.

Flight Controls

Aileron Trim

Power Source	Left Essential DC bus
Distribution	Electric trim motor
Control	Control wheel trim (four-way)
Monitor	Trim indicator
Protection	ROLL CB

Rudder Trim

Power Source	Left Essential DC bus
Distribution	Electric trim motor
Control	Center panel split rocker switch
Monitor	Trim indicator
Protection	YAW CB

Stabilizer Trim

Power Source	Essential DC bus L/R
Distribution	Electric trim motors Servo actuator in upper vertical stabilizer
Control	Switches Control wheel trim (four-way) WHEEL MASTER (beneath control wheel trim switch) P TRIM/OFF/EMER PITCH EMERGENCY PITCH NOSE DOWN/ NOSE UP (center pedestal)
Monitor	NOSE DN/T.O./UP pitch trim indicator Annunciators TAKEOFF TRIM PITCH TRIM OVSP
Protection	PITCH CB (Left Essential bus) EMER P TRIM CB (Right Essential bus)

Stall Warning System

Power Source	Hot Battery bus
Control	Switches L/R STALL warning **CIII/CIIIs**: Flap bias (8°/13°/25°) **Mark II wing**: Flap bias (9°/19°/36°) Stall test L/R
Monitor	AOA L/R indicators L/R STALL WARNING annunciators **Mark II wing**: Fast/slow glareshield indicator
Protection	L/R STALL WRN CBs

Mach Overspeed System

Power Source	Left Battery bus
Distribution	Pitot/static sources Mach/overspeed warning switches Autopilot pitch servo
Control	Switches Control wheel master (cutout) Mach TEST L STALL WARNING
Monitor	Mach overspeed warning horn Stick puller M_{MO} barber pole
Protection	AFC/SS PITCH (DC) CB

Spoilers

Power Source	Aircraft hydraulic system Right Essential bus (primary) Emergency battery system (backup)
Control	SPOILER switch
Monitor	SPOILER annunciator Illumination with spoilers greater than 1°
Protection	SPOILER CB

Flaps

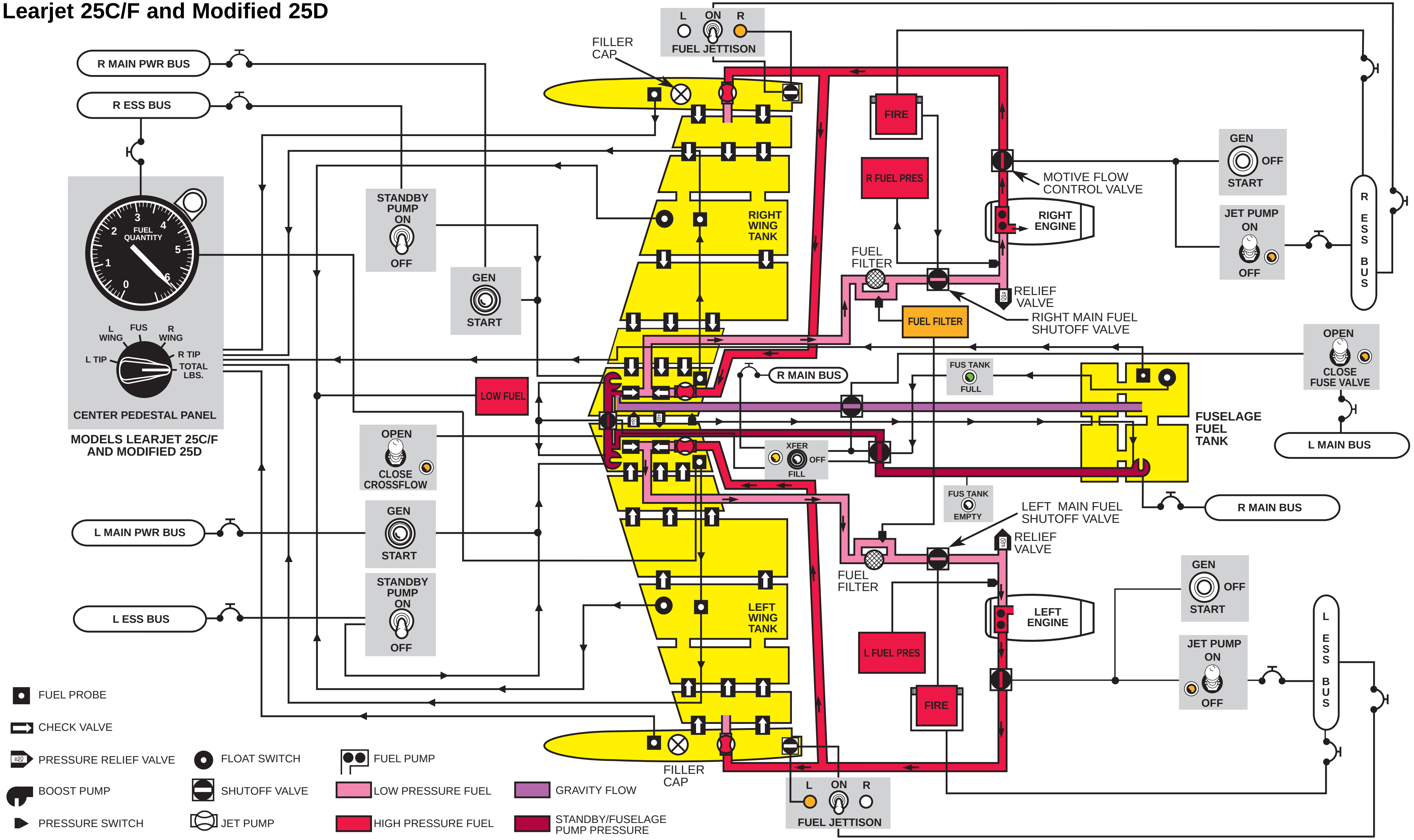
Power Source	Aircraft hydraulic system Right Essential bus (primary) Emergency battery system (backup)
Control	Learjet wing: Flap UP/OFF/DN switch Mark II wing: Flap UP/OFF/DN switch or preselect switch UP/10/20/DN with NORM/FLAP/ALT switch and UP/DN switch
Monitor	FLAP position indicator
Protection	Flaps CB TAB CB – for indicator 1,650 PSI pressure relief valve for flap retraction with high flight loads Interconnect cables that prevent split-flap condition if one actuator fails

Yaw Damper

Power Source	**Learjet 24 single yaw damper system** Left Essential bus Left 115V AC bus **Learjet 25 dual yaw damper system** Essential L/R buses 115V AC L/R buses
Control	Control WHEEL MASTER switch S/N 263 and subsequent with AAK 83-4 Rudder pedals with yaw damper force sensors **Learjet 24/25** PRI YAW DAMPER switch (A/P panel) **Learjet 25 only** PRI/SEC YAW DAMPER select switch SEC YAW DAMPER ENGAGE switch
Monitor	PRI YAW EFFORT on autopilot effort indicator SEC YAW EFFORT INDICATOR (center pedestal)
Protection	Circuit breakers PRI AFCS (Left AC bus) AFCS YAW (Left Essential bus) SEC AFCS (Right AC bus) SEC AFCS (Right Essential bus)

Fuel System

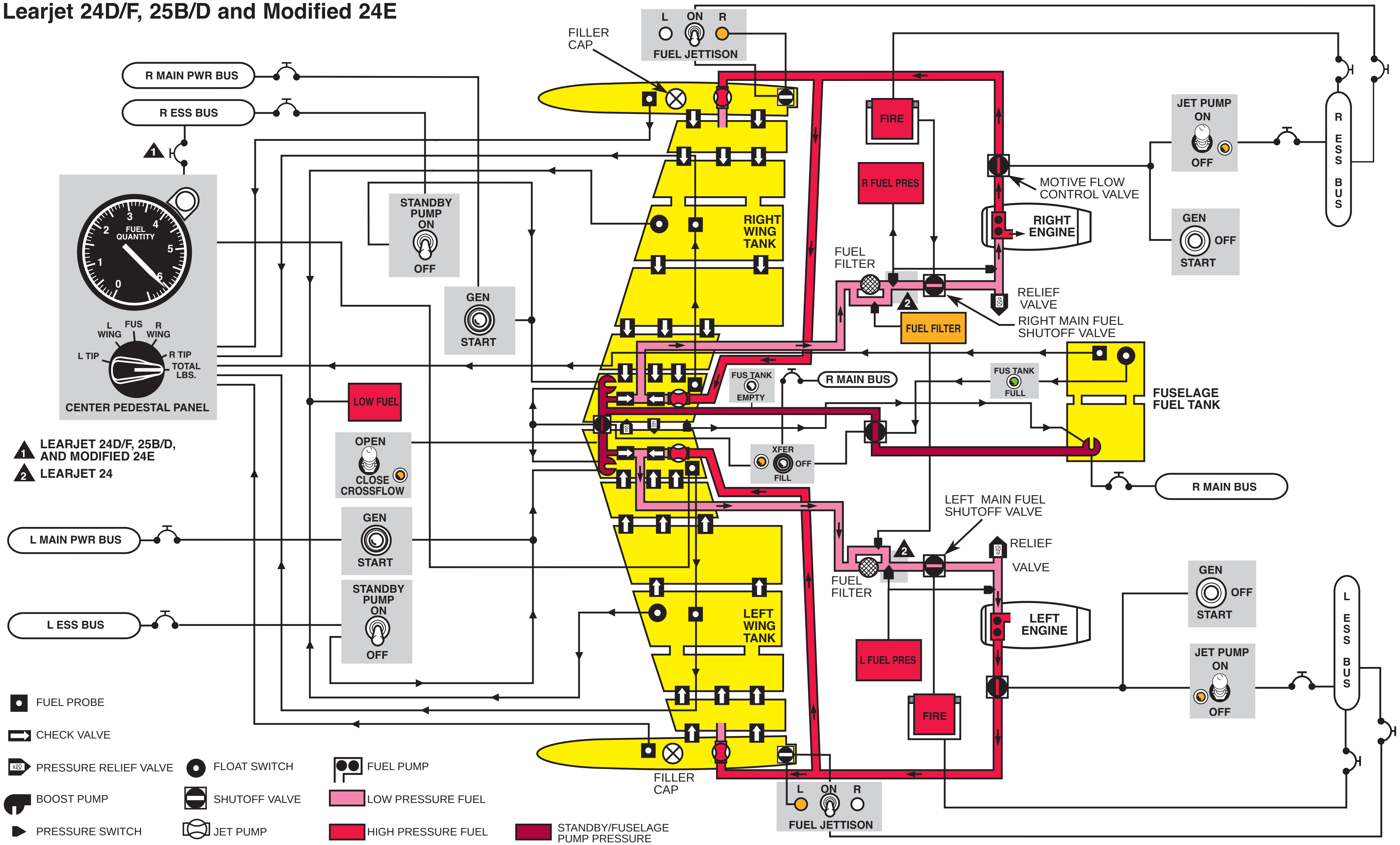
Learjet 25C/F and Modified 25D



FUEL PROBE
CHECK VALVE
PRESSURE RELIEF VALVE
BOOST PUMP
PRESSURE SWITCH
FLOAT SWITCH
SHUTOFF VALVE
JET PUMP
FUEL PUMP
LOW PRESSURE FUEL
HIGH PRESSURE FUEL
GRAVITY FLOW
STANDBY/FUSELAGE PUMP PRESSURE

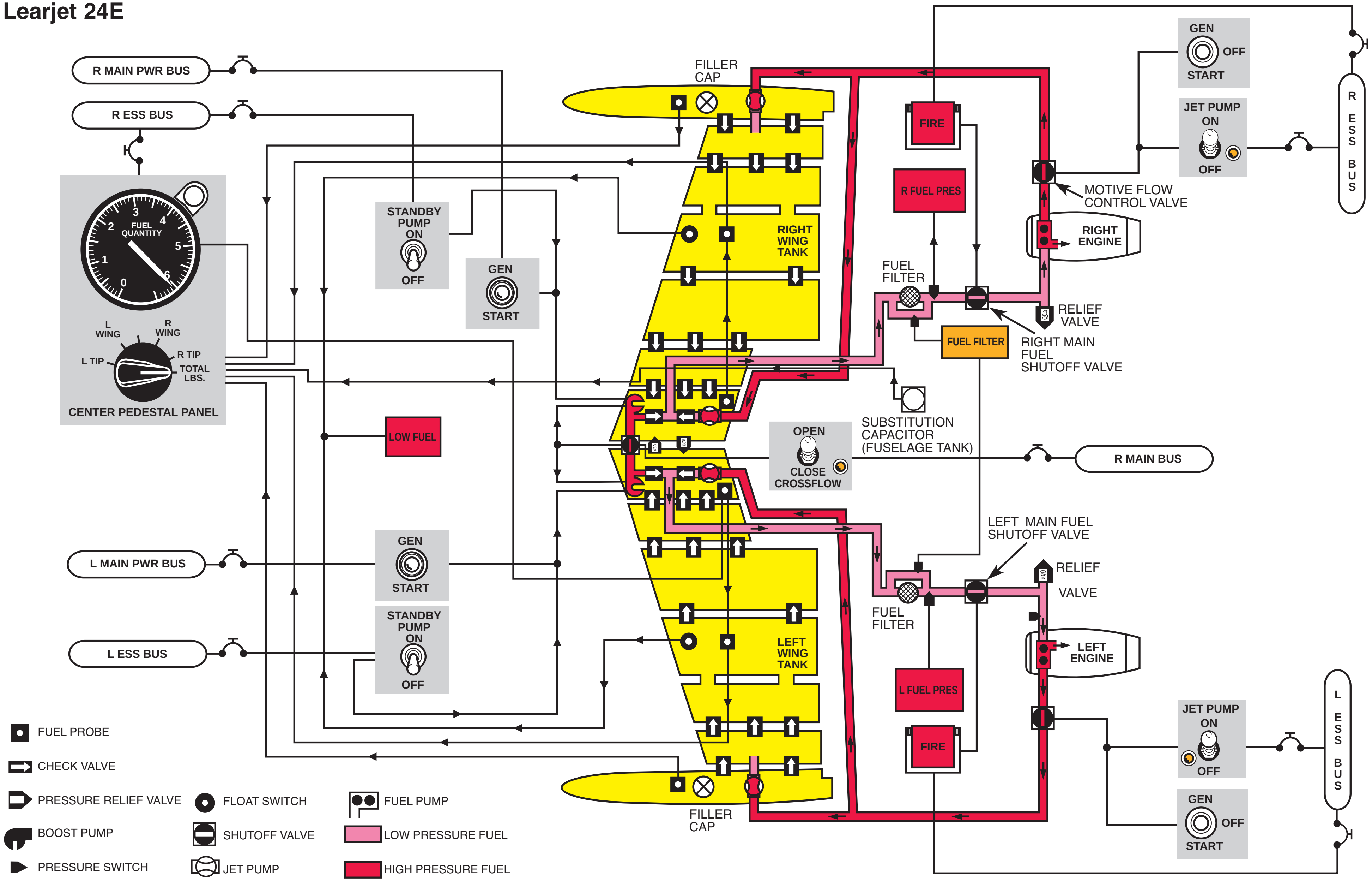
Fuel System

Learjet 24D/F, 25B/D and Modified 24E

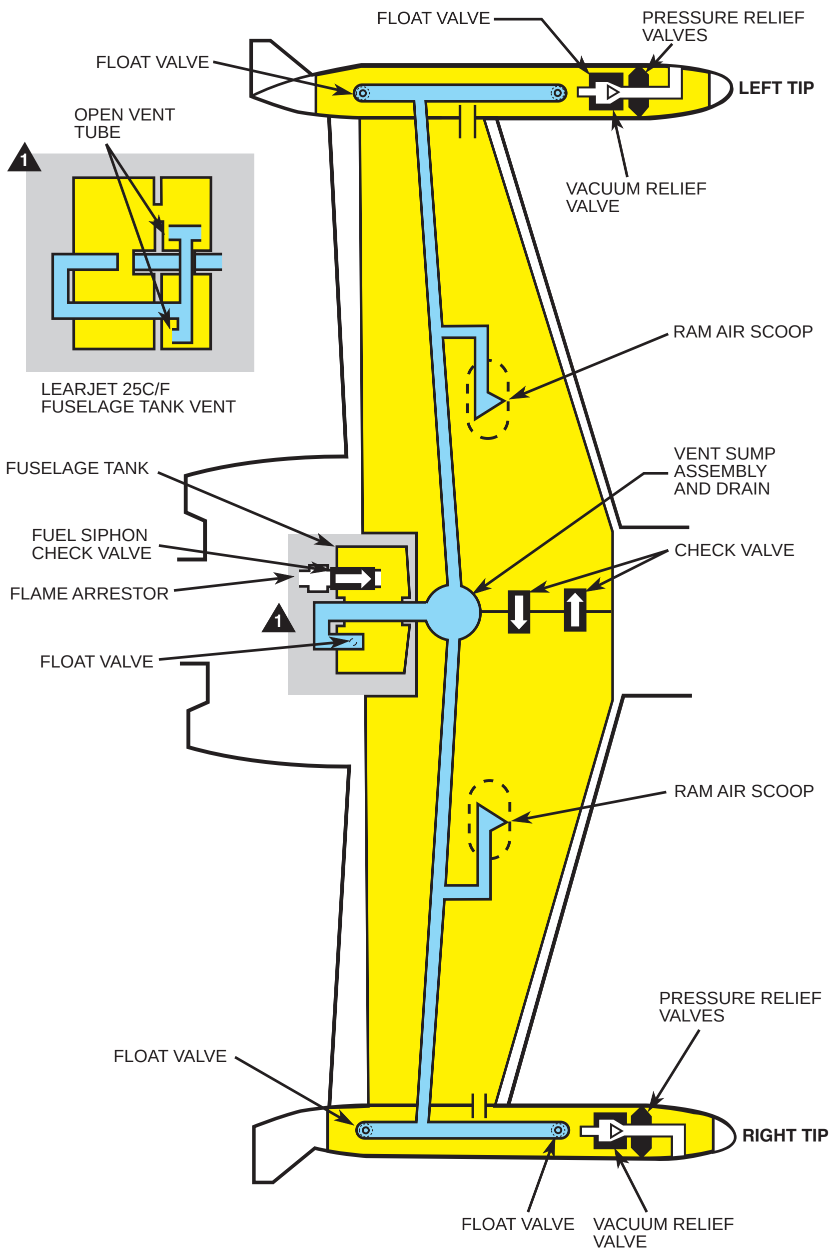


Fuel System

Learjet 24E



Fuel Vent System



Model	Differences
25D	Fuselage tank has two bladder-type cells One transfer line and one transfer valve (optional two lines and two valves)
25C/F	Fuselage tank has four bladder-type cells Two transfer lines and two transfer valves
24D/F, 24E, 25B	Fuselage tank has two bladder-type cells One transfer line and one transfer valve
24E (unmodified)	No fuselage tank
24D, 25B/C/D/F with XR Modification	Tanks added to inboard section of wing

Table 4F-A; Fuel System Differences

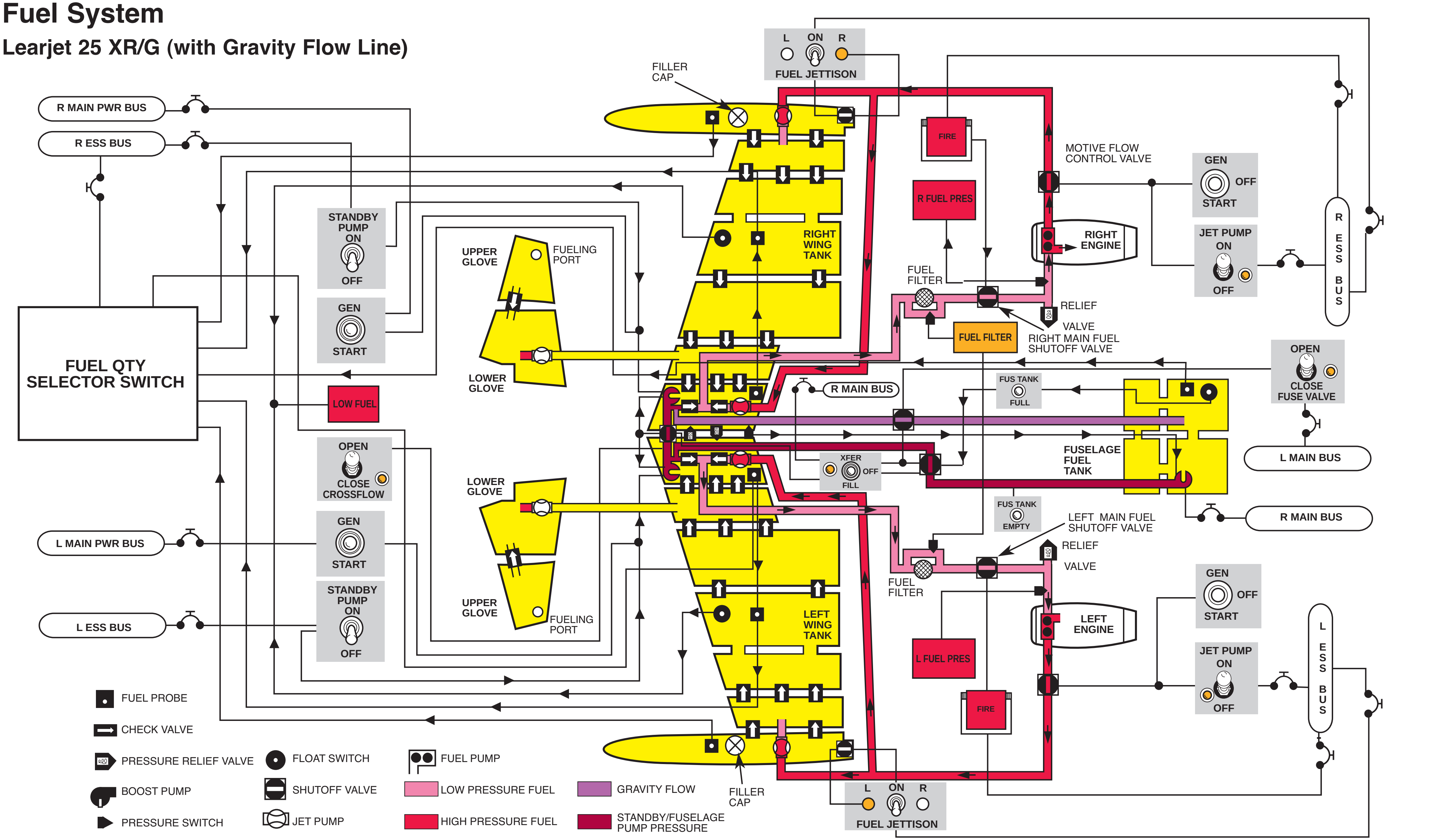
Model	Fuselage Tank	Wing Tanks	Tip Tanks	Left & Right Aux.
25B/D	1305	1160 Each	1235 Each	
25C/F	2603	1160 Each	1235 Each	
25B/D/G with XR	1305	1160 Each	1235 Each	268 Each
25C/F with XR	2603	1160 Each	1235 Each	268 Each
24D/F	840	1160 Each	1235 Each	
24E Unmodified	None	1160 Each	1235 Each	
24D with XR	840	1160 Each	1235 Each	268 Each
Tip Tank Fuel Capacity is determined by Combinations of Recognition Lights and Fuel Jettison.			**L.T.**	**R.T.**
One Recognition Light			1235	1195
One Recognition Light and Fuel Jettison			1220	1180
Fuel Jettison			1220	1220

Table 4F-B; Fuel Capacity Differences

Model	Differences
25D, 25-231 and subsequent	Two indicator needles
24D/E/F, 25B/C, 25-070 to 205, 25D, 25-206 to 230	Single indicator needle L/R switch

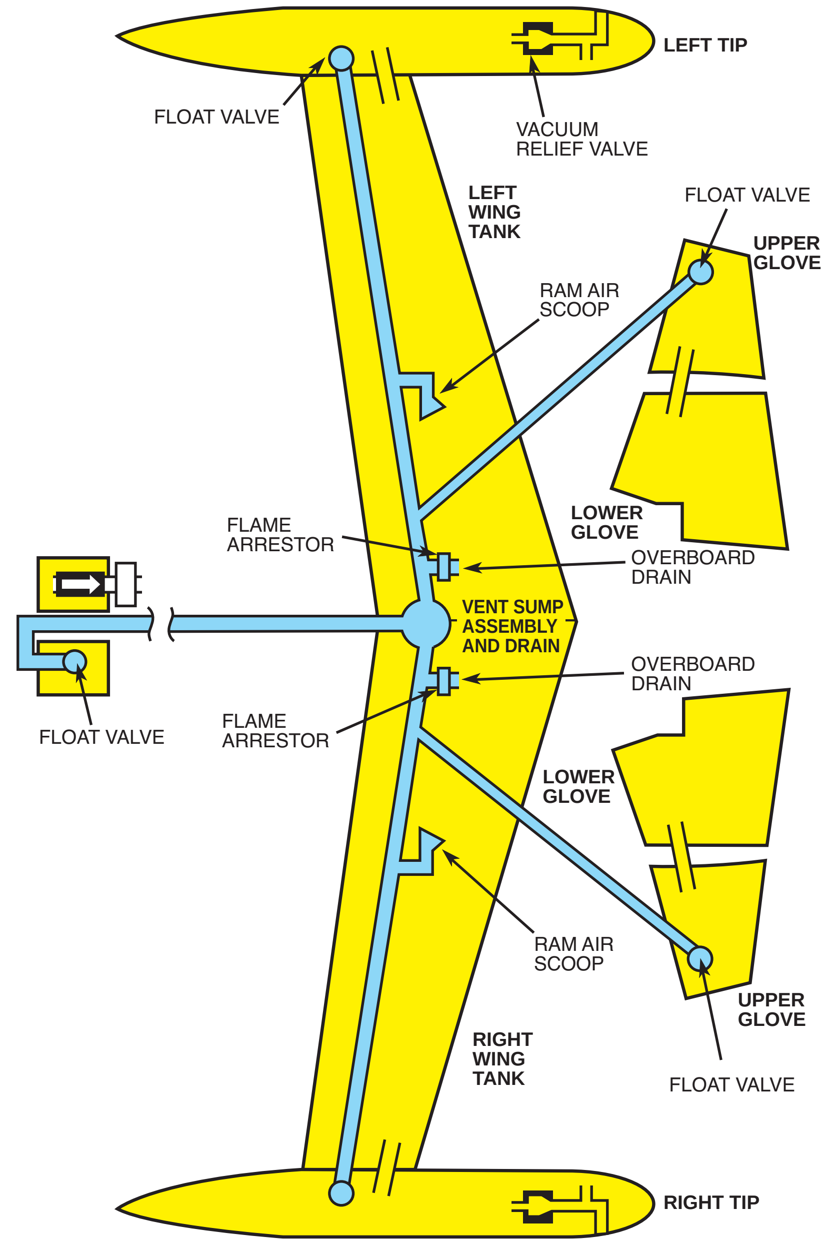
Fuel System

Learjet 25 XR/G (with Gravity Flow Line)



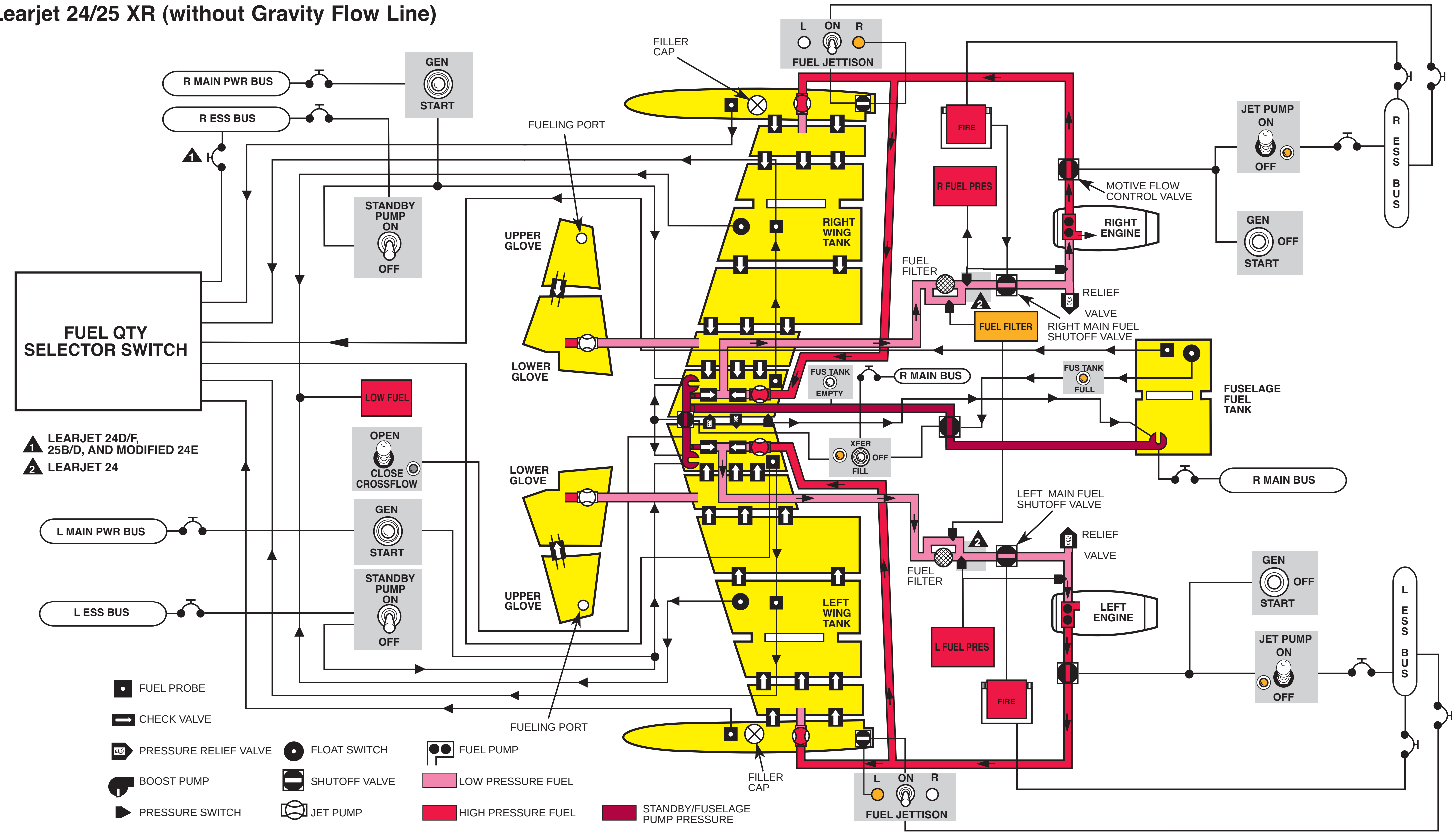
Fuel Vent System

XR Modification



Fuel System

Learjet 24/25 XR (without Gravity Flow Line)



Fuel System

The fuel system comprises the following subsystems:

- a fuel storage system, which includes the wing tanks, tip tanks and fuselage tank (**except unmodified Learjet 24E**). In addition, the fuel vent system is a part of the storage system.
- a fuel distribution system, which includes the pumps, valves, and plumbing required to move the fuel through the aircraft to the engines. Fuel filtration and optional jettison are part of the fuel distribution system.

Both subsystems have associated indicators and annunciators.

Fuel Storage

Tip Tanks

Fuel filler ports in the tip tanks permit fueling operations for the aircraft. The tip tanks then supply fuel to the wing tanks via a jet pump installed in the bottom of each tank. Fuel also gravity feeds into wing tanks from the upper portion of the tank through a flapper valve that restricts fuel from back-flowing to the tip. Baffles in each tip tank prevent fuel from sloshing and causing center of gravity (CG) problems during flight.

A vent tube connects the tip tank to the wing tank via a separate line to the ram air vent system. Another vent tube is an open line in the top of the wing that passes into the top of the tip tank. Relief valves in each tank prevent positive and negative system pressure from damaging the tanks (see Ventilation section, this chapter).

Fuel jettison valves, **if installed**, are in the aft end of the tip tanks; they permit fuel to be jettisoned (see Fuel Distribution section, this chapter).

Wing Tanks

A sealed wing structure forms the full-span, integral wing tanks that are the main fuel tanks. The wing ribs and spars act as baffles to prevent sloshing. Flapper valves in the ribs allow fuel to flow easily inward toward the sump and restrict the flow of fuel outboard.

Two pressure relief valves between the wings prevent over pressurization during crossflow operations by opening at a pressure of 1.0 PSID.

A wing pressure switch in the RH wheel well senses wing tank pressure during fuel transfer from the fuselage tank; it de-energizes the fuselage pump if an over pressurization condition of 5.0 PSI occurs.

XR Modification

The XR modification (**Dee Howard STC No. SA 944 NW**) adds fuel tanks and an associated fuel vent system to the inboard section of the wings. The addition of the "cuff" alters the shape of the inboard third of the wing. The tanks add an additional 536 lbs of usable fuel.

Jet pump failure or high pressure flow loss prevents use of lower glove tank fuel. Fuel from the upper glove tank continues to gravity feed into the wing tank through the flapper valves.

Fuel indicating components include an indicator, amplifier, selector switch and two fuel probes. The XR failure indicating system uses the existing pressure switch and fuel probes in the wing, tip, and fuselage tanks.

Fuselage Tank

The fuselage tank, constructed of bladder cells, is behind the aft pressure bulkhead in the fuselage between the engines. The fuselage tank on the **Learjet 25D/F and 24D/F** contains two bladder-type cells; the fuselage tank on the **Learjet 25C/F** has two additional cells. The **unmodified Learjet 24E** does not have a fuselage tank.

A transfer pump in the bottom of the tank transfers fuel from the fuselage tank to the wings. The **Learjet 24D/F and 25B** has one transfer line and one transfer valve; the **Learjet 25C/F** (and as **an option to the Learjet 25D**) has a second transfer line and valve to provide faster filling of the fuselage tank and gravity feeding to the wing tanks.

Ventilation

The fuel vent system provides continuous ram air pressure to the tip tanks, wing tanks, and fuselage tank while the aircraft is in flight to ensure positive pressure during all flight conditions.

The wing tanks vent to the tip tanks, which, in turn, vent overboard through the ram air fuel vent system.

This ensures positive internal tank pressure to prevent possible tank collapse.

Ram Air Scoops

Flush-mounted, NACA type, underwing ram air scoops admit air through tubing into the tip tanks and fuselage tank. Ram air pressure vents to the wing tanks through wing-to-tip tank interconnects, which are separate from the tip and fuselage vent lines.

A sump assembly and drain valve in the center of the fuselage permits draining of moisture and/or fuel from the vent system.

Fuel Quantity Indicating

Quantity Gage/Selector

The FUEL QUANTITY gage on the pedestal is calibrated in increments of 100 to show pounds of fuel for either total fuel quantity or quantity in a specific tank as selected on the fuel quantity selector directly below the gage. The quantity indicated on the gage reflects compensation for fuel temperature, but can be in error by as much as ±100 lbs in each position.

A red LOW FUEL annunciator illuminates when a float switch indicates the fuel level in either wing drops below 400 to 500 lbs.

The fuel quantity selector is a six-position switch below the FUEL QUANTITY gage. Position the switch to select the desired tank or total system fuel quantity to be read on the gage. Each of five switch positions is labeled with the name of its corresponding tank and that tank's capacity; the sixth position for TOTAL quantity provides the most accurate reading.

Usable tank capacities labeled on the switch are based on a fuel density of 6.7 lbs per gallon. Learjets with the **XR modification** have two additional positions for the glove tanks. The **unmodified Learjet 24E** has no fuselage position.

Fuel Probes

A series of seven fuel probes supply information to the FUEL QUANTITY gage through the fuel quantity selector switch.

Fuel Counter

The fuel counter indicates total pounds of fuel used on a digital-type counter. Pressing the fuel counter reset button resets the four-digit counter to zero. The fuel flow transmitter of each engine supplies voltage to operate the fuel counter and the fuel flow gage. The counter does not regulate fuel jettisoned.

Fuel Flow Gage

Learjet 24D/E/F, 25B/C 070 through 205, and 25D, 206 through 230 aircraft have a fuel flow gage which is a source-selectable indicator with a single needle and a L/R switch to select a reading from either the left or right engine.

The fuel flow gage on **Learjet 25D, 231 and subsequent aircraft** is a dual reading gage that has a separate needle for each engine. The gage displays fuel flow in pounds-per-hour (PPH) from 0 to 3,000 PPH.

Fuel Distribution

The fuel distribution system consists of two independent systems, one for each engine. Each system consists of the following components:

- a jet pump
- an electric standby pump
- a fuel filter
- a shutoff valve
- a motive flow valve
- a pressure switch
- control relays in the fuel control relay panel
- fuel supply line check valves.

The fuel control panel on the center pedestal provides the pilot with control and management of the fuel system; lights verify system operation. Relays in the fuel control relay panel of the tailcone section manage fuel distribution.

Fuel Pumps

Each of the distribution systems contains two pumps: a jet pump and an electric standby pump.

Jet Pump

The jet pump is near the lowest point of the wing to ensure it is submerged in fuel until the tanks are virtually empty. It has no moving parts and operates on the venturi principle.

When the JET PUMP switch on the fuel control panel on the center pedestal is set to ON, the motive flow valve opens; high pressure fuel from the engine-driven fuel pump flows through a nozzle in the jet pump to draw fuel from the tank. Disagreement lights illuminate to indicate the motive flow valve position does not correspond to the setting of the associated jet pump switch. The JET PUMPS switches normally remain in the ON position.

The motive flow fuel pressure from the engine-driven pump ranges from approximately 250 PSI at low fuel flow rates at sea level with engines at idle to approximately 300 PSI during high fuel flow rates at 45,000 ft altitude. Jet pump pressure ranges from 10 to 12 PSI.

A red L or R FUEL PRESS annunciator illuminates if fuel pressure to the associated engine drops below 0.25 PSI.

Standby Pump

An electric standby pump is adjacent to the jet pump. The submerged type standby pump provides fuel crossflow, fuselage fill operation, and engine starting; it is also a standby if a jet pump fails.

STANDBY PUMP switches on the fuel control panel control the pump. Placing a switch in the ON position closes a switch that turns on the associated standby pump in the wing tank. The Left and Right Essential buses supply DC power to the left and right standby pumps, respectively. The pumps can produce a maximum fuel pressure of 18 PSI.

Fuel Filters

Low pressure fuel filters in the main fuel line from tank to engine remove contaminants from the fuel before it enters the engine. The filters have either a single disposable paper element or a washable dual metal element, each with an internal filter bypass that allows continued fuel flow if the filter becomes clogged.

A switch connected to the bypass illuminates the amber FUEL FILTER annunciator when a pressure differential indicates bypass of either fuel filter is occurring.

Fuel Valves

Firewall Shutoff Valve

The electrically operated shutoff valves are two-position (open and closed) ball-and-seat type. The valves allow the pilot to shut off the supply of fuel to the engine if an engine fire occurs.

The appropriate engine FIRE switchlight on the glareshield provides DC power to close the valve when it is pushed in; it again provides power to open the valve when it is pushed a second time. Because the valves are motor-driven, they remain in the last selected position if power is lost.

Motive Flow Valve

Each engine's fuel distribution system incorporates a two-position (open and closed) motive flow valve. The JET PUMP switch electrically controls the rotary actuator-type motive flow valve to route high pressure fuel to the associated tip tank and wing jet pumps.

High Pressure Relief Valve

The valves relieve any pressure buildup caused by thermal expansion of trapped fuel when the engine is shut down. The relief valve opens at 75 PSI, vents fuel overboard, and drains out the bottom of the aft fuselage.

Fuel Supply Line Check Valve

These check valves prevent fuel from being pumped backward through each pump by the standby pump. The flapper-type valves have a small orifice in the flapper that allows fuel to drain back from the engines after engine shutdown.

CROSSFLOW Switch

Placing the CROSSFLOW switch in the OPEN position opens the crossflow valve to transfer fuel between wing tanks; a disagreement light next to the switch illuminates when the crossflow valve position does not correspond to the switch setting.

Placing the switch in the CLOSE position closes the crossflow valve and stops fuel transfer between wing tanks. When installed, an amber FUEL XFLO annunciator next to the annunciator panel illuminates when the crossflow valve is open.

FILL Operations

If fuselage fuel is required for the flight, it must be transferred from the wing tanks. If adequate fuel remains in the wing tanks, use a GPU for this operation to conserve aircraft batteries.

Move the XFER/FILL switch to the FILL position to open the transfer and crossflow valves and turn on the standby pumps. The amber disagreement light next to the XFER/FILL switch for the transfer valve and the amber disagreement light next to the crossflow switch illuminate momentarily while the valves are in transit.

When the fuselage tank is full, a float switch in the top of the tank turns on a green FULL light next to the XFER/FILL switch; this automatically closes the transfer and crossflow valves, and deactivates the standby pumps. For the **Learjet 25C/F or modified 25D with the gravity feed line installed**, the fuselage valve also opens and the amber disagreement light next to the FUS VALVE switch illuminates while the valve is in transit. This accelerates the filling operation.

The green FULL light remains on until the XFER/FILL switch is turned off.

If only a partial fuselage tank load is required, manually initiate the float switch functions by turning off the XFER/FILL switch when the required fuel is in the tank.

XFER Operations

Perform normal fuel transfer from the fuselage tank to the wing tanks by moving the XFER/FILL switch to XFER. If one or both standby pumps are on, they are disabled automatically until the XFER/FILL switch is moved to OFF.

A pressure switch in the transfer line senses a drop in pressure when the tank is empty and turns on the white EMPTY light next to the XFER/FILL switch. The XFER/FILL switch must be turned off to close the valves and turn off the fuselage pump since the pressure switch does not initiate these actions.

The **25C/F and modified 25D with the gravity feed line** may gravity feed fuel from the fuselage tank while in flight. When the FUS VALVE switch is moved to the OPEN position, the fuselage valve and crossflow valve open and their disagreement lights illuminate while the valves are in transit.

Fuel Jettison

The **optional** fuel jettison system consists of an electrically operated control valve in the aft end of each tip tank.

Moving the FUEL JETTISON switch on the fuel control panel to ON applies voltage to open the control valves in the tip tanks to jettison fuel. Fuel then gravity feeds from each tip tank. Lights on either side of the switch indicate whether the associated jettison valve is fully open. Only fuel in the tip tanks can be jettisoned.

Drains

Fuel quick-drain valves are in the fuel lines, crossflow lines, vent system lines, fuel filters, and each fuel tank. The semi-flush, externally-mounted drain valves push-to-open to allow sediment, moisture and/or fuel to drain from the system.

Operations

Normal Operations

During normal operation, each engine receives fuel via its jet pump at 10 to 12 PSI from its respective wing tank. During engine start, the electric standby pumps supply fuel to the engines.

Placing the START-GEN switch in START energizes the respective standby pump and closes the motive flow valve. Fuel flows through the fuel filter and the firewall shutoff valve to the engine-driven pump. Moving the thrust lever out of CUTOFF opens an on-off control valve in the main fuel control unit that allows fuel to flow to the engine (refer to Powerplant chapter).

Moving the START/GEN switch out of the START position to OFF or GEN turns off the standby pump and opens the motive flow valve; the engine-driven pump supplies the fuel. An amber disagreement light next to the jet pump switch illuminates while the valve is in transit. If the motive flow valve does not fully close when the START/GEN switch is moved to the START position, the starter does not engage and the disagreement light remains on.

Crossflow Operations

To initiate crossflow operations, position the CROSSFLOW switch to OPEN (FUEL XFER annunciator illuminates, **if installed**); this applies power to the motorized crossflow valve to allow fuel flow between the wing tanks.

To balance wing fuel, open the crossflow valve by moving the crossflow switch to OPEN. Then turn on the standby pump in the heavy wing to transfer the fuel from the heavy wing to the light wing.

If the aircraft is on the ground, an imbalance between the tip tanks can be corrected only if the wing tanks are full. Fuel can be pumped into a tip tank by opening the crossflow valve and turning on the opposite side standby pump. If the wing tank is full, this forces fuel into the tip tank through the vent tube in the top of the wing. If the tip tank also becomes full, fuel vents overboard through the over-pressure relief valve in the tip tank. To terminate crossflow operations, position the CROSSFLOW and STANDBY PUMPS switches to OFF.

Jettisoning

Fuel can be jettisoned from the tip tanks with any combination of flaps, landing gear, and speeds. Fuel jettisoning is faster, and the most fuel is jettisoned, when the aircraft is in a nose-up attitude. Time to jettison fuel from full tip tanks is approximately five minutes.

Move the FUEL JETTISON switch to ON to begin jettisoning. Both fuel jettison lights should illuminate to indicate the control valve in the associated tip tank is open. If only one light illuminates, only that valve has opened; the FUEL JETTISON switch must be switched OFF.

Observe aft edge of tip tanks and FUEL QUANTITY indicator after actuating the FUEL JETTISON switch to ensure that fuel is flowing from both tanks. Monitoring the FUEL QUANTITY indicator is required at night or other times when visibility is reduced. Once jettisoning is completed, position the FUEL JETTISON switch to OFF and check that both FUEL JETTISON lights are extinguished.

Fuel System

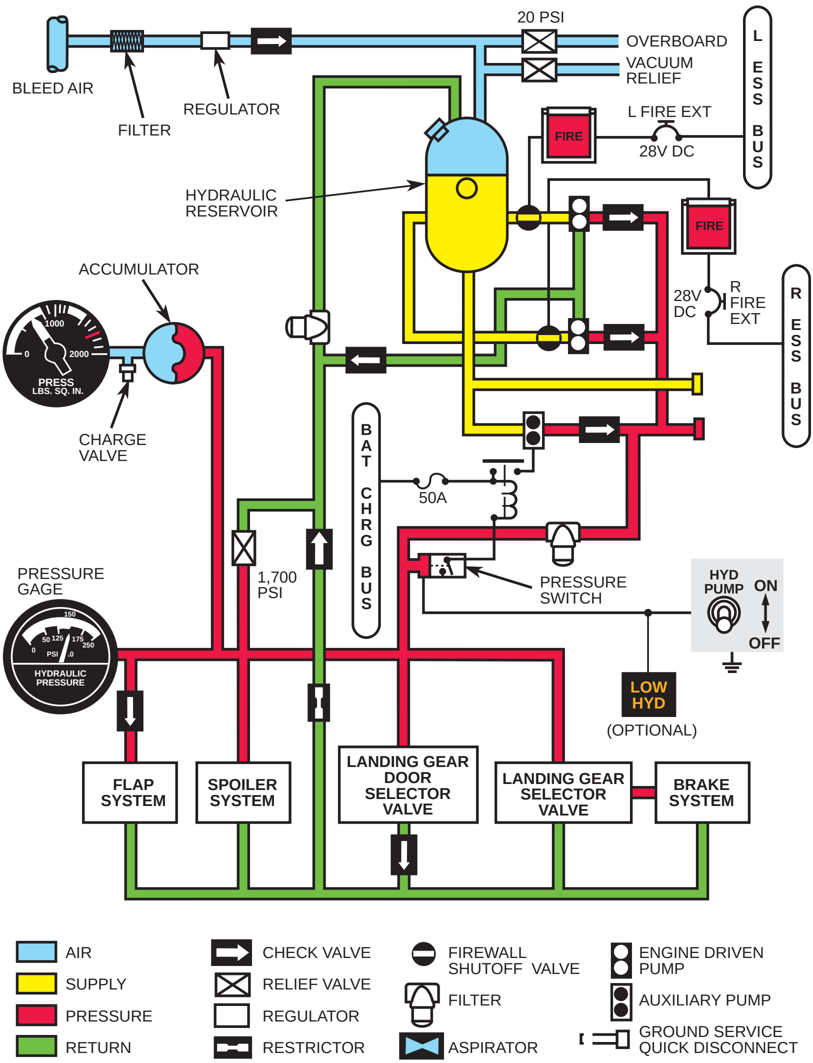
Power Source	Left/Right Essential buses – jet pump and standby pump Right Main bus – fuselage pump, FILL/XFER Engine-driven fuel pump
Distribution	Tip tanks Wing tanks Fuselage tank (**except on unmodified 24E**) Standard fill and transfer line – fuselage to wing Gravity transfer line to wings (**standard on 25C, optional on all other models**) Engine motive flow to tip and wing jet pumps Fuel jettison valves for tip tank fuel (**optional**) Jet or standby pump to fuel filter, firewall shutoff valve, pressure switch, and engine-driven fuel pump (order changes, depending on whether aircraft is **model 24 or 25**)
Control	Switches JET PUMP L/R STANDBY PUMP L/R START/GEN L/R XFER-FILL FUSE VALVE OPEN/CLOSE (**25C/F; optional on other models**) CROSSFLOW OPEN/CLOSE FUEL JTSN (**optional**) L/R FIRE switchlights – firewall shutoff valves
Monitor	Annunciators FUEL PRESS L/R FUEL XFLO (**optional**) FUEL FILTER Lights EMPTY/FULL Valve disagreement Fuel jettison (**optional**)

Fuel System (cont.)

Protection	Fuselage float switch for overfill prevention Firewall shutoff valves Fuel vent for negative and overpressure relief Right wing pressure switch to stop fuel transfer if right wing pressure exceeds 5 PSI Wing overpressure release valves (1 PSID between wings)

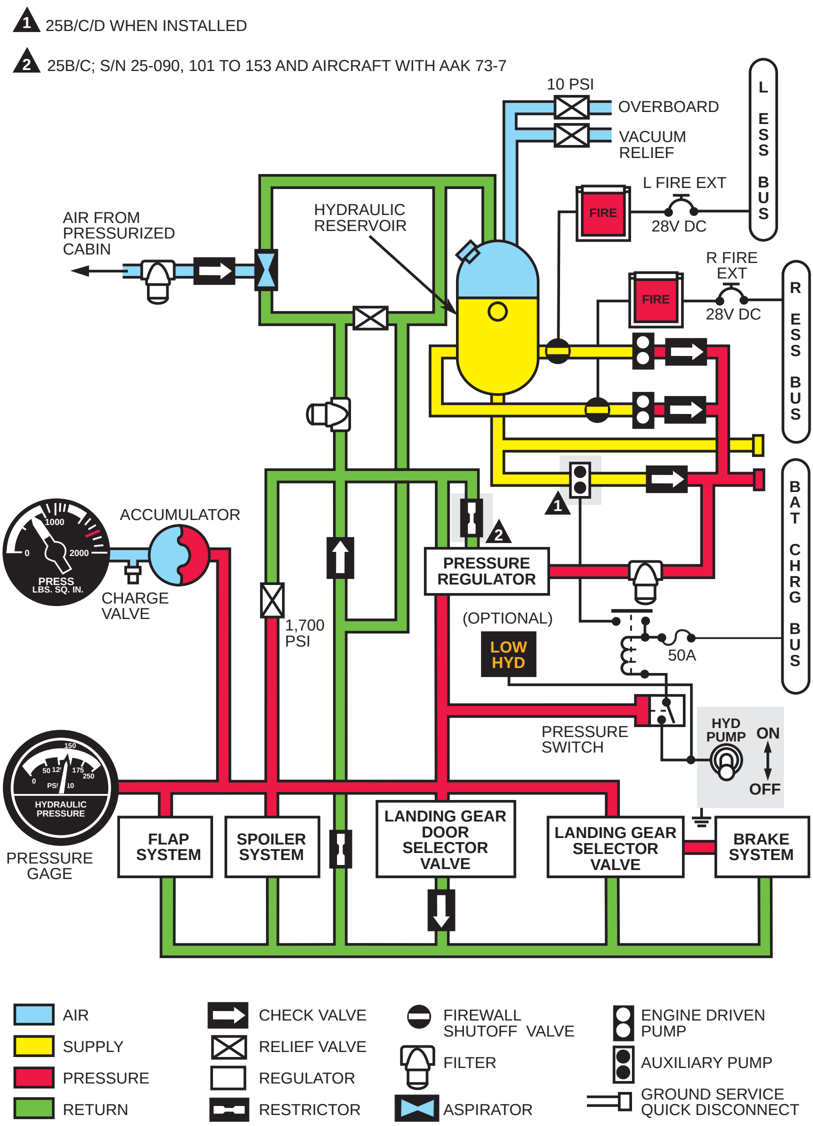
Hydraulic System (Later)

Learjet 25B/C 25-181 to 25-205 and 25-135; Learjet 25D/F 25-206 and subsequent; Learjet 24D 24-297 to 24-328; Learjet 24E/F 24-329 and subsequent



Hydraulic System (Early)

Learjet 25B/C 25-061, 25-070 to 25-180 except 25-135; Learjet 24D 24-230 to 24-296



Hydraulic System

The Learjet 24/25 hydraulic system supplies fluid for operation of the following:

- brakes
- landing gear
- main gear doors
- flaps
- spoilers
- thrust reversers (**if installed**).

Hydraulic fluid flows from a reservoir in three separate directions through supply lines. Two lines carry the fluid to individual shutoff valves. From the shutoff valves the lines carry the fluid to an independent engine-driven pump. The engine-driven hydraulic pumps maintain fluid under pressure through lines, check valves, and filters to the hydraulically operated systems upon demand. The third line carries the reserve fluid to an electric auxiliary hydraulic pump.

On **later** aircraft (**S/Ns 24D, 24-297 to 328; 24E/F, 24-329 and subsequent; 25B/C, 25-181 to 205; 25D/F, 25-206 and subsequent**), the hydraulic system operates at 1,450 PSI.

On the **earlier** aircraft (**S/Ns 24D, 24-230 to 296; 25B/C, 25-061, 070 to 180**), the hydraulic system operates at 1,500 PSI.

The hydraulic system consists of the following:

- a hydraulic reservoir
- three system filters
- two firewall shutoff valves
- two engine-driven pumps
- an accumulator
- a pressure relief valve
- pressure regulator

- a HYD PRESS indicator
- an electric auxiliary pump (see Auxiliary System, this chapter).

Hydraulic Reservoir

The airtight, pressurized 1.9 gallon hydraulic reservoir in the tailcone equipment bay supplies fluid through two 28V DC, motor-operated supply shutoff valves. The fluid continues to the engine-driven pumps and the auxiliary pump. The reservoir is considered full when fluid covers the sight gage or the float ball (**aircraft with SB 23/24/25-29-1**) is at the top of the sight glass. Only 1.5 gals are available to the engine-driven pumps due to their location off the pump ports on the hydraulic reservoir.

The reservoir automatically pressurizes to 17 PSI with the operation of one or both engines. On **earlier systems**, the reservoir pressure equals cabin pressure, 10 PSI maximum. This pressure provides a positive fluid flow to the engine-driven pumps and prevents fluid foaming.

On the **later system**, a pressure regulator maintains the reservoir pressure at approximately 17 PSI. Bleed air from the bleed air manifold travels via a pressure line through a pressure regulator to the reservoir.

Shutoff Valves

Each firewall shutoff valve isolates fluid from its respective engine-driven pump by blocking flow from the reservoir. The respective engine FIRE switchlight in the cockpit eyebrow controls the ball-type, motor-driven shutoff valve.

Pressing the engine FIRE switchlight closes the corresponding motor-driven shutoff valve. In addition, the respective fire extinguisher ARMED annunciator and the red pin head light illuminates (see Fire Protection chapter).

Engine-Driven Pumps

On the **later system**, each engine drives a conventional, axial piston-type variable volume engine-driven pump mounted on the accessory gear box. Each pump, at approximately 6,000 rpm, produces 4.0 gpm at 1,450 PSI.

On the **early system**, each engine drives one constant displacement pump mounted on the accessory gear box. At 7,800 rpm, the pump supplies fluid through a pressure regulator to the hydraulic system at a rate of 2.25 GPM at 1,500 PSI.

Accumulator

On **S/Ns 24D/E/F-285 and subsequent; 25B/C/D/F-154 and subsequent**, the accumulator is a cylindrical shaped unit. On **S/Ns 24D-230 to 284; 25B/C-061, 070 to 153**, the accumulator is a spherical unit. The hydraulic accumulator in the aft equipment bay absorbs and dampens sudden hydraulic surges.

The spherical accumulator is divided by a diaphragm charged with nitrogen or dry air on one side. The cylindrical unit uses a piston. An air charging valve and direct-reading pressure gage on the air side of the accumulator allow servicing of the unit. The accumulator contains an 850 PSI charge (750 PSI normal minimum).

Pressure Regulator

On the **Early system**, the hydraulic pressure regulator is an unloading valve that regulates and maintains the aircraft's hydraulic system pressure. A restrictor in the regulator drain port dampens regulator noise (chirp) in the pressure regulator unloading valve. A regulator noise (chirp) may be apparent on aircraft that have not operated for a period of time. Once the regulator cycles, the chirping should stop.

HYD PRESS Indicator

The direct reading HYDRAULIC PRESSURE indicator on the upper right copilot instrument panel displays system pressure (PSI x 10). The indicator markings are 0, 50, 125, 150, 175, and 250, with a pointer.

Auxiliary System

The auxiliary system components are:

- an auxiliary hydraulic pump
- an **optional** LO HYD PRESS annunciator
- a HYD PUMP switch.

Auxiliary Hydraulic Pump

The auxiliary hydraulic pump in the aft equipment bay provides hydraulic pressure. The pump can use total system fluid or 0.4 gals in the bottom of the reservoir that may be available during a hydraulic malfunction. The pump draws fluid from the reservoir reserve and discharges it at a rate of 0.5 gpm and 1,250 PSI; this maintains sufficient pressure to support the following:

- flap system
- spoiler system
- brake system
- thrust reversers.

With the auxiliary hydraulic switch ON, the pressure switch opens and closes as preset pressure to cycle the pump on and off. On **Model 25 without AMK 72-10**, the switch opens at 1,400 ±40 PSI and closes at 1,200 ±100 PSI. On **Model 25 with AMK 72-10**, the switch opens at 1,250 ±40 PSI and closes at 1,125 ±25 PSI.

On **Model 24 with pressure switch P/N 730617**, the switch opens at 1,300 ±40 PSI to interrupt power to the pump; when the pressure drops to 1,140 ±50 PSI, the switch closes to return power to the pump. On **Model 24 with pressure switch P/N 730605**, the switch opens at 1,400 ±50 PSI and closes at 1,200 ±100 PSI.

LOW HYD Annunciator (Optional)

The amber LOW HYD annunciator on the glareshield illuminates to alert the crew of a system pressure drop to the values listed above. The auxiliary hydraulic pump pressure switch senses system pressure and illuminates the LOW HYD annunciator.

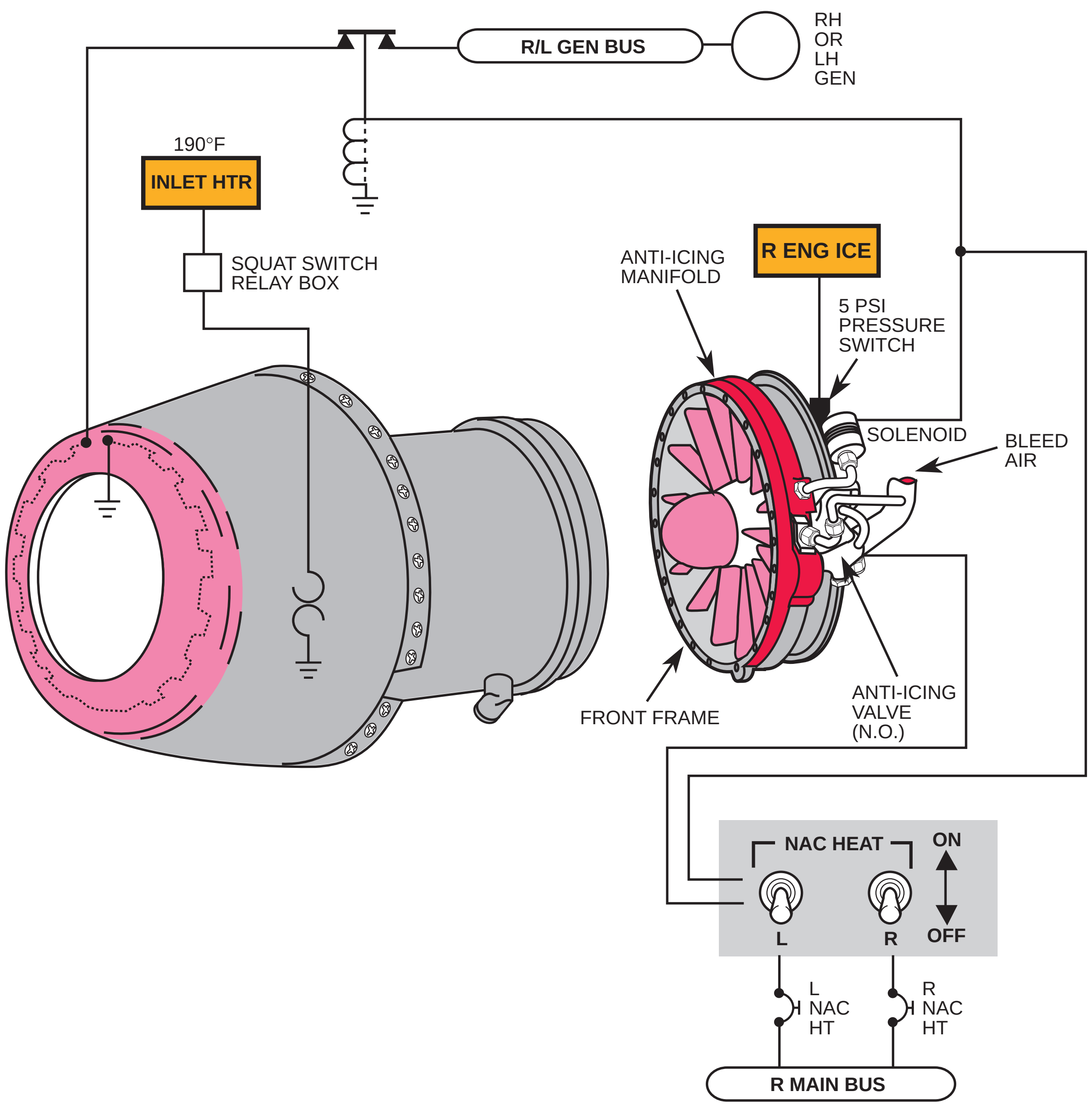
HYD PUMP Switch

The HYD PUMP switch on the lower center instrument panel provides a completed circuit to operate the auxiliary pump. The switch label reads HYD PUMP. Selection of HYD PUMP (ON) arms the auxiliary power circuit to initiate the pump to run at pressures indicated (see Auxiliary Hydraulic Pump, previous page). When the pressure switch closes, the pump shuts off automatically.

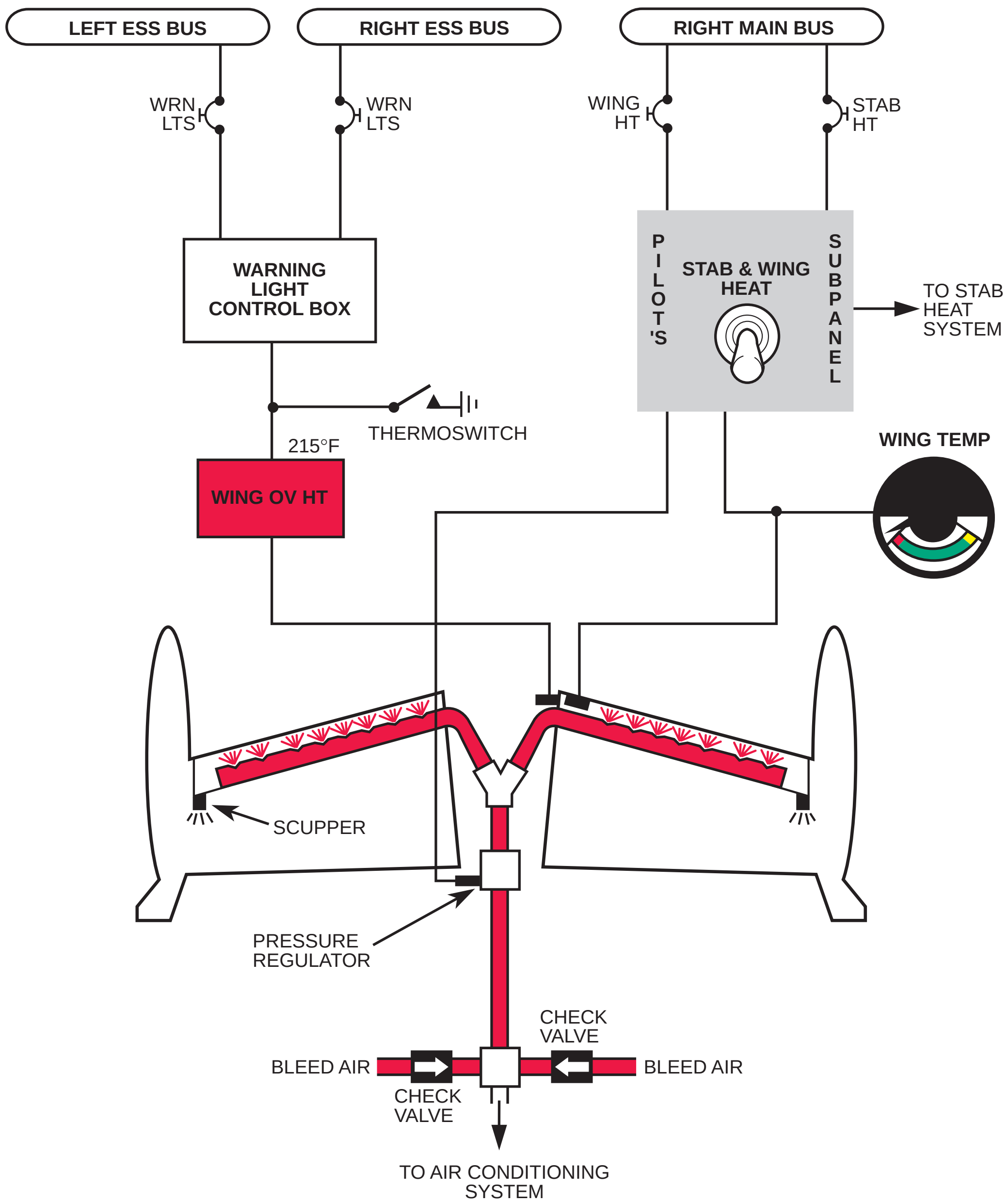
Hydraulic Systems

Power Source	**Later System (Learjet 24D/E/F S/N 24-297 and subsequent; 25B/C/D/F S/N 25-135, 181 and subsequent)** Engine-driven self-regulating, variable volume pump (4 GPM) Battery Charging bus – auxiliary hydraulic system (0.5 GPM)
	Early System (Learjet 24D S/N 24-230 to 296; 25B/C S/N 25-061, 070 to 180, except 135) Engine-driven constant-displacement pump (2.25 GPM) Battery Charging bus – auxiliary hydraulic system (0.5 GPM)
Distribution	Engine-driven pumps or auxiliary pump Spoilers Flaps Landing Gear Brakes Thrust reversers (**if installed**)
Control	AUX HYD PUMP switch L/R FIRE switchlights
Monitor	HYDRAULIC PRESSURE indicator LOW HYD annunciator (**if installed**) Accumulator precharge gage (**preflight**) Hydraulic reservoir sight glass (**preflight**)
Protection	Overpressure relief valve actuation at 1,700 PSI Auxiliary hydraulic pump pressure switch Firewall shutoff valves (L/R FIRE switches activate) Hydraulic reservoir pressurization fluid-foaming prevention via bleed air (direct from manifold or cabin air pressure) with overpressure and vacuum relief

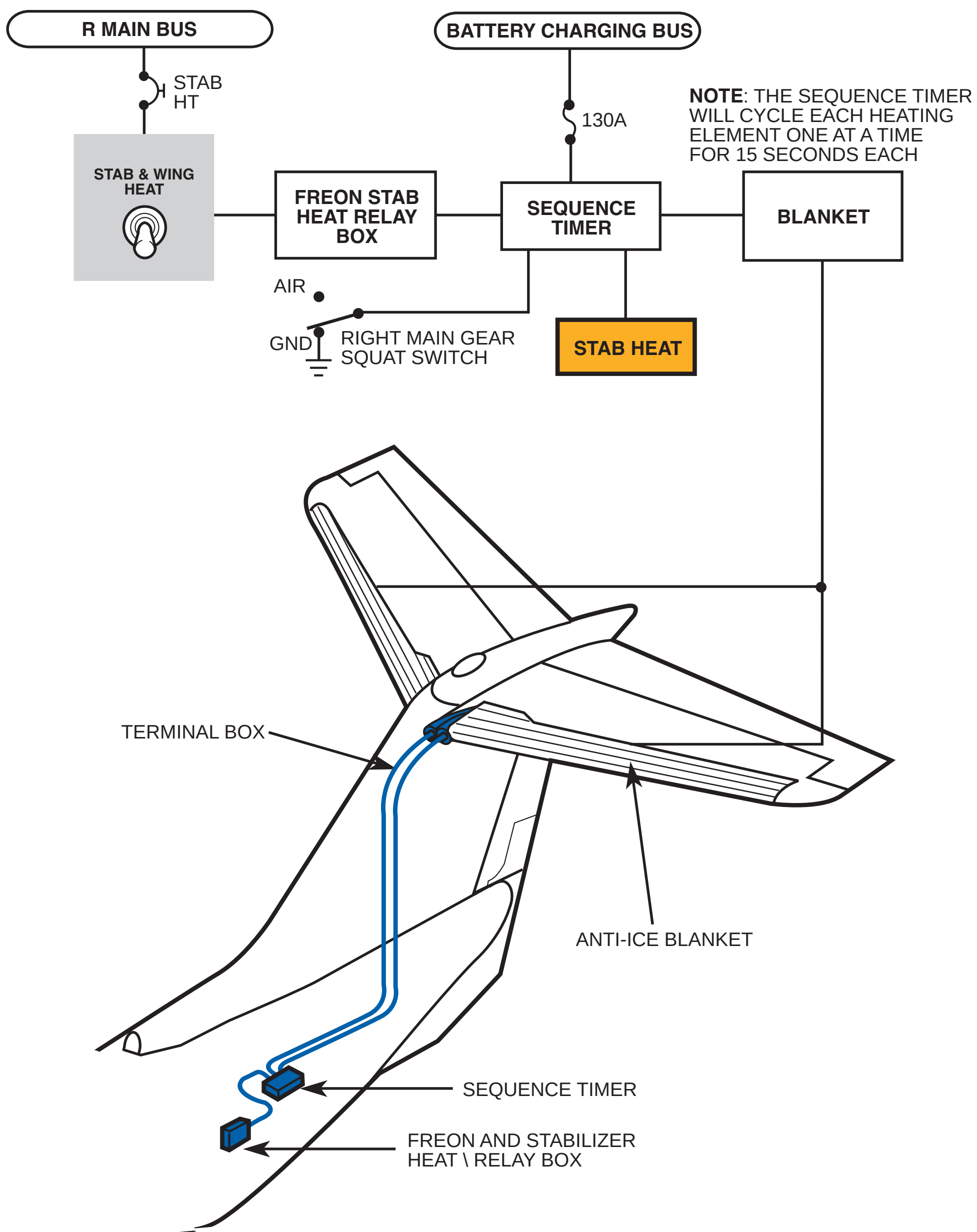
Engine/Nacelle Anti-Ice System



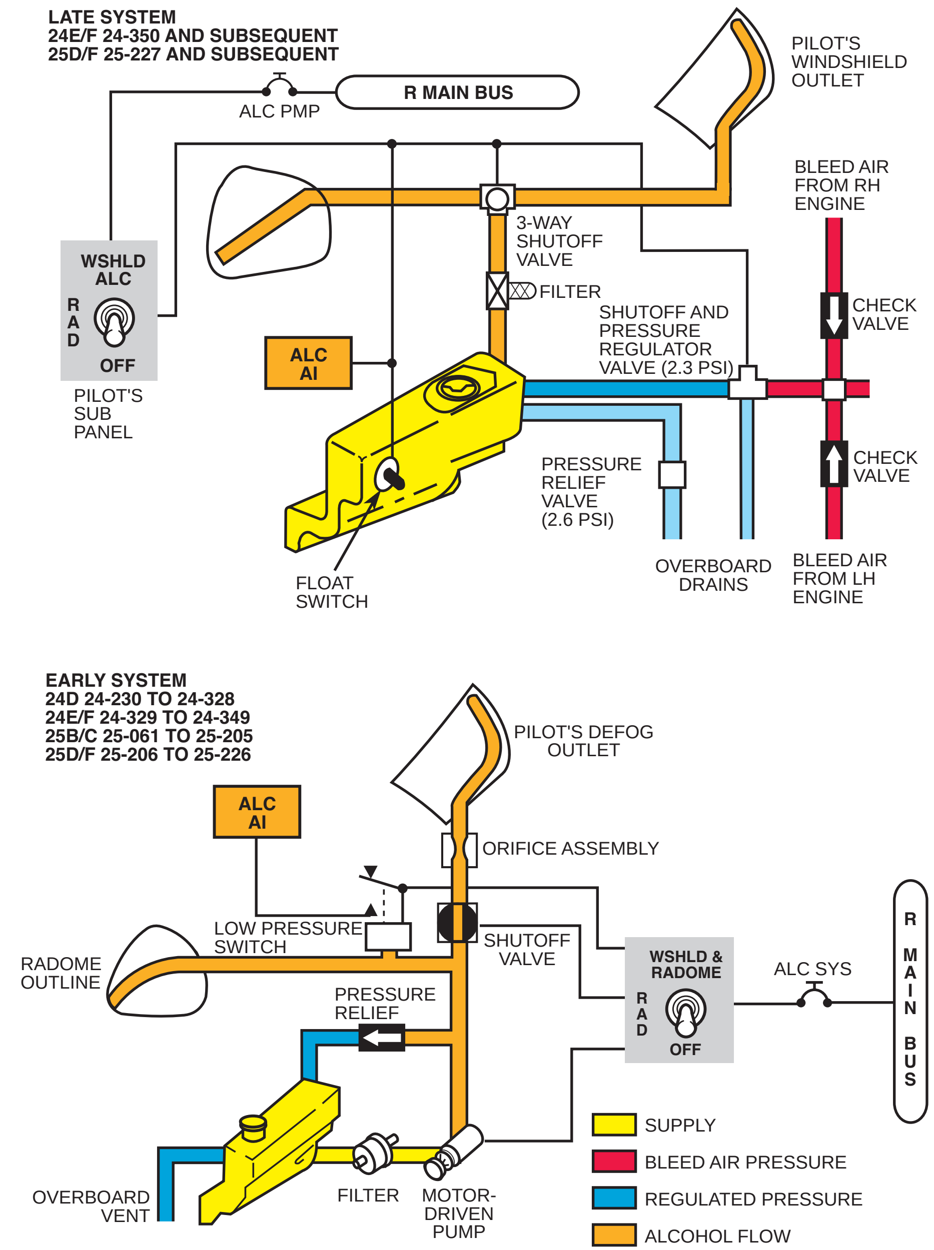
Wing Anti-Ice System



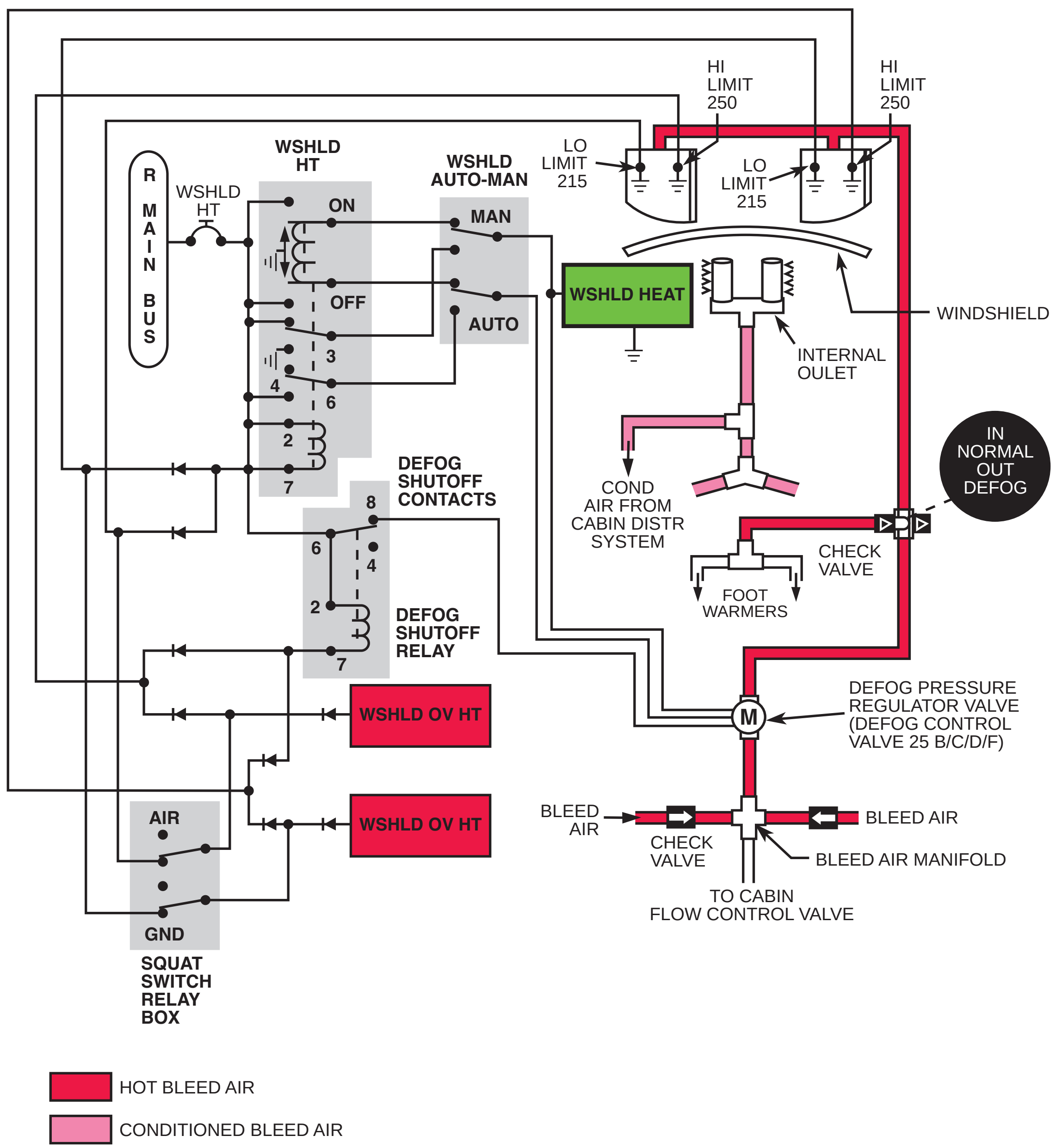
Horizontal Stabilizer Anti-Ice System



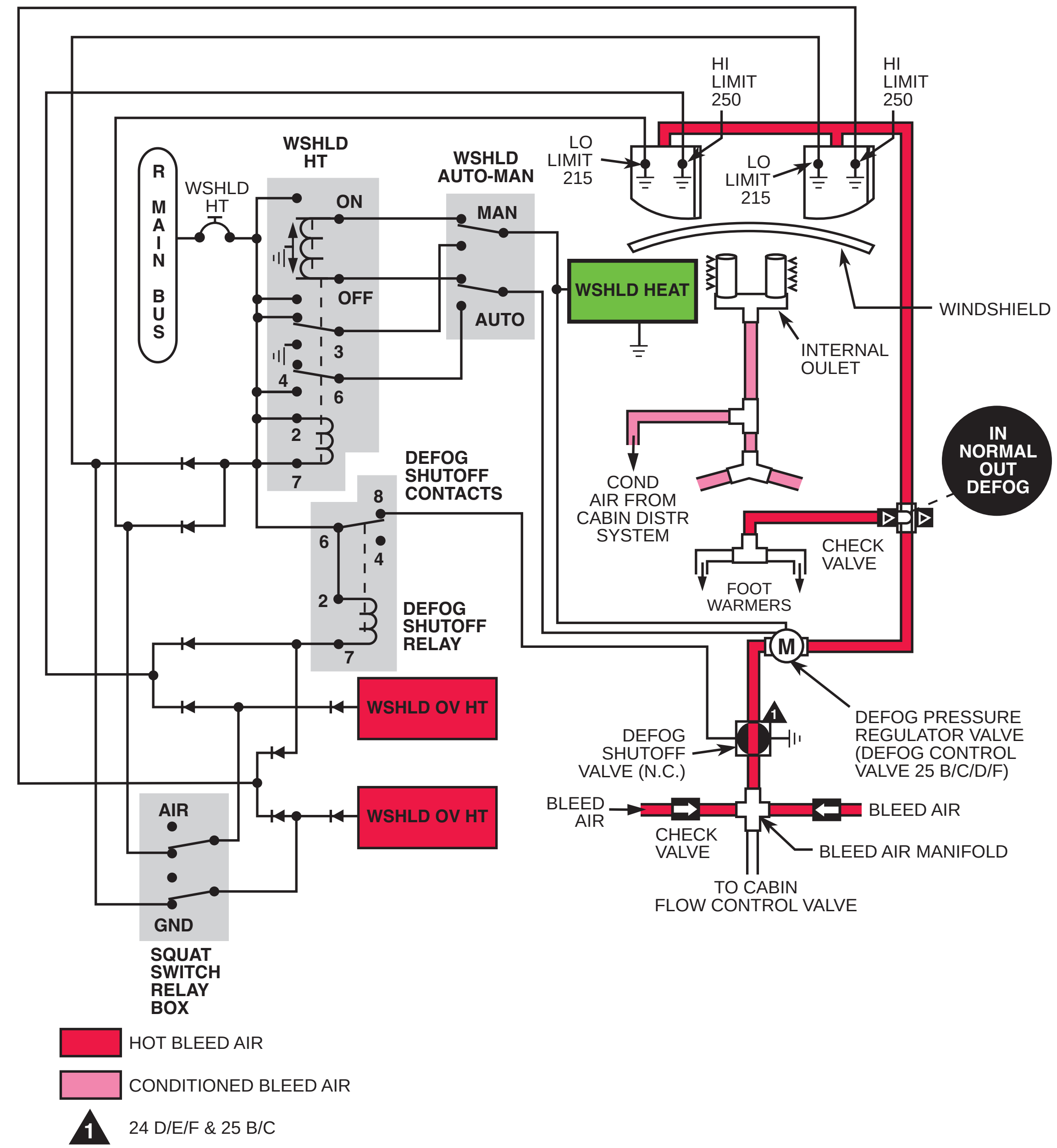
Windshield Alcohol Anti-Ice System



Early Windshield Bleed Air Anti-Ice System



Later Windshield Bleed Air Anti-Ice System



Ice and Rain Protection

The ice and rain protection systems for the Learjet 24/25 are anti-icing systems. Although they can remove ice, they are not deice systems. Anti-icing systems for the Learjet include engine, engine nacelle, wing and horizontal stabilizer, windshield and radome.

Engine eighth-stage bleed air supplies hot air to anti-ice the engine front frame, bullet nose, and guide vanes. Bleed air is also utilized for the windshield and wing leading edges. The engine nacelle and horizontal stabilizer are heated electrically. A windshield alcohol system provides back-up for the normal windshield heat system.

Whenever battery switches are on, the static ports are heated; the PITOT HEAT switches control heating of the pitot tubes and stall warning vanes. The ice detection system consists of windshield ice detect lights and an **optional** wing inspection light.

Ice Detection

During daylight operations, visually check for ice on the aircraft by checking for ice formation on the lower corners of the windshield or on the nose of the tip tanks.

During night operations, check for ice by using the windshield ice detection light. When installed, the **optional** emergency exit/wing inspection light on the right side of the fuselage illuminates the right wing to allow inspection.

Normally, the wing inspection light receives power from the Right Main bus through the WING INSP LTS CB and WING INSP switch on the copilot's dimmer panel. During an emergency, the baggage compartment emergency lighting system battery supplies this light.

Windshield Ice Detector Lights

The windshield ice detector system consists of two red light assemblies on the glareshield and two CBs. The light on the pilot's side is in an area cleared by the windshield anti-ice system. The light on the copilot's side is in an area partially outside the windshield anti-ice airflow system. These locations are such that if the windshield anti-ice system is operating, an indication is still available on the copilot's side. These lights are on anytime DC power flows to the Essential DC buses.

Setting either Battery switch ON applies 28V DC through individual CBs to its respective light. When particles of ice or moisture form, light refraction takes place; this results in the appearance of two red areas, approximately 1-1/2 inches in diameter, on the windshield.

Anti-Ice Systems

Engine and Nacelle Inlet Anti-Ice System

Engine bleed air provides anti-ice protection of engine areas, while the DC electrical system provides nacelle anti-icing. Anti-ice system components for each engine include the following:

- anti-icing control valve
- anti-icing pressure switch
- two amber ENG ICE annunciators.

Components of the nacelle anti-ice system include:

- heating elements in the nacelle lip
- an overheat sensor in each engine inlet
- control relays
- L and R NAC HEAT switches
- an amber INLET HTR light.

The nacelle heat switches control both the bleed air and electric anti-ice protection. Placing the NAC HEAT switches to the ON position de-energizes the anti-ice valves open and applies 28V DC to the anti-ice pressure switch nacelle heat control relay and heating elements.

If the bleed air pressure in the anti-ice duct drops below 5 PSI, an amber ENG ICE annunciator illuminates. To ensure adequate bleed air for anti-icing, a minimum of 80% rpm should be maintained while in icing conditions. If, on the ground (i.e., squat switches in the ground mode), the heating elements on the nacelle lip exceed 190°F, an amber INLET HTR light illuminates. Turn the nacelle heat switches off to allow the heating elements to cool.

Wing Anti-Ice System

Engine bleed air directed through the wing leading edge provides anti-icing protection for the wing. The system consists of:

- a pressure regulator valve (N.C.)
- a thermoswitch
- a temperature sensor
- a wing temperature indicator
- an WING OVHT annunciator
- a system switch
- a Wing HT CB.

Placing the STAB & WING HT switch ON provides DC power to open the pressure regulator valve. The surfaces heat as bleed air passes through diffuser tubes along the inside of the leading edges and then vents overboard through scuppers at the outboard ends of the wings.

The temperature sensor in the right wing leading edge senses the wing leading edge skin surface temperature and the WING TEMP indicator provides the pilot with a visual indication of wing leading edge skin temperature.

All aircraft have wing temperature indicators with red, green, and yellow segments. An indicator in the red segment (left of the indicator) indicates freezing temperature range; the yellow segment (right of the indicator) indicates a potential overheat condition.

The red WING OVHT annunciator on the glareshield illuminates when the temperature of the right wing leading edge exceeds 215°F.

Horizontal Stabilizer Anti-Ice System

Two neoprene/electrical blankets protect the horizontal stabilizer leading edge from ice accumulation. Each blanket is segmented into seven elements, the seventh (or center) element is the parting element. The system also includes:

- a sequence timer
- WING OVHT annunciator
- STAB/WING HEAT switch
- relays
- STAB HT CBs
- a current limiter.

The Right Main bus provides 28V DC power to the STAB & WING HT switch. When the switch is in the up position, the system is on.

The parting elements are powered all the time when the system is on. The sequence timer alternately heats one element at a time in a pattern that starts with an upper element followed by a lower element in a forward-to-aft sequence. The STAB HT annunciator illuminates if the left parting elements fails to heat.

The anti-ice system is inoperative on the ground when the right main squat switch is in the ground mode. If the system is left on while the aircraft is on the ground and the R MAIN SQUAT switch remains in the air mode without sufficient cooling airflow, the system could overheat and fail.

Windshield Bleed Air Anti-Ice System

Engine bleed air flows through defog ducting and three valves to external outlets to prevent ice accumulation on the windshield. Components of the defog system consist of:

- an IN-NORMAL/OUT-DEFOG knob
- a defog shutoff valve
- a defog pressure regulator valve
- AUTO-MAN defog control switch
- ON/OFF spring-loaded switch
- two low-limit and two high-limit thermoswitches
- a green WSHLD HEAT annunciator
- two red WSHLD OVHT annunciators
- a WSHLD HT circuit breaker.

The IN-NORMAL/OUT-DEFOG knob on the left forward side of the pedestal is below the forward instrument panel and above the emergency gear blow down lever. The IN-NORMAL position directs defog air to the foot warmers in the cockpit. The OUT-DEFOG position directs defog air to the external defog ducts forward and below the windshield to assist in windshield heat and rain removal.

Ground Manual Operation

With the AUTO/MAN switch in MAN, the pilot manipulates the defog pressure regulator valve with the ON/ OFF switch. Heat is supplied to the windshield with the switch in ON; the WSHLD HT light illuminates.

When the temperature reaches 215°F, the low thermoswitches illuminate on or both red WSHLD OVHT lights (the green WSHLD HT light remains illuminated). If the system is not shut down, an overheat can occur because of the lower cooling airflow across the windshield. If the system continues to heat and the 250°F thermoswitches activate the defog control relay, defog airflow ceases until the thermoswitches cool off.

Air Manual Operation

With the AUTO/MAN switch in MAN, the pilot manipulates the defog pressure regulator valve with the ON/OFF switch. The system operates normally until the 250°F thermoswitches activate the closing of the defog shutoff valve (the low thermoswitches do not function in the air in MAN). The green WSHLD HT annunciator remains illuminated. Illumination of the red WSHLD OVHT annunciator(s) signals that the thermoswitches have closed the defog shutoff valve and flow has ceased. **Learjet 24 models** do not have a defog shutoff valve; the defog pressure regulator is the only flow restrictor.

Auto Operation

When the AUTO/MAN switch is in AUTO, the spring-loaded ON/OFF switch is inoperative. The defog pressure regulator valve is driven fully open and the green WSHLD HT annunciator illuminates.

On the ground, as the temperature reaches 215°F, the low thermo-switch(es) illuminates one or both red WSHLD OVHT annnunciator(s). The green WSHLD HT annunciator extinguishes when the defog pressure regulator valve closes. When the system cools, the process repeats.

In the air, the system works the same except that illumination of either WSHLD OVHT annunciator indicates a failure of both low thermoswitches.

Recommended Procedures

Once the aircraft has reached a negative RAT reading on the climbout, turn on the windshield heat. This should prevent crazing and checking of the windshield. A manual setting of two seconds should be sufficient.

At the top of descent or 30 minutes prior to landing, open the valve for four to five seconds; this should be sufficient for normal low humidity conditions. In icing conditions or high humidity, position the system in full AUTO.

The life of the windshield can be prolonged by maintaining a slightly warm windshield rather than cold soaking followed by hot air blasts.

Windshield Alcohol Anti-Ice System

The alcohol anti-ice system provides windshield anti-ice protection if the normal windshield defog system malfunctions. On **aircraft with the 510 pressurization system**, the alcohol anti-ice system includes a 1.75-gallon pressurized tank containing methyl alcohol (methanol), a shutoff valve and pressure regulator valve, a relief valve, a float switch, a three-way valve and a filter. On **aircraft with the 450 pressurization system**, the system consists of a 2.2-gallon tank containing methyl alcohol (methanol), an electrically-driven pump, an anti-ice shutoff valve, and a low pressure relief valve.

The alcohol anti-ice system can also be utilized for radome anti-ice. The system prevents ice build-up on the radome that could be ingested into the engine.

510 Pressurization System Operation

Setting the alcohol system switch to RADOME completes two circuits through a control relay:

- a power circuit opens the shutoff and pressure regulator valve
- a power circuit positions the 3-way control valve for alcohol flow to the radome.

Operation of the system is the same when the system switch is set to RADOME/WSHLD except that the three-way control valve positions to supply alcohol pressure to both the windshield and the radome. When the system switch is set to OFF, the pressure regulator valve closes. The relief valve regulates to 2.6 PSI to prevent overpressurization if the pressure regulator fails. A float switch in the lower portion of the tank illuminates the ALC AI annunciator when the alcohol tank is almost empty.

The alcohol lasts for approximately 45 minutes when used for both windshield and radome anti-ice and for 2 hours and 9 minutes when used for radome anti-ice only.

450 Pressurization System Operation

Placing the alcohol system switch to RAD energizes the motor-driven pump and supplies methanol to the radome. The normally-closed shutoff valve prevents any alcohol from reaching the pilot's defog outlet nozzle. If the supply of alcohol depletes, the low pressure switch actuates and illuminates the ALC AI annunciator.

If the normal defog system malfunctions, set the alcohol system switch to WSHLD & RADOME. This energizes (opens) the shutoff valve to allow alcohol flow through the orifice assembly to the radome and the pilot's defog outlet nozzle.

The alcohol lasts approximately 45 minutes when used for both windshield and radome anti-ice and for approximately 90 minutes when used for radome anti-ice only.

Miscellaneous Systems

Pitot/Static Anti-Ice System

DC powered integral heating elements are in four static ports, two shoulder ports (**aircraft with Century III or RAS kits**), two pitot tubes and masts, and two stall warning vanes (Refer to **Table 4H-A** for shoulder port heat applicability).

PITOT HEAT annunciators indicate pitot heat failure. An aircraft may have one or two PITOT HT annunciators. Some **early** aircraft have been retrofitted with two small single bulb (peanut) lights – one for the left and one for the right pitot heat. The lights illuminate if current is not flowing through the pitot heat system, or if the pitot heat switches are not in the ON position.

XR/Mark II with Teledyne AOA System

The probe is heated for de-icing, and is ported and shielded to prevent ingestion of moisture in use or on the ground. When the PITOT HEAT switch is ON for ground use, taxi, and pre-takeoff, a low heat mode is provided to the probe. When both the STALL WARNING and PITOT HEAT switches are ON, high heat, which is the inflight de-icing mode, is provided. High heat is used from start of takeoff roll to completion of flight; low heat is used for all ground operation where anti-icing is required.

The high heat mode must not be used for more than two minutes without airflow over the probe; the heating element could be destroyed. On the ground, high heat makes the probe hot enough to cause serious burns; use caution when touching the probes.

Model	Serial Numbers	Reduced Approach Speed Kit (AAK 76-4)		CIII Wing	Shoulder Heat[1]
		Without	With		
25D/F	206 to 229			X	Yes
	230 to 362			X	Yes
	(except 337 and 342)				Yes
	342, 363 to 373			X	Yes
25B/C	70 to 205	X			No
			X		Yes
24E/F	329 to 349			X	Yes
	350 to 357			X	Yes
	(except 351 and 355)				Yes
24D	230 to 328	X			No
			X		Yes

Table 4H-A; Shoulder Port Heat

[1] On aircraft with **the XR modification, Mark II wings, AMK 81-12, or AMK 82-6**, the heating status of the shoulder static port does not change when the aircraft is modified (i.e., if the shoulder static ports are unheated prior to the modification, they remain so; if they are heated prior to the modification, they remain so). Therefore, these aircraft may or may not have heated shoulder static ports, depending on individual configuration.

Ice and Rain Protection System

Wing Anti-Ice System

Power Source	Bleed air manifold Right Main bus – WING HT CB
Distribution	Bleed air ducts to wing leading edges
Control	STAB & WING HEAT switch
Monitor	WING OV HT annunciator
Protection	WING HT CB

Stabilizer Anti-Ice System

Power Source	Right Main bus (control) Battery Charging bus (power)
Distribution	Electric blankets on stabilizer leading edges
Control	STAB & WING HEAT switch
Monitor	STAB HEAT annunciator Ammeters
Protection	STAB HT CB Current Limiter Right landing gear squat switch

Windshield Bleed Air Anti-Ice System

Power Source	Bleed air manifold Right Main bus
Distribution	Bleed air manifold Defog shutoff valve Pressure regulating normal shutoff valve Windshield diffuser outlets

Control	IN-NORMAL/OUT-DEFOG knob
	Switches
	    WSHLD HEAT AUTO/MAN
	    WSHLD HEAT ON/OFF

Monitor	WSHLD OVHT two red annunciators WSHLD HEAT green light
Protection	Circuit breaker High- and low-limit thermoswitches

Engine Anti-Ice System

Power Source	Right Main bus – nacelle lip heat (control) Generator bus L/R (power) Eighth stage engine bleed air – engine front frame heat

Distribution	Each engine
	    Nacelle lip
	    Front frame anti-ice air manifold
	    Inlet guide vanes
	    Bullet nose

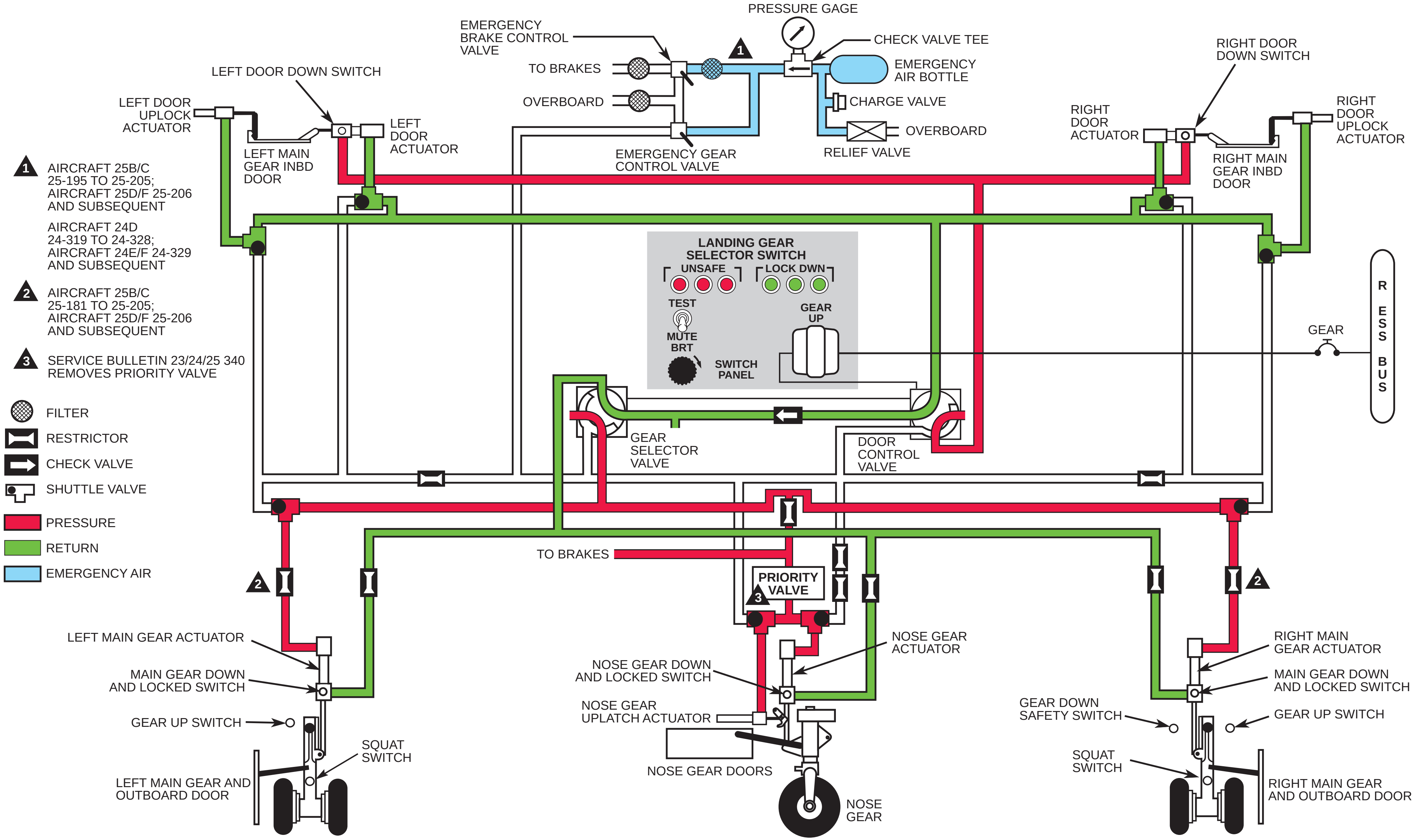
Control	L/R NAC HEAT switches
Monitor	L/R ammeters L/R ENG ICE annunciators Inlet HTR annunciator
Protection	NAC HT CBs Squat switch relay box

Alcohol Anti-Ice System

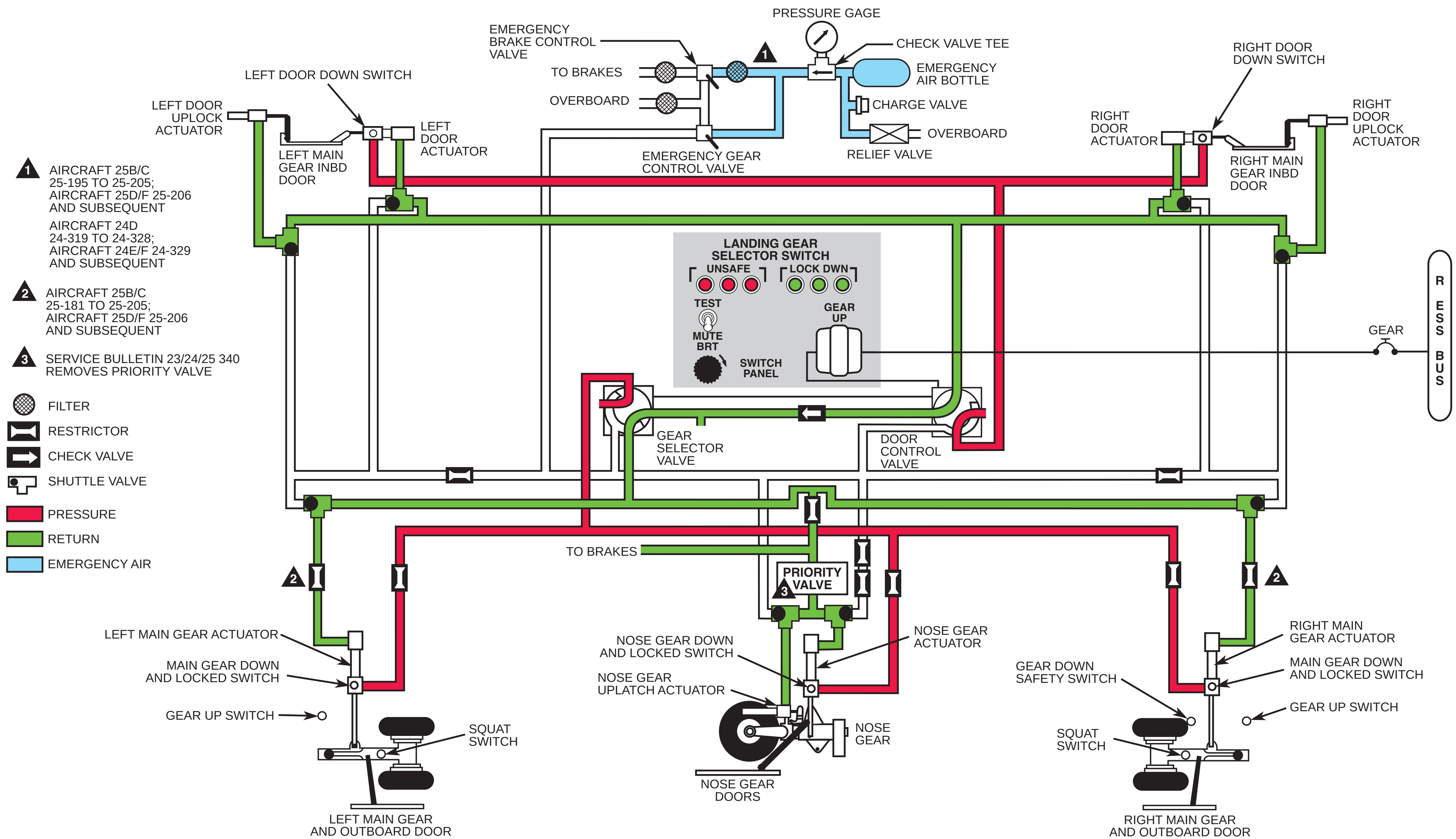
Power Source	Right Main bus – nacelle lip heat (control) Alcohol (methanol) reservoir **510 system**: 1.75 gal pressurized tank **450 system**: 2.2 gal tank **510 system**: L/R Engine bleed air
Distribution	**510 system** Bleed air from left and right engines Shutoff and pressure regulator valve Reservoir through filter Three-way shutoff valve Pilot's windshield and/or radome **450 system** Electric motor-driven, constant-flow pump Filter Reservoir Normally closed (without electric power) shutoff valve Pilot's windshield and/or radome
Control	**510 system**: WSHLD ALC/RAD/OFF switch **450 system**: WSHLD & RADOME/RAD/OFF switch
Monitor	ALC AI annunciator
Protection	**510 system** 2.6 PSI pressure relief valve 2.3 PSI shutoff and pressure regulator valve Reservoir float switch Two overboard drains **450 system** Low pressure switch in radome alcohol line Overboard vent Pressure relief check valve

NOTE: With either pressurization system, the alcohol lasts approximately 45 minutes when used for both windshield and radome anti-ice. When used for the radome anti-ice only, the alcohol lasts approximately 90 minutes with the **450 system** or two hours and nine minutes with the **510 system**.

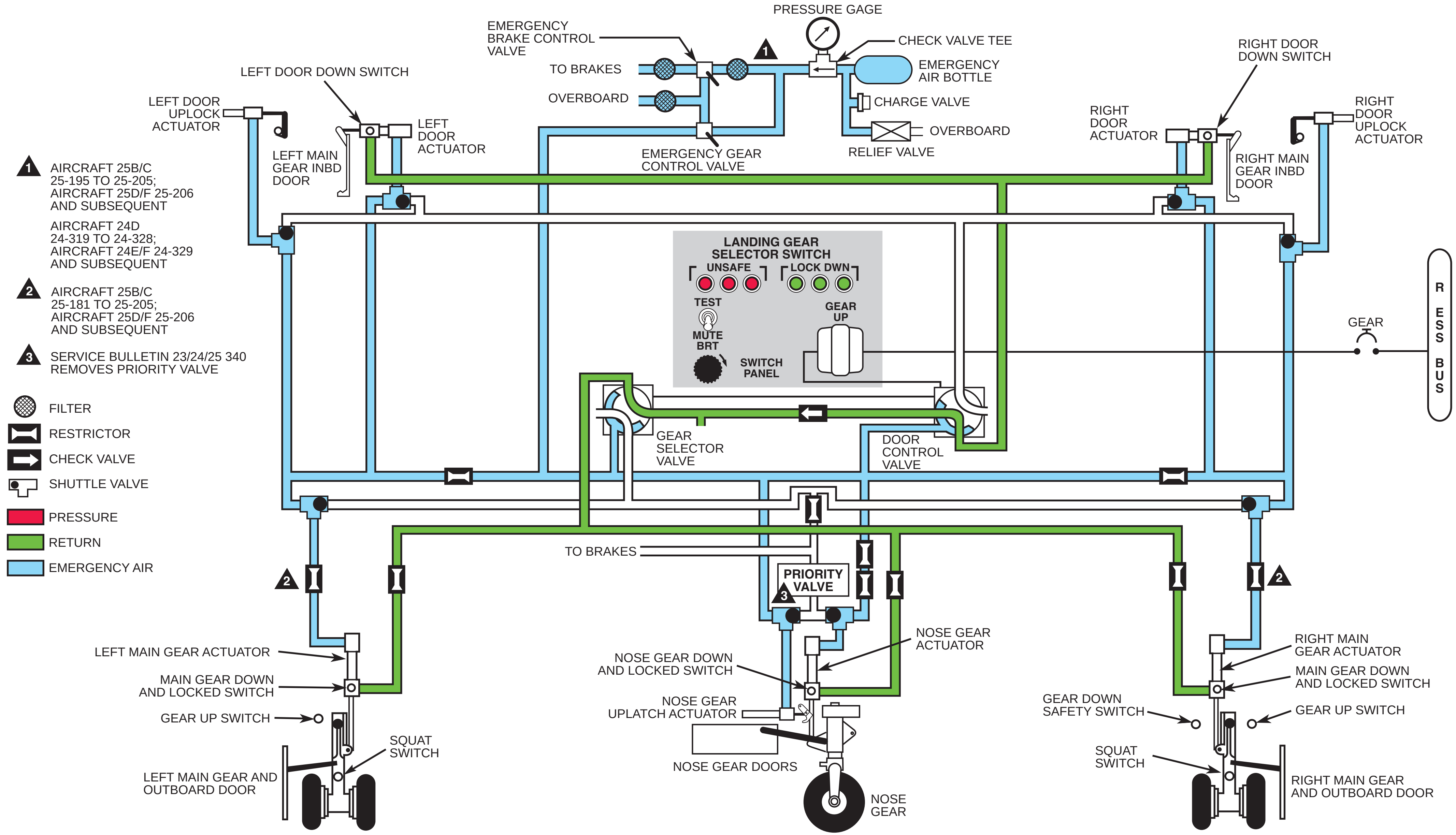
Landing Gear System – Gear Down



Landing Gear System – Gear Up



Landing Gear System – Emergency Air



Landing Gear Systems

The landing gear system on the Learjet 24/25 is a conventional tricycle configuration with air-hydraulic shock strut-type nose and main gear. The gear is electrically controlled and hydraulically operated.

The main gear consists of a dual wheel and brake assembly, and the nose gear utilizes a single wheel. The nose gear has a chined tire to prevent splashing water or slush into the engine inlets.

The brake system on the Learjet 24/25 has rudder-pedal-operated multiple disc brakes on the main gear wheels. The system is mechanically controlled and hydraulically actuated. A pneumatic backup system provides air pressure for braking if the hydraulic system fails.

An anti-skid system provides maximum braking efficiency on all runway surfaces. Speed sensors in each wheel provide electrical signals to the anti-skid valves that release brake pressure when an impending wheel lock and skid occurs.

Squat Switches

The squat switches, one on each main gear, provide verification of the aircraft's status. When the struts are compressed on the ground, the squat switches close and place the relay box in the ground mode. As the main gear struts extend on takeoff, the squat switches open and send a signal to the relay box, placing it in the air mode.

Either of the squat switches can indicate the aircraft is on the ground; however, both squat switches must indicate the aircraft is in the air before the squat switch relay box is in the air mode.

The individual left or right squat switches affect the aircraft systems in either mode (ground or flight) as shown in **Table 4I-A**, next page.

Switch	Functions
Left Main (Made-Ground Mode)	**Enables**: Stall Warning Test Anti-Skid Outboard Left Squat Switch Relay **Disables**: Left Gear Retract
Right Main (Made-Ground Mode)	**Enables**: Stall Warning Test Anti-Skid Inboard Right Squat Switch Relay **Disables**: Stabilizer Heat Right Gear Retract
Squat Switch Relay Panel (One Switch Made-Ground Mode)	**Enables**: Nosewheel Steer Pressurization Dump No. 1 and No. 2 valves are powered and No. 4 is grounded Windshield Heat Ground Mode Inlet Heater Overheat Takeoff Trim Annunciator Trim Overspeed Test Pusher Test Puller Test Autopilot P and R Tests **Disables**: Hobbs Meter Yaw Damper (**AAK 83-4**)

Table 4I-A; Squat Switch Functions

The relay panel receives electrical power from the 7.5A squat switch CB on the Left Main bus to initiate ground mode signals. The relay panel is powered to the ground mode when an electrical ground is present through either squat switch.

If an abnormality occurs or for maintenance purposes, put the squat switch relay box into the air mode by pulling the 7.5A squat switch CB on the Left Main bus. When power is removed, the relay box switches to the air mode.

Landing Gear Operation

Landing Gear Control Lever

The LANDING GEAR control lever on the center instrument panel is a lever-lock type switch; it must be pulled aft before selecting the UP or DOWN position. The gear valve will not energize unless the aircraft is in the air mode.

If the landing gear is extended with the emergency air system, both the gear and door selector valves are pneumatically actuated.

The gear can also be operated with the emergency battery switch in the ON position if an electrical failure occurs.

Retraction

Setting the landing gear control switch to UP energizes the gear door control valve to the down position.

Pressure unlatches the gear door uplocks and opens the inboard main gear doors. When the inboard main gear doors open, the door down switches actuate and the landing gear selector valve energizes to the up position.

The two main gear UNSAFE lights illuminate and, when the inboard main gear doors are fully open, the gear selector valve is energized. With the gear off the ground, the squat switches are in the air mode.

Mechanical linkages from the landing gear struts pull the nose gear and outboard main gear doors closed. When the gear retracts fully, strikers on top of the left and right landing gear struts actuate the gear up switches. In addition, the right main gear down safety switch sends electrical voltage to the up solenoid of the gear selector valve to maintain continuous hydraulic pressure in the actuators.

When the gear is fully retracted with all doors closed, the door up switches and nose gear up and locked switch extinguish the red UNSAFE lights.

Extension

Placing the landing gear control switch to DN energizes the open solenoid on the gear door control valve to the down position. When the door uplatches open, the door up switches cause the red UNSAFE lights to illuminate.

The outboard main gear and nose gear doors open through mechanical linkages connected to the gear struts.

Once the nose gear is down and locked, the nose gear down-and-locked switch illuminates the green nose gear LOCKED DN annunciator and extinguishes the red UNSAFE light. When both main gear are down and locked, the main gear down-and-locked switches energize the gear door control valve to the up position and illuminate the green main gear LOCKED DN lights.

After the main gear door uplock mechanism engages, the door up switches actuate and the left and right main gear red UNSAFE lights extinguish.

Mechanical locks in the nose and main gear actuators hold the gear in the down and locked position.

Landing Gear Alternate Extension

In the event of a main hydraulic system failure or an electrical system malfunction, extend the landing gear pneumatically. Accomplish pneumatic gear extension using the alternate blow down system.

The emergency air bottle in the right side of the nose aft avionics compartment supplies air pressure to operate the blow down system. The alternate gear extension lever on the console left of the pedestal controls the emergency air bottle.

When selecting alternate gear extension, place the LANDING GEAR selector switch in the DN position and pull the GEAR CB to prevent inadvertent gear retraction if electrical or hydraulic power to the system is restored.

The emergency air bottle is charged to 1,800 to 3,000 PSI.

Landing Gear Blow Down

If the hydraulic system fails or an electrical fault exists in the landing gear system, use the blow down extension system to pneumatically blow the gear down. The alternate gear extension lever is guarded to prevent unintentional actuation.

Pushing the lever down admits high pressure air from the emergency air bottle to the blow down system through the lever-actuated blow down valve.

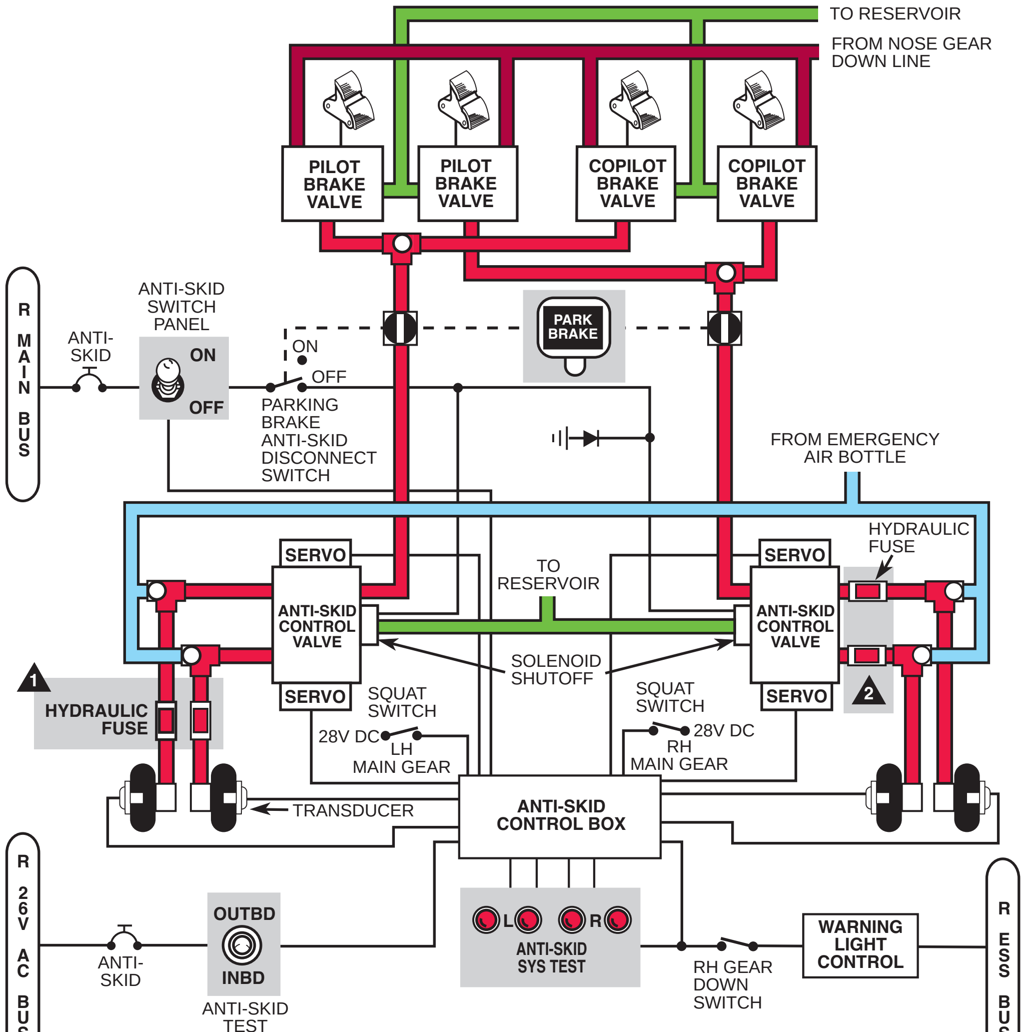
When the landing gear is down and locked, the three green LOCKED DN lights illuminate. The two main inboard door gear red UNSAFE lights remain illuminated after gear extension because the main gear doors remain open. After the gear is down and locked, return the emergency gear extended lever to the UP position; this ensures that air is available in the event there is a leak in the air line.

Return the lever to the UP position by pulling the small sheet metal tab on the top of the handle housing. The lever should spring back to the UP position.

Audible Indication

A warning horn sounds when the gear is retracted and thrust levers are retarded below 70%. The warning horn also sounds when the gear is retracted and the flaps are extended more than 25°. Lowering the gear, increasing power, or moving the TEST/MUTE switch to MUTE silences the gear warning horn if the throttles are set lower than 70%. With the gear up and the flaps at more than 25°, the mute switch can not silence the horn unless the gear is lowered or the flaps are retracted above 25°. In this condition, the red UNSAFE lights do not illuminate.

Brake System
Learjet 25

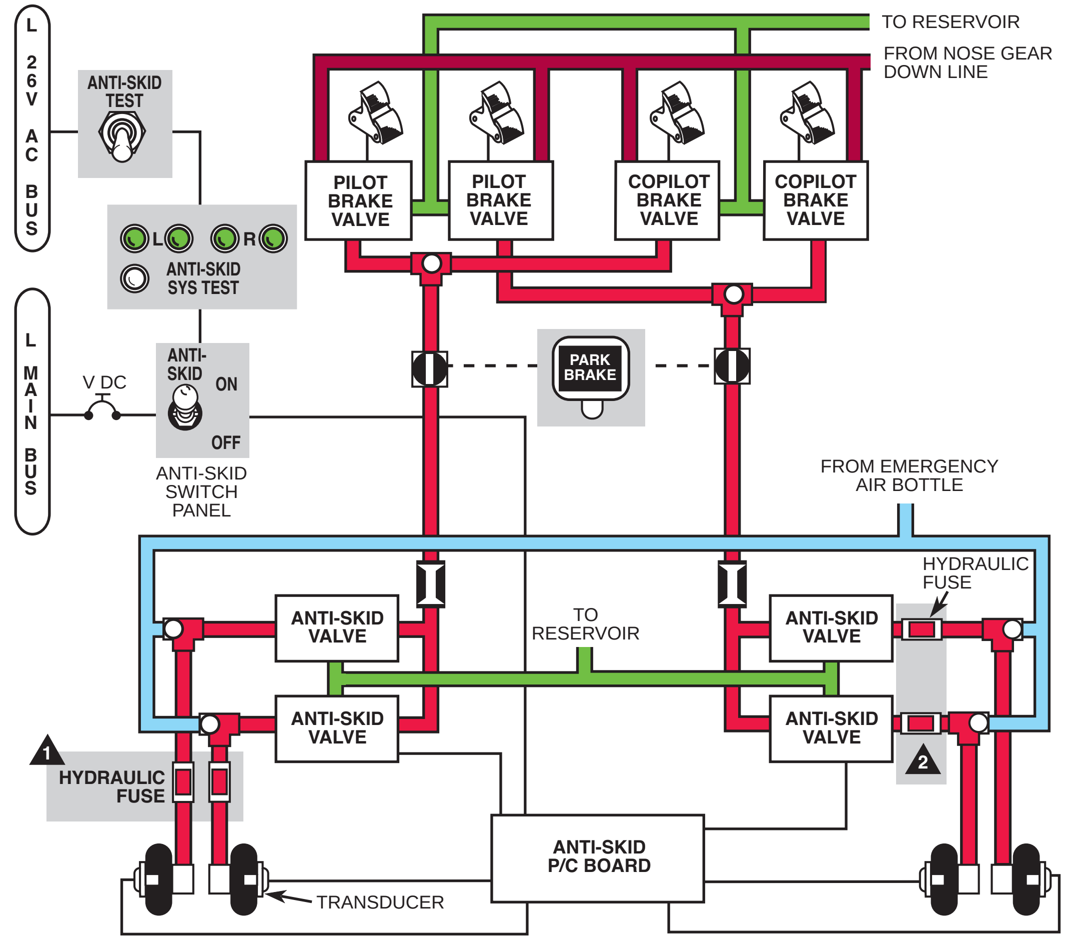


1 AIRCRAFT 25B/C 25-061, 25-070 TO 25-184 REPRESENTED BY LEFT SIDE

2 AIRCRAFT 25B/C 25-184 AND SUBS. REPRESENTED BY RIGHT SIDE

SUPPLY PRESSURE
BRAKE PRESSURE
RETURN
EMERGENCY AIR
MECHANICAL CONNECTION
ELECTRICAL CONNECTION

Brake System
Learjet 24

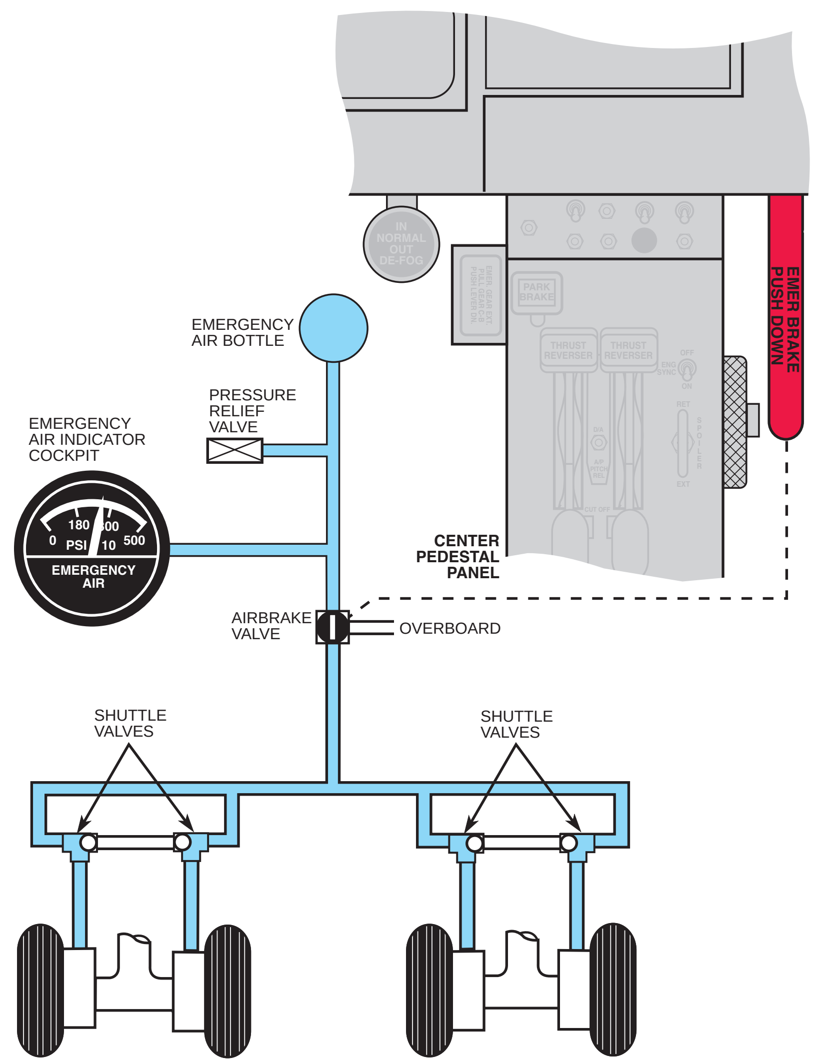


1 AIRCRAFT 24D, 24-230, TO 24-310 REPRESENTED BY LEFT SIDE

2 AIRCRAFT 24D, 24-310 AND SUBS. REPRESENTED BY RIGHT SIDE

SUPPLY PRESSURE
BRAKE PRESSURE
RETURN
EMERGENCY AIR
MECHANICAL CONNECTION
ELECTRICAL CONNECTION

Emergency Air Brake



Brake System

The brake system incorporates four power-boosted disc brakes with an integral anti-skid system. The system also incorporates a parking brake.

Rudder-pedal controlled power brake valves hydraulically actuate the disc-type brake in each main landing gear. The hydraulic brake system consists of the following components:

- four multiple disc brake assemblies
- four power brake valves
- six shuttle valves
- four hydraulic fuses
- two parking brake valves.

A main gear brake anti-skid control system prevents skidding and provides maximum braking efficiency on wet, dry, or icy runways.

An emergency pneumatic braking system provides braking if the hydraulic system fails.

Wheel Brakes

There is one brake assembly for each main gear wheel. Each multiple disc brake assembly consists of:

- two rotating discs
- one stationary disc
- one back plate
- one torque tube
- a brake housing.

Parking Brake Valves

The manually operated parking brake valves are interconnected. Actuating the parking brake valves with brake pressure applied closes the brake lines and maintains pressure on the brake assemblies. Actuate the parking brake valves by pressing the brake pedals and pulling the PARKING BRAKE lever to the locked position.

On the **Model 25**, setting the parking brake removes power from the anti-skid system. Setting the PARKING BRAKE also sends a signal to close a shutoff valve in each anti-skid control valve to prevent a loss of pressure.

Brake Operation

Pressing the brake pedals opens the power brake valves and directs hydraulic pressure through the anti-skid system, brake fuses, and shuttle valves to the brake assemblies.

An integral brake snubber in the gear retraction system stops main gear wheel rotation during retraction. A restrictor creates a back pressure of 100 to 180 PSI in the brake system to lightly apply the brakes. When the landing gear reaches the full up-and-locked position, brake pressure is removed and the brakes release.

Emergency Braking

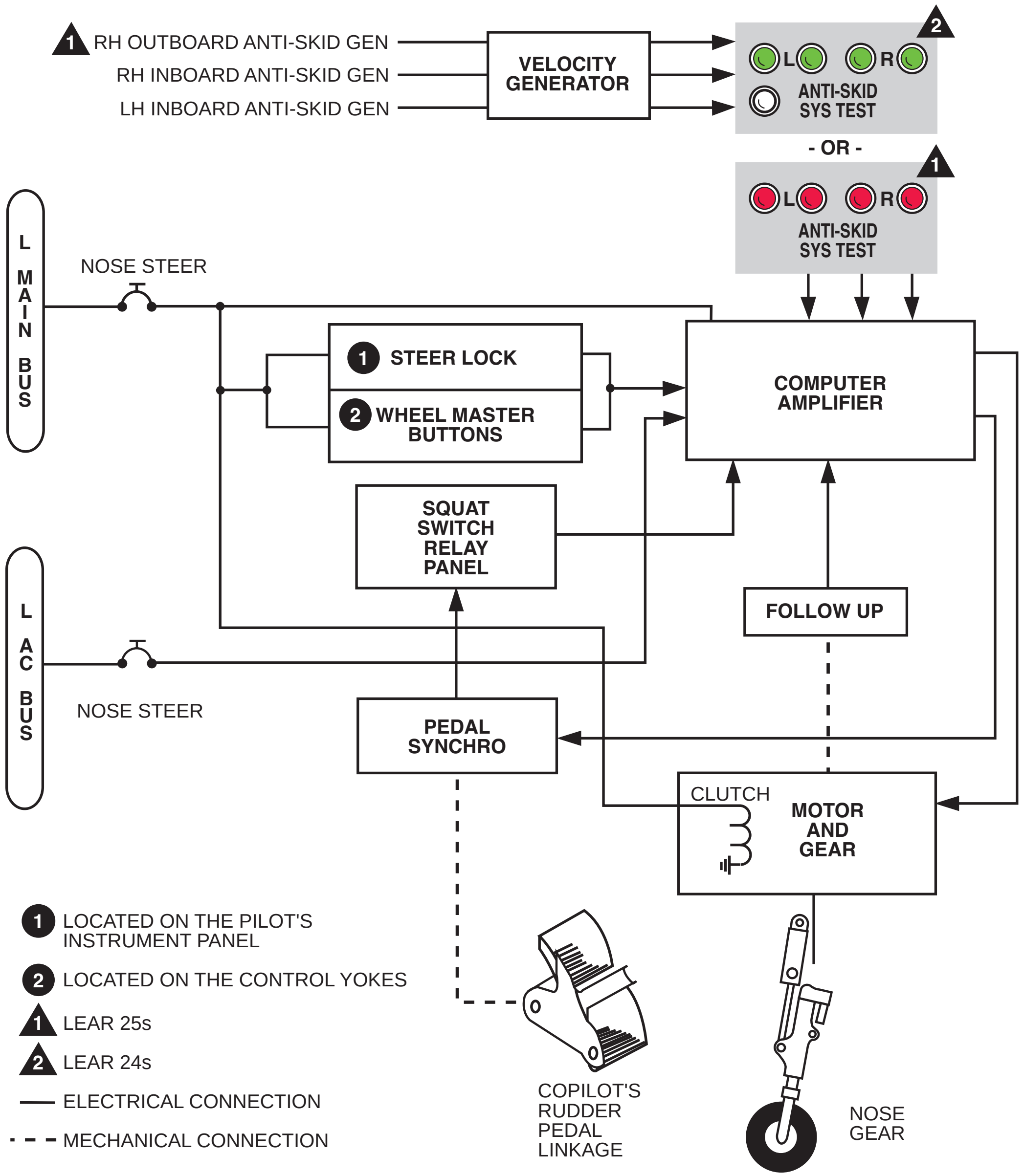
In the event of main hydraulic system failure, apply the wheel brakes pneumatically. The red EMER BRAKE lever right of the center console below copilot's instrument panel initiates and controls emergency (pneumatic) braking.

Pushing the EMER BRAKE lever down ports air pressure from the emergency air bottle to the wheel brake shuttle valves through the lever-actuated emergency brake valve. After brake lever release, excess air vents overboard and the brakes release.

The parking brake is inoperable when using the emergency air brake. Differential braking and anti-skid are not available.

Nosewheel Steering

(Learjet 24D-25B, 260, 264 and subsequent; 25B/C 104 to 205; 25D/F 205 and subsequent



1 LOCATED ON THE PILOT'S INSTRUMENT PANEL

2 LOCATED ON THE CONTROL YOKES

1 LEAR 25s

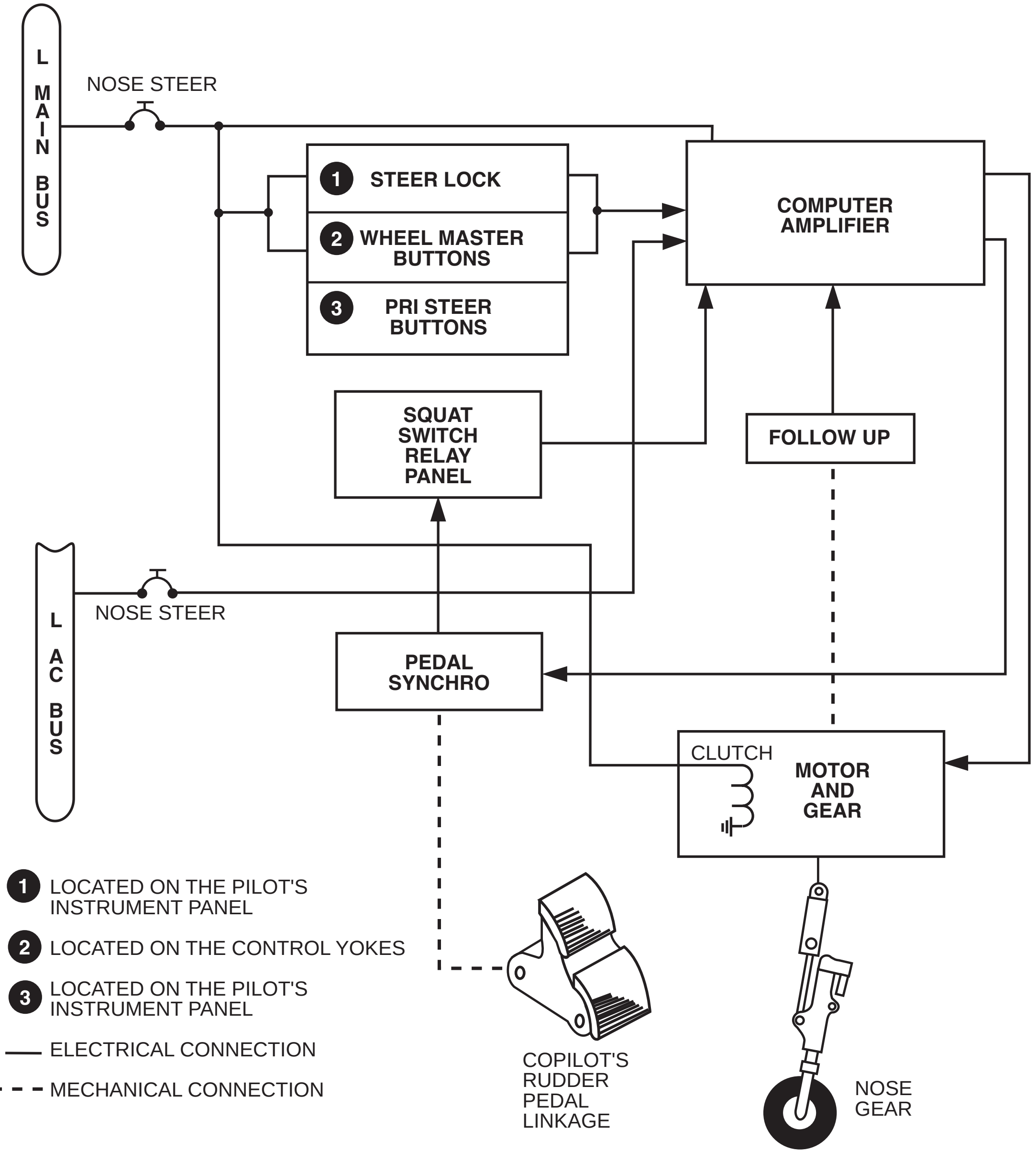
2 LEAR 24s

—— ELECTRICAL CONNECTION

- - - MECHANICAL CONNECTION

Nosewheel Steering

(Learjet 24D 230 to 257, 259, 261-263; 25B/C 062, 070 to 103



1 LOCATED ON THE PILOT'S INSTRUMENT PANEL

2 LOCATED ON THE CONTROL YOKES

3 LOCATED ON THE PILOT'S INSTRUMENT PANEL

—— ELECTRICAL CONNECTION

- - - MECHANICAL CONNECTION

Nosewheel Steering

The Learjet 24/25 has two types of nosewheel steering. Both types have 8° nosewheel steering available left and right of center (16° total travel) at approximately 45 kts ground speed; at less than 10 kts, 45° is available left and right of center (90° total travel).

The nosewheel steering system consists of the following:

- electrically powered steering actuator
- steering computer-amplifier
- steering relays
- wheel master switch on each control wheel
- STEER LOCK switch on the pilot's instrument panel
- PRI STEER button on the pilot's instrument panel (**early aircraft**)
- wheel speed transducers.

The steering actuator acts as a shimmy damper to eliminate nosewheel shimmy during takeoff, taxi, and rollout. The squat switch relay panel provides excitation voltage for the rudder pedal position sensor.

Variable Authority System

Learjet S/Ns 24D, 24-258, 260, 264 and subsequent; 24E/F, 24-320 and subsequent; 25B/C, 25-104 to 205; 25D/F, 25-205 and subsequent utilize a variable authority, electrically controlled nosewheel steering system that is controlled through the wheel master and STEER LOCK switches.

Inputs from the anti-skid generators modify the rudder pedal position sensor to vary available steering deflection with aircraft groundspeed. As groundspeed increases, the available angle decreases from approximately 45° to 8°.

Learjet 24D/E/F with variable authority steering: with both inboard anti-skid governors inoperative, taxi speed is limited to 10 kts or less. **Learjet 25B/C/D/F** with variable authority steering: with any two of the following three ANTI-SKID lights illuminated (two inboard and right outboard) the taxi speed is limited to 10 kts or less.

The STEER ON annunciator on the glareshield illuminates when nosewheel steering is active. Without AC power, the annunciator illuminates but steering is inoperative since AC power controls the systems and DC power actuates it.

STEER LOCK is released by depressing the control wheel master switch. The control wheel master switch is normally used on takeoff for nosewheel steering.

Primary Steer System

Learjet S/Ns 24D, 24-230 to 257, 259, 261 to 263; and 25B/C, 25-062, 070 to 103 utilize the PRI STEER button on the pilot's and copilot's instrument panel for up to 45° and the wheel master switch on each control wheel or the STEER LOCK switch for up to 8°.

Nosewheel Spin-Up System

An **optional** nosewheel spin-up system enables the crew to spin the nosewheel up prior to landing on unpaved runways.

The system consists of the following:

- vane rotor assembly attached to the nosewheel
- two nozzle assemblies
- diverter valve and control cable
- RPM sensor
- electrical control box
- annunciator.

The nosewheel spin-up control switch is on the copilot's control panel. In the OUT-SPIN UP position, the diverter valve routes bleed air from the windshield defog system to the spin-up system. The WSHLD HT switch must be on prior to the using the spin-up system so that bleed air is available.

At a wheel speed of 700 ±500 RPM, the NOSE WHEEL SPIN-UP annunciator blinks. At 1,820 ±20 RPM, the annunciator illuminates steadily to indicate the nosewheel is at maximum speed and safe for landing. The nosewheel spin-up system takes approximately 1.5 minutes to reach maximum speed.

Anti-Skid

Two anti-skid systems are available on the Learjet 24/25.

- a modulating system for **Learjet S/Ns 25B/C, 25-061, 070 to 196, 198 to 204; and 25D/F, 25-206 and subsequent.**
- a non-modulating system for **Learjet S/Ns 24D, 24-230 to 328; and 24E/F, 24-329 and subsequent**

Modulating System

The anti-skid system becomes operational at 7 to 10 kts groundspeed, or 150 RPM wheel spin-up. If the wheel speed deviates from the normal deceleration limits, the control box signals the affected wheel's control valve and reduces braking pressure on that wheel. Normal braking pressure is restored as wheel speed increases.

The gear down safety switch makes contact (right main gear) on gear extension and sends electrical signals to the anti-skid control box to allow anti-skid testing only when the gear is down and locked. Testing cannot be accomplished in flight with the gear retracted. The squat switches provide locked wheel protection on landing. There will be no brake action until 1 to 1.5 seconds after touchdown. This will allow time for the anti-skid generators to spin up.

ANTI-SKID GEN Lights

Learjet S/Ns 25B/C, 25-061, 070 to 196, 198 to 204 without the Reduced Airspeed kit have four red lights and a three-position test switch. **Learjet S/Ns 25B/C, 25-061, 070 to 196, 198 to 204 with the Reduced Airspeed kit; Learjet S/Ns 25B/C, 25-197 and 205; 25D/F, 25-206 and subsequent** have four lights only.

The lights provide a continuous cockpit indication of the anti-skid system control circuits. The anti-skid control box continuously monitors the system circuits and illuminates the applicable lights if any of the following conditions occur: loss of input power, open or short transducer circuits, open or short control valve circuits. The lights also illuminate any time the gear is down and locked, power is on, and the anti-skid switch is OFF.

Non-Modulating System

During normal braking operation, the control circuit discharges according to the decreasing output voltage of the transducer. If a skid condition develops, i.e., a sudden large decrease in transducer output voltage, the control circuit discharges at a higher rate than normal. This higher rate energizes a control relay that applies 28V DC to energize the anti-skid solenoid valve.

Once the solenoid valve energizes, braking pressure, which is dumped to return, allows wheel rotation to increase; this, in turn, increases wheel speed transducer output voltage and slows the discharging rate of the control circuit.

When the discharging rate again falls within the normal rate, the control relay de-energizes to open the solenoid valve; this reapplies braking pressure. The anti-skid system is inoperative during emergency braking because air pressure position operates the shuttle valve in place of hydraulic pressure.

ANTI-SKID GEN Lights

Learjet S/Ns 24D, 24-230 to 328; and 24E/F, 24-329 and subsequent have four green lights and one white test light with a two-position test switch.

The green lights illuminate with normal generator voltage output (normal wheel rotation); they extinguish when the generator output drops (wheels stop). When generator output and wheel speed increases, the lights again illuminate.

Anti-Skid Switch

The anti-skid switch on the pilot's switch panel has two positions: ON (anti-skid) and OFF. When the switch is in ON (anti-skid), the anti-skid system control circuits receive 28V DC. Normally, the switch remains in ON (anti-skid) for all operations.

Landing Gear Systems

Landing Gear System

Power Source	Hydraulic system Right Essential bus Emergency battery Emergency air bottle
Distribution	Door control valve Gear control valve (**see Note**) Door actuators Gear actuators Nose gear uplock release Inboard door uplock releases
Control	GEAR control lever Alternate gear extension lever TEST/MUTE switch
Monitor	UNSAFE (3 red) lights LOCK DWN (3 green) lights Gear warning horn Emergency air gage Hydraulic pressure indicator
Protection	Gear CB Squat switches Warning horn actuation on flap extension beyond 25° with gear retracted

NOTE: To retract gear, both squat switches must be in the air mode.

Squat Switches

Power Source	Strut compression/decompression
Distribution	Left switch Enables outboard brakes (**ground mode**)
Ground or Air Mode	Right switch Enables inboard brakes (ground mode) Disables stabilizer heat in ground mode (see Ice and Rain chapter) Both switches Disable brakes in air mode (see Landing Gear/Brakes chapter) Must open to move squat switch relay box to air mode Either or both switches Disable gear retraction circuitry (**ground mode**) Either switch Can energize squat switch relay box to ground mode to enable both thrust reversers

Squat Switch Relay Box

Power Source	Left Main bus
Distribution	Cabin pressurization (**air mode**) Nosewheel steering (**ground mode**) Thrust reversers (**ground mode**) Windshield heat low limit thermoswitches (**ground mode**) Ten-second timer for WSHLD OVHT annunciators Amber TAKEOFF TRIM light (**ground mode**) Hobbs meters in air mode (**optional**) Safety valve vacuum shutoff solenoid (**ground mode**) Stall warning, Mach, and autopilot systems test for **24E/F, 25D/F, and aircraft with Century III wings**
Protection	SQUAT SWITCH CB (7.5A)

Brake System

Power Source	Hydraulic pressure Left Main bus Emergency air bottle

Distribution	Hydraulic pressure
	    Nose gear down line
	    Power brake valves (rudder pedals)
	    Parking brake valves
	    Anti-skid control valves
	    Brake actuators
	DC power
	    Anti-skid computer
	    Anti-skid control valves
	Brake air
	    Emergency brake valve
	    Brake actuators

Control	Rudder pedals Parking brake handle ANTI-SKID switch Emergency brake lever

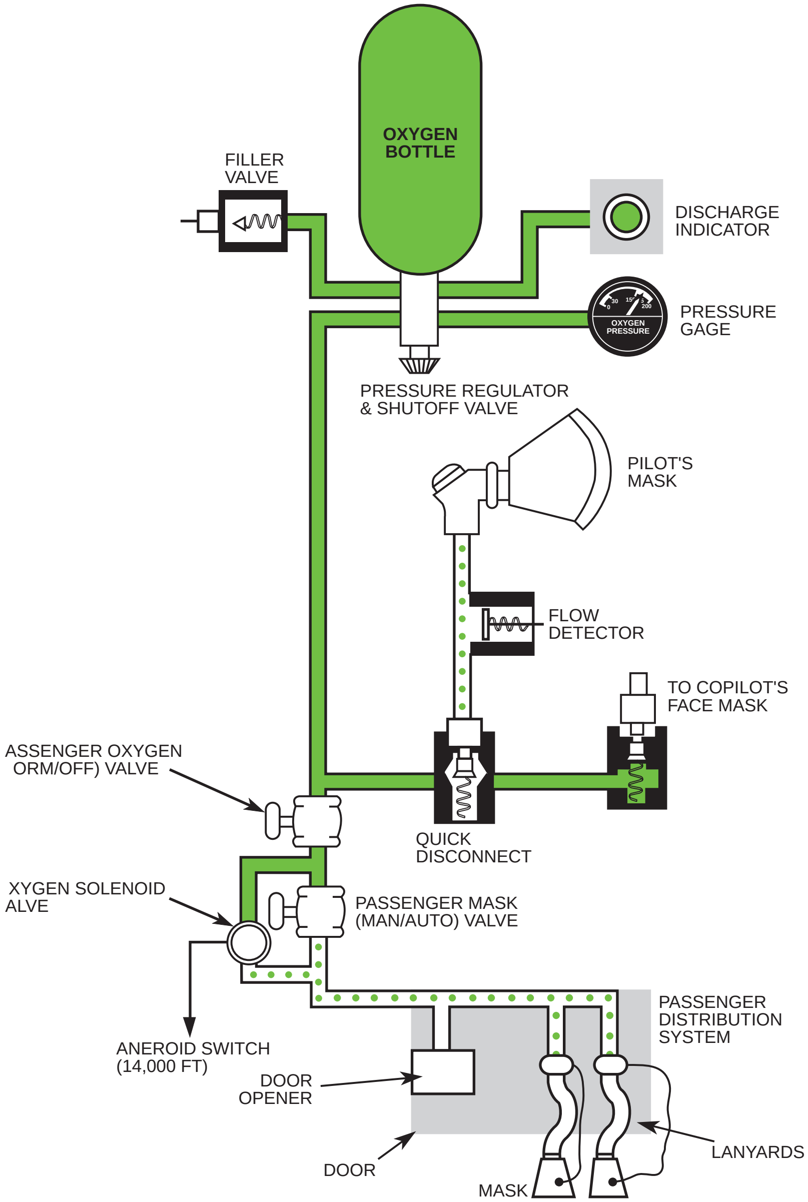
Monitor	Four anti-skid indicator lights
	    (**Learjet 24**: green, **Learjet 25**: red)
	Learjet 24: ANTI-SKID SYS TEST light
	On some early **Learjet 25**: INBD/OUTBD
	    TEST switch

Protection	Squat swithces Hydraulic fuses

NOTE: Both squat switches in air mode disable both brakes. Recover brakes in flight by turning the ANTI-SKID switch off for testing. The switch must be turned on prior to landing to regain anti-skid protection.

Oxygen System

Dorsal or Nose Installation



Oxygen Systems

This chapter discusses the crew and passenger oxygen systems.

This oxygen system provides an emergency air supply to the crew through quick-donning pressure-demand or diluter-demand masks while passenger masks deploy automatically from overhead compartments if the cabin altitude exceeds 14,000 ±750 ft. If required, the flight crew can manually deploy the passenger masks.

Oxygen System

Supplemental oxygen is used primarily as an emergency oxygen supply. Oxygen is available to the crew at all times and to the passengers either manually through cockpit control or automatically if cabin altitude exceeds 14,000 ±750 ft; the pressurization system normally maintains an 8,000 ft cabin altitude.

The oxygen system components include the following:

- a high-pressure oxygen storage cylinder
- a shutoff valve/pressure regulator assembly
- a relief valve and overboard discharge indicator
- a direct-reading cockpit pressure gage
- an oxygen aneroid switch
- a manual aneroid bypass valve on the control panel (PASS MASK-MAN/AUTO)
- an oxygen solenoid valve
- a manual passenger oxygen valve on the control panel (PASS OXY-NORM/OFF).

A 38-cubic ft oxygen cylinder is in the right nose compartment on **Learjet 24D/E/F** and in the dorsal fin at the base of the vertical stabilizer on **Learjet 25B/C/D/F**.

A fully charged bottle (1,850 PSI) provides approximately 29 minutes of 100% oxygen for the crew and six passengers at a 20,000 ft cabin altitude. To compute duration for the actual number of people aboard, consult the Oxygen Duration Tables (see Oxygen Duration) that apply to the type of crew mask in your aircraft.

The oxygen pressure gage on the upper right instrument panel indicates cylinder pressure. The gage is calibrated from 0 to 2,000 PSI. A fully serviced system should read in the green arc between 1,550 and 1,850 PSI.

Passenger Oxygen

Two control valves on the oxygen control panel on the left cockpit sidewall regulate passenger oxygen distribution and control passenger mask deployment. Oxygen is available to the crew at all times when the oxygen cylinder shutoff valve is open.

The PASS MASK two-way control valve (MAN/AUTO) allows manual or automatic deployment of the passenger masks. The PASS OXY two-way control valve (NORM/OFF) opens or closes oxygen flow to the passenger oxygen system.

With the PASS MASK valve in AUTO, the masks automatically deploy via the aneroid-controlled solenoid valve; if cabin altitude exceeds 14,000 ±750 ft, the aneroid switch opens the solenoid valve to deploy the masks. The 7.5-amp OXY VAL CB on the pilot's circuit breaker panel powers the oxygen solenoid valve.

Placing the PASS MASK valve to MAN bypasses the solenoid valve and allows oxygen pressure to deploy the passenger oxygen masks. Use this position to deploy the masks at any altitude.

With the PASS OXY valve in NORM position, oxygen is available to the passengers as soon as the masks are deployed and the lanyards pulled. Placing the PASS OXY valve to OFF cuts off oxygen flow to the passenger distribution system, regardless of the PASS MASK valve position. Use the OFF position when oxygen is required for the crew only.

On **Learjet S/Ns 24D/E/F, 24-247 and subsequent and 25B/C/D/F, 25-090 and subsequent**, the oxygen system aneroid switch also operates the depressurization lighting system. Once cabin altitude reaches 14,000 ±750 ft, the aneroid switch energizes the depressurization relay.

For normal operation, place the PASS MASK control in AUTO position and the PASS OXY control in NORM position.

Passenger Oxygen Masks

Passenger masks stow in overhead compartments above each passenger seat. The masks deploy automatically or manually, depending on the oxygen control valve position. After the masks drop, each passenger must pull the lanyard on his/her mask to release a constant flow of oxygen at the rate of 4.1 liters per minute. If the compartment doors are inadvertently deployed from the cockpit, pull one of the lanyards to bleed pressure from the system before re-stowing the masks.

Crew Oxygen

A quick-donning or horse collar type flight crew mask is behind each pilot seat, secured with straps or in brackets. A bayonet in the mask's oxygen supply line inserts into a quick-disconnect jack on each pilot's side jack panel. To verify oxygen pressure, check that a green flow detector or an extended plunger is visible in the supply line.

On **Learjet S/Ns 24D, 24-230 to 328; 24E, 24-329 to 349; 25B/C, 25-061, 070 to 205; 25D, 25-206 to 226**, a two-position lever on each mask regulator allows selection of diluted oxygen (NORM position) or 100% oxygen (100% position). In normal operation, maintain a 100% OXY setting on the regulator so the mask is ready for quick-donning in case of pressurization loss or smoke in the cabin. However, for oxygen use below 20,000 feet cabin altitude, select the NORM position to provide greater oxygen duration.

On **Learjet 24E/F, 350, 351, 355 and subsequent; 25D/F, 25-227 and subsequent**, depending on the operator's preference, crewmembers use one of the following three types of masks:

- ZMR 100 series diluter-demand
- 6600214 series with Robertshaw regulator
- 6600214 series with Puritan-Bennet regulators.

Diluter-Demand Mask

Select 100% OXY position (control lever down) on the mask regulator to provide 100% oxygen at all cabin altitudes. Maintain the 100% OXY position on stowed masks to reduce action time in donning masks during an emergency (e.g., pressurization failure/ smoke in the cabin). 100% oxygen must be selected for cabin altitudes above 20,000 ft.

Select the NORMAL position (control lever up) on the mask regulator to provide diluted oxygen. For oxygen use at cabin altitudes below 20,000 ft, select NORMAL to conserve oxygen and provide greater oxygen duration.

Robertshaw Regulator

Select NORMAL on the pressure regulator control and normal on the diluter control (100% lever locked up) for automatic oxygen dilution up to 30,000 ft cabin altitude and automatic 100% oxygen above 30,000 ft. With 100% oxygen, the mask maintains a slight positive pressure.

To receive 100% oxygen at any time, depress the 100% lever.

For emergency operation, select EMERGENCY on the pressure regulator control and depress the 100% lever on the diluter control; with this combined setting, the crew mask delivers 100% oxygen and maintains a slight positive pressure for respiratory protection from smoke and fumes.

Puritan-Bennett Regulator

Select NORM on the pressure regulator control to receive automatic oxygen dilution up to 33,000 ft cabin altitude and 100% oxygen above 33,000 ft. The mask provides automatic positive pressure breathing above 39,000 ft cabin altitude. To obtain 100% oxygen at any time, select 100% on the pressure regulator control. For emergency operation, select EMER on the pressure regulator control; this delivers 100% oxygen and maintains a slight positive pressure in the mask cup at all times for protection from smoke or fumes. In addition, EMER selection provides automatic positive pressure breathing above 39,000 ft cabin altitude.

Crew Mask Microphone

For crew communication during oxygen use, a mask microphone plugs into the OXY-MIC jack adjacent to the oxygen quick-disconnect jack. Move the OXY-MIC ON/OFF switch to ON, select interphone (INPH) on the audio control panel, and increase the master volume (MASTER VOL) level. Key the microphone through the microphone push-to-talk switch on each control wheel for crew communication.

Oxygen Duration

Oxygen duration is as shown in **Tables 4J-A and 4J-B**.

- Bold face numbers (**xxx**) indicate 100% oxygen.
- Light face numbers (xxx) indicate diluter demand (NORMAL position on regulator).
- Prior to overwater flights, plan flights so that enough oxygen is available for all occupants if pressurization fails.
- For cabin altitudes of 10,000 ft and above, oxygen duration time includes cabin altitude ascent time from 8,000 ft to final stabilized cabin altitude.

- Crew and passenger oxygen masks are not approved for use above 40,000 ft cabin altitude. Passenger duration above 30,000 ft cabin altitude are provided for information only. Prolonged operation above 25,000 ft cabin altitude with passengers on board is not recommended.
- To calculate oxygen duration for a less than fully charged system, use the following formula: Duration = Duration from chart X (system pressure/1,850).

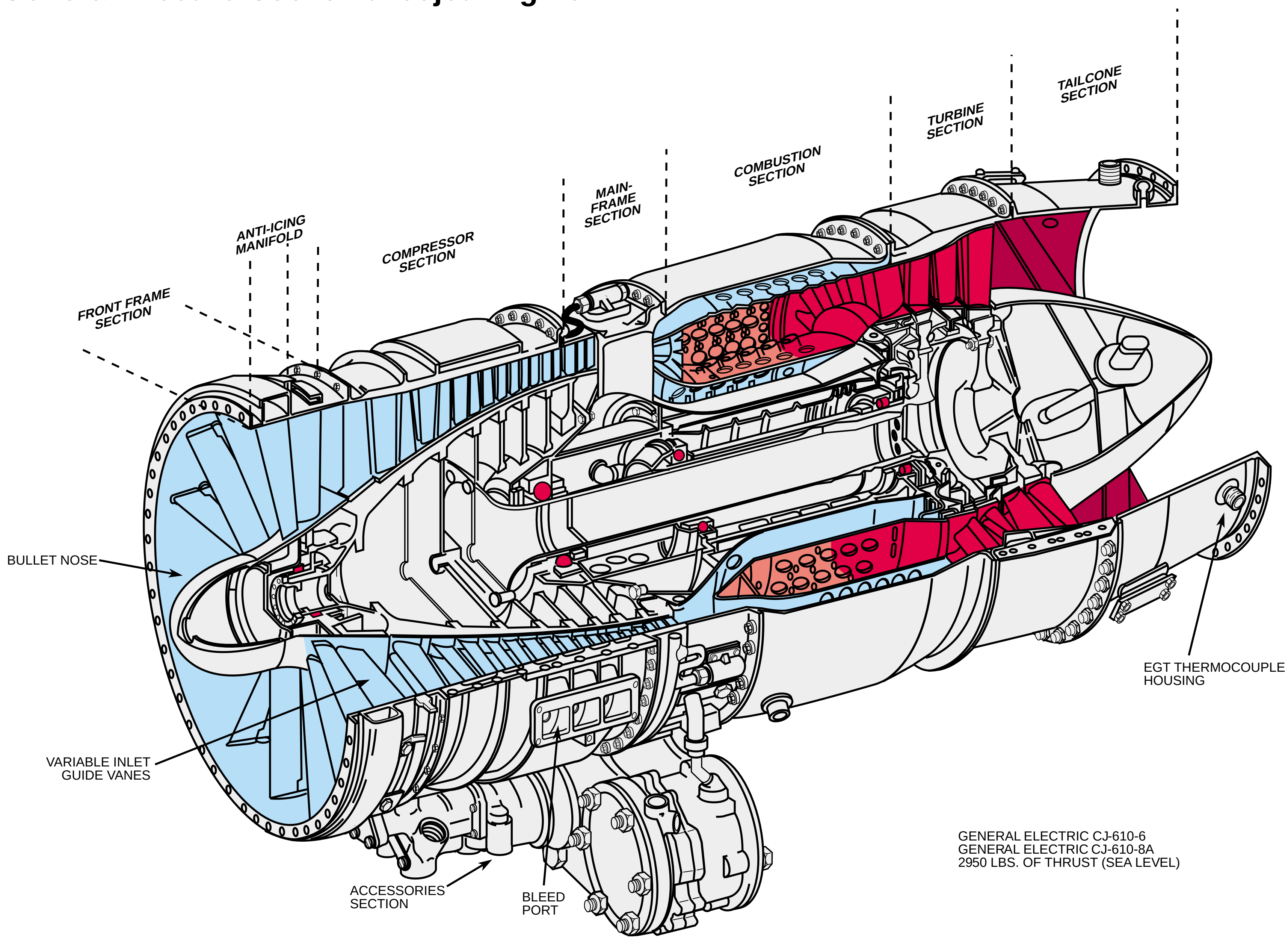
ZMR 100 Series Crew Masks (Fully Charged System)							
Cabin Alt	Oxygen Duration (minutes)						
	2 Crew	2 Crew 2 Pass.	2 Crew 4 Pass.	2 Crew 6 Pass.	2 Crew 8 Pass.	2 Crew 9 Pass.	2 Crew 11 Pass.
40,000	**251**	**80**	**48**	**35**	**28**	**25**	**22**
35,000	**182**	**71**	**45**	**33**	**23**	**24**	**20**
30,000	**135**	**63**	**42**	**32**	**26**	**23**	**20**
25,000	**105**	**56**	**39**	**30**	**25**	**23**	**20**
20,000	175 **84**	73 **51**	47 **37**	35 **29**	29 **25**	26 **23**	23 **20**
15,000	124 **67**	63 **45**	44 **34**	34 **28**	28 **24**	26 **23**	23 **20**
10,000	91 **54**	Passenger Oxygen Not Required					
8,000	82 **50**						
7,000	78 **48**						

Table 4J-A; Oxygen Duration

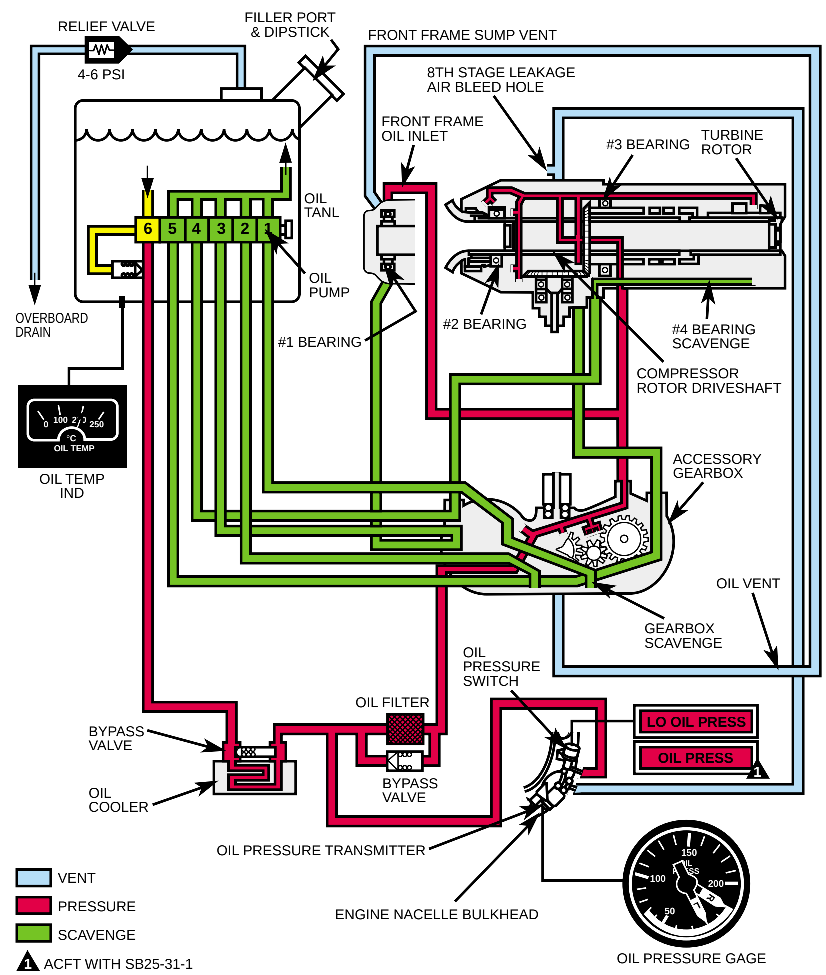
6600214 Series Crew Masks (Fully Charged System)							
Cabin Alt	Oxygen Duration (minutes)						
	2 Crew	2 Crew 2 Pass.	2 Crew 4 Pass.	2 Crew 6 Pass.	2 Crew 8 Pass.	2 Crew 9 Pass.	2 Crew 11 Pass.
40,000	267 **251**	84 **79**	51 **47**	36 **34**	29 **27**	26 **24**	22 **21**
35,000	195 **182**	76 **71**	48 **45**	35 **33**	28 **26**	26 **24**	22 **21**
30,000	219 **135**	79 **64**	49 **42**	36 **32**	29 **26**	26 **23**	22 **20**
25,000	252 **105**	83 **56**	50 **39**	37 **30**	29 **25**	26 **23**	22 **20**
20,000	175 **84**	73 **51**	47 **37**	35 **29**	29 **25**	26 **23**	23 **20**
15,000	124 **67**	63 **45**	44 **34**	34 **28**	28 **24**	26 **23**	23 **20**
10,000	163 **54**	Passenger Oxygen Not Required					
8,000	153 **50**						
7,000	148 **48**						

Table 4J-B; Oxygen Duration

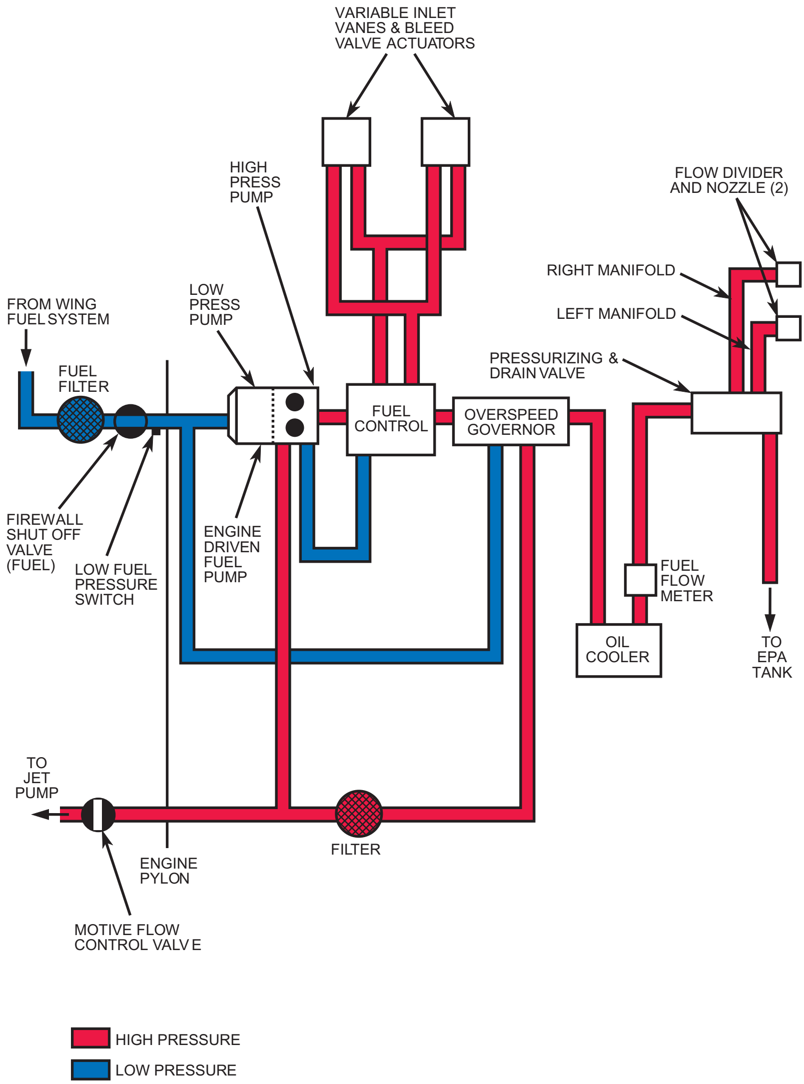
General Electric CJ610 Turbojet Engine



Lubrication System



Fuel System



VARIABLE INLET
VANES & BLEED
VALVE ACTUATORS
HIGH
PRESS
PUMP
FLOW DIVIDER
AND NOZZLE (2)
RIGHT MANIFOLD
LEFT MANIFOLD
FROM WING
FUEL SYSTEM
LOW
PRESS
PUMP
PRESSURIZING &
DRAIN VALVE
FUEL
FILTER
FUEL
CONTROL
OVERSPEED
GOVERNOR
FIREWALL
SHUT OFF
VALVE
(FUEL)
LOW FUEL
PRESSURE
SWITCH
ENGINE
DRIVEN
FUEL
PUMP
FUEL
FLOW
METER
OIL
COOLER
TO
EPA
TANK
TO
JET
PUMP
FILTER
ENGINE
PYLON
MOTIVE FLOW
CONTROL VALVE
HIGH PRESSURE
LOW PRESSURE

Powerplant

The Powerplant chapter contains information on several areas:

- the turbojet engine, including its components, instrumentation, and operation
- lubrication system
- ignition
- fuel and fuel control.

The General Electric CJ610-6 and CJ610-8A turbojet engines power various models of the Learjet 24D/E/F and Learjet 25B/C/D/F series of aircraft. Both the -6 and -8A engines provide 2,950 lbs of static takeoff thrust at sea level.

MODEL	CJ610-8A	CJ610-6	CJ610-6 Higher EGT Limits
Learjet 25D/F	25-230 to 373; prior with AAK 83-1 *	25-206 to 229	
Learjet 25B/C	AAK 83-1 *	25-197 and 205	25-061 to 204 except 197
Learjet 24E/F	24-350, 352 to 357 except 355; prior with AAK 83-1 *	24-329 to 349, 355	
Learjet 24D	AAK 83-1 *	24-324 to 328	24-230 to 323

Table 4-A; Engines

* AAK 831-1; Replacement of CJ610-6 with CJ610-8A Engines (24D, 24-230 and 548, 24E/F, 24-329 to 349, 25B/C 25-061, 070 to 205, 25D/F 25-206 to 229).

Turbojet Engines

A turbojet engine compresses air, mixes it with fuel, and burns the fuel/air mixture to produce high velocity gases. The engine uses these high velocity gases to drive a compressor and produce thrust.

The General Electric CJ610, developed from the J-85 used in the Northrop F5 and T-38, is a compact, lightweight, axial flow engine with an eight-stage compressor driven by a two-stage reaction-type turbine. Variable geometry inlet guide vanes regulate the flow of air into the engine and reduce the engine surging and compressor stalling.

Thrust begins with the induction of air through the engine inlet. Stator vanes straighten and direct air from the inlet to the eight-stage compressor. Each compressor stage consists of a rotating turbine disk followed by stator vanes. Each stage progressively compresses the air flow before it reaches the combustion section. The combustion section takes the high pressure, low velocity air flow and mixes it with atomized fuel. Within the combustion section, two igniter plugs provide the initial ignition source; once the engine is operating, the combustion process is self-sustaining.

The expanding, high velocity, hot gases flow from the combustion section through the turbine nozzle before reaching the turbine section. Within the turbine section, turbine rotors convert most of the kinetic energy produced by the combustion process into mechanical energy to drive the compressor. The rest of the high velocity gas stream exits through the exhaust nozzle as thrust.

During engine operation, each compressor stage (stator and rotor), compresses air and increases its velocity. This process transfers energy from the compressor to the air in the form of kinetic energy.

The combustion section contains components that control the mixing of air and fuel and burning of this mixture. Two igniter plugs provide an ignition source during engine starting; the combustion process is self-sustaining after engine start cycle completion.

The turbine section obtains energy from the flow of heated air from the combustion section to drive the compressor section. The turbine section consists of a stator assembly and a turbine rotor assembly.

The exhaust section confines and directs the flow of hot exhaust gases leaving the turbine section toward the exhaust nozzle. Turbine discharge pressure probes and exhaust gas temperature probes mount on bosses on the outer casing.

A turbine discharge pressure probe is at the six and twelve o'clock positions on the aft end of the outer casing. The probes provide an average exhaust pressure to the exhaust pressure ratio (EPR) indicating system. Eight EGT probes extending into the exhaust stream at varying depths provide an average exhaust gas temperature reading to the EGT gage in the cockpit.

Engine Stall Warning System

On **Learjet 24E/F; 24-350 and subsequent, except 351 and 355 with AMK 82-6, Learjet 25D/F; 25-342, 363 and subsequent; 25D/F, 25-230 to 341, 343 to 362 with AMK 81-12**, an engine stall warning system provides a visual and tactile warning of a possible engine flameout. This system is required for certification to 51,000 ft.

If airspeed falls 0.02 Mach below the desired airspeed for aircraft altitude, the system activates the stall warning system and air ignition switches. The L STALL and R STALL warning lights flash simultaneously, the stick shaker activates, and the air ignition system operates. Increasing airspeed by 0.02 Mach or descending 600 feet deactivates the system.

Lubrication

The lubrication system is a closed-circuit, pressurized system that provides oil for engine lubrication, cooling, and cleaning to the engine sumps, bearings, and seals as well as the accessory gearbox.

The system consists of an oil tank, lube and scavenge pump, oil cooler, oil filter, transfer tubes and passages, venting system, and a pressure and temperature sensing and indicating system.

Ignition

The ignition system provides high-voltage sparks to ignite the fuel/air mixture in the combustion chamber For each engine, the system consists of an ignition exciter, two igniter plugs, and ignition leads.

Ignition Exciter

The ignition exciter (igniter unit) provides a high-voltage output to two igniter plugs during engine starting and when conditions require continuous ignition operation. The exciter is a capacitance- discharge unit that provides dual 800 volt outputs; each output supplies an igniter plug in the combustion liner.

During the engine start cycle, automatic ignition occurs with the START/GEN switch in START and the throttle in the IDLE position. Power supplied through the START/ GEN switch flows to the ignition exciter through the ignition switch on the thrust lever. Each throttle lever ignition switch operates from above the cutoff throttle lever position to the 70% RPM position.

Manual ignition operates when the respective AIR IGN switch is in ON. The AIR IGN switch supplies 28V DC power to the ignition exciter; the system operates continuously. The left engine ignition exciter receives power from the Left Essential bus through the L AIR IGN circuit breaker; the right engine exciter receives power from the Right Essential bus through the R AIR IGN circuit breaker.

An amber light above each AIR IGN switch illuminates when the AIR IGN is ON. Power flows from the ignition switch (thrust lever) to the exciter, or when the annunciator panel TEST button is pressed.

Igniter Plugs

An igniter plug at the one and seven o'clock positions that extend through the engine mainframe section into the combustion liner provide the initial spark for engine starting. The igniter plugs also operate when the respective AIR IGN switch is ON.

Fuel and Control

The fuel and control system provides proper fuel flow for optimum engine performance. The system also operates the variable inlet guide vanes, lubricates and operates servos in the fuel control, and cools engine oil.

Fuel from the fuel tank pump flows through the airframe fuel filter to the engine fuel shutoff valve. From the shutoff valve, the fuel flows to the engine-driven fuel pump. The dual-element fuel pump supplies fuel under pressure to the fuel control and the overspeed governor servos. The fuel pump also supplies high pressure fuel through the motive flow control valve to the jet pumps in the fuel tanks.

The fuel control automatically meters fuel to the combustion chamber under varying operating conditions to meet power requirements. The hydro-mechanical overspeed governor prevents an engine overspeed by restricting fuel flow to the engine; normally there is an unrestricted fuel flow through the governor.

After passing through the overspeed governor, fuel travels through the flowmeter and oil cooler. From the oil cooler, fuel enters the pressurizing and drain valve. The pressurizing and drain valve maintains back pressure on the fuel control to ensure proper bleed air valve, variable inlet guide vane, and fuel control actuator operation. It also drains fuel from the manifolds and fuel nozzles during engine shutdown.

Two fuel manifolds carry fuel from the pressurizing and drain valve to the 12 fuel nozzles. The 12 nozzles, equally arranged around the engine mainframe, provide a finely atomized spray of metered fuel into the combustion chamber.

Fuel Control

The fuel control, driven by the fuel pump, is a hydro-mechanical unit that controls engine power based on throttle position and engine parameters by varying fuel flow to the fuel nozzles.

The fuel control accomplishes the following:

- establishes the maximum safe fuel flow limit during all operating conditions
- regulates engine speed by regulating fuel flow
- maintains desired power setting by altering fuel schedules as temperature and pressures change
- varies inlet guide vane position to prevent engine surging and stalling
- prevents engine flameouts due to lean fuel/air mixtures during engine deceleration
- provides a positive fuel cutoff during engine shutdown.

The fuel control has a fuel density adjustment on the front of the control unit. This allows the fuel control to vary fuel metering depending on the density of various fuels.

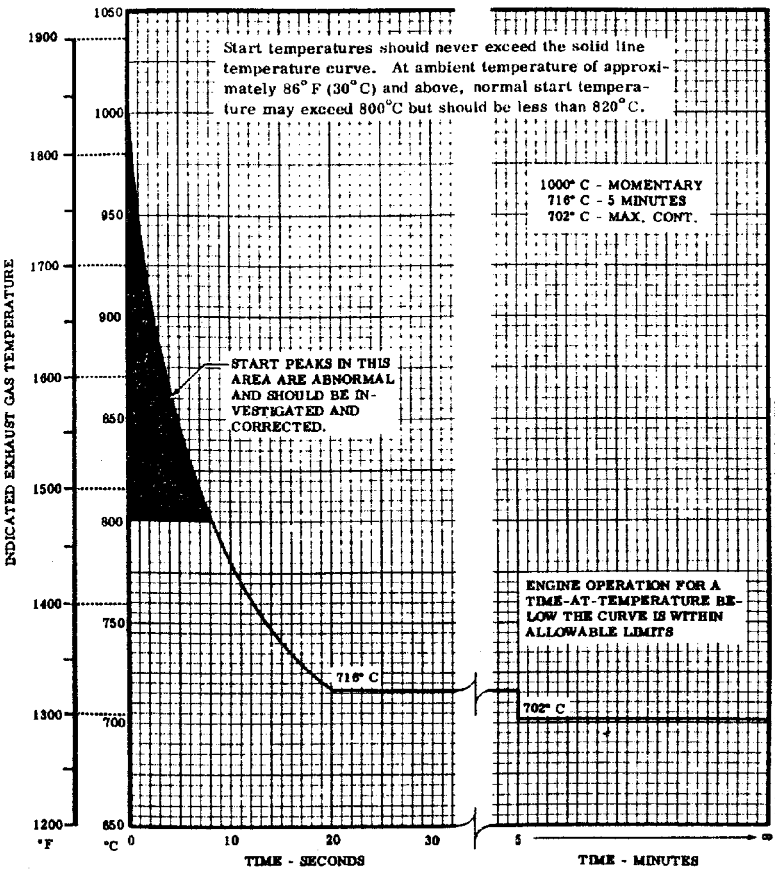
Initial movement of the throttle lever opens a stopcock on the fuel control. The stopcock is an on/off control valve that prevents or allows the flow of fuel to the engine. With the engine windmilling and the stopcock closed, a port provides fuel to the metering section. This prevents fuel overheating caused by an overloaded fuel pump.

Overspeed Governor

A hydro-mechanical overspeed governor, driven by the accessory gearbox, limits engine RPM. The self-contained unit regulates fuel flow to the engine independently from the fuel control. Normally, fuel passes through the governor without restriction. If engine speed exceeds 103.5 ±0.5% (16,995 to 17,160 RPM), the governor restricts fuel flow to the engine to maintain engine speed at 103.5 ±0.5%. The governor then routes excess fuel back to the high pressure pump inlet.

CJ610-6 Exhaust Gas Temperature Limits

Learjet25B/C, 25-061 to 204 except 197;
Learjet 24D, 24-230 to 323



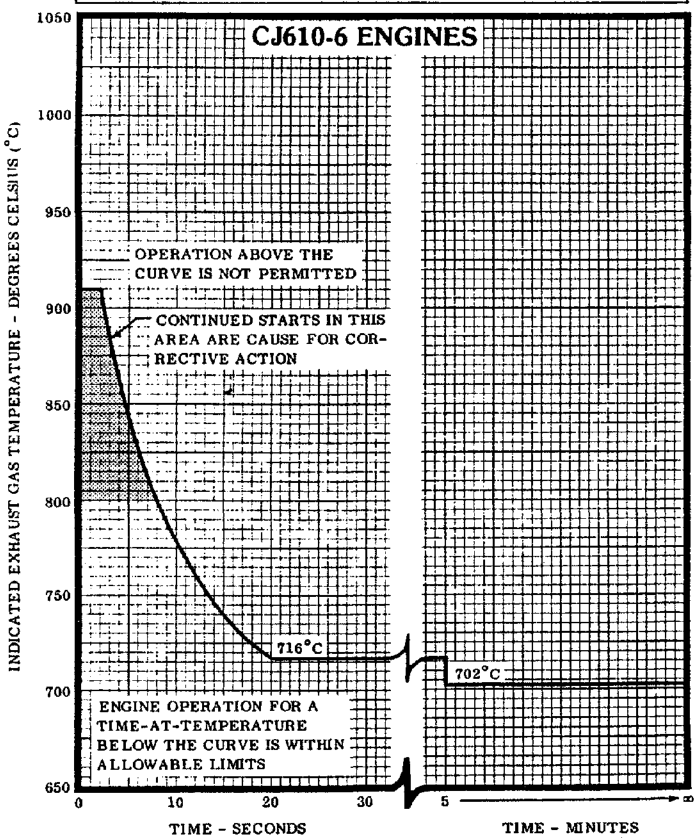
CJ610-6 Exhaust Gas Temperature Limits

Learjet25D/F, 25-206 to 229; Learjet 25B/C, 25-197 and 205; Learjet 24E/F, 23-329 to 349; 355; Learjet 24D, 24-324 to 328

INVESTIGATE ABOVE — °C	TIME	MAXIMUM LIMIT — °C
800	0-2 SECONDS	910
800	5 SECONDS	854
782	10 SECONDS	782
716	5 MINUTES (TAKEOFF)	716
702	MAX. CONTINUOUS	702

NOTE

START TEMPERATURES SHOULD NEVER EXCEED THE SOLID LINE TEMPERATURE CURVE. AT AMBIENT TEMPERATURES OF APPROXIMATELY 86°F (30°C) AND ABOVE, NORMAL START TEMPERATURES MAY EXCEED 800°C BUT SHOULD BE LESS THAN 820°C.



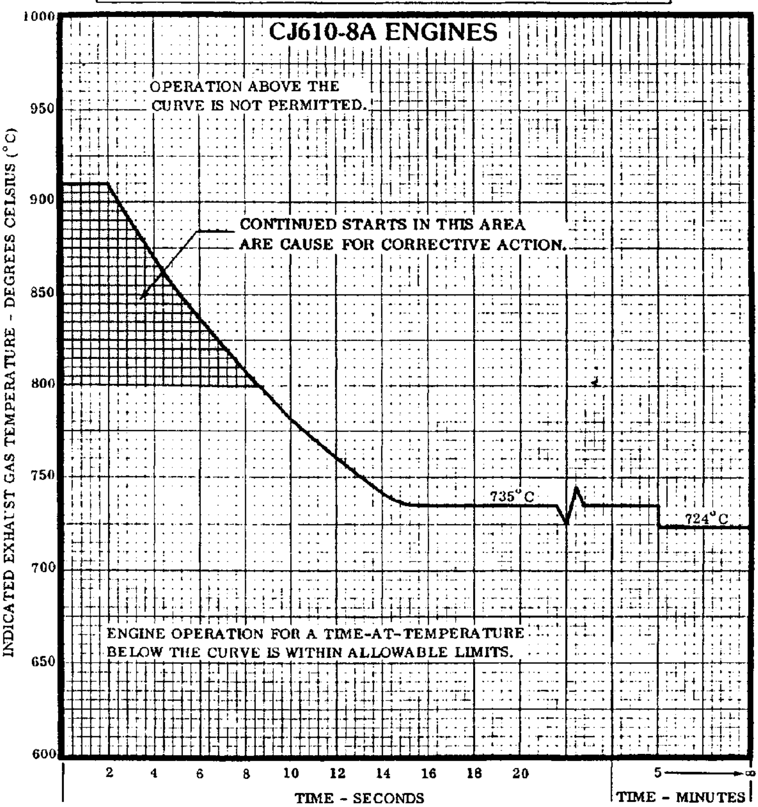
CJ610-8A Exhaust Gas Temperature Limits

Learjet25D/F, 25-230 to 373; Learjet 25B/C/D/F, 25-003 to 229 with AAK 83-1; Learjet 24E/F, 24-350, 352 to 357 except 355; Learjet 24D/E/F, 24-181 to 349 with AAK 83-1

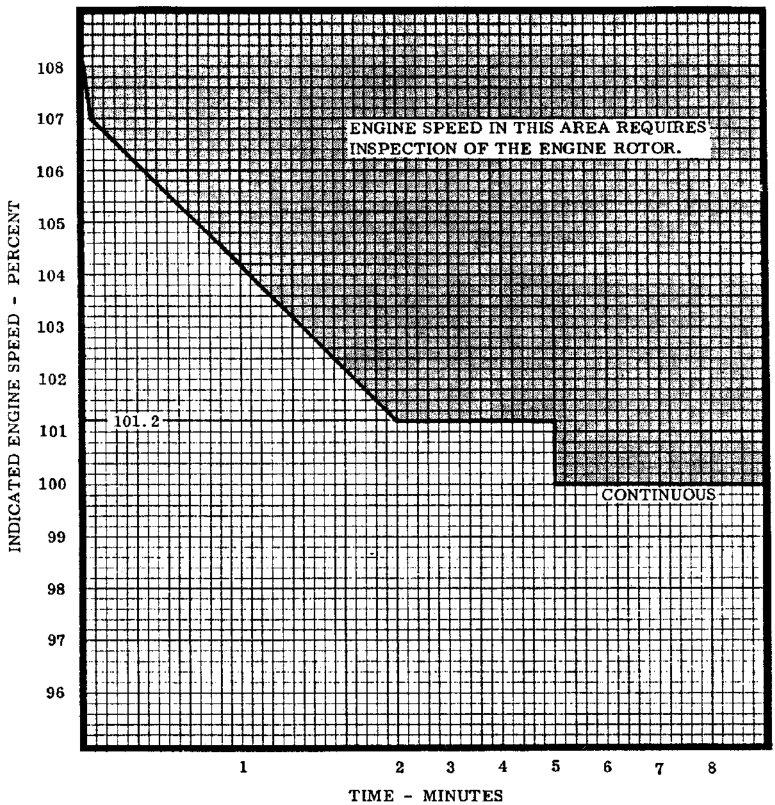
INVESTIGATE ABOVE – °C	TIME	MAXIMUM LIMIT – °C
800	0-2 SECONDS	910
800	5 SECONDS	854
782	10 SECONDS	782
735	5 MINUTES (TAKEOFF)	735
724	MAX. CONTINUOUS	724

NOTE

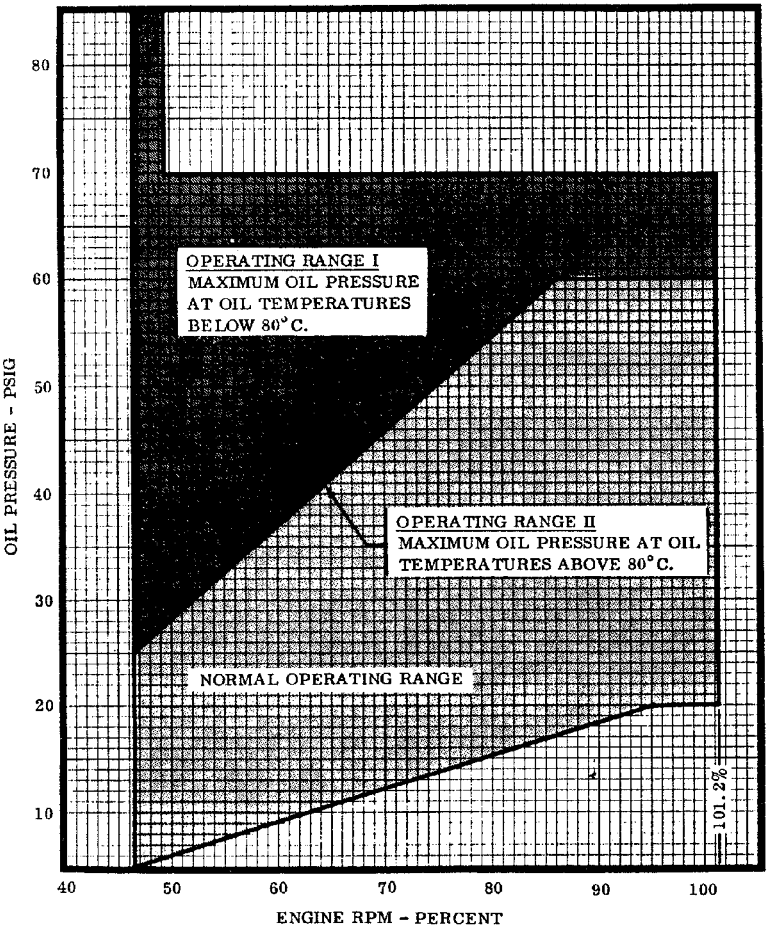
START TEMPERATURES SHOULD NEVER EXCEED THE SOLID LINE TEMPERATURE CURVE. AT AMBIENT TEMPERATURES OF APPROXIMATELY 86°F (30°C) AND ABOVE, NORMAL START TEMPERATURES MAY EXCEED 800°C BUT SHOULD BE LESS THAN 820°C.



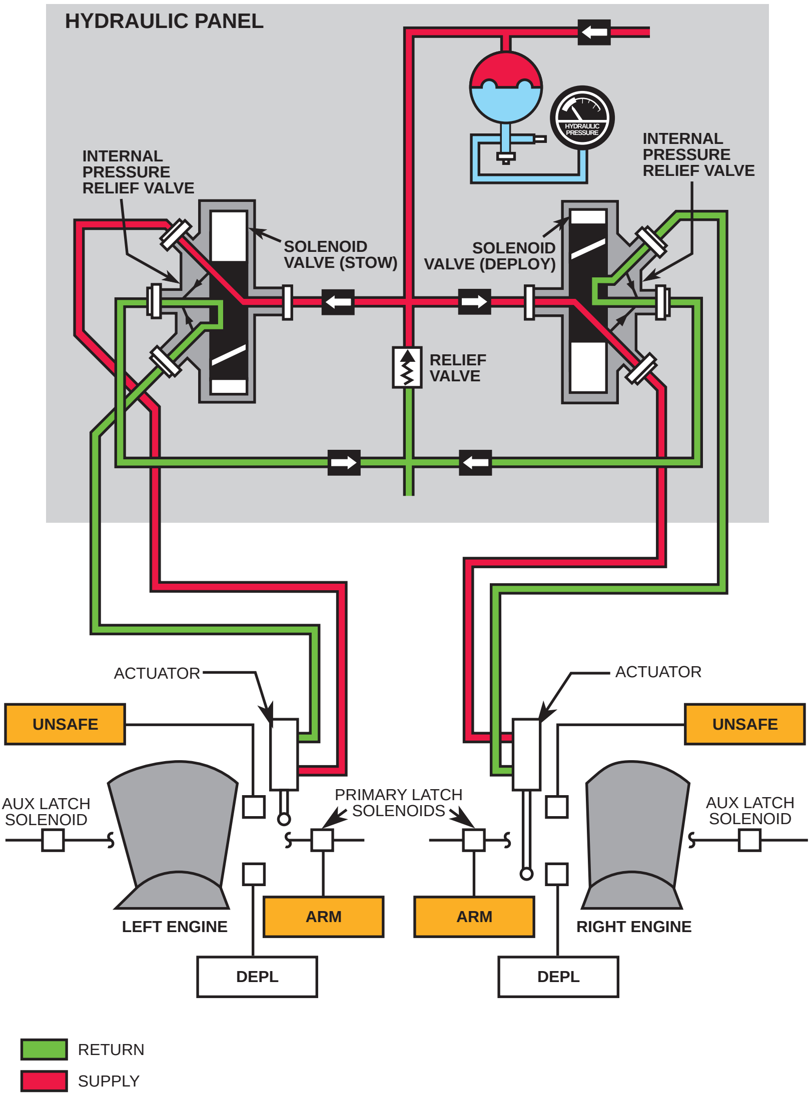
Engine Speed Limits



Oil Pressure Limits



Thrust Reverser System



Thrust Reversers

On **aircraft with the optional Dee Howard thrust reversers (T/R)**, reverse thrust is available for extra deceleration during the landing roll on short runways, for speed control on icy runways, or whenever runway situations call for additional braking assistance.

The electrically controlled target-type thrust reversers actuate hydraulically. The Left and Right Main DC buses power the left and right thrust reverser control circuits, respectively. Though powered by Main DC buses, the circuit breakers are on the third row (i.e., aft end of the top Essential bus row). If one bus fails, the opposite bus powers both thrust reverser control circuits. The aircraft hydraulic system provides pressure to each engine's hydraulic actuator, which deploys the reverser clamshell doors.

When deployed, the reverser doors redirect engine exhaust to produce reverse thrust. When stowed, the doors fold into the nacelle contours to form the aft section of the nacelle.

The thrust reverser system on each engine nacelle includes two clamshell doors, a door actuator, two mechanical latches, and a latch actuator. The door actuator connects to the inboard hinge of the clamshell doors, and a deploy switch is on the outboard hinge. Two independently actuated mechanical locks, one inboard (auxiliary) and one outboard (primary) of the forward end of the reverser assembly engage latch plates at the forward edge of the upper and lower clamshell doors to hold the doors in stowed position.

Hydraulic Actuating System

Although each thrust reverser system is independent, all components of the thrust reverser hydraulic system, with the exception of the door-actuating cylinders, are on the hydraulic panel on the right side of the tailcone just aft of the access door. The main aircraft hydraulic lines route through the T/R hydraulic panel and connect to the door-actuating cylinder on the inboard T/R mechanism on each nacelle.

Check Valves

One check valve in the pressure inlet line at the T/R hydraulic accumulator in the tailcone isolates the thrust reverser system if the main hydraulic system fails. In this case, the accumulator provides backup pressure sufficient for one full deploy and stow T/R cycle. The accumulator must be kept charged with dry air or nitrogen to between 600 ±50 PSI when hydraulic pressure is zero. The crew checks the pressure gage on the accumulator during the preflight inspection (see Hydraulic System chapter).

Four additional check valves are in the following locations:

- two at the return line cross tee: one in each selector valve return line
- one at the hydraulic pressure line on the right selector valve (the aft valve on the T/R hydraulic panel)
- one at the hydraulic pressure line on the left selector valve (the forward valve on the T/R hydraulic panel).

Pressure Relief Valve

To protect the T/R hydraulic system from overpressure, the pressure line vents through a pressure relief valve to the return line. Each selector valve has an internal pressure relief valve in both the stow and deploy lines. On **Learjet 25**, the pressure line vents through a restrictor as well as the pressure relief valve.

Control

The thrust reverser annunciator control panel is typically on the glareshield above the aircraft annunciator panel; in some aircraft, however, it may be on the instrument panel. Condition indicating lights (UNSAFE/ DEPL/ARM) and test/fault lights, as well as arming switches (L/R ARM/ OFF) and emergency stowing switches (L/R NORM/EMERG STOW), are on the control panel.

Thrust Reverser Levers

The pilot controls the thrust reverser system with thrust reverser levers that mount piggy-back on the engine throttle levers. One T/R lever mounts on each throttle for independent manipulation as needed during emergency procedures, crosswind landings, or other abnormal landing situations.

The thrust reverser system is armed when all of the following occur:

- the aircraft is firmly on the ground (i.e., squat switches activated)
- the engine throttles are at IDLE
- the L/R ARM/OFF switches on the control panel are in the ARM position.

Mechanical interlocks in the throttle quadrant prevent reverser door deployment until the system is armed. Retarding the throttles to IDLE releases the interlocks and illuminates the amber ARM lights.

Squat Switches

Squat switches on the left and right main landing gear (see Landing Gear chapter) prevent actuation of the thrust reversers in flight. Compression of the landing gear when the aircraft is on the ground mechanically actuates the switches. The left or right squat switch will energize the squat switch relay box to the ground mode arming the deploy solenoids. The stow solenoids do not require squat switch input to operate.

Deployment

To deploy the reverser doors, move the engine throttles to IDLE and raise the T/R levers to the deploy position (IDLE detents). The T/R levers cannot move further aft until the reverser doors are fully deployed. The amber UNSAFE lights illuminate to indicate the doors are in transit. Once the thrust reversers fully deploy, the UNSAFE lights extinguish and the white DEPL lights illuminate.

For speed control on icy runways, deploy the thrust reversers to the idle detents to eliminate residual thrust or cycle the T/R levers as necessary. A friction stop in the throttle quadrant prevents T/R lever creep.

Once the reverser doors fully deploy, the T/R lever safety solenoids actuate to allow further aft movement of the T/R levers. Modulate engine speed in reverse as needed with this aft movement to a maximum reverse thrust of 85% rpm.

Stowing

When engines reach the 85% cutoff speed, cycle the T/R levers forward, then on to the STOW position as required. Move the thrust reverser control lever forward to the STOW position to actuate the stow switch in the throttle quadrant; the control selector valve opens and hydraulic pressure routes to the stow ports of the reverser door actuators. When the reverser doors fully stow, the selector valve closes and the thrust reverser hydraulic system depressurizes. The DEPL/ARM lights extinguish.

Emergency Stowing

If the thrust reverser doors fail to stow normally, turn the ARM/OFF switch to OFF and move the emergency stow switch to the EMERG STOW position. This bypasses the normal hydraulic system and provides an electrical override stow command to the selector valve stow solenoid. After the reverser doors stow, the DEPL and UNLOCK lights extinguish; however the ARM light remains illuminated until the emergency stow switch is moved to the NORM position.

Thrust Reversers

Power Source	Aircraft hydraulic system Hydraulic accumulator (emergency backup/ one cycle only) Main DC L/R buses
Distribution	Stow and deploy solenoids Hydraulic lines Check/isolation valves Accumulator Left and right solenoid valves Left and right clamshell door actuators
Control	T/R levers Switches L/R ARM/OFF EMERG STOW
Monitor	UNSAFE/DEPL/ARM indicators Emergency stow lights
Protection	Circuit breakers Squat switches Thrust lever switches IDLE stop T/R lever lockout solenoid Emergency stow system Hydraulic isolation check valve Hydraulic accumulator

Flight Planning

Table of Contents

Frequent or Planned Destinations Record

Airport ______________________________ Ident. ___________

FBO __________________ Freq. ______ Tel: (___)________

Fax: (___)________

Hotel _______________________________ Tel: (___)________

Fax: (___)________

Catering _____________________________ Tel: (___)________

Airport ______________________________ Ident. ___________

FBO __________________ Freq. ______ Tel: (___)________

Fax: (___)________

Hotel _______________________________ Tel: (___)________

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Catering _____________________________ Tel: (___)________

Airport ______________________________ Ident. ___________

FBO __________________ Freq. ______ Tel: (___)________

Fax: (___)________

Hotel _______________________________ Tel: (___)________

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Catering _____________________________ Tel: (___)________

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Airport ______________________________ Ident. ___________

FBO __________________ Freq. ______ Tel: (___)________

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Hotel _______________________________ Tel: (___)________

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Notes ____

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Flight Planning – General

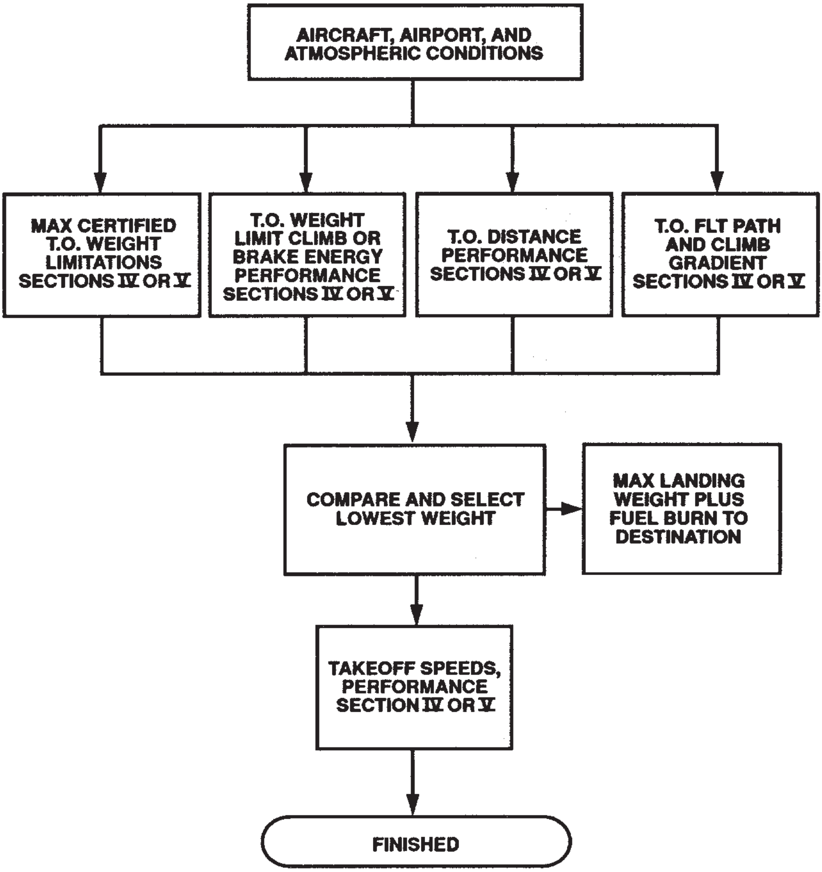
Takeoff Weight Determination

Charts in the Aircraft Flight Manual (AFM), Performance Section V (**Learjet 25**) or Section IV (**Learjet 24**), facilitate determination of the maximum takeoff gross weight permitted by FAR 25, as well as associated speeds and flight paths. On **Learjet 24D, 25B/C with Howard Raisbeck Mark II wing and 24XR**, refer to AFM supplements. Climb, cruise, descent and other data are in the Operating Handbook flight planning section or appropriate Pilot's Manual.

The flow chart (**Figure 5-1**) on the following page illustrates the steps to determine appropriate takeoff weight.

The aircraft may be limited in takeoff gross weight by the most restrictive of aircraft, airport, or atmospheric conditions (**Figure 5-2**, page 5-7).

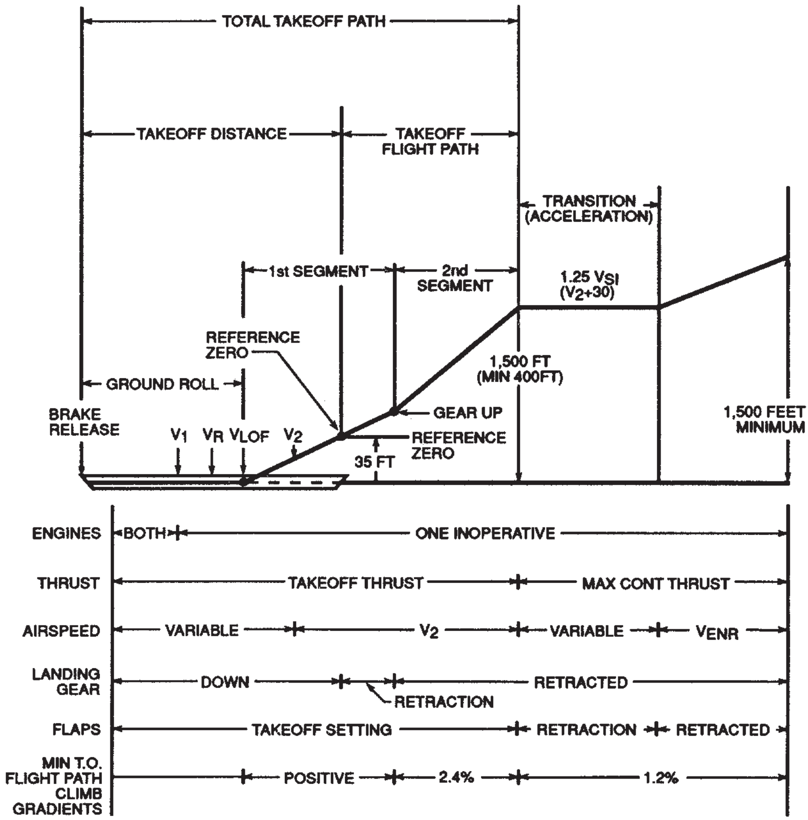
Takeoff Weight Determination Procedure



5-1

Minimum Climb/Obstacle Clearance

One Engine Inoperative



5-2

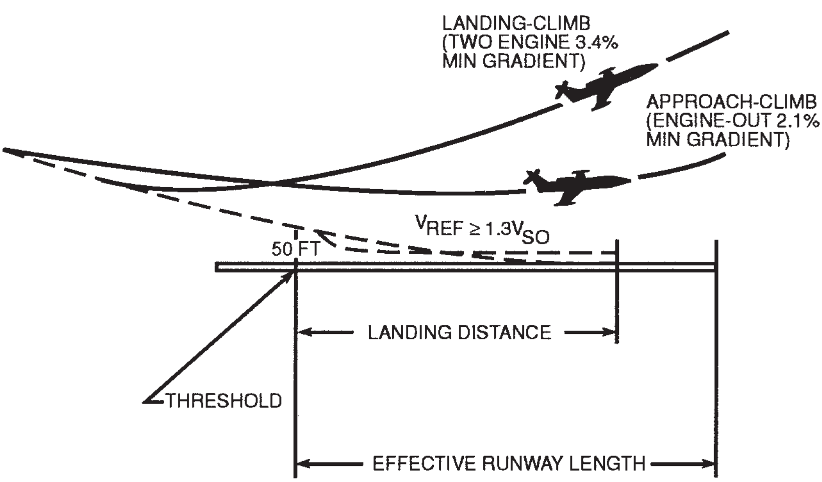
Maximum Allowable Landing Gross Weight Determination

Charts in the Aircraft Flight Manual (AFM), Performance Section V, facilitate determination of approach and landing climb performance, landing field length requirements, and approach speed values. On **Learjet 24D, 25B/C with Howard Raisbeck Mark II wing, 24XR, and 25XR**, refer to AFM supplements. Climb, cruise, descent, and other data are in the Operating Handbook flight planning section or appropriate Pilot's Manual.

The maximum allowable landing weight (**Figure 5-3**) is limited by the most restrictive of the following: aircraft structure, landing weight limit (i.e., approach climb, brake energy), or landing distance.

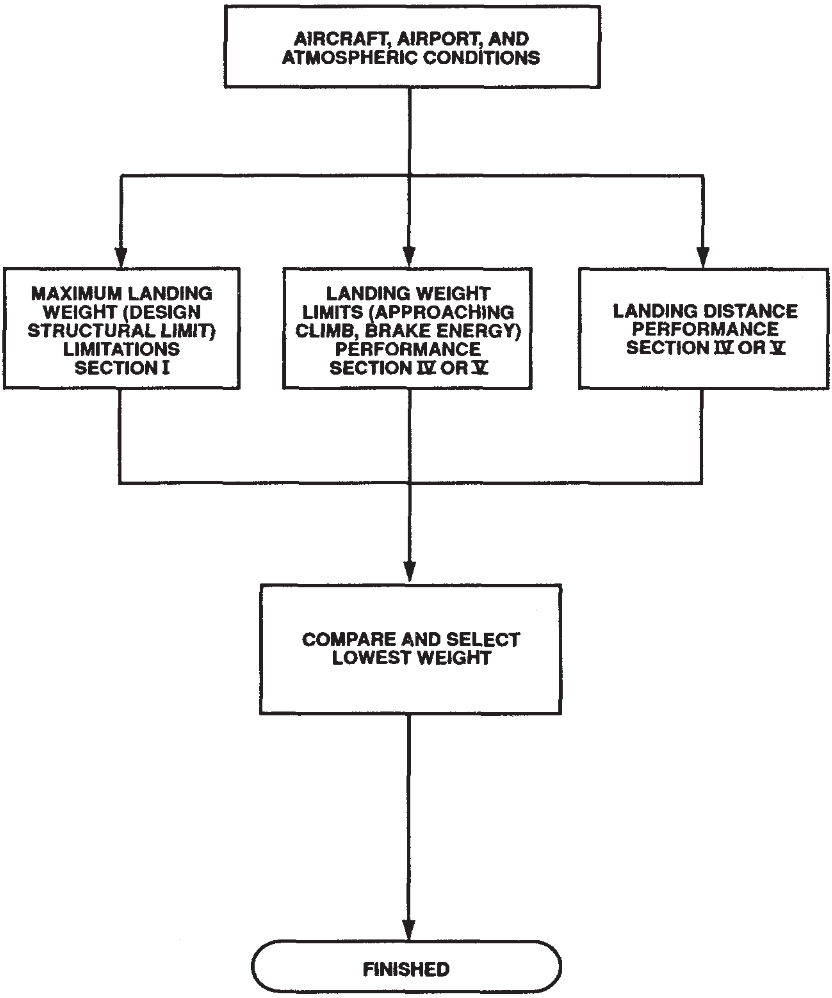
The flow chart (**Figure 5-4**) on the following page illustrates the steps to determine maximum allowable landing gross weight.

Landing Path Profile



5-3

Landing Weight Determination Procedure



5-4

Aircraft Loading Form

Learjet 24D/E/F

	STA.	QUANTITY	WEIGHT	MOMENT	C.G.
Basic Empty Weight	XXX	XXX			
Crew	103	2			
Provisions	114	XXX			
Provisions – Powder Rm.	144	XXX			
Wash Basin	135	XXX			
Chemical Toilet	127	XXX			
Operating Weight	XXX	XXX			
Pass. – Jump Seat	124	1			
Pass. – Potty	132	1			
Pass. – Swivel	167	2			
Pass. – Divan	210	3			
Baggage – Max. 500 lbs.	252	XXX			
A/C Less Fuel	XXX	XXX			
Fus. Tank (Fuel) *	XXX				
Wing Tank (Fuel)	XXX				
Tip Tank (Fuel)	XXX				
Ramp Weight	XXX	XXX			
Taxi Burnoff Out of Tip – 10 lbs. per eng. per min.	XXX				
Takeoff Weight	XXX	XXX			
A/C Less Fuel	XXX	XXX			
Wing Tank (Fuel)	XXX				
Tip Tanks (Fuel)	XXX				
Fus. Tank (Fuel) *	XXX				
Landing Weight	XXX				

* Except 24E without fuselage tank

$$CG\ \%MAC = \frac{\text{Center of Gravity} - 210.04}{84.49} \times 100$$

Aircraft Loading Form

Learjet 25B/C/D/F

	STA.	QUANTITY	WEIGHT	MOMENT	C.G.
Basic Empty Weight	XXX	XXX			
Crew	217	2			
Provisions	228	XXX			
Provisions – Powder Rm.	258	XXX			
Wash Basin	249	XXX			
Chemical Toilet	241	XXX			
Operating Weight	XXX	XXX			
Pass. – Jump Seat	238	1			
Pass. – Potty	246	1			
Pass. – Fwd. Swivel	294	2			
Pass. – Aft Swivel	327	2			
Pass. – Divan	360	3			
Baggage – Max. 500 lbs.	402	XXX			
A/C Less Fuel	XXX	XXX			
Fus. Tank (Fuel)	XXX				
Wing Tank (Fuel)	XXX				
Tip Tank (Fuel)	XXX				
Ramp Weight	XXX	XXX			
Taxi Burnoff Out of Tip – 10 lbs. per eng. per min.	XXX				
Takeoff Weight	XXX	XXX			
A/C Less Fuel	XXX	XXX			
Wing Tank (Fuel)	XXX				
Tip Tanks (Fuel)	XXX				
Fus. Tank (Fuel)	XXX				
Landing Weight	XXX				

$$CG\ \%MAC = \frac{\text{Center of Gravity} - 360.02}{84.49} \times 100$$

Weight and Balance Determination

Follow the steps below to compute a loading moment and establish that CG is within allowable limits.

1. Record the basic empty weight/moment (weight of the aircraft including full oil and all undrainable fluids); find these figures on the aircraft weighing form. If the aircraft is altered, refer to the weight and balance record for corrected information.

2. Determined operating empty weight/moment by adding basic empty weight/moment to those for the crew, provisions, miscellaneous supplies, and equipment. Assume standard fixed weights of 170 lbs for each pilot, 20 lbs for refreshments, 20 lbs for provisions, and on **Learjet 24D/E/F and 25B/C**, 20 lbs for powder room provisions as well.

> **NOTE:** Load station weight multiplied by its arm equals moment. Divide the moment by 1,000 to facilitate further computations; this is referred to as moment/index.

3. From the appropriate AFM Payload Moments Chart, find the weight/moment of each element and record on the Aircraft Loading Form. Add the weights/moments of passengers and baggage to the operating empty weight/moment. The result is zero fuel weight/moment.

4. Determine the moment for fuel required for the trip. Use the Usable Fuel Moments tables to determine weight/moment of fuel in the wing tanks. Record these figures on the loading form, then subtract wing fuel figures from the total fuel load figures to determine fuselage tank fuel weight.

5. To determine fuselage tank fuel moment, enter the Usable Fuel Moments table and find the fuselage tank fuel load closest to, but higher than, the actual fuel load. Divide the moment by the weight, then multiply the result by 1,000; this is the fuselage station for that fuel load.

6. Multiply the fuel load by the fuselage station and divide the result by 1,000 to determine the moment for that load.

7. To determine ramp weight/moment, add the zero fuel, wing fuel, and fuselage fuel weights/moments.

8. Determine the takeoff gross weight/moment by subtracting the taxi fuel weight/moment from ramp weight/moment.

NOTE: Assume a standard taxi fuel burnoff of 300 lbs (a moment of 118.79).

9. Use the AFM Weight-Moment-C.G. Envelope to determine if the calculated takeoff weight/moment are within acceptable limits.

10. Subtract the weight/moment of the total fuel burned in flight (i.e., total fuel burn less 300 lbs taxi fuel burnoff) from the takeoff weight/moment to determine landing weight. For **Learjet 24D, 25B/C with Howard Raisbeck Mark II wing and 24/25XR**, refer to AFM supplements.

International Flight Planning

Frequently Used International Terms

International Term	Explanation
ACC	Area Control Center
ADCUS	Advise Customs
AFIL	Air-Filed ICAO Flight Plan
ARINC	Aeronautical Radio Inc.
ATS	Air Traffic Services
BERNA	Swiss Radio Service
DEC	General Declaration (customs)
ETP	Equal Time Point (navigation)
FIC	Flight Information Center
FIR	Flight Information Region
GCA	Ground Controlled Approach
GEOMETER	A clear plastic attachment to a globe that aids in making surface measurements and determining points on the globe
IATA	International Air Traffic Association
ICAO	International Civil Aviation Organization
MET	See METAR
METAR	Routine Aviation Weather Reports
MNPS	Minimum Navigation Performance Specifications
NAT	North Atlantic

International Term	Explanation
NOPAC	North Pacific
OAG	Official Airline Guide
OKTA	Measure of cloud cover in eighths (five OKTAs constitute a ceiling)
OTS	Organized Track Structure
PPO	Prior Permission Only
PSR	Point of Safe Return (navigation)
QFE	Used in some nations; an altimeter setting that causes the altimeter to read zero feet when on the ground
QNE	Altimeter setting used at or above transition altitude (FL 180 in U.S.); this setting is always 29.92
QNH	Altimeter setting that causes altimeter to read field elevation on the ground
SITA	Societe Internationale de Telecommunications Aeronautiques; international organization provides global telecommunications network information to the air transport industry
SPECI	Aviation selected special WX reports
SSR	Secondary Surveillance Radar
TAF	Terminal Airdrome Forecast
UIR	Upper Information Region
UTA	Upper Control Area
WWV/WWVH	Time and frequency standard broadcast stations

International Operations Checklist

Aircrews are required to carry all appropriate FAA licenses and at least an FCC Restricted Radio Telephone Operations license. In addition, passport, visas, and an International Certificate of Vaccination are often required. The International Flight Information Manual (IFIM) specifies passport, inoculation and visa requirements for entry to each country.

The IFIM is a collection of data from Aeronautical Information Publications (AIP) published by the civil aviation authorities (CAA) of various countries.

The following detailed checklist should be helpful in establishing international operations requirements and procedures. You may want to use it to prepare your own customized checklist for your organization's planned destinations.

I. DOCUMENTATION

PERSONNEL, CREW

- ❐ Airman's certificates
- ❐ Physical
- ❐ Passport
- ❐ Extra photos
- ❐ Visa
- ❐ Tourist card
- ❐ Proof of citizenship (not driver's license)
- ❐ Immunization records
- ❐ Traveler's checks
- ❐ Credit cards
- ❐ Cash
- ❐ Passenger manifest (full name, passport no.)
- ❐ Trip itinerary
- ❐ International driver's license

AIRCRAFT

- ❒ Airworthiness certificate
- ❒ Registration
- ❒ Radio licenses
- ❒ MNPS certification
- ❒ Aircraft flight manual
- ❒ Maintenance records
- ❒ Certificates of insurance (U.S. military and foreign)
- ❒ Import papers (for aircraft of foreign manufacture)

II. OPERATIONS

PERMITS

- ❒ Flight authorization letter
- ❒ Overflights
- ❒ Landing
- ❒ Advance notice
- ❒ Export licenses (navigation equipment)
- ❒ Military
- ❒ Customs overflight
- ❒ Customs landing rights

SERVICES

Inspection

- ❒ Customs forms
- ❒ Immigrations
- ❒ Agricultural (disinfectant)

Ground

- ❒ Handling agents
- ❒ FBOs
- ❒ Fuel (credit cards, carnets)
  - ❒ Prist

    - ❒ Methanol
    - ❒ Anti-ice/De-ice
- ❒ Maintenance
    - ❒ Flyaway kit (spares)
    - ❒ Fuel contamination check

Financial

- ❒ Credit cards
- ❒ Carnets
- ❒ Letters of credit
    - ❒ Banks
    - ❒ Servicing air carriers
    - ❒ Handling
    - ❒ Fuelers
- ❒ Traveler's checks
- ❒ Cash

COMMUNICATIONS

Equipment

- ❒ VHF
- ❒ UHF
- ❒ HF SSB
- ❒ Headphones
- ❒ Portables (ELTs, etc.)
- ❒ Spares

Agreements

- ❒ ARINC
- ❒ BERNA (Switzerland)
- ❒ SITA
- ❒ Stockholm

NAVIGATION

Equipment

- ❐ VOR
- ❐ DME
- ❐ ADF
- ❐ Inertial
- ❐ VLF/OMEGA
- ❐ LORAN
- ❐ GPS

Publications

- ❐ Onboard computer (update)
- ❐ En route charts (VFR, IFR)
- ❐ Plotting charts
- ❐ Approach charts (area, terminal)
- ❐ NAT message (current)
- ❐ Flight plans
- ❐ Blank flight plans

III. OTHER PUBLICATIONS

- ❐ Operations manual
- ❐ International Flight Information Manual
- ❐ Maintenance manuals
- ❐ Manufacturer’s sources
- ❐ World Aviation Directory
- ❐ Interavia ABC
- ❐ Airports International Directory
- ❐ MNPS/NOPAC
- ❐ Customs Guide

IV. SURVIVAL EQUIPMENT

- ❒ Area survival kit (with text)
- ❒ Medical kit (with text)
- ❒ Emergency locator transmitter
- ❒ Floatation equipment
  - ❒ Raft
  - ❒ Life Jackets

V. FACILITATION AIDS

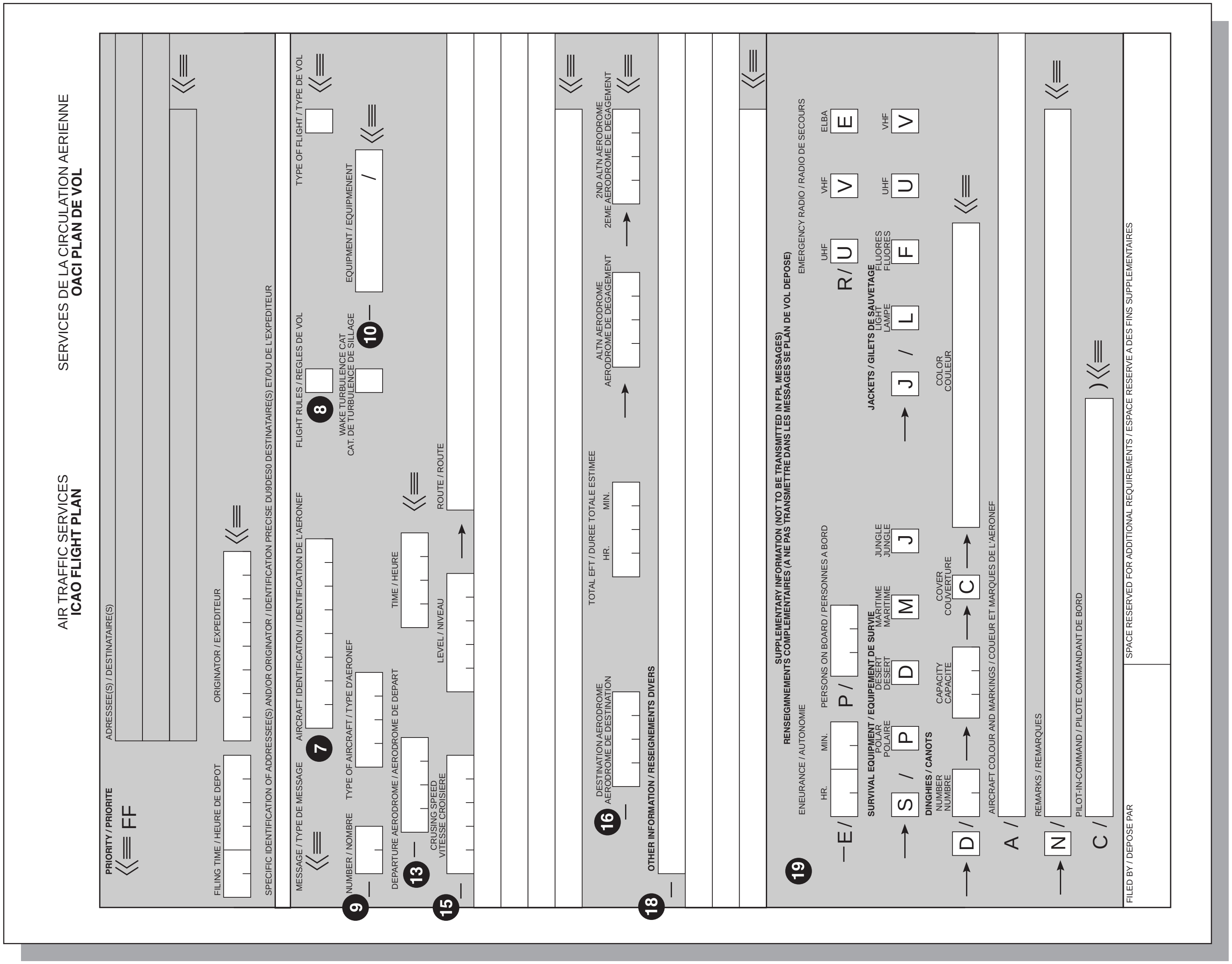
- ❒ U.S. Department of State
- ❒ U.S. Department of Commerce
- ❒ U.S. Customs Service
- ❒ National Flight Data Center (FAA) Notams
- ❒ FAA Office of International Aviation
- ❒ FAA Aviation Security

VI. OTHER CONSIDERATIONS

- ❒ Pre-flight planner
- ❒ Aircraft locks
- ❒ Spare keys
- ❒ Security devices
- ❒ Commissary supplies
- ❒ Electrical adapters (razors, etc.)
- ❒ Ground transportation
- ❒ Hotel reservations
- ❒ NBAA International Feedback cards
- ❒ Catering
- ❒ WX service
- ❒ Reservations
- ❒ Slot times

CAE SimuFlite

ICAO International Flight Plan Form



AIR TRAFFIC SERVICES
ICAO FLIGHT PLAN

SERVICES DE LA CIRCULATION AERIENNE
OACI PLAN DE VOL

PRIORITY / PRIORITE ≡ FF

ADRESSEE(S) / DESTINATAIRE(S)

FILING TIME / HEURE DE DEPOT

ORIGINATOR / EXPEDITEUR

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR / IDENTIFICATION PRECISE DU9DES0 DESTINATAIRE(S) ET/OU DE L'EXPEDITEUR

MESSAGE / TYPE DE MESSAGE

7 AIRCRAFT IDENTIFICATION / IDENTIFICATION DE L'AERONEF

8 FLIGHT RULES / REGLES DE VOL

TYPE OF FLIGHT / TYPE DE VOL

9 NUMBER / NOMBRE

TYPE OF AIRCRAFT / TYPE D'AERONEF

WAKE TURBULENCE CAT / CAT. DE TURBULENCE DE SILLAGE

10 EQUIPMENT / EQUIPEMENT /

13 DEPARTURE AERODROME / AERODROME DE DEPART

TIME / HEURE

15 CRUSING SPEED / VITESSE CROISIERE

LEVEL / NIVEAU

ROUTE / ROUTE

16 DESTINATION AERODROME / AERODROME DE DESTINATION

TOTAL EFT / DUREE TOTALE ESTIMEE HR. MIN.

ALTN AERODROME / AERODROME DE DEGAGEMENT

2ND ALTN AERODROME / 2EME AERODROME DE DEGAGEMENT

18 **OTHER INFORMATION / RESEIGNEMENTS DIVERS**

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
RENSEIGNMENEMENTS COMPLEMENTAIRES (A NE PAS TRANSMETTRE DANS LES MESSAGES SE PLAN DE VOL DEPOSE)

19 ENEURANCE / AUTONOMIE HR. MIN. — E /

PERSONS ON BOARD / PERSONNES A BORD P /

EMERGENCY RADIO / RADIO DE SECOURS UHF R/ U VHF V ELBA E

SURVIVAL EQUIPMENT / EQUIPEMENT DE SURVIE POLAR POLAIRE DESERT DESERT MARITIME MARITIME JUNGLE JUNGLE

S / P D M J

JACKETS / GILETS DE SAUVETAGE LIGHT LAMPE FLUORES FLUORES UHF VHF

J / L F U V

DINGHIES / CANOTS NUMBER NOMBRE CAPACITY CAPACITE COVER COUVERTURE COLOR COULEUR

D / C

AIRCRAFT COLOUR AND MARKINGS / COUEUR ET MARQUES DE L'AERONEF

A /

REMARKS / REMARQUES

N /

PILOT-IN-COMMAND / PILOTE COMMANDANT DE BORD

C /)

FILED BY / DEPOSE PAR

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS / ESPACE RESERVE A DES FINS SUPPLEMENTAIRES

ICAO Flight Plan Form Completion – Items 7-19

Complete all ICAO flight plans prior to departure. Although the ICAO flight plan form is printed in numerous languages, the format is always the same.

Always enter cruising speed and cruising level as a group. In the body of the flight plan form, if one item changes, the other item must be re-entered to keep speed and level a matched pair.

Always enter latitude and longitude as 7 or 11 characters. If entering minutes of one, enter minutes of the other as well, even if zeros.

Significant points should not be more than one hour apart.

Consider entering overflight/landing permissions after RMK/ in Item 18.

Item 7: Aircraft Identification (7 characters maximum)

Insert (A) the aircraft registration marking or (B) aircraft operating agency ICAO designator followed by the flight identification.

A. Insert only the aircraft registration marking (e.g., EIAKO, 4XBCD, N2567GA) if one of the following is true:

- the aircraft's radiotelephony call sign consists of the aircraft registration marking alone (e.g., OOTEK)
- the registration marking is preceded by the ICAO telephone designator for the aircraft operating agency (e.g., SABENA OOTEK
- the aircraft is not equipped with radio.

B. Insert the ICAO designator for the aircraft operating agency followed by the flight identification (e.g., KL511, WT214, K7123, JH25) if the aircraft's radiotelephony call sign consists of the ICAO telephony designator for the operating agency followed by the flight identification (e.g. KLM 511, NIGERIA 213, KILO UNIFORM 123, JULIETT HOTEL 25).

Item 8: Flight Rules and Type of Flight (1 or 2 characters)

Flight Rules: Insert one of the following letters to denote the intended flight rules category:

I if IFR

V if VFR

Y if IFR first*

Z if VFR first*

*Note: Specify in Item 15 (Route) the point(s) where a flight rules change is planned.

Type of Flight: Insert one of the following letters to denote the type of flight when so required by the appropriate ATS authority:

S if scheduled air service

N if non-scheduled air transport operation

G if general aviation

M if military

X if other than the above

Item 9: Number (1 or 2 characters) and Type of Aircraft (2 to 4 characters) and Wake Turbulence Category (1 character)

Number of Aircraft: Insert number of aircraft if more than one.

Type of Aircraft: Insert the appropriate designator as specified in ICAO Doc 8643, Aircraft Type Designators. If no such designator has been assigned, or in case of formation flight comprising more than one aircraft type, insert ZZZZ, then specify in Item 18 the number(s) and type(s) of aircraft, preceded by TYP/.

Wake Turbulence Category: Insert / + H, M, or L:

- **/H** Heavy – maximum certificated T/O mass of 136,000 kg (300,000 lbs) or more
- **/M** Medium – maximum certificated T/O mass of less than 136,000 kg but more than 7,000 kg (between 15,500 and 300,000 lbs)
- **/L** Light – maximum certificated T/O mass of 7,000 kg or less (15,500 lbs)

Item 10: Equipment

Radio Communication, Navigation, and Approach Aid Equipment: Insert one of the following letters:

- **N** if COM/NAV/approach aid equipment is not carried or is inoperative.
- **S** if standard COM/NAV/approach aid equipment (VHF RTF, ADF, VOR, ILS, or equipment prescribed by ATS authority) is on board and operative;

and/or insert one of the following letters to indicate corresponding COMM/NAV/approach aid equipment is available and operative:

A	not allocated	**O**	VOR
B	not allocated	**P**	not allocated
C	LORAN C	**Q**	not allocated
D	DME	**R**	RNP type certification
E	not allocated		
F	ADF	**T**	TACAN
G	(GNSS)	**U**	UHF RTF
H	HF RTF	**V**	VHF RTF
I	Inertial Navig.	**W**	when prescribed by ATS
J	(Data Link)	**X**	when prescribed by ATS
K	(MLS)	**Y**	when prescribed by ATS
L	ILS	**Z**	Other (specify in Item 18)
M	Omega		

SSR Equipment: Insert one of the following letters to describe the operative SSR equipment on board:

- **N** None
- **A** Transponder Mode A (4 digits- 4 096 codes)
- **C** Transponder Mode A and Mode C
- **X** Transponder Mode S without aircraft ID or pressure-altitude transmission
- **P** Transponder Mode S with pressure altitude transmission, but without aircraft ID transmission
- **I** Transponder Mode S with aircraft ID transmission, but without pressure-altitude transmission
- **S** Transponder Mode S with both pressure altitude and aircraft ID transmission

Item 13: Departure Aerodrome (4 characters) and Time (4 characters)

Departure Aerodrome: Insert one of the following:

- ICAO four-letter location indicator of the departure aerodrome.
- If no location indicator assigned, insert ZZZZ, then specify in Item 18 the name of the aerodrome, preceded by DEP/.
- If flight plan submitted while in flight, insert AFIL, then specify in Item 18 the four-letter location indicator of the ATS unit from which supplementary flight plan data can be obtained, preceded by DEP/.

Time: Insert one of the following:

- for a flight plan submitted before departure: the estimated off-block time
- for a flight plan submitted while in flight: the actual or estimated time over the first point of the route to which the flight plan applies.

Item 15: Cruising Speed (5 characters), Cruising Level (5 characters), and Route

Cruising Speed: Insert the true air speed for the first or whole cruising portion of the flight in one of the following forms:

- Kilometers per hour: K + 4 figures (e.g., K0830)
- Knots: N + 4 figures (e.g., N0485)
- Mach number: M + 3 figures (e.g., M082) if prescribed by ATS.

Cruising Level: Insert the planned cruising level for the first or whole portion of the planned route using one of the following forms:

- Flight level: F + 3 figures (e.g., F085; F330)
- Standard metric level in tens of metres: S + 4 figures (e.g., S1130) if prescribed by ATS.
- Altitude in hundreds of feet: A + 3 figures (e.g., A045; A100)
- Altitude in tens of metres: M + 4 figures (e.g., M0840)
- For uncontrolled VFR flights: VFR

Route: Include changes of speed, level, and/or flight rules.

For flights along designated ATS routes:

- If the departure aerodrome is on or connected to the ATS route, insert the designator of the first ATS route.
- If the departure aerodrome is not on or connected to the ATS route, insert the letters DCT followed by the point of joining the first ATS route, followed by the designator of the ATS route.
- Insert each point at which a change of speed, change of level, change of ATS route, and/or a change of flight rules is planned. For a transition between lower and upper ATS routes oriented in the same direction, do not insert the point of transition.
- In each case, follow with the designator of the next ATS route segment even if it is the same as the previous one (or with DCT if the flight to the next point is outside a designated route), unless both points are defined by geographical coordinates.

Flights outside designated ATS routes:

- Insert points not normally more than 30 minutes flying time or 200 nautical miles apart, including each point at which a change of speed or level, a change of track, or a change of flight rules is planned.
- When required by ATS, define the track of flights operating predominantly in an east-west direction between 70°N and 70°S by reference to significant points formed by the intersections of half or whole degrees of latitude with meridians spaced at intervals of 10 degrees of longitude. For flights operating in areas outside those latitudes, define the tracks by significant points formed by the intersection of parallels of latitude with meridians normally spaced not to exceed one hour's flight time. Establish additional significant points as deemed necessary.

  For flights operating predominantly in a north-south direction, define tracks by reference to significant points formed by the intersection of whole degrees of longitude with specified parallels of latitude that are spaced at 5 degrees.
- Insert DCT between successive points unless both points are defined by geographical coordinates or bearing and distance.

Examples of Route Sub-entries

Enter a space between each sub-entry.

1. ATS route (2 to 7 characters): BCN1, B1, R14, KODAP2A
2. Significant point (2 to 11 characters): LN, MAY, HADDY
   - degrees only (7 characters – insert zeros, if necessary): 46N078W
   - degrees and minutes (11 characters – insert zeros if necessary): 4620N07805W
   - bearing and distance from navigation aid (NAV aid ID [2 to 3 characters] + bearing and distance from the NAV aid [6 characters – insert zeros if necessary]): a point 180 magnetic at a distance of 40 nautical miles from VOR "DUB" = DUB180040

3. Change of speed or level (max 21 characters):

   insert point of change/cruising speed and level – LN/N0284A045, MAY/N0305F180, HADDY/N0420F330, DUB180040/M084F350

4. Change of flight rules (max 3 characters):

   insert point of change (space) change to IFR or VFR – LN VFR, LN/N0284A050 IFR

5. Cruise climb (max 28 characters)

   insert C/point to start climb/climb speed / levels –

   C/48N050W / M082F290F350

   C/48N050W / M082F290PLUS

   C/52N050W / M220F580F620

Item 16: Destination Aerodrome (4 characters), Total Estimated Elapsed Time (EET, 4 characters), Alternate Aerodrome(s) (4 characters)

Destination aerodrome: insert ICAO four-letter location indicator. If no indicator assigned, insert ZZZZ.

Total EET: insert accumulated estimated elapsed time. If no location indicator assigned, specify in Item 18 the name of the aerodrome, preceded by DEST/.

Alternate aerodrome(s): insert ICAO four-letter location indicator. If no indicator assigned to alternate, insert ZZZZ and specify in Item 18 the name of the alternate aerodrome, preceded by ALTN/.

Item 18: Other Information

This section may be used to record specific information as required by appropriate ATS authority or per regional air navigation agreements. Insert the appropriate indicator followed by an oblique stroke (/) and the necessary information. See examples below.

- Estimated elapsed time/significant points or FIR boundary designators: EET/CAP0745, XYZ0830.
- Revised destination aerodrome route details/ICAO aerodrome location indicator: RIF/DTA HEC KLAX. (Revised route subject to reclearance in flight.)
- Aircraft registration markings, if different from aircraft I.D. in Item 7: REG/N1234.
- SELCAL code: SEL/_____.
- Operator's name, if not obvious from the aircraft I.D. in Item 7: OPR/_____.
- Reason for special handling by ATS (e.g., hospital aircraft, one-engine inoperative): STS/HOSP, STS/ONE ENG INOP.
- As explained in Item 9: TYP/_____.
- Aircraft performance data: PER/_____.
- Communication equipment significant data: COM/UHF Only.
- Navigation equipment significant data: NAV/INS.
- As explained in Item 13: DEP/_____.
- As explained in Item 16: DEST/_____, or ALTN/_____.
- Other remarks as required by ATS or deemed necessary: RMK/____________.

Item 19: Supplementary Information

Endurance: insert fuel endurance in hours and minutes.

Persons on Board: insert total persons on board, including passengers and crew. If unknown at time of filing, insert TBN (to be notified).

Emergency Radio, Survival Equipment, Jackets, Dinghies: cross out letter indicators of all items not available; complete blanks as required for items available. (jackets: L = life jackets with lights, J = life jackets with fluorescein).

ICAO Position Reporting Format

Outside the U.S., position reports are required unless specifically waived by the controlling agency.

Initial Contact (Frequency Change)

1. Call sign
2. Flight level (if not level, report climbing to or descending to cleared altitude)
3. Estimating (next position) at (time) GMT

Position Report

1. Call sign
2. Position (if position in doubt, use phonetic identifier. For oceanic reports, first report the latitude, then the longitude (e.g., 50N 60W)
3. Time (GMT) or (UST)
4. Altitude or flight level (if not level, report climbing to or descending to altitude)
5. Next position
6. Estimated elapsed time (EET)

FAA Flight Plan Form

US DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION **FLIGHT PLAN**	(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER	TIME STARTED	SPECIALIST INITIALS

1. TYPE VFR IFR DVFR	2. AIRCRAFT IDENTIFICATION	3. AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4. TRUE AIRSPEED	5. DEPARTURE POINT	6. DEPARTURE TIME PROPOSED (Z) ACTUAL (Z)	7. CRUISING ALTITUDE

8. ROUTE OF FLIGHT

9. DESTINATION (Name of airport and city)	10. EST TIME ENROUTE HOURS MINUTES	11. REMARKS

12. FUEL ON BOARD HOURS MINUTES	13. ALTERNATE AIRPORT(S)	14. PILOTS NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE 17. DESTINATION CONTACT / TELEPHONE (OPTIONAL)	15. NUMBER ABOARD

18. COLOR OF AIRCRAFT	CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you to file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1956, as amended). Filing of a VFR flight plan is recomended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FAA Flight Plan Form Completion Instructions

Block 1 Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

Block 2 Enter your complete aircraft identification, including the prefix “N,” if applicable.

Block 3 Enter the designator for the aircraft, or if unknown, the aircraft manufacturer’s name.

When filing an IFR flight plan for a TCAS equipped aircraft, add the prefix T for TCAS.
Example: T/G4/R.

When filing an IFR flight plan for flight in an aircraft equipped with a radar beacon transponder, DME equipment, TACAN-only equipment or a combination of both, identify equipment capability by adding a suffix to the AIRCRAFT TYPE, preceded by a slant (/) as follows:

/X no transponder

/T transponder with no altitude encoding capability

/U transponder with altitude encoding capability

/D DME, but no transponder

/B DME and transponder, but no altitude encoding capability

/A DME and transponder with altitude encoding capability

/M TACAN only, but no transponder

/N TACAN only and transponder, but with no altitude encoding capability

/P TACAN only and transponder with altitude encoding capability

/C RNAV and transponder, but with no altitude encoding

/R RNAV and transponder with altitude encoding capability

/W RNAV but no transponder

/G Global Positioning System (GPS)/Global Navigation Satellite system (GNSS) equipped aircraft with oceanic, en route, terminal, and GPS approach capability.

/E Flight Management System (FMS0 with barometric Vertical Navigation (VNAV), oceanic, en route, terminal, and approach capability. Equipment requirements are: (a) dual FMS which meets the specifications of AC25-15, Approval of Flight Management Systems in Transport Category Airplanes; AC20-129, Airworthiness Approval of Vertical Navigation (VNAV) Systems for use in the U>S> National Airspace System (NAS) and Alaska; AC20-130, Airworthiness Approval of Multi-Sensor Navigation Systems for use in the U.S. National Airspace System (NAS) and Alaska; or equivalent criteria as approved by Flight Standards.

(b) A flight director and autopilot control system capable of following the lateral and vertical FMS flight path.

(c) At least dual inertial reference units (IRUs).

(d) A database containing the waypoints and speed/altitude constraints for the route and/or procedure to be flown that is automatically loaded into the FMS flight plan.

(e) An electronic map.

/F A single FMS with barometric VNAV, en route, terminal, and approach capability that meets the equipment requirements of /E (a) above.

Block 4 Enter your true airspeed (TAS).

Block 5 Enter the departure airport identifier code, or if code is unknown, the name of the airport.

Block 6 Enter the proposed departure time in Coordinated Universal Time (UTC). If airborne, specify the actual or proposed departure time as appropriate.

Block 7 Enter the appropriate IFR altitude (to assist the briefer in providing weather and wind information).

Block 8 Define the route of flight by using NAVAID identifier codes, airways, jet routes, and waypoints.

Block 9 Enter the destination airport identifier code, or if unknown, the airport name. Include the city name (or even the state name) if needed for clarity.

Block 10 Enter estimated time enroute in hours and minutes.

Block 11 Enter only those remarks pertinent to ATC or to the clarification of other flight plan information, such as the appropriate call sign associated with the designator filed in Block 2 or ADCUS.

Block 12 Specify the fuel on board in hours and minutes.

Block 13 Specify an alternate airport, if desired or required.

Block 14 Enter the complete name, address, and telephone number of the pilot in command. Enter sufficient information to identify home base, airport, or operator. This information is essential for search and rescue operations.

Block 15 Enter total number of persons on board (POB), including crew.

Block 16 Enter the aircraft's predominant colors.

Block 17 Record the FSS name for closing the flight plan. If the flight plan is closed with a different FSS or facility, state the recorded FSS name that would normally have closed your flight plan. Information transmitted to the destination FSS consists only of that in Blocks 3, 9, and 10. Estimated time enroute (ETE) will be converted to the correct estimated time of arrival (ETA).

Optional Record a destination telephone number to assist search and rescue contact should you fail to report or cancel your flight plan within $^1/_2$ hour after your estimated time of arrival (ETA).

ICAO Weather Format

On July 1, 1993, the worldwide (ICAO) and North American aerodrome weather codes merged into a new international code for forecasts and reports. The new codes are the result of an effort to meet revised aeronautical requirements and reduce confusion in the aviation community.

The United States converted to METAR/TAF format on July 1, 1996 with terminal aerodrome forecast (TAF) replacing the terminal forecast airport and meteorological aviation routine weather report (METAR) replacing the airport surface observation (AOS).

Although the aviation community now uses a standard set of codes, some differences remain between U.S. and ICAO codes. For example, the following differences may remain in effect.

❑ Horizontal visibility is reported in statute miles (SM) in the U.S. code and in meters in the ICAO code. To avoid confusion, the suffix SM follows the visibility value if it is reported in U.S. code. Additionally, when forecast visibility in the U.S. exceeds six statute miles, the prefix P appears (e.g., P6SM - a visibility forecast greater than six statute miles).

❑ Runway visual range (RVR) is reported in feet (FT) in the U.S. code and in meters in ICAO code. When RVR is reported for a U.S. runway, the suffix FT is added (e.g., R27L/2700FT, runway 27 left RVR 2,700 ft). RVR is reported only in actual weather, not a forecast TAF.

❑ Ceiling and visibility okay (CAVOK) is not used in the U.S.

❑ Temperature, turbulence, and icing conditions are not forecast in a U.S. TAF. Turbulence and icing are forecast in Area Forecasts (FAS). Surface temperatures are forecast only in public service and agricultural forecasts.

❑ Trend forecasts are not included in U.S. METARs.

- ❏ An altimeter setting in a U.S. METAR is in inches of mercury. In an ICAO METAR, it is in hectopascals (millibars). To avoid confusion, a prefix is always assigned: an A for a U.S. report or a Q for an ICAO report (e.g., A2992 or Q1013).
- ❏ In the U.S., remarks (RMKs) precede recent (RE) weather and wind shear (WS) information reported at the end of METARs.
- ❏ Low level windshear, not associated with convective activity, will appear in U.S., Canadian, and Mexican TAFs.

Sample TAF

A terminal aerodrome forecast (TAF) describes the forecast prevailing conditions at an airport and covers either a 9-hour period or a 24-hour period. Nine-hour TAFs are issued every three hours; 24-hour TAFs are issued every six hours. Amendments (AMD) are issued as necessary. A newly issued TAF automatically amends and updates previous versions. Also, many foreign countries issue eighteen hour TAFs at six hour intervals.

The following example has detailed explanations of the new codes.

KHPN 091720Z 091818 22020KT 3/4SM -SHRA
BKN020CB FM2030 30015G25KT 1500 SHRA
OVC015CB PROB40 2022 1/4SM TSRA OVC008CB
FM2300 27008KT 1 1/2SM -SHRA BKN020
OVC040 TEMPO 0407 00000KT 1/2SM -RABR
VV004 FM1000 22010KT 1/2SM -SHRA OVC020
BECMG 1315 20010KT P6SM NSW SKC

KHPN. ICAO location indicator. The usual 3 letter identifiers we are familiar with are now preceeded by a K for the contiguous United States. Alaska and Hawaii will use 4 letter identifiers with PA and PH respectively. Changes are planned to incorporate alphabetic identifiers for those weather reporting stations where numbers and letters are now used (e.g., W10 changed to KHEF).

091720Z. Issuance time. The first two digits (**09**) indicate the date; the following four digits (**1720**) indicate time of day. All times are in UTC or Zulu.

091818. Valid period. The first two digits (**09**) indicate the date. The second two digits (**18**) are the hour that the forecast period begins. The last two digits (**18**) indicate the hour that the forecast expires. The example is a 24-hour forecast.

22020KT. Surface wind. The first three digits (**220**) are true direction to the nearest 10°. The next two digits (**20**) indicate speed. **KT** indicates the scale is in knots. TAFs may also use kilometers-per-hour (**KMH**) or meters per second (**MPS**). If gusts are forecast, a **G** and a two-digit maximum gust speed follow the five-digit wind reading (e.g., **22020G10KT**). Five zeros and the appropriate suffix indicate calm winds (e.g., **00000KT/KMH/MPS**).

NOTE: Towers, ATIS and airport advisory service report wind direction as magnetic.

3/4SM. Prevailing horizontal visibility. Visibility (**3/4SM**) is in statue milles in the U.S. However, most countries use meters which appears with no suffix (e.g., **1200**).

-SHRA. Weather and/or obstruction to visibility (**Table 5-A**, page 5-42). The minus sign (-) indicates light, a plus sign (+) indicates heavy, and no prefix indicates moderate. If no significant weather is expected, the group is omitted. If the weather ceases to be significant after a change group, the weather code is replaced by the code for no significant weather (**NSW**).

BKN020CB. Cloud coverage/height/type. The first three letters indicate expected cloud coverage. Cloud height is indicated by the second set of three digits; these are read in hundreds of feet (or multiples of 30 meters). When cumulonimbus is forecast, cloud type (**CB**) follows cloud height.

When an obscured sky is expected and information on vertical visibility is available, the cloud group is replaced by a different five-digit code (e.g., **VV004**). The first two digits are Vs. The three figures following indicate vertical visibility in units of 100 ft. For indefinite vertical visibility, the two Vs would be followed by two slash marks (**VV**//).

NOTE: More than one cloud layer may be reported.

FM2030. Significant change expected in prevailing weather. The from code (**FM**) is followed by a four-digit time code (**2030**). Prevailing weather conditions consist of surface wind, visibility, weather, and cloud coverage.

PROB40 2022. Probability (**PROB**) and a two-digit code for percent (**40**) is followed by a four-digit code (**2022**) that indicates a beginning time (**20**) and an ending time (**22**) to the nearest whole hour for probable weather conditions. Only 30% and 40% probabilities are used; less than these are not sufficient to forecast; 50% and above support the normal forecast.

TEMPO. Temporary change followed by a four-digit time. Forecasts temporary weather conditions. Indicates that changes lasting less than an hour and a half may occur anytime between the two-digit beginning time and two-digit ending time.

Decoding TAFs

The latter half of the sample TAF is decoded based on the preceding information.

30015G25KT 1/2SM SHRA OVC015CB

- Surface winds, 300° true direction
- Mean speed, 15 kts
- Gusts, maximum gust 25 kts
- Visibility, 1/2 statute mile
- Moderate showers of rain
- Overcast at 1,500 ft with cumulonimbus clouds

FM2300 27008KT 1 1/2SM -SHRA BKN020 OVC040

- Significant change expected from 2300 hours
- Surface winds, 270° true direction at 8 kts
- Visibility, one and one-half statute mile
- Light showers of rain
- Broken clouds at 2,000 ft with a second overcast layer at 4,000 ft

TEMPO 0407 00000KT 1/4SM -RA BR VV004

- Temporary between 0400 and 0700 hours
- Calm winds
- Visibility 1/4 statute mile
- Light rain and mist
- Indefinite ceiling, vertical visibility 400 ft

FM1000 22010KT 1/2SM -SHRA OVC020

- Significant change expected from 1000 hours
- Surface winds, 220° true direction at 10 kts
- Visibility, 1/2 statute mile
- Light showers of rain
- Overcast skies at 2,000 ft

BECMG 1315 20010KT P6SM NSW SKC

- Change to the forecast conditions between 1300 and 1500 hours
- Expected surface winds, 200° true direction at 10 kts
- Visibility, more than 6 statute miles
- No significant weather
- Clear skies

Sample METAR

A routine aviation weather report on observed weather, or METAR, is issued at hourly or half-hourly intervals. A special weather report on observed weather, or SPECI, is issued when certain criteria are met. Both METAR and SPECI use the same codes.

A forecast highly likely to occur, or TREND, covers a period of two hours from the time of the observation. A TREND forecast indicates significant changes in respect to one or more of the following elements: surface wind, visibility, weather, or clouds. TREND forecasts use many of the same codes as TAFs.

Most foreign countries may append a TREND to a METAR or SPECI. In the U.S., however, a TREND is not included in a METAR or SPECI.

The following example indicates how to read a METAR.

KHPN 201955Z 22015G25KT 2SM
R22L/1000FT TSRA OVC010CB 18/16 A2990
RERAB25 BECMG 2200 24035G55

KHPN. ICAO location indicator.

201955Z. Date and time of issuance. METARs are issued hourly.

22015G25KT. Surface wind (same as TAF). If the first three digits are VAR, the wind is variable with wind speed following. If direction varies 60° or more during the ten minutes immediately preceding the observation, the two extreme directions are indicated with the letter V inserted between them (e.g., **280V350**).

NOTE: G must vary 10 kts or greater to report gust.

2SM. Prevailing horizontal visibility in statute miles. In the U.S., issued in statute miles with the appropriate suffix (**SM**) appended. When a marked directional variation exists, the reported minimum visibility is followed by one of the eight compass points to indicate the direction (e.g., **2SMNE**).

R22L/1000FT. The runway visual range group. The letter **R** begins the group and is followed by the runway description (**22L**). The range in feet follows the slant bar (**1000FT**). In other countries range is in meters and no suffix is used.

TSRA OVC010CB. Thunderstorms (**TS**) and rain (**RA**) with an overcast layer at 1,000 ft and cumulonimbus clouds.

NOTE: More than one cloud layer may be reported.

18/16. Temperatures in degrees Celsius. The first two digits (**18**) are observed air temperature; the last two digits (**16**) are dew point temperature. A temperature below zero is reported with a minus (**M**) prefix code (e.g., **M06**).

A2990. Altimeter setting. In the U.S., **A** is followed by inches and hundredths; in most other countries, **Q** is followed by hectopascals (i.e., millibars).

RERAB25. Recent operationally significant condition. A two letter code for recent (**RE**) is followed by a two letter code for the condition (e.g., **RA** for rain). A code for beginning or ending (**B** or **E**) and a two-digit time in minutes during the previous hour. When local circumstances also warrant, wind shear may also be indicated (e.g., **WS LDG RWY 22**).

NOTE: A remark (RMK) code is used in the U.S. to precede supplementary data of recent operationally significant weather.

NOTE: RMK [SLP 013] breaks down SEA LVL press to nearest tenth (e.g., 1001.3 reported as SLP 013).

BECMG AT 2200 24035G55. A TREND forecast. The becoming code (**BECMG**) is followed by a when sequence (**AT 2200)** and the expected change (e.g., surface winds at 240° true at 35 kts with gusts up to 55 kts).

NOTE: For more information on METAR/TAF, consult the FAA brochure "New Aviation Weather Format METAR/TAF." Copies may be obtained by writing to: FAA/ASY-20, 400 7th Street, S.W. Washington, DC 20590.

Servicing

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Servicing Record

	DATE	QTY	DATE	QTY
Engine Oil				
Hydraulic Fluid				
Alcohol				

Servicing Record (continued)

	DATE	QTY	DATE	QTY
Pneumatic Bottle				
Oxygen				
Other				

Fuels

Approved Fuels

Fuels conforming to any of the following specifications are approved for use (**Tables 6-A, 6-B** and **6-C**). Fuels conforming to ASTM Specification ES 2074 are also eligible. Mixing of fuels is permissible.

FUEL	24D	24E/F	25B/C	25D/F
Air Total Turbine Fuel, A and 1A	X	X	X	X
ASTM Jet A Aircraft Turbine Fuel	X	X	X	X
ASTM Jet A-1	X	X	X	X
D. ENG. R.D. 2482, AVTUR 40	X	X	X	X
D. ENG. R.D. 2494, AVTUR 50	X	X	X	X
D. ENG. R.D. 2498, AVCAT 48	X	X	X	X
D. ENG. R.D. 2488, AVCAT	X	X	X	X
Canadian Fuel 3-GP-23	X	X	X	X
Canadian Fuel 3-GP-24		X		X
France Air 3404/B		X		X
France Air 3405/C		X		X
Germany TL9130-007		X		X
MIL-T-5624G JP-%	X	X	X	X
NATO F-30 (Jet A)	X	X	X	X
NATO F-34 (Jet A-1)	X	X	X	X
NATO F-35 (Jet A-1)	X	X	X	X
NATO F-42 (JP-5)	X	X	X	X
NATO F-44 (JP-5)	X	X	X	X
Romania 3754/73 (CS-3)		X		X
USSR GOST 10227 (TS-1)		X		X
USSR GOST 12308 (T-7)		X		X

Table 6-A; Approved JP-5 Industry/Government Specification Fuels

FUEL	24D	24E/F	25B/C	25D/F
Aeroshell Turbine Fuel JP-4	X	X	X	X
Atlantic Arcojet B	X	X	X	X
BP A.T.G.	X	X	X	X
Caltex Jet B	X	X	X	X
Chevron Turbine Fuel B	X	X	X	X
Conoco JP-4	X	X	X	X
Esso Turbo Fuel B	X	X	X	X
Enco Turbo Fuel B	X	X	X	X
Mobil Jet B	X	X	X	X
Mobil Jet 4	X	X	X	X
Philjet JP-4	X	X	X	X
Standard Turbine Fuel B	X	X	X	
Texaco Avjet B	X	X	X	X
Union JP-4	X	X	X	X

Table 6-B; Approved JP-4 Commercial Fuels

FUEL	24D	24E/F	25B/C	25D/F
ASTM Jet B Aircraft Turbine Fuel	X	X	X	X
D. ENG. R.D. 2486, AVTAG	X	X	X	X
Canadian Fuel 3-GP-22	X	X	X	X
France Air 3407/B		X		X
Germany TL9130-006		X		X
MIL-T-5624 JP-4	X	24E only	X	X
MIL-T-5624G		24F only		
NATO F-40 (JP-4)	X	X	X	X
NATO F-45 (JP-4)	X	X	X	X

Table 6-C; Approved JP-4 Industry/Government Specification Fuels

Aviation Gasoline

The use of aviation gasoline (avgas) is permitted, with restrictions, as an emergency fuel and may be mixed with jet fuels (**Table 6-D**, page 6-10).

Refer to Limitations Chapter, Aviation Gasoline, for avgas usage restrictions.

Fuel Additives

Approved Anti-Icing Additives

NOTE: Refer to Limitations chapter, Anti-Icing Additives.

Required Type MIL-I-27686

24F Required Types . . . . . . MIL-I-27686 OR MIL-I-85470

Concentration Range by Volume

Minimum 0.06%
(20 FL OZ/260 GAL [984.2 LITERS])

Maximum 0.15%
(20 FL OZ/104 GAL [393.7 LITERS])

For over-the-wing blending of MIL-I-27686, use the following products:

- Hi-Flo Prist 20-oz aerosol blender
- **24E/F, 25D/F:** Quell 20-oz aerosol blender

NOTE: On **24E/F**, no products are qualified for blending MIL-I-85470. Refer to your AFM for approved alternatives.

Military JP-4 fuel refined in the U.S. is factory pre-blended, and no additional treatment is necessary. However, some non-military JP-4 type fuels do not contain the required anti-icing additive. Prior to refueling, check with the fuel supplier to determine if this is the case; add additive as necessary.

WARNING: Fuel anti-icing may be harmful if inhaled or swallowed. Use adequate ventilation. Avoid contact with skin and eyes. If sprayed into eyes, flush with large amounts of water and contact a physician immediately.

CAUTION: Direct anti-ice additive into the flowing fuel stream; stop the additive flow before the fuel flow stops. Do not allow concentrated additive to contact the fuel tank's coated interior or the aircraft's painted surfaces.

CAUTION: Lack of anti-icing additive may cause fuel filter icing and subsequent engine flameout.

Biocide Additive

Biobor JF is approved for use as a biocide additive when pre-mixed in the fuel supply facility. It can be used concurrently with the anti-icing agent; however, Biobor JF itself is not an anti-icing agent. Over-the-wing mixing of Biobor is not approved.

Maximum Concentration . . . . 270 PPM

CAUTION: Drain all sumps prior to refueling with fuel containing Biobor JF.

Auxiliary Fuselage Fuel Transfer – Aircraft With FUS VALVE Switch

Activated standby pumps override gravity transfer and close the right transfer and crossflow valves. If the crossflow valve fails to open, fuselage fuel gravity-flows into the right wing until heads are equal; this causes a right-wing-heavy condition.

Fuel Density Adjustments – 24E, 25B/C/D/F

Either of two types of fuel control units may be on the engines. The fuel control density adjustment knobs, which differ on each of these units, are designated Type A and Type B. For optimum engine acceleration, adjust the knob to the fuel density setting for the fuel type in use.

To make an adjustment, push the fuel control density knob in, rotate to the desired setting, and release. The knob must be in its positioning detent for satisfactory operation. If necessary, jiggle the knob until it locks.

Set the fuel control density adjustment knob according to **Table 6-D**, following page, depending upon the mixture of aviation gasoline and JP-4 and JP-5 type fuels.

CAUTION: Engine stall margin may be reduced during high-altitude operation if the fuel control density adjustment knob is set to a lower density setting than that recommended for the type of fuel in use.

% Aviation Gasoline (By Volume)	Density Setting	
	Type A	Type B
Below 20 (JP-4)	7⊥8 (JP-4)	-2
Below 20 (JP-5)	81⊥3 (JP-5)	-3
20 to 35	7⊥5	-1
35 to 50	7⊥2	▲
Above 50	6⊥9	+1

Table 6-D; Aviation Gasoline Fuel Density Adjustments (Models 24D/F, 25B/C, and 25D/F)

Fuselage Fuel Transfer

On **24D/F and 25B/D without FUS VALVE switch**, fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. Fuselage fuel gravity-flows into the right wing tank until the heads are equal; this causes a right-wing-heavy condition. Plan fuel requirements to ensure return to the takeoff point or to an alternate if the fuselage tank fails to transfer.

On **25B,** fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. Fuselage fuel gravity-flows into the left wing tank until heads are equal; this causes a left-wing-heavy condition.

On **25D with FUS VALVE switch** and **25F**, fuselage fuel cannot be transferred forward to the wing tanks using the transfer pump if the crossflow valve fails to open. Fuselage fuel gravity-flows into the left wing tank until the heads are equal; this causes a left-wing-heavy condition.

CAUTION: Do not energize the fuselage fuel transfer system when wing and tip tanks are full.

Fueling Procedures

Safety Precautions

- Refuel and defuel in areas that permit free movement of fire equipment.
- Ground fuel truck, and bond truck to nose gear uplatch spacer.
- Bond fuel nozzle to tip tank grounding jack.
- Fill both tip tanks simultaneously or add 125 gals alternately to each tip tank until fuel reaches desired level.
- Add anti-icing additive if not premixed to MIL-I-27866 specification (check with supplier).
- Refer to Cautions under Anti-Icing Additive, this chapter.

Over-The-Wing Gravity Fueling – Except 24E

Determine the quantity of fuel required and proceed as follows.

Hi-Flo Prist Blender . . . . ATTACH TO NOZZLE

Battery Switches . . . . ON

Fuselage Tank Switch . . . . FILL

25D/F FUS VALVE Switch . . . . CHECK/CLOSED

Refueling . . . . START

Fuel Flow Rate . . . . CHECK

Flow should be 30 GPM minimum to 60 GPM maximum; however, topping-off rate may be less than 30 GPM.

Full Light . . . . ON

Fuselage Tank Switch . . . . OFF

Monitor fuselage FULL light to ensure valves close automatically when tank is full. If valves do not close, fuel gravity-flows back to the wing tanks.

CAUTION: Monitor filling operation. If the fuselage tank float switch malfunctions, the fuselage tank overflows. Fuel dripping from the wing vent air scoops indicates an overflow.

If fuselage tank overflow occurs, proceed as follows:

- Refueling . . . . STOP
- Transfer-Fill Switch . . . . OFF
- Battery Switch(es) . . . . OFF
- Fuel Vent System . . . . DRAIN

Ground Power Unit

Voltage . . . . 28 TO 33 ± 2V DC

Amperage . . . . 1,000A MAX

Hydraulic System

Approved Fluid Type MIL-H-5606

Reservoir Capacities:

- Total System . . . . 1.9 GAL
- Available to Engine-Drive Pumps . . . . 1.5 GAL
- Available to AUX Pump for Emergencies . . . . . . 0.4 GAL

Hydraulic Accumulator Precharge . . . . 850 PSI

Landing Gear System

Emergency Air

Type . . . . DRY AIR OR NITROGEN

Normal Pressure Range . . . . 1,800 TO 3,000 PSI

Strut Extension

Main Gear . . . . $3^{1}/_{4}$ $\pm^{1}/_{4}$ INCHES

Nose Gear . . . . $5^{1}/_{2}$ $\pm^{1}/_{4}$ INCHES

Tire Inflation

Main Wheels (unloaded) . . . . 115 ±5 PSI

Main Wheels (loaded) . . . . 114 TO 125 PSI

Nose Wheel (unloaded) . . . . 105 ±5 PSI

Nose Wheel (loaded) . . . . 104 TO 114 PSI

Oil – Engine

Approved Engine Oils – 24D/E/F, 25B/C

- The oils shown in **Table 6-E**, following page, are approved for use when filtered through a 10-micron filter.
- Type 1 oils, Humble 2389 Turbo Oil, Mobil RM 184A, and Shell Aircraft Oil 307 are approved for all models.
- On **24D/E,** the manufacturer recommends servicing the engine lubrication system only with approved Type 2 oils because they are capable of withstanding higher operating temperatures than Type 1 oils; they also have improved anti-coking characteristics.
- Type 1 oils have a lower viscosity than Type 2 oils. Therefore, expect 5 to 10 PSI lower stabilized oil pressure indication with Type 1 oils than with Type 2 oils under similar RPM and oil temperature conditions.

Approved Engine Oils – 25D/F

- Oils conforming to GE Specification D50TF1 (current revision) filtered through a 10-micron filter are approved for use. The engine manufacturer specifically approves the oils listed in **Table 6-E**, following page.
- Type 1 oils: 2389 Turbo Oil, RM 184A, and Shell Aircraft Oil 307 are approved for all models.

CAUTION: The intermixing of different brands of the same type oil is authorized; however, the intermixing of types is not authorized. If an approved oil type is not available or types are inadvertently mixed, drain the engine oil system, flush, and refill at the earliest opportunity.

CAUTION: The change from a Type 1 to a Type 2 oil during an engine TBO may cause a marked change in oil color (sometimes to black). This condition is caused by carbon particles in suspension and is influenced by engine TBO at the time of the oil change. If this occurs, drain, flush, refill, and closely monitor the engine oil system.

OIL	24D	24E/F	25B/C	25D/F
Aeroshell Turbine Oil 550	X	X	X	X
Aeroshell Turbine Oil 555	X	X	X	X
Aeroshell Turbine Oil 560		X		
AVTUR Oil Synthetic	X	X	X	X
Castrol 205	X	X	X	X
Caltex RPM Jet Engine Oil 5	X	X	X	X
Caltex Starjet 5	X	X	X	X
Caltex 7388	X	X	X	X
Chevron Jet Engine Oil 5	X	X	X	X
Enco Turbo Oil 2380	X	X	X	X
Esso Turbo Oil 2380	X	X	X	X
Exxon Turbo Oil 2380	X	X	X	X
Mobil Jet Engine Oil II	X	X	X	X
Mobil Oil 254		X		X
Sinclair Turbo-S Type 2	X	X	X	X
Stauffer Jet II	X	X	X	X
Texaco SATO 7388	X	X	X	X
Texaco Starjet 5	X	X	X	X

Table 6-E: Approved Type II Oils

Consumption

Maximum Consumption . . . . 0.40 U.S. PINTS/HOUR

Capacity

Tank Capacity . . . . 4.0 QTS (3.0 QTS USABLE)

Identical Oils

Each of the following groups of oils represents identical oils.

- Stauffer Jet II, AVTUR Oil Synthetic, and Castrol 205
- Texaco SATO 7388 and Caltex 7388
- Chevron Jet Engine Oil 5 and Caltex RPM Jet Engine Oil 5
- Enco Turbo Oil 2389, Esso Turbo Oil 2380, and Exxon Turbo Oil 2380
- Texaco Starjet 5 and Caltex Starjet 5

Engine Oil Procedures

Checking/Adding Oil

NOTE: Check oil within 15 minutes after shutdown.

Oil Filler Access Door . . . . OPEN

Oil Filler Cap . . . . UNLOCK/REMOVE

Dipstick . . . . WITHDRAW/WIPE/REINSERT

Oil Level . . . . CHECK

Oil Tank . . . . FILL AS NEEDED

Oil should be filtered with 10-micron filter.

Oil Filler Cap . . . . REINSTALL/LOCK

Oxygen Cylinder

Capacity . . . . 38 CUBIC FT

Oxygen Type . . . . MIL-O-2710 TYPE 1

Pressure (Fully Charged) . . . . 1,850 PSI

Windshield Anti-Ice Fluid

Type MIL-O-M-232
(GRADE A METHYL ALCOHOL)

Capacity:

Electric Pump System . . . . 2.2 GAL

Bleed Air Pressurized System . . . . 1.75 GAL

Emergency Information

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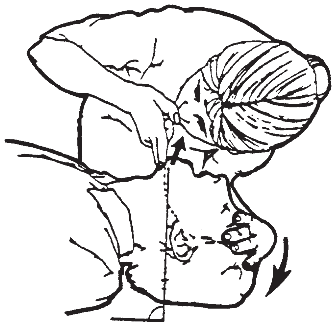
MedAire,™ Inc.
Inflight Medical Support

Airway



Breathing

Circulation

The ABCs of Emergency CPR

Establish victim's unresponsiveness.

Gently shake victim and shout, "Are you all right?"

AIRWAY

- Open airway: lift chin, tilt head. (With neck injury, lift chin but do not tilt head.)
- Look for chest movement.
- Listen for sound of breathing.
- Feel for breath on your cheek.

BREATHING

- Head tilt position – pinch victim's nose shut while lifting chin with your other hand.
- Give two full breaths while maintaining airtight seal with your mouth over victim's mouth.

  Note: A pocket mask can be used instead, but proper head position and air-tight seal must be maintained.

CIRCULATION

- Locate carotid artery pulse; hold 10 seconds. If no pulse:
- Begin external chest compressions by locating hand position two fingers above notch and placing heal of hand on breast-bone.
- Perform 15 compressions of 1 1/2 to 2 inches at a rate of 80 to 100 compressions per minute. (Count, "One and two and three and …," etc.) Come up smoothly, keeping hand contact with victim's chest at all times.
- Repeat the cycle of two breaths, 15 compressions until victim's pulse and breathing return. If only the pulse is present, continue rescue breathing until medical assistance is available.

Heart Attack

Signals

- Pressure, squeezing, fullness, or pain in center of chest behind breastbone.
- Sweating
- Nausea
- Shortness of breath
- Feeling of weakness

Actions for Survival

- Recognize signals
- Stop activity and lie or sit down
- Provide oxygen if available
- If signals persist greater than two minutes, get victim to medical assistance

Choking

If victim can cough or speak:

- encourage continued coughing
- provide oxygen if available.

If victim cannot cough or speak

- perform Heimlich maneuver (abdominal thrusts):
  1. stand behind victim; wrap arms around victim's waist
  2. place fist of one hand (knuckles up) in upper abdomen*
  3. grasp fist with opposite hand
  4. press fist into upper abdomen* with quick, inward and upward thrusts
  5. perform maneuver until foreign body is expelled
- provide supplemental oxygen if available.

  *If victim is pregnant or obese, perform chest thrusts instead of abdominal thrusts.

Emergency Equipment Record

Emergency Equipment	Location	Date Last Serviced
First Aid Kit	______	______
Fire Extinguisher(s)	______	______
	______	______
	______	______
Fire Axe	______	______
Life Raft	______	______
Life Vests	______	______
Therapeutic Oxygen	______	______
Overwater Survival Kit	______	______
Other:	______	______
	______	______
	______	______

Conversion Tables

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Distance Conversion

Meters/Feet

Meters	Feet / Meters	Feet
.3048	1	3.2908
.61	2	6.58
.91	3	9.87
1.22	4	13.16
1.52	5	16.45
1.83	6	19.74
2.13	7	23.04
2.44	8	26.33
2.74	9	29.62
3.1	10	32.9
6.1	20	65.8
9.1	30	98.7
12.2	40	131.6
15.2	50	165.5
18.3	60	197.4
21.3	70	230.4
24.4	80	263.3
27.4	90	296.2
31	100	329
61	200	658
91	300	987
122	400	1316
152	500	1645
183	600	1974
213	700	2304
244	800	2633
274	900	2962
305	1000	3291

Statute Miles/Kilometers/Nautical Miles

Statute Miles	Kilometers	Nautical Miles
.62137	1	.53996
1.24	2	1.08
1.86	3	1.62
2.49	4	2.16
3.11	5	2.70
3.73	6	3.24
4.35	7	3.78
4.97	8	4.32
5.59	9	4.86
6.21	10	5.40
12.43	20	10.80
18.64	30	16.20
24.85	40	21.60
31.07	50	27.00
37.28	60	32.40
43.50	70	37.80
49.71	80	43.20
55.92	90	48.60
62.14	100	54.00
124.27	200	107.99
186.41	300	161.99
248.55	400	215.98
310.69	500	269.98
372.82	600	323.98
434.96	700	377.97
497.10	800	431.97
559.23	900	485.96
621.37	1000	539.96

Kilometers/Nautical Miles/Statute Miles

Kilometers	Nautical Miles	Statute Miles
1.8520	1	1.1508
3.70	2	2.30
5.56	3	3.45
7.41	4	4.60
9.26	5	5.75
11.11	6	6.90
12.96	7	8.06
14.82	8	9.21
16.67	9	10.36
18.52	10	11.51
37.04	20	23.02
55.56	30	34.52
74.08	40	46.03
92.60	50	57.54
111.12	60	69.05
129.64	70	80.56
148.16	80	92.06
166.68	90	103.57
185.20	100	115.08
370.40	200	230.16
555.60	300	345.24
740.80	400	460.32
926.00	500	575.40
1111.20	600	690.48
1296.40	700	805.56
1481.60	800	920.64
1666.80	900	1035.72
1852.00	1000	1150.80

Weight Conversion

Lbs/Kilograms

Lbs	Kgs / Lbs	Kgs
2.2046	1	.4536
4.40	2	.91
6.61	3	1.36
8.82	4	1.81
11.02	5	2.27
13.23	6	2.72
15.43	7	3.18
17.64	8	3.63
19.84	9	4.08
22.0	10	4.5
44.1	20	9.1
66.1	30	13.6
88.2	40	18.1
110.2	50	22.7
132.3	60	27.2
154.3	70	31.8
176.4	80	36.3
198.4	90	40.8
220	100	45
441	200	91
661	300	136
882	400	181
1102	500	227
1323	600	272
1543	700	318
1764	800	363
1984	900	408
2205	1000	454

Fuel Weight to Volume Conversion

U.S. Gal/Lbs; Liter/Lbs; Liter/Kg

TURBINE FUEL Volume/Weight (*up to 5 lbs variation per 100 gallons due to fuel grade and temperature*)										
U.S. Gal	Lbs	U.S. Gal	Lbs	Ltr	Lbs	Ltr	Lbs	Ltr	Kg	Ltr	Kg
.15	1	6.7	.57	1	1.8	1.25	1	.8
.30	2	13.4	1.14	2	3.6	2.50	2	1.6
.45	3	20.1	1.71	3	5.4	3.75	3	2.4
.60	4	26.8	2.28	4	7.2	5.00	4	3.2
.75	5	33.5	2.85	5	9.0	6.25	5	4.0
.90	6	40.2	3.42	6	10.8	7.50	6	4.8
1.05	7	46.9	3.99	7	12.6	8.75	7	5.6
1.20	8	53.6	4.56	8	14.4	10.00	8	6.4
1.35	9	60.3	5.13	9	16.2	11.25	9	7.2
1.5	10	67	5.7	10	18	12.5	10	8
3.0	20	134	11.4	20	36	25.0	20	16
4.5	30	201	17.1	30	54	37.5	30	24
6.0	40	268	22.8	40	72	50.0	40	32
7.5	50	335	28.5	50	90	62.5	50	40
9.0	60	402	34.2	60	108	75.0	60	48
10.5	70	469	39.9	70	126	87.5	70	56
12.0	80	536	45.6	80	144	100.0	80	64
13.5	90	603	51.3	90	162	113.5	90	72
15	100	670	57	100	180	125	100	80
30	200	1340	114	200	360	250	200	160
45	300	2010	171	300	540	375	300	240
60	400	2680	228	400	720	500	400	320
75	500	3350	285	500	900	625	500	400
90	600	4020	342	600	1080	750	600	480
105	700	4690	399	700	1260	875	700	560
120	800	5360	456	800	1440	1000	800	640
135	900	6030	513	900	1620	1125	900	720
150	1000	6700	570	1000	1800	1250	1000	800

Volume Conversion

Imp Gal/U.S. Gal; U.S. Gal/Ltr; Imp Gal/Ltr

Imp Gal	U.S. Gal	Imp Gal	U.S. Gal	U.S. Gal	Ltr	U.S. Gal	Ltr	Imp Gal	Ltr	Imp Gal	Ltr
.83267	1	1.2010	.26418	1	3.7853	.21997	1	4.5460			
1.67	2	2.40	.52	2	7.57	0.44	2	9.09			
2.49	3	3.60	.79	3	11.35	0.66	3	13.64			
3.33	4	4.80	1.06	4	15.14	0.88	4	18.18			
4.16	5	6.01	1.32	5	18.92	1.10	5	23.73			
5.00	6	7.21	1.59	6	22.71	1.32	6	27.28			
5.83	7	8.41	1.85	7	26.50	1.54	7	31.82			
6.66	8	9.61	2.11	8	30.28	1.76	8	36.37			
7.49	9	10.81	2.38	9	34.07	1.98	9	40.91			
8.3	10	12.0	2.6	10	37.9	2.2	10	45.6			
16.7	20	24.0	5.3	20	75.7	4.4	20	91.0			
24.9	30	36.0	7.9	30	113.5	6.6	30	136.4			
33.3	40	48.0	10.6	40	151.4	8.8	40	181.8			
41.6	50	60.1	13.2	50	189.2	11.0	50	227.3			
50.0	60	72.1	15.9	60	227.1	13.2	60	272.8			
58.3	70	84.1	18.5	70	265.0	15.4	70	318.2			
66.6	80	96.1	21.1	80	302.8	17.6	80	363.7			
74.9	90	108.1	23.8	90	340.7	19.8	90	409.1			
83	100	120	26.4	100	379	22	100	455			
167	200	240	53	200	757	44	200	909			
249	300	360	79	300	1136	66	300	1364			
333	400	480	106	400	1514	88	400	1818			
416	500	601	132	500	1893	110	500	2273			
500	600	721	159	600	2271	132	600	2728			
583	700	841	185	700	2650	154	700	3182			
666	800	961	211	800	3028	176	800	3637			
749	900	1081	238	900	3407	198	900	4091			
833	1000	1201	264	1000	3785	220	1000	4546			

Temperature Conversion

Celsius/Fahrenheit

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
-54	-65	-32	-26	-10	14	12	54	34	93
-53	-63	-31	-24	- 9	16	13	55	35	95
-52	-62	-30	-22	- 8	18	14	57	36	97
-51	-60	-29	-20	- 7	19	15	59	37	99
-50	-58	-28	-18	- 6	21	16	61	38	100
-49	-56	-27	-17	- 5	23	17	63	39	102
-48	-54	-26	-15	- 4	25	18	64	40	104
-47	-53	-25	-13	- 3	27	19	66	41	106
-46	-51	-24	-11	- 2	28	20	68	42	108
-45	-49	-23	- 9	- 1	30	21	70	43	109
-44	-47	-22	- 8	0	32	22	72	44	111
-43	-45	-21	- 6	1	34	23	73	45	113
-42	-44	-20	- 4	2	36	24	75	46	115
-41	-42	-19	- 2	3	37	25	77	47	117
-40	-40	-18	0	4	39	26	79	48	118
-39	-38	-17	1	5	41	27	81	49	120
-38	-36	-16	- 3	6	43	28	82	50	122
-37	-35	-15	- 5	7	45	29	84	51	124
-36	-33	-14	- 7	8	46	30	86	52	126
-35	-31	-13	- 9	9	48	31	88	53	127
-34	-29	-12	-10	10	50	32	90	54	129
-33	-27	-11	-12	11	52	33	91	55	131

International Standard Atmosphere (ISA)

Altitude/Temperature

Altitude (ft)	ISA (˚C)	Altitude (ft)	ISA (˚C)	Altitude (ft)	ISA (˚C)	Altitude (ft)	ISA (˚C)
S.L.	15.0	11,000	-6.8	22,000	-28.5	33,000	-50.3
1,000	13.0	12,000	-8.8	23,000	-30.5	34,000	-52.3
2,000	11.0	13,000	-10.7	24,000	-32.5	35,000	-54.2
3,000	9.1	14,000	-12.7	25,000	-34.5	36,000	-56.2
4,000	7.1	15,000	-14.7	26,000	-36.5	37,000	-56.5
5,000	5.1	16,000	-16.7	27,000	-38.4	38,000	-56.5
6,000	3.1	17,000	-18.7	28,000	-40.4	39,000	-56.5
7,000	1.1	18,000	-20.6	29,000	-42.4	40,000	-56.5
8,000	-0.8	19,000	-22.6	30,000	-44.4	41,000	-56.5
9,000	-2.8	20,000	-24.6	31,000	-46.3	42,000	-56.5
10,000	-4.8	21,000	-26.6	32,000	-48.3	43,000	-56.5

Altimeter Setting Conversion

Hectopascals or Millibars/Inches of Mercury

1 hectopascal = 1 millibar = 0.02953 inch of mercury

Hectopascals or Millibars	0	1	2	3	4	5	6	7	8	9
	Inches of Mercury									
880	25.99	26.02	26.05	26.07	26.10	26.13	26.16	26.19	26.22	26.25
890	26.28	26.31	26.34	26.37	26.40	26.43	26.46	26.49	26.52	26.55
900	26.58	26.61	26.64	26.67	26.70	26.72	26.75	26.78	26.81	26.84
910	26.87	26.90	26.93	26.96	26.99	27.02	27.05	27.08	27.11	27.14
920	27.17	27.20	27.23	27.26	27.29	27.32	27.34	27.37	27.40	27.43
930	27.46	27.49	27.52	27.55	27.58	27.61	27.64	27.67	27.70	27.73
940	27.76	27.79	27.82	27.85	27.88	27.91	27.94	27.96	27.99	28.02
950	28.05	28.08	28.11	28.14	28.17	28.20	28.23	28.26	28.29	28.32
960	28.35	28.38	28.41	28.44	28.47	28.50	28.53	28.56	28.58	28.61
970	28.64	28.67	28.70	28.73	28.76	28.79	28.82	28.85	28.88	28.91
980	28.94	28.97	29.00	29.03	29.06	29.09	29.12	29.15	29.18	29.21
990	29.23	29.26	29.29	29.32	29.35	29.38	29.41	29.44	29.47	29.50
1000	29.53	29.56	29.59	29.62	29.65	29.68	29.71	29.74	29.77	29.80
1010	29.83	29.85	29.88	29.91	29.94	29.97	30.00	30.03	30.06	30.09
1020	30.12	30.15	30.18	30.21	30.24	30.27	30.30	30.33	30.36	30.39
1030	30.42	30.45	30.47	30.50	30.53	30.56	30.59	30.62	30.65	30.68
1040	30.71	30.74	30.77	30.80	30.83	30.86	30.89	30.92	30.95	30.98
1050	31.01	31.04	31.07	31.10	31.12	31.15	31.18	31.21	31.24	31.27

Cabin Altitude