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LEARJET 31A PILOT TRAINING MANUAL VOLUME 1

Record of Revision No. .03

This is a revision of the *Learjet 31A Pilot Training Manual.*

The portion of the text or figure affected by this revision is indicated by a solid vertical line in the margin. A vertical line adjacent to blank space means that material has been deleted. In addition, each revised page is marked "Revision .03" in the lower left or right corner.

The changes made in this revision will be further explained at the appropriate time in the training course.

This revision includes all AFM changes up to and including Change 27.

the best safety device in any aircraft is a well-trained crew. . .

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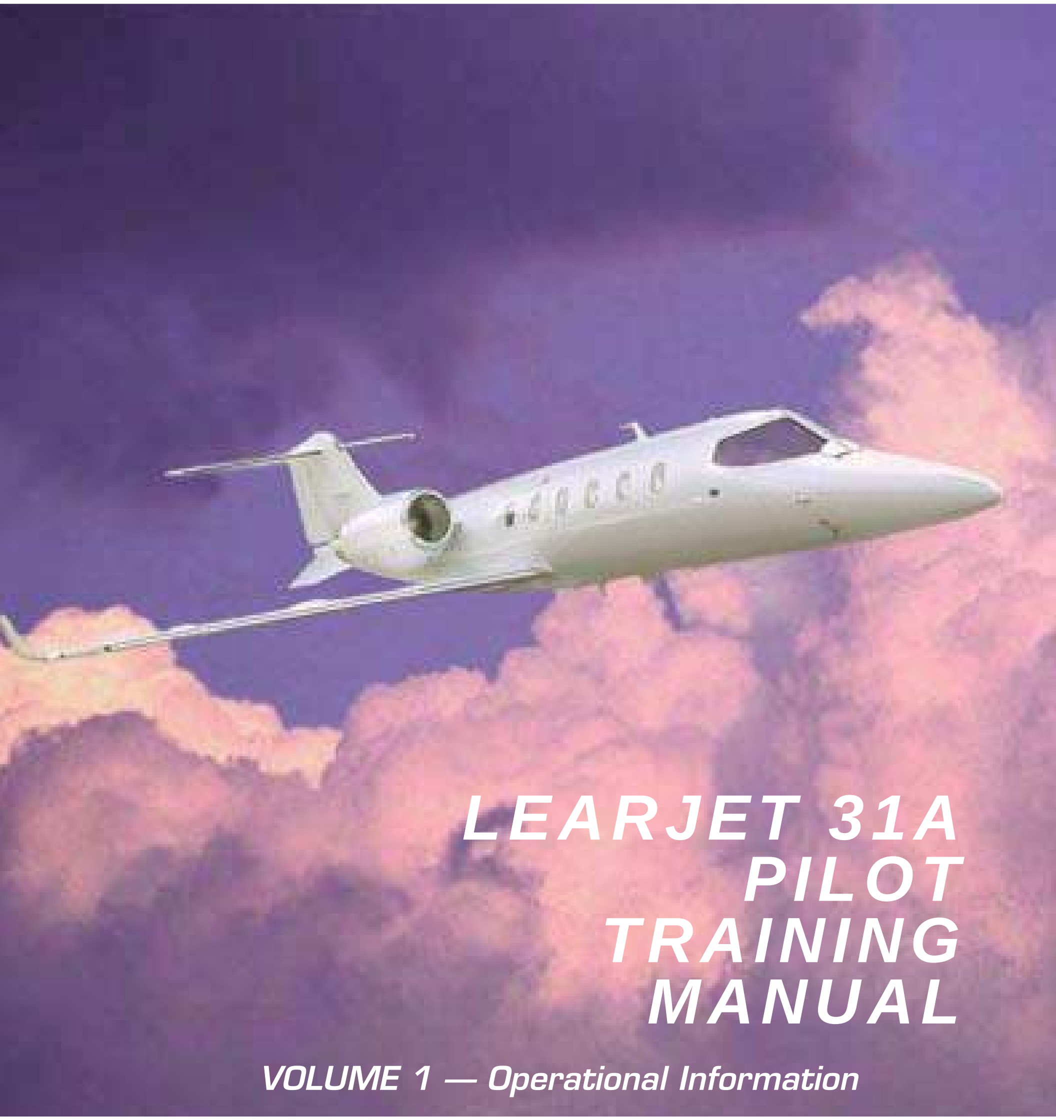

LEARJET 31A PILOT TRAINING MANUAL

VOLUME 1 — Operational Information

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NOTICE

The material contained in this training manual is based on information obtained from the aircraft manufacturer's Pilot Manuals and Maintenance Manuals. It is to be used for familiarization and training purposes only.

At the time of printing it contained then-current information. In the event of conflict between data provided herein and that in publications issued by the manufacturer or the FAA, that of the manufacturer or the FAA shall take precedence.

We at FlightSafety want you to have the best training possible. We welcome any suggestions you might have for improving this manual or any other aspect of our training program.

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EXPANDED CHECKLIST

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NORMAL PROCEDURES

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NORMAL PROCEDURES

INTRODUCTION

The procedures in this section of the manual have been developed by Learjet Inc. for the certification of this aircraft. This section contains those procedures which may be considered routine in day-to-day operations. The presentation includes, but is not limited to, detailed checklist procedures by flight phase.

THROUGH-FLIGHT PROCEDURES (BOTH ENGINES SHUT DOWN)

Normal preflight procedures (all checklist line items) must be accomplished prior to takeoff at the original departure point of a flight. At each intermediate stop of flight where both engines are shut down, the Through-Flight checklist may be used for preflight provided certain criteria are met during a stop. In the following section, procedures marked with this symbol (◆) denote Through-Flight checklist items. When permitted, accomplishment of all Through-Flight checklist items fulfills a minimum preflight requirement.

The Through-Flight checklist may be used following an intermediate stop with both engines shut down provided the following criteria have been satisfied during that stop:

- There has been no change in flight crew personnel.
- No maintenance has been performed on the aircraft. Routine line servicing is not considered maintenance.
- No more than three (3) hours have elapsed between engine shutdown and engine start.
- Extreme weather conditions (heavy precipitation, ice, snow, extreme cold, etc.) have not occurred which would change the preflight status of the aircraft.

For intermediate stops with one or no engine shut down, completion of the Quick Turn-Around procedure in this section provides the minimum preflight requirements.

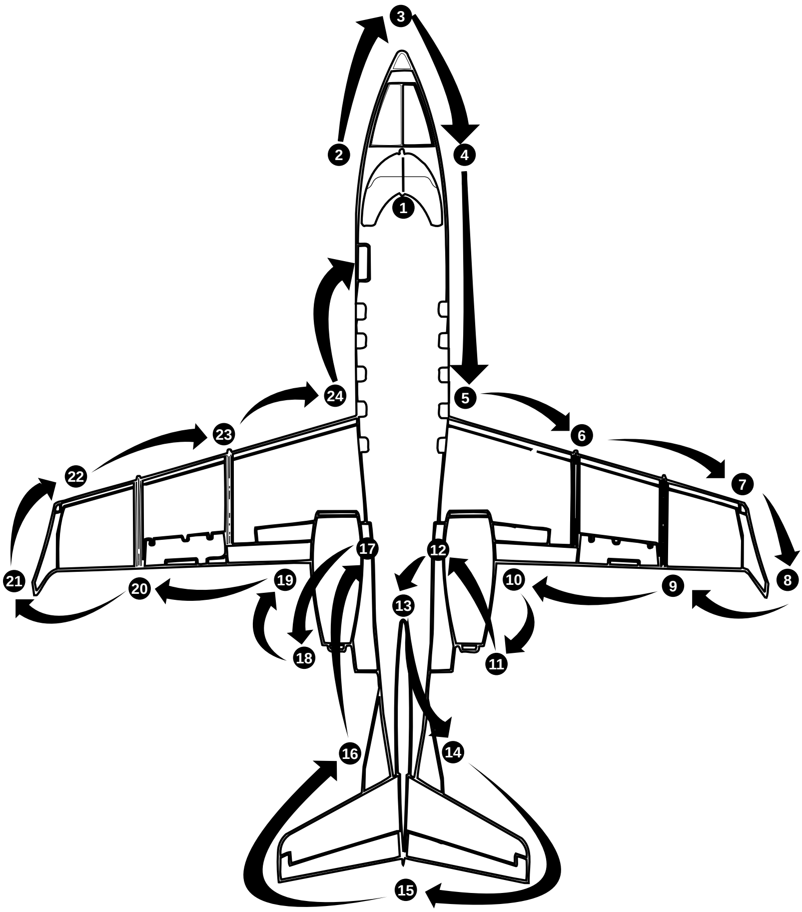


Figure NP-1. Walkaround Inspection

EXTERIOR INSPECTION

POWER OFF CHECKS

◆ During exterior inspection, check all vents clear, check access doors for security, and all aircraft surfaces for condition.

1 ◆ a. Controls Lock .... REMOVE AND STOW

2 a. Pilot's Windshield Alcohol Discharge Outlets and Pilot's Defog Outlet .... CLEAR OF OBSTRUCTIONS

◆ b. Left Pitot-Static Probe.. COVER REMOVED, CLEAR OF OBSTRUCTIONS

◆ c. Left Stall Warning Vane.. FREEDOM OF MOVEMENT

Leave in the down position.

d. Left Pitot-Static Drain Valves (3) .... DRAIN

Required only if moisture in the pitot-static system is known or suspected.

NOTE

If pitot-static drain valves are opened, assure that valve stem returns to the closed position.

e. Nose Gear and Wheel Well.......................... HYDRAULIC LEAKAGE, CONDITION, AND COOLING VENTS CLEAR

◆ f. Nosewheel and Tire... CONDITION AND NOSE GEAR UPLOCK FORWARD

NOTE

Chine on nose tire must be a minimum of 3/4 inch (19 mm) from ground to operate safely with an accumulation of 3/4 inch (19 mm) water on runway surface.

3 a. Radome Alcohol Discharge Port.. CLEAR OF OBSTRUCTIONS

b. Radome and Radome Erosion Shoe .... CONDITION

4 a. Oxygen Bottle Supply Valve (if applicable) .... OPEN (ON)

◆ b. Right Pitot-Static probe .... COVER REMOVED, CLEAR OF OBSTRUCTIONS

c. Total Temperature probe (if installed) .... CLEAR OF OBSTRUCTIONS

◆ d. Right Stall Warning vane .... FREEDOM OF MOVEMENT

Leave in the down position.

e. Pressurization Static Port .... CLEAR OF OBSTRUCTIONS

f. Right Pitot-Static Drain valves (2) .... DRAIN

Required only if moisture in the pitot-static system is known or suspected.

NOTE

If pitot-static drain valves are opened, assure that valve stem returns to closed position.

g. Oxygen Discharge Disc (if applicable) .... CONDITION

h. Copilot's Windshield Defog Outlet .... CLEAR OF OBSTRUCTIONS

i. Wing Inspection Light and Lens .... CONDITION

j. Lower Fuselage Antennas, Rotating Beacon Light and Lens .... CONDITION

5 a. Emergency Exit .... SECURE

b. Upper Fuselage Antennas, and Dorsal Inlet .... CONDITION

◆ c. Right Engine
Inlet and Fan .... CLEAR OF OBSTRUCTIONS AND CONDITION

WARNING

- If fan is windmilling, stop by pressing on fan spinner. Do not attempt to stop windmilling by grabbing blades.

- The wing, flight control surfaces, and engine inlet must be free of frost, snow, and ice.

d. Generator and Nacelle
Cooling Scoops .... CLEAR

e. Fuel Crossover Drain Valve,
Wing Scavenge Pump Drain valves (2),
Wing Sump Drain valves (2), and
Engine Fuel Drain valves (2)... DRAIN

f. Right Main Gear and
Wheel Well .... HYDRAULIC/FUEL LEAKAGE AND CONDITION

g. Right Main Gear Landing
Light and Doors .... CONDITION

◆ h. Right Main Gear Wheels,
Brakes and Tires.. CONDITION

6 a. Wing Stall Fences .... CONDITION

b. Leading Edge .... CONDITION

c. Inboard Fuel Vent
Ram Airscoop
(Underside of Wing) .... CLEAR OF OBSTRUCTIONS

d. Right Wing Access Panels
(Underside of Wing) .... CHECK FOR FUEL LEAKAGE

7 a. Outboard Fuel Vent
Ram Airscoop
(Underside of Wing) .... CLEAR OF OBSTRUCTIONS

Outboard Vent Sump .... DRAIN

◆ b. Right Wing Fuel
Filler Cap .... CONDITION AND SECURITY

8 a. Right Winglet
Light(s) and Lens .... CONDITION

b. Right Winglet Static
Discharge Wicks .... CONDITION

c. Recognition and
Beacon Light and Lens .... CONDITION

9 a. Right Aileron .... CHECK FREE MOTION, BALANCE TAB LINKAGE AND BRUSH SEAL CONDITION

b. Boundary Layer Energizers .... CONDITION

10 a. Right Spoiler and Flap .... CONDITION

b. Right Engine Oil .... OPEN ACCESS

Check oil level (normal) and oil tank filler cap for security. Secure access.

NOTE

If preflight oil level checks low, start and run engine until stabilized at idle. Shut down engine and recheck oil level. If there is no oil level indication, add enough oil to obtain an indication before starting engine to recheck oil level.

c. Right Engine Oil Bypass
Valve Indicator .... CHECK NOT EXTENDED

If red pin indicator protrudes .... INVESTIGATE.

11 ◆ a. Right Engine Turbine
Exhaust Area .... CONDITION/CLEAR OF OBSTRUCTIONS

12 ◆ a. Single-point Fueling
Access Doors (if applicable) .... SECURE

b. *On Aircraft not Equipped with Fuel Heaters:*

Right Engine Fuel
Bypass Valve Indicator .... CHECK NOT EXTENDED

If red pin indicator protrudes....................................... INVESTIGATE

◆ c. Fuel Vent Drain valves .... DRAIN COMPLETELY

d. Fuselage Tank Sump Drain valve,
Expansion Line Drain valves (2),
and Transfer Line Drain valve.. DRAIN

e. Fuel Filter Drain valves (2) and
Fuel Computer Drain valves (2) .... DRAIN

f. Single-point Fueling Pressure
Vent Screen (if applicable).. CLEAR

13 a. Tailcone Access Door .... OPEN

b. Tailcone Interior... CHECK FOR FLUID LEAKS, SECURITY AND CONDITION OF INSTALLED EQUIPMENT

c. Hydraulic Accumulator
Pressure... CHECK/750 PSI MINIMUM

d. Drag Chute (if applicable) .... CHECK FOR PROPER INSTALLATION

e. Tailcone Access Door..................................... CLOSE AND SECURE

14 a. Oxygen Discharge Disc
(if applicable).. CONDITION

b. Right VOR/LOC Antenna... CONDITION

c. Right ELT Antenna
(if applicable).. CONDITION

15 a. Vertical Stabilizer, Rudder,
Horizontal Stabilizer,
Elevator, and Delta Fins .... CONDITION, DRAIN HOLES CLEAR

WARNING

The vertical and horizontal stabilizers and flight control surfaces must be free of frost, snow, and ice.

b. Static Discharge Wicks (6 on Elevators, 1 above Navigation Light, and 4 on Delta Fins) .... CONDITION

c. Vertical Fin Navigation Lights, Strobe Light and Lens .... CONDITION

d. VLF H-Field Antenna (if applicable) .... CONDITION

◆ e. Tailstand .... REMOVED

16 a. Left VOR/LOC Antenna .... CONDITION

b. Left ELT Antenna (if applicable) .... CONDITION

17 a. Fire Extinguisher Discs .... CONDITION

b. Left Engine Oil Bypass Valve Indicator .... CHECK, NOT EXTENDED

If red pin indicator protrudes .... INVESTIGATE

18 ◆ a. Left Engine Turbine Exhaust Area .... CONDITION/CLEAR OF OBSTRUCTIONS

19 a. *On Aircraft Not Equipped with Fuel Heaters:*

Left Engine Fuel Bypass Valve Indicator .... CHECK NOT EXTENDED

If red pin indicator protrudes .... INVESTIGATE

b. Left Engine Oil .... OPEN ACCESS/CHECK OIL LEVEL (NORMAL) SECURE ACCESS

NOTE

If preflight oil level checks low, start and run engine until stabilized at idle; then shut down engine and recheck oil level. If there is no oil level indication, add enough oil to obtain an indication before starting engine to recheck oil level.

c. Left Spoiler and Flap .... CONDITION

20 a. Left Aileron .... CHECK FREE MOTION, BALANCE AND TRIM TAB LINKAGE, AND BRUSH SEAL CONDITION

b. Boundary Layer Energizers .... CONDITION

21 a. Left Winglet Static Discharge Wicks .... CONDITION

b. Left Winglet Light(s) and Lens .... CONDITION

22 ◆ a. Left Wing Fuel Filler Cap .... CONDITION AND SECURITY

b. Outboard Fuel Vent Ram Airscoop (Underside of Wing) .... CLEAR OF OBSTRUCTIONS

Outboard Vent Sump .... DRAIN

23 a. Left Wing Access Panels (Underside of Wing) .... CHECK FOR FUEL LEAKAGE

b. Inboard Fuel Vent Ram Airscoop (Underside of Wing) .... CLEAR OF OBSTRUCTIONS

c. Wing Leading Edge .... CONDITION

d. Wing Stall Fences .... CONDITION

24 a. Left Main Gear and Wheel Well .... HYDRAULIC/FUEL LEAKAGE AND CONDITION

b. Left Main Gear Landing Light and Doors .... CONDITION

◆ c. Left Main Gear Wheels Brakes and Tires .... CONDITION

◆ d. Left Engine Inlet and Fan .... CLEAR OF OBSTRUCTIONS AND CONDITION

WARNING

- If fan is windmilling, stop by pressing on fan spinner. Do not attempt to stop windmilling by grabbing blades.

- The wing, flight control surfaces, and engine inlet must be free of frost, snow, and ice.

e. Generator Nacelle Cooling Scoops .... CLEAR

POWER ON CHECKS

1 Landing Gear Switch .... DOWN
Both BATTERY Switches .... ON
Fuel Quantities .... CHECK
PITOT HEAT Switches .... ON

2 4 Use caution when touching pitot-static mast leading edges and probes, total temperature probe (if installed), and stall warning vanes to check for heat. Set PITOT HEAT switches OFF.

5 8 If night flight is anticipated, check exterior lighting.

All Exterior Light Switches .... ON

15 21 Check Proper Illumination; then:

All Exterior Light Switches .... OFF

1 Both BATTERY Switches .... OFF

CABIN PREFLIGHT

◆ 1. Baggage .... SECURE

2. Cabin Blower Switch .... AS REQUIRED
(on blower duct in aft cabin, if applicable)

NOTE

When cabin blower switch is in the OFF position, airflow is diverted above the headliner at all times except during auxiliary heater operation.

◆ 3. Emergency Exit .... AISLE CLEAR AND HANDLE UNOBSTRUCTED

◆ 4. Brief Passengers .... AS REQUIRED

Briefing includes seat belt operation, oxygen system operation, life vest location and operation, emergency evacuation, and fire extinguisher location.

NOTE

- Inform passengers that smoking in the lavatory area when the privacy curtains are closed is prohibited.
- Passengers should be advised not to use portable electronic equipment during takeoff, approach, and landing.

BEFORE STARTING ENGINES

◆ 1. Controls Lock.. STOWED

◆ 2. Safety Belts, Shoulder Harnesses, and Seats .... SECURE AND ADJUST

NOTE

Ensure that seat is adjusted so that full travel can be obtained on all controls.

◆ 3. Flight Controls .... CHECK

Full travel on all controls.

NOTE

Ensure that, during full rudder pedal movement, foot wear does not hinder movement of rudder pedals.

4. Oxygen System:

a. PASSENGER OXYGEN valve .... AUTO

◆ b. Oxygen Pressure gage .... CHECK

c. Crew Masks:

(1) Check oxygen flow available and masks properly stowed

◆ 5. Circuit-Breaker Panels:

a. Breakers .... IN

b. BUS TIE switches.. OPEN (DOWN)

6. EMER BAT 1 and 2 switches ....ON

Check standby attitude gyro for starting and erection, amber EMR PWR 1 and 2 lights illuminated, Fan Speed (N_1) indicators Off flags out of view, and green gear DOWN lights illuminated.

◆ *For thru flight;* EMER BAT switches...ON

Check standby attitude gyro for starting and erection.

◆ 7. Panel Switches and Avionics .... OFF OR SET

a. RUDDER BOOST Switch .... ON AS DESIRED

b. STATIC SOURCE Switch .... BOTH

c. FUEL CMPTR Switches .... ON

d. EMER BUS Switch .... NORMAL

e. ANTI-SKID Switch .... ON

f. LANDING GEAR Switch .... DOWN

g. BLEED AIR Switches .... ON

h. EMER PRESS Switches .... NORMAL

NOTE

For takeoff at field elevations above 8,500 feet pressure altitude, refer to Pressurization System Operation, this section.

i. PITCH TRIM Switch .... PRI

j. JET PUMP Switches .... ON

8. Battery Check:

NOTE

- Setting battery switches ON also energizes the windshield ice detect lights. Check turbine temperature (ITT), fan speed (N_1), and turbine speed (N_2) to ensure red OFF flags are retracted.
- Do not move aircraft during AHS alignment (approximately 45 seconds).

a. BATTERY 1 Switch .... SET TO BATTERY 1

Check for proper voltage; amber EMR PWR lights will go out.

b. BATTERY 2 Switch .... SET TO BATTERY 2

c. BATTERY 1 Switch .... OFF

Check for proper voltage, then BATTERY 1 switch set to BATTERY 1.

◆ *For Through-flight*:
Both BATTERY switches .... ON

NOTE

- *On aircraft with Lead-Acid Batteries*, do not attempt a battery start with less than 24 VDC each battery at 70°F (21°C) or below, or less than 25 VDC each battery at 110°F (43°C) or above. Interpolate for temperatures between 70°F (21°C) and 110°F (43°C).

- *On aircraft with Nickel-Cadmium Batteries*, do not attempt a battery start with less than 23 VDC each battery.

◆ 9. GPU (if desired)..CONNECT

NOTE:

Ensure unit is regulated to 28 VDC and limited to 1000 amps maximum.

10. Inverter System Check:

a. Auxiliary Inverter (if installed) Check:

(1) AUX INV switch.. L

Check L VAC reading is within normal range

(2) AUX INV switch.. R

Check R VAC reading is within normal range

(3) AUX INV switch.. OFF

◆ b. L INVERTER switch.. ON

Check L VAC reading is within normal range

◆ c. R INVERTER switch .... ON

Check R VAC reading is within normal range

NOTE

For normal operation, the left and right AC buses are separated(AC BUS TIE open), the left inverter powers the left AC bus and the right inverter powers the right AC bus. Each AC bus should be powered by only one inverter.

11. EMER LT Switch (if installed) .... TEST

Check for illumination, then switch .... ARMED

◆ *For through-flight*:
EMER LT Switch (if installed) .... ARMED

◆ 12. Systems Pressure Checks:

a. HYDRAULIC PRESS Gage .... CHECK
If Pressure Is Below 1,000 psi, HYD PUMP Switch .... ON

b. EMERGENCY AIR
Pressure Gage .... CHECK

◆ 13. PARKING BRAKE .... SET

PARK BRAKE light illuminated.

◆ 14. HYD PUMP Switch .... OFF

15. Warning Light Test Switch
(under glareshield) .... DEPRESS

Check that all glareshield, instrument panel, and pedestal lights illuminate. Check for audible indication of scavenge pumps operation. During daylight, check photoelectric cells by covering both cells and noting that lights dim. Alternately uncover and cover cells to assure warning lights dim and come on full bright. During darkness, check photoelectric cells by shining flashlight on each cell and noting that lights are full bright. Then note that lights dim when light source is removed.

16. Warning System Checks:

a. Windshield Ice Detect Lights .... CHECK

Check illuminated by placing an object between the lights and windshield. Use care to prevent scratching windshield when checking Ice Detect lights.

b. Takeoff Warning System .... CHECK HORN

Advance right thrust lever and note that warning horn sounds.

c. Landing Gear Warning Lights:

(1) Check three (3) green DOWN lights illuminated

(2) SYSTEM TEST Selector Switch .... ROTATE TO GEAR, DEPRESS AND HOLD

Check horn sounds and amber MUTE and three (3) red UNSAFE lights illuminated.

(3) TEST Button .... RELEASE

◆ d. Fire Detect System .... CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO FIRE DET

(2) TEST Button .... DEPRESS

ENG FIRE PULL T-Handle shall illuminate and flash. This indicates continuity of the fire detect systems.

(3) TEST Button .... RELEASE

e. Air Data System .... CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO ADC

(2) TEST Button .... MOMENTARILY DEPRESS

The pilot's system will test and the overspeed warning will sound, then the copilot's system will test and the overspeed warning will sound. Air data instruments, (Airspeed/Mach, Altimeter/Vertical Speed, and SAT/TAS), will display all 8's.

f. Cabin Altitude Warning .... CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO CABIN ALT

Then, TEST Button .... DEPRESS AND HOLD

Cabin altitude warning horn shall sound and ***on aircraft 31-240 and subsequent and prior aircraft modified by SB 31-31-5*** the MSTR WARN light and CAB ALT HI will illuminate.

(2) Thrust Lever MUTE Switch .... MOMENTARILY ENGAGE

Cabin altitude warning shall cease.

(3) TEST Button.. RELEASE

g. Stall Warning System Check:

(1) SYSTEM TEST
Selector Switch.. ROTATE TO L STALL

Then, TEST Button... DEPRESS AND HOLD

The pilot's angle-of-attack indicator needle will begin to sweep from the green segment to the red segment. As the needle passes the green-yellow margin, the shaker will actuate, the MSTR WARN lights will illuminate, and the red L STALL warning light shall flash. Shaker actuation is made evident by high-frequency vibration of the control column.

(2) TEST Button.. RELEASE

(3) SYSTEM TEST
Selector Switch.. ROTATE TO R STALL

Then, TEST Button... DEPRESS AND HOLD

The test operation will be identical to Step (1) above except needle will sweep the copilot's angle-of-attack indicator, and the red R STALL warning light will flash.

(4) TEST Button.. RELEASE

NOTE

Except for system test, the stall warning shakers and lights are disabled on the ground. However, the angle-of-attack indicators will function normally.

◆ 17. Uncage standby attitude gyro.

Check standby attitude gyro for starting and erection.

18. Pressurization and
Temperature Controls .... CHECK AND SET AS FOLLOWS

a. Pressurization Controls:

NOTE

- For manual mode pressurization, refer to Pressurization System Operation, this section.

- For takeoff at field elevations above 8,500 feet pressure altitude, refer to Pressurization System Operation, this section.

(1) CAB AIR Switch .... OFF

(2) PRESSURIZATION
AUTO–MAN Switch.. AUTO

◆ (3) CABIN CONTROLLER .... SELECT CRUISING ALTITUDE OR DESIRED CABIN ALTITUDE

(4) Cabin RATE Selector.. POSITION AS DESIRED

b. CABIN CLIMATE
Control Switches.. AS DESIRED

- Automatic Mode Operation:

(1) AUTO–MAN Switch.. AUTO

(2) COLD–HOT Knob .... ON

Rotate to desired cabin temperature. After takeoff, the cabin temperature control system will automatically maintain the cabin at the desired setting.

- Manual Mode Operation:

(1) AUTO–MAN Switch .... MAN

(2) COLD–HOT Knob.. ROTATE TO DESIRED SETTING

19. Trim Check:

NOTE

- The following procedure accomplishes the minimum trim systems preflight check. For the complete trim systems operational check, refer to Trim Systems Operational Check in this section.
- Throughout the following procedure, verify that the trim-in-motion audio clicker sounds approximately 1/4 second after initiating pitch trim with the flaps up. The trim-in-motion audio clicker will not sound when the flaps are lowered beyond 3°.

a. Mach Trim .... CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO MACH TRIM

(2) Depress and hold TEST button. The stabilizer should trim slowly in the nose up direction for one to three seconds and then stop. The trim-in-motion audio clicker may or may not sound. The amber MACH TRIM light shall illuminate.

(3) TEST Button.. RELEASE

Amber MACH TRIM light shall go out.

b. Trim Monitor .... CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO TRIM MON

(2) TEST Button .... DEPRESS

Amber PITCH TRIM light shall illuminate.

(3) TEST Button.. RELEASE

c. Trim Speed.. CHECK

(1) SYSTEM TEST Selector Switch .... ROTATE TO TRIM OVRSPD

(2) While trimming NOSE UP or NOSE DN with either Control Wheel Trim Switch, depress TEST button. Amber PITCH TRIM light shall illuminate.

(3) TEST Button .... RELEASE

(4) SYSTEM TEST Selector Switch.. OFF

d. Secondary Pitch Trim .... CHECK

(1) PITCH TRIM Selector Switch (pedestal)............................. SEC

(2) Operate NOSE DN–OFF–NOSE UP switch (pedestal) NOSE UP and NOSE DN. Trim motion shall occur in both directions.

(3) Check that depressing either control wheel master switch (MSW) while trimming NOSE UP and NOSE DN will stop trim motion while control wheel master switch (MSW) is held.

e. PITCH TRIM
Selector Switch .... PRI

f. Pilot's and Copilot's Control
Wheel Trim Switches .... CHECK
INDIVIDUALLY

◆ (1) Without depressing arming button, move switch NOSE UP and NOSE DN. Trim motion shall not occur.

(2) Without depressing arming button, move switch LWD and RWD. Trim motion shall not occur.

◆ (3) Depress arming button and move switch NOSE UP and NOSE DN. Trim motion shall occur.

◆ (4) Check that depressing either control wheel master switch (MSW) while trimming NOSE UP and NOSE DN will stop trim motion.

(5) Depress arming button and move switch LWD and RWD. Trim motion shall occur.

g. Rudder Trim Switch (pedestal).. CHECK

Check operation by moving both halves of switch simultaneously to NOSE LEFT and NOSE RIGHT. Trim motion shall occur.

◆ h. Trim.. SET

Set all axes for takeoff and check the amber T.O. TRIM light is extinguished. Refer to Figure NP-2 for takeoff trim setting.

20. Fuel Panel

- ◆ a. Fuel Quantities .... CHECK
- ◆ b. Fuel Counter .... ZERO
- c. L STANDBY PUMP .... ON

  Check white light above switch (if installed) illuminated and red L FUEL PRESS light not illuminated.
- d. L STANDBY PUMP .... OFF
- e. R STANDBY PUMP .... ON

  Check white light above switch (if installed) illuminated and red R FUEL PRESS light not illuminated.

EXAMPLE:

1. Center of Gravity .... 19.0% MAC
2. Takeoff Trim Setting .... 7.0°

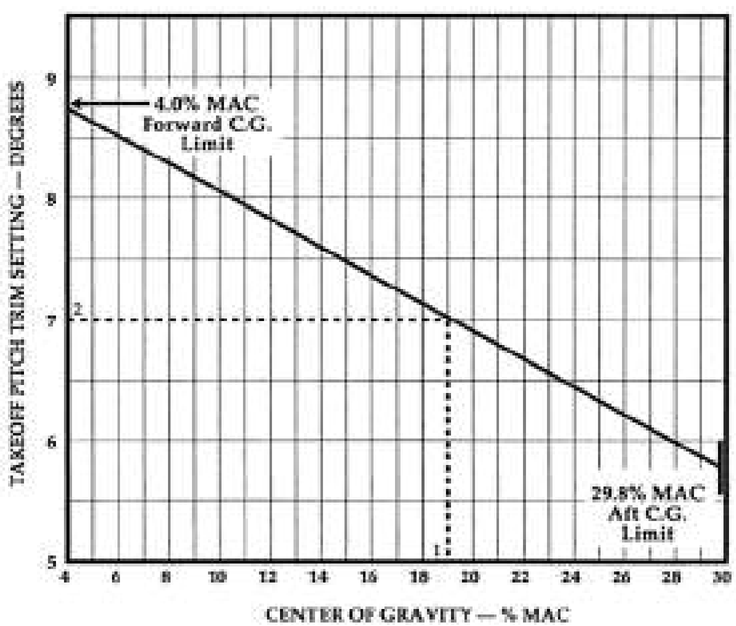


Figure NP-2. Takeoff Trim—CG Function

f. R STANDBY PUMP .... OFF

◆ g. CROSSFLOW Switch .... CLOSE

◆ h. FUS TANK XFR–FILL Switch .... OFF

◆ i. GRAV XFR Switch .... CLOSE

◆ 21. DRAG CHUTE
Handle (if installed) .... STOWED

22. Autopilot Controller Warning Lights .... EXTINGUISHED

23. Rudder Boost System Check (if applicable):

a. RUDDER BOOST Switch .... ON

b. Amber RB Annunciator .... CHECK EXTINGUISHED

c. Yaw Damper .... DISENGAGED

(YD annunciator extinguished.)

d. Rudder Pedal .... DEPRESS

Green RB annunciator shall illuminate when rudder pedal force reaches approximately 35 pounds and extinguish when rudder pedal force is released.

e. Repeat check using opposite rudder pedal.

◆ 24. Takeoff Data
(N_1, V_1, V_R, V_2, Distance) .... COMPUTED AND BUGS SET

Refer to Section V of the *AFM*.

STARTING ENGINES

It is recommended that a GPU be used when ambient temperature is 32°F (0°C) or below. Ensure GPU supply is regulated to 28 VDC, has adequate capacity for engine starting, and is limited to 1,000 amps maximum.

WARNING

Airflow into the TFE 731 engine is sufficient to draw personnel and equipment into the engine inlet. Personnel in proximity of the engine inlet should maintain a safe distance at all times during engine operation.

CAUTION

On aircraft equipped with nickel-cadmium batteries, do not dispatch if red BAT 140 or BAT 160 warning light comes on at any time prior to takeoff, including engine start. Check batteries per *Learjet Maintenance Manual*.

◆ 1. Cabin Door .... CLOSED AND LOCKED

    a. Both Door Handles .... FORWARD

    b. Door Hooks .... RELEASED

    c. DOOR Light (red) .... NOT ILLUMINATED

◆ 2. COOL Switch .... OFF

◆ 3. AUX HT Switch .... OFF

◆ 4. Electric Power Monitor (AC & DC) .... CHECK FOR MINIMUM VOLTAGE

◆ 5. PARKING BRAKE (Hydraulic Pressure Required) .... SET

    PARK BRAKE light illuminated

◆ 6. HYD PUMP Switch .... OFF

◆ 7. BCN/STROBE Light Switch .... BCN

8. Thrust Levers .... CUTOFF

◆ 9. Engine .... START

a. START–GEN Switch .... START

Starter engaged light will illuminate.

b. Thrust Lever .... IDLE AT 10% TURBINE SPEED (N_2)

Ignition light will illuminate.

c. If temperature is 0°F (–17.8°C) or below, SPR switch set to L or R, depending on engine being started. Release switch at 300–400°C turbine temperature (ITT). Use of SPR switch is not required at temperatures above 0°F (–17.8°C).

NOTE

Do not energize SPR switch at any time other than engine start.

d. Monitor the following:

(1) Fan Speed (N_1) .... INCREASING AS TURBINE SPEED (N_2) INCREASES

(2) Turbine Temperature (ITT) .... MAX 860°C

(3) OIL PRESS .... INDICATION WITHIN 10 SECONDS

(4) Fuel Flow

e. At approximately 45% to 50% turbine speed (N_2), the starter circuit will automatically disengage. Check:

(1) IGN Light .... OUT

(2) Starter Engaged Light .... OUT

If starter engaged light remains illuminated, refer to Starter Engaged Light Remains Illuminated After Start, in “Abnormal Procedures” chapter.

NOTE

If engine does not start, adhere to the following cooling periods between starting attempts.

After Start Attempt	Wait
1	One Minute
2	One Minute
3	Thirty Minutes

The above cycle may then be repeated.

f. Engine Instruments .... CHECK FOR NORMAL INDICATIONS

(1) At Turbine Speed (N_2) Idle 55%–62%.......... CHECK FAN SPEED (N_1) 26%–32%

(2) OIL PRESS.......... CHECK

Check applicable red L or R OIL PRESS light is extinguished.

◆ 10. START–GEN Switch .... GEN AT IDLE

NOTE

- The generator will not come on line with a GPU connected.
- Illumination of a FUEL PRESS light when the START–GEN switch is set to GEN indicates a jet pump failure.

11. Spoiler Check:

a. SPOILER Switch.......... EXT

Check that spoilers extend fully and symmetrically. SPOILER light will illuminate (flaps up) or flash (flaps extended).

b. SPOILER Switch.......... RET

Check that spoilers retract fully and symmetrically and SPOILER light goes out.

◆ 12. Flaps.......... SET 20° OR 8°

◆ 13. HYD PRESS.......... CHECK

Check LO HYD PRESS light not illuminated.

◆ 14. Electrical Power Monitor (AC and DC)................................ CHECK FOR MINIMUM VOLTAGE

◆ 15. Start other engine by repeating steps 9 and 10.

◆ 16. GPU (if applicable) ....DISCONNECT
Note that both Generators come online.

◆ 17. Electrical Power Monitor (AC and DC).. CHECK
GEN lights extinguished.

BEFORE TAXI

◆ 1. AVIONICS

a. LEFT and RIGHT MASTER Switches... ON

b. COMM 1 .... ON

c Avionics .... ON AND SET AS DESIRED

d. FMS.. INITIALIZE

◆ 2. Radar .... STANDBY

◆ 3. Circuit Breakers.. CHECK, IN

◆ 4. Coffee/Oven Switches (if installed) .... AS REQUIRED

5. Fuel Control Governor Check:

a. Left Thrust Lever .... IDLE

CAUTION

If the engine accelerates uncontrolled during the following step, set FUEL CMPTR switch ON until engine stabilizes at idle. Shut down engine and determine and correct cause prior to flight.

b. L FUEL CMPTR Switch .... MAN

Note amber L FUEL CMPTR light illuminated (Engine RPM may increase or decrease slightly).

CAUTION

If turbine speed does not respond during the following steps, shut down engine and determine and correct cause prior to flight.

c. Once rpm stabilizes, gradually advance thrust lever until an increase in turbine speed (N_2) is observed.

d. Retard thrust lever and note decrease in turbine speed (N_2).

e. If turbine speed responds to thrust lever changes, set L FUEL CMPTR switch to ON and note that the L FUEL CMPTR light is out.

f. Repeat steps a. through e. using R FUEL CMPTR switch and right thrust lever.

6. Anti-Ice Systems

◆ a. WSHLD DEFOG .... ON IF DESIRED

◆ b. Purge windshield heat system of possible moisture accumulation (first flight of day and if exposed to moisture):

(1) WSHLD HEAT Switch .... ON UNTIL WATER HAS CLEARED

(2) WSHLD HEAT Switch .... AS REQUIRED

NOTE

Maintain minimum rpm required to keep windshield clear.

c. STAB WING HEAT Switch .... ON

Check amber STAB HEAT light illuminated, and no additional rise in DC amperes. Check for increase in ITT indicating bleed air is being extracted for wing heat.

CAUTION

If amber STAB HEAT light does not illuminate and DC amperes increase, immediately set STAB WING HEAT switch to OFF.

◆ d. STAB WING HEAT Switch .... AS REQUIRED

Monitor WING TEMP indicator to prevent overheat condition.

e. Pitot Heat .... CHECK, THEN OFF

(1) L PITOT HEAT Switch .... ON

Note that PITOT HT light remains illuminated.

(2) R PITOT HEAT Switch .... ON

Check PITOT HT light goes out.

(3) L PITOT HEAT Switch .... OFF

Check PITOT HT light comes on.

(4) R PITOT HEAT Switch .... OFF

f. NAC HEAT Switches .... ON ONE AT A TIME

Check amber NAC HT lights extinguish by 60% fan speed (N_1) and green NAC HT ON light illuminated.

◆ g. NAC HEAT Switches .... AS REQUIRED

◆ 7. Lights .... ON, AS REQUIRED

◆ 8. ANTI -SKID Lights .... OUT

◆ 9. Cabin Check:

a. Passengers Briefed

b. Swivel Seats.................................. FORWARD OR AS PLACARDED

Seat backs in upright and locked position

c. Work Tables and Toilet Door (if installed).............. CHECK STOWED

d. Emergency Exit .... AISLE CLEAR AND HANDLE UNOBSTRUCTED..

◆ 10. NO SMOKING FASTEN SEAT BELT Switch.................................... ON

◆ 11. •*Aircraft 31-035 through 31-054 not incorporating SB 31-32-2,* Nosewheel Steering.. AS DESIRED

NOTE

- Nosewheel steering may be locked in by depressing the STEER LOCK switch. The STEER ON light will illuminate. The steer lock may be disengaged at any time by depressing and releasing the pilot's or copilot's control wheel master switch (MSW).

- The PITCH TRIM light will illuminate whenever either control wheel master switch (MSW) is depressed.

•*Aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2*
Nosewheel Steering.. ARM

NOTE

- *Aircraft equipped with digital nosewheel steering computer P/N 501-1661-04*: Upon initial powerup, nosewheel steering will not be available unless ARM is selected (i.e., control wheel master switch [MSW] can not be used to engage steering). This situation also exists any time a power interruption is experienced. If a power interruption is experienced, rearm the system using the NOSE STEER switch.

- Nosewheel steering is armed by depressing the NOSE STEER switch. The ARM & STEER ON light will illuminate. The steering may be disengaged at any time by depressing and releasing the pilot's or copilot's control wheel master switch (MSW) or by depressing the NOSE STEER switch.

- The PITCH TRIM light will illuminate whenever either control wheel master switch (MSW) is depressed.

◆ 12. PARKING BRAKE... RELEASE

Check PARK BRAKE light is extinguished.

TAXI AND BEFORE TAKEOFF

◆ 1. Brakes and Nosewheel Steering............... CHECK, AND AS REQUIRED THROUGHOUT TAXI

NOTE

When taxiing through slush or snow, use brakes to create some friction heat in the brake discs to prevent brakes from freezing.

2. Fuel Panel:

◆ a. Fuel Quantities .... CHECK AND BALANCED

b. CROSSFLOW Switch .... CLOSE

c. FUS TANK XFR-FILL Switch.. OFF

d. GRAV XFR Switch .... CLOSE

3. Flight Controls.. CHECKED

◆ 4. Flight Instruments .... CHECK

a. EFIS Controls .... CHECK

Normal and on-side systems selected (green annunciations).

NOTE

For dispatch, two symbol generators must be operational and the pilot's and copilot's EFIS displays must be sourced by separate symbol generators. Symbol Generator 3 (amber) may be selected as a source.

b. Pilot, Copilot, and Standby Airspeed/Mach Indicators.............. VALID NO FLAGS

c. Pilot, Copilot Altimeter/Vertical Speed Indicators and Standby Altimeter.............. SET BAROMETRIC PRESSURE VALID, NO FLAGS

d. EADIs and Standby Attitude Gyro ....VALID, NO FLAGS

e. EHSIs and Standby HSI..................... HEADING VALID, NO FLAGS

◆ 5. Takeoff Data (N_1, V_1, V_R, V_2) .... REVIEWED AND BUGS SET

◆ 6. Engine Instruments .... CHECK

◆ 7. Navigation Equipment .... SET FOR TAKEOFF

◆ 8. Radar .... AS REQUIRED

◆ 9. Spoilers .... RETRACTED AND SPOILER LIGHT OUT

◆ 10. Flaps .... SET 20° OR 8°, CHECK INDICATION

◆ 11. Trims .... SET FOR TAKEOFF

Check PITCH TRIM switch in PRI and T.O. TRIM light out.

◆ 12. Pressurization System .... SET

◆ 13. CAB AIR Switch .... ON

◆ 14. Cabin Temp Controls .... SET

◆ 15. Anti-ice Systems:

WARNING

The wings, vertical and horizontal stabilizers, flight control surfaces, and engine inlets must be free of frost, snow, and ice.

NOTE

- Anti-ice systems should be turned on prior to flight into visible moisture and static air temperature 5°C or below.
- If anti-ice systems are required during takeoff, they should be turned ON prior to setting takeoff power.

a. WSHLD HEAT Switch .... AS REQUIRED

b. NAC HEAT Switches .... AS REQUIRED

c. STAB WING HEAT Switch .... AS REQUIRED

WARNING

Even **small** accumulations of ice on the wing leading edge can cause an increase in stall speed and possibly a degradation in stall characteristics.

NOTE

Wing-heat bleed air exits overboard through the center wing/wheel well area. If takeoff were made from a snow- or slush-covered runway, activation of STAB WING HEAT for approximately 10 minutes will help to melt moisture on the wheels and brakes. Monitor WING TEMP indicator for overheat condition.

◆ 16. Crew Takeoff Briefing .... COMPLETE

RUNWAY LINEUP

◆ 1. Parking Brake .... RELEASED

Check the PARK BRAKE light is extinguished.

◆ 2. Transponder .... ON

◆ 3. PITOT HEAT Switches .... ON

Check PITOT HT light is out.

◆ 4. Lights:

a. RECOG Light Switch .... ON

b. BCN/STROBE Light Switch .... BCN/STROBE

c. LDG LT–TAXI Switches .... ON AS DESIRED

◆ 5. IGNITION Switches .... ON

◆ 6. Annunciator Panel and Warning Lights .... CHECK

Check that lights are not illuminated, except the STEER ON light and PITCH TRIM light (if Control Wheel Master switch [MSW] is depressed).

NOTE

- STAB HEAT, WSHLD HT, and NAC HT lights will illuminate if the corresponding systems have been turned on.

- L and R WS DEFOG lights will illuminate upon initial activation of the windshield defog system and remain illuminated until windshield temperature reaches 80°F (27°C).

TAKEOFF

◆ 1. *Aircraft 31-035 through 31-054 not incorporating 31-32-2,*

Nosewheel Steering.. AS REQUIRED FOR HEADING CONTROL

Release at first indication of airspeed.

NOTE

- If STEER LOCK was used to engage nosewheel steering, depressing and then releasing control wheel master switch (MSW) will disengage steering.

- If control wheel master switch (MSW) was used to engage nosewheel steering, releasing MSW will disengage steering.

- The PITCH TRIM light will be illuminated when the control wheel master switch (MSW) is depressed.

AFTER TAKEOFF

NOTE

- JET PUMP switches should always be in the ON position. However, at any time during flight, if either or both switches are noted to be in the OFF position, reset to ON during steady engine operation at 80% Fan Speed (N_1), or above.

- 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.

1. LANDING GEAR switch .... UP

   Landing gear should be fully retracted prior to retracting flaps.

2. Yaw Damper .... AS DESIRED

3. Flaps .... UP PRIOR TO V_{FE}

4. IGNITION switches .... OFF

   Set to OFF unless ambient conditions require ignition to remain ON.

NOTE

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

5. LDG LT–TAXI switches .... OFF

6. HYD PRESS gage .... CHECK, NORMAL

7. Pressurization System:

NOTE

- For manual mode pressurization, refer to Pressurization System Operation, this section.

- For takeoff at field elevations above 8,500 feet pressure altitude, refer to Pressurization System Operation, this section.

a. Cabin Altitude and Cabin Climb Indicators .... MONITOR

b. Cabin RATE Selector .... AS DESIRED

CLIMB

10,000-Foot Checks

1. NO SMOKING FASTEN SEATBELT Switch .... AS REQUIRED

18,000-Foot (or Transition Altitude) Checks

1. Altimeters (3) .... SET TO 29.92 IN. HG. (1,013 MB)
2. RECOG Light Switch .... OFF
3. WSHLD DEFOG Switch .... AS DESIRED
4. Oxygen Pressure Gage .... CHECK
5. EMER PRESS Switches .... NORMAL

FL 350 Checks

On aircraft 31-035 through 31-190,

1. COOL Switch.. OFF

CRUISE

Once established at cruise altitude, crew duties consist mainly of monitoring aircraft systems indications and annunciators to ensure proper operation. Monitor pressurization and engine instruments. Monitor fuel distribution and crossflow fuel as required to maintain wings balanced. Use small thrust adjustments as necessary to maintain desired cruise Mach.

NOTE

On aircraft 31-035 through 31-093, at high altitudes (FL 450 or above), engine compressor stalls may occur during engine decelerations. These compressor stalls will not result in engine damage, and may be corrected by an increasing or decreasing thrust lever change.

DESCENT

1. WSHLD DEFOG switch.. CHECK ON
2. Pressurization .... SET AS FOLLOWS

NOTE

- For manual mode pressurization, refer to Pressurization System Operation, this section.
- Maintain sufficient RPM, especially at high altitudes, to maintain cabin pressurization.
- For landing at field elevations above 8,500 feet pressure altitude, refer to Pressurization System Operation, this section.

a. CABIN CONTROLLER selector knob .... TURN TO DESTINATION FIELD ELEVATION

b. Cabin RATE selector....................................... ADJUST AS DESIRED DURING DESCENT

3. Anti-ice Systems .... AS REQUIRED

WARNING

Even **small** accumulations of ice on the wing leading edge can cause an increase in stall speed and possibly a degradation in stall characteristics.

NOTE

- Anti-ice systems should be turned on prior to flight into visible moisture and SAT of 5°C or below.
- Use of external windshield heat is required for anti-icing and recommended for rain removal. When the electric windshield defog system is operating, use of the external windshield heat (bleed air) will not be required for defog.

FL 180 (or Transition Level) Checks

4. Altimeters (3) .... SET

   Set to field barometric pressure. Cross-check pilot's, copilot's and standby instruments.

5. RECOG Light Switch .... ON

6. Pressurization .... CHECK

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

8. Cabin Check:

   a. Passengers .... BRIEFED

   b. Swivel Seats .... FORWARD OR AS PLACARDED

      Check seat backs in upright and locked position.

   c. Work Table and Toilet Doors (if installed) .... CHECK STOWED

   d. Emergency Exit .... AISLE CLEAR AND HANDLE UNOBSTRUCTED

APPROACH

1. Circuit Breakers .... CHECK IN

2. Systems Pressure .... CHECK

   a. HYD PRESS .... 1,500 TO 1,550 PSI

   b. EMER AIR Pressure .... 1,800 TO 3,000 PSI

3. Landing Approach Speed (V_{REF}), Approach Climb Speed (approximately V_{REF} + 7), and N_1 for Go-Around .... COMPUTED AND BUGS SET

   Refer to Section V of the *AFM*.

   CAUTION

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

4. Fuel .... BALANCED

5. Radio Altimeter .... SET TO APPROACH MINIMUMS

6. Crew Approach Briefing .... COMPLETE

7. Spoilers .... CHECK, RETRACTED

BEFORE LANDING

1. Flaps .... 8° OR 20°

2. LANDING GEAR Switch .... DN AT V_{LO} OR LESS

   Check for green DOWN indication.

NOTE

- If taxi and/or takeoff were on ice, snow, or slush: ANTI-SKID switch—OFF, pump brakes 6 to 10 times, then ANTI-SKID switch—ON. Brake application will tend to crack any ice between brake discs and between the discs and wheels.
- The amber ENG SYNC light will illuminate whenever the nose gear is down and the ENG SYNC switch is in the SYNC position.

3. *Aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2,*
   Nosewheel Steering .... CHECK ARM

4. LDG LT-TAXI Switches.. ON AS REQUIRED

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.

5. ANTI-SKID Lights... CHECK OUT

6. ENG SYNC Switch... OFF

7. Flaps .... DN, CHECK INDICATION

8. HYDRAULIC PRESS Gage .... CHECK (1,500 TO 1,550 PSI)

9. IGNITION Switches.. ON

10. Autopilot .... DISENGAGE

NOTE

Control Wheel Master switch (MSW) will also disengage yaw damper.

11. Yaw Dampers as follows:

    • *If Rudder Boost ON,* Yaw Damper......................................AS DESIRED

    • *If Rudder Boost OFF,* Yaw Damper ....DISENGAGE

GO-AROUND

1. Autopilot .... DISENGAGED

NOTE

Depressing Go-Around button in left thrust lever handle will disengage autopilot and select flight director go-around mode.

2. Thrust Levers.. SET

   Set to takeoff power or as required.

3. SPOILER switch .... CHECK RET

4. Flags .... 20°

5. LANDING GEAR switch .... UP

   Position after positive rate of climb is established.

6. Climb at Approach Climb Speed (approximately V_{REF} + 7).

7. When clear of obstacles, accelerate to V_{REF} + 20 and retract flaps.

LANDING

1. Brakes.. AS REQUIRED
2. SPOILER switch.. EXT

CAUTION

- If, upon touchdown, one or more ANTI-SKID lights come on, 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 drop may cause false signals in the anti-skid system and dump brake pressure for 2 to 3 seconds.

3. Thrust Reversers or
   Drag Chute (if installed).. AS DESIRED
4. •*Aircraft 31-035 thru 31-054 not incorporating SB 31-32-2,*
   Nose Wheel Steering .... AS REQUIRED BELOW 45 KNOTS

NOTE

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

•*Aircraft 31-055 and subsequent and prior incorporating SB 31-32-2,*
Nose Wheel Steering .... CHECK STEER ON LIGHT ILLUMINATED BELOW 90 KNOTS

AFTER LANDING/CLEARING RUNWAY

1. IGNITION Switches .... OFF
2. CAB AIR Switch... OFF
3. Anti-Ice Systems:

a. WSHLD DEFOG and
WSHLD HEAT Switches .... AS REQUIRED

NOTE

Maintain minimum rpm required to keep windshield clear.

b. ALCOHOL Switch .... OFF

c. STAB WING HEAT Switch .... AS REQUIRED

Monitor WING TEMP indicator to prevent overheat condition.

CAUTION

If amber STAB HEAT light is not illuminated and DC ammeter indicates stabilizer heat operation, ***immediately*** set STAB WING HEAT switch to OFF.

d. PITOT HEAT Switches .... OFF

e. NAC HEAT Switches .... AS REQUIRED

4. Lights .... AS DESIRED

5. Thrust Lever (on engine started first) .... CUTOFF (OPTIONAL)

NOTE

Idle engine for 2 minutes prior to thrust lever cutoff.

6. SPOILER Switch .... RET

7. Flaps .... 20°, 8°, OR UP

8. HYDRAULIC PRESS Gage .... CHECK

9. Unnecessary Avionics .... OFF

10. Transponder .... STBY OR OFF

SHUTDOWN

1. PARKING BRAKE and/or Chocks .... SET
2. WSHLD DEFOG Switch .... OFF
3. Anti-ice Systems .... OFF
4. EMER LT Switch (if installed) .... DISARM
5. Panel Switches and Avionics .... OFF OR SET
   a. RUDDER BOOST Switch .... ON AS DESIRED
   b. FUEL CMPTR Switches .... ON

   NOTE

   A flashing FUEL CMPTR light during shutdown indicates a failed ITT system or shorted manual mode solenoid driver circuit. Correct before further flight.

   c. ANTI-SKID Switch .... ON
   d. BLEED AIR Switches .... ON
   e. JET PUMPS Switches .... ON
6. Standby Attitude Gyro .... CAGE
7. EMER BAT Switches .... OFF
8. Coffee and Oven Switches (if installed) .... OFF
9. Thrust Lever(s) .... CUTOFF
10. START–GEN switches .... OFF
11. INVERTER switches .... OFF
12. Fuel Transfer .... OFF

    CROSSFLOW switch .... CLOSE
13. BCN/STROBE Light switch .... OFF

14. Battery switches .... OFF

15. Controls lock .... INSTALL

QUICK TURNAROUND (ONE OR NO ENGINE SHUTDOWN)

1. Cabin Door .... CLOSED AND LATCHED
DOOR LIGHT OUT

2. Cabin Check:

   a. Passengers .... BRIEFED

   b. Swivel Seats .... FORWARD OR AS PLACARDED

      Seat backs in upright and locked position.

   c. Work Tables and Toilet Door (if installed) .... CHECK STOWED

   d. Emergency Exit .... AISLE CLEAR AND
HANDLE UNOBSTRUCTED

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

4. COOL Switch .... OFF

5. AUX HT Switch .... OFF

6. Engine .... START (TWO RUNNING)

   Check N_1 rotation during start.

7. START–GEN Switches .... GEN

8. Electrical Power Monitor .... CHECK

9. Circuit Breakers .... IN

10. AVIONICS LEFT and RIGHT MASTER Switches .... ON

11. FMS .... SET

12. Coffee/Oven Switches (if installed) .... ON, AS DESIRED

13. Anti-Ice Systems .... AS REQUIRED

14. • *Aircraft 31-035 thru 31-054 not incorporating SB 31-32-2,*
    Nosewheel Steering .... AS REQUIRED

- *Aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2,*

  Nosewheel Steering .... CHECK ARM

TAXI

1. Fuel Control Panel and Quantity.. CHECK
2. Takeoff Data
   (N_1, V_1, V_R, V_2, Distance) .... COMPUTE

   Bugs.. SET

   Refer to Section V of the *AFM*.
3. Nav Equipment... SET
4. Radar.. AS REQUIRED
5. Flight Controls .... CHECK
6. Flight Instruments .... CHECK
7. SPOILER Lever .... RET
8. Flaps .... SET 20° OR 8°, CHECK INDICATION
9. Trims (3) .... SET FOR TAKEOFF
10. Pressurization .... SELECT CRUISING ALTITUDE OR DESIRED CABIN ALTITUDE
11. CAB AIR Switch .... ON
12. Crew Takeoff Briefing .... COMPLETE

RUNWAY LINEUP

1. Parking Brake.. RELEASED

   Check PARK BRAKE light extinguished.
2. Transponder .... ON

3. PITOT HEAT Switches.. ON

   PITOT HT light out.

4. Anti-ice Systems:

WARNING

The wings, vertical and horizontal stabilizers, flight control surfaces, and engine inlets must be free of frost, snow, and ice.

NOTE:

- Anti-ice systems should be turned on prior to flight into visible moisture and SAT of 5°C or below.
- If anti-ice systems are required during takeoff, they should be turned on prior to setting takeoff thrust.

   a. WSHLD HEAT Switch... AS REQUIRED
   b. NAC HEAT Switches.. AS REQUIRED
   c. STAB WING HEAT Switch .... AS REQUIRED

WARNING

Even **small** accumulations of ice on the wing leading edge can cause an increase in stall speed and possibly, a degradation in stall characteristics.

NOTE

Wing-heat bleed air exits overboard through the center wing/wheel well area. If takeoff is made from a snow or slush covered runway, activation of STAB WING HEAT for approximately 10 minutes after takeoff will help to clear moisture on the wheels and brakes. Monitor WING TEMP gage for overheat condition.

5. Lights:

   a. RECOG Light Switch... ON

b. BCN/STROBE Light Switch .... BCN/STROBE

c. LDG LT-TAXI Switches .... ON AS DESIRED

6. IGNITION Switches .... ON

7. Annunciator Panel and
Warning Lights .... LIGHTS NOT ILLUMINATED

Lights not illuminated, except STEER ON light, and PITCH TRIM light (if control wheel master switch [MSW] is depressed).

NOTE

- STAB HEAT, WSHLD HT, and NAC HT lights will illuminate if the corresponding systems have been turned on.

- L and R WS DEFOG lights will illuminate upon initial activation of the windshield defog system and remain illuminated until windshield temperature reaches 80°F (27°C).

COLD WEATHER OPERATION

Operational problems related to cold weather may occur unless proper preflight and inspection procedures are accomplished. Additionally, operational difficulties due to ice, snow, slush, or water accumulation may be encountered. The following instructions supplement the normal procedures and, when followed, will help ensure satisfactory operation of the aircraft and its systems in cold climatic conditions.

PREFLIGHT PREPARATION

It is essential to take off with an aerodynamically clean airplane. Low temperatures and precipitation associated with cold weather operation create problems while the airplane is on the ground in that frost, ice, and snow adhere to and accumulate on the surfaces of the airplane. All surfaces of the airplane (wing, vertical and horizontal stabilizers, flight controls, spoilers, and flaps, including gaps between control surfaces and aircraft structure) must be free of frost, ice, and snow before take off. During periods of precipitation, once the airplane has been deiced, anti-icing is likely to be required to ensure that the airplane has been deiced. Anti-icing is likely to be required to ensure that the airplane remains aerodynamically clean for departure. Deicing/anti-icing must be accomplished at the last possible time prior to takeoff to maximize the time that anti-icing will be able to provide protection (holdover time). Refer to Learjet addendum in *AFM* for deicing/anti-icing procedures.

PREFLIGHT INSPECTION

1. Conduct normal exterior inspection.

2. Check the entire aircraft (including top surface of horizontal stabilizer) for ice, snow, and frost. Brush off light snow. Remove all frost, encrusted snow, and ice from the entire aircraft.

3. Remove ice, snow, and dirt from landing gear shock struts and wheel wells. Check gear doors, position switches, squat switches, wheels, brakes, and tires.

4. Carefully inspect engines for frozen precipitation in fan duct and tailpipe. Under certain climactic conditions, ice can form on the back of fan blades and cause vibration during start.

ENGINE START

Use of a GPU for an engine start is recommended at ambient temperatures of 32°F (0°C) or below. Ensure GPU is regulated to 28 VDC, has adequate capacity (at least 500 amps), and is limited to 1,000 amps maximum.

Use of SPR is recommended for engine starts at ambient temperatures of 0°F (–17.8°C) or below. During an engine start using SPR, discontinue SPR at 300–400°C Turbine Temperature (ITT).

NOTE

Use of SPR is not required above 0°F (–17.8°C). Do not energize SPR at any time other than engine start.

If the engines are exposed to extremely cold temperatures (below –40°F [–40°C]) for an extended period, the engines should be preheated prior to attempting a start. For ambient temperatures between –40°F (–40°C) and –65°F (–54°C), direct warm air flow into each engine for a minimum of 30 minutes prior to engine start.

During engine starts in cold weather, engine acceleration, particularly Fan Speed (N_1), is much slower than normal and Turbine Temperature (ITT) has a tendency to increase more rapidly due to the increased spool-up times. Additionally, higher than normal oil pressure can be expected which may exceed the maximum allowable transients.

CAUTION

During engine starts in cold conditions:

- If Fan Speed (N_1) does not rise with Turbine Speed (N_2) or stops during the start attempt, abort start attempt.

- If Turbine Temperature (ITT) is rising rapidly and appears likely to exceed the start limit, abort start attempt.
- Exceeding idle power with oil temperature below 30°C is not recommended. However, if ambient temperature prevents attainment of 30°C, idle power may be exceeded as required to further warm the oil to normal operating limits prior to takeoff.

When the aircraft has been cold soaked at ambient temperatures below –13°F (–25°C), the engines should be operated a minimum of 3 minutes to bring the hydraulic system up to normal operating temperature.

TAXIING

Use normal taxi procedures if the ramp and taxiways are clean and dry. If it is necessary to taxi on ice, snow, slush, or water, taxi at reduced speed and allow greater distance for decreased braking efficiency.

If taxi is to be accomplished through slush or snow, use the brakes to create some friction induced heating of the brake discs to prevent the brakes from freezing.

Use both engines for taxi on slippery surfaces. Directional control may be difficult to maintain during one-engine taxi on a slick surface.

Use anti-ice systems as required.

Insofar as possible, taxi should be accomplished with the flaps up on snow or slush covered surfaces.

Avoid taxiing in the exhaust wake or propeller wash of other aircraft on other than hard packed or dry surfaces.

Thrust reversers (if installed) should be used with extreme caution on slippery surfaces and only when absolutely necessary to maintain directional control.

Do not use thrust reversers (if installed) if taxiways and ramps are covered with slush, ice, standing water or snow except in the interest of safety.

TAKEOFF

Refer to the WET/CONTAMINATED RUNWAY DATA for guidance material pertaining to takeoff on a wet or contaminated runway.

If anti-ice systems are required for takeoff, the systems should be energized prior to setting takeoff power.

Do not take off with frost, snow, or ice on the wings or aircraft control surfaces, including the horizontal stabilizer and elevators.

WARNING

Even ***small*** accumulations of ice on the wing leading edge can cause an increase in stall speed and, possibly, a degradation in stall characteristics.

AFTER TAKEOFF

After takeoff from a snow-covered or slush-covered runway, delay retracting landing gear to allow residual slush to be thrown or blown off. Wing-heat bleed air exits overboard through the center wing/wheel well area. If takeoff was made from a snow or slush covered runway, activation of STAB WING HEAT for approximately 10 minutes will help to melt moisture on the wheels and brakes. Monitor WING TEMP indicator for overheat condition.

BEFORE LANDING

If taxi or takeoff was made from a snow-covered or slush-covered field, it is recommended that the following procedure be used to help crack any ice between brake discs and between the brake discs and wheels:

1. After landing gear is extended, set ANTI-SKID switch to OFF.
2. Pump brakes 6 to 10 times. Use moderate to heavy braking pressure.
3. Prior to touchdown, set ANTI-SKID switch ON and check ANTI-SKID lights are out.

LANDING

Use normal landing procedures if runway is clean and dry. Refer to the WET/CONTAMINATED RUNWAY DATA for guidance material pertaining to landing on a wet or contaminated runway.

AFTER CLEARING RUNWAY

On aircraft 31-035 thru 31-054 not incorporating SB 31-32-2, moderate to heavy braking action on patchy snow or ice, avoid use of nosewheel steering above 10 knots.

CAUTION

For taxi after landing on a slush or snow covered field, it is recommended that the flaps not be retracted above 20°. This will protect flaps and wing from damage in the event ice or snow has accumulated on the flaps.

SHUTDOWN AND POSTFLIGHT

When the aircraft must be parked outside in extremely cold or fluctuating freeze/thaw temperatures, perform the following in addition to the normal shutdown and postflight procedures:

1. Chock main gear wheels before releasing park brake. Do not leave aircraft parked for extended periods in subfreezing weather with parking brake set.
2. Remove ice, snow, and dirt from landing gear shock struts and wheel wells. Check gear doors, position switches, squat switches, wheels, and tires.
3. Remove ice, snow, and dirt from flaps and flap tracks before retracting flaps.
4. If the aircraft is to be parked for an extended period at ambient temperatures of 20°F (–6.7°C) or below, it is recommended that the crew oxygen masks be stowed in a heated room or the cabin should be warmed to at least 20°F (–6.7°C) before use.
5. If the aircraft is to remain in subfreezing temperatures for an extended period, remove water and beverage containers from the aircraft. Remove toilet-tank and reservoir fluid from aircraft or add ethylene glycol base antifreeze containing antifoam agent to the flush fluid.
6. Install aircraft protective covers.
7. If the aircraft will be exposed to extremely cold temperatures for an extended period, it is recommended that the batteries be removed and stored in a warm area, if possible.

ICE DETECTION

During atmospheric conditions conducive to icing, identification of ice on aircraft surfaces may be accomplished by the following methods:

1. During daylight operations, a visual inspection of the lower corners of the windshield or the wing leading edge for ice accumulation can be made.
2. The windshield ice-detect lights will indicate ice or moisture formation on the windshield during night operations. These lights are illuminated whenever the BATTERY switches are ON and will cause red areas approximately 1 1/2 inches (38 mm) in diameter to appear on the windshield if ice or moisture is encountered. The light on the pilot’s side is located in the anti-ice airstream, and the light on the copilot’s side is

located outside the anti-ice airstream. Therefore, the copilot's light must be monitored whenever windshield heat or alcohol anti-ice systems are operating. The lights indicate ice encounters when SAT is below freezing and moisture encounters when SAT is above freezing.

3. The wing inspection light may be used to visually inspect the right wing leading edge for ice accumulation during night operations. The light is illuminated by depressing the WING INSP LT button on the copilot's dimmer switch panel. The light illuminates a black dot on the outboard wing leading edge to enhance visual detection of ice accumulation.

4. Wing structure temperature conditions where icing can occur may be identified through observing the WING TEMP indicator. When the indicator pointer is in the green band, the wing temperature is above 40°F (4°C) and is warm enough so that ice will not adhere. When the indicator pointer is in the blue band, the wing temperature is below 40°F (4°C) and the wing anti-ice system should be used if flying through visible moisture. If the indicator pointer is in the blue band and the STAB WING HEAT switch is ON, a wing heat system failure is indicated.

ANTI-ICE SYSTEMS

Anti-ice systems should be turned on prior to operation in icing conditions.

Icing conditions exist when the SAT is 5°C to -40°C and visible moisture in any form is present (such as clouds, rain, snow, sleet, ice crystals, or fog with visibility of 1 mile or less).

If icing conditions are encountered and the anti-ice systems have not been energized, turn them on prior to significant ice accumulation. Observe *AFM* recommendations for normal use of all anti-ice systems.

WARNING

Even ***small*** accumulations of ice on the wing leading edge can cause an increase in stall speed and, possibly, a degradation in stall characteristics.

The aircraft is approved for icing conditions, however, icing conditions vary widely. Therefore, as with any plane, caution should be used when operating in icing conditions.

Minimize the duration of the icing encounters as much as practical. Minimize holding in icing conditions with flaps extended. This includes requesting an altitude above or below icing conditions, if practical.

Intermittently operating with the autopilot off will allow more readily detectable changes in flight control feel.

Move center of gravity as far forward as practical. This includes transferring fuselage fuel to the wing tanks. A forward center of gravity keeps the elevator more streamlined with the horizontal stabilizer, thus providing the elevator horn more protection from icing.

Delay flap extension to a slower speed. For example, consider delaying flaps 8° until slowing to 170 KIAS instead of extending flaps at 250 KIAS. Extending flaps at a higher speed than necessary exposes the elevator horn to icing conditions.

If flight has been conducted in icing conditions, check the elevator horn after landing and remove any accumulated ice prior to next flight.

NOTE

Ensure any accumulated ice is removed from the elevator horn area prior to the next flight.

In the event of significant ice accumulation or failure of any portion of the anti-ice system, refer to Inadvertent Icing Encounter procedures in “Abnormal Procedures” chapter.

When using wing and/or nacelle anti-ice systems, maintain the higher of the following: 60% fan speed or sufficient engine power to keep the wing temperature indicator in the green band.

Aircraft anti-icing is accomplished through the use of electrically heated anti-ice systems, engine bleed-air heated anti-ice systems, and alcohol anti-ice systems. Electrically heated systems include pitot-static probes, engine inlet air-temperature/pressure sensor, stall warning vanes, total temperature probe, and horizontal stabilizer. Engine bleed air is utilized to heat the wing leading edge, windshield, and for engine anti-icing. An alcohol anti-ice system is installed for radome anti-ice and as a backup for windshield bleed-air anti-ice system.

An electrically heated windshield provides defogging of the windshield interior. The heat output of the windshield is not sufficient to prevent ice formation. Therefore, bleed-air windshield heat (WSHLD HEAT) should be turned on prior to entering icing conditions.

Systems controls and control functions are as follows:

1. **STAB WING HEAT switch—**Controls wing heat system (bleed air) and the horizontal stabilizer heat system (electric)

2. **NAC HEAT switches—**Control engine anti-icing (bleed air) and engine inlet air temperature/pressure sensor electric heaters

3. **PITOT HEAT switches—**Energize pitot-static probe, stall warning vane heaters, and total temperature probe heaters

4. **ALCOHOL switch—**Controls windshield and radome alcohol anti-ice system

5. **WSHLD HT switch—**Controls bleed air to the windshield for defog, anti-ice and rain removal.

6. **WSHLD DEFOG switch—**Controls the electrically heated windshield for defog.

7. The red ice detect lights are energized whenever the BATTERY switches are ON.

EXTERIOR WINDSHIELD DEFOG, ANTI-ICE AND RAIN REMOVAL

The WSHLD HT switch has three positions labeled WSHLD HEAT, HOLD, and OFF. In the OFF position no windshield airflow is available. In the WSHLD HEAT position, the control valve is fully open allowing maximum airflow to the windshield. The HOLD position is used to stop the control valve in any position between fully closed and fully open. If a change in airflow is desired, set switch to OFF or WSHLD HEAT until desired airflow is obtained then set switch to HOLD. The control valve will fully open or close in approximately 15 seconds. Illumination of the red WSHLD OV HT light indicates a windshield heat system failure.

To activate the system:

1. WSHLD HT Switch .... WSHLD HEAT

   The green WSHLD HT light will illuminate.

   NOTE

   The overheat shutoff valve may cycle to prevent overheating of the windshield. When the overheat shutoff valve cycles closed, the green WSHLD HT light will extinguish. The system will automatically reset (green WSHLD HT light will illuminate) after the system cools.

2. To reduce flow in the event of excessive noise or system cycling:

   WSHLD HT Switch .... OFF UNTIL FLOW IS ACCEPTABLE, THEN HOLD

If red WSHLD OV HT light illuminates:

1. WSHLD HT Switch .... OFF

Leave in OFF until red WSHLD OV HT light extinguishes, then HOLD.

To deactivate the system:

1. WSHLD HT Switch .... OFF

If airflow should fail, the pilot's windshield may be anti-iced by the following:

1. ALCOHOL Switch .... WS/RAD

   This will anti-ice the radome and pilot's windshield and give alcohol flow for approximately 45 minutes. The amber ALC LOW light will illuminate when alcohol level is low.

2. ALCOHOL Switch... OFF

   Position to OFF when alcohol is depleted or clear of icing conditions.

INTERIOR WINDSHIELD AND PASSENGER WINDOW DEFOG

Interior windshield defogging is provided by electrically heated windshield panels. Passenger windows are normally defogged by normal cabin airflow.

To provide interior windshield defogging:

1. WLSHD DEFOG Switch.. ON

   This activates the electrically heated windshield panels.

NOTE

Normal system operation is indicated by illumination of the L and R WS DEFOG lights when the system is activated (windshield temperature below 80°F). When the windshield is heated above 80°F, the WS DEFOG lights will extinguish.

On aircraft 31-191 and subsequent, for additional windshield defogging:

1. COOL Switch .... COOL
2. CREW FAN Control.. HIGHEST SETTING
3. Pilot and Copilot Overhead
   Gasper Outlets.. CLOSE

To ensure all of the air delivered from the evaporator will be directed to eyebrow outlets above the windshield

For maximum windshield defogging:

1. At start of descent, WSHLD HEAT.. ON

2. Leave CAB AIR, WSHLD DEFOG, and WSHLD HEAT.. ON UNTIL SHUTDOWN

RADOME ANTI-ICE

Anti-icing the radome prevents ice from shedding off the nose and entering the engines. Anti-icing the radome is accomplished by setting the ALCOHOL switch to RAD. Alcohol for radome anti-icing only will last for approximately 2 hours 9 minutes. The ALC LOW light will illuminate when alcohol level is low. Set ALCOHOL switch OFF when alcohol is depleted or clear of icing conditions.

NOTE

Use WS/RAD position of the switch if bleed air for the windshield anti-ice has failed or as needed.

WING ANTI-ICE

The wing anti-ice system utilizes engine bleed air directed through diffuser tubes in the leading edges for anti-icing.

Wing-heat bleed air exits overboard through the center wing/wheel well area. If takeoff was made from a snow- or slush-covered runway, activation of STAB WING HEAT for approximately 10 minutes will help to melt moisture on the wheels and brakes. Monitor WING TEMP indicator for overheat condition.

1. STAB WING HEAT Switch .... ON

2. Monitor WING TEMP indicator. Adjust power as necessary to maintain the higher of the following: 60% fan speed or sufficient engine power to keep the wing temp indicator in the green band. Also, visually monitor the right wing for any ice accumulation. At night, the wing inspection light will be required. If indicator progresses to the red band, structure is approaching “too hot” condition. Monitor the WING OV HT warning light. Corrective action can be taken by turning the STAB WING HEAT switch to OFF and/or reducing engine rpm until indicator pointer returns to the green band.

NOTE

If the system is on and the WING TEMP indicator pointer is in the blue band or either wing shows signs of ice accumulation, a system failure has occurred. Refer to Wing Heat Failure procedure in “Abnormal Procedures” chapter.

HORIZONTAL STABILIZER ANTI-ICE

The horizontal stabilizer anti-ice system utilizes sequenced electrical heating elements along the horizontal stabilizer leading edge for anti-icing. The system is controlled by the STAB WING HEAT switch. Control circuits for the system are wired through the squat switch to prevent overheating the elements when the airplane is on the ground.

1. STAB WING HEAT Switch .... ON
2. Monitor amps for an increase in load from the heating elements. A fluctuating amps reading indicates proper operation due to the sequencing of the elements.

CAUTION

For ground operation and to prevent overheating of the horizontal stabilizer heating elements, ensure that the amber STAB HEAT light is illuminated and there is no additional amps increase. If the STAB HEAT light is not illuminated and amps increase, ***immediately*** set STAB WING HEAT switch to OFF.

NOTE

During flight, if the electrical heating elements should fail, the amber STAB HEAT light on the annunciator panel will illuminate.

NACELLE HEAT

The NAC HEAT switches energize both nacelle heat and engine inlet air pressure and temperature sensor heat. The NAC HT ON light will illuminate anytime a NAC HEAT switch is set ON. Maintain 60% N_1 or above for effective anti-icing.

CAUTION

To prevent damage to the engine inlet sensor heating element, nacelle heat operation should be limited to 30 seconds if the engine is not running.

NOTE

- Illumination of the L or R NAC HT lights with the NAC HEAT switches ON indicates that bleed-air pressure is not being applied to the nacelle heat anti-ice system because of a malfunction.

- Illumination of the L or R NAC HT lights with the NAC HEAT switches OFF indicates that bleed-air pressure is being applied to the nacelle heat system because of a malfunction.

PITOT-STATIC HEAT

Anti-ice protection for pitot-static probe, stall warning vanes, and total temperature probe heater is accomplished by setting the L and R PITOT HEAT switches ON.

A dual pitot heat monitor system provides the crew with a means of determining if sufficient current is being applied to the pitot-static probe heating elements.

With the BATTERY and PITOT HEAT switches ON, illumination of the amber PITOT HT light indicates insufficient current is being applied to a pitot-static probe heating element. A failure in either system will cause the light to illuminate. The light will also illuminate whenever the BATTERY switches are ON and either PITOT HEAT switch is OFF.

ANNUNCIATOR PANEL

The annunciator panel lights may be tested by pressing the test switch under the glareshield which causes the lights to illuminate. Photoelectric cells, outboard of each ENG FIRE PULL T-Handle, automatically dim the lights to a level corresponding to existing light in the cockpit or to a minimum preset level for a totally dark cockpit. If an annunciator light illuminates and the condition is corrected, the light will extinguish. If the condition recurs, the light will again illuminate. Any time a red annunciator light illuminates, the MSTR WARN lights on the pilot's and copilot's instrument panel will also illuminate and flash. Depressing the MSTR WARN light will extinguish the MSTR WARN light; however, the annunciator light will remain on as long as the condition exits.

AUDIO CONTROL SYSTEM PANEL

The audio control system panels provide a means of controlling communications and/or navigation audio information being received or transmitted. The panel also controls audio communication within the cabin.

TRANSMIT SELECT SWITCH

The TRANSMIT SELECT switch is a multiposition rotary-type switch labeled "VHF 1," "VHF 2," "HF," and "PASS SPKR." This switch provides the proper microphone audio inputs for the respective functions.

1. **VHF 1, VHF 2, and HF positions—**When any of these positions are selected, microphone inputs are provided for the respective transceiver. Microphone must be keyed to transmit.

2. **PASS SPKR position—**When this position is selected, the pilot or copilot, utilizing this function, may speak to the passengers through the passenger speaker. Microphone must be keyed to transmit.

NOTE

PASS SPKR should not be selected on both audio control panels simultaneously as degradation of the volume level may result.

MIC SELECT SWITCH

1. **NORM position—**When the switch is in this position, voice transmissions are accomplished with the headset microphone or hand-held microphone.

2. **OXY position—**When the switch is in this position, voice transmissions are accomplished with the oxygen mask microphone. Both cockpit speakers, phone and interphone functions (see MIXER SWITCHES) will be active. The microphone must be keyed to transmit to the passengers or via a communications radio.

VOLUME CONTROLS

1. **MASTER VOL—**This control regulates the volume level of all audio output.

2. **PASS VOL—**This control regulates the volume level of the passenger speaker audio.

SPEAKER SWITCH

1. **Speaker OFF position—**When the switch is pushed in and any mixer switch is on, audio is fed to the on-side headphones only. Rotating the knob will adjust the volume level to the headphones.

2. **Speaker ON position—**When the switch is pulled out and any mixer switch is on, audio is fed to the on-side headphones and on-side cockpit speaker. Rotating the knob will adjust the volume level to the headphones and cockpit speaker. The ON (pulled) position is indicated as follows:

- ***During daylight***—A white ring on the switch stem will be exposed.

- **During darkness**—The switch will be illuminated.

MIXER SWITCHES

All mixer switches have a volume control which is rotated to regulate the volume level of individual audio inputs. The ON (pulled) position of each mixer switch is indicated as follows:

- ***During daylight***—A white ring on the switch stem will be exposed.

- ***During darkness***—The switch will be illuminated.

Mixer switches on the audio control panel are labeled and perform the following functions:

1. **VHF 1 and VHF 2 switches—**When in the ON (pulled) position, provide audio from the VHF 1 and VHF 2 transceivers, respectively.

2. **HF switch—**When in the ON (pulled) position, provides audio from HF transceiver (if installed).

3. **INPH switches—**When in the ON (pulled) position, provides audio from the interphone, employs a voice-activated hot microphone.

4. **NAV 1 and NAV 2 switches—**When in the ON (pulled) position, provide audio from the NAV 1 and NAV 2 receivers, respectively.

5. **ADF 1 and ADF 2 switches—**When in the ON (pulled) position, provide audio from the ADF 1 and ADF 2 receivers, respectively.

6. **MKR 1 and MKR 2 switches—**When in the ON (pulled) position, provide "marker" audio from the MKR 1 and MKR 2 receivers, respectively.

7. **DME 1 and DME 2 switches—**When in the ON (pulled) position, provide audio identification signals from the DME 1 and DME 2 receivers. DME 1 switch controls audio for the DME channel tuned by the NAV 1 receiver and DME 2 switch controls audio for the DME channel tuned by the NAV 2 receiver.

BOTH/VOICE/IDENT SWITCH

This switch controls the audio ***filtering*** for the NAV and ADF receivers.

1. **BOTH position—**When the switch is in this position, both the station identifier and voice transmissions will be heard. The BOTH position is the normal position.

2. **VOICE position—**When the switch is in this position, only voice transmissions will be heard.

3. **IDENT position—**When the switch is in this position, only the station identifier will be heard.

MKR HI/LO SWITCH

1. **HI position—**When the switch is in this position, the marker beacon receiver sensitivity is increased.

2. **LO position—**When the switch is in this position, the marker beacon receiver sensitivity is decreased.

AUDIO CONTROL—FLIGHT OPERATION

1. **MASTER VOL control—**Rotate to a comfortable listening level.

2. **Applicable Mixer switches—**Pull "on" and adjust audio gain controls on each system for comfortable volume level.

NOTE

The VHF 1 and VHF 2 volume controls do not affect sidetone levels. The HF volume control will affect the sidetone level on most models since audio and sidetone utilize a common line from the transceivers. Some HF transceivers do not have sidetone capabilities.

3. **TRANSMIT SELECT switch—**Rotate to desired position.

AUTOPILOT/FLIGHT DIRECTOR SYSTEM

A Bendix/King KFC 3100 Flight Control System is installed to provide automatic flight control and guidance for climb, cruise, descent, and approach. The system's dual flight computers provide separate pilot and copilot flight directors, and either computer can be coupled to the autopilot. Mode selection and annunciation for each flight director and engage controls for autopilot and yaw damper are provided through the glareshield-mounted autopilot controller. Mode and system status annunciation is also provided on the appropriate EFIS displays.

Refer to *Bendix/King KFC 3100 Flight Control System Pilot's Guide* (No. 006-08486-0000) for a detailed description and operation of the autopilot/flight director system.

SELF-TEST

The system initiates a self-test sequence when the system is powered up (both AC and DC power). If the self-test sequence is not successfully completed, a failure will be displayed on the mode controller and the autopilot will not engage. Also, an “FD” flag will be displayed on the EADI.

TO ENGAGE AUTOPILOT

1. XFR Button ....SELECT DESIRED FLIGHT GUIDANCE COMPUTER (LEFT OR RIGHT)

2. AP Button ....DEPRESS

   A green AP light will illuminate and an appropriate annunciation will appear on the flight displays. The yaw damper will also engage if not already engaged.

NOTE

- The autopilot will not engage if:
  1. The PITCH TRIM selector switch is in the OFF position.
  2. A red “PT” annunciator on the autopilot controller is illuminated.
- Upon engagement, if no modes are selected, the autopilot will automatically assume the attitude hold mode and maintain the attitude existing at the time of engagement.

TO DISENGAGE AUTOPILOT

- Depressing the AP button will disengage the pitch and roll axes.
- Either Control Wheel Trim switch (arming button depressed) moved in any of four directions (NOSE UP, NOSE DN, LWD, or RWD) will disengage the pitch and roll axes.
- Either Control Wheel Master switch (MSW), when depressed, will disengage the pitch and roll axes, and the yaw damper.
- PITCH TRIM selector switch, when moved to OFF position, will disengage the pitch and roll axes.
- Moving the pedestal NOSE DN-OFF-NOSE UP switch to NOSE UP or NOSE DN will disengage the pitch and roll axes.
- Depressing the GO-AROUND button (left thrust lever knob) will disengage the pitch and roll axes and select flight director go-around mode.

- Depressing the XFR button will disengage the pitch and roll axes.

NOTE

Whenever the autopilot disengages, the autopilot disengage tone will sound.

TO ENGAGE YAW DAMPER

- Yaw damper will automatically engage each time the autopilot is engaged.
- If the yaw damper is not engaged, depressing the YD button will engage the yaw damper.

TO DISENGAGE YAW DAMPER

- If yaw damper is engaged, depressing the YD button will disengage the yaw damper.
- Depressing either Control Wheel Master switch will disengage the yaw damper.

AUTOPILOT/FLIGHT DIRECTOR MODE SELECTION

Autopilot and flight director modes are selected by depressing the applicable mode selector button on the autopilot controller. Flight director only mode selection is accomplished by depressing the applicable mode selector button without the autopilot engaged. Engaged autopilot and flight director modes may be disengaged by depressing the selector button a second time or selecting an incompatible mode. Autopilot/flight director mode engagement is also annunciated on the associated EFIS displays.

CONTROL WHEEL SWITCHES

CONTROL WHEEL MASTER SWITCH (MSW)

Depressing the Control Wheel Master switch (MSW) on the outboard horn of either control wheel will disengage the autopilot pitch and roll axes and the yaw damper.

CONTROL WHEEL TRIM SWITCHES (VERTICAL AND LATERAL COMMAND)

When either Control Wheel Trim switch (arming button depressed) is moved to any of the four positions (LWD, RWD, NOSE UP, or NOSE DN), an aircraft trim input is made and the autopilot will disengage. If the arming button is not depressed, the switch may be used to input lateral commands (LWD and RWD) and vertical commands (NOSE UP and NOSE DN) to the autopilot/flight director. Refer to the *Bendix/King KFC 3100 Flight Control System Pilot's Guide* for a detailed explanation of the Control Wheel Trim switch functions.

FD CLEAR SWITCH

Depressing the FD CLEAR switch will stow the on-side flight director command bars during flight director only operation. The FD CLEAR switch has no affect if the autopilot is coupled.

CWS SWITCH

Depressing the CWS (Control Wheel Steering) switch decouples autopilot servo clutches (if engaged) and synchronizes the on-side flight director command bars with the current vertical and lateral modes. Manual pitch, roll, and trim commands can be made while the switch is depressed. Selected roll and pitch modes will not disengage when the switch is depressed. When the switch is released, the autopilot servo clutches reengage and the flight director commands attitudes to maintain the current values set in the engaged modes. If the flight director is not engaged, depressing the CWS switch will activate the flight director Attitude Hold mode.

GO-AROUND SWITCH

Depressing the GO-AROUND switch in the left thrust lever knob will disengage the autopilot and select flight director GA mode on both flight directors.

AUTOPILOT RESET

An autopilot reset function is provided to reset the autopilot in the event it disengages and cannot be reengaged.

WARNING

Do not reset the autopilot during taxi, takeoff or landing because of momentary servo engagement.

To Reset Autopilot:

1. SYSTEM TEST Selector switch........................ ROTATE TO A/P RESET

2. TEST Button .... DEPRESS AND RELEASE

NOTE

On the ground, both autopilots will test. In flight, the selected autopilot will test; however, the servos will not engage.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM

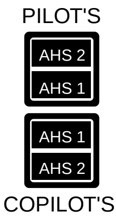
The electronic flight instruments system is a Bendix / King 5-tube EFS 50. The EFIS consists of an EADI and EHSI on both pilot's and copilot's instrument panels, a multifunction display (MFD) on the center instrument panel, three symbol generators and control panels to operate the EADI's, EHSI's and MFD.

The EFIS is used to display airplane attitude data , navigational data, flight director commands, mode annunciators, weather, checklists, warnings and diagnostic messages.

Refer to *Bendix/King EFS 50 Electronic Flight Instrumentation System Pilot's Guide* (No. 006-08485-0000) for a detailed description and operation of the EFIS system.

EFIS CONTROL PANEL

An EFIS control panel is installed on both the pilot's and copilot's instrument panel. Each panel controls its respective EFIS. Each switch is an alternate action switch. On-side selection is indicated by a green annunciation and cross-side or reversionary mode selection is indicated by an amber annunciation. The EFIS system will power up in the normal, non-reversionary mode.

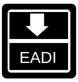


This switch selects the attitude heading system for the respective EFIS display, autopilot and other systems requiring attitude or heading data. The switch is used to recover attitude and heading data if the on-side AHS fails.

Whenever cross-side AHS data is selected, the pitch, roll, and heading comparators will be disabled, and all equipment normally sourced by the on-side AHS will be sourced by the cross-side AHS. Standby HSI heading data and weather radar antenna stabilization functions are provided by AHS 2 and cannot be assumed by AHS 1.

This switch selects the air data system for the respective air data displays, EFIS display, autopilot and other systems requiring air data. The switch is used to recover air data if the on-side ADC fails.

This reversionary mode selection switch is used to combine the EADI and EHSI display on the upper or lower EFIS tube. This would be used if an EADI or EHSI tube fails and is not desired to use the reversionary EADI down selection.



This reversionary mode selection switch is used to move the EADI display down to the EHSI display. On the pilot's side, the EHSI will move over to the MFD. This switch is used to display an EADI if an upper EFIS tube fails. On the copilot's side, use of the EADI down mode may only be used in conjunction with the composite mode.

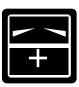
PILOT'S

This switch selects the symbol generator (either the on-side SG or SG 3) for the respective EFIS display. This switch is used to recover EADI and EHSI displays if the on-side symbol generator fails.

COPILOT'S

If SG 3 is selected on both the pilot's and copilot's side, the copilot's displays will repeat the pilot's displays including pilot's flight director commands. The pilot's EFIS controls will control both sides. The copilot's EFIS controls will be disabled. The copilot's autopilot should not be used since the operational modes will not be displayed on the copilot's EFIS.

For dispatch, the pilot's and copilot's EFIS displays must be sourced by two separate symbol generators.



This switch is used to select either single-cue (V-bar or double-cue cross pointer) format on the flight director.

AVIONICS MASTER SWITCH

Two Avionics Master switches are installed which allow the crew to turn certain avionics equipment off and on without using the individual system's switches. The LEFT MASTER switch is installed on the pilot's switch panel and the RIGHT MASTER switch is installed on the copilot's switch panel.

The equipment controlled by the avionics master switches is shown in the following list:

LEFT MASTER	RIGHT MASTER
	VHF COMM 2
VHF NAV 1	VHF NAV 2
MARKER BEACON 1	MARKER BEACON 2
DME 1	DME 2 (IF INSTALLED)
ATC TRANSPONDER 1	ATC TRANSPONDER 2 (IF INSTALLED)
ADF 1	ADF 2 (IF INSTALLED)
HF 1 (IF INSTALLED)	HF 2 (IF INSTALLED)
PILOT'S EADI	COPILOT'S EADI
PILOT'S EHSI	COPILOT'S EHSI
RADIO ALTIMETER	RADIO ALTIMETER 2 (IF INSTALLED)
MFD	RADAR

NOTE

VHF COMM 1 is not controlled by the Avionics Master switches.

STANDBY HSI

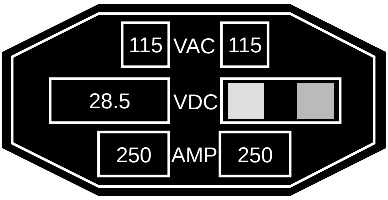
The standby HSI provides the pilot with an additional indicator to display the following data:

- Compass Heading (AHS 2)
- VOR 1 Bearing Pointer
- ADF 1 Bearing Pointer
- VOR 1 Course Deviation
- LOC 1 Course Deviation
- Glide-Slope Deviation

Pilot's controls consist of an HSI/RMI selector switch and course select knob. In the RMI mode, VOR 1 bearing pointer and ADF 1 bearing pointer are provided. In the HSI mode, VOR/LOC 1 course deviation and ADF 1 bearing pointer are provided. In both modes, heading data from AHS 2 is presented. Failure flags will drop into view if the associated data is invalid.The ADF bearing pointer will park at the 3:00 o'clock position with the loss of the ADF signal. With the loss of ADF receiver or DC power, the pointer will park at either the 1:30 o'clock position or its last position.

ELECTRIC POWER MONITOR

An electric power monitor is installed which monitors left and right AC bus voltage, left and right DC generator load and the DC charging bus voltage. Digital displays are used for voltage and amperage readouts.



Each parameter being monitored is divided into ranges as follows:

- Normal
- Caution
- Warning

Whenever any parameter goes from the normal range to the caution range, the indicator's amber light and affected parameter will flash. If the parameter progresses into the warning range, the indicator's red light and affected parameter will flash. The amber ELEC PWR light (annunciator panel) will illuminate (steady or flashing) anytime an amber or red light on the indicator is illuminated (steady or flashing). Whenever any parameter goes into the warning range, the MSTR WARN lights will flash. Depressing the amber or red light, as applicable, will cause the lights and displays to stop flashing. Depressing either MSTR WARN light will cancel the flashing of red warnings, the affected parameter and the amber ELEC PWR light. The amber or red light will remain illuminated (steady) until the affected parameter returns to normal range.

A malfunction which affects the accuracy of the indicator will cause EE.E to be displayed in the VDC readout and dashes ”-” in all other readouts.

Whenever the left and right inverters are out-of-phase, a “C” will flash in the least significant digit of each VAC display.

Caution and warning annunciations are inhibited during starter engagement.

ENGINE SYNCHRONIZER

The engine synchronizer consists of the R ENG indicator, two ENG SYNC switches below the thrust levers, an amber ENG SYNC light on the glareshield annunciator panel, and an engine synchronizer control box. During flight, the engine synchronizer, if selected, will maintain the right engine Fan Speed (N_1) or Turbine Speed (N_2) in sync with left engine Fan Speed (N_1) or Turbine Speed (N_2). The engine synchronizer must not be used during takeoff, landing or during single-engine operations.

The amber ENG SYNC light will be illuminated whenever the nose gear is down and the ENG SYNC SYNC–OFF switch is in the SYNC position.

The R ENG indicator provides an indication of right engine synchronization with left engine Fan (N_1) or Turbine (N_2) speed. The indicator indicates fan sync when the ENG SYNC selector switch is in the FAN position and turbine sync when the selector switch is in the TURB position. The indicator can be used to manually synchronize the engine or to monitor operation of the automatic synchronizer. The indicator is operative whenever the right fuel computer is ON and operative.

Automatic engine synchronization can be utilized whenever both fuel computers are ON and operating and the ENG SYNC SYNC–OFF switch is set to SYNC. Since the engine synchronizer authority is limited, the operator should manually synchronize the desired parameter (N_1 or N_2) within approximately 2.5% before selecting SYNC.

CABIN TEMPERATURE CONTROL

Cabin air is provided by cooling engine bleed air in a ram-air heat exchanger. Primary heating and cooling is obtained by controlling the amount of warm air that goes through the heat exchanger.

CABIN AIR LIGHT ***(Aircraft 31-240 and subsequent and prior aircraft modified by SB 31-31-5).***

A white CABIN AIR advisory light, located in the glareshield annunciator panel, indicates that any of the following switches are in the off position, L or R BLEED AIR or CAB AIR.

BLEED-AIR HEATING AND COOLING

1. BLEED AIR Switches .... ON

2. CAB AIR Switch .... ON

NOTE

With the aircraft sitting statically on the ground, do not perform extended engine operation above IDLE with CAB AIR switch ON. There is no ram-airflow through the heat exchanger and possible damage to air-conditioning components may occur.

3. AUTO–MAN Switch .... AUTO

4. COLD–HOT Knob .... ROTATE

   Rotate to desired cabin temperature. In flight, the cabin temperature control system will automatically maintain the cabin at the desired temperature.

5. If satisfactory cabin temperature is not maintained:

   a. AUTO–MAN Switch .... MAN

   b. COLD–HOT Knob .... ROTATE TO DESIRED SETTING

ADDITIONAL COOLING OR TO DECREASE CABIN HUMIDITY

NOTE

Power for the cooling system must be supplied by an engine generator or GPU.

1. COOL Switch .... COOL

2. • *On aircraft 31-035 through 31-190,*
CREW and CABIN FAN Controls .... AS DESIRED

NOTE

- If the overhead air outlets are closed, the cockpit blower must be turned off to prevent overheating of fan motor.

- *On aircraft with an optional forward evaporator and blower unit:*

  1. CABIN FAN Control:

     a. CABIN FAN control in the off detent—Cabin fan will operate on high speed and the airflow will be diverted above the headliner.

     b. CABIN FAN control in any position but the OFF detent—Cabin fan speed will vary with the position of the control and the airflow will be directed straight forward from the aft evaporator and blower unit.

  2. CREW FAN Control:

     a. CREW FAN control in the off detent—Cockpit fan (forward evaporator and blower unit) will operate on low speed and cockpit fan (aft evaporator and blower units) will be off.

     b. CREW FAN control in any position but the OFF detent—Cockpit fan speed (both forward and aft evaporator and blower units) will vary with the position of the control.

• *On aircraft 31-191 and subsequent,*
CREW FAN, GASPER FAN and
FLOOD FAN Controls... AS DESIRED

NOTE

If all of the cabin gasper vents are closed, the GASPER FAN must be turned off to prevent overheating of fan motor.

1. GASPER FAN Control:

    a. GASPER FAN control in the off detent—Cabin fan will operate on low speed.

    b. GASPER FAN control in any position but the OFF detent—Cabin fan speed will vary with the position of the control.

2. FLOOD FAN Control:

    a. FLOOD FAN control in the off detent—Flood fan will not operate.

    b. FLOOD FAN control in any position but the OFF detent—Flood fan speed will vary with the position of the control.

    c. Flood fan will only operate with the COOL Switch in COOL position.

3. CREW FAN Control:

    a. CREW FAN control in the off detent—Crew fan will operate on low speed.

    b. CREW FAN control in any position but the OFF detent—Crew fan speed will vary with the position of the control.

ADDITIONAL HEATING

NOTE

Power for the auxiliary heater must be supplied by an engine generator or GPU.

Cockpit

1. AUX/HT Switch.. CREW

CAUTION

To prevent damage to the heater element, CAB AIR must be ON and airflow available before activating the cockpit heater. *On aircraft 31-046 and subsequent,* the cockpit heater will not activate unless an engine is running and bleed air from that engine is available to the RH distribution duct.

Cabin

1. Cabin Blower Switch (on blower duct in aft cabin) (if applicable) .... SET ON
2. AUX HT Switch .... CAB & CREW

ADDITIONAL AIR CIRCULATION

1. For additional cabin air circulation,
   On aircraft 31-035 through 31-190,
   CABIN FAN Control.. AS DESIRED

   On aircraft 31-191 and subsequent,
   GASPER FAN Control.. AS DESIRED

NOTE

On aircraft 31-191 and subsequent, if all of the cabin gasper vents are closed, the GASPER FAN must be turned off to prevent overheating of fan motor.

2. For additional cockpit air circulation,
   CREW FAN Control... AS DESIRED

NOTE

On aircraft 31-035 through 31-190, if all the overhead air outlets are closed, the CREW FAN must be turned off to prevent overheating of fan motor.

OXYGEN SYSTEM

WARNING

Smoking is prohibited while oxygen system is in use.

OXYGEN DURATION

Figures AP-2 and AP-3 in the Abnormal Procedures chapter show oxygen supply duration of a fully charged system as a function of cabin altitude and number of occupants using the system. Passenger durations above 30,000 feet cabin altitude are provided for information only. Prior to extended overwater flights, plan oxygen requirements to provide sufficient oxygen for all occupants in the event of a pressurization failure. Additional oxygen may be required to assure that both oxygen duration and range (fuel) requirements are satisfied.

PASSENGER OXYGEN

WARNING

- Passenger oxygen masks are intended for use during an emergency descent to an altitude not requiring supplemental oxygen.
- Passenger masks will not provide sufficient oxygen for prolonged operation above 34,000 feet cabin altitude. Prolonged operation above 25,000 feet cabin altitude with passengers on board is not recommended.

1. With the PASSENGER OXYGEN valve in the OFF position no oxygen is supplied to the cabin.
2. With the PASSENGER OXYGEN valve in the AUTO position, the passenger oxygen masks will drop from their storage compartments if the cabin altitude reaches 14,000 (±750) feet. Whenever the oxygen masks deploy, the upper center panel lights will illuminate to provide maximum visibility for donning masks. The passengers must don the masks and pull the attached lanyards to start the flow of oxygen.

NOTE

If Generator and Battery switches are OFF, automatic presentation of masks will not occur. In this event, turn PASSENGER OXYGEN valve to DEPLOY if passenger oxygen is required.

3. With the PASSENGER OXYGEN valve in the DEPLOY position, the passenger oxygen masks will drop. The passengers must don the masks and pull the attached lanyards to start the flow of oxygen. This should be used if the automatic presentation of the masks does not occur.

4. Deploy passenger oxygen, if pressurization irregularities are encountered above 10,000 feet.

NOTE

The rebreather bag will not inflate even though oxygen is flowing. This is normal.

CREW OXYGEN

1. If oxygen is required by the crew only:

   PASSENGER OXYGEN Valve .... OFF

2. When oxygen masks are worn by the crew:

   MIC SELECT Switch .... OXY

   When set to OXY, the interphone function of the audio control system will be active allowing communication between crew members.

3. Crew Oxygen Masks:

   • *Operate 6600214 series masks as follows:*

   a. With NORM selected on the pressure regulator control, the crew mask will deliver automatic oxygen dilution from SL to 33,000 feet cabin altitude and 100% oxygen above 33,000 feet cabin altitude. Automatic positive pressure breathing is provided above 39,000 feet cabin altitude.

   b. To obtain 100% oxygen at any time, select 100% on the pressure regulator control.

   c. For emergency operation, select EMER on the Pressure Regulator control. With the regulator control in this position, the crew mask will deliver 100% oxygen, maintain a slight positive pressure in the mask cup at all times for respiratory protection from smoke or fumes, and automatic positive pressure breathing above 39,000 feet cabin altitude.

• *Operate Scott ATO MC 10-15-01 masks as follows:*

a. To check for oxygen availability to the mask while stowed, depress the PRESS TO TEST button/knob on the bottom of mask pressure regulator—oxygen will flow while the button is held.

b. To don crew oxygen masks:

(1) Remove hats and “ear muff” type headsets.

NOTE

Headsets and eyeglasses worn by crewmembers may interfere with quick-donning capabilities.

(2) Squeeze and hold the red handles on the mask pressure regulator together to inflate the pneumatic harness for donning.

(3) Position harness over the head, position mask as desired, then release red handles.

(4) Ensure that mask is properly sealed. Reposition mask if required.

NOTE

Beards worn by crewmembers may make proper sealing of the mask more difficult.

c. With the 100% lever extended and the PRESS TO TEST button/knob rotated to the ⯊ position, the mask will deliver automatic oxygen dilution from SL to 30,000 feet cabin altitude, 100% oxygen above 30,000 feet cabin altitude and automatic pressure breathing above approximately 37,000 feet cabin altitude.

d. To obtain 100% oxygen at any time, depress 100% lever on mask pressure regulator.

e. For emergency operation, select EMERGENCY (rotate PRESS TO TEST button/knob to ●). With the mask pressure regulator controls in this position the crew mask will deliver 100% oxygen at all cabin altitudes and maintain a positive pressure in the mask cup at all times for respiratory protection from smoke or fumes.

• *Operate Puritan Bennet Seep-on 2000 masks as follows:*

a. An inline pressure detector will show green when oxygen pressure is available to the mask.

b. To don crew oxygen masks:

(1) Remove hats and "ear muff" type headsets.

NOTE

Headsets and eyeglasses worn by crewmembers may interfere with quick-donning capabilities.

(2) Remove mask from stowage box.

(3) Squeeze and hold the red handles on the mask pressure regulator together to inflate the pneumatic harness for donning.

(4) Position harness over the head, position mask as desired, then release red handles.

(5) Ensure that mask is properly sealed. Reposition mask if required.

NOTE

Beards worn by crewmembers may make proper sealing of the mask more difficult.

c. With the the regulator set to NORM, the mask will deliver automatic oxygen dilution from SL to 33,000 feet cabin altitude, 100% oxygen above 33,000 feet cabin altitude and automatic pressure breathing above approximately 39,000 feet cabin altitude.

d. To obtain 100% oxygen at any time, rotate the regulator knob to 100%.

e. For emergency operation, rotate the regulator knob to EMER. With the mask pressure regulator knob in this position the crew mask will deliver 100% oxygen at all cabin altitudes and maintain a positive pressure in the mask cup at all times for respiratory protection from smoke or fumes.

PRESSURIZATION SYSTEM OPERATION

NOTE

For Automatic Mode operation, refer to BEFORE STARTING ENGINES, BEFORE TAKEOFF, AFTER TAKEOFF and DESCENT procedures in this section.

MANUAL MODE OPERATION

1. AUTO–MAN switch .... MAN

2. UP–DN Manual control (red) .... AS REQUIRED TO MAINTAIN SATISFACTORY PRESSURIZATION

3. To return to automatic operation, proceed as follows:

NOTE

If cabin altitude should increase to 8,750 (±250) feet or above, the automatic pressurization mode is deactivated and the amber CAB ALT light will illuminate. Automatic mode operation will not be available until the cabin altitude is decreased to extinguish the CAB ALT light.

a. CABIN CONTROLLER .... SET AT OR BELOW 7,200 FT

b. UP–DN Manual control (red).......... CONTROL TO ALTITUDE SELECTED ON CABIN CONTROLLER

c. AUTO–MAN switch .... AUTO

d. CABIN CONTROLLER.......... RESET (IF REQUIRED)

Reset to appropriate cabin altitude for flight altitude.

LANDING AT FIELD ELEVATION ABOVE 8,500 FEET

Descent

1. EMER PRESS switches .... OVERRIDE

2. AUTO–MAN switch .... MAN

3. UP–DN Manual control (red) .... UP TO DESTINATION FIELD ELEVATION

NOTE

- After landing, leave EMER PRESS switches in OVERRIDE position. If the switches are set to

NORMAL above approximately 9,500 feet, emergency pressurization will activate. In the event of inadvertent activation of emergency airflow, the system may be reset as follows:

a. EMER PRESS switches .... OVERRIDE

b. Both BLEED AIR switches................ OFF THEN ON

- Applicable operating rules, pertaining to the use of oxygen at high cabin altitude, must be observed.

TAKEOFF AT FIELD ELEVATION ABOVE 8,500 FEET

Before Starting Engines

1. EMER PRESS Switches.. OVERRIDE
2. BLEED AIR Switches .... ON
3. CAB AIR Switch.. OFF
4. AUTO–MAN Switch .... MAN

NOTE

- Applicable operating rules, pertaining to the use of oxygen at high cabin altitude, must be observed.
- At field elevations above 8,750 (±250) feet, the automatic pressurization mode will be deactivated and the CAB ALT light will be illuminated.

5. CABIN CONTROLLER.. SELECT CRUISING ALTITUDE OR DESIRED CABIN ALTITUDE

Taxi

1. CAB AIR Switch .... ON

After Takeoff

1. UP–DN Manual control (red) .... DN

   Position DN to obtain cabin altitude selected on CABIN CONTROLLER.

2. AUTO–MAN Switch .... AUTO

NOTE

The pressurization system cannot be reset to automatic mode until the CAB ALT light is extinguished.

3. EMER PRESS Switches .... NORMAL

FUEL MANAGEMENT

For aircraft range calculations, use TOTAL fuel quantity indications. Do not use individual tank fuel quantity readings because, when summed, these gage readings will be less accurate than the TOTAL gage reading. The accuracy of the individual readings is adequate for the fuel management procedures (crossflow and transfer) presented in this section. Each individual tank and the TOTAL indication reads zero when its unusable fuel quantity is reached. The accuracy of all fuel quantity readings will be enhanced when taken with the aircraft in wings level, unaccelerated cruise flight.

The amber LOW FUEL light on the glareshield annunciator panel will illuminate when the fuel level in either wing tank is approximately 350 pounds. If the FUS TANK XFR–FILL switch is in the FILL position when the LOW FUEL light illuminates, the switch will revert to the OFF position and fuselage fill will stop.

The FUEL XFLO light on the glareshield will be illuminated whenever the crossflow valve is open. The crossflow valve will be open during wing-to-wing transfer, wing-to-fuselage transfer, or fuselage-to-wing transfer.

Steady illumination of any of the amber fuel system valve lights on the fuel control panel indicates the corresponding valves are not in the position selected or a loss of power. Momentary illumination while the corresponding valve is in transit after switching modes indicates proper operation.

On aircraft 31-037 & subsequent and prior aircraft incorporating SB 31-28-7, illumination of either white light, adjacent to the standby pump switches, indicates power is applied to the corresponding standby pump (regardless of switch position). It is normal for the lights to illuminate during starter-assisted starts, fuselage tank FILL operations and whenever the STANDBY PUMP switch is ON.

The fuel control panel on the pedestal contains all the necessary switches and indicators to fuel the aircraft and maintain proper fuel management.

NOTE

The FUS TANK XFR–FILL switch utilizes a timed magnetic latch in the FILL position. The switch must be held to FILL for a minimum of 3 seconds before the latch will engage.

FUSELAGE TANK-TO-WING FUEL TRANSFER

Fuel may be transferred from the fuselage tank to the wings by either of the methods described below. However, fuel transfer pump operation may be minimized by selecting gravity transfer after cruise attitude has been established. If gravity transfer is selected, normal transfer should be selected when the wing fuel quantity starts to decrease.

Normal Transfer Procedure

1. FUS TANK
   XFR–FILL switch.. XFR

   Set to XFR when wing tank fuel quantity indicates 1,200 pounds or less in each tank. When XFR is selected, the standby pumps will be deenergized, the crossflow valve will open, the left fuselage fuel transfer valve will open, and the transfer pump will be energized. If the green L or R WING FULL light illuminates, the left fuselage transfer valve will close and the transfer pump will shut off until the WING FULL light extinguishes.

2. FUS TANK
   XFR–FILL switch... OFF

   Position to OFF when FUS TANK EMPTY light illuminates.

NOTE

Some fuel may remain in the fuselage tank after the FUS TANK EMPTY light illuminates. This fuel can be transferred to the wings by cycling the XFR–FILL switch to XFR several times.

Gravity Transfer Procedure

1. FUS TANK
   XFR–FILL switch... OFF

2. FUS TANK
   GRAV XFR switch.. OPEN

When OPEN is selected, the standby pumps will be deenergized, the crossflow valve will open, and both transfer valves will open. Fuel will gravity flow from the fuselage tank until the wing tanks are full or the fuselage and wing tank heads are equal. When using gravity transfer, 150 to 300 pounds (depending upon flight attitude) of fuselage fuel will be unusable.

3. FUS TANK
GRAV XFR switch .... CLOSE

Position switch to CLOSE when gravity transfer is complete or prior to approach.

NOTE

- Gravity transfer may be used after cruise is established to minimize transfer pump operation. When the wing fuel quantity starts to decrease, use NORMAL TRANSFER PROCEDURE to transfer remaining fuselage fuel.

- When flying in extreme nose-up attitude for extended periods, fuel may gravity flow from the wing tanks to the fuselage tank. Periodically transfer fuel back into wings.

WING-TO-FUSELAGE TANK FUEL TRANSFER

To transfer fuel from the wing to the fuselage tank, the following procedure may be used:

1. FUS TANK
XFR–FILL switch.. HOLD TO FILL
UNTIL SWITCH LATCHES
(3 SECONDS MINIMUM)

When FILL is selected, both standby pumps will be energized, both transfer valves will open, and the crossflow valve will open. Fuel will be transferred from the wing tanks to the fuselage tank until:

a. Green FUS TANK FULL light comes on, causing the standby pumps to deenergized, and both transfer valves to close. When the XFR–FILL switch is positioned to OFF, the FULL light will go out and the crossflow valve will close.

b. LOW FUEL light comes on, causing the FUS TANK XFR–FILL switch to move to the OFF position. Transfer can be restarted with the LOW FUEL light on, if required.

c. The aircraft lifts off causing the FUS TANK XFR–FILL switch to move to the OFF position. Transfer can be restarted after liftoff, if required.

2. FUS TANK
   XFR–FILL switch .... OFF

   Position to OFF when desired fuselage fuel quantity is reached. Check that fuel transfer and crossflow valves close.

FUEL CROSSFLOW (WING-TO-WING FUEL TRANSFER)

NOTE

Do not crossflow with main jet pump(s) inoperative. Engine starvation may occur due to fuel being pumped through open crossflow valve into opposite wing.

1. CROSSFLOW Switch .... OPEN
2. STANDBY PUMP
   Switch (heavy wing) .... ON
3. STANDBY PUMP
   Switch (light wing) .... OFF
4. CROSSFLOW Switch .... CLOSE AFTER FUEL BALANCE IS OBTAINED
5. STANDBY PUMP Switches .... OFF
6. If the preceding procedure fails to balance fuel, unequal power settings may be used to balance fuel load.

OPERATION WITH COLD WING FUEL

Operation on wing fuel exposed to indicated Total Air Temperatures (TAT) below the freeze-points shown below for 30 minutes or more may result in a reduction of usable fuel due to fuel freezing.

Fuel Type	**Maximum Freeze-Point (TAT)**
JET-A	–40°C
JP-5	–46°C
JET-A1	–50°C
JP-8	–50°C

To minimize fuel freezing at TATs below these values, transfer the warmer fuel from the fuselage tank to maintain approximately 800 pounds of fuel in each wing tank.

REFUELING

The airplane may be refueled through a filler on the top of each wing tank or through the single-point pressure filler (if installed) below the right engine. Usable fuel using either refuel procedure is given with the applicable procedure. Refer to *Addendum I—FUEL SERVICING* for refuel procedures.

On aircraft not equipped with fuel heaters, to prevent fuel filter icing and possible engine flameout, anti-icing additive must be blended with the fuel in the concentration specified in FUEL LIMITS, Section I of the *AFM*.

The engine fuel computers must be adjusted to the recommended specific gravity position as specified in FUEL LIMITS, Section I of the *AFM*. Refer to *Addendum I—FUEL SERVICING* for adjustment procedures.

BRAKE SYSTEMS

The primary brake system utilizes hydraulic system pressure for power boost and incorporates an anti-skid system to prevent tire skid and/or tire blow-out during landing or aborted takeoff. The brakes are operated by depressing the upper portion of the rudder pedals.

NOTE

Large temperature differences between wheels after landing may indicate improper brake operation.

A parking brake is installed. The parking brake is operated by depressing and holding the toe brakes (hydraulic system pressurized) and then pulling the PARKING BRAKE handle (pedestal) to set the brakes. Whenever the PARKING BRAKE handle is not fully in, the amber PARK BRAKE light will be illuminated.

An emergency air braking system is installed to provide emergency braking in the event of a hydraulic system failure. Refer to EMERGENCY PROCEDURES (Section III of the *AFM*) for emergency braking procedures.

NORMAL BRAKING

Anti-skid On Operation

1. ANTI-SKID Switch .... ON

   Check ANTI-SKID lights extinguished.

NOTE

If, during approach, an ANTI-SKID light or lights remain illuminated after the landing gear is lowered, setting the ANTI-SKID switch to OFF, then back to ON, should clear the system.

2. Apply brakes as required. Maximum braking pressures can be maintained when anti-skid is operative.

NOTE

The takeoff and landing distances with anti-skid ON, presented in Section V of the *AFM*, are based on full anti-skid braking from first brake application to complete stop.

Anti-skid Off Operation

When anti-skid is inoperative, care must be used during brake application and stopping distances will be increased. Refer to Section IV of the *AFM* for operation of the brake system with anti-skid off, and Section V for increased stopping distances for takeoff and landing.

EMERGENCY BRAKING

In the event of a normal brake system failure, emergency (pneumatic) brakes can be used to stop the airplane. Refer to Section III of the *AFM* for operation of the emergency brake system.

LANDING GEAR WARNING SYSTEM

The landing gear warning horn only will sound under the following conditions:

- Landing gear is not extended.
- Flaps are lowered beyond 25°.

NOTE

When the horn sounds because the flaps are lowered, the horn cannot be silenced by the mute switches.

The landing gear warning horn will sound and the three red UNSAFE lights will illuminate under the following conditions:

- Landing gear is not extended.
- Altitude is below 14,500 feet.
- Airspeed is below 170 KIAS.
- At least one thrust lever is below 55–60% N_1.

NOTE

When the horn sounds under these conditions, the horn can be silenced by moving the LANDING GEAR–MUTE switch to MUTE or depressing the GEAR MUTE button in the right thrust lever handle. The UNSAFE light indication will continue until either the gear is lowered or one of the above conditions is corrected.

REDUCED VERTICAL SEPARATION MINIMUMS (RVSM)

(Aircraft 31-213, 31-222 & Subsequent and prior aircraft modified by SB 31-34-11)

This aircraft has been shown to meet the airworthiness requirements for operation in Reduced Vertical Separation Minimum (RVSM) airspace between 29,000 and 41,000 feet inclusive. This does not constitute an operational approval.

BEFORE STARTING ENGINES

1. Altimeters — Set pilot, copilot and standby. Verify the pilot’s and copilot’s altimeters agree within 75 feet of the local field elevation.

CRUISE

Check pilot’s (ADC1) and copilot’s (ADC 2) altimeter agree within 150 feet.

The autopilot Altitude Hold (ALT HOLD) mode should be operative and engaged during level cruise except when circumstances such as the need to retrim the aircraft or turbulence require disengagement. If autopilot is coupled to the pilot’s flight director, select transponder 1 as the active transponder. If autopilot is coupled to the copilot’s flight director, select transponder 2 as the active transponder.

RUDDER BOOST SYSTEM

The rudder boost system reduces rudder forces, increases directional control effectiveness, and improves takeoff performance. Whenever the pilot exerts approximately 35 pounds of rudder pedal force, the system engages (if armed) and using the yaw damper servo assists the pilot in deflecting the rudder. A RUDDER BOOST switch is used to arm the system and system status is provided by green RB (active) and amber RB (fail) lights on the glareshield-mounted autopilot controller. If a conflict exists between the yaw damper and rudder boost commands, the rudder boost system will override the yaw damper.

SELF TEST

The system initiates a self-test when the system is powered up. During the self-test sequence, the amber RB fail light will be continuously displayed and the green RB active light will blink. Successful completion of the self-test sequence will extinguish both RB lights and arm the rudder boost system. Failure of the self-test sequence will leave the amber RB light illuminated and the rudder boost will not be armed.

TO ENGAGE RUDDER BOOST

If the system is armed and a rudder pedal force of approximately 35 pounds or more is present, the rudder boost computer will activate rudder boost and assist the pilot in deflecting the rudder. The green RB light will illuminate to indicate rudder boost is active. Failure of the rudder boost system is indicated by illumination of the amber RB light.

TO DISENGAGE RUDDER BOOST

- Setting the RUDDER BOOST switch to OFF will disengage rudder boost.
- Depressing either control wheel master switch (MSW) will disable rudder boost while the switch is held.
- Pulling the RUDDER BOOST circuit breaker (LEFT AFCS group) will disengage rudder boost.

NOTE

On aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2, nosewheel steering will not arm with the RUDDER BOOST circuit breaker pulled. *Refer to Section IV, Abnormal Procedures, Operation with Nosewheel Steering Not Armed.*

TRIM SYSTEMS OPERATIONAL CHECK

The following procedure performs the complete three-axis trim systems operational check. This check must be completed a minimum of once every 10 hours of flight operation.

NOTE

- Throughout the following checks, verify that the trim-in-motion audio clicker sounds approximately 1/4 second after initiating pitch trim with the flaps up. The trim-in-motion audio clicker will not sound when the flaps are lowered beyond 3°.

- The amber PITCH TRIM light on the glareshield will illuminate whenever either Control Wheel Master switch (MSW) is depressed.

1. BATTERY Switches .... ON

2. INVERTER Switch
   (L or R) .... ON

3. Flaps .... UP

4. PITCH TRIM Selector
   switch (pedestal).. SEC

   a. NOSE DN–OFF–NOSE UP
      switch (pedestal)... CHECK OPERATION

      (1) Operate switch NOSE UP and NOSE DN. Trim motion shall occur in both directions.

      (2) Check that depressing either Control Wheel Master switch (MSW) while trimming NOSE UP or NOSE DN will stop trim motion while Control Wheel Master switch (MSW) is held.

   b. Pilot’s Control
      Wheel Trim switch
      (arming button depressed).................................. OPERATE NOSE UP AND NOSE DN

      Trim motion shall not occur. Repeat using copilot’s Control Wheel Trim switch.

5. PITCH TRIM Selector
   switch (pedestal).. OFF

   a. NOSE DN–OFF–NOSE UP
      switch (pedestal) .... Operate NOSE UP and NOSE DN

      Trim motion shall not occur.

   b. Pilot’s Control
      Wheel Trim switch
      (arming button depressed).................................. OPERATE NOSE UP AND NOSE DN

Trim motion shall not occur. Repeat using copilot's Control Wheel Trim switch.

6. PITCH TRIM Selector switch (pedestal).. PRI

   a. NOSE DN–OFF–NOSE UP switch (pedestal) .... OPERATE NOSE UP AND NOSE DN

      Trim motion shall not occur.

   b. Pilot's and copilot's Control Wheel Trim switches... CHECK INDIVIDUALLY AS FOLLOWS:

      (1) Without depressing arming button, move switch NOSE UP, NOSE DN, LWD, and RWD. Trim motion shall not occur.

      (2) Depress arming button without displacing switch. Trim motion shall not occur.

      (3) Depress arming button and move switch NOSE UP, NOSE DN, LWD, and RWD. Trim motion shall occur in all directions.

      (4) Check that depressing pilot's Control Wheel Master switch (MSW) while trimming NOSE UP and NOSE DN will stop trim motion. Repeat step using copilot's Control Wheel Master switch (MSW).

   c. Trim by positioning copilot's Control Wheel Trim switch. While trimming, trim in opposite direction using pilot's Control Wheel Trim switch. Pilot's trim shall override copilot's trim. Repeat for each trim position.

7. Mach Trim.. CHECK

   a. SYSTEM TEST Selector switch....................................... ROTATE TO MACH TRIM

   b. TEST button.. DEPRESS AND HOLD

      Stabilizer should trim slowly in the nose up direction for 1 to 3 seconds and then stop. The trim-in-motion audio clicker may or may not sound. The amber MACH TRIM light shall illuminate.

   c. TEST button .... RELEASE

      MACH TRIM light shall go out.

8. Trim Monitor... CHECK

NOTE

The trim monitor continuously monitors the primary pitch trim system for electrical faults which could cause a trim runaway if an additional fault were to occur. During flight, the trim monitor will illuminate the amber PITCH TRIM light to alert the crew a fault has occurred. During ground test, a signal simulating an electrical fault is applied to the trim monitor.

a. TEST Selector switch.. ROTATE TO TRIM MON

b. TEST button.. DEPRESS

Amber PITCH TRIM light shall illuminate.

c. TEST button .... RELEASE

9. Trim Speed and Trim Speed Monitor .... CHECK

NOTE

The trim speed monitor compares pitch trim rate with flap position. During flight, the monitor will illuminate the amber PITCH TRIM light to alert the flight crew that the aircraft is trimming at the high trim rate with the flaps up. During ground test, a flaps down signal is applied to the trim speed controller and a flaps up signal is applied to the trim speed monitor simulating the high trim rate with the trim speed monitor in the low trim rate mode.

a. TEST Selector switch.. ROTATE TO TRIM OVRSPD

b. While trimming NOSE UP or NOSE DN with either Control Wheel Trim switch:

TEST button.. DEPRESS

Amber PITCH TRIM light shall illuminate.

c. TEST button .... RELEASE

d. Flaps .... DN

e. Either Control Wheel Trim switch .... NOSE UP OR NOSE DN

Verify that PITCH TRIM indicator needle moves faster with flaps down.

10. Either Control Wheel Trim switch (arming button depressed).. OPERATE

Operate as required to move PITCH TRIM indicator pointer through the 4 to 11° point to observe illumination of the T.O. TRIM light. The amber T.O. TRIM light shall be illuminated whenever the indicator pointer is less than the 5° point or more than the 10° point, and shall be extinguished whenever the indicator pointer is within the T.O. segment.

11. Rudder Trim switch (pedestal)... CHECK

Switch operation should occur as follows:

a. Move each half of switch separately to NOSE LEFT and NOSE RIGHT. Trim motion shall not occur.

b. Move both halves of switch simultaneously to NOSE LEFT and NOSE RIGHT. Trim motion shall occur.

12 INVERTER switch.. OFF

13. BATTERY switches .... OFF

ABNORMAL PROCEDURES

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ABNORMAL PROCEDURES

INTRODUCTION

The procedures presented here have been developed by Learjet, Inc. for certification of this aircraft. This chapter contains those operating procedures using special systems and/or alternate use of regular systems which, if followed, will maintain an acceptable level of airworthiness or reduce operational risk resulting from a failure condition. Procedures in this chapter emphasized by a shaded ▭ are memory items and should be accomplished without reference to the checklist.

The procedures located in this section supplement Normal Procedures when a failure condition exists. Use of Normal Procedures should be continued when applicable. Sound judgement as well as thorough knowledge of the aircraft, its characteristics, and the flight manual procedures are essential in the handling of any failure condition.

OVERRIDING CONSIDERATIONS

In all emergencies, the overriding consideration must be to:

- Maintain Airplane Control
- Analyze the Situation
- Take Proper Action

TERMINOLOGY

Some abnormal procedures require that a landing be made as soon as practical, as some emergencies require more urgency in landing the aircraft. The degree of urgency required varies with the emergency; therefore, the terms “land as soon as possible” and “land as soon as practical” are employed. These terms are defined as follows:

Land as Soon as Possible—A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, ambient lighting, and aircraft gross weight.

Land as Soon as Practical—Emergency conditions are less urgent, and although the mission is to be terminated, the degree of the emergency is such that an immediate landing at the nearest adequate airfield may not be necessary.

ANTI-ICING

ALC LOW LIGHT ILLUMINATED

Illumination of the amber ALC LOW light indicates the alcohol level in the windshield/radome alcohol anti-ice reservoir is low.

1. Fly out of icing conditions as soon as possible.

2. ALCOHOL Switch.. OFF

   Switch to OFF when alcohol stops flowing.

3. After landing, assure alcohol reservoir is properly replenished.

ENGINE ICE INGESTION

Engine ice ingestion can result in fan damage and abnormal engine operation. Engine ice ingestion can be suspected whenever ice is shed from the wing, fuselage, windshield, or nacelle. This may occur when anti-ice systems are energized after significant ice accumulation has occurred on the above surfaces. Ice ingestion may be evident by a change in engine sound or frequency, audible report, sharp rise in turbine temperature (ITT), or rpm hang-up.

Experience to date has shown that, if proper procedures are observed, there is a very high probability of satisfactory engine operation after experiencing foreign object damage from ice in the engine fan. Such damage can reduce the compressor stall margin so that the engine could become more sensitive to rapid thrust lever movements, inlet pressure profile variation due to maneuvering, and high rpm operation. Some compressor stalls will result in engine flameout.

1. IGNITION Switches.. ON

   Leave ON for the duration of the condition.

2. Thrust lever movements should be slow and cautious.

3. Engine rpm .... SET

   Set rpm as low as possible (60% fan speed or higher as required to maintain the WING TEMP indicator pointer in the green segment).

4. Avoid any abrupt changes in pitch, yaw, or roll.

5. To determine extent of engine damage due to ice ingestion, proceed as follows:

   a. Thrust Levers (one at a time).. RETARD TO FLIGHT IDLE

   Then cautiously advance and check for any vibration or abnormal noise on each engine.

   NOTE

   If compressor stall is encountered, retard thrust lever until smooth operation is obtained. (If any of the fan blades have been damaged, the noise level and frequency will increase with an increase of rpm.)

   b. If either engine flames out, airstart in accordance with ENGINE AIRSTART procedure, this section. After restart, repeat step 5, but stay below engine speed at which engine flamed out.

   c. If ice damage has been experienced, land as soon as practical and stay within the operating limitations of engine as defined by this procedure.

   NOTE

   Inspect engine for damage any time inadvertent icing conditions have been encountered.

INADVERTENT ICING ENCOUNTER

If icing is inadvertently encountered:

1. All Anti-ice systems .... ACTIVATE IMMEDIATELY

   Immediate action precludes ice accumulation.

   If approach and landing must be made with any amount of ice on the airframe:

   a. Do not extend flaps beyond 20°.

   b. Use landing procedure for a wing and stabilizer heat failure. Refer to ABNORMAL LANDINGS, this section.

WARNING

Even ***small*** accumulations of ice on the wing leading edge can cause an increase in stall speed and possibly a degradation in stall characteristics.

NOTE

Ice accumulation on the stabilizer can cause deterioration in trim speeds, elevator buffeting, changes in elevator forces, and control column oscillations/pulsing. During flight tests, control column oscillations and pulsing tended to increase in intensity with increases in power. Low speed flight should be approached with care so that detection of abnormal flying qualities can be obtained.

If heavy ice accumulation has occurred, proceed as follows:

If enroute and destination temperatures remain below freezing, consideration should be given to landing with ice on the wings.

If landing with ice on the wings:

1. WING HT Circuit Breaker
   (R ANTI-ICE Group) .... PULL

   The WING TEMP indicator will be inoperative.

2. STAB WING HEAT Switch .... STAB WING HEAT

   This will provide stabilizer heat without activating wing heat.

3. Use landing procedure for a wing heat failure. Refer to Abnormal Landings, this section.

If attempting to remove ice accumulation:

1. IGNITION Switches .... ON

2. Engine rpm .... SET

   Set as low as possible (60% fan speed minimum)

3. NAC HEAT switch (for one engine) .... ON

   Wait until satisfactory engine operation is apparent, then:

   Opposite engine NAC HEAT switch .... ON

   Observe Turbine Temperature (ITT) rise and check that the L and R NAC HT lights are out for operation of engine anti-ice.

4. After satisfactory engine operation is apparent:

   STAB WING HEAT switch .... ON

5. After satisfactory engine operation is apparent, energize remaining anti-ice systems, one system at a time, waiting for satisfactory engine operation between energizing each system.

NAC HT LIGHT ILLUMINATED

A failure of the nacelle heat system (bleed air) is indicated by illumination of the amber L or R NAC HT light. Two types of failures are annunciated with these lights:

- Uncommanded application of nacelle heat
- Failure of nacelle heat to activate when commanded

Affected Engine:

1. NAC HT Circuit Breaker
   (ANTI-ICE group) .... PULL AND/OR RESET

If light remains illuminated:

2. • *If associated NAC HEAT switch is OFF:*

   Engine RPM .... REDUCE TO MIN REQUIRED

   • *If associated NAC HEAT switch is ON:*

   Engine RPM .... INCREASE TO IMPROVE AIRFLOW

   Fly out of icing conditions if possible

PITOT HT LIGHT ILLUMINATED

Illumination of the amber PITOT HT light indicates that one or more of the pitot-static mast heaters are inoperative or one or both PITOT HEAT switches are OFF.

1. PITOT HEAT Switches .... CHECK/ON

2. L PITOT HT and R PITOT HT
   Circuit Breakers
   (ANTI-ICE Group) .... CHECK/IN

If PITOT HT light remains illuminated:

   a. Fly out of icing conditions as soon as possible.

3. Cross-check the dual pitot-static systems.

STAB HT LIGHT ILLUMINATED

With the STAB WING HEAT switch ON, a failure of the stabilizer heating blanket parting element is indicated by illumination of the amber STAB HT light while in flight. The remaining elements will continue to operate.

1. STAB HT Circuit Breaker
   (R ANTI-ICE Group)... CHECK

   Reset if necessary.

2. If STAB HT cannot be restored:

   a. Fly out of icing conditions, if possible.

   b. Do not extend flaps beyond 20°.

Ice accumulation on the stabilizer may cause deterioration in trim speeds, elevator buffeting, changes in elevator forces, and control column oscillations/pulsing. During flight tests, control column oscillations and pulsing tended to increase in intensity with increases in power. Low speed flight should be approached with care so that detection of abnormal flying qualities can be obtained.

For landing procedure with a stabilizer heat failure, refer to Stabilizer Heat Failure - Landing procedure, this section.

WING HEAT FAILURE

With the STAB WING HEAT switch ON, a failure is indicated by the WING TEMP indicator remaining in the blue (below 40°F [4°C]) range and/or visual indications of ice accumulation.

WARNING

Even ***small*** accumulations of ice on the wing leading edge can cause an increase in stall speed and, possibly, a degradation in stall characteristics.

1. WING HT Circuit Breaker (R ANTI-ICE Group)........ CHECK

   Reset if necessary.

2. Engine RPM........ ADJUST AS REQUIRED

   Maintain WING TEMP indicator in the green band.

3. If WING TEMP indicator remains in the blue range and/or visual indications of ice accumulation remain, fly out of icing conditions.

If approach and landing must be made with any ice (or suspected ice during night operations) on the wing leading edge, refer to Wing Heat Failure—Landing procedure, this section.

WINDSHIELD HEAT FAILURE

With the WSHLD HEAT system activated, a failure is indicated by the formation of ice on the heated portion of the windshield.

1. WSHLD HT Circuit Breaker (ANTI-ICE Group)........ Check

   Reset if necessary

2. WSHLD HEAT Switch........ WSHLD HEAT (FULL AIRFLOW)

3. Engine RPM........ INCREASE AS REQUIRED

   Increase to improve airflow.

If system fails to anti-ice the windshield:

4. ALCOHOL Switch .... WS/RAD IF REQUIRED

   This will anti-ice the radome and windshield with alcohol flow for approximately 45 minutes.

5. ALCOHOL Switch.. OFF

   Place switch to OFF when alcohol is depleted or when out of icing conditions.

WS DEFOG LIGHT ILLUMINATED

NOTE

Any illumination (including momentary flashes) of the L or R WS DEFOG light, other than upon initial activation, should be considered a malfunction. A momentary flash indicates cycling of the overtemperature protection circuit and is not normal.

Illumination of the amber L or R WS DEFOG light indicates an overtemperature condition, undertemperature condition, or loss of AC or DC power. Illumination of the WS DEFOG lights, upon initial activation when the windshield temperature is below 80°F (27°C), does not indicate a malfunction. Determination of an overheat or underheat condition can be made by feeling the indicated windshield near the crewmember's head. If an undertemperature condition occurs, deactivation of the system is not required. In the event an overheat condition persisting for more than 10 minutes, it is desirable to deactivate the windshield defog system.

To deactivate the affected windshield defog system:

1. L or R WSHLD/DEFOG Circuit Breaker (ANTI-ICE Group).. PULL

2. Check that affected windshield does not continue to heat.

If descending with an inoperative defog system into conditions, requiring defogging:

1. WSHLD HEAT Switch.. ON

2. Cockpit Shoulder and Ankle Outlets .... CLOSE

3. AUX HT Switch .... CREW

4. At FL 350:

   a. COOL Switch .... COOL

NOTE

On aircraft 31-191 and subsequent, to aid in windshield defog, turn CREW FAN control to highest setting and close pilot and copilot overhead gasper outlets to ensure all of the air delivered from the evaporator will be directed to eyebrow outlets above windshield.

   b. AUTO–MAN Switch .... MAN

   c. COLD–HOT Knob .... AS REQUIRED

5. Leave CAB AIR and WSHLD HEAT on until shutdown.

ELECTRICAL

ELEC PWR LIGHT ILLUMINATED

Illumination of the amber ELEC PWR light indicates that one or more electrical system parameter is at or approaching its limit. Illumination of the ELEC PWR light will be accompanied by an amber or red light on the electrical power monitor and flashing of the affected display. This indicates one or more of the following:

- AC voltage is above or below limits.
- DC voltage is above or below limits.
- Generator load is high and may be in excess of generator limits.

1. Electric Power Monitor .... CHECK

2. • ***If a VAC display is flashing:***

   a. Refer to AC Bus Failure procedure, Emergency Procedures chapter.

   • ***If the VDC display is flashing and voltage is low:***

   a. Reduce electrical load.

   • ***If the VDC display is flashing and voltage is high:***

   a. L START–GEN Switch .... OFF

   Check DC voltage.

• ***If voltage is still high:***

b. L START– GEN Switch.. GEN

R START–GEN Switch .... OFF

Check DC voltage.

• ***If voltage is still high:***

c. Both START–GEN Switches... OFF

Refer to Dual Generator Failure procedure, Emergency Procedures chapter.

• ***If an AMP display is flashing:***

a. Electrical Load.. CHECK

Reduce, if required, to observe generator limits.

SINGLE GENERATOR FAILURE— L OR R GEN LIGHT ILLUMINATED

1. START–GEN Switch .... GEN

2. IGN–START and GEN Circuit Breakers.. CHECK, IN

3. Electrical Load.. SHED AS REQUIRED TO OBSERVE GENERATOR LIMITS

NOTE

On aircraft 31-191 and subsequent, during single generator operations in flight, the air-conditioning system is automatically deactivated. To ensure air-conditioning system is deactivated, COOL Switch—OFF.

4. GEN RESET SWITCH.. DEPRESS MOMENTARILY

If generator does not reset:

5. Turbine Speed (N_2).. 80% OR GREATER

6. START–GEN Switch .... OFF, THEN GEN

7. GEN RESET Switch .... DEPRESS MOMENTARILY

If generator does not reset:

8. START–GEN Switch .... OFF

ENGINES

ABNORMAL ENGINE OPERATION

Fan Speed (N_1) or Turbine Speed (N_2) Decreasing or Inappropriate for Thrust Lever Position

Affected engine:

1. Thrust Lever .... IDLE

2. FUEL CMPTR Switch .... MAN

3. • ***If engine characteristics appear normal:***

   a. Continue flight with fuel computer in MAN mode.

   • ***If engine characteristics remain abnormal:***

   a. FUEL CMPTR Switch .... OFF

   b. If engine characteristics do not improve:

      FUEL CMPTR Switch .... MAN

   c. Continue flight with fuel computer switch in selected position.

4. Refer to FUEL CMPTR LIGHT ILLUMINATED procedure, this section.

AIRSTART

WARNING

Do not attempt an airstart following an engine failure which was accompanied by indications of internal engine damage or fire.

CAUTION

- ***Do not*** attempt an airstart without an indication of fan rotation.
- If turbine temperature (ITT) is approaching the limit and rising rapidly, immediately place thrust lever in CUTOFF position and abort start.
- At least one inverter must be operating to energize oil pressure indicator. If oil pressure is not indicated within 10 seconds, abort start.
- If the malfunction is isolated to the fuel computer, airstart engine with fuel computer in the manual mode and remain in the manual mode for remainder of the flight.

Affected engine:

1. Assure that aircraft is within appropriate airstart envelope as shown in Figure AP-1 if conditions permit.
2. FUEL CMPTR Switch.. ON OR MAN AS APPLICABLE

CAUTION

The OFF position of the FUEL CMPTR switch should only be used when MAN and ON operation is not available.

3. Thrust Lever .... CUTOFF

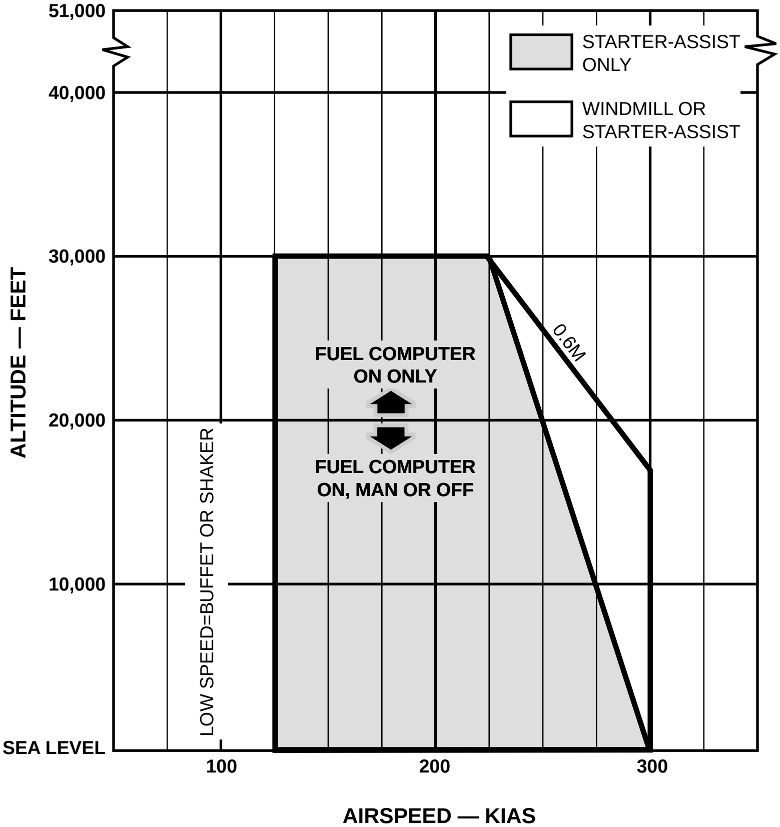
   Wait 10 seconds to allow fuel to drain from engine.

4. Fuel Supply .... CHECK

   a. Fuel available from wing tank

   b. ENG FIRE PULL T-handle .... CHECK IN

5. Fuel Panel Switches... AS FOLLOWS



- FUEL COMPUTER ON AIRSTARTS MAY BE MADE AT ANY ALTITUDE UP TO 30,000 FEET.
- MAINTAINING AN AIRSPEED WITHIN THE WINDMILLING AIRSTART ENVELOPE WILL ENHANCE AIRSTART.
- STARTER-ASSIST AIRSTARTS *MUST BE* USED WHEN TURBINE SPEED (N_2) IS BELOW 15%.
- FUEL COMPUTER MAN AIRSTARTS SHOULD ONLY BE ATTEMPTED WHEN FUEL COMPUTER ON OPERATION IS NOT AVAILABLE. FUEL COMPUTER OFF AIRSTARTS SHOULD ONLY BE ATTEMPTED WHEN FUEL COMPUTER ON OR MAN OPERATION IS NOT AVAILABLE. *DO NOT* ATTEMPT FUEL COMPUTER OFF OR MAN AIRSTART ABOVE 20,000 FEET.

Figure AP-1. Airstart Envelope

a. • ***Fuel Computer ON:***

JET PUMP Switch .... CHECK/ON

• ***Fuel Computer MAN or OFF:***

JET PUMP Switch.. OFF

b. STANDBY PUMP Switch .... ON

c. CROSSFLOW Switch .... CLOSE

d. FUS TANK XFR–FILL Switch... OFF

e. GRAV XFR Switch .... CLOSE

6. Electrical Load.. REDUCE

7. BLEED AIR Switch... OFF

8. • ***Starter Assisted Airstart:***

   START–GEN Switch.. START

   Starter Engaged light will illuminate.

   • ***Windmilling Airstart:***

   IGNITION Switch.. ON

9. • ***Starter Assisted Airstart:***

   Thrust Lever (At Minimum
   10% Turbine Speed [N_2]) .... IDLE

   • ***Windmilling Airstart:***

   Thrust Lever (At Minimum
   15% Turbine Speed [N_2]) .... IDLE

10. IGNITION Light and FUEL FLOW.. CHECK

11. Turbine Temperature (ITT):

   • ***Fuel Computer ON:*** Check rise within 5 seconds. If light-off has not occurred within 5 seconds after the thrust lever is placed in IDLE position; energize SPR switch, then release at 300–400° turbine temperature (ITT). Check rise within 5 seconds.

- ***Fuel Computer MAN or OFF:*** Check rise within 10 seconds. If light-off has not occurred within 10 seconds after thrust lever is placed in IDLE, abort start.

CAUTION

If engine accelerates above 80% fan speed (N_1) with thrust lever in IDLE, abort start.

12. At 45% Turbine Speed (N_2):

    a. START–GEN Switch .... GEN

    Check starter engaged light is out.

    b. IGNITION Switch .... OFF

    Check IGNITION light goes out.

13. Engine Instruments.. NORMAL INDICATIONS

CAUTION

If fuel computer is off, monitor engine instruments since fuel computer limiting functions are inoperative.

14. BLEED AIR Switch .... ON

15. JET PUMP and STANDBY PUMP Switches.. AS REQUIRED

If no indication of light off is obtained in 10 seconds:

16. Thrust Lever .... CUTOFF

17. START–GEN Switch .... OFF

18. IGNITION Switch.. OFF

19. STANDBY PUMP Switches.. OFF

20. Repeat airstart procedure.

CAUTION

No more than three consecutive starter-assist airstarts should be attempted to prevent severe battery drain and generator burnout.

If engine will not restart:

21. Perform Engine Shutdown in Flight procedure, this section.

FUEL CMPTR LIGHT ILLUMINATED

Illumination of an amber FUEL CMPTR light indicates that the corresponding fuel computer has failed. Automatic fuel regulation functions of the affected engine are lost and engine operation reverts to fuel computer manual mode. Engine instruments must be monitored to ensure limits are maintained.

Engine thrust may tend to increase or decrease depending on ambient temperature and flight conditions.

WARNING

Engine acceleration with fuel computer inoperative is much slower than with fuel computer on.

Affected Engine:

1. FUEL CMPTR Circuit Breaker (ENGINES–FUEL Group) .... CHECK AND RESET IF NECESSARY

2. FUEL CMPTR Switch .... SET TO OFF THEN ON

   If fuel computer does not come back on line:

   FUEL CMPTR Switch .... MAN

3. CROSSFLOW Switch .... CLOSE

4. FUS TANK Switches as follows:

   a. XFR–FILL Switch .... OFF

   b. GRAV XFR Switch .... CLOSE

5. STANDBY PUMP Switch .... ON

6. JET PUMP Switch .... OFF

NOTE

Use of the standby pump as the primary pump on the engine with the inoperative fuel computer will prevent fuel control pneumatic circuit icing by recirculating fuel within the fuel control.

7. To crossflow or transfer fuel, refer to Operation with One Fuel Computer Inoperative (Cruise) procedure, this section.

ENGINE CHIP LIGHT ILLUMINATED

Illumination of either the amber LH or RH ENG CHIP light indicates the presence of metallic particles in the engine oil.

1. Engine Instruments .... MONITOR FOR INDICATION OF MALFUNCTION

2. Investigate cause at earliest possible maintenance.

ENGINE OVERSPEED

Affected engine:

1. Thrust Lever .... RETARD

CAUTION

Do not set affected engine FUEL CMPTR switch OFF. The fuel computer provides additional overspeed protection which may be beneficial.

2. If engine does not respond to thrust lever movement, shut down engine. Refer to Engine Shutdown in Flight procedure, this section.

ENGINE SHUTDOWN IN FLIGHT

Affected engine:

1. ENG SYNC Switch.. OFF
2. Thrust Lever .... CUTOFF

CAUTION

The engine fuel and hydraulic pumps will continue to operate with a windmilling engine. Prolonged operation without fluid available to the pumps may cause damage. Therefore, the ENG FIRE PULL T-Handle should not be pulled unless a fuel or hydraulic leak is suspected.

3. Rudder Trim .... AS REQUIRED
4. Yaw Damper .... AS DESIRED
5. IGNITION Switch.. OFF
6. START–GEN Switch .... OFF
7. Electrical Load....................... REDUCE, AS REQUIRED TO PREVENT OVERLOADING THE OPERATING GENERATOR
8. BLEED AIR Switch.. OFF
9. CROSSFLOW Switch... OPEN

   Monitor fuel balance. Crossflow is required.

NOTE

During single-engine operation, maintain slip indicator ball centered.

10. Refer to Airstart or Single-Engine Landing procedure, this section.

STARTER ENGAGED LIGHT REMAINS ILLUMINATED AFTER START

Ground Start

1. Affected START–GEN Switch.. GEN

   If starter engaged light remains illuminated, the start contactor is still engaged.

2. Shut down affected engine.

3. Turn off all electrical power.

4. Do not dispatch until trouble has been corrected.

Starter-Assist Airstart

1. Complete AIRSTART procedure.

2. Affected START–GEN Switch.. GEN

   If starter engaged light remains illuminated, the start contactor is still engaged.

3. Continue flight.

   NOTE

   A speed sensor, in the starter–generator, automatically switches the starter–generator to the generator mode at 45 to 50% turbine speed (N_2). The generator will operate normally for the remainder of the flight (may be necessary to reset the generator). At shutdown, set BATTERY switches to OFF to disengage the starter.

4. Correct trouble before next flight.

ENVIRONMENTAL

FAILURE TO DEPRESSURIZE ON THE GROUND

1. CAB AIR Switch.. OFF

2. Both BLEED
AIR Switches .... OFF

INADVERTENT ACTIVATION OF EMERGENCY AIRFLOW

1. Retard power to 90% rpm or below if practical.

2. Reset L EMER PRESS circuit breaker (L ENVIRONMENT group) or R EMER PRESS circuit breaker (R ENVIRONMENT group) if tripped.

NOTE

Emergency airflow is activated with the loss of electrical power.

If emergency airflow continues:

3. One BLEED AIR Switch .... OFF

   If emergency flow stops:

   Continue with
   BLEED AIR Switch.. OFF

If emergency airflow continues:

4. BLEED AIR Switch .... ON

   Other BLEED AIR Switch.. OFF

OVERPRESSURIZATION (DIFFERENTIAL PRESSURE EXCEEDS RED ARC)

1. AUTO–MAN Switch .... MAN

2. UP–DN Manual Control (red).. UP

   Position UP or as required to maintain satisfactory pressurization.

If unable to regulate the overpressurization in manual mode:

3. One BLEED AIR Switch .... OFF

4. Adjust power on opposite engine to control cabin pressurization.

CAB ALT LIGHT ILLUMINATED OR CABIN ALTITUDE EXCEEDS 8,500 FEET

1. Crew Oxygen Masks.. DON

   Select 100% oxygen.

NOTE

Whenever cabin altitude exceeds 8,750 (±250) feet, the amber CAB ALT light illuminates and control pressure to the outflow valve is trapped. This deactivates the Automatic Mode and stops cabin altitude from rising higher if failure is in automatic control system.

2. If aircraft is climbing, stop climbing and level off at (or descend to) the nearest appropriate altitude.

3. Pilot and Copilot MIC SELECT Switches.. OXY

4. CAB AIR Switch .... ON

5. L and R BLEED AIR Switches .... ON

6. Cabin Altitude.. CHECK

7. • **If cabin altitude continues to climb:**

   a. AUTO–MAN Switch .... MAN

b. UP–DN Manual Control (red) .... UP OR DN

Position as required to maintain satisfactory pressurization.

If cabin altitude continues to climb:

c. L and R BLEED AIR Switches.. EMER

NOTE

- Windshield and wing bleed air anti-ice are not available with both left and right bleed-air systems in the emergency pressurization mode. Nacelle Heat and Windshield/Radome alcohol anti-ice will be available.

- The emergency pressurization valves will automatically reposition to the emergency mode and route full bleed air into the cabin at 9,500 (+ 250) feet cabin altitude with the BLEED AIR switches in the ON position and the EMER PRESS switches in the NORMAL position.

- **If cabin altitude stabilizes at a safe altitude:**

a. Continue flight. Continued use of the oxygen system is at the crew's discretion.

b. If cabin temperature becomes hot from the use of EMER BLEED AIR:

(1) Turn one BLEED AIR Switch .... OFF

Ensure cabin pressure is maintained. It is recommended that the left BLEED AIR Switch be set to OFF first because the RH air distribution system delivers air more evenly to the crew compartment and cabin, and is required for internal defog of the windshield.

(2) If temperature is still too high, reduce power on engine supplying bleed air.

TO RETURN TO NORMAL PRESSURIZATION AIRFLOW

NOTE

If cabin altitude exceeds 8,750 (±250) feet, the automatic pressurization mode is deactivated and the amber CAB ALT light will illuminate. Automatic mode operation will not be available until the cabin altitude is decreased to extinguish the CAB ALT light.

If normal operation is assured and the CAB ALT light is out, the following procedure accomplishes resetting emergency pressurization valves and reactivation of automatic pressurization mode.

1. CAB AIR Switch .... ON
2. AUTO–MAN Switch .... MAN
3. UP–DN Manual Control (red).. UP OR DN

   Position as required to maintain cabin altitude below 7,200 feet.

4. One BLEED AIR Switch.. OFF THEN ON
5. Other BLEED AIR Switch .... OFF THEN ON
6. UP–DN Manual Control (red).. UP OR DN

   Position as required to maintain cabin altitude appropriate for flight altitude.

Return to automatic mode if desired:

7. CABIN CONTROLLER .... SET

   Set appropriate cabin altitude for flight altitude (at or below 7,200 feet).

8. UP–DN Manual Control (red).. UP OR DN

   Position as required to obtain cabin altitude selected on CABIN CONTROLLER.

9. AUTO–MAN Switch .... AUTO

OXYGEN DURATION

Figures AP-2 and AP-3 (Figures 4-2 and 4-3 in Section IV of the *AFM*) show oxygen supply duration of a fully charged system as a function of cabin altitude and number of occupants using the system. Passenger durations above 30,000 feet cabin altitude are provided for information only. Prior to extended overwater flights, plan oxygen requirements to provide sufficient oxygen for all occupants in the event of a pressurization failure. Additional oxygen may be required to assure that both oxygen duration and range (fuel) requirements are satisfied.

FINAL STABILIZED CABIN ALTITUDE — 1,000 FEET	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	261 **251**	82 **79**	50 **48**	36 **35**	28 **27**	26 **25**	22 **21**
35	192 **182**	75 **71**	47 **45**	35 **33**	28 **26**	25 **24**	22 **20**
30	145 **135**	68 **64**	45 **42**	34 **32**	27 **26**	25 **24**	22 **20**
25	153 **105**	70 **56**	46 **39**	34 **30**	28 **25**	25 **24**	22 **20**
20	203 **84**	78 **50**	49 **36**	37 **29**	29 **24**	27 **23**	23 **20**
15	261 **67**	86 **45**	53 **34**	39 **28**	32 **24**	29 **23**	25 **20**
10	253 **54**	**PASSENGER OXYGEN NOT REQUIRED**					
8	153 **50**						
7	148 **48**						

- **BOLD FACE** NUMBERS (**XXX**) INDICATE 100% OXYGEN.
- LIGHT FACE NUMBERS (XXX) INDICATE DILUTER DEMAND.
- CREW AND PASSENGER OXYGEN MASKS ARE NOT APPROVED FOR USE ABOVE 40,000 FEET CABIN ALTITUDE. ***PASSENGER DURATIONS ABOVE 30,000 FEET CABIN ALTITUDE ARE PROVIDED FOR INFORMATION ONLY. PASSENGER MASKS WILL NOT PROVIDE SUFFICIENT OXYGEN FOR PROLONGED OPERATION ABOVE 34,000 FEET CABIN ALTITUDE. PROLONGED OPERATION ABOVE 25,000 FEET CABIN ALTITUDE WITH PASSENGERS ON BOARD IS NOT RECOMMENDED.***
- PRIOR TO OVERWATER FLIGHTS, PLAN OXYGEN REQUIREMENTS TO PROVIDE SUFFICIENT OXYGEN FOR ALL OCCUPANTS IN THE EVENT OF A PRESSURIZATION FAILURE. ADDITIONAL OXYGEN MAY BE REQUIRED TO ASSURE THAT BOTH OXYGEN DURATION AND RANGE (FUEL) REQUIREMENTS ARE SATISFIED.
- FOR CABIN ALTITUDES OF 10,000 FEET AND ABOVE, THE OXYGEN DURATION TIMES INCLUDE CABIN ALTITUDE ASCENT TIME FROM 8,000 FEET TO FINAL STABILIZED CABIN ALTITUDE.
- TO CALCULATE OXYGEN DURATION FOR A LESS THAN FULLY CHARGED SYSTEM THE FOLLOWING FORMULA MAY BE USED:

DURATION = DURATION FROM CHART X (SYSTEM PRESSURE ÷ 1,850)

Figure AP-2. Oxygen Duration in Minutes for a Fully Charged System—Aircraft with Scott ATO MC 10-15-01

FINAL STABILIZED CABIN ALTITUDE —1,000 FEET	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	267 **251**	84 **79**	51 **47**	36 **34**	29 **27**	26 **24**	22 **21**
35	195 **182**	76 **71**	48 **45**	35 **33**	28 **26**	26 **24**	22 **21**
30	219 **135**	79 **64**	49 **42**	36 **32**	29 **26**	26 **23**	22 **20**
25	252 **105**	83 **56**	50 **39**	37 **30**	29 **25**	26 **23**	22 **20**
20	228 **84**	81 **50**	51 **37**	37 **29**	30 **25**	27 **23**	24 **20**
15	192 **67**	77 **45**	50 **34**	37 **28**	31 **24**	28 **23**	24 **20**
10	163 **54**	**PASSENGER OXYGEN NOT REQUIRED**					
8	153 **50**						
7	148 **48**						

- **BOLD FACE** NUMBERS (**XXX**) INDICATE 100% OXYGEN.
- LIGHT FACE NUMBERS (XXX) INDICATE DILUTER DEMAND.
- CREW AND PASSENGER OXYGEN MASKS ARE NOT APPROVED FOR USE ABOVE 40,000 FEET CABIN ALTITUDE. ***PASSENGER DURATIONS ABOVE 30,000 FEET CABIN ALTITUDE ARE PROVIDED FOR INFORMATION ONLY. PASSENGER MASKS WILL NOT PROVIDE SUFFICIENT OXYGEN FOR PROLONGED OPERATION ABOVE 34,000 FEET CABIN ALTITUDE. PROLONGED OPERATION ABOVE 25,000 FEET CABIN ALTITUDE WITH PASSENGERS ON BOARD IS NOT RECOMMENDED*.**
- PRIOR TO OVERWATER FLIGHTS, PLAN OXYGEN REQUIREMENTS TO PROVIDE SUFFICIENT OXYGEN FOR ALL OCCUPANTS IN THE EVENT OF A PRESSURIZATION FAILURE. ADDITIONAL OXYGEN MAY BE REQUIRED TO ASSURE THAT BOTH OXYGEN DURATION AND RANGE (FUEL) REQUIREMENTS ARE SATISFIED.
- FOR CABIN ALTITUDES OF 10,000 FEET AND ABOVE, THE OXYGEN DURATION TIMES INCLUDE CABIN ALTITUDE ASCENT TIME FROM 8,000 FEET TO FINAL STABILIZED CABIN ALTITUDE.
- TO CALCULATE OXYGEN DURATION FOR A LESS THAN FULLY CHARGED SYSTEM THE FOLLOWING FORMULA MAY BE USED:

DURATION = DURATION FROM CHART X (SYSTEM PRESSURE ÷ 1,850)

Figure AP-3. Oxygen Duration in Minutes for a Fully Charged System—Aircraft with 6600214 Series Crew Masks

FLIGHT CONTROLS

MACH TRIM LIGHT ILLUMINATED IN FLIGHT

A Mach trim malfunction will be indicated by illumination of the amber MACH TRIM light and, if above 0.78 M_I with autopilot not engaged, the over-speed warning horn will sound.

1. Airspeed.. BELOW 0.78 M_I

2. Check that primary pitch trim is available:

   a. PITCH TRIM Switch.. PRI

   b. PRI PITCH TRIM Circuit Breaker
   (L TRIM–FLT CONT Group).. CLOSED

3. MACH TRIM Circuit Breaker
(L AFCS Group).. CHECK

• ***If the MACH TRIM Circuit Breaker is open:***

   a. MACH TRIM Circuit Breaker.. RESET

   b. SYSTEM TEST
   Selector Switch.. ROTATE TO MACH TRIM

   c. TEST Button.. DEPRESS, THEN RELEASE

   Depressing and releasing the TEST button resynchronizes the system.

   d. If the MACH TRIM circuit breaker opens again, leave it open.

• ***If the MACH TRIM Circuit Breaker is closed:***

The MACH TRIM monitor has deactivated the system.

   a. If desired, reset the MACH TRIM Monitor as follows:

      (1) SYSTEM TEST
      Selector Switch.. ROTATE TO MACH TRIM

(2) TEST Button.. DEPRESS, THEN RELEASE

Depressing and releasing the TEST button resynchronizes the system.

b. If MACH TRIM light continues to illuminate:

MACH TRIM Circuit Breaker .... PULL

NOTE

With the Mach trim system inoperative, flight above 0.78 M_I is permitted when the autopilot is engaged.

PITCH TRIM LIGHT ILLUMINATED IN FLIGHT

Illumination of the amber PITCH TRIM light in flight indicates the trim speed monitor has detected a trim speed fault allowing high trim rates with the flaps up or that the trim monitor has detected a fault that would allow a trim runaway if an additional fault were to occur.

NOTE

The PITCH TRIM light will illuminate whenever either control wheel master switch (MSW) is depressed.

1. PITCH TRIM
   Switch (Pedestal).. SEC

2. NOSE DN–OFF–NOSE UP
   Switch (Pedestal) .... OPERATE

   Operate as required to maintain trim.

STALL WARNING SYSTEM FAILURE

If both left and right stall warning systems fail, the angle-of-attack indicators will also be inoperative and stalls may be avoided by reference to the airspeed indicator only. In this event:

1. Maintain airspeed at least 30 knots above stall speeds shown in Section V of the *AFM*. Normal landing approach speed may be maintained on final approach in the landing configuration.

2. Limit bank angles to 30° maximum.

FUEL SYSTEM

CROSSFLOW VALVE FAILS TO OPEN

1. Maintain wing fuel balance by adjusting power setting.

2. Use gravity transfer procedure in "Normal Procedures" chapter to transfer fuselage tank fuel.

   a. Monitor individual wing fuel indications to ensure fuel balance.

   b. • *If right wing becomes heavy during gravity transfer:*

      (1) FUS TANK
      XFR–FILL Switch.. XFR

      (2) When wing tanks are balanced:

      FUS TANK
      XFR–FILL Switch.. OFF

      • *If left wing becomes heavy during gravity transfer:*

      (1) GRAV XFR Switch .... CLOSE

      (2) L JET PUMP–XFR
      VAL Circuit Breaker
      (L ENGINES FUEL Group) .... PULL

      (3) GRAV XFR Switch... OPEN

      (4) When wing tanks are balanced:

      L JET PUMP–XFR
      VAL Circuit Breaker .... RESET

FUEL FILTER LIGHT ILLUMINATED

Aircraft Not Equipped with Fuel Heaters

On aircraft with replaceable paper fuel filter elements: This is an indication that a filter element is clogging. Fuel filter elements should be replaced prior to the next flight.

On aircraft with cleanable metal fuel filter elements: This is an indication that a primary filter element is clogged and is being bypassed; however, the secondary element is still filtering fuel. The fuel filter elements should be cleaned prior to the next flight.

1. STANDBY PUMP Switches .... ON, WHEN POSSIBLE

Aircraft Equipped with Fuel Heaters

Ground operations: Illumination of the FUEL FILTER light during ground operations indicates that either an engine (primary) fuel filter or aircraft (secondary) fuel filter is clogging. The affected filter elements should be replaced prior to flight.

Flight operations: Illumination of the FUEL FILTER light during flight indicates that an engine (primary) filter is clogging or may be icing due to a fuel heater failure. Prior to the next flight, the affected filter elements should be inspected and replaced if necessary. If filter elements are clean, check fuel heater per the *Engine Maintenance Manual*.

1. STANDBY PUMP Switches .... ON, WHEN POSSIBLE

FUEL IMBALANCE DURING FUEL TRANSFER

1. FUS TANK XFR–FILL Switch .... OFF
2. GRAV XFR Switch .... CLOSE
3. STANDBY PUMP Switch (Heavy Wing) .... ON
4. STANDBY PUMP Switch (Light Wing) .... OFF
5. CROSSFLOW Switch .... OPEN
6. Monitor fuel balance.
7. • *If fuel load balances:*

   a. CROSSFLOW Switch .... CLOSE

   b. Both STANDBY PUMP Switches .... OFF

   c. Monitor fuel balance when transferring fuselage fuel.

   • *If fuel load **does not** balance:*

   a. STBY–SCAV PUMP CB (Light Wing) .... PULL

   b. STANDBY PUMP Switch (Heavy Wing) .... CHECK, ON

c. CROSSFLOW Switch .... CHECK, OPEN

d. Monitor fuel balance.

e. • *If fuel load balances:*

(1) CROSSFLOW Switch .... CLOSE

(2) Both STANDBY
PUMP Switches .... OFF

NOTE

The problem is a system failure allowing the standby pump to run whenever the circuit breaker is in. In this event, the following conditions will exist:

- Fuselage fuel transfer may be used while the affected STBY–SCAV PUMP circuit breaker is pulled.
- STBY–SCAV PUMP circuit breaker must be reset for conditions requiring the use of the standby pump (i.e., airstarts and loss of fuel pressure).
- STBY–SCAV PUMP circuit breaker must be reset to transfer fuel from the affected wing (crossflow).
- Scavenge pump, on affected side, will be disabled while STBY–SCAV PUMP circuit breaker is pulled. If LOW FUEL light illuminates, discontinue fuel transfer, close crossflow valve, and reset STBY–SCAV PUMP circuit breaker.

• *If fuel load still **does not** balance:*

(1) CROSSFLOW Switch .... CLOSE

(2) Both STANDBY
PUMP Switches .... OFF

(3) STBY–SCAV PUMP
CB (Affected Side).. RESET

NOTE

- Fuel cannot be transferred to the affected wing and fuselage fuel transfer will aggravate the fuel imbalance. Plan flight accordingly.
- Unequal power settings may be used to balance fuel load.

FUEL TRANSFER VALVE FAILS TO CLOSE

Failure of a fuselage fuel transfer valve does not affect operation of the crossflow valve. If a fuel transfer valve fails to close at the completion of fuel transfer, the crossflow valve will close normally and operation of the corresponding standby pump will transfer fuel back into the fuselage tank.

1. Fuel crossflow operations should be conducted with caution as standby pump operation will transfer fuel back into the fuselage tank.

2. Periodically transfer fuel back into wings.

NOTE

Since continuous operation of a standby pump may not be possible, a descent to 25,000 feet or below will be required if a jet pump should fail.

FUEL VALVE LIGHTS ILLUMINATED

Steady illumination of any of the amber fuel valve lights on the fuel control panel indicates the corresponding valve is not in the position selected or a loss of power. Momentary illumination while the corresponding valve is in transit after switching modes indicates proper operation.

LOW FUEL LIGHT ILLUMINATED

The amber LOW FUEL light on the glareshield annunciator panel will illuminate when the fuel level in either wing tank is approximately 350 pounds (158.7 kilograms) and the aircraft is in level flight.

1. Fuel Quantities .... CHECK

   Correct fuel distribution, if required:

   a. Balance wing fuel. Refer to FUEL CROSSFLOW procedure, “Normal Procedures” chapter.

   b. Transfer fuselage fuel to the wings. Refer to Fuselage Tank to Wing Fuel Transfer procedure, “Normal Procedures” chapter.

2. Replan flight if necessary.

NORMAL FUEL TRANSFER SYSTEM FAILURE

1. FUS TANK XFR–FILL Switch .... OFF

2. GRAV XFR Switch.. OPEN

NOTE

Depending upon flight attitude, 150–300 pounds (68–136 kilograms) of fuselage fuel will be unusable using this fuel transfer method.

2. GRAV XFR Switch.. CLOSE

   Position to CLOSE when gravity transfer is complete, or prior to approach.

STANDBY PUMP FAILS TO SHUT OFF

AIRCRAFT SNS 31-037 AND SUBSEQUENT AND PRIOR AIRCRAFT INCORPORATING SB 31-28-7

Operation of the electric standby fuel pumps is indicated by illumination of the corresponding white standby pump light. The pumps are turned on manually with the corresponding STANDBY PUMPS switch and automatically during starter-assisted engine starts and during fuselage tank FILL.

If standby pump light does not extinguish when pump is selected off:

1. Corresponding STANDBY
   PUMP Switch .... CYCLE

If standby pump light does not extinguish:

2. Corresponding
   STBY–SCAV PUMP
   CB (ENGINES FUEL Group).. PULL

HYDRAULIC SYSTEM FAILURE/ALTERNATE GEAR EXTENSION

Either engine-driven hydraulic pump will supply sufficient pressure to operate all hydraulic systems.

Hydraulic system failure is indicated by a loss of hydraulic pressure. Landing gear, flap, spoiler, and wheel brake systems will be affected. If hydraulic pressure is not regained, spoilers will not be available and emergency brakes will be required after landing.

1. SPOILER Switch .... RET

On Approach:

2. Airspeed .... V_{LO} OR LESS (V_{REF} + 30 RECOMMENDED)

3. LANDING GEAR Switch .... DN

4. GEAR Circuit Breaker (R HYDRAULICS group) .... PULL

5. FLAP Switch .... 20°

6. Extend Landing Gear as follows:

   a. EMER GEAR Lever (Right Side of Pedestal) .... PUSH FULL DOWN TO LATCHED POSITION

   b. Three Green DOWN and Two Red (Main Gear) UNSAFE Lights .... CHECK

      Check that the lights are illuminated.

CAUTION

Do not attempt to retract landing gear once emergency gear extension has been selected. To do so may cause excessive air pressure to be introduced into the hydraulic return lines, thereby rupturing the reservoir.

NOTE

The two red UNSAFE lights will be illuminated after emergency gear extension because the inboard gear doors remain open.

c. After gear is down and locked:

EMER GEAR Lever .... RETURN TO FULL UP

Return to the FULL UP (latched) position. This is accomplished by lifting the ratchet release (small metal tab accessible through hole forward of emergency gear extension handle) and then pulling the lever to the FULL UP (latched) position.

WARNING

The EMER GEAR lever must be returned to the UP position or air pressure for emergency braking will not be available in the event there is a leak in the air line.

d. *If any gear is not down and locked*, refer to Gear Up Landing procedure, this section.

e. Refer to Hydraulic System Failure—Landing procedure, this section.

LO HYD PRESS LIGHT ILLUMINATED

The LO HYD PRESS light will illuminate when system pressure drops below approximately 1,000 psi (6.9Mpa).

Either engine-driven hydraulic pump will supply sufficient pressure to operate all hydraulic systems. However, the LO HYD PRESS light may illuminate during single hydraulic pump operation.

If hydraulic pressure is not regained, landing gear, flaps, spoilers, brakes, and thrust reversers (if installed) may be affected. Landing distance with no flaps, no spoilers, and no antiskid will be greatly increased. Refer to HYDRAULIC SYSTEM FAILURE - LANDING procedure (this section) for landing distance increase.

In Flight:

1. HYD PRESS Gage.. CHECK

2. • *If pressure is normal*, continue to monitor.

• *If pressure is low:*

a. Assume spoilers inoperative, limit altitude to 41,000 feet.

b. Refer to Hydraulic System Failure/Alternate Gear Extension procedure and Hydraulic System Failure—Landing procedure, this section.

INSTRUMENTS/AVIONICS

SINGLE AIR DATA COMPUTER (ADC)/AIRSPEED OR ALTITUDE/VERTICAL SPEED INDICATOR FAILURE

A single ADC failure is indicated by flags and loss of valid air data on pilot's or copilot's air data instruments. A flashing "Er" in a digital display indicates loss of data.

NOTE

Resetting the altitude preselect or baro setting may correct the fault.

Failure of an airspeed or altitude/vertical speed indicator is indicated by a fail flag on the instrument, "FAIL" in the digital display or a complete loss of data.

1. Cross-check airspeed and altitude indications with the standby instruments.

2. ADC Switch (EFIS Control Panel) on Failed Side .... SELECT CROSS-SIDE ADC

NOTE

- There may be momentary data loss during ADC transfer.
- If ADC 1 fails and ADC 2 cannot be transferred to the pilot's side, Mach trim will be inoperative. Some failures of either ADC 1 or ADC 2 may cause the Mach trim to be inoperative. **Do not exceed M_{MO} (0.78 M_I)**.

If time and conditions permit:

3. Applicable ADC, A/S or ALTM VSI Circuit Breaker (INSTRUMENTS Group).................................... PULL AND/OR RESET

4. ADC Switch on Failed Side.. RESELECT ON-SIDE ADC

5. Cross-check airspeed and altitude indications with the standby instruments.

6. • ***If air data computer is not recovered:***

   a. ADC Switch on Failed Side .... SELECT CROSS-SIDE ADC

   b. The following systems and instruments may malfunction or be inoperative:

      (1) On-side stall warning system altitude bias

      (2) Mach trim

   • ***If the indicator failure remains:***

   a. ADC Switch on Failed Side.................................... CHECK ON-SIDE ADC SELECTED

AIR DATA COMPUTER COMPARATOR WARNING

A flashing "C" in the airspeed or altitude/vertical speed indicator indicates a mismatch between the pilot's and copilot's airspeed or altitude data.

NOTE

Resetting the altitude preselect or baro setting may correct the fault.

1. Refer to the standby altimeter and airspeed indicator to determine the correct indications.

ATTITUDE HEADING SYSTEM (AHS) MALFUNCTION

A system malfunction is indicated by a red "ATT" on the EADI and/or "HDG" on the EHSI.

1. Maintain aircraft control with reference to the standby attitude gyro and cross-side instruments.

2. AHS Switch (EFIS Control Panel) on Failed Side .... SELECT CROSS-SIDE AHS

NOTE

- The amber attitude (↔ **"ATT"**) and heading (↔ **"HDG"**) comparator flags will be displayed.

- The autopilot will disengage and will not reengage. Flight director and yaw damper will be operative after selection of a valid AHS on the failed side.

- Standby HSI heading data and weather radar antenna stabilization functions are only provided by AHS 2 and cannot be assumed by AHS 1.

3. Compare indications with the standby attitude gyro and magnetic compass.

If time and conditions permit, recover failed AHS:

NOTE

Recovery of a failed AHS may be possible but should only be attempted when flight situation permits operation without one attitude display and straight and level flight for approximately 90 seconds.

4. Establish aircraft in straight and level, unaccelerated flight.

5. EMER BAT 2 Switch .... OFF

6. Failed AHS DC and AC Circuit Breakers (INSTRUMENTS Group)... PULL AND RESET BOTH

7. EMER BAT 2 Switch.. ON

8. AHS Switch on Failed Side .... RESELECT ON-SIDE AHS

Reselect on-side AHS on the failed side to monitor AHS initialization. Maintain aircraft attitude by monitoring the operating side EADI and the standby attitude gyro. Initialization should occur within approximately 90 seconds. Successful initialization is indicated by attitude display on the EADI with no flags and heading on the EHSI with no flags.

NOTE

- Attitude and heading may differ slightly (less than 5° pitch or roll) from the nonfailed side, but should gradually agree. These small heading splits may be quickly cleared by cycling the HEADING SLAVE–FREE switch to FREE and then back to SLAVE while the aircraft is not turning or accelerating.

- Verify proper attitude and heading information before utilizing displays.

9. If initialization does not occur within approximately 90 seconds as indicated by no attitude or heading information, red ATT or HDG flags, or excessive differences in attitude (greater than 5° pitch or roll):

   AHS Switch on Failed Side .... SELECT CROSS-SIDE AHS

AHS LIGHT ILLUMINATED

Illumination of an amber AHS light indicates a fault in the attitude heading system.

- **Prior to Takeoff:**

  Dispatch is not permitted with an amber AHS light illuminated.

1. Refer problem to maintenance personnel for correction prior to dispatch.

- **In Flight:**

1. Continue using the displays verifying the data with alternate instruments.

NOTE

If associated with a red “ATT” on the EADI and/or “HDG” on the EHSI, refer to Attitude Heading System (AHS) Malfunction procedure this section.

ATTITUDE OR HEADING COMPARATOR WARNING

A mismatch of pilot's and copilot's attitude or heading data is indicated by an amber **"ATT"** on the EADI and/or **"HDG"** on the EHSI.

1. Compare indications with the standby attitude gyro and/or magnetic compass to determine faulty system.

2. • ***If "ATT" flag is displayed:***

   a. AHS Switch (EFIS Control Panel) on Failed Side .... SELECT CROSS-SIDE AHS

   NOTE

   - Attitude comparator flags will remain displayed.
   - The autopilot will disengage and will not reengage. Flight director and yaw damper will be operative after selection of a valid AHS on the failed side.

   • ***If "HDG" flag is displayed:***

   a. Establish aircraft in straight and level, unaccelerated flight.

   b. • If single system is in error:

      Associated HEADING SLAVE–FREE Switch .... FREE, THEN SLAVE

      • If heading cannot be determined:

      Both HEADING SLAVE–FREE Switches .... FREE, THEN SLAVE

   c. If heading split cannot be corrected:

      AHS Switch (EFIS Control panel) on Failed Side .... SELECT CROSS-SIDE AHS

   NOTE

   Heading comparator flags will remain displayed.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM FAILURE

EADI Display Failure

Tube failure is indicated by a malfunction of the EADI only (EHSI not affected) and no "SG" failure flags to indicate a symbol generator failure.

1. Perform one of the following:
   - EADI Down Switch (Failed Side) .... DEPRESS

   NOTE

   - *On the copilot's side*, EADI down mode may only be used in conjunction with the composite mode.
   - EADI will be displayed on the lower tube. *On the pilot's side*, EHSI will be displayed on the multifunction display (MFD).

   - CMPST/DSPL Switch (Failed Side) .... DEPRESS

   NOTE

   The combined EADI and EHSI information will both be displayed on the lower tube.

2. Failed EADI Circuit Breaker (INSTRUMENTS Group) .... PULL

EHSI Display Failure

Tube failure is indicated by a malfunction of the EHSI only (EADI not affected) and no "SG" failure flags to indicate a symbol generator failure.

1. Perform one of the following:
   - MFD Controls .... SELECT EHSI FOR DISPLAY ON THE MFD

   or

   - CMPST/DSPL Switch (Failed Side) .... DEPRESS

NOTE

The combined EADI and EHSI information will both be displayed on the upper tube.

2. Failed EHSI Circuit Breaker (INSTRUMENTS Group) .... PULL

Display Unit "DU" Fan Failure

Display unit fan failure is indicated by a boxed amber "DU" in the lower left area of the affected display. The display will continue to operate for a minimum of 30 minutes under normal temperature conditions.

NOTE

To extend operating time, reduce the display data and the brightness on the affected display.

Symbol Generator "SG" Failure

A small "SG" enclosed in a red box or a large red "SG" enclosed in a black box on the EADI and/or EHSI indicates a symbol generator failure affecting the display unit annunciating the failure.

If either red "SG" flag is displayed:

1. SG Switch (Failed Side) .... SELECT SG 3

NOTE

The EADI and EHSI will be driven by symbol generator 3.

2. Compare indications with functioning side and standby instruments.

3. Failed SG EADI and SG EHSI Circuit Breakers (INSTRUMENTS Group) .... PULL

4. *If SG3 is selected on both the pilot's and copilot's side:*

   Copilot's Autopilot/Flight
   Director Modes .... DESELECT

   Do not use copilot's autopilot.

A yellow "SG" flag indicates a failure of the symbol generator cooling fan. The symbol generator will continue to operate for a minimum of 30 minutes under normal temperature conditions.

If a yellow "SG" flag is displayed:

1. Continue using the displays verifying the data with alternate instruments.

NOTE

To extend operating time, reduce the display data and the brightness on the affected display.

PITOT-STATIC SYSTEM MALFUNCTION

Static pressure for the pilot's air data computer is supplied by a static port on each (L and R) pitot-static probe. Static pressure for the copilot's air data computer and standby instruments is supplied by another static port on each of the pitot-static probes. Either or both pitot-static probes can be selected to supply static pressure to the pilot's and copilot's air data computer and standby instruments through the STATIC SOURCE switch. Normally the switch is in the BOTH position.

If pitot-static source malfunction is known or suspected:

1. Maintain aircraft control with safe attitude and thrust setting.

2. Compare pilot's, copilot's and standby instruments pitot-static data. The standby instruments and copilot's instruments are driven from the same pitot-static source. A pitot pressure malfunction will affect airspeed and Mach indications. A static pressure malfunction will affect airspeed, Mach, altitude, and vertical speed indications.

3. Pitot Heat:

   a. PITOT HEAT Switches .... CHECK, ON

   b. L and R PITOT HT
      Circuit Breakers .... CHECK, IN

4. Determine malfunctioning system:

   a. Cross-check angle-of-attack indicators.

   b. Compare indications with estimated performance for existing conditions (attitude, thrust setting, weight, temperature, and altitude).

   c. Compare data from other available sources.

NOTE

The overspeed warning horn will sound if either the pilot's or copilot's airspeed indicator needle is above the V_{MO}/M_{MO} "barber pole" pointer.

Speed data may be obtained from the following:

- FMS 1 and SAT/TAS systems (if installed) provide a source for true airspeed from the ADC selected on the pilot's pitot-static system.
- DME systems and ground based radar provide a source for groundspeed. By applying the winds to the groundspeed, the aircraft's airspeed may be calculated.

If static pressure malfunction is known or suspected:

5. Autopilot .... DISENGAGE

6. STATIC SOURCE Switch .... L OR R AS APPLICABLE

7. Autopilot .... AS DESIRED

NOTE

Selecting L or R static source does not affect airspeed calibrations or altitude position corrections as presented in Section V of the *AFM*.

LANDING GEAR

ALTERNATE GEAR EXTENSION/ELECTRICAL MALFUNCTION

1. Airspeed.. V_{LO} OR LESS

2. LANDING GEAR Switch .... DN

3. GEAR Circuit Breaker
   (R HYDRAULICS Group)... PULL

4. Extend landing gear as follows:

   a. EMER GEAR Lever
      (Right Side of Pedestal) .... PUSH

      Push full down to latched position.

   b. Three Green DOWN
      and Two Red (Main Gear)
      UNSAFE Lights .... CHECK

      Check that the lights are illuminated.

CAUTION

Do not attempt to retract landing gear once emergency gear extension has been selected. To do so may cause excessive air pressure to be introduced into the hydraulic return lines, thereby rupturing the reservoir.

NOTE

The two red UNSAFE lights will be illuminated after emergency gear extension because the inboard gear doors remain open.

   c. *If any gear is not down and locked*, refer to GEAR UP LANDING procedure, this section.

ANTI-SKID LIGHT ILLUMINATED— ANTI-SKID OFF OPERATION

Illumination of any red ANTI-SKID light indicates an anti-skid problem with the associated wheel. If ANTI-SKID switch is OFF, all four ANTI-SKID lights will illuminate. When anti-skid (for any wheel) is inoperative, care must be used during brake application and stopping distances will be increased. Refer to Section V of the *AFM* for increased stopping distances for takeoff and landing.

1. ANTI-SKID Switch .... OFF, THEN ON

   This should clear the system.

If any ANTI-SKID light(s) remain illuminated:

a. ANTI-SKID Switch .... OFF

   Refer to Section V of the *AFM* for increased stopping distances for takeoff and landing.

b. Cautiously apply brakes as required.

CAUTION

With anti-skid inoperative, heavy brake pressures may skid the tires and cause tire blowout. During flight tests, it was determined that modulating toe-brake pressures will produce improved feel and reduce the probability of tire skid.

c. Be prepared to use EMERGENCY BRAKING procedure, "Emergency Procedures" chapter, if necessary.

NOSEWHEEL STEERING MALFUNCTION

Aircraft SNs 31-035 through SNs 31-054 Not Incorporating SB 31-32-2

A nosewheel steering malfunction is indicated by an unwanted swerve in either direction. In the event of a nosewheel steering malfunction:

NOTE

- If STEER LOCK switch was used to engage nosewheel steering, depressing and then releasing the control wheel master switch (MSW) will disengage steering.
- If control wheel master switch (MSW) was used to engage nosewheel steering, releasing MSW will disengage steering.

At Normal Taxi Speeds

1. Nosewheel Steering .... DISENGAGE (USE MSW)
2. Thrust Levers... IDLE
3. Brake to a stop.
4. Taxi using differential braking and thrust.

During Takeoff

1. Nosewheel Steering .... DISENGAGE IMMEDIATELY (USE MSW)
2. Continue takeoff using rudder and/or brakes for directional control.

Aircraft SNs 31-055 and Subsequent and Prior Aircraft Incorporating SB 31-32-2

In the event the nosewheel steering system malfunctions, internal monitors should disconnect the system and a disconnect tone will sound. A nosewheel steering malfunction may be accompanied by an unwanted swerve in either direction.

NOTE

- If nosewheel steering fails to disconnect during a malfunction, depressing and then releasing the control wheel master switch (MSW) or depressing the NOSE STEER switch will disengage the system.
- If the control wheel master switch (MSW) was used to engage nosewheel steering, releasing MSW will disengage steering.

At Normal Taxi Speeds:

1. Nosewheel Steering .... DISENGAGE (USE MSW)
2. Thrust Levers .... IDLE
3. Brake to a stop.
4. Taxi using differential braking and thrust.

During Takeoff Or Landing:

1. Nosewheel Steering .... DISENGAGE IMMEDIATELY (USE MSW)

2. Continue takeoff or landing using rudder and/or brakes for directional control.

ABNORMAL LANDINGS

GEAR-UP LANDING

If a gear-up landing must be made, select a long, wide runway with as little crosswind as possible. If time and conditions permit, plan the descent to ensure minimum fuel remaining on the aircraft. Ensure sufficient fuel for controlled, power-on approach.

CAUTION

> If emergency gear extension has been selected, ***do not*** attempt to retract the landing gear. To do so may cause excessive air pressure to be introduced into the hydraulic system return lines, thereby rupturing the reservoir.

1. Notify controlling agency of the emergency.

2. Brief passengers as required:

   a. Location and operation of emergency exits

   b. All Loose Items.. SECURE

   c. Shoulder Harness and Seat Belts .... SECURE

   d. Emergency landing brace position

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

4. CAB AIR Switch... OFF

   The aircraft should be depressurized prior to landing.

5. Flaps .... DN

CAUTION

The landing gear warning will sound and will not be mutable with any landing gear not down and the flaps fulldown.

6. EMER BAT Switches .... OFF

7. • ***If no gear have extended,*** touch down slightly nose high.

   • ***If the nose gear fails to extend:***

   a. Relocate passengers aft to obtain aft CG, if possible.

   b. HYD PUMP Switch .... ON

   c. Hold the nose off the runway as long as elevator control is available. If hydraulic pressure is available, normal braking may be available. Use rudder and/or brakes for directional control. Be prepared, to use EMER BRAKE. Refer to Emergency Braking, “Emergency Procedures” chapter.

   • ***If a main gear fails to extend,*** land on the same side of the runway as the extended gear.

   a. HYD PUMP Switch .... ON

   b. ANTI-SKID Switch .... OFF

   c. Hold the applicable wing up as long as possible. Maintain directional control with rudder and nosewheel steering. If hydraulic pressure is available, braking (anti-skid off) may be available. Refer to Anti-Skid Off Operation, this section. Be prepared to use EMER BRAKE, Refer to Emergency Braking, “Emergency Procedures” chapter.

8. Perform normal power-on approach at V_{REF} and touch down at the lowest possible airspeed with minimum sink rate. Do not decelerate below shaker speed.

9. Thrust Levers .... CUTOFF AT TOUCHDOWN

10. ENG FIRE PULL T-Handles .... PULL

11. After aircraft stops, battery switches .... OFF

12. Evacuate the aircraft:

    a. Cabin Entry Door.............................. OPEN AND EXIT AIRCRAFT

    The upper door is openable with the landing gear retracted.

    b. Emergency Exit Window .... OPEN AND EXIT USING THE WING STEP AREA

HYDRAULIC SYSTEM FAILURE—LANDING

1. HYD PUMP Switch.. ON

If auxiliary hydraulic pressure is available:

2. FLAP Switch .... DN
3. HYD PUMP Switch... OFF, WHEN MAXIMUM FLAP ANGLE IS OBTAINED
4. Final Approach Speed—As appropriate for flap deflection:

   Flaps .... UP, V_{REF} + 20

   Flaps .... 8°, V_{REF} + 15

   Flaps .... 20°, V_{REF} + 10

   Flaps .... DN, V_{REF}
5. Landing Distance... MULTIPLY BY 3.15
6. Crew Approach Briefing .... COMPLETE
7. EMER BRAKE Handle..................................... PULL OUT OF RECESS

Just prior to landing:

8. HYD PUMP Switch.. ON

After touchdown:

9. • ***If hydraulic pressure is being maintained:***

   a. Spoiler Switch ....EXT AFTER LANDING

   b. Brakes .... AS REQUIRED AFTER LANDING

- ***If hydraulic pressure is not being maintained:***

a. EMER BRAKE Handle—Push down slowly to apply brake pressure (handle must be pushed downward approximately two inches [five centimeters] before braking action begins). Apply brakes smoothly with small movements to produce improved feel and reduce the probability of tire skid. Do ***not*** pump the brake handle.

b. Rudder and/or nosewheel steering .... AS REQUIRED

NOTE

Use of drag chute or thrust reversers (if installed) is recommended.

JAMMED STABILIZER LANDING

If elevator pull force is encountered—*Stabilizer jammed in nosedown trim position (aircraft in climb or cruise configuration):*

WARNING

Control pressure will be heavy. Copilot assistance with this procedure is recommended. Anticipate highest pull forces at landing flare.

1. Move CG aft if possible. Transfer fuel to the fuselage tank if possible. Do ***not*** reengage autopilot.

2. Land as soon as practical to minimize forward CG movement.

3. Final Approach Configuration .... GEAR—DN
FLAPS—8°

4. Final Approach Speed .... V_{REF} + 40

5. Landing Distance.. MULTIPLY BY 1.50

If elevator push force is encountered—*Stabilizer jammed in noseup trim position (aircraft in landing configuration):*

1. Move CG forward if possible. Transfer fuel to the wing tanks if possible. Do ***not*** reengage autopilot.

2. Final Approach Configuration .... GEAR—DN FLAPS—DN

3. Final Approach Speed .... V_{REF}

ONE OR BOTH SPOILERS-UP LANDING

1. Final Approach Configuration .... GEAR—DN FLAPS—UP

2. Final Approach Speed .... V_{REF} + 30

3. Yaw Damper .... OFF PRIOR TO LANDING

4. Landing Distance .... MULTIPLY BY 1.60

NOTE

- Aerodynamic braking at higher speeds will cause the aircraft to become airborne even with the spoilers extended.
- Use of drag chute or thrust reversers (if installed) is recommended.

PARTIAL FLAPS LANDING

1. Final Approach Configuration .... GEAR—DN

2. Final Approach Speed .... AS APPROPRIATE FOR FLAP DEFLECTION

   Use the final approach speed for the lesser flap deflection for flap settings between those listed.

3. Yaw Damper .... OFF PRIOR TO LANDING

4. Landing Distance .... AS APPROPRIATE FOR FLAP DEFLECTION

NOTE

Use of drag chute or thrust reversers (if installed) is recommended.

NOTE

See Table AP-1 for Partial Flaps Landing Data, next page.

Table AP-1. PARTIAL FLAPS LANDING DATA

FLAP SETTING	FINAL APPROACH SPEED	MULTIPLY DISTANCE BY
UP	V_{REF} + 20	1.60
8°	V_{REF} + 15	1.20
20°	V_{REF} + 10	1.10

SINGLE-ENGINE LANDING

1. Final Landing Configuration .... GEAR—DN, FLAPS—20°
2. Approach Speeds .... V_{REF} + 10
3. Landing Distance... MULTIPLY BY 1.10

NOTE

Idle reverse thrust (if installed) is available on operative engine.

STABILIZER HEAT FAILURE—LANDING

1. Final Approach Configuration .... GEAR—DN, FLAPS—20°
2. Final Approach Speed .... V_{REF} + 10
3. Landing Distance.. MULTIPLY BY 1.10

WING HEAT FAILURE—LANDING

1. Final Approach Configuration .... GEAR—DN, FLAPS—DN
2. Final Approach Speed .... V_{REF} + 15
3. Touchdown Speed .... 15 KNOTS ABOVE NORMAL
4. Landing Distance.. MULTIPLY BY 1.30

WING AND STABILIZER HEAT FAILURE—LANDING

1. Final Approach Configuration .... GEAR—DN, FLAPS—20°
2. Final Approach Speed .... V_{REF} + 25
3. Touchdown Speed .... 25 KNOTS ABOVE NORMAL
4. Landing Distance.. MULTIPLY BY 1.35

TURBULENT AIR PENETRATION

Flight through severe turbulence should be avoided, if possible. When flying at 30,000 feet or higher, it is not advisable to avoid a turbulent area by climbing over it unless it is obvious that it can be overflown well in the clear. For turbulence of the same intensity, greater buffet margins are achieved by flying the recommended speeds at reduced altitude.

1. Airspeed .... 250 KIAS OR 0.73 M_I, WHICHEVER IS LESS

Severe turbulence will cause large and often rapid variations in indicated airspeed. ***Do not chase the airspeed.***

2. Thrust: IGNITION Switches .... ON

   Make an initial thrust setting for the target airspeed. **C*hange thrust only in the case of extreme airspeed variation.***

3. Attitude .... MAINTAIN WINGS LEVEL AND DESIRED PITCH ATTITUDE

   Use attitude indicator as the primary instrument. In extreme drafts, large altitude changes may occur. ***Do not use sudden large control movements.***

4. Stabilizer ....MAINTAIN CONTROL OF THE AIRPLANE WITH THE ELEVATORS

   After establishing the trim setting for penetration speed*,* ***do not change the stabilizer trim.***

5. Altitude .... ALLOW THE ALTITUDE TO VARY

   Large altitude variations are possible in severe turbulence. Sacrifice altitude in order to maintain the desired attitude and airspeed. ***Do not chase altitude.***

6. Autopilot and Yaw Damper:

   - Yaw Damper... ENGAGED
   - If severe turbulence is penetrated with autopilot ON, use attitude hold mode with SOFT RIDE mode engaged.

OPERATION WITH ONE FUEL COMPUTER INOPERATIVE

The following text (operation with one fuel computer inoperative) is applicable to ferry flight only per applicable regulations.

In the event the electronic fuel computer becomes inoperative, the engine will be controlled manually. The protection offered by the electronic fuel computer (except overspeed protection in manual mode) will not be available when in the fuel computer manual mode of operation or if the fuel computer is inoperative. Therefore, to complete a flight mission, the following procedures should be adhered to and extra caution must be exercised to ensure that engine limits are not exceeded.

Engine acceleration with the fuel computer in manual mode or inoperative is considerably slower than with the fuel computer on.

CAUTION

As overspeed protection is retained in the MAN mode, fuel computer OFF operation should only be used if MAN or ON operation is not available.

STARTING ENGINES

Follow the procedure for a normal engine start as outlined under Starting Engines in “Normal Procedures” chapter, except for the following:

1. Affected Engine
   FUEL CMPTR Switch .... MAN

   Note FUEL CMPTR light is illuminated.

2. SPR is a fuel computer function and will be inoperative during fuel computer manual mode.

BEFORE TAXI

Refer to Before Taxi checklist in “Normal Procedures” chapter and accomplish the fuel control governor check on appropriate engine.

TAXI

Taxi operations are conducted as described in “Normal Procedures” chapter, except as follows:

1. STANDBY PUMP
   Switch (Affected Engine) .... ON

2. JET PUMP Switch
   (Affected Engine) .... OFF

NOTE

By using the standby pump as the primary pump on the engine with the inoperative fuel computer, fuel control pneumatic circuit icing is prevented by recirculating fuel within the fuel control.

TAKEOFF

A takeoff using one engine with an inoperative fuel computer is accomplished in the same manner as a normal two-engine takeoff; however, takeoff should be made from a standing start.

WARNING

Do not dispatch if the required takeoff fan speed (N_1) setting cannot be obtained.

NOTE

- Thrust lever mismatch may occur with both engines operating at takeoff power.
- Monitor engine instruments to ensure engine limits are not exceeded.

CRUISE

Cruise operations with one fuel computer inoperative are conducted as described in "Normal Procedures" chapter, except for fuel transfer. Normal fuel transfers may be accomplished at cruise power settings with one fuel computer inoperative as follows:

NOTE

Monitor turbine speed (N_2) and fan speed (N_1) during fuel transfer. Before switching JET PUMP switch to ON, ensure steady engine operation at 80% N_1 or above.

1. JET PUMP Switch (Affected Engine) .... ON
2. STANDBY PUMP Switch (Affected Engine) .... OFF
3. Crossflow or Transfer Fuel .... AS REQUIRED
4. STANDBY PUMP Switch (Affected Engine) .... ON
5. JET PUMP Switch (Affected Engine) .... OFF

APPROACH

Refer to “Normal Procedures” chapter for Approach checklist. If required, accomplish fuel balance in accordance with fuel transfer procedures under Cruise above.

GO-AROUND

A go-around with one fuel computer inoperative is flown as described in “Normal Procedures” chapter.

WARNING

Engine acceleration is considerably slower with the fuel computer inoperative.

NOTE

Monitor engine instruments while advancing thrust levers.

OPERATION WITH NOSEWHEEL STEERING INOPERATIVE

Aircraft SNs 31-035 through 31-054 not incorporating SB 31-32-2 may be operated with the nosewheel steering inoperative provided DC power is available to supply nosewheel shimmy damping.

Aircraft SNs 31-055 and subsequent and prior aircraft incorporating SB 31-32-2 may be operated with the nosewheel steering inoperative.

TAXI

Taxi operations are relatively easy using differential braking and power. Avoid sharp turns, if possible.

NOTE

When taxiing without the nosewheel steering system engaged, it is possible to cause the nose wheel to turn 180° from the desired straight ahead position as the nose wheel free castors when the electric steering system is not engaged. If takeoff is performed with the nose wheel in this position, the uplock will not engage.

RUNWAY LINEUP

Visually ensure nose gear uplock is forward.

TAKEOFF

For takeoff, taxi on runway centerline for a short distance to ensure the nosewheel is straight, before applying takeoff power.

OPERATION WITH NOSEWHEEL STEERING NOT ARMED

AIRCRAFT SNS 31-055 AND SUBSEQUENT AND PRIOR AIRCRAFT INCORPORATING SB 31-32-2

In order for the nosewheel steering to “ARM,” DC and AC power must be available, the nose gear must be in the down-and-locked position, and the system must be fault-free as determined by the system monitor. In some instances, even though the system will not “ARM,” it may be possible to operate the nosewheel steering with full authority by depressing and holding the control wheel master switch (MSW). Limited authority nosewheel steering will be available if power is removed from the rudder boost system or a fault is detected in the rudder force sensors.

Use the following procedure to operate nosewheel steering:

1. Pilot or Copilot Control
   Wheel Master Switch (MSW) .... DEPRESS AND HOLD

2. Taxi slowly to determine the amount of steering authority.

   - If full authority is available, taxi normally.

   - If limited authority is available, taxi using rudder pedal movement for control. Differential braking will assist in turns; however, the minimum turn radius will increase approximately two times. Avoid sharp turns, if possible.

3. STEER ON Light.. MONITOR

NOTE

In the event of a malfunction, the nosewheel steering internal monitors should disconnect the system. When the system disconnects, the STEER ON light will extinguish; however, the disconnect tone will not sound.

OPERATION WITH SINGLE BATTERY

In the event a battery becomes inoperative, the following procedures should be followed. These procedures supplement existing procedures in the areas listed.

EXTERIOR PREFLIGHT

1. The operative battery must be installed in the Number 1 battery position (left side). Both battery power quick-disconnects must be connected or the left battery quick-disconnect connected and the right battery quick-disconnect disconnected and secured.

BEFORE STARTING ENGINES

NOTE

Use of GPU (if available) is recommended.

1. BATTERY 1 Switch.. ON

   Check for proper voltage.

2. BATTERY 2 Switch .... OFF

DUAL GENERATOR FAILURE

NOTE

- With the EMER BUS switch in the EMER BUS position, the auxiliary hydraulic pump will be inoperative.
- Electrical power will be supplied by the ship's battery (EMER BUS) and the emergency power supplies. Only red colored circuit breakers will be powered. A fully charged ship's battery should power the minimum electrical equipment for night instrument flight for a minimum of 0.54 hours with EM BUS TIE closed.

AIRSTART

NOTE

Use windmilling airstart procedure at night or in instrument meteorological conditions. If a starter-assist airstart must be used, the EADIs, EHSIs and air data displays may blank or momentarily lose data.

EMERGENCY PROCEDURES

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EMERGENCY PROCEDURES

INTRODUCTION

The procedures presented here have been developed by Learjet, Inc. for certification of this aircraft. This chapter contains those operating procedures using special systems and/or regular systems in order to protect the occupants and the aircraft from harm during a critical situation requiring immediate response. Procedures or parts of procedures in this chapter emphasized by a shaded box ▭ are memory items and should be accomplished without reference to the checklist.

The procedures located in this section supplement the Normal Procedures when an emergency condition exists. Use of Normal Procedures should be continued when applicable. Sound judgement as well as thorough knowledge of the aircraft, its characteristics, and the flight manual procedures are essential in the handling of any emergency situation.

OVERRIDING CONSIDERATIONS

In all emergencies, the overriding consideration must be to:

- Maintain Airplane Control
- Analyze the Situation
- Take Proper Action

TERMINOLOGY

Many emergencies require some urgency in landing the aircraft. The degree of urgency required varies with the emergency; therefore, the terms “land as soon as possible” and “land as soon as practical” are employed. These terms are defined as follows:

Land as Soon as Possible—A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, ambient lighting, and aircraft gross weight.

Land as Soon as Practical—Emergency conditions are less urgent, and although the mission is to be terminated, the degree of the emergency is such that an immediate landing at the nearest adequate airfield may not be necessary.

ELECTRICAL

WING OV HT LIGHT ILLUMINATED

The red WING OV HT light will illuminate in the event that the wing structure heats to 215°F (102°C).

1. WING TEMP Indicator.. CHECK

2. If WING TEMP Indicator is approaching or in the red band, a wing overheat condition exists:

   a. STAB WING HEAT Switch .... OFF

   b. WING HT Circuit Breaker (R ANTI-ICE group)........................ PULL

      The WING TEMP indicator will be inoperative.

   c. STAB WING HEAT Switch................................. STAB WING HEAT.

      This will provide stabilizer heat without activating the wing heat.

   d. Fly out of icing conditions.

WARNING

Even **small** accumulations of ice on the wing leading edge can cause an increase in stall speed and possibly a degradation in stall characterstics.

If approach and landing must be made with any ice (or suspected ice during night operations) on the wing leading edge, refer to WING HEAT FAILURE—LANDING procedure, “Abnormal Procedures” chapter.

WSHLD OV HT LIGHT ILLUMINATED

Illumination of the red WSHLD OV HT light indicates the bleed-air temperature in the windshield nozzles has exceeded the system limits. Airflow should automatically shut off when the WSHLD OV HT light illuminates.

If airflow did not shut off when WSHLD OV HT light illuminated:

1. WSHLD HEAT Switch .... OFF

AC BUS FAILURE

Each AC bus is intended to be powered by only one inverter. Therefore, the AC BUS TIE Switch (copilot’s circuit breaker panel) is normally in the OPEN (down) position isolating the pilot's and copilot's AC buses. The AC BUS TIE Switch should only be closed after setting one of the INVERTER Switches to OFF. Also, the auxiliary inverter (if installed) should only be switched into an AC bus after setting the applicable INVERTER Switch to OFF.

An AC bus failure is indicated by illumination of the amber ELEC PWR annunciator, an amber or red light on the electric power monitor and flashing of the associated VAC display. The most likely cause is either an inverter failure or open AC bus feeder circuit breaker (AC BUS or 115 VAC).

1. Affected INVERTER Switch(es) .... OFF

2. AC BUS TIE Switch .... OPEN

   Ensure switch is in the down position.

3. Affected INV
   Circuit Breakers .... PULL AND/OR RESET

4. Affected AC BUS or 115 VAC (if applicable)
   Circuit Breaker .... PULL AND/OR RESET

5. Reduce AC Load on affected bus(es) .... REFER TO TABLE

6. Affected INVERTER Switch(es) .... ON

If AC power is not regained:

NOTE

A failure on either AC bus may cause partial loss of windshield defog capability.

7. Affected INVERTER Switch(es) .... OFF

8. *Aircraft with auxiliary inverter*
   AUX INV Switch .... L OR R AS APPLICABLE

NOTE

Malfunction of the auxiliary inverter system, after being connected to the failed AC bus, indicates a fault on the AC bus.

9. If only one inverter is operational and it is desired to power loads on the failed bus:

a. *Aircraft 31-035 through 31-065 except 31-061*, reduce load on both AC buses. Refer to table.

b. AC BUS TIE Switch—Switch to closed(up) position. Both AC uses will be powered by the operating inverter. If the BUS TIE switch opens, leave it open.

NOTE

The following circuit breaker listings do not include circuit breakers added as a result of optional equipment installations.

AC buses and their associated loads are:

• *31-035 through 31-065 except 31-061* **(NORMAL MODE)**

L AC BUS	L 163 VAC	R AC BUS	R 163 VAC
- ELECTRICAL - L 26 VAC **- AFCS -** AP 1 MON MACH TRIM **- INSTRUMENTS -** AHS 1 **- LIGHTS -** FLOOD LTS L EL LTS **- TRIM-FLT CONT -** NOSE STEER **- ENGINE INSTR -** L OIL PRESS **- AVIONICS -** NOSE FAN	**- ANTI-ICE -** * L WSHLD DEFOG	**- ELECTRICAL -** R 26 VAC **- AFCS -** AP 2 MON **- INSTRUMENTS -** AHS 2 STBY HSI **- LIGHTS -** R EL LTS **- ENGINE INSTR -** R OIL PRESS **- AVIONICS -** RADAR	**- ANTI-ICE -** * R WSHLD DEFOG

• *31-061, 31-066 and Subsequent* **(NORMAL MODE)**

L 115 VAC BUS	L 26 VAC BUS	R 115 VAC BUS	R 26 VAC BUS
- AFCS - AP 1 MON MACH TRIM **- LIGHTS -** FLOOD LTS L EL LTS **- TRIM-FLT CONT -** NOSE STEER **- AVIONICS -** NOSE FAN	**- INSTRUMENTS -** AHS 1 **- ENGINE INSTR -** L OIL PRESS	**- AFCS -** AP 2 MON **- LIGHTS -** R EL LTS	**- INSTRUMENTS -** AHS 2 STBY HSI **- ENGINE INSTR -** R OIL PRESS **- AVIONICS -** RADAR

L 163 VAC	R 163 VAC
- ANTI-ICE - * L WSHLD DEFOG	**- ANTI-ICE -** * R WSHLD DEFOG

AC circuit breakers are denoted as follows:

- *Aircraft 31-035 through 31-065 except 31-061,* white rings on the overlay denote AC circuit breakers.
- *Aircraft 31-061, 31-066 and subsequent,* white rings on the overlay denote AC circuit breakers not on the EMER BUS.

* DC circuit breaker

All **(EMER BUS MODE)**

L AC EMER BUS	R AC EMER BUS
- ELECTRICAL - L 26 VAC **- LIGHTS -** FLOOD LTS	**- INSTRUMENTS -** AHS 2 STBY HSI

EMER BUS circuit breakers are denoted as follows:

- *Aircraft 31-035 through 31-065 except 31-061*, red collars are installed on the circuit-breaker stem.
- *Aircraft 31-061, 31-066 and subsequent,* segmented red/white rings on the overlay denote AC EMER BUS circuit breakers.

NOTE

If a total AC power failure occurs, the equipment in the preceding tables will be inoperative with the following exceptions:

- AHS attitude and heading data displayed on the EFIS will be valid.
- Heading data (AHS 2), on the standby HSI, will be invalid. Navigational data will remain valid.
- The AHS AC circuit breakers provide power for systems requiring analog attitude and heading data.

BATTERY OVERHEAT (AIRCRAFT WITH NICKEL-CADMIUM BATTERIES)

NOTE

If either red BAT 140 or BAT 160 light illuminates during flight, both batteries must be checked per Chapter 12 of the *Maintenance Manual* after landing.

BAT 140 Light Illuminated

1. BAT TEMP Indicator .... MONITOR TO DETERMINE AFFECTED BATTERY

2. Affected BATTERY Switch .... OFF

3. Land as soon as practical.

BAT 160 Light Illuminated

1. BAT TEMP Indicator .... MONITOR TO DETERMINE AFFECTED BATTERY

2. Affected BATTERY Switch .... OFF

3. Land as soon as possible.

CURRENT LIMITER FAILURE/ CUR LIM LIGHT ILLUMINATED IN FLIGHT

A battery charging bus current limiter (275-amp) failure is evidenced by illumination of the red CUR LIM light. Should a battery charging bus current limiter fail:

NOTE

Generator loading may not read equally..

1. Electric Power Monitor ....CHECK

   Failure of both 275-amp current limiters is indicated if VDC reading (battery Voltage) is 25 VDC or less and/or AMP readings (generator load) do not increase when COOL, AUX HT or STAB HEAT is momentarily energized.

2. • ***If one 275-amp current limiter has failed:***

   a. Electrical Load .... REDUCE IF REQUIRED

      Reduce load to observe generator limits.

   b. Continue flight but monitor electrical loads.

• ***If both 275-amp current limiters have failed:***

a. COOL Switch .... OFF

b. STAB HEAT Circuit
Breaker (R Anti-ice Group) .... PULL

c. RECOG Light Switch .... OFF

d. AUX HT Switch.. OFF

e. AUX INV Switch (if installed) .... OFF

NOTE

Electrical power to the battery charging bus is being supplied by the ship's batteries. If the batteries should become depleted, primary pitch trim system will be inoperative.

3. After landing, replace failed 275-amp current limiter(s) prior to next flight.

DC BUS FAILURE

The DC BUS TIE switches (copilot's circuit-breaker panel) are normally in the open (down) position isolating the pilot's and copilot's DC buses.

The EMER BUSES are powered from the respective DC BUS 1 during normal operation. Upon the loss of a DC BUS 1 bus, the corresponding EMER BUS will lose power. The EM BUS TIE (copilot's circuit-breaker panel) is only functional when the EMER BUS switch is positioned to EMER BUS.

NOTE

The circuit breaker tables in this procedure do not include circuit breakers added as a result of optional equipment installation.

If a L or R DC BUS 1, 2, or 3 circuit breaker opens in flight:

1. Affected BUS TIE Switch.. CHECK

   Ensure switch is in the open (down) position.

2. Electrical Load on
   Affected Bus.. REDUCE, REFER TO TABLE

3. Affected DC BUS
   Circuit Breaker .... RESET

NOTE

Wait at least one minute cooling time before attempting to reset DC BUS circuit breakers.

4. If DC BUS circuit breaker holds after being reset, add loads only as necessary for safe operation.

5. If DC BUS circuit breaker (DC BUS 1, DC BUS 2, or DC BUS 3) will not stay closed and it is desired to operate a load connected to that bus:

   a. Reduce load on both affected DC buses to a minimum.

   b. Affected BUS TIE Switch .... SWITCH TO CLOSED (UP) POSITION

   If the BUS TIE circuit breaker opens, leave it open.

NOTE

The following circuit breaker listings do not include circuit breakers added as a result of optional equipment installations.

If both L or R DC BUS 1 circuit breakers open in flight:

1. DC BUS 1 TIE Switch .... ENSURE SWITCH IS IN THE OPEN (DOWN) POSITION

2. Electrical load on L and R DC BUS .... REDUCE. REFER TO TABLE

3. L and R DC BUS Circuit Breakers .... RESET, ONE AT A TIME

NOTE

Wait at least one minute cooling time before attempting to reset circuit breakers.

4. • *If either or both DC BUS 1 circuit breaker(s) hold after being reset:*

   a. Add loads only as necessary for safe operation.

   b. Land as soon as practical.

   • *If neither DC BUS 1 circuit breaker(s) hold after being reset:*

   a. EMER BAT Switches .... CHECK ON

   b. EMER BUS Switch .... EMER BUS

NOTE

- The generators will provide electrical service to DC BUS 2 and 3. The ship's batteries will provide electrical service to those circuits denoted by either a red collar on the circuit breaker stem or a red ring on the circuit breaker overlays. Fully charged ship's batteries should power the minimum electrical equipment for night instrument flight for at least 1.1 hour.

- The ship's batteries will not be charged while operating in EMER BUS mode. Occasionally switching back to NORMAL will allow the batteries to be charged, but results in the loss of service to all DC BUS 1 loads.

c. Airspeed .... 0.78 M_I OR BELOW

d. If there is fuel in the fuselage tank,
FUS TANK GRAV XFR Switch.. OPEN

NOTE

With GRAV XFR selected, 150 to 300 pounds (68 to 136 kilograms) (depending upon flight attitude) of fuselage fuel will be unusable.

e. Land as soon as practical.

f. Before landing,
FUS TANK GRAV XFR Switch .... CLOSE

If both L and R DC Bus 2 circuit breakers open in flight:

1. DC BUS 2 TIE Switch.............................. ENSURE SWITCH IS IN THE OPEN (DOWN) POSITION

2. Electrical load on L and R DC BUS 2 ...... REDUCE. REFER TO TABLE

3. L and R DC BUS 2 Circuit Breakers................ RESET, ONE AT A TIME

NOTE

Wait at least one minute cooling time before attempting to reset circuit breakers.

4. • *If either or both DC BUS 2 circuit breaker(s) holds after being reset:*

a. Add loads only as necessary for safe operation.

b. Land as soon as practical.

- *If neither DC BUS 2 circuit breaker holds after being reset:*

a. Land as soon as practical.

If both L and R DC Bus 3 circuit breakers open in flight:

1. DC BUS 3 TIE Switch .... ENSURE SWITCH IS IN THE OPEN (DOWN) POSITION

2. Electrical load on L and R DC BUS 3 ...... REDUCE. REFER TO TABLE

3. L and R DC BUS 3 Circuit Breakers................ RESET, ONE AT A TIME

NOTE

Wait at least one minute cooling time before attempting to reset circuit breakers.

4. • *If either or both DC BUS 3 circuit breaker(s) holds after being reset:*

a. Add loads only as necessary for safe operation.

b. Land as soon as practical.

- *If neither DC BUS 3 circuit breaker holds after being reset:*

a. Land as soon as practical.

DC buses and their associated loads on the pilot's circuit breaker panel are:

L EMER BUS	L DC BUS 1	L DC BUS 2	L DC BUS 3
- ELECTRICAL - EL PWR MON L INV EMER BAT 1 **- ENGINES-FUEL -** L FIRE DET L FIRE EXT L IGN L FW SOV L JET PUMP-XFR VAL **- INSTRUMENTS -** PILOT A/S PILOT ALTM VSI ADC 1 **- LIGHTS -** WARN LTS **- TRIM-FLT CONT -** PRI PITCH TRIM L STALL WARN WHEEL MASTER **- ENGINE INSTR -** L ITT **- ANTI-ICE -** L PITOT HT **- ENVIROMENT -** L BLEED AIR L EMER PRESS **- AVIONICS -** L AUDIO COMM 1 NAV 1 ADF 1 ATC 1	**- ELECTRICAL -** EL PWR MON L INV EMER BAT 1 **- ENGINES-FUEL -** L FIRE DET L FIRE EXT L IGN L FW SOV L JET PUMP-XFR VAL **- INSTRUMENTS -** PILOT A/S PILOT ALTM VSI EADI 1 EHSI 1 SG 1 EADI SG 1 EHSI EFIS SW 1 UNIT ADC 1 AHS 1 MFD **- LIGHTS -** STROBE LTS WARN LTS **- TRIM-FLT CONT -** PRI PITCH TRIM L STALL WARN WHEEL MASTER **- ENGINE INSTR -** L ITT **- ANTI-ICE -** L PITOT HT TAT PROBE HT **- ENVIROMENT -** L BLEED AIR L EMER PRESS CREW & CAB FAN ① FLOOD FAN ② COOL-CREW FAN ② **- AVIONICS -** L AUDIO COMM 1 NAV 1 ADF 1 ATC 1	**- ENGINES-FUEL -** L FUEL CMPTR **- INSTRUMENTS -** STATIC SOURCE L CLOCK **- LIGHTS -** NAV LTS L LDG-TAXI LTS **- TRIM-FLT CONT -** ROLL TRIM YAW TRIM SQUAT SW NOSE STEER **- ENGINE INSTR -** L N_1 L N_2 **- ANTI-ICE -** WSHLD HT L STALL VANE HT L NAC HT **- AVIONICS -** DME 1 RADIO ALT	**-AFCS -** AP 1 FLT DIR 1 RUDDER BOOST SYSTEM TEST **- ENGINES-FUEL -** L IGN-START L STBY-SCAV PUMP FUS XFR PUMP **- INSTRUMENTS -** SAT-TAS SG 3 EADI SG 3 EHSI **- LIGHTS -** L INSTR LTS **- ENGINE INSTR -** L OIL TEMP **- ANTI-ICE -** L WSHLD DEFOG L ICE DET **- ENVIROMENT -** OXY VALVE FREON ① CABIN AIR AUX CREW HT **- AVIONICS -** L AV MASTER

① Applicable to aircraft 31-035 through 31-190.
② Applicable to aircraft 31-191and subsequent.

EMER BUS circuit breakers are denoted as follows:

- *Aircraft 31-035 through 31-065 except 31-061*, red collars are installed on the circuit-breaker stem.

- *Aircraft 31-061, 31-066 and subsequent*, solid red rings on the overlay denote DC EMER BUS circuit breakers.

DC buses and their associated loads on the copilot's circuit breaker panel are:

R EMER BUS	R DC BUS 1	R DC BUS 2	R DC BUS 3
- ELECTRICAL - EMER BAT 2 **- ENGINES-FUEL -** R FIRE DET R FIRE EXT R IGN R FW SOV R JET PUMP-XFR VAL XFLO VALVE FUEL QTY **- INSTRUMENTS -** AHS 2 STBY HSI **- LIGHTS -** WARN LTS **- TRIM-FLT CONT -** SEC PITCH TRIM FLAPS SPOILER R STALL WARN TRIM-FLAP IND WARN HORNS **- HYDRAULICS -** GEAR **- ENGINE INSTR -** R ITT **- ANTI-ICE -** R PITOT HT **- ENVIROMENT -** R BLEED AIR R EMER PRESS **- AVIONICS -** R AUDIO	**- ELECTRICAL -** R INV EMER BAT 2 **- ENGINES-FUEL -** R FIRE DET R FIRE EXT R IGN R FW SOV R JET PUMP-XFR VAL XFLO VALVE FUEL QTY **- INSTRUMENTS -** CP A/S CP ALTM VSI EADI 2 EHSI 2 SG 2 EADI SG 2 EHSI EFIS SW 2 UNIT ADC 2 AHS 2 STBY HSI **- LIGHTS -** WARN LTS **- TRIM-FLT CONT -** SEC PITCH TRIM FLAPS SPOILER R STALL WARN TRIM-FLAP IND WARN HORNS **- HYDRAULICS -** GEAR **- ENGINE INSTR -** R ITT **- ANTI-ICE -** R PITOT HT **- ENVIROMENT -** R BLEED AIR R EMER PRESS **- CABIN -** CABIN LTS GASPER FAN (1) **- AVIONICS -** R AUDIO	**- ENGINES-FUEL -** AUX INV **-AFCS -** AP FAN **- ENGINES-FUEL -** R FUEL CMPTR **- INSTRUMENTS -** INSTR FANS **- LIGHTS -** WING INSP LT **- HYDRAULICS -** HYD PRESS IND AIR PRESS IND **- ENGINE INSTR -** R N_1 R N_2 **- ANTI-ICE -** R STALL VANE HT R NAC HT **- ENVIRONMENT -** PRESS CONT CAB TEMP & CONT IND **- CABIN -** PASS SPKR **- AVIONICS -** COMM 2 NAV 2 RADAR ATC 2	**-AFCS -** AP 2 FLT DIR 2 **- ENGINES-FUEL -** R IGN-START R STBY-SCAV PUMP **- INSTRUMENTS -** R CLOCK **- LIGHTS -** BCN LTS R INSTR LTS RECOG LT R LDG-TAXI LTS **- HYDRAULICS -** ANTI SKID **- ENGINE INSTR -** R OIL TEMP **- ANTI-ICE -** R WSHLD DEFOG STAB HT R ICE DET WING HT ALC SYS **- AVIONICS -** R AV MASTER HR METER

* If installed

(1) *Applicable to AC 31-191 & subsequent*

EMER BUS circuit breakers are denoted as follows:

- *Aircraft 31-035 through 31-065 except 31-061*, red collars are installed on the circuit-breaker stem.
- *Aircraft 31-061, 31-066, and subsequent,* solid red rings on the overlay denote DC EMER BUS circuit breakers.

DUAL GENERATOR FAILURE

1. START–GEN Switches... CHECK, GEN
2. L and R IGN–START and GEN Circuit Breakers.. CHECK, IN
3. Electrical Load... REDUCE
   a. COOL Switch .... OFF
   b. AUX HEAT Switch.. OFF
   c. WSHLD DEFOG Switch.. OFF
4. GEN RESET Switches .... RESET MOMENTARILY

If generators do not reset:

5. Turbine Speed (N_2)... 80% RPM OR ABOVE
6. START–GEN Switches .... OFF, THEN GEN
7. GEN RESET Switches .... RESET MOMENTARILY

If generators do not rest:

8. START–GEN Switches .... OFF
9. JET PUMP Switches.. CHECK, ON
10. Both FUEL CMPTR Switches... MAN, ONE AT A TIME

    Control engines manually.

CAUTION

- Engine response will be much slower with the fuel computers in MAN mode.
- Monitor Fan Speed (N_1) indicators. If an engine accelerates uncontrolled, immediately set applicable FUEL CMPTR switch(es)—ON. If this occurs, it may be necessary to shed electrical loads manually rather than switching to EMER BUS.

11. If there is fuel in the fuselage tank:

    FUS TANK GRAV XFR Switch .... OPEN

NOTE

When using GRAV XFR, 150 to 300 pounds (68-136 Kg) (depending upon flight attitude) of fuselage fuel will be unusable.

12. Floodlights .... ON, FOR NIGHT OPERATION

13. EMER BAT Switches .... CHECK, ON

14. EMER BUS Switch .... EMER BUS

15. *Aircraft 31-035 through 31-065 except 31-061*
    EM BUS TIE Switch .... CLOSED (UP) POSITION

16. *Aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2*
    RUDDER BOOST Switch .... OFF

NOTE

- Electrical power will be supplied by the ship's batteries (EMER BUS) and the emergency power supplies. Only red colored circuit breakers will be powered. Fully charged ship's batteries (standard lead-acid) and the emergency power supply should power the minimum electrical equipment for night instrument flight for a minimum of 1.1 hours from the time both generators are off.
- EMER BUS switch may be returned to the NORMAL position if it is desired to restore electrical power to all systems. The ship's batteries will discharge at a faster rate under this condition.

17. Table EP-1 lists conditions that will exist.

18. Land as soon as practical.

    Before landing:

    a. EMER BUS Switch .... NORMAL

    b. FUS TANK GRAV XFR Switch .... CLOSE

Table EP-1. CONDITIONS—GENERATORS NOT RESETTING

SYSTEM	CONDITION
Anti-Ice	
Nacelle Heat	Nacelle heat (bleed air) will be on regardless of NAC HEAT switch position.
Pitot Heat	Operative
All Other Systems	Inoperative. Avoid incing conditions.
Antiskid	Inoperative
Autopilot/Yaw Damper	Inoperative
Aux Hyd Pump	Operative
Avionics	
ADF	ADF 1 operative; ADF 2 (if installed) inoperative.
COM	COM 1 operative; COM 2 inoperative.
NAV	NAV 1 operative; NAV 2 inoperative; NAV capability through standby HSI.
ATC	ATC 1 operative; ATC 2 (if installed) inoperative
Audio Panels	Both operative
All other avionics	Inoperative
Engines	
Fuel Computers	Inoperative
Engine Fire	
Detection	Operative
Extinguishing	Operative
Firewall Shutoff Valves	Operative
Flaps	Operative
Fuel	
Electric Pumps	Inoperative
Jet Pumps	Operative
XFLO Valve	Operative
Gravity XFR	Operative
Ignition	Operative

Table Continued Next Page

If aircraft's batteries are depleted (See Table EP-3):

NOTE

If the aircraft's batteries are depleted, the only electrical power available will be from the emergency battery.

19. Land as soon as possible. Nosewheel steering, anti-skid, flaps, and spoiler will be inoperative for landing. Use V_{REF} + 20 as the final approach speed. Landing distance will be approximately 315% (multiplied by 3.15) of actual landing distance for anti-skid ON shown in Section V of the *AFM*.

20. Table EP-3 lists conditions that will exist.

Table EP-1. CONDITIONS—GENERATORS NOT RESETTING (Cont)

SYSTEM	CONDITION
Indicators	
N_1	Operative
ITT	Operative
Fuel Quantity	Operative
Flap Position	Operative
Elect Power Monitor	Operative
N_2	Inoperative
Oil Pressure	Inoperative
Oil Temp	Inoperative
SAT–TAS	Inoperative
Fuel Flow	Inoperative
Fuel Counter	Inoperative
Wing Temp	Inoperative
Instruments	
Airspeed/Mach	Both operative
Altimeter/VSI	Both operative
EFIS Displays	Inoperative
Standby HSI	Operative
Standby Airspeed & Altimeter	Operative
Standby Gyro	Operative
Landing Gear	Operative; DOWN and UNSAFE lights operative
Lighting—Cockpit	
Floodlights	Operative
Instruments	Lighting for standby gyro, N_1 indicators, standby airspeed indicator, standby altimeter, standby HSI and magnetic compass will be operative. For night operations, a flashlight may be necessary to see certain instruments.
Lighting—Exterior	Inoperative
Pressurization	
Auto Mode	Operative
Manual Mode	Inoperative
Spoilers	Operative
Trim	
Mach	Inoperative. **Do not exceed M_{MO} (0.78 M_I)**.
Primary and Secondary Pitch	Operative
Aileron	Inoperative; Will remain at last setting
Rudder	Inoperative; Will remain at last setting
Warning System	
Lights	Operative
Horns	Operative
Trim-in-Motion	Operative
Stall Warning	Operative

Table EP-2. EQUIPMENT AND OPERATING TIME

POWER SUPPLY	THIRD ATTITUDE GYRO	FAN SPEED (N_1) INDICATOR	GEAR INDICATOR LIGHTS	INSTRUMENT LIGHTING	TOTAL OPERATING TIME
BAT 1	•	•	•	•	2.2 Hours

**** Operating time is from the time of the dual generator failure.***

Table EP-3. CONDITIONS—BATTERIES DEPLETED

SYSTEM	CONDITION
Anti-Ice	All systems are inoperative except for nacelle heat. Nacelle heat (bleed air) will be on regardless of NAC HEAT switch position. Avoid icing conditions.
Antiskid	Inoperative
Autopilot/Yaw Damper	Inoperative
Aux Hyd Pump	Inoperative
Avionics	All avionics inoperative
Engines	
Fuel Computers	Inoperative
Engine Fire	
Detection	Inoperative
Extinguishing	Inoperative
Flaps	Inoperative
Fuel	
Electric Pumps	Inoperative
System Valves	Will remain in their last position.
Ignition	Inoperative

Table Continued Next Page

Table EP-3. CONDITIONS—BATTERIES DEPLETED (Cont)

SYSTEM	CONDITION
Indicators	
N_1	Operative
ITT	Inoperative
Fuel Quantity	Inoperative
Flap Position	Inoperative
N_2	Inoperative
Oil Pressure	Inoperative
Oil Temp	Inoperative
SAT–TAS	Inoperative
Fuel Flow	Inoperative
Fuel Counter	Inoperative
Wing Temp	Inoperative
Instruments	
Airspeed/Mach	Both inoperative
Altimeter/VSI	Both inoperative
EFIS Displays	Inoperative. Use standby gryo.
Standby HSI	Inoperative
Standby Airspeed & Altimeter	Operative
Standby Gyro	Operative
Landing Gear	Inoperative. Use ALTERNATE GEAR EXTENSION/ ELECTRICAL MALFUNCTION procedure in Section IV of the *AFM*. DOWN and UNSAFE lights will be operative.
Lighting—Cockpit	
Floodlights	Inoperative
Instruments	Lighting for standby gyro, N_1 indicators, standby airspeed indicator, standby altimeter, standby HSI, and magnetic compass will be operative. For night operations, a flashlight may be necessary to see certain instruments.
Lighting—Exterior	Inoperative
Pressurization	Will revert to the emergency mode
Spoilers	Inoperative. ***Do not exceed 41,000 feet.***
Trim	
Pitch, Roll, and Yaw	Inoperative; Will remain at last setting
Mach	Inoperative. ***Do not exceed*** M_{MO} ***(0.78MI).***
Warning System	
Lights	Inoperative
Horns	Inoperative
Trim-in-Motion	Inoperative
Stall Warning	Inoperative. Maintain adequate margin above stall speed by reference to airspeed indicator.

ENGINE

ENGINE FAILURE

During Takeoff

Below V_1 Speed

1. Thrust Levers .... IDLE
2. Wheel Brakes .... APPLY
3. Spoilers .... EXT

4. Drag Chute or Thrust Reversers (if installed) .... DEPLOY, IF NECESSARY

Above V_1 Speed

1. Rudder and Ailerons.. AS REQUIRED, FOR DIRECTIONAL CONTROL
2. Accelerate to V_R.

NOTE

Directional control is improved if the nosewheel is kept on the runway until V_R.

3. Rotate at V_R; Climb at V_2.
4. GEAR .... UP

   Position gear UP when positive rate of climb is established.
5. When clear of obstacles, accelerate to V_2 +20 and retract flaps.

6. Refer to ENGINE FAILURE IN FLIGHT procedure, “Abnormal Procedures” chapter or ENGINE FIRE—SHUTDOWN procedures in this section.

In Flight

1. Control Wheel Master Switch (MSW)........... DEPRESS. YAW DAMPER AND AUTOPILOT WILL DISENGAGE

2. Rudder and Ailerons.. AS REQUIRED, FOR DIRECTIONAL CONTROL
3. Thrust Lever (operative engine).................... INCREASE AS REQUIRED
4. ENG SYNC Switch.. OFF
5. Rudder Trim .... AS REQUIRED
6. Yaw Damper .... AS DESIRED
7. Autopilot.. AS DESIRED
8. Refer to ENGINE SHUTDOWN IN FLIGHT procedure, "Abnormal Procedures" chapter.

During Approach

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

   Yaw damper and autopilot will disengage.

2. Thrust Lever (Operative Engine).. INCREASE AS REQUIRED
3. Flaps .... 20°

   NOTE

   If aircraft is configured with landing flaps (DN) when engine failure occurs, thrust increase (on operative engine) and flap retraction to 20° should be near simultaneous actions

4. Airspeed .... V_{REF} + 10

5. Rudder Trim .... AS REQUIRED

NOTE

During a coupled approach, full rudder trim may be required with an actual engine failure. Use rudder pedal force as necessary to maintain slip indicator ball centered.

6. Yaw Damper .... AS DESIRED

7. Autopilot .... AS DESIRED

8. Refer to either of the following as applicable:

   - SINGLE-ENGINE LANDING PROCEDURE, "Abnormal Procedures" chapter.

   - GO-AROUND procedure, "Normal Procedures" chapter, and ENGINE SHUTDOWN IN FLIGHT procedure, "Abnormal Procedures" chapter.

ENGINE FIRE—SHUTDOWN

An engine fire is usually accompanied by other indications, such as: excessive Turbine Temperature (ITT), erratic or rough engine operation, fluctuating engine indications, or smoke in the cabin.

Affected Engine:

1. Thrust Lever .... IDLE
   Unless a critical thrust situation exists.

2. • If fire continues more than 15 seconds or there are other indications of fire:

   a. Thrust Lever .... CUTOFF

   b. ENG FIRE PULL T-Handle .... PULL

   NOTE

   Pulling the ENG FIRE PULL T-Handle stops the flow of fuel and hydraulic fluid to the engine, shuts off bleed air from the engine and arms the fire-extinguishing system.

   c. ENG EXT ARMED Light .... DEPRESS ONE

   d. • ***If fire continues:***

      (1) Depress remaining ENG EXT ARMED light.

      (2) Land as soon as possible.

      (3) Go to step e.

      • ***If fire extinguishes:***

      (1) Land as soon as practical.

      (2) Go to step e.

e. IGNITION Switch .... OFF

f. Yaw Damper... OFF, RETRIM AS DESIRED; THEN YAW DAMPER, AS DESIRED

g. ENG SYNC Switch .... OFF

h. JET PUMP Switch.. OFF
STANDBY PUMP Switch.. OFF

i. START-GEN Switch .... OFF

j. Electrical Load .... REDUCE, IF REQUIRED TO MAINTAIN GENERATOR LOAD LIMITS

k. CROSSFLOW Switch .... OPEN
Monitor fuel balance. Crossflow as required.

NOTE

During single-engine operation, maintain slip indicator ball centered.

1. Refer to SINGLE-ENGINE LANDING, "Abnormal Procedures" chapter.

- ***If fire extinguishes in less than 15 seconds:***

a. Leave thrust lever at IDLE, unless a critical thrust situation exists.

b. Yaw Damper... OFF, RETRIM AS DESIRED; THEN YAW DAMPER – AS DESIRED

c. ENG SYNC Switch .... OFF

d. Monitor fuel balance. Crossflow as required.

e. Land as soon as practical.

f. Refer to SINGLE-ENGINE LANDING, "Abnormal Procedures" chapter.

IMMEDIATE ENGINE AIRSTART

WARNING

Do not attempt an airstart following an engine failure which was accompanied by indications of internal engine damage or fire.

An immediate airstart may be attempted before engine decelerates.

Affected Engine:

1. Thrust Lever .... IDLE
2. IGNITION Switch .... ON
3. STANDBY PUMP Switch .... ON

CAUTION

If ITT is approaching the limit and rising rapidly, immediately retard thrust lever to CUTOFF.

After airstart is complete:

4. Thrust Lever .... ADVANCE
5. IGNITION Switch .... OFF
6. STANDBY PUMP Switch .... OFF

If no indication of light-off is obtained within 10 seconds:

7. Thrust Lever .... CUTOFF
8. START–GEN Switch .... OFF
9. STANDBY PUMP Switch .... OFF
10. IGNITION Switch .... OFF
11. Perform ENGINE SHUTDOWN IN FLIGHT procedure, “Abnormal Procedures” chapter.

OIL PRESS LIGHT ILLUMINATED

Illumination of a red OIL PRESS light indicates that oil pressure for the respective engine is below 25 psi. In the event a low OIL PRESS light illuminates in flight:

Affected Engine:

1. OIL PRESS and OIL TEMP Indicators........... CHECK TO DETERMINE OIL PRESSURE AND OIL TEMPERATURE

2. • **Oil pressure is less than 25 psi:**

   If flight conditions permit, a precautionary engine shutdown is advised. Refer to ENGINE SHUTDOWN IN FLIGHT procedure, “Abnormal Procedures” chapter.

   • **Oil pressure is between 25 and 38 psi, or oil temperature is high:**

   If flight conditions permit, reduce power to maintain oil temperature limits.

   • **Oil pressure and oil temperature are normal:**

   Continue to monitor engine operation.

BLEED AIR LIGHT ILLUMINATED

If either red BLEED AIR L or BLEED AIR R light illuminates, an overheat sensor in the bleed-air ducting or pylon structure has tripped the light.

1. Corresponding BLEED AIR Switch ....OFF

DOOR LIGHT ILLUMINATED

Illumination of the red DOOR light indicates that one or more of the cabin entry door locking pins may not be fully engaged, or the cabin entry door actuator hook(s) are still engaged. During flight, the door should not be approached if the red DOOR light is illuminated; however, while on the ground, door latch pin engagement may be visually verified. The cabin entry door has 10 latch pins. *On aircraft with a 36-inch* cargo door, the six pins on the upper portion can be viewed through a port in the door upholstery. *On aircraft with 24-inch* cargo door, only one of the six pins on the upper portion can be viewed through a port in the door upholstery. Two pins in the lower portion may be viewed by opening the inspection doors on the step to reveal the pin mechanism. Assure that white lines on the door structure align with white lines on latch pins. Two latch pins, located at the upper/lower door interface, are visible through an upholstery gap at the interface and do not have white lines. If all latch pins are fully engaged and door actuator hook(s) are disengaged, the most probable cause of the illuminated DOOR light is a latch pin switch malfunction.

If light was accompanied by evidence of door failure:

WARNING

Door failure may be indicated by loud noise, pressurization leak, or rumble emanating from door area. ***Do not approach door.***

1. FASTEN SEAT BELT Switch .... ON

2. Cabin Altitude ....UP TO MAXIMUM POSSIBLE

NOTE

Increasing cabin altitude to 9,000 feet will reduce differential pressure while avoiding actuation of the emergency pressurization system. The amber CAB ALT light will illuminate.

3. Airspeed.. REDUCE

4. Establish descent.

5. Land as soon as practical.

If light was not accompanied by evidence of door failure:

WARNING

Do not approach door.

1. FASTEN SEAT BELT Switch .... ON

2. Continue flight. The most probable cause is a latch pin switch malfunction.

CABIN ALTITUDE WARNING HORN ACTIVATES, OR CABIN ALTITUDE EXCEEDS 10,000 FEET, OR CAB ALT HI LIGHT ILLUMINATES (IF APPLICABLE) (EMERGENCY DESCENT)

NOTE

CAB ALT HI light installed only on aircraft 31-240 and subsequent and prior aircraft modified by SB 31-31-5.

1. Crew Oxygen Masks .... DON

   Select 100% oxygen.

2. Thrust Levers .... IDLE

3. Autopilot .... DISENGAGE

4. SPOILER Switch .... EXT

5. Descend AT M_{MO}/V_{MO} as appropriate, but *not* below minimum safe altitude.

6. PASSENGER OXYGEN Valve .... DEPLOY

WARNING

If aircraft structural failure is evident, limit speeds and maneuvering loads as much as possible in descent.

NOTE

- Descent from 51,000 feet to 15,000 feet requires approximately 4 minutes 30 seconds.
- Hats and "ear-muff" tuype headsets must be removed prior to donning crew oxygen masks.
- The thrust lever MUTE button will mute the cabin altitude warning horn for 60 seconds.

7. Pilot and Copilot MIC SELECT Switches.. OXY

NOTE

With the switches in this position, both cockpit speakers, phone and interphone function will be activated, enabling the crew to communicate via the interphone.

If time and conditions permit:

8. Transponder .... EMERGENCY 7700

9. Notify controlling agency.

10. Check condition of passengers and provide assistance if conditions permit.

NOTE

Communication with passengers can be accomplished by using PASS SPKR function of the AUDIO CONTROL panel.

CABIN/COCKPIT FIRE, SMOKE, OR FUMES

1. Crew Oxygen Masks .... DON

   Select 100% oxygen.

2. Smoke Goggles .... DON

3. Pilot and Copilot MIC SELECT Switches .... OXY

NOTE

It may be necessary to select EMERGENCY on the crew oxygen mask regulator if mask does not seal properly.

Whether or not smoke has dissipated, if it cannot be visibly verified that the fire has been extinguished:

4. Cockpit Door/Curtain.. OPEN

5. Land as soon as possible.

6. **If source is known:**

   a. Extinguish fire using hand held extinguisher or eliminate the source of smoke or fumes.

NOTE

Crew exposure to high levels of Halon fire extinguisher vapors may result in dizziness, impaired coordination and reduced mental alertness.

b. • *If fire is not extinguighed:*

(1) Land as soon as possible.

(2) This checklist is complete.

• *If fire has been extinguished and can be visibly verified:*

(1) Land as soon as practical. At the crew's discretion, the oxygen system may be returned to normal.

(2) This checklist is complete.

If smoke or fumes continue:

7. One or Both BLEED AIR Switches .... EMER

   EMER until smoke or fumes are eliminated. Advancing thrust levers will increase airflow.

8. Pressurization AUTO–MAN Switch .... MAN

9. UP–DN Manual Control (red) .... UP; MAXIMUM 13,000 FEET

If time and conditions permit:

10. Isolate source of smoke or fumes.

    • **If bleed-air system is suspected source:**

    R BLEED AIR Switch .... OFF

    If smoke is reduced, continue operation with switch OFF. If smoke is not reduced:

    R BLEED AIR Switch .... ON

    and

    L BLEED AIR Switch .... OFF

    If smoke is reduced, continue operation with switch OFF.

• If smoke or fume source is electrical:

a. Floodlights.. ON, FOR NIGHT OPERATION

b. EMER BAT Switches .... CHECK, ON

c. EMER BUS Switch... EMER BUS

d. Both START–GEN Switches.. OFF

e. Use standby attitude gyro and standby HSI for attitude and directional reference.

f. Cross-check pilot's altimeter and airspeed indicator with standby instruments.

NOTE

All nonessential equipment is now off. Allow time for smoke and fumes to dissipate.

11. **• If smoke or fumes continue:**

The malfunctioning system is connected to the EMER BUS or the EMER BAT supplies. In this event, proceed as follows:

a. Both START–GEN Switches... GEN

b. EMER BUS Switch .... NORMAL

c. EMER BAT Switches .... OFF

d. Circuit Breakers.. PULL ALL EMER BUS DC AND AC CIRCUIT BREAKERS

For a listing of circuit breakers, refer to DC Bus Failure and AC Bus Failure procedures, this section. EMER BUS circuit breakers are denoted with red marking either on the circuit breaker stem or overlay.

NOTE

Electrical power to all equipment on EMER BUS is now off.

e. Reset EMER BUS circuit breakers one at a time. Pause after resetting each circuit breaker to determine defective system. Whenever high electrical loads and/or smoke and fumes occur, pull last circuit breaker reset.

f. EMER BAT Switches..................................... ON, ONE AT A TIME

If smoke and fumes recur:

EMER BAT Switches .... OFF

• **If smoke and fumes cleared when EMER BUS was selected:**

The malfunctioning system is connected to the normal electrical system. In this event, it may be necessary to isolate the malfunctioning system as follows:

a. Copilot's Circuit-Breaker Panel:

BUS TIE Switches (AC and DC)................................ OPEN (DOWN)

NOTE

If smoke or fume source is positively identified on the pilot's side, proceed with step e. below.

b. Copilot's Circuit-Breaker Panel .... PULL

The copilot circuit breakers shown in Table EP-4 must be pulled.

Table EP-4. COPILOT CIRCUIT BREAKERS

BUS CBs	ADDITIONAL CBs
R AC BUS (31-035 THROUGH 31-065, EXCEPT 31-061) R 115 VAC (31-061, 31-066 AND SUB) R AUX AC BUS* R 26 VAC R DC BUS 1 R DC BUS 2 R DC BUS 3 CABIN PWR BUS	R EMER BUS CONT R GEN DOOR MOTOR (31-035 THROUGH 31-065, EXCEPT 31-061)

*If installed

NOTE

All electrical power from the copilot's circuit-breaker panel is now off. Allow time for smoke and fumes to dissipate.

c. Both START–GEN Switches .... GEN

d. EMER BUS Switch .... NORMAL

e. • **If smoke and fumes do not recur,** the source of the smoke and fumes is on the copilot's circuit-breaker panel. Proceed to step f. below to isolate malfunctioning system.

- **If smoke and fumes recur or the pilot's side has been positively identified as the source of smoke and fumes,** proceed as follows:

(1) EMER BUS Switch.. EMER

(2) Both START-GEN Switches.. OFF

(3) Copilot Circuit Breakers .... RESET ALL

(4) Pilot's Circuit Breaker Panel.. PULL

The pilot's circuit breakers shown in Table EP-5 must be pulled.

Table EP-5. PILOT CIRCUIT BREAKERS

BUS CBs	ADDITIONAL CBs
L AC BUS (31-035 THROUGH 31-065 31-065, EXCEPT 31-061) L 115 VAC (31-061, 31-066 AND SUB) L AUX AC BUS* L 26 VAC L DC BUS 1 L DC BUS 2 L DC BUS 3	ENTRY LTS L EMER BUS CONT L GEN AUX CAB HT DOOR MOTOR (31-061, 31-066 AND SUB)

*If installed

NOTE

All electrical power from the pilot's circuit-breaker panel is now off. Allow time for smoke or fumes to dissipate.

(5) Both START-GEN Switches.. GEN

(6) EMER BUS Switch .... NORMAL

f. To determine the affected system (pilot's or copilot's circuit-breaker panel), it will be necessary to pull all the remaining circuit breakers on the affected panel and then proceed as follows:

(1) One BUS (AC or DC) Circuit Breaker RESET

Then, one at a time, reset circuit breakers powered by that BUS circuit breaker. Pause after resetting each circuit breaker to determine defective system. Whenever high electrical loads and/or smoke and fumes occur, pull last circuit-breaker reset. For a listing of circuit breakers refer to DC Bus Failure and AC Bus Failure procedures, this section.

(2) Repeat procedure for each bus on affected panel.

CONTROL SYSTEM JAM

Perform Pitch Axis Malfunction or Roll or Yaw Axis Malfunction procedure in this section as applicable to attempt to clear difficulty. If problem is not corrected, attempt to overpower jam. If jam can be overpowered, make a normal landing.

NOTE

For landing with a control jam, fly a long straight-in approach and establish final aircraft configuration at a safe altitude, well before landing.

AILERON JAM

NOTE

For landing, a wide runway with minimum turbulence and crosswind is recommended.

1. Rudder .... AS REQUIRED TO CONTROL ROLL AND TRACK

NOTE

- Yaw damper should be on to minimize roll oscillations.
- For prolonged flight in sideslip, set CROSSFLOW switch to OPEN and both STANDBY PUMP switches to ON.

2. Final Approach Configuration .... GEAR—DN, FLAPS—20°
3. Final Approach Speed .... V_{REF} + 10
4. Maintain power to touchdown and do not flare.

ELEVATOR JAM

1. Primary Pitch Trim .... AS REQUIRED FOR PITCH CONTROL
2. Final Approach Configuration .... GEAR—DN, FLAPS—20°
3. Final Approach Speed .... V_{REF} + 10

NOTE

Fly a long straight-in approach to minimize pitch changes and establish final aircraft configuration at a safe altitude, well before landing.

4. Maintain power to touchdown and do not flare.

RUDDER JAM

NOTE

For landing, a wide runway with minimum turbulence and crosswind is recommended.

1. Aileron.. AS REQUIRED TO CONTROL TRACK
2. Use asymmetric power, if required, to minimize sideslip.

NOTE

For prolonged flight in sideslip, set CROSSFLOW switch to OPEN and both STANDBY PUMP switches to ON.

3. Final Approach Configuration ....GEAR—DN, FLAPS—20°
4. *Aircraft 31-055 and Subsequent and prior aircraft incorporating SB 31-32-2,* NOSE STEER Switch... DEPRESS

   ARM light off prior to touchdown.
5. Final Approach Speed .... V_{REF} + 10
6. Maintain power to touchdown and do not flare.
7. After landing, maintain directional control with differential braking.

NOTE

If asymmetric power is used, do not retard power until directional control is established.

OVERSPEED RECOVERY—OVERSPEED WARNING HORN ACTIVATES

If V_{MO} or M_{MO} is inadvertently exceeded:

1. Thrust Levers .... IDLE
2. Autopilot .... DISENGAGE
3. Identify aircraft pitch and roll attitude.

NOTE

- In any aircraft, attitude (particularly roll attitude) may be difficult to identify from visual and instrument references in an extreme nosedown condition.
- ***Do not*** apply elevator force until bank angle is reduced to less than 90°. A pull elevator force when the bank angle is greater than 90° will increase the nose-down attitude.

4. Level Wings.
5. Elevator and Pitch Trim .... AS REQUIRED TO RAISE THE NOSE

WARNING

On speed excursions beyond M_{MO}, the elevator control should be smoothly and steadily applied to prevent encountering aileron activity.

If Mach or airspeed is severe or if pitch and/or roll attitude is extreme or unknown:

6. LANDING GEAR Switch.. DOWN

   Lowering the landing gear at high speed will increase drag and cause a moderate nose-up pitching moment which is easily controllable, but should be anticipated.

   Extending the landing gear has been flight tested to 0.85 M_I and 320 KIAS. Analysis of flight test data indicates that this procedure is applicable at higher speeds.

CAUTION

Minor damage to the landing gear doors may be experienced when the gear is lowered at very high speed. ***Do not retract landing gear for remainder of flight.*** After landing, a thorough inspection of the landing gear and doors for condition must be made.

PITCH AXIS MALFUNCTION

A nose-up pitch axis malfunction or nose-up pitch trim system runaway can result in high pitch attitudes, heavy airframe buffet, and required control forces of 75 pounds for recovery.

A nose-down pitch axis malfunction, nose-down pitch trim system runaway, or nose-down overspeed can result in high airspeeds and require control forces in excess of 75 pounds for recovery.

A binding elevator is evidenced by difficulty in moving the control column when making manual pitch changes.

WARNING

On speed excursions well beyond M_{MO}, the elevator control should be smoothly and steadily applied to prevent encountering aileron activity.

NOTE

Control pressures may be heavy. Copilot assistance is recommended with this procedure.

1. Control Wheel
   Master Switch (MSW) .... DEPRESS AND HOLD

NOTE

- Yaw damper and autopilot will disengage.
- Stabilizer trim actuator (PRI and SEC pitch trim) will be inoperative while the switch is held.

2. Attitude Control.. AS REQUIRED TO MAINTAIN AIRCRAFT CONTROL

   - *If in nose-up attitude, roll into bank or maintain existing bank until the aircraft nose passes through the horizon.*
   - *If in nose-down attitude,* ***do not*** *apply elevator force until bank angle is reduced to less than 90°. A pull elevator force when the bank angle is greater than 90° will increase the nose-down attitude.*

3. Thrust Levers... AS REQUIRED

   - *If in high-speed nose-down attitude, immediately reduce thrust levers to IDLE position.*
   - *If near stall, advance thrust levers as required to accelerate out of stall regime.*

4. PITCH TRIM
   Switch (pedestal) .... OFF

5. AP 1 and AP 2 Circuit Breakers (AFCS group)................................ PULL

6. Control Wheel Master Switch (MSW) .... RELEASE

If flight conditions permit, isolate malfunction as follows:

NOTE

A trim system malfunction, with the flaps up, will be accompanied by the audio clicker; however, the autopilot system also runs pitch trim.

7. PITCH TRIM
   Switch (pedestal).. OPERATE

   Operate to PRI then SEC to isolate malfunctioning trim system.

• ***If malfunction recurs in PRI pitch trim:***

a. PITCH TRIM
Switch (pedestal).. SEC

b. NOSE DN–NOSE UP
Switch (pedestal) .... OPERATE

Operate to retrim aircraft as required.

c. PRI PITCH TRIM Circuit
Breaker (L TRIM–FLT CONT group) .... PULL

NOTE

Mach trim will be inoperative. If autopilot is not engaged, ***do not exceed*** $\mathbf{M_{MO}}$ **(0.78$\mathbf{M_I}$)**

• ***If malfunction recurs in SEC pitch trim:***

a. PITCH TRIM
Switch (pedestal).. PRI

b. Control Wheel
Trim Switch .... OPERATE

Operate to retrim aircraft as required.

c. SEC PITCH TRIM Circuit
Breaker (R TRIM–FLT CONT group).. PULL

NOTE

Autopilot trim will be inoperative.

• ***If malfunction does not recur:***

a. PITCH TRIM
Switch (pedestal).. PRI OR SEC
AS DESIRED

b. Maintain aircraft trim with selected trim system.

NOTE

Probable cause of malfunction was autopilot (if autopilot was engaged). Do not engage autopilot.

- ***If neither PRI nor SEC pitch trim can be restored, refer to Jammed Stabilizer Landing, "Abnormal Procedures" chapter.***

8. If malfunction has not been isolated to autopilot:

   a. AP 1 and AP 2 Circuit Breakers (AFCS Group) .... RESET

   b. Autopilot .... AS DESIRED

9. Yaw Damper .... AS DESIRED

ROLL OR YAW AXIS MALFUNCTION

1. Control Wheel Master Switch (MSW) .... DEPRESS AND HOLD

   Yaw damper and autopilot will disengage and rudder boost will be interrupted correcting the malfunction if any of these was the cause.

2. Attitude Control........ AS REQUIRED TO MAINTAIN AIRCRAFT CONTROL

If control force continues:

3. Airspeed .... REDUCE TO MINIMIZE FORCE

4. ROLL TRIM or YAW TRIM Circuit Breaker (L TRIM–FLT CONT Group) .... PULL AFFECTED AXIS

5. RUDDER BOOST Switch .... OFF

6. Control Wheel Master Switch (MSW) .... RELEASE

7. • ***If malfunction was isolated to yaw damper:***

   a. AP 1 and AP 2 Circuit Breakers (AFCS group)........ PULL

   Autopilot and yaw damper will be inoperative.

- ***If malfunction was isolated to autopilot:***

a. Do not engage autopilot.

b. Yaw damper.. AS DESIRED

- ***If malfunction was isolated to rudder boost system:***

a. RUDDER BOOST Switch .... LEAVE OFF

b. RUDDER BOOST Circuit Breaker
(L AFCS group) .... PULL

c. Autopilot .... AS DESIRED

d. Yaw Damper.. AS DESIRED

- ***If malfunction was isolated to roll or yaw trim system:***

a. Use asymmetric thrust and fuel imbalance as required to minimize mistrim.

b. Land as soon as practical.

NOTE

- A normal approach and landing can be made with only light control forces to overcome full roll or yaw trim.
- *On aircraft 31-055 and subsequent and prior aircraft incorporating SB 31-32-2,* nosewheel steering will not arm with the RUDDER BOOST circuit breaker pulled. *Refer to Section IV Abnormal Procedures, Operation with Nosewheel Steering not Armed.*

FUEL PRESS LIGHT ILLUMINATED

Illumination of a red FUEL PRESS light is an indication of loss of fuel pressure to the engine. Probable cause is a jet pump failure.

Affected Engine:

1. Thrust Lever.. RETARD
2. STANDBY PUMP Switch... ON
3. IGNITION Switch .... ON
4. CROSSFLOW Switch.. CLOSE
5. FUS TANK XFR-FILL Switch.. OFF

NOTE

Fuselage fuel transfer deactivates the wing standby pumps. The fuel in the fuselage tank will not be available above 25,000 feet. Below 25,000 feet, the engine-driven fuel pump will suction feed sufficient fuel to supply the engine and fuselage fuel transfer can be accomplished. Replan flight accordingly.

6. GRAV XFR Switch.. CLOSE

7. JET PUMP Switch .... OFF

If FUEL PRESS light does not extinguish:

8. Flight can be continued at altitude if engines are operating properly.

NOTE

The altitude at which the engine-driven fuel pump will suction feed sufficient fuel to supply the engine will vary depending upon fuel temperature and type.

DUAL AIR DATA COMPUTER (ADC) FAILURE

A dual ADC failure is indicated by flags and loss of valid air data on both pilot's and copilot's air data instruments.

1. Maintain aircraft control with reference to the standby instruments.

NOTE

Mach trim will be inoperative. ***Do not exceed*** **M_{MO} (0.78 M_I).**

2. ADC 1 and ADC 2 Circuit Breakers (INSTRUMENTS group)... CHECK AND RESET

3. The following systems and instruments may malfunction or be inoperative:
   a. Pilot's and copilot's air data instruments
   b. SAT/TAS/TAT indicator
   c. Altitude alerter
   d. Mach trim
   e. Overspeed warning
   f. Left and right stall warning systems altitude bias

g. Landing gear horn altitude and airspeed bias

h. Autopilot/flight director modes requiring ADC input

NOTE

Pitch attitude hold and lateral modes can be engaged.

i. Yaw damper

j. Certain functions of the FMS system requiring airspeed and altitude data

k. Encoded altitude function of the transponders

NOTE

The attitude heading systems will revert to basic mode with the loss of air data. Attitude and heading data will be valid.

DITCHING

This aircraft has not been certified for ditching under all the applicable provisions of FAR 25. However, a successful ditching has been conducted in a similar model Learjet. The following procedure will enhance the probability of a successful ditching.

Plan the descent to ensure minimum fuel remaining and improve buoyancy. Ensure sufficient fuel for controlled, power-on approach. This aircraft exhibits good buoyancy properties, floating near level or slightly tail low. After ditching, the airplane may remain afloat for some time if it does not sustain serious damage on landing.

1. If time and conditions permit:

   a. Head toward nearest land or vessel.

   b. Notify controlling agency.

   c. Transponder .... EMERGENCY 7700

   d. ELT Switch (if installed) .... ON

   e. Life Vests .... ON

   NOTE

   Inform passengers ***not*** to inflate life vests while inside aircraft.

   f. Brief passengers as required.

(1) Use of available flotation equipment

(2) Location and operation of emergency exits: ***Do not*** open lower half of cabin door at any time.

(3) All Loose Items.. SECURE

(4) Emergency landing brace position.

(5) Several impacts may be felt, depending on the sea conditions. ***Do not*** release seat belts after first impact is felt.

g. NO SMOKING/FASTEN SEAT BELTS Switch .... ON

h. Seat Belts.. ON

Leave ON until aircraft comes to a complete stop.

2. LANDING GEAR Switch... UP

3. Flaps .... DN

NOTE

The landing gear warning horn will sound with landing gear up and flaps down.

4. CAB AIR Switch.. OFF

5. EMER BAT Switches.. OFF

6. Perform normal power-on approach at V_{REF}.

NOTE

Plan landing direction as follows:

a. Calm Sea.................................... INTO WIND

b. Moderate Swells .... PARALLEL TO SWELLS

c. High Winds .... INTO WIND

Land into wind, attempting to land on upwind (far) side of swell.

7. Thrust Levers .... CUTOFF AT TOUCHDOWN

8. ENG FIRE PULL T-handles .... PULL

9. BATTERY Switches .... OFF

10. Emergency Exit(s) .... OPEN

    Open after airplane comes to a complete stop.

    Do not open lower half of cabin door at any time.

EMERGENCY BRAKING

In the event of failure of a normal brake system, emergency brakes can be used to stop the airplane. When using emergency braking, anti-skid protection is not available, and the anti-skid OFF corrections presented in Section V of the *AFM* will be applicable.

1. Pull EMER BRAKE handle out of recess.

2. Push downward on handle to apply pressure.

NOTE

- The EMER BRAKE handle must be pushed down approximately 2 inches (5 centimeters) before braking action begins. To realize the optimum benefit from the emergency braking system, the following technique should be employed:

  a. Apply the brakes smoothly with small movements to produce improved feel and reduce the probability of tire skid. Do not pump the brake handle.

  b. Avoid taxiing if sufficient brake pressure is not available.

- An emergency air bottle charged to the lower end of the green segment (1,800 psi) will provide for landing gear extension using the abnormal procedure and approximately 10 brake applications.

3. Rudder and/or Nosewheel Steering .... AS REQUIRED FOR DIRECTIONAL CONTROL

EMERGENCY EVACUATION

1. Stop the aircraft.
2. PARKING BRAKE .... SET
3. Thrust Levers .... CUTOFF
4. • *If an engine fire is suspected:*
   a. Applicable ENG FIRE PULL T-Handle .... PULL
   b. Either ENG EXT ARMED Light .... DEPRESS
   c. Other ENG FIRE PULL T-Handle .... PULL

   • *If engine fire is not suspected:*
   a. Both ENG FIRE PULL T-Handles .... PULL
5. Both BATTERY Switches .... OFF
6. Evacuate the aircraft:

   a. Cabin Entry Door .... OPEN AND EXIT AIRCRAFT THE UPPER DOOR IS OPENABLE WITH THE LANDING GEAR RETRACTED.

   b. Aft Cabin Emergency Exit .... OPEN AND EXIT USING THE WING STEP AREA

FORCED LANDING—BOTH ENGINES INOPERATIVE

The recommended airplane best glide speed is V_{REF} + 50 with the gear and flaps up. The still-air gliding distance is approximately 2.0 nm per 1,000 feet of altitude.

1. If time permits:

   a. Transponder .... Emergency 7700

   b. Advise controlling agency.

   c. Prepare passengers for emergency landing.

   d. NO SMOKING/FASTEN SEAT BELTS Sign .... ON

2. HYD PUMP Switch.. ON

3. LANDING GEAR Switch .... DN

4. Flaps .... DN

5. ENG FIRE PULL T-handles.. PULL

NOTE

Pulling the ENG FIRE PULL T-handles stops the flow of fuel and hydraulic fluid to the engines, shuts off bleed air from the engines, and arms the engine fire extinguisher systems.

6. START–GEN Switches .... OFF

7. BATTERY Switches.. OFF

8. EMER BAT Switches.. OFF PRIOR TO TOUCHDOWN

9. Touchdown in normal landing attitude.

10. After touchdown:

    Cabin Door and Emergency Exit.. OPEN

STALL WARNING ACTIVATES

The stall warning system has sensed a limit angle-of-attack. The red L and/or R STALL lights will flash, the control column stick shaker will activate, and the angle-of-attack indication will be in the yellow approaching the red.

1. Lower the pitch attitude to reduce angle-of-attack.

2. Thrust Levers .... SET TO TAKEOFF POWER

3. Level the wings.

4. Accelerate out of the stall condition.

ABORTED TAKEOFF

1. Thrust Levers .... IDLE
2. Wheel Brakes .... APPLY
3. Spoilers .... EXT
4. Drag Chute or Thrust
   Reversers (if installed) .... DEPLOY
   IF NECESSARY

TAKEOFF WARNING HORN ACTIVATES

The takeoff monitor aural warning will sound during ground operations when the right thrust lever is advanced above the 82% N_1 position and one or more of the following conditions exist:

- Flaps not set for takeoff
- Spoilers not retracted
- Pitch trim not in a safe position for takeoff
- Parking brake not released
- Thrust reverser unlocked (if applicable)

NOTE

On aircraft 31-035 through 31-103 equipped with thrust reversers, not incorporating SB 31-31-4; a thrust reverser unlocked condition may not trigger the takeoff monitor aural warning during cockpit low-light conditions. However, a thrust reverser unlock condition will be annunciated bya flashing DEPLOY light.

1. Thrust Levers.. IDLE
2. Wheel Brakes .... APPLY
3. After stopping, check takeoff configuration.

LIMITATIONS

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LIMITATIONS

GENERAL

CERTIFICATION STATUS

This airplane is certified in accordance with FAR 25.

TYPE OF OPERATION

This airplane is approved for:

- VFR (Visual)
- IFR (Instrument)
- Day
- Night
- Icing conditions

This airplane is not approved for ditching under FAR 25.801.

PERFORMANCE CONFIGURATION

The airplane configuration must be as presented under Standard Performance Conditions in Section V of the *AFM*.

MINIMUM FLIGHT CREW

The minimum flight crew shall consist of pilot and copilot.

WEIGHT AND CG LIMITS

MAXIMUM RAMP WEIGHT

Standard	15,750 lb/7,144 kg
Optional	16,750 lb/7,598 kg
Optional	17,200 lb/7,802 kg

MAXIMUM CERTIFIED TAKEOFF WEIGHT

Standard .... 15,500 lb/7,031 kg

Optional .... 16,500 lb/7,484 kg

Optional .... 17,000 lb/7,711 kg

NOTE

Refer to Takeoff Weight Limit placard installed on the airplane instrument panel.

MAXIMUM ZERO FUEL WEIGHT

Maximum Zero Fuel Weight .... 13,500 lb/6,123 kg

NOTE

All weights in excess of Maximum Zero Fuel Weight must consist of fuel.

MAXIMUM ALLOWABLE TAKEOFF WEIGHT

The takeoff weight is limited by the most restrictive of the following requirements:

- Maximum Certified Takeoff Weight
- Maximum Takeoff Weight (Climb or Brake Energy Limited) for altitude and temperature as determined from the applicable figure entitled "Takeoff Weight Limits" in Section V of the *AFM*
- Maximum Takeoff Weight for the runway and ambient conditions as determined from the applicable figure entitled "Takeoff Distance" in Section V of the *AFM*
- Maximum Takeoff Weight for obstacle clearance as determined from the applicable "Takeoff Flight Path" and "Climb Gradient" figures in Section V of the *AFM*, if required

MAXIMUM CERTIFIED LANDING WEIGHT

Aircraft 31-035 through 31-190, and 31-192 not modified by SB 31-8-1 .... 15,300 lb/6,940 kg

Aircraft 31-191, 31-193, and subsequent, and prior aircraft modified by SB 31-8-1 .... 16,000 lb/7,258 kg

MAXIMUM ALLOWABLE LANDING WEIGHT

The landing weight is limited by the most restrictive of the following requirements:

- Maximum Certified Landing Weight

NOTE

Perform Hard or Overweight Landing Inspection (Chapter 5, *Learjet 31/31A Maintenance Manual*) if Maximum Certified Landing Weight is exceeded.

- Maximum Landing Weight for the runway and ambient conditions as determined from the ACTUAL LANDING DISTANCE and FACTORED LANDING DISTANCE (if applicable) charts in Section V of the *AFM*.
- Maximum Landing Weight (Approach Climb or Brake Energy Limited), for altitude and temperature as determined from the applicable figure entitled Landing Weight Limits in Section V of the *AFM*.

CENTER-OF-GRAVITY

The airplane center of gravity, as loaded for flight, must be maintained within the Center-of-Gravity Envelope defined in Figures LIM-1, LIM-2 or LIM-3 as applicable.

AIRSPEED/MACH LIMITS

NOTE

All Airspeed/Mach Limits are expressed in terms of indicated values unless otherwise stated. Instrument error is assumed to be zero.

MAXIMUM OPERATING SPEED V_{MO}/M_{MO}

V_{MO}/M_{MO} may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training.

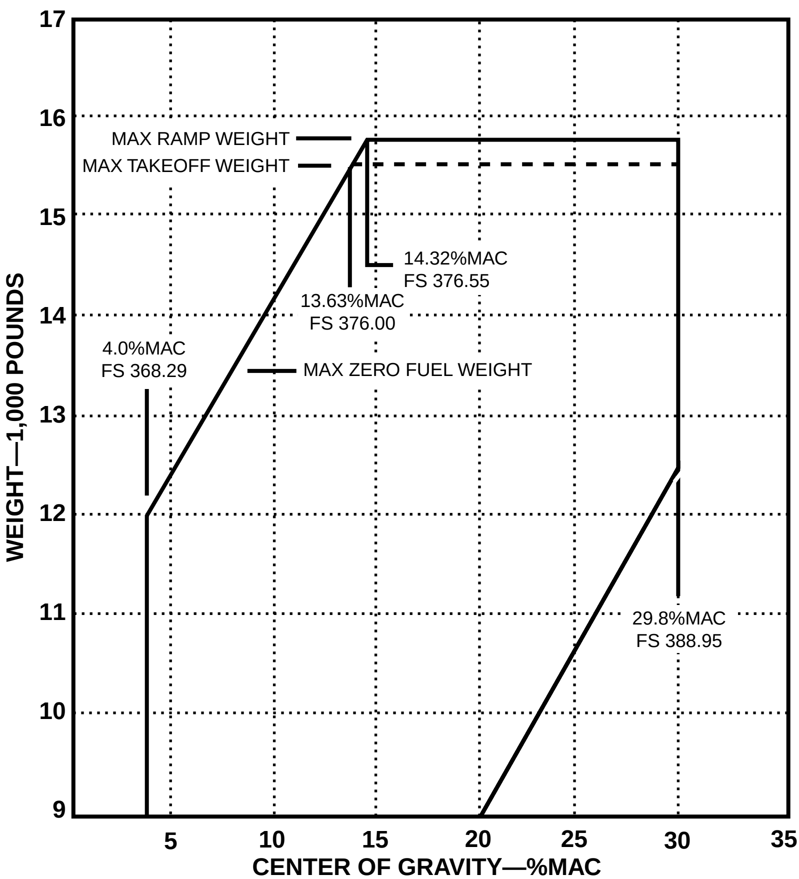
V_{MO} .... 325 KIAS

M_{MO}
- Up to 43,000 feet .... $0.81\ M_I$
- 43,000 to 46,000 feet .... 0.81 to $0.80\ M_I$
- 46,000 to 47,000 feet .... 0.80 to $0.79\ M_I$
- 47,000 feet and above .... $0.79\ M_I$
- With both the Mach Trim inoperative and Autopilot disengaged .... $0.78\ M_I$
- With any missing Boundary Layer Energizers .... $0.77\ M_I$

NOTE

The M_{MO} limits expressed above are based upon compressibility effects. Refer to Recovery From Inadvertent Overspeed procedure in "Emergency Procedures" chapter.

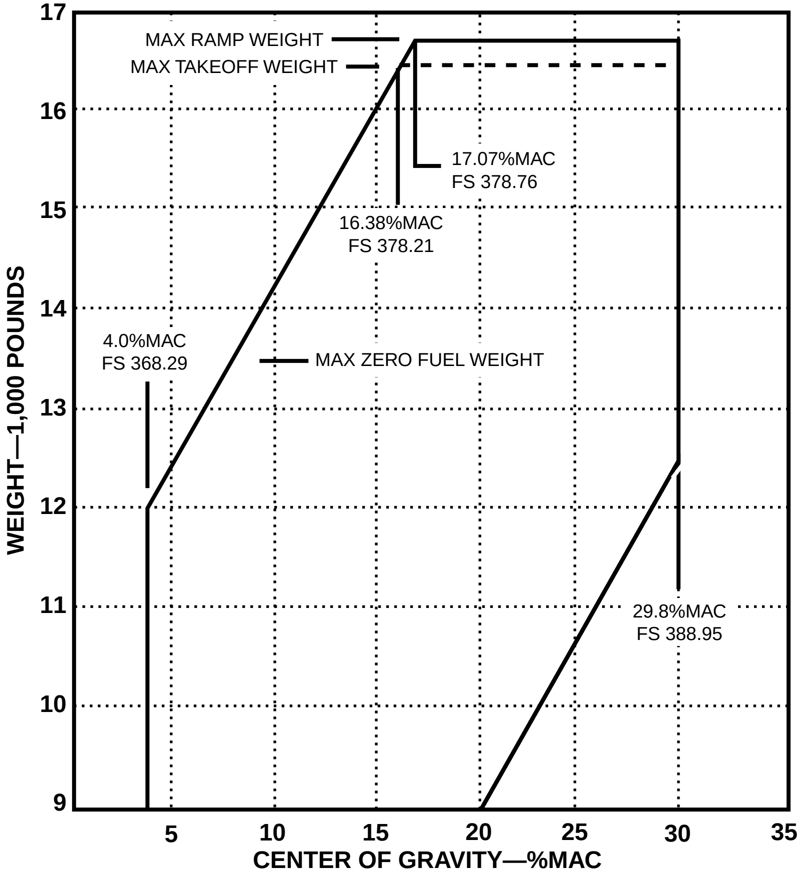
Refer to Figure LIM-4.



FORWARD FLIGHT LIMIT—FS 368.29 (4.0%MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 376.00 (13.63% MAC) AT 15,500 POUNDS (7,031 KG) TO FS 376.55 (14.32%MAC) AT 15,750 POUNDS (7,144 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0%MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8%MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8%MAC) UP TO AND INCLUDING 15,750 POUNDS (7,144 KG).

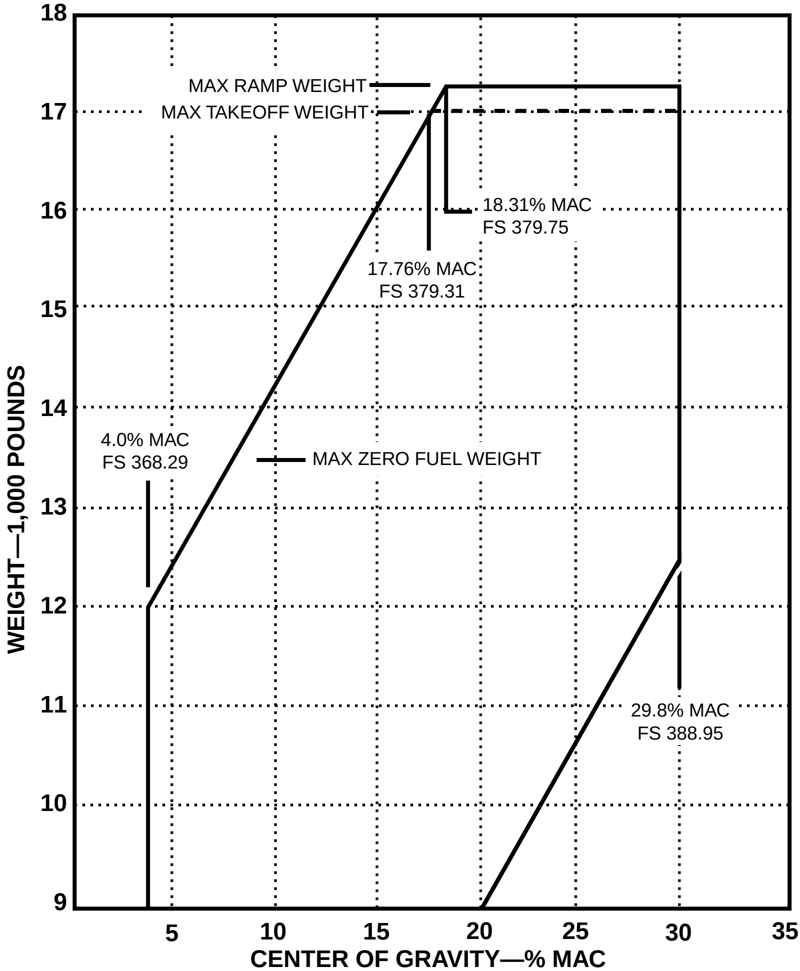
Figure LIM-1. Center-of-Gravity Envelope—Standard 15,500 lb (7,031 kg) Takeoff Weight



FORWARD FLIGHT LIMIT—FS 368.29 (4.0%MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 378.21 (16.38% MAC) AT 16,500 POUNDS (7,484 KG) TO FS 378.76 (17.07%MAC) AT 16,750 POUNDS (7,598 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0%MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8%MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8%MAC) UP TO AND INCLUDING 16,750 POUNDS (7,144 KG).

Figure LIM-2. Center-of-Gravity Envelope—Optional 16,500 lb (7,484 kg) Takeoff Weight



FORWARD FLIGHT LIMIT—FS 368.29 (4.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 379.31 (17.76% MAC) AT 17,000 POUNDS (7,711 KG) TO FS 379.75 (18.31% MAC) AT 17,200 POUNDS (7,802 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8% MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8% MAC) UP TO AND INCLUDING 17,200 POUNDS (7,802 KG).

Figure LIM-3. Center-of-Gravity Envelope—Optional 17,000 lb (7,711 kg) Takeoff Weight

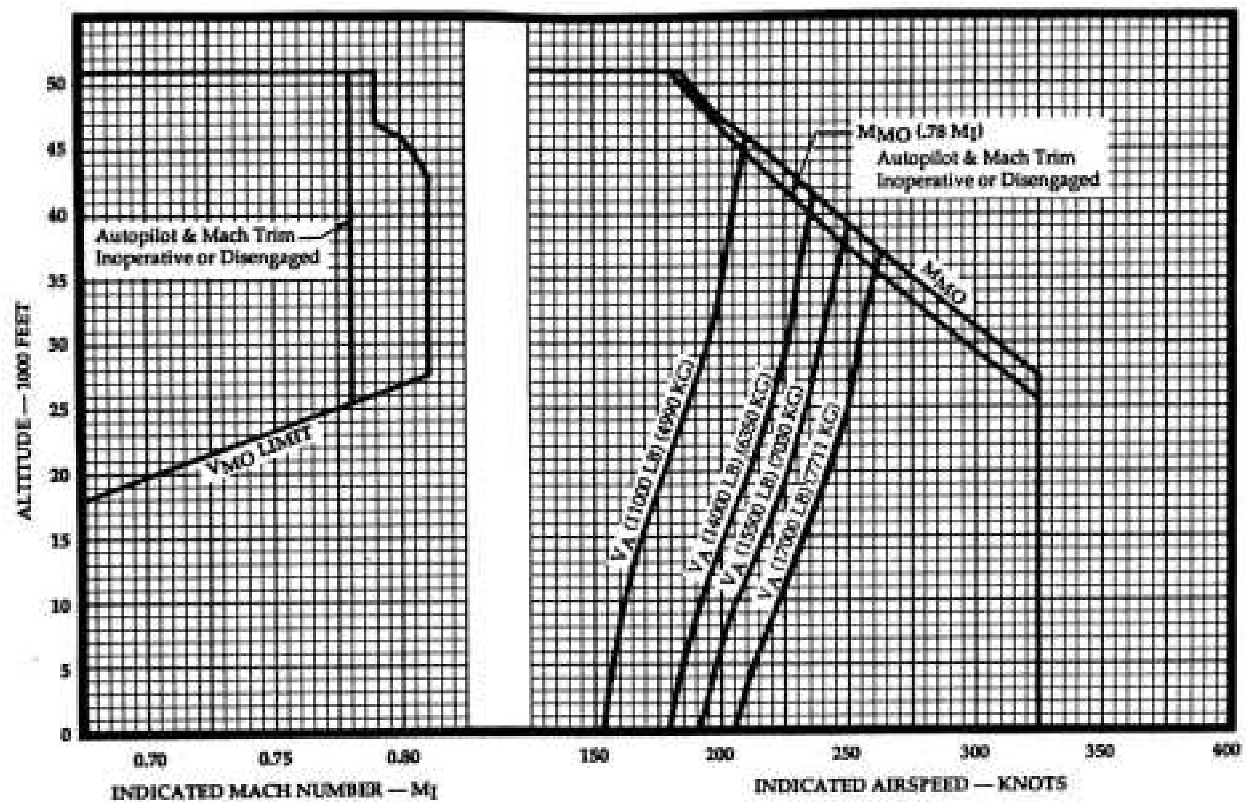


Figure LIM-4. Airspeed/Mach Limits

MANEUVERING SPEED V_A

V_A is the highest speed that full aileron and rudder control can be applied without overstressing the aircraft, or the speed at which the aircraft will stall with a load factor of 3.0 g's at maximum gross weight, whichever is less. Therefore, maneuvers involving full control travel should be confined to speeds below this value.

Refer to Figure LIM-4. for V_A.

MAXIMUM LANDING GEAR OPERATING SPEED V_{LO}

V_{LO} is the maximum speed at which the landing gear can be safely extended or retracted.

V_{LO} .... 200 KIAS

MAXIMUM LANDING GEAR EXTENDED SPEED V_{LE}

V_{LE} is the maximum speed at which the aircraft can be safely flown with the landing gear extended.

V_{LE} .... 260 KIAS

MAXIMUM FLAP EXTENDED SPEED V_{FE}

V_{FE} is the maximum speed permissible with the wing flaps in a prescribed extended position:

- Flaps 8° .... 250 KIAS
- Flaps 20° .... 200 KIAS
- Flaps 40° .... 150 KIAS

MINIMUM CONTROL SPEED AIR V_{MCA}

V_{MCA} is a function of altitude and temperature. During flight tests, the aircraft was controllable down to stall speed. The speed shown is the critical minimum control speed which occurs at the maximum thrust point (Sea Level, 68°F [20°C]). Section V Performance Charts of the *AFM* account for the appropriate values.

V_{MCA} for the following flap positions are:

- Flaps 8° .... 93 KIAS
- Flaps 20° .... 87 KIAS

MINIMUM CONTROL SPEED GROUND V_{MCG}

V_{MCG} is a function of altitude and temperature. The speed shown is a maximum, which occurs at the maximum thrust point (Sea Level, 68°F [20°C]). Section V Performance Charts of the *AFM* account for the appropriate values.

V_{MCG} (Rudder Boost System Off) .... 109 KIAS

V_{MCG} (Rudder Boost System On) .... 100 KIAS

CRITICAL ENGINE FAILURE SPEED V_1

Refer to applicable figure entitled TAKEOFF SPEEDS in Section V of the *AFM*.

ROTATION SPEED V_R

Refer to applicable figure entitled TAKEOFF SPEEDS in Section V of the *AFM*.

TAKEOFF SAFETY SPEED V_2

Refer to applicable figure entitled TAKEOFF SPEEDS in Section V of the *AFM*.

OPERATIONAL LIMITS/REQUIREMENTS

TAKEOFF

Maximum Pressure Altitude .... 10,000 ft

Ambient Temperature .... Refer to Figure LIM-4

Tailwind Component .... 10 kts

Runway Conditions

Takeoff is limited to paved runways.

Runway water/slush accumulation .... 3/4 inch (19 mm)

Fuel Computers .... ON[1]

Engine Sync.. OFF

Trim .... All axes set for takeoff

Fuel Load .... Wings balanced within 200 lb

[1]Both fuel computers must be ON and operative except for ferry flight as permitted by applicable regulations.

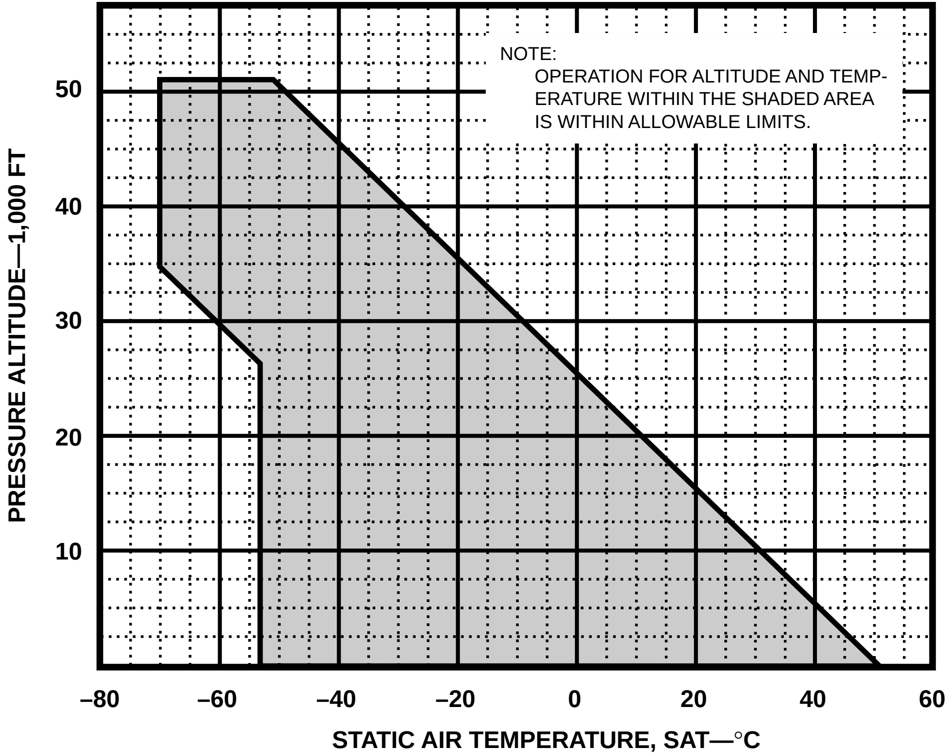


Figure LIM-5. Ambient Temperature Limits

The following must be checked and operational:

- Trim Systems
- Standby Attitude Gyro
- Both ADC Systems
- Stall Warning System
- Rudder Boost[2]
- 3 Symbol Generators[3]
- Both EADIs and EHSIs
- Both AHS Systems

ENROUTE

Maximum Pressure Altitude

- With spoilers operative .... 51,000 ft
- With spoilers inoperative .... 41,000 ft

Ambient Temperature .... Refer to Figure LIM-4

On Aircraft 31-035 through 31-190, Cooling System...... OFF above FL 350

Fuel Load .... Wings balanced within 500 lb

[1]Both fuel computers must be ON and operative except for ferry flight as permitted by applicable regulations.

[2]Required only if system is to be used.

[3]Airplane may dispatch with two symbol generators provided separate symbol generators are selected for pilot's and copilot's displays.

LANDING

Maximum Pressure Altitude .... 10,000 ft

Ambient Temperature .... Refer to Figure LIM-4

Tailwind Component .... 10 kts

Runway Conditions

Landing is limited to paved runways.

Runway water/slush accumulation .... 3/4 inch (19 mm)

Pressurization .... Cabin not pressurized

Engine Sync.. OFF

Fuel Load .... Wings balanced within 200 lb

FLIGHT LOAD ACCELERATION LIMITS

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

- Flaps Up .... +3.0 to –1.0 g
- Flaps Down .... +2.0 to 0.0 g

DEMONSTRATED CROSSWIND

Refer to Meteorological Definitions in Section V of the *AFM* Performance.

MANEUVERS

No aerobatic maneuvers, including spins, are approved.

Intentional stalls are prohibited above 18,000 feet with flaps and/or landing gear extended.

SEAT BELTS AND SHOULDER HARNESSES

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

SYSTEM LIMITS

AIR DATA SYSTEM

Both air data systems must be operative and the onside system selected (ADC 1 for pilot's side and ADC 2 for copilot's side) for takeoff.

All flags on airspeed/Machmeters and altitude/vertical speed indicators must be retracted for takeoff.

To assure proper air data system operation the BEFORE STARTING ENGINES air data system check must be accomplished in accordance with "Normal Procedures" chapter.

Reduced Vertical Separation Minimums (RVSM) *(Aircraft 31-213, 31-222 & Subsequent and prior aircraft modified by SB 31-34-11)* — This aircraft has been shown to meet the airworthiness requirements for operation in Reduced Vertical Separation Minimum (RVSM) airspace between 29,000 and 41,000 feet inclusive. This does not constitute an operational approval.

ATTITUDE HEADING REFERENCE SYSTEM

The onside attitude heading system must selected (i.e., AHS 1 for pilot's side and AHS 2 for copilot's side) for takeoff.

AUTOPILOT/FLIGHT DIRECTOR

The Bendix/King KFC 3100 Pilot's Guide (No. 006-08486-0000) must be immediately available to the flight crew.

The autopilot/flight director system is approved for category I ILS approaches.

When using autopilot, the pilot or copilot must be in their respective seat with their seat belt fastened.

Autopilot pitch and roll axes must not be used for takeoff and landing.

The minimum altitude for use of autopilot is:

- Approach Configuration.. 200 ft AGL
- Enroute Configuration.. 1,000 ft AGL

CABIN PRESSURIZATION

Do not takeoff or land with the cabin pressurized.

Maximum Differential Pressure .... 10.0 psi

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The Bendix/King EFS 50 Electronic Flight Instrumentation System Pilot's Guide (No. 006-08485-0000) must be immediately available to the flight crew. The pilot's guide must be of a revision level compatible with the level of software installed.

Airplane performance and operation must not be predicated on the use of the multifunction display as the source of the required performance and operational data.

Whenever a symbol generator (SG) or EFIS control panel is removed and replaced, the reversionary modes must be verified prior to flight.

Both EADIs, both EHISs and the standby attitude gyro must be operational for takeoff.

A minimum of two symbol generators must be operational for takeoff. The pilot's and copilot's displays must be sourced by separate symbol generators.

On the copilot's side, the reversionary EADI down mode may only be used in conjunction with the composite (CMPST) mode.

ENGINE SYNCHRONIZER

Engine sync must be OFF for takeoff, landing, and single-engine operation.

EXTERNAL POWER

The maximum amperage from an external power source must be limited to 1,000 amps.

COOLING SYSTEM

Do not switch the cooling system ON or OFF during takeoff or landing.

On all aircraft 31-035 through 31-190, the cooling system must be OFF above FL350.

GENERATOR LIMITS

Generator output is limited as follows:

- 325 amps maximum for any altitude and turbine speed (N_2) except as noted below.
- 400 amps for:
  - SL–25,000 ft for turbine speed (N_2) of 80%. or above
  - 25,000 ft–41,000 ft for turbine speed (N_2) of 86% or above

- 41,000 ft–51,000 ft for turbine speed (N_2) of 93% or above

NOTE

For single generator operation on the ground, the generator output is limited to approximately 220 amps to protect the 275-amp current limiters. If more electrical load is applied, the current will be drawn from the aircraft batteries and will not be shown on the DC AMPS display. If this occurs, DC voltage will be reduced. A DC voltage of 26 volts or less indicates a heavy drain on the aircraft batteries.

HYDRAULIC SYSTEM

Do not exceed auxiliary hydraulic pump duty cycle of 3 minutes ON, then 20 minutes OFF.

Only hydraulic fluid conforming to MIL-H-5606 is approved.

NOSEWHEEL STEERING
Aircraft 31-035 thru 21-054 not incorporating SB 31-32-2

Maximum Ground Speed .... 45 kts

Maximum Ground Speed with any two of the following three ANTI-SKID lights illuminated:

Left and right inboard and right outboard ....10 kts

OXYGEN SYSTEM

The following aircraft certification requirements are in addition to the requirements of applicable operating rules. The most restrictive requirements (certification or operating) must be observed.

Above FL250, crew masks must be in the quick-donning position which allows donning within 5 seconds.

On aircraft with inflatable crew masks, hats and "earmuff" type headsets must be removed prior to donning crew oxygen masks.

NOTE

Headsets and eyeglasses worn by crewmembers may interfere with quick-donning capabilities.

Crew and passenger oxygen masks are not approved for use above 40,000 feet **cabin** altitude.

WARNING

- Passenger masks are intended for use during an emergency descent to an altitude not requiring supplement oxygen.
- Passenger masks will not provide sufficient oxygen for prolonged operation above 34,000 feet cabin altitude. Prolonged operation above 25,000 feet cabin altitude with passengers on board is not recommended.

RUDDER BOOST SYSTEM

If rudder boost is to be used, the Before Starting Engines rudder boost check must be accomplished in accordance with "Normal Procedures" chapter.

SINGLE-POINT REFUEL SYSTEM (IF INSTALLED)

Use of single-point refuel system is limited to aircraft equipped with fuel heaters.

SPOILERS

Do not extend spoilers with flaps extended while airborne.

If the spoilers are inoperative in flight, the maximum operating altitude is limited to 41,000 feet.

STALL WARNING SYSTEM

To assure proper stall warning system operation, the Before Starting Engines stall warning system operation checks in "Normal Procedures" chapter must be completed on each flight.

The angle-of-attack indicators may be used as a reference, but do not replace the airspeed indicators as primary instruments.

THRUST REVERSERS (IF INSTALLED)

When thrust reversers are installed, refer to the applicable Thrust Reverser Supplement for limitations, normal procedures, emergency procedures, abnormal procedures, and performance data.

TIRES

Main Tire Limiting Speed (Ground Speed) .... 182 kts

TRIM SYSTEMS

To assure proper trim systems operation, the Before Starting Engines trim systems checks in "Normal Procedures" chapter must be successfully completed before each flight.

The complete Trim Systems Operational check in "Normal Procedures" chapter shall be successfully completed a minimum of once every 10 hours of airplane flight operation.

WARNING

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.

VHF COMM/VHF NAV

The use of VHF COMM frequency 119.00 MHz is prohibited whenever a VHF NAV frequency of 116.00 MHz is in use.

NOTE

If the above combination of frequencies is used, keying the COMM causes the NAV to flag.

WINDSHIELD ALCOHOL ANTI-ICE

Methyl alcohol (Methanol) per Federal Specification 0-M-232, Grade A, is required.

The alcohol reservoir shall be refilled after each use.

POWERPLANT LIMITS

ENGINE TYPE

The Learjet 31 aircraft are equipped with Garrett model TFE731-2-3B turbofan engine, part number 3073610-3 (with fuel heaters) or 3073610-1 (without fuel heaters)

ENGINE SPEED

The engine speed limits are listed in Table LIM-1.

Table LIM-1. ENGINE SPEED LIMITS

CONDITION	LIMIT
OVERSPEED[1]	105% N^1 or N^2
TRANSIENT[2]	
5 SECONDS	103–105% N^1 or N^2
1 MINUTE	100–103% N^1 or N^2
TAKEOFF[3]	Refer to Takeoff Thrust (N^1) charts in Section V, *AFM*
MAXIMUM CONTINUOUS[3]	Refer to Maximum Continuous Thrust (N^1) tables in Section V, *AFM.*

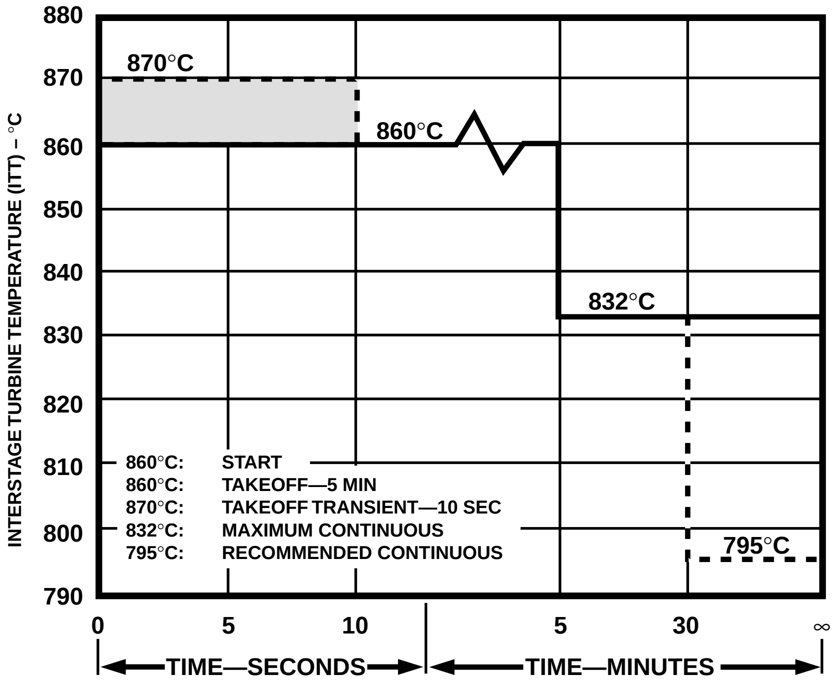
1. If engine overspeed limit is exceeded, contact nearest Garrett Field Service Propulsion Engine representative prior to engine removal for overspeed inspection.
2. If limit is exceeded, reduce thrust to within limits and make necessary fuel control adjustment prior to next flight.
3. Thrust settings above performance chart values may exceed engine rated thrust.

ENGINE OPERATING TEMPERATURES

Refer to Figure LIM-6.

AIRSTART ENVELOPE

Refer to Figure 4-1 RELIGHT ENVELOPE in Section IV of the *AFM* for airstart envelope.



START

- IF START ITT LIMIT IS EXCEEDED, ABORT START AND REFER TO ENGINE *SERVICE MANUAL* FOR CORRECTIVE ACTION.

TAKEOFF

- IF TAKEOFF LIMIT IS EXCEEDED, REDUCE THRUST SETTING TO WITHIN LIMITS AND RECORD BOTH TEMPERATURE AND DURATION IN EXCESS OF LIMIT IN ENGINE LOG. AN ITT OVERSHOOT RESULTING FROM APPLICATION OF TAKEOFF THRUST NOT EXCEEDING TAKEOFF TRANSIENT LIMIT IS ALLOWABLE AND DOES NOT REQUIRE AN ENGINE LOG ENTRY.
- IF TAKEOFF TRANSIENT LIMIT IS EXCEEDED, REDUCE THRUST SETTING TO WITHIN LIMITS AND MAKE ELECTRONIC COMPUTER N_1 ADJUSTMENT BEFORE NEXT FLIGHT. OBSERVE TAKEOFF ITT LIMIT.
- IF A TAKEOFF ITT OF 870°C OR MORE IS ATTAINED FOR MORE THAN 10 SECONDS OR 930°C IS ATTAINED OR EXCEEDED, REFER TO ENGINE *SERVICE MANUAL* FOR CORRECTIVE ACTION.

MAXIMUM CONTINUOUS

- MAXIMUM CONTINUOUS LIMIT IS 832°C. HOWEVER, FOR GREATEST ENGINE LIFE, IT IS RECOMMENDED THAT, UNDER NORMAL CONDITIONS, ENGINE THRUST BE REDUCED TO AN ITT OF 795°C OR LESS AFTER 30 MINUTES OF MAXIMUM CONTINUOUS OPERATION.

Figure LIM-6. Turbine Temperature Limits

OIL LIMITS

OIL TEMPERATURE LIMITS

Sea Level to 30,000 feet.. 127°C

Above 30,000 feet .... 140°C

Transient (2 minutes maximum) .... 149°C

OIL PRESSURE LIMITS

Minimum .... 25 psi

Idle Range.. 25 to 46 psi

Normal Operating Range .... 38 to 46 psi

Maximum Transient (3 minutes maximum) .... 55 psi

APPROVED OILS

Oils conforming to Garrett specification EMS 53110, Type II are approved. Refer to Addendum II—Oil Servicing for a listing of approved oils.

FUEL LIMITS

FUEL LOAD/BALANCE

Do not takeoff or land with wing fuel unbalance greater than 200 pounds.

During flight, wing fuel balance must be maintained within 500 pounds.

UNUSABLE FUEL

The fuel remaining in the fuel tanks when the fuel quantity indicator reads zero is not usable in flight.

FUEL TEMPERATURE

If using JP-5, JP-8, JET A, JET A-1 or equivalent fuels, ***do not*** takeoff with fuel temperatures below –29°C (–20°F).

NOTE

Prolonged operation at ambient temperatures below the freezing point of the fuel used may result in a reduction in usable fuel because of fuel freezing if proper fuel management procedures are not used. Refer to Fuel Management procedures in "Normal Procedures" chapter.

DIGITAL ELECTRONIC ENGINE CONTROL (DEEC) SPECIFIC GRAVITY

WARNING

Engine surge may occur if the recommended specific gravity adjustment is not adhered to for the type of fuel being used. If surge is encountered, refer to the *Engine Maintenance Manual*.

CAUTION

A decrease in the specific gravity setting on the fuel computer, without a change in fuel specific gravity, results in higher turbine temperatures in start, acceleration, and deceleration.

The digital electronic engine control must be adjusted to the recommended specific gravity setting in the engine log book for the type of fuel being used. If no entry is made in the engine log book, the following settings must be observed:

- Jet A, Jet A-1, JP-5 and JP-8 5

APPROVED FUELS

The mixing of fuel types is allowed.

Jet-A, Jet-Al, JP-5 and JP-8 fuels conforming to Garrett Specifications EMS 53111, EMS 53112, and EMS 53116 are approved. Refer to Addendum I—Fuel Servicing for a listing of approved fuels.

AVIATION GASOLINE

The use of aviation gasoline is not approved.

ANTI-ICING ADDITIVE

On aircraft equipped with fuel heaters, anti-icing additive is not a requirement. However, for microbial protection, it is recommended that fuel containing either an approved biocide additive or an anti-icing additive conforming to MIL-I-27686 be used at least once a week for aircraft in regular use and whenever a fueled aircraft will be out of service for a week or more.

On aircraft not equipped with fuel heaters, anti-icing additive conforming to MIL-I-27686 or MIL-I-85470 is required. The additive concentration, by volume, shall be as follows:

ADDITIVE TYPE	CONCENTRATION BY VOLUME MINIMUM	MAXIMUM
MIL-I-27686	0.06%	0.15%
MIL-I-85470	0.10%	0.15%

NOTE

Anti-icing conforming to MIL-I-85470 does not inhibit microbial growth. For microbial protection, it is recommended that fuel containing either an approved biocide additive or an anti-icing additive conforming to MIL-I-27686 be used at least once a week for aircraft in regular use and whenever a fueled aircraft will be out of service for a week or more.

Refer to Addendum I—Fuel Servicing for additional information and the proper anti-icing additive blending procedure.

CAUTION

On aircraft not equipped with fuel heaters, 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 premixed in the fuel supply facility. Additive concentration is not to exceed 270 ppm. Refer to Addendum I—Fuel Servicing for additional information.

INSTRUMENT MARKINGS

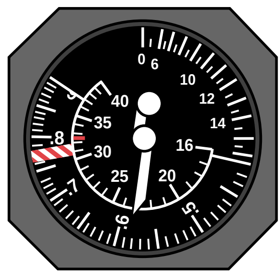
PILOT AND COPILOT AIRSPEED/MACH INDICATORS

Barber Pole
Pick-Up at .... V_{MO}/M_{MO}

STANDBY AIRSPEED/MACH INDICATOR

Red Line .... 325 KIAS

Barber Pole .... 0.78 M_I



CABIN ALTIMETER/ DIFFERENTIAL PRESSURE

Green Arc .... 0 to 9.4 psi

Yellow Arc .... 9.4 to 9.7 psi

Red Line.................... 9.7 to 10.0 psi

OIL PRESSURE

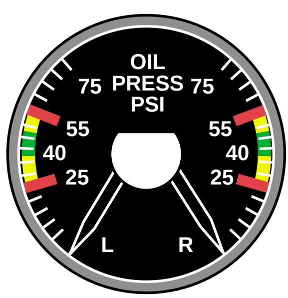
Red Line (MIN)...................... 25 psi

Yellow Arc .... 25 to 38 psi

Green Arc...................... 38 to 46 psi

Yellow Arc .... 46 to 55 psi

Red Line
(3 Minutes MAX) .... 55 psi

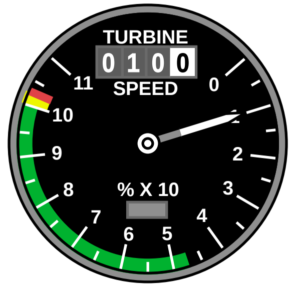


TURBINE SPEED (N_2)

Green Arc .... 48 to 100%

Yellow Arc .... 100 to 103%
(One minute limit)

Red Line 103%

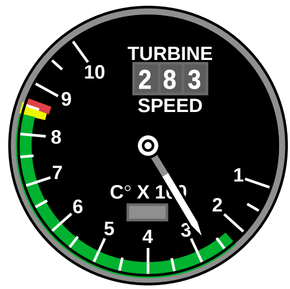


TURBINE TEMPERATURE (ITT)

Green Arc.................... 230 to 832°C

Yellow Arc .... 832 to 860°C

Red Line .... 860°C
(Refer to Figure LIM-5.)



FAN SPEED (N_1)

Green Arc .... 24 to 100%

Yellow Arc .... 100 to 103%
(One-minute limit)

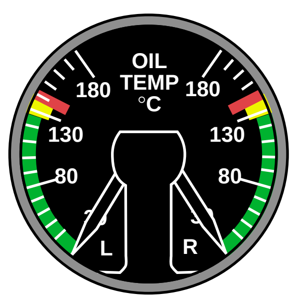
Red Line 103%

OIL TEMPERATURE

Green Segment .... 30 to 127°C

Yellow Segment .... 127 to 140°C

Red Line .... 140°C

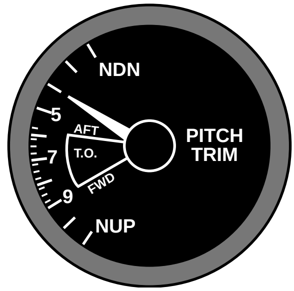


NOTE

Do not exceed 127°C below 30,000 feet.

PITCH TRIM

Takeoff Range.............. 5.75 to 8.75°



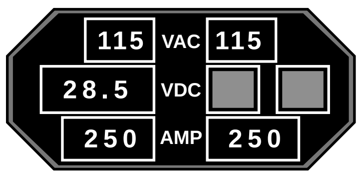
ELECTRIC POWER MONITOR

AC Voltage

Normal Range .... 100 to 130 volts

Amber Range .... 90 to 109 volts
and 131 to 134 volts

Red Range .... Below 90 volts
and Above 135 volts



DC Voltage

Normal Range .... 22 to 29.5 volts

Amber Range .... 18 to 21.9 volts
and 29.6 to 31.5 volts

Red Range .... Below 18 volts
and Above 31.5 volts

DC Amperes

Normal Range .... 0 to 325 amps

Amber Range.......... 326 to 400 amps

Red Range.............. Above 400 amps

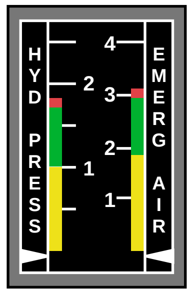
OXYGEN PRESSURE

Green Segment .... 1,550 to 1,850 psi

Yellow Segment .... 0 to 300 psi

Red Line .... 2,000 psi

HYDRAULIC PRESSURE



Yellow Segment .... 0 to 1,000 psi

Green Segment .... 1,000 to 1,750 psi

Red Line .... 1,750 psi

EMERGENCY AIR

Yellow Segment .... 0 to 1,800 psi

Green Segment .... 1,800 to 3,000 psi

Red Line .... 3,000 psi

NOTE

If air bottle is serviced near the high end of yellow segment (slightly above 1,800 psi), pressure may drop during flight as the system cools; satisfactory gear extension and braking can still be expected.

MANEUVERS AND PROCEDURES

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MANEUVERS AND PROCEDURES

INTRODUCTION

The general pilot information in this chapter is intended to supplement and expand upon information in other sources. It is not intended to supercede any official publication. If there is any conflict between the information in this chapter and that in any official publication, the information in the official publication takes precedence.

GENERAL

General pilot information includes Standard Operating Procedures and the maneuvers normally encountered during Learjet training and operations. The following abbreviations are used in this chapter.

ABBREVIATIONS

AFM	*Airplane Flight Manual*
AGL	Above Ground Level
ATA	Airport Traffic Area (Class D Airspace effective 9/16/93)
ATC	Air Traffic Control
CDI	Course Deviation Indicator
COM/NAV	Communication/Navigation
DH	Decision Height
FAF	Final Approach Fix
FL	Flight Level
HAA	Height Above Airport
HAT	Height Above Touchdown
IAF	Initial Approach Fix
KIAS	Knots, Indicated Airspeed
MAP	Missed Approach Point
MDA	Minimum Descent Altitude
MEA	Minimum Enroute Altitude
M_{MO}	Mach, Maximum Operational
MSL	Mean Sea Level
N_1	Fan Speed
PF	Pilot Flying
PIC	Pilot in Command
PNF	Pilot Not Flying
SOP	Standard Operating Procedure
VDP	Visual Descent Point
V_{FE}	Velocity Flaps Extended
V_{MO}	Velocity Maximum Operational
V_1	Critical Engine Failure Speed
V_R	Rotation Speed
V_{REF}	Reference Speed
V_2	Takeoff Safety Speed

STANDARD OPERATING PROCEDURES

GENERAL

Standard Operating Procedures (SOPs) are used to supplement the information in the *AFM* and Federal Air Regulations. Adherence to SOPs enhances individual and crew situational awareness and performance. SOPs may include assignment of responsibilities, briefing guides and procedures to be followed during specific segments of flight. The SOPs in this section are not intended to be mandatory or to supercede any individual company SOPs. They are simply provided as examples of good operating practices.

RESPONSIBILITIES

PIC—The Pilot in Command is designated by the company for flights requiring more than one pilot. Responsible for conduct and safety of the flight. Designates pilot flying and pilot not flying duties.

PF—The Pilot Flying controls the airplane with respect to heading, altitude and airspeed and accomplishes other tasks as directed by the PIC.

PNF—The Pilot Not Flying maintains ATC communications, obtains clearances, accomplishes checklists, makes altitude call outs and other tasks as directed by the PIC.

All crewmembers are responsible for providing advice and council to the PIC. The PIC may choose to accept or reject such advice. That is a prerogative of the PIC. But neither the PIC's acceptance nor rejection of advice relieves other crewmembers of the responsibility of providing it.

CHECKLIST PROCEDURES

Normally, the PF initiates all checklists. However, if the PNF thinks a checklist should be accomplished, and the PF has not called for it, the PNF should prompt the PF. For example, "Ready for the Approach checklist, Captain?"

FlightSafety International recommends the use of the checklist challenge and response concept. Using Normal Procedures checklists, the PNF challenges the PF and the PF responds. Using Abnormal or Emergency Procedures checklists, the PNF challenges the PF and, as a memory aid, also gives the checklist item response. The PF then responds.

The PF may elect to have the PNF accomplish some Abnormal or Emergency Procedure checklists on the PF's command. In this case, the PNF gives the checklist item and response. The PF replies with the response and the PNF accomplishes the action.

When a checklist has been completed the PNF reports the checklist is complete and that he/she is standing by with the next checklist. For example, "Approach checklist complete. Standing by with the Before Landing checklist."

If an emergency occurs on takeoff after V_1 speed and the takeoff is continued, no checklist should be initiated before the airplane reaches a safe altitude above the ground; at least 400 feet.

BRIEFING GUIDES

General

While the Learjet *AFM* does not specifically require before takeoff and approach briefings, such briefings are appropriate under some circumstances. The briefing guides presented below should be used when flying with unfamiliar crewmembers or any other time the PIC believes they are necessary.

It should be noted that many of these items can, and should, be briefed well before engine start. Many of them can be discussed before arriving at the airplane.

Pretakeoff Briefing

The pretakeoff briefing should address the following items:

- Type of takeoff: rolling or standing, flap setting, etc
- Review takeoff data to include power setting and speeds
- Procedures to be used in the event of an emergency before or after V_1 speed including emergency return procedures
- Headings and altitudes to be flown during the departure including restrictions, if any
- Radio, navigational systems and flight director settings
- Anti-icing requirements, if applicable
- Specific PNF duties and callouts. (See "Takeoff Procedures," later in this section, for additional information.)
- A request for "Any questions?" directed to all cockpit crewmembers

Approach Briefing

The approach briefing should be completed before starting descent and address the following items. The PF normally transfers airplane control to the PNF during the briefing.

- Approach to be used and backup approach, if available
- Special procedures to be used during the approach, such as circling approach procedures, interception of a radial from an arc, VDP, etc.
- Altitudes of IAF, FAF, stepdowns, sector and obstacles
- Minimums (DH, MDA), (HAT, HAA), radio altimeter setting
- Missed approach point and procedures, timing to MAP/VDP
- Radio (COM/NAV) setup desired

- Anti-icing requirements
- Specific PNF duties and callouts. (See “Approach Procedures,” later in this section, for additional information.)
- The procedure for transitioning to visual flight
- A request for “Any questions?” directed to all cockpit crewmembers

At the completion of the Approach briefing, the PF announces “Approach briefing complete,” and reassumes control of the airplane if control has been transferred to the PNF.

TAKEOFF PROCEDURES

When cleared for takeoff the PNF reports “Before Takeoff checklist complete, cleared for takeoff.” The PF advances power toward the takeoff power setting, the PNF taps PF’s hand and makes the final power setting.

At initial airspeed indication, the PNF cross-checks airspeed indicators and reports “Airspeed alive.” PF releases nosewheel steering (airplanes without digital nosewheel steering only).

At V_1 speed, the PNF calls “Vee One.” The PF releases the thrust levers and puts both hands on the control column.

At V_R, the PNF calls “Rotate.” The PF rotates airplane to a 9° noseup pitch attitude.

With positive rate of climb, the PF calls “Positive rate, gear up.” The PNF positions gear switch to up and calls “Gear selected up.” The PNF monitors the gear while it is retracting and reports “Gear up,” when retraction is complete.

Before V_{FE} (V_2 plus 20 knots minimum), the PF calls, “Flaps up, After Takeoff checklist.” The PNF positions the flap handle to up and calls “Flaps selected up.” The PNF monitors the flaps while they are retracting and reports “Flaps up,” when retraction is complete. PNF accomplishes the After Takeoff checklist.

CLIMB AND CRUISE PROCEDURES

The PNF announces all assigned altitudes and sets them in the altitude alerter. The PNF also calls out 1,000 feet above, or below, all assigned altitudes and altitude restrictions. These calls normally are made by stating the existing altitude and the assigned altitude or restriction. For example, “Through 9,000 feet, cleared to 8,000,” or “Through flight level 460 for 470.” The PNF also announces other significant altitudes, such as, “Through 18,000 feet, altimeter 29.92,” or, “Flight level 410, going on oxygen.”

The PF periodically announces his intentions and targets throughout the flight, such as “Accelerating to 250 knots,” “Turning right to 260 degrees and descending to 3,000 feet," "We'll hold this heading until intercepting the 090 degree radial and then turn right to the station."

Any change in cockpit function is announced by the pilot making the change and acknowledged by the other pilot. For example, the PNF announces, "VOR number two set to Springfield and identified." PF acknowledges, "VOR two on Springfield." PF announces, "Autopilot engaged and coupled in climb and heading modes." PNF acknowledges, "Roger."

Transfer of airplane control is announced by the pilot initiating the change and acknowledged by the pilot assuming control. Specific target values are provided to the pilot assuming control. For example, the PF announces, "Take the airplane for a minute. We're climbing at 250 knots to 7,000 on a vector to the 045 radial." PNF acknowledges, "I've got the airplane, climbing at 250 to 7,000 on this heading until intercepting the 045 radial."

APPROACH PLANNING

Approach planning and briefing should be accomplished during cruise. Review hazardous terrain, MEAs, and minimum sector altitudes. Complete and review performance data to include V_{REF} speed, landing distance, approach climb speed and power setting.

The PF directs the PNF to obtain destination weather or obtains it himself. If the PNF obtains the weather, the PF normally assumes ATC communications while the PNF is obtaining weather. In either case, after checking weather, the pilot who did so briefs the other pilot on the destination weather, the expected approach, and any other significant information.

If a VDP has not been published, a "time to see the runway" may be computed as follows. Take the MDA, divided by 10, and subtract that, in seconds, from the time from the FAF to the MAP. For example, assume the MDA is 400 feet and the time from the FAF to the MAP is 1 minute and 45 seconds. Four hundred, divided by 10 equals 40. Subtracting that from 1:45 equals 1:05 from the FAF to see the runway. If the runway is not in sight at the end of that time, either a faster than normal rate of descent is required, or the airplane lands beyond the normal touchdown zone.

Normally ATC determines when a descent may be started. However, descents may sometimes be started at the PF's discretion. To determine how far out to start descent for an approach, use 3 times the altitude to be lost, divided by 1,000. For example, to lose 40,000 feet, 3 times 40,000 equals 120,000, divided by 1,000 equals 120 miles out to start descent.

The Descent checklist should be started before, or early in, the descent to permit proper windshield heat and pressurization system operation.

Descent below flight level 180 will not be started before obtaining a local area altimeter setting.

DESCENT PROCEDURES

The same procedures used during climb and cruise are used during descent. The PNF accomplishes the Descent checklist, as directed by the PF, and makes altitude callouts to include the transition level and 10,000 feet.

APPROACH PROCEDURES

The PF initiates the Approach checklist when descending out of 18,000 feet or when within 50 miles of the destination airport. The checklist is accomplished so as to not interfere with the visual lookout for other traffic.

Configuration changes during the approach are accomplished using the same crew coordination techniques used after takeoff. The PF calls for a configuration change. The PNF acknowledges, selects the switch position, monitors and reports when gear and flaps are in the selected positions.

The Approach checklist is completed and the airplane slowed to V_{REF} + 30 knots (minimum) before reaching the IAF.

Over the IAF, for other than a straight-in approach, the PF turns outbound, call for flaps 8°, slows the airplane to V_{REF} + 25 knots (minimum) and begins a descent, if necessary. The PNF starts timing, announces the time to be flown and the outbound course, or heading, and altitude if an altitude change is required.

If a procedure turn is to be made, any accepted procedure turn maneuver may be used. At the expiration of the time from the IAF, the PNF announces that time is up, the direction of turn, and the next heading. For example, "Time's up, left turn now to 045 degrees." Wings-level outbound in the procedure turn, the PNF starts timing, announces the time to be flown and the next heading and altitude. At the expiration of the procedure turn outbound time, the PNF announces the time is up, the direction of turn, the next heading and altitude, if an altitude change is required. For example, "Time's up, right turn now to 225° and cleared down to 3,000."

Approaching the final approach course, the PNF monitors the CDI or bearing pointer and reports "CDI alive," or "Within 5° of the inbound course."

Established on final approach, the PF will call for flaps 20° and slow the airplane to V_{REF}+20 (minimum) and begin a descent, if necessary. After the flaps have been set to 20° and within 3–5 miles of the final approach fix, the PF will call "Gear Down Before Landing Checklist". The PNF extends the landing gear, completes the Before Landing Checklist up to flaps down and reports, before Landing Checklist complete except full flaps.

Over the FAF, on a two-engine, straight-in approach, the PF calls for flaps 40°, slows the airplane to V_{REF} (minimum) and begins a descent. For a circling approach, the flaps remain at 20° until the aircraft is continuously in a position from which a descent to a normal landing on the intended runway can be made at a normal rate of descent using normal maneuvers. If single-engine, the flaps remain at 20° until landing. The PNF begins timing, if necessary,extends the flaps and completes the Before Landing checklist. The PNF also confirms that the COM/NAV radios are set properly, checks the flight instruments, airspeed bugs, altitude alerter, radio altimeter setting and MDA or DH. The PNF then reports, "Before Landing checklist complete, no flags, cleared to descend to _________ feet."

After passing the FAF, the PNF begins looking for visual references outside the airplane. However, he/she also monitors the instruments and calls out significant deviations such as 1 dot, or more, deflection on the CDI or glideslope and airspeed variations greater than –0 to +10 knots from V_{REF}. If the PF does not respond to the callout, the PNF repeats it. If the PF does not respond to the second callout, the PNF assumes the PF has been incapacitated and announces that he/she (the PNF) is taking control of the airplane.

The PNF calls out the time to the VDP/MAP and 1,000, 500 and 100 feet above MDA or DH. The PNF also reports visual contact with the ground such as, "Visual contact, no runway yet," "Approach lights in sight at 11 o'clock," or "Runway in sight straight ahead."

Approaching minimums, or the missed approach point, the PF begins cross-checking outside the airplane for visual references. When satisfied that visual references are adequate for landing, the PF announces, "I'm going visual," or "Going outside." At this point, the PNF directs his attention primarily inside the airplane, while cross-checking outside, and calls airspeed, descent rate and altitude. The purpose is to provide the PF, verbally, the same information he/she would have if still on instruments.

Airspeed should be called as plus or minus V_{REF}, descent rate as up or down and altitude above the ground. For example, "Plus 5, down 500, 100 feet," indicates the airspeed is V_{REF} plus 5 knots, the airplane is descending at 500 feet per minute and is 100 feet above the ground.

GO-AROUND/BALKED LANDING

If a go-around/balked landing is necessary, the PF will call "Going around", set power to Take-off thrust and simultaneously establish a 9° nose-up pitch altitude. Selecting the flight director to Go-around mode will disengage the auto-pilot and set the pitch bars to 9°. Spoilers will be checked retracted and flaps set to 20°. The PNF will confirm spoilers and flaps set and will call out the direction of turn if one is required, along with the missed approach heading and altitude. The PNF notifies ATC of the missed approach.

MANEUVERS

GENERAL

This section contains a description of most of the maneuvers that are likely to be encountered during Learjet training and operational flying. While there is always more than one way to fly an airplane, these procedures have been developed over many years of Learjet operations. They have proven to be safe, efficient and readily manageable. These procedures are consistent with the *AFM*. However, if a conflict should develop between these procedures and those in the *AFM*, the *AFM* procedures should be used.

PERFORMANCE STANDARDS

The performance standards in Table MAP-1 should be maintained during all Learjet flight operations.

Table MAP-1. PERFORMANCE STANDARDS

Steep Turns		
	Bank angle: 45°, ±5°	
	Altitude: ±100 feet	
	Airspeed: ±10 KIAS	
	Heading: ±10°	
Approach to Stall		
	Initiate recovery at stick shaker onset Recover with minimum altitude loss	
Holding		
	Altitude: ±100 feet	
	Airspeed: ±10 knots	
Instrument Approaches		
	Initial:	Altitude: ±100 feet
		Airspeed: ±10 knots
	Final:	Airspeed: –0, +5 knots
		Localizer: ±one dot
		Glide Slope: ±one dot
		Bearing Pointer: ±5°
	MDA:	Altitude: –0, +50 feet
Circling Approaches		
	Bank Angle: 30° maximum	
	Altitude: –0, +100 feet	
	Airspeed: –0, +5 knots	
Missed Approach		
	DH: Altitude: –0 before initiation of the missed approach	
	MDA: Altitude: –0, unless runway environment had been in sight before the missed approach	
Landings		
	Traffic Pattern:	Airspeed: ±10 knots
		Altitude: ±100 feet
	Final Approach:	Airspeed: –0, +5 knots

MINIMUM MANEUVERING SPEEDS

Minimum maneuvering speeds are expressed in terms of V_{REF} speed which is 1.3 times the stalling speed in the landing configuration.

For maneuvering with up to 30° of bank, the following minimum speeds should be used:

Spoilers deployed . . . . V_{REF} + 40 knots

Flaps up . . . . V_{REF} + 30 knots

Flaps 8° . . . . V_{REF} + 25 knots

Flaps 20° . . . . V_{REF} + 20 knots

Flaps 40° . . . . V_{REF} + 10 knots

For maneuvering with up to 15° of bank, on final approach for landing, for example, the following minimum speeds should be used:

Spoilers deployed . . . . V_{REF} + 30 knots

Flaps up . . . . V_{REF} + 20 knots

Flaps 8° . . . . V_{REF} + 15 knots

Flaps 20° . . . . V_{REF} + 10 knots

Flaps 40° . . . . V_{REF}

POWER SETTINGS

Actual power settings vary depending upon the temperature, pressure altitude, and airplane gross weight. The following target settings are approximate, but may be used to provide a starting point to determine the actual power setting.

Below 10,000 MSL, 60% N_1 to maintain 200 KIAS, 70 to 75% N_1 to maintain 250 KIAS.

Between 10,000 MSL and FL 250, 75 to 80% N_1 to maintain 250 KIAS.

TAKEOFF

Either 8 or 20° of flaps may be used for takeoff. The normal, standing takeoff (Figure MAP-1) must be used to achieve the performance specified in the *AFM*. If the runway available is at least 10 percent longer than the planned takeoff distance, a rolling takeoff (Figure MAP-2) may be used. The procedures are the same except for a standing takeoff, power is set before brake release. For a rolling takeoff, the brakes are released before the power is set. During a rolling takeoff, takeoff power must be set before the runway remaining equals the takeoff distance.

Normally, before V_{FE} (V_2 plus 20 knots minimum) the flaps are retracted and the After Takeoff checklist is accomplished. However, if traffic conditions warrant, the After Takeoff checklist may be delayed until the airplane is clear of local traffic.

Approaching 200 knots the PF should adjust power and pitch attitude if necessary, to maintain 200 knots or less within the ATA (Class D Airspace). For passenger comfort and ease of airplane control, it is recommended that the pitch attitude not exceed 20° noseup.

The maximum continuous climb power setting is a variable depending on temperature and pressure altitude. The "Maximum Continuous Thrust (N_1)" chart, in the Performance Data section of the checklist, and *AFM* thrust setting procedures should be used.

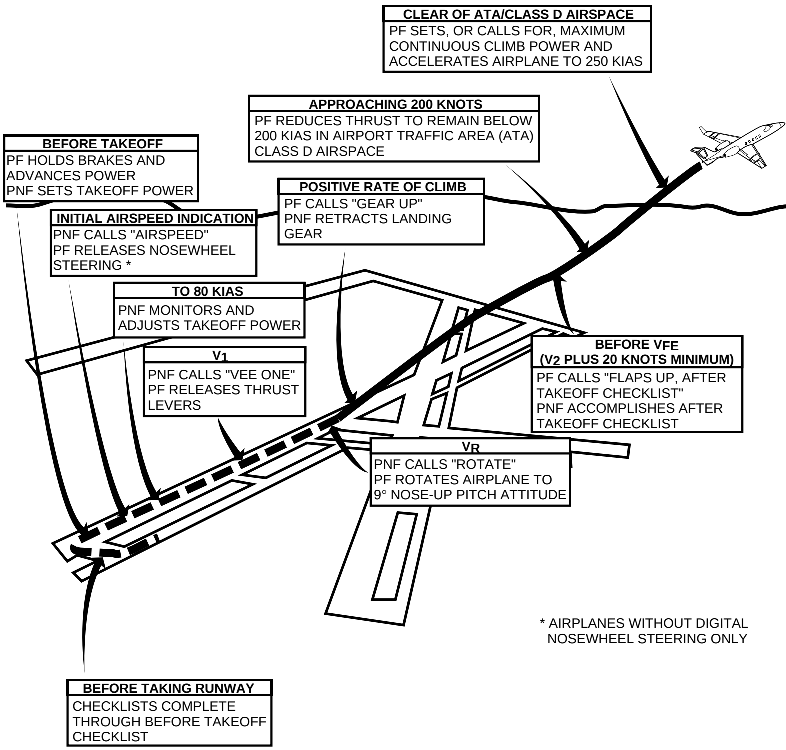

Figure MAP-1. Standing Takeoff

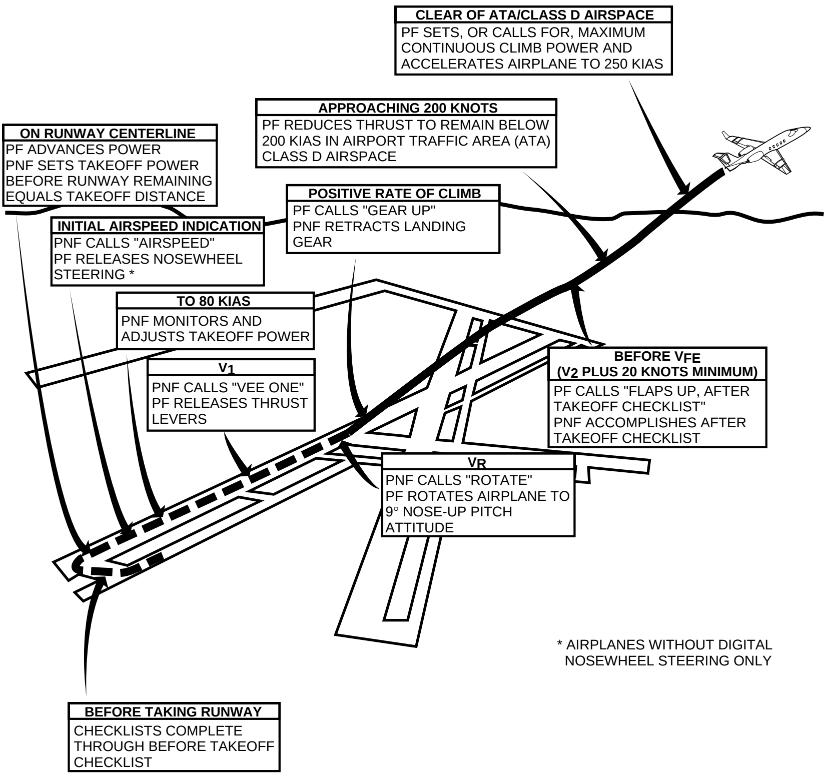

Figure MAP-2. Rolling Takeoff

ENGINE FAILURE BELOW V_1 SPEED

If an engine fails below V_1 speed (Figure MAP-3), the takeoff must be aborted. The PF simultaneously reduces power to idle, applies maximum braking and deploys the spoilers. The drag chute or thrust reversers (if installed) are deployed if necessary.

Takeoffs may be aborted for malfunctions other than engine failure, however, the same procedures should normally be used.

ENGINE FAILURE ABOVE V_1 SPEED

If an engine fails above V_1 speed (Figure MAP-4), the takeoff is normally continued. The PF maintains directional control with ailerons and rudder and keeps the nosewheel on the runway until reaching rotate speed. After liftoff, the initial climb is made at V_2 speed with takeoff flaps until the airplane is clear of obstacles or, if there are no obstacles, to 1,500 feet AGL. The PF then accelerates the airplane to V_2 plus 20 knots (minimum) and directs the PNF to retract the flaps. The PF then accelerates the airplane to single-engine climb speed (normally 200 knots) and climbs to the assigned altitude.

At a safe altitude above the ground, (normally, no lower than 400 feet) the memory items for the Engine Failure/Fire Shutdown in Flight checklists are completed. The rest of the Engine Failure/Fire Shutdown in Flight checklists, and the After Takeoff checklist, are normally completed at, or above, 1,500 feet AGL. The crew then elects to obtain clearance to return to the departure airport for landing or proceeds to an alternate airport.

STEEP TURNS

Steep turns (Figure MAP-5) are used to build confidence in the airplane and improve instrument cross-check. They may be accomplished at any altitude above 5,000 feet AGL. The higher the altitude, the more difficult the maneuver is to perform correctly. Steep turns are accomplished without flight director steering commands since the flight director does not command 45° of bank.

Power must be increased approximately 2% N_1 to maintain airspeed during steep turns. The airplane should be kept in trim and the bank angle should be held constant. If altitude corrections are necessary, they should be made in pitch only. It is not necessary to shallow the bank to climb during a steep turn in a Learjet.

Steep turns of at least 180°, preferably 360°, should be practiced in each direction.

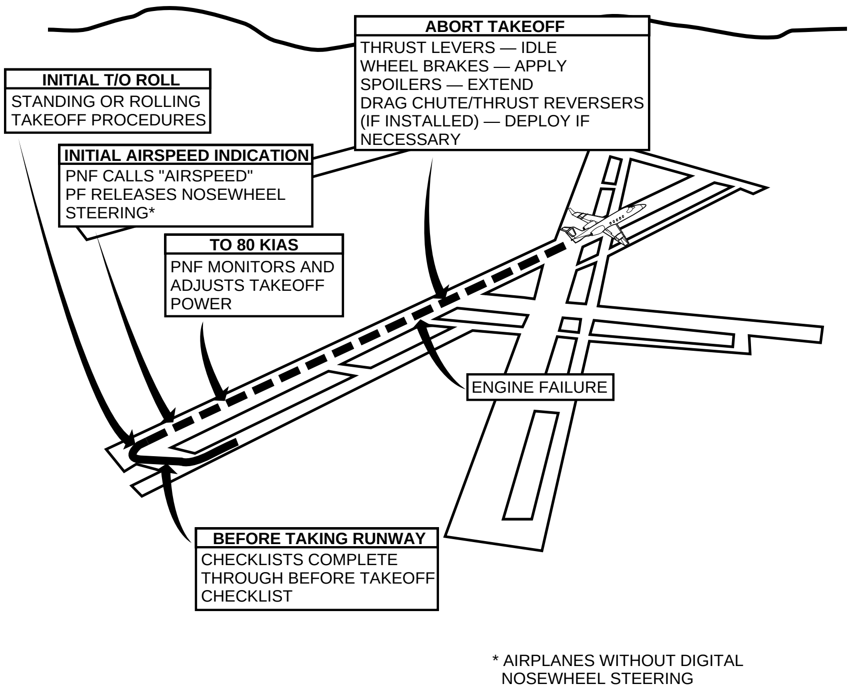

Figure MAP-3. Engine Failure Below V_1 Speed

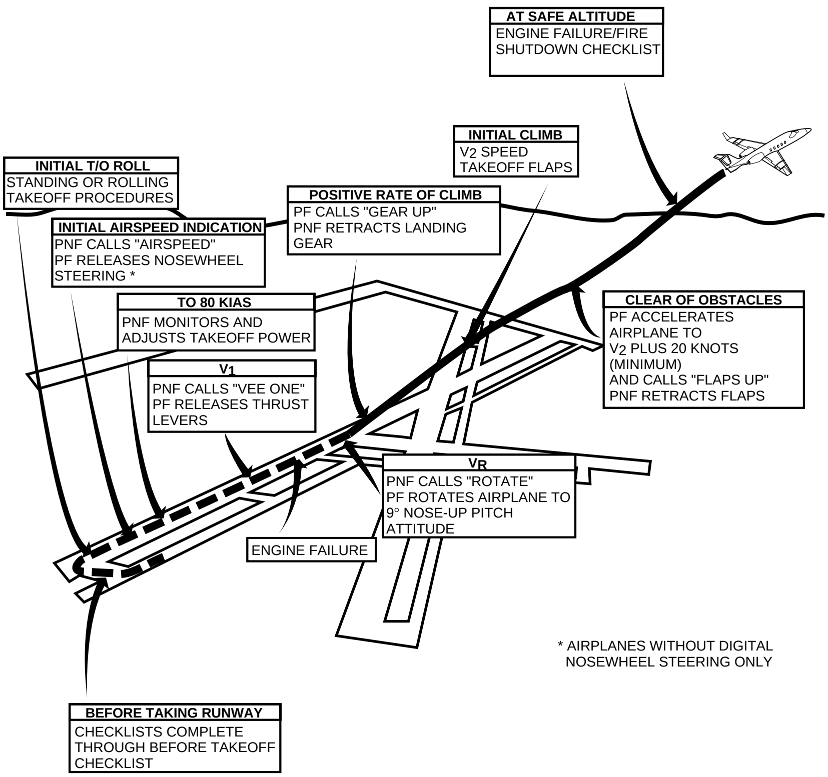

Figure MAP-4. Engine Failure Above V_1 Speed

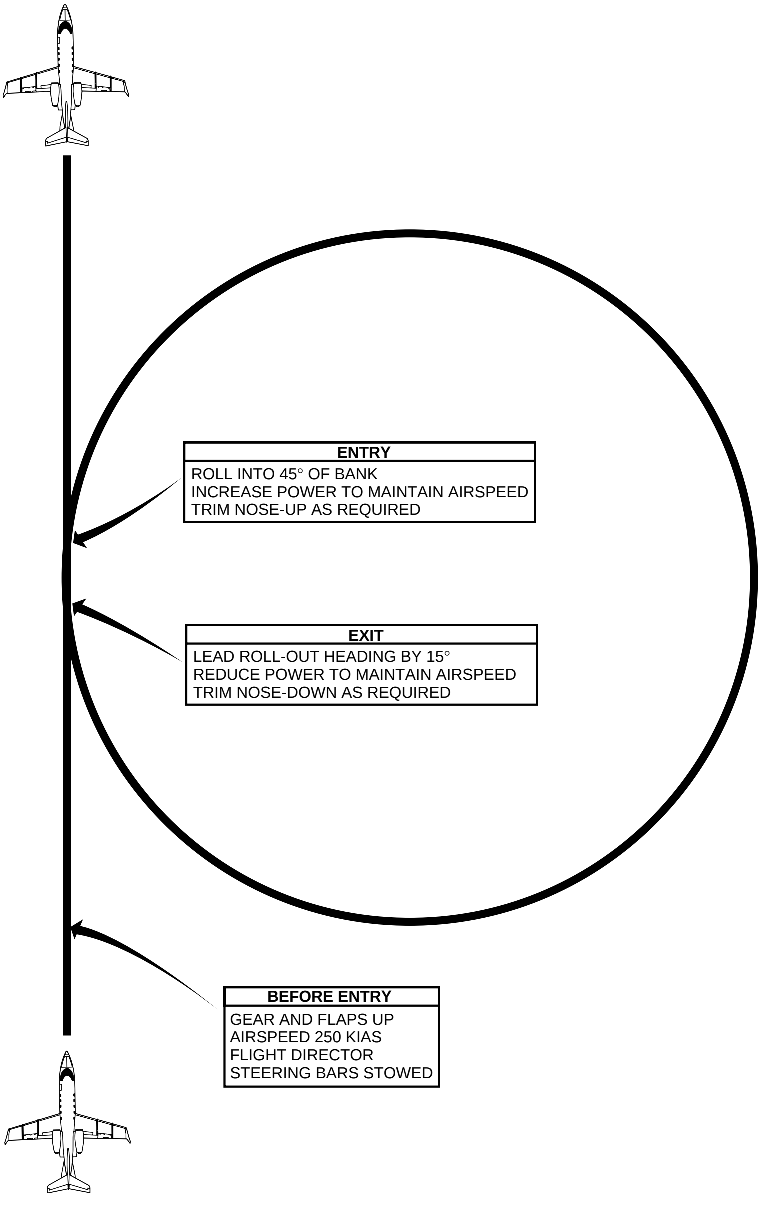

Figure MAP-5. Steep Turns

SLOW FLIGHT

Slow flight is used to develop the pilot's sense of feel for the airplane's low speed handling characteristics and improve the pilot's coordination and instrument cross-check. Slow flight is accomplished in the clean, takeoff and landing configurations (Figures MAP-6, MAP-7 and MAP-8), and is normally accomplished between 10,000 and 15,000 feet MSL. Slow flight should not be accomplished below 5,000 AGL. To stay above 5,000 AGL, high terrain may require that slow flight be accomplished above 15,000 MSL.

Slow flight may be practiced while maintaining a constant altitude and heading or while maintaining a constant altitude and making turns to preselected headings. Slow flight may also be practiced while making constant rate climbs and descents to preselected altitudes. Slow flight practice may be terminated by a recovery to normal cruise or an approach to stall.

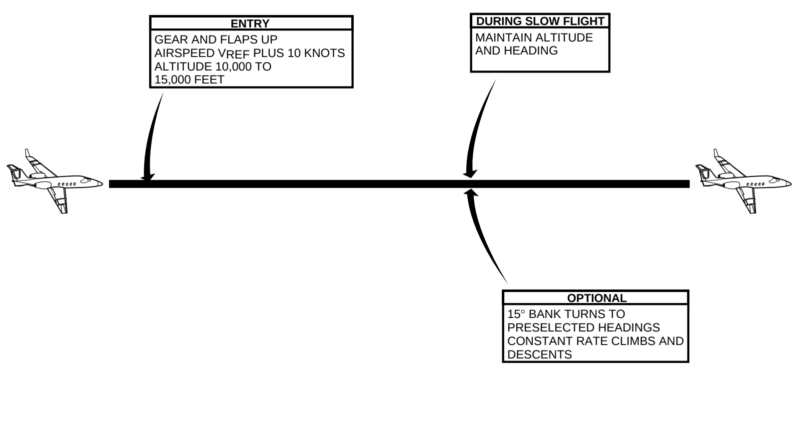

Figure MAP-6. Slow Flight—Clean Configuration

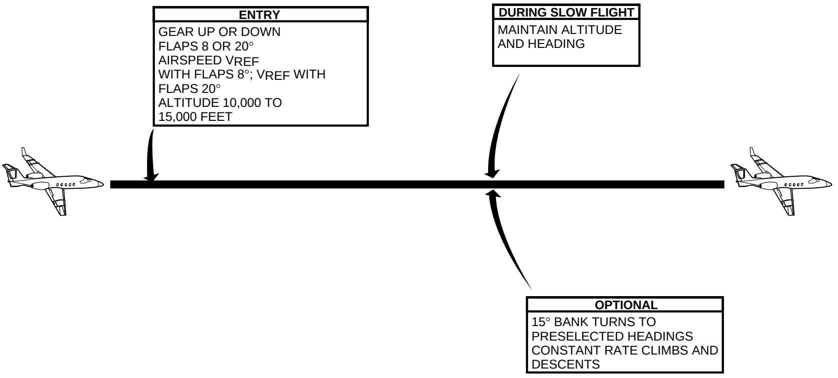

Figure MAP-7. Slow Flight—Takeoff Configuration

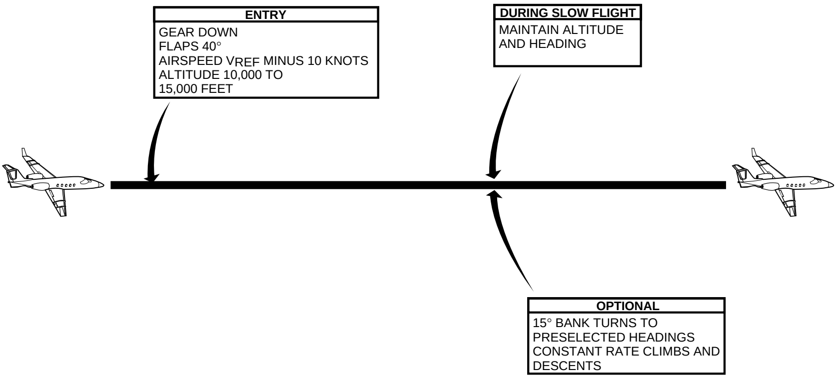

Figure MAP-8. Slow Flight—Landing Configuration

APPROACH TO STALL

Approaches to stalls are accomplished in the clean, takeoff, and landing configurations (Figures MAP-9. MAP-10, and MAP-11), and are normally accomplished between 10,000 and 15,000 feet MSL. Approaches to stalls should not be accomplished below 5,000 AGL. Approaches to stalls may be made from level or turning flight with 15 to 30° of bank. Approaches to stalls may also be combined with slow flight practice. All recoveries are made with power and minimum loss of altitude.

Approach to stall recovery is initiated at the first indication of an impending stall. This indication is provided by the stick shaker and stall warning annunciator lights which activate as the angle of attack indicator needle moves into the yellow band.

Power should be advanced to maximum and the existing pitch attitude maintained. However, the angle-of-attack indicator should be monitored and the pitch attitude reduced, if necessary, to keep the needle at the line between the green and yellow bands.

To set maximum power in minimum time, the PF should move the thrust levers smoothly forward to the stop and then the PNF should monitor and adjust the power setting if necessary. Approaches to stall from the landing configuration are normally terminated by a simulated missed approach, (Figure MAP-11).

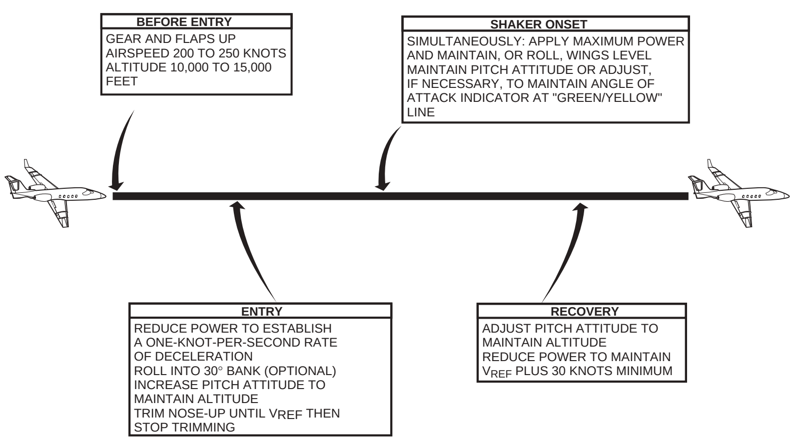

Figure MAP-9. Approach to Stall—Clean Configuration

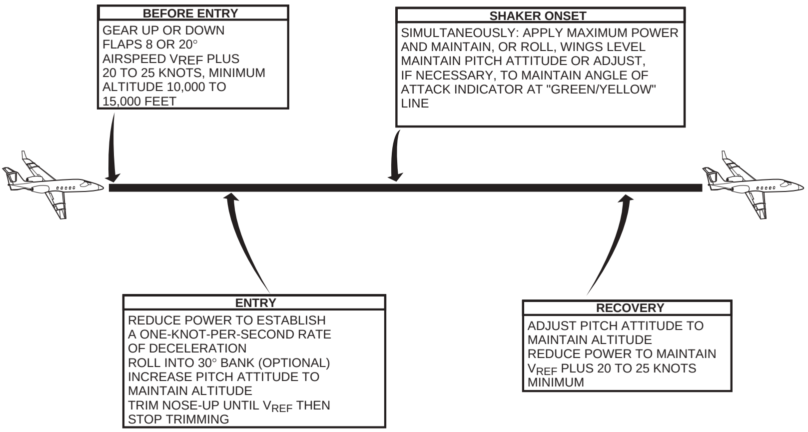

Figure MAP-10. Approach to Stall—Takeoff Configuration

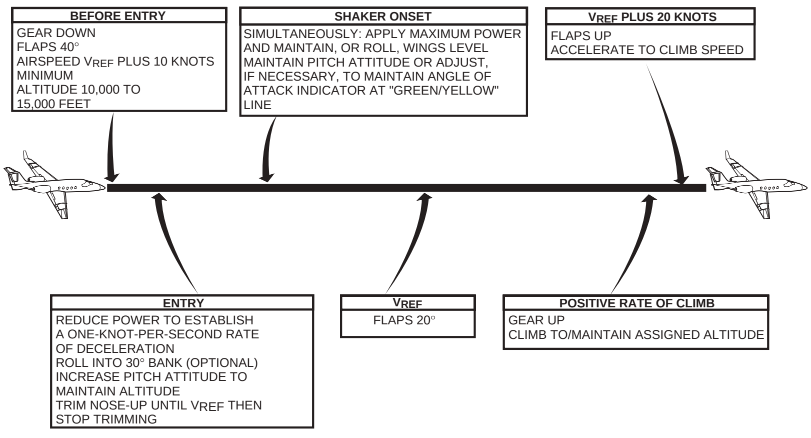

Figure MAP-11. Approach to Stall—Landing Configuration

EMERGENCY DESCENT

Emergency descents are accomplished in accordance with *AFM* procedures as shown in Figure MAP-12. The PF should accomplish the checklist memory items and allow the airplane to pitch down to a 10 to 15° nosedown pitch attitude. This pitch attitude is maintained until the airplane accelerates to M_{MO}/V_{MO}. Then the pitch attitude is adjusted to maintain M_{MO}/V_{MO}.

After the emergency descent has been established, the crew should determine the desired level-off altitude.

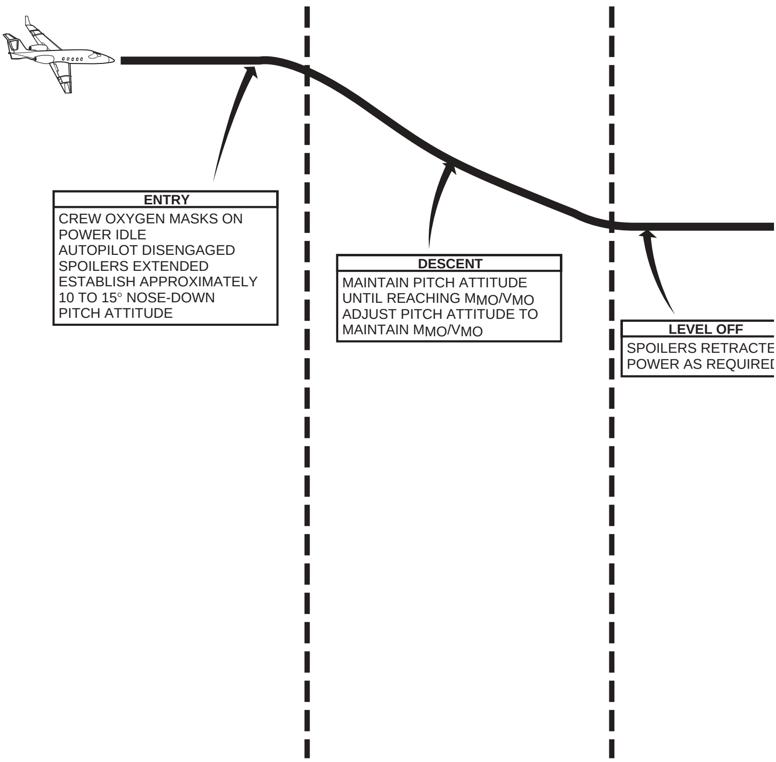

Figure MAP-12. Emergency Descent

VISUAL TRAFFIC PATTERN, TWO ENGINES

A two-engine visual traffic pattern is shown in Figure MAP-13. The airspeeds indicated on the diagram are minimums. Traffic pattern altitude for jet airplanes is normally 1,500 feet AGL. During gusty wind conditions, 1⁄2 the gust velocity should be added to V_{REF} on final approach. If a crosswind exists, final approach should be flown with a drift correction angle (crab) to maintain alignment with the runway center line. Approaching touchdown, rudder should be applied to align the airplane with the runway centerline and the upwind wing lowered with aileron to prevent drift.

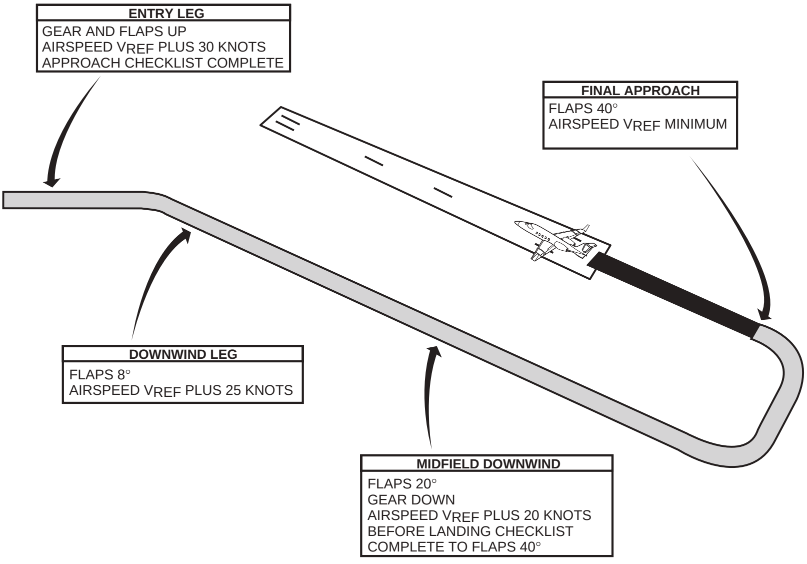

Figure MAP-13. Visual Traffic Pattern—Two Engines

VISUAL TRAFFIC PATTERN, SINGLE-ENGINE

A single-engine visual traffic pattern (Figure MAP-14) is flown exactly the same as a two-engine pattern except for the flap setting on final approach. For a single-engine landing, final approach is flown with flaps 20° at V_{REF} plus 10 knots until landing. Additionally, the PF may elect to have the PNF remove some, or all, of the rudder trim on final approach.

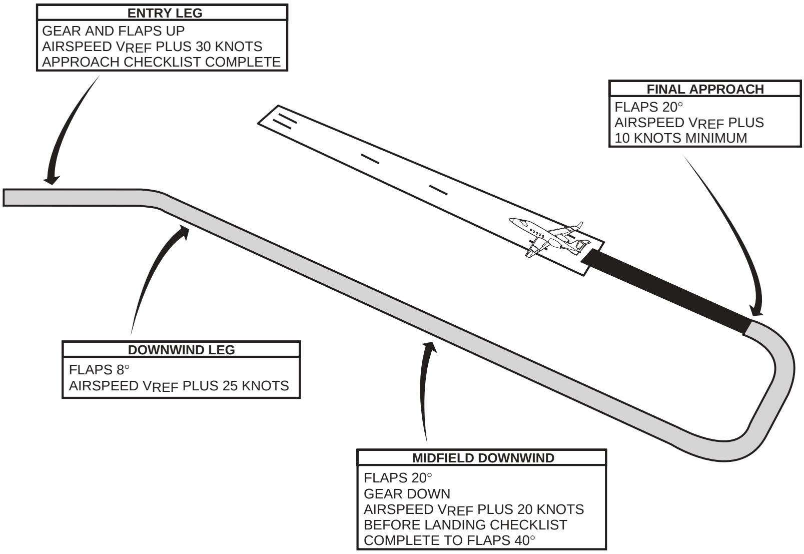

Figure MAP-14. Visual Traffic Pattern—Single Engine

FLAPS UP LANDING

The corrected landing distance for a flaps up landing (Figure MAP-15) is determined by multiplying the normal landing distance by 1.6. Consideration should be given to reducing the airplane's weight, if possible, to lower the landing speed and reduce landing distance, if the available runway length is marginal.

To avoid excessive floating during the landing flare, the PF should establish the landing attitude as power is reduced to idle, maintain the attitude and allow the airplane to touch down. The use of the drag chute, or thrust reversers, (if installed) is recommended during a flaps up landing.

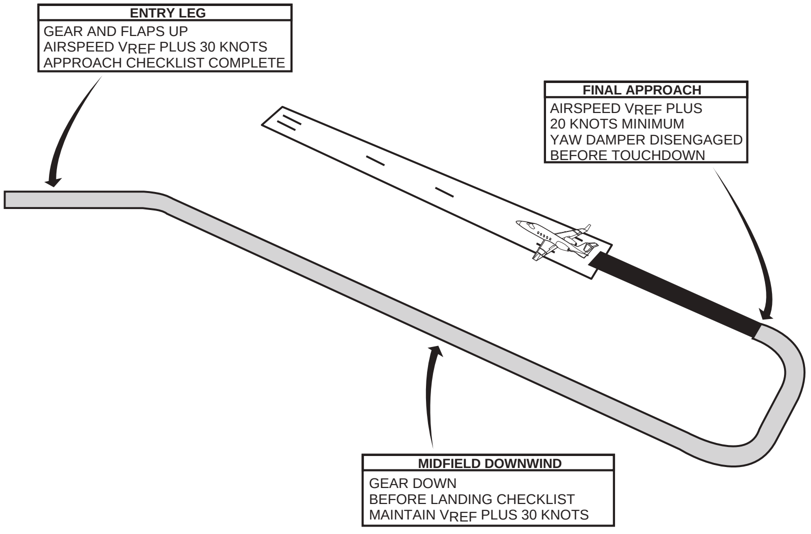

Figure MAP-15. Flaps Up Landing

PRECISION INSTRUMENT APPROACH

A typical, precision instrument approach is shown in Figure MAP-16. All accepted instrument flying procedures and techniques should be used while making instrument approaches in the Learjet.

Two-engine, precision approaches should be flown with a stabilized airspeed and configuration from the final approach fix (FAF) inbound. Single-engine, precision approaches should be flown with flaps 20° at V_{REF} plus 10 knots from the FAF inbound.

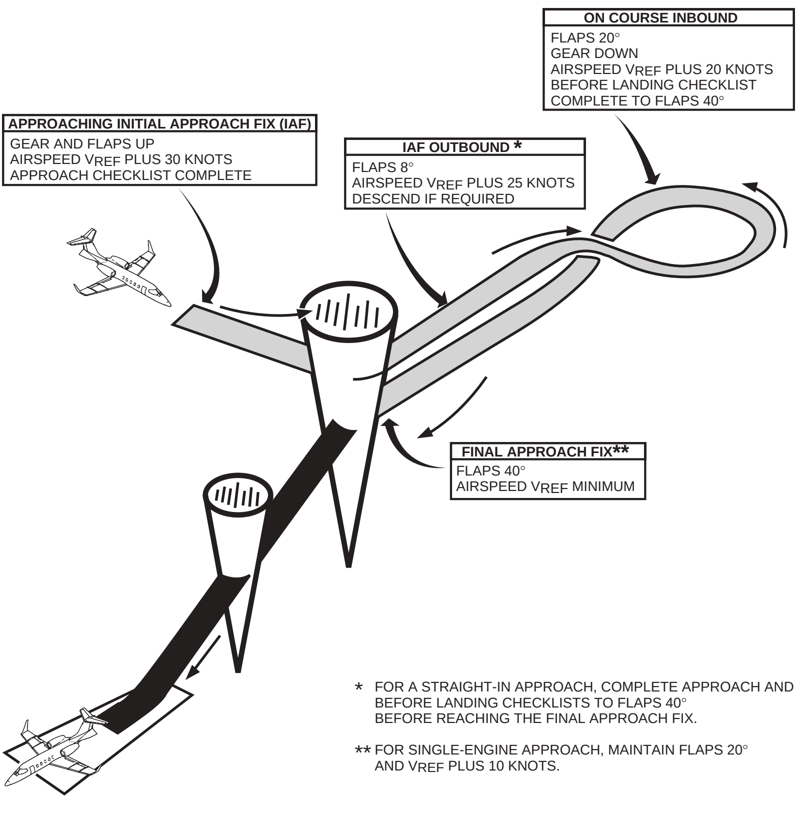

Figure MAP-16. Precision Instrument Approach

NONPRECISION INSTRUMENT APPROACH

A typical, nonprecision instrument approach is shown in Figure MAP-17. All accepted instrument flying procedures and techniques should be used while making instrument approaches in the Learjet.

Two-engine, nonprecision approaches should be flown with a stabilized airspeed and configuration from the final approach fix (FAF) inbound. Single-engine, nonprecision approaches should be flown with flaps 20° at V_{REF} plus 10 knots from the FAF inbound.

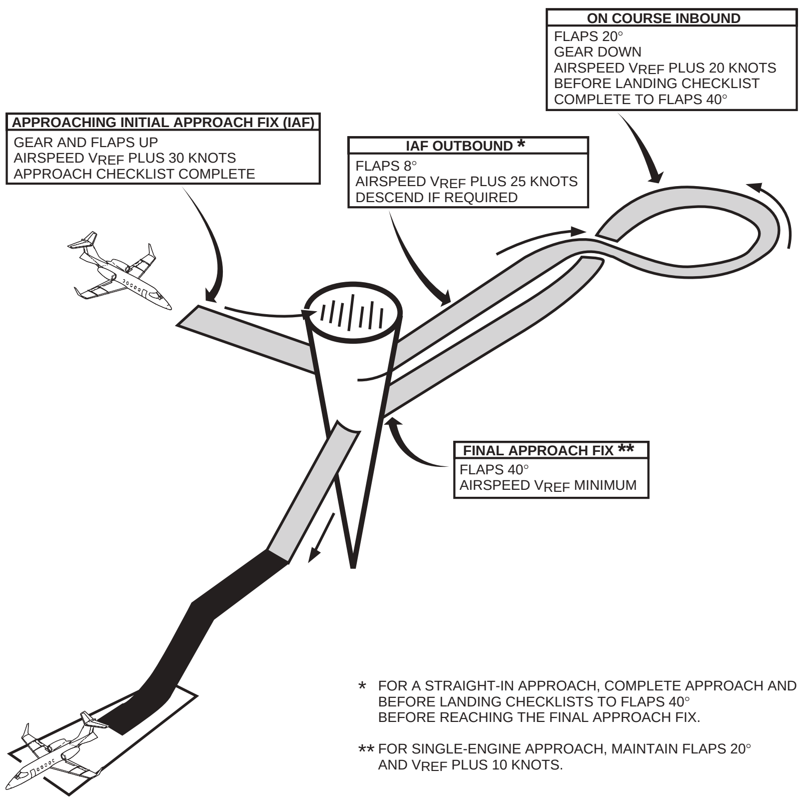

Figure MAP-17. Nonprecision Instrument Approach

CIRCLING INSTRUMENT APPROACH

Any instrument approach that requires a heading change of 30° or more to line up with the landing runway is a circling approach. An identifiable part of the airport must be distinctly visible to the pilot during the circling approach, unless the inability to see an identifiable part of the airport results only from a normal bank of the airplane. The circling MDA and weather minima to be used are those for the runway to which the approach is flown.

The Learjet is an approach category C airplane. However, category D minimums should be used if the airplane will be maneuvered at speeds over 141 knots (the minimum for category D airplanes) during the circling approach.

There are two types of circling approaches. The first type of circling approach positions the airplane within 90°, or less, of the runway heading on a base leg for landing. With two engines, this type of approach is normally flown with the gear down and 40° of flaps at V_{REF} plus 10 knots from the FAF inbound. When landing is assured, airspeed may be reduced to V_{REF} minimum.

The second type of circling approach (Figure MAP-18) requires a heading change of more than 90° to line up with the landing runway. With two engines, this type of approach is normally flown with the gear down and 20° of flaps at V_{REF} plus 20 knots from the FAF inbound. On final approach, flaps should be extended to 40° and airspeed reduced to V_{REF} minimum.

All single-engine circling approaches should be flown with 20° of flaps at V_{REF} + 20 knots from the FAF inbound. When landing is assured, the airspeed can be reduced to V_{REF} + 10 knots.

GO-AROUND/BALKED LANDING

The Learjet go-around/balked landing procedure, shown in Figure MAP-19, should be used for all missed approaches. Generally, if a missed approach is started at, or above, MDA or DH, it is considered a go-around. If a missed approach is started below MDA or DH, it is considered a rejected, or balked, landing. During training, rejected, or balked, landings will normally be initiated over the runway threshold at an altitude of approximately 50 feet.

In either case, use of the flight director go-around mode is recommended to provide a target 9° nose-high pitch attitude. After the airplane is clear of obstacles and the flaps have been retracted, the pitch attitude and power may be adjusted to maintain the desired airspeed.

If the go-around/balked landing is made from an instrument approach, the published missed approach procedure should be accomplished unless otherwise instructed. If the go-around/balked landing is made during a circling approach, the initial turn to the missed approach heading must be made toward the landing runway. The turn may then be continued until the airplane is established on the missed approach heading.

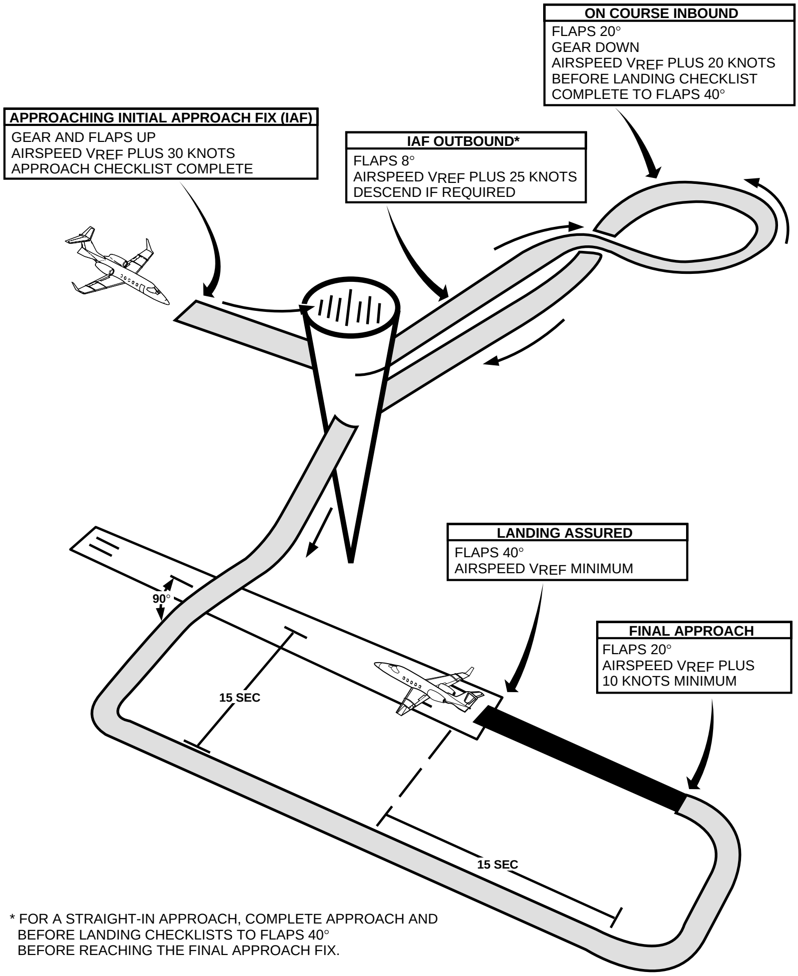

Figure MAP-18. Circling Instrument Approach

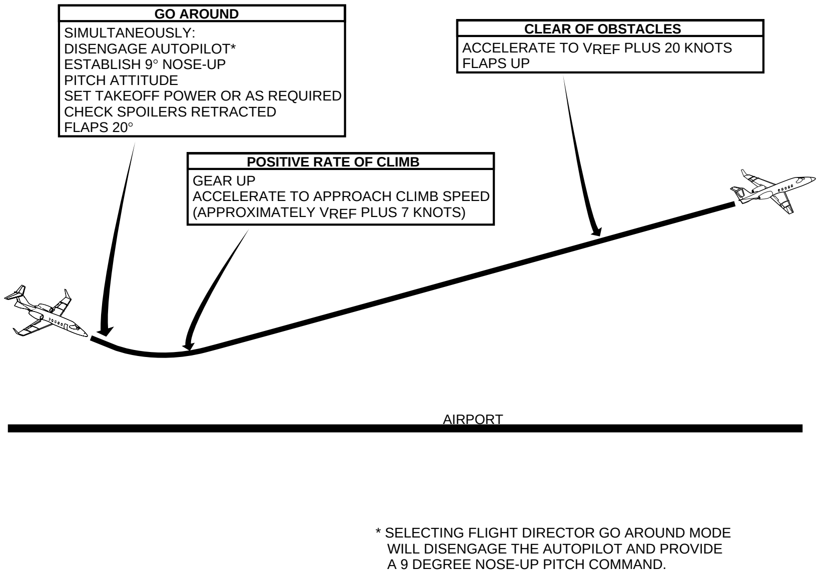

Figure MAP-19. Go-Around/Balked Landing

SINGLE-ENGINE DRIFT DOWN

The single-engine drift down procedure shown in Figure MAP- 20 is used to cover the greatest possible distance while descending to single-engine cruise altitude after an engine failure at high altitude.

As the note on the chart explains, the speed schedule depicted also approximates the best single-engine, rate-of- climb speed below the single- engine service ceiling. This speed schedule may then also be used to climb to single- engine cruise altitude after an engine failure at low altitude.

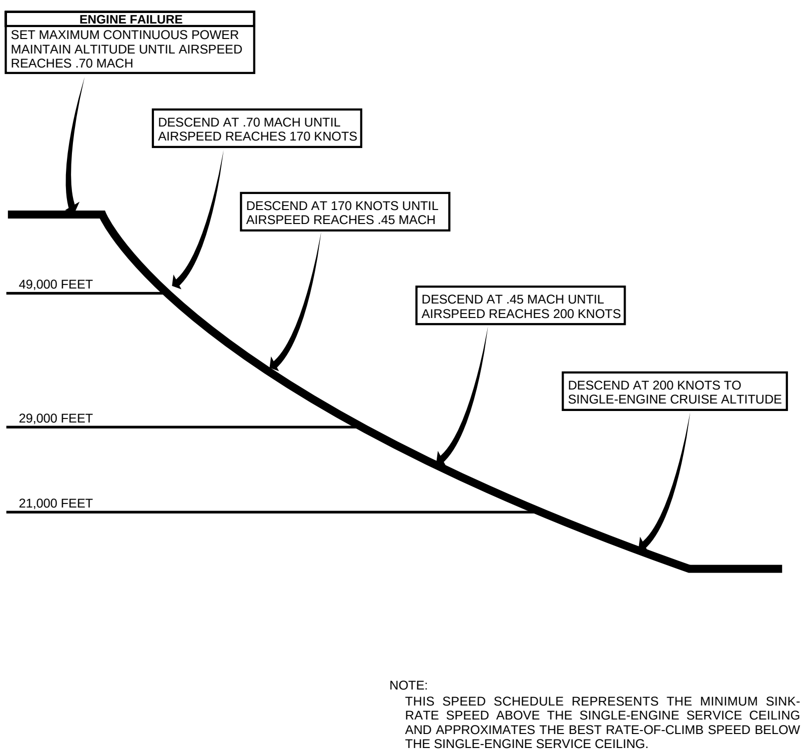

Figure MAP-20. Single-Engine Drift Down

WEIGHT AND BALANCE

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WEIGHT AND BALANCE

INTRODUCTION

The airplane weight and load arrangement, as loaded for flight, must be within limits of the applicable center-of-gravity envelope (Figures WB-1, WB-2 and WB-3). It is the pilot's responsibility to ensure that the airplane is loaded properly to ensure acceptable stability, control, performance, and structural loads.

Weight and balance data are supplied in the Weight and Balance Data section of the *AFM* by the manufacturer when the airplane is delivered. The Weight and Balance Data section also contains charts and tables necessary for CG computations.

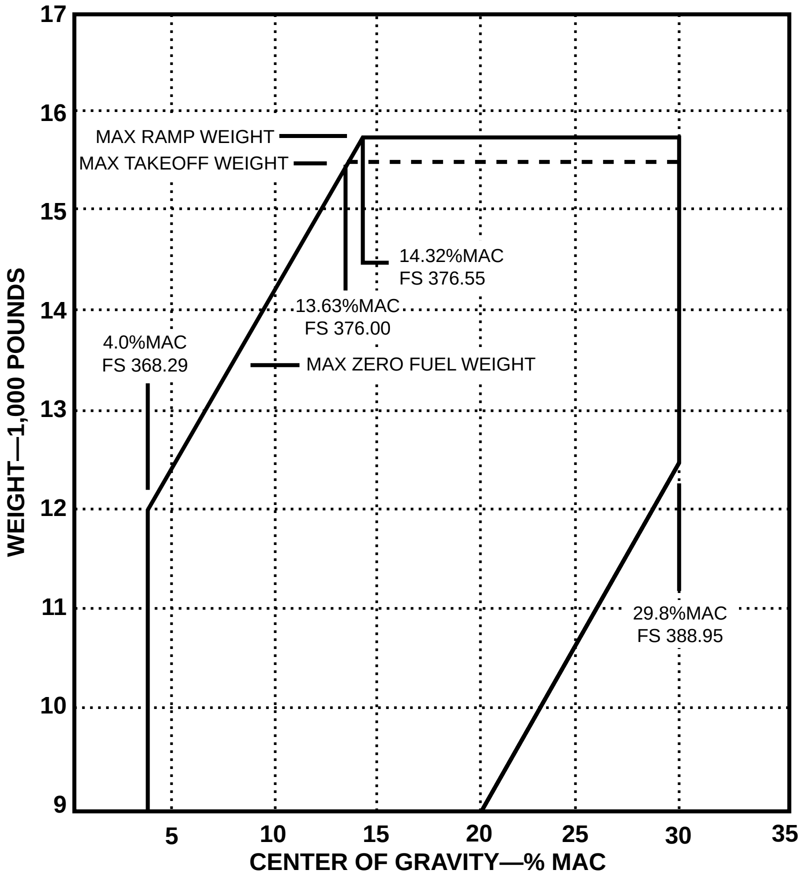
CAUTION

To prevent aircraft damage caused by tip back, some aircraft may require that a tail stand be used or have ballast placed in the cockpit during ground handling or in gusty wind conditions. This is particularly important if the aircraft is fully fueled with no other payload. A placard on the nose strut explains this requirement.

It is the responsibility of the aircraft owner and pilot to ensure that the aircraft is loaded properly. The basic empty weight and center of gravity noted are for the aircraft as delivered from the factory. In the event the aircraft is altered, refer to the Aircraft Records.

Owners are advised to contact the aircraft manufacturer when any change is made to the aircraft which would appreciably affect the location of useful load items.

Refer to dimensional data shown in Figure WB-4.

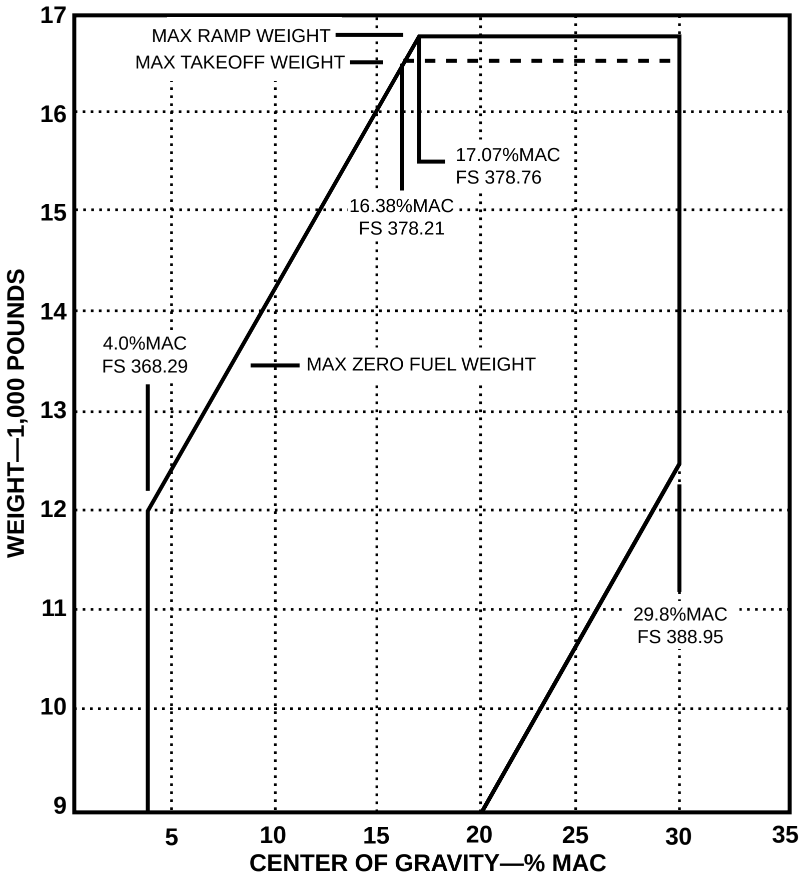


FORWARD FLIGHT LIMIT—FS 368.29 (4.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 376.00 (13.63% MAC) AT 15,500 POUNDS (7,031 KG) TO FS 376.55 (14.32% MAC) AT 15,750 POUNDS (7,144 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8% MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8% MAC) UP TO AND INCLUDING 15,750 POUNDS (7,144 KG).

MAX RAMP WEIGHT—15,750 LB
MAX TAKEOFF WEIGHT—15,500 LB
MAX ZERO FUEL WEIGHT—13,500 LB

Figure WB-1. Center-of-Gravity Envelope—Standard 15,500 lb (7,031 kg) Takeoff Weight

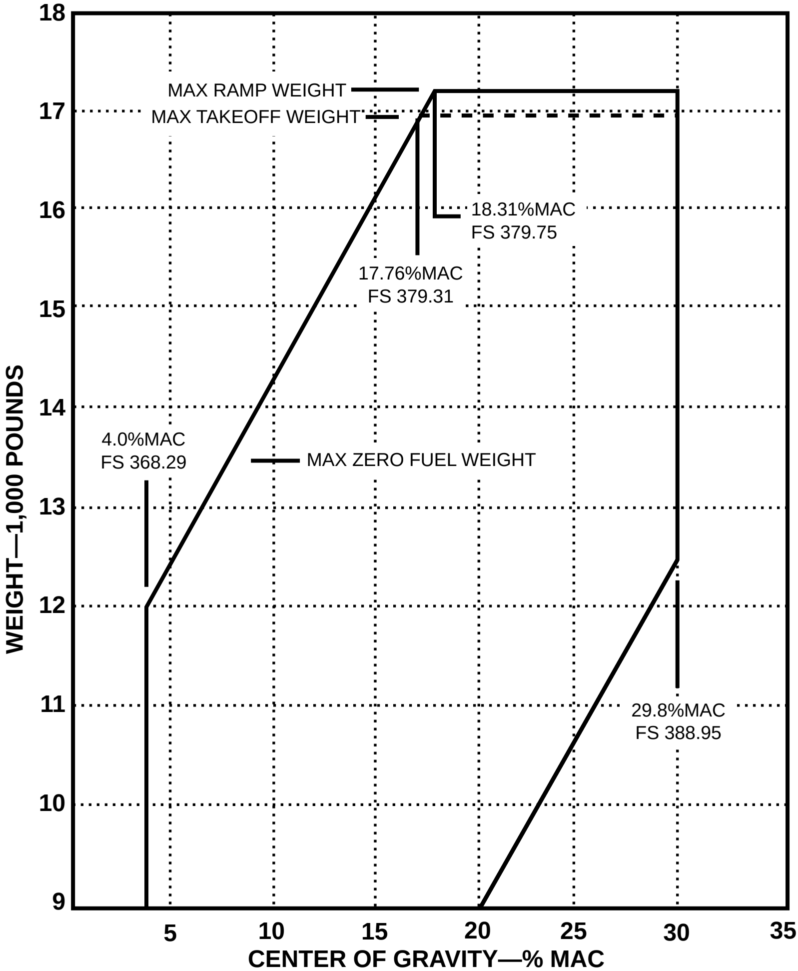


FORWARD FLIGHT LIMIT—FS 368.29 (4.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 378.21 (16.38% MAC) AT 16,500 POUNDS (7,484 KG) TO FS 378.76 (17.07% MAC) AT 16,750 POUNDS (7,598 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8% MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8% MAC) UP TO AND INCLUDING 15,750 POUNDS (7,144 KG).

MAX RAMP WEIGHT—16,750 LB
MAX TAKEOFF WEIGHT—16,500 LB
MAX ZERO FUEL WEIGHT—13,500 LB

Figure WB-2. Center-of-Gravity Envelope—Optional 16,500 lb (7,484 kg) Takeoff Weight



FORWARD FLIGHT LIMIT—FS 368.29 (4.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 12,000 POUNDS (5,443 KG) AND TAPERS THROUGH FS 379.31 (17.76% MAC) AT 17,000 POUNDS (7,711 KG) TO FS 379.75 (18.31% MAC) AT 17,200 POUNDS (7,802 KG).

AFT FLIGHT LIMIT—FS 381.11 (20.0% MAC) FOR ALL WEIGHTS UP TO AND INCLUDING 9,000 POUNDS (4,082 KG), AND TAPERS TO FS 388.95 (29.8% MAC) AT 12,500 POUNDS (5,670 KG), AND REMAINS AT FS 388.95 (29.8% MAC) UP TO AND INCLUDING 17,200 POUNDS (7,802 KG).

MAX RAMP WEIGHT—17,200 LB
MAX TAKEOFF WEIGHT—17,000 LB
MAX ZERO FUEL WEIGHT—13,500 LB

Figure WB-3. Center-of-Gravity Envelope—Optional 17,000 lb (7,711 kg) Takeoff Weight

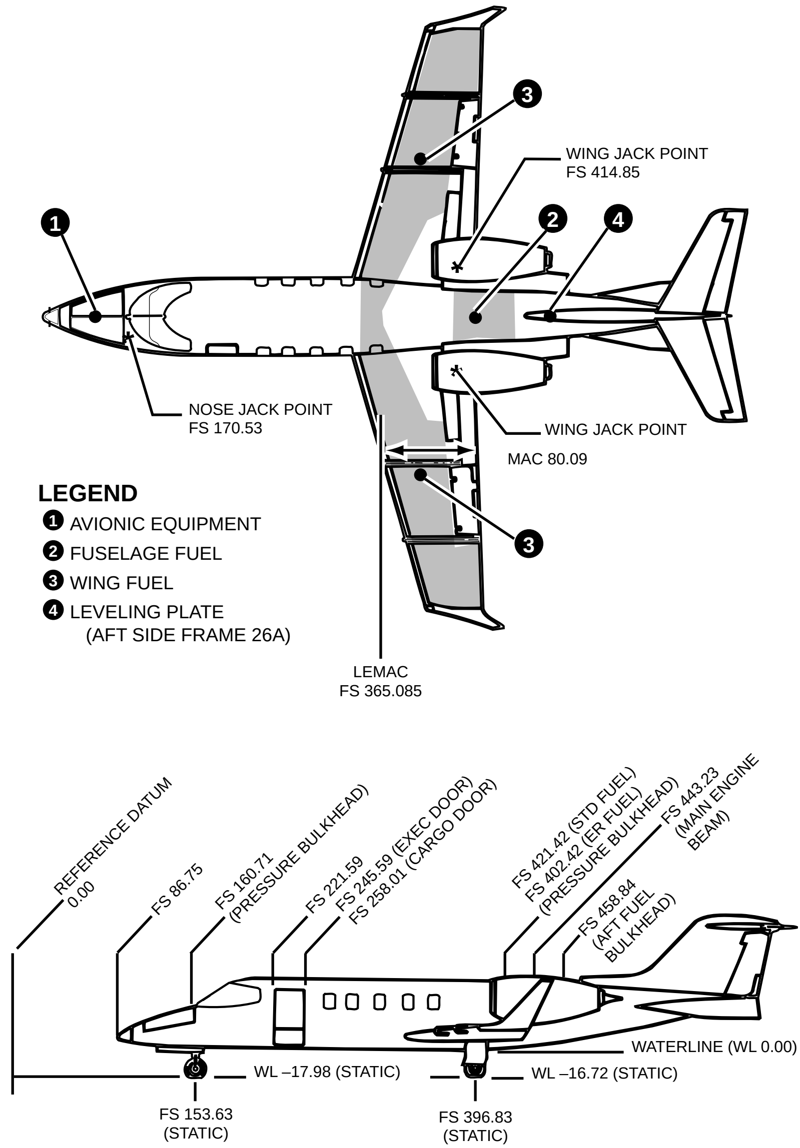


Figure WB-4. Dimensional Data

DEFINITIONS

The following contains abbreviations and definitions which are used in the Weight and Balance section of the *Flight Manual* and in this discussion.

Datum—(reference datum). An imaginary vertical plane or line from which all measurements of arm are taken. On the 31/31A, the datum is 86.75 inches forward of the nose. The distance from the datum is sometimes called "Fuselage Station".

LEMAC—Leading Edge of the Mean Aerodynamic Chord. On the Learjet 31/31A aircraft, the LEMAC is 365.085 inches aft of the datum.

MAC—Mean Aerodynamic Chord. The average distance from the leading edge to the trailing edge of the wing. The MAC is specified for the aircraft by determining the average chord of an imaginary wing which has the same aerodynamic characteristics as the actual wing. On the 31/31A aircraft, the MAC is 80.09 inches.

Moment Index (or index). The moment divided by a constant. In the Learjet, the moment is divided by 1,000. The purpose of the index is to simplify computations and avoid the use of long numbers.

WEIGHT AND BALANCE COMPUTATION

The aircraft loading form, Figure WB-5, may be used for weight and balance calculations. The first step in computing weight and balance is to determine the basic empty weight and moment from the *Flight Manual* or aircraft records. The moment will be listed as a seven- digit figure. When the moment is entered on the worksheet, it is converted to a moment index by moving the decimal point three digits to the left. This will reduce numbers in the data to a more manageable size. All Learjet weight and balance computations are based on an index of moment/1000.

Weights and moments for crew, service provisions, and any additional equipment should be added to the basic empty weight and moment on the aircraft loading form to arrive at the operating weight. The moment index for these weights is found on the payload moments tables of the *AFM* (Figure WB-6) showing the interior arrangement applicable for your specific airplane. On the 31 model aircraft, several different interior arrangements may appear in the *Flight Manual*. On the 31A, only a specific aircraft interior should be found.

The weight and moment index for the passengers and baggage should be added to the operating weight. These moments are also on the payload moments tables of the *AFM*. The total of these will result in the zero fuel weight and its moment. The maximum zero fuel weight is one of the airplane limitations.

The Usable Fuel Moments table (Figure WB-7) must be used to find the correct moment for the fuel load. The use of this table is necessary because there is no average arm for the fuel tanks. The arm varies with the amount of fuel in the tanks. Enter the table with gallons or pounds on the left and find the moment/1000 in the column for the tank.

The weight of the fuel should be added to the zero fuel weight to determine the ramp weight. Fuel consumed for engine start and taxi must be subtracted from the ramp weight to leave takeoff weight. Fuel burnoff for engine start and taxi is approximately 3.5 pounds per engine per minute from the wing tanks. To find the moment for this fuel burn, the Fuel Used Vs. Moment Loss table is used (Figure WB-8). A separate table is used for aircraft with the standard fuselage tank and for those with the extended range tank. The taxi fuel and its moment should be subtracted from the ramp weight and moment to arrive at the takeoff weight and moment.

After the takeoff weight and moment/1000 have been computed, one of three methods may be used to determine the takeoff CG.

The first of the methods that can be used to find the CG is the Weight-Moment-CG Envelope in your *AFM* (Figure WB-9). This chart depicts the flight envelope with heavy dark lines. Enter this chart at the left side and follow the horizontal line corresponding to the aircraft weight to the right until it intersects the sloping moment/1000 line. Follow the vertical lines to the bottom of the chart to read the CG as a per cent of MAC. If the takeoff weight and moment lines intersect within the envelope, the airplane load is within limits for flight. If the lines intersect outside the envelope, changes should be made to bring the weight and CG to within limits.

AIRCRAFT LOADING FORM

INTERIOR CONFIGURATION ____________________

MISSING OR ADDITIONAL EQUIPMENT ____________________

	WEIGHT	FS	MOM/1000	% MAC
BASIC EMPTY WEIGHT				
MISSING/ADDITIONAL EQUIPMENT				—
CREW				—
PROVISIONS—FWD				—
PROVISIONS—MID				—
PROVISIONS—AFT				—
PROVISIONS—TOILET				—
WATER				—
MISCELLANEOUS				—
				—
OPERATING WEIGHT EMPTY				
BAGGAGE—FWD				—
BAGGAGE—AFT				—
PASSENGER —FWD SIDEFACING				—
PASSENGER —FWD SWIVEL				—
PASSENGER —AFT SWIVEL				—
PASSENGER —DIVAN				—
				—
				—
				—
ZERO FUEL WEIGHT				—
FUEL—FUSELAGE TANK				—
FUEL—WING TANKS				—
RAMP WIEGHT				—
TAXI BURNOFF OUT OF WINGS*				—
TAKEOFF GROSS WEIGHT				—

ZERO FUEL WEIGHT				—
FUEL—WING TANKS				—
FUEL—FUSELAGE TANK				—
LANDING WEIGHT				—

*FUEL BURNOFF IS APPROXIMATELY 3.5 POUNDS PER ENGINE PER MINUTE.

Figure WB-5. Aircraft Loading Form

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

PAYLOAD MOMENTS—MOMENT/1,000

FS →	204.0	221.6	234.7	267.0	267.8	281.2	289.0	308.2	362.4	402.0	← FS
ITEM → / WEIGHT—POUNDS	PILOT OR COPILOT	LEFT SERVICE CABINET PROVISIONS 20 LB MAX	PASS 1	PASS 2	TOILET PROVISIONS	PASS 3	MID CABINET PROVISIONS 24 LB MAX	PASS 4/5	PASS 6/7/8	AFT BAGGAGE 500 LB MAX	← ITEM / WEIGHT—POUNDS
10	2.04	2.22	2.35	2.67	2.68	2.81	2.89	3.08	3.62	4.02	10
20	4.08	4.43	4.69	5.34	5.36	5.62	5.78	6.16	7.25	8.04	20
30	6.12	—	7.04	8.01	8.03	8.44	6.94 *	9.25	10.87	12.06	30
40	8.16	—	9.39	10.68	10.71	11.25	—	12.33	14.50	16.08	40
50	10.20	—	11.73	13.35	—	14.06	—	15.41	18.12	20.10	50
60	12.24	—	14.08	16.02	—	16.87	—	18.49	21.74	24.12	60
70	14.28	—	16.43	18.69	—	19.68	—	21.57	25.37	28.14	70
80	16.32	—	18.78	21.36	—	22.50	—	24.66	28.99	32.16	80
90	18.36	—	21.12	24.03	—	25.31	—	27.74	32.62	36.18	90
100	20.40	—	23.47	26.70	—	28.12	—	30.82	36.24	40.20	100
110	22.44	—	25.82	29.37	—	30.93	—	33.90	39.86	44.22	110
120	24.48	—	28.16	32.04	—	33.74	—	36.98	43.49	48.24	120
130	26.52	—	30.51	34.71	—	36.66	—	40.07	47.11	52.26	130
140	28.56	—	32.86	37.38	—	39.34	—	43.15	50.74	56.28	140
150	30.60	—	35.20	40.05	—	42.88	—	46.23	54.36	60.30	150
160	32.64	—	37.55	42.72	—	44.99	—	49.31	57.98	64.32	160
170	34.68	—	39.90	45.39	—	47.80	—	52.39	61.61	68.34	170
180	36.72	—	42.25	48.06	—	50.62	—	55.48	65.23	72.36	180
190	38.76	—	44.59	50.73	—	53.43	—	58.56	68.86	76.38	190
200	40.80	—	46.94	53.40	—	56.24	—	61.64	72.48	80.40	200
210	42.84	—	49.29	56.07	—	59.05	—	64.72	76.10	84.42	210
220	44.88	—	51.63	58.74	—	61.86	—	67.80	79.73	88.44	220
230	46.92	—	53.98	61.41	—	64.68	—	70.89	83.35	92.46	230
240	48.96	—	56.33	64.08	—	67.49	—	73.97	86.98	96.48	240
250	51.00	—	58.67	66.75	—	70.30	—	77.05	90.60	100.50	250
										104.52	260
										108.54	270
										112.56	280
										116.58	290
										120.60	300
										124.62	310
										128.64	320
										132.66	330
										136.68	340
										140.70	350
										144.72	360
										148.74	370
										152.76	380
										156.78	390
										160.80	400
										164.82	410
										168.84	420
										172.86	430
										176.88	440
										180.90	450
										184.92	460
										188.94	470
										192.96	480
										196.98	490
										201.00	500

*24 LB

NOTES:

- THIS TABLE PRESENTED FOR USE WITH AIRCRAFT LOADING FORM.
- PASSENGER WEIGHTS SHOULD INCLUDE CARRY-ON BAGGAGE STOWED UNDER SEATS.
- PASSENGER MOMENTS BASED ON SEATS LOCATED AGAINST THE SEAT STOP OR INDEX AND FACING AS SHOWN.
- CREW MOMENTS BASED ON SEATS BEING IN THE NOMINAL POSITION.

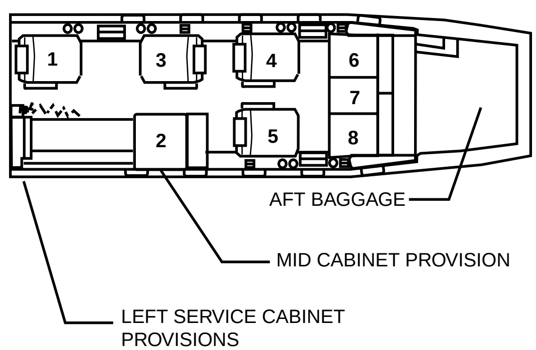


Figure WB-6. Payload Moments

FOR TRAINING PURPOSES ONLY

WING AND FUSELAGE TANK

GALLONS	POUNDS: KEROSENE 6.7 LB/GAL	POUNDS: JP-4 6.5 LB/GAL	MOMENT/1,000: WING KEROSENE	MOMENT/1,000: WING JP-4	MOMENT/1,000: STANDARD FUSELAGE KEROSENE	MOMENT/1,000: STANDARD FUSELAGE JP-4	MOMENT/1,000: ER FUSELAGE KEROSENE	MOMENT/1,000: ER FUSELAGE JP-4
20	134	130	50.33	48.83	58.67	56.92	58.17	56.43
40	268	260	100.81	97.80	117.64	114.13	117.63	114.12
60	402	390	151.85	147.32	177.15	171.86	177.81	172.50
80	536	520	203.39	197.32	236.59	229.52	234.81	227.80
100	670	650	254.98	247.37	295.44	286.62	292.54	283.81
120	804	780	306.85	297.69	353.43	343.85	350.81	340.34
140	938	910	358.78	348.07	413.53	401.19	407.81	395.64
160	1072	1040	410.74	398.48	472.87	458.75	465.17	451.28
180	1206	1170	462.85	449.03	531.71	515.84	523.17	507.55
197	1320	1281	—	—	581.55	564.37	—	—
200	1340	1300	515.10	499.72	—	—	581.17	563.82
220	1474	1430	567.49	550.55	—	—	639.54	620.45
240	1608	1560	620.10	601.59	—	—	697.81	676.98
260	1742	1690	672.91	652.82	—	—	754.44	731.92
272.7	1827	1773	—	—	—	—	790.00	766.65
280	1876	1820	725.91	704.24	—	—	—	—
300	2010	1950	779.19	755.93	—	—	—	—
320	2144	2080	832.67	807.81	—	—	—	—
340	2278	2210	886.33	859.87	—	—	—	—
360	2412	2340	940.28	912.21	—	—	—	—
380	2546	2470	994.39	964.71	—	—	—	—
400	2680	2600	1048.63	1017.33	—	—	—	—
418	2804	2720	1099.07	1066.26	—	—	—	—
420	2814	2730	1103.14	1070.21	—	—	—	—
421.8	2826	2742	1108.10	1075.01	—	—	—	—

EFFECTIVITY:
ALL AIRCRAFT

Figure WB-7. Usable Fuel Moments

WING AND FUSELAGE TANK

GALLONS	POUNDS		MOMENT/1,000			
			WING		STANDARD FUSELAGE	
	KEROSENE 6.7 LB/GAL	JP-4 6.5 LB/GAL	KEROSENE	JP-4	KEROSENE	JP-4
20	134	130	54.49	52.86	58.79	57.04
40	268	260	108.72	105.47	117.72	114.21
60	402	390	162.82	157.96	176.66	171.39
80	536	520	216.75	210.28	235.59	228.56
100	670	650	270.39	262.32	294.53	285.74
120	804	780	323.86	314.19	353.47	342.92
140	938	910	377.12	365.86	412.40	400.09
160	1072	1040	430.10	417.26	471.33	457.26
180	1206	1170	482.89	468.48	530.19	514.36
197	1320	1280	—	—	580.22	562.90
200	1340	1300	535.49	519.51	—	—
220	1474	1430	587.87	570.32	—	—
240	1608	1560	640.11	621.00	—	—
260	1742	1690	692.21	671.55	—	—
280	1876	1820	744.17	721.96	—	—
300	2010	1950	796.09	772.33	—	—
320	2144	2080	847.94	822.63	—	—
340	2278	2210	899.53	872.68	—	—
360	2412	2340	951.03	922.64	—	—
380	2546	2470	1002.03	972.12	—	—
400	2680	2600	1052.49	1021.07	—	—
418.5	2804	2720	1099.07	1066.14	—	—

EFFECTIVITY:
AIRCRAFT WITH STANDARD FUEL TANK

Figure WB-8. Fuel Used Vs. Moment Loss (Sheet 1 of 2)

WING AND FUSELAGE TANK

GALLONS	POUNDS: KEROSENE 6.7 LB/GAL	POUNDS: JP-4 6.5 LB/GAL	MOMENT/1,000: WING KEROSENE	MOMENT/1,000: WING JP-4	MOMENT/1,000: ER FUSELAGE KEROSENE	MOMENT/1,000: ER FUSELAGE JP-4
20	134	130	54.15	52.54	56.00	54.33
40	268	260	108.31	105.07	113.00	109.63
60	402	390	162.46	157.61	172.00	166.87
80	536	520	216.61	210.15	230.00	223.13
100	670	650	270.77	262.68	288.00	279.40
120	804	780	324.09	314.41	346.00	335.67
140	938	910	377.12	365.86	403.00	390.97
160	1072	1040	430.15	417.31	460.00	446.27
180	1206	1170	483.19	468.77	519.00	503.51
200	1340	1300	536.22	520.22	576.00	558.81
220	1474	1430	588.57	571.00	633.00	614.10
240	1608	1560	640.68	621.55	695.00	674.25
260	1742	1690	692.79	672.11	753.00	730.52
272.7	1827	1773	—	—	790.00	766.65
280	1876	1820	744.90	722.66	—	—
300	2010	1950	797.01	773.22	—	—
320	2144	2080	848.77	823.43	—	—
340	2278	2210	899.86	873.00	—	—
360	2412	2340	950.95	922.57	—	—
380	2546	2470	1002.05	972.13	—	—
400	2680	2600	1053.14	1021.70	—	—
420	2814	2730	1104.23	1071.27	—	—
421.8	2826	2742	1108.81	1075.85	—	—

EFFECTIVITY:
AIRCRAFT WITH EXTENDED RANGE FUEL TANK

Figure WB-8. Fuel Used Vs. Moment Loss (Sheet 2 of 2)

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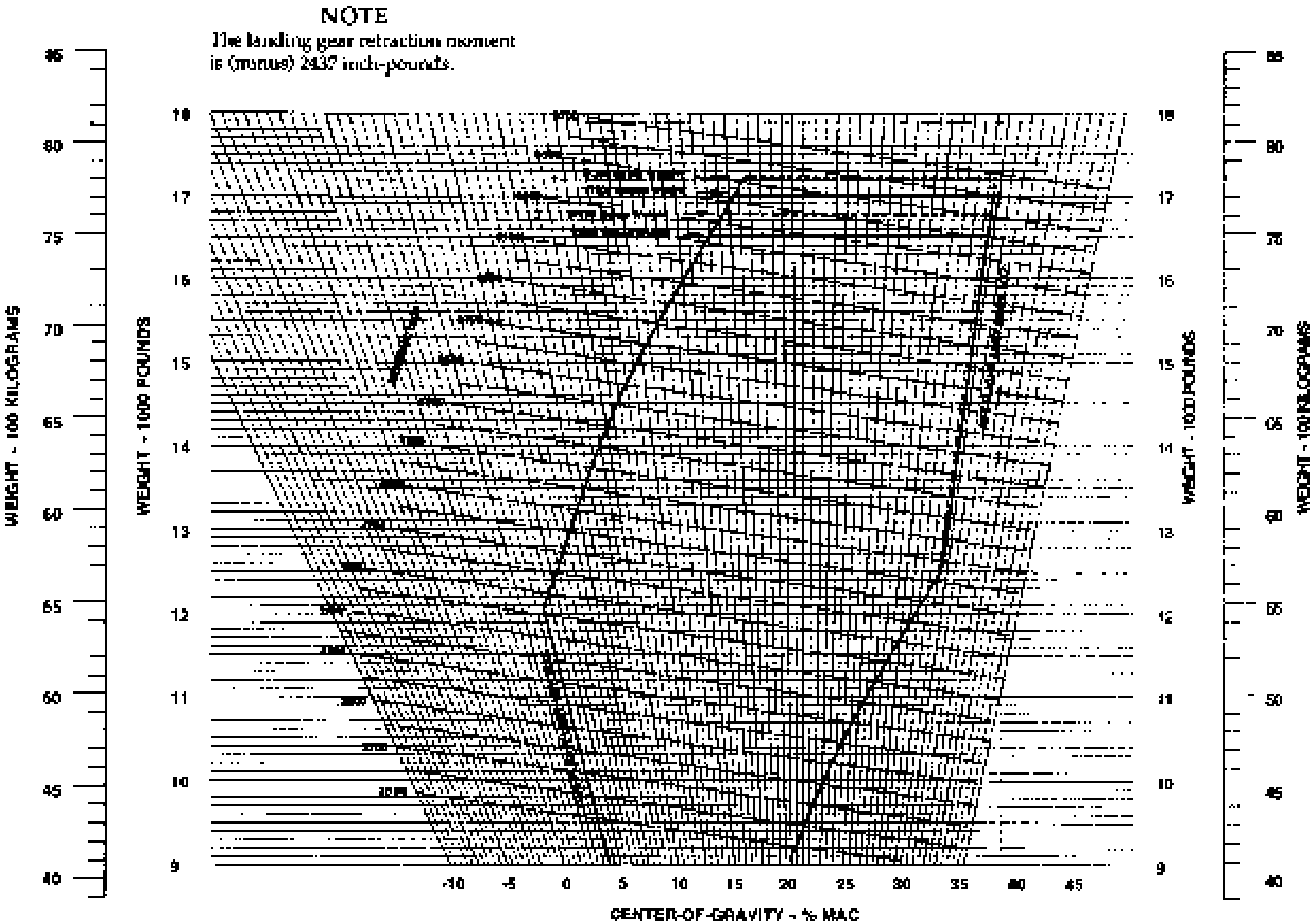

Figure WB-9. Weight-Moment-CG Envelope

Since the weight and moment lines cross at a rather shallow angle, a small error in plotting can result in an error in computing CG. As a second method, the point on the chart can be more accurately plotted by mathematically computing CG as a per cent of MAC and then finding the point on the CG envelope where the weight and CG (as a percent of MAC) lines cross. The formula for this computation is given in your *Flight Manual*. The following will give the same result:

- Move the decimal point of the moment three places to the right to convert the moment index back to a moment.
- Divide the moment by the weight to find the CG in inches aft of the reference datum.
- Subtract the LEMAC (365.085) from the CG in the previous step and divide the remainder by the MAC (80.09).

The result of these steps can be multiplied by 100 to convert to a percent. This computation should be plotted on the CG envelope in the *Flight Manual* to ensure that it is within limits.

A third method of computing the center of gravity is the Center-of-Gravity table in the *Flight Manual* (Figure WB-10).

Enter the table on its left with the airplane weight and move to the right to find the moment/1000. The center of gravity is read at the top of the column of moments. Interpolate as necessary to compute the CG. If the weight and moment falls beyond the limits, loading or weight must be changed.

The aircraft loading form uses a simple method to compute the landing weight and moment index. Since the zero fuel weight will not change for landing, copy this information to the appropriate blocks at the bottom of the form. Next, enter the estimated fuel remaining on landing. Go to the Usable Fuel Moments table (Figure WB-7) to determine the moment/1000 for this estimated fuel. Interpolation may be necessary to compute the correct moment.

Add the zero fuel weight and the estimated landing fuel with their moments to find the landing weight and its moment. All that remains is to use any of the three methods described earlier to determine the landing center of gravity.

MOMENT/1000

POUNDS GROSS WEIGHT	FWD LIMIT %MAC	FWD LIMIT STA	FWD LIMIT MOM/1000	10%MAC STA 373.09	15%MAC STA 377.10	20%MAC STA 381.10	25%MAC STA 385.11	AFT LIMIT %MAC	AFT LIMIT STA	AFT LIMIT MOM/1000
9000	4.00	368.29	3314.60	3357.85	3393.89	3429.93	BEYOND LIMITS	20.00	381.10	3429.93
9100	4.00	368.29	3351.43	3395.16	3431.60	3468.04	BEYOND LIMITS	20.28	381.33	3470.08
9200	4.00	368.29	3388.26	3432.46	3469.31	3506.15	BEYOND LIMITS	20.56	381.55	3510.27
9300	4.00	368.29	3425.08	3469.77	3507.02	3544.26	BEYOND LIMITS	20.84	381.78	3550.51
9400	4.00	368.29	3461.91	3507.08	3544.73	3582.37	BEYOND LIMITS	21.12	382.00	3590.80
9500	4.00	368.29	3498.74	3544.39	3582.44	3620.48	BEYOND LIMITS	21.40	382.22	3631.13
9600	4.00	368.29	3535.57	3581.70	3620.15	3658.59	BEYOND LIMITS	21.68	382.45	3671.51
9700	4.00	368.29	3572.40	3619.01	3657.86	3696.70	BEYOND LIMITS	21.96	382.67	3711.93
9800	4.00	368.29	3609.23	3656.32	3695.57	3734.81	BEYOND LIMITS	22.24	382.90	3752.39
9900	4.00	368.29	3646.06	3693.63	3733.28	3772.92	BEYOND LIMITS	22.52	383.12	3792.90
10000	4.00	368.29	3682.89	3730.94	3770.98	3811.03	BEYOND LIMITS	22.80	383.35	3833.46
10100	4.00	368.29	3719.71	3768.25	3808.69	3849.14	BEYOND LIMITS	23.08	383.57	3874.05
10200	4.00	368.29	3756.54	3805.56	3846.40	3887.25	BEYOND LIMITS	23.36	383.79	3914.70
10300	4.00	368.29	3793.37	3842.87	3884.11	3925.36	BEYOND LIMITS	23.64	384.02	3955.39
10400	4.00	368.29	3830.20	3880.18	3921.82	3963.47	BEYOND LIMITS	23.92	384.24	3996.12
10500	4.00	368.29	3867.03	3917.49	3959.53	4001.58	BEYOND LIMITS	24.20	384.47	4036.90
10600	4.00	368.29	3903.86	3954.80	3997.24	4039.69	BEYOND LIMITS	24.48	384.69	4077.72
10700	4.00	368.29	3940.69	3992.11	4034.95	4077.80	BEYOND LIMITS	24.76	384.92	4118.59
10800	4.00	368.29	3977.52	4029.42	4072.66	4115.91	4159.16	25.04	385.14	4159.51
10900	4.00	368.29	4014.35	4066.72	4110.37	4154.02	4197.67	25.32	385.36	4200.47
11000	4.00	368.29	4051.17	4104.03	4148.08	4192.13	4236.18	25.60	385.59	4241.47
11100	4.00	368.29	4088.00	4141.34	4185.79	4230.24	4274.69	25.88	385.81	4282.52
11200	4.00	368.29	4124.83	4178.65	4223.50	4268.35	4313.20	26.16	386.04	4323.61
11300	4.00	368.29	4161.66	4215.96	4261.21	4306.46	4351.71	26.44	386.26	4364.75
11400	4.00	368.29	4198.49	4253.27	4298.92	4344.57	4390.23	26.72	386.49	4405.93
11500	4.00	368.29	4235.32	4290.58	4336.63	4382.68	4428.74	27.00	386.71	4447.16
11600	4.00	368.29	4272.15	4327.89	4374.34	4420.79	4467.25	27.28	386.93	4488.43
11700	4.00	368.29	4308.98	4365.20	4412.05	4458.91	4505.76	27.56	387.16	4529.75
11800	4.00	368.29	4345.81	4402.51	4449.76	4497.02	4544.27	27.84	387.38	4571.11
11900	4.00	368.29	4382.63	4439.82	4487.47	4535.13	4582.78	28.12	387.61	4612.52
12000	4.00	368.29	4419.46	4477.13	4525.18	4573.24	4621.29	28.40	387.83	4653.97
12100	4.28	368.51	4458.96	4514.44	4562.89	4611.35	4659.80	28.68	388.05	4695.46
12200	4.55	368.73	4498.50	4551.75	4600.60	4649.46	4698.31	28.96	388.28	4737.00
12300	4.83	368.95	4538.058	4589.06	4638.31	4687.57	4736.82	29.24	388.50	4778.59
12400	5.10	369.17	4577.71	4626.37	4676.02	4725.68	4775.33	29.52	388.73	4820.22
12500	5.38	369.39	4617.38	4663.67	4713.73	4763.79	4813.84	29.80	388.95	4861.90
12600	5.65	369.61	4657.10	4700.98	4751.44	4801.90	4852.35	29.80	388.95	4900.79
12700	5.93	369.83	4696.86	4738.29	4789.15	4840.01	4890.87	29.80	388.95	4939.69
12800	6.20	370.05	4736.66	4775.60	4826.86	4878.12	4929.38	29.80	388.95	4978.58
12900	6.48	370.27	4776.51	4812.91	4864.57	4916.23	4967.89	29.80	388.95	5017.48
13000	6.75	370.49	4816.40	4850.22	4902.28	4954.34	5006.40	29.80	388.95	5056.37
13100	7.03	370.71	4856.34	4887.53	4939.99	4992.45	5044.91	29.80	388.95	5095.27
13200	7.30	370.93	4869.32	4924.84	4977.70	5030.56	5083.42	29.80	388.95	5134.16
13300	7358	371.15	4936.34	4962.15	5015.41	5068.67	5121.93	29.80	388.95	5173.06
13400	7.85	371.37	4976.41	4999.46	5053.12	5106.78	5160.44	29.80	388.95	5211.95
13500	8.13	371.59	5016.52	5036.77	5090.83	5144.89	5198.95	29.80	388.95	5250.85
13600	8.40	371.81	5056.68	5074.08	5128.54	5183.00	5237.46	29.80	388.95	5289.74
13700	8.68	372.03	5096.88	5111.39	5166.25	5221.11	5275.97	29.80	388.95	5328.64
13800	8.95	372.25	5137.12	5148.70	5203.96	5259.22	5314.48	29.80	388.95	5367.54
13900	9.23	372.47	5177.41	5186.01	5241.67	5297.33	5352.99	29.80	388.95	5406.43
14000	9.50	372.69	5217.75	5223.32	5279.38	5335.44	5391.50	29.80	388.95	5445.33
14100	9.78	372.92	5258.12	5260.63	5317.09	5373.55	5430.02	29.80	388.95	5484.22
14200	10.05	373.14	5298.54	BEYOND LIMITS	5354.80	5411.66	5468.53	29.80	388.95	5523.12
14300	10.33	373.36	5339.01	BEYOND LIMITS	5392.51	5449.77	5507.04	29.80	388.95	5572.01
14400	10.60	373.58	5376.52	BEYOND LIMITS	5430.22	5487.88	5545.55	29.80	388.95	5600.91
14500	10.88	373.80	5420.07	BEYOND LIMITS	5467.93	5525.99	5584.06	29.80	388.95	5639.80

Figure WB-10. Center-of-Gravity Table (Sheet 1 of 2)

POUNDS GROSS WEIGHT	FWD LIMIT %MAC	FWD LIMIT STA	FWD LIMIT MOM/1000	10%MAC STA 373.09	15%MAC STA 377.10	20%MAC STA 381.10	25%MAC STA 385.11	AFT LIMIT %MAC	AFT LIMIT STA	AFT LIMIT MOM/1000
14600	11.15	374.02	5460.67		5505.64	5564.10	5622.57	29.80	388.95	5678.70
14700	11.43	374.24	5501.31		5543.35	5602.21	5661.08	29.80	388.95	5717.59
14800	11.70	374.46	5541.99		5581.06	5640.32	5699.59	29.80	388.95	5756.49
14900	11.98	374.68	5582.72		5618.77	5678.43	5738.10	29.80	388.95	5795.38
15000	12.25	374.90	5623.50		5656.48	5716.54	5776.61	29.80	388.95	5834.28
15100	12.53	375.12	5664.31		5694.19	5754.66	5815.12	29.80	388.95	5873.17
15200	12.81	375.34	5705.18		5731.90	5792.77	5853.63	29.80	388.95	5912.07
15300	13.08	375.56	5746.08		5769.61	5830.88	5892.14	29.80	388.95	5950.96
15400	13.36	375.78	5787.03		5807.32	5868.99	5930.66	29.80	388.95	5989.86
15500	13.63	376.00	5828.03		5854.03	5907.10	5969.17	29.80	388.95	6028.75
15600	13.91	376.22	5869.06		5882.74	5945.21	6007.68	29.80	388.95	6067.65
15700	14.18	376.44	5910.15		5920.45	5983.32	6046.19	29.80	388.95	6106.54
15800	14.46	376.66	5951.27		5958.16	6021.43	6084.70	29.80	388.95	6145.44
15900	14.73	376.88	5992.44		5995.87	6059.54	6123.21	29.80	388.95	6184.33
16000	15.01	377.10	6033.66			6097.65	6161.72	29.80	388.95	6223.23
16100	15.28	377.32	6074.92			6135.76	6200.23	29.80	388.95	6262.12
16200	15.56	377.54	6116.22	BEYOND LIMITS		6173.87	6238.74	29.80	388.95	6301.02
16300	15.83	377.76	6157.56			6211.98	6277.25	29.80	388.95	6339.91
16400	16.11	377.99	6198.95			6250.09	6315.76	29.80	388.95	6378.81
16500	16.38	378.21	6240.39			6288.20	6354.27	29.80	388.95	6417.71
16600	16.66	378.43	6281.87			6326.31	6392.78	29.80	388.95	6456.60
16700	16.93	378.65	6323.39			6364.42	6431.30	29.80	388.95	6495.50
16800	17.21	378.87	6364.96			6402.53	6469.81	29.80	388.95	6534.39
16900	17.48	379.09	6406.57			6440.64	6508.32	29.80	388.95	6573.29
17000	17.76	379.31	6448.22			6478.75	6546.83	29.80	388.95	6612.18
17100	18.03	379.53	6489.92			6516.86	6585.34	29.80	388.95	6651.08
17200	18.31	379.75	6531.61			6554.97	6623.85	29.80	388.95	6689.97

Figure WB-10. Center-of-Gravity Table (Sheet 2 of 2)

WEIGHING INSTRUCTIONS

Periodic weighing may be required to keep the BASIC EMPTY WEIGHT current. All changes to the aircraft affecting weight and balance are the responsibility of the aircraft operator. For additional detailed information relating to weighing and leveling procedures, refer to *Maintenance Manual*, Chapter 8.

1. The BASIC EMPTY WEIGHT is established with the wheels down.

2. Fuel should be drained through the drain valves prior to weighing and with the aircraft in level or static position. If unable to drain fuel, refer to the Unusable and Trapped Fuel table (Figure WB-11) to determine weight and balance. Unusable and trapped fluids are included in the basic empty weight.

3. The engine oil must be at full level in each oil tank. Total engine oil is 36.0 pounds at FS 439.17.

4. Hydraulic reservoir, accumulator, oxygen bottles, alcohol tank, and gear shock struts must be filled to normal operating capacities.

5. Determine aircraft configuration at time of weighing. Missing item(s) in aircraft (but not part of BASIC EMPTY WEIGHT) should be noted and the final BASIC EMPTY WEIGHT shall be corrected for these items. All items should be in their normal place during weighing.

EFFECTIVITY:
ALL AIRCRAFT

NOTE:
THE BASIC EMPTY WEIGHT INCLUDES FUEL OIL, TRAPPED, SUMP, AND UNUSABLE FUEL. IF THE AIRCRAFT IS WEIGHED AFTER DRAINING THE FUEL AND OIL, THE SUMP AND UNUSABLE FUEL AND DRAINABLE OIL MUST BE ADDED TO THE "AS WEIGHED" CONDITION TO OBTAIN THE BASIC EMPTY WEIGHT.

WHEN THE AIRCRAFT IF WEIGHED WITH COMPLETELY DRY FUEL AND DRAINED OIL SYSTEMS, THE TRAPPED, SUMP, AND UNUSABLE FUEL AND DRAINABLE OIL WEIGHT AND MOMENT MUST BE ADDED TO THE "AS WEIGHED" CONDITION TO OBTAIN THE BASIC EMPTY WEIGHT OF THE AIRCRAFT. THIS DRY FUEL CONDITION WOULD OCCUR ONLY IF THE FUEL SYSTEM WERE PURGED.

UNUSABLE AND TRAPPED FUEL

ITEM	GALLONS	POUNDS		MOMENT/1000	
		KEROSENE 6.7 LB/GAL	JP-4 6.5 LB/GAL	KEROSENE	JP-4
TRAPPED FUEL	2.69	18.0	17.5	6.56	6.37
DRAINABLE SUMP	1.34	9.0	8.7	3.43	3.32
INFLIGHT UNUSABLE	12.53	84.0	81.5	32.43	31.46
TOTAL	16.56	111.0	107.7	42.42	41.15

TRAPPED AND DRAINABLE ENGINE OIL

ITEM	GALLONS	WEIGHT (8.0 LB/GAL)	MOMENT/1000
TRAPPED OIL	1.0	8.0	3.54
DRAINABLE OIL	3.5	28.0	12.27
TOTAL OIL	4.5	36.0	15.81

Figure WB-11. Unusable and Trapped Fluids

NOSE WHEEL	℄ WHEEL FUS. STA.	MAIN WHEELS	℄ WHEEL FUS. STA.
FULLY COMPRESSED	153.88	FULLY COMPRESSED	397.00
STATIC	153.63	STATIC	396.82
FULLY EXTENDED	152.62	FULLY EXTENDED	396.04

Figure WB-12. Landing Gear Dimensional Data

6. The aircraft must be in a level attitude at the time of weighing. Level is determined with a plumb bob attached to a clip on the upper aft side of frame 26A and the level plate hole on the lower portion of the frame.

7. Weighing should always be made in an enclosed area free of drafts. The scales used should be properly certified and calibrated.

8. Weighing the aircraft on jacks:

   a. Three jackpoints are provided for weighing: Two on the wing at FS 414.85 and one on the forward fuselage at FS 170.53.

   b. Leveling is accomplished by adjusting the jacks.

9. Weighing the aircraft on wheels (refer to Figure WB-12):

   a. Inflate the tires to the proper pressure.

   b. Deflate the shock struts. This is to establish the fuselage station of the centerline of the nose wheel axle. The fuselage station for the nose wheel axle in this condition is 153.88.

   c. Leveling is accomplished by inflating the main gear struts.

   d. Measure the perpendicular distance between the nose and main gear axle center lines (approximately 243.2 inches) if shock struts are inflated. Add this measurement to the nose gear axle position (FS 153.88) to obtain the main gear fuselage station.

   e. Substitute the nose and main gear stations for the jackpoint stations on the Aircraft Weighing Record (Figure WB-13) and proceed as in jackpoint weighing.

DATE WEIGHED	MODEL **31A**	SERIAL NO.
PLACED WEIGHED	WEIGHING INSPECTOR	

REACTION	SCALE READING	TARE	NET WEIGHT	ARM	MOMENT
LEFT JACK					
RIGHT JACK					
SUBTOTAL				414.85*	
NOSE JACK				170.53*	
TOTAL (AS WEIGHED)					
TOTAL ITEMS TABLE I			–		
TOTAL ITEMS TABLE II			+		
BASIC AIRPLANE					

TABLE I

ITEMS WEIGHED BUT NOT PART OF BASIC AIRPLANE	WEIGHT	ARM	MOMENT
JACK PADS			
TOTAL			

TABLE II

BASIC ITEMS NOT IN WHEN WEIGHED	WEIGHT	ARM	MOMENT
UNUSABLE FUEL			
TOTAL			

* JACKPOINT STATIONS FOR ELECTRONIC SCALES WEIGHING

Figure WB-13. Aircraft Weighing Record

WEIGHT AND CENTER-OF-GRAVITY LIMITS

NOTE

- The Normal Empty Weight Center of Gravity may be aft of the Flight Limit.
- For Fuel Used vs. Moment Loss (For Flight Planning), refer to Figure WB-8.

The airplane center of gravity, as loaded for flight, must be maintained within the center-of-gravity envelope defined in Figures WB-1 and WB-2 as applicable.

CAUTION

To prevent aircraft damage caused by tip back, some aircraft may require the installation of tailstand P/N 3170002 or placing ballast in the cockpit during ground handling operations and/or gusty wind conditions. Potential tip back condition occurs when the aircraft is loaded with full fuel prior to loading passengers and other payload items. ***On aircraft 31-024, 31-028 and subsequent***, refer to the placard on the nose gear strut for further guidance.

LOADING INSTRUCTIONS

It is the responsibility of the pilot to see that this aircraft is loaded within the weight and CG limits. The loading forms (Figure WB-5) may be used.

1. Enter the BASIC EMPTY WEIGHT and MOMENT from page 1 of the AFM; or, in the event the airplane has been altered, enter the BASIC EMPTY WEIGHT and MOMENT from the Aircraft Records.

2. Enter the payload weights and moments (crew, passengers, provisions, baggage, etc.) using the Payload Moments charts, Figure WB-6.

3. Compute the ZERO FUEL WEIGHT and MOMENT (OPERATING WEIGHT values plus passenger and baggage values).

4. Enter the fuel weights and moments using the Usable Fuel Moments charts, Figure WB-7.

5. Compute RAMP WEIGHT and MOMENT (ZERO FUEL WEIGHT values plus fuel values).

6. Compute TAKEOFF WEIGHT and MOMENT (RAMP WEIGHT values minus taxi burnoff out of wings).

7. Compare TAKEOFF WEIGHT and MOMENT with weight and CG limits from Weight-Moment-CG Envelope, Figure WB-9, or Center-of-Gravity Table, Figure WB-10. If not within limits, reduce weight or rearrange load as required to obtain weight and CG within limits.

8. LANDING WEIGHT and MOMENT may be calculated by adding the fuel weight and moment remaining at the destination to the ZERO FUEL WEIGHT.

9. The formula to calculate the CG in % MAC is:

$$\text{CG in \% MAC} = \left[\frac{\text{Fuselage Station (Center of Gravity)} - 365.085}{80.09} \right] \times 100$$

PERFORMANCE

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PERFORMANCE

INTRODUCTION

This chapter will introduce the various charts, tables, and methods used to compute airplane performance and weight and balance.

GENERAL

Takeoff and landing performance data is located in Section V, the Performance section, of the *Airplane Flight Manual (AFM)*. This data is presented in tabular-chart form. Tabular performance charts are provided in the *Pilot's Manual* and the aircrew checklist. However, the tabular performance charts do not address the effects of wind, runway gradient, antiskid-off, and anti-ice on operations. To account for these factors, the *AFM* charts must be used. Climb, cruise, and descent data may be found in the appropriate *Learjet Pilot's Manual*.

REGULATORY COMPLIANCE

Performance data information in the *AFM* and in this chapter is presented for the purpose of compliance with the appropriate performance criteria and certification requirements of FAR 25.

STANDARD PERFORMANCE CONDITIONS

All performance calculations in this section are based on the following performance conditions:

- Pertinent thrust ratings less installation, airbleed, and accessory losses.
- Full temperature accountability within the operational limits for which the airplane is certified.

NOTE

> Should OAT be below the lowest temperature shown on the performance charts, use performance at the lowest temperature shown.

- Wing flap positions as follows:
  - Takeoff .... 8 or 20°
  - Enroute .... UP—0°
  - Approach .... 20°
  - Landing .... DN—40°
- Thrust settings (N_1) from appropriate charts or tables.

VARIABLE FACTORS

Details of variables affecting performance are given with the charts to which they apply. Conditions which relate to all performance calculations are:

- Cabin Air is ON.
- Humidity effects performance.
- Winds, for which graphical correction is presented on the charts, are to be taken as the tower winds (10 meters above runway surface).
- Factors for 50% headwind component and 150% tailwind components have been applied as prescribed in pertinent regulations.
- The percentages of stall speed are calculated from speeds as expressed in calibrated airspeed (KCAS).
- The standard (coplanar) nozzle is installed.

NOTE

The performance of airplanes equipped with thrust reversers is equivalent to performance shown in the *Flight Manual*. However, the power setting charts for thrust reverser equipped airplanes are different and are contained in the *Dee Howard Thrust Reverser Supplement* to the *AFM*, and in the aircrew checklist.

DEFINITIONS

The following contains the symbols and definitions which are used in the Performance section of the *AFM*.

AIRSPEEDS

CAS—Calibrated Airspeed. This is the airspeed indicator reading for instrument and position error. KCAS is calibrated airspeed expressed in knots.

IAS—Indicated Airspeed. This is the airspeed indicator reading as installed in the airplane. KIAS is indicated airspeed expressed in knots. The information in this manual is presented in terms of indicated airspeed, unless otherwise stated, and assumes zero instrument error.

M—Calibrated Mach Number. This number is the Machmeter reading corrected for instrument and position error.

M_I—Indicated Mach Number. This number is the Machmeter reading as installed in the airplane. Zero instrument error is assumed for presentations in this section of the manual.

Refer to Figures PER-1 through PER-3 pertaining to airspeed calibrations.

FLAPS UP/GEAR UP

EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE:

1. INDICATED AIRSPEED.. 200 KIAS
2. CALIBRATED AIRSPEED.................................... 198 KCAS
   POSITION CORRECTION.................................. –2 KNOTS

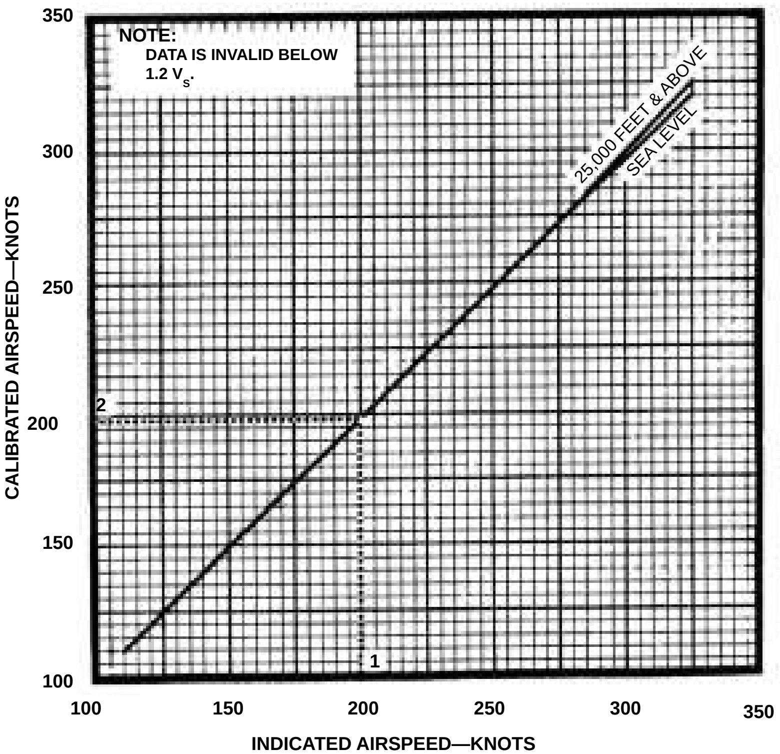


Figure PER-1. Airspeed Calibration (Sheet 1 of 2)

FLAPS AT 8°, 20°, OR DOWN
GEAR UP OR DOWN

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. INDICATED AIRSPEED.. 170 KIAS
2. CALIBRATED AIRSPEED.. 168 KIAS
   POSITION CORRECTION.. –2 KNOTS

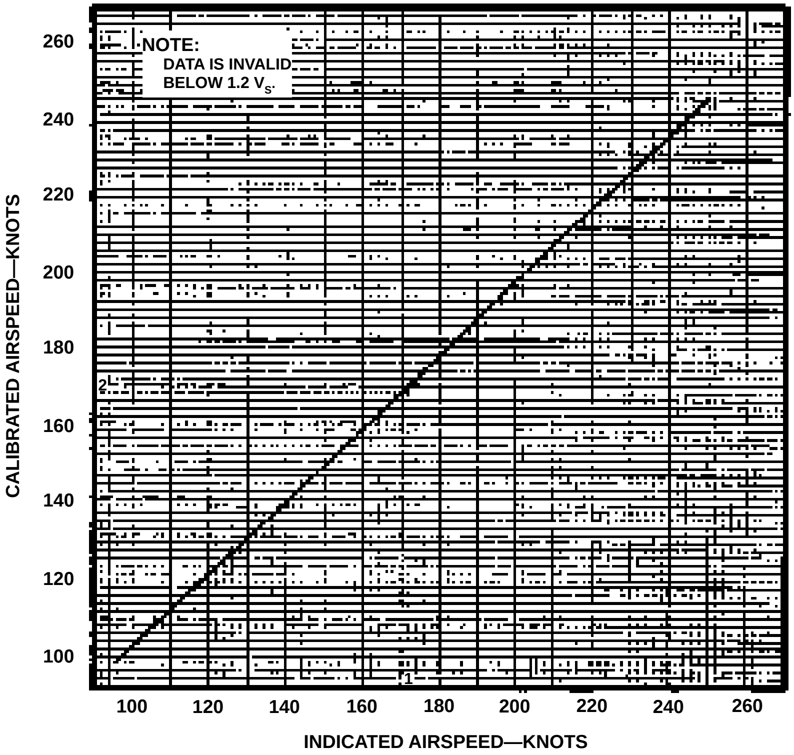


Figure PER-1. Airspeed Calibration (Sheet 2 of 2)

FLAPS AT 8° OR 20°
GEAR DOWN

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. INDICATED AIRSPEED.. 120 KIAS
2. CALIBRATED AIRSPEED.. 118 KCAS
   POSITION CORRECTION.. –2 KNOTS

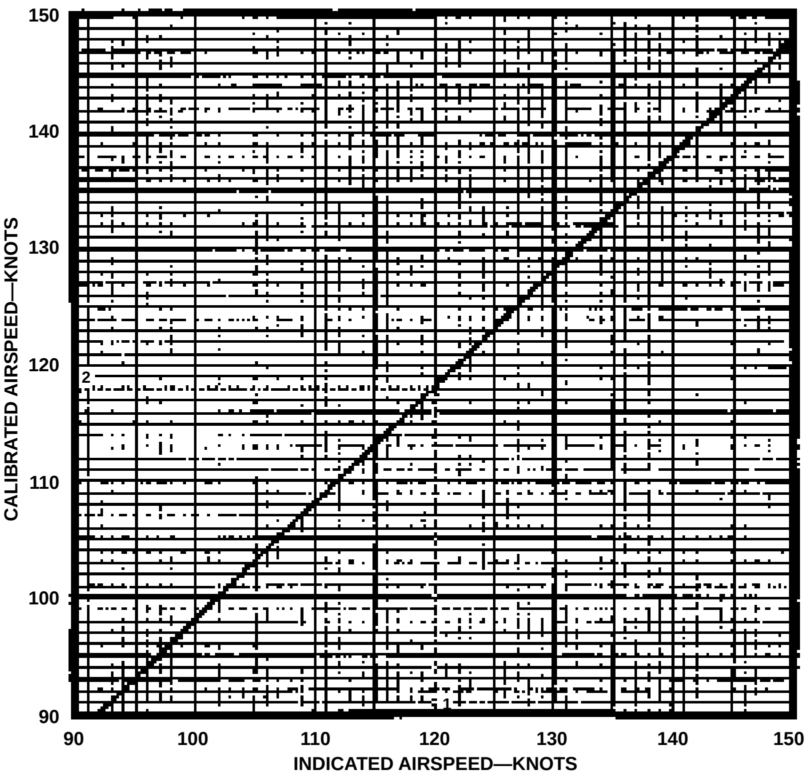


Figure PER-2. Ground Airspeed Calibration

FLAPS UP/GEAR UP

EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE:

1. INDICATED MACH NO. .... 0.700 M_I
2. ALTITUDE .... 20,000 FT
3. CALIBRATED MACH NO. .... 0.694 M
   POSITION CORRECTION .... –.006

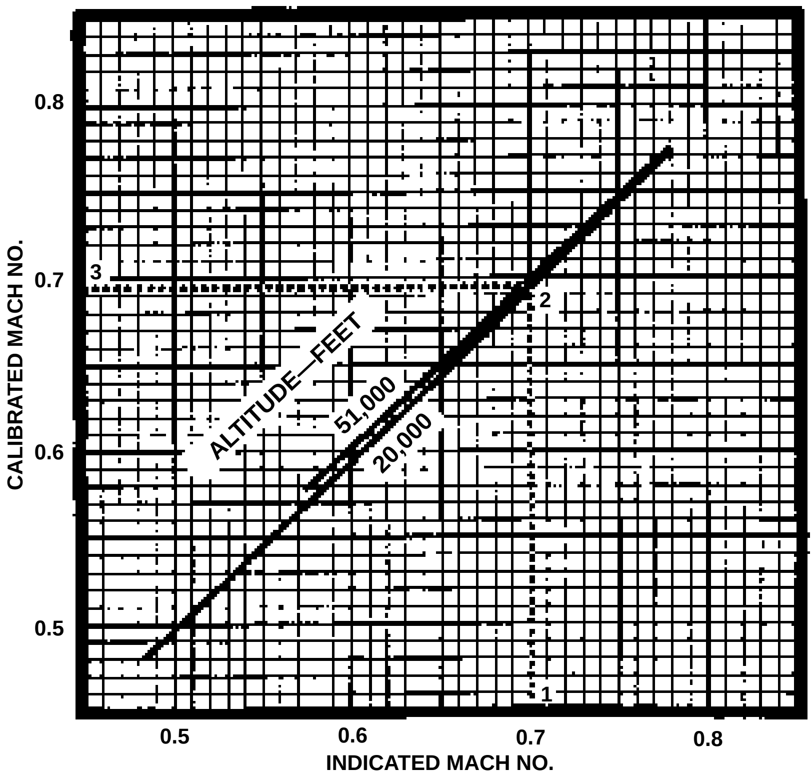


Figure PER-3. Mach Calibration

V_A—Maneuvering Speed. V_A is the highest speed full aileron and rudder control that can be applied without overstressing the aircraft, or the speed at which the aircraft will stall with the load factor of 3.0 at maximum gross weight, whichever is less.

V_{LOF} (Liftoff speed)—Actual speed of aircraft at liftoff

V_{SO}—Stalling speed in the landing configuration

V_{SI}—Stalling speed in the appropriate gear/flap configuration

Refer to Figures PER-4 and PER-5.

V_{MCA}—Minimum Control Speed, Air. The minimum flight speed at which the airplane is controllable with 5° of bank when one engine suddenly becomes inoperative and the remaining engine is operating at takeoff thrust

V_{MCG}—Minimum Control Speed, Ground. The minimum speed on the ground at which control can be maintained using aerodynamic controls alone, when one engine suddenly becomes inoperative and the remaining engine is operating at takeoff thrust

V_{MO}/M_{MO}—Maximum Operating Limit Speed. The speed that may not be deliberately exceeded in any flight condition except where specifically authorized for flight test or in approved emergency procedures. V_{MO} is expressed in knots. M_{MO} is expressed in Mach number.

V_1—Critical Engine Failure Speed. If engine failure occurs at V_1, the distance to continue the takeoff to 35 feet will not exceed the usable takeoff distance; or, the distance to bring the airplane to a full stop will not exceed the accelerate-stop distance available. V_1 must not be less than V_{MCG} or greater than V_R.

V_R—Rotation Speed. The speed at which rotation is initiated during takeoff to attain V_2 at or before a height of 35 feet above the runway surface

V_2—Takeoff Safety Speed. The actual speed at 35 feet above the runway surface as demonstrated in flight during single-engine takeoff. V_2 must not be less than 1.2 times the stalling speed, or less than 1.1 times the air minimum control speed (V_{MCA}), or less than rotation speed (V_R) plus an increment in speed attained prior to reaching a height of 35 feet above the runway surface

V_{APP}—Approach Climb Speed. The airspeed is equal to 1.3 V_{S1} (airplane in the approach configuration).

V_{REF}—Landing Approach Speed. The airspeed is equal to 1.3 V_{SO} (airplane in the landing configuration).

GEAR UP OR DOWN / IDLE THRUST

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. WEIGHT .... 14,000 LB (6350 KG)
2. FLAP SETTING .... 40°
3. STALL SPEED .... 90 KIAS

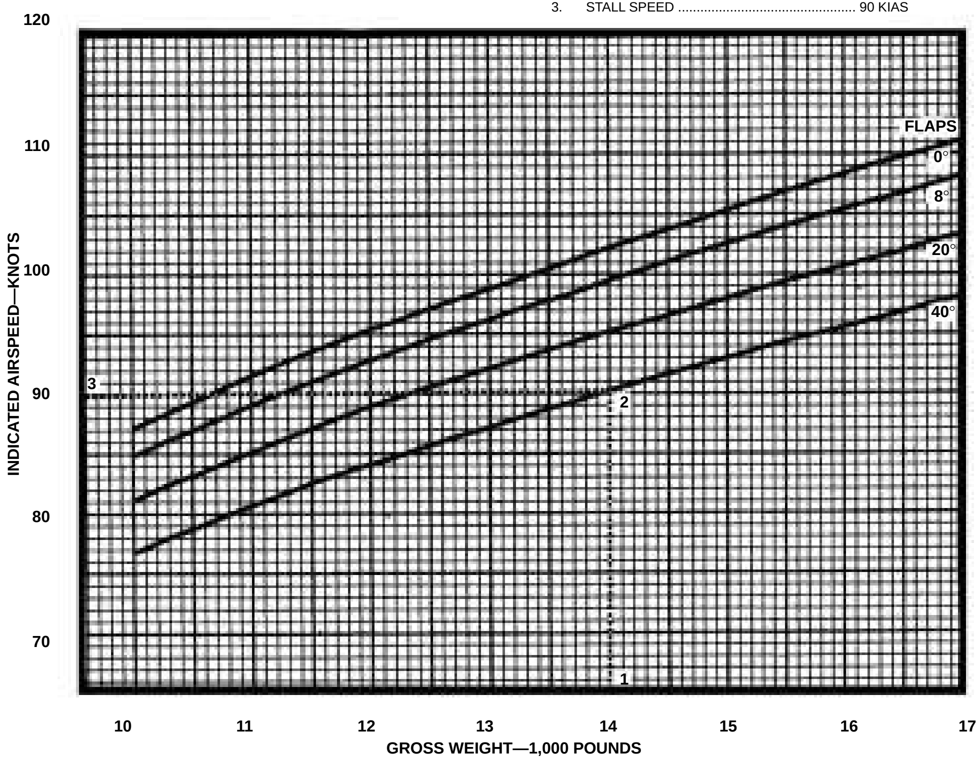


Figure PER-4. Stall Speeds (Sheet 1 of 2)

GEAR UP OR DOWN / IDLE THRUST

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. BANK ANGLE .... 50°
2. WEIGHT ....12,000 LB(5443KG)
3. FLAP .... 40°
4. STALL SPEED .... 106 KIAS

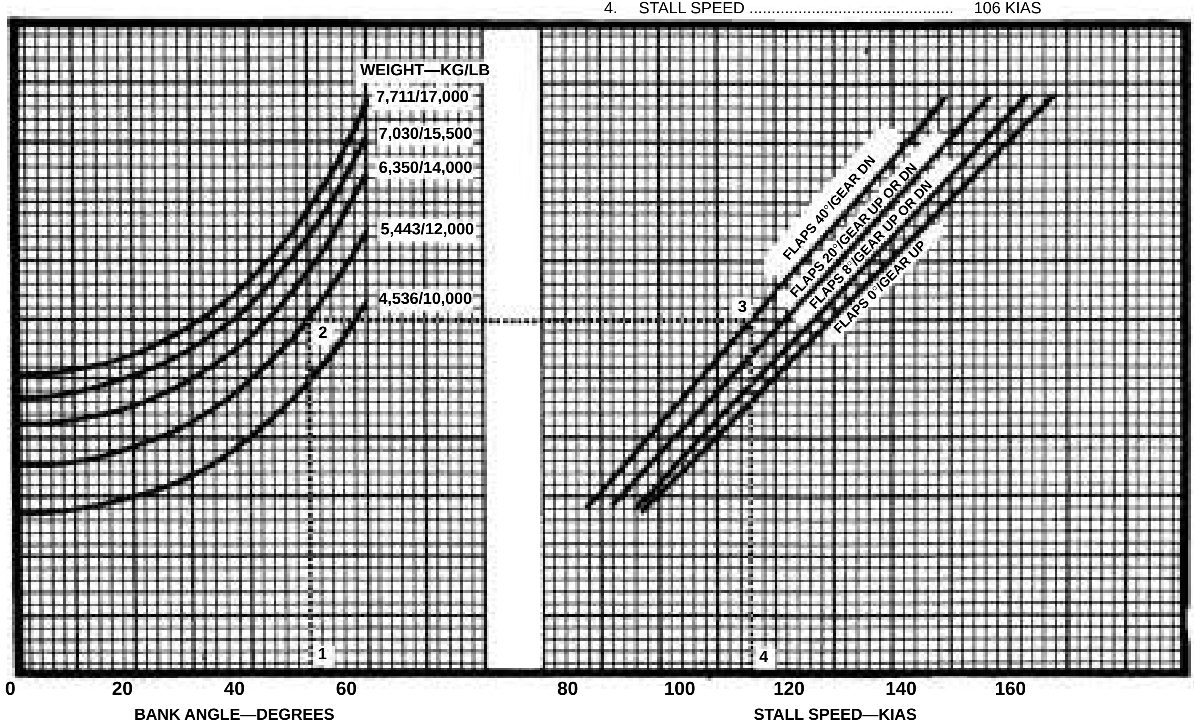


Figure PER-4. Stall Speeds (Sheet 2 of 2)

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

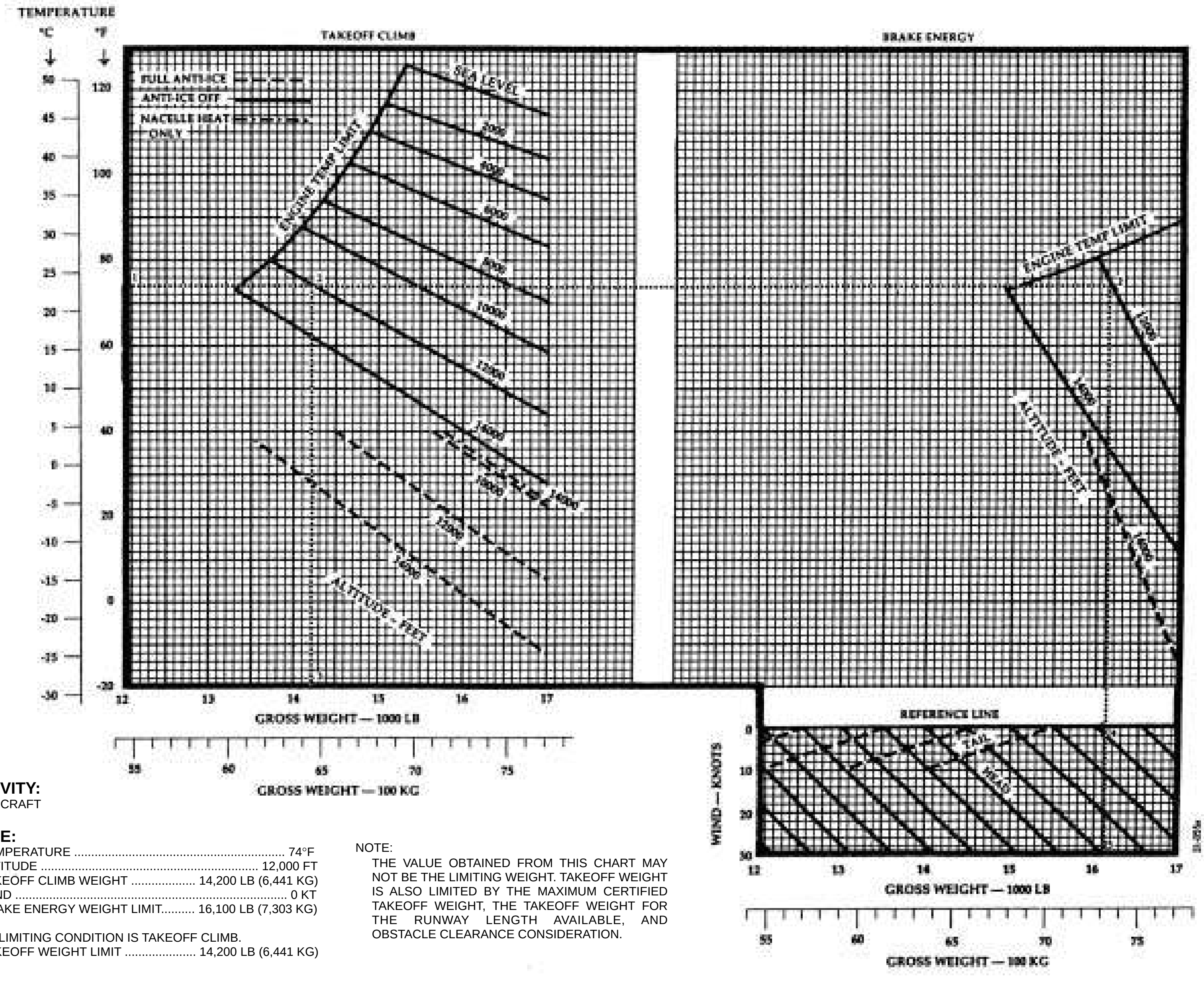


Figure PER-5. Buffet Boundary

EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE:

1. TEMPERATURE .... 74°F
2. ALTITUDE .... 12,000 FT
3. TAKEOFF CLIMB WEIGHT .... 14,200 LB (6,441 KG)
4. WIND .... 0 KT
5. BRAKE ENERGY WEIGHT LIMIT.......... 16,100 LB (7,303 KG)

THE MOST LIMITING CONDITION IS TAKEOFF CLIMB.

- TAKEOFF WEIGHT LIMIT .... 14,200 LB (6,441 KG)

NOTE:

THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. TAKEOFF WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED TAKEOFF WEIGHT, THE TAKEOFF WEIGHT FOR THE RUNWAY LENGTH AVAILABLE, AND OBSTACLE CLEARANCE CONSIDERATION.

FOR TRAINING PURPOSES ONLY

WEIGHTS

Maximum Allowable Takeoff Weight. The maximum allowable takeoff weight at the start of the takeoff roll is limited by the most restrictive of the following requirements:

- Maximum certified takeoff weight.
- Maximum takeoff weight (Climb or brake energy limited) for altitude and temperature as determined from the applicable Takeoff Weight Limits chart.
- Maximum takeoff weight for the runway and ambient conditions as determined from the applicable Takeoff Distance chart.
- Maximum takeoff weight for obstacle clearance determined from the applicable Takeoff Flight Path and Climb Gradient charts.

Maximum Allowable Landing Weight. The maximum landing weight is limited by the most restrictive of the following requirements:

- Maximum certified landing weight.
- Maximum landing weight for the runway and ambient conditions as determined from the applicable Landing Distance chart.
- Maximum landing weight (Approach climb or brake energy limited) for altitude and temperature as determined from the applicable Landing Weight Limits chart.

DISTANCES

Accelerate-Stop Distance. The accelerate-stop distance is the horizontal distance traversed from brake release until the airplane comes to a complete stop on a takeoff during which one engine fails at V_1 and the pilot elects to stop.

Engine-Out Accelerate-Go Distance. The engine-out accelerate-go distance is the horizontal distance traversed from brake release until the airplane attains a height of 35 feet above the runway surface on a takeoff during which one engine fails at V_1 and the pilot elects to continue.

Takeoff Field Length. The takeoff field lengths presented in this section are based on a smooth, dry, paved runway. The takeoff field length given for each combination of airplane weight, atmospheric temperature, altitude, wind, and runway gradient is the greatest of the following:

- 115% of the all-engine takeoff distance from start to a height of 35 feet above the runway surface.
- Accelerate-stop distance.
- Engine-out accelerate-go distance.

No specific identification is made on the charts as to which of the above distances governs a specific case. However, in all cases for which charts are furnished, the field length is governed by either accelerate-stop or engine-out accelerate-go distance as the all-engine takeoff distance is shorter than either.

Actual Landing Distance. The landing field lengths presented in this section are based on a smooth, dry, paved runway. The landing field length is equal to the horizontal distance from a point 50 feet above the runway surface to the point at which the airplane would come to a full stop on the runway.

Factored Landing Distance. The factored landing distances presented are equal to the actual landing distance divided by 0.60. The factored wet landing distance is the factored dry landing distance multiplied by 1.15.

METEOROLOGY

ISA—International Standard Atmosphere.

OAT—Outside Air Temperature. The free air static temperature obtained from either ground meteorological sources or from inflight temperature indications adjusted for instrument error and compressibility effects.

RAT—Ram Air Temperature. The static air temperature corrected for full adiabatic compression rise corresponding to the calibrated Mach number and multiplied by a recovery factor.

SAT—Static Air Temperature. Static air temperature is equivalent to OAT.

TAT—Total Air Temperature. This is the static air temperature corrected for full adiabatic compression rise corresponding to the calibrated Mach. (The recovery factor has been accounted for in the TAT display.)

Altitude—All altitudes given are pressure altitudes unless otherwise stated.

Wind—The wind velocities on the performance charts are headwind or tailwind components of the actual winds at 20 feet (10 meters)above the runway surface (tower winds).

Demonstrated Crosswind—The demonstrated crosswind velocity of 30 knots is velocity of the reported tower winds (measured at a 10-meter height) for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.

The meteorological data is shown in Figures PER-6 through PER-8 and Table PER-1 through Table PER-4.

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. OAT .... –22°C
2. ALTITUDE .... 17,000 FT
3. TEMPERATURE .... ISA –4°C

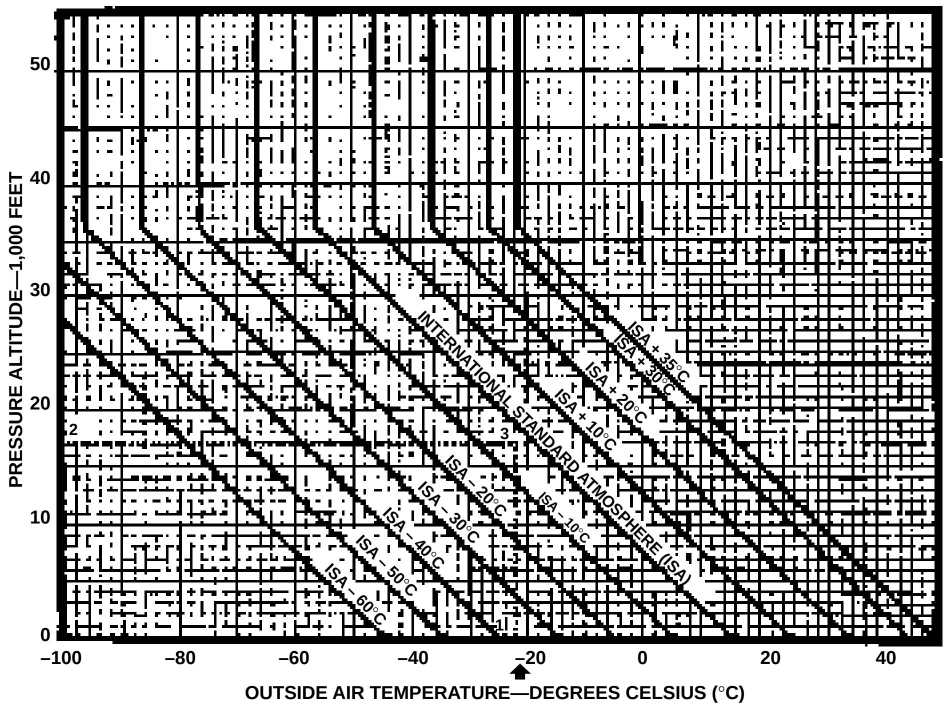


Figure PER-6. Relation of Temperature to ISA

Table PER-1. TEMPERATURE CONVERSION

EFFECTIVITY:
ALL AIRCRAFT

NOTE:

- TO CONVERT FROM CELSIUS TO FAHRENHEIT, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER REPRESENTING THE CELSIUS TEMPERATURE TO BE CONVERTED. THE EQUIVALENT FAHRENHEIT TEMPERATURE IS READ IN THE ADJACENT COLUMN HEADED °F.
- TO CONVERT FROM FAHRENHEIT TO CELSIUS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER REPRESENTING THE CELSIUS TEMPERATURE TO BE CONVERTED. THE EQUIVALENT CELSIUS TEMPERATURE IS READ IN THE ADJACENT COLUMN HEADED °C.

°F		°C	°F		°C	°F		°C	°F		°C	°F		°C
–148.0	**–100**	–73.3	–58.0	**–50**	–45.6	32.0	**0**	–17.8	122.0	**50**	10.0	212.0	**100**	37.8
–146.2	**–99**	–72.8	–56.2	**–49**	–45.0	33.8	**1**	–17.2	123.8	**51**	10.6	213.8	**101**	38.3
–144.4	**–98**	–72.2	–54.4	**–48**	–44.4	35.6	**2**	–16.7	125.6	**52**	11.1	215.6	**102**	38.9
–142.6	**–97**	–71.7	–52.6	**–47**	–43.9	37.4	**3**	–16.1	127.4	**53**	11.7	217.4	**103**	39.4
–140.8	**–96**	–71.1	–50.8	**–46**	–43.3	39.2	**4**	–15.6	129.2	**54**	12.2	219.2	**104**	40.0
–139.0	**–95**	–70.6	–49.0	**–45**	–42.8	41.0	**5**	–15.0	131.0	**55**	12.8	221.0	**105**	40.6
–137.2	**–94**	–70.0	–47.2	**–44**	–42.2	42.8	**6**	–14.4	132.8	**56**	13.3	222.8	**106**	41.1
–135.4	**–93**	–69.4	–45.4	**–43**	–41.7	44.6	**7**	–13.9	134.6	**57**	13.9	224.6	**107**	41.7
–133.6	**–92**	–68.9	–43.6	**–42**	–41.1	46.4	**8**	–13.3	136.4	**58**	14.4	226.4	**108**	42.2
–131.8	**–91**	–68.3	–41.8	**–41**	–40.6	48.2	**9**	–12.8	138.2	**59**	15.0	228.2	**109**	42.8
–130.0	**–90**	–67.8	–40.0	**–40**	–40.0	50.0	**10**	–12.2	140.0	**60**	15.6	230.0	**110**	43.3
–128.2	**–89**	–67.2	–38.2	**–39**	–39.4	51.8	**11**	–11.7	141.8	**61**	16.1	231.8	**111**	43.9
–126.4	**–88**	–66.7	–36.4	**–38**	–38.9	53.6	**12**	–11.1	143.6	**62**	16.7	233.6	**112**	44.4
–124.6	**–87**	–66.1	–34.6	**–37**	–38.3	55.4	**13**	–10.6	145.4	**63**	17.2	235.4	**113**	45.0
–122.8	**–86**	–65.6	–32.8	**–36**	–37.8	57.2	**14**	–10.0	147.2	**64**	17.8	237.2	**114**	45.6
–121.0	**–85**	–65.0	–31.0	**–35**	–37.2	59.0	**15**	–9.4	149.0	**65**	18.3	239.0	**115**	46.1
–119.2	**–84**	–64.4	–29.2	**–34**	–36.7	60.8	**16**	–8.9	150.8	**66**	18.9	240.8	**116**	46.7
–117.4	**–83**	–63.9	–27.4	**–33**	–36.1	62.6	**17**	–8.3	152.6	**67**	19.4	242.6	**117**	47.2
–115.6	**–82**	–63.3	–25.6	**–32**	–35.6	64.4	**18**	–7.8	154.4	**68**	20.0	244.4	**118**	47.8
–113.8	**–81**	–62.8	–23.8	**–31**	–35.0	66.2	**19**	–7.2	156.2	**69**	20.6	246.2	**119**	48.3
–112.0	**–80**	–62.2	–22.0	**–30**	–34.4	68.0	**20**	–6.7	158.0	**70**	21.1	248.0	**120**	48.9
–110.2	**–79**	–61.7	–20.2	**–29**	–33.9	69.8	**21**	–6.1	159.8	**71**	21.7	249.8	**121**	49.4
–108.4	**–78**	–61.1	–18.4	**–28**	–33.3	71.6	**22**	–5.6	161.6	**72**	22.2	251.6	**122**	50.0
–106.6	**–77**	–60.6	–16.6	**–27**	–32.8	73.4	**23**	–5.0	163.4	**73**	22.8	253.4	**123**	50.6
–104.8	**–76**	–60.0	–14.8	**–26**	–32.2	75.2	**24**	–4.4	165.2	**74**	23.3	255.2	**124**	51.1
–103.0	**–75**	–59.4	–13.0	**–25**	–31.7	77.0	**25**	–3.9	167.0	**75**	23.9	257.0	**125**	51.7
–101.2	**–74**	–58.9	–11.2	**–24**	–31.1	78.8	**26**	–3.3	168.8	**76**	24.4	258.8	**126**	52.2
–99.4	**–73**	–58.3	–9.4	**–23**	–30.6	80.6	**27**	–2.8	170.6	**77**	25.0	260.6	**127**	52.8
–97.6	**–72**	–57.8	–7.6	**–22**	–30.0	82.4	**28**	–2.2	172.4	**78**	25.6	262.4	**128**	53.3
–95.8	**–71**	–57.2	–5.8	**–21**	–29.4	84.2	**29**	–1.7	174.2	**79**	26.1	264.2	**129**	53.9
–94.0	**–70**	–56.7	–4.0	**–20**	–28.9	86.0	**30**	–1.1	176.0	**80**	26.7	266.0	**130**	54.4
–92.2	**–69**	–56.1	–2.2	**–19**	–28.3	87.8	**31**	–0.6	177.8	**81**	27.2	267.8	**131**	55.0
–90.4	**–68**	–55.6	–0.4	**–18**	–27.8	89.6	**32**	0.0	179.6	**82**	27.8	269.6	**132**	55.6
–88.6	**–67**	–55.0	1.4	**–17**	–27.2	91.4	**33**	0.6	181.4	**83**	28.3	271.4	**133**	56.1
–86.8	**–66**	–54.4	3.2	**–16**	–26.7	93.2	**34**	1.1	183.2	**84**	28.9	273.2	**134**	56.7
–85.0	**–65**	–53.9	5.0	**–15**	–26.1	95.0	**35**	1.7	185.0	**85**	29.4	275.0	**135**	57.2
–83.2	**–64**	–53.3	6.8	**–14**	–25.6	96.8	**36**	2.2	186.8	**86**	30.0	276.8	**136**	57.8
–81.4	**–63**	–52.8	8.6	**–13**	–25.0	98.6	**37**	2.8	188.6	**87**	30.6	278.6	**137**	58.3
–79.6	**–62**	–52.2	10.4	**–12**	–24.4	100.4	**38**	3.3	190.4	**88**	31.1	280.4	**138**	58.9
–77.8	**–61**	–51.7	12.2	**–11**	–23.9	102.2	**39**	3.9	192.2	**89**	31.7	282.2	**139**	59.4
–76.0	**–60**	–51.1	14.0	**–10**	–23.3	104.0	**40**	4.4	194.0	**90**	32.2	284.0	**140**	60.0
–74.2	**–59**	–50.6	15.8	**–9**	–22.8	105.8	**41**	5.0	195.8	**91**	32.8	285.8	**141**	60.6
–72.4	**–58**	–50.0	17.6	**–8**	–22.2	107.6	**42**	5.6	197.6	**92**	33.3	287.6	**142**	61.1
–70.6	**–57**	–49.4	19.4	**–7**	–21.7	109.4	**43**	6.1	199.4	**93**	33.9	289.4	**143**	61.7
–68.8	**–56**	–48.9	21.2	**–6**	–21.1	111.2	**44**	6.7	201.2	**94**	34.4	291.2	**144**	62.2
–67.0	**–55**	–48.3	23.0	**–5**	–20.6	113.0	**45**	7.2	203.0	**95**	35.0	293.0	**145**	62.8
–65.2	**–54**	–47.8	24.8	**–4**	–20.0	114.8	**46**	7.8	204.8	**96**	35.6	294.8	**146**	63.3
–63.4	**–53**	–47.2	26.6	**–3**	–19.4	116.6	**47**	8.3	206.6	**97**	36.1	296.6	**147**	63.9
–61.6	**–52**	–46.7	28.4	**–2**	–18.9	118.4	**48**	8.9	208.4	**98**	36.7	298.4	**148**	64.4
–59.8	**–51**	–46.1	30.2	**–1**	–18.3	120.2	**49**	9.4	210.2	**99**	37.2	300.2	**149**	65.0

Table PER-2. LINEAR CONVERSION

EFFECTIVITY:
ALL AIRCRAFT

NOTE:

- TO CONVERT FROM METERS TO FEET, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF METERS TO BE CONVERTED. THE EQUIVALENT NUMBER OF FEET IS READ IN THE ADJACENT COLUMN HEADED FEET.

- TO CONVERT FROM FEET TO METERS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF FEET TO BE CONVERTED. THE EQUIVALENT NUMBER OF METERS IS READ IN THE ADJACENT COLUMN HEADED METERS.

METERS	◀ ▶	FEET	METERS	◀ ▶	FEET	METERS	◀ ▶	FEET
304.8	**1000**	3280.8	1341.1	**4400**	14435.5	2377.5	**7800**	25590.2
335.3	**1100**	3608.9	1371.6	**4500**	14763.6	2407.9	**7900**	25918.3
365.8	**1200**	3937.0	1402.1	**4600**	15901.7	2438.4	**8000**	26246.4
396.2	**1300**	4265.0	1432.6	**4700**	15419.8	2468.9	**8100**	26574.5
426.7	**1400**	4593.1	1463.1	**4800**	15747.8	2499.4	**8200**	26902.6
457.2	**1500**	4921.2	1493.5	**4900**	16075.9	2529.9	**8300**	27230.6
487.7	**1600**	5249.3	1524.0	**5000**	16404.0	2560.4	**8400**	27558.7
518.2	**1700**	5577.4	1554.5	**5100**	16732.1	2590.8	**8500**	27886.8
548.6	**1800**	5905.4	1585.0	**5200**	17060.2	2621.3	**8600**	28214.9
579.1	**1900**	6233.5	1615.5	**5300**	17388.2	2651.8	**8700**	28543.0
609.6	**2000**	6561.6	1645.9	**5400**	17716.3	2682.3	**8800**	28871.0
640.1	**2100**	6889.7	1676.4	**5500**	18044.4	2712.8	**8900**	29199.1
670.6	**2200**	7217.8	1706.9	**5600**	18372.5	2743.2	**9000**	29527.2
701.0	**2300**	7545.8	1737.4	**5700**	18700.6	2773.7	**9100**	29855.3
731.5	**2400**	7873.9	1767.9	**5800**	19028.6	2804.2	**9200**	30183.4
762.0	**2500**	8202.0	1798.3	**5900**	19356.7	2834.7	**9300**	30511.4
792.5	**2600**	8530.1	1828.8	**6000**	19684.8	2865.2	**9400**	30839.5
823.0	**2700**	8858.2	1859.3	**6100**	20012.9	2895.6	**9500**	31167.6
853.5	**2800**	9186.2	1889.8	**6200**	20341.0	2926.1	**9600**	31495.7
883.9	**2900**	9514.3	1920.3	**6300**	20669.0	2956.6	**9700**	31823.8
914.4	**3000**	9842.4	1950.7	**6400**	20997.1	2987.1	**9800**	32151.8
944.9	**3100**	10170.5	1981.2	**6500**	21325.2	3017.6	**9900**	32479.9
975.4	**3200**	10498.6	2011.7	**6600**	21653.3	3048.0	**10000**	32808.8
1005.9	**3300**	10826.6	2042.2	**6700**	21981.4	3352.8	**11000**	36.88.8
1036.3	**3400**	11154.7	2072.7	**6800**	22309.4	3657.6	**12000**	39369.6
1066.8	**3500**	11482.8	2103.1	**6900**	22637.5	3962.4	**13000**	42650.4
1097.3	**3600**	11810.9	2133.6	**7000**	22965.6	4267.3	**14000**	45931.2
1127.8	**3700**	12139.0	2164.1	**7100**	23293.7	4572.1	**15000**	49212.0
1158.3	**3800**	12467.0	2194.6	**7200**	23621.8	4876.9	**16000**	52492.8
1188.7	**3900**	12795.1	2225.1	**7300**	23949.8	5181.7	**17000**	55773.6
1219.2	**4000**	13123.2	2255.5	**7400**	24277.9	5486.5	**18000**	59054.4
1249.7	**4100**	13451.3	2286.0	**7500**	24606.0	5791.3	**19000**	62335.2
1280.2	**4200**	13779.4	2316.5	**7600**	24934.1	6096.1	**20000**	65616.0
1310.7	**4300**	14107.4	2347.0	**7700**	25262.2	6400.9	**21000**	68896.8

Table PER-3. VOLUME CONVERSION

EFFECTIVITY:
ALL AIRCRAFT

NOTE:
- TO CONVERT FROM LITERS TO GALLONS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF LITERS TO BE CONVERTED. THE EQUIVALENT NUMBER OF GALLONS IS READ IN THE ADJACENT COLUMN HEADED GALLONS.

- TO CONVERT FROM GALLONS TO LITERS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF GALLONS TO BE CONVERTED. THE EQUIVALENT NUMBER OF LITERS IS READ IN THE ADJACENT COLUMN HEADED LITERS.

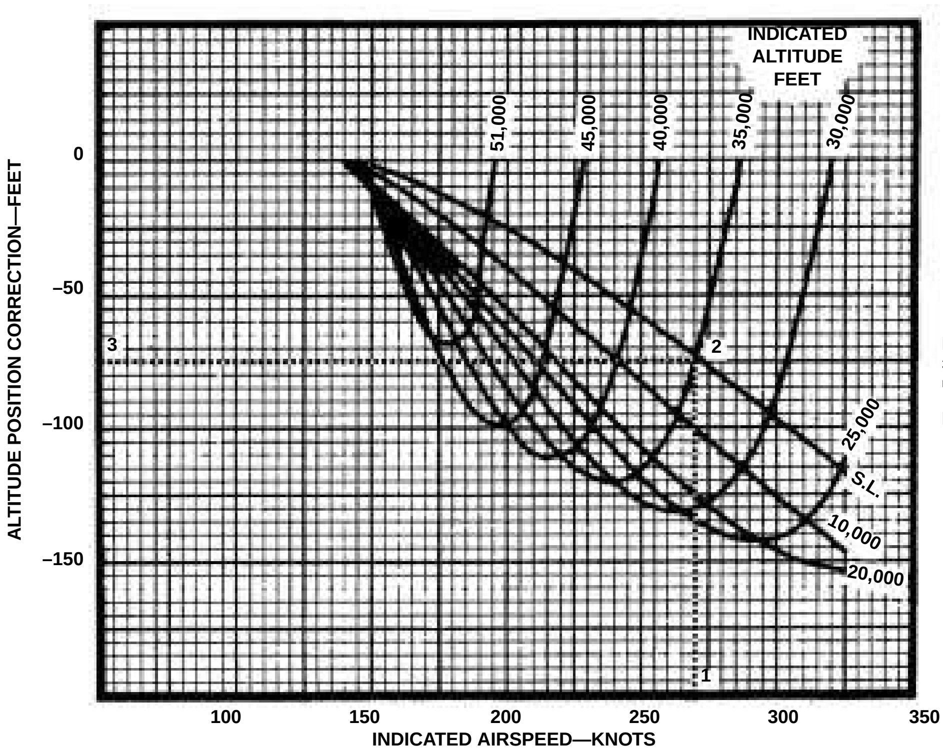
LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS
18.9	**5**	1.3	1476.2	**390**	103.0	2952.3	**780**	206.1
37.9	**10**	2.6	1514.0	**400**	105.7	2990.2	**790**	208.7
75.7	**20**	5.3	1551.9	**410**	108.3	3028.0	**800**	211.7
113.6	**30**	7.9	1589.7	**420**	111.0	3065.9	**810**	214.0
151.4	**40**	10.6	1627.6	**430**	113.6	3103.7	**820**	216.6
189.3	**50**	13.2	1665.4	**440**	116.2	3141.6	**830**	219.3
227.1	**60**	15.9	1703.3	**450**	118.9	3179.4	**840**	221.9
265.0	**70**	18.5	1741.1	**460**	121.5	3217.3	**850**	224.6
302.8	**80**	21.1	1779.0	**470**	124.2	3255.1	**860**	227.2
340.7	**90**	23.8	1816.8	**480**	126.8	3293.0	**870**	229.9
378.5	**100**	26.4	1854.7	**490**	129.5	3330.8	**880**	232.5
416.4	**110**	29.1	1892.5	**500**	132.1	3368.7	**890**	235.1
454.2	**120**	31.7	1930.4	**510**	134.7	3406.5	**900**	237.8
492.1	**130**	34.3	1968.2	**520**	137.4	3444.4	**910**	240.4
529.9	**140**	37.0	2006.1	**530**	140.0	3482.2	**920**	243.1
567.8	**150**	39.6	2043.9	**540**	142.7	3520.1	**930**	245.7
605.6	**160**	42.3	2081.8	**550**	145.3	3557.9	**940**	248.3
643.5	**170**	44.9	2119.6	**560**	148.0	3595.8	**950**	251.0
681.3	**180**	47.6	2157.5	**570**	150.6	3633.6	**960**	253.6
719.2	**190**	50.2	2195.3	**580**	153.2	3671.5	**970**	256.3
757.0	**200**	52.8	2233.2	**590**	155.9	3709.3	**980**	258.9
794.9	**210**	55.5	2271.0	**600**	158.5	3747.2	**990**	261.6
832.7	**220**	58.1	2308.9	**610**	161.2	3785.0	**1000**	264.2
870.6	**230**	60.8	2346.7	**620**	163.8	4163.5	**1100**	290.6
908.4	**240**	63.4	2384.6	**630**	166.4	4542.0	**1200**	317.0
946.3	**250**	66.0	2422.4	**640**	169.1	4920.5	**1300**	343.5
984.1	**260**	68.7	2460.3	**650**	171.7	5299.0	**1400**	369.9
1022.0	**270**	71.3	2498.1	**660**	174.4	5677.5	**1500**	396.3
1059.8	**280**	74.0	2536.0	**670**	177.0	6056.0	**1600**	422.7
1097.7	**290**	76.6	2573.8	**680**	179.7	6434.5	**1700**	449.1
1135.5	**300**	79.3	2611.7	**690**	182.3	6813.0	**1800**	475.6
1173.4	**310**	81.9	2649.5	**700**	184.9	7191.5	**1900**	502.0
1211.2	**320**	84.5	2687.4	**710**	187.6	7570.0	**2000**	528.4
1249.1	**330**	87.2	2725.2	**720**	190.2	7948.5	**2100**	554.8
1286.9	**340**	89.8	2763.1	**730**	192.9	8327.0	**2200**	581.2
1324.8	**350**	92.5	2800.9	**740**	195.5	8705.5	**2300**	607.7
1362.6	**360**	95.1	2838.8	**750**	198.1	9084.0	**2400**	634.1
1400.5	**370**	97.8	2876.6	**760**	200.8	9462.5	**2500**	660.5
1438.3	**380**	100.4	2914.5	**770**	203.4	9841.0	**2600**	686.9

Table PER-4. WEIGHT CONVERSION

EFFECTIVITY:
ALL AIRCRAFT

NOTE:
- TO CONVERT FROM KILOGRAMS TO POUNDS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF KILOGRAMS TO BE CONVERTED. THE EQUIVALENT NUMBER OF POUNDS IS READ IN THE ADJACENT COLUMN HEADED POUNDS.
- TO CONVERT FROM POUNDS TO KILOGRAMS, FIND, IN THE BOLD FACE COLUMNS, THE NUMBER OF POUNDS TO BE CONVERTED. THE EQUIVALENT NUMBER OF KILOGRAMS IS READ IN THE ADJACENT COLUMN HEADED KILOGRAMS.

KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS
4.5	**10**	22.0	208.7	**460**	1014.1	412.8	**910**	2006.2
9.1	**20**	44.1	213.2	**470**	1036.2	417.3	**920**	2028.2
13.6	**30**	66.1	217.7	**480**	1058.2	421.8	**930**	2050.3
18.1	**40**	88.2	222.3	**490**	1080.3	426.4	**940**	2072.3
22.7	**50**	110.2	226.8	**500**	1102.3	430.9	**950**	2094.4
27.2	**60**	132.3	231.3	**510**	1124.3	435.5	**960**	2116.4
31.8	**70**	154.3	235.9	**520**	1146.4	440.0	**970**	2138.5
36.3	**80**	176.4	240.4	**530**	1168.4	444.5	**980**	2160.5
40.8	**90**	198.4	244.9	**540**	1190.5	449.1	**990**	2185.6
45.4	**100**	220.5	249.5	**550**	1212.5	453.6	**1000**	2204.6
49.9	**110**	242.5	254.0	**560**	1234.6	499.0	**1100**	2425.1
54.4	**120**	264.6	258.6	**570**	1256.6	544.3	**1200**	2645.5
59.0	**130**	286.6	263.1	**580**	1278.7	589.7	**1300**	2866.0
63.5	**140**	308.6	267.6	**590**	1300.7	635.0	**1400**	3086.4
68.0	**150**	330.7	272.2	**600**	1322.8	680.4	**1500**	3306.9
72.6	**160**	352.7	276.7	**610**	1344.8	907.2	**2000**	4409.2
77.1	**170**	374.8	281.2	**620**	1366.9	1134.0	**2500**	5511.5
81.6	**180**	396.8	285.8	**630**	1388.9	1360.8	**3000**	6613.8
86.2	**190**	418.9	290.3	**640**	1410.9	1567.6	**3500**	7716.1
90.7	**200**	440.9	294.8	**650**	1433.0	1814.4	**4000**	8818.4
95.3	**210**	463.0	299.4	**660**	1455.0	2041.2	**4500**	9920.7
99.8	**220**	485.0	303.9	**670**	1477.1	2268.0	**5000**	11023.0
104.3	**230**	507.1	308.4	**680**	1499.1	2494.8	**5500**	12125.3
108.9	**240**	529.1	313.0	**690**	1521.2	2721.6	**6000**	13227.6
113.4	**250**	551.1	317.5	**700**	1543.2	2948.4	**6500**	14329.9
117.9	**260**	573.2	322.1	**710**	1565.3	3175.2	**7000**	15432.2
122.5	**270**	595.2	326.6	**720**	1587.3	2402.0	**7500**	16534.5
127.0	**280**	617.3	331.1	**730**	1609.4	3628.8	**8000**	17636.8
131.5	**290**	639.3	335.7	**740**	1631.4	2855.6	**8500**	18739.1
136.1	**300**	661.4	340.2	**750**	1653.4	4082.4	**9000**	19841.4
140.6	**310**	683.4	344.7	**760**	1675.5	4309.2	**9500**	20943.7
145.2	**320**	705.5	349.3	**770**	1697.5	4536.0	**10000**	22046.0
149.7	**330**	727.5	353.8	**780**	1719.6	2989.6	**11000**	24250.6
154.2	**340**	749.6	358.3	**790**	1741.6	5443.2	**12000**	26455.2
158.8	**350**	771.6	362.9	**800**	1763.7	5896.8	**13000**	28659.8
163.3	**360**	793.7	367.4	**810**	1785.7	6350.4	**14000**	30864.4
167.8	**370**	815.7	371.9	**820**	1807.8	6804.0	**15000**	33069.0
172.4	**380**	837.7	376.5	**830**	1829.8	7257.6	**16000**	35273.6
176.9	**390**	859.8	381.0	**840**	1851.9	7711.1	**17000**	37478.2
181.4	**400**	881.8	385.6	**850**	1873.9	8164.7	**18000**	39682.8
186.0	**410**	903.9	390.1	**860**	1896.0	8618.3	**19000**	41887.4
190.5	**420**	925.9	394.6	**870**	1918.0	9071.9	**20000**	44092.0
195.0	**430**	948.0	399.2	**880**	1940.0	9525.5	**21000**	46296.6
199.6	**440**	970.0	403.7	**890**	1962.1	9979.1	**22000**	48501.2
204.1	**450**	992.1	408.2	**900**	1984.1	10432.7	**23000**	50705.8



FLAPS UP / GEAR UP

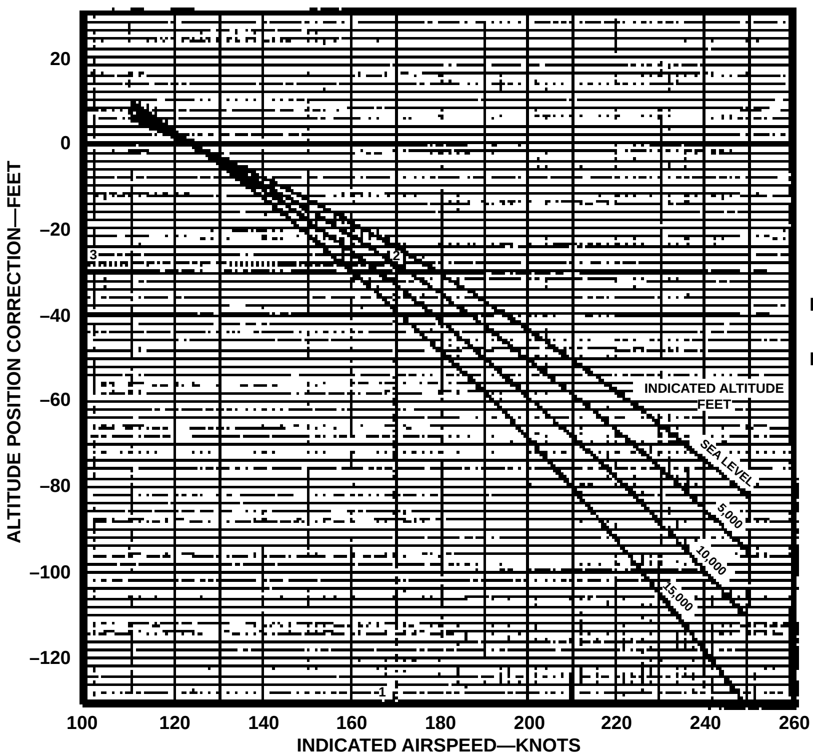
EFFECTIVITY:

31-035 thru 31-212 & 31-214 thru 31-221 not modified by SB 31-34-11

EXAMPLE:

1. INDICATED AIRSPEED .... 270 KIAS
2. INDICATED ALTITUDE .... 35,000 FT
3. POSITION CORRECTION .... –75 FT
   ACTUAL ALTITUDE .... 34,925 FT

Figure PER-7. Altitude Position Correction (Sheet 1 of 4)



FLAPS AT 8° / GEAR UP OR DOWN

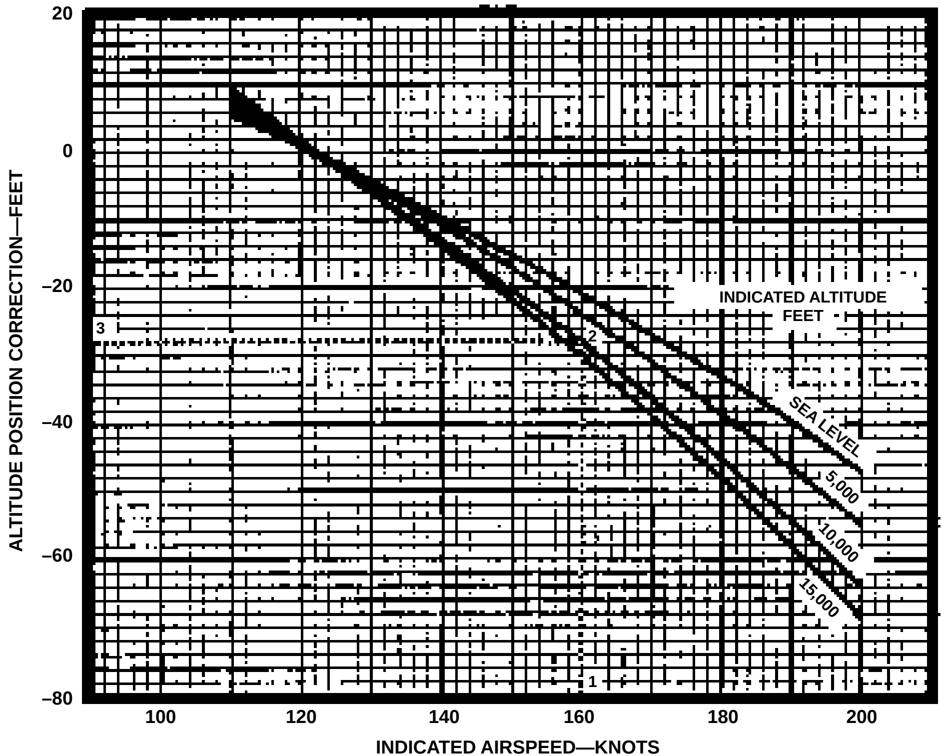
EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. INDICATED AIRSPEED .... 170 KIAS
2. INDICATED ALTITUDE .... 5,000 FT
3. POSITION CORRECTION .... –28 FT

ACTUAL ALTITUDE .... 4,972 FT

Figure PER-7. Altitude Position Correction (Sheet 2 of 4)



FLAPS AT 20° / GEAR UP OR DOWN

EFFECTIVITY:

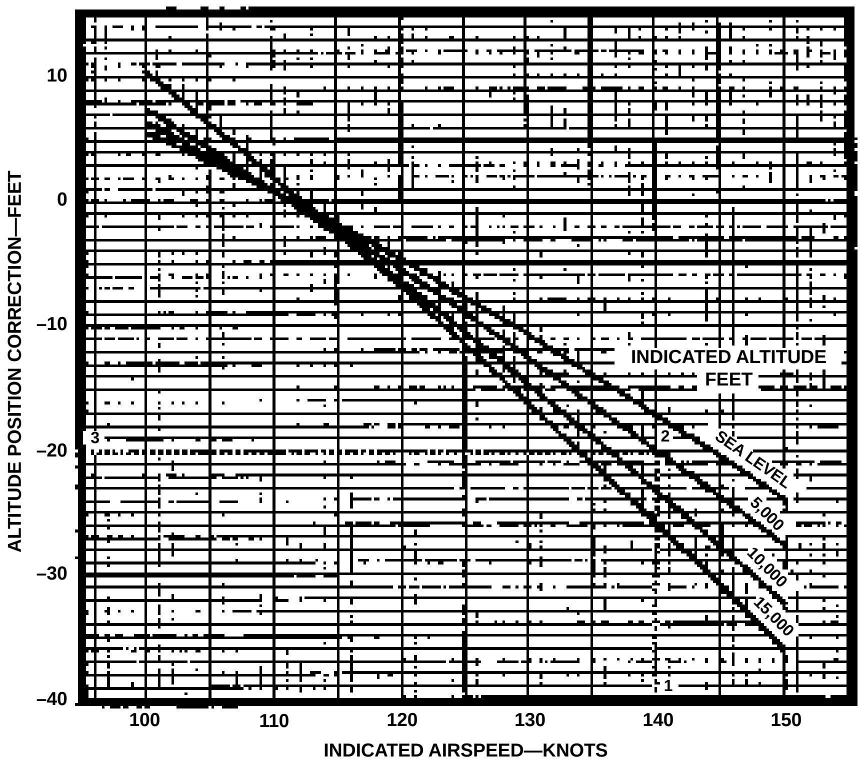
ALL AIRCRAFT

EXAMPLE:

1. INDICATED AIRSPEED .... 160 KIAS
2. INDICATED ALTITUDE .... 10,000 FT
3. POSITION CORRECTION .... –28 FT

ACTUAL ALTITUDE .... 9,972 FT

Figure PER-7. Altitude Position Correction (Sheet 3 of 4)

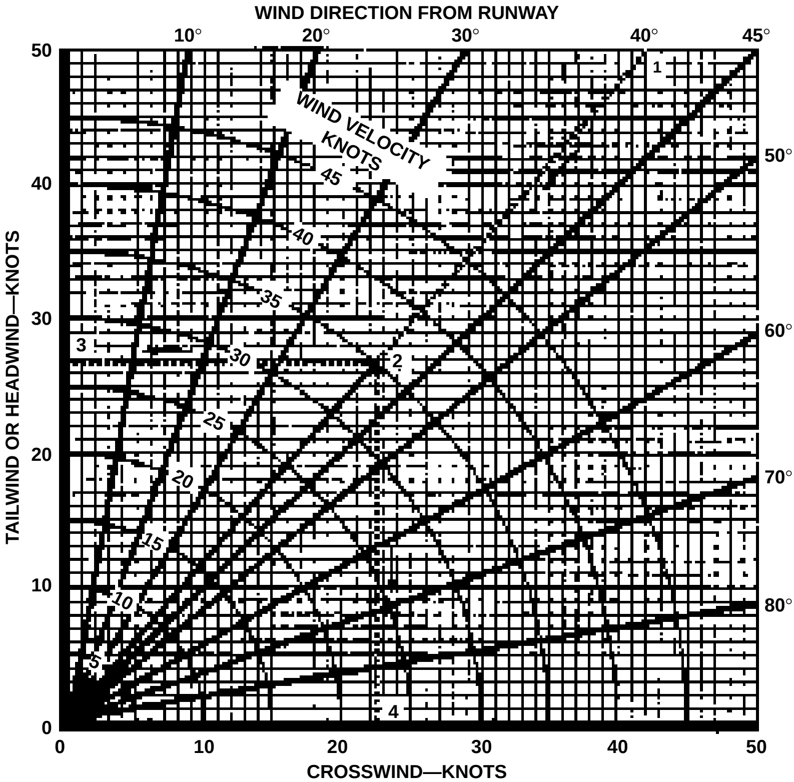


FLAPS DOWN / GEAR DOWN

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. INDICATED AIRSPEED .... 140 KIAS
2. INDICATED ALTITUDE .... 5,000 FT
3. POSITION CORRECTION .... –20 FT
   ACTUAL ALTITUDE .... 4,980 FT

Figure PER-7. Altitude Position Correction (Sheet 4 of 4)



EFFECTIVITY:

ALL AIRCRAFT

CONDITIONS:

- WIND VELOCITY.. 35 KNOTS
- WIND DIRECTION.. 300°
- RUNWAY HEADING.. 340°

EXAMPLE:

1. WIND DIRECTION FROM RUNWAY (SEE NOTE).. 40°
2. WIND VELOCITY.. 35 KNOTS
3. HEADWIND COMPONENT.. 26.7 KNOTS
4. CROSSWIND COMPONENT.. 22.5 KNOTS

NOTE:

TO CALCULATE WIND DIRECTION FROM RUNWAY, SUBTRACT WIND DIRECTION FROM RUNWAY HEADING. ENTER THE CHART AT THE ABSOLUTE VALUE OF WIND DIRECTION FROM RUNWAY.

Figure PER-8. Wind Components

MISCELLANEOUS

Static Position Correction—The static position corrections is applied to indicated airspeed or altitude to eliminate the effect of the static source location on the instrument reading. Instrument error is assumed to be zero. Since all airspeeds and altitudes in this sect on are presented as “indicated” values, no position corrections need be made when reading from the charts. Any change in the airspeed-altitude system external to the airplane, or locating any external object near the pressure pickup sources, requires calibration of the system and revision of the charts.

Takeoff Brake Energy—The maximum brake energy demonstrated during emergency stop tests. Maximum effort braking at weights associated with the takeoff brake energies shown on the TAKEOFF WEIGHT LIMITS charts will meet the accelerate-stop distances expressed on the TAKEOFF DISTANCE charts if the takeoff is aborted at V_1. However, after the stop, wheel fuse plugs will release and brake and tire damage will occur.

Landing Brake Energy—The maximum brake energy demonstrated during landing tests. Maximum effort braking at weights associated with the landing brake energies shown on the LANDING WEIGHT LIMITS charts will meet the stopping distances expressed on the ACTUAL LANDING DISTANCE chart. Maximum effort stops above the maximum landing brake energy weight may cause excessive brake wear, and after the stop, may cause wheel fuse plug release and damage tires..

Runway Gradient—Runway gradient is a change in runway elevation per 100 feet of runway length. The values given are positive for uphill gradients and negative for downhill gradients.

Gradient of Climb—This is the ratio of the change in height during a portion of the climb to the horizontal distance traversed in the same time interval.

Gross Climb Gradient—The gross climb gradient is one the airplane can actually achieve given ideal conditions.

Net Climb Gradient—This is the gross climb gradient reduced by 0.8% during the takeoff phase and 1.1 enroute. This conservatism is required by FAR 25 for terrain clearance determination to account for variables encountered in service.

CLIMB SEGMENTS (IN ORDER OF OCCURRENCE)

First Segment Climb—Climb from the point at which the airplane becomes airborne to the point at which the landing gear is fully retracted. The gross climb gradient with one engine not operating and the other engine at takeoff thrust must be positive, without ground effect. This requirement is satisfied by observing the Takeoff Weight Limits chart. Velocity increase is from lift-off velocity (V_{LOF}) to V_2 with gradient calculated at V_{LOF}.

Second Segment Climb—Second segment climb is calculated at a height of 400 feet. The gross climb gradient may not be less than 2.4% with one engine not operating and the other engine at takeoff thrust. This requirement is satisfied by observing the Takeoff Weight Limits chart. Velocity for this segment is V_2.

Final Segment Climb—Final segment climb is calculated at a height of 1,500 feet. The gross climb gradient may not be less than 1.2% with one engine not operating and the other engine at maximum continuous thrust. This requirement is satisfied by observing the Takeoff Weight Limits chart. Velocity for this segment is V_2 + 20 KIAS. The final segment climb gradients are presented for pilot reference and are not used in takeoff path calculation.

Enroute Climb—Climb with flaps UP (0°), landing gear retracted and maximum continuous thrust on one engine. There is no minimum requirement for enroute climb gradients. The enroute net climb gradients are presented for pilot reference. Velocity is presented in Enroute Climb Gradient chart.

Approach Climb—Climb from a missed or aborted approach with approach (20°) flaps, landing gear retracted, one engine not operating and the other engine at takeoff thrust. The gross climb gradient may not be less than 2.1%. This requirement is satisfied by observing the Landing Weight Limits chart. Velocity for this segment is 1.3 V_{S1}.

Landing Climb—Climb from an aborted landing with landing flaps DN (40°), landing gear extended, and takeoff thrust on both engines. The gross climb gradient may not be less than 3.2%. This requirement is satisfied by observing the Landing Weight Limits chart. Velocity for this segment is 1.3 VSO.

Configurations

The configurations referred to by name in the charts correspond to the settings listed in Table PER-5.

Table PER-5. CLIMB SEGMENT CONFIGURATIONS

CONFIGURATION	NO. OF ENGINES OPERATION	THRUST	FLAP SETTING	GEAR
1ST SEGMENT TAKEOFF CLIMB	1	TAKEOFF	8 OR 20°	DOWN
2ND SEGMENT TAKEOFF CLIMB	1	TAKEOFF	8 OR 20°	UP
FINAL SEGMENT CLIMB	1	MAX CONT	UP—0°	UP
ENROUTE CLIMB	1	MAX CONT	UP—0°	UP
APPROACH CLIMB	1	TAKEOFF	20°	UP
LANDING CLIMB	2	TAKEOFF	DN—40°	DOWN

NOISE LEVELS

The noise levels are in compliance with the requirements of FAR 36 (Stage 3) (Table PER-3) which are equal to or more severe than the requirements outlined in ICAO Annex 16, Chapter 3.

These noise levels established in compliance with FAR 36 (Stage 3) are listed in Table PER-6.

Table PER-6. NOISE LEVEL IN EPNdB

CONDITION	ACTUAL FLAPS 8°	ACTUAL FLAPS 20°	MAXIMUM ALLOWABLE
SIDELINE			
15,500 LB (7,031 KG)	87.2	87.4	94
16,500 LB (7,484 KG)	87.0	87.1	94
TAKEOFF			
15,500 LB (7,031 KG)	79.6	80.9	89
16,500 LB (7,484 KG)	81.0	82.4	89
APPROACH	FLAPS 40°		
15,300 LB (6,940 KG)	92.8		98

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

These noise values are stated for 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 weights listed above, V_2 + 10 knots climb speed, 8 and 20° flaps, anti-ice systems off, and all engine takeoff with takeoff thrust setting. No thrust cutback was required for compliance.

Landing approach noise levels were established on a 3° glideslope, gear down, maximum landing weights listed above, approach speed of VREF + 10 knots, and 40° flaps. No special noise abatement procedures were used.

TAKEOFF

MAXIMUM TAKEOFF WEIGHT

The charts on the following pages (Figures PER-11 through PER-29) present the information necessary to determine the maximum allowable takeoff weight as limited by gross climb performance or brake energy limits. The climb limitations portion of the charts do not specify the limiting climb segment, only that any one or a combination of the takeoff climb segments (first, second or final) are limiting.

Takeoff must be made within the limitations of the maximum takeoff weight, Takeoff Weight Limits chart, and by the performance determined from the Takeoff Distance chart.

Example:

1. Maximum certified takeoff weight.

2. From the applicable Takeoff Weight Limits chart, determine maximum takeoff weight for airport altitude and temperature.

3. From the applicable Takeoff Distance chart, determine the maximum takeoff weight for the runway and ambient conditions.

4. From the applicable Takeoff Flight Path and Climb Gradient charts, determine the maximum takeoff weight for obstacle clearance, if required.

5. The lowest of the weights from steps 1, 2, 3, and 4 is the heaviest allowable weight at which the airplane can take off.

TAKEOFF FLIGHT PATH

The takeoff flight path is divided into segments defined by changes in the airplane configuration. The terms used in flight path plotting are defined as follows and illustrated on the Takeoff Profile in Figure PER-30.

Reference Zero—A point 35 feet above the runway surface at the final point of the takeoff run (takeoff distance).

First Segment—Segment extending from the 35-foot height at the end of the takeoff run (Reference Zero) to the height at the end of gear retraction.

NOTE

The First Segment of the Takeoff Flight Path represents only a portion of the First Segment Climb as shown on the Takeoff Profile figure.

Second Segment—Segment beginning at the end of gear retraction (end of first segment) and continuing to a height of up to 1,500 feet above the runway at V_2 speed. For obstacle clearance, maintain second segment climb (gear up, flaps at takeoff setting, takeoff thrust and V_2) until reaching obstacle clearance altitude. This procedure will produce the performance shown in the Takeoff Flight Path charts.

Transition Segment—Segment beginning at the end of second segment (1,500 feet or 5-minute limit on takeoff thrust) for level-off, acceleration to V_2 + 20

KIAS and flap retraction at maximum continuous thrust. The horizontal distance traversed during this segment will be less than 11 nautical miles at the most limiting conditions.

NOTE

Under the most limiting conditions, 5 minutes at takeoff thrust will result in a climb of 1,350 feet for the second segment. Therefore, the horizontal distance stated includes the distance traversed for 150 feet climb in the final segment configuration (clean).

Effect of Wind on Flight Path—The effect of wind is to increase or decrease the climb gradients or horizontal distances on each segment of the flight path.

The Takeoff Flight Path charts presented in this manual are separated into Close-in and Distant flight paths. The Close-in Takeoff Flight Path charts facilitate determination of required gradients within approximately two miles horizontal distance from Reference Zero. The Distant Takeoff Flight Path charts facilitate determination of required gradients to nearly eight miles from Reference Zero.

On these charts each flight path line is marked with numbers showing the net climb gradients required for obstacle clearance at the end of the first and second segment climb. The origin of each line is Reference Zero, and the slope of the line segments (scale vertical distance divided by scale horizontal distance) are the slopes of the required climb segments in space in zero wind conditions. Since the zero wind first and second segment climbs are uniquely related to each other for each airplane weight and environment, it can be seen that the actual flight path in still air can be obtained from the Takeoff Flight Path charts by knowing only one of the applicable gradients.

CLIMB GRADIENTS

Climb performance charts for 8 and 20° flap settings are presented in terms of altitude, temperature, weight, wind, and anti-ice systems on or off. The gradients for First, Second, and Final Segments are read at the temperature and pressure altitude for the departure airport and are the net gradients that will be achieved at the appropriate segment of the Takeoff Flight Path.

These charts show the net gradients available and are to be used with the Takeoff Flight Path charts which show the required net gradients when flight planning for obstacle clearance.

DETERMINATION OF TAKEOFF FLIGHT PATH FOR OBSTACLE CLEARANCE

The weight used for the following determination is defined as the airplane weight at the beginning of the takeoff roll. Using this weight for each climb segment will result in some small conservatism, since the gradients are presented in terms of instantaneous gross weight rather than the weight at the beginning of takeoff roll.

When flight path planning for obstacle clearance is desired, the following procedure may be used:

1. From the applicable Takeoff Weight Limits chart, determine the highest weight at which a takeoff may be made for the local temperature and pressure altitude.

2. From the applicable Takeoff Distance chart, determine the highest weight at which a takeoff may be made using the runway gradient, appropriate wind component, field pressure altitude, and local temperature. The lower of this weight and the weight from the Takeoff Weight Limits chart is the first trial takeoff gross weight.

3. Determine the horizontal distance of the obstacle from reference zero.

4. From the applicable Takeoff Flight Path chart, for the first or second segment, depending on where the critical obstacle is considered to be, determine the required climb gradient for obstacle clearance (zero wind gradient).

5. From the applicable Climb Gradient chart, determine the aircraft climb gradient performance.

NOTE

It is noted at this point that a headwind serves to increase climb gradient performance, whereas a tailwind decreases climb gradient performance.

6. If step 5 (climb gradient performance) is more than step 4 (required gradient), obstacle clearance is satisfactory.

Or:

6. If step 5 (climb gradient performance) is less than step 4 (required gradient), obstacle clearance is unsatisfactory and procedures must be repeated using a lesser weight. When weight is reduced to achieve obstacle clearance, note that the horizontal distance between the obstacle and reference zero increases, since the takeoff field length is less. Consequently an interpolative process is required to find the exact minimum gradient and maximum weight for obstacle clearance.

TAKEOFF FROM WET OR CONTAMINATED RUNWAY

Refer to the WET/CONTAMINATED RUNWAY DATA for guidance material pertaining to takeoff on a wet or contaminated runway.

TAKEOFF PROCEDURE

The takeoff distances on the Takeoff Distance charts can be realized by following the Engine Failure During Takeoff procedure in Section III of the *AFM* and using the following techniques:

1. Set takeoff N_1 prior to brake release. Adjust Fan Speed (N_1) continuously up to 80 KIAS.
2. For engine failure above V_1:
   a. Rotate to approximately 9° nose up at V_R.

   b. Accelerate to V_2 then increase pitch as required to maintain V_2 through a height of 35 feet.

NOTE

For a two-engine takeoff, maintain V_2 + 8 knots up through the 35-foot point.

Or:

2. For rejected takeoff (engine failure below V_1):

   a. Braking Techniques:

   - Anti-skid operative—Apply maximum anti-skid braking until the airplane stops.
   - Anti-skid inoperative—Apply brakes judiciously to prevent tire skid or failure. Modulating brake pressures will improve feel and reduce the probability of tire skid.

TAKEOFF DISTANCE

The Takeoff Distance charts in the *AFM* are presented for 8 or 20° flap settings and show required field length in terms of altitude, temperature, weight, wind, runway gradient, anti-skid on or off, and anti-ice systems on or off. These charts may be used to determine either of the following:

- The runway length required given the airplane weight, runway gradient, pressure altitude, temperature, and wind. The example on the applicable chart illustrates determination of runway length required.
- The maximum airplane takeoff weight corresponding to a specific runway length, runway gradient, pressure altitude, temperature, and wind. Takeoff weight for runway length available may be determined by working through the chart in the opposite manner as finding runway length.

SIMPLIFIED TAKEOFF DATA

The simplified takeoff data may be used for all certified takeoff weights (rudder boost ON or OFF) if the listed conditions are satisfied (Table PER-7). If the listed conditions are not satisfied, refer to the appropriate figures in this section.

Table PER-7. SIMPLIFIED TAKEOFF DATA

AMBIENT TEMPERATURE	V_1 KIAS	V_R KIAS	V_2 KIAS	N_1 %
8 – 48°F (–13 – 9°C)	118	118	122	91.5
48 – 88°F (9 – 31°C)	118	118	122	95.5

CONDITIONS:

1. ENGINE NOZZLE—STANDARD
2. FLAPS—20°
3. ANTI-ICE SYSTEMS—OFF
4. ANTI-SKID— OPERATIVE
5. RUNWAY LENGTH AVAILABLE— DRY, PAVED 5,000 FEET OR GREATER
6. OBSTACLES—NONE
7. TAILWIND —NONE
8. RUNWAY GRADIENT—NONE
9. FIELD ELEVATION—2,000 FEET OR LESS
10. TEMPERATURE — 8 TO 88°F (–13 TO 31°C) INCLUSIVE

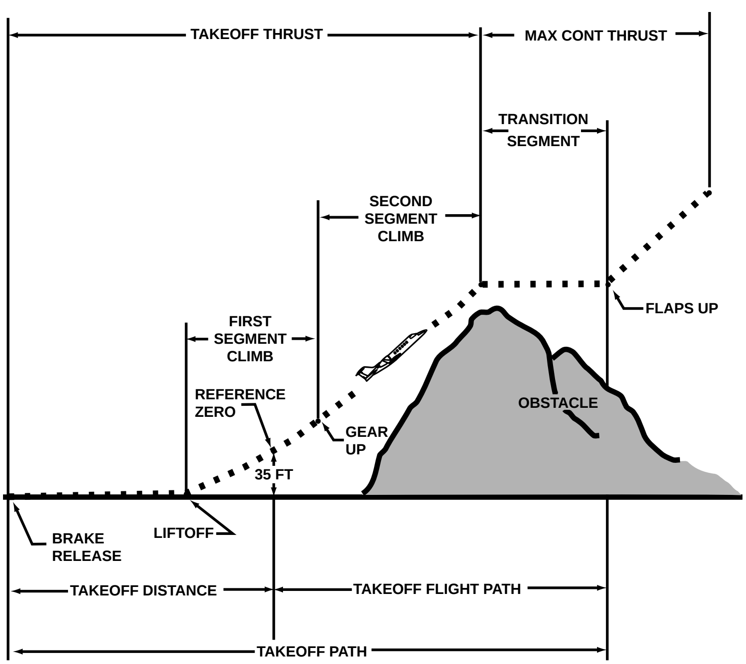


Figure PER-9. Takeoff Profile

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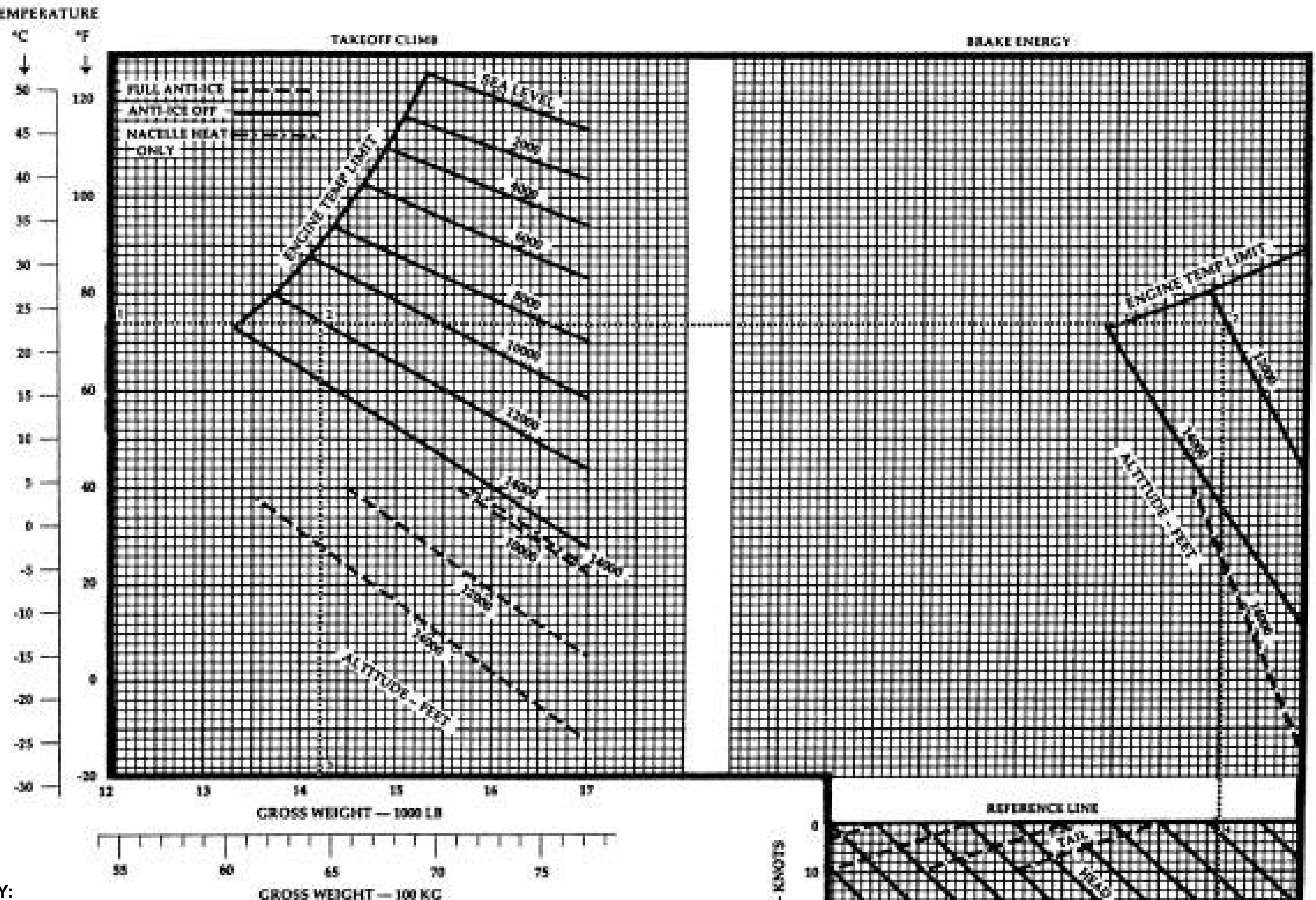

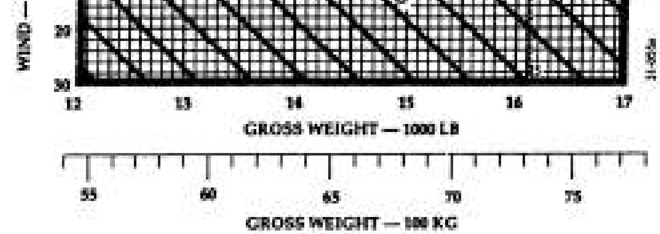

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. TEMPERATURE .... 74°F
2. ALTITUDE .... 12,000 FT
3. TAKEOFF CLIMB WEIGHT .... 14,200 LB (6,441 KG)
4. WIND .... 0 KT
5. BRAKE ENERGY WEIGHT LIMIT.......... 16,100 LB (7,303 KG)

THE MOST LIMITING CONDITION IS TAKEOFF CLIMB.

- TAKEOFF WEIGHT LIMIT .... 14,200 LB (6,441 KG)

NOTE:
THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. TAKEOFF WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED TAKEOFF WEIGHT, THE TAKEOFF WEIGHT FOR THE RUNWAY LENGTH AVAILABLE, AND OBSTACLE CLEARANCE CONSIDERATION.

Figure PER-10. Takeoff Weight Limit—FLAPS at 8°

UNCORRECTED TAKEOFF FIELD LENGTH—FT

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	2250	2350	2440	2540	2640	2730	2790	2910	3040	3190	3370	3580
	11,000	2320	2420	2520	2620	2710	2810	2870	3000	3150	3310	3510	3740
	12,000	2380	2490	2590	2690	2800	2890	2960	3100	3260	3440	3650	3950
	13,000	2460	2570	2670	2780	2880	2980	3050	3200	3370	3560	3790	4280
	14,000	2530	2640	2750	2860	2970	3070	3140	3300	3480	3690	4050	4600
	15,000	2600	2720	2830	2940	3060	3160	3240	3410	3700	4120	4630	5270
	15,500	2640	2760	2870	2990	3100	3210	3290	3570	3950	4410	4970	5710
	16,000	2790	2910	3020	3140	3260	3360	3470	3810	4220	4710	5290	6440
	17,000	3130	3280	3400	3540	3690	3790	3910	4310	4770	5320	6090	8750
2,000	10,000	2420	2530	2630	2730	2830	2940	3060	3210	3370	3550	3770	4040
	11,000	2490	2600	2710	2820	2920	3030	3160	3320	3490	3700	3940	4340
	12,000	2570	2680	2790	2900	3010	3120	3270	3440	3630	3850	4150	4730
	13,000	2650	2770	2880	2990	3100	3220	3380	3560	3760	4000	4500	5110
	14,000	2730	2850	2970	3090	3200	3320	3490	3680	3900	4280	4830	5540
	15,000	2810	2940	3060	3180	3300	3420	3600	3940	4380	4890	5560	7230
	15,500	2850	2990	3100	3230	3350	3480	3810	4210	4690	5250	5990	8650
	16,000	3030	3190	3310	3440	3550	3700	4060	4480	5000	5610	6760	11240
	17,000	3420	3590	3730	3870	4000	4180	4590	5070	5660	6460	9040	
4,000	10,000	2590	2710	2830	2940	3050	3250	3400	3560	3750	3970	4220	
	11,000	2670	2800	2910	3030	3140	3360	3520	3700	3900	4140	4480	
	12,000	2750	2880	3000	3120	3240	3470	3640	3840	4060	4330	4890	
	13,000	2830	2970	3090	3220	3340	3590	3770	3980	4220	4700	5250	
	14,000	2920	3060	3190	3320	3440	3710	3900	4130	4500	5020	5730	
	15,000	3000	3160	3290	3420	3550	3830	4190	4640	5160	5790	7060	
	15,500	3060	3220	3350	3490	3620	4070	4480	4960	5520	6230	8200	
	16,000	3260	3430	3560	3710	3840	4340	4770	5280	5900	6830	9890	
	17,000	3670	3870	4020	4180	4340	4920	5400	5990	6760	8880		
6,000	10,000	2810	2940	3060	3180	3340	3630	3790	3980	4200	4460	4800	
	11,000	2900	3030	3150	3280	3440	3750	3930	4140	4380	4690	5290	
	12,000	2990	3120	3250	3380	3550	3890	4080	4300	4580	5120	5790	
	13,000	3080	3210	3350	3480	3660	4020	4230	4480	4970	5490	6550	
	14,000	3170	3310	3460	3590	3780	4160	4390	4790	5300	5950	7350	
	15,000	3270	3420	3560	3700	3900	4520	4970	5480	6110	7230	10990	
	15,500	3350	3510	3660	3800	4060	4820	5320	5870	6600	8310		
	16,000	3560	3730	3890	4050	4320	5170	5650	6280	7190	9840		
	17,000	4020	4210	4390	4560	4870	5840	6430	7200	9290			
8,000	10,000	3070	3210	3340	3480	3730	4060	4270	4500	4780	5180		
	11,000	3160	3310	3440	3580	3850	4200	4430	4690	5070	5700		
	12,000	3260	3410	3550	3690	3980	4360	4610	4940	5460	6160		
	13,000	3360	3510	3660	3800	4110	4520	4820	5300	5920	7140		
	14,000	3460	3620	3770	3920	4250	4690	5160	5690	6420	8130		
	15,000	3570	3730	3890	4040	4480	5320	5890	6600	7690			
	15,500	3700	3870	4030	4200	4790	5700	6310	7130	9210			
	16,000	3930	4120	4290	4460	5100	6130	6790	7850	11260			
	17,000	4440	4650	4830	5020	5780	6930	7780	10360				
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	3330	3480	3630	3870	4190	4590	4820	5090	5420			
	11,000	3420	3580	3730	3990	4330	4760	5020	5350	5970			
	12,000	3520	3680	3840	4110	4480	4950	5280	5750	6410			
	13,000	3620	3790	3950	4240	4640	5160	5650	6220	7180			
	14,000	3730	3900	4070	4380	4800	5570	6080	6790	8000			
	15,000	3840	4020	4190	4550	5310	6360	7070	8140	11560			
	15,500	3980	4160	4340	4850	5690	6850	7610	9360				
	16,000	4230	4440	4640	5170	6110	7330	8330	11110				
	17,000	4770	4980	5230	5850	6900	8520	11020					
12,000	10,000	3680	3840	4090	4420	4800	5270	5540	5860				
	11,000	3760	3940	4200	4550	4950	5470	5820	6340				
	12,000	3860	4040	4310	4690	5130	5710	6240	6890				
	13,000	3970	4150	4440	4840	5310	6150	6750	7640	ABOVE ENGINE TEMP LIMITS			
	14,000	4080	4270	4570	5000	5580	6630	7390	8570				
	15,000	4200	4390	4710	5430	6390	7730	8950	12630				
	15,500	4310	4520	4990	5810	6860	8320	10360					
	16,000	4580	4820	5320	6240	7340	9290	12830					
	17,000	5150	5430	6020	7050	8490	12900						
14,000	10,000	4150	4420	4720	5100	5550	6100	6430	6970				
	11,000	4230	4510	4830	5240	5730	6320	6880	7600				
	12,000	4320	4630	4950	5400	5920	6810	7470	8450				
	13,000	4430	4750	5090	5570	6210	7340	8230	10090				
	14,000	4540	4880	5250	5750	6670	8050	9320					
	15,000	4670	5020	5580	6530	7740	9840						
	15,500	4790	5340	5980	7010	8300	11690						
	16,000	5100	5690	6440	7510	9020							
	17,000	5760	6480	7300	8690	11010							

Figures in shaded area are provided for interpolation only.

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED TAKEOFF FIELD LENGTH (from table)........ 4,700 FT (1,433 M)
2. REFERENCE LINE
3. HEADWIND........ 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT........ 1.3% UP
6. REFERENCE LINE
7. ANTI-SKID........ ON
8. REFERENCE LINE
9. ANTI-ICE........ OFF
10. REFERENCE LINE
11. ALTITUDE........ 1,000 FT
12. CORRECTED TAKEOFF FIELD LENGTH........ 5,170 FT (1,576 M)

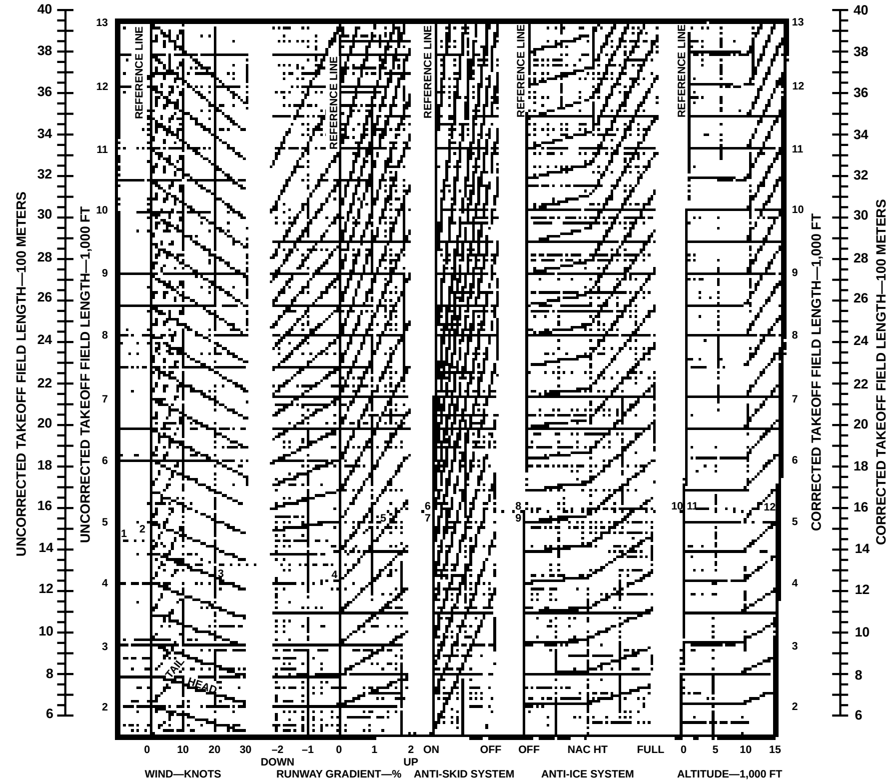

Figure PER-11. Takeoff Distance—Flaps at 8° and Rudder Boost OFF

UNCORRECTED TAKEOFF FIELD LENGTH—FT

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	1760	1840	1910	1980	2060	2130	2170	2270	2370	2500	2640	2800
	11,000	1820	1900	1970	2050	2120	2190	2240	2350	2460	2590	2750	2930
	12,000	1870	1960	2030	2110	2190	2270	2320	2430	2550	2700	2880	3200
	13,000	1980	2070	2140	2220	2290	2360	2420	2590	2780	3020	3330	3770
	14,000	2220	2320	2400	2480	2570	2650	2720	2910	3140	3450	3880	4380
	15,000	2470	2580	2670	2770	2870	2960	3040	3270	3570	3970	4460	5080
	15,500	2610	2730	2820	2920	3040	3130	3210	3460	3820	4250	4790	5610
	16,000	2750	2870	2970	3080	3190	3290	3380	3680	4080	4550	5130	6380
	17,000	3040	3180	3290	3420	3560	3670	3780	4170	4630	5180	6010	8590
2,000	10,000	1890	1970	2050	2130	2210	2290	2390	2500	2630	2780	2950	3160
	11,000	1950	2040	2120	2200	2280	2360	2470	2590	2730	2900	3090	3460
	12,000	2020	2110	2190	2280	2360	2440	2560	2690	2840	3020	3370	3830
	13,000	2140	2230	2310	2390	2470	2560	2730	2930	3180	3530	3960	4510
	14,000	2390	2490	2590	2690	2780	2870	3080	3320	3660	4090	4610	5360
	15,000	2670	2790	2890	3000	3100	3220	3460	3800	4210	4720	5360	7110
	15,500	2820	2960	3050	3160	3280	3400	3680	4060	4520	5070	5880	8460
	16,000	2970	3100	3220	3340	3450	3580	3930	4350	4840	5440	6650	10890
	17,000	3300	3460	3600	3750	3880	4050	4460	4950	5530	6370	8870	
4,000	10,000	2020	2120	2200	2290	2370	2530	2650	2780	2930	3100	3300	
	11,000	2080	2190	2270	2360	2450	2620	2750	2890	3050	3240	3590	
	12,000	2150	2260	2350	2440	2530	2720	2850	3010	3180	3510	3950	
	13,000	2270	2380	2470	2560	2640	2900	3110	3350	3700	4120	4650	
	14,000	2540	2670	2780	2870	2970	3280	3520	3880	4300	4810	5450	
	15,000	2840	2990	3100	3220	3330	3690	4040	4470	4980	5590	6940	
	15,500	3000	3150	3270	3400	3520	3940	4340	4800	5350	6020	9030	
	16,000	3170	3320	3450	3590	3720	4210	4630	5140	5740	6710	9660	
	17,000	3550	3740	3690	4060	4210	4790	5280	5860	6610	8690		
6,000	10,000	2190	2280	2380	2470	2590	2820	2950	3100	3270	3480	3840	
	11,000	2260	2360	2460	2550	2680	2930	3070	3230	3420	3760	4210	
	12,000	2340	2440	2540	2640	2770	3040	3190	3370	3700	4140	4660	
	13,000	2460	2560	2660	2760	2920	3320	3570	3940	4360	4870	5510	
	14,000	2760	2880	3010	3120	3300	3790	4150	4580	5110	5720	7210	
	15,000	3100	3220	3360	3480	3690	4370	4810	5310	5940	7100	10640	
	15,500	3260	3400	3540	3680	3930	4680	5160	5710	6380	8140		
	16,000	3440	3600	3760	3920	4200	5010	5530	6110	7050	9630		
	17,000	3890	4080	4270	4440	4760	5720	6290	7040	9110			
8,000	10,000	2390	2490	2590	2690	2890	3150	3310	3500	3720	4140		
	11,000	2460	2570	2680	2780	2990	3280	3460	3660	4040	4520		
	12,000	2540	2660	2770	2880	3100	3410	3600	3980	4450	5020		
	13,000	2680	2900	2900	3010	3330	3830	4220	4700	5260	5970		
	14,000	3020	3160	3280	3400	3770	4450	4930	5500	6200	7960		
	15,000	3380	3530	3660	3810	4330	5160	5730	6390	7790	12750		
	15,500	3570	3740	3890	4060	4640	5540	6140	6880	9020			
	16,000	3800	3990	4160	4340	4980	5950	6620	7690	10950			
	17,000	4320	4540	4720	4920	5670	6760	7630	10060				
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	2570	2690	2800	2990	3240	3550	3740	3950	4320			
	11,000	2650	2770	2890	3090	3360	3700	3900	4260	4730			
	12,000	2740	2860	2980	3200	3490	3880	4250	4700	5240			
	13,000	2860	2980	3110	3400	3830	4560	5010	5550	6210			
	14,000	3230	3370	3510	3840	4450	5360	5890	6520	7830			
	15,000	3610	3780	3940	4400	5140	6190	6830	7960	11170			
	15,500	3830	4020	4200	4720	5540	6640	7360	9030				
	16,000	4100	4300	4490	5040	5940	7180	8150	10770				
	17,000	4660	4880	5110	5750	6750	8320	10640					
12,000	10,000	2820	2950	3140	3390	3690	4060	4280	4650				
	11,000	2900	3030	3240	3510	3830	4230	4620	5080				
	12,000	2990	3120	3340	3630	3980	4620	5080	5620		ABOVE ENGINE TEMP LIMITS		
	13,000	3090	3230	3500	3930	4570	5480	6040	6670				
	14,000	3480	3630	3960	4550	5360	6410	7080	8370				
	15,000	3900	4090	4530	5260	6220	7470	8740	12120				
	15,500	4170	4380	4840	5670	6710	8060	10080					
	16,000	4450	4670	5180	6080	7140	9070	12230					
	17,000	5050	5310	5910	6900	8260	12310						
14,000	10,000	3150	3360	3590	3890	4240	4670	5040	5550				
	11,000	3230	3460	3700	4020	4400	5030	5500	6020				
	12,000	3320	3560	3810	4160	4650	5530	6080	6720				
	13,000	3420	3710	4060	4680	5510	6600	7230	8470				
	14,000	3840	4200	4700	5480	6500	7730	9080	12920				
	15,000	4350	4850	5440	6380	7490	9620						
	15,500	4650	5190	5820	6880	8070	11230						
	16,000	4960	5560	6270	7300	8740							
	17,000	5630	6340	7140	8470	10650							

Figures in shaded area are provided for interpolation only.

EFFECTIVITY:

ALL

EXAMPLE:

1. UNCORRECTED TAKEOFF FIELD LENGTH (from table)...................................... 4,700 FT (1,433 M)
2. REFERENCE LINE
3. HEADWIND.. 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT.. 1.3% UP
6. REFERENCE LINE
7. ANTI-SKID... ON
8. REFERENCE LINE
9. ANTI-ICE.. OFF
10. REFERENCE LINE
11. ALTITUDE.. 1,000 FT
12. CORRECTED TAKEOFF FIELD LENGTH.. 5,170 FT (1,576 M)

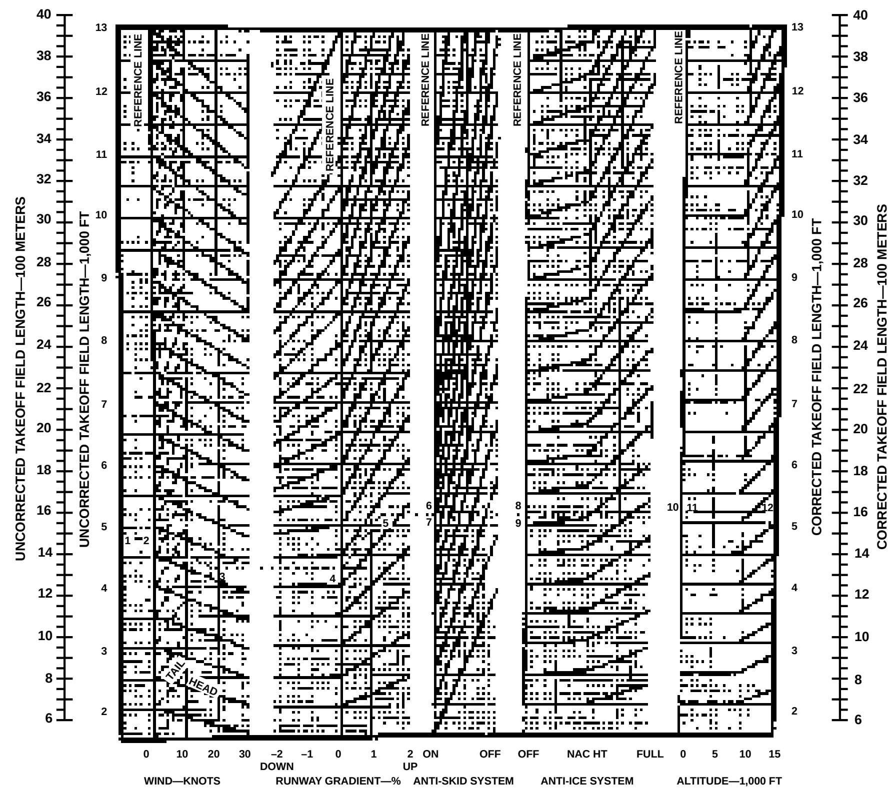

Figure PER-12. Takeoff Distance—Flaps at 8° and Rudder Boost ON

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LEARJET 31A PILOT TRAINING MANUAL

V_R/V_2 — KIAS			
ALTITUDE FEET	WEIGHT LB	KIAS	
		V_R	V_2
SEA LEVEL	10,000	114	119
	11,000	114	119
	12,000	114	119
	13,000	114	119
	14,000	115	119
	15,000	119	122
	15,500	120	124
	16,000	122	126
	16,500	124	127

NOTE:
APPLICABLE AT ALL ALTITUDES

EFFECTIVITY:
ALL AIRCRAFT

CRITICAL ENGINE FAILURE SPEED—V_1
ROTATION SPEED—V_R
TAKEOFF SAFETY SPEED—V_2

CAUTION:
V_R MUST NEVER BE LESS THAN V_1. IF V_R FROM FIGURE IS LESS THAN V_1 FROM FIGURE, INCREASE V_R AND V_2 BY THE DIFFERENCE BETWEEN V_R AND V_1.

EXAMPLE:
1. UNCORRECTED CRITICAL ENGINE FAILURE SPEED (from table).................................. 115 KIAS
2. REFERENCE LINE
3. HEADWIND.. 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT.. 1% UP
6. REFERENCE LINE
7. ANTI-ICE.. FULL
8. REFERENCE LINE
9. ANTI-SKID... ON
10. CORRECTED CRITICAL ENGINE FAILURE SPEED... 122 KIAS
11. COMPARE V_1 WITH V_R

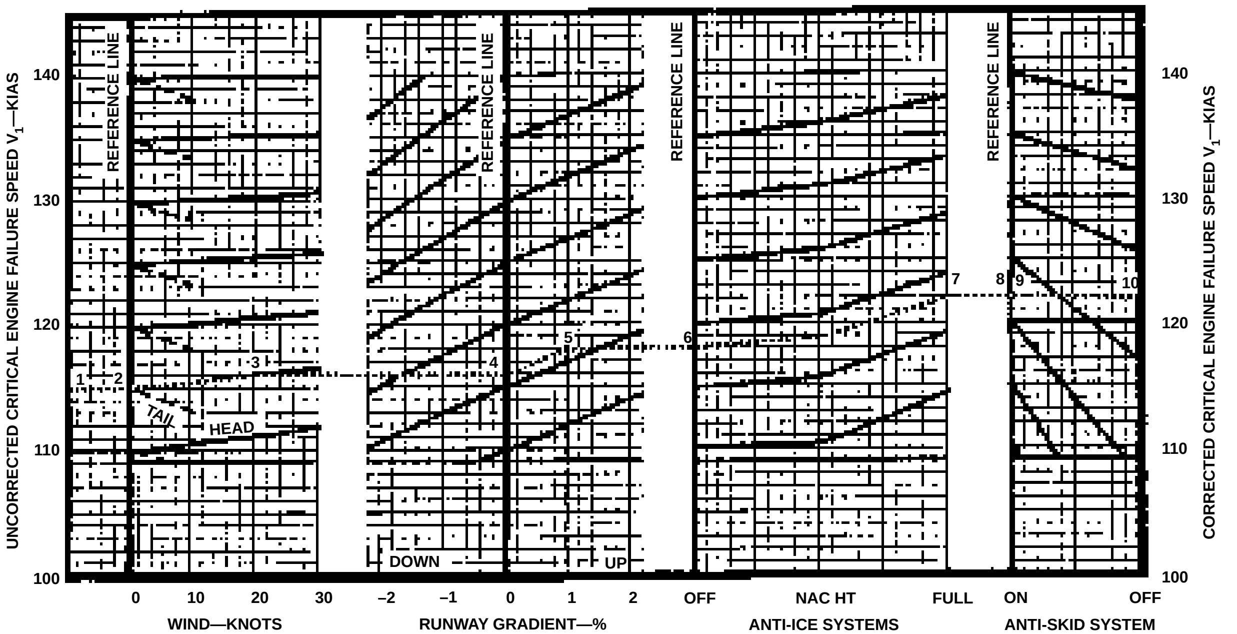

Figure PER-13. Takeoff Speeds—Flaps at 8° and Rudder Boost OFF (Sheet 1 of 2)

V_1—KIAS

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	109	109	109	109	109	109	109	109	109	109	109	109
	11,000	109	109	109	109	109	109	109	109	109	109	109	109
	12,000	109	109	109	109	109	109	109	109	109	109	109	110
	13,000	109	109	109	109	109	109	109	109	109	109	109	112
	14,000	109	109	109	109	109	109	109	109	109	109	110	113
	15,000	109	109	109	109	109	109	109	109	110	113	116	118
	15,500	109	109	109	109	109	109	109	110	112	115	118	121
	16,000	111	111	111	111	111	111	111	113	116	118	121	123
	17,000	116	116	116	116	116	116	116	118	121	123	126	127
2,000	10,000	109	109	109	109	109	109	109	109	109	109	109	109
	11,000	109	109	109	109	109	109	109	109	109	109	109	110
	12,000	109	109	109	109	109	109	109	109	109	109	110	112
	13,000	109	109	109	109	109	109	109	109	109	109	112	114
	14,000	109	109	109	109	109	109	109	109	109	111	113	116
	15,000	109	109	109	109	109	109	109	111	113	116	118	120
	15,500	109	109	109	109	109	109	111	113	116	118	121	122
	16,000	112	112	112	112	111	112	114	116	119	121	123	124
	17,000	116	116	116	116	116	117	119	121	124	126	127	
4,000	10,000	109	109	109	109	109	109	109	109	109	109	109	
	11,000	109	109	109	109	109	109	109	109	109	109	110	
	12,000	109	109	109	109	109	109	109	109	109	109	112	
	13,000	109	109	109	109	109	109	109	109	109	111	113	
	14,000	109	109	109	109	109	109	109	109	110	113	115	
	15,000	109	109	109	109	109	109	111	113	116	118	120	
	15,500	109	109	109	109	109	112	114	116	118	121	122	
	16,000	112	112	112	112	112	114	116	118	121	123	124	
	17,000	117	117	117	117	117	119	121	124	126	127		
6,000	10,000	109	109	109	109	109	109	109	109	109	109	109	
	11,000	109	109	109	109	109	109	109	109	109	109	112	
	12,000	109	109	109	109	109	109	109	109	109	112	114	
	13,000	109	109	109	109	109	109	109	109	111	113	114	
	14,000	109	109	109	109	109	109	109	111	113	115	117	
	15,000	109	109	109	109	109	111	114	116	118	120	121	
	15,500	109	109	109	109	110	114	116	118	121	122		
	16,000	112	112	112	112	113	117	119	121	124	124		
	17,000	117	117	117	117	118	122	124	127	127			
8,000	10,000	109	109	109	109	109	109	109	109	109	110		
	11,000	109	109	109	109	109	109	109	109	110	112		
	12,000	109	109	109	109	109	109	109	110	111	114		
	13,000	109	109	109	109	109	109	109	111	113	114		
	14,000	109	109	109	109	109	109	111	113	115	117		
	15,000	109	109	109	109	110	114	116	118	120			
	15,500	110	110	110	110	113	117	119	121	122			
	16,000	113	113	113	113	115	120	122	124	124			
	17,000	118	118	118	118	121	125	127	127				
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	109	109	109	109	109	109	109	109	109			
	11,000	109	109	109	109	109	109	109	109	112			
	12,000	109	109	109	109	109	109	110	111	113			
	13,000	109	109	109	109	109	109	111	113	114			
	14,000	109	109	109	109	109	111	113	115	117			
	15,000	109	109	109	109	113	116	119	121	121			
	15,500	110	110	110	112	115	119	122	122				
	16,000	113	113	113	115	119	122	124	124				
	17,000	118	118	118	120	123	127	128					
12,000	10,000	109	109	109	109	109	109	109	109				
	11,000	109	109	109	109	109	109	110	111				
	12,000	109	109	109	109	109	109	111	113				
	13,000	109	109	109	109	109	111	113	114				
	14,000	109	109	109	109	110	113	115	117				
	15,000	109	109	109	112	115	119	121	121				
	15,500	110	110	111	115	118	122	123					
	16,000	112	112	114	118	121	124	125					
	17,000	117	117	118	123	125	128						
14,000	10,000	109	109	109	109	109	109	109	110				
	11,000	109	109	109	109	109	109	111	113				
	12,000	109	109	109	109	109	111	113	114				
	13,000	109	109	109	109	110	113	114	114				
	14,000	109	109	109	109	112	116	117					
	15,000	109	109	111	114	118	121						
	15,500	110	112	114	117	121	123						
	16,000	112	114	117	120	123							
	17,000	118	120	122	124	128							

ABOVE ENGINE TEMP LIMITS

Figures in shaded area are provided for interpolation only.

Figure PER-13. Takeoff Speeds—Flaps at 8° and Rudder Boost OFF (Sheet 2 of 2)

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

V_R/V_2 — KIAS			
ALTITUDE FEET	WEIGHT LB	KIAS	
		V_R	V_2
SEA LEVEL	10,000	105	110
	11,000	105	110
	12,000	108	110
	13,000	112	115
	14,000	115	118
	15,000	119	122
	15,500	120	124
	16,000	122	126
	16,500	124	127

NOTE:
APPLICABLE AT ALL ALTITUDES

EFFECTIVITY:
ALL

CRITICAL ENGINE FAILURE SPEED—V_1
ROTATION SPEED—V_R
TAKEOFF SAFETY SPEED—V_2

CAUTION:
V_R MUST NEVER BE LESS THAN V_1. IF V_R FROM FIGURE IS LESS THAN V_1 FROM FIGURE, INCREASE V_R AND V_2 BY THE DIFFERENCE BETWEEN V_R AND V_1.

EXAMPLE:
1. UNCORRECTED CRITICAL ENGINE FAILURE SPEED.......... 115 KIAS
2. REFERENCE LINE
3. HEADWIND.......... 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT.......... 1% UP
6. REFERENCE LINE
7. ANTI-ICE.......... OFF
8. REFERENCE LINE
9. ANTI-SKID.......... ON
10. CORRECTED CRITICAL ENGINE FAILURE SPEED.......... 118 KIAS
11. COMPARE V_1 WITH V_R

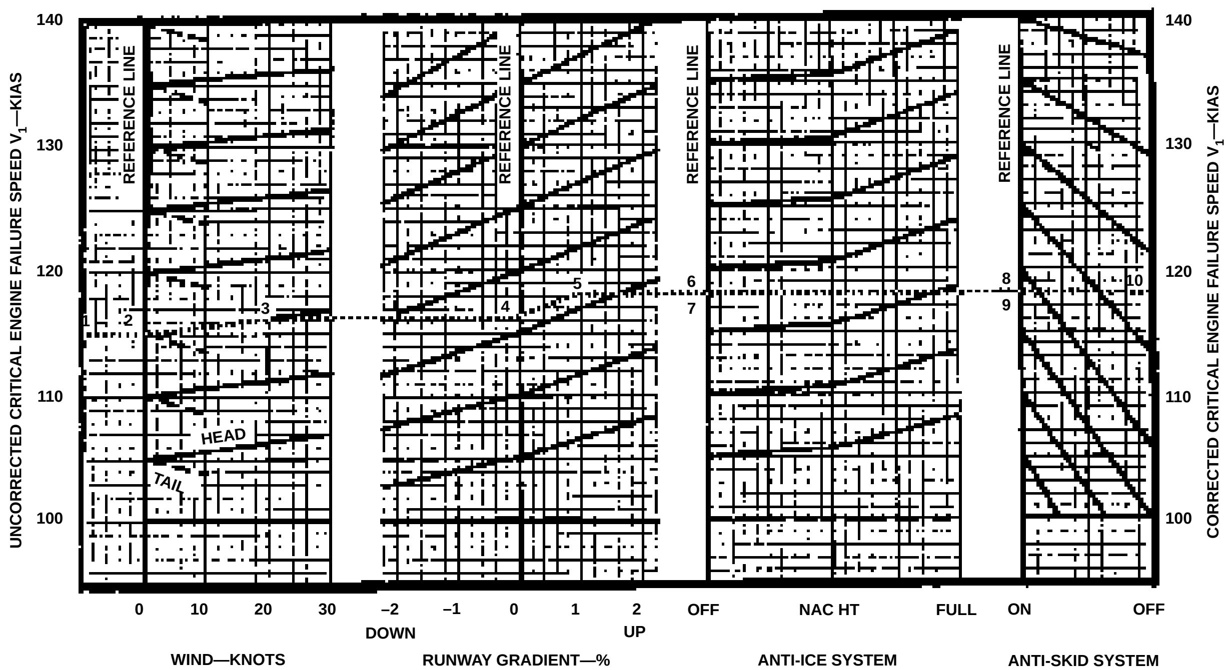

Figure PER-14. Takeoff Speeds—Flaps at 8° and Rudder Boost ON (Sheet 1 of 2)

FOR TRAINING PURPOSES ONLY

V_1—KIAS													
ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F											
		–40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	100	100	100	100	100	100	100	100	100	100	100	100
	11,000	100	100	100	100	100	100	100	100	100	100	100	100
	12,000	100	100	100	100	100	100	100	100	100	100	100	102
	13,000	101	101	101	101	101	101	101	102	102	103	105	108
	14,000	106	106	105	105	105	105	105	106	107	109	111	114
	15,000	110	109	109	109	109	109	109	110	112	114	116	119
	15,500	112	111	111	111	111	111	111	112	115	117	119	121
	16,000	114	114	114	113	113	113	113	115	117	119	121	123
	17,000	118	118	117	117	117	117	117	119	122	124	126	126
2,000	10,000	100	100	100	100	100	100	100	100	100	100	100	100
	11,000	100	100	100	100	100	100	100	100	100	100	100	102
	12,000	100	100	100	100	100	100	100	100	100	100	102	105
	13,000	101	101	101	101	101	101	102	102	104	105	108	110
	14,000	106	105	105	105	105	105	106	107	109	111	114	116
	15,000	110	110	110	109	109	109	110	112	114	116	119	119
	15,500	112	112	112	111	111	111	113	115	117	119	121	121
	16,000	114	114	114	113	113	113	115	117	119	121	123	123
	17,000	118	118	118	118	118	118	120	122	124	126	126	
4,000	10,000	100	100	100	100	100	100	100	100	100	100	100	
	11,000	100	100	100	100	100	100	100	100	100	100	102	
	12,000	100	100	100	100	100	100	100	100	100	102	104	
	13,000	101	101	101	101	101	102	102	104	105	108	110	
	14,000	105	105	105	105	105	106	107	109	111	113	115	
	15,000	110	110	109	109	109	111	112	114	116	118	119	
	15,500	112	112	111	111	111	113	115	117	119	121	121	
	16,000	114	114	114	113	113	115	117	119	121	123	123	
	17,000	118	118	118	118	118	120	122	124	126	126		
6,000	10,000	100	100	100	100	100	100	100	100	100	100	102	
	11,000	100	100	100	100	100	100	100	100	100	101	104	
	12,000	100	100	100	100	100	100	100	100	102	104	106	
	13,000	101	101	101	101	101	103	104	106	108	110	112	
	14,000	105	105	105	105	105	107	109	111	113	115	116	
	15,000	110	109	109	109	110	113	115	116	118	119	119	
	15,500	112	112	112	111	112	115	117	119	121	121		
	16,000	114	114	114	114	114	118	120	121	123	123		
	17,000	118	118	118	118	119	122	124	126	126			
8,000	10,000	100	100	100	100	100	100	100	100	100	102		
	11,000	100	100	100	100	100	100	100	100	102	104		
	12,000	100	100	100	100	100	100	100	102	104	106		
	13,000	101	101	101	101	102	104	106	108	110	112		
	14,000	105	106	105	105	106	110	111	114	116	116		
	15,000	110	110	110	109	112	115	117	119	119	119		
	15,500	112	112	112	112	114	117	119	121	121			
	16,000	114	114	114	114	116	120	122	123	123			
	17,000	119	119	119	119	121	124	126	126				
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	100	100	100	100	100	100	100	100	102			
	11,000	100	100	100	100	100	100	100	102	104			
	12,000	100	100	100	100	100	100	102	104	106			
	13,000	101	101	100	101	103	106	108	110	112			
	14,000	105	105	105	106	109	112	114	116	116			
	15,000	109	109	109	111	114	117	119	119	119			
	15,500	112	112	112	113	116	119	121	121				
	16,000	114	114	114	116	119	122	123	123				
	17,000	119	119	119	120	123	126	126					
12,000	10,000	100	100	100	100	100	100	100	101				
	11,000	100	100	100	100	100	100	102	103				
	12,000	100	100	100	100	100	102	104	106				
	13,000	100	100	100	102	105	108	110	112				
	14,000	105	105	106	108	111	114	115	116		ABOVE ENGINE TEMP LIMITS		
	15,000	109	109	110	113	116	119	119	119				
	15,500	111	111	113	115	118	121	121					
	16,000	114	114	115	118	120	123	123					
	17,000	118	118	120	122	125	126						
14,000	10,000	100	100	100	100	100	100	101	103				
	11,000	100	100	100	100	100	102	103	105				
	12,000	100	100	100	100	101	104	105	107				
	13,000	100	101	102	104	107	110	111	112				
	14,000	105	105	107	110	113	115	116	116				
	15,000	109	110	112	115	117	120						
	15,500	111	113	114	117	120	121						
	16,000	114	115	117	119	122							
	17,000	118	120	121	124	126							

Figures in shaded area are provided for interpolation only.

Figure PER-14. Takeoff Speeds—Flaps at 8° and Rudder Boost ON (Sheet 2 of 2)

UNCORRECTED FIRST SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	17.1	16.9	17.0	17.1	17.2	17.4	17.2	15.2	13.3	11.4	9.5	7.7
	11,000	14.7	14.6	14.6	14.7	14.8	15.0	14.8	13.0	11.3	9.6	7.9	6.2
	12,000	12.6	12.6	12.6	12.7	12.7	13.0	12.7	11.1	9.6	8.0	6.5	4.9
	13,000	10.9	10.8	10.9	10.9	11.0	11.2	11.0	9.5	8.1	6.6	5.2	3.8
	14,000	9.3	9.2	9.3	9.4	9.4	9.6	9.4	8.1	6.7	5.4	4.1	2.8
	15,000	7.8	7.8	7.8	7.9	7.9	8.1	7.9	6.7	5.5	4.2	3.0	1.8
	15,500	7.2	7.1	7.1	7.2	7.2	7.4	7.3	6.1	4.9	3.7	2.5	1.3
	16,000	6.5	6.5	6.5	6.6	6.6	6.8	6.6	5.5	4.3	3.2	2.0	0.9
	17,000	5.4	5.3	5.4	5.4	5.5	5.6	5.5	4.4	3.3	2.2	1.2	0.1
2,000	10,000	16.5	16.3	16.4	16.5	16.7	16.6	14.8	13.0	11.1	9.4	7.6	5.8
	11,000	14.2	14.0	14.1	14.2	14.4	14.3	12.6	11.0	9.3	7.7	6.1	4.5
	12,000	12.2	12.1	12.1	12.2	12.4	12.3	10.8	9.3	7.8	6.3	4.8	3.4
	13,000	10.5	10.3	10.4	10.5	10.6	10.6	9.2	7.8	6.4	5.1	3.7	2.4
	14,000	8.9	8.8	8.9	9.0	9.1	9.0	7.8	6.5	5.2	4.0	2.7	1.5
	15,000	7.5	7.4	7.4	7.5	7.7	7.6	6.4	5.2	4.1	2.9	1.7	0.6
	15,500	6.8	6.7	6.8	6.8	7.0	6.9	5.8	4.6	3.5	2.4	1.3	0.2
	16,000	6.2	6.1	6.2	6.2	6.4	6.3	5.2	4.1	3.0	1.9	0.8	–0.2
	17,000	5.1	5.0	5.1	5.1	5.2	5.2	4.1	3.1	2.1	1.1	0.1	–0.9
4,000	10,000	16.2	16.1	16.2	16.2	16.4	14.4	12.7	11.0	9.4	7.7	6.1	
	11,000	13.9	13.8	13.9	13.9	14.1	12.3	10.8	9.3	7.8	6.3	4.8	
	12,000	12.0	11.9	11.9	12.0	12.1	10.5	9.1	7.7	6.3	5.0	3.6	
	13,000	10.3	10.2	10.2	10.3	10.4	8.9	7.6	6.4	5.1	3.8	2.6	
	14,000	8.8	8.7	8.7	8.8	8.9	7.5	6.3	5.2	4.0	2.8	1.7	
	15,000	7.3	7.3	7.3	7.3	7.4	6.2	5.1	4.0	2.9	1.8	0.8	
	15,500	6.7	6.6	6.6	6.7	6.8	5.5	4.5	3.5	2.4	1.4	0.3	
	16,000	6.1	6.0	6.0	6.1	6.2	5.0	4.0	3.0	2.0	1.0	–0.1	
	17,000	5.0	4.9	4.9	5.0	5.1	4.0	3.0	2.1	1.1	0.2	–0.4	
6,000	10,000	15.8	15.8	15.7	15.9	15.2	12.1	10.6	9.1	7.6	6.1	4.6	
	11,000	13.6	13.5	13.5	13.6	13.0	10.2	8.9	7.5	6.2	4.8	3.5	
	12,000	11.7	11.6	11.5	11.7	11.1	8.6	7.4	6.1	4.9	3.7	2.4	
	13,000	10.0	9.9	9.9	10.0	9.5	7.2	6.0	4.9	3.8	2.6	1.5	
	14,000	8.5	8.5	8.4	8.5	8.1	5.9	4.9	3.8	2.7	1.7	0.6	
	15,000	7.1	7.1	7.0	7.1	6.7	4.7	3.7	2.7	1.8	0.8	–0.2	
	15,500	6.4	6.4	6.4	6.5	6.1	4.2	3.2	2.3	1.3	0.4	–0.8	
	16,000	5.8	5.8	5.8	5.9	5.5	3.6	2.7	1.8	0.9	0.0	–0.9	
	17,000	4.7	4.7	4.7	4.8	4.4	2.7	1.8	1.0	0.1	–0.7		
8,000	10,000	15.2	15.1	15.1	15.2	13.0	10.3	8.8	7.3	5.8	4.3		
	11,000	13.0	12.9	13.0	13.0	11.1	8.6	7.3	5.9	4.5	3.2		
	12,000	11.1	11.0	11.1	11.2	9.4	7.1	5.9	4.6	3.4	2.1		
	13,000	9.5	9.4	9.5	9.5	7.9	5.8	4.7	3.5	2.4	1.2		
	14,000	8.0	8.0	8.0	8.1	6.6	4.7	3.6	2.5	1.5	0.4		
	15,000	6.7	6.6	6.6	6.7	5.3	3.6	2.6	1.6	0.6	–0.4		
	15,500	6.1	6.0	6.0	6.1	4.7	3.0	2.1	1.1	0.2	–0.8		
	16,000	5.5	5.4	5.4	5.5	4.2	2.6	1.6	0.7	–0.2			
	17,000	4.4	4.4	4.4	4.4	3.2	1.7	0.8	0.0	–0.9			
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	15.2	15.1	15.1	13.5	11.1	8.5	7.2	5.9	4.6			
	11,000	13.0	12.9	12.9	11.5	9.3	6.9	5.8	4.6	3.4			
	12,000	11.1	11.1	11.0	9.7	7.7	5.6	4.5	3.5	2.4			
	13,000	9.5	9.4	9.4	8.2	6.4	4.4	3.4	2.5	1.5			
	14,000	8.0	8.0	8.0	6.9	5.2	3.4	2.4	1.5	0.6			
	15,000	6.7	6.6	6.6	5.6	4.0	2.3	1.5	0.7	–0.2			
	15,500	6.0	6.0	6.0	5.0	3.5	1.9	1.1	0.2	–0.8			
	16,000	5.4	5.4	5.4	4.5	3.0	1.4	0.6	–0.1				
	17,000	4.4	4.3	4.3	3.5	2.1	0.6	-0.1	–0.8				
12,000	10,000	15.2	15.1	13.8	11.4	9.1	6.8	5.6	4.4				
	11,000	13.0	12.9	11.7	9.6	7.5	5.4	4.3	3.3				
	12,000	11.1	11.0	10.0	8.0	6.1	4.2	3.2	2.3				
	13,000	9.5	9.4	8.4	6.7	4.9	3.1	2.2	1.3		ABOVE ENGINE TEMP LIMITS		
	14,000	8.0	8.0	7.1	5.4	3.8	2.2	1.3	0.5				
	15,000	6.7	6.6	5.8	4.3	2.8	1.2	0.5	–0.3				
	15,500	6.0	6.0	5.2	3.7	2.3	0.8	0.1	–0.9				
	16,000	5.5	5.4	4.6	3.2	1.8	0.4	–0.3					
	17,000	4.4	4.3	3.6	2.3	1.0	-0.3	–1.0					
14,000	10,000	14.7	13.2	11.6	9.5	7.4	5.3	4.2	3.2				
	11,000	12.5	11.2	9.8	7.9	5.9	4.1	3.1	2.1				
	12,000	10.7	9.5	8.2	6.4	4.7	3.0	2.1	1.2				
	13,000	9.1	8.0	6.8	5.2	3.6	2.0	1.3	0.4				
	14,000	7.7	6.7	5.6	4.1	2.6	1.1	0.4	–0.4				
	15,000	6.4	5.4	4.4	3.0	1.6	0.3	–0.4					
	15,500	5.8	4.8	3.9	2.5	1.2	–0.1						
	16,000	5.2	4.3	3.4	2.1	0.8	–0.5						
	17,000	4.2	3.3	2.4	1.2	0.0	–1.2						

Figures in shaded area are provided for interpolation only.

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED NET CLIMB GRADIENT (from table).......... 5 %
2. REFERENCE LINE
3. HEADWIND.......... 20 KT
4. REFERENCE LINE
5. ANTI-ICE SYSTEMS.......... FULL
6. CORRECTED NET CLIMB GRADIENT.......... 3.16%

CONDITIONS:
- SINGLE ENGINE
- THRUST.......... TAKEOFF
- GEAR.......... DOWN
- FLAPS.......... 8°
- SPEED.......... V_{LOF}

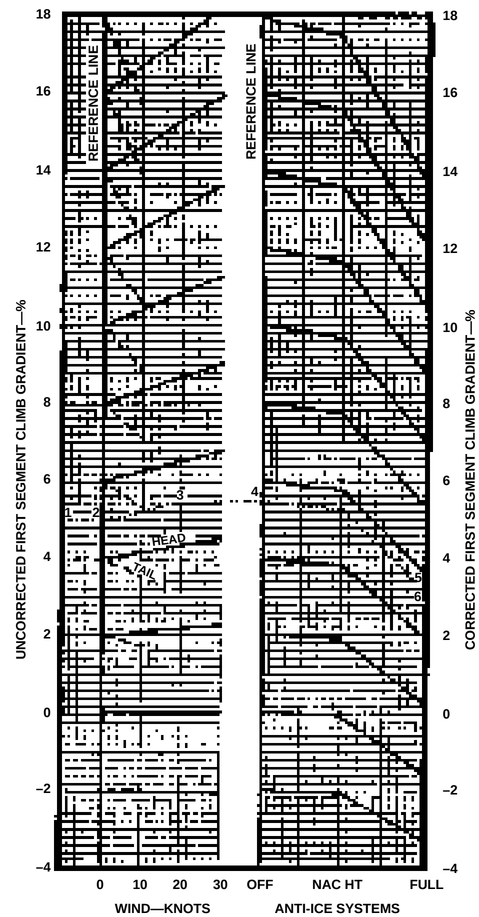

Figure PER-15. First Segment Climb Gradient—Flaps at 8°

UNCORRECTED SECOND SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	20.1	20.0	20.1	20.1	20.3	20.3	8.8	16.9	15.0	13.2	11.4	9.5
	11,000	17.4	17.3	17.4	17.4	17.6	17.6	16.2	14.6	12.9	11.2	9.5	7.9
	12,000	15.1	15.0	15.1	15.1	15.3	15.3	14.1	12.5	11.0	9.5	8.0	6.5
	13,000	13.2	13.1	13.1	13.2	13.3	13.3	12.2	10.8	9.4	8.0	6.6	5.2
	14,000	11.4	11.3	11.4	11.4	11.6	11.6	10.5	9.2	7.9	6.7	5.4	4.1
	15,000	9.9	9.8	9.9	9.9	10.0	10.0	9.1	7.9	6.7	5.5	4.3	3.1
	15,500	9.2	9.1	9.2	9.2	9.4	9.3	8.4	7.3	6.1	5.0	3.8	2.7
	16,000	8.6	8.5	8.6	8.6	8.7	8.7	7.8	6.7	5.6	4.5	3.4	2.3
	17,000	7.5	7.4	7.4	7.5	7.6	7.5	6.7	5.7	4.6	3.6	2.6	1.5
2,000	10,000	19.8	19.6	19.7	19.8	20.0	18.4	16.6	14.9	13.1	11.4	9.7	8.1
	11,000	17.1	17.0	17.1	17.1	17.3	15.9	14.3	12.7	11.2	9.6	8.1	6.6
	12,000	14.9	14.7	14.8	14.9	15.0	13.7	12.3	10.9	9.4	8.0	6.6	5.2
	13,000	12.9	12.8	12.9	12.9	13.0	11.9	10.6	9.3	8.0	6.7	5.4	4.1
	14,000	11.2	11.1	11.2	11.2	11.3	10.2	9.0	7.8	6.6	5.4	4.2	3.1
	15,000	9.7	9.6	9.7	9.7	9.8	8.8	7.7	6.6	5.5	4.4	3.3	2.1
	15,500	9.0	8.9	9.0	9.0	9.1	8.2	7.1	6.0	4.9	3.9	2.8	1.7
	16,000	8.4	8.3	8.4	8.4	8.5	7.6	6.5	5.5	4.5	3.4	2.4	1.4
	17,000	7.3	7.2	7.2	7.3	7.4	6.5	5.5	4.6	3.6	2.6	1.7	0.7
4,000	10,000	19.4	19.3	19.3	19.4	18.9	16.1	14.5	12.9	11.3	9.8	8.3	
	11,000	16.8	16.7	16.7	16.8	16.4	13.8	12.4	10.9	9.5	8.1	6.7	
	12,000	14.6	14.5	14.4	14.6	14.2	11.8	10.5	9.3	8.0	6.7	5.4	
	13,000	12.6	12.6	12.5	12.6	12.3	10.2	9.0	7.8	6.6	5.4	4.3	
	14,000	10.9	10.9	10.9	11.0	10.6	8.7	7.6	6.5	5.4	4.3	3.2	
	15,000	9.5	9.4	9.4	9.5	9.2	7.4	6.3	5.3	4.3	3.3	2.3	
	15,500	8.8	8.8	8.7	8.8	8.5	6.8	5.8	4.8	3.8	2.9	1.9	
	16,000	8.2	8.1	8.1	8.2	7.9	6.2	5.3	4.3	3.4	2.5	1.5	
	17,000	7.1	7.0	7.0	7.1	6.9	5.3	4.4	3.5	2.6	1.7	0.8	
6,000	10,000	18.8	18.7	18.7	18.8	17.0	14.1	12.6	11.0	9.5	8.0	6.5	
	11,000	16.2	16.1	16.2	16.3	14.6	12.0	10.6	9.3	7.9	6.5	5.2	
	12,000	14.1	14.0	14.0	14.1	12.6	10.3	9.0	7.7	6.5	5.2	4.0	
	13,000	12.2	12.1	12.1	12.2	10.8	8.7	7.5	6.4	5.2	4.1	2.9	
	14,000	10.5	10.5	10.5	10.5	9.3	7.3	6.2	5.2	4.1	3.0	2.0	
	15,000	9.1	9.0	9.1	9.1	7.9	6.1	5.1	4.1	3.1	2.1	1.2	
	15,500	8.5	8.4	8.4	8.5	7.3	5.6	4.6	3.7	2.7	1.7	0.8	
	16,000	7.9	7.8	7.8	7.9	6.8	5.1	4.2	3.2	2.3	1.4	0.5	
	17,000	6.8	6.7	6.7	6.8	5.8	4.2	3.3	2.4	1.6	0.7	-0.2	
8,000	10,000	18.6	18.5	18.5	17.3	14.9	12.2	10.9	9.5	8.1	6.8		
	11,000	16.1	16.0	16.0	14.9	12.7	10.3	9.1	7.9	6.6	5.4		
	12,000	13.9	13.9	13.8	12.9	10.9	8.7	7.6	6.5	5.3	4.2		
	13,000	12.0	12.0	12.0	11.1	9.3	7.3	6.2	5.2	4.2	3.1		
	14,000	10.4	10.4	10.3	9.5	7.9	6.0	5.0	4.1	3.1	2.1		
	15,000	9.0	8.9	8.9	8.2	6.6	4.9	4.0	3.1	2.2	1.3		
	15,500	8.3	8.3	8.3	7.6	6.1	4.4	3.5	2.7	1.8	1.0		
	16,000	7.7	7.7	7.7	7.0	5.5	3.9	3.1	2.3	1.5	0.6		
	17,000	6.6	6.6	6.6	6.0	4.6	3.1	2.3	1.6	0.8	0.0		
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	18.6	18.5	17.5	15.3	12.9	10.5	9.2	8.0	6.7			
	11,000	16.0	16.0	15.0	13.1	10.9	8.7	7.6	6.5	5.4			
	12,000	13.9	13.8	13.0	11.2	9.3	7.2	6.2	5.2	4.2			
	13,000	12.0	12.0	11.2	9.6	7.8	5.9	5.0	4.1	3.1			
	14,000	10.4	10.3	9.6	8.1	6.5	4.8	3.9	3.1	2.1			
	15,000	9.0	8.9	8.3	6.9	5.3	3.7	3.0	2.2	1.3			
	15,500	8.3	8.3	7.7	6.3	4.8	3.3	2.5	1.8	0.9			
	16,000	7.7	7.7	7.1	5.8	4.4	2.9	2.1	1.4	0.6			
	17,000	6.6	6.6	6.0	4.8	3.5	2.1	1.4	0.7	0.0			
12,000	10,000	18.2	17.0	15.5	13.3	11.1	8.9	7.8	6.7	ABOVE ENGINE TEMP LIMITS			
	11,000	15.7	14.6	13.3	11.3	9.3	7.3	6.3	5.3				
	12,000	13.6	12.6	11.4	9.6	7.8	6.0	5.0	4.1				
	13,000	11.8	10.9	9.7	8.1	6.4	4.8	3.9	3.1				
	14,000	10.1	9.3	8.3	6.7	5.2	3.7	2.9	2.1				
	15,000	8.7	8.0	7.0	5.6	4.2	2.7	2.0	1.3				
	15,500	8.1	7.4	6.4	5.1	3.7	2.3	1.6	0.9				
	16,000	7.5	6.8	5.9	4.6	3.3	1.9	1.3	0.6				
	17,000	6.5	5.8	5.0	3.7	2.5	1.2	0.6	0.0				
14,000	10,000	17.8	15.2	13.3	11.3	9.3	7.4	6.4	5.4				
	11,000	15.3	13.0	11.3	9.5	7.7	6.0	5.1	4.1				
	12,000	13.2	11.1	9.6	8.0	6.3	4.7	3.9	3.1				
	13,000	11.4	9.5	8.1	6.6	5.1	3.6	2.9	2.1				
	14,000	9.8	8.1	6.8	5.4	4.0	2.6	1.9	1.2				
	15,000	8.5	6.8	5.8	4.3	3.0	1.8	1.1	0.4				
	15,500	7.9	6.3	5.1	3.9	2.6	1.4	0.7	0.1				
	16,000	7.3	5.8	4.6	3.4	2.2	1.0	0.4	–0.2				
	17,000	6.3	4.9	3.8	2.6	1.5	0.4	-0.2	–0.8				

Figures in shaded area are provided for interpolation only.

EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE:

1. UNCORRECTED NET CLIMB GRADIENT (from table)........11 %
2. REFERENCE LINE
3. TAILWIND........ 5 KT
4. REFERENCE LINE
5. NACELLE HEAT........ ON
6. CORRECTED NET CLIMB GRADIENT........ 9.95%

CONDITIONS:

- SINGLE ENGINE
- THRUST........ TAKEOFF
- GEAR........ UP
- FLAPS........ 8°
- SPEED........ V_2

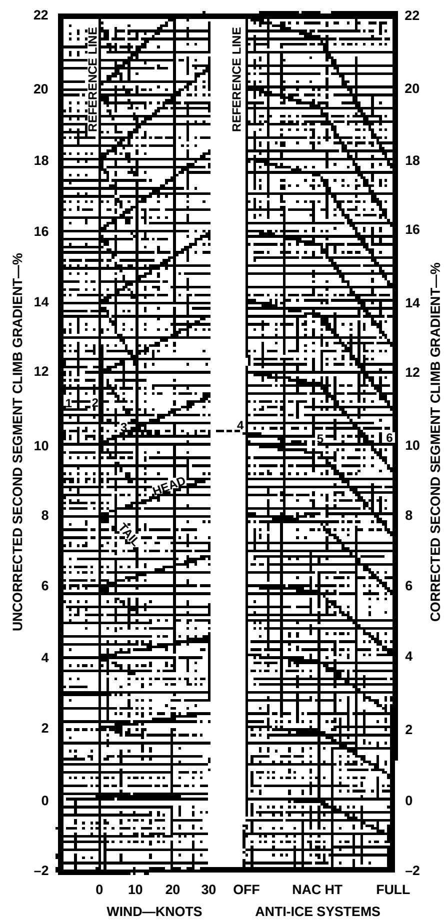

Figure PER-16. Second Segment Climb Gradient—Flaps at 8°

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. TEMPERATURE.. 90°F
2. ALTITUDE.. 6,000 FT
3. TAKEOFF WEIGHT LIMIT... 15,500 LB

NOTE:
THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. TAKEOFF WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED TAKEOFF WEIGHT, THE TAKEOFF WEIGHT FOR THE RUNWAY LENGTH AVAILABLE, AND OBSTACLE CLEARANCE CONSIDERATIONS.

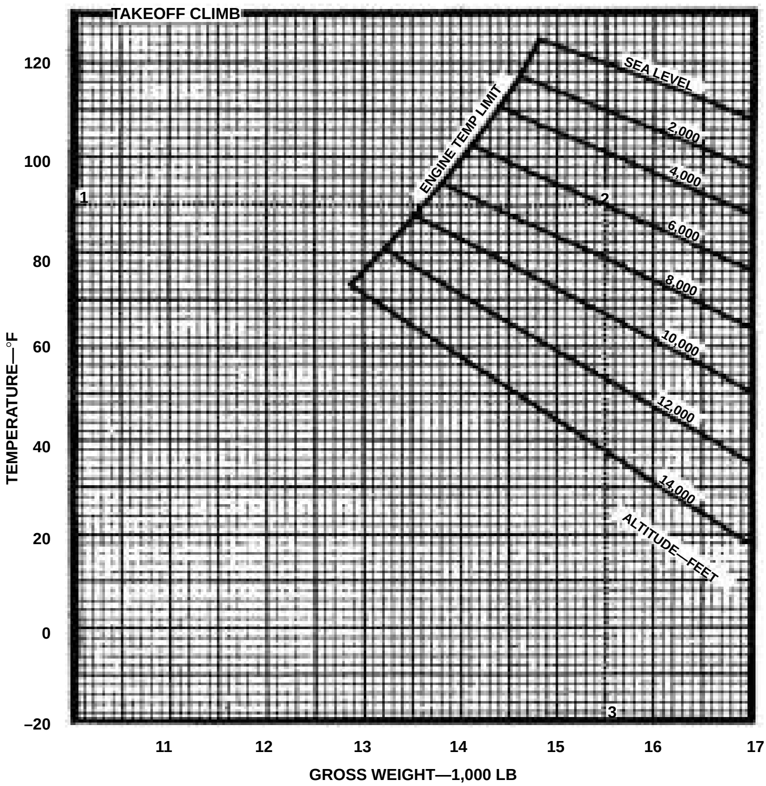

Figure PER-17. Takeoff Weight Limit—Flaps at 20° and Anti-Ice OFF

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. TEMPERATURE.. 24° F
2. ALTITUDE (NACELLE HEAT ON)................................ 14,000 FT
3. TAKEOFF WEIGHT LIMIT.. 16,300 LB

NOTE:
THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. TAKEOFF WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED TAKEOFF WEIGHT, THE TAKEOFF WEIGHT FOR THE RUNWAY LENGTH AVAILABLE, AND OBSTACLE CLEARANCE CONSIDERATIONS.

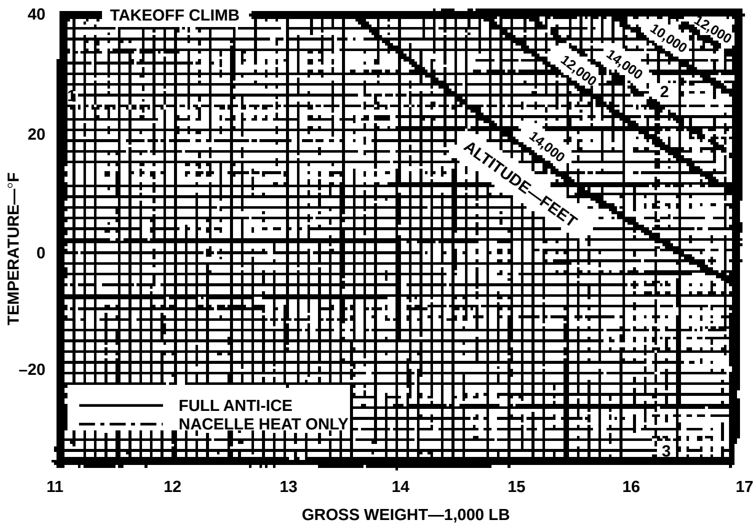

Figure PER-18. Takeoff Weight Limit—Flaps at 20° and Anti-Ice ON

UNCORRECTED TAKEOFF FIELD LENGTH—FT

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	2360	2460	2560	2660	2760	2860	2920	3050	3190	3340	3530	3750
	11,000	2410	2520	2620	2720	2830	2930	2990	3130	3280	3450	3650	3890
	12,000	2470	2580	2690	2790	2900	3000	3070	3210	3370	3560	3780	4070
	13,000	2540	2650	2760	2870	2980	3080	3150	3300	3480	3680	3920	4430
	14,000	2600	2720	2830	2940	3060	3160	3240	3400	3590	3800	4190	4820
	15,000	2670	2800	2910	3030	3140	3250	3330	3500	3700	3990	4530	6380
	15,500	2710	2840	2950	3070	3180	3290	3370	3550	3770	4260	4900	8610
	16,000	2750	2870	2990	3110	3230	3340	3420	3610	4020	4580	5650	
	17,000	3000	3140	3260	3390	3520	3630	3750	4150	4620	5290	9570	
2,000	10,000	2530	2650	2760	2870	2970	3080	3210	3360	3530	3720	3940	4420
	11,000	2590	2710	2820	2930	3040	3150	3300	3460	3640	3850	4100	4490
	12,000	2660	2780	2900	3010	3120	3240	3390	3560	3760	3980	4290	4930
	13,000	2730	2860	2970	3090	3210	3320	3490	3670	3880	4130	4640	5790
	14,000	2810	2940	3060	3180	3290	3420	3590	3790	4020	4410	5070	8750
	15,000	2890	3020	3140	3270	3390	3510	3700	3910	4230	4790	6590	
	15,500	2930	3060	3190	3310	3430	3560	3750	4050	4550	5170	8800	
	16,000	2970	3100	3230	3360	3480	3610	3890	4320	4870	5960		
	17,000	3280	3450	3580	3710	3830	4000	4420	4910	5700	10330		
4,000	10,000	2710	2850	2960	3080	3200	3410	3560	3730	3930	4150	4410	
	11,000	2780	2910	3030	3150	3270	3500	3670	3850	4060	4300	4610	
	12,000	2850	2990	3110	3240	3360	3600	3780	398-	4210	4470	5040	
	13,000	2920	3070	3200	3320	3450	3710	3900	4110	4360	4810	5580	
	14,000	3000	3150	3280	3420	3540	3820	4020	4250	4630	5250	7570	
	15,000	3090	3240	3380	3510	3640	3930	4150	4470	5050	6420		
	15,500	3130	3290	3420	3560	3700	3990	4330	4810	5460	8070		
	16,000	3170	3340	3470	3610	3750	4160	4620	5150	6160			
	17,000	3520	3710	3860	4010	4150	4740	5220	6040	10090			
6,000	10,000	2950	3080	3210	3340	3500	3800	3980	4170	4400	4660	5010	
	11,000	3020	3160	3290	3420	3590	3910	4100	4310	4560	4850	5520	
	12,000	3100	3240	3370	3510	3690	4030	4230	4460	4730	5440	6350	
	13,000	3180	3320	3470	3600	3790	4160	4370	4620	5080	5780	9420	
	14,000	3270	3410	3560	3700	3900	4290	4520	4920	5530	7510		
	15,000	3360	3510	3660	3810	4010	4430	4800	5400	6800			
	15,500	3410	3560	3710	3860	4070	4690	5170	5580	8550			
	16,000	3450	3610	3770	3920	4140	5030	5490	6660				
	17,000	3870	4050	4220	4380	4710	5640	6660	11870				
8,000	10,000	3230	3370	3510	3650	3920	4260	4470	4720	5010	5420		
	11,000	3300	3450	3590	3740	4020	4380	4620	4890	5210	5970		
	12,000	3380	3540	3680	3830	4130	4520	4780	5120	5690	7090		
	13,000	3470	3630	3780	3930	4250	4670	4950	5470	6280	12060		
	14,000	3570	3730	3890	4040	4380	4830	5290	5960	8640			
	15,000	3670	3840	4000	4160	4510	5160	5820	7610				
	15,500	3720	3890	4050	4220	4630	5570	6330	10170				
	16,000	3770	3950	4110	4280	4970	5980	7330					
	17,000	4290	4500	4670	4860	5540	7280	16100					
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	3510	3660	3820	4080	4410	4820	5060	5340	5670			
	11,000	3580	3740	3900	4170	4520	4970	5230	5540	6180			
	12,000	3660	3830	3990	4280	4650	5140	5470	5980	6840			
	13,000	3750	3920	4090	4390	4800	5320	5830	6550	9730			
	14,000	3850	4030	4200	4520	4950	5700	6350	8470				
	15,000	3960	4140	4320	4650	5130	6300	8140					
	15,500	4010	4190	4380	4720	5530	6900	11090					
	16,000	4070	4250	4440	5030	5930	8320						
	17,000	4610	4820	5040	5600	6720							
12,000	10,000	3890	4060	4320	4660	5060	5550	5840	6160				
	11,000	3950	4130	4400	4760	5190	5720	6030	6660				
	12,000	4020	4210	4490	4880	5340	5910	6510	7350				
	13,000	4120	4310	4600	5020	5500	6380	7140	10660		ABOVE ENGINE TEMP LIMITS		
	14,000	4220	4410	4720	5160	5710	6970	9770					
	15,000	4320	4520	4850	5320	6270	9670						
	15,500	4380	4580	4920	5650	6770							
	16,000	4440	4640	5170	6030	7260							
	17,000	4990	5240	5850	6850	11090							
14,000	10,000	4410	4700	5010	5410	5880	6450	6800	7450				
	11,000	4450	4750	5080	5510	6010	6720	7260	8320				
	12,000	4520	4830	5180	5630	6180	7120	8020					
	13,000	4610	4940	5300	5780	6390	7830	12440					
	14,000	4710	5050	5430	5950	6930	11760						
	15,000	4820	5180	5580	6390	7990							
	15,500	4880	5250	5820	6900	9830							
	16,000	4940	5570	6230	7420								
	17,000	5590	6210	7050	9580								

Figures in shaded area are provided for interpolation only.

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. UNCORRECTED TAKEOFF FIELD LENGTH (from table)........ 6,500 FT (1,433 M)
2. REFERENCE LINE
3. HEADWIND........ 6 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT........ –1% DN
6. REFERENCE LINE
7. ANTI-SKID........ ON
8. REFERENCE LINE
9. ANTI-ICE........ FULL
10. REFERENCE LINE
11. ALTITUDE........ 5,000 FT
12. CORRECTED TAKEOFF FIELD LENGTH........ 11,500 FT (3,505 M)

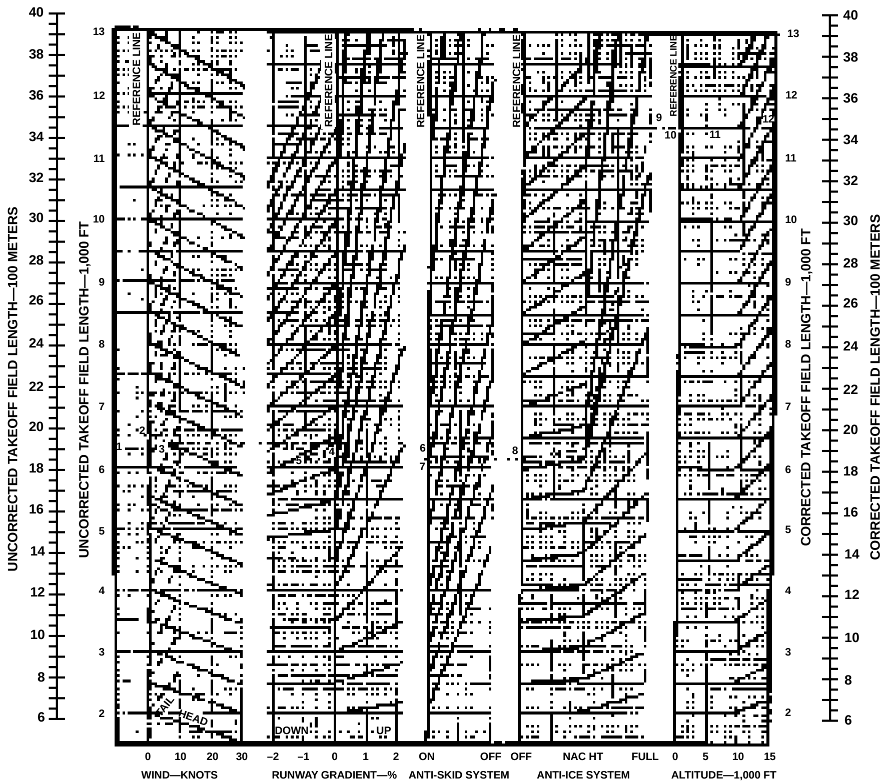

Figure PER-19. Takeoff Distance—Flaps at 20° and Rudder Boost OFF

UNCORRECTED TAKEOFF FIELD LENGTH—FT

ALTITUDE FEET	WEIGHT LB	–40	–20	0	20	40	60	70	80	90	100	110	120
		TEMPERATURE—°F											
SEA LEVEL	10,000	1820	1900	1980	2060	2130	2210	2250	2350	2460	2590	2730	2900
	11,000	1870	1960	2030	2110	2190	2270	2320	2420	2540	2680	2840	3100
	12,000	1930	2010	2090	2170	2250	2330	2380	2500	2630	2770	2980	3380
	13,000	1980	2070	2150	2240	2320	2400	2450	2580	2720	2870	3200	3650
	14,000	2090	2180	2250	2330	2410	2480	2540	2740	2970	3300	3720	4430
	15,000	2340	2430	2520	2610	2700	2780	2850	3080	3420	3820	4340	6200
	15,500	2460	2570	2660	2750	2850	2930	3010	3290	3650	4080	4840	8510
	16,000	2600	2710	2800	2900	3010	3100	3180	3510	3890	4380	5580	
	17,000	2900	3030	3130	3260	3390	3490	3610	3980	4450	5230	9430	
2,000	10,000	1960	2050	2130	2210	2290	2370	2480	2590	2720	2880	3060	3390
	11,000	2010	2100	2190	2270	2360	2440	2550	2680	2820	2990	3260	3720
	12,000	2070	2170	2250	2340	2430	2510	2630	2770	2920	3150	3560	4250
	13,000	2130	2230	2320	2410	2500	2590	2720	2860	3030	3380	3830	4670
	14,000	2250	2350	2430	2520	2600	2690	2890	3140	3500	3930	4580	7440
	15,000	2520	2620	2720	2820	2910	3010	3270	3630	4040	4570	6420	
	15,500	2650	2780	2870	2980	3070	3190	3500	3880	4340	5030	8670	
	16,000	2810	2940	3040	3160	3260	3390	3740	4150	4660	5900		
	17,000	3150	3310	3440	3570	3690	3860	4260	4750	5630	10140		
4,000	10,000	2090	2200	2280	2370	2460	2630	2750	2880	3030	3210	3500	
	11,000	2150	2260	2350	2440	2530	2710	2840	2980	3150	3400	3840	
	12,000	2210	2320	2420	2510	2600	2800	2940	3090	3320	3710	4240	
	13,000	2280	2390	2490	2590	2680	2890	3040	3210	3550	3990	4580	
	14,000	2390	2510	2600	2690	2790	3070	3350	3710	4130	4660	6650	
	15,000	2670	2800	2910	3020	3120	3510	3860	4280	4810	6260		
	15,500	2820	2970	3090	3190	3300	3750	4140	4600	5200	7970		
	16,000	2990	3150	3280	3410	3530	4020	4440	4940	6070			
	17,000	3380	3560	3710	3860	4010	4580	5080	5930	9830			
6,000	10,000	2270	2370	2470	2570	2690	2930	3060	3210	3390	3670	4120	
	11,000	2340	2440	2540	2640	2770	3020	3170	3340	3590	4010	4600	
	12,000	2400	2510	2620	2720	2860	3130	3290	3520	3910	4430	5600	
	13,000	2480	2590	2690	2800	2950	3240	3420	3780	4210	4750	6890	
	14,000	2600	2700	2810	2910	3080	3610	3970	4390	4920	6640		
	15,000	2910	3030	3150	3270	3480	4170	4600	5120	6590			
	15,500	3080	3210	3360	3490	3730	4480	4950	5610	8420			
	16,000	3270	3430	3580	3710	3990	4800	5320	6590				
	17,000	3710	3890	4070	4240	4550	5500	6570	11420				
8,000	10,000	2480	2590	2690	2800	3000	3270	3440	3630	3960	4440		
	11,000	2550	2660	2770	2880	3100	3380	3570	3870	4310	5000		
	12,000	2620	2740	2850	2960	3200	3510	3780	4210	4760	6160		
	13,000	2700	2820	2940	3050	3300	3670	4060	4540	5130	7970		
	14,000	2830	2950	3060	3180	3570	4260	4730	5330	7570			
	15,000	3180	3330	3460	3590	4140	4950	5530	7370				
	15,500	3390	3560	3690	3850	4440	5320	6130	9850				
	16,000	3620	3800	3950	4120	4760	5730	7240					
	17,000	4120	4340	4510	4710	5440	7160	14930					
10,000	10,000	2680	2800	2920	3110	3370	3690	3880	4180	4670			
	11,000	2750	2870	2990	3200	3480	3830	4130	4540	5080			
	12,000	2820	2950	3080	3300	3600	4100	4480	4950	6120			
	13,000	2910	3040	3170	3400	3720	4390	4850	5390	7370			
	14,000	3020	3150	3280	3620	4260	5140	5700	7530				
	15,000	3410	3560	3720	4190	4940	6000	7850					
	15,500	3640	3810	3980	4490	5330	6810	10670					
	16,000	3890	4080	4260	4830	5690	8130						
	17,000	4440	4670	4890	5500	6570							
12,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	2940	3080	3280	3540	3850	4230	4560	5030	ABOVE ENGINE TEMP LIMITS			
	11,000	3010	3150	3360	3640	3970	4500	4920	5440				
	12,000	3090	3230	3450	3750	4120	4880	5370	6530				
	13,000	3170	3320	3550	3870	4410	5290	5890	7940				
	14,000	3260	3410	3730	4330	5140	6260	8550					
	15,000	3680	3870	4300	5060	5980	9270						
	15,500	3950	4150	4620	5420	6460							
	16,000	4230	4450	4950	5810	7120							
	17,000	4840	5090	5650	6670	10720							
14,000	10,000	3300	3520	3760	4070	4430	4990	5390	5970				
	11,000	3360	3590	3840	4180	4570	5360	5900	7100				
	12,000	3440	3680	3940	4300	4910	5860	7060	9500				
	13,000	3520	3780	4060	4490	5310	6450	8770					
	14,000	3620	3990	4470	5260	6240	9970						
	15,000	4110	4610	5230	6110	7730							
	15,500	4410	4950	5590	6580	9540							
	16,000	4730	5330	5990	7110								
	17,000	5420	6060	6870	9340								

Figures in shaded area are provided for interpolation only.

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED TAKEOFF FIELD LENGTH (from table)........ 6,500 FT (1,433 M)
2. REFERENCE LINE
3. HEADWIND........ 6 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT........ –1% DN
6. REFERENCE LINE
7. ANTI-SKID........ ON
8. REFERENCE LINE
9. ANTI-ICE........ FULL
10. REFERENCE LINE
11. ALTITUDE........ 5,000 FT
12. CORRECTED TAKEOFF FIELD LENGTH........ 11,500 FT (3,505 M)

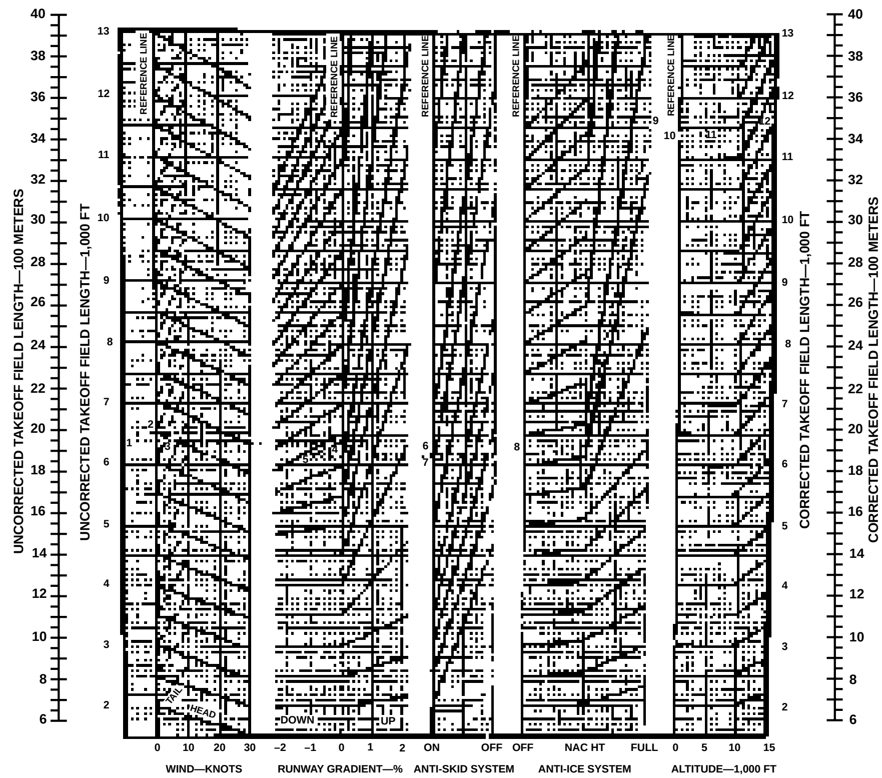

Figure PER-20. Takeoff Distance—Flaps at 20° and Rudder Boost ON

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LEARJET 31A PILOT TRAINING MANUAL

V_R/V_2 — KIAS			
ALTITUDE FEET	WEIGHT LB	KIAS V_R	KIAS V_2
SEA LEVEL	10,000	114	117
	11,000	114	117
	12,000	114	117
	13,000	114	117
	14,000	114	117
	15,000	114	117
	15,500	115	118
	16,000	117	120
	17,000	120	124

NOTE:
APPLICABLE AT ALL ALTITUDES

EFFECTIVITY:
ALL AIRCRAFT

CRITICAL ENGINE FAILURE SPEED—V_1
ROTATION SPEED—V_R
TAKEOFF SAFETY SPEED—V_2

CAUTION:
V_R MUST NEVER BE LESS THAN V_R. IF V_R FROM FIGURE IS LESS THAN V_1 FROM FIGURE, INCREASE V_R AND V_2 BY THE DIFFERENCE BETWEEN V_R AND V_1.

EXAMPLE:
1. UNCORRECTED CRITICAL ENGINE FAILURE SPEED (from table)................................ 114 KIAS
2. REFERENCE LINE
3. HEADWIND.. 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT.. 0%
6. REFERENCE LINE
7. ANTI-ICE.. OFF
8. REFERENCE LINE
9. ANTI-SKID.. OFF
10. CORRECTED CRITICAL ENGINE FAILURE SPEED.. 109 KIAS
11. COMPARE V_1 WITH V_R

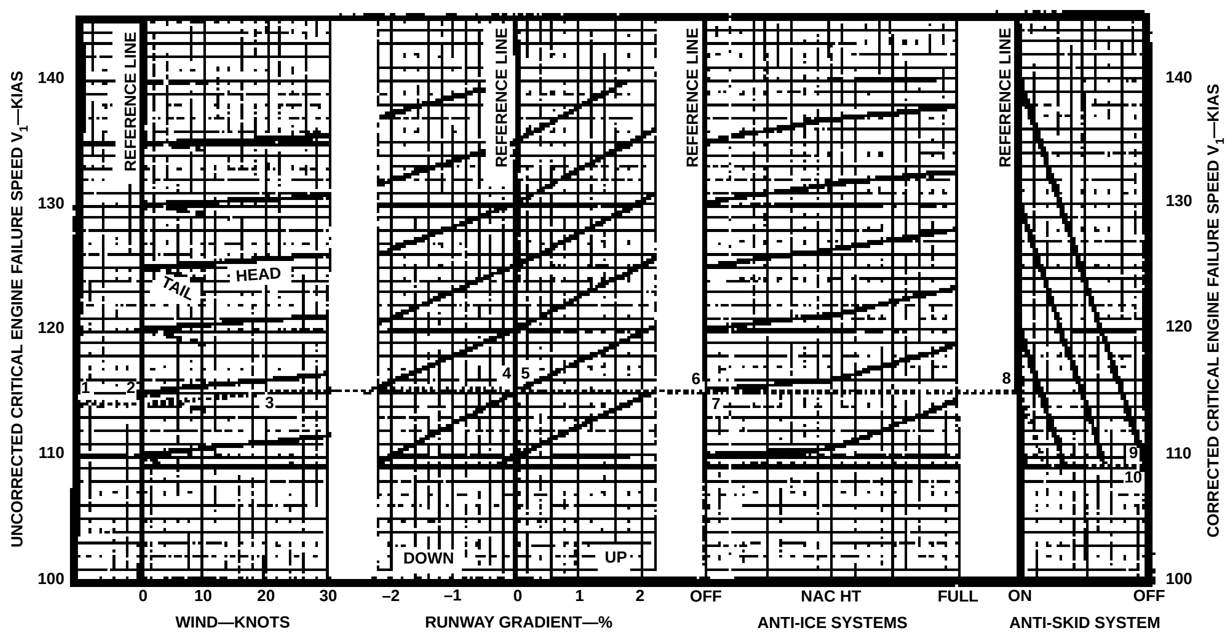

Figure PER-21. Takeoff Speeds—Flaps at 20° and Rudder Boost OFF (Sheet 1 of 2)

FOR TRAINING PURPOSES ONLY

V_1—KIAS

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	109	109	109	109	109	109	109	109	109	109	109	109
	11,000	109	109	109	109	109	109	109	109	109	109	109	109
	12,000	109	109	109	109	109	109	109	109	109	109	109	112
	13,000	109	109	109	109	109	109	109	109	109	109	109	114
	14,000	109	109	109	109	109	109	109	109	109	109	110	115
	15,000	109	109	109	109	109	109	109	109	109	110	113	116
	15,500	109	109	109	109	109	109	109	109	110	112	116	
	16,000	109	109	109	109	109	109	109	110	112	115	117	
	17,000	112	112	112	112	112	112	112	115	117	120	121	
2,000	10,000	109	109	109	109	109	109	109	109	109	109	109	109
	11,000	109	109	109	109	109	109	109	109	109	109	109	110
	12,000	109	109	109	109	109	109	109	109	109	109	109	112
	13,000	109	109	109	109	109	109	109	109	109	109	111	114
	14,000	109	109	109	109	109	109	109	109	109	111	114	114
	15,000	109	109	109	109	109	109	109	109	110	113	115	
	15,500	109	109	109	109	109	109	109	110	113	116	11	
	16,000	109	109	109	109	109	109	110	113	116	117		
	17,000	113	113	113	113	113	113	115	118	120	121		
4,000	10,000	109	109	109	109	109	109	109	109	109	109	109	
	11,000	109	109	109	109	109	109	109	109	109	109	109	
	12,000	109	109	109	109	109	109	109	109	109	109	112	
	13,000	109	109	109	109	109	109	109	109	109	111	114	
	14,000	109	109	109	109	109	109	109	109	110	113	114	
	15,000	109	109	109	109	109	109	109	110	113	115		
	15,500	109	109	109	109	109	109	110	113	116	116		
	16,000	109	109	109	109	109	110	113	116	118			
	17,000	113	113	113	113	113	116	118	121	121			
6,000	10,000	109	109	109	109	109	109	109	109	109	109	109	
	11,000	109	109	109	109	109	109	109	109	109	109	112	
	12,000	109	109	109	109	109	109	109	109	109	111	114	
	13,000	109	109	109	109	109	109	109	109	111	114	114	
	14,000	109	109	109	109	109	109	109	110	113	114		
	15,000	109	109	109	109	109	109	110	113	115			
	15,500	109	109	109	109	109	111	113	116	116			
	16,000	109	109	109	109	109	114	116	118				
	17,000	114	114	114	114	115	118	121	121				
8,000	10,000	109	109	109	109	109	109	109	109	109	110		
	11,000	109	109	109	109	109	109	109	109	109	112		
	12,000	109	109	109	109	109	109	109	109	112	114		
	13,000	109	109	109	109	109	109	109	111	114	114		
	14,000	109	109	109	109	109	109	111	113	114			
	15,000	109	109	109	109	109	111	114	115				
	15,500	109	109	109	109	110	114	117	117				
	16,000	109	109	109	109	113	117	118					
	17,000	114	114	114	114	117	121	121					
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	109	109	109	109	109	109	109	109	109			
	11,000	109	109	109	109	109	109	109	109	111			
	12,000	109	109	109	109	109	109	110	111	114			
	13,000	109	109	109	109	109	109	111	114	114			
	14,000	109	109	109	109	109	111	113	114				
	15,000	109	109	109	109	109	114	115					
	15,500	109	109	109	109	112	116	117					
	16,000	109	109	109	112	115	118						
	17,000	114	114	114	116	120							
12,000	10,000	109	109	109	109	109	109	109	109				
	11,000	109	109	109	109	109	109	109	111				
	12,000	109	109	109	109	109	109	111	114				
	13,000	109	109	109	109	109	111	114	114				
	14,000	109	109	109	109	109	114	114					
	15,000	109	109	109	109	112	116						
	15,500	109	109	109	112	116							
	16,000	109	109	111	114	118							
	17,000	114	114	116	119	122							
14,000	10,000	109	109	109	109	109	109	109	111				
	11,000	109	109	109	109	109	110	111	114				
	12,000	109	109	109	109	109	111	114	114				
	13,000	109	109	109	109	109	114	114					
	14,000	109	109	109	109	112	114						
	15,000	109	109	109	111	116							
	15,500	109	109	111	114	117							
	16,000	109	112	113	118								
	17,000	114	116	119	122								

ABOVE ENGINE TEMP LIMITS

Figures in shaded area are provided for interpolation only.

Figure PER-21. Takeoff Speeds—Flaps at 20° and Rudder Boost OFF (Sheet 2 of 2)

LEARJET 31A PILOT TRAINING MANUAL

V_R/V_2 — KIAS			
ALTITUDE FEET	WEIGHT LB	KIAS V_R	KIAS V_2
SEA LEVEL	10,000	105	110
	11,000	105	110
	12,000	105	110
	13,000	107	110
	14,000	110	113
	15,000	113	116
	15,500	115	118
	16,000	117	120
	17,000	120	124

NOTE:
APPLICABLE AT ALL ALTITUDES

EFFECTIVITY:
ALL AIRCRAFT

CRITICAL ENGINE FAILURE SPEED—V_1
ROTATION SPEED—V_R
TAKEOFF SAFETY SPEED—V_2

CAUTION:
V_R MUST NEVER BE LESS THAN V_1. IF V_R FROM FIGURE IS LESS THAN V_1 FROM FIGURE, INCREASE V_R AND V_2 BY THE DIFFERENCE BETWEEN V_R AND V_1.

EXAMPLE:
1. UNCORRECTED CRITICAL ENGINE FAILURE SPEED (from table)................................. 109 KIAS
2. REFERENCE LINE
3. HEADWIND... 20 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT.. 1% UP
6. REFERENCE LINE
7. ANTI-ICE... OFF
8. REFERENCE LINE
9. ANTI-SKID... OFF
10. CORRECTED CRITICAL ENGINE FAILURE SPEED.. 100 KIAS
11. COMPARE V_1 WITH V_R

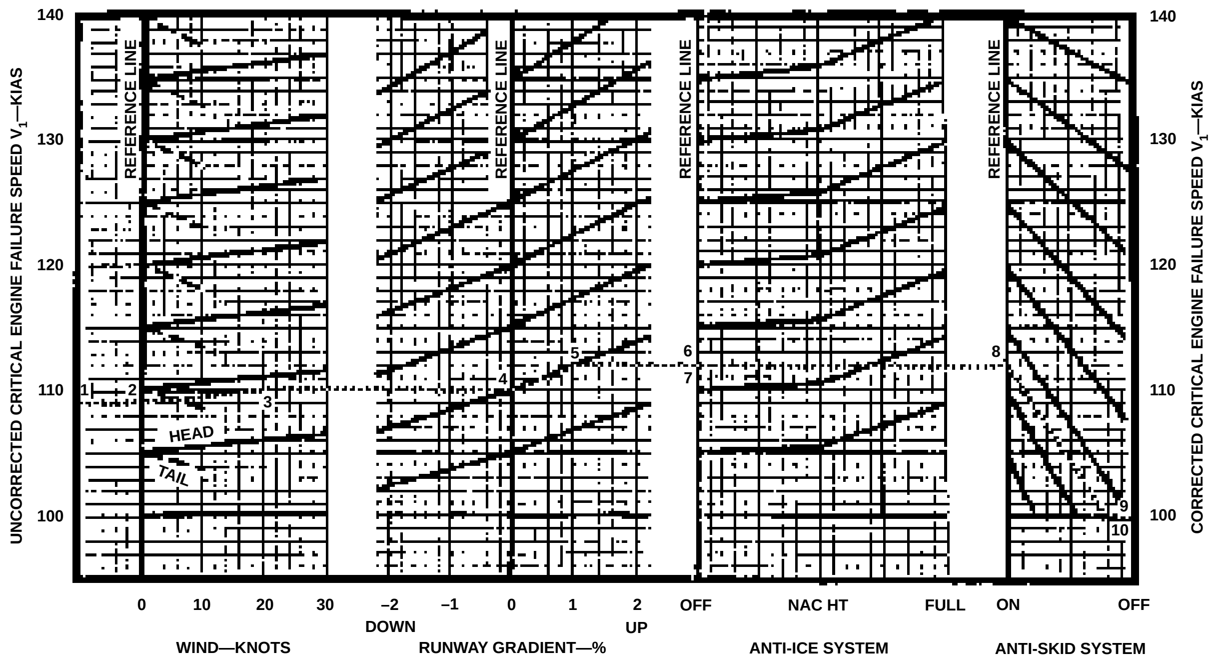

Figure PER-22. Takeoff Speeds—Flaps at 20° and Rudder Boost ON (Sheet 1 of 2)

FOR TRAINING PURPOSES ONLY

V_1—KIAS

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	100	100	100	100	100	100	100	100	100	100	100	100
	11,000	100	100	100	100	100	100	100	100	100	100	100	101
	12,000	100	100	100	100	100	100	100	100	100	100	100	103
	13,000	100	100	100	100	100	100	100	100	100	100	102	105
	14,000	101	101	101	101	100	100	100	101	103	105	108	111
	15,000	105	105	105	105	104	104	104	106	108	110	113	114
	15,500	107	107	107	107	106	106	108	108	111	113	116	116
	16,000	109	109	109	109	109	108	109	111	113	116	117	
	17,000	114	114	113	113	113	113	114	116	118	120	120	
2,000	10,000	100	100	100	100	100	100	100	100	100	100	100	102
	11,000	100	100	100	100	100	100	100	100	100	100	101	104
	12,000	100	100	100	100	100	100	100	100	100	101	103	105
	13,000	100	100	100	100	100	100	100	100	100	102	105	107
	14,000	101	101	101	101	100	100	101	103	105	108	111	111
	15,000	105	105	105	105	104	105	106	108	111	113	114	
	15,500	107	107	107	107	107	107	109	111	113	116	116	
	16,000	110	109	109	109	109	109	111	113	116	117		
	17,000	114	114	114	114	114	114	116	118	120	120		
4,000	10,000	100	100	100	100	100	100	100	100	100	100	101	
	11,000	100	100	100	100	100	100	100	100	100	101	103	
	12,000	100	100	100	100	100	100	100	100	101	103	105	
	13,000	100	100	100	100	100	100	100	100	102	104	107	
	14,000	101	101	101	101	100	101	103	105	108	110	111	
	15,000	105	105	105	105	105	106	109	111	113	114		
	15,500	107	107	107	107	107	109	111	113	116	116		
	16,000	109	109	109	109	109	111	114	116	117			
	17,000	114	114	114	114	114	116	118	120	120			
6,000	10,000	100	100	100	100	100	100	100	100	100	101	103	
	11,000	100	100	100	100	100	100	100	100	101	103	105	
	12,000	100	100	100	100	100	100	100	101	103	105	105	
	13,000	100	100	100	100	100	100	100	102	105	107	107	
	14,000	101	101	101	100	101	104	106	108	110	111		
	15,000	105	105	105	105	105	109	111	113	114			
	15,500	107	107	107	107	108	112	114	116	116			
	16,000	110	110	110	110	110	114	116	117				
	17,000	115	115	115	114	115	119	120	120				
8,000	10,000	100	100	100	100	100	100	100	100	101	103		
	11,000	100	100	100	100	100	100	100	101	103	105		
	12,000	100	100	100	100	100	100	101	103	105	105		
	13,000	100	100	100	100	100	100	103	105	107	107		
	14,000	101	101	101	101	102	106	108	110	111			
	15,000	105	105	105	105	108	111	113	114				
	15,500	108	108	108	108	110	114	116	116				
	16,000	110	110	110	110	113	116	117					
	17,000	115	115	115	115	117	120	120					
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	100	100	100	100	100	100	100	101	103			
	11,000	100	100	100	100	100	100	101	103	105			
	12,000	100	100	100	100	100	102	103	105	105			
	13,000	100	100	100	100	100	103	105	107	107			
	14,000	100	100	100	102	105	108	110	111				
	15,000	105	105	105	107	110	114	114					
	15,500	108	108	108	110	113	116	116					
	16,000	110	110	110	112	115	117						
	17,000	115	115	115	117	120							
12,000	10,000	100	100	100	100	100	100	101	103				
	11,000	100	100	100	100	100	101	103	105				
	12,000	100	100	100	100	100	103	105	105				
	13,000	100	100	100	100	102	105	107	107				
	14,000	100	100	101	104	107	111	111					
	15,000	105	105	106	109	112	114						
	15,500	107	107	109	112	115							
	16,000	110	110	111	114	117							
	17,000	115	115	116	119	120							
14,000	10,000	100	100	100	100	100	101	102	104				
	11,000	100	100	100	100	100	103	105	105				
	12,000	100	100	100	100	102	105	105	105				
	13,000	100	100	100	101	104	107	107					
	14,000	100	101	103	106	109	111						
	15,000	105	107	109	111	114							
	15,500	107	109	111	114	116							
	16,000	110	112	113	117								
	17,000	115	116	118	120								

ABOVE ENGINE TEMP LIMITS

Figures in shaded area are provided for interpolation only.

Figure PER-22. Takeoff Speeds—Flaps at 20° and Rudder Boost ON (Sheet 2 of 2)

UNCORRECTED FIRST SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	15.1	15.0	15.1	15.1	15.2	15.5	15.2	13.3	11.4	9.5	7.6	5.7
	11,000	12.8	12.7	12.8	12.9	13.0	13.2	13.0	11.2	9.5	7.8	6.1	4.4
	12,000	10.9	10.8	10.9	10.9	11.0	11.2	11.0	9.4	7.9	6.3	4.8	3.2
	13,000	9.2	9.2	9.2	9.2	9.3	9.5	9.3	7.9	6.4	5.0	3.6	2.2
	14,000	7.7	7.7	7.7	7.7	7.8	8.0	7.8	6.5	5.2	3.8	2.5	1.2
	15,000	6.4	6.3	6.4	6.4	6.5	6.7	6.5	5.3	4.0	2.8	1.5	0.3
	15,500	5.8	5.7	5.7	5.7	5.9	6.0	5.9	4.6	3.4	2.3	1.1	–0.1
	16,000	5.1	5.1	5.1	5.1	5.2	5.4	5.2	4.0	2.9	1.7	0.6	–0.8
	17,000	4.0	3.9	4.0	4.0	4.1	4.2	4.1	3.0	1.9	0.8	–0.3	–1.3
2,000	10,000	14.5	14.4	14.5	14.6	14.8	14.7	12.8	11.0	9.2	7.4	5.7	3.9
	11,000	12.4	12.2	12.3	12.4	12.6	12.5	10.8	9.2	7.6	5.9	4.3	2.7
	12,000	10.5	10.3	10.4	10.5	10.7	10.6	9.1	7.6	6.1	4.6	3.2	1.7
	13,000	8.8	8.7	8.8	8.8	9.0	8.9	7.6	6.2	4.8	3.5	2.1	0.7
	14,000	7.4	7.3	7.3	7.4	7.6	7.5	6.2	4.9	3.7	2.4	1.1	–0.1
	15,000	6.1	6.0	6.0	6.1	6.2	6.2	5.0	3.8	2.6	1.4	0.3	–0.9
	15,500	5.4	5.3	5.4	5.4	5.6	5.5	4.4	3.2	2.1	1.0	–0.2	
	16,000	4.8	4.7	4.8	4.8	5.0	4.9	3.8	2.7	1.6	0.5	–0.9	
	17,000	3.7	3.6	3.6	3.7	3.8	3.8	2.7	1.7	0.7	–0.4		
4,000	10,000	14.3	14.2	14.2	14.3	14.5	12.5	10.8	9.1	7.5	5.8	4.2	
	11,000	12.1	12.0	12.1	12.1	12.3	10.5	9.0	7.5	6.0	4.5	3.0	
	12,000	10.3	10.2	10.2	10.3	10.4	8.8	7.4	6.0	4.6	3.3	1.9	
	13,000	8.6	8.6	8.6	8.7	8.8	7.3	6.0	4.7	3.5	2.2	1.0	
	14,000	7.2	7.1	7.2	7.2	7.3	5.9	4.8	3.6	2.4	1.3	0.1	
	15,000	5.9	5.8	5.9	5.9	6.0	4.7	3.6	2.6	1.5	0.4	–0.7	
	15,500	5.3	5.2	5.2	5.3	5.4	4.2	3.1	2.0	1.0	–0.1		
	16,000	4.6	4.6	4.6	4.7	4.8	3.6	2.6	1.5	0.5	–0.8		
	17,000	3.5	3.5	3.5	3.5	3.6	2.5	1.6	0.6	–0.3	–1.3		
6,000	10,000	13.9	13.8	13.8	13.9	13.3	10.2	8.7	7.2	5.7	4.2	2.7	
	11,000	11.8	11.7	11.7	11.8	11.2	8.4	7.1	5.7	4.4	3.0	1.7	
	12,000	9.9	9.9	9.8	10.0	9.4	6.9	5.7	4.4	3.2	2.0	0.7	
	13,000	8.4	8.3	8.3	8.4	7.9	5.6	4.4	3.3	2.1	1.0	–0.1	
	14,000	6.9	6.9	6.8	7.0	6.5	4.4	3.3	2.2	1.2	0.1	–0.9	
	15,000	5.7	5.6	5.6	5.7	5.3	3.3	2.3	1.3	0.3	–0.7		
	15,500	5.0	5.0	5.0	5.1	4.7	2.7	1.8	0.8	–0.1			
	16,000	4.4	4.4	4.3	4.4	4.1	2.2	1.3	0.4	–0.8			
	17,000	3.3	3.3	3.3	3.4	3.0	1.3	0.4	–0.7	–1.3			
8,000	10,000	13.2	13.1	13.2	13.3	11.1	8.4	6.9	5.4	3.9	2.4		
	11,000	11.2	11.1	11.1	11.2	9.3	6.8	5.5	4.1	2.7	1.4		
	12,000	9.4	9.3	9.4	9.4	7.7	5.5	4.2	2.9	1.7	0.5		
	13,000	7.9	7.8	7.8	7.9	6.3	4.2	3.1	1.9	0.8	–0.4		
	14,000	6.5	6.4	6.5	6.5	5.0	3.1	2.0	1.0	–0.1			
	15,000	5.2	5.2	5.2	5.3	3.9	2.1	1.1	0.1	–0.9			
	15,500	4.6	4.6	4.6	4.7	3.3	1.6	0.6	–0.3				
	16,000	4.0	4.0	4.0	4.1	2.8	1.1	0.2	–0.7				
	17,000	3.0	2.9	3.0	3.0	1.8	0.3	–0.9					
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	13.2	13.2	13.1	11.6	9.1	6.5	5.3	4.0	2.7			
	11,000	11.2	11.1	11.1	9.7	7.5	5.1	4.0	2.8	1.6			
	12,000	9.4	9.4	9.3	8.0	6.0	3.9	2.8	1.8	0.7			
	13,000	7.8	7.8	7.8	6.6	4.8	2.8	1.8	0.8	–0.2			
	14,000	6.5	6.4	6.4	5.3	3.6	1.8	0.9	0.0	–1.0			
	15,000	5.2	5.2	5.2	4.2	2.6	0.9	0.0	–0.8				
	15,500	4.6	4.6	4.6	3.6	2.1	0.4	–0.4					
	16,000	4.0	4.0	4.0	3.1	1.6	0.0	–0.8					
	17,000	2.9	2.9	2.9	2.1	0.7	–0.8						
12,000	10,000	13.2	13.1	11.8	9.5	7.2	4.9	3.7	2.5				
	11,000	11.2	11.1	9.9	7.8	5.7	3.6	2.5	1.5				
	12,000	9.4	9.3	8.3	6.3	4.4	2.5	1.5	0.6				
	13,000	7.9	7.8	6.8	5.0	3.3	1.5	0.6	–0.3				
	14,000	6.5	6.4	5.5	3.9	2.3	0.6	–0.2				ABOVE ENGINE TEMP LIMITS	
	15,000	5.2	5.2	4.3	2.8	1.3	–0.2						
	15,500	4.6	4.6	3.8	2.3	0.8	–0.7						
	16,000	4.0	4.0	3.2	1.8	0.4	–1.1						
	17,000	3.0	2.9	2.2	0.9	–0.4	–1.8						
14,000	10,000	12.7	11.2	9.7	7.6	5.5	3.4	2.3	1.3				
	11,000	10.7	9.4	8.0	6.1	4.2	2.3	1.3	0.3				
	12,000	9.0	7.8	6.5	4.8	3.0	1.3	0.4	–0.5				
	13,000	7.5	6.4	5.2	3.6	2.0	0.4	–0.4					
	14,000	6.1	5.1	4.0	2.5	1.0	–0.4						
	15,000	4.9	4.0	3.0	1.6	0.2	–1.2						
	15,500	4.3	3.4	2.4	1.1	–0.2							
	16,000	3.8	2.9	1.9	0.8	–0.7							
	17,000	2.7	1.9	1.0	–0.2	–1.4							

Figures in shaded area are provided for interpolation only.

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. UNCORRECTED NET CLIMB GRADIENT (from table)........ 9 %
2. REFERENCE LINE
3. HEADWIND........ 22 KT
4. REFERENCE LINE
5. ANTI-ICE SYSTEMS........ OFF
6. CORRECTED NET CLIMB GRADIENT........ 9.65%

CONDITIONS:

- SINGLE ENGINE
- THRUST........ TAKEOFF
- GEAR........ DOWN
- FLAPS........ 20°
- SPEED........ V_{LOF}

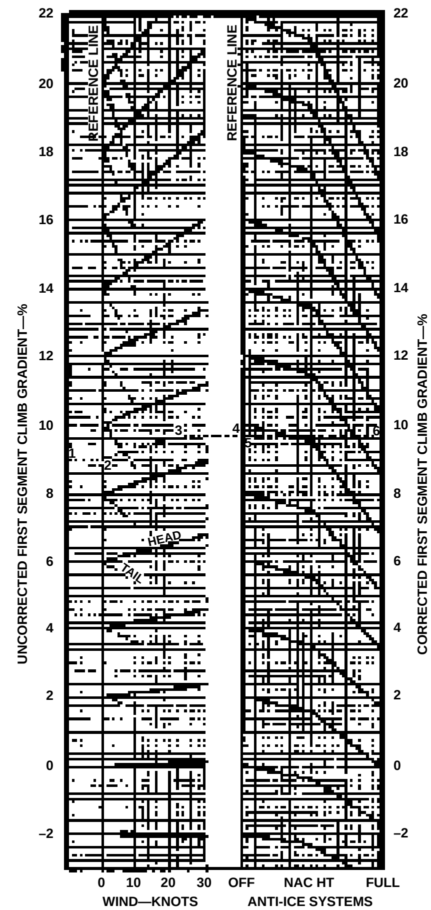

Figure PER-23. First Segment Climb Gradient—Flaps at 20°

UNCORRECTED SECOND SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	17.9	17.7	17.8	17.9	18.1	18.1	16.6	14.7	12.9	11.0	9.2	7.4
	11,000	15.4	15.2	15.3	15.4	15.5	15.5	14.2	12.5	10.8	9.2	7.5	5.9
	12,000	13.2	13.1	13.1	13.2	13.4	13.4	12.2	10.6	9.1	7.6	6.1	4.6
	13,000	11.3	11.2	11.3	11.3	11.5	11.5	10.4	90	7.6	6.2	4.8	3.4
	14,000	9.7	9.6	9.6	9.7	9.8	9.8	8.8	7.5	6.2	4.9	3.6	2.4
	15,000	8.2	8.1	8.2	8.2	8.3	8.3	7.4	6.2	5.0	3.8	2.6	1.4
	15,500	7.5	7.4	7.5	7.5	7.7	7.7	6.8	5.6	4.4	3.3	2.1	1.0
	16,000	6.9	6.8	6.9	6.9	7.0	7.0	6.1	5.0	3.9	2.8	1.7	0.6
	17,000	5.7	5.7	5.7	5.8	5.9	5.9	5.0	4.0	2.9	1.9	0.9	–0.2
2,000	10,000	17.5	17.4	17.5	17.5	17.7	16.2	14.4	12.7	11.0	9.3	7.6	5.9
	11,000	15.1	14.9	15.0	15.1	15.2	13.8	12.2	10.7	9.1	7.6	6.1	4.5
	12,000	12.9	12.8	12.9	12.9	13.1	11.8	10.4	9.0	7.5	6.1	4.7	3.4
	13,000	11.1	11.0	11.0	11.1	11.2	10.1	8.7	7.4	6.1	4.9	3.6	2.3
	14,000	9.5	9.4	9.4	9.5	9.6	8.5	7.3	6.1	4.9	3.7	2.5	1.3
	15,000	8.0	7.9	8.0	8.0	8.1	7.1	6.0	4.9	3.8	2.6	1.5	0.4
	15,500	7.3	7.2	7.3	7.3	7.5	6.5	5.4	4.3	3.2	2.2	1.1	0.0
	16,000	6.7	6.6	6.7	6.7	6.8	5.9	4.8	3.8	2.8	1.7	0.7	–0.4
	17,000	5.6	5.5	5.5	5.6	5.7	4.8	3.8	2.8	1.9	0.9	–0.1	–1.0
4,000	10,000	17.2	17.1	17.1	17.2	16.7	13.9	12.3	10.7	9.2	7.6	6.1	
	11,000	14.7	14.6	14.6	14.7	14.3	11.8	10.3	8.9	7.5	6.1	4.7	
	12,000	12.6	12.6	12.5	12.6	12.3	9.9	8.6	7.4	6.1	4.8	3.5	
	13,000	10.8	10.8	10.7	10.8	10.5	8.4	7.2	6.0	4.8	3.6	2.5	
	14,000	9.2	9.1	9.1	9.2	8.9	6.9	5.8	4.7	3.6	2.6	1.5	
	15,000	7.8	7.7	7.7	7.8	7.5	5.7	4.6	3.6	2.6	1.6	0.6	
	15,500	7.1	7.1	7.0	7.1	6.8	5.1	4.1	3.1	2.1	1.1	0.2	
	16,000	6.5	6.4	6.4	6.5	6.2	4.5	3.6	2.6	1.7	0.7	–0.2	
	17,000	5.4	5.3	5.3	5.4	5.1	3.5	2.7	1.8	0.9	0.0	–0.9	
6,000	10,000	16.6	16.5	16.5	16.6	14.8	11.9	10.4	8.9	7.4	5.9	4.4	
	11,000	14.2	14.1	14.1	14.2	12.6	10.0	8.6	7.2	5.9	4.5	3.2	
	12,000	12.1	12.0	12.1	12.2	10.7	8.4	7.1	5.8	4.6	3.3	2.1	
	13,000	10.4	10.3	10.3	10.4	9.0	6.9	5.7	4.6	3.4	2.3	1.1	
	14,000	8.8	8.7	8.7	8.8	7.6	5.6	4.5	3.4	2.4	1.3	0.2	
	15,000	7.4	7.3	7.3	7.4	6.2	4.4	3.4	2.4	1.4	0.4	–0.6	
	15,500	6.7	6.7	6.7	6.8	5.6	3.9	2.9	1.9	1.0	0.0		
	16,000	6.1	6.1	6.1	6.2	5.1	3.4	2.4	1.5	0.6	–0.4		
	17,000	5.0	5.0	5.0	5.1	4.1	2.5	1.6	0.7	–0.2	–1.0		
8,000	10,000	16.4	16.3	16.3	15.1	12.7	10.1	8.7	7.4	6.0	4.6		
	11,000	14.0	14.0	13.9	12.9	10.7	8.3	7.1	5.9	4.6	3.4		
	12,000	12.0	11.9	11.9	11.0	9.0	6.8	5.7	4.6	3.4	2.3		
	13,000	10.2	10.2	10.2	9.3	7.5	5.5	4.4	3.4	2.4	1.3		
	14,000	8.7	8.6	8.6	7.8	6.1	4.3	3.3	2.4	1.4	0.4		
	15,000	7.3	7.2	7.2	6.5	4.9	3.2	2.3	1.4	0.5	–0.4		
	15,500	6.6	6.6	6.6	5.9	4.4	2.7	1.8	1.0	0.1	–0.8		
	16,000	6.0	6.0	6.0	5.3	3.8	2.2	1.4	0.6	–0.3			
	17,000	4.9	4.9	4.9	4.3	2.9	1.4	0.6	–0.2	–0.9			
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	16.4	16.3	15.3	13.1	10.7	8.3	7.1	5.9	4.6			
	11,000	14.0	13.9	13.0	11.1	8.9	6.7	5.6	4.5	3.4			
	12,000	12.0	11.9	11.1	9.3	7.4	5.3	4.4	3.4	2.3			
	13,000	10.2	10.1	9.4	7.8	6.0	4.1	3.2	2.3	1.3			
	14,000	8.7	8.6	7.9	6.4	4.7	3.0	2.2	1.3	0.4			
	15,000	7.3	7.2	6.6	5.2	3.6	2.0	1.2	0.4	–0.4			
	15,500	6.6	6.6	5.9	4.6	3.1	1.6	0.8	0.0				
	16,000	6.0	6.0	5.4	4.1	2.6	1.2	0.4	–0.3				
	17,000	4.9	4.9	4.3	3.1	1.8	0.4	–0.3					
12,000	10,000	16.0	14.8	13.3	11.1	8.9	6.8	5.7	4.6				
	11,000	13.7	12.6	11.2	9.3	7.3	5.3	4.3	3.3				
	12,000	11.7	10.7	9.5	7.7	5.9	4.1	3.2	2.3				
	13,000	9.9	9.1	7.9	6.3	4.6	3.0	2.1	1.3				
	14,000	8.4	7.6	6.5	5.0	3.5	1.9	1.2	0.4	ABOVE ENGINE TEMP LIMITS			
	15,000	7.0	6.3	5.3	3.9	2.4	1.0	0.3	–0.4				
	15,500	6.4	5.7	4.7	3.4	2.0	0.6	–0.1					
	16,000	5.8	5.1	4.2	2.9	1.5	0.2	–0.5					
	17,000	4.8	4.1	3.3	2.0	0.8	–0.5						
14,000	10,000	15.5	13.0	11.2	9.2	7.2	5.3	4.3	3.3				
	11,000	13.3	11.0	9.3	7.5	5.7	4.0	3.1	2.2				
	12,000	11.3	9.2	7.7	6.1	4.4	2.9	2.0	1.2				
	13,000	9.6	7.7	6.3	4.8	3.3	1.8	1.1	0.3				
	14,000	8.1	6.3	5.1	3.7	2.3	0.9	0.2	–0.5				
	15,000	6.8	5.1	3.9	2.6	1.3	0.1	–0.6					
	15,500	6.1	4.5	3.4	2.1	0.9	–0.3						
	16,000	5.6	4.0	2.9	1.7	0.5	–0.7						
	17,000	4.6	3.1	2.1	0.9	–0.2	–1.3						

Figures in shaded area are provided for interpolation only.

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EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED NET CLIMB GRADIENT (from table)........ 2.6 %
2. REFERENCE LINE
3. WIND........ 0 KT
4. REFERENCE LINE
5. NACELLE HEAT........ ON
6. CORRECTED NET CLIMB GRADIENT........ 2.4 %

CONDITIONS:
- SINGLE ENGINE
- THRUST........ TAKEOFF
- GEAR........ UP
- FLAPS........20°
- SPEED........ V_2

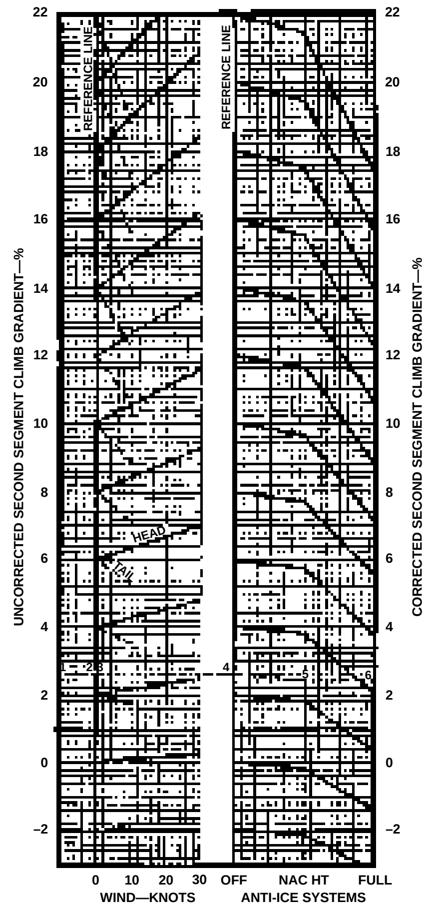

Figure PER-24. Second Segment Climb Gradient—Flaps at 20°

UNCORRECTED FINAL SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	21.4	21.4	21.5	21.5	20.8	18.9	17.0	15.1	13.2	11.4	7.6	3.7
	11,000	18.3	18.3	18.4	18.4	17.8	16.1	14.4	12.7	11.1	9.4	6.0	2.5
	12,000	15.8	15.8	15.8	15.9	15.3	13.8	12.3	10.7	9.3	7.8	4.7	1.5
	13,000	13.7	13.7	13.8	13.8	13.3	11.9	10.5	9.1	7.8	6.4	3.6	0.7
	14,000	12.0	12.0	12.0	12.0	11.6	10.3	9.0	7.7	6.5	5.3	2.6	0.0
	15,000	10.4	10.5	10.5	10.5	10.1	8.9	7.7	6.5	5.4	4.3	1.8	–0.6
	15,500	9.8	9.8	9.8	9.8	9.4	8.3	7.2	6.0	4.9	3.8	1.5	–0.9
	16,000	9.1	9.2	9.2	9.2	8.8	7.7	6.6	5.5	4.5	3.4	1.1	–1.1
	17,000	8.0	8.0	8.0	8.1	7.7	6.7	5.7	4.6	3.6	2.6	0.5	–1.6
2,000	10,000	21.0	21.0	21.0	21.0	19.4	16.7	14.9	13.2	11.5	9.8	3.3	–3.0
	11,000	18.0	18.0	17.9	17.9	16.5	14.1	12.5	11.0	9.5	7.9	2.2	–3.5
	12,000	15.5	15.5	15.5	15.5	14.2	12.0	10.6	9.2	7.8	6.4	1.2	–4.0
	13,000	13.4	13.4	13.4	13.4	12.3	10.3	9.0	7.7	6.4	5.2	0.4	–4.3
	14,000	11.7	11.7	11.7	11.7	10.7	8.8	7.6	6.4	5.3	4.1	–0.3	
	15,000	10.2	10.2	10.2	10.2	9.3	7.6	6.5	5.4	4.3	3.2	–0.8	
	15,500	9.5	9.5	9.5	9.5	8.6	7.0	5.9	4.9	3.8	2.8	–1.1	
	16,000	8.9	8.9	8.9	8.9	8.0	6.5	5.4	4.4	3.4	2.4	–1.4	
	17,000	7.8	7.8	7.8	7.8	7.0	5.5	4.6	3.6	2.7	1.7	–1.8	
4,000	10,000	20.6	20.6	20.4	10.1	17.8	14.5	12.9	11.3	9.8	7.8	–0.1	
	11,000	17.6	17.6	17.4	17.2	15.1	12.2	10.8	9.4	7.9	6.2	–0.9	
	12,000	15.1	15.1	15.0	14.7	12.9	10.3	9.0	7.7	6.4	4.9	–1.6	
	13,000	13.1	13.1	13.0	12.8	11.1	8.7	7.5	6.4	5.2	3.7	–2.2	
	14,000	11.4	11.4	11.3	11.1	9.6	7.4	6.3	5.2	4.1	2.8	–2.6	
	15,000	10.0	9.9	9.9	9.7	8.3	6.3	5.2	4.2	3.2	2.0	–3.0	
	15,500	9.3	9.3	9.2	9.0	7.7	5.7	4.8	3.8	2.8	1.6	–3.2	
	16,000	8.7	8.7	8.6	8.4	7.1	5.3	4.3	3.4	2.4	1.3	–3.4	
	17,000	7.6	7.6	7.5	7.3	6.1	4.4	3.5	2.6	1.7	0.7	–3.7	
6,000	10,000	20.1	20.1	19.4	18.0	15.6	12.6	11.1	9.7	8.3	5.0	–1.5	
	11,000	17.2	17.1	16.4	15.3	13.1	10.5	9.2	7.9	6.6	3.7	–2.2	
	12,000	14.8	14.7	14.2	13.1	11.2	8.8	7.6	6.4	5.2	2.6	–2.7	
	13,000	12.8	12.8	12.3	11.3	9.5	7.3	6.2	5.2	4.1	1.7	–3.2	
	14,000	11.1	11.1	10.7	9.7	8.1	6.1	5.1	4.1	3.1	0.9	–3.6	
	15,000	9.7	9.6	9.3	8.4	6.9	5.1	4.1	3.2	2.3	0.2	–3.9	
	15,500	9.0	9.0	8.6	7.8	6.4	4.6	3.7	2.8	1.9	–0.1		
	16,000	8.4	8.4	8.1	7.3	5.9	4.1	3.3	2.4	1.6	–0.3		
	17,000	7.3	7.3	7.0	6.2	4.9	3.3	2.5	1.7	0.9	–0.9		
8,000	10,000	19.7	19.6	18.4	15.9	13.4	10.7	9.4	8.1	6.8	2.3		
	11,000	16.8	16.7	15.6	13.5	11.2	8.8	7.6	6.4	5.3	1.2		
	12,000	14.4	14.4	13.4	11.5	9.4	7.2	6.2	5.1	4.0	0.4		
	13,000	12.5	12.4	11.6	9.8	7.9	5.9	5.0	4.0	3.0	–0.3		
	14,000	10.8	10.8	10.0	8.4	6.6	4.8	3.9	3.0	2.1	–1.0		
	15,000	9.4	9.3	8.7	7.2	5.6	3.9	3.0	2.2	1.4	–1.5		
	15,500	8.7	8.7	8.1	6.6	5.1	3.4	2.6	1.8	1.0	–1.7		
	16,000	8.1	8.1	7.5	6.1	4.6	3.0	2.3	1.5	0.7	–1.9		
	17,000	7.0	7.0	6.5	5.2	3.8	2.3	1.6	0.9	0.1	–2.3		
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	18.9	18.2	16.6	14.1	11.6	9.1	7.5	5.8	4.2			
	11,000	16.0	15.5	14.1	11.8	9.6	7.4	5.9	4.5	3.0			
	12,000	13.8	13.2	12.0	10.0	8.0	6.0	4.6	3.3	2.0			
	13,000	11.9	11.4	10.3	8.4	6.6	4.8	3.6	12.3	1.1			
	14,000	10.3	9.8	8.8	7.1	5.4	3.8	2.6	1.5	0.4			
	15,000	8.9	8.5	7.6	6.0	4.4	2.9	1.8	0.8	–0.2			
	15,500	8.3	7.9	7.0	5.5	4.0	2.5	1.5	0.5	–0.5			
	16,000	7.7	7.3	6.5	5.0	3.6	2.1	1.1	0.2	–0.8			
	17,000	6.7	6.3	5.5	4.2	2.8	1.4	0.5	–0.4				
12,000	10,000	18.1	16.5	14.6	12.2	9.9	7.7	5.6	3.5	ABOVE ENGINE TEMP LIMITS			
	11,000	15.4	14.0	12.3	10.2	8.1	6.1	4.2	2.3				
	12,000	13.2	11.9	10.4	8.5	6.6	4.8	3.1	1.4				
	13,000	11.4	10.2	8.8	7.1	5.4	3.7	2.1	0.6				
	14,000	9.8	8.7	7.5	5.9	4.3	2.8	1.3	–0.1				
	15,000	8.5	7.5	6.3	4.8	3.4	1.9	0.6	–0.7				
	15,500	7.9	6.9	5.8	4.4	3.0	1.6	0.3	–1.0				
	16,000	7.3	6.4	5.3	3.9	2.6	1.2	0.0	–1.2				
	17,000	6.3	5.4	4.4	3.2	1.9	0.6	–0.5					
14,000	10,000	15.2	13.2	11.2	9.2	7.3	5.3	3.1	0.8				
	11,000	13.1	11.2	9.4	7.6	5.8	4.0	2.0	0.0				
	12,000	11.3	9.6	7.9	6.3	4.7	3.0	1.2	–0.7				
	13,000	9.7	8.2	6.7	5.2	3.7	2.1	0.4	–1.2				
	14,000	8.4	7.0	5.6	4.2	2.8	1.4	–0.2					
	15,000	7.3	6.0	4.7	3.4	2.1	0.7	–0.7					
	15,500	6.8	5.5	4.3	3.0	1.7	0.4	–1.0					
	16,000	6.3	5.1	3.9	2.6	1.4	0.1	–1.2					
	17,000	5.5	4.3	3.1	2.0	0.9	–0.4						

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EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED NET CLIMB GRADIENT (from table)........ 4 %
2. WIND........ 0 KT
3. REFERENCE LINE
4. NACELLE HEAT........ ON
5. CORRECTED NET CLIMB GRADIENT........ 3.6 %

CONDITIONS:
- SINGLE ENGINE
- THRUST........ MAX CONTINUOUS
- GEAR........ UP
- FLAPS........ UP
- SPEED........ 1.25 V_{S1}

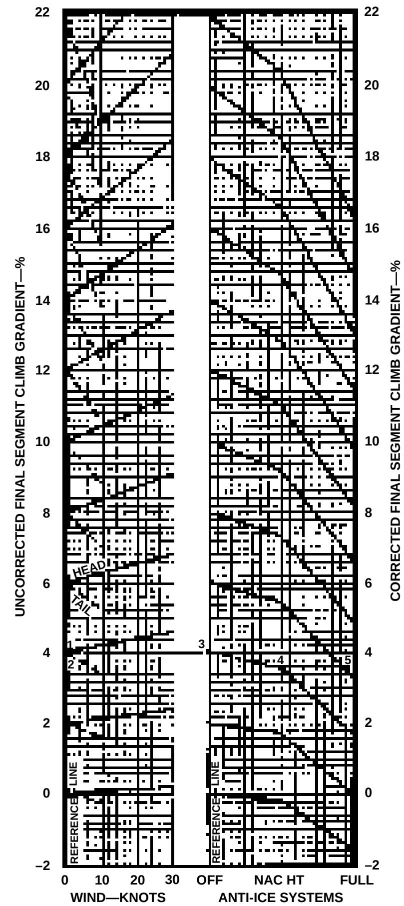
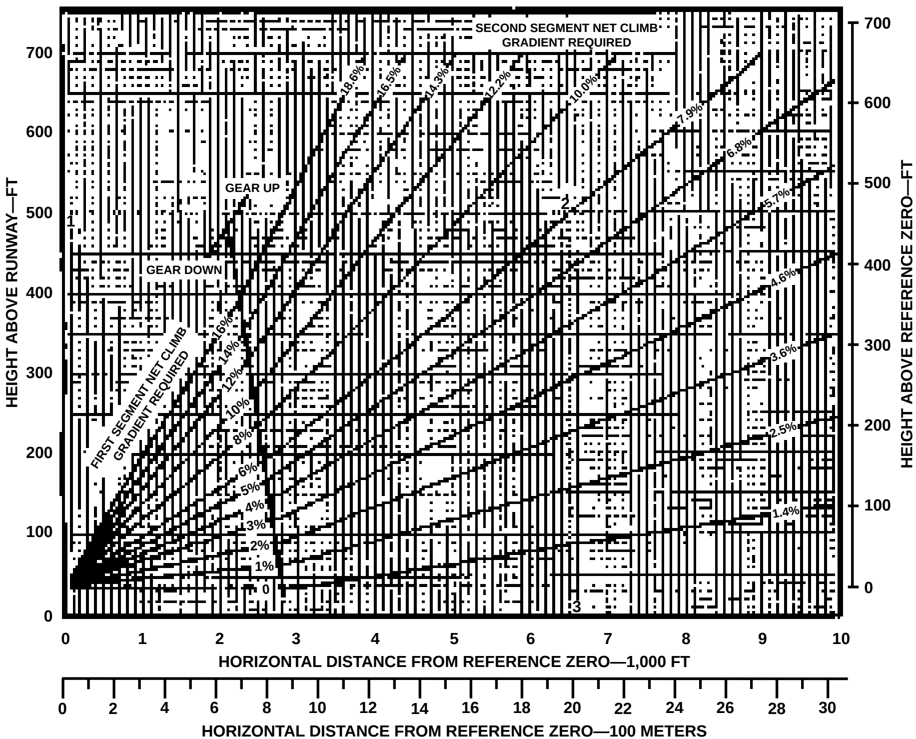


Figure PER-25. Final Segment Climb Gradient



EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. OBSTACLE DISTANCE (HORIZONTAL FROM REFERENCE ZERO) .... 6,500 FT (1,981 M)
2. OBSTACLE HEIGHT (ABOVE RUNWAY SURFACE)... 500 FT
3. REQUIRED NET CLIMB GRADIENT.................................... 7.9%

Figure PER-26. Close-In Takeoff Flight Path

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. OBSTACLE DISTANCE (HORIZONTAL FROM REFERENCE ZERO) .... 16,000 FT (4,877 M)
2. OBSTACLE HEIGHT (ABOVE RUNWAY SURFACE).......... 950 FT
3. REQUIRED NET CLIMB GRADIENT.......... 6%

NOTE:
ALL GRADIENTS SHOWN ON THIS CHART ARE WITHIN THE ALLOWABLE 5 MINUTE TAKEOFF THRUST LIMIT.

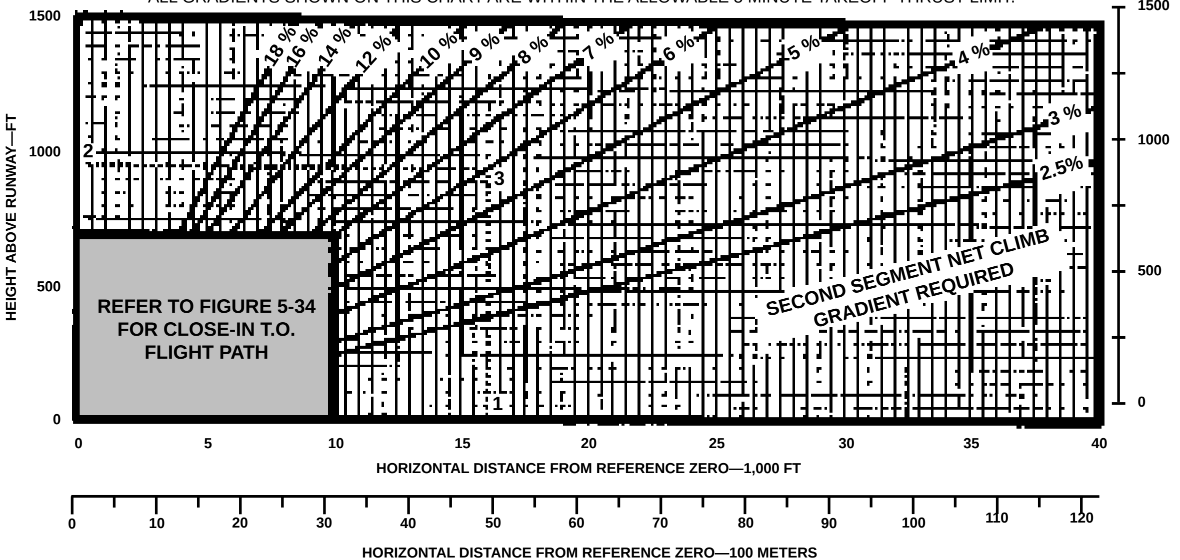


Figure PER-27. Distant Takeoff Flight Path

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UNCORRECTED ENROUTE SEGMENT NET CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F −80	−60	−40	−20	0	20	40	60	80	100	120
SEA LEVEL	10,000		13.3	13.4	13.4	13.5	13.5	13.6	12.5	9.0	5.7	2.5
	11,000		11.7	11.8	11.8	11.9	11.9	12.0	11.0	7.8	4.8	1.9
	12,000		10.4	10.4	10.5	10.5	10.6	10.6	9.7	6.8	4.1	1.4
	13,000		9.3	9.3	9.3	9.4	9.4	9.4	8.6	5.9	3.4	1.0
	14,000		8.3	8.3	8.3	8.4	8.4	8.4	7.7	5.2	2.9	0.6
	15,000		7.4	7.4	7.4	7.5	7.5	7.5	6.9	4.5	2.4	0.2
	16,000		6.6	6.6	6.7	6.7	6.7	6.7	6.1	3.9	1.9	−0.1
	17,000		5.9	5.9	5.9	6.0	6.0	6.0	5.4	3.4	1.5	−0.4
5,000	10,000		12.5	12.4	12.4	12.4	12.4	10.7	7.8	5.0	2.2	
	11,000		11.0	10.9	10.9	10.9	10.9	9.4	6.8	4.2	1.6	
	12,000		9.7	9.7	9.7	9.7	9.7	8.2	5.9	3.5	1.2	
	13,000		8.6	8.6	8.6	8.6	8.6	7.3	5.1	2.9	0.7	
	14,000		7.6	7.6	7.6	7.6	7.6	6.4	4.4	2.4	0.4	
	15,000		6.8	6.8	6.8	6.8	6.8	5.7	3.8	1.9	0.0	
	16,000		6.1	6.1	6.1	6.0	6.0	5.0	3.2	1.5	−0.3	
	17,000		5.4	5.4	5.4	5.4	5.4	4.4	2.7	1.1	−0.6	
10,000	10,000		11.4	11.3	11.3	10.8	8.5	6.2	3.9	1.6	−4.2	
	11,000		10.0	9.9	9.9	9.5	7.4	5.3	3.2	1.2	−4.2	
	12,000		8.8	8.8	8.7	8.3	6.4	4.5	2.6	0.7	−4.2	
	13,000		7.8	7.7	7.7	7.4	5.6	3.8	2.1	0.3	−4.2	
	14,000		6.9	6.9	6.8	6.5	4.9	3.2	1.6	0.0	−4.2	
	15,000		6.1	6.1	6.0	5.8	4.2	2.7	1.2	−0.3	−4.2	
	16,000		5.4	5.4	5.3	5.1	3.6	2.2	0.8	−0.6	−4.3	
	17,000		4.8	4.7	4.7	4.5	3.1	1.8	0.4	−0.9	−4.3	
15,000	10,000		11.3	10.6	8.6	6.6	4.7	2.8	0.8	−3.1		
	11,000		9.9	9.3	7.5	5.7	3.9	2.2	0.4	−3.1		
	12,000		8.7	8.2	6.5	4.9	3.3	1.7	0.1	−3.2		
	13,000		7.7	7.2	5.7	4.2	3.7	1.2	−0.3	−3.3		
	14,000		6.8	6.4	5.0	3.6	2.2	0.8	−0.6	−3.4		
	15,000		6.1	5.6	4.3	3.0	1.7	0.4	−0.8	−3.5		
	16,000		5.4	5.0	3.7	2.5	1.3	0.1	−1.1	−3.5		
	17,000		4.7	4.4	3.2	2.0	0.9	−0.2	−1.3	−3.6		
20,000	10,000		7.8	6.0	4.3	2.7	1.2	−0.3	−2.9			
	11,000		6.7	5.1	3.5	2.2	0.8	−0.6	−3.0			
	12,000		5.8	4.4	2.9	1.6	0.4	−0.9	−3.0			
	13,000		5.1	3.7	2.4	1.2	0.0	−1.1	−3.1			
	14,000		4.4	3.1	1.9	0.8	−0.3	−1.3	−3.2			
	15,000		3.8	2.6	1.4	0.4	−0.6	−1.6	−3.3			
	16,000		3.2	2.1	1.0	0.1	−0.8	−1.8	−3.4			
	17,000		2.7	1.7	0.7	−0.2	−1.1	−2.0	−3.5			
25,000	10,000		5.9	4.4	2.8	1.4	0.0	1.9				
	11,000		5.0	3.5	2.1	0.8	−0.5	2.1				
	12,000		4.1	2.8	1.5	0.4	−0.8	2.4				
	13,000		3.4	2.2	1.0	−0.1	−1.2	2.6				
	14,000		2.8	1.6	0.5	−0.5	−1.5	2.8				
	15,000		2.2	1.1	0.1	−0.8	−1.8	3.0				
	16,000		1.7	0.7	−0.3	−1.2	−2.1	3.2				
	17,000		1.2	0.2	−0.7	−1.5	−2.3	3.4				
30,000	10,000	3.8	2.8	1.6	0.5	−0.6	−1.8					
	11,000	3.0	2.1	1.1	0.0	−0.9	−2.0					
	12,000	2.3	1.5	0.6	−0.4	−1.3	−2.3					
	13,000	1.7	1.0	0.1	−0.8	−1.6	−2.5					
	14,000	1.2	0.5	−0.3	−1.2	−1.9	_2.7					
	15,000	0.7	0.1	−0.7	−1.5	−2.2	−3.0					
	16,000	0.3	−0.4	−1.1	−1.8	−2.4	−3.2					
	17,000	−0.2	−0.7	−1.4	−2.1	−2.7	−3.4					
35,000	10,000	1.0	0.1	−0.8	−1.8	−2.6						
	11,000	0.5	−0.3	−1.2	−2.0	−2.8						
	12,000	0.0	−0.7	−1.5	−2.3	−3.0						
	13,000	−0.4	−1.1	−1.8	−2.5	−3.1						
	14,000	−0.8	−1.4	−2.1	−2.7	−3.3						
	15,000	−1.2	−1.7	−2.3	−2.9	−3.5						
	16,000	−1.4	−2.0	−2.6	−3.1	−3.7						
	17,000	−1.8	−2.3	−2.8	−3.4	−3.8						
40,000	10,000	−1.2	−2.0	−2.8	−3.5	−4.1						
	11,000	−1.5	−2.2	−2.9	−3.6	−4.1						
	12,000	−1.8	−2.4	−3.1	−3.7	−4.2						
	13,000	−2.1	−2.7	−3.2	−3.8	−4.2						
	14,000	−2.3	−2.9	−3.4	−3.9	−4.3						
	15,000	−2.6	−3.0	−3.5	−4.0	−4.4						
	16,000	−2.8	−3.2	−3.7	−4.1	−4.5						
	17,000	−3.0	−3.4	−3.9	−4.3	−4.6						

ABOVE ENGINE TEMP LIMITS

Figures in shaded area are provided for interpolation only.

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F −80	−60	−40	−20
45,000	10,000	−2.7	−3.3	−3.9	−4.7
	11,000	−2.8	−3.4	−4.0	−4.6
	12,000	−3.0	−3.5	−4.0	−4.6
	13,000	−3.2	−3.6	−4.1	−4.7
	14,000	−3.3	−3.8	−4.2	−4.7
	15,000	−3.5	−3.9	−4.3	−4.8
	16,000	−3.6	−4.0	−4.4	−4.8
	17,000	−3.8	−4.2	−4.5	−4.9
51,000	10,000	−4.4	−5.1	−6.0	
	11,000	−4.6	−5.2	−6.0	
	12,000	−4.7	−5.3	−6.0	
	13,000	−4.9	−5.4	−6.1	
	14,000	−5.1	−5.5	−6.2	
	15,000	−5.2	−5.7	−6.3	
	16,000	−5.4	−5.8	−6.4	
	17,000	−5.6	−6.0	−6.5	

EFFECTIVITY:

ALL AIRCRAFT

ENROUTE CLIMB SPEED SCHEDULE:

SEA LEVEL TO 21,000 FT.................... 200 KIAS
21,000 TO 29,000 FT................................ 0.45 M_I
29,000 TO 49,000 FT.............................. 170 KIAS
49,000 TO 51,000 FT................................ 0.70 M_I

NOTE:

THIS SPEED SCHEDULE APPROXIMATES BEST RATE-OF-CLIMB SPEEDS OR, ABOVE THE SINGLE-ENGINE CEILING, THE MINIMUM SINK-RATE SPEED.

EXAMPLE:

1. UNCORRECTED NET CLIMB GRADIENT (from table)............................ 1 %
2. ANTI-ICE SYSTEMS............................. FULL
3. CORRECTED NET CLIMB GRADIENT.............................. –1.4 %

CONDITIONS:

- SINGLE ENGINE
- THRUST........................ MAX CONTINUOUS
- GEAR.. UP
- FLAPS... UP
- SPEED.................... (SEE ENROUTE CLIMB SPEED SCHEDULE)

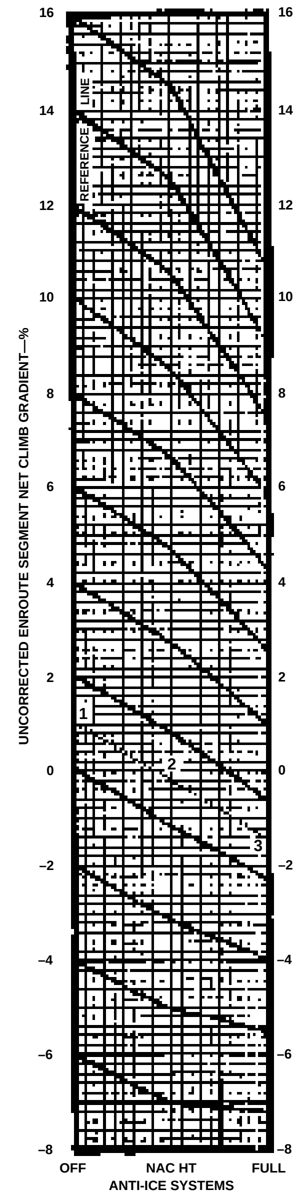

Figure PER-28. Enroute Climb Gradient—Single Engine

THRUST SETTING PROCEDURE

TAKEOFF THRUST

From the applicable Takeoff Thrust (N_1) chart, determine the Fan Speed (N_1) setting for temperature and altitude. Move thrust lever until Fan Speed (N_1) indicator aligns with chart value.

NOTE

During takeoff, Fan Speed (N_1) may decrease slightly from the initial static reading. Therefore, Fan Speed (N_1) should be continuously monitored and adjusted until reaching 80 KIAS. Fan speed may continue to decrease slightly; however, this decrease is accounted for in the Takeoff Thrust Setting charts.

Fan Speed (N_1) is the value where the temperature line intersects the pressure altitude line. N_1s above this line may exceed the airframe and engine limits. N_1s below this line will not meet the performance in this section.

Operation at a specific Fan Speed (N_1) should always be within the Turbine Temperature (ITT) Limits. Turbine Temperature ((ITT) Limit must be observed.

MAXIMUM CLIMB THRUST

From the applicable Maximum Continuous Thrust (N_1) table, determine the Fan Speed (N_1) setting for estimated temperature and altitude at the start of the climb. Adjust Fan Speed (N_1) for temperature and altitude during climb. Turbine Temperature (ITT) Limit must be observed.

Alternate Climb Power Management Procedure

An alternate climb power management procedure may be employed for climb above 15,000 feet. This is accomplished by setting the required Fan Speed (N_1) at 15,000 feet and observing the resulting Turbine Temperature (ITT). The digital electronic engine control will maintain N_1 values near the chart values and near constant ITT to altitude. Thrust lever adjustment may be made to maintain the ITT observed at 15,000 feet.

NOTE

A slightly different Fan Speed (N_1) Turbine Temperature (ITT) relationship may exist between engines; however, each engine should be operated at the Turbine Temperature (ITT) which provided the required N_1 at 15,000 feet.

Climb Power Management Procedure For Anti-Ice Operation

A climb power management procedure for anti-ice operation during climb may be accomplished. Using the applicable Maximum Continuous Thrust (N_1) table (Figure PER-32), determine the recommended Full Anti-ice On Fan Speed (N_1) for the estimated temperature and altitude. Prior to reducing power and selecting anti-ice, note the ITT. Select anti-ice on and reset power to determined anti-ice on N_1 value. If the resulting ITT is higher than the noted anti-ice off ITT, maintain the full anti-ice on N_1 adjusting for ambient temperature and altitude during climb. Operation should always be within the ITT limits. If the resulting ITT is lower than the noted anti-ice off ITT, N_1 can then be reset up to the noted anti-ice off ITT.

ANTI-ICE—OFF
STANDARD NOZZLE

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. TEMPERATURE.................... 66°F (19°C)
2. ALTITUDE.................... 4,000 FT
3. TAKEOFF THRUST SETTING.................... 97.9% N_1

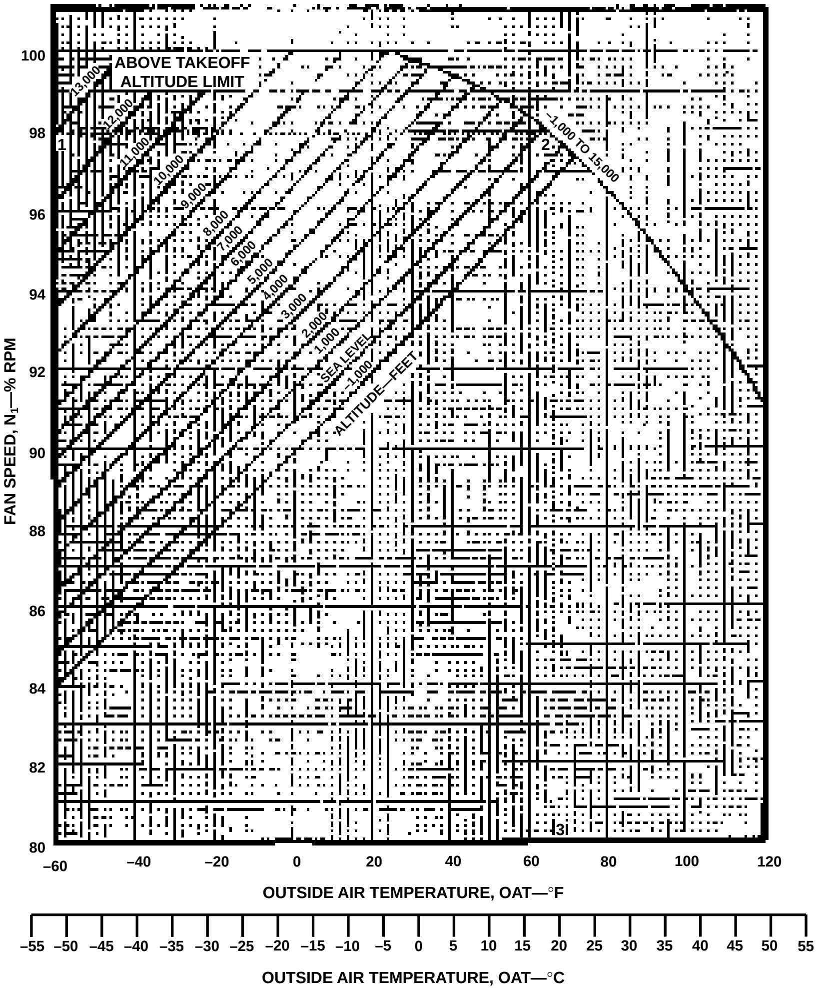

Figure PER-29. Takeoff Thrust Setting (Sheet 1 of 3)

NACELLE HEAT ONLY
STANDARD NOZZLE

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. TEMPERATURE.................... 30°F (–1°C)
2. ALTITUDE.................... 8,000 FT
3. TAKEOFF THRUST SETTING.................... 99.5% N_1

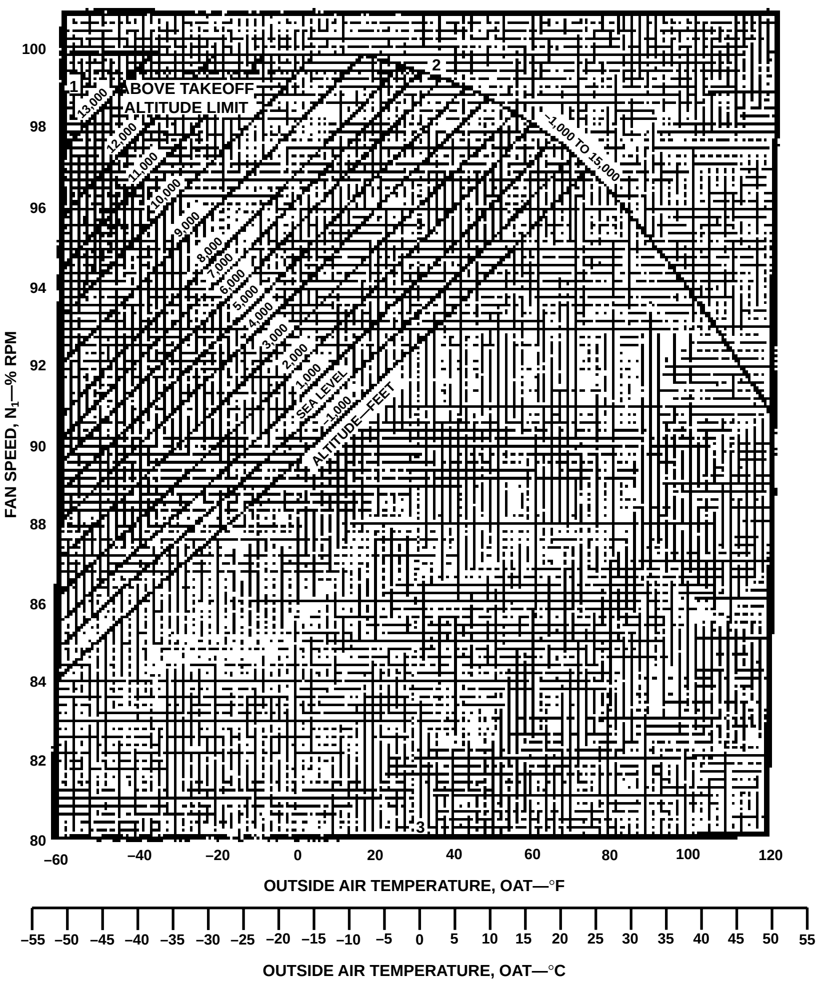

Figure PER-29. Takeoff Thrust Setting (Sheet 2 of 3)

FULL ANTI-ICE
STANDARD NOZZLE

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. TEMPERATURE.......... 0°F (–18°C)
2. ALTITUDE.......... 4,000 FT
3. TAKEOFF THRUST SETTING.......... 91.6% N_1

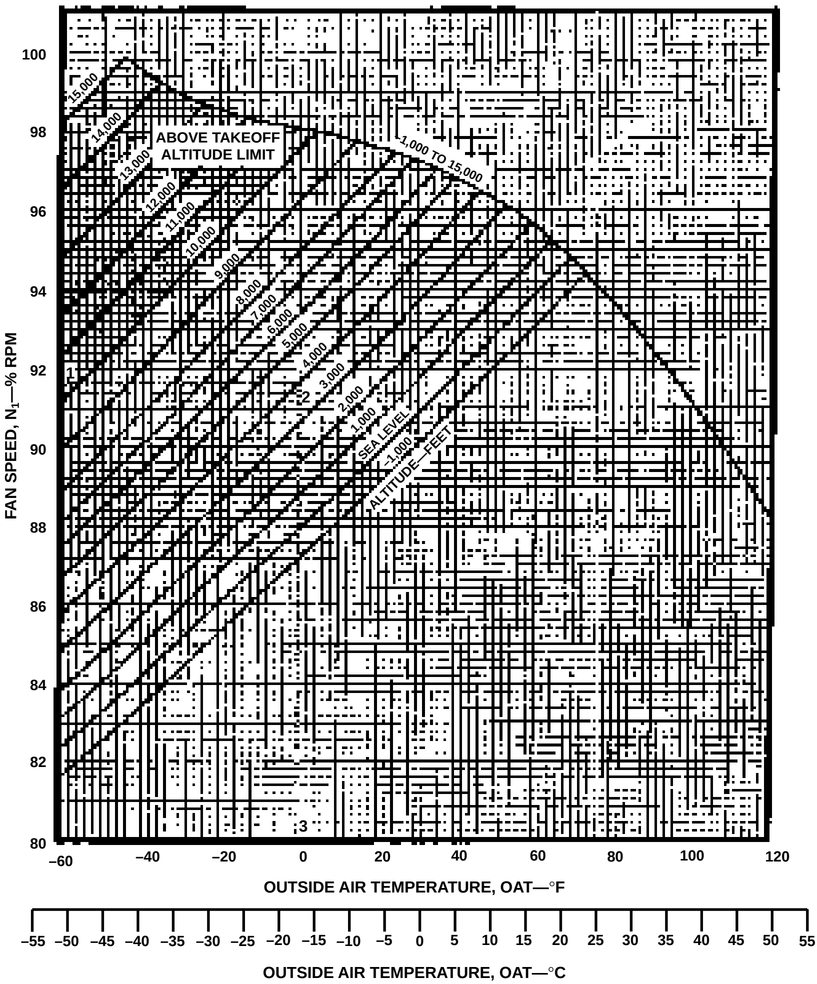

Figure PER-29. Takeoff Thrust Setting (Sheet 3 of 3)

ALL ENGINE/STANDARD NOZZLE

EFFECTIVITY:
ALL AIRCRAFT

XX.X ANTI-ICE OFF OR NACELLE HEAT ONLY
XX.X FULL ANTI-ICE ON

SPEED SCHEDULE:
- 250 KIAS TO 32,000 FT
- .70 M_I TO 51,000 FT

STATIC AIR TEMPERATURE—°C \ ALTITUDE—1,000 FEET	SL	5	10	15	20	25	30	35	40	45	50	51
50	**87.5** 84.8											
45	**88.8** 85.0											
40	**90.1** 87.1	**90.1** 87.2										
35	**91.5** 88.3	**91.5** 88.3										
30	**92.8** 89.5	**92.6** 89.5	**92.5** 89.6									
25	**93.8** 90.5	**93.7** 90.6	**93.6** 90.7									
20	**94.8** 91.5	**94.7** 91.6	**94.5** 91.6	**94.4** 91.7								
15	**95.5** 92.4	**95.4** 92.5	**95.3** 92.5	**95.2** 92.5								
10	**95.5** 93.1	**96.1** 93.2	**96.0** 93.2	**95.8** 93.2	**95.6** 93.2							
5	**94.5** 92.2	**96.7** 93.8	**96.5** 93.8	**96.4** 93.8	**96.1** 93.7							
0	**93.6** 91.2	**97.0** 94.4	**96.9** 94.4	**96.7** 94.4	**96.5** 94.3	**96.2** 94.0						
–5	**92.6** 90.4	**96.5** 94.4	**97.3** 94.8	**97.1** 94.7	**96.9** 94.8	**96.1** 94.5						
–10	**91.7** 89.4	**95.5** 93.5	**97.5** 95.1	**97.4** 95.0	**97.2** 94.9	**96.9** 94.8	**96.4** 94.4					
–15	**90.7** 88.5	**94.6** 92.5	**97.7** 95.3	**97.6** 95.2	**97.5** 95.1	**97.3** 95.0	**96.8** 94.7					
–20	**89.9** 87.6	**93.6** 91.6	**97.6** 95.5	**97.8** 95.4	**97.7** 95.3	**97.5** 95.2	**97.1** 94.9	**96.3** 94.3				
–25	**88.9** 86.7	**92.7** 90.7	**96.8** 94.6	**98.0** 95.5	**97.9** 95.5	**97.7** 95.4	**97.4** 95.1	**96.7** 94.6				
–30	**88.1** 85.8	**91.8** 89.8	**95.7** 93.6	**98.2** 95.7	**98.0** 95.6	**97.9** 95.5	**97.6** 95.3	**97.0** 94.9	**95.3** 90.7	**92.9** 89.7	**91.6** 86.2	**91.2** 86.0
–35	**87.2** 85.0	**90.8** 88.8	**94.7** 92.7	**98.4** 95.8	**98.2** 95.7	**98.0** 95.6	**97.8** 95.4	**97.3** 95.1	**95.7** 91.2	**94.6** 90.4	**92.2** 89.4	**91.9** 86.8
–40	**86.3** 84.1	**89.9** 87.9	**93.7** 91.7	**98.8** 95.9	**98.5** 95.8	**98.3** 95.7	**98.0** 95.6	**97.5** 95.3	**96.1** 91.6	**95.1** 90.9	**92.8** 90.1	**92.5** 89.9
–45	**85.4** 83.3	**89.0** 87.0	**92.7** 90.7	**97.8** 95.2	**98.9** 95.9	**98.7** 95.8	**98.3** 95.7	**97.8** 95.4	**96.5** 93.5	**95.6** 91.4	**94.4** 90.7	**94.1** 90.5
-50	**84.5** 82.4	**88.1** 86.1	**91.8** 89.8	**96.7** 94.2	**99.3** 96.1	**99.1** 95.9	**98.6** 95.6	**98.1** 95.5	**97.0** 93.8	**96.0** 91.7	**94.9** 91.1	**94.6** 90.9
-55							**99.1** 96.0	**98.6** 95.6	**97.4** 94.0	**96.6** 93.4	**95.5** 91.4	**95.2** 91.3
-60							**99.6** 96.2	**99.1** 95.9	**98.0** 94.2	**97.2** 93.7	**96.1** 93.0	**95.8** 92.9
-65								**99.7** 96.3	**98.8** 94.5	**97.9** 94.0	**96.8** 93.4	**96.6** 93.3
-70										**98.8** 94.5	**97.6** 93.9	**97.3** 93.7

Figure PER-30. Maximum Continuous Thrust for Climb (N_1) (Sheet 1 of 2)

SINGLE ENGINE/STANDARD NOZZLE

ALTITUDE—1,000 FEET

STATIC AIR TEMPERATURE—°C	SL	5	10	15	20	25	30	35	40	45	50	51
50	**86.8** 84.0											
45	**88.2** 85.3											
40	**89.6** 86.5	**89.5** 86.6										
35	**91.1** 87.7	**91.0** 87.8										
30	**92.4** 89.0	**92.3** 89.0	**92.2** 89.0									
25	**93.5** 90.1	**93.4** 90.1	**93.2** 90.1									
20	**94.5** 91.2	**94.4** 91.2	**94.2** 91.2	**94.1** 91.2								
15	**95.4** 92.1	**95.3** 92.1	**95.1** 92.1	**94.9** 92.1								
10	**95.3** 92.9	**96.0** 92.9	**95.9** 92.9	**95.7** 92.9	**95.5** 92.9							
5	**94.4** 92.0	**96.8** 93.6	**96.4** 93.6	**96.3** 93.6	**96.1** 93.6							
0	**93.5** 91.1	**97.0** 94.2	**96.9** 94.2	**96.7** 94.2	**96.5** 94.1	**96.2** 93.9						
–5	**92.6** 90.1	**96.7** 94.5	**97.2** 94.6	**97.1** 94.6	**96.6** 94.5	**96.6** 94.4						
–10	**91.7** 89.3	**95.7** 93.5	**97.4** 94.9	**97.3** 94.9	**97.2** 94.9	**96.9** 94.7	**96.3** 94.2					
–15	**90.7** 88.3	**94.8** 92.5	**97.6** 95.2	**97.5** 95.2	**97.4** 95.1	**97.2** 95.0	**96.7** 94.6					
–20	**89.8** 87.5	**93.8** 91.7	**97.7** 95.4	**97.7** 95.3	**97.6** 95.3	**97.4** 95.2	**96.9** 94.9	**96.0** 94.1				
–25	**88.9** 86.6	**92.9** 90.7	**96.7** 94.6	**97.9** 95.5	**97.8** 95.4	**97.6** 95.3	**97.2** 95.0	**96.3** 94.4				
–30	**88.0** 85.7	**92.0** 89.8	**95.7** 93.6	**98.1** 95.6	**97.9** 95.6	**97.8** 95.5	**97.4** 95.0	**96.6** 94.6	**94.3** 90.6	**91.7** 89.7	**87.2** 86.2	**86.9** 86.0
–35	**87.2** 84.8	**91.0** 88.9	**94.7** 92.7	**98.4** 95.7	**98.2** 95.7	**98.0** 95.5	**97.6** 95.3	**96.9** 94.9	**94.8** 91.1	**92.3** 90.4	**90.8** 89.4	**90.3** 86.8
–40	**86.3** 83.9	**90.1** 88.0	**93.8** 91.7	**98.8** 95.9	**98.6** 95.8	**98.4** 95.7	**97.9** 95.5	**97.2** 95.0	**95.3** 91.5	**94.1** 90.9	**91.5** 90.1	**91.1** 89.9
–45	**85.4** 83.1	**89.2** 87.1	**92.8** 90.8	**98.8** 96.0	**99.0** 96.0	**98.8** 95.9	**98.4** 95.6	**97.5** 95.2	**95.7** 93.3	**94.6** 91.3	**92.1** 90.7	**91.8** 90.5
-50	**84.5** 82.3	**88.3** 86.2	**91.9** 89.8	**97.8** 95.0	**99.5** 96.2	**99.2** 96.1	**98.8** 95.9	**98.0** 95.4	**96.2** 93.5	**95.1** 93.0	**93.8** 91.1	**92.3** 90.9
-55							**99.4** 96.3	**98.6** 95.7	**96.7** 93.8	**95.7** 93.3	**94.4** 91.4	**94.1** 91.3
-60							**100.0** 96.7	**99.2** 96.2	**97.5** 94.0	**96.3** 93.6	**95.0** 93.0	**94.7** 92.9
-65								**99.8** 96.6	**98.1** 94.5	**97.0** 94.0	**95.7** 93.4	**95.4** 93.3
-70										**97.8** 94.5	**96.5** 93.9	**96.2** 93.7

EFFECTIVITY:

ALL AIRCRAFT

XX.X ANTI-ICE OFF OR NACELLE HEAT ONLY
XX.X FULL ANTI-ICE ON

SPEED SCHEDULE:

- 250 KIAS TO 21,000 FT
- .45 M_I FROM 21,000 TO 49,000 FT
- 170 KIAS FROM 29,000 TO 49,000 FT
- .70 M_I FROM 49,000 TO 51,000 FT

Figure PER-30. Maximum Continuous Thrust for Climb (N_1) (Sheet 2 of 2)

CLIMB, CRUISE, AND DESCENT

An operational planning form is provided in the Flight Planning section of the *Pilot Manual*.

CLIMB PERFORMANCE

A set of climb performance tables are provided in the *Pilot's Manual* to determine time, distance (no wind), and fuel required for climb from sea level. If climb is started at an altitude above sea level, subtract the values for the starting altitude from the values for the level off altitude to find the time, distance, and fuel required for climb between two altitudes. Each table shows the climb performance data for a specific airplane weight at the start of climb.

CRUISE PERFORMANCE

Cruise performance tables are provided in the airplane checklist or the *Pilot's Manual* for two-engine normal cruise, high-speed cruise, long-range cruise and single-engine long-range cruise.

Normal Cruise

Normal cruise tables provide fuel flows and true airspeed for constant 0.76 MI cruise. Engine power is adjusted to maintain the constant Mach as weight decreases. Enter the appropriate table for the mid-weight between the start cruise weight and the end cruise weight. For example, with a start cruise weight of 15,000 pounds and an estimated fuel burn of 1,000 pounds per hour, enter the normal cruise table to find the hourly fuel flow for a weight of 14,500 pounds.

High-Speed Cruise

High-speed cruise tables provide fuel flows, indicated Mach or airspeed, and true airspeed for an M_{MO}/V_{MO} or V_{MAX} cruise. Power for maximum speed cruise is set for the limiting conditions (M_{MO}/V_{MO}, % rpm, or maximum continuous ITT). Enter the appropriate table for the average airplane weight during each cruise segment.

Long-Range Cruise—Two Engine

The Long-Range Cruise—Two Engine tables provide fuel flow, indicated Mach and true airspeed for 99% maximum range cruise. It can be seen from the chart that as airplane gross weight decreases, the altitude that provides best fuel economy increases. Therefore, when planning for maximum range, the cruise portion of the flight should be divided into segments, with an appropriately higher cruise altitude planned as airplane gross weight decreases.

Long-Range Cruise—One Engine

The Long-Range Cruise—One Engine tables provide the fuel flow, indicated Mach or airspeed and true airspeed for 99% maximum range cruise with a single engine.

DESCENT PERFORMANCE

Descent Performance schedules are provided in the *Pilot's Manual* to provide time, distance (no wind), and fuel used for descent to sea level. The descent speed schedules presented at the bottom of the table should be followed to achieve the desired results.

APPROACH AND LANDING

The charts on the following pages (Figures PER-33 through PER-35) present approach and landing climb gradients, maximum landing weights as limited by approach and landing climb performance, and landing weights as limited by maximum brake energy.

MAXIMUM ALLOWABLE LANDING WEIGHT

Landings must be made within the limitations of the maximum landing weight as governed by the Landing Weight Limits chart and by the performance determined from the Actual Landing Distance and Factored Landing Distance (if applicable) charts. The heaviest weight at which the aircraft can land is the lowest of the following weights:

- The maximum landing weight (design structural limit for landing) is 15,300 pounds (6,940 kg).
- The landing weight limit for airport altitude and reported surface temperature as determined from the Landing Weight Limits chart.
- The maximum landing weight for the runway and ambient conditions as determined from the Actual Landing Distance and Factored Landing Distance (if applicable) charts.

The landing worksheet, Figure PER-36, can be used to record these limits after they have been computed.

NOTE

If the aircraft weight over the destination is greater than the lowest of the above weights, fuel must be burned off until the proper weight is achieved.

MAXIMUM LANDING WEIGHT (APPROACH CLIMB OR BRAKE ENERGY LIMITED)

The landing weight limit chart defines the maximum weight for temperature and pressure altitude that meets the minimum climb requirement for a single engine missed approach. This requirement is for a 2.1% gross climb gradient in the approach climb configuration. A section of the chart shows the maximum weight for brake energy limits if applicable.

LANDING DISTANCE

The Actual Landing Distance chart shows the demonstrated landing distance in terms of altitude, outside air temperature, weight, wind, runway gradient, and anti-skid on or off. The Factored Landing Distance chart shows the operational landing field length when a factored landing distance is required by applicable regulations. These charts may be used to determine either of the following:

- The landing field length required given the airplane weight, runway gradient, pressure altitude, reported surface temperature, and wind.
- The maximum landing weight corresponding to a specific runway length, runway gradient, pressure altitude, reported surface temperature, and wind. Landing weight for runway length available may be determined by working through the chart in the opposite manner as finding landing distance. Landing weight determined in this manner may not be the limiting landing weight; refer to Maximum Landing Weight.

Landing on Wet or Contaminated Runway

Refer to the Wet/Contaminated Runway Data for guidance material pertaining to landing on a wet or contaminated runway.

Landing Procedure

The landing distances on the Actual Landing Distance chart (Figure PER-34) can be realized when the following procedure is used.

1. Approach over the end of the runway on a 3° glideslope to the normal touchdown point (approximately 1,000 feet from end of runway) at V_{REF} with flaps and gear down, using thrust for a 3° glideslope.
2. After passing through the 50-foot point, reduce thrust until thrust levers are at IDLE at 30 feet above the runway.
3. Maintain existing attitude until touchdown.
4. Wheel Brakes—Apply as soon as practical.
    - Anti-skid operative—Apply maximum anti-skid braking until the airplane stops.
    - Anti-skid inoperative—Apply brakes judiciously to prevent tire skid or failure. Modulating brake pressures will improve feel and reduce the probability of tire skid.

NOTE

- Pulling the control column aft will shift weight to the main wheels and improve braking efficiency. Pull control column as far aft as possible—***do not lift nosewheel***.

- On wet or icy runway surfaces, full aft control column movement may not be practical due to the possibility of nosewheel lift-off.

The landing distance chart is based upon smooth, dry, hard-surfaced runways. The landing field length is equal to the horizontal distance from a point 50 feet above the runway surface to the point at which the airplane comes to a full stop on the runway.

Wet Runway Landing Factor

NOTE

The wet runway landing factors presented here are based on estimates and are provided for information only.

The distances presented on the Actual Landing Distance and Factored Landing Distance charts are based upon smooth, dry, hard-surface runways. The appropriate correction to be applied for wet runway (less than 0.1 inch [3 mm] of standing water) operations is as follows.

NOTE

The correction to be applied to account for more than 0.1 inch (3 mm) of standing water or the presence of solid ice, snow, or slush is unknown.

Actual Landing Distance Correction

Field elevation above 4,000 feet, apply a 1.6 wet runway factor to the Actual Landing Distance (Figure PER-34). For example, if the actual landing distance is 2,000 feet, the landing distance corrected for wet runway will be 3,200 feet.

Field elevation 4,000 feet or less, apply a 1.4 wet runway factor to the Actual Landing Distance (Figure PER-34). For example, if the actual landing distance is 2,000 feet, the landing distance corrected for wet runway will be 2,800 feet.

If it is not known whether the water on a wet runway may be in the process of freezing, a factor of at least 2.5 should be applied to the dry runway Actual Landing Distance if the field elevation is below 8,000 feet. A factor of at least 3.0 should be applied for field elevations of 8,000 feet and above.

Factored Landing Distance Correction

Apply a 1.15 wet runway factor to the Factored Landing Distance (Figure PER-35). For example, if the factored landing distance is 3,000 feet, the factored landing distance corrected for wet runway will be 3,450 feet.

LANDING APPROACH SPEED (V_{REF})

V_{REF} is computed from the landing speeds table (Figure PER-37) and is determined by airplane weight.

These are the minimum speeds for final approach:

- No-flaps—V_{REF} + 20 KIAS
- FLAPS 8°—V_{REF} + 15 KIAS
- FLAPS 20°—V_{REF} + 10 KIAS
- FLAPS 40°—V_{REF}

For maneuvering, and before final approach, 10 KIAS should be added to the above speeds.

APPROACH CLIMB SPEED (V_{APP})

The approach climb speed is based on 1.3 V_{S1} and is the speed used to establish the approach climb weight limit. This speed will give the maximum climb in the event of a single engine missed approach. Approach climb speed is also computed from the landing speeds table.

APPROACH AND LANDING CLIMB GRADIENT CHARTS

Approach and Landing Climb Gradient charts is given in the *AFM* and are read at the airport temperature and pressure altitude. The gradients will be achieved using the speeds shown in the Landing Speeds chart.

EFFECTIVITY:
ALL AIRCRAFT

LANDING APPROACH SPEED—V_{REF}
APPROACH CLIMB SPEED—V_{APP}

WEIGHT LB	KIAS V_{REF}	KIAS V_{APP}
10,000	99	104
11,000	104	110
12,000	108	114
13,000	112	119
14,000	116	123
15,000	120	127
15,300	121	128
15,500	122	128
16,000	124	131
17,000	127	134

WEIGHT KG	KIAS V_{REF}	KIAS V_{APP}
4500	99	104
5000	104	110
5500	110	115
6000	114	120
6500	118	125
6940	122	128
7000	122	129
7500	126	133
7711	127	134

Figure PER-31. Landing Speeds

UNCORRECTED APPROACH GROSS CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F –40	–20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	20.0	19.9	20.0	20.1	20.2	20.4	20.1	18.1	16.2	14.2	12.3	10.3
	11,000	16.9	16.8	16.9	17.0	17.1	17.3	17.1	15.3	13.5	11.8	10.0	8.3
	12,000	14.5	14.4	14.4	14.5	14.6	14.8	14.6	12.9	11.4	9.8	8.2	6.6
	13,000	12.4	12.3	12.4	12.4	12.5	12.7	12.5	11.0	9.6	8.1	6.7	5.2
	14,000	10.6	10.6	10.6	10.7	10.7	10.9	10.7	9.4	8.0	6.7	5.4	4.1
	15,000	9.1	9.1	9.1	9.2	9.2	9.4	9.2	8.0	6.7	5.5	4.3	3.0
	15,500	8.5	8.4	8.4	8.5	8.5	8.7	8.5	7.3	6.1	5.0	3.8	2.6
	16,000	7.8	7.8	7.8	7.8	7.9	8.1	7.9	6.7	5.6	4.4	3.3	2.2
	17,000	6.7	6.6	6.7	6.7	6.7	6.9	6.8	5.7	4.6	3.5	2.5	1.4
2,000	10,000	19.5	19.3	19.4	19.5	19.7	19.7	17.7	15.8	14.0	12.1	10.2	8.4
	11,000	16.4	16.3	16.4	16.4	16.7	16.6	14.9	13.2	11.5	9.9	8.2	6.6
	12,000	14.0	13.9	13.9	14.0	14.2	14.1	12.6	11.1	9.6	8.1	6.6	5.1
	13,000	12.0	11.9	11.9	12.0	12.2	12.1	10.7	9.3	6.9	6.5	5.2	3.8
	14,000	10.3	10.1	10.2	10.3	10.4	10.3	9.1	7.8	6.5	5.3	4.0	2.8
	15,000	8.8	8.7	8.7	8.8	8.9	8.8	7.7	6.5	5.3	4.2	3.0	1.8
	15,500	8.1	8.0	8.1	8.1	8.3	8.2	7.0	5.9	4.8	3.7	2.6	1.4
	16,000	7.5	7.4	7.5	7.5	7.7	7.6	6.5	5.4	4.3	3.2	2.1	1.0
	17,000	6.4	6.3	6.4	6.4	6.5	6.5	5.4	4.5	3.4	2.4	1.4	0.4
4,000	10,000	19.4	19.1	19.2	19.2	19.4	17.3	15.5	13.8	12.1	10.4	8.7	
	11,000	16.3	16.1	16.2	16.2	16.4	14.5	13.0	11.4	9.9	8.4	6.8	
	12,000	13.9	13.7	13.8	13.8	13.9	12.3	10.9	9.5	8.1	6.7	5.3	
	13,000	11.8	11.7	11.7	11.8	11.9	10.4	9.1	7.8	6.6	5.3	4.0	
	14,000	10.1	10.0	10.0	10.1	10.2	8.8	7.6	6.5	5.3	4.1	3.0	
	15,000	8.6	8.5	8.6	8.6	8.7	7.5	6.4	5.3	4.2	3.1	2.0	
	15,500	8.0	7.9	7.9	8.0	8.1	6.8	5.8	4.7	3.7	2.7	1.6	
	16,000	7.3	7.3	7.3	7.4	7.5	6.3	5.3	4.3	3.2	2.2	1.2	
	17,000	6.2	6.2	6.2	6.2	6.3	5.2	4.3	3.4	2.5	1.5	0.5	
6,000	10,000	18.8	18.7	18.7	18.8	18.1	15.0	13.4	11.9	10.3	8.8	7.2	
	11,000	15.9	15.8	15.7	15.9	15.3	12.4	11.0	9.7	8.3	6.9	5.5	
	12,000	13.5	13.4	13.4	13.5	12.9	10.4	9.1	7.9	6.6	5.4	4.1	
	13,000	11.5	11.4	11.4	11.5	11.0	8.7	7.5	6.4	5.2	4.1	2.9	
	14,000	9.8	9.8	9.7	9.8	9.4	7.2	6.2	5.1	4.1	3.0	2.0	
	15,000	8.4	8.3	8.3	8.4	8.0	6.0	5.0	4.0	3.1	2.1	1.1	
	15,500	7.7	7.7	7.7	7.8	7.4	5.5	4.5	3.6	2.6	1.7	0.7	
	16,000	7.1	7.1	7.1	7.2	6.8	4.9	4.0	3.1	2.2	1.3	0.4	
	17,000	6.0	6.0	6.0	6.1	5.8	4.1	3.1	2.3	1.4	0.6	–0.3	
8,000	10,000	18.1	18.0	18.0	18.1	15.9	13.1	11.5	10.0	8.4	6.9		
	11,000	15.2	15.1	15.2	15.2	13.2	10.8	9.4	8.0	6.6	5.2		
	12,000	12.9	12.8	12.9	12.9	11.1	8.9	7.6	6.3	5.1	3.8		
	13,000	11.0	10.9	11.0	11.0	9.4	7.3	6.1	5.0	3.8	2.7		
	14,000	9.4	9.3	9.3	9.4	7.9	6.0	4.9	3.8	2.8	1.7		
	15,000	8.0	7.9	8.0	8.0	6.6	4.8	3.9	2.9	1.9	0.9		
	15,500	7.4	7.3	7.3	7.4	6.0	4.3	3.4	2.4	1.5	0.5		
	16,000	6.8	6.7	6.7	6.8	5.5	3.9	2.9	2.0	1.1	0.2		
	17,000	5.7	5.6	5.7	5.7	4.6	3.0	2.1	1.2	0.4	–0.5		
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	18.1	18.1	18.0	16.3	13.8	11.1	9.8	8.5	7.1			
	11,000	15.2	15.2	15.1	13.6	11.4	9.0	7.8	6.6	5.4			
	12,000	12.9	12.9	12.8	11.5	9.5	7.3	6.2	5.2	4.1			
	13,000	11.0	10.9	10.9	9.7	7.9	5.9	4.9	3.9	2.9			
	14,000	9.3	9.3	9.3	8.2	6.5	4.7	3.8	2.9	1.9			
	15,000	7.9	7.9	7.9	6.9	5.3	3.6	2.8	1.9	1.1			
	15,500	7.3	7.3	7.2	6.3	4.8	3.2	2.3	1.5	0.7			
	16,000	6.7	6.7	6.6	5.8	4.3	2.7	1.9	1.2	0.3			
	17,000	5.6	5.6	5.6	4.8	3.4	1.9	1.2	0.5	–0.3			
12,000	10,000	18.1	17.9	16.5	14.1	11.7	9.3	8.2	7.0	ABOVE ENGINE TEMP LIMITS			
	11,000	15.2	15.1	13.9	11.7	9.8	7.4	6.4	5.3				
	12,000	12.9	12.8	11.7	9.8	7.8	5.9	4.9	3.9				
	13,000	11.0	10.9	9.9	8.1	6.4	4.6	3.7	2.8				
	14,000	9.3	9.3	8.4	6.8	5.1	3.5	2.6	1.8				
	15,000	7.9	7.9	7.1	5.6	4.1	2.5	1.7	1.0				
	15,500	7.3	7.3	6.5	5.0	3.6	2.1	1.3	0.6				
	16,000	6.7	6.7	5.9	4.5	3.1	1.7	1.0	0.3				
	17,000	5.7	5.6	4.9	3.6	2.3	1.0	0.3	–0.4				
14,000	10,000	17.4	15.9	14.3	12.1	10.0	7.8	6.8	5.7				
	11,000	14.7	13.3	11.9	9.9	8.0	6.1	5.1	4.1				
	12,000	12.5	11.2	9.9	8.2	6.4	4.6	3.8	2.9				
	13,000	10.6	9.5	8.3	6.7	5.0	3.4	2.6	1.8				
	14,000	9.0	8.0	6.9	5.4	3.9	2.4	1.7	0.9				
	15,000	7.7	6.7	5.7	4.3	2.9	1.6	0.8	0.1				
	15,500	7.1	6.1	5.2	3.8	2.5	1.2	0.5	–0.2				
	16,000	6.5	5.6	4.7	3.4	2.1	0.8	0.1	–0.5				
	17,000	5.5	4.6	3.7	2.5	1.3	0.1	–0.5					

Figures in shaded area are provided for interpolation only.

FlightSafety International
LEARJET 31A PILOT TRAINING MANUAL

EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:
1. UNCORRECTED GROSS CLIMB GRADIENT (from table) .... 15.4 %
2. WIND .... 0 KT
3. REFERENCE LINE
4. ANTI-ICE SYSTEMS .... FULL
5. CORRECTED GROSS CLIMB GRADIENT .... 11.3 %

CONDITIONS:
- SINGLE ENGINE
- THRUST .... TAKEOFF
- GEAR .... UP
- FLAPS .... 20°
- SPEED .... 1.3 V_{S1}

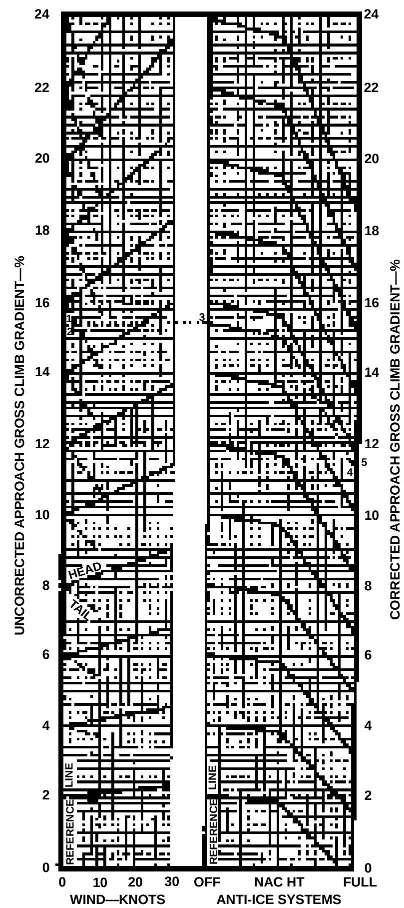

Figure PER-32. Approach Climb Gradient

UNCORRECTED LANDING GROSS CLIMB GRADIENT—%

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F −40	−20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	47.2	46.9	47.1	47.3	47.5	48.3	47.5	42.3	37.3	32.7	28.2	24.0
	11,000	39.3	39.1	39.2	39.4	39.6	40.2	39.6	35.2	31.1	27.1	23.3	19.5
	12,000	33.3	33.1	33.2	33.4	33.5	34.0	33.5	29.8	26.2	22.7	19.3	16.0
	13,000	28.6	28.4	28.5	28.6	28.8	29.2	28.7	25.5	22.3	19.1	16.1	13.1
	14,000	24.7	24.5	24.6	24.8	24.9	25.3	24.9	21.9	19.0	16.2	13.4	10.7
	15,000	21.4	21.3	21.4	21.5	21.6	22.0	21.6	18.9	16.3	13.7	11.1	8.6
	15,500	20.0	19.9	20.0	20.1	20.2	20.5	20.2	17.6	15.1	12.6	10.1	7.7
	16,000	18.7	18.6	18.6	18.7	18.8	19.2	18.8	16.4	13.9	11.6	9.2	6.8
	17,000	16.3	16.2	16.3	16.4	16.4	16.8	16.5	14.2	11.9	9.7	7.5	5.3
2,000	10,000	45.7	45.3	45.5	45.7	46.3	46.2	41.3	36.6	32.1	27.9	23.8	19.8
	11,000	38.1	37.7	37.9	38.1	38.6	38.5	34.4	30.4	26.6	22.9	19.4	15.9
	12,000	32.2	31.9	32.1	32.2	32.6	32.5	29.0	25.6	22.2	19.0	15.8	12.7
	13,000	27.6	27.4	27.5	27.6	28.0	27.9	24.8	21.7	18.7	15.8	13.0	10.1
	14,000	23.9	23.6	23.7	23.9	24.2	24.0	21.3	18.5	15.8	13.2	10.6	8.0
	15,000	20.7	20.5	20.6	20.7	21.0	20.9	18.3	15.8	13.3	10.9	8.5	6.1
	15,500	19.3	19.1	19.2	19.3	19.6	19.4	17.0	14.6	12.2	9.9	7.6	5.3
	16,000	18.0	17.8	17.9	18.0	18.3	18.1	15.8	13.5	11.2	9.0	6.8	4.6
	17,000	15.7	15.5	15.6	15.7	16.0	15.8	13.6	11.5	9.4	7.3	5.2	3.2
4,000	10,000	45.1	44.8	45.0	45.1	45.6	40.1	35.9	31.8	27.9	24.1	20.4	
	11,000	37.6	37.3	37.4	37.6	37.9	33.4	29.8	26.3	23.0	19.7	16.4	
	12,000	31.8	31.6	31.8	31.9	32.2	28.2	25.1	22.0	19.0	16.1	13.2	
	13,000	27.2	27.1	27.2	27.3	27.6	24.1	21.3	18.5	15.9	13.2	10.6	
	14,000	23.5	23.4	23.5	23.6	23.8	20.7	18.1	15.7	13.2	10.8	8.4	
	15,000	20.3	20.2	20.3	20.4	20.6	17.8	15.5	13.2	11.0	8.7	6.5	
	15,500	18.9	18.9	18.9	19.0	19.2	16.5	14.3	12.1	10.0	7.8	5.7	
	16,000	17.6	17.5	17.6	17.7	18.0	15.4	13.2	11.1	9.0	7.0	4.9	
	17,000	15.4	15.2	15.3	15.4	15.6	13.2	11.3	9.3	7.4	5.4	3.5	
6,000	10,000	44.0	43.8	43.7	44.0	42.2	34.5	30.9	27.4	23.9	20.6	17.3	
	11,000	36.7	36.5	36.4	38.7	35.2	28.7	25.6	22.5	19.5	16.5	13.6	
	12,000	31.0	30.9	30.8	31.0	29.7	24.0	21.3	18.6	15.9	13.3	10.7	
	13,000	26.5	26.4	26.3	26.6	25.4	20.4	17.9	15.4	13.0	10.7	8.3	
	14,000	22.9	22.8	22.6	22.9	21.9	17.3	15.0	12.8	10.6	8.4	6.3	
	15,000	19.8	19.7	19.6	19.8	18.9	14.7	12.7	10.6	8.6	6.6	4.6	
	15,500	18.4	18.4	18.3	18.5	17.6	13.6	11.6	9.6	7.7	5.8	3.8	
	16,000	17.2	17.1	17.0	17.2	16.4	12.5	10.6	8.7	6.9	5.0	3.1	
	17,000	14.9	14.9	14.8	15.0	14.2	10.6	8.9	7.1	5.3	3.6	1.9	
8,000	10,000	42.1	41.9	42.0	42.2	36.7	30.1	26.6	23.2	19.8	16.6		
	11,000	35.1	34.9	35.0	35.2	30.5	24.9	21.8	18.8	15.9	13.0		
	12,000	29.8	29.5	29.7	29.8	25.7	20.8	18.1	15.4	12.8	10.2		
	13,000	25.5	25.3	25.4	25.5	21.9	17.5	15.0	12.6	10.2	7.8		
	14,000	21.9	32.8	21.9	22.0	18.7	14.7	12.5	10.2	8.0	5.9		
	15,000	19.0	18.8	18.9	19.0	16.0	12.4	10.3	8.2	6.2	4.2		
	15,500	17.7	17.5	17.6	17.7	14.9	11.3	9.3	7.4	5.4	3.5		
	16,000	16.5	16.3	16.4	16.5	13.7	10.3	8.4	6.5	4.6	2.7		
	17,000	14.2	14.1	14.2	14.2	11.7	8.5	6.7	5.0	3.2	1.5		
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	42.3	42.2	42.0	37.7	31.8	25.7	22.8	19.9	17.1			
	11,000	35.2	35.1	35.0	31.4	26.3	21.0	18.5	16.0	13.4			
	12,000	29.8	29.7	29.6	26.5	22.0	17.4	15.1	12.9	10.6			
	13,000	25.5	25.4	25.3	22.6	18.6	14.4	12.3	10.3	8.2			
	14,000	21.9	21.8	21.8	19.4	15.8	11.9	10.0	8.2	6.3			
	15,000	18.9	18.9	18.8	16.7	13.3	9.8	8.1	6.4	4.6			
	15,500	17.6	17.5	17.5	15.5	12.3	8.9	7.2	5.5	3.8			
	16,000	16.4	16.3	16.3	14.3	11.3	8.0	6.4	4.8	3.1			
	17,000	14.2	14.1	14.1	12.3	9.4	6.4	4.9	3.4	1.9			
12,000	10,000	42.1	41.8	38.2	32.5	27.1	21.8	19.2	16.7				
	11,000	35.1	34.8	31.8	26.9	22.3	17.6	15.4	13.1				
	12,000	29.7	29.5	27.0	22.7	18.5	14.4	12.3	10.3				
	13,000	25.4	25.2	23.0	19.2	15.4	11.7	9.8	8.0				
	14,000	21.9	21.7	19.8	16.3	12.9	9.4	7.7	6.1	ABOVE ENGINE TEMP LIMITS			
	15,000	18.9	18.8	17.0	13.8	10.7	7.5	6.0	4.4				
	15,500	17.6	17.5	15.8	12.7	9.7	6.7	5.2	3.6				
	16,000	16.4	16.3	14.7	11.7	8.8	5.9	4.4	3.0				
	17,000	14.2	14.1	12.6	9.9	7.2	4.4	3.1	1.7				
14,000	10,000	40.4	36.6	32.9	27.9	23.1	18.5	16.2	14.0				
	11,000	33.7	30.5	27.3	23.0	18.8	14.8	12.8	10.8				
	12,000	28.7	25.8	23.0	19.2	15.5	11.8	10.0	8.2				
	13,000	24.5	22.0	19.5	16.1	12.7	9.4	7.7	6.0				
	14,000	21.2	18.9	16.6	13.4	10.3	7.3	5.8	4.2				
	15,000	18.3	16.2	14.1	11.2	8.4	5.5	4.1	2.7				
	15,500	17.0	15.1	13.0	10.2	7.5	4.8	3.4	2.0				
	16,000	15.8	14.0	12.0	9.3	6.6	4.0	2.7	1.3				
	17,000	13.7	12.0	10.1	7.6	5.2	2.7	1.4	0.2				

Figures in shaded area are provided for interpolation only.

EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE:

1. UNCORRECTED GROSS CLIMB GRADIENT (from table) .... 12.5 %
2. WIND .... 0 KT
3. REFERENCE LINE
4. NACELLE HEAT .... ON
5. CORRECTED GROSS CLIMB GRADIENT .... 12 %

CONDITIONS:

- SINGLE ENGINE
- THRUST .... TAKEOFF
- GEAR .... DOWN
- FLAPS .... 40°
- SPEED .... 1.3 V_{S1}

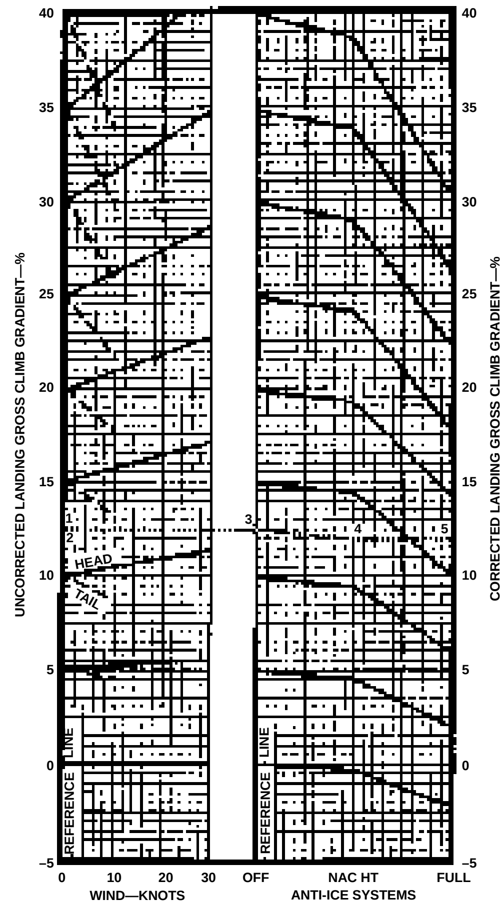

Figure PER-33. Landing Climb Gradient

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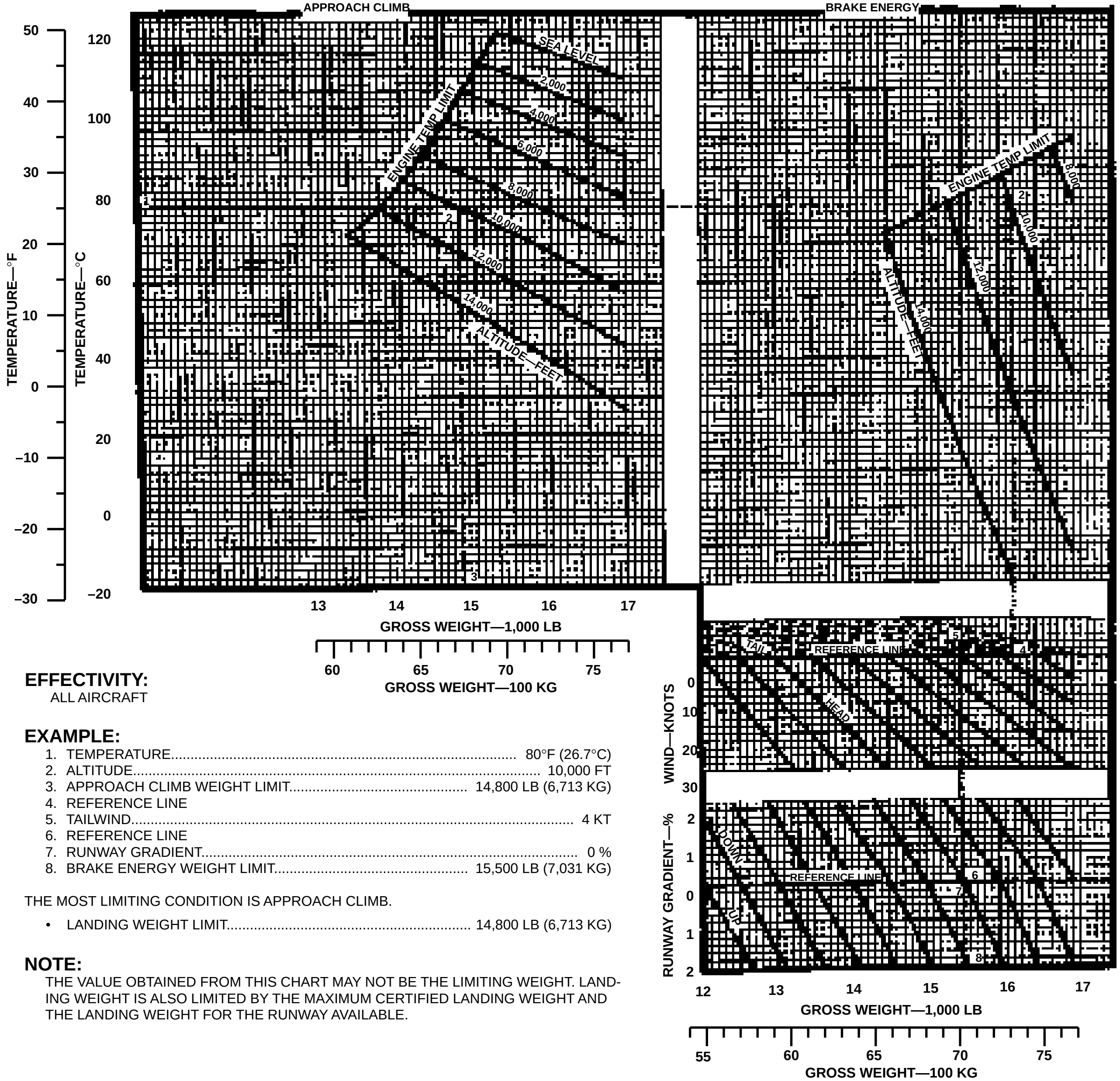
ANTI-ICE—OFF



EFFECTIVITY:
ALL AIRCRAFT

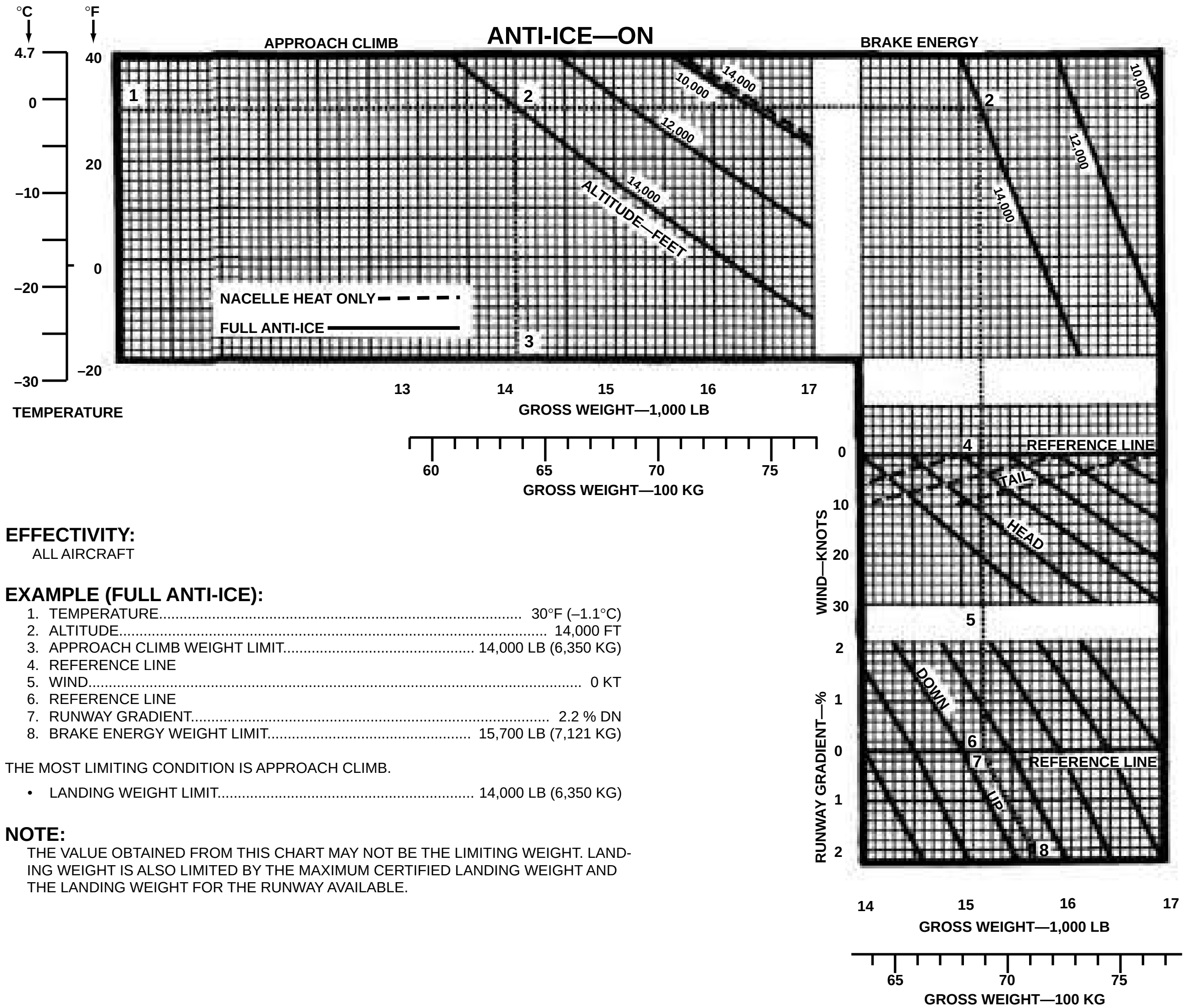
EXAMPLE:
1. TEMPERATURE.......... 80°F (26.7°C)
2. ALTITUDE.......... 10,000 FT
3. APPROACH CLIMB WEIGHT LIMIT.......... 14,800 LB (6,713 KG)
4. REFERENCE LINE
5. TAILWIND.......... 4 KT
6. REFERENCE LINE
7. RUNWAY GRADIENT.......... 0 %
8. BRAKE ENERGY WEIGHT LIMIT.......... 15,500 LB (7,031 KG)

THE MOST LIMITING CONDITION IS APPROACH CLIMB.

- LANDING WEIGHT LIMIT.......... 14,800 LB (6,713 KG)

NOTE:
THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. LANDING WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED LANDING WEIGHT AND THE LANDING WEIGHT FOR THE RUNWAY AVAILABLE.

Figure PER-34. Landing Weight Limit (Sheet 1 of 2)



EFFECTIVITY:

ALL AIRCRAFT

EXAMPLE (FULL ANTI-ICE):

1. TEMPERATURE .... 30°F (–1.1°C)
2. ALTITUDE .... 14,000 FT
3. APPROACH CLIMB WEIGHT LIMIT .... 14,000 LB (6,350 KG)
4. REFERENCE LINE
5. WIND .... 0 KT
6. REFERENCE LINE
7. RUNWAY GRADIENT .... 2.2 % DN
8. BRAKE ENERGY WEIGHT LIMIT .... 15,700 LB (7,121 KG)

THE MOST LIMITING CONDITION IS APPROACH CLIMB.

- LANDING WEIGHT LIMIT .... 14,000 LB (6,350 KG)

NOTE:

THE VALUE OBTAINED FROM THIS CHART MAY NOT BE THE LIMITING WEIGHT. LANDING WEIGHT IS ALSO LIMITED BY THE MAXIMUM CERTIFIED LANDING WEIGHT AND THE LANDING WEIGHT FOR THE RUNWAY AVAILABLE.

Figure PER-34. Landing Weight Limit (Sheet 2 of 2)

UNCORRECTED LANDING DISTANCE—FT

ALTITUDE FEET	WEIGHT LB	TEMPERATURE—°F −40	−20	0	20	40	60	70	80	90	100	110	120
SEA LEVEL	10,000	1950	1990	2040	2080	2120	2160	2180	2210	2230	2250	2270	2290
	11,000	2050	2100	2140	2190	2230	2280	2300	2320	2350	2370	2390	2420
	12,000	2150	2200	2250	2300	2350	2400	2420	2450	2470	2490	2520	2540
	13,000	2250	2300	2360	2410	2460	2510	2540	2570	2590	2610	2640	2670
	14,000	2350	2410	2460	2520	2570	2630	2660	2690	2710	2720	2770	2800
	15,000	2450	2510	2570	2630	2690	2750	2780	2800	2830	2860	2890	2930
	15,500	2480	2540	2600	2660	2720	2780	2810	2840	2870	3910	2940	2980
	16,000	2550	2610	2680	2740	2800	2870	2910	2940	2980	3020	3050	3090
	17,000	2650	2720	2790	2870	2940	3020	3060	3100	3140	3180	3220	3270
2,000	10,000	2020	2060	2110	2160	2200	2250	2270	2290	2310	2340	2360	2380
	11,000	2120	2170	2220	2270	2320	2370	2390	2420	2440	2470	2490	2510
	12,000	2230	2280	2330	2390	2440	2490	2520	2550	2570	2600	2620	2650
	13,000	2330	2390	2450	2500	2560	2620	2640	2670	2700	2730	2760	2780
	14,000	2440	2500	2560	2620	2680	2740	2770	2800	2830	2860	2890	2920
	15,000	2540	2610	2670	2730	2800	2860	2890	2930	2970	3000	3040	3080
	15,500	2580	2640	2700	2770	2830	2900	2940	2980	3020	3050	3090	3130
	16,000	2650	2720	2780	2860	2930	3010	3050	3090	3130	3180	3220	3220
	17,000	2760	2840	2920	3010	3090	3180	3220	3270	3310	3360	3400	3450
4,000	10,000	2100	2150	2200	2250	2290	2340	2370	2390	2420	2440	2470	
	11,000	2210	2260	2310	2370	2420	2470	2500	2520	2550	2580	2600	
	12,000	2320	2380	2430	2490	2550	2600	2630	2660	2690	2720	2750	
	13,000	2430	2490	2550	2610	2670	2730	2760	2790	2820	3850	2880	
	14,000	2540	2600	2670	2730	2800	2860	2900	2930	2960	2990	3030	
	15,000	2650	2720	2790	2860	2930	3010	3050	3090	3130	3170	3210	
	15,500	2680	2750	2820	2900	2980	3060	3100	3140	3180	3230	3270	
	16,000	2760	2840	2920	3010	3090	3180	3230	3270	3320	3360	3410	
	17,000	2890	2990	3080	3170	3270	3360	3410	3460	3510	3560	3610	
6,000	10,000	2190	2240	2300	2350	2410	2460	2490	2510	2540	2570	2590	
	11,000	2310	2360	2420	2480	2540	2590	2620	2650	2680	2710	2740	
	12,000	2420	2490	2550	2610	2670	2730	2760	2800	2830	2860	2890	
	13,000	2540	2610	2670	2740	2800	2870	2900	2940	2970	3000	3030	
	14,000	2660	2730	2800	2870	2940	3010	3050	3090	3130	3170	3210	
	15,000	2770	2850	2920	3010	3100	3190	3230	3280	3320	3370	3410	
	15,500	2810	2880	2970	3060	3150	3240	3290	3340	3380	3430	3480	
	16,000	2900	2990	3090	3180	3280	3380	3430	3480	3530	3580	3630	
	17,000	3050	3160	3260	3360	3470	3580	3630	3690	3750	3800	3860	
8,000	10,000	2300	2360	2420	2480	2540	2590	2620	2650	2680	2710		
	11,000	2420	2480	2550	2610	2670	2740	2770	3800	2830	2860		
	12,000	2550	2610	2680	2750	2820	2880	2920	2950	2980	3020		
	13,000	2670	2740	2810	2880	2960	3030	3060	3100	3140	3170		
	14,000	2790	2870	2940	3020	3110	3200	3240	3290	3330	3380		
	15,000	2910	3000	3100	3200	3300	3400	3450	3500	3550	3600		
	15,500	2960	3050	3150	3250	3350	3460	3510	3560	3620	3670		
	16,000	3070	2170	3280	3390	3500	3610	3660	3720	3780	3840		
	17,000	3240	3350	3470	3590	3710	3830	3900	3960	4020	4090		
10,000 MAX CERTIFIED TAKEOFF ALTITUDE	10,000	2430	2500	2560	2630	2690	2760	2790	2820	2850			
	11,000	2560	2630	2700	2770	2840	2900	2940	2970	3010			
	12,000	2690	2760	2840	2910	2990	3060	3100	3130	3170			
	13,000	2820	2900	2970	3050	3130	3210	3260	3310	3350			
	14,000	2950	3030	3120	3220	3320	3420	3470	3530	3580			
	15,000	3100	3200	3310	3420	3530	3640	3700	3760	3820			
	15,500	3150	3260	3370	3480	3600	3710	3770	3830	3890			
	16,000	3270	3390	3510	3630	3750	3880	3940	4010	4080			
	17,000	3460	3590	3720	3860	3990	4130	4220	4320	4420			
12,000	10,000	2590	2660	2730	2810	2880	2950	2990	3020	ABOVE ENGINE TEMP LIMITS			
	11,000	2720	2800	2880	2950	3030	3110	3140	3180				
	12,000	2860	2940	3020	3100	3190	3270	3310	3350				
	13,000	2990	3080	3170	3260	3360	3460	3520	3570				
	14,000	3130	3240	3350	3470	3580	3700	3760	3820				
	15,000	3320	3440	3560	3690	3820	3950	4010	4080				
	15,500	3380	3500	3630	3760	3890	4030	4090	4160				
	16,000	3520	3650	3790	3930	4070	4220	4290	4370				
	17,000	3730	3870	4030	4180	4380	4620	4740	4870				
14,000	10,000	2780	2860	2940	3030	3110	3190	3230	3270				
	11,000	2920	3000	3090	3180	3260	3350	3390	3440				
	12,000	3060	3150	3250	3330	3430	3530	3580	3630				
	13,000	3200	3300	3420	3530	3650	3770	3830	3890				
	14,000	3380	3510	3640	3770	3900	4040	4100	4170				
	15,000	3590	3730	3870	4020	4170	4320	4400	4480				
	15,500	3660	3800	3950	4100	4250	4410	4490	4580				
	16,000	3810	3970	4130	4290	4460	4690	4810	4940				
	17,000	4050	4230	4440	4710	4990	5310	5470	5650				

Figures in shaded area are provided for interpolation only.

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EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. UNCORRECTED LANDING DISTANCE (from table)........ 4,400 FT (1,341 M)
2. REFERENCE LINE
3. HEADWIND........ 30 KT
4. REFERENCE LINE
5. RUNWAY GRADIENT........ –1% DN
6. REFERENCE LINE
7. ANTI-SKID........ ON
8. REFERENCE LINE
9. ALTITUDE........ 5,000 FT
10. CORRECTED LANDING DISTANCE........ 4,000 FT (1,220 M)

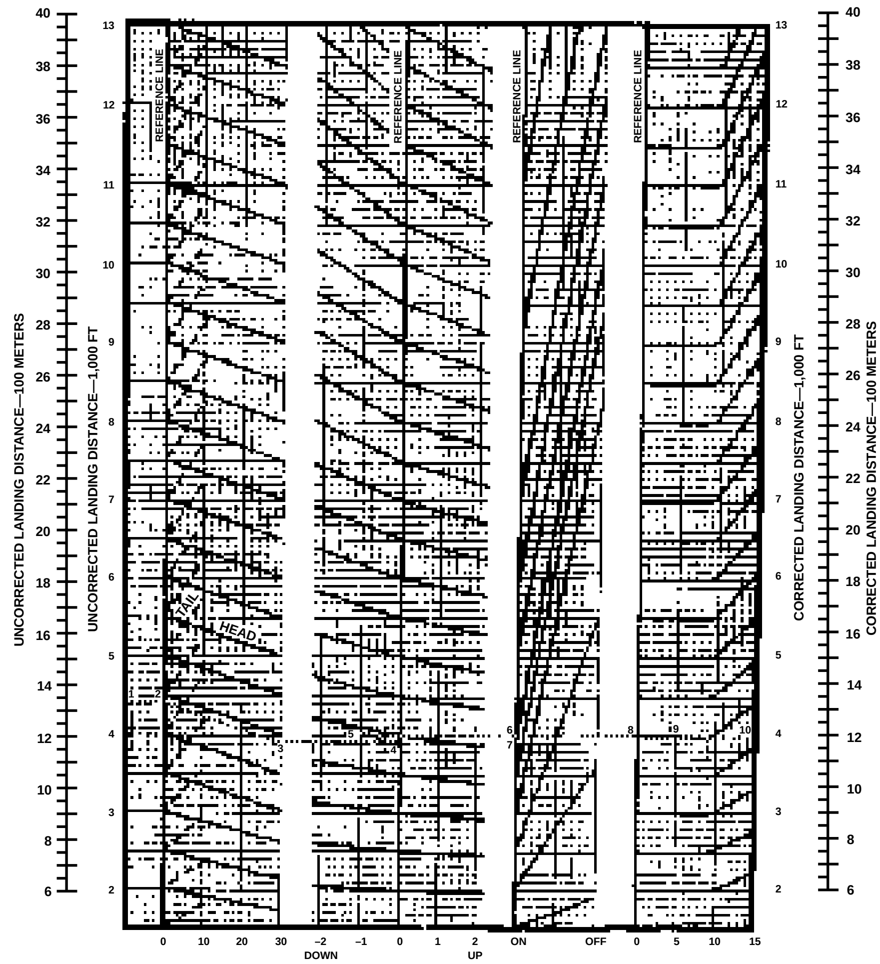
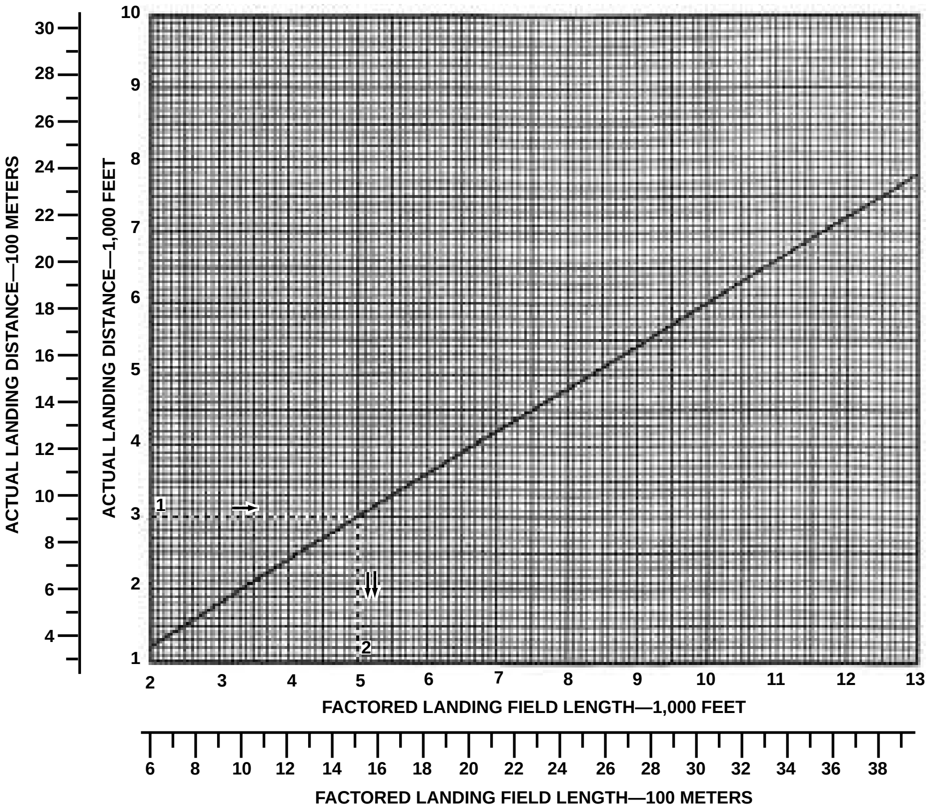


Figure PER-35. Actual Landing Distance



EFFECTIVITY:
ALL AIRCRAFT

EXAMPLE:

1. ACTUAL LANDING DISTANCE.................... 3,000 FT (914 M)
2. FACTORED LANDING DISTANCE.................... 5,000 FT (1,524 M)

NOTE:
THE FACTORED LANDING DISTANCE DETERMINED FROM THIS CHART IS EQUAL TO THE ACTUAL LANDING DISTANCE DIVIDED BY 0.60.

Figure PER-36. Factored Landing Distance

CREW RESOURCE MANAGEMENT

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ILLUSTRATIONS

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CREW RESOURCE MANAGEMENT (CRM)

CREW CONCEPT BRIEFING GUIDE

INTRODUCTION

Experience has shown that adherence to SOPs helps to enhance individual and crew cockpit situational awareness and will allow a higher performance level to be attained. Our objective is for standards to be agreed upon prior to flight and then adhered to, such that maximum crew performance is achieved. These procedures are not intended to supercede any individual company SOP, but rather are examples of good operating practices.

COMMON TERMS

PIC — Pilot in Command

Designated by the company for flights requiring more than one pilot. Responsible for conduct and safety of the flight. Designates pilot flying and pilot not flying duties.

PF — Pilot Flying

Controls the aircraft with respect to assigned airway, course, altitude, airspeed, etc., during normal and emergency conditions. Accomplishes other tasks as directed by the PIC.

PNF — Pilot Not Flying

Maintains ATC communications, copies clearances, accomplishes checklists and other tasks as directed by the PIC.

B — Both

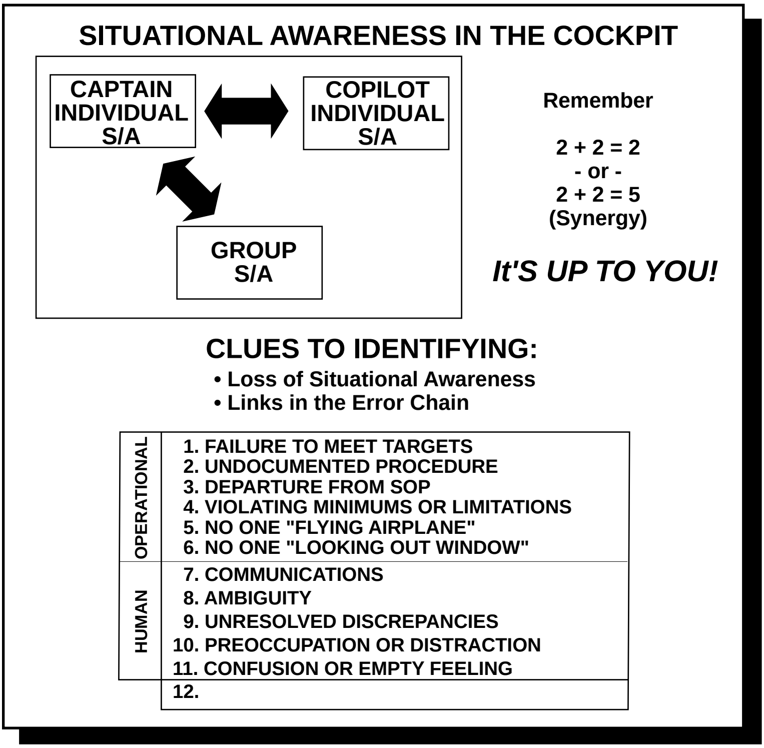


Figure CRM-1. Situational Awareness in the Cockpit

Figure CRM-2. Command and Leadership

PRETAKEOFF BRIEFING (IFR/VFR)

NOTE

The following briefing is to be completed during item 1 of the Pretakeoff checklist. The pilot flying will accomplish the briefing.

1. Review the departure procedure (route and altitude, type of takeoff, significant terrain features, etc.).

2. Review anything out of the ordinary.

3. Review required callouts, unless standard calls have been agreed upon, in which case a request for "Standard Callouts" may be used.

4. Review the procedures to be used in case of an emergency on departure.

5. As a final item, ask if there are any questions.

6. State that the pretakeoff briefing is complete.

CREW COORDINATION APPROACH SEQUENCE

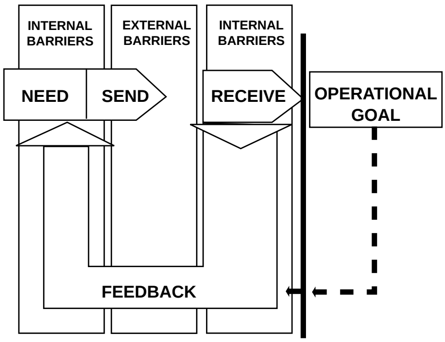
NOTE

The following crew coordination approach sequence should be completed as early as possible, prior to initiating an IFR approach. These items are accomplished during the “APPROACH (IN RANGE)” checklist.

PF—Requests the pilot not flying to obtain destination weather. (Transfer of communication duties to the pilot flying may facilitate the accomplishment of this task.)

PNF—Advises the pilot of current destination weather, approach in use, and special information pertinent to the destination.

COMMUNICATION PROCESS



THINK:
- Solicit and give feedback
- Listen carefully
- Focus on behavior, not people
- Maintain focus on the goal
- Verify operation outcome is achieved

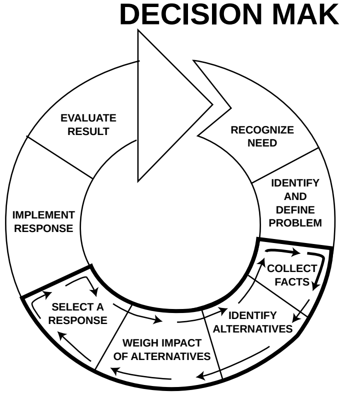
ADVOCACY: to increase others' S/A
- State Position
- Suggest Solutions
- Be Persistent and Focused
- Listen Carefully

INQUIRY: to increase your own S/A
- Decide What, Whom, How to ask
- Ask Clear, Concise Questions
- Draw Conclusions from Valid Information
- Keep an Open Mind

— REMEMBER—
Questions enhance communication flow.
Don't give in to the temptation to ask questions when Advocacy is required.
Use of Advocacy or inquiry should raise a "red flag."

Figure CRM-3. Communication Process

DECISION MAKING PROCESS



HINTS:
- Identify the problem:
  - — Communicate it
  - — Achieve agreement
  - — Obtain commitment
- Consider appropriate SOP's
- Think beyond the obvious alternatives
- Make decisions as a result of the process
- Resist the temptation to make an immediate decision and then support it with facts

Figure CRM-4. Decision Making Process

PF—Requests the pilot not flying to perform the approach setup.

PNF—Accomplishes the approach setup and advises of frequency tuned, identified and course set.

PF—Transfers control of the aircraft to the pilot not flying, advising, “You have control, heading _________, altitude ___________” and special instructions. (Communications duties should be transferred back to the pilot not flying at this point.)

PNF—Responds, “I have control, heading ________, altitude ________.”

PF—Advises, "Approach Briefing."

PF—At the completion of the approach briefing, the pilot flying advises, “Approach Briefing Complete.”

PF—Advises, “I have control, heading _________, altitude __________.”

PNF—Confirms “You have control, heading ________, altitude _________.”

PF—”Before Landing checklist.”

PNF—”Before Landing checklist complete.”

NOTE

The above sequence should be completed prior to the FAF.

NOTE

During the above sequence, the terms F and N have not been reversed during the time that transfer of control occurs.

ALTITUDE CALLOUTS

ENROUTE

1000 ft Prior to Level Off

PNF	PF
State altitude leaving and assigned level off altitude	"ROGER"
"100 ft above/below"	

APPROACH—PRECISION

PNF	PF
At 1,000 ft above minimums	
"1,000 feet above minimums"	"DH _______"
At 500 ft above minimums	
"500 feet above minimums"	"NO FLAGS"
At 100 ft above minimums	
"100 feet above minimums"	"APPROACHING MINIMUMS"
At decision height (DH)	
"Minimums, approach lights at (clock position)"	"CONTINUING"
OR	
"Minimums, runway at (clock position)"	"CONTINUING"
OR	
"Minimums, runway not in sight"	"GO AROUND"

APPROACH—NONPRECISION

PNF	PF
At 1,000 ft above minimums	
"1,000 feet above minimums"	"MDA ___________"
At 500 ft above minimums	
"500 feet above minimums"	"NO FLAGS"
At 100 ft above minimums	
"100 feet above minimums"	"APPROACHING MINIMUMS"
At minimum descent altitude (MDA)	
"Minimums"	"LEVEL"
At missed approach point (MAP)	
"Approach lights at (clock position)"	"CONTINUING"
OR	
"Runway at (clock position)"	"CONTINUING"
OR	
"Runway not in sight"	"GO AROUND"

SIGNIFICANT DEVIATION CALLOUTS

PNF	PF
IAS ± 10 KIAS	
“V_{REF} ± _____”	“CORRECTING TO ______”
Heading ± 10° enroute 5° on approach	
“Heading _______ degrees left/right	“CORRECTING TO ______”
Altitude ±100 ft enroute +50/-0 ft on final approach	
“Altitude ______ high/low”	“CORRECTING TO ______”
CDI left or right one dot	
“Left/right of course _____ dot”	“CORRECTING”
RMI course left or right ±5°	
“Left/right of course ______ degrees”	“CORRECTING”
Vertical descent speed greater than 1,000 fpm on final approach	
“Sink rate _______”	“CORRECTING”
Bank in excess of 30°	
“Bank _______ degrees”	“CORRECTING”